

# Material Data Sheets for Piping and Valve Components



#### **Revision history**

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# Acknowledgements

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

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# **Foreword**

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).



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# Introduction

The purpose of this specification is to define a minimum common set of supplementary requirements for the specification for procurement of the most commonly used materials and to facilitate the manufacture of stock products to reduce cost and increase availability, for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order, define the overall technical specification for procurement.



JIP33 Specification for Procurement Documents
Technical Specification

Quality and information requirements for the supply of piping and valve components are specified in the individual material data sheet rather than through separate quality requirements specification (QRS) and information requirements specification (IRS). Quality and information requirements for piping and valve components purchased as part of an equipment item are supplemented by the equipment QRS and IRS.

Unless defined otherwise in the requisition, the order of precedence (highest authority listed first) of the documents shall be:

- a) regulatory requirements;
- b) contract documentation (e.g. purchase order);
- c) user defined requirements (equipment data sheet, equipment IRS, equipment QRS);
- d) this specification.

This specification is not intended to preclude the use of alternative generic materials or grades within a referenced material standard. Where the use of alternative materials/grades are considered appropriate, the end user is responsible for specifying any additional requirements necessary to meet design and design code or specification.



# 1 Scope

This specification is a collection of material data sheets (MDSs) and element data sheets (EDSs) for the most commonly used components for piping systems and valves for Normal fluid service, Category D fluid service and High Pressure fluid service as defined in ASME B31.3.

NOTE The scope of IOGP S-563 is design code independent and it is not restricted to piping designed to ASME B31.3.

Supplementary material requirements for services defined in ASME B31.3 as Category M fluid service, elevated temperature fluid service, high purity fluid service, severe cyclic conditions are excluded from the scope.

This specification addresses specific minimum requirements for materials exposed to sour environments as defined in ISO 15156 /NACE MR0175 and ISO 17945 /NACE MR0103. However, this specification does not provide guidelines for material selection and the selection of suitable materials for a specific service including any necessary additional material requirements remains the responsibility of the end (equipment) user.

Line pipe material for pipeline systems is outside the scope of this specification.

The material data sheets cover 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, type 321, type 347, type 321H, type 347H;
- Austenitic stainless steel 200-series: grade XM-19;
- Martensitic stainless steel: types 12Cr and 13Cr;
- Copper-Nickel alloys: type 90-10 and aluminium bronze;
- Nickel alloys: types 625 and 825;
- Nickel alloy bolting: types 625 and 718;
- Precipitation-hardened stainless steel: austenitic grade 660 and martensitic grade 630;
- Titanium grade 2;
- High strength, low alloy steels;
- Nickel-alloyed steel: type 3.5 % Ni;
- Cr-Mo alloyed steel: 1¼ Cr ½ Mo and 2¼ Cr 1 Mo grades.

The element data sheets address the following:

- Hard facing by weld overlay;
- Hard facing by thermal spraying;
- Electroless nickel plating;



- Corrosion resistant weld overlay;
- Solid tungsten carbide.

# 2 Normative references

The following publications are referred to in this document in such a way that some or all of their content constitutes requirements of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Irregularities

API Recommended Practice 934-A, Materials and Fabrication of 2½Cr-1Mo, 2½Cr-1Mo-½V, 3Cr-1Mo, and 3Cr-1Mo-½V Steel Heavy Wall Pressure Vessels for High-temperature, High-pressure Hydrogen Service

API Recommended Practice 934-C, Materials and Fabrication of 1½Cr-½Mo Steel Heavy Wall Pressure Vessels for High-pressure Hydrogen Service Operating at or Below 825 °F (440 °C)

API Specification 5L, Line Pipe

API Standard 6ACRA, Age-hardened Nickel-based Alloys for Oil and Gas Drilling and Production Equipment

ASME B16.34, Valves — Flanged, Threaded, and Welding End

ASME B31.3, Process piping

ASME BPVC, Section V, Nondestructive Examination

ASME BPVC, Section VIII, Division 1, Rules for Construction of Pressure Vessels

ASME BPVC, Section IX, Welding, Brazing, and Fusing Qualifications

ASME BPVC Code Case 2120-1, Nickel-Iron-Chromium-Molybdenum-Copper Low Carbon Alloy (UNS N08926) for Code Construction Section VIII, Division 1

ASNT SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing

ASTM A20/A20M, Standard Specification for General Requirements for Steel Plates for Pressure Vessels

ASTM A29/A29M, Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

ASTM A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications

ASTM A106/A106M, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

ASTM A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A194/A194M, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

ASTM A203/A203M, Standard Specification for Pressure Vessel Plates, Alloy Steel, Nickel



ASTM A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM A217/A217M, Standard Specification for Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service

ASTM A234/234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A269/A269M, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

ASTM A276/A276M, Standard Specification for Stainless Steel Bars and Shapes

ASTM A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

ASTM A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service

ASTM A333/A333M, Standard Specification for Seamless and Welded Steel Pipe for Low- Temperature Service and Other Applications with Required Notch Toughness

ASTM A334/A334M, Standard Specification for Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service

ASTM A335/A335M, Standard Specification for Seamless Ferritic Alloy-Steel Pipe for High-Temperature Service

ASTM A350/A350M, Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components

ASTM A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

ASTM A352/A352M, Standard Specification for Steel Castings, Ferritic and Martensitic, for Pressure-Containing Parts, Suitable for Low-Temperature Service

ASTM A358/A358M, Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications

ASTM A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM A387/A387M, Standard Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum

ASTM A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

ASTM A420/420M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service

ASTM A453/A453M, Standard Specification for High-Temperature Bolting, with Expansion Coefficients Comparable to Austenitic Stainless Steels

ASTM A479/A479M, Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels



ASTM A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A488/A488M, Standard Practice for Steel Castings, Welding, Qualifications of Procedures and Personnel

ASTM A494/A494M, Standard Specification for Castings, Nickel and Nickel Alloy

ASTM A516/A516M, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

ASTM A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes

ASTM A578/A578M, Standard Specification for Straight-Beam Ultrasonic Examination of Rolled Steel Plates for Special Applications

ASTM A671/A671M, Standard Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures

ASTM A672/672M, Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures

ASTM A691/A691M, Standard Specification for Carbon and Alloy Steel Pipe, Electric-Fusion-Welded for High-Pressure Service at High Temperatures

ASTM A694/A694M, Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service

ASTM A696, Standard Specification for Steel Bars, Carbon, Hot-Wrought or Cold-Finished, Special Quality, for Pressure Piping Components

ASTM A703/A703M, Standard Specification for Steel Castings, General Requirements, for Pressure-Containing Parts

ASTM A705/705M, Standard Specification for Age-Hardening Stainless Steel Forgings

ASTM A739, Standard Specification for Steel Bars, Alloy, Hot-Wrought, for Elevated Temperature or Pressure-Containing Parts, or Both

ASTM A788/A788M, Standard Specification for Steel Forgings, General Requirements

ASTM A789/A789M, Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Tubing for General Service

ASTM A790/A790M, Standard Specification for Seamless and Welded Ferritic/Austenitic Stainless Steel Pipe

ASTM A815/815M, Standard Specification for Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings

ASTM A928/A928M, Standard Specification for Ferritic/Austenitic (Duplex) Stainless Steel Pipe Electric Fusion Welded with Addition of Filler Metal

ASTM A960/A960M, Standard Specification for Common Requirements for Wrought Steel Piping Fittings

ASTM A961/A961M, Standard Specification for Common Requirements for Steel Flanges, Forged Fittings, Valves, and Parts for Piping Applications



ASTM A962/A962M, Standard Specification for Common Requirements for Bolting Intended for Use at Any Temperature from Cryogenic to the Creep Range

ASTM A985/A985M, Standard Specification for Steel Investment Castings General Requirements, for Pressure-Containing Parts

ASTM A988/A988M, Standard Specification for Hot Isostatically-Pressed Stainless Steel Flanges, Fittings, Valves, and Parts for High Temperature Service

ASTM A995/A995M, Standard Specification for Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure-Containing Parts

ASTM A1058, Standard Test Methods for Mechanical Testing of Steel Products-Metric

ASTM A1082/A1082M, Standard Specification for High Strength Precipitation Hardening and Duplex Stainless Steel Bolting for Special Purpose Applications

ASTM B124/B124M, Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes

ASTM B148, Standard Specification for Aluminium-Bronze Sand Castings

ASTM B150/B150M, Standard Specification for Aluminum Bronze Rod, Bar, and Shapes

ASTM B151/B151M, Standard Specification for Copper-Nickel-Zinc Alloy (Nickel Silver) and Copper-Nickel Rod and Bar

ASTM B171/B171M, Standard Specification for Copper-Alloy Plate and Sheet for Pressure Vessels, Condensers, and Heat Exchangers

ASTM B265, Standard Specification for Titanium and Titanium Alloy Strip, Sheet, and Plate

ASTM B338, Standard Specification for Seamless and Welded Titanium and Titanium Alloy Tubes for Condensers and Heat Exchangers

ASTM B348, Standard Specification for Titanium and Titanium Alloy Bars and Billets

ASTM B363, Standard Specification for Seamless and Welded Unalloyed Titanium and Titanium Alloy Welding Fittings

ASTM B366/B366M, Standard Specification for Factory-Made Wrought Nickel and Nickel Alloy Fittings

ASTM B367, Standard Specification for Titanium and Titanium Alloy Castings

ASTM B381, Standard Specification for Titanium and Titanium Alloy Forgings

ASTM B423, Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloy (UNS N08825, N08221, and N06845) Seamless Pipe and Tube

ASTM B424, Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloys Plate, Sheet, and Strip

ASTM B425, Standard Specification for Nickel-Iron-Chromium-Molybdenum-Copper Alloys Rod and Bar

ASTM B443, Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy and Nickel-Chromium-Molybdenum-Silicon Alloy Plate, Sheet, and Strip

ASTM B444, Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloys (UNS N06625 and UNS N06852) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Pipe and Tube



ASTM B446, Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar

ASTM B462, Standard Specification for Forged or Rolled Nickel Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service

ASTM B499, Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals

ASTM B564, Standard Specification for Nickel Alloy Forgings

ASTM B571, Standard Practice for Qualitative Adhesion Testing of Metallic Coatings

ASTM B578, Standard Test Method for Microhardness of Electroplated Coatings

ASTM B602, Standard Test Method for Attribute Sampling of Metallic and Inorganic Coatings

ASTM B705, Standard Specification for Nickel-Alloy (UNS N06625, N06219 and N08825) Welded Pipe

ASTM B733, Standard Specification for Autocatalytic (Electroless) Nickel-Phosphorus Coatings on Metal

ASTM B834, Standard Specification for Pressure Consolidated Powder Metallurgy Iron- Nickel- Chromium-Molybdenum (UNS N08367), Nickel-Chromium- Molybdenum-Columbium (Nb) (UNS N06625), Nickel-Chromium-Iron Alloys (UNS N06600 and N06690), and Nickel-Chromium-Iron-Columbium- Molybdenum (UNS N07718) Alloy Pipe Flanges, Fittings, Valves, and Parts

ASTM B861, Standard Specification for Titanium and Titanium Alloy Seamless Pipe

ASTM B862, Standard Specification for Titanium and Titanium Alloy Welded Pipe

ASTM C633, Standard Test Method for Adhesion or Cohesion Strength of Thermal Spray Coatings

ASTM E10, Standard Test Method for Brinell Hardness of Metallic Materials

ASTM E18, Standard Test Methods for Rockwell Hardness of Metallic Materials

ASTM E165/E165M, Standard Practice for Liquid Penetrant Examination for General Industry

ASTM E384, Standard Test Method for Microindentation Hardness of Materials

ASTM E562, Standard Test Method for Determining Volume Fraction by Systematic Manual Point Count

ASTM F467, Standard Specification for Nonferrous Nuts for General Use

ASTM F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use

ASTM F788, Standard Specification for Surface Discontinuities of Bolts, Screws, Studs, and Rivets, Inch and Metric Series

ASTM F812, Standard Specification for Surface Discontinuities of Nuts, Inch and Metric Series

ASTM F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

ASTM G28, Standard Test Methods for Detecting Susceptibility to Intergranular Corrosion in Wrought, Nickel-Rich, Chromium-Bearing Alloys

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ASTM G48, Standard Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution

EEMUA Pub. 234, 90/10 Copper Nickel Alloy Piping for Offshore Applications Specification

EN 10204, Metallic products - Types of inspection documents

ISO 148-1, Metallic materials — Charpy pendulum impact test — Part 1: Test method

ISO 3452 (all parts), Non-destructive testing — Penetrant testing

ISO 4624, Paints and varnishes — Pull-off test for adhesion

ISO 4499 (all parts), Hardmetals — Metallographic determination of microstructure

ISO 6506-1, Metallic materials — Brinell hardness test — Part 1: Test method

ISO 6507-1, Metallic materials — Vickers hardness test — Part 1: Test method

ISO 6508-1, Metallic materials — Rockwell hardness test — Part 1: Test method

ISO 6892-1, Metallic materials — Tensile testing — Part 1: Method of test at room temperature

ISO 9001, Quality management systems — Requirements

ISO 9606 (all parts), Qualification testing of welders — Fusion welding

ISO 9712, Non-destructive testing — Qualification and certification of NDT personnel

ISO 10474, Steel and steel products — Inspection documents

ISO 11970, Specification and qualification of welding procedures for production welding of steel castings

ISO 14732, Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials

ISO 15156-1 /NACE MR0175-1, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials

ISO 15156-2 /NACE MR0175-2, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 2: Cracking-resistant carbon and low-alloy steels, and the use of cast irons

ISO 15156-3 /NACE MR0175-3, Petroleum and natural gas industries — Materials for use in H2S-containing environments in oil and gas production — Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys

ISO 17637, Non-destructive testing of welds — Visual testing of fusion-welded joints.

ISO 17781, Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels

ISO 17782, Petroleum, petrochemical and natural gas industries — Scheme for conformity assessment of manufacturers of special materials

ISO 17945 /NACE MR0103, Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments

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ISO 28079, Hardmetals — Palmqvist toughness test

MSS SP-147, Quality Standard for Steel Castings Used in Standard Class Steel Valves - Sampling Method for Evaluating Casting Quality

NACE TM0284, Evaluation of Pipeline and Pressure Vessel Steels for Resistance to Hydrogen-Induced Cracking

NORSOK M-650, Qualification of manufacturers of special materials

# 3 Terms, definitions, acronyms and abbreviations

#### 3.1 Terms and definitions

#### 3.1.1

#### carbon steel

alloy of carbon and iron containing up to 2 % mass fraction carbon and up to 1.65 % mass fraction manganese and residual quantities of other elements, except those intentionally added in specific quantities for deoxidation (usually silicon and/or aluminium)

#### 3.1.2

# low-alloy steel

steel containing a total alloying element content of less than 5 % mass fraction, or steels with less than 10.5 % mass fraction chromium, but more than that specified for carbon steel

#### 3.1.3

#### stainless steel

steel containing ≥ 10.5 % Cr (by mass), possibly with other elements added to secure special properties

#### 3.1.4

#### austenitic stainless steel

stainless steel whose microstructure at room temperature consists predominantly of austenite

#### 3.1.5

# stainless steel types 304 and 316

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

#### 3.1.6

#### stainless steel type 6Mo

austenitic stainless steel alloys with 6 % Mo and PREN ≥ 40.0

#### 3.1.7

# stainless steel type 22Cr duplex

ferritic-austenitic stainless steel alloys with 30.0 ≤ PREN < 40.0 and Cr ≥ 19 % (by mass)

#### 3.1.8

#### stainless steel type 25Cr duplex

ferritic-austenitic stainless steel alloys with 40.0 ≤ PREN < 48.0, often referred to as "super duplex"

#### 3.1.9

# martensitic stainless steel

stainless steel whose microstructure at room temperature consists predominantly of martensite

#### 3.1.10

#### precipitation-hardened stainless steel

stainless steel with a high strength resulting from the precipitation of intermetallic compounds by a final heat treatment



#### 3.1.11

# nickel alloys

metallic material in which nickel is the major element

#### 3.1.12

#### pilot casting

casting made and tested as part of the initiation and development of the production method such as the first casting from a new or modified pattern produced using identical foundry practices as the production castings it is intended to represent

#### 3.1.13

#### nominal pipe size

numerical designation of size in inches which is common to components in piping systems

#### 3.1.14

# quality specification level

#### **QSL**

level defining the extent of control activities, typically including verification, inspection and testing to be undertaken by supplier to demonstrate conformance with requirements based on determination of service risk (e.g. on the basis of pressure class, material, valve size and service) or obligations

#### 3.1.15

#### nickel-alloyed steel

alloyed steel containing more than 1.5 % Ni

#### 3.1.16

# end (equipment) user

company or organization (normally an oil company) that is responsible for the operation of an installation/facility and its component (e.g. piping, valve)

#### 3.1.17

#### manufacturer (material)

party, including subcontractors, which carries out operations (e.g. forming, heat treatment, welding) that affect the material properties of the finished product

# 3.2 Acronym, abbreviations and symbols

ACCP ASNT Central Certification Program

AOD argon oxygen decarburization

BPVC boiler and pressure vessel code

CE carbon equivalent (% C + % Mn / 6 + (% Cr + % Mo + % V) / 5 + (% Ni + % Cu) / 15), with chemical

element concentration expressed in mass fraction percent

CLR crack length ratio

CSR crack sensitivity ratio

CTR crack thickness ratio

DN diamètre nominal (French for nominal diameter)

EBW electron beam welding

EDS element datasheet



FCAW flux-cored arc welding

GTAW gas tungsten arc welding

HAZ heat affected zone

HBW Brinell hardness with Tungsten ball

HIC hydrogen-induced cracking

HIP hot isostatic pressing

HRB Rockwell hardness, B scale

HRC Rockwell hardness, C scale

HV Vickers hardness

HVOF high velocity oxygen fuel

LBW laser beam welding

MDS material data sheet

MCPR manufacturing procedure conformity record

MPS material process specification

MT magnetic particle testing

NDE non-destructive examination (equivalent to NDT)

NDT non-destructive testing

NPS nominal pipe size

OD outer diameter

PREN pitting resistance equivalent number (%Cr + 3.3 x % (Mo + 0.5W) + 16 x %N), with chemical

element concentration expressed in mass fraction percent.

PSL product specification level

PT penetrant testing

PTAW plasma transfer arc welding

PWHT post weld heat treatment

QL quality level

QSL quality specification level

QTR qualification test record

RT radiographic testing

SAW submerged arc welding



SMAW shielded metal arc welding

UNS unified numbering system

UT ultrasonic testing

VT visual testing

WC tungsten carbide

WPS welding procedure specification

#### 4 Material and element data sheets

# 4.1 General

The material data sheets (MDSs) are collated in Annex A. They define applicable options and requirements that supplement or amend the referenced material standard or specification. The material shall be delivered in accordance with the standard specification referenced in the MDSs including any additional requirements specified therein. Unless otherwise specified in the MDSs, all the requirements of the referenced standard or specification shall apply. The latest issue of the referenced standard or specification at the time of purchase shall apply.

NOTE ASTM standard designations comprising the "M" specification designation for SI units, appear in the MDSs in an abbreviated form, e.g. ASTM A105/A105M is referenced as ASTM A105 in the MDS.

Welded pipes MDSs specifying acceptance classes give welding quality factors ranging from 0.8 to 1.0 according to ASME B31.3. The required class shall be specified on the piping class sheet and the purchase order shall specify acceptable class for each relevant item.

The element data sheets (EDSs) are included in Annex B. They define the requirements for special processes and parts used in connection with manufacturing or assembly of piping and valves. Processes and parts shall comply with the minimum requirement specified in the EDS and any standard referenced therein.

# 4.2 MDS and EDS numbering system

Each MDS and EDS number consists of a two-letter prefix followed by a three-digit sequential number and a supplementary requirements suffix.

The first letter is fixed and consists of the letter "I" to indicate an IOGP MDS or EDS.

The second letter identifies the type of material or element with the following interpretation:

- C carbon steels
- D ferritic-austenitic stainless steels, type 22Cr duplex, type 25Cr duplex
- H hard facing, by welding, thermal spray, metal plating or use of sintered material
- K copper-nickel alloy 90-10 and other copper alloys including aluminium bronze
- L nickel-alloyed steel
- M martensitic stainless steel
- N nickel alloys



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- O overlay welding, corrosion-resistant
- R austenitic stainless steels, type 6Mo
- S austenitic stainless steels, excluding type 6Mo
- T titanium and titanium alloys
- U precipitation-hardened stainless steels
- V Cr and Cr-Mo alloyed steels
- X high strength low alloyed steels

The suffix identifies a material delivered in accordance with the MDS including the supplementary requirements for the following service:

- S sour service, excluding HIC testing
- SH sour service including HIC testing and UT examination, where applicable to the material and product form
- K hydrogen service at elevated temperature and pressure

Material data sheets designated with supplementary suffix "S" or "SH" also satisfy all the MDS requirements for general, non-sour service.

EXAMPLE 1 MDS IC003 designates carbon steel fittings for general, non-sour service, as opposed to IC003S which designates carbon steel fittings which also comply with the additional supplementary requirements for sour service, excluding HIC testing.

EXAMPLE 2 MDS IC003SH designates carbon steel fittings complying with the additional supplementary requirements for sour service plus HIC and UT testing, where applicable.

# 4.3 Implementation of statutory regulations

This 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.

# 4.4 Ferritic-austenitic stainless steels (MDS ID series)

The compositional and microstructural requirements including ferrite content and acceptance criteria for intermetallic phases and precipitates in parent material and welds are specified in accordance with ISO 17781. Compliance with ISO 17781 is considered to fulfil the microstructural requirements of ISO 15156-3 /NACE MR0175-3.

# 4.5 Mechanical testing

Tensile testing shall in general be carried out in accordance with the referenced standard specifications in the respective MDS. Where testing to ASTM A370 is specified, 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 50 mm as far as is practical.



Impact testing shall, in general, be carried out in accordance with the referenced standard specifications in the respective MDS. Where testing to ASTM A370 is specified, testing in accordance with ISO 148-1 using a striker radius of 8 mm is considered equivalent and thereby also acceptable.

The impact test temperature for carbon steels and duplex stainless steels is in general specified to be minus 46 °C. 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.

Hardness testing shall be performed in strict compliance with the methods described in the MDS and EDS, as applicable. The use of alternative methods permitted by the product standard and use of conversion tables or other correlations for individual materials shall require approval of the end (equipment) user. In case of dispute, the hardness scale stated in the MDS or EDS shall govern. For the purposes of this specification, ASTM E384 is equivalent to ISO 6507-1, ASTM E18 is equivalent to ISO 6508-1 and ASTM E10 is equivalent to ISO 6506-1. The use of portable hardness testing methods shall require approval by the end (equipment) user.

# 4.6 Machining of valve components from bar

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

# 4.7 NDT of piping and valve components

#### 4.7.1 General

Where MDSs specify NDT requirements, this is intended to represent the minimum level of NDT that shall be performed at the material manufacturing stage.

NDT of fabricated piping systems are not included in the MDSs and additional NDT may be required for valve components when a quality specification level (QSL) is specified by the purchaser in the valve data sheet or purchase order documentation. For details of any additional NDT requirements for finished valve components or piping assembly, reference shall be made to the applicable IOGP valve specification or piping fabrication specification.

Where MDSs do not specify additional NDT requirements, the relevant material standard shall apply with no additional requirements except as specified below in this section.

Where a frequency of inspection less than 100 % is specified, at least one item per lot shall be examined. If defects outside the acceptance criteria are detected, two or more items from the same lot shall be tested and if any of these two fails, all items in the lot shall be examined.

#### 4.7.2 NDT Personnel

NDT personnel shall be qualified in accordance with ISO 9712 or ASNT SNT-TC-1A. Personnel performing NDT evaluation shall be certified according to Level 2. Certification shall be performed by an independent third-party certification body, or authorized qualifying body in accordance with ISO 9712 or the ASNT Central Certification Program (ACCP).

# 4.8 Pilot castings

#### 4.8.1 General

The casting foundry or manufacturer shall produce a pilot casting (see definition in 3.1.12) prior to the production of castings, in accordance with MSS SP-147.

The pilot casting may be taken from the first production order of castings, subject to purchaser approval. Acceptance of a production casting as pilot casting shall require that NDT complies with the requirements for pilot casting and all testing specified in the MDS for production casting shall be met.



# 4.8.2 Material qualification ranges for pilot castings

A new pilot casting shall be produced when the casting material is outside the qualification ranges given in Table 1.

Table 1 — Pilot casting material qualification ranges

Pilot casting material type	Qualification range for pilot casting material
Carbon steel	All grades of carbon steel and low alloyed steel
Low-alloy steel	All grades of carbon steel and low alloyed steel
Nickel-alloyed steel	All grades of nickel-alloyed steel
Martensitic stainless steel	All grades of martensitic stainless steel
Austenitic stainless steel	All grades of austenitic stainless steel except 6Mo
22Cr and 25Cr duplex stainless steel	All grades of 22Cr and 25Cr duplex stainless steel
6Mo stainless steel	All grades of 6Mo and austenitic stainless steel and Ni-alloys
Nickel alloys	All grades of austenitic stainless steel including 6Mo and Ni-alloys
Titanium (un-alloyed)	All un-alloyed grades of titanium
Ni-Al bronze	All grades of Ni-Al bronze

# 4.8.3 NDE of pilot castings

All pilot castings shall be evaluated without weld repairs.

All accessible internal and external surfaces of the pilot casting shall be inspected by VT, PT or MT. The extent of volumetric inspection shall be in accordance with the applicable casting MDS. The acceptance criteria shall be as stated in the applicable casting MDS, unless agreed otherwise with the end (equipment) user.

Dimensional inspection shall be in accordance with the casting design drawing.

A pilot casting that fails to comply with the requirements of the MDS shall be rejected. Corrective actions shall be implemented by the casting foundry/manufacturer and a new pilot casting shall be made to confirm effectiveness of the corrective actions.

Upon completion of all required examinations and tests, the documentation for the pilot casting shall be retained and be available for review at the casting foundry/manufacturer.

# 4.9 Low temperature and cryogenic service

#### 4.9.1

Materials exposed to low temperature and cryogenic service shall be impact tested in accordance with the applicable design code, in addition to the requirement of the MDS.

#### 4.9.2

Procedures for hard facing by overlay welding of parts exposed to low temperature and cryogenic service shall be impact tested at the design minimum temperature specified for the parent metal by the applicable design code with test sampling and location in accordance with the EDS.



# 4.10 High pressure service

# 4.10.1

Material for service designated as high pressure service shall comply with the requirements of ASME B31.3, Chapter IX, which amend the MDS, and the following provisions.

# 4.10.2

Sampling of impact test specimens for 22Cr and 25Cr duplex stainless steels wrought products shall comply with the MDS.

# 4.10.3

Location and orientation of impact test specimens for bars intended for machining of valve parts in high pressure service shall be in accordance with the MDS.

# 4.10.4

Acceptance criteria for 22Cr and 25Cr duplex stainless steels shall be according to ISO 17781 QL I.



# Annex A (normative) Material data sheets

The material data sheets are listed in Table A.1 and compiled in this annex.

Table A.1 — List of material data sheets per type of material

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
Non-impact tested	ASTM A106 Grade B	Seamless pipes	IC001	01
carbon steel	API SPEC 5L Grade B PSL1, PSL2	Seamless pipes	IC001	01
	ASTM A672 Grade C60, C65, C70	Welded pipes	IC002	01
	API SPEC 5L Grade B PSL1, PSL2	Welded pipes	IC002	01
	ASTM A234 Grade WPB, WPBW	Wrought fittings	IC003	01
	ASTM A105	Forgings	IC004	01
	ASTM A516 Grade 60, 65, 70	Plates	IC005	01
	ASTM A216 Grade WCB, WCC	Castings	IC006	02
	ASTM A696 Grade B, C	Bars	IC007	01
Impact tested carbon	ASTM A333 Grade 6	Seamless pipes	IC101	01
steel	ASTM A671 Grade CC60, CC65, CC70	Welded pipes	IC102	01
	ASTM A420 Grade WPL 6	Wrought fittings	IC103	01
	ASTM A350 Grade LF2, LF6	Forgings	IC104	01
	ASTM A516 Grade 60, 65, 70	Plates	IC105	01
	ASTM A352 Grade LCC	Castings	IC106	02
	ASTM A696 Grade B, C	Bars	IC107	01
Ferritic- austenitic	ASTM A790 UNS S31803, UNS S32205	Seamless pipes	ID141	01
stainless steel type 22Cr Duplex	ASTM A928 UNS S31803, UNS S32205	Welded pipes	ID142	01
	ASTM A815 UNS S31803, UNS S32205	Wrought fittings	ID143	01
	ASTM A182 Grade F51, F60	Forgings	ID144	01
	ASTM A240 UNS S31803, UNS S32205	Plates	ID145	01
	ASTM A995 Grade 4A (UNS J92205)	Castings	ID146	01
	ASTM A276 / ASTM A479 UNS S31803, UNS S32205	Bars	ID147	01
	ASTM A789 UNS S31803, UNS S32205	Tubes	ID148	01
	ASTM A988 UNS S31803, UNS S32205	HIP products	ID149	01



Table A.1 — List of material data sheets per type of material (continued)

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
Ferritic- austenitic stainless steel type 25Cr Duplex	ASTM A790 UNS S32550, UNS S32750, UNS S32760	Seamless pipes	ID251	01
	ASTM A928 UNS S32550, UNS S32750, UNS S32760	Welded pipes	ID252	01
	ASTM A815 UNS S32550, UNS S32750, UNS S32760	Wrought fittings	ID253	01
	ASTM A182 Grade F53 (UNS S32750), Grade F55 (UNS S32760), Grade F61 (UNS S32550)	Forgings	ID254	02
	ASTM A240 UNS S32550, UNS S32750, UNS S32760	Plates	ID255	01
	ASTM A995 Grade 6A (UNS J93380), Grade 5A (UNS J93404)	Castings	ID256	01
	ASTM A276 / ASTM A479 UNS S32550, UNS S32750, UNS S32760	Bars	ID257	01
	ASTM A789 UNS S32550, UNS S32750, UNS S32760	Tubes	ID258	01
	ASTM A1082 (modified) UNS S32750, UNS S32760 (strain hardened)	Bolting	ID259	01
	ASTM A1082 UNS S32750, UNS S32760 (solution annealed)	Bolting	ID260	01
	ASTM A988 UNS S32750, UNS S32750, UNS S32505	HIP products	ID269	01
Copper- nickel 90-10	EEMUA 234 Grade 7060X	Seamless pipes and tubes	IK101	02
	EEMUA 234 Grade 7060X	Welded pipes	IK102	02
	EEMUA 234 Grade 7060X	Wrought fittings	IK103	02
	EEMUA 234 Grade 7060X	Flanges	IK104	02
	ASTM B171 UNS C70600	Plates and sheets	IK105	02
	ASTM B151 UNS C70600	Bars and rods	IK107	02
Aluminium - bronze	ASTM B148 UNS C95800	Castings	IK106	01
	ASTM B124 UNS C63000	Forgings	IK204	01
	ASTM B150 UNS C63200	Bars and rods	IK207	01
Nickel alloys	ASTM F467 UNS N06625 Grade 2	Nuts	IN100S a	01
	ASTM F468 UNS N06625	Studs, bolts, screws	IN100S a	01
	ASTM B705 UNS N06625	Welded pipes	IN102S a	01
	ASTM B366 UNS N06625	Wrought fittings	IN103S a	01
	ASTM B564 UNS N06625	Forgings	IN104S a	01
	ASTM B443 UNS N06625	Plates	IN105S a	01
	ASTM A494 Grade CW6MC, CX2MW	Castings	IN106S a	02



Table A.1 — List of material data sheets per type of material (continued)

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
Nickel alloys	ASTM B446 UNS N06625	Bars	IN107S a	01
(continued)	ASTM B444 UNS N06625	Seamless pipes and tubes	IN111S a	01
	ASTM B834 UNS N06625 Grade 1	HIP products	IN119S a	01
	ASTM A962, API STD 6ACRA Grade 120K	Bolting	IN120S a	01
	ASTM B423 UNS N08825	Seamless pipes and tubes	IN201Sa	01
	ASTM B705 UNS N08825	Welded pipes	IN202Sa	01
	ASTM B366 UNS N08825	Wrought fittings	IN203Sa	01
	ASTM B564 UNS N08825	Forgings	IN204Sa	01
	ASTM B424 UNS N08825	Plates	IN205Sa	01
	ASTM A494 Grade CU5MCuC	Castings	IN206Sa	01
	ASTM B425 UNS N08825	Bars	IN207Sa	01
Austenitic stainless steel type 6Mo	ASTM A312 UNS S31254, UNS N08367, UNS N08926	Seamless pipes	IR111	01
	ASTM A358 UNS S31254, UNS N08367, UNS N08926	Welded pipes	IR112	01
	ASTM A403 UNS S31254, UNS N08367, UNS N08926	Wrought fittings	IR113	01
	ASTM A182 Grade F44 (UNS S31254), F62 (UNS N08367), UNS N08926	Forgings	IR114	01
	ASTM A240 UNS S31254, UNS N08367, UNS N08926	Plates	IR115	02
	ASTM A351 Grade CK3MCuN, CN3MN	Castings	IR116	01
	ASTM A276 / ASTM A479 UNS S31254, UNS N08367, UNS N08926	Bars	IR117	01
	ASTM A269 UNS S31254, UNS N08367, UNS N08926	Tubes	IR118	01
	ASTM A988 UNS S31254, UNS N08367	HIP products	IR119	01
Austenitic stainless	ASTM A312 Grade TP316	Seamless pipes	IS101	01
steel type 316	ASTM A312 Grade TP316	Welded pipes	IS102	01
	ASTM A358 Grade 316	Welded pipes	IS102	01
	ASTM A403 Grade WP316	Wrought fittings	IS103	01
	ASTM A182 Grade F316	Forgings	IS104	01
	ASTM A240 Grade 316	Plates	IS105	01
	ASTM A351 Grade CF3M, CF8M	Castings	IS106	01
	ASTM A276 / ASTM A479 Grade 316	Bars	IS107	01
	ASTM A269 Grade 316	Tubes	IS108	01
	ASTM A193 Grade B8M, B8M2, B8MA	Studs, bolts, screws	IS109	01
	ASTM A194 Grade 8M, 8MA	Nuts	IS109	01
	ASTM A320 Grade B8M, B8MA	Studs, bolts, screws	IS109	01
	•	•	•	



Table A.1 — List of material data sheets per type of material (continued)

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
Austenitic stainless steel type 304	ASTM A312 Grade TP304	Seamless pipes	IS221	01
	ASTM A312 Grade TP304	Welded pipes	IS222	01
	ASTM A358 Grade 304	Welded pipes	IS222	01
	ASTM A403 Grade WP304	Wrought fittings	IS223	01
	ASTM A182 Grade F304	Forgings	IS224	01
	ASTM A240 Grade 304	Plates	IS225	01
	ASTM A351 Grade CF3, CF8	Castings	IS226	01
	ASTM A276 / ASTM A479 Grade 304	Bars	IS227	01
	ASTM A269 Grade 304	Tubes	IS228	01
Austenitic stainless	ASTM A312 Grade TP321, TP347	Seamless pipes	IS301	01
steel, stabilized grade	ASTM A312 / ASTM A358 Grade TP321, TP347	Welded pipes	IS302	01
	ASTM A403 Grade WP321, WP347	Wrought fittings	IS303	01
	ASTM A182 Grade F321, F347	Forgings	IS304	01
	ASTM A240 Grade 321, 347	Plates	IS305	01
	ASTM A351 Grade CF8C	Castings	IS306	01
	ASTM A276 / ASTM A479 Grade 321, 347	Bars	IS307	01
	ASTM A269 Grade TP321, TP347	Tubes	IS308	01
	ASTM A312 Grade TP321H, TP347H	Seamless pipes	IS321	01
	ASTM A312 / ASTM A358 Grade TP321H, TP347H	Welded pipes	IS322	01
	ASTM A403 Grade WP321H, WP347H	Wrought fittings	IS323	01
	ASTM A182 Grade F347H, F321H	Forgings	IS324	01
	ASTM A240 Grade 321H, 347H	Plates	IS325	01
	ASTM A479 Grade 321H, 347H	Bars	IS327	01
Austenitic stainless	ASTM A182 F XM-19 (UNS S20910)	Forgings	IS404	01
steel, 200-series	ASTM A276 / ASTM A479 XM-19 (UNS S20910)	Bars	IS407	01
Martensitic stainless	ASTM A182 F6A	Forgings	IM104	01
steel	ASTM A217 CA15 (UNS J91150)	Castings	IM106	01
	ASTM A276 / ASTM A479 410 (UNS S41000)	Bars	IM107	01
	ASTM A276 420 (UNS S42000)	Bars	IM127	01
Martensitic stainless	ASTM A705 Grade 630 (UNS S17400)	Forgings	IU604	01
steel, precipitation- hardened	ASTM A564 Grade 630 (UNS S17400)	Bars	IU607	01



Table A.1 — List of material data sheets per type of material (continued)

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
3.5% nickel alloyed	ASTM A333 Grade 3	Seamless pipes	IL101	01
steel	ASTM A671 CFE 70	Welded pipes	IL102	01
	ASTM A420 WPL3, WPL3W	Wrought fittings	IL103	01
	ASTM A350 LF3	Forgings	IL104	01
	ASTM A203 Grade D, E	Plate	IL105	01
	ASTM A352 LC3 (UNS J31550)	Castings	IL106	01
	ASTM A334 Grade 3	Tubes	IL108	01
Titanium Grade 2	ASTM B861 Grade 2	Seamless pipes	IT101	01
	ASTM B862 Grade 2	Welded pipes	IT102	01
	ASTM B363 Grade WPT2/WPT2W	Wrought fittings	IT103	01
	ASTM B381 Grade F2	Forgings	IT104	01
	ASTM B265 Grade 2	Plates	IT105	01
	ASTM B367 Grade C2	Castings	IT106	01
	ASTM B348 Grade 2	Bars	IT107	01
	ASTM B338 Grade 2	Tubes	IT108	01
Precipitation -hardened stainless steel (austenitic)	ASTM A453 Grade 660 (UNS S66286)	Bolting	IU100	01
High strength low	ASTM A320 Grade L7, L7M, L43	Studs, bolts, screws (HDG)	IX100	01
alloy steel	ASTM A194 Grade 7, 7M, L43	Nuts (HDG)	IX100	01
	ASTM A320 Grade L7, L7M, L43	Studs, bolts, screws (black or uncoated)	IX109	01
	ASTM A194 Grade 7, 7M	Nuts (black or uncoated)	IX109	01
	ASTM A193 Grade B7, B7M	Studs, bolts, screws (black or uncoated)	IX110	01
	ASTM A194 Grade 2H, 2HM	Nuts (black or uncoated)	IX110	01
	ASTM A193 Grade B7, B7M	Studs, bolts, screws (HDG)	IX120	01
	ASTM A194 Grade 2H, 2HM	Nuts (HDG)	IX120	01
	ASTM A694 Grade F52, F60, F65	Forgings	IX124	01
	ASTM A29 Grade 4140, F52, F60, F65	Bars	IX127	01
1¼ Cr ½ Mo alloy	ASTM A335 P11	Seamless pipes	IV101	01
steel	ASTM A691 1¼ Cr	Welded pipes	IV102	01
	ASTM A234 WP11	Wrought fittings	IV103	01
	ASTM A182 F11	Forgings	IV104	01
	ASTM A387 Grade 11	Plate	IV105	01
	ASTM A217 WC6	Castings	IV106	01



Table A.1 — List of material data sheets per type of material (continued)

Type of material	Material standard and grade(s)	Product form	MDS No.	MDS rev.
2¼ Cr 1 Mo alloy	ASTM A335 P22	Seamless pipes	IV201	01
steel	ASTM A691 2¼ Cr	Welded pipes	IV202	01
	ASTM A234 WP22	Wrought fittings	IV203	01
	ASTM A182 F22	Forgings	IV204	01
	ASTM A387 Grade 22	Plate	IV205	01
	ASTM A217 WC9	Castings	IV206	01
	ASTM A739 B22	Bars	IV207	01

NOTE The supplementary suffix "S" is added to the MDS designation to indicate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination. The supplementary suffix "SH" is added to the MDS designation to indicate a material complying with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination, where applicable to the product form. Supplementary suffix "K" is added to the MDS designation to indicate a material delivered in accordance with the MDS including the additional supplementary requirements for hydrogen service.

<sup>&</sup>lt;sup>a</sup> MDSs for Ni-alloy are designated with supplementary suffix "S" only.



# A.2 IOGP material data sheets

**Table A.2 — MDS IC001 / IC001S** 

Material Data Sh	neet	MDS No. IC	MDS No. IC001 / IC001S a Rev. 01		
TYPE OF MATERIAL	L: Non-impact tested ca	rbon steel			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Seamless pipes	ASTM A106	В	-	ASTM A106 S6	
	API 5L	В	PSL1 or PSL2	-	
		Page 1 c	of 1		
Scope	This MDS defines ap specification.	plicable options and/or re	equirements that supplement or ame	nd the referenced standard	
Metal making	API 5L Grade B PSL	1 pipe steel shall be killed	d.		
Manufacturing	Cold-drawn pipes sh	all be heat treated after c	old forming.		
Chemical composition	For ASTM A106 supplementary requirement, S6 applies with the following restrictions: $C \le 0.23 \ \%, \ S \le 0.020 \ \%, \ P \le 0.025 \ \%, \ CE \le 0.43 \ \%.$ The following restrictions apply to API 5L pipes: $C \le 0.23 \ \%, \ CE \le 0.43 \ \%.$				
	Microalloying elements (Nb, V, Ti, B) shall not be deliberately added.				
Repair of defects	Weld repair is not permitted.				
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
	<u>Chemical composition</u> S ≤ 0.010 %				
	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.				
Marking		The pipes shall be marked to ensure full traceability to melt and heat treatment lot.			
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another			
Cei uncauon	quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	<ul> <li>Heat treatment condition. For tempered condition, tempering temperature shall be stated.</li> </ul>				
a The supplementary s requirements for sou		esignate a material delivered	in accordance with the MDS plus the add	litional supplementary	



# **Table A.3 — MDS IC002 / IC002S**

Material Data Sh	neet N	/IDS No. IC002 / IC	002S a / IC002SH b	Rev. 01	
TYPE OF MATERIA	L: Non-impact tested car	bon steel			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Welded pipes	ASTM A672	C60	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
	ASTM A672	C65	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
	ASTM A672	C70	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
	API 5L	В	PSL1 or PSL2	-	
	•	Page 1 o	of 2		
Scope	This MDS defines appropriately specification.	olicable options and/or re	equirements that supplement or ame	nd the referenced standard	
Metal making	API 5L Grade B PSL1	pipe steel shall be kille	d and made according to fine grain p	ractice.	
Manufacturing	_	•	made using the SAW process. s A-No.1 as per ASME <i>BPVC</i> , Sec. I	X, Table QW-442.	
Chemical	C ≤ 0.23 %, S ≤ 0.020 %, P ≤ 0.025 %, CE ≤ 0.43 %.				
composition	Microalloying element	s (Nb, V, Ti, B) shall not	be deliberately added.		
Heat treatment	For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).				
Non-destructive testing	Welded pipe to API 5L: 100 % RT of weld seam.				
Repair of defects	Weld repair of the bas	e material is not permitt	ed.		
	Repairs to weld metal are acceptable in accordance with the standard specification and shall meet the chemistry requirements of the original manufacturing weld.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
manufacturing, testing and	Chemical composition				
certification requirements)	S ≤ 0.003 %				
a, b	Ni < 1.0 % for the weld metal				
	Hardness testing     Welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 250HV.				
	<ul> <li>Production testing shall be performed on one length of pipe per lot as follows.</li> <li>Vickers hardness traverse shall be made across the base material, HAZ and weld metal at both ends of the pipe to include the centre of the pipe wall and 1.0 mm - 2.0 mm below the internal and external surfaces, with a maximum hardness of 250HV.</li> </ul>				
	HIC testing and UT examination				
	When suffix SU applies, one finished pipe per ASTM A672 S14 (lot) shall be tested as follows.				
	<ul> <li>HIC testing:</li> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> </ul>				
	<ul> <li>Acceptance criteria per specimen shall be CLR ≤ 15%, CTR ≤ 5 %, CSR ≤ 2 %.</li> </ul>				
	Maximum individual crack length shall be reported for each section.				
	UT examination:				
	ASTM A672, S11 shall apply.				
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.				



a Sheet MDS No. IC002 / IC002S a / IC002SH b			Rev. 01	
TYPE OF MATERIAL: Non-impact tested carbon steel				
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
ASTM A672	C60	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
ASTM A672	C65	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
ASTM A672	C70	Cl. 12 or Cl. 22 or Cl. 32 or Cl. 42	-	
API 5L	В	PSL1 or PSL2	-	
	Page 2 c	of 2		
The pipes shall be marked to ensure full traceability to melt and heat treatment lot.				
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
The inspection documents shall include the following information:				
<ul> <li>Heat treatment condition. For tempered condition, tempering temperature shall be stated.</li> </ul>				
	ASTM A672  ASTM A672  ASTM A672  ASTM A672  API 5L  The pipes shall be m  The material manufa quality requirements The inspection docu confirm compliance The inspection docu	L: Non-impact tested carbon steel  STANDARD  GRADE  ASTM A672  C60  ASTM A672  C70  API 5L  B  Page 2 co  The pipes shall be marked to ensure full trace  The material manufacturer shall have a quality quality requirements standard accepted by the The inspection documents shall be issued in a confirm compliance with this specification.  The inspection documents shall include the fo	L: Non-impact tested carbon steel  STANDARD  GRADE  ACCEPTANCE CLASS  ASTM A672  C60  CI. 12 or Cl. 22 or Cl. 32 or Cl. 42  ASTM A672  C65  CI. 12 or Cl. 22 or Cl. 32 or Cl. 42  ASTM A672  C70  CI. 12 or Cl. 22 or Cl. 32 or Cl. 42  API 5L  B  PSL1 or PSL2  Page 2 of 2  The pipes shall be marked to ensure full traceability to melt and heat treatment lot.  The material manufacturer shall have a quality system certified in accordance with quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 1020 confirm compliance with this specification.  The inspection documents shall include the following information:	

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# Table A.4 — MDS IC003 / IC003S / IC003SH

Material Data Sh	neet Mi	DS No. IC003 / IC00	03S a / IC003SH b	Rev. 01		
TYPE OF MATERIAL: Non-impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A234	WPB	-	ASTM A234 S3		
	ASTM A234	WPBW	-	ASTM A234 S3		
		Page 1 of	2			
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Chemical composition		Supplementary requirement ASTM A234 S3 applies with the following restrictions: $C \le 0.23 \%$ , $S \le 0.020 \%$ , $P \le 0.025 \%$ , $CE \le 0.43 \%$ .				
	Microalloying elements	s (Nb, V, Ti, B) shall not	pe deliberately added.			
Heat treatment	Normalized or normalized and tempered or quenched and tempered. For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).  All hot formed or forged fittings, including those manufactured by locally heating a portion of the fitting stock, shall be heat treated after manufacture.					
Tensile testing	specimens is not poss	Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.				
Non-destructive testing	UT is not acceptable in	UT is not acceptable in lieu of RT.				
Repair of defects	Weld repair of the base material is not permitted.					
	Repairs to weld metal are acceptable in accordance with the standard specification and shall meet the chemistry requirements of the original manufacturing weld.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a, b</sup>	<ul> <li>Chemical composition</li> <li>S ≤ 0.010 % for WPB and WPBW fittings made from products other than flat-rolled or forged</li> <li>S ≤ 0.003 % for WPBW fitting made from flat-rolled products</li> <li>S ≤ 0.020 % for WPB fitting made from forging</li> </ul>					
	Hardness testing  WPB fittings production hardness testing shall be performed in accordance with the requirements in ASTM A234.					
	<ul> <li>Hardness testing for WPBW fittings:</li> <li>Welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 250HV.</li> </ul>					
	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A234 and shall include parent material, weld and HAZ.</li> </ul>					
	HIC testing and UT examination  When suffix SH applies, one finished WPBW fitting made from flat-rolled products per lot shall be tested as follows:  HIC testing:					
	<ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> </ul>					
	Maximum individual crack length shall be reported for each section.					
	<ul> <li>UT testing of flat-rolled product before manufacture:</li> <li>ASTM A578, S1, S2.1 shall apply.</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-2 /NACE MR0175-2, section 9 and this MDS.					



Material Data Sh	Sheet MDS No. IC003 / IC003S a / IC003SH b		Rev. 01			
TYPE OF MATERIAL: Non-impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A234	WPB	-	ASTM A234 S3		
	ASTM A234	WPBW	-	ASTM A234 S3		
		Page 2 c	of 2			
Marking	The fittings shall be marked to ensure full traceability to melt and heat treatment lot.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or and quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
The inspection documents shall include the following information:  - Heat treatment condition. For tempered condition, tempering temperature shall be stated.						
				l be stated.		
		esignate a material delivered i C testing and UT examination	n accordance with the MDS plus the addi	itional supplementary		

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# **Table A.5 — MDS IC004 / IC004S**

Material Data Sheet		MDS No. IC004 / IC004S a		Rev. 01		
TYPE OF MATERIAL: Non-impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLAS	SS SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A105	-	-	ASTM A105 S2, S4		
		Page 1	of 1	•		
Scope	This MDS defines applica specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	Supplementary requirement S4 applies with the following restrictions: $C \le 0.23 \%$ , $S \le 0.020 \%$ , $P \le 0.025 \%$ , $CE \le 0.43 \%$ .					
	Microalloying elements (N	Microalloying elements (Nb, V, Ti, B) shall not be deliberately added.				
Heat treatment		Normalized or normalized and tempered or quenched and tempered.  For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).				
Non-destructive testing	Visual inspection  VT shall be carried out on each forging or bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.					
	Valve forgings NDT					
	Inspection shall be accord		•	ahall annly		
	If a QSL is not specified by the purchaser, the NDT requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitted.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	<u>Hardness testing</u>					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A105.					
requirements)	75-2, section 9 and this MDS.					
Marking	The forgings shall be marked to ensure full traceability to melt and heat treatment lot.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment conditi</li> </ul>	on. For tempered co	ondition, tempering temperature	shall be stated.		
a The supplementary so requirements for sou		te a material delivered	in accordance with the MDS plus the	additional supplementary		



### Table A.6 — MDS IC005 / IC005S / IC005SH

TYPE OF MATERIAL: Non-impact tested carbon steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Plates	ASTM A516	60	-	-			
	ASTM A516	65	-	-			
	ASTM A516	70	-	-			
	-	Page 1 of	1				
Scope	This MDS defines app specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Chemical composition	•	%, P ≤ 0.025 %, CE ≤ 0. 5 mm thick and thinner,					
	Microalloying elements	s (Nb, V, Ti, B) shall not b	oe deliberately added.				
Non-destructive testing			ance with the product standard. The				
	Valve plates NDT Inspection of plates for specified by the purcha	ording to the applicable valve speci this MDS shall apply.	fication. If a QSL is not				
Repair of defects	Weld repair is not pern	Weld repair is not permitted.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
manufacturing, testing and certification requirements) <sup>a, b</sup>	<u>Chemical composition</u> S ≤ 0.003 %						
. • <b></b>	Hardness testing Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity at each location						
	HIC testing and UT examination When suffix SH applies, one plate per lot shall be tested as follows.						
	HIC testing:     HIC testing in accordance with NACE TM0284, using Test Solution A.						
	<ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> </ul>						
	Maximum individual crack length shall be reported for each section.						
	- UT examination:						
	ASTM A578, S1, S2.1 shall apply.						
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.						
Marking	The plates shall be ma	The plates shall be marked to ensure full traceability to melt and heat treatment lot.					
Certification	quality requirements st	andard accepted by the	•				
	confirm compliance with	th this specification.	ecordance with ISO 10474 /EN 1020	04 Type 3.1 and shall			
	· ·	ents shall include the following	· ·	he stated			
		·	ndition, tempering temperature shall accordance with the MDS plus the addi				

<sup>&</sup>lt;sup>a</sup> The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# **Table A.7 — MDS IC006 / IC006S**

Material Data Sh	neet	MDS No. IC006	/ IC006S a	Rev. 02		
TYPE OF MATERIAL	L: Non-impact tested ca	rbon steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A216	WCB	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		
	ASTM A216	WCC	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		
		Page 1 of	4			
Scope	This MDS defines ap specification.	plicable options and/or rec	quirements that supplement or ame	nd the referenced standard		
	For steel castings produced by the investment casting process, the requirements of ASTM A988 MDS shall apply.					
Chemical composition	Supplementary requirements ASTM A216 S50 and S52 apply with the following restrictions: $C \le 0.23 \%$ , $S \le 0.020 \%$ , $P \le 0.025 \%$ , $CE \le 0.43 \%$ .					
	Microalloying elements (Nb, V, Ti, B) shall not be deliberately added.					
Heat treatment	For products delivered (1 148 °F).	For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).				
Extent of testing	ASTM A703 S14 or A	ASTM A985 S14 shall appl	y.			
Test sampling	For castings with weight 250 kg (551 lb) 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. Thickness of the test block shall be equal to the thickest part of the casting represented up to a maximum thickness of 100 mm (4 in). For flanged components, the largest flange thickness is the ruling section. 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.					
		T or min.				
	T/2 x  T/4 T/4  T/4  T/4  T/4  T/4  T/4  T/4					
			according to ASTM A985. Test bloc ncluding any post weld stress relie			



Material Data Sheet		MDS No. IC00	6 / IC006S a	Rev. 02		
TYPE OF MATERIAL: Non-impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A216	WCB	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		
	ASTM A216	wcc	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		

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# Non-destructive testing

### Visual inspection

NDE requirement	Pilot casting (section 4.8)	Production casting		
Frequency	Each pilot casting Each production casting			
Method	ANSI/MSS SP-55			
Extent	100 % of all accessible surfaces including welding ends			
Acceptance criteria ANSI/MSS SP-55				
NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to				

### Magnetic particle testing

ASTM A216 supplementary requirement S4 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>				
Frequency <sup>b</sup>	100 %					
Method	ASME BPVC, Sec. V, Article 7					
Extent <sup>c</sup>	100 %					
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7					
NOTE. The destinate bullet a social and offer an addition of a solicable. Note and bullet a described and addition to						

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- Production valve casting, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Frequency of inspection 100 % means that each item shall be examined.
- <sup>c</sup> All accessible internal and external surfaces shall be examined.



Material Data Sheet		MDS No. IC006 / IC006S <sup>a</sup> Rev. 02								
TYPE OF MATERIAL	L: Non-impact tested carb	oon steel								
PRODUCT FORM	STANDARD	GRADE		A	ACCEPT	ANCE CI	.ASS	SUPPLEN REQUIRE		
Castings	ASTM A216	WCB			S52 AS' S20 AS'			S52 ASTM A70 S20	ASTM A703 S12, S14, S20 ASTM A985 S12, S14,	
	ASTM A216	wcc			-			S52 ASTM A70 S20	16 S4, S5, S50 03 S12, S14, 85 S12, S14,	
		Pa	age 3 of 4	ļ						
Non-destructive	Radiographic testing									
testing (continued)	ASTM A216 suppleme	ntary requiremer	nt S5 shal	l apply a	s amend	ed by this	MDS.			
	NDE requirement	Pilot casting			Р	roductio	n castin	g		
		(section 4.8)			Valve o	astings	a		Other pressure containing castings <sup>b</sup>	
	Frequency °	Frequency <sup>c</sup> 100 %			Pressure class			100 %		
			NPS	DN	< 200	600	1	_		
			. 2	< 50	≤ 300	N/R	900 N/D	≥ 1500		
			< 2 ≥ 2	≥ 50	N/R N/R	5 %	N/R 5 %	N/R 5 %		
			≥ 6	≥ 150	N/R	5 %	5 %	100 %		
			≥ 10	≥ 150	5 %	5 %	5 %	100 %		
			≥ 16	≥ 400	5 %	5 %	100 %	100 %		
			≥ 10	≥ 500	5 %	100 %	100 %	100 %		
	Method			ASME	BPVC	Sec. V, A	rticle 2			
	Extent	Areas define changes in sec		E B16.3 I at the ju	4 for spe	cial class	valves,		100 % <sup>d</sup>	
	Acceptance criteria		AS	ME <i>BPV</i>	C, Sec. V	'III, Div. 1	, Append	dix 7		
	NOTE N/R means not r	equired, unless spe	ecified othe	rwise by t	he purcha	ser.				
	Production valve cass purchaser, the requir     Production casting of Frequency of inspect a minimum of one ite	ements in this table her than valve cast ion 100 % means t	shall appling.	y. em shall b	e examine	d. When r	andom ex	·	·	
	d Production casting ot order and/or applicab agreed with the purch	her than valve cast le product specifica	ing, inspec	tion shall	include otl	ner critical	areas as			
Repair of defects	ASTM A703 or ASTM additional requirements	s:					·			
	<ul><li>Repairs as describe be documented in a</li><li>The repair welding</li></ul>	accordance with	ASTM A7	03 or AS	STM A98	5 S20.2.				
	data sheet using a  - Weld repairs are no	cast plate.						11.130 110	2	
	<ul> <li>Examination of maj</li> </ul>	jor repair welds c	n pressu	re contai	ning part	s shall als	so includ	e RT.		



<b>Material Data Sh</b>	neet	MDS No. IC006	5 / IC006S a	Rev. 02		
TYPE OF MATERIA	L: Non-impact tested ca	arbon steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A216	WCB	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		
	ASTM A216	WCC	-	ASTM A216 S4, S5, S50, S52 ASTM A703 S12, S14, S20 ASTM A985 S12, S14, S20		
	<u> </u>	Page 4 of	4			
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements)	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness shall be 22HRC from three readings taken in close proximity.</li> </ul>					
	<ul> <li>Welding procedure qualification testing for all repair welding shall meet the requirements of ISO 15156-2/NACE MR0175-2, section 7.3.3, using Vickers method, with a maximum hardness of 250HV.</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.					
Marking	The castings shall b	e marked to ensure full trad	ceability to melt and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	•	The inspection documents shall include the following information:				
	<ul> <li>Heat treatment condition. For tempered condition, tempering temperature shall be stated.</li> </ul>					



# **Table A.8 — MDS IC007 / IC007S**

Material Data Sh	neet	MDS No. IC007 / IC0	007S a	Rev. 01		
TYPE OF MATERIAL	L: Non-impact tested carbon	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A696	В	-	-		
	ASTM A696	С	-	-		
	ASTM A105	-	-	-		
	-	Page 1 of 2	•			
Scope	specification. This MDS includes addition	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  This MDS includes additional requirements for valve parts DN 100 (NPS 4) and under manufactured from bars, when permitted by the valve specification.				
Manufacturing	hot rolled bars manufaction (10 in).	in ASTM A788 and certific ctured to ASTM A696 Grad				
Chemical composition	C ≤ 0.23 %, S ≤ 0.020 %, I	-				
Heat treatment		and tempered or quenched	d and tempered. For products	delivered in the tempered		
Test sampling	<ul> <li>Valve parts manufactured from bar</li> <li>Sampling of test specimens for bars intended for machining of valve parts shall comply with the following additional requirements:         <ul> <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 (4 in), 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 100 mm (4 in) from the end of the bar.</li> <li>For bar with outside diameter &lt; 100 mm (4 in): tensile test in accordance with the standard.</li> <li>For bar with outside diameter ≥ 100 mm (4 in): in addition to the standard requirement, one tensile test specimen shall be taken in tangential direction of the bar. The specified minimum tensile strength properties of the referenced standard shall be met in both directions.</li> </ul> </li> </ul>					
Non-destructive testing	Visual inspection  VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  NDT of valve parts manufactured from bar  Inspection shall be according to the applicable valve specification.  If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitte	d.				
Sour service (additional metallurgical, manufacturing, testing and certification	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Chemical composition S ≤ 0.020 %, Ni < 1.0 %					
requirements) <sup>a</sup>	Hardness testing Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the end surface of one bar per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	i ne materiai snali be trace	able in accordance with IS	O 15156-2/NACE MR0175-2	, section 9 and this MDS.		



Material Data Sheet		MDS No. IC00	MDS No. IC007 / IC007S a				
TYPE OF MATERIAL: Non-impact tested carbon steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A696	В	-	-			
	ASTM A696	С	-	-			
	ASTM A105	-	-	-			
	•	Page 2 c	of 2	•			
Marking	The bars shall be m	arked to ensure full tracea	bility to melt and heat treatment lot.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:							
						- Heat treatment of	condition. For tempered co
a The supplementary s requirements for sou		designate a material delivered	in accordance with the MDS plus the add	ditional supplementary			



# Table A.9 — MDS IC101 / IC101S

Material Data Sheet		MDS No. IC101	/ IC101S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	.: Impact tested carbon	n steel				
PRODUCT FORM	STANDARD	GRADE	SUPPLEMENTARY REQUIREMENT			
Seamless pipes	ASTM A333	6	-	-		
		Page 1 of	f 1			
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical	C ≤ 0.23 %, S ≤ 0.02	20 %, P ≤ 0.025 %, CE ≤ 0	.43 %.			
composition	Microalloying elemen	nts (Nb, V, Ti, B) shall not	be deliberately added.			
Heat treatment	each pipe including	any quenching operation.	be placed in such a way as to ensu			
Impact testing / toughness testing	Impact testing is required for thickness ≥ 6 mm (0.236 in); for pipes with a weld end, the weld end thickness shall govern.  The test temperature shall be minus 46 °C (-50 °F).  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.					
Repair of defects	Weld repair is not pe	ermitted.				
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
testing and certification	<u>Chemical composition</u> S ≤ 0.010 %					
requirements) <sup>a</sup>	Hardness testing					
	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be	e traceable in accordance	with ISO 15156-2/NACE MR0175-2	2, section 9 and this MDS.		
Marking	The pipes shall be m	narked to ensure full tracea	ability to melt and heat treatment lot			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
		The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:					
			ndition, tempering temperature shal			



# Table A.10 — MDS IC102 / IC102S / IC102SH

Material Data Sh	ieet N	IDS No. IC102 / IC	102S a / IC102SH b	Rev. 01		
TYPE OF MATERIAL	.: Impact tested carbon	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A671	CC60	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	ASTM A671	CC65	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	ASTM A671	CC70	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	- 1	Page 1	of 2			
Scope	This MDS defines ap specification.	plicable options and/or r	equirements that supplement or ame	end the referenced standard		
Manufacturing	-	=	ade using the SAW process. -No.1 per ASME <i>BPVC</i> , Sec. IX, Tab	le QW-442.		
Chemical	C ≤ 0.23 %, S ≤ 0.02	0 %, P ≤ 0.025 %, CE ≤	0.43 %.			
composition	Microalloying elemen	nts (Nb, V, Ti, B) shall no	t be deliberately added.			
Heat treatment	During the heat treat each pipe including a	During the heat treatment process, pipes shall be placed in such a way as to ensure free circulation around each pipe including any quenching operation.				
Impact testing / toughness testing	Impact testing is required for thickness ≥ 6 mm (0.236 in); for pipes with a weld end, the weld end thickness shall govern.					
	The test temperature shall be minus 46 °C (-50 °F).  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 single.					
Extent of testing	For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).  Impact testing per ASTM A671 supplementary requirement S2, as modified by this MDS, shall also be carried					
			rement S14 shall apply for lot definition			
Non-destructive testing	ASTM A671 supplen	nentary requirement S7 s	shall apply.			
Repair of defects	Weld repair of the ba	se material is not permit	ted.			
		al are acceptable in acconts of the original manufa	rdance with the standard specificatio acturing weld.	n and shall meet the		
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Chemical composition					
certification requirements) <sup>a, b</sup>	S ≤ 0.003 %					
4	Ni < 1.0 % for the weld metal					
		NACE MR0175-2/ISO 15	r manufacturing and any repair weldi 156-2, section 7.3.3, using Vickers m			
	<ul> <li>Production testin</li> <li>Vickers hardness</li> <li>the pipe to include</li> </ul>	g shall be performed on a traverse shall be made	one length of pipe per lot as follows. across the base material, HAZ and w wall and 1,0 mm - 2,0 mm (0.04 in - 0 ardness of 250 HV.			



Material Data Sh	neet M	MDS No. IC102 / IC1	02S a / IC102SH b	Rev. 01		
TYPE OF MATERIAL: Impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A671	CC60	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	ASTM A671	CC65	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	ASTM A671	CC70	Cl. 12 Cl. 22 or Cl. 32 or Cl.42	ASTM A671 S2, S7, S14		
	1	Page 2 c	of 2	-		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a, b (continued)	<ul> <li>HIC testing and UT examination</li> <li>When suffix SH applies, one finished pipe per ASTM A671 S14 (lot) shall be tested as follows.</li> <li>HIC testing: <ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT examination: <ul> <li>ASTM A671, S11 shall apply.</li> </ul> </li> <li>The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.</li> </ul> </li> </ul>					
Marking	The pipes shall be m	The pipes shall be marked to ensure full traceability to melt and heat treatment lot.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment condition. For tempered condition, tempering temperature shall be stated.					

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# Table A.11 — MDS IC103 / IC103S / IC103SH

Material Data Sh	neet MDS	No. IC103 / IC10	3S a / IC103SH b	Rev. 01			
TYPE OF MATERIA	L: Impact tested carbon steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Wrought fittings	ASTM A420	WPL6	-	ASTM A960 S51, S53, S57, S69			
	ASTM A420	WPL6W	-	ASTM A960 S51, S53, S57, S69			
		Page 1 of 2	2				
Scope	This MDS defines applicate specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Chemical composition	C ≤ 0.23 %, S ≤ 0.020 %,	C ≤ 0.23 %, S ≤ 0.020 %, P ≤ 0.025 %, CE ≤ 0.43 %.					
composition	Microalloying elements (Nb, V, Ti, B) shall not be deliberately added.						
Heat treatment	During the heat treatment process, fittings shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.						
	All hot formed or forged fit shall be heat treated after		manufactured by locally heating a	portion of the fitting stock,			
	For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).						
Tensile testing	ASTM A960 supplementary requirement S51 shall apply as amended by this MDS. Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.						
Impact testing / toughness testing	Impact testing is required for thickness ≥ 6 mm (0.236 in); for fittings with a weld end, the weld end thickness shall govern.						
	The test temperature shall be minus 46 °C (-50 °F).						
	The minimum absorbed er single.	nergy for full size spec	imens shall be 27 J (20 ft lbf) ave	rage and 20 J (15 ft lbf)			
Hardness testing		ninimum two fittings, ir	all apply with the following require cluding parent material, weld and				
Extent of testing	Impact testing shall also b	e carried out for each	heat and heat treatment load.				
Non-destructive	UT is not acceptable in lie	u of RT.					
testing	Magnetic particle testing						
	ASTM A960 supplementar	ry requirement S53 an	d S69 shall apply as amended by	this MDS.			
	NDE requirement		Nominal thickness				
		< 12.7 m	m (½ in) ≥	: 12.7 mm (½ in)			
	Frequency <sup>a</sup>	10	%	100 %			
	Method		ASME BPVC, Sec. V, Article	e 7			
	Extent <sup>b</sup>		100 %				
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 6						
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.						
	<ul> <li>Frequency of inspection 100 % means that each item shall be examined. When random examination (10 %) is specified, a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>						
Repair of defects	Weld repair of the base managements to weld metal are chemistry requirements of	acceptable in accorda	nce with the standard specification	on and shall meet the			



Material Data Sh	neet M	MDS No. IC103 / IC10	03S a / IC103SH b	Rev. 0			
TYPE OF MATERIAL: Impact tested carbon steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Wrought fittings	ASTM A420	WPL6	-	ASTM A960 S51, S53, S57, S69			
	ASTM A420	WPL6W	-	ASTM A960 S51, S53, S57, S69			
		Page 2 of	2	1			
Sour service (additional metallurgical,		15156/NACE MR0175 or I	by the purchaser, the material shall SO 17945/NACE MR0103, and the				
manufacturing, testing and	Chemical composition	on					
certification		<ul> <li>S ≤ 0.010 % for WPL6 and WPL6W fittings made from products other than flat-rolled or forged</li> </ul>					
requirements) <sup>a, b</sup>	<ul> <li>S ≤ 0.003 % for WPL6W fitting made from flat-rolled products</li> </ul>						
	<ul> <li>S ≤ 0.020 % for WPL6 fitting made from forging or hot rolled/wrought bar</li> </ul>						
	<ul> <li>Ni &lt; 1.0 % for the weld metal of WPL6W fittings</li> </ul>						
	<u>Hardness testing</u>						
	For WPL6W fittings, in addition to the hardness testing requirement in the MDS, welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 250HV.						
	HIC testing and UT examination						
	When suffix SH applies, one finished WPL6W fitting made from flat-rolled products per lot shall be tested as follows.						
	<ul> <li>HIC testing:</li> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> </ul>						
	<ul> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> </ul>						
	<ul> <li>Maximum individual crack length shall be reported for each section.</li> </ul>						
	UT examination of flat-rolled product before manufacture:						
	ASTM A578 S1, S2.1 shall apply.						
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.						
Marking	The fittings shall be	marked to ensure full trace	ability to melt and heat treatment lo	t.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	·	ments shall include the follo	<u> </u>				
	<ul> <li>Heat treatment c</li> </ul>	ondition. For tempered con	ndition, tempering temperature shall	be stated.			

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# Table A.12 — MDS IC104 / IC104S

Material Data Sheet		MDS No. IC104	/ IC104S a	Rev. 01	
TYPE OF MATERIAL	.: Impact tested carbon steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A350	LF2	Class 1	ASTM A350 S6 ASTM A961 S55	
	ASTM A350	LF6	Class 1 or 2	ASTM A350 S6 ASTM A961 S55	
		Page 1 of	2		
Scope	This MDS defines applical specification.	ole options and/or red	quirements that supplement or ame	nd the referenced standard	
Chemical composition	Supplementary requirement ASTM A350 S6 applies with the following restrictions: $C \le 0.23 \text{ %, } S \le 0.020 \text{ %, } P \le 0.025 \text{ %, } CE \le 0.43 \text{ %.}$				
	LF2 forgings: microalloying	g elements (Nb, V, Ti	, B) shall not be deliberately added	•	
Heat treatment		quenching operation	all be placed in such a way as to en. For products delivered in the tem C (1 148 °F).		
Impact testing / toughness testing	Impact testing is required for thickness ≥ 6 mm (0.236 in); for forgings with a weld end, the weld end thickness shall govern.  The test temperature shall be minus 46 °C (-50 °F) for grade LF2 and minus 51 °C (-60 °F) for grade LF6.  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.				
Extent of testing	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 2 000 kg (4 400 lb) for forgings with as forged weight up to 50 kg (110 lb), and 5 000 kg (11 000 lb) for forgings with as forged weight > 50 kg (110 lb).				
Non-destructive testing			rdance with the product standard. T on-machined surfaces shall be clea		
	Magnetic particle testing				
	ASTM A961 supplementar	ry requirement S55 s	hall apply as amended by this MDS	i.	
	NDE requirement		Forgings		
	Frequency <sup>a</sup>	10 %			
	Method		ASME BPVC, Sec. V, Article	:7	
	Extent <sup>b</sup>		100 %		
	Acceptance criteria		ASME BPVC, Sec. VIII, Div. 1, App		
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.  a For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.  b All accessible internal and external surfaces shall be examined.				
	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.				
Repair of defects	Weld repair is not permitte	ed.			
Sour service (additional metallurgical, manufacturing,			by the purchaser, the material shall SO 17945/NACE MR0103, and the		
testing and certification requirements) a	Hardness testing Production hardness testing	ng shall be performed	I in accordance with the requiremer	nts in ASTM A350.	
<i>4.</i>	The material shall be trace	eable in accordance v	vith ISO 15156-2/NACE MR0175-2	, section 9 and this MDS.	



Material Data Sheet		MDS No. IC10	MDS No. IC104 / IC104S <sup>a</sup>				
TYPE OF MATERIAL: Impact tested carbon steel							
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT					
Forgings	ASTM A350	LF2	Class 1	ASTM A350 S6 ASTM A961 S55			
	ASTM A350	LF6	Class 1 or 2	ASTM A350 S6 ASTM A961 S55			
		Page 2 c	of 2				
Marking	The forgings shall b	e marked to ensure full tra	ceability to melt and heat treatment	lot.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or anoth quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and sh confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	<ul> <li>Heat treatment of</li> </ul>	condition. For tempered co	ndition, tempering temperature shall	l be stated.			
a The supplementary s		designate a material delivered	in accordance with the MDS plus the add	ditional supplementary			



# Table A.13 — MDS IC105 / IC105S / IC105SH

Material Data Sh	eet MD	S No. IC105 / IC10	5S a / IC105SH b	Rev. 01			
TYPE OF MATERIAL	.: Impact tested carbon s	teel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Plates	ASTM A516	60	-	ASTM A516 S5			
	ASTM A516	65	-	ASTM A516 S5			
	ASTM A516	70	-	ASTM A516 S5			
		Page 1 o	f 2				
Scope	This MDS defines app specification.	licable options and/or re	equirements that supplement or ame	nd the referenced standard			
Chemical composition	*	C ≤ 0.23 %, S ≤ 0.020 %, P ≤ 0.025 %, CE ≤ 0.43 %. For Grade 60 plate 12,5 mm (½ in) thick and thinner, C ≤ 0.21 %.					
	Microalloying elements	s (Nb, V, Ti, B) shall not	be deliberately added.				
Heat treatment		ent process, componen uding any quenching op	ts shall be placed in such a way as t eration.	o ensure free circulation			
Impact testing / toughness testing	The minimum absorbe single.	Impact testing is required for thickness ≥ 6 mm (0.236 in). The test temperature shall be minus 46 °C (-50 °F). The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.  The test specimen shall be taken in the longitudinal orientation to the final direction of rolling.					
Non-destructive testing	Visual inspection  VT shall be carried out on each plate in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  Valve plates NDT  Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.						
Repair of defects	Weld repair is not perr	nitted.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
manufacturing, testing and certification requirements) a, b	<u>Chemical composition</u> S ≤ 0.003 %						
requirements	Hardness testing Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity at each location.						
	<ul> <li>HIC testing:</li> <li>HIC testing in a</li> <li>Acceptance crit</li> <li>Maximum individed</li> <li>UT examination:</li> </ul>	s, one plate per lot shall ccordance with NACE T eria per specimen shall	be tested as follows.  M0284, using Test Solution A. be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ be reported for each section.	2 %.			
	The material shall be t	raceable in accordance	with ISO 15156-2/NACE MR0175-2	, section 9 and this MDS.			
Marking	The plates shall be ma	irked to ensure full trace	eability to melt and heat treatment lo	i.			



Material Data Sheet		IDS No. IC105 / IC10	Rev. 01				
TYPE OF MATERIAL: Impact tested carbon steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Plates	ASTM A516	60	-	ASTM A516 S5			
	ASTM A516	65	-	ASTM A516 S5			
	ASTM A516	70	-	ASTM A516 S5			
	•	Page 2 c	f 2				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or anothe quality requirements standard accepted by the purchaser.						
	•	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:						
	<ul> <li>Heat treatment</li> </ul>	condition. For tempered co	ndition, tempering temperature shall	be stated.			

requirementary surfix 'S shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service, but excluding HIC testing and UT examination.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.



# Table A.14 — MDS IC106 / IC106S

Material Data Sheet		MDS No. IC106 /	IC106S a	Rev. 02				
TYPE OF MATERIAL	:: Impact tested carbon stee	el						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	S SUPPLEMENTARY REQUIREMENT				
Castings	ASTM A352	LCC	-	ASTM A352 S4, S5, S52 ASTM A703 S8, S14, S20				
		Page 1 of 3						
Scope	This MDS defines applica specification.	his MDS defines applicable options and/or requirements that supplement or amend the referenced standard pecification.						
Chemical composition	Supplementary requirementary c ≤ 0.23 %, S ≤ 0.020 %,	• •	•					
	Microalloying elements (N	Nb, V, Ti, B) shall not be	deliberately added.					
Heat treatment	each casting including po	During the heat treatment process, castings shall be placed in such a way as to ensure free circulation around each casting including possible quenching operation.  For products delivered in the tempered condition, the minimum tempering temperature shall be 620 °C (1 148 °F).						
Impact testing / toughness testing		ASTM A703 supplementary requirement S8 shall apply. Impact testing shall be performed at a minimum temperature of -46 °C (-50 °F). Acceptance criteria shall be 27 J (20 ft lbf) average, 20 J (15 ft lbf) single.						
Extent of testing	ASTM A703 supplementa	ary requirement S14 sha	ıll apply.					
Test sampling	heat treatment operations. Thickness of the test block thickness of 100 mm (4 in Dimensions of test blocks for integral and gated test from end of test speciments.)	grally cast or gated onto the casting and shall accompany the castings through all sincluding any post weld stress relieving.  ck shall be equal to the thickest part of the casting represented up to a maximum n). For flanged components, the largest flange thickness is the ruling section. It is and location of test specimens within the test blocks are shown in the figure below at block. The test specimens shall be taken within the cross hatched area. Distance n to end of test block shall minimum be T/4.  To min.  To min.						
Non-destructive testing	<u>Visual inspection</u>							
	NDE requirement	Pilot casting (		Production casting				
	Frequency	Each pilot		ach production casting				
	Method		ANSI/MSS SP-55					
	Extent	100 % o	f all accessible surfaces includ	ing welding ends				
	Acceptance criteria		ANSI/MSS SP-55					
	NOTE the testing shall be testing.	carried out after machining	, if applicable. Non-machined surfa	ces shall be cleaned prior to the				



Material Data Sheet		MDS No. IC10	MDS No. IC106 / IC106S <sup>a</sup>		
TYPE OF MATERIAL: Impact tested carbon steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A352	LCC	-	ASTM A352 S4, S5, S52 ASTM A703 S8, S14, S20	
	1	Page 2 d	of 3		

# Non-destructive testing (continued)

#### Magnetic particle testing

ASTM A352 supplementary requirement S4 shall apply as amended by this MDS.

Pilot casting (section 4.8) Production casting <sup>a</sup>				
100 %				
ASME BPVC, Sec. V, Article 7				
100 %				
ASME BPVC, Sec. VIII, Div. 1, Appendix 7				
	100 ASME <i>BPVC</i> , S 100			

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- <sup>a</sup> Production valve castings, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Frequency of inspection 100 % means that each item shall be examined.
- <sup>c</sup> All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A352 supplementary requirement S5 shall apply as amended by this MDS.

NDE requirement	Pilot casting	Production casting						
	(section 4.8)	valve castings a Otropress conta castin				Other pressure containing castings <sup>b</sup>		
Frequency <sup>c</sup>	100 %	NPS	DN		Pressu	re class		100 %
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method	ASME <i>BPVC</i> , Sec. V, Article 2							
Extent	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							
Acceptance criteria		ASM	E BPVC	, Sec. VI	II, Div. 1,	Append	ix 7	

 $\label{eq:NOTE_NOTE_NOTE} \mbox{NOTE means not required, unless specified otherwise by the purchaser.}$ 

- <sup>a</sup> Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



<b>Material Data Sh</b>	neet	MDS No. IC106	MDS No. IC106 / IC106S a Rev. 02			
TYPE OF MATERIAL	L: Impact tested carbon	steel				
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT				
Castings	ASTM A352	LCC	-	ASTM A352 S4, S5, S52 ASTM A703 S8, S14, S20		
	•	Page 3 of	3			
Repair of defects	<ul> <li>ASTM A703 supplementary requirement S20 shall apply with the following additional requirements:</li> <li>Repairs as described in ASTM A352, sections 9.3 and 9.4 shall be considered major repairs and shall be documented in accordance with ASTM A703 S20.2.</li> <li>The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this data sheet using a cast plate.</li> <li>Weld repairs are not acceptable for castings that leak during pressure testing.</li> <li>Examination of major repair welds on pressure containing parts shall also include RT.</li> </ul>					
Sour service (additional metallurgical, manufacturing, testing and certification	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  — Production hardness testing shall be performed in accordance with the requirements in					
ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hard be 22HRC from three readings taken in close proximity.  Welding procedure qualification testing for all repair welding shall meet the requirements of NACE MR0175 2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardner.  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and						
Marking	The castings shall be	marked to ensure full trace	eability to melt and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall					
	confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment condition. For tempered condition, tempering temperature shall be stated.					
The supplementary s requirements for sou		signate a material delivered in	accordance with the MDS plus the add	ditional supplementary		



# Table A.15 — MDS IC107 / IC107S

Material Data Sheet		MDS No. IC10	07 / IC107S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	: Impact tested carbon	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A696	В	-	ASTM A696 S5		
	ASTM A696	С	-	ASTM A696 S5		
	ASTM A350	LF2	Class 1			
	ASTM A350	LF6	Class 1 or 2			
		Page 1	of 2			
Scope	specification. This MDS includes ac	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  This MDS includes additional requirements for valve parts DN 100 (NPS 4) and under manufactured from bars, when permitted by the valve specification.				
Manufacturing	<ul><li>bar forgings as de</li><li>hot rolled bars ma (10 in).</li></ul>	NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold				
Chemical	C ≤ 0.23 %, S ≤ 0.020 %, P ≤ 0.025 %, CE ≤ 0.43 %.					
composition	Except for ASTM A350 LF6 bars, microalloying elements (Nb, V, Ti, B) shall not be deliberately added.					
Heat treatment	For products delivered (1 148 °F).	During the heat treatment process, bars shall be placed in such a way as to ensure free circulation around				
Impact testing / toughness testing		ired for thickness ≥ 6 m	m (0.236 in); for bars with a weld en	d, the weld end		
	The test temperature shall be minus 46 °C (-50 °F).					
	The minimum absorb single.	ed energy for full size sp	pecimens shall be 27 J (20 ft lbf) ave	rage and 21 J (15 ft lbf)		
Test sampling	Valve parts manufact	ured from bar				
	Sampling of test specimens for bars intended for machining of valve parts shall comply with the following requirements:					
	<ul> <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 (4 in), 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> </ul>					
	<ul> <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 100 mm (4 in) from the end of the bar.</li> </ul>					
			all be located perpendicular to the ba			
	<ul> <li>For bar with outside taken.</li> </ul>	de diameter < 100 mm (	4 in): one tensile and one set impact	test specimens shall be		
	<ul> <li>For bar with outside diameter ≥ 100 mm (4 in): one tensile and set impact test specimens shall be taken in axial direction of the bar. 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 100 mm (4 in) from the end of the bar.</li> </ul>					
		mum tensile strength of e met in both directions.	the referenced standard and impac	t energies specified in this		



Material Data Sh	neet	MDS No. IC10	7 / IC107S a	Rev. 01		
TYPE OF MATERIA	L: Impact tested carbon st	eel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A696	В	-	ASTM A696 S5		
	ASTM A696	С	-	ASTM A696 S5		
	ASTM A350	LF2	Class 1			
	ASTM A350	LF6	Class 1 or 2			
	•	Page 2 o	of 2			
Non-destructive	Visual inspection					
testing	VT shall be carried out on each bar in accordance with the product standard. The testing shall be after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.					
	NDT of valve parts mai	nufactured from bar				
	Inspection shall be acc	ording to the applicable	e valve specification.			
	If a QSL is not specified particle testing according		requirements in this MDS shall appl e.	y including magnetic		
	NDE requirement		Part manufactured from ba	ar		
	Frequency <sup>a</sup>	10 %				
	Method	ASME BPVC, Sec. V, Article 7				
	Extent <sup>b</sup>	100 %				
	Acceptance criteria	ia ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 6				
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.					
	shall be as defined fo		one item per lot in any purchase order shall be examined.	all be examined. The test lot		
Repair of defects	Weld repair is not perm	nitted.				
Sour service (additional metallurgical,		5156/NACE MR0175 or	by the purchaser, the material shall ISO 17945/NACE MR0103, and the			
manufacturing, testing and	Chemical composition					
certification requirements) a	S ≤ 0.020 %, Ni < 1.0 %	6				
requirements)	Hardness testing					
	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the end surface of one bar per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be tr	aceable in accordance	with ISO 15156-2/NACE MR0175-2	, section 9 and this MDS.		
Marking	The bars shall be mark	ed to ensure full tracea	bility to melt and heat treatment lot.			
Certification	The material manufactu		system certified in accordance with purchaser.	ISO 9001 or another		
	The inspection docume confirm compliance wit		accordance with ISO 10474 /EN 1020	04 Type 3.1 and shall		
	The inspection docume		· ·	Uh a sakada d		
			ndition, tempering temperature shall			
a The supplementary s requirements for sou		gnate a material delivered	in accordance with the MDS plus the add	litional supplementary		



# Table A.16 — MDS ID141 / ID141S

Material Data Sh	eet	MDS No. ID141 / ID1	41S <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	.: Ferritic-Austenitic stainless	steel type 22Cr duplex		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Seamless pipes	ASTM A790	UNS S31803	-	-
	ASTM A790	UNS S32205	-	-
	T	Page 1 of 1		
Scope	This MDS defines applicate specification.	ole options and/or requirem	ents that supplement or ame	nd the referenced standard
Qualification			e qualified in accordance wit the requirements of this MDS	
Metal making	The melt shall be refined b	y AOD or equivalent metho	od.	
Chemical composition	UNS S31803: N = 0.14 %	- 0.20 %.		
Heat treatment	Pipes shall be placed in su	n annealed followed by rapid such a way as to ensure free nent process including quer	circulation of heating and co	oling media around each
Impact testing / toughness testing	The sampling of test speci ISO 17781 QL II.	mens, testing methodology	and acceptance criteria shal	I comply with
Hardness testing	Hardness testing shall be p	performed by the Rockwell	C method.	
Corrosion testing	The sampling of test speci ISO 17781.	mens, testing methodology	and acceptance criteria shal	I be in accordance with
Micrographic examination		mens, testing methodology ents shall be in accordance	and acceptance criteria for rewith ISO 17781.	nicrostructural examination
Extent of testing		pact tests, one corrosion tes rried out for each heat and	st and one micrographic exar heat treatment lot.	nination including ferrite
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.			
testing and	Hardness testing			
certification requirements) <sup>a</sup>			cordance with the requiremer all be 28HRC from three rea	
	The material shall be trace	able in accordance with IS	O 15156-3/NACE MR0175-3	, section 7.2 and this MDS.
Surface treatment and finish	Finished pipes shall be pic	kled or bright annealed.		
Marking	The pipes shall be marked	to ensure full traceability to	heat and heat treatment lot	•
Certification		shall have a quality systen ard accepted by the purcha	n certified in accordance with	ISO 9001 or another
	The inspection documents confirm compliance with the		nce with ISO 10474 /EN 1020	04 Type 3.1 and shall
	· ·	shall include the following		
		or the MCPR/QTR number	used.	
	Steel manufacturer.  Solution appealing tom	novotuvo halalina (lasa a l	augnobing	ototod (holdin mitim - '-
		perature, holding time and produced hot finished and	quenching medium shall be direct quenched).	stated (notaing time is
The supplementary serequirements for sour	uffix "S" shall be used to designate service.	te a material delivered in accord	dance with the MDS plus the add	litional supplementary



# Table A.17 — MDS ID142 / ID142S

Material Data Sh	neet	MDS No. ID142 / ID142S a				
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	steel type 22Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A928	UNS S31803	Class 1, 3, 4 and 5	ASTM A928 S3, S4		
	ASTM A928	UNS S32205	Class 1, 3, 4 and 5	ASTM A928 S3, S4		
	Page 1 of 2					
Scope	This MDS defines applicate specification.	ole options and/or require	ements that supplement or ame	nd the referenced standard		
Qualification			I be qualified in accordance wit et the requirements of this MDS			
Metal making	The melt shall be refined b	y AOD or equivalent me	thod.			
Chemical composition	UNS S31803: N = 0.14 %	- 0.20 %				
Welding	examinations as for the pro-	oduction testing and fulfi same material grade (U	ME BPVC, Sec. IX or ISO 1561 the acceptance criteria of ISO NS number) as used in product require requalification.	17781. The qualification		
Heat treatment	The pipes shall be solution Pipes shall be placed in su pipe during the heat treatm	ıch a way as to ensure fı	ee circulation of heating and co	ooling media around each		
Impact testing / toughness testing	The sampling of test speci ISO 17781 QL II.	mens, testing methodolo	gy and acceptance criteria sha	Il comply with		
Corrosion testing	The sampling of test speci ISO 17781.	mens, testing methodolo	gy and acceptance criteria sha	Il be in accordance with		
Micrographic examination	Supplementary requirementary require	mens, testing methodolo	gy and acceptance criteria for r	microstructural examination		
Extent of testing	One tensile, one set of imp		test and one micrographic exar d heat treatment lot.	mination including ferrite		
	same heat, same processi	ng conditions including v	ot exceeding the lot definition in weld procedure and same heat with the product standards.			
Non-destructive testing	Liquid penetrant testing ASTM A928 supplementar	y requirement S3 shall a	pply as amended by this MDS.			
	NDE requirement		Welded pipe			
	Frequency <sup>a</sup>		10 %			
	Method		ASME BPVC, Sec. V, Article	6		
	Extent <sup>b</sup>		100 %			
	Acceptance criteria	AS	ME BPVC, Sec. VIII, Div. 1, App	pendix 8		
	NOTE The testing shall be carried out after any calibration, pickling/bright annealing and machining. The weld at each end of the examined pipe shall be ground flush in a length of 100 mm (4 in) prior to penetrant testing.					
	<ul> <li>For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>All external and accessible internal surfaces of the weld shall be examined.</li> </ul>					
Repair of defects	Weld repair of base materi For repair of welds, the rec welds shall be heat treated	quirements for production	n welding above shall apply to t uction weld.	he repair WPS. Repair		



Material Data Sh	neet	MDS No. ID142 / ID142S a Rev. 02				
TYPE OF MATERIAL	L: Ferritic-Austenitic sta	ninless steel type 22Cr duple.	х			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A928	UNS S31803	Class 1, 3, 4 and 5	ASTM A928 S3, S4		
	ASTM A928	UNS S32205	Class 1, 3, 4 and 5	ASTM A928 S3, S4		
	•	Page 2 of 2				
Sour service (additional metallurgical,		15156/NACE MR0175 or IS	the purchaser, the material shal O 17945/NACE MR0103, and the			
manufacturing, testing and certification requirements) <sup>a</sup>	<ul> <li>Hardness testing</li> <li>Welding procedure qualification testing for manufacturing and repair welding shall require hardness testing. Hardness surveys shall comply with NACE MR0103/ISO 17945, section 13.8.2, using Vickers method with a maximum hardness of 310HV (average), 320HV (single value).</li> </ul>					
	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 28HRC from three readings taken in close proximity at each location.</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall	be pickled or bright annealed	d.			
Marking	The pipes shall be m	narked to ensure full traceab	lity to heat and heat treatment lo	t.		
Certification		acturer shall have a quality system to a standard accepted by the posterior	/stem certified in accordance with urchaser.	n ISO 9001 or another		
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
		<ul> <li>MPS identification or MCPR/QTR number used.</li> </ul>				
		the starting material.				
	<ul> <li>Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>					



# Table A.18 — MDS ID143 / ID143S

Material Data Sheet		MDS No. ID143 /	' ID143S <sup>a</sup>	Rev. 01	
TYPE OF MATERIAL	: Ferritic-Austenitic sta	inless steel type 22Cr duple	x		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A815	UNS S31803	WP-W, WP-S or WP-WX	ASTM A815 S2, S7	
	ASTM A815	UNS S32205	WP-W, WP-S or WP-WX	ASTM A815 S2, S7	
		Page 1 of 2			
Scope	This MDS defines ap specification.	plicable options and/or requ	irements that supplement or amer	nd the referenced standard	
Qualification		o.	nall be qualified in accordance with neet the requirements of this MDS		
Metal making	The melt shall be refi	ned by AOD or equivalent m	nethod.		
Chemical composition	UNS S31803: N = 0.	14 % - 0.20 %			
Welding	same examinations a qualification shall be	as for the base material and carried out on the same ma	SME BPVC, Sec. IX or ISO 15614 shall meet the acceptance criteria terial grade (UNS number) as use bles shall require requalification.	of ISO 17781. The	
Heat treatment	Fittings shall be place	colution annealed followed be ed in such a way as to ensu treatment process including	re free circulation of heating and c	ooling media around each	
Tensile testing	Supplementary requirement S2 shall apply. Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.				
Impact testing / toughness testing	The sampling of test ISO 17781 QL II.	specimens, testing methodo	ology and acceptance criteria shall	comply with	
Corrosion testing	The sampling of test ISO 17781.	specimens, testing methodo	ology and acceptance criteria shall	be in accordance with	
Micrographic examination		specimens, testing methodo surements shall be in accord	ology and acceptance criteria for malance with ISO 17781.	nicrostructural examination	
Extent of testing		ests and corrosion test and or each lot as defined below	one micrographic examination incl	uding ferrite measurement	
		e all fittings from the same h nd, where applicable, welded	eat and heat treatment load, with d with the same WPS.	a wall thickness range	
			he requirements in ASTM A815 sl it shall be hardness tested as req		



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Material Data Sheet		MDS No. ID143 / ID143S <sup>a</sup> Rev. 01				
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	steel type 22Cr duple	(			
PRODUCT FORM	STANDARD	GRADE	ACCEPTAN	CE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A815	UNS S31803	WP-W, WP-S	or WP-WX	ASTM A815 S2, S7	
	ASTM A815	UNS S32205	WP-W, WP-S	or WP-WX	ASTM A815 S2, S7	
	Page 2 of 2					
Non-destructive	Ultrasonic testing is not ac	ceptable as replaceme	nt for RT of fittings.			
testing	Liquid penetrant testing					
	ASTM A815 supplementar					
	NDE requirement		Nominal T			
	NDE requirement	Coomicoo	1		alded fittings 3	
	_	Seamless		VV	elded fittings <sup>a</sup>	
	Frequency <sup>b</sup>	10 9			100 %	
	Method		ASME BPVC, S	ec. V, Article	6	
	Extent <sup>c</sup>		100	%		
	Acceptance criteria	A	SME <i>BPVC</i> , Sec. VI	II, Div. 1, App	endix 8	
	NOTE The testing shall be of testing.	carried out after machining	, if applicable. Non-ma	chined surfaces	s shall be pickled prior to the	
		a oxtorrial darradod driair b				
Sour service (additional	weld repair of base materi For repair of welds, the rec be heat treated as per the  When sour service require requirements of ISO 15156	quirements for producti original production we ments are specified by	on welding shall app d. the purchaser, the r	ly to the repa	conform to the	
Sour service (additional metallurgical, manufacturing, testing and	Weld repair of base materi For repair of welds, the rec be heat treated as per the  When sour service require requirements of ISO 15156 requirements to the MDS.  Hardness testing  Welding procedure qua testing. Hardness surve method with a maximu  Production testing shal fittings per lot. When or hardness of the base n proximity at each locati	quirements for production riginal production we ments are specified by 6/NACE MR0175 or IS alification testing for making the matching of 310HV lb be performed in according one fitting is production.	on welding shall app d. the purchaser, the r O 17945/NACE MRO anufacturing and rep IACE MR0103/ISO (average), 320HV (s rdance with the requed, it shall be hardn metal shall be 28HF	material shall p103, and the air welding sh 17945, section ingle value). irrements in A ess tested as CC from three	ir WPS. Repair welds shall conform to the following additional mall require hardness in 13.8.2, using Vickers  STM A370/A1058 on two required. The maximum readings taken in close	
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	Weld repair of base matering For repair of welds, the received be heat treated as per the When sour service requirements of ISO 15156 requirements to the MDS.  Hardness testing  Welding procedure quatesting. Hardness survemethod with a maximum Production testing shall fittings per lot. When on hardness of the base in proximity at each location. The material shall be trace	quirements for production original production we ments are specified by 6/NACE MR0175 or IS alification testing for making shall comply with 1 m hardness of 310HV II be performed in acconstant one fitting is production.	on welding shall apped.  the purchaser, the root 17945/NACE MRO anufacturing and replace MR0103/ISO (average), 320HV (strance with the requed, it shall be hardnetal shall be 28HF	material shall plo3, and the air welding sh 17945, section ingle value). irements in A ess tested as RC from three	ir WPS. Repair welds sha conform to the following additional all require hardness in 13.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close	
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	Weld repair of base materi For repair of welds, the rec be heat treated as per the  When sour service require requirements of ISO 15156 requirements to the MDS.  Hardness testing  Welding procedure qua testing. Hardness surve method with a maximu  Production testing shal fittings per lot. When or hardness of the base n proximity at each locati	quirements for production original production we ments are specified by 6/NACE MR0175 or IS alification testing for making shall comply with 1 m hardness of 310HV II be performed in acconstant one fitting is production.	on welding shall apped.  the purchaser, the root 17945/NACE MRO anufacturing and replace MR0103/ISO (average), 320HV (strance with the requed, it shall be hardnetal shall be 28HF	material shall plo3, and the air welding sh 17945, section ingle value). irements in A ess tested as RC from three	ir WPS. Repair welds shat conform to the following additional stall require hardness in 13.8.2, using Vickers  STM A370/A1058 on two required. The maximum readings taken in close	
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	Weld repair of base matering For repair of welds, the received be heat treated as per the When sour service requirements of ISO 15156 requirements to the MDS.  Hardness testing  Welding procedure quatesting. Hardness survemethod with a maximum Production testing shall fittings per lot. When on hardness of the base in proximity at each location. The material shall be trace	quirements for production original production we be ments are specified by 6/NACE MR0175 or IS alification testing for making shall comply with Nm hardness of 310HV II be performed in accomply one fitting is production. The production accordance with the production accordance wi	on welding shall apped.  the purchaser, the reduction of the purchaser, and repuised in the reduction of the purchaser of the purch	material shall 0103, and the air welding sh 17945, sectior ingle value). irements in A ess tested as RC from three E MR0175-3, ckling.	ir WPS. Repair welds shat conform to the following additional mall require hardness in 13.8.2, using Vickers  STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MDS	
Repair of defects  Sour service (additional metallurgical, manufacturing, testing and certification requirements) a  Surface treatment and finish  Marking  Certification	Weld repair of base materi For repair of welds, the rec be heat treated as per the  When sour service require requirements of ISO 1515c requirements to the MDS.  Hardness testing  - Welding procedure qua testing. Hardness surve method with a maximu  - Production testing shal fittings per lot. When or hardness of the base in proximity at each locati  The material shall be trace  Finished fittings shall be pi	quirements for production original production we original production we ments are specified by 6/NACE MR0175 or IS alification testing for making shall comply with 1 m hardness of 310HV all be performed in accomply one fitting is production. The production of the	on welding shall apped.  the purchaser, the root 17945/NACE MRO anufacturing and replace MR0103/ISO (average), 320HV (strance with the required, it shall be hardned, it shall be 28HF in ISO 15156-3/NAC ces do not require picture of the control of	material shall ploa, and the material shall ploa, and the mair welding shall ploa, section ingle value). It is section as the material shall ploa shall pl	ir WPS. Repair welds she conform to the following additional sall require hardness in 13.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD t.  ISO 9001 or another sall and shall confirm	

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# Table A.19 — MDS ID144 / ID144S

Material Data Sh	eet	MDS No. ID144 / ID144S a Rev. 0		
TYPE OF MATERIAL	: Ferritic-Austenitic stainless	steel type 22Cr duplex		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Forgings	ASTM A182	F51 (UNS S31803)	-	ASTM A961 S56
	ASTM A182	F60 (UNS S32205)	-	ASTM A961 S56
		Page 1 of 2	•	
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Product covered by this MDS is limited to a maximum thickness of 300 mm (12 in). For thickness exceeding 300 mm (12 in), qualification and specification requirements shall be subject to agreement.			
Qualification			e qualified in accordance with he requirements of this MDS	
Metal making	The melt shall be refined b	y AOD or equivalent metho	d.	
Chemical composition	UNS S31803: N = 0.14 %	- 0.20 %		
Heat treatment	Forgings shall be placed in	ion annealed followed by wa such a way as to ensure fr t treatment process includin	ee circulation of heating and	l cooling media around each
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodology	and acceptance criteria shal	Il comply with
Corrosion testing			and acceptance criteria shal shall be taken from the surf	
Micrographic examination	including ferrite measurem specimens shall be taken f	ents shall be in accordance	and acceptance criteria for r with ISO 17781 for forging htre of the forging with no we	with weld ends. Test
Extent of testing		nd corrosion test, and one r		cluding ferrite measurement
	The testing shall be carried	d out on the forgings with he	aviest wall thickness within	the heat treatment load.
		2 000 kg (4 400 lb) for forgir gings with as forged weight	ngs with as forged weight up > 50 kg (110 lb).	to 50 kg (110 lb), and
Non-destructive testing			with the product standard. T hined surfaces shall be pick	
	Liquid penetrant testing ASTM A961 supplementar	y requirement S56 shall app	oly as amended by this MDS	).
	NDE requirement		Forgings <sup>a</sup>	
	Frequency b		10 %	
	Method	Į.	ASME BPVC, Sec. V, Article	6
	Extent <sup>c</sup>		100 %	
	Acceptance criteria	ASME	BPVC, Sec. VIII, Div. 1, App	pendix 8
	NOTE The testing shall be of testing.	carried out after machining, if ap	plicable. Non-machined surface	s shall be pickled prior to the
	The test lot shall be as define	10 %), a minimum of one item p	per lot in any purchase order sha	all be examined.



<b>Material Data Sh</b>	eet	MDS No. ID144 / I	MDS No. ID144 / ID144S <sup>a</sup> Rev. 01			
TYPE OF MATERIAL	.: Ferritic-Austenitic sta	inless steel type 22Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F51 (UNS S31803)	-	ASTM A961 S56		
	ASTM A182	F60 (UNS S32205)	-	ASTM A961 S56		
	•	Page 2 of 2				
Non-destructive testing (continued)	· ·	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.				
Repair of defects	Weld repair is not pe	ermitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following addition requirements to the MDS.					
manufacturing, testing and certification requirements) a  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM ASTM ASTM ASTM ASTM ASTM ASTM ASTM						
Surface treatment and finish		all be pickled. Machined surface	ISO 15156-3/NACE MR0175-3 ces do not require pickling.	, section 7.2 and this MDS.		
Marking	The forgings shall be	e marked to ensure full traceat	pility to heat and heat treatment	lot.		
Certification		acturer shall have a quality sys standard accepted by the pur	tem certified in accordance with chaser.	ISO 9001 or another		
		ments shall be issued in accorwith this specification.	dance with ISO 10474 /EN 102	04 Type 3.1 and shall		
	The inspection docu	ments shall include the followi	ng information:			
	<ul> <li>The MPS identified</li> </ul>	cation or the MCPR/QTR num	ber used.			
	<ul> <li>Steel manufactur</li> </ul>	er.				
	<ul> <li>Solution annealir</li> </ul>	ng temperature, holding time a	nd quenching medium shall be	stated.		
The supplementary s requirements for sour	Solution annealir  uffix "S" shall be used to d	ng temperature, holding time a	nd quenching medium shall be cordance with the MDS plus the add			



# Table A.20 — MDS ID145 / ID145S

Material Data Sheet		MDS No. ID145 / ID	145S <sup>a</sup>	Rev. 01	
TYPE OF MATERIAL	Ferritic-Austenitic stainless	steel type 22Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Plates, sheets, strips	ASTM A240	UNS S31803	-	ASTM A240 S1	
	ASTM A240	UNS S32205	-	ASTM A240 S1	
	T	Page 1 of 2			
Scope	This MDS defines applicab specification.	ole options and/or requirem	nents that supplement or ame	nd the referenced standard	
Qualification			pe qualified in accordance with the requirements of this MDS		
Metal making	The melt shall be refined b	y AOD or equivalent meth	od.		
Chemical composition	UNS S31803: N = 0.14 % ·	- 0.20 %			
Heat treatment	The plates shall be solution Plates shall be placed in suplate during the heat treatr	uch a way as to ensure fre	e circulation of heating and co	poling media around each	
Tensile testing	Tensile test specimens sha	all be sampled in the trans	verse orientation to the directi	on of final rolling.	
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodology	y and acceptance criteria shal	I comply with	
Corrosion testing	The sampling of test special ISO 17781.	mens, testing methodology	y and acceptance criteria shal	I be in accordance with	
Micrographic examination	The sampling of test specin including ferrite measurem		y and acceptance criteria for nee with ISO 17781.	nicrostructural examination	
Extent of testing	One tensile, one set of imp		est and one micrographic exan eel and heat treatment lot.	nination including ferrite	
Non-destructive testing			with the product standard. The faces shall be cleaned prior to		
	Valve plate NDT Inspection of plate for valve specified by the purchaser		to the applicable valve specifi MDS shall apply.	cation. If a QSL is not	
Repair of defects	Weld repair is not permitte	d.			
Sour service (additional metallurgical,			purchaser, the material shall 7945/NACE MR0103, and the		
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plat per lot. For coil, tests shall be carried out at both ends of the coil. The maximum hardness shall be 28HRC from three readings taken in close proximity at each location.				
	The material shall be trace	able in accordance with IS	O 15156-3/NACE MR0175-3	, section 7.2 and this MDS.	
Surface treatment and finish	Finished plates, sheets or	strips shall be pickled.			
Marking	The plates, sheets or strips	s shall be marked to ensur	e full traceability to heat and h	neat treatment lot.	



Material Data Sheet		MDS No. ID145	MDS No. ID145 / ID145S a			
TYPE OF MATERIAL: Ferritic-Austenitic stainless steel type 22Cr duplex						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Plates, sheets, strips	ASTM A240	UNS S31803	-	ASTM A240 S1		
	ASTM A240	UNS S32205	-	ASTM A240 S1		
		Page 2 of 2	1			
Certification		acturer shall have a quality sy s standard accepted by the p	rstem certified in accordance with urchaser.	ISO 9001 or another		
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection docu	ments shall include the follow	ving information:			
	<ul> <li>MPS identification</li> </ul>	on or MCPR/QTR number use	ed.			
	<ul> <li>Steel manufactu</li> </ul>	rer.				
	<ul> <li>Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>					
<sup>a</sup> The supplementary surequirements for sour		designate a material delivered in a	accordance with the MDS plus the add	litional supplementary		



# Table A.21 — MDS ID146 / ID146S

Material Data Sh	eet MDS No. ID146 / ID146S a			Rev. 01	
TYPE OF MATERIAL	.: Ferritic-Austenitic stainless	steel type 22Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE	CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A995	4A (UNS J92205)	-		ASTM A995 S5, S6, S11, ASTM A703 S20
		Page 1 of 3	•		
Scope	This MDS defines applicab specification.	ole options and/or require	ments that suppleme	nt or ame	nd the referenced standard
Qualification	Manufacturers and the ma NORSOK M-650. The qua				
Metal making	The melt shall be refined b refined scrap as permitted				
Chemical composition	N = 0.14 % - 0.30 %				
Heat treatment	The castings shall be solut	ion annealed followed by	water/liquid quenchir	ng.	
	Castings shall be placed in casting during the heat treat			ating and	cooling media around each
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodolog	y and acceptance cr	iteria shal	I comply with
Corrosion testing	The sampling of test special ISO 17781.	mens, testing methodolog	y and acceptance cr	iteria shal	l be in accordance with
Micrographic examination	The sampling of test speciments including ferrite measurements			iteria for n	nicrostructural examination
Extent of testing	measurement shall be carr	One tensile, one set of impact tests, one corrosion test and one micrographic examination including ferrite measurement shall be carried out for each heat of steel and heat treatment load (including any PWHT).  A test lot shall not exceed 5 000 kg (11 000 lb) in weight.			
Test sampling	The test blocks shall be in	compliance with ISO 177	81.		
Non-destructive testing	Visual inspection				
· ·	NDE requirement	Pilot casting (se	ction 4.8)	Pro	oduction casting
	Frequency	Each pilot ca	sting	Each	production casting
	Method		ANSI/MSS S	P-55	
	Extent	100 % of a	I accessible surfaces	including	welding ends
	Acceptance criteria		MSS SP-5	55	
	NOTE The testing shall be of testing.	carried out after machining, if	applicable. Non-machin	ed surfaces	s shall be cleaned prior to the



Material Data Sheet		MDS No. ID146 / ID146S a		Rev. 01
TYPE OF MATERIAL: Ferritic-Austenitic stainless steel type 22Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A995	4A (UNS J92205)	-	ASTM A995 S5, S6, S11, ASTM A703 S20

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# Non-destructive testing (continued)

#### Liquid penetrant testing

ASTM A995 supplementary requirement S6 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8) Production casting <sup>a</sup>				
Frequency <sup>b</sup>	100 %				
Method	ASME BPVC, Sec. V, Article 6				
Extent <sup>c</sup>	100 %				
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7				

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.

- <sup>a</sup> Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Frequency of inspection 100 % means that each item shall be examined.
- c All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A995 supplementary requirement S5 shall apply as amended by this MDS.

NDE requirement	Pilot casting	Production casting						
	(section 4.8)	pr					Other pressure containing castings <sup>b</sup>	
Frequency <sup>c</sup>	100 %	NPS DN Pressure class					100 %	
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method	ASME, BPVC, Sec. V, Article 2							
Extent	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							
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7							

NOTE  $\,$  N/R means not required, unless specified otherwise by the purchaser.

- <sup>a</sup> Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



Material Data Sheet		MDS No. ID146 / I	MDS No. ID146 / ID146S <sup>a</sup>				
TYPE OF MATERIAL	L: Ferritic-Austenitic stail	nless steel type 22Cr duplex					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Castings	ASTM A995	4A (UNS J92205)	-	ASTM A995 S5, S6, S11, ASTM A703 S20			
	_	Page 3 of 3	·				
Repair of defects	All major repairs as desupplementary require		e documented in accordance w	ith ASTM A703			
	The repair welding profollowing:	ocedure shall be qualified in a	accordance with ASTM A488 or	ISO 11970 and the			
	<ul> <li>Welding procedure production.</li> </ul>	e shall be qualified on the sar	ne cast material grade (UNS ກເ	umber) as used in			
	FCAW processes.	<ul> <li>Change of specific make of filler metal (brand names) requires requalification for SMAW and FCAW processes.</li> </ul>					
	in accordance with	<ul> <li>Microstructure examination, ferrite measurement, Charpy V-notch and corrosion tests shall be carried out in accordance with ISO 17781.</li> </ul>					
	Examination of major repair welds on pressure containing parts shall also include RT. Weld repairs are not acceptable for castings that leak during pressure testing.						
	Post weld heat treatment is required after all weld repairs.						
	If a minor cosmetic repair is required, heat treatment may be excluded providing the welding procedure meets all the specified microstructural, mechanical and corrosion material requirements of this data sheet in the aswelded condition.						
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
manufacturing, testing and	Hardness testing						
certification requirements) <sup>a</sup>	<ul> <li>Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness shall be 28HRC from three readings taken in close proximity at each location.</li> </ul>						
	<ul> <li>Welding procedure qualification testing for all repair welding shall require hardness testing. Hardness surveys shall comply with NACE MR0103/ISO 17945, section 13.8.2, using Vickers method with a maximum hardness of 310HV (average), 320HV (single value).</li> </ul>						
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Surface treatment and finish	Finished castings shall be pickled. Machined surfaces do not require pickling.						
Marking	The castings shall be marked to ensure full traceability to heat and heat treatment lot.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	The MPS identification or the MCPR/QTR number used.  Out of the property						
	<ul> <li>Steel melting and refining practice.</li> <li>Solution annealing temperature, holding time and quenching medium shall be stated.</li> </ul>						
The supplementary s requirements for sou		signate a material delivered in ac	cordance with the MDS plus the add	aitional supplementary			



# Table A.22 — MDS ID147 / ID147S

Material Data Sheet		MDS No. ID147 / I	MDS No. ID147 / ID147S a Rev. 01				
TYPE OF MATERIAL: Ferritic-Austenitic stainless steel type 22Cr duplex							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A276	UNS S31803	-	-			
	ASTM A276	UNS S32205	-	-			
	ASTM A479	UNS S31803	-	-			
	ASTM A479	UNS S32205	-	-			
	ASTM A182	F51 (UNS S31803)	-	-			
	ASTM A182	F60 (UNS S32205)	-	-			
	1	Page 1 of 2					
Scope	specification.  This MDS includes a bars, when permitted Product covered by	additional requirements for valved by the valve specification.  This MDS is limited to a maxim	ements that supplement or ame re parts DN 100 (NPS 4) and ur um thickness of 300 mm (12 in) irrements shall be subject to ag	nder manufactured from  . For thickness exceeding			
Qualification	Manufacturers and t	he manufacturing process sha	ll be qualified in accordance wit et the requirements of this MDS	h ISO 17782 or			
Metal making	The melt shall be ref	fined by AOD or equivalent me	thod.				
Manufacturing	<ul> <li>Bars shall be manufactured to the following requirements:</li> <li>bar forgings as defined in ASTM A788 and certified to ASTM A182; or</li> <li>hot or cold finished cylindrical shaped bar manufactured to ASTM A276 or A479 with maximum diameter of 300 mm (12 in).</li> <li>NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted.</li> </ul>						
Chemical composition	UNS S31803: N = 0.14 % - 0.20 %						
Heat treatment	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.						
Tensile testing	Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions. The centreline of tensile specimen shall be located at a distance from the bar OD in accordance with ASTM A370, Annex A.						
Impact testing / toughness testing	Except as modified in the MDS, sampling and acceptance criteria shall comply with ISO 17781 QL II.  Where impact testing in the tangential direction is required by this MDS, the acceptance criteria shall be 45 J (33 ft lbf) average, 35 J (26 ft lbf) minimum single.						
Corrosion testing	The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781. Test specimens shall be taken from the surface and the centre of the bar.						
Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781. Test specimens shall be taken from the surface and the centre of the bar and sample an area of 10 mm (0.4 in) by 10 mm (0.4 in) minimum.						
Extent of testing	Tensile, impact tests and corrosion tests, and one micrographic examination including ferrite measurements shall be carried out for each lot as defined in ASTM A484.						
Test sampling	equal to the bar outs bar.	The mid-length of axial (longitudinal) and tangential (transverse) specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar.  Valve parts manufactured from bar					
	For bars with outside diameter ≥ 100 mm (4 in) intended for machining of valve parts, in addition to tensile testing and impact testing in the longitudinal direction, one tensile test specimen and one set of three impact test specimens shall be taken in the tangential direction. Acceptance criteria shall comply with this MDS.						



Material Data Sheet		MDS No. ID147 / ID147S <sup>a</sup> Rev. 01					
TYPE OF MATERIAL	L: Ferritic-Austenitic stainles	ss steel type 22Cr duplex					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A276	UNS S31803	-	-			
	ASTM A276	UNS S32205	-	-			
	ASTM A479	UNS S31803	-	-			
	ASTM A479	UNS S32205	-	-			
	ASTM A182	F51 (UNS S31803)	-	-			
	ASTM A182	F60 (UNS S32205)	-	-			
		Page 2 of 2					
Non-destructive testing	after machining, if application in the second secon	able, and non-machined su ctured from bar manufactured from bar sha ne purchaser, the requirem	with the product standard. The urfaces shall be cleaned prior to all be according to the applicable to this MDS shall apply in	the testing.			
	NDE requirement	g according to the following table.  E requirement Part manufactured from bar <sup>a</sup>					
	Frequency b		10 %				
	Method	ASME BPVC, Sec. V, Article 6					
	Extent <sup>c</sup>	100 %					
	Acceptance criteria						
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.						
	a Part of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be examined.						
Repair of defects	Weld repair is not permitt	t permitted.					
Sour service (additional metallurgical,	tallurgical, nufacturing, ting and tiffication  requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058						
testing and certification requirements)							
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Surface treatment and finish	Finished product shall be white pickled.						
Marking	The bars shall be marked to ensure full traceability to heat and heat treatment lot.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	· ·	The MPS identification or the MCPR/QTR number used.					
			oer used.				
	Steel manufacturer of	starting material.	per used. and quenching medium shall be	stated.			



# Table A.23 — MDS ID148 / ID148S

tubes ASTM A789 UNS S31803	Material Data Sheet		MDS No. ID148 / ID	Rev. 01			
tubes ASTM A789 UNS S31803	TYPE OF MATERIAL	.: Ferritic-Austenitic stainless	steel type 22Cr duplex				
Page 1 of 1  This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.  Metal making  The melt shall be refined by AOD or equivalent method.  Metal making  The melt shall be solution annealed followed by rapid cooling.  Tubes shall be solution annealed followed by rapid cooling.  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.  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 of ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurement shall be in accordance with ISO 17781.  Tensille testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service additional metallurgical, manufacturing, sesting and pertification equirements.  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  The material shall be traceable in accordance with ISO 16176-3/NACE MR0175-3, section 7.2 and this MDS.  The material manufacturer of the stating material.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification	PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS			
This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.  Metal making  The melt shall be refined by AOD or equivalent method.  UNS \$31803: N = 0.14 % - 0.20 %  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 OIL II.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Extent of testing  The sampling of test specimens and corrosion test, and one micrographic examination including ferrite measurements shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional equirements of ISO 15166/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15166/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15166/NACE MR0175 or ISO 17945/NACE MR0103, and the following	Tubes	ASTM A789	UNS S31803	-	-		
This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.  Metal making  The melt shall be refined by AOD or equivalent method.  UNS S31803: N = 0.14 % - 0.20 %  The tubes shall be solution annealed followed by rapid cooling.  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.  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 OL II.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  Weld repair is not permitted.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0175-3, section 7.2 and this MDS.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality req		ASTM A789	UNS S32205	-	-		
Specification   Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.   Interest		_	Page 1 of 1				
NORSOK M-650. The qualification testing shall meet the requirements of this MDS.	Scope		ole options and/or requirem	ents that supplement or ame	nd the referenced standard		
In the tubes shall be solution annealed followed by rapid cooling. 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.  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 QL II.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this speci	Qualification						
The tubes shall be solution annealed followed by rapid cooling. 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.  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 QL II.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements to the MDS.  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  The material amanufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  MPS identifica	Metal making	The melt shall be refined b	y AOD or equivalent metho	od.			
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.  The sampling of test specimens, testing methodology and the acceptance criteria shall comply with ISO 17781 OL II.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15156/NACE MR0175 or ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Furface treatment and finish  Finished tubes shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Finished tubes shall be pickled or bright annealed.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing te	Chemical composition	UNS S31803: N = 0.14 %	- 0.20 %				
The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  Prinished tubes shall be pickled or bright annealed.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Heat treatment	Tubes shall be placed in s	uch a way as to ensure free	e circulation of heating and co	poling media around each		
ISO 17781.  The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service additional metallurgical, manufacturing, esting and vertification equirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements) and the performed in accordance with the requirements in ASTM A370/A1058 of one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Impact testing / toughness testing						
including ferrite measurements shall be in accordance with ISO 17781.  Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  Certification  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Corrosion testing						
measurement shall be carried out for each lot as defined in the standard for mechanical tests.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.					
Sour service additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  Finished tubes shall be pickled or bright annealed.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Extent of testing	Tensile testing, one set of impact tests and corrosion test, and one micrographic examination including ferrite measurement shall be carried out for each lot as defined in the standard for mechanical tests.					
requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  Certification  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Repair of defects	Weld repair is not permitted.					
Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 of one tube per lot. The maximum hardness shall be 28HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.  Surface treatment and finish  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Sour service (additional metallurgical,	requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional					
Finished tubes shall be pickled or bright annealed.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	testing and certification requirements) a	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on					
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.		The material shall be trace	eable in accordance with IS	O 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Surface treatment and finish	Finished tubes shall be pickled or bright annealed.					
compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer of the starting material.  Solution annealing temperature, holding time and quench medium shall be stated.	Certification	quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
<ul> <li>MPS identification or MCPR/QTR 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>							
<ul> <li>Steel manufacturer of the starting material.</li> <li>Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>		,					
<ul> <li>Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>							
The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary	a The supplementary s		·	•			

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## Table A.24 — MDS ID149 / ID149S

Material Data Sheet		MDS No. ID149 / ID149S <sup>a</sup> Rev. 01			
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	steel type 22Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
HIP products	ASTM A988	UNS S31803	-	ASTM A988 S5	
	ASTM A988	UNS S32205	-	ASTM A988 S5	
		Page 1 of 2			
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification.  Product covered by this MDS is limited to a maximum thickness of 300 mm (12 in). For thickness exceeding 300 mm (12 in), requirements shall be subject to agreement.				
Qualification			I be qualified in accordance wit et the requirements of this MDS		
Metal making	Gas atomized powder mad powder heats in terms of c		al. Powder blends shall be a ho and other properties.	omogenous mixture of	
Chemical composition	UNS S31803: N = 0.14 %	- 0.20 %			
Heat treatment	'	such a way as to ensure	d by water/liquid quenching. e free circulation of heating and uenching.	d cooling media around each	
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodolo	gy and the acceptance criteria	shall comply with	
Corrosion testing	The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 for HIP product with weld ends. Test specimens shall be taken from the surface and the centre of the product with no weld ends.				
Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781 for HIP product with weld ends. Test specimens shall be taken from the surface and the centre of the product with no weld ends and shall sample an area of 10 mm (0.4 in) by 10 mm (0.4 in) minimum.				
Extent of testing	One tensile, one set of impact tests, one corrosion test and one microstructure examination including ferrite measurement shall be carried out for each lot. A lot shall include all products from a single powder blend, same manufacturing procedure and same heat treatment load.				
Non-destructive testing			with the product standard. The urfaces shall be pickled prior to		
	Liquid penetrant testing ASTM A988 supplementar	y requirement S5 shall a	pply as amended by this MDS.		
	NDE requirement		HIP product <sup>a</sup>		
	Frequency <sup>b</sup>		10 %		
	Method		ASME BPVC, Sec. V, Article	6	
	Extent °		100 %		
	Acceptance criteria	ASM	ME BPVC, Sec. VIII, Div. 1, App	pendix 8	
	testing.		f applicable. Non-machined surface	s shall be pickled prior to the	
	<ul> <li>For random examination ( shall be as defined for me</li> </ul>	a Parts of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be examined.			



Material Data SI	neet	MDS No. ID149 / ID149S <sup>a</sup> Rev. 01			
TYPE OF MATERIA	L: Ferritic-Austenitic sta	ainless steel type 22Cr duple	х		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
HIP products	ASTM A988	UNS S31803	-	ASTM A988 S5	
	ASTM A988	UNS S32205	-	ASTM A988 S5	
		Page 2 of 2	2		
Repair of defects	Weld repair is not pe	ermitted.			
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following requirements to the MDS.				
manufacturing, testing and	Hardness testing				
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or two parts per lot. When only one part is produced, it shall be hardness tested as required. The maximum hardness shall be 25HRC from three readings taken in close proximity.				
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.				
Surface treatment and finish	Finished components shall be pickled. Machined surfaces do not require pickling.				
Marking	The powder blend shall have a unique identity marked on the powder container and this identity shall be recorded and maintained throughout production of the product. The components shall be marked to ensure full traceability to lot as defined in this MDS.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	<ul> <li>MPS identification or MCPR/QTR number used.</li> </ul>				
	<ul> <li>MPS identification</li> </ul>	on or MCPR/QTR number us	ou.		
	<ul> <li>Steel manufactu</li> </ul>	rer of the starting material (p	owder) for the finished product.  and quench medium shall be sta		



## Table A.25 — MDS ID251 / ID251S

Material Data She	eet	MDS No. ID251 / ID2	<b>51S</b> <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	: Ferritic-Austenitic stainless	steel type 25Cr duplex		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Seamless pipes	ASTM A790	UNS S32550	-	-
	ASTM A790	UNS S32750	-	-
	ASTM A790	UNS S32760	-	-
		Page 1 of 1	•	•
Scope	This MDS defines applicab standard specification.	ole options and/or requireme	ents that supplement or ame	nd the referenced ASTM
Qualification			e qualified in accordance with he requirements of this MDS	
Metal making	The melt shall be refined b	y AOD or equivalent method	d.	
Chemical composition	PREN ≥ 40.0			
Heat treatment	Pipes shall be placed in su	annealed followed by rapid ich a way as to ensure free nent process including quen	circulation of heating and co	oling media around each
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodology	and acceptance criteria shal	I comply with
Hardness testing	Hardness testing shall be p	performed by the Rockwell (	C method.	
Corrosion testing	The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.			
Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.			
Extent of testing		pact tests, one corrosion testied out for each heat and he	t and one microstructure exa	amination including ferrite
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional metallurgical, manufacturing,			ourchaser, the material shall 945/NACE MR0103, and the	
testing and certification requirements)	Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A105 one length of pipe per lot. The maximum hardness shall be 32HRC from three readings taken in close proximity.			
	The material shall be trace	able in accordance with ISC	) 15156-3/NACE MR0175-3	, section 7.2 and this MDS.
Surface treatment and finish	Finished pipes shall be pic	kled or bright annealed.		
Marking	The pipes shall be marked	to ensure full traceability to	heat and heat treatment lot.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.			
	compliance with this specif	fication.	ISO 10474 /EN 10204 Type	e 3.1 and shall confirm
	· ·	shall include the following in	nformation:	
	<ul> <li>MPS identification or M</li> <li>Steel manufacturer.</li> </ul>	ICPR/QTR number used.		
	<ul> <li>Solution annealing tem</li> </ul>	perature, holding time and of produced hot finished and	quench medium shall be stat direct quenched).	ed (holding time is
<sup>a</sup> The supplementary su requirements for sour	Iffix "S" shall be used to designat service.	te a material delivered in accord	ance with the MDS plus the add	itional supplementary



## Table A.26 — MDS ID252 / ID252S

Material Data Sh	neet	MDS No. ID252 / ID252S <sup>a</sup> Rev. 0 <sup>a</sup>					
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	steel type 25Cr duple	ex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Welded pipes	ASTM A928	UNS S32550	Class 1, 3, 4 and 5	ASTM A928 S3, S4			
	ASTM A928	UNS S32750	Class 1, 3, 4 and 5	ASTM A928 S3, S4			
	ASTM A928	UNS S32760	Class 1, 3, 4 and 5	ASTM A928 S3, S4			
	Page 1 of 2						
Scope	This MDS defines applicate specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standa specification.					
Qualification	Manufacturers and the ma NORSOK M-650. The qua	nufacturing process s lification testing shall	hall be qualified in accordance wit meet the requirements of this MDS	h ISO 17782 or S.			
Metal making	The melt shall be refined b	y AOD or equivalent i	method.				
Chemical composition	PREN ≥ 40.0						
Welding	same examinations as for qualification shall be carrie	the production testinged out on the same ma	ASME BPVC, Sec. IX or ISO 1561 and shall fulfil the acceptance critaterial grade (UNS number) as useables shall require requalification.	eria of ISO 17781. The			
Heat treatment	Pipes shall be placed in su	The pipes shall be solution annealed followed by rapid cooling.  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.					
Impact testing / toughness testing	The sampling of test speci ISO 17781 QL II.	mens, testing method	ology and acceptance criteria shal	Il comply with			
Corrosion testing	The sampling of test speci ISO 17781.	mens, testing method	ology and acceptance criteria shal	Il be in accordance with			
Micrographic examination	Supplementary requirementary requirement	mens, testing method	ology and acceptance criteria for r	nicrostructural examination			
Extent of testing	One tensile, one set of imp		on test and one microstructure exa and heat treatment lot.	amination including ferrite			
	same heat, same processi	ng conditions includin	not exceeding the lot definition in g weld procedure and same heat	treatment load.			
		ne lot definition shall t	comply with the product standards	•			
Non-destructive testing	<u>Liquid penetrant testing</u> ASTM A928 supplementary requirement S3 shall apply as amended by this MDS.						
	NDE requirement		Welded pipe				
	Frequency <sup>a</sup>		10 %				
	Method		ASME BPVC, Sec. V, Article	6			
	Extent <sup>b</sup>		100 %				
	Acceptance criteria	ļ.	ASME BPVC, Sec. VIII, Div. 1, App	pendix 8			
		•	ration, pickling/bright annealing and mangth of 100 mm (4 in) prior to penetran	3			
	shall be as defined for me	end of the examined pipe shall be ground flush in a length of 100 mm (4 in) prior to penetrant testing.  a For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.  b All external and accessible internal surfaces of the weld shall be examined.					



Material Data Sh	eet	MDS No. ID252 / ID252S a Rev. 01			
TYPE OF MATERIAL	: Ferritic-Austenitic sta	ninless steel type 25Cr duple	х		
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT			
Welded pipes	ASTM A928	UNS S32550	Class 1, 3, 4 and 5	ASTM A928 S3, S4	
	ASTM A928	UNS S32750	Class 1, 3, 4 and 5	ASTM A928 S3, S4	
	ASTM A928	UNS S32760	Class 1, 3, 4 and 5	ASTM A928 S3, S4	
	1	Page 2 of 2	) :	1	
Repair of defects	For repair of welds, t	material is not permitted. the requirements for product treated as per original produ	ion welding above shall apply to to	he repair WPS. Repair	
Sour service (additional metallurgical,		15156/NACE MR0175 or IS	the purchaser, the material shall O 17945/NACE MR0103, and the		
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing				
	<ul> <li>Welding procedure qualification testing for manufacturing and repair welding shall require hardness testing. Hardness surveys shall comply with NACE MR0103/ISO 17945, section13.8.2, using Vickers method with a maximum hardness of 310HV (average), 320HV (single value).</li> </ul>				
	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 32HRC from three readings taken in close proximity at each location.</li> </ul>				
	The material shall be	e traceable in accordance wi	th ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.	
Surface treatment and finish	Finished pipes shall	be pickled or bright anneale	d.		
Marking	The pipes shall be m	narked to ensure full traceab	ility to heat and heat treatment lot		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
		n or MCPR/QTR number us	ed.		
		the starting material.			
	<ul> <li>Solution annealir</li> </ul>	ng temperature, holding time	and quench medium shall be state	ted.	



## Table A.27 — MDS ID253 / ID253S

Material Data Sheet		MDS No. ID253	MDS No. ID253 / ID253S a	
TYPE OF MATERIAL	L: Ferritic-Austenitic sta	inless steel type 25Cr duple	x	
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Wrought fittings	ASTM A815	UNS S32550	WP-W, WP-S or WP- WX	ASTM A815 S2, S7
	ASTM A815	UNS S32750	WP-W, WP-S or WP- WX	ASTM A815 S2, S7
	ASTM A815	UNS S32760	WP-W, WP-S or WP- WX	ASTM A815 S2, S7
	•	Page 1 of 2	2	
Scope	This MDS defines ap specification.	plicable options and/or requ	irements that supplement or amer	nd the referenced standard
Qualification			nall be qualified in accordance with meet the requirements of this MDS	
Metal making	The melt shall be ref	ined by AOD or equivalent n	nethod.	
Chemical composition	PREN ≥ 40.0			
Welding	The WPS shall be qualified in accordance with ASME <i>BPVC</i> , Sec. 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 shall require requalification.			
Heat treatment	Fittings shall be place	solution annealed followed be ed in such a way as to ensu t treatment process including	re free circulation of heating and c	ooling media around each
Tensile testing	Supplementary requirement S2 shall apply. Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.			
Impact testing / toughness testing	The sampling of test ISO 17781 QL II.	specimens, testing methodo	ology and acceptance criteria shall	comply with
Corrosion testing	The sampling of test ISO 17781.	specimens, testing methodo	ology and acceptance criteria shall	be in accordance with
Micrographic examination		specimens, testing methodo surements shall be in accord	ology and acceptance criteria for mance with ISO 17781.	nicrostructural examination
Extent of testing	shall be carried out for A test lot shall includ of ±5 mm (±0.2 in) an Production hardness	or each lot as defined below e all fittings from the same hand, where applicable, welded testing in accordance with the	neat and heat treatment load, with	a wall thickness range



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Material Data Sheet		MDS No. 1D253	MDS No. ID253 / ID253S a		
TYPE OF MATERIAL	L: Ferritic-Austenitic stair	nless steel type 25Cr duple	х		
PRODUCT FORM	STANDARD	GRADE	ACCEPTAN	CE CLASS	SUPPLEMENTARY REQUIREMENT
Nrought fittings	ASTM A815	UNS S32550	WP-W, WP-S	S or WP- WX	ASTM A815 S2, S7
	ASTM A815	UNS S32750	WP-W, WP-S	S or WP- WX	ASTM A815 S2, S7
	ASTM A815	UNS S32760		S or WP- WX	ASTM A815 S2, S7
	7.011117.010	Page 2 of 2		3 01 VVI VVX	7.01117.010 02, 07
Non-destructive esting	Liquid penetrant testin	ot acceptable as replacement	ent for RT of fittings.	by this MDS.	
	NDE requirement		Nominal t	hickness	
		Seamless	fittings	W	elded fittings <sup>a</sup>
	Frequency <sup>b</sup>	10			100 %
	Method		ASME <i>BPVC</i> , S	Sec. V. Article	
	Extent <sup>c</sup>		100		-
	Acceptance criteria	Δ	SME <i>BPVC</i> , Sec. VI		endix 8
		Il be carried out after machinin			
	specified, a minimur	tion 100 % means that each it n of one item per lot in any pur	chase order shall be ex		t lot shall be as defined for
Repair of defects  Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	mechanical testing.  All accessible internonly.  Weld repair of base mechanical testing.  For repair of welds, the beheat treated as performed to the Mechanical testing.  When sour service recrequirements of ISO 1 requirements to the Mechanical testing.  Welding procedure testing.  Welding procedure testing. Hardness method with a maximum and the mechanical testing.  Production testing fittings per lot. When the mechanical testing is the proximity at each less that the mechanical testing.	n of one item per lot in any pural and external surfaces shall laterial is not permitted.  e requirements for product the original production we quirements are specified by 5156/NACE MR0175 or ISDS.  e qualification testing for m surveys shall comply with kimum hardness of 310HV shall be performed in according to the production only one fitting is producted in and weld as ematerial, HAZ and weld and and according to the production of the pr	ion welding shall applid.  If the purchaser, the report of the purchaser, the report of the purchaser, the report of the purchaser, the requirement of the purchaser, and report of the purchaser, and report of the purchaser, it shall be harded to the purchaser of the purchaser o	material shall on the search welding shall on the search well as the search welding shall on the search well as the s	ir WPS. Repair welds shoonform to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close
Sour service additional metallurgical, manufacturing, esting and certification requirements) a	mechanical testing.  All accessible internonly.  Weld repair of base of For repair of welds, the heat treated as performed by the heat treated as performed by the heat treated by	n of one item per lot in any pural and external surfaces shall land and external is not permitted.  The original production we requirements are specified by 5156/NACE MR0175 or ISDS.  The qualification testing for mesurveys shall comply with eximum hardness of 310HV shall be performed in according to the production of the production of the production.	ion welding shall appld.  / the purchaser, the ion 17945/NACE MRO anufacturing and repnace MRO103/ISO (average), 320HV (sordance with the requed, it shall be hardnal metal shall be 32Hf	camined. The test of fittings, the test of fittings, the test of the repair material shall of 0103, and the 0103, and the original value). Lirements in Alless tested as RC from three CE MR0175-3,	ir WPS. Repair welds shoonform to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close
Sour service (additional metallurgical, manufacturing, testing and certification	mechanical testing.  All accessible internonly.  Weld repair of base mechanical testing only.  Weld repair of welds, the heat treated as performed in the sour service recomments of ISO 1 requirements to the Mechanical me	n of one item per lot in any pural and external surfaces shall land and external surfaces for product of the original production we equirements are specified by 5156/NACE MR0175 or ISDS.  The qualification testing for measurveys shall comply with liking many shall be performed in accordance of the production.	ion welding shall appld.  If the purchaser, the point of the purchase of the purchase with the requirement of the purchase of	camined. The test of fittings, the test of fittings, the test of fittings, the test of the repair was all the control of the c	or WPS. Repair welds shown to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD
Sour service fadditional metallurgical, manufacturing, testing and certification requirements) a Surface treatment and finish	mechanical testing. All accessible internonly.  Weld repair of base mechanical testing. For repair of welds, the beheat treated as perfective ments of ISO 1 requirements of ISO 1 requirements to the Mechanical	al and external surfaces shall land external surfaces for product of the original production we equirements are specified by 5156/NACE MR0175 or ISDS.  The qualification testing for measurveys shall comply with land external surfaces only one fitting is producted in accordance with the pickled. Machined surfaces arked to ensure full tracea turer shall have a quality standard accepted by the plants shall be in accordance.	ion welding shall applid.  If the purchaser, the recommend of the purchaser, the recommend of the purchaser, the requirement of the purchaser, and the requirement of the purchaser of the purchaser.  In the purchaser, the requirement of the purchaser of the purchaser of the purchaser of the purchaser.	camined. The test of fittings, the test of fittings, the test of set of fittings, the test of set of	ir WPS. Repair welds shoonform to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD
Sour service 'additional metallurgical, manufacturing, testing and certification requirements) a  Surface treatment and finish  Marking	mechanical testing.  All accessible internonly.  Weld repair of base mechanical testing and treated as performed as performed as performed as the performed as performed as the	al and external surfaces shall land external surfaces for product of the original production we equirements are specified by 5156/NACE MR0175 or ISDS.  The qualification testing for measurveys shall comply with land external surfaces only one fitting is producted in accordance with the pickled. Machined surfaces arked to ensure full tracea turer shall have a quality standard accepted by the plants shall be in accordance.	ion welding shall appld.  If the purchaser, the point of the purchaser of the pur	camined. The test of fittings, the test of fittings, the test of set of fittings, the test of set of	ir WPS. Repair welds shoonform to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD
Sour service 'additional metallurgical, manufacturing, testing and certification requirements) a  Surface treatment and finish  Marking	mechanical testing. All accessible internonly.  Weld repair of base mechanical testing only.  Weld repair of welds, the heat treated as perfequirements of ISO 1 requirements to the Mechanical mechan	n of one item per lot in any pural and external surfaces shall land and external surfaces shall are requirements for product of the original production we appropriately surfaces. The original production we appropriately surfaces and surfaces of 310HV shall be performed in accordance with the pickled. Machined surfaces arked to ensure full tracea turer shall have a quality standard accepted by the plants shall be in accordance pecification.	ion welding shall appld.  If the purchaser, the recommend of the purchaser, the recommend of the purchaser o	camined. The test of fittings, the test of fittings, the test of set of fittings, the test of set of	ir WPS. Repair welds shoonform to the following additional all require hardness 113.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD
Sour service additional metallurgical, manufacturing, testing and certification requirements) a  Surface treatment and finish  Marking	mechanical testing. All accessible internonly.  Weld repair of base means for repair of welds, the heat treated as perfequirements of ISO 1 requirements to the Means testing.  Welding procedure testing. Hardness method with a maximum production testing fittings per lot. When the heat treated in the heat t	al and external surfaces shall land external surfaces shall land and external surfaces shall land and external surfaces shall land and external surfaces shall land are requirements for product the original production we equirements are specified by 5156/NACE MR0175 or ISDS.  The qualification testing for me surveys shall comply with eximum hardness of 310HV shall be performed in accept only one fitting is producted as material, HAZ and wellow ocation.  The pickled in accordance with the pickled in accordance precification.	ion welding shall appld.  If the purchaser, the response of the purchaser, the response of the purchaser, the response of the purchaser, the requirement of the purchaser of the purchaser of the purchaser of the purchaser.  If the purchaser, the repurchaser of the purchaser of t	camined. The test of fittings, the test of fittings, the test of fittings, the test of the repair material shall of the polyses of the polyse	conform to the following additional all require hardness 13.8.2, using Vickers STM A370/A1058 on two required. The maximum readings taken in close section 7.2 and this MD.  ISO 9001 or another 3.1 and shall confirm

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## Table A.28 — MDS ID254 / ID254S

Material Data Sh	eet	MDS No. ID254 / ID2	254S <sup>a</sup>	Rev. 02	
TYPE OF MATERIAL	.: Ferritic-Austenitic stainless	steel type 25Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A182	F53 (UNS S32750)	-	ASTM A961 S56	
	ASTM A182	F55 (UNS S32760)	-	ASTM A961 S56	
	ASTM A182	F61 (UNS S32550)	-	ASTM A961 S56	
		Page 1 of 2			
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTN standard specification.  Product covered by this MDS is limited to a maximum thickness of 200 mm (8 in). For thickness exceeding			For thickness exceeding	
	` ' '		nents shall be subject to agre		
Qualification			e qualified in accordance wit the requirements of this MDS		
Metal making	The melt shall be refined b	y AOD or equivalent metho	d.		
Chemical composition	PREN ≥ 40.0				
Heat treatment	Forgings shall be placed in	ion annealed followed by wan such a way as to ensure fratment process including qu	ee circulation of heating and	l cooling media around each	
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	The sampling of test specimens, testing methodology and acceptance criteria shall comply with ISO 17781 QL II.			
Corrosion testing		The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 for forging with weld ends. Test specimens shall be taken from the surface and the centre of the forging with no weld ends.			
Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781 for forging with weld ends. Test specimens shall be taken from the surface and the centre of the forging with no weld ends and shall sample an area of 10 mm (0.4 in) by 10 mm (0.4 in) minimum.				
Extent of testing		nd corrosion test, and one in the heat and heat treatment less than the streatment less than the		cluding ferrite measurement	
	A test lot shall not exceed	• •	aviest wall thickness within things with as forged weight up to 50 kg (110 lb).		
Non-destructive testing			dance with the product stand		
	Liquid penetrant testing				
	ASTM A961 supplementar	y requirement S56 shall app	ply as amended by this MDS	b	
	NDE requirement		Forgings <sup>a</sup>		
	Frequency <sup>b</sup>		10 %		
	Method	ļ ,	ASME BPVC, Sec. V, Article	6	
	Extent <sup>c</sup>		100 %		
	Acceptance criteria	<del> </del>	BPVC, Sec. VIII, Div. 1, App		
	NOTE The testing shall be of testing.	carried out after machining, if ap	oplicable. Non-machined surface	s shall be pickled prior to the	
	testing.  a Parts of size DN > 50 (NPS > 2).  b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.  c All accessible internal and external surfaces shall be examined.				



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Material Data Sh	eet	MDS No. ID254 / II	D254S <sup>a</sup>	Rev. 02	
TYPE OF MATERIAL	.: Ferritic-Austenitic sta	ainless steel type 25Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A182	F53 (UNS S32750)	-	ASTM A961 S56	
	ASTM A182	F55 (UNS S32760)	-	ASTM A961 S56	
	ASTM A182	F61 (UNS S32550)	-	ASTM A961 S56	
		Page 2 of 2			
Non-destructive testing (continued)	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.				
Repair of defects	Weld repair is not pe	ermitted.			
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	When compliance with sour service requirements is specified by the purchaser, the material shall conform to ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or two forgings per lot. When only one part is produced, it shall be hardness tested as required. The maximum hardness shall be 32HRC from three readings taken in close proximity.				
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS				
Surface treatment and finish	Finished forgings sh	all be pickled. Machined surfac	es do not require pickling.		
Marking	The forgings shall be	e marked to ensure full traceab	ility to heat and heat treatment	lot.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
		cation or the MCPR/QTR numb			
		rer of starting material for the fir	•		
	<ul> <li>Solution annealir</li> </ul>	na tomporatura, holdina timo ar	nd quenching medium shall be	ctated	

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## Table A.29 — MDS ID255 / ID255S

Material Data She	eet	MDS No. ID255 /	ID255S a	Rev. 01				
TYPE OF MATERIAL	: Ferritic-Austenitic stainle	ess steel type 25Cr duplex						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Plates, sheets, strips	ASTM A240	UNS S32550	-	ASTM A240 S1				
	ASTM A240	UNS S32750	-	ASTM A240 S1				
	ASTM A240	UNS S32760	-	ASTM A240 S1				
		Page 1 of 2						
Scope	This MDS defines applic specification.	cable options and/or requi	rements that supplement or ame	nd the referenced standard				
Qualification			all be qualified in accordance with neet the requirements of this MDS					
Metal making	The melt shall be refine	d by AOD or equivalent m	ethod.					
Chemical composition	PREN ≥ 40.0							
Heat treatment	The plates shall be solu	tion annealed followed by	water/liquid quenching.					
		n such a way as to ensure atment process including	free circulation of heating and coquenching.	poling media around each				
Tensile testing	Tensile test specimens	shall be sampled in the tra	ansverse orientation to the directi	on of final rolling.				
Impact testing / toughness testing	The sampling of test spellsO 17781 QL II.	The sampling of test specimens, testing methodology and acceptance criteria shall comply with ISO 17781 QL II.						
Corrosion testing	The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781.							
Micrographic examination	The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with ISO 17781.							
Extent of testing		mpact tests, one corrosion carried out for each heat a	n test and one micrographic exar nd heat treatment lot.	nination including ferrite				
Non-destructive	<u>Visual inspection</u>							
testing			ce with the product standard. The surfaces shall be cleaned prior to					
	Valve plate NDT							
	Inspection shall be according the requirements in this	ording to the applicable va MDS shall apply.	lve specification. If a QSL is not s	specified by the purchaser,				
Repair of defects	Weld repair is not permi	tted.						
Sour service (additional metallurgical,		156/NACE MR0175 or IS0	the purchaser, the material shall D 17945/NACE MR0103, and the					
manufacturing, testing and	Hardness testing							
certification requirements) <sup>a</sup>	per lot. For coil, tests sh		nce with the requirements in AST ends of the coil. The maximum hach location.					
	The material shall be tra	aceable in accordance wit	h ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.				
Surface treatment and finish	Finished plates, sheets	and strips shall be pickled	I.					
Marking	The plates, sheets and	strips shall be marked to e	ensure full traceability to heat and	heat treatment lot.				
	I.							



Material Data Sheet		MDS No. ID255 /	MDS No. ID255 / ID255S a				
TYPE OF MATERIAL: Ferritic-Austenitic stainless steel type 25Cr duplex							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Plates, sheets, strips	ASTM A240	UNS S32550	-	ASTM A240 S1			
	ASTM A240	UNS S32750	-	ASTM A240 S1			
	ASTM A240	UNS S32760	-	ASTM A240 S1			
		Page 2 of 2					
Certification		acturer shall have a quality system is standard accepted by the p	ystem certified in accordance with urchaser.	ISO 9001 or another			
	The inspection docu		e with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm			
	The inspection documents shall include the following information:						
	MPS identification or MCPR/QTR number used.						
	Steel manufacturer of the starting material for the finished product.						
	Solution annealing temperature, holding time and quench medium shall be stated.						



## Table A.30 — MDS ID256 / ID256S

Material Data Sh	neet	MDS No. ID256 / ID256S <sup>a</sup> Rev. 01			
TYPE OF MATERIAL	: Ferritic-Austenitic stainless	s steel type 25Cr duplex			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CL	ASS SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A995	5A (UNS J93404)	-	ASTM A995 S5, S6, S11 ASTM A703 S20	
	ASTM A995	6A (UNS J93380)	-	ASTM A995 S5, S6, S11 ASTM A703 S20	
		Page 1 of 3			
Scope	This MDS defines applical specification.	ole options and/or require	ments that supplement o	r amend the referenced standard	
Qualification	Manufacturers and the ma				
Metal making	The melt shall be refined to refined scrap as permitted			AOD refined ingot or equally D refined materials.	
Chemical composition	PREN ≥ 40.0				
Heat treatment	The castings shall be solution annealed followed by water/liquid quenching.  Castings shall be placed in such a way as to ensure free circulation of heating and cooling media around each casting during the heat treatment process including quenching.				
Impact testing / toughness testing	The sampling of test speci ISO 17781 QL II.	mens, testing methodolog	gy and acceptance criteri	a shall comply with	
Corrosion testing	The sampling of test speci ISO 17781.	mens, testing methodolog	gy and acceptance criteri	a shall be in accordance with	
Micrographic examination	The sampling of test speci including ferrite measurem			a for microstructural examination	
Extent of testing	measurement shall be car	One tensile, one set of impact tests, one corrosion test and one micrographic examination including ferrite measurement shall be carried out for each heat of steel and heat treatment load (including any PWHT).  A test lot shall not exceed 5 000 kg (11 000 lb) in weight.			
Test sampling	The test blocks shall be in	compliance with ISO 177	81.		
Non-destructive testing	Visual inspection				
	NDE requirement	Pilot casting (se	ction 4.8)	Production casting	
	Frequency	Each pilot ca	asting	Each production casting	
	Method		ANSI/MSS SP-5	55	
	Extent	100 % of a	Il accessible surfaces inc	cluding welding ends	
	Acceptance criteria		MSS SP-55		
	NOTE The testing shall be testing.	carried out after machining, if	applicable. Non-machined s	surfaces shall be cleaned prior to the	



Material Data Sheet		MDS No. ID256 / II	MDS No. ID256 / ID256S a		
TYPE OF MATERIAL: Ferritic-Austenitic stainless steel type 25Cr duplex					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A995	5A (UNS J93404)	-	ASTM A995 S5, S6, S11 ASTM A703 S20	
	ASTM A995	6A (UNS J93380)	-	ASTM A995 S5, S6, S11 ASTM A703 S20	

#### Page 2 of 3

# Non-destructive testing (continued)

#### Liquid penetrant testing

ASTM A995 supplementary requirement S6 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>			
Frequency <sup>b</sup>	100 %				
Method	ASME BPVC, Sec. V, Article 6				
Extent <sup>c</sup>	100 %				
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7				

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.

- Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Frequency of inspection 100 % means that each item shall be examined.
- All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A995 supplementary requirement S5 shall apply as amended by this MDS.

NDE requirement	Pilot casting	Production casting						
	(section 4.8)			Valve	castings	а		Other pressure containing castings <sup>b</sup>
Frequency <sup>c</sup>	100 %	NPS	DN		Pressu	re class		100 %
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method			ASME	BPVC, S	ec. V, Ar	ticle 2		_
Extent		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				100 % <sup>d</sup>		
Acceptance criteria		ASM	E <i>BPVC</i>	, Sec. VI	II, Div. 1,	Appendi	x 7	

NOTE  $\,$  N/R means not required, unless specified otherwise by the purchaser.

- Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- <sup>b</sup> Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



Material Data Sh	neet	MDS No. ID256 / II	D256S a	Rev. 01		
TYPE OF MATERIAL	L: Ferritic-Austenitic stail	nless steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A995	5A (UNS J93404)	-	ASTM A995 S5, S6, S11 ASTM A703 S20		
	ASTM A995	6A (UNS J93380)	-	ASTM A995 S5, S6, S11 ASTM A703 S20		
	•	Page 3 of 3				
Repair of defects	All major repairs as de requirement S20.2.	efined by A995 shall be docur	mented in accordance with AST	M A703 supplementary		
	The repair welding prosheet.	ocedure shall be qualified in a	accordance with ASTM A488 or	ISO 11970 and this data		
	production.	·	ne cast material grade (UNS nu	,		
	processes.		ames) requires requalification fo			
	Microstructure examination, ferrite measurement, Charpy V-notch and corrosion tests shall be carried out in accordance with ISO 17781.  The state of the sta					
	Examination of major repair welds on pressure containing parts shall also include RT. Weld repairs are not acceptable for castings that leak during pressure testing.  Post weld heat treatment is required after all weld repairs.					
	If a minor cosmetic repair is required, heat treatment may be excluded providing the welding procedure meets					
	all the specified microstructural, mechanical and corrosion material requirements of this data sheet welded condition.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	<ul> <li>Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness shall be 32 HRC from three readings taken in close proximity at each location.</li> </ul>					
	<ul> <li>Welding procedure qualification testing for all repair welding shall require hardness testing. Hardness surveys shall comply with NACE MR0103/ISO 17945, section 13.8.2, using Vickers method with a maximum hardness of 310HV (average), 320HV (single value).</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished castings sha	Il be pickled. Machined surfac	ces do not require pickling.			
Marking	The castings shall be	marked to ensure full traceab	ility to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	•	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
		nents shall include the following	· ·			
		ation or the MCPR/QTR numb	per used.			
	Steel melting and     Solution appealing	01	ad augnobing modium shall be	atotod		
	_		nd quenching medium shall be s			
The supplementary s requirements for source		signate a material delivered in acc	cordance with the MDS plus the add	litional supplementary		



## Table A.31 — MDS ID257 / ID257S

Material Data Sheet		MDS No. ID257 / IE	)257S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	.: Ferritic-Austenitic sta	ninless steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A276	UNS S32550	-	-		
	ASTM A276	UNS S32750	-	-		
	ASTM A276	UNS S32760	-	-		
	ASTM A479	UNS S32550	-	-		
	ASTM A479	UNS S32750	-	-		
	ASTM A479	UNS S32760	-	-		
	ASTM A182	F53 (UNS S32750)	-	-		
	ASTM A182	F55 (UNS S32760)	-	-		
	ASTM A182	F61 (UNS S32550)	-	-		
		Page 1 of 3				
Scope	standard specification This MDS includes a bars, when permitted Product covered by	oplicable options and/or require on. additional requirements for valve by the valve specification. this MDS is limited to a maximufication and specification require	e parts DN 100 (NPS 4) and ur	nder manufactured from For thickness exceeding		
Qualification	Manufacturers and t	he manufacturing process shall ne qualification testing shall mee	be qualified in accordance wit	h ISO 17782 or		
Metal making	The melt shall be ref	ined by AOD or equivalent met	hod.			
Manufacturing	<ul><li>bar forgings as d</li><li>hot or cold finish</li><li>of 200 mm (8 in).</li></ul>	Bars shall be manufactured to the following requirements:  - bar forgings as defined in ASTM A788 and certified to ASTM A182; or  - hot or cold finished cylindrical shaped bar manufactured to ASTM A276 or A479 with maximum diameter of 200 mm (8 in).  NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold				
Chemical composition	PREN ≥ 40.0					
Heat treatment	Bars shall be placed	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.				
Tensile testing	properties of the refe	Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions. The centreline of tensile specimen shall be located at a distance from the bar OD in accordance with ASTM A370, Annex A.				
Impact testing / toughness testing	Where impact testing	Except as modified in the test MDS, sampling and acceptance criteria shall comply with ISO 17781 QL II. Where impact testing in the tangential direction is required by this MDS, the acceptance criteria shall be 45 J (33 ft lbf) average, 35 J (26 ft lbf) minimum single.				
Corrosion testing		The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781. Test specimens shall be taken from the surface and the centre of the bar.				
Micrographic examination	including ferrite mea	specimens, testing methodolog surements shall be in accordan centre of the bar and sample ar	ice with ISO 17781. Test speci	mens shall be taken from		
Extent of testing		s and corrosion tests, and one not or each lot as defined in ASTM		ding ferrite measurements		



Material Data Sh	neet	MDS No. ID257 / ID	0257S a	Rev. 01		
TYPE OF MATERIA	L: Ferritic-Austenitic stainless	steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A276	UNS S32550	-	-		
	ASTM A276	UNS S32750	-	-		
	ASTM A276	UNS S32760	-	-		
	ASTM A479	UNS S32550	-	-		
	ASTM A479	UNS S32750	-	-		
	ASTM A479	UNS S32760	-	-		
	ASTM A182	F53 (UNS S32750)	-	-		
	ASTM A182	F55 (UNS S32760)	-	-		
	ASTM A182	F61 (UNS S32550)	-	-		
		Page 2 of 3		1		
	equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar.  Valve parts manufactured from bar  For bars with outside diameter ≥ 100 mm (4 in) intended for machining of valve parts, in addition to tensile testing and impact testing in the longitudinal direction, one tensile test specimen and one set of three impact test specimens shall be taken in the tangential direction. Acceptance criteria shall comply with this MDS.					
Non-destructive testing	Visual inspection  VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  NDT valve parts manufactured from bar  Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply including liquid penetrant testing according to the following table.					
	NDE requirement Part manufactured from bar <sup>a</sup>					
	Frequency <sup>b</sup>		10 %			
	Method	ASME BPVC, Sec. V, Article 6				
	Extent <sup>c</sup>		100 %			
	Acceptance criteria	ASM	IE BPVC, Sec. VIII, Div. 1, App	pendix 8		
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.					
	<ul> <li>a Part of size DN &gt; 50 (NPS &gt; 2).</li> <li>b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>c All accessible internal and external surfaces shall be examined.</li> </ul>					
Repair of defects	Weld repair is not permitte	d.				
Sour service additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
naniitactiirinn	Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or the end surface of one bar per lot. The maximum hardness shall be 32HRC from three readings taken in close proximity.					
testing and certification	the end surface of one bar		ardness shall be 32HRC from t	hree readings taken in clos		
manufacturing, testing and certification requirements) <sup>a</sup>	the end surface of one bar proximity.	per lot. The maximum ha	urdness shall be 32HRC from t SO 15156-3/NACE MR0175-3			
testing and certification	the end surface of one bar proximity.	per lot. The maximum ha				



Material Data Sheet		MDS No. ID257 / IE	D257S a	Rev		
TYPE OF MATERIA	L: Ferritic-Austenitic sta	ainless steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
3ars	ASTM A276	UNS S32550	-	-		
	ASTM A276	UNS S32750	-	-		
	ASTM A276	UNS S32760	-	-		
	ASTM A479	UNS S32550	-	-		
	ASTM A479	UNS S32750	-	-		
	ASTM A479	UNS S32760	-	-		
	ASTM A182	F53 (UNS S32750)	-	-		
	ASTM A182	F55 (UNS S32760)	-	-		
	ASTM A182	F61 (UNS S32550)	-	-		
		Page 3 of 3				
Certification		acturer shall have a quality systems acturer shall have a quality systems standard accepted by the purc		ISO 9001 or another		
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>The MPS identification or the MCPR/QTR number used.</li> </ul>					
	<ul> <li>Steel melting and</li> </ul>	d refining practice.				
	<ul> <li>Solution annealir</li> </ul>	ng temperature, holding time an	d quenching medium shall be	stated.		

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## Table A.32 — MDS ID258 / ID258S

Material Data Sheet		MDS No. ID258 / I	Rev. 01				
TYPE OF MATERIAL	: Ferritic-Austenitic stainles	s steel type 25Cr duplex					
Product Form	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Tubes	ASTM A789	UNS S32550	-	-			
	ASTM A789	UNS S32750	-	-			
	ASTM A789	UNS S32760	-	-			
	I	Page 1 of 1					
Scope	This MDS defines applica standard specification.	able options and/or require	ements that supplement or ame	nd the referenced ASTM			
Qualification			l be qualified in accordance wit et the requirements of this MDS				
Metal making	The melt shall be refined	by AOD or equivalent me	thod.				
Chemical composition	PREN ≥ 40.0						
Heat treatment	Tubes shall be placed in	on annealed followed by ra such a way as to ensure f ment process including ra	ree circulation of heating and c	ooling media around each			
Impact testing / toughness testing	The sampling of test species ISO 17781 QL II.	cimens, testing methodolo	gy and the acceptance criteria	shall comply with			
Corrosion testing		cimens, testing methodolo ments shall be in accorda	gy and acceptance criteria for r	nicrostructural examination			
Micrographic examination		cimens, testing methodolo ments shall be in accorda	gy and acceptance criteria for rnce with ISO 17781.	microstructural examination			
Extent of testing			on test, and one micrographic e efined in the standard for mech				
Repair of defects	Weld repair is not permitt	ed.					
Sour service (additional metallurgical,		56/NACE MR0175 or ISO	ne purchaser, the material shall 17945/NACE MR0103, and the				
manufacturing, testing and	Hardness testing						
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one tube per lot. The maximum hardness shall be 32HRC from three readings taken in close proximity.						
	The material shall be trace	eable in accordance with	ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.			
Surface treatment and finish	Finished tubes shall be p	ickled or bright annealed.					
Marking	The tubes shall be marke	ed to ensure full traceability	y to heat and heat treatment lot				
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	compliance with this spec	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	· ·	s shall include the following	-				
		MCPR/QTR number used	•				
	<ul><li>Steel heat and refining</li><li>Solution annealing ter</li></ul>		nd quench medium shall be sta	ted.			
a The supplementary si		· · · · · · · · · · · · · · · · · · ·	cordance with the MDS plus the add				
requirements for sour		and a material delivered in del	The pide the duc				



## Table A.33 — MDS ID259 / ID259S

Material Data Sheet		MDS No. ID259 / ID259S <sup>a</sup> Rev. 0				
TYPE OF MATERIAL	: Ferritic-Austenitic stainless	steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bolting (strain hardened)	ASTM A1082 (modified)	UNS S32550	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	ASTM A1082 (modified)	UNS S32760	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
		Page 1 of 2		•		
Scope	This MDS defines applicab specification.	ole options and/or requireme	nts that supplement or ame	nd the referenced standard		
Qualification	qualified in accordance wit requirements of this MDS. Manufacturers and the ma working (except for cold ro	nufacturing process for bars h ISO 17782 or NORSOK M nufacturing process for proc lling of threads) and/or heat h ISO 17782 or NORSOK M	1-650. The qualification testi luction of bolting that involve treatment of bar pre-materia	ng shall meet the es any further hot/cold		
Metal making	The melt shall be refined b	y AOD or equivalent method	d.			
Manufacturing	Headed bolts shall be manufactured by machining from A276 Condition S strain hardened bar.  No further working of the strain hardened bar is permitted.  Nuts shall be machined from solution annealed and water quenched bar or forgings.  Threads on studs and bolts may be made by cold rolling or machining. Threads in nuts shall be machined.					
Chemical composition	PREN ≥ 40.0					
Heat treatment	No heat treatment of the st	train hardened bar and boltin	ng shall be permitted.			
Tensile testing	accordance with ASTM F6			ting the finished bolting in		
	All tensile tests shall meet	the specified properties of A	STM A276 Condition S.			
Impact testing / toughness testing	representing the finished b	nall be carried out in accorda olting. Charpy V-notch tests e 45 J (33 ft lbf) average of t	shall be carried out at -46°	C (-50 °F) and the		
Hardness testing	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.					
Proof load testing	ASTM A1082 S5 shall app	ly to at least one nut per tes	t lot. The load shall comply	with A194 Grade 7.		
		ASTM A1082 S5 shall apply to at least one nut per test lot. The load shall comply with A194 Grade 7.  Alternatively, ASTM A1082 S6 may be applied as substitute to proof load testing for nuts with size M36 (1½ in) or above; the hardness shall not exceed the values specified in ASTM A276 Condition S for the specified grades.				
Corrosion testing	Testing shall be carried out on a sample representing the finished bolting. The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with the principles in ISO 17781.					
Micrographic examination	Testing shall be carried out on a sample representing the finished bolting. The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with the principles in ISO 17781.					
Extent of testing	One tensile, one set of impact tests, one corrosion test and one micrographic examination including ferrite measurement shall be carried out for each test lot where a test lot is as defined in ASTM A962 for non-heat treated, strain hardened bolting including the same lot for the bar material.					
Non-destructive testing		6 visually examined in all are specified in ASTM F788 for				
Repair of defects	Weld repair is not permitte	d.				



Material Data Sheet		MDS No. ID259 / ID259S <sup>a</sup> Rev. 01					
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	s steel type 25Cr duple	ex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bolting (strain hardened)	ASTM A1082 (modified)	UNS S32550	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66			
	ASTM A1082 (modified)	UNS S32760	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66			
	1	Page 2 of 2	2	-			
Sour service (additional metallurgical, manufacturing,	Material covered by this MDS is not referenced in ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103.  NOTE Use of this material in sour service shall require separate qualification according to ISO 15156-3/NACE MR0175-3 or ISO 17945/NACE MR0103, as applicable.						
testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS. The inspection documents required in this MDS shall also include the qualification test reports.						
Dimensional tolerances	The maximum size of stud	ds/bolts shall be M50 (	2 in).				
Marking	ASTM A962 S66 shall app	oly.					
Certification	The material manufacture quality requirements stand		ystem certified in accordance with	ISO 9001 or another			
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	<ul> <li>The MPS identification or the MCPR/QTR number used (for bar and/or bolting as appropriate).</li> </ul>						
	<ul> <li>Bar manufacturer.</li> </ul>						
	<ul> <li>Heat treatment condition for pre-material shall be</li> </ul>		nnealing temperature, holding time	e and quenching medium			
<sup>a</sup> The supplementary s requirements for sou	0	te a material delivered in	accordance with the MDS plus the add	ditional supplementary			



## Table A.34 — MDS ID260 / ID260S

Material Data Sh	eet	MDS No. ID260 /	ID260S a	Rev. 01		
TYPE OF MATERIAL	: Ferritic-Austenitic stail	nless steel type 25Cr duplex	(			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bolting (solution annealed)	ASTM A1082	UNS S32550	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	ASTM A1082	UNS S32750	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	ASTM A1082	UNS S32760	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	- 1	Page 1 of 2	-			
Scope	This MDS defines appearance standard specification		rements that supplement or ame	nd the referenced ASTM		
Qualification	qualified in accordance requirements of this Manufacturers and the working (except for co	Manufacturers and the manufacturing process for bars as pre-material for bolting to this MDS shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.  Manufacturers and the manufacturing process for production of bolting that involves any further hot/cold working (except for cold rolling of threads) and/or heat treatment of bar pre-material shall be separately qualified in accordance with ISO 17782 or NORSOK M-650 and this MDS.				
Metal making	The melt shall be refin	ned by AOD or equivalent m	nethod.			
Manufacturing	Threads on studs and	bolts may be made by cold	I rolling or machining. Threads in	nuts shall be machined.		
Chemical composition	PREN ≥ 40.0					
Impact testing / toughness testing	representing the finish	Impact testing of bolting shall be carried out in accordance with the requirements in ASTM A962 on a sample representing the finished bolting. Charpy V-notch tests shall be carried out at -46 °C (-50 °F) and the acceptance criteria shall be 45 J (33 ft lbf) average of three specimens, 35 J (26 ft lbf) minimum single specimen.				
Proof load testing	Alternatively, ASTM A	1082 S6 may be applied as	er test lot - the load shall comply s alternative to proof load testing alues specified in ASTM A1082 fo	for nuts with size M36 (1 1/2		
Corrosion testing			nting the finished bolting. The sar I be in accordance with the princi			
Micrographic examination	testing methodology a	Testing shall be carried out on a sample representing the finished bolting. The sampling of test specimens, testing methodology and acceptance criteria for microstructural examination including ferrite measurements shall be in accordance with the principles in ISO 17781.				
Extent of testing	measurement shall be	One tensile, one set of impact tests, one corrosion test and one micrographic examination including ferrite measurement shall be carried out for each test lot where a test lot is as-defined in ASTM A962 for non-heat treated, strain hardened bolting including the same lot for the bar material.				
Non-destructive testing			all areas of threads, shanks, and 8 for bolts/studs and ASTM F812			
Repair of defects	Weld repair is not per	Weld repair is not permitted.				
Sour service (additional metallurgical,		15156/NACE MR0175 or IS	the purchaser, the material shall O 17945/NACE MR0103, and the			
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness may be me operation. The maxim taken in close proxim					
	The material shall be	traceable in accordance wit	h ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		



Material Data Sheet		MDS No. ID260 /	MDS No. ID260 / ID260S a			
TYPE OF MATERIA	L: Ferritic-Austenitic sta	inless steel type 25Cr duple	(			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bolting (solution annealed)	ASTM A1082	UNS S32550	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	ASTM A1082	UNS S32750	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	ASTM A1082	UNS S32760	-	ASTM A1082 S5 or S6 (nuts only), ASTM A962 S66		
	•	Page 2 of 2	·			
Marking	ASTM A962 S66 sha	II apply.				
Certification		cturer shall have a quality sy standard accepted by the pu	rstem certified in accordance with urchaser.	ISO 9001 or another		
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	The MPS identification or the MCPR/QTR number used (for bar and/or bolting as appropriate).					
	<ul> <li>Bar manufacturer</li> </ul>					
	<ul> <li>Solution annealing</li> </ul>	g temperature, holding time	and quenching medium shall be	stated.		



## Table A.35 — MDS ID269 / ID269S

Material Data Sheet		MDS No. ID269 / ID269S a R				
TYPE OF MATERIAL	L: Ferritic-Austenitic stainless	steel type 25Cr duplex				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
HIP products	ASTM A988	UNS S32750	-	ASTM A988 S5		
	ASTM A988	UNS S32760	-	ASTM A988 S5		
	ASTM A988	UNS S32505	-	ASTM A988 S5		
		Page 1 of 2				
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Product covered by this MDS is limited to a maximum thickness of 200 mm (8 in). For thickness exceeding 200 mm (8 in), qualification and specification requirements shall be subject to agreement.					
Qualification			all be qualified in accordance wit eet the requirements of this MDS			
Metal making	Gas atomized powder mad powder heats in terms of c		etal. Powder blends shall be a hoe and other properties.	omogenous mixture of		
Chemical composition	PREN ≥ 40.0					
Heat treatment	· ·	such a way as to ensu	ed by water/liquid quenching. ire free circulation of heating and uding quenching.	d cooling media around		
Impact testing / toughness testing	The sampling of test special ISO 17781 QL II.	mens, testing methodol	ogy and the acceptance criteria	shall comply with		
Corrosion testing	ISO 17781 for HIP product	The sampling of test specimens, testing methodology and acceptance criteria shall be in accordance with ISO 17781 for HIP product with weld ends. Test specimens shall be taken from the surface and the centre of the product with no weld ends.				
Micrographic examination	including ferrite measurem	ents shall be in accordate rom the surface and the	ogy and acceptance criteria for rance with ISO 17781 for HIP proece centre of the product with no wound.	duct with weld ends. Test		
Extent of testing		ied out for each lot. A lo	n test and one microstructure exa ot shall include all products from eatment load.			
Non-destructive testing			e with the product standard. The surfaces shall be pickled prior to			
	Liquid penetrant testing ASTM A988 supplementar	y requirement S5 shall	apply as amended by this MDS.			
	NDE requirement		HIP product <sup>a</sup>			
	Frequency <sup>b</sup>		10 %			
	Method		ASME BPVC, Sec. V, Article	6		
	Extent <sup>c</sup>		100 %			
	Acceptance criteria	AS	SME BPVC, Sec. VIII, Div. 1, App	pendix 8		
	NOTE The testing shall be of testing.	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.				
	a Parts of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be examined.					



Material Data Sh	ieet	MDS No. ID269 / ID269S a Rev. (					
TYPE OF MATERIAL	: Ferritic-Austenitic sta	ninless steel type 25Cr duplex	(				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
HIP products	ASTM A988	UNS S32750	-	ASTM A988 S5			
	ASTM A988	UNS S32760	-	ASTM A988 S5			
	ASTM A988	UNS S32505	-	ASTM A988 S5			
	•	Page 2 of 2					
Repair of defects	Weld repair is not pe	ermitted.					
Sour service (additional metallurgical,			the purchaser, the material shall O 17945/NACE MR0103, and this				
menufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A105 two parts per lot. When only one part is produced, it shall be hardness tested as required. The maximum hardness shall be 32HRC from three readings taken in close proximity.						
	The material shall be	e traceable in accordance wit	h ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.			
Surface treatment and finish	Finished component	s shall be pickled. Machined	surfaces do not require pickling.				
Marking	recorded and mainta	The powder blend shall have a unique identity marked on the powder container and this identity shall be recorded and maintained throughout production of the product. The components shall be marked to ensure full traceability to lot as defined in this MDS.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection docu compliance with this		e with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm			
	The inspection documents shall include the following information:						
	<ul> <li>MPS identification</li> </ul>	MPS identification or MCPR/QTR number used.					
			owder) for the finished product.				
	<ul> <li>Solution annealir</li> </ul>	ng temperature, holding time	and quench medium shall be sta	ted.			
The supplementary s requirements for source		esignate a material delivered in a	accordance with the MDS plus the add	ditional supplementary			



## **Table A.36 — MDS IK101**

Material Data Sh	eet	MDS No.	IK101	Rev. 02			
TYPE OF MATERIAL: Copper-Nickel 90-10							
PRODUCT FORM	STANDARD	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Seamless pipes and tubes	EEMUA 234	7060X	-	-			
		Page 1 o	of 1				
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard					
Heat treatment	(1 472 °F) do not nee	Hot formed pipe and tube: products hot formed in the temperature range of 760 °C (1 400 °F) to 800 °C (1 472 °F) do not need annealing after forming.  Cold formed pipe and tube: annealed.					
Tensile testing		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.					
Test sampling	Test samples may be	e cut from the products th	nemselves, from prolongations or from	m sacrificial pipe and tube.			
Repair of defects	Weld repair is not pe	Weld repair is not permitted.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						



## **Table A.37 — MDS IK102**

Material Data Sheet MDS No. IK102								
TYPE OF MATERIAL	.: Copper-Nickel 90-10							
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLEMENTARY REQUIREMENT							
Welded pipes	EEMUA 234	EEMUA 234 7060X						
		Page 1 of 1						
Scope	This MDS defines applicab specification.	ole options and/or requireme	nts that supplement or ame	nd the referenced standard				
Welding	An electric fusion welding p Welding procedures shall be	process shall be used. be established and qualified	in accordance with ASME E	BPVC, Sec. IX.				
Heat treatment	need annealing after forming Cold formed pipes: annealing	•		to 800 °C (1 472 °F) do not				
Tensile testing		all be taken from each lot when the same has a same has						
Test sampling	Test samples may be cut f	rom the products themselve	s, from prolongations or fror	n sacrificial pipes.				
Non-destructive testing	<ul> <li>Radiographic testing</li> <li>SCH 10S: Welds shall be spot radiographed in accordance with the requirements of ASME BPVC, Sec. VIII, Div. 1, Paragraph UW-52.</li> <li>Other schedules: Welds shall be 100 % radiographed in accordance with the requirements of ASME BPVC, Sec. VIII, Div. 1, Paragraph UW-51.</li> </ul>							
Repair of defects	Weld repair of base material is not permitted.  For repair of welds, the requirements for production welding shall apply to the repair WPS.							
Certification	quality requirements stand	shall have a quality system ard accepted by the purchas shall be in accordance with fication.	ser.					



## **Table A.38 — MDS IK103**

Material Data Sheet MDS No. IK103 Rev. 02							
TYPE OF MATERIAL	L: Copper-Nickel 90-10						
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLEMENTA REQUIREMENT						
Fittings	EEMUA 234 7060X						
		Page 1 d	of 1				
Scope	This MDS defines applica specification.	ble options and/or re	equirements that supplement or ame	nd the referenced standard			
Welding	An electric fusion welding Welding procedures shall	•	ed. qualified in accordance with ASME <i>E</i>	BPVC, Sec. IX.			
Heat treatment	not need annealing after f Cold formed fittings: anne	Hot formed fittings: fittings hot formed in the temperature range of 760 °C (1 400 °F) to 800 °C (1 472 °F) do not need annealing after forming.  Cold formed fittings: annealed.  Welded fittings: annealed or as-welded from annealed materials.					
Tensile testing			ch lot where a lot is defined as all pre e same heat of material and subject				
Test sampling	Test samples may be cut	from the products th	emselves, from prolongations or fror	m sacrificial fittings.			
Non-destructive testing	Sec. VIII, Div. 1, Paraç  Other schedules: Weld						
Repair of defects	Weld repair of base material is not permitted. For repair of welds, the requirements for production welding shall apply to the repair WPS.						
Certification	quality requirements stand	dard accepted by the s shall be in accorda	y system certified in accordance with a purchaser. Ince with ISO 10474 /EN 10204 Type				



## **Table A.39 — MDS IK104**

Material Data Sh	eet	MDS No. IK104	Rev. 02					
TYPE OF MATERIAL	TYPE OF MATERIAL: Copper-Nickel 90-10							
PRODUCT FORM	STANDARD	GRADE	SUPPLEMENTARY REQUIREMENT					
Flanges	EEMUA 234	7060X	-	-				
		Page 1 of 1						
Scope	This MDS defines applicable specification.	ole options and/or requireme	ents that supplement or amer	nd the referenced standard				
Heat treatment	not need annealing after fo	Hot formed flanges: flanges hot formed in the temperature range of 760 °C (1 400 °F) to 800 °C (1 472 °F) do not need annealing after forming.  Cold formed flanges: annealed.						
Tensile testing	· ·	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.						
Test sampling	Test samples may be cut f	rom the products themselve	es, from prolongations or fron	n sacrificial flanges.				
Repair of defects	Weld repair is not permitte	Weld repair is not permitted.						
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents compliance with this specif		n ISO 10474 /EN 10204 Type	e 3.1 and shall confirm				



## **Table A.40 — MDS IK105**

Material Data Sh	neet	MDS No.	IK105	Rev. 02		
TYPE OF MATERIAL	L: Copper-Nickel 90-10					
PRODUCT FORM	STANDARD	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Plates	ASTM B171	UNS C70600	-	-		
		Page 1 o	f 1			
Scope	This MDS defines application.	able options and/or re	quirements that supplement or ame	nd the referenced standard		
Chemical composition	According to EEMUA 23-	According to EEMUA 234 grade 7060X.				
Heat treatment	Plate shall be annealed. (1 472 °F) do not need a		e in the temperature range of 760 $^{\circ}$ C	C (1 400 °F) to 800 °C		
Tensile testing		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.				
Test sampling	Test samples may be cur	t from the products the	emselves, from prolongations or fror	m sacrificial plates.		
Repair of defects	Weld repair is not permit	Weld repair is not permitted.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or and quality requirements standard accepted by the purchaser.					
	The inspection documen compliance with this spec		nce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		



## **Table A.41 — MDS IK107**

Material Data Sheet MDS No. IK107						
TYPE OF MATERIAL: Copper-Nickel 90-10						
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLEI REQUIRE					
Rods and bars	ASTM B151	UNS C70600	-	-		
	•	Page 1 of	1			
Scope	This MDS defines ap specification.	oplicable options and/or req	uirements that supplement or ame	nd the referenced standard		
Chemical composition	According to EEMUA	A 234 grade 7060X.				
Manufacturing		Cold forming or hot forming may be used according to written procedures established in cooperation with the material manufacturers.				
Heat treatment	Rods and bars hot for annealing after forming Cold formed rods and	ng.	inge of 760 °C (1 400 °F) to 800 °C	(1 472 °F) do not need		
Tensile testing		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.				
Test sampling	Test samples may be	Test samples may be cut from the products themselves, from prolongations or from sacrificial rods and bars.				
Repair of defects	Weld repair is not pe	Weld repair is not permitted.				
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection document compliance with this		ce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		



## **Table A.42 — MDS IK106**

TYPE OF MATERIA			S No. IK106				Rev. 0
	<b>L:</b> Aluminium bronze						
PRODUCT FORM	STANDARD	GRADE		ACCEPTAN	ICE CLASS	SUPPLEM! REQUIREN	
astings	ASTM B148	UNS C958	300	-		-	
		F	Page 1 of 2				
cope	This MDS defines ap specification.	defines applicable options and/or requirements that supplement or amend the referenced standard on.					
leat treatment	Heat treatment may b	e carried out at t	carried out at the discretion of the manufacturer.				
xtent of testing	One tensile test shall	pe carried out for each lot as defined by the in ASTM B148.					
lon-destructive	Visual inspection						
esting	VT shall be carried ou performed after mach						
	Liquid penetrant testi	Liquid penetrant testing					
	NDE requirement	Pilot o	easting (section	4.8)	Prod	luction castii	ng <sup>a</sup>
	Frequency <sup>b</sup>		100 %				
	Method		AS	ME <i>BPVC</i> , Se	ec. V, Article 6		
	Extent <sup>c</sup>			100 '	%		
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 7						
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.						
	<ul><li>Frequency of inspect</li><li>All accessible interr</li></ul>	ction 100 % means al and external sur					
	Radiographic testing	al and external sur	that each item sha	nined.			
	c All accessible interr	Pilot casting	that each item sha	nined.	duction castir	ng	
	Radiographic testing	al and external sur	that each item sha	nined.		ng	containin
	Radiographic testing	Pilot casting	that each item sha	Prod Valve cas B DN I		ss )	pressure containing
	c All accessible interreservations.  Radiographic testing.  NDE requirement  Frequency c	Pilot casting (section 4.8)	that each item sha faces shall be exar	Prod Valve cas  B DN   1	Pressure clas ≤ 150 300  N/R N/R  5 % 5 %	ss )	pressure containing castings
	Radiographic testing  NDE requirement	Pilot casting (section 4.8)  100 %	NPS  < 10  ≥ 10  ASM  ed by ASME B16  ections and at the	Proc Valve cas  S DN I  C 250  D ≥ 250  ME BPVC, Sec.  34 for specia	Pressure clas ≤ 150 300 N/R N/R 5 % 5 %  c. V, Article 2 I class valves,	at abrupt	pressure containin castings
	c All accessible interr  Radiographic testing  NDE requirement  Frequency c  Method	Pilot casting (section 4.8)  100 %	NPS  ASM and by ASME B16 ctions and at the	Proc Valve cas S DN I 0 < 250 0 ≥ 250 ME BPVC, Sec .34 for special i junctions of riec casting	Pressure clas ≤ 150 300 N/R N/R 5 % 5 %  c. V, Article 2 I class valves,	at abrupt	pressure containin castings 100 %
	c All accessible interreserved.  Radiographic testing  NDE requirement  Frequency c  Method  Extent	Pilot casting (section 4.8)  100 %  Areas define changes in se	NPS  < 10  ≥ 10  ASMed by ASME B16  ASME BF	Prod Valve cas  B DN I  C < 250 C ≥ 250 C ≥ 250 C E BPVC, Sec. C 34 for special gunctions of riel casting VC, Sec. VIII,	Pressure clas  ≤ 150 300  N/R N/R  5 % 5 %  c. V, Article 2  I class valves, isers, gates of	at abrupt	pressure containing castings 100 %



Material Data Sh	neet	MDS No. II	<b>K106</b>	Rev. 01			
TYPE OF MATERIAL: Aluminium bronze							
PRODUCT FORM	STANDARD	TANDARD GRADE ACCEPTANCE CLASS SUP					
Castings	ASTM B148	UNS C95800	-	-			
	•	Page 2 of 2	2				
Repair of defects	repairs shall be documer	nted with a sketch show	148, section 10.1 shall be conside ing location and size of excavation	ns.			
	and impregnation are pro		t leak during the final pressure tes	ting. Repairs by peening			
	The repair welding proce metal brand names requ		n accordance with ASME BPVC, S	Sec. IX; a change of filler			
Sour service (additional metallurgical, manufacturing, testing and certification requirements)	There are no additional r	There are no additional requirements to the MDS when sour service is specified by the purchaser.					
Certification	The material manufactur quality requirements star		ystem certified in accordance with purchaser.	ISO 9001 or another			
	•	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documen	ts shall include the follo	wing information:				
	<ul> <li>Heat treatment condi</li> </ul>	tion (annealing tempera	ature).				



## **Table A.43 — MDS IK204**

Material Data Sh	neet	MDS No. I	K204	Rev. 01		
TYPE OF MATERIAL	L: Aluminium bronze					
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT				
Forgings	ASTM B124	UNS C63000	-	-		
		Page 1 of	1			
Scope	This MDS defines appli specification.	cable options and/or rec	quirements that supplement or ame	nd the referenced standard		
Manufacturing	Hot working shall be us	ed.				
Heat treatment	Forgings shall be hot w	orked and supplied in O	61- Annealed condition.			
Tensile testing			h lot where a lot is defined as all pr same material heat and heat treatr			
Test sampling	Test samples may be o	ut from the products the	mselves, from prolongations or fror	n sacrificial forging.		
Non-destructive testing	Valve forgings NDT Inspection shall be accommodated	ording to the applicable	valve specification.			
Repair of defects	Weld repair is not perm	itted.				
Marking	The forging shall be ma	arked to ensure full trace	ability to cast and heat treatment lo	ot.		
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection docume compliance with this sp		ce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
	The inspection docume	nts shall include the follo	owing information:			
	- Heat treatment cond	ditions.				



## **Table A.44 — MDS IK207**

Material Data Sh	eet	MDS N	Rev. 01				
TYPE OF MATERIAL: Aluminium bronze							
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT					
Rods and bars	ASTM B150	UNS C63200	-	-			
		Page 1 of	1				
Scope	This MDS defines application.	able options and/or red	quirements that supplement or ame	nd the referenced standard			
Manufacturing	Hot rolling or hot forging	may be used.					
Heat treatment	Temper annealed for all	diameters or thickness	to condition O20 or O25.				
Tensile testing			h lot where a lot is defined as all prosame material heat and heat treat				
Test sampling	Test samples may be cut	from the products the	mselves, from prolongations or fror	m sacrificial rods or bars.			
Repair of defects	Weld repair is not permit	ted.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documen	ts shall include the foll	owing information:				
	- Heat treatment condit	tion.					



## Table A.45 — MDS IN100S

Material Data Sheet		MDS No. IN100S a		Rev. 01			
TYPE OF MATERIAL	.: Nickel alloy type 625						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bolting	ASTM F468	UNS N06625	-	-			
	ASTM F467	UNS N06625	Grade 2	-			
		Page 1 of	1				
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.						
Metal making	Basic electric furnace (EF) melt shall be refined by AOD or VOD followed by electro slag remelting (ESR) or vacuum arc remelting (VAR) or equivalent multiple refining methods. In alternative, vacuum induction melting (VIM) can be followed by single refining method such as ESR or VAR.						
Manufacturing	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.						
Tensile testing	For sizes above 37.5 mm (1½ in) in diameter the strength properties shall be agreed.						
Non-destructive testing	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.						
Repair of defects	Weld repair is not permitted.						
Sour service (additional	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and this MDS.						
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Marking	Each bolt and nut shall be marked on the end/head to ensure full traceability to heat and heat treatment lot.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	Heat treatment conditions (annealing temperature and time shall be stated);						
	Original inspection documents of the bar material shall be included in the documentation.						



## Table A.46 — MDS IN102S

Material Data Sheet		MDS No. IN102S a		Rev. 01		
TYPE OF MATERIAL	.: Nickel alloy type 625					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM B705	UNS N06625 Grade 1	Class 2	-		
		Page 1 of 1				
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Metal making	Basic electric furnace (EF) melt shall be refined by AOD or VOD followed by electro slag remelting (ESR) or vacuum arc remelting (VAR) or equivalent multiple refining methods. In alternative, vacuum induction melting (VIM) can be followed by single refining method such as ESR or VAR.					
Welding	Welding procedures shall be qualified in accordance with ASME <i>BPVC</i> , Sec. IX or ISO 15614-1 using the same material grade (UNS number) as used in production.					
Heat treatment	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 any rapid cooling/quenching					
Extent of testing	A lot shall consist of all pipes of the same type, size and wall thickness, manufactured from one heat of material, and using the same classification of welding product.					
Repair of defects	Weld repair of base material is not permitted.  For repair of welds, the requirements for production welding shall apply to the repair WPS.					
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall be pickled.					
Marking	The pipe shall be marked to ensure full traceability to heat and heat treatment lot.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:  - Heat treatment condition (annealing temperature shall be stated).					
			·			
The supplementary s service.	uffix "S" designates a material de	livered in accordance with the I	MDS plus the additional supplem	entary requirements for sour		



# Table A.47 — MDS IN103S

Material Data Sh	neet	MDS No. IN1035	<b>S</b> a	Rev. 01		
TYPE OF MATERIAL	.: Nickel alloy type 625					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM B366	UNS N06625 Grade 1	WP CI. S, WP CI. W, WP CI. WX	ASTM B366 S3		
	•	Page 1 of 1				
Scope	This MDS defines applicate specification.	ole options and/or requirem	ents that supplement or amer	nd the referenced standard		
Metal making	vacuum arc remelting (VAI		OD or VOD followed by electroning methods. In alternative, as ESR or VAR.			
Welding	same material grade (UNS			ISO 15614-1 using the		
Heat treatment		such a way as to ensure fre ment process including any	ee circulation of heating and c y rapid cooling/quenching.	ooling media around each		
Extent of testing		A lot shall consist of all fittings 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.				
Non-destructive testing			d end area of 10 % of seamle ings, the testing shall cover th			
Repair of defects	Weld repair of base materi For repair of welds, the rec	•	velding shall apply to the repa	ir WPS.		
Sour service (additional	The material shall conform and this MDS.	to the requirements of ISC	) 15156/NACE MR0175 or IS	O 17945/NACE MR0103,		
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be trace	eable in accordance with IS	O 15156-3/NACE MR0175-3,	section 7.2 and this MDS.		
Surface treatment and finish	Finished fittings shall be pi	ickled. Machined surfaces	do not require pickling.			
Marking	The fittings shall be marke	d to ensure full traceability	to heat and heat treatment lo	t.		
Certification		shall have a quality syster lard accepted by the purcha	m certified in accordance with aser.	ISO 9001 or another		
	confirm compliance with the	is specification.	nce with ISO 10474 /EN 1020	04 Type 3.1 and shall		
	·	shall include the following				
	Heat treatment condition	on (annealing temperature	shall be stated).			
The supplementary s service.	uffix "S" designates a material de	livered in accordance with the	MDS plus the additional suppleme	entary requirements for sour		



# Table A.48 — MDS IN104S

Material Data Sh	eet	MDS No. IN104S a		Rev. 01			
TYPE OF MATERIAL	.: Nickel alloy type 625						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Forgings	ASTM B564	UNS N06625	-	ASTM B564 S5.3			
		Page 1 of 2		•			
Scope	This MDS defines applicable specification.	licable options and/or requirements that supplement or amend the referenced standard					
Metal making	vacuum arc remelting (VAI		DD or VOD followed by electrining methods. In alternative as ESR or VAR.				
Heat treatment			ree circulation of heating and g any rapid cooling/quenching				
Extent of testing	A lot shall consist of all forgmaterial.	A lot shall consist of all forgings of the same type, size, and wall thickness, manufactured from one heat of material.					
Non-destructive testing		<u>Visual inspection</u> VT shall be carried out on each forging or bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the testing.					
	<u>Liquid penetrant testing</u> ASTM B564 supplementary requirement S5.3 shall apply as amended by this MDS.						
	NDE requirement	Forgings					
	Frequency <sup>b</sup>	10 %					
	Method	,	ASME BPVC, Sec. V, Article	6			
	Extent <sup>c</sup>		100 %				
	Acceptance criteria	ASME	BPVC, Sec. VIII, Div. 1, App	endix 8			
	NOTE The testing shall be of testing.	carried out after machining, if ap	oplicable. Non-machined surface	s shall be pickled prior to the			
	shall be as defined for me	on (10 %), a minimum of one item per lot in any purchase order shall be examined. The tes					
		'alve forgings NDT  Is pection shall be according to the applicable valve specification.  a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitte	d.					
Sour service (additional	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and this MDS.						
metallurgical, manufacturing, testing and certification requirements) a  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2							
Surface treatment and finish	Finished components shall	be pickled. Machined surfa	aces do not require pickling.				
Marking	The component shall be m	arked to ensure full traceab	ility to heat and heat treatme	ent lot.			



Material Data Sheet		MDS No. IN1049	MDS No. IN104S a				
TYPE OF MATERIAL: Nickel alloy type 625							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Forgings	ASTM B564	UNS N06625	-	ASTM B564 S5.3			
		Page 2 of 2		<u> </u>			
Certification		acturer shall have a quality s standard accepted by the p	ystem certified in accordance with urchaser.	ISO 9001 or another			
		The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection docu	ments shall include the follo	ving information:				
	- Heat treatment condition (annealing temperature shall be stated).						
Heat treatment condition (annealing temperature shall be stated).      The supplementary suffix "S" designates a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.							



# Table A.49 — MDS IN105S

Material Data Sh	aterial Data Sheet MDS No. IN105S <sup>a</sup>			
TYPE OF MATERIAL	: Nickel alloy type 625			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Plates, sheets, strips	ASTM B443	UNS N06625 Grade 1	-	-
		Page 1 of 1		•
Scope	This MDS defines applicable specification.	ole options and/or requireme	nts that supplement or ame	nd the referenced standard
Metal making	VAR (vacuum arc remelting	melt shall be refined by AO g) or equivalent multiple refiningle refining method such a	ning methods. In alternative	
Heat treatment		hall be placed in such a way at during the heat treatment p		
Non-destructive testing		each plate in accordance wi lle, and non-machined surfa		
	Valve plate NDT Inspection shall be accordithe requirements in this MI	ng to the applicable valve sp S shall apply.	pecification. If a QSL is not s	specified by the purchaser,
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional	The material shall conform and this MDS.	to the requirements of ISO	15156/NACE MR0175 or IS	O 17945/NACE MR0103,
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished components shall	be pickled.		
Marking	The plates, sheets and stri	ps shall be marked to ensur	e full traceability to heat and	I heat treatment lot.
Certification		shall have a quality system ard accepted by the purchas		ISO 9001 or another
	The inspection documents confirm compliance with th	shall be issued in accordants specification.	ce with ISO 10474 /EN 1020	04 Type 3.1 and shall
		shall include the following in		
	<ul> <li>Heat treatment condition</li> </ul>	on (annealing temperature sh	nall be stated).	
a The supplementary su service.	ıffix "S" designates a material de	livered in accordance with the M	DS plus the additional supplement	entary requirements for sour



# Table A.50 — MDS IN106S

Material Data Sh	neet	MDS No. IN1068	<b>3</b> a	Rev. 02		
TYPE OF MATERIAL	L: Nickel alloy					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A494	Grade CW6MC (UNS N26625)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16		
	ASTM A494	Grade CX2MW (UNS N26022)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16		
	•	Page 1 of 4	-	1		
Scope	specification.		nents that supplement or ame			
	apply.	g p	, <b></b>			
Qualification			pe qualified in accordance with the requirements of this MDS			
Metal making	The melt shall be refined be equivalent to AOD refi		od. Induction melting of AOD	refined ingot is regarded to		
Heat treatment		in such a way as to ensure featment process including q	free circulation of heating and uenching.	cooling media around each		
Corrosion testing	the exposure time shall be mechanical testing. Cut e pickled before being weig solution of 20 % HNO3 + The acceptance criteria a	Corrosion test according to ASTM G 48 Method A is required. Test temperature shall be 50 °C (122 °F) and the exposure time shall be 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 (140 °F) in a solution of 20 % HNO3 + 5 % HF.  The acceptance criteria are:  No pitting at 20x magnification.				
Extent of testing	Tensile test and corrosion test lot shall not exceed 5		n heat and heat treatment loa	d (including any PWHT). A		
Test sampling	operations. Thickness of the test bloc thickness is the ruling sec Dimensions of test blocks The test specimens shall of test block shall minimu During any PWHT the test	k shall be equal to the thick tion. and location of test specim be taken within the cross ha	est part of the casting casting ens within the test blocks are atched area. Distance from er lonto the casting.	s; the largest flange shown in the figure below. nd of test specimen to end		
	For investment casting, te	est sampling shall be accord to operations including any pro-	ling to A957. Test blocks shall	Block		



Material Data Sheet		MDS No. IN106	Rev. 02	
TYPE OF MATERIAL	L: Nickel alloy			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A494	Grade CW6MC (UNS N26625)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16
	ASTM A494	Grade CX2MW (UNS N26022)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16

#### Page 2 of 4

# Non-destructive testing (continued)

#### Visual inspection

NDE requirement	Pilot casting (section 4.8)	Production casting				
Frequency	Each pilot casting	Each production casting				
Method	ANSI/MS	SS SP-55				
Extent	100 % of all accessible surfaces including welding ends					
Acceptance criteria MSS SP-55						
NOTE The testing shall be of	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the					

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.

#### Liquid penetrant testing

ASTM A494 supplementary requirement S3 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>		
Frequency <sup>b</sup>	100 %			
Method	ASME BPVC, Sec. V, Article 6			
Extent <sup>c</sup>	100 %			
Acceptance criteria	ASME <i>BPVC</i> , Sec. V	III, Div. 1, Appendix 7		

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

<sup>&</sup>lt;sup>a</sup> Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.

<sup>&</sup>lt;sup>b</sup> Frequency of inspection 100 % means that each item shall be examined.

<sup>&</sup>lt;sup>c</sup> All accessible internal and external surfaces shall be examined.



Material Data Sheet		MDS No. IN106	Rev. 02	
TYPE OF MATERIA	L: Nickel alloy			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A494	Grade CW6MC (UNS N26625)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16
	ASTM A494	Grade CX2MW (UNS N26022)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16

#### Page 3 of 4

# Non-destructive testing (continued)

#### Radiographic testing

ASTM A494 supplementary requirement S2 shall apply as amended by this MDS.

NDE requirement	Pilot casting			Pr	oduction	n casting	I	
	(section 4.8)		Valve castings <sup>a</sup>				Other pressure containing castings <sup>b</sup>	
Frequency <sup>c</sup>	100 %		T	1				100 %
		NPS	DN		Pressu	re class		
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method	ASME <i>BPVC</i> , Sec. V, Article 2							
Extent	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							
Acceptance criteria		ASN	IE <i>BPVC</i>	, Sec. VI	II, Div. 1,	Appendi	x 7	

NOTE N/R means not required, unless specified otherwise by the purchaser.

<sup>&</sup>lt;sup>a</sup> Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.

b Production casting other than valve casting.

Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.

Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



	MDS No. IN106	•	Rev. 0	
.: Nickel alloy				
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
ASTM A494	Grade CW6MC (UNS N26625)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16	
ASTM A494	Grade CX2MW (UNS N26022)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16	
	Page 4 of 4			
All major repairs as defined by ASTM A494 shall be documented in accordance with ASTM A781 S16 or ASTM A957 S16, as applicable.  The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and as follows:  Welding procedure shall be qualified on the same cast material grade (UNS number) as used in production.  Change of specific make of filler metal (brand names) requires requalification for SMAW and FCAW processes.  A macro and corrosion test specimen shall include the weld zone.  Testing methodology and acceptance criteria shall be in accordance with the requirements of this MDS for the parent material.  Examination of major repair welds on pressure containing parts shall also include RT.  Weld repairs are not acceptable for castings that leak during pressure testing.  Post weld heat treatment is required after all major weld repairs. If a minor cosmetic repair is required, heat treatment may be excluded providing the welding procedure meets all the specified microstructural, mechanical and corrosion material requirements of this MDS in the as-welded condition.				
The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.				
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall				
confirm compliance with this specification.				
The inspection documents shall include the following information:				
Trout troutinont o	` .	and holding time shall be stat	ea).	
J	ing process. n or MCPR/QTR number used.			
	ASTM A494  ASTM A494  ASTM A494  ASTM A957 S16, as The repair welding production.  Change of specific FCAW processes.  A macro and cord for the parent material manufaction and cord.  Testing methodo for the parent material shall cord.  The material shall cord and this MDS.  The material shall be sha	ASTM A494  Grade CW6MC (UNS N26625)  ASTM A494  Grade CX2MW (UNS N26022)  Page 4 of 4  All major repairs as defined by ASTM A494 shall be ASTM A957 S16, as applicable. The repair welding procedure shall be qualified in accordance of specific make of filler metal (brand na FCAW processes.  A macro and corrosion test specimen shall included for the parent material.  Examination of major repair welds on pressure contained welding procedure to the parent material.  Examination of major repair welds on pressure contained to the parent material.  Examination of major repair welds on pressure contained to the parent material and corrosion material requirements of the parent may be excluded providing the welding procedure may be excluded providing the welding procedure the procedure of the parent material shall conform to the requirements of the parent material shall conform to the requirements of the material shall be traceable in accordance with IS and this MDS.  The material manufacturer shall have a quality systed quality requirements standard accepted by the purch the inspection documents shall be issued in accordance with this specification.  The inspection documents shall include the following the inspection documents shall include	ASTM A494  Grade CW6MC (UNS N26625)  ASTM A494  Grade CX2MW (UNS N26022)  Page 4 of 4  All major repairs as defined by ASTM A494 shall be documented in accordance with ASTM A957 S16, as applicable. The repair welding procedure shall be qualified in accordance with ASTM A488 or Welding procedure shall be qualified on the same cast material grade (UNS nu production.  Change of specific make of filler metal (brand names) requires requalification for FCAW processes.  A macro and corrosion test specimen shall include the weld zone.  Testing methodology and acceptance criteria shall be in accordance with the refor the parent material.  Examination of major repair welds on pressure containing parts shall also include tweld repairs are not acceptable for castings that leak during pressure testing.  Post weld heat treatment is required after all major weld repairs. If a minor cosmet treatment may be excluded providing the welding procedure meets all the specifie mechanical and corrosion material requirements of this MDS in the as-welded con The material shall conform to the requirements of this MDS in the as-welded con The material shall conform to the requirements of ISO 15156/NACE MR0175 or IS and this MDS.  The material manufacturer shall have a quality system certified in accordance with quality requirements standard accepted by the purchaser.  The inspection documents shall have a quality system certified in accordance with this specification.  The inspection documents shall be issued in accordance with ISO 10474 /EN 1020 confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment condition (annealing temperature and holding time shall be stated in accordance with laccordance with l	



# Table A.51 — MDS IN107S

Material Data Sh	neet	MDS No. IN1078	<b>3</b> a	Rev. 01		
TYPE OF MATERIAL	L: Nickel alloy type 625					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM B446	UNS N06625 Grade 1	-	-		
	1	Page 1 of 1	-	1		
Scope	This MDS defines applicab specification.	le options and/or requirem	ents that supplement or ame	nd the referenced standard		
Metal making	vacuum arc remelting (VAF	Basic electric furnace (EF) melt shall be refined by AOD or VOD followed by electro slag remelting (ESR) or vacuum arc remelting (VAR) or equivalent multiple refining methods. In alternative, vacuum induction melting (VIM) can be followed by single refining method such as ESR or VAR.				
Heat treatment	Bars shall be placed in suc during the heat treatment p		circulation of heating and coc cooling/quenching.	oling media around each bar		
Non-destructive testing	after machining, if applicabed NDT valve parts manufacted Inspection of valve parts manufacted SL is not specified by the	Visual inspection  VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  NDT valve parts manufactured from bar  Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply including liquid penetrant testing according to the following table.				
	NDE requirement	Part manufactured from bar <sup>a</sup>				
	Frequency <sup>b</sup>	10 %				
	Method	ASME BPVC, Sec. V, Article 6				
	Extent <sup>c</sup>	100 %				
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 8				
	testing.  a Part of size DN > 50 (NPS b For random examination ( shall be as defined for me	5 > 2). 10 %), a minimum of one item	oplicable. Non-machined surface per lot in any purchase order sha			
Repair of defects	Weld repair is not permitted	d.				
Sour service (additional	The material shall conform and this MDS.	to the requirements of ISC	) 15156/NACE MR0175 or IS	O 17945/NACE MR0103,		
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be trace	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS				
Surface treatment and finish	Finished components shall	be pickled.				
Marking	The bars shall be marked t	o ensure full traceability to	heat and heat treatment lot.			
Certification	The material manufacturer quality requirements stand		n certified in accordance with	ISO 9001 or another		
	confirm compliance with th	is specification.	nce with ISO 10474 /EN 1020	04 Type 3.1 and shall		
	The inspection documents	ŭ				
		n (annealing temperature	<u> </u>			
The supplementary s service.	suffix "S" designates a material del	overed in accordance with the	NDS plus the additional supplem	entary requirements for sour		



# Table A.52 — MDS IN111S

Material Data Sh	neet MDS No. IN111S <sup>a</sup> F			Rev. 01
TYPE OF MATERIAL	: Nickel alloy type 625			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Seamless pipes and tubes	ASTM B444	UNS N06625 Grade 1	-	-
	•	Page 1 of 1		
Scope	This MDS defines applicate specification.	ole options and/or requireme	nts that supplement or ame	nd the referenced standard
Metal making	vacuum arc remelting (VAI	melt shall be refined by AOR) or equivalent multiple refi single refining method such a	ning methods. In alternative	
Heat treatment		placed in such a way as to er g the heat treatment process		
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional	The material shall conform and this MDS.	to the requirements of ISO	15156/NACE MR0175 or IS	O 17945/NACE MR0103,
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished pipes and tubes s	shall be pickled.		
Marking	The pipes and tubes shall	be marked to ensure full trad	ceability to heat and heat tre	eatment lot.
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.			
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.			
	The inspection documents	The inspection documents shall include the following information:		
	<ul> <li>Heat treatment condition (annealing temperature shall be stated).</li> </ul>			
<sup>a</sup> The supplementary su service.	uffix "S" designates a material de	livered in accordance with the M	DS plus the additional supplement	entary requirements for sour



# **Table A.53 — MDS IN119S**

eet	MDS No. IN119S	а	Rev. 01	
: Nickel alloy type 625				
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
ASTM B834	UNS N06625 Grade 1	-	ASTM B834 S1, S2	
	Page 1 of 1		•	
This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
			homogenous mixture of	
NDE requirement		HIP product <sup>a</sup>		
Frequency <sup>b</sup>				
Method ASME BPVC, Sec. V, Article 6				
Extent ° 100 %				
				NOTE The testing shall be the testing.  a Parts of size DN > 50 (NP
shall be as defined for me	chanical testing.		an be examined. The test let	
Weld repair is not permitted	d.			
The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.				
The material shall be trace	able in accordance with ISC	) 15156-3/NACE MR0175-3	, section 7.2 and this MDS.	
Finished components shall	be pickled. Machined surfa	aces do not require pickling.		
The powder blend shall have a unique identity marked on the powder container and this identity shall be recorded and maintained throughout production of the product. The components shall be marked to ensure full traceability to heat and heat treatment lot.				
quality requirements standa	ard accepted by the purcha	ser.		
	documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall nce with this specification.			
confirm compliance with the	is specification.		• •	
confirm compliance with the The inspection documents	is specification. shall include the following i		,	
confirm compliance with the The inspection documents  - Manufacturer of the sta	is specification. shall include the following i rting material (powder) for t	he finished product.		
confirm compliance with the The inspection documents  Manufacturer of the sta  Heat treatment condition	is specification. shall include the following i	he finished product.		
	STANDARD  ASTM B834  This MDS defines applicable specification.  Manufacturers and the man NORSOK M-650. The qualified powder made powder heats in terms of components shall be placed each component during the search component searc	STANDARD  GRADE  ASTM B834  UNS N06625 Grade 1  Page 1 of 1  This MDS defines applicable options and/or requirement specification.  Manufacturers and the manufacturing process shall be NORSOK M-650. The qualification testing shall meet to Gas atomized powder made from vacuum-refined met powder heats in terms of composition, particle size and Components shall be placed in such a way as to ensure each component during the heat treatment process in the visual inspection  NDE requirement  Frequency b  Method  Extent c  Acceptance criteria  ASME  NOTE The testing shall be carried out after machining, if the testing.  Parts of size DN > 50 (NPS > 2).  For random examination (10 %), a minimum of one item is shall be as defined for mechanical testing.  All accessible internal and external surfaces shall be examination and external surfaces shall be examination to the requirements of ISO and this MDS.  The material shall conform to the requirements of ISO and this MDS.  The material shall be traceable in accordance with ISO and this MDS.  Finished components shall be pickled. Machined surfaces and maintained throughout production of the full traceability to heat and heat treatment lot.  The material manufacturer shall have a quality system.	STANDARD  GRADE  ACCEPTANCE CLASS  ASTM B834  UNS N06625 Grade 1  Page 1 of 1  This MDS defines applicable options and/or requirements that supplement or ame specification.  Manufacturers and the manufacturing process shall be qualified in accordance with NORSOK M-650. The qualification testing shall meet the requirements of this MDS Gas atomized powder made from vacuum-refined metal. Powder blends shall be a powder heats in terms of composition, particle size and other properties.  Components shall be placed in such a way as to ensure free circulation of heating each component during the heat treatment process including any rapid cooling/que visual inspection  VI shall be carried out on each item in accordance with the product standard. The after machining, if applicable, and non-machined surfaces shall be pickled prior to Liquid penetrant testing  NDE requirement  HIP product *  Frequency b  10 %  Method  ASME BPVC, Sec. V, Article Extent c  100 %  Acceptance criteria  ASME BPVC, Sec. Vill, Div. 1, App.  NOTE  The testing shall be carried out after machining, if applicable. Non-machined surfa the testing.  Parts of size DN > 50 (NPS > 2).  For random examination (10 %), a minimum of one item per lot in any purchase order sha shall be as defined for mechanical testing.  All accessible internal and external surfaces shall be examined.  Weld repair is not permitted.  The material shall conform to the requirements of ISO 15156/NACE MR0175 or IS and this MDS.  The material shall conform to the requirements of the product. The components sfull traceable in accordance with ISO 15156-3/NACE MR0175-3.  Finished components shall be pickled. Machined surfaces do not require pickling.  The powder blend shall have a unique identity marked on the powder container an recorded and maintained throughout production of the product. The components full traceabliity to heat and heat treatment tot.	



# Table A.54 — MDS IN120S

Material Data Sh	eet	MDS No. IN12	<b>20S</b> <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	: Nickel alloys			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Bolting	API STD 6ACRA	UNS N07718	120K	ASTM A962 S56
		Page 1 of 1		•
Scope	This MDS defines applicable specification.	ole options and/or requi	rements that supplement or ame	end the referenced standard
Qualification			all be qualified in accordance wit neet the requirements of this MD	
Manufacturing	Manufacturing general req	uirements shall be acco	ording to ASTM A962 as amende	ed by this MDS.
	Threads on studs and bolts be machined.	s shall be made by cold	d rolling after precipitation harder	ning. Threads in nuts shall
Heat treatment	Solution annealing and ago	eing heat treatment sha	all be carried out after the final ho	ot forming operation.
Impact testing / toughness testing	The impact testing require	ments of API 6ACRA sl	hall apply.	
Hardness testing	Maximum hardness 40HR	C. Hardness shall not b	be tested in the threaded area.	
Macro etch / micrographic examination	Bolting shall be examined	in accordance with API	6ACRA and meet the required a	acceptance criteria.
Proof load testing	Proof load testing shall be comply with the requireme		nce with ASTM A194 and the acc	ceptance criteria shall
Extent of testing		For heat treatment in continuous furnace a heat treatment load (lot) is defined as all bolting heat treated continuously in the same furnace, or maximum for 8 h of operation, of the same heat and nominal thickness.		
Non-destructive testing	<u>Visual inspection</u> 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.			
	Liquid penetrant testing			
	Liquid penetrant testing sh % of the bolting.	all be according to AST	TM A962. Supplementary require	ement S56 shall apply to 10
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional	The material shall conform and this MDS.	to the requirements of	ISO 15156/NACE MR0175 or IS	SO 17945/NACE MR0103,
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be trace	able in accordance with	h ISO 15156-3/NACE MR0175-3	3, section 7.2 and this MDS.
Surface treatment and finish	White pickled.	White pickled.		
Marking	Each bolting shall be mark	ed to ensure full tracea	bility to melt and heat treatment	lot.
Certification	The material manufacturer quality requirements stand		stem certified in accordance with rchaser.	n ISO 9001 or another
	The inspection documents confirm compliance with the		ordance with ISO 10474 /EN 102	04 Type 3.1 and shall
	The MRS identification		•	
	<ul><li>The MPS identification</li><li>Steel manufacturer, me</li></ul>			
		on. Solution annealing t	emperature, quenching medium	, ageing temperature
<sup>a</sup> The supplementary st service.	uffix "S" designates a material de	livered in accordance with	the MDS plus the additional supplem	nentary requirements for sour



# Table A.55 — MDS IN201S

Material Data Sh	eet MDS No. IN201S a Rev			Rev. 01
TYPE OF MATERIAL	: Nickel alloy type 825			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Seamless pipes and tubes	ASTM B423	UNS N08825	-	-
	•	Page 1 of 1		
Scope	This MDS defines applicate specification.	ole options and/or requ	irements that supplement or ame	nd the referenced standard
Metal making	Basic electric furnace (EF)	melt shall be refined l	by AOD or VOD.	
Chemical composition	PREN ≥ 32			
Heat treatment			s to ensure free circulation of hear rocess including any rapid cooling	
Corrosion testing	Corrosion test according to ASTM G28 Method A is required per lot.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y;  No intergranular attack visible at 50 times magnification.			
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished pipes and tubes shall be pickled or bright annealed.			
Marking	The pipes and tubes shall	be marked to ensure f	ull traceability to heat and heat tre	eatment lot.
Certification	quality requirements stand	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.		
		The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.		
	•	The inspection documents shall include the following information:		
			ture and holding time shall be stat	
The supplementary se service.	uffix "S" designates a material de	elivered in accordance wit	h the MDS plus the additional supplem	nentary requirements for sour



# Table A.56 — MDS IN202S

Material Data Sh	Sheet MDS No. IN202S a Rev.			Rev. 01
TYPE OF MATERIAL	L: Nickel alloy type 825			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Welded pipes	ASTM B705	UNS N00825	Class 2	-
	•	Page 1 of	f 1	
Scope	This MDS defines applicate specification.	ole options and/or re	quirements that supplement or an	nend the referenced standard
Metal making	Basic electric furnace (EF)	melt shall be refined	d by AOD or VOD.	
Chemical composition	PREN ≥ 32			
Corrosion testing	Test specimen shall includ Acceptance criteria: — Corrosion rate ≤ 0.5 mi	Corrosion test according to ASTM G28 Method A is required per lot.  Test specimen shall include the weld.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times magnification.		
Welding	Welding procedures shall be qualified in accordance with ASME <i>BPVC</i> , Sec. IX or ISO 15614-1 using the same material grade (UNS number) as used in production.			
Heat treatment	Annealed.  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 any rapid cooling/quenching			
Repair of defects	'	Weld repair of base material is not permitted.  For repair of welds, the requirements for production welding shall apply to the repair WPS.		
Sour service (additional	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.			
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished pipes shall be pic	Finished pipes shall be pickled or bright annealed.		
Marking	The pipe shall be marked	to ensure full traceat	pility to heat and heat treatment lo	t.
Certification	The material manufacturer quality requirements stand		system certified in accordance w purchaser.	ith ISO 9001 or another
	The inspection documents confirm compliance with the		ccordance with ISO 10474 /EN 10	0204 Type 3.1 and shall
	The inspection documents		· ·	
	<ul> <li>Heat treatment condition</li> </ul>	on (annealing tempe	rature and holding time shall be st	tated).
a The supplementary s service.	suffix "S" designates a material de	elivered in accordance v	with the MDS plus the additional supple	ementary requirements for sour



# Table A.57 — MDS IN203S

Material Data Sh	neet MDS No. IN203S a Rev			Rev. 01
TYPE OF MATERIAL	L: Nickel alloy type 825			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Wrought fittings	ASTM B366	UNS N08825	WP CI. S, WP CI. W, WP CI. WX	ASTM B366 S3
		Page 1 of 1	·	
Scope	This MDS defines applicable specification.	ole options and/or requiren	nents that supplement or amer	nd the referenced standard
Metal making	Basic electric furnace (EF)	melt shall be refined by A	OD or VOD.	
Chemical composition	PREN≥32			
Welding	Welding procedures shall be same material grade (UNS A change of filler metal cla	number) as used in prod		ISO 15614-1 using the
Heat treatment			ree circulation of heating and cannot any rapid cooling/quenching.	ooling media around each
Tensile testing	Seamless fitting made from annealed seamless pipe.	n seamless pipe shall com	nply with the tensile testing requ	uirements for cold-worked
Corrosion testing	Corrosion test according to ASTM G28 Method A is required.  Test specimen for welded fitting shall include the weld.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times magnification.			
Extent of testing		Testing shall be per lot and per furnace charge. A lot shall consist of all fittings 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.		
Non-destructive testing	100 % of welded fittings at	Supplementary requirement S3 shall apply to the weld end area of 10 % of seamless fittings from each lot and 100 % of welded fittings above DN 50 (NPS 2). For welded fittings, the testing shall cover the weld only.  Acceptance criteria shall be according to ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 8.		
Repair of defects	Weld repair of base material is not permitted.			
	For repair of welds, the rec	quirements for production	welding shall apply to the repa	ir WPS.
Sour service (additional metallurgical,	The material shall conform and this MDS.	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.		
manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished fittings shall be pi	ckled or bright annealed.	Machined surfaces do not requ	ire pickling.
Marking	The fittings shall be marke	The fittings shall be marked to ensure full traceability to heat and heat treatment lot.		
Certification	The material manufacturer requirements standard acc		m certified in accordance with	ISO 9001 or another quality
	confirm compliance with th	is specification.	ance with ISO 10474 /EN 1020	4 Type 3.1 and shall
	The inspection documents  - Heat treatment condition		g information: and holding time shall be state	ed).
a The supplementary s		· · · · · · · · · · · · · · · · · · ·	e MDS plus the additional supplem	·
service.	-			



# Table A.58 — MDS IN204S

Material Data Sh	eet MDS No. IN204S a Rev. 0			Rev. 01
TYPE OF MATERIAL	: Nickel alloy type 825			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Forgings	ASTM B564	UNS N08825	-	ASTM B564 S5.3
		Page 1 of 2	-	
Scope	This MDS defines applicable specification.	le options and/or requireme	nts that supplement or amer	nd the referenced standard
Metal making	Basic electric furnace (EF)	melt shall be refined by AO	D or VOD.	
Chemical composition	PREN≥32			
Heat treatment			ee circulation of heating and gany rapid cooling/quenching	
Corrosion testing	Acceptance criteria:  - Corrosion rate ≤ 0.5 mr	o ASTM G28 Method A is red m/y. visible at 50 times magnifica		
Extent of testing	Testing shall be per lot and wall thickness, manufactur	d per furnace charge. A lot si ed from one heat of material	hall consist of all forgings of	the same type, size, and
Non-destructive testing	Liquid penetrant testing ASTM B564 supplementary requirement S5.3 shall apply as amended by this MDS.			<b>3</b> .
	NDE requirement Forgings			
	Frequency <sup>b</sup>		10 %	
	Method	AS	SME BPVC, Sec. V, Article 6	5
	Extent <sup>c</sup>		100 %	
	Acceptance criteria		BPVC, Sec. VIII, Div. 1, Appe	
	NOTE The testing shall be of testing.	carried out after machining, if app	olicable. Non-machined surfaces	s shall be pickled prior to the
	<ul> <li>Parts of size DN &gt; 50 (NPS &gt; 2).</li> <li>For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>			Il be examined. The test lot
	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.			
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional metallurgical,	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and this MDS.			
manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished components shall	be pickled or bright anneal.	Machined surfaces do not r	equire pickling.
Marking	The component shall be m	arked to ensure full traceabi	lity to heat and heat treatme	nt lot.



Material Data	Sheet MDS No. IN204S <sup>a</sup>		Rev. 01		
TYPE OF MATE	ERIAL: Nickel alloy type 825	5			
PRODUCT FOR	RM STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM B564	UNS N08825	-	ASTM B564 S5.3	
	<u>.</u>	Page 2 of 2	2		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	<ul> <li>Heat treatment condition (annealing temperature and holding time shall be stated).</li> </ul>				
The supplemer service.	The inspection documents shall include the following information:  - Heat treatment condition (annealing temperature and holding time shall be stated).  supplementary suffix "S" designates a material delivered in accordance with the MDS plus the additional supplementary requirements for				



# Table A.59 — MDS IN205S

Nickel alloy type 825						
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
ASTM B424	UNS N08825	-	-			
	Page 1 of 1					
This MDS defines applical specification.	ble options and/or requ	uirements that supplement or ame	nd the referenced standard			
Basic electric furnace (EF)	) melt shall be refined	by AOD or VOD.				
PREN ≥ 32						
Corrosion test according to ASTM G28 Method A is required per lot.  Acceptance criteria:  — Corrosion rate ≤ 0.5 mm/y.  — No intergranular attack visible at 50 times magnification.						
<u>Valve plate NDT</u> Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.						
Weld repair is not permitte	ed.					
The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.						
The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Finished components shall be pickled or bright annealed.						
The plates, sheets and str	ips shall be marked to	ensure full traceability to heat and	I heat treatment lot.			
			ISO 9001 or another			
		cordance with ISO 10474 /EN 1020	04 Type 3.1 and shall			
•		· ·				
- Heat treatment condition	on (annealing tempera	ture and holding time shall be stat	ed).			
	ASTM B424  This MDS defines applical specification.  Basic electric furnace (EF PREN ≥ 32  Plates, sheets and strips a media around each productorrosion test according the Acceptance criteria:  Corrosion rate ≤ 0.5 m  No intergranular attack Valve plate NDT  Inspection shall be according the requirements in this M weld repair is not permitted. The material shall conformand this MDS.  The material shall be traced from the plates, sheets and strong the material manufacture quality requirements standard the inspection documents confirm compliance with the inspection documents.	ASTM B424  Page 1 of This MDS defines applicable options and/or requispecification.  Basic electric furnace (EF) melt shall be refined PREN ≥ 32  Plates, sheets and strips shall be placed in such media around each product during the heat treat Corrosion test according to ASTM G28 Method Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times may Valve plate NDT  Inspection shall be according to the applicable vithe requirements in this MDS shall apply.  Weld repair is not permitted.  The material shall conform to the requirements of and this MDS.  The material shall be traceable in accordance with the material shall be traceable in accordance with the material manufacturer shall have a quality signality requirements standard accepted by the part of the inspection documents shall be issued in acconfirm compliance with this specification.  The inspection documents shall include the follows.	ASTM B424 UNS N08825 -  Page 1 of 1  This MDS defines applicable options and/or requirements that supplement or amer specification.  Basic electric furnace (EF) melt shall be refined by AOD or VOD.  PREN ≥ 32  Plates, sheets and strips shall be placed in such a way as to ensure free circulation media around each product during the heat treatment process including any rapid  Corrosion test according to ASTM G28 Method A is required per lot.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times magnification.  Valve plate NDT  Inspection shall be according to the applicable valve specification. If a QSL is not sthe requirements in this MDS shall apply.  Weld repair is not permitted.  The material shall conform to the requirements of ISO 15156/NACE MR0175 or IS and this MDS.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3.  Finished components shall be pickled or bright annealed.  The plates, sheets and strips shall be marked to ensure full traceability to heat and the material manufacturer shall have a quality system certified in accordance with quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 1020			



# Table A.60 — MDS IN206S

Material Data Sh	neet	MDS No. IN20	06S <sup>a</sup>	Rev. 02
TYPE OF MATERIAL	L: Nickel alloy			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A494	Grade CU5MCuC (UNS N08826)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16
		Page 1 of 4	1	
Scope	specification.		ements that supplement or ame rocess, the requirements of AS	
Metal making			ethod. Induction melting of AOD	refined ingot is regarded to
Chemical composition	PREN ≥ 32			
Heat treatment	Castings shall be placed in casting during the heat tre		re free circulation of heating and g quenching.	cooling media around each
Corrosion testing	Corrosion test according to ASTM G28 Method A is required.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times magnification.			
Extent of testing		Tensile test and corrosion test shall be made for each heat and heat treatment load (including any PWHT). A test lot shall not exceed 5 000 kg (11 000 lb).		
Test sampling	Test blocks shall be integral or gated with the casting(s) they represent castings through all heat treatment operations.  Thickness of the test block shall be equal to the thickest part of the casting castings; the largest flange thickness is the ruling section.			s; the largest flange
	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. Distance from end of test specimen to end of test block shall minimum be T/4.			
	For investment casting, ter	egrated at Block	7/4 T 50	



Material Data Sh	eet	MDS No. IN20	<b>6S</b> <sup>a</sup>	Rev. 02
TYPE OF MATERIAL	: Nickel alloy			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A494	Grade CU5MCuC (UNS N08826)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16

#### Page 2 of 4

#### Non-destructive testing

#### Visual inspection

NDE requirement	Pilot casting (section 4.8)	Production casting	
Frequency	Each pilot casting	Each production casting	
Method	ANSI/MSS SP-55		
Extent	100 % of all accessible surfaces including welding ends		
Acceptance criteria	MSS SP-55		
NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the			

testing.

#### Liquid penetrant testing

ASTM A494 supplementary requirement S3 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8) Production casting		
Frequency <sup>b</sup>	100 %		
Method	ASME BPVC, S	Sec. V, Article 6	
Extent <sup>c</sup>	100 %		
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7		

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.

Frequency of inspection 100 % means that each item shall be examined.

All accessible internal and external surfaces shall be examined.



Material Data Sheet		MDS No. IN20	<b>6S</b> <sup>a</sup>	Rev. 02		
TYPE OF MATERIAL: Nickel alloy						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A494	Grade CU5MCuC (UNS N08826)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16		
		Page 3 of 4	1	1		

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# Non-destructive testing (continued)

#### Radiographic testing

ASTM A494 supplementary requirement S2 shall apply as amended by this MDS.

NDE requirement	Pilot casting	<u> </u>							
	(section 4.8)	Valve castings <sup>a</sup>						Other pressure containing castings b	
Frequency <sup>c</sup>	100 %	NPS DN			Pressu	re class			100 %
				≤ 300	600	900	≥ 1500		
		< 2	< 50	N/R	N/R	N/R	N/R		
		≥ 2	≥ 50	N/R	5 %	5 %	5 %		
		≥ 6	≥ 150	N/R	5 %	5 %	100 %		
		≥ 10	≥ 250	5 %	5 %	5 %	100 %		
		≥ 16	≥ 400	5 %	5 %	100 %	100 %		
		≥ 20	≥ 500	5 %	100 %	100 %	100 %		
Method	ASME <i>BPVC</i> , Sec. V, Article 2								
Extent						100 % <sup>d</sup>			
LAOIR		anges in sections and at the junctions of risers, gates or feeders to the casting					100 70		
Acceptance criteria		ASME	BPVC,	Sec. VII	I, Div. 1,	Appendi	x 7		

 $\label{eq:note_norm} \mbox{NOTE} \quad \mbox{N/R means not required, unless specified otherwise by the purchaser.}$ 

- Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.

#### Repair of defects

All major repairs as defined by ASTM A494 shall be documented in accordance with ASTM A781 S16 or ASTM A957 S16, as applicable.

The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and as follows:

- Welding procedure shall be qualified on the same cast material grade (UNS number) as used in production;
- Change of specific make of filler metal (brand names) requires requalification for SMAW and FCAW processes;
- A macro and corrosion test specimen shall include the weld zone;
- Testing methodology and acceptance criteria shall be in accordance with the requirements of this MDS for the parent material.

Examination of major repair welds on pressure containing parts shall also include RT.

Weld repairs are not acceptable for castings that leak during pressure testing.

Post weld heat treatment is required after all major weld repairs. If a minor cosmetic repair is required, heat treatment may be excluded providing the welding procedure meets all the specified microstructural, mechanical and corrosion material requirements of this data sheet in the as-welded condition.



Material Data Sheet		MDS No. IN20	Rev. 0				
TYPE OF MATERIAL: Nickel alloy							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Castings	ASTM A494	Grade CU5MCuC (UNS N08826)	-	ASTM A494 S2, S3 ASTM A781 S16 ASTM A957 S16			
		Page 4 of 4	-	1			
Sour service (additional	The material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE Mand this MDS.						
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be	ial shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and					
Certification		cturer shall have a quality sys standard accepted by the pur	tem certified in accordance with chaser.	ISO 9001 or another			
		ments shall be issued in accor with this specification.	dance with ISO 10474 /EN 1020	04 Type 3.1 and shall			
	The inspection docu	ments shall include the following	ng information:				
	<ul> <li>Heat treatment c stated).</li> </ul>	ondition (solution annealing ar	nd stabilization temperatures and	d holding times shall be			
	siaicu).						



# Table A.61 — MDS IN207S

Material Data She	eet	MDS No.	IN207S a	Rev. 01		
TYPE OF MATERIAL:	: Nickel alloy type 825					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars and rods	ASTM B425	UNS N08825	-	-		
		Page 1 of 1	•	•		
Scope	This MDS defines application.	able options and/or requ	irements that supplement or ame	nd the referenced standard		
Metal making	Basic electric furnace (E	F) melt shall be refined l	by AOD or VOD.			
Chemical composition	PREN ≥ 32					
Heat treatment	Bars shall be placed in s during the heat treatmen		free circulation of heating and coorapid cooling/quenching.	ling media around each bar		
Corrosion testing	Corrosion test according to ASTM G28 Method A is required.  Acceptance criteria:  Corrosion rate ≤ 0.5 mm/y.  No intergranular attack visible at 50 times magnification.					
Extent of testing	Corrosion test shall be m	nade for each lot as defi	ned for mechanical testing.			
Non-destructive testing	NDT valve parts manufactured from bar Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. I QSL is not specified by the purchaser, the requirements in this MDS shall apply including liquid penetrant testing according to the following table.					
	NDE requirement Part manufactured from bar <sup>a</sup>					
	Frequency b 10 %					
	Method ASME BPVC, Sec. V, Article 6					
	Extent <sup>c</sup>		100 %			
	Acceptance criteria	AS	ME BPVC, Sec. VIII, Div. 1, Apper	ndix 8		
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.  a Part of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be examined.					
	All accessible internal a	and external surfaces shall be	pe examined.			
Repair of defects	Weld repair is not permit		pe examined.			
Sour service (additional	Weld repair is not permit	ted.	oe examined.  If ISO 15156/NACE MR0175 or IS	O 17945/NACE MR0103,		
Sour service	Weld repair is not permit The material shall confor and this MDS.	ted. rm to the requirements o				
Sour service (additional metallurgical, manufacturing, testing and certification	Weld repair is not permit The material shall confor and this MDS. The material shall be trace	ted.  m to the requirements of the contract of	f ISO 15156/NACE MR0175 or IS	, section 7.2 and this MDS.		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup> Surface treatment	Weld repair is not permit The material shall confor and this MDS. The material shall be trace Finished bars shall be pic	ted.  Im to the requirements of the ceable in accordance with the ceable in the ceable	of ISO 15156/NACE MR0175 or IS th ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup> Surface treatment and finish	Weld repair is not permit The material shall confor and this MDS. The material shall be trace Finished bars shall be pic The bars shall be marked The material manufactur quality requirements star	ted.  Im to the requirements of ceable in accordance with the ceable with the ceable in accordance with the ceable with the ce	of ISO 15156/NACE MR0175 or IS th ISO 15156-3/NACE MR0175-3, and the surfaces do not require pickling the surfaces do not treatment lot.  System certified in accordance with urchaser.	section 7.2 and this MDS.  D.  ISO 9001 or another		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup> Surface treatment and finish Marking	Weld repair is not permit The material shall confor and this MDS. The material shall be trace Finished bars shall be pic The bars shall be marked The material manufactur quality requirements star The inspection documen confirm compliance with	ted.  Im to the requirements of ceable in accordance with the ceable wit	of ISO 15156/NACE MR0175 or ISO th ISO 15156-3/NACE MR0175-3.  The interpretation of the importance of	section 7.2 and this MDS.  D.  ISO 9001 or another		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup> Surface treatment and finish Marking	Weld repair is not permit The material shall confor and this MDS. The material shall be trace Finished bars shall be pic The bars shall be marked The material manufactur quality requirements star The inspection documen confirm compliance with The inspection documen	ted.  Im to the requirements of ceable in accordance with the ceable with the ceable in accordance with the ceable with the ce	of ISO 15156/NACE MR0175 or ISO th ISO 15156-3/NACE MR0175-3.  The interpretation of the importance of	ISO 9001 or another 04 Type 3.1 and shall		



# Table A.62 — MDS IR111 / IR111S

Material Data Sheet		MDS No. IR111 /	IR111S a	Rev. 01		
TYPE OF MATERIAL	: Austenitic stainless s	teel type 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Seamless pipes	ASTM A312	UNS S31254	-	-		
	ASTM A312	UNS N08367	-	-		
	ASTM A312	UNS N08926	-	-		
	-1	Page 1 of 1				
Scope	This MDS defines ap specification.	plicable options and/or requ	irements that supplement or ame	nd the referenced standard		
Qualification			nall be qualified in accordance wit neet the requirements of this MDS			
Metal making	The melt shall be ref	ined by AOD or equivalent m	nethod.			
Chemical composition	PREN ≥ 40.0					
Heat treatment	The pipes shall be so	olution annealed followed by	rapid cooling.			
		d in such a way as to ensure treatment process including	free circulation of heating and coquenching.	ooling media around each		
Corrosion testing	Corrosion test accord	ding to ASTM G48 Method A	is required.			
	internal surfaces and ASTM G48. The comperformed for 5 min The acceptance crite - No pitting at 20x	I a cross section surface in function and the specimen shall be pict at 60 °C (140 °F) in a solution are:	exposure time 24 h. The test sha ull wall thickness. Cut edges shall kled before being weighed and te n of 20 % HNO3 + 5 % HF.	I be prepared according to		
Extent of testing	+		It for each heat and heat treatmen	nt lot		
			it for each fleat and fleat treatmen	11.101.		
Repair of defects	Weld repair is not pe					
Sour service (additional metallurgical,			the purchaser, the material shall O 17945/NACE MR0103, and this			
manufacturing,	Hardness testing					
testing and certification requirements) <sup>a</sup>	Production hardness one length of pipe per proximity.	testing shall be performed in er lot. The maximum hardnes	n accordance with the requiremer ss shall be 35HRC from three rea	nts in ASTM A370/A1058 on dings taken in close		
	The material shall be	traceable in accordance wit	th ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Finished pipes shall	be pickled or bright annealed	d.			
Marking	The pipes shall be m	arked to ensure full traceabi	lity to heat and heat treatment lot			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	· ·	ments shall include the follow	· ·			
		n or MCPR/QTR number use	ed.			
			and quench medium shall be stated and direct quenched).	ted (holding time is		
The supplementary s     requirements for soul		esignate a material delivered in a	accordance with the MDS plus the add	ditional supplementary		



# Table A.63 — MDS IR112 / IR112S

Material Data Sheet		MDS No. IR112 / IR112S a Rev				
TYPE OF MATERIAL	.: Austenitic stainless steel ty	rpe 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A358	UNS S31254	Class 1, 3 and 5	ASTM A358 S3		
	ASTM A358	UNS N08367	Class 1, 3 and 5	ASTM A358 S3		
	ASTM A358	UNS N08926	Class 1, 3 and 5	ASTM A358 S3		
		Page 1 of 2		•		
Scope	This MDS defines applicable specification.	ole options and/or require	ements that supplement or ame	nd the referenced standard		
Qualification			l be qualified in accordance wit et the requirements of this MDS			
Metal making	The melt shall be refined b	y AOD or equivalent me	thod.			
Chemical composition	PREN ≥ 40.0					
Welding	<ul> <li>A matching consumable the S content of the color</li> <li>The welding procedure</li> <li>The qualification shall be</li> </ul>	<ul> <li>The WPS shall be qualified in accordance with ASME BPVC, Sec. IX or ISO 15614-1 and this MDS:</li> <li>A matching consumable with enhanced Mo or Cr content compared to the base material shall be used; the S content of the consumable shall not exceed 0.015 %.</li> <li>The welding procedure qualification shall be corrosion tested as specified below.</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 shall require requalification.</li> </ul>				
Heat treatment	pipe during the heat treatment of the pipe during the heat treatment of the pipe during the pi	uch a way as to ensure fr nent process including qu ng is not required for pipe	ee circulation of heating and co	up to 7.11 mm (0.28 in)		
Corrosion testing	Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50 °C (122 °F) and the exposure time 24 h. 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 min at 60 °C (140 °F) in a solution of 20 % HNO3 + 5 % HF.  The acceptance criteria are:  No pitting at 20x magnification.  The weight loss shall be less than 4.0 g/m².					
Extent of testing	For batch heat treatme same processing conditions	One tensile and corrosion test shall be carried out for each lot as defined below:  - For batch heat treatment, a lot is defined as maximum 60 m (197 ft) of pipes of the same heat, same processing conditions including weld procedure, same size and heat treatment load.  - For continuous heat treatment, a lot is defined as maximum 60 m (197 ft) of pipes of the same heat,				
			cedure, same size and which is			
Non-destructive testing	less than 4.0 mm (0.16 in). ASTM A358 supplementar The weld of each examine Method of testing shall be	.  y requirement S3 shall a d pipe shall be ground flu according to ASME <i>BPV</i>	pply to the longitudinal weld en ush for a length of 100 mm (4 ir C, Sec. V Article 6 and accepte sting shall be carried out after a	ds of 10 % of pipes per lot.  a) prior to penetrant testing.  ance criteria shall be to		
Repair of defects	Weld repair of base materi	ial is not permitted. quirements for production	n welding above shall apply to t			



Material Data Sheet		MDS No. IR112	MDS No. IR112 / IR112S a			
TYPE OF MATERIAL	: Austenitic stainless s	teel type 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded Pipes	ASTM A358	UNS S31254	Class 1, 3 and 5	ASTM A358 S3		
	ASTM A358	UNS N08367	Class 1, 3 and 5	ASTM A358 S3		
	ASTM A358	UNS N08926	Class 1, 3 and 5	ASTM A358 S3		
	-1	Page 2 of 2				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 35HRC from three readings taken in close proximity at each location.					
	The material shall be	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.				
Surface treatment and finish	Finished pipes shall	be pickled or bright anneale	d.			
Marking	The pipes shall be m	narked to ensure full traceab	lity to heat and heat treatment lot			
Certification		acturer shall have a quality so	/stem certified in accordance with urchaser.	ISO 9001 or another		
		The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection docu	ments shall include the follow	ving information:			
	<ul> <li>MPS identificatio</li> </ul>	n or MCPR/QTR number us	ed.			
	<ul> <li>Steel manufactur</li> </ul>	rer.				
	<ul> <li>Solution annealir</li> </ul>	ng temperature, holding time	and quench medium shall be state	ted.		



# Table A.64 — MDS IR113 / IR113S

Material Data Sheet		MDS No. IR113	/ IR113S <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	L: Austenitic stainless s	teel type 6Mo		
PRODUCT FORM	STANDARD	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A403	UNS S31254	WP-S, WP-WX and WP-W	ASTM A960 S52
	ASTM A403	UNS N08367	WP-S, WP-WX and WP-W	ASTM A960 S52
	ASTM A403	UNS N08926	WP-S, WP-WX and WP-W	ASTM A960 S52
		Page 1 of 2	2	
Scope	This MDS defines apspecification.	oplicable options and/or requ	irements that supplement or ame	nd the referenced standard
Qualification			nall be qualified in accordance wit meet the requirements of this MDS	
Metal making	The melt shall be ref	ined by AOD or equivalent n	nethod.	
Chemical composition	PREN ≥ 40.0			
Welding	<ul> <li>A matching cons the S content of</li> <li>The welding prod</li> <li>The qualification</li> </ul>	umable with enhanced Mo on the consumable shall not exceedure qualification shall be a shall be carried out on the s	rdance with ASME BPVC IX or IS r Cr content compared to the base ceed 0.015 %. corrosion tested as specified belowame material grade (UNS number relding consumables shall require	e material shall be used; w. r) as used in production.
Heat treatment	Fittings shall be place	solution annealed followed b ed in such a way as to ensu it treatment process including	re free circulation of heating and o	cooling media around each
Corrosion testing	the exposure time 24 in full wall thickness. pickled before being of 20 % HNO3 + 5 % The acceptance crite.  No pitting at 20x	4 h. The test shall expose the Cut edges shall be prepare weighed and tested. Picklin 6 HF.	A is required. Test temperature she external and internal surfaces and according to ASTM G48. The cog may be performed for 5 min at 6	nd a cross section surface omplete specimen shall be
	-			
Extent of testing	A test lot shall include		ut for each lot as defined below. neat and heat treatment load, with d with the same WPS.	a wall thickness range
Test sampling	removal of specimer	ns is not possible due to the	nens cut from a fitting, where dime size of the fitting, a prolongation o neat treatment load as the fittings	or a length of starting



Material Data Sheet		MDS No. IR113	'IR113S a		Rev. 01		
TYPE OF MATERIAL	L: Austenitic stainless steel	type 6Mo					
PRODUCT FORM	STANDARD	GRADE ACCEPT		RD GRADE ACCEPTANCE CLAS		PTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Wrought fittings	ASTM A403	UNS S31254	WP-S, WPW	WP-WX and	ASTM A960 S52		
	ASTM A403	UNS N08367	WP-S, WPW	WP-WX and	ASTM A960 S52		
	ASTM A403	UNS N08926	WP-S, WPW	WP-WX and	ASTM A960 S52		
		Page 2 of 2	•				
Non-destructive	Liquid penetrant testing						
testing	ASTM A960 supplement	ary requirement S52 sha	all apply as am	ended by this MDS	<b>.</b>		
	NDE requirement		Nom	inal thickness			
		Seamless fi			ded fittings <sup>a</sup>		
	Frequency <sup>b</sup>	10 %	yo	110.	100 %		
	, ,	10 /0	A CME DO	V/C Coo V/ Article			
	Method		ASIVIE BP	VC, Sec. V, Article	0		
	Extent <sup>c</sup>			100 %			
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 8						
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.  a Welded fittings of size DN > 50 (NPS > 2).  b Frequency of inspection 100 % means that each item shall be examined. When random examination (10 %) is specified, a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.						
	c All accessible internal a	and external surfaces shall be arou			esting shall cover the weld only rior to penetrant testing		
Repair of defects	Weld repair of base mate For repair of welds, the r welds shall be heat treat	equirements for producti	on welding abo	ove shall apply to the	he repair WPS. Repair		
Sour service (additional	When sour service requirequirements of ISO 151						
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on two fittings per lot. When only one fitting is produced, it shall be hardness tested as required. The maximum hardness of the base material, HAZ and weld metal shall be 35HRC from three readings taken in close proximity at each location.						
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3 section, 7.2 and this MDS.						
Surface treatment and finish	Finished fittings shall be	pickled. Machined surfa	ces do not requ	uire pickling.			
Marking	The fittings shall be mark	ked to ensure full traceat	oility to heat an	d heat treatment lo	rt.		
Certification	The material manufactur quality requirements star			in accordance with	ISO 9001 or another		
	The inspection documen compliance with this spe	ts shall be in accordance		74 /EN 10204 Type	e 3.1 and shall confirm		
	The inspection documen	ts shall include the follow	ving informatio	n:			
		MCPR/QTR number use	ed.				
	<ul> <li>Steel manufacturer.</li> </ul>						
	<ul> <li>Solution annealing te</li> </ul>	mperature, holding time	and quench m	edium shall be stat	ted.		
<ul> <li>The supplementary s requirements for sou</li> </ul>	suffix "S" shall be used to desigr r service.	nate a material delivered in a	accordance with	the MDS plus the add	litional supplementary		



# Table A.65 — MDS IR114 / IR114S

Material Data Sheet		MDS No. IR114 / IF	R114S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	L: Austenitic stainless st	eel type 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F44 (UNS S31254)	-	ASTM A961 S56		
	ASTM A182	F62 (UNS N08367)	-	ASTM A961 S56		
	ASTM B462	UNS N08926	-	ASME <i>BPVC</i> , Code Case 2120-1		
		Page 1 of 2	•			
Scope	specification.  Product covered by the	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  Product covered by this MDS is limited to a maximum thickness of 200 mm (8 in). For thickness exceeding 200 mm (8 in), qualification and specification requirements shall be subject to agreement.				
Qualification			be qualified in accordance wit et the requirements of this MDS			
Metal making	The melt shall be refi	ned by AOD or equivalent met	hod.			
Chemical composition	PREN ≥ 40.0					
Heat treatment	Forgings shall be place component during the	e heat treatment process inclu	e free circulation of heating and ding quenching.			
Corrosion testing	the exposure time 24 in full wall thickness. a cross section from section from surface to complete specimen s 60 °C (140 °F) in a so. The acceptance criter	Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50 °C (122 °F) and the exposure time 24 h. 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 100 mm (4 in) 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 50 mm (2 in). 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 min at 60 °C (140 °F) in a solution of 20 % HNO3 + 5 % HF.  The acceptance criteria are:  No pitting at 20x magnification.				
Extent of testing	One tensile and corro	sion test shall be carried out f	or each lot as defined below.			
		ngs with as forged weight 50 k	e heat, heat treatment load and cg (110 lb), and 5 000 kg (11 00			
		mid length shall be at least 50	, T ≤ 50 mm (2 in), the test spe mm (2 in) from any second sur			
		nearest surface and mid-leng	, T > 50 mm (2 in), the test spe th of test specimens at least T			
	<ul> <li>Sketches shall be test specimens.</li> </ul>	established showing type, and	d size of test samples and loca	tion for extraction of		
Non-destructive testing			cordance with the product stand pachined surfaces shall be pick			



Material Data Sh	neet MDS No.	IR114 / IR114S a		Rev. 01		
TYPE OF MATERIAL	L: Austenitic stainless steel t	ype 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F44 (UNS S31254)	-	ASTM A961 S56		
	ASTM A182	F62 (UNS N08367)	-	ASTM A961 S56		
	ASTM B462	UNS N08926	-	ASME <i>BPVC</i> , Code Case 2120-1		
	-	Page 2 of 2		1		
Non-destructive testing (continued)	Liquid penetrant testing					
	NDE requirement		Forgings <sup>a</sup>			
	Frequency <sup>b</sup>		10 %			
	Method		ASME BPVC, Sec. V, Article	6		
	Extent <sup>c</sup>		100 %			
	Acceptance criteria	ASN	ME BPVC, Sec. VIII, Div. 1, App	endix 8		
	NOTE The testing shall be testing.	carried out after machining, if	applicable. Non-machined surface	s shall be pickled prior to the		
	shall be as defined for m  All accessible internal ar  Valve forgings NDT  Inspection shall be accord	(10 %), a minimum of one ite echanical testing.  Indexternal surfaces shall be external surfaces shall be external surfaces.	m per lot in any purchase order sha examined.  e specification. If a QSL is not s			
Repair of defects	the requirements in this N Weld repair is not permitte	,				
Sour service (additional	When sour service require	ements are specified by th	e purchaser, the material shall 17945/NACE MR0103, and this			
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	two forgings per lot. When		accordance with the requiremer d, it shall be hardness tested as n in close proximity.			
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished forgings shall be	pickled. Machined surfac	es do not require pickling.			
Marking	The forgings shall be mar	ked to ensure full traceabi	lity to heat and heat treatment	lot.		
Certification		er shall have a quality systematic accepted by the pure	em certified in accordance with haser.	ISO 9001 or another		
	compliance with this spec	ification.	vith ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
	The inspection document	s shall include the followin	=			
	*	LODD OTD .				
	- MPS identification or I	MCPR/QTR number used.				
	<ul><li>MPS identification or I</li><li>Steel manufacturer.</li></ul>		d quench medium shall be stat	ed.		



# Table A.66 — MDS IR115 / IR115S

Material Data Sheet	Sheet MDS No. IR115 / IR115S a Rev.						
TYPE OF MATERIAL: Auster	nitic stainless steel type 6N	Ло					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLAS	S SUPPLEMENTARY REQUIREMENT			
Plates, sheets, strips	ASTM A240	UNS S31254	-	-			
	ASTM A240	UNS N08367	-	-			
	ASTM A240	UNS N08926	-	-			
		Page 1 of 2					
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.						
Qualification	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.						
Metal making	The melt shall be refined	The melt shall be refined by AOD or equivalent method.					
Chemical composition	PREN ≥ 40.0						
Tensile testing	Tensile test specimens s	hall be sampled in th	ne transverse orientation to th	ne direction of final rolling.			
Corrosion testing	and the exposure time 24 h. 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 formin at 60 °C (140 °F) in a solution of 20 % HNO3 + 5 % HF.  The acceptance criteria are:  No pitting at 20x magnification.  Weight loss shall be less than 4.0 g/m².						
Extent of testing	One tensile and corrosion test shall be carried out for each heat of steel and heat treatment lot.						
Non-destructive testing	<u>Visual inspection</u>						
	VT shall be carried out on each plate in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.						
	Valve plate NDT						
	Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.						
Repair of defects	Weld repair is not permitted.						
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.						
manufacturing, testing and certification requirements)	Hardness testing						
a	Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. For coil, tests shall be carried out at both ends of the coil. The maximum hardness shall be 35HRC from three readings taken in close proximity at each location.						
	The material shall be trad	ceable in accordance	e with ISO 15156-3/NACE MI	R0175-3, section 7.2 and this			
Surface treatment and finish	Finished plates, sheets and strips shall be pickled.						



stainless steel ty	ne 6Mo							
	TYPE OF MATERIAL: Austenitic stainless steel type 6Mo							
TANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT					
STM A240	UNS S31254	-	-					
STM A240	UNS N08367	-	-					
STM A240	UNS N08926	-	-					
	Page 2 of 2	-						
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.								
The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.								
The inspection documents shall include the following information:								
<ul> <li>MPS identification or MCPR/QTR number used.</li> </ul>								
<ul> <li>Steel manufacturer.</li> </ul>								
<ul> <li>Solution annealing temperature, holding time and quench medium shall be stated.</li> </ul>								
	another quality req The inspection doc confirm compliance The inspection doc - MPS identificat - Steel manufact	STM A240  UNS N08367  Page 2 of 2  The material manufacturer shall have a qual another quality requirements standard acceptive inspection documents shall be in according to confirm compliance with this specification. The inspection documents shall include the form of the inspection of MCPR/QTR numbers.	STM A240  UNS N08367  Page 2 of 2  The material manufacturer shall have a quality system certified in accordange another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 1020 confirm compliance with this specification.  The inspection documents shall include the following information:  MPS identification or MCPR/QTR number used.  Steel manufacturer.					



# Table A.67 — MDS IR116 / IR116S

Material Data Sh	ieet	MDS No. IR116 / IR116S a Rev				
TYPE OF MATERIAL	: Austenitic stainless stee	el type 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A351	CK3MCuN (UNS J93254)	-	ASTM A351 S5, S6, ASTM A703 S20 ASTM A985 S20		
	ASTM A351	CN3MN (UNS J94651)	-	ASTM A351 S5, S6, ASTM A703 S20 ASTM A985 S20		
		Page 1 of 3				
Scope	specification.	icable options and/or requirement by the investment casting proce				
Qualification		manufacturing process shall be qualification testing shall meet t				
Metal making	The melt shall be refine refined scrap as permit	ed by AOD or equivalent method ted by ISO 17782 is regarded to	d. Induction melting of AOD o be equivalent to AOD refin	refined ingot or equally led materials.		
Chemical composition	P ≤ 0.030 % PREN ≥ 40.0					
Heat treatment	Material shall be solution annealed at temperature ≥ 1 225 °C (2 237 °F) followed by water/liquid quenching.					
	Castings 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.					
Corrosion testing	Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50 °C (122 °F) the exposure time 24 h. The test shall expose the external and internal surfaces and a cross section surin full wall thickness. Cut edges shall be prepared according to ASTM G48. The complete specimen shall before being weighed and tested. Pickling may be performed for 5 min at 60 °C (140 °F) in a surface of 20 % HNO3 + 5 % HF.					
	The acceptance criteria	a are:				
	No pitting at 20x magnification.					
	I he weight loss sha	all be less than 4.0 g/m <sup>2</sup> .				
Extent of testing	One tensile and corrosion test shall be carried out for each heat of steel and heat treatment load (including any PWHT). A test lot shall not exceed 5 000 kg (11 000 lb) in weight.					
Test sampling	through all heat treatme					
Thickness of the test block shall be equal to the thickest part of the casting represented. For flar the largest flange thickness is the ruling section.						
	Dimensions of test blocks and location of test specimens within the test blocks are shown in the fig The test specimens shall be taken within the cross hatched area and in a distance of T/4 from the					
	During any PWHT the t	est block shall be tack welded	J	m in		
		1	T/4			
	1	T/2 X		11 1/4		
	T/4			T/2 X T+X		
		ntegrated est Block	Gat Test			



Istenitic stainless stee TANDARD STM A351 STM A351	GRADE  CK3MCuN (	(UNS J932		ACCEPTA	NCE CL			
STM A351	CK3MCuN (	(UNS J932			NCE CL			
		(UNS J932	254) -				SUPPLEMENTARY REQUIREMENT	
STM A351	CN3MN (UN	CK3MCuN (UNS J93254)					ASTM A35 ASTM A70 ASTM A98	3 S20
	CN3MN (UNS J94651)		-	l A			ASTM A351 S5, S6, ASTM A703 S20 ASTM A985 S20	
	Pa	ge 2 of 3						
adiographic testing								
STM A351 supplemer	ntary requirement	t S5 shall	apply a	as amende	d by this	MDS.		
NDE requirement	Pilot casting	<u> </u>					9	
	(section 4.8) Valve castings <sup>a</sup>			a	Other pressure containing castings			
Frequency <sup>c</sup>	100 %	NPS D	DN	N Pressure class			100 %	
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method	ASME BPVC, Sec. V, Article 2							
Extent	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					100 % <sup>d</sup>		
Acceptance criteria	ria ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 7							
NOTE N/R means not required, unless specified otherwise by the purchaser.								
	IDE requirement  Frequency c  Method Extent  IOTE N/R means not re Production valve cast purchaser, the require Production casting of	Pilot casting (section 4.8)  Frequency c 100 %  Frequency c 100 %  Areas defined changes in section 200 casting the section 4.8 changes in section 200 casting the section 200 casting 200 casting the section 200 casting 200	Frequency ° 100 % NPS    Interpretation   Pilot casting (section 4.8)	Pilot casting (section 4.8)  Pilot casting (	Trequency ° 100 % Production 4.8)    Production 4.8   Production 4.8   Production valve casting acceptance criteria   ASME BPVC, Sec. Valve casting control of the casting acceptance criteria   ASME BPVC, Sec. Valve casting ac	Trequency °  100 %    NPS   DN   Pressure     ≤ 300   600     < 2   < 50   N/R   5 %     ≥ 2   ≥ 50   N/R   5 %     ≥ 10   ≥ 250   5 %   5 %     ≥ 10   ≥ 250	The A351 supplementary requirement S5 shall apply as amended by this MDS.    Production casting (section 4.8)   Production casting Valve castings a	The state of the production casting and the production casting section 4.8)    Pilot casting (section 4.8)   Production casting

a minimum of one item per lot of each pattern in any purchase order shall be examined.

Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



Material Data Sheet MDS No. IR116			16 / IR116S <sup>a</sup> Rev. 0 <sup>a</sup>				
TYPE OF MATERIAL	L: Austenitic stainless st	eel type 6Mo					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Castings	ASTM A351	CK3MCuN (UNS J93254)	-	ASTM A351 S5, S6, ASTM A703 S20 ASTM A985 S20			
	ASTM A351	CN3MN (UNS J94651)	-	ASTM A351 S5, S6, ASTM A703 S20 ASTM A985 S20			
		Page 3 of 3					
Repair of defects		Repairs as described in ASTM A351, section 10.2 shall be considered major. All major repairs shall be documented in accordance with ASTM A703 S20.2 or A985 S20, as applicable.					
	The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and the following requirements.						
	<ul> <li>Welding procedure shall be qualified on the same cast material grade (UNS number) as used in production.</li> </ul>						
	<ul> <li>Welding shall be carried out with Ni-based consumable with enhanced Mo or Cr content compared to the base material; the S content of the consumable shall not exceed 0.015 %.</li> </ul>						
	<ul> <li>Change of specific make of filler metal (brand names) requires requalification for SMAW and FCAW processes.</li> </ul>						
		ecimen shall include the weld zone					
	<ul> <li>Testing methodol for the parent material</li> </ul>	ogy and acceptance criteria shall lerial.	be in accordance with the re	equirements of this MDS			
	•	Examination of major repair welds on pressure containing parts shall also include RT.					
	·	Weld repairs are not acceptable for castings that leak during pressure testing.  Post weld heat treatment is required after all weld repairs					
		Post weld heat treatment is required after all weld repairs.  If a minor cosmetic repair is required, heat treatment may be excluded providing the welding procedure meets					
		pair is required, heat treatment mostructural, mechanical and corros					
Sour service (additional	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.						
metallurgical, manufacturing,	<u>Hardness testing</u>						
testing and certification requirements) <sup>a</sup>	the pilot casting and	roduction hardness testing shall be performed in accordance with the requirements in ASTM A370/A10 e pilot casting and one casting per lot thereafter for CK3MCuN castings. The maximum hardness shall 00HRB (22HRC) from three readings taken in close proximity.					
	For other alloys the maximum hardness shall not exceed 35HRC.						
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS						
Surface treatment and finish	Finished castings shall be pickled. Machined surfaces do not require pickling						
Marking	The castings shall be marked to ensure full traceability to heat and heat treatment load.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	MPS identification or MCPR/QTR number used.						
		- Steel manufacturer.					
		g temperature, holding time and q	·				
The supplementary s requirements for sou		signate a material delivered in accorda	ance with the MDS plus the add	litional supplementary			



# Table A.68 — MDS IR117 / IR117S

Material Data Sh	neet	MDS No. IR117 / IF	R117S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	L: Austenitic stainless s	teel type 6Mo				
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLE REQUIR					
Bars	ASTM A276	UNS S31254	-	-		
	ASTM A276	UNS N08367	-	-		
	ASTM A276	UNS N08926	-	-		
	ASTM A479	UNS S31254	-	-		
	ASTM A479	UNS N08367	-	-		
	ASTM A479	UNS N08926	-	-		
	ASTM A182	F44 (UNS S31254)	-	-		
	ASTM A182	F62 (UNS N08367)	-	-		
	1	Page 1 of 2				
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  This MDS includes additional requirements for valve parts DN 100 (NPS 4) and under manufactured from bars, when permitted by the valve specification.  Product covered by this MDS is limited to a maximum thickness of 200 mm (8 in). For thickness exceeding 200 mm (8 in), qualification and specification requirements shall be subject to agreement.					
Qualification	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.					
Metal making	The melt shall be refined by AOD or equivalent method.					
Manufacturing	Bars shall be hot or cold finished cylindrical shaped with maximum diameter of 200 mm (8 in).  NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted.					
Chemical composition	PREN ≥ 40.0					
Tensile testing	Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions.					
Corrosion testing	the exposure time 24 in full wall thickness. pickled before being of 20 % HNO3 + 5 % The acceptance crite – No pitting at 20x	eria are: magnification.	xternal and internal surfaces and coording to ASTM G48. The co	nd a cross section surface omplete specimen shall be		
	1	shall be less than 4.0 g/m <sup>2</sup> .				
Extent of testing	Tensile and corrosion tests shall be carried out for each lot as defined in ASTM A484.					
Test sampling		The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar.				
	The centreline of tensile specimen shall be located at a distance from the bar OD in accordance with ASTM A370, Annex A.					
		<u>tured from bar</u> e diameter ≥ 100 mm (4 in) inter longitudinal and transverse dire		rts, tensile testing shall		
Non-destructive testing	Visual inspection  VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.					



Material Data Sh	neet	MDS No. IR117 / IR117S <sup>a</sup> Rev. 01					
TYPE OF MATERIAL	: Austenitic stainless steel	type 6Mo					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A276	UNS S31254	-	-			
	ASTM A276	UNS N08367	-	-			
	ASTM A276	UNS N08926	-	-			
	ASTM A479	UNS S31254	-	-			
	ASTM A479	UNS N08367	-	-			
	ASTM A479	UNS N08926		-			
	ASTM A182	F44 (UNS S31254)	-	-			
	ASTM A182	F62 (UNS N08367)	-	-			
	7.0111171102	Page 2 of 2					
Non-destructive testing (continued)	NDT valve parts manufaction of valve parts	ctured from bar	all be according to the applicab	le valve specification. If a			
	Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply including liquid penetrant testing according to the following table.						
	NDE requirement		Part manufactured from bar	a			
	Frequency <sup>b</sup>	10 %					
	Method	ASME BPVC, Sec. V, Article 6					
	Extent <sup>c</sup>		100 %				
	Acceptance criteria	ASME	BPVC, Sec. VIII, Div. 1, Appe	endix 8			
	NOTE The testing shall be testing.	e carried out after machining, if	applicable. Non-machined surface	s shall be pickled prior to the			
	<ul> <li>Part of size DN &gt; 50 (NPS &gt; 2).</li> <li>For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>						
Repair of defects	Weld repair is not permitt	ed.					
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	Hardness testing Production hardness test the end surface of one ba	r service requirements are specified by the purchaser, the material shall conform to the nts of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.					
requirements	proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Surface treatment and finish	Finished product shall be	white pickled.					
Marking	The bars shall be marked	to ensure full traceability t	o heat and heat treatment lot.				
Certification		er shall have a quality syste	em certified in accordance with haser.	ISO 9001 or another			
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
		The inspection documents shall include the following information:					
		MCPR/QTR number used.					
	<ul> <li>Steel manufacturer.</li> <li>Solution annealing ter</li> </ul>	mnerature, holding time on	d quench medium shall be stat	ted			
3 TI							
<ul> <li>The supplementary s requirements for sour</li> </ul>		ale a material delivered in acco	ordance with the MDS plus the add	illional supplementary			



# Table A.69 — MDS IR118 / IR118S

TYPE OF MATERIAL	.: Austenitic stainless st	eel type 6Mo					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Tubes	ASTM A269	UNS S31254	-	-			
	ASTM A269	UNS N08367	-	-			
	ASTM A269	UNS N08926		-			
	7.67.200	Page 1 of	I				
Scope	This MDS defines ap specification.		uirements that supplement or ame	end the referenced standar			
Qualification			hall be qualified in accordance wit meet the requirements of this MD				
Metal making	The melt shall be refi	ned by AOD or equivalent r	method.				
Chemical composition	PREN ≥ 40.0						
Heat treatment	The tubes shall be so	olution annealed followed by	y rapid cooling.				
		d in such a way as to ensur reatment process including	re free circulation of air and quenc g cooling.	hing medium around each			
Tensile testing	The following accepta	ance criteria shall apply.					
	- UNS S31254: Rp0	0.2 ≥ 310 MPa (45 ksi); Rm	n ≥ 675 MPa (98 ksi); A ≥ 35 %				
	- UNS N08367 Rp0	0.2 ≥ 310 MPa (45 ksi); Rm	≥ 690 MPa (100 ksi); A ≥ 35 %				
	- UNS N08926 Rp0	6 Rp0.2 ≥ 300 MPa (44 ksi); Rm ≥ 650 MPa (94 ksi); A ≥ 35 %					
Corrosion testing	the exposure time 24 including weld zone is specimen shall be pic (140 °F) in a solution  The acceptance crite  No pitting at 20x r	h. The test shall expose the full wall thickness. Cut edokled before being weighed of 20 % HNO3 + 5 % HF. ria are:	A is required. Test temperature she external and internal surfaces a iges shall be prepared according to and tested. Pickling may be perfo	nd a cross section surface o ASTM G48. The comple			
Extent of testing	One tensile test, one tests.	corrosion test shall be carr	ied out for each lot as defined in the	ne standard for mechanica			
Repair of defects	Weld repair is not per	mitted.					
Sour service (additional			y the purchaser, the material shall SO 17945/NACE MR0103, and thi				
metallurgical, manufacturing,	Hardness testing						
testing and	Production hardness testing shall be performed in accordance with the requirements in ASTM A269.						
certification requirements) <sup>a</sup>	The material shall be	traceable in accordance w	ith ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS			
Surface treatment and finish	Finished product sha	Il be white pickled or bright	annealed.				
Marking	The tubes shall be ma	arked to ensure full traceab	pility to heat and heat treatment lot	 i.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection document	nents shall include the follo	wing information:				
	<ul> <li>MPS identification or MCPR/QTR number used.</li> </ul>						
	- Steel manufacturer.						
			e and quench medium shall be sta				



# Table A.70 — MDS IR119 / IR119S

Material Data Sh	MDS No. IR119 / IR119S a					
TYPE OF MATERIAL	L: Austenitic stainless steel ty	pe 6Mo				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
HIP Products	ASTM A988	UNS S31254	-	ASTM A988 S5		
	ASTM A988	UNS N08367	-	ASTM A988 S5		
		Page 1 of 2				
Scope	specification.  Product covered by this M	ole options and/or requireme  DS is limited to a maximum on and specification requirem	thickness of 200 mm (8 in).	For thickness exceeding		
Qualification		nufacturing process shall be lification testing shall meet t				
Manufacturing		de from AOD-refined metal. composition, particle size and		omogenous mixture of		
Chemical composition	PREN ≥ 40.0					
Heat treatment	Products shall be placed in	on annealed followed by wan such a way as to ensure fr treatment process including	ee circulation of heating and	d cooling media around		
Corrosion testing	Corrosion test according to ASTM G48 Method A is required. Test temperature shall be 50 °C (122 °F) and the exposure time 24 h. 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 min at 60 °C (140 °F) in a solution of 20 % HNO3 + 5 % HF.  The acceptance criteria are:  No pitting at 20x magnification.  The weight loss shall be less than 4.0 g/m².					
Extent of testing	A lot shall consist of finishe	test shall be carried out for each parts with the same dime ress using the same parame	nsions made from the same	powder blend consolidated same final heat-treatment		
Non-destructive testing	after machining, if applicat	each item in accordance wit ble, and non-machined surfa				
	Liquid penetrant testing ASTM A988 supplementary requirement S5 shall apply as amended by this MDS.					
	NDE requirement		HIP product <sup>a</sup>			
	Frequency <sup>b</sup>		10 %			
	Method	Д	ASME BPVC, Sec. V, Article	6		
	Extent <sup>c</sup>		100 %			
	Acceptance criteria	ASME	BPVC, Sec. VIII, Div. 1, App	pendix 8		
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.  a Parts of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be examined.					
Repair of defects	Weld repair is not permitte	d.				



Material Data Sheet		MDS No. IR119	MDS No. IR119 / IR119S a				
TYPE OF MATERIAL: Austenitic stainless steel type 6Mo							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
HIP Products	ASTM A988	UNS S31254	-	ASTM A988 S5			
	ASTM A988	UNS N08367	-	ASTM A988 S5			
		Page 2 of 2					
Sour service (additional metallurgical,		15156/NACE MR0175 or IS	the purchaser, the material shall O 17945/NACE MR0103, and the				
manufacturing, testing and certification requirements)  Hardness testing Production hardness testing shall be performed in accordance with the requirements in AS two parts per lot. When only one part is produced, it shall be hardness tested as required. hardness shall be 35HRC from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section				equired. The maximum			
Surface treatment and finish	Finished component	s shall be pickled. Machined	surfaces do not require pickling.				
Marking	recorded and mainta		arked on the powder container an of the product. The components s				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	MPS identification or MCPR/QTR number used.						
		the starting material (powder	'				
	<ul> <li>Solution annealir</li> </ul>	a tamparatura halding tima	and quench medium shall be stat	ام م			



# Table A.71 — MDS IS101 / IS101S

Material Data Sh	eet	MDS No. IS101 / IS101S <sup>a</sup>					
TYPE OF MATERIAL	.: Austenitic stainless steel ty	rpe 316					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS SUPPREQU				
Seamless pipes	ASTM A312	TP316	-	-			
	•	Page 1 of 1					
Scope	This MDS defines applicate specification.	ole options and/or requireme	nts that supplement or ame	nd the referenced standard			
Chemical composition	The chemical composition	shall comply with UNS S316	603 (dual certified 316/316L)	).			
Repair of defects	Weld repair is not permitte	d.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156 /NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.						
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Surface treatment and finish	Finished pipes shall be pic	kled or bright annealed. Mad	chined surfaces do not requi	re pickling.			
Marking	The pipes shall be marked	to ensure full traceability to	heat and heat treatment lot.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection documents shall include the following information:						
	<ul> <li>Heat treatment conditions.</li> </ul>						
	The inspection docume	ents shall confirm compliance	e to both UNS S31603 and I	JNS S31600.			
a The supplementary s requirements for sour	uffix "S" shall be used to designate service.	te a material delivered in accord	ance with the MDS plus the add	itional supplementary			



# Table A.72 — MDS IS102 / IS102S

Material Data Sheet		MDS No. IS102 / IS102S a F				
TYPE OF MATERIAL	.: Austenitic stainless ste	el type 316				
PRODUCT FORM	STANDARD	STANDARD GRADE ACCEPTANCE CLASS				
Welded pipes	ASTM A312	TP316	-	-		
	ASTM A358	316	Class 1, 3, 4 or 5	-		
		Page 1 of	1			
Scope	This MDS defines appl specification.	icable options and/or red	quirements that supplement or ame	nd the referenced standard		
Chemical composition	The chemical composit	tion shall comply with UN	NS S31603 (dual certified 316/316L)	).		
Repair of defects		•	ction welding above shall apply to thuction weld.	ne repair WPS. Repair		
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
testing and certification requirements) <sup>a</sup>	Hardness testing     Welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-3, section 6.2.2, with a maximum hardness of 70.8HR 15N or 250HV.					
			med on one length of pipe per lot. T Il be 22HRC from three readings tal			
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall be	pickled or bright anneal	ed. Machined surfaces do not requi	ire pickling.		
Marking	The pipes shall be mar	ked to ensure full tracea	bility to heat and heat treatment lot.			
Certification	quality requirements st	andard accepted by the				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	- Heat treatment conditions;					
<ul> <li>The inspection documents shall confirm compliance to both UNS S31603 and UNS S3160</li> </ul>						



# Table A.73 — MDS IS103 / IS103S

Material Data Sh	eet	MDS No. IS103 / IS1	103S <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	.: Austenitic stainless steel ty	pe 316		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Wrought fittings	ASTM A403	WP316	W or S or WX	-
		Page 1 of 1		
Scope	This MDS defines applicable specification.	ole options and/or requirem	ents that supplement or amer	nd the referenced standard
Chemical composition	The chemical composition	shall comply with UNS S31	603 (dual certified 316/316L)	).
Heat treatment	During heat treatment fittin during the heat treatment p		a way as to ensure free circul quenching operation.	lation around each fittings
Non-destructive testing	Ultrasonic testing is not ac	ceptable as replacement fo	r radiography.	
Repair of defects	Weld repair of base materi For repair of welds, the rec welds shall be heat treated	quirements for production w	relding above shall apply to the	ne repair WPS. Repair
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  Seamless fittings:  Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot.			
<ul> <li>The maximum hardness shall be 22HRC from three readings taken in close proximity.</li> <li>Welded fittings:</li> <li>Welding procedure qualification testing for manufacturing and any repair welding shall requirements of NACE MR0175-3/ISO 15156-3, section 6.2.2 with a maximum hardnes 15N or 250HV.</li> <li>Production testing shall be performed in accordance with the requirements in ASTM A3 one fitting per lot.</li> <li>The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from taken in close proximity at each location.</li> </ul>				
	The material shall be trace	eable in accordance with IS	O 15156-3/NACE MR0175-3,	section 7.2 and this MDS.
Surface treatment and finish	Finished fittings shall be pi	ckled or bright annealed. M	lachined surfaces do not requ	uire pickling.
Marking	The fittings shall be marke	d to ensure full traceability	to heat and heat treatment lo	t.
Certification	quality requirements stand The inspection documents compliance with this specif The inspection documents  Heat treatment condition	ard accepted by the purchar shall be in accordance with fication. shall include the following ons.	n ISO 10474 /EN 10204 Type	3.1 and shall confirm
The supplementary s requirements for sour	uffix "S" shall be used to designate r service.	te a material delivered in accord	dance with the MDS plus the add	itional supplementary



# Table A.74 — MDS IS104 / IS104S

Material Data Sheet MDS No. IS104 / IS104S <sup>a</sup>			Rev. 01			
TYPE OF MATERIAL	.: Austenitic stainless steel ty	rpe 316				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F316	-	-		
	•	Page 1 of 1	•			
Scope	This MDS defines applicate specification.	ole options and/or require	ements that supplement or ame	nd the referenced standard		
Chemical composition	The chemical composition	shall comply with F316L	(dual certified F316/F316L).			
Heat treatment	Forgings shall be supplied Forgings shall be placed ir treatment process includin	n such a way as to ensur	e free circulation around each f	orging during the heat		
Non-destructive testing	<u>Visual inspection</u> VT shall be carried out on each forging or bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the testing. <u>Valve forgings NDT</u> Inspection shall be according to the applicable valve specification.  If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitte		···	•		
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) a Hardness testing Shall be performed in accordance with the requirements in ASTM one forging per lot. The maximum hardness shall be 22HRC from three readings taken in close testing shall be 22						
Surface treatment and finish			ISO 15156-3/NACE MR0175-3 ed. Machined surfaces do not re			
Marking	The forgings shall be mark	ced to ensure full traceat	oility to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:					
	Heat treatment condition		19omadon.			
	The inspection documents shall confirm compliance to both F316 and F316L.					
<sup>a</sup> The supplementary so requirements for sour		te a material delivered in ac	cordance with the MDS plus the add	litional supplementary		



# Table A.75 — MDS IS105 / IS105S

Material Data Sheet		MDS No. IS10	Rev. 01			
TYPE OF MATERIAL	: Austenitic stainless steel ty	/pe 316				
PRODUCT FORM	STANDARD	GRADE	SUPPLEMENTARY REQUIREMENT			
Plates, sheets, strips	ASTM A240	316	-	-		
		Page 1	of 1			
Scope	This MDS defines applical specification.	ble options and/or r	equirements that supplement or am	end the referenced standard		
Chemical composition	The chemical composition	shall comply with t	JNS S31603 (dual certified 316/316	SL).		
Non-destructive	Visual inspection					
testing			dance with the product standard. T ned surfaces shall be cleaned prior			
	Valve plates NDT					
	Inspection of plates for va specified by the purchase		ccording to the applicable valve spe in this MDS shall apply.	cification. If a QSL is not		
Repair of defects	Weld repair is not permitte	ed.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be trace	eable in accordance	e with ISO 15156-3/NACE MR0175	-3 section 7.2 and this MDS.		
Surface treatment and finish	According to the requirem	ents in ASTM A480				
Marking	The plates, sheets and str	ips shall be marked	I to ensure full traceability to heat a	nd heat treatment lot.		
Certification	The material manufacture quality requirements stand		y system certified in accordance wi	th ISO 9001 or another		
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1.					
	The inspection documents shall confirm compliance with this specification and shall include the following information:					
	Heat treatment condition					
	The inspection document	ents shall confirm c	ompliance to both UNS S31603 and	d UNS S31600.		
The supplementary su requirements for sour		ite a material delivered	d in accordance with the MDS plus the a	dditional supplementary		



# Table A.76 — MDS IS106 / IS106S

Material Data Sh	neet	MDS No. IS106 / IS106S a					
TYPE OF MATERIAL	L: Austenitic stainless steel	type 316					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS		SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A351	CF8M	-		ASTM A351 S5, S6, ASTM A703 S20		
	ASTM A351	CF3M	-		ASTM A351 S5, S6, ASTM A703 S20		
	•	Page 1 of 3					
Scope	This MDS defines applica specification.	able options and/or requirer	ments that suppl	ement or ame	nd the referenced standard		
Extent of testing	Tensile testing is required	for each heat and heat tre	eatment lot include	ding any PWH	т.		
Test sampling	For castings with a weight of 250 kg (551 lb) 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.						
Non-destructive testing	<u>Visual inspection</u>						
3	NDE requirement	Pilot casting (section 4.8)		Pro	duction casting		
	Frequency	Each pilot cast	ing	production casting			
	Method	ANSI/MSS SP-55					
	Extent	100 % of all accessible surfaces including welding ends					
	Acceptance criteria		MSS S	SP-55			
	Liquid penetrant testing	e carried out after machining, if					
	NDE requirement	Pilot casting (section	on 4.8)	Proc	luction casting <sup>a</sup>		
	Frequency <sup>b</sup>		100	%			
	Method		ASME <i>BPVC</i> , S	ec. V, Article 6	3		
	Extent <sup>c</sup>		100	%			
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7					
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.						
	<ul> <li>Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.</li> <li>Frequency of inspection 100 % means that each item shall be examined.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>						



Material Data Sh	eet	MDS No. IS	106 / IS	106S	a				Rev. 0
TYPE OF MATERIAL	.: Austenitic stainless ste	eel type 316							
PRODUCT FORM	STANDARD	GRADE			SUPPLEMENTARY REQUIREMENT				
Castings	ASTM A351	CF8M		-				ASTM A35 ASTM A70	
	ASTM A351	CF3M		-				ASTM A35 ASTM A70	
	_	Pa	ge 2 of 3						
Non-destructive testing (continued)	Radiographic testing ASTM A351 supplement	entary requirement	: S5 shall a	apply as	amende	d by this	MDS.		
	NDE	Pilot casting			Pr	oductio	n castin	g	
	requirement	(section 4.8)			Valve o	astings	a		Other pressure containing castings <sup>b</sup>
	Frequency <sup>c</sup>	100 %	NPS	DN		Pressu	re class		100 %
					≤ 300	600	900	≥ 1500	
			< 2	< 50	N/R	N/R	N/R	N/R	
			≥ 2	≥ 50	N/R	5 %	5 %	5 %	
			≥ 6	≥ 150	N/R	5 %	5 %	100 %	
			≥ 10	≥ 250	5 %	5 %	5 %	100 %	
			≥ 16	≥ 400	5 %	5 %	100 %	100 %	
			≥ 20	≥ 500	5 %	100 %	100 %	100 %	
	Method	ASME BPVC, Sec. V, Article 2						1	
	Extent	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							
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7							
	NOTE N/R means not	required, unless spec	cified other	vise by th	ne purchas	er.			
	purchaser, the requi  b Production casting c  c Frequency of inspec a minimum of one ite  d Production casting c	sting, RT shall be acc rements in this table so other than valve castination 100 % means the em per lot of each pat other than valve castination ble product specifications.	shall apply. ng. at each iten ttern in any ng, inspection	n shall be purchase on shall ir	e examined e order sha nclude othe	I. When ra all be exan er critical a	andom exa nined. areas as d	amination (5	%) is specified,
Repair of defects	Repairs as described documented in accord				conside	red majo	r. All ma	jor repairs s	shall be
	The repair welding pro	•							
	<ul> <li>Welding procedure in production.</li> </ul>	e shall be qualified	on casting	g or plat	e of the s	ame cas	t materia	al grade as	used
	<ul> <li>Testing methodology and acceptance criteria shall be in accordance with the requirements of this MDS for the parent material.</li> </ul>								
	Weld repairs are not a	•	•		• .		ıg.		
	Solution annealing he If a minor cosmetic re omitted provided the v	pair is required to a	a semi-fini	shed or	finished	cast com			



Material Data Sheet		MDS No. IS106	MDS No. IS106 / IS106S a			
TYPE OF MATERIAL: Austenitic stainless steel type 316						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A351	CF8M	-	ASTM A351 S5, S6, ASTM A703 S20		
	ASTM A351	CF3M	-	ASTM A351 S5, S6, ASTM A703 S20		
		Page 3 o	f3	•		
Sour service (additional	When sour service r requirements of ISO	by the purchaser, the material shall ISO 17945/NACE MR0103 and this	conform to the MDS.			
manufacturing, testing and certification requirements) <sup>a</sup>	<ul> <li>Production hardness testing shall be performed in accordance with the requirements in A 370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness testing and one casting per lot thereafter.</li> </ul>					
Surface treatment and finish	Finished castings sh	all be pickled. Machined s	urfaces do not require pickling.	<u>,                                      </u>		
Marking	The castings shall be	e marked to ensure full tra	ceability to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment c</li> </ul>	onditions.				
The supplementary s requirements for soul		esignate a material delivered	in accordance with the MDS plus the add	ditional supplementary		



# Table A.77 — MDS IS107 / IS107S

Material Data Sh	terial Data Sheet MDS No. IS107 / IS107S a			Rev. 01
TYPE OF MATERIAL	.: Austenitic stainless steel ty	pe 316		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Bars	ASTM A276	316	-	-
	ASTM A479	316	-	-
		Page 1 of 2		
Scope	This MDS defines applicate specification.	ole options and/or require	ments that supplement or ame	nd the referenced standard
Manufacturing		•	with maximum diameter of 300 g or polishing (singly or in combinat	, ,
Chemical composition	The chemical composition	shall comply with UNS S	31603 (dual certified 316/316L	).
Heat treatment	Bars shall be supplied in the Bars shall be placed in suctreatment process including	ch a way as to ensure free	e circulation around each comp	ponent during the heat
Tensile testing	Where tensile testing in bo properties of the reference		by this MDS, all tensile tests sh in both directions.	all meet the specified
Test sampling	distance equal to the bar of end of the bar. The centreline of tensile sp ASTM A370, Annex A.	outside diameter or minim	(transverse) tensile specimens um of 100 mm (4 in), whicheve at a distance from the bar surfa	er is the greater, from the
	Valve parts manufactured For bars with outside diam in both the longitudinal and	eter ≥ 100 mm intended f	or machining of valve parts, te	nsile testing shall be taken
Non-destructive testing	after machining, if applicate NDT valve parts manufact	ole, and non-machined su ured from bar	with the product standard. The refaces shall be cleaned prior to	the testing.
			all be according to the applicab ents in this MDS shall apply.	le valve specification. If a
Repair of defects	Weld repair is not permitte	d.		
Sour service (additional metallurgical,			e purchaser, the material shall 17945/NACE MR0103 and the	
manufacturing, testing and certification requirements)			ccordance with the requiremer ardness shall be 22HRC from t	
	The material shall be trace	able in accordance with I	SO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.
Surface treatment and finish	Finished bars shall be pick	led or bright annealed. M	achined surfaces do not requir	re pickling.
Marking	The bars shall be marked	to ensure full traceability t	to heat and heat treatment lot.	



Material Data Sh	aterial Data Sheet MDS No. IS107 / IS107S a			Rev. 01			
TYPE OF MATERIAL: Austenitic stainless steel type 316							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A276	316	-	-			
	ASTM A479	316	-	-			
		Page 2 c	of 2	-			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection docu		nce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm			
	The inspection documents shall include the following information:						
	- Heat treatment co	onditions.					
	- The inspection do	ocuments shall confirm cor	mpliance to both UNS S31603 and U	JNS S31600.			
a The supplementary s		lesignate a material delivered	in accordance with the MDS plus the add	ditional supplementary			



# Table A.78 — MDS IS108 / IS108S

Material Data Sheet		MDS No. IS108 / IS108S a Re			
TYPE OF MATERIAL	: Austenitic stainless steel ty	rpe 316			
PRODUCT FORM	STANDARD	GRADE	SUPPLEMENTARY REQUIREMENT		
Tubes	ASTM A269	316	-	-	
		Page 1	of 1		
Scope	This MDS defines applicat specification.	ole options and/or r	equirements that supplement or am	end the referenced standard	
Chemical composition	The chemical composition	shall comply with l	JNS S31603 (dual certified 316/316	SL).	
Tensile testing	The following acceptance	criteria shall apply:	Rp0.2 ≥ 207 MPa (30 ksi); Rm ≥ 5	17 MPa (75 ksi); A ≥ 35 %.	
Extent of testing	Tensile testing shall be ca	rried out for each lo	at as defined in the standard for me	chanical tests.	
Non-destructive testing	Welded tubes: non-destruction	ctive electric testing	ı is required.		
Repair of defects	Weld repair of base mater For repair of welds, the rec welds shall be heat treated	quirements for prod	uction welding above shall apply to	the repair WPS. Repair	
Sour service (additional metallurgical,			d by the purchaser, the material shart r ISO 17945/NACE MR0103 and th		
manufacturing, testing and	Hardness testing				
certification requirements) a	Production hardness testir	ng shall be perform	ed in accordance with the requirem	ents in ASTM A269.	
requirements)	The material shall be trace	eable in accordance	e with ISO 15156-3/NACE MR0175	-3, section 7.2 and this MDS.	
Surface treatment and finish	Finished tubes shall be pid	ckled or bright anne	aled.		
Marking	The tubes shall be marked to ensure full traceability to heat and heat treatment lot.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents		ollowing information:		
	<ul> <li>Heat treatment condition</li> </ul>				
	The inspection docume	ents shall confirm c	ompliance to both UNS S31603 and	d UNS S31600.	
The supplementary s requirements for sour		te a material delivered	I in accordance with the MDS plus the a	dditional supplementary	



# Table A.79 — MDS IS109 / IS109S

Material Data Sh	neet	MDS No. IS109 / IS1	1 <b>09S</b> a	Rev. 01		
TYPE OF MATERIAL	L: Austenitic stainless s	teel type 316				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bolting	ASTM A193	B8M (UNS S31600)	Class 1 - for size over M72 (3 in)	ASTM A193 S5		
	ASTM A193	B8M (UNS S31600)	Class 2 - for size M36 (1.5 in) and smaller	ASTM A193 S5, ASTM A193 S10		
	ASTM A193	B8M2 (UNS S31600)	Class 2B - for size over M36 (1.5 in) and up to size M72 (3 in)	ASTM A193 S5 ASTM A193 S10		
	ASTM A193	B8MA (UNS S31600) <sup>a</sup>	Class 1A	ASTM A193 S5		
	ASTM A320	B8M (UNS S31600)	Class 1 - for size over M72 (1.5 in)	ASTM A962 S50		
	ASTM A320	B8M (UNS S31600)	Class 2 - for size M36 (1.5 in) and smaller	ASTM A962 S50, ASTM A320 S3		
	ASTM A320	B8MA (UNS S31600) <sup>a</sup>	Class 1A	ASTM A962 S50		
	ASTM A194	8M (UNS S31600)	-	ASTM A194 S4		
	ASTM A194	8MA (UNS S31600) a	-	ASTM A194 S4		
		Page 1 of 1				
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Manufacturing	Except for Class 1A	Threading of studs, bolts and screws may be done by machining or rolling.  Except for Class 1A bolting, thread rolling shall be done after heat treatment.  Threads in nuts shall be machined.				
Hardness testing	Supplementary requ	irement ASTM A193 S10 or AST	M A320 S3 shall apply to Cla	ss 2 and Class 2B bolting.		
Proof load testing	Supplementary requ	irement ASTM A194 S4 shall app	ply for nut size M42 (1 <sup>5</sup> / <sub>8</sub> in) a	nd larger.		
Non-destructive testing		100 % visually examined in all a nents specified in ASTM F788 fo				
Repair of defects	Weld repair is not pe	ermitted.				
Sour service (additional		equirements are specified by the 15156/NACE MR0175 or ISO 17		conform to the		
metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be	e traceable in accordance with IS	O 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Marking	Supplementary requ	irement ASTM A193 S5 or ASTM	A A962 S50 shall apply.			
Certification	quality requirements	ncturer shall have a quality syster standard accepted by the purcha	aser.			
		ments shall be issued in accorda with this specification.	Ince with ISO 10474 /EN 1020	04 Type 3.1 and shall		
a The supplementary s requirements for sou		designate a material delivered in acco	rdance with the MDS plus the add	ditional supplementary		
•						



# Table A.80 — MDS IS221 / IS221S

Material Data Sh	neet	MDS No. IS221 / IS221S <sup>a</sup> Rev. 01				
TYPE OF MATERIAL: Austenitic stainless steel type 304						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Seamless pipes	ASTM A312	TP304	-	-		
	<u>.</u>	Page 1 of	1	<u> </u>		
Scope	This MDS defines applical specification.	ble options and/or red	quirements that supplement or ame	nd the referenced standard		
Chemical composition	The chemical composition	The chemical composition shall comply with UNS S30403 (dual certified 304/304L).				
Repair of defects	Weld repair is not permitte	ed.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall be pickled or bright annealed. Machined surfaces do not require pickling.					
Marking	The pipes shall be marked	to ensure full tracea	bility to heat and heat treatment lot			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment condition</li> </ul>					
	<ul> <li>The inspection docume</li> </ul>	ents shall confirm cor	npliance to both UNS S30403 and	UNS S30400.		



# Table A.81 — MDS IS222 / IS222S

Material Data Sheet		MDS No. IS222	MDS No. IS222 / IS222S a Rev. 0			
TYPE OF MATERIAL	: Austenitic stainless st	eel type 304				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A312	TP304	-	-		
	ASTM A358	304	Class 1, 3, 4 or 5	-		
		Page 1 of	f 1	•		
Scope	This MDS defines ap specification.	plicable options and/or re	quirements that supplement or ame	nd the referenced standard		
Chemical composition	The chemical compos	sition shall comply with UI	NS S30403 (dual certified 304/304L)	).		
Repair of defects	For repair of welds, the	Weld repair of base material is not permitted.  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.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing     Welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-3, section 6.2.2, with a maximum hardness of 70.8HR 15N or 250HV.					
	<ul> <li>Production hardness testing shall be performed on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall b	pe pickled or bright annea	lled. Machined surfaces do not requi	ire pickling.		
Marking	The pipes shall be marked to ensure full traceability to heat and heat treatment lot.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	· ·	nents shall include the foll	lowing information:			
	<ul> <li>Heat treatment co</li> </ul>					
	<ul> <li>The inspection documents shall confirm compliance to both UNS S30403 and UNS S30400.</li> </ul>					



# Table A.82 — MDS IS223 / IS223S

Material Data Sh	ieet	MDS No. IS22	23 / IS223S a	Rev. 01		
TYPE OF MATERIAL	: Austenitic stainless steel ty	rpe 304				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLAS	S SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A403	WP304	W or S or WX	-		
		Page 1	of 1			
Scope	This MDS defines applicate specification.	ole options and/or r	equirements that supplement or a	mend the referenced standard		
Chemical composition	The chemical composition	shall comply with I	JNS S30403 (dual certified 304/30	04L).		
Heat treatment			in such a way as to ensure free cossible quenching operation.	irculation around each fitting		
Non-destructive testing	Ultrasonic testing is not ac	ceptable as replac	ement for radiography.			
Repair of defects	Weld repair of base materi For repair of welds, the rec welds shall be heat treated	quirements for proc	luction welding above shall apply	to the repair WPS. Repair		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	requirements of ISO 15156 requirements to the MDS.  Hardness testing  Seamless fittings: Production testing sone fitting per lot. To proximity. Welded fittings: Welding procedure requirements of NA 15N or 250HV.	shall be performed he maximum hard qualification testing	d by the purchaser, the material single ISO 17945/NACE MR0103 and in accordance with the requirements shall be 22HRC from three regions of 15156-3, section 6.2.2 with a material accordance with the requirements accordance with the requirements.	nts in ASTM A370/A1058 on eadings taken in close  r welding shall meet the eximum hardness of 70.8HR		
	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.</li> </ul>					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished fittings shall be pi	ickled or bright ann	ealed. Machined surfaces do not	require pickling.		
Marking	The fittings shall be marke	d to ensure full trad	ceability to heat and heat treatmer	nt lot.		
Certification	quality requirements stand	lard accepted by the shall be in accordation.	ance with ISO 10474 /EN 10204 T			
	Heat treatment condition					
	The inspection docume	ents shall confirm c	ompliance to both UNS S30403 a	nd UNS S30400.		
The supplementary s requirements for source		te a material delivered	d in accordance with the MDS plus the	additional supplementary		



# Table A.83 — MDS IS224 / IS224S

Material Data Sheet		MDS No. IS224 / IS224S <sup>a</sup>			Rev. 01	
TYPE OF MATERIAL	.: Austenitic stainless steel	type 304				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANC	E CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A182	F304	-		-	
		Page 1 o	of 1			
Scope	This MDS defines application.	able options and/or re	equirements that supplem	ent or ame	nd the referenced standard	
Chemical composition	The chemical composition	n shall comply with F	304L (dual certified F304	/F304L).		
Heat treatment	Forgings shall be placed	Forgings shall be supplied in the solution annealed conditions.  Forgings shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including possible quenching operation.				
Non-destructive testing	<u>Visual inspection</u> VT shall be carried out on each forging or bar in accordance with the product standard. The testin performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the					
	<u>Valve forgings NDT</u> Inspection shall be accor the requirements in this N		e valve specification. If a	QSL is not s	specified by the purchaser,	
Repair of defects	Weld repair is not permit	ted.				
Sour service (additional metallurgical,	When sour service requirements of ISO 151 requirements to the MDS	56/NACE MR0175 oi				
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one forging per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be trac	ceable in accordance	with ISO 15156-3/NACE	MR0175-3	, section 7.2 and this MDS.	
Surface treatment and finish	Finished forgings shall be	e pickled or bright an	nealed. Machined surface	es do not re	quire pickling.	
Marking	The forgings shall be ma	rked to ensure full tra	ceability to heat and hea	t treatment	lot.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documen		llowing information:			
	Heat treatment conditions		p	. <b></b>		
	<u>'</u>		ompliance to both F304 a			
The supplementary si requirements for sour	uffix "S" shall be used to design service.	nate a material delivered	in accordance with the MDS	plus the add	itional supplementary	



# Table A.84 — MDS IS225 / IS225S

emical composite inspection If be carried out eachining, if applicate NDT in of plates for each by the purchate pair is not permeters.	GRADE  304  Page 1  licable options and/or in the state of the shall comply with the state of th	of 1 requirements that sup UNS S30403 (dual ce ordance with the produ ined surfaces shall be according to the applica	ertified 304/304L act standard. The cleaned prior to able valve speci	e testing shall be performed	
DS defines application.  emical composite inspection If be carried out achining, if applicate NDT ion of plates for ed by the purchal epair is not permentation.	304  Page 1  licable options and/or a strong shall comply with to on each plate in accollicable, and non-maching revalve parts shall be a aser, the requirements	of 1 requirements that sup UNS S30403 (dual ce ordance with the produ ined surfaces shall be according to the applica	plement or ame artified 304/304L act standard. The cleaned prior to able valve speci	nd the referenced standard  ).  e testing shall be performed the testing.	
DS defines application.  emical composite transpection  Il be carried out achining, if applicate NDT in ordinates for each of the purchase pair is not permeter and the permeter in the permeter is not permeter in the permet	Page 1 licable options and/or a lition shall comply with t on each plate in acco licable, and non-maching r valve parts shall be a aser, the requirements	of 1 requirements that sup UNS S30403 (dual ce ordance with the produ ined surfaces shall be according to the applica	ertified 304/304L act standard. The cleaned prior to able valve speci	e testing shall be performed the testing.	
emical composite inspection If be carried out eachining, if applicate NDT in of plates for each by the purchar epair is not permeters.	licable options and/or a licable options and/or a licable shall comply with ton each plate in accollicable, and non-maching a licable, and aser, the requirements	UNS S30403 (dual ce	ertified 304/304L act standard. The cleaned prior to able valve speci	e testing shall be performed the testing.	
emical composite inspection If be carried out eachining, if applicate NDT in of plates for each by the purchar epair is not permeters.	t on each plate in acco licable, and non-mach	UNS S30403 (dual ce	ertified 304/304L act standard. The cleaned prior to able valve speci	e testing shall be performed the testing.	
inspection Il be carried out achining, if applicate NDT ion of plates for ad by the purchate pair is not permeters.	t on each plate in acco licable, and non-mach r valve parts shall be a aser, the requirements	ordance with the produ nined surfaces shall be according to the applica	act standard. The cleaned prior to	e testing shall be performed the testing.	
Il be carried out achining, if appliance NDT ion of plates for by the purchasepair is not permenant	licable, and non-mach r valve parts shall be a aser, the requirements	ined surfaces shall be	cleaned prior to	o the testing.	
achining, if appli plate NDT ion of plates for ed by the purcha epair is not perm	licable, and non-mach r valve parts shall be a aser, the requirements	ined surfaces shall be	cleaned prior to	o the testing.	
ion of plates for ed by the purcha epair is not perm	aser, the requirements			ification. If a QSL is not	
ed by the purcha	aser, the requirements			ification. If a QSL is not	
	nitted.				
When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.					
Hardness testing					
Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
terial shall be tr	raceable in accordance	e with ISO 15156-3/N	5156-3/NACE MR0175-3, section 7.2 and this MDS.		
ng to the require	rements in ASTM A480	0.			
The plates, sheets and strips shall be marked to ensure full traceability to heat and heat treatment lot.					
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
		dance with ISO 10474	/EN 10204 Type	e 3.1 and shall confirm	
The inspection documents shall include the following information:					
inspection docu	cuments shall confirm of	compliance to both UN	NS S30403 and	UNS S30400.	
i	ates, sheets and aterial manufact requirements s spection docum ance with this s spection docum at treatment cor	ates, sheets and strips shall be marked aterial manufacturer shall have a qual requirements standard accepted by the spection documents shall be in accordance with this specification.  Spection documents shall include the stat treatment conditions.	ing to the requirements in ASTM A480.  Ites, sheets and strips shall be marked to ensure full tracea aterial manufacturer shall have a quality system certified in a requirements standard accepted by the purchaser. Spection documents shall be in accordance with ISO 10474 ance with this specification.  Inspection documents shall include the following information: at treatment conditions.	ing to the requirements in ASTM A480.  Ites, sheets and strips shall be marked to ensure full traceability to heat and aterial manufacturer shall have a quality system certified in accordance with requirements standard accepted by the purchaser.  Spection documents shall be in accordance with ISO 10474 /EN 10204 Type ance with this specification.  Spection documents shall include the following information:	



# Table A.85 — MDS IS226 / IS226S

Material Data Sh	eet	MDS No. IS226 / IS226S a Rev.					
TYPE OF MATERIAL	: Austenitic stainless steel t	ype 304					
PRODUCT FORM	STANDARD	GRADE ACCEPTANCE CLASS		LASS SUPPLEMENTARY REQUIREMENT			
Castings	ASTM A351	CF8	-	ASTM A351 S5, S6, ASTM A703 S20			
	ASTM A351	CF3	-	ASTM A351 S5, S6, ASTM A703 S20			
	_	Page 1 of 3					
Scope	This MDS defines applica specification.	able options and/or requirements that supplement or amend the referenced standard					
Extent of testing	Tensile testing is required	for each heat and heat treat	ment lot including ar	ny PWHT.			
Test sampling	casting and shall accomp	at of 250 kg (551 lb) or more, the test blocks shall be integrally cast or gated onto the pany the castings through all heat treatment operations.					
Non-destructive testing	<u>Visual inspection</u>						
Ü	NDE requirement	Pilot casting (section 4.8) Pro		Production casting			
	Frequency	Each pilot casting	g	Each production casting			
	Method	ANSI/MSS SP-55					
	Extent	100 % of all accessible surfaces including welding ends					
	Acceptance criteria	MSS SP-55					
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.  Liquid penetrant testing						
	ASTM A351 supplementary requirement S6 shall apply as amended by this MDS.						
	NDE requirement	Pilot casting (section	on 4.8)	Production casting <sup>a</sup>			
	Frequency <sup>b</sup>		100 %				
	Method	A	SME <i>BPVC</i> , Sec. V,	Article 6			
	Extent °		100 %				
	Acceptance criteria	ASME I	BPVC, Sec. VIII, Div.	1, Appendix 7			
	NOTE The testing shall be testing.	carried out after machining, if ap	plicable. Non-machined	d surfaces shall be cleaned prior to the			
	purchaser, the requirement b Frequency of inspection	a Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.  b Frequency of inspection 100 % means that each item shall be examined.  c All accessible internal and external surfaces shall be examined.					



Material Data Sh	neet	MDS No. IS	S226 / IS	S226S	а			Re	v. 01
TYPE OF MATERIAL	L: Austenitic stainless stee	el type 304							
PRODUCT FORM	STANDARD	GRADE				SUPPLEME REQUIREN			
Castings	ASTM A351	CF8		-				ASTM A351 ASTM A703	
	ASTM A351	CF3		-				ASTM A351 ASTM A703	
		Page	e 2 of 3						
Non-destructive testing (continued)	Radiographic testing ASTM A351 supplement	ntary requirement S	S5 shall a	pply as	amended	d by this N	MDS.		
,	NDE requirement	Pilot casting			Pr	oduction	n casting	g	
	Fragues of G	(section 4.8)			Valve o	castings	а		Other pressure containing castings b
	Frequency <sup>c</sup>	100 %	NPS	DN	N Pressure class		100 %		
					≤ 300	600	900	≥ 1500	
			< 2	< 50	N/R	N/R	N/R	N/R	
			≥ 2	≥ 50	N/R	5 %	5 %	5 %	
			≥ 6	≥ 150	N/R	5 %	5 %	100 %	
			≥ 10	≥ 250	5 %	5 %	5 %	100 %	
			≥ 16	≥ 400	5 %	5 %	100 %	100 %	
			≥ 20	≥ 500	5 %	100 %	100 %	100 %	
	Method	ASME BPVC, Sec. V, Article 2							
	Extent	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						100 % <sup>d</sup>	
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7							
	NOTE N/R means not re	equired, unless specif	ied otherw	se by the	e purchase	er.			
	<ul> <li>Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.</li> <li>Production casting other than valve casting.</li> <li>Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.</li> <li>Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.</li> </ul>								
Repair of defects	Repairs as described in documented in accorda The repair welding procedure in production.  Testing methodolog for the parent mater	ance with ASTM A7 cedure shall be qua shall be qualified o yy and acceptance	03 S20.2 dified in a n casting	ccordan or plate	of the sa	ASTM A4 ame cast	88 or IS0 material	ວ 11970 ar grade as ເ	nd this MDS.
	Weld repairs are not acceptable for castings that leak during pressure testing.  Solution annealing heat treatment is required after all major 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 all the test requirements of this data sheet in the as-welded condition.								



Material Data Sheet		MDS No. IS22	MDS No. IS226 / IS226S a				
TYPE OF MATERIAL: Austenitic stainless steel type 304							
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT					
Castings	ASTM A351	CF8	-	ASTM A351 S5, S6, ASTM A703 S20			
	ASTM A351	CF3	-	ASTM A351 S5, S6, ASTM A703 S20			
		Page 3 c	of 3				
Sour service (additional metallurgical, manufacturing,		15156/NACE MR0175 or	by the purchaser, the material shall ISO 17945/NACE MR0103, and the				
testing and certification requirements) <sup>a</sup>	Hardness testing     Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness shall be 22HRC from three readings taken in close proximity.  Welding procedure qualification testing for all repair welding on shall meet the requirements of NACE MR0175-2/ISO 15156-3, section 6.2.6 with a maximum hardness of 70.8HR 15N or 250HV.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.						
Surface treatment and finish	Finished castings sh	all be pickled. Machined s	surfaces do not require pickling.				
Marking	The castings shall be marked to ensure full traceability to heat and heat treatment lot.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
		The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
		ments shall include the fo	llowing information:				
	<ul> <li>Heat treatment c</li> </ul>	onditions.					



# Table A.86 — MDS IS227 / IS227S

Material Data Sho	eet	MDS No. IS227 / IS227S a				
TYPE OF MATERIAL	: Austenitic stainless steel ty	pe 304				
PRODUCT FORM	STANDARD	NDARD GRADE ACCEPTANCE CLASS SUPPLEMENT REQUIREMENT				
Bars	ASTM A276	304	-	-		
	ASTM A479	304	-	-		
	1	Page 1 of 2				
Scope	This MDS defines applicab specification.	le options and/or requireme	nts that supplement or ame	nd the referenced standard		
Manufacturing		•	th maximum diameter of 300 polishing (singly or in combinati	, ,		
Chemical composition	The chemical composition	shall comply with UNS S30-	403 (dual certified 304/304L)	).		
Heat treatment			ons. irculation around each bar d	uring the heat treatment		
Tensile testing		th directions is required by t d standard specification in b	his MDS, all tensile tests shooth directions.	all meet the specified		
Test sampling			ansverse) tensile specimens of 100 mm (4 in), whicheve			
	ASTM A370, Annex A.		a distance from the bar surfa	ce in accordance with		
			ed for machining of valve par on.	ts, tensile testing shall		
Non-destructive testing			the product standard. The t			
			ne according to the applicab ts in this MDS shall apply.	le valve specification. If a		
Repair of defects	Weld repair is not permitted	d.				
Sour service (additional metallurgical,			ourchaser, the material shall 045/NACE MR0103, and the			
manufacturing, testing and certification requirements) a  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370 the end surface of one bar per lot. The maximum hardness shall be 22HRC from three readings take proximity.						
	The material shall be trace	able in accordance with ISC	) 15156-3/NACE MR0175-3,	section 7.2 and this MDS.		
Surface treatment and finish	Finished bars shall be pick	led or bright annealed. Mac	hined surfaces do not requir	e pickling.		
Marking	The bars shall be marked t	o ensure full traceability to h	neat and heat treatment lot.			



Material Data Sh	neet	MDS No. IS22	MDS No. IS227 / IS227S a					
TYPE OF MATERIAL: Austenitic stainless steel type 304								
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Bars	ASTM A276	304	-	-				
	ASTM A479	304	-	-				
	•	Page 2 c	of 2					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.							
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.							
	The inspection documents shall include the following information:							
	<ul> <li>Heat treatment conditions.</li> </ul>							
	- The inspection d	ocuments shall confirm co	empliance to both UNS S30403 and	UNS S30400.				
a The supplementary s		lesignate a material delivered	in accordance with the MDS plus the add	ditional supplementary				



# Table A.87 — MDS IS228 / IS228S

Material Data Sheet		MDS No. IS22	Rev. 01		
TYPE OF MATERIAL	: Austenitic stainless stee	l type 304			
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT			
Tubes	ASTM A269	304	-	-	
		Page 1 o	of 1		
Scope	This MDS defines applical specification.	ble options and/or re	equirements that supplement or am	end the referenced standard	
Chemical composition	The chemical composition	shall comply with L	JNS S30403 (dual certified 304/304	L).	
Tensile testing	The following acceptance	criteria shall apply:	Rp0.2 ≥ 207 MPa (30 ksi); Rm ≥ 51	7 MPa (75 ksi); A ≥ 35 %.	
Extent of testing	Tensile testing shall be ca	rried out for each lo	t as defined in the standard for med	hanical tests.	
Non-destructive testing	Welded tubes: non-destru	ctive electric testing	is required.		
Repair of defects	Weld repair of base material is not permitted.  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.				
Sour service (additional metallurgical,			by the purchaser, the material sharts ISO 17945/NACE MR0103, and the		
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing	ng shall be performe	ed in accordance with the requireme	ents in ASTM A269.	
	The material shall be trace	eable in accordance	with ISO 15156-3/NACE MR0175-	3, section 7.2 and this MDS.	
Surface treatment and finish	Finished tubes shall be pid	ckled or bright anne	aled. Machined surfaces do not req	uire pickling.	
Marking	The tubes shall be marked	d to ensure full trace	eability to heat and heat treatment lo	ot.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	Heat treatment conditions.				
	I The increation decume		empliance to both UNS S30403 and		



# Table A.88 — MDS IS301 / IS301S

Material Data Sh	eet	MDS No. IS30	MDS No. IS301 / IS301S <sup>a</sup> Rev. 0			
TYPE OF MATERIAL: Austenitic stainless steel, stabilized						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Seamless pipes	ASTM A312	TP321	-	S6		
	ASTM A312	TP347	-	S6		
	•	Page 1 of	f1			
Scope	This MDS defines appropriately specification.	olicable options and/or re	quirements that supplement or ame	nd the referenced standard		
Heat treatment		ement S6 applies with the	e following requirement: be in the range of 815 °C to 900 °C	(1 500 °F to 1 650 °F).		
Repair of defects	Weld repair is not per	mitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	<u>Hardness testing</u>					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall b	e pickled or bright annea	led. Machined surfaces do not requ	ire pickling.		
Marking	The pipes shall be ma	arked to ensure full tracea	ability to heat and heat treatment lot			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment conditions.</li> </ul>					



# Table A.89 — MDS IS302 / IS302S

Material Data Sh	neet	MDS No. IS302 / IS302S <sup>a</sup> Re				
TYPE OF MATERIAL: Austenitic stainless steel, stabilized						
PRODUCT FORM	STANDARD	STANDARD GRADE ACCEPTANCE CLASS				
Welded pipes	ASTM A312	TP321	-	S6		
	ASTM A312	TP347	-	S6		
	ASTM A358	TP321	Class 1, 3, 4, 5	S5		
	ASTM A358	TP347	Class 1, 3, 4, 5	S5		
	_	Page 1 o	f 1			
Scope	This MDS defines ap specification.	plicable options and/or re	quirements that supplement or ame	nd the referenced standard		
Heat treatment	1		r ASTM A358 S5 apply with the follobe in the range of 815 °C to 900 °C	• •		
Repair of defects	ASTM A312: weld repair is not permitted.  ASTM A358: weld repair of base material is not permitted.  Repair welds shall be heat treated as per original production weld.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.					
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished pipes shall I	pe pickled or bright annea	aled. Machined surfaces do not requ	ire pickling.		
Marking	The pipes shall be m	arked to ensure full tracea	ability to heat and heat treatment lot			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:  — Heat treatment conditions.					
<sup>a</sup> The supplementary s requirements for sour		esignate a material delivered	in accordance with the MDS plus the add	ditional supplementary		



# Table A.90 — MDS IS303 / IS303S

Material Data Sh	eet	MDS No. IS303 / IS303S a Rev				
TYPE OF MATERIAL: Austenitic stainless steel, stabilized						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A403	WP321	W or S or WX	ASTM A403 S2		
	ASTM A403	WP347	W or S or WX	ASTM A403 S2		
		Page 1 c	of 1	•		
Scope	This MDS defines ap specification.	plicable options and/or re	equirements that supplement or ar	nend the referenced standard		
Heat treatment	During heat treatmen	rement ASTM A403 S2 s t fittings shall be placed i nent process including qu	n such a way as to ensure free cir	culation around each fitting		
Non-destructive testing	Ultrasonic testing is r	ot acceptable as replace	ment for radiography.			
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.					
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Hardness testing  Seamless fittings:  Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.  Welded fittings:  Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Surface treatment and finish	Finished fittings shall	be pickled or bright anne	ealed. Machined surfaces do not r	equire pickling.		
Marking	The fittings shall be n	narked to ensure full trac	eability to heat and heat treatmen	t lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment conditions.					



# Table A.91 — MDS IS304 / IS304S

Material Data Sh	neet	MDS No. IS304 / IS304S a Rev. 0				
TYPE OF MATERIAL	L: Austenitic stainless steel,	stabilized				
PRODUCT FORM	STANDARD	STANDARD GRADE ACCEPTANCE CLASS				
Forgings	ASTM A182	F321	-	S10		
	ASTM A182	F347	-	S10		
	•	Page 1 of	<sup>†</sup> 1			
Scope	This MDS defines applica specification.	ble options and/or red	quirements that supplement or ame	nd the referenced standard		
Heat treatment	Supplementary requireme Forgings shall be placed i treatment process including	n such a way as to er	nsure free circulation around each con.	component during the heat		
Non-destructive testing						
		<u>Valve forgings NDT</u> Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.				
Repair of defects	Weld repair is not permitte	ed.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>			d in accordance with the requiremer all be 22HRC from three readings to			
	The material shall be trac	eable in accordance v	with ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Finished forgings shall be	pickled or bright ann	ealed. Machined surfaces do not re	quire pickling.		
Marking	The forgings shall be mar	ked to ensure full trac	ceability to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment conditi</li> </ul>	ons.				
The supplementary s requirements for source		ate a material delivered i	n accordance with the MDS plus the add	litional supplementary		



# Table A.92 — MDS IS305 / IS305S

Material Data Sheet		MDS No. IS305 / IS305S a				
TYPE OF MATERIAL	: Austenitic stainless steel, s	tabilized				
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLEMEN REQUIREMEN					
Plates, sheets, strips	ASTM A240	321	-	-		
	ASTM A240	347	-	-		
		Page 1 of 1				
Scope	This MDS defines applicate specification.	ole options and/or requirement	ents that supplement or ame	nd the referenced standard		
Heat treatment	Following annealing, a sta 900 °C (1 500 °F to 1 650		all be carried out in the tempe	erature range of 815 °C to		
Non-destructive testing			ith the product standard. The			
	<u>Valve plate NDT</u> Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitte	d.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one plate per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be trace	eable in accordance with IS	O 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Pickled, descaled or bright	annealed according to the	requirements in ASTM A480			
Marking	The plates, sheets and stri	ps shall be marked to ensu	re full traceability to heat and	I heat treatment lot.		
Certification	quality requirements stand	lard accepted by the purcha shall be in accordance with	n certified in accordance with iser. In ISO 10474 /EN 10204 Type			
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment conditions.</li> </ul>					
<sup>a</sup> The supplementary su requirements for sour		te a material delivered in accord	dance with the MDS plus the add	itional supplementary		



# Table A.93 — MDS IS306 / IS306S

Material Data Sh	ata Sheet MDS No. IS306 / IS306S a					
TYPE OF MATERIAL	: Austenitic stainless steel,	stabilized				
PRODUCT FORM	DUCT FORM STANDARD GRADE ACCEPTANCE CLAS				SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A351	CF8C	-		ASTM A351 S5, S6, S33 ASTM A703 S20	
	-	Page 1 of 3	•			
Scope	This MDS defines applica specification.	ble options and/or requireme	ents that supple	ement or ame	nd the referenced standard	
Heat treatment	ASTM A351 supplementa	ry requirement S33 shall app	oly.			
Extent of testing	Tensile testing is required	for each heat and heat treat	ment lot includ	ling any PWH	Т.	
Test sampling	casting and shall accompa	For castings with a weight of 250 kg (551 lb) 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.				
Non-destructive testing	<u>Visual inspection</u>					
	NDE requirement	Pilot casting (section 4.8) Pro		duction casting		
	Frequency	Each pilot castin	g	Each	production casting	
	Method	ANSI/MSS SP-55				
	Extent	100 % of all a	ccessible surfa	ces including	g welding ends	
	Acceptance criteria		MSS S	SP-55		
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.					
	Liquid penetrant testing ASTM A351 supplementa	ry requirement S6 shall appl	y as amended	by this MDS.		
	NDE requirement	Pilot casting (section	on 4.8)	Pro	duction casting <sup>a</sup>	
	Frequency <sup>b</sup>		100	) %		
	Method	ļ ,	SME BPVC, S	Sec. V, Article	6	
	Extent c	100 %				
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7				
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.					
	<ul> <li>Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.</li> <li>Frequency of inspection 100 % means that each item shall be examined.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>					



Material Data Sh	eet	MD	S No. IS306 /	IS306S	а					Rev. (
TYPE OF MATERIAL	.: Aust	enitic stainless	steel, stabilized							
PRODUCT FORM	STA	ANDARD	GRADE			ACCE	PTANCE	E CLASS		EMENTARY IREMENT
Castings	AS	TM A351	CF8C			-				A351 S5, S6, S A703 S20
	•			Page 2 o	f 3	1			•	
Non-destructive	Rad	liographic testin	g							
testing (continued)	AST	M A351 supple	mentary requirem	ent S5 sh	all apply	as ame	nded by t	his MDS		
		NDE	Pilot casting (section 4.8)			Pr	oduction	n casting	1	
		requirement	(Section 4.6)			Valve	castings	a		Other pressure containing castings <sup>b</sup>
		Frequency <sup>c</sup>	100 %	NPS	DN		Droceu	re class		100 %
				141 3		≤ 300	600	900	≥ 1500	
				< 2	< 50	N/R	N/R	N/R	N/R	
				≥ 2	≥ 50	N/R	5 %	5 %	5 %	
				≥ 6	≥ 150	N/R	5 %	5 %	100 %	
				≥ 10	≥ 250	5% 5% 5% 100%				
				≥ 16	≥ 400	5 %	5 %	100 %	100 %	
				≥ 20	≥ 500	5 %	100 %	100 %	100 %	
	Method			ASME	BPVC S	ec. V, Ar	ticle 2			
		Extent Areas defined by ASME B16.34 for special clarifications of rise the casting				ial class	valves, a		100 % <sup>d</sup>	
		Acceptance criteria	•					x 7	1	
		NOTE N/R me	means not required, unless specified otherwise by the purchaser.							
		by the purch b Production of Frequency of specified, and d Production of purchase ord	alve casting, RT sha aser, the requiremer asting other than val f inspection 100 % m minimum of one item asting other than val der and/or applicable ed and agreed with the	nts in this to ve casting neans that per lot of ve casting product sp	able shall  each item each patte , inspection pecification	apply.  shall be ern in any on shall income	examined. purchase clude othe	When rar order shal r critical ar	ndom examin I be examin reas as defir	nation (5 %) is ed.
Repair of defects	Repairs as described in ASTM A351 section 10.2 shall be considered major. All madocumented in accordance with ASTM A703 S20.2.					najor repai	rs shall be			
			procedure shall be	•						
		Welding proced production.	ure shall be qualifi	iea on ca:	sung or p	piate of t	ne same	cast mat	eriai grade	as used in
		Testing methode he parent mate	ology and accepta	ince critei	ria shall l	be in acc	ordance	with the	requireme	nts of this MDS f
	Wel	d repairs are no	ot acceptable for ca d after all major w			luring pro	essure te	sting. So	lution anne	ealing heat
	omit		repair is required e welding procedu							•



Material Data S	heet N	IDS No. IS306 / IS306S a		Rev. 01	
TYPE OF MATERIA	L: Austenitic stainless	steel, stabilized			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A351	CF8C	-	ASTM A351 S5, S6, S33 ASTM A703 S20	
	•	Page 3 of 3			
Sour service (additional metallurgical,		equirements are specified by the p MR0175 or ISO 17945/NACE MR			
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per lot thereafter. The maximum hardness shall be 22HRC from three readings taken in close proximity.				
	The material shall be	traceable in accordance with ISC	) 15156-3/NACE MR0175-3, s	section 7.2 and this MDS.	
Surface treatment and finish	Finished castings sha	all be pickled. Machined surfaces	do not require pickling.		
Marking	The castings shall be	marked to ensure full traceability	to heat and heat treatment lo	t.	
Certification		cturer shall have a quality system daccepted by the purchaser.	certified in accordance with IS	SO 9001 or another quality	
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection docur	nents shall include the following ir	nformation:		
	- Heat treatment co	onditions.			
a The supplementary requirements for so		designate a material delivered in acco	rdance with the MDS plus the add	litional supplementary	



# Table A.94 — MDS IS307 / IS307S

Material Data Sh	eet	MDS No. IS30	7 / IS307S a	Rev. 01		
TYPE OF MATERIAL	.: Austenitic stainless s	teel, stabilized				
PRODUCT FORM	STANDARD	SUPPLEMENTARY REQUIREMENT				
Bars	ASTM A276	321	-	-		
	ASTM A276	347	-	-		
	ASTM A479	321	-	-		
	ASTM A479	347	-	-		
	-	Page 1 c	of 1	-		
Scope	This MDS defines ap specification.	plicable options and/or re	equirements that supplement or ame	end the referenced standard		
Manufacturing		hall be restricted to turning, g	naped with maximum diameter of 30 rinding or polishing (singly or in combina	, ,		
Heat treatment	Stabilization heat trea	in such a way as to ensu	ed conditions. be in the range of 815 °C to 900 °C re free circulation around each bar o	,		
Tensile testing		in both directions is requ renced standard specifica	uired by this MDS, all tensile tests shation in both directions.	nall meet the specified		
Test sampling  Non-destructive	distance equal to the The centreline of ten ASTM A370, Annex Valve parts manufac For bars with outside	The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be located at a distance equal to the bar outside diameter or 100 mm (4 in), whichever is the lesser, from the end of the bar. The centreline of tensile specimen shall be located at a distance from the bar surface in accordance with ASTM A370, Annex A.  Valve parts manufactured from bar  For bars with outside diameter ≥ 100 mm (4 in) intended for machining of valve parts, tensile testing shall be taken in both the longitudinal and transverse direction.				
testing	Inspection of valve p	arts manufactured from b	ar shall be according to the applicat uirements in this MDS shall apply.	ole valve specification. If a		
Repair of defects	Weld repair is not pe	rmitted.				
Sour service (additional metallurgical,		15156/NACE MR0175 or	by the purchaser, the material shall ISO 17945/NACE MR0103, and the			
manufacturing, testing and certification requirements) a  Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM ASTM ASTM ASTM ASTM ASTM ASTM ASTM						
	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3	3, section 7.2 and this MDS.		
Surface treatment and finish	Finished bars shall b	e pickled or bright anneal	ed. Machined or peeled surfaces do	not require pickling.		
Marking	The bars shall be ma	The bars shall be marked to ensure full traceability to heat and heat treatment lot.				
Certification	quality requirements The inspection docur compliance with this	standard accepted by the ments shall be in accorda specification.	ality system certified in accordance with ISO 9001 or another the purchaser. rdance with ISO 10474 /EN 10204 Type 3.1 and shall confirm			
	The inspection documents shall include the following information:  - Heat treatment conditions.					
The supplementary s requirements for sour		esignate a material delivered	in accordance with the MDS plus the add	ditional supplementary		



## Table A.95 — MDS IS308 / IS308S

Material Data Sh	eet	MDS No. IS30	8 / IS308S <sup>a</sup>	Rev. 0		
TYPE OF MATERIAL	: Austenitic stainless s	teel, stabilized				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Tubes	ASTM A269	TP321	-	S3		
	ASTM A269	TP347	-	S3		
		Page 1 o	f 1			
Scope	This MDS defines ap specification.	plicable options and/or re	quirements that supplement or amer	nd the referenced standar		
Heat treatment		rement S3 shall apply wit 00 °C (1 500 °F to 1 650 °	h stabilization heat treatment carried F).	I out in the temperature		
Tensile testing	The following accept	ance criteria shall apply: F	Rp0.2 ≥ 207 MPa (30 ksi); Rm ≥ 517	MPa (75 ksi); A ≥ 35 %.		
Extent of testing	Tensile testing shall	be carried out for each lot	as defined in the standard for mech	anical tests.		
Non-destructive testing	Welded tubes: non-destructive electric testing is required.					
Repair of defects	Weld repair of base material is not permitted.  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.					
Sour service (additional metallurgical,		15156/NACE MR0175 or	by the purchaser, the material shall ISO 17945/NACE MR0103, and the			
manufacturing, testing and certification	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A269.					
requirements) <sup>a</sup>	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3,	, section 7.2 and this MDS		
Surface treatment and finish	Finished tubes shall	be pickled or bright annea	aled. Machined surfaces do not requi	ire pickling.		
Marking	The tubes shall be m	arked to ensure full trace	ability to heat and heat treatment lot.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
		The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection docur	ments shall include the fol	lowing information:			
<ul> <li>Heat treatment conditions.</li> </ul>						



## Table A.96 — MDS IS321 / IS321S

Material Data Sheet		MDS No. IS321	/ IS321S a	Rev. 01	
TYPE OF MATERIAL	: Austenitic stainless st	eel, stabilized			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Seamless pipes	ASTM A312	TP321H		S6	
	ASTM A312	TP347H	-	S6	
		Page 1 of	1		
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	C ≤ 0.08 %				
Heat treatment	Supplementary requirement S6 applies with the following requirement: Stabilization heat treatment temperature shall be in the range of 815 °C to 900 °C (1 500 °F to 1 650 °F).				
Repair of defects	Weld repair is not permitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
manufacturing, testing and	Hardness testing				
certification requirements) a Production hardness testing shall be performed in accordance with the requirements in AST one length of pipe per lot. The maximum hardness shall be 22HRC from three readings taken proximity.					
	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3	section 7.2 and this MDS.	
Surface treatment and finish	Finished pipes shall t	pe pickled or bright anneal	led. Machined surfaces do not requi	re pickling.	
Marking	The pipes shall be ma	arked to ensure full tracea	bility to heat and heat treatment lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	·	nents shall include the foll	owing information:		
	<ul> <li>Heat treatment co</li> </ul>	anditions			

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## Table A.97 — MDS IS322 / IS322S

Material Data Sheet MDS No. IS322 / IS322S a Rev. 01							
TYPE OF MATERIAL	: Austenitic stainless s	teel, stabilized					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Welded pipes	ASTM A312	TP321H	-	S6			
	ASTM A312	TP347H	-	S6			
	ASTM A358	TP321H	Class 1, 3, 4, 5	S5			
	ASTM A358	TP347H	Class 1, 3, 4, 5	S5			
	•	Page 1 c	of 1				
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Chemical composition	C ≤ 0.08 %						
Heat treatment		Supplementary requirement ASTM A312 S6 or ASTM A358 S5 apply with the following requirement: Stabilization heat treatment temperature shall be in the range of 815 °C to 900 °C (1 500 °F to 1 650 °F).					
Repair of defects	Weld repair of base material is not permitted.  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.						
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
manufacturing, testing and	<u>Hardness testing</u>						
certification requirements) <sup>a</sup>	Production hardness testing shall be performed on one length of pipe per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.						
	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS			
Surface treatment and finish	Finished pipes shall	be pickled or bright annea	aled. Machined surfaces do not requ	ire pickling.			
Marking	The pipes shall be m	narked to ensure full trace	ability to heat and heat treatment lot				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	The inspection document compliance with this		nce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm			
	· .	ments shall include the fo	llowing information:				
	<ul> <li>Heat treatment comment</li> </ul>	onditions.					

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## Table A.98 — MDS IS323 / IS323S

Material Data Sheet		MDS No. IS323	MDS No. IS323 / IS323S a Rev. (			
TYPE OF MATERIAL	L: Austenitic stainless s	teel, stabilized				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A403	WP321H	W or S or WX	ASTM A403 S2		
	ASTM A403	WP347H	W or S or WX	ASTM A403 S2		
		Page 1 of	1			
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	C ≤ 0.08 %	C ≤ 0.08 %				
Heat treatment	During heat treatmer	Supplementary requirement ASTM A403 S2 shall apply.  During heat treatment fittings shall be placed in such a way as to ensure free circulation around each fitting during the heat treatment process including quenching operation.				
Non-destructive testing	Ultrasonic testing is	Ultrasonic testing is not acceptable as replacement for radiography.				
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.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and	Hardness testing					
certification requirements) a	- Seamless fittings:					
requirements)	Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	Welded fittings:					
	Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness of the base material, HAZ and weld metal shall be 22HRC from three readings taken in close proximity at each location.					
	The material shall be	traceable in accordance v	with ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Finished fittings shal	l be pickled or bright annea	aled. Machined surfaces do not req	uire pickling.		
Marking	The fittings shall be r	marked to ensure full trace	ability to heat and heat treatment lo	vt.		
Certification	quality requirements	standard accepted by the	•			
	The inspection document compliance with this		ice with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
	The inspection documents shall include the following information:  Heat treatment conditions.					
The supplementary s requirements for sou		esignate a material delivered in	n accordance with the MDS plus the add	litional supplementary		



## Table A.99 — MDS IS324 / IS324S

Material Data Sheet		MDS No. IS324	MDS No. IS324 / IS324S <sup>a</sup> Rev. 01			
TYPE OF MATERIAL	L: Austenitic stainless s	teel, stabilized				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F321H	-	S10		
	ASTM A182	F347H	-	S10		
	1	Page 1 of	1	1		
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	C ≤ 0.08 %	C ≤ 0.08 %				
Heat treatment	Forgings shall be pla	Supplementary requirement S10 shall apply.  Forgings shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including quenching operation.				
Non-destructive testing	<u>Visual inspection</u> VT shall be carried out on each forging or bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the testing.					
	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the puthe requirements in this MDS shall apply.					
Repair of defects	Weld repair is not pe	rmitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A one forging per lot. The maximum hardness shall be 22HRC from three readings taken in close proxing					
	The material shall be	traceable in accordance v	vith ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Finished forgings sha	all be pickled or bright anno	ealed. Machined surfaces do not re	quire pickling.		
Marking	The forgings shall be	marked to ensure full trac	eability to heat and heat treatment	lot.		
Certification		cturer shall have a quality standard accepted by the	system certified in accordance with purchaser.	ISO 9001 or another		
	The inspection docur compliance with this		ce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
	·	The inspection documents shall include the following information:  Heat treatment conditions.				
a The supplementary s requirements for sou		esignate a material delivered in	n accordance with the MDS plus the add	litional supplementary		



## Table A.100 — MDS IS325 / IS325S

Material Data Sheet		MDS No. IS32	MDS No. IS325 / IS325S a Rev. 01			
TYPE OF MATERIAL	: Austenitic stainless st	eel, stabilized				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Plates, sheets, strips	ASTM A240	321H	-	-		
	ASTM A240	347H	-	-		
		Page 1 c	f 1			
Scope	This MDS defines ap specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	C ≤ 0.08 %	C ≤ 0.08 %				
Heat treatment	Stabilization heat trea	Stabilization heat treatment shall be carried out in the temperature range of 815 °C to 900 °C (1 500 °F to 1 350 °F)				
Non-destructive	Visual inspection					
testing	VT shall be carried out on each plate in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.					
	Valve plate NDT					
Inspection of plates for valve parts shall be according to the applicable valve specification specified by the purchaser, the requirements in this MDS shall apply.						
Repair of defects	Weld repair is not per	mitted.				
Sour service (additional metallurgical,		15156/NACE MR0175 or	by the purchaser, the material shall ISO 17945/NACE MR0103, and the			
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>			d in accordance with the requiremen Il be 22HRC from three readings tak			
	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Surface treatment and finish	Pickled, descaled or l	oright annealed according	g to the requirements in ASTM A480	).		
Marking	The plates, sheets ar	nd strips shall be marked	to ensure full traceability to heat and	d heat treatment lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection docume compliance with this s		nce with ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
		nents shall include the fo	lowing information:			
	<ul> <li>Heat treatment co</li> </ul>					
a The supplementary su requirements for sour		esignate a material delivered	in accordance with the MDS plus the add	litional supplementary		



## Table A.101 — MDS IS327 / IS327S

Material Data Sh		MDS No. IS327 / IS	3213	Rev. 01			
TYPE OF MATERIAL	L: Austenitic stainless s	teel, stabilized					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A479	321H	-	-			
	ASTM A479	347H	-	-			
		Page 1 o	f 1				
Scope	This MDS defines ap specification.	oplicable options and/or re	quirements that supplement or ame	nd the referenced standard			
Manufacturing	Bars shall be hot or cold finished cylindrical shaped with maximum diameter of 300 mm (12 in).  NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold forming is not permitted.						
Chemical composition	C ≤ 0.08 %	C ≤ 0.08 %					
Heat treatment	Stabilization heat tre Bars shall be placed	Bars shall be supplied in the stabilised annealing conditions.  Stabilization heat treatment temperature shall be in the range of 815 °C to 900 °C (1 500 °F to 1 650 °F).  Bars shall be placed in such a way as to ensure free circulation around each bar during the heat treatment process including quenching operation.					
Tensile testing		Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions.					
Test sampling	The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be located at a distance equal to the bar outside diameter or 100 mm (4 in), whichever is the lesser, from the end of the bar. The centreline of tensile specimen shall be located at a distance from the bar surface in accordance with ASTM A370, Annex A.  Valve parts manufactured from bar  For bars with outside diameter ≥ 100 mm (4 in) intended for machining of valve parts, tensile testing shall be taken in both the longitudinal and transverse direction.						
Non-destructive testing	Inspection of valve p	NDT valve parts manufactured from bar Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not pe	rmitted.					
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.						
testing and certification requirements) <sup>a</sup>			d in accordance with the requiremer um hardness shall be 22HRC from t				
	The material shall be	traceable in accordance	with ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.			
Surface treatment and finish	Finished bars shall b	e pickled or bright anneal	ed. Machined or peeled surfaces do	not require pickling.			
Marking	The bars shall be ma	arked to ensure full tracea	bility to heat and heat treatment lot.				
Certification	The bars shall be marked to ensure full traceability to heat and heat treatment lot.  The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment conditions.						



## Table A.102 — MDS IS404 / IS404S

Material Data Sheet		MDS No. IS404 / IS404S <sup>a</sup> Rev. 0				
TYPE OF MATERIAL	.: Austenitic stainless ste	el, 200-series				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F XM-19 (UNS S20910)	-	-		
	1	Page 1 of 1	•			
Scope	This MDS defines app specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Heat treatment	Forgings shall be place	Forgings shall be supplied solution annealed or hot rolled or solution annealed and cold worked.  Forgings shall be placed in such a way as to ensure free circulation around each component during the heat treatment process including possible quenching operation.				
Non-destructive testing	Visual inspection  VT shall be carried out on each forging or bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the testing.  Valve forgings NDT  Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not pern	Weld repair is not permitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a</sup>		esting shall be performed in acc e maximum hardness shall be 3				
	The material shall be t	raceable in accordance with ISC	) 15156-3/NACE MR0175-3,	section 7.2 and this MDS.		
Surface treatment and finish	Finished forgings shall	be pickled or bright annealed.	Machined surfaces do not re	quire pickling.		
Marking	The forgings shall be r	marked to ensure full traceability	to heat and heat treatment	ot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection docume compliance with this spectrum.	ents shall be in accordance with pecification.	ISO 10474 /EN 10204 Type	3.1 and shall confirm		
	The inspection docume	ents shall include the following i	nformation:			
	<ul> <li>Heat treatment cor</li> </ul>	nditions.				



## Table A.103 — MDS IS407 / IS407S

Material Data Sheet		MDS No. IS407 / IS4	Rev. 01			
TYPE OF MATERIAL	.: Austenitic stainless stee	el, stabilized				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A276	XM-19 (UNS S20910)	-	-		
	ASTM A479	XM-19 (UNS S20910)	-	-		
		Page 1 of 1	1	1		
Scope	This MDS defines appli specification.	nis MDS defines applicable options and/or requirements that supplement or amend the referenced standard pecification.				
Manufacturing	Bars shall be hot or cold	d finished cylindrical shaped v	vith maximum diameter of 300	) mm (12 in).		
Heat treatment	Bars shall be placed in	Bars shall be supplied solution annealed or hot rolled or solution annealed and cold worked.  Bars shall be placed in such a way as to ensure free circulation around each bar during the heat treatment process including possible quenching operation.				
Tensile testing		Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions.				
Test sampling	The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be locate distance equal to the bar outside diameter or 100 mm (4 in), whichever is the lesser, from the end.  The centreline of tensile specimen shall be located at a distance from the bar surface in accordance.					
	ice in accordance with					
		For bars with outside diameter ≥ 100 mm (4 in) intended for machining of valve parts, tensile testing shall be				
	taken in both the longitu	udinal and transverse direction	1.			
Non-destructive	NDT valve parts manuf	actured from bar				
testing		s manufactured from bar shall the purchaser, the requireme		le valve specification. If a		
Repair of defects	Weld repair is not perm	itted.				
Sour service (additional metallurgical, manufacturing,	requirements of ISO 15	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
testing and certification requirements) <sup>a</sup>		Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 of the end surface of one bar per lot. The maximum hardness shall be 35HRC from three readings taken in closest control of the co				
	The material shall be tra	aceable in accordance with IS	O 15156-3/NACE MR0175-3	section 7.2 and this MDS.		
Surface treatment and finish	Finished bars shall be p	oickled or bright annealed. Ma	chined or peeled surfaces do	not require pickling.		
Marking	The bars shall be mark	ed to ensure full traceability to	heat and heat treatment lot.			
Certification	quality requirements sta	urer shall have a quality system andard accepted by the purch	aser.			
	The inspection docume compliance with this sp	nts shall be in accordance wit ecification.	h ISO 10474 /EN 10204 Type	e 3.1 and shall confirm		
	·	nts shall include the following	information:			
The supplementary s requirements for source.		gnate a material delivered in accor	rdance with the MDS plus the add	itional supplementary		



## Table A.104— MDS IM104 / IM104S

Material Data Sh	neet	MDS No. IM104/	IM104S a	Rev. 01		
TYPE OF MATERIAL	L: Martensitic stainless stee	ı				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F6A (UNS S41000)	Class 1, Class 2	-		
		Page 1 of 1	<u> </u>			
Scope	This MDS defines applica specification.	able options and/or requi	irements that supplement or ame	end the referenced standard		
Heat treatment	temperature than the inte	Forgings shall be placed in such a way as to ensure free circulation around each forging during the heat				
Non-destructive testing	Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not permitt	ed.				
Sour service (additional	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.					
metallurgical, manufacturing, testing and			n accordance with the requireme			
certification requirements) <sup>a</sup>	one forging per lot. The n	naximum hardness shall	be 22HRC from three readings	taken in close proximity.		
	The material shall be trac	ceable in accordance wit	h ISO 15156-3/NACE MR0175-3	3, section 7.2 and this MDS.		
Marking	The forgings shall be ma	rked to ensure full tracea	ability to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection document		· ·			
	Heat treatment conditions including tempering temperature.					



## Table A.105 — MDS IM106 / IM106S

Material Data Sh	neet	MDS No. IM106 / II	M106S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	L: Martensitic stainless stee	el				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A217	CA15 (UNS J91150)	-	ASTM A217 S4, S5, S21, S52.6 ASTM A703 S14, S20		
	- 1	Page 1 of 3	-	1		
Scope	This MDS defines applic specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	Supplementary requirem	nent ASTM A217 S52.6 sha	ıll apply.			
Heat treatment	Supplementary requirement ASTM A217 S21 shall apply.  Castings shall be supplied in the normalized and double-temper condition with the final temper at a lower temperature than the intermediate temper. The minimum tempering temperature shall be 621 °C (1 150 °F).  During the heat treatment process, castings shall be placed in such a way as to ensure free circulation around each casting.					
Test sampling	each casting.  For castings with a weight of 250 kg (551 lb) or more, the test blocks shall be integrally cast or gat casting and shall accompany the castings through all heat treatment operations including any post relieving.  Thickness of the test block shall be equal to the thickest part of the casting represented up to a mathickness of 100 mm (4 in). For flanged components, the largest flange thickness is the ruling sect Dimensions of test blocks and location of test specimens within the test blocks are shown in the first for integral and gated test block. The test specimens shall be taken within the cross hatched area from end of test specimen to end of test block shall minimum be T/4.			sented up to a maximum is the ruling section. The shown in the figure below the section is the ruling section. The shown in the figure below the section is the ruling section. The shown in the figure below the section is the ruling section. The section is the ruling section.		
Extent of testing	any PWHT.	tary requirement S14 shall	apply for each heat and heat t	reatment charge including		
Non-destructive testing	Visual inspection					
	NDE requirement	Pilot casting (sec	ion 4.8) Pr	oduction casting		
	Frequency	Each pilot cas	ting Eac	n production casting		
	Method		ANSI/MSS SP-55			
	Extent	100 % of all	accessible surfaces including	welding ends		
	Acceptance criteria		MSS SP-55			
	NOTE The testing shall b testing.	e carried out after machining, i	f applicable. Non-machined surfac	es shall be pickled prior to the		



Material Data Sheet		MDS No. IM106 / IN	MDS No. IM106 / IM106S a		
TYPE OF MATERIAL: Martensitic stainless steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A217	CA15 (UNS J91150)	-	ASTM A217 S4, S5, S21, S52.6 ASTM A703 S14, S20	

#### Page 2 of 3

## Non-destructive testing (continued)

#### Magnetic particle testing

ASTM A217 supplementary requirement S4 shall apply as amended by this MDS.

NDE requirement Pilot casting (section 4.8)		Production casting <sup>a</sup>	
Frequency <sup>b</sup>	100 %		
Method	ASME BPVC, Sec. V, Article 7		
Extent <sup>c</sup>	100 %		
Acceptance criteria	ASME BPVC, Sec. V	III, Div. 1, Appendix 7	

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- Production valve castings, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Frequency of inspection 100 % means that each item shall be examined.
- All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A217 supplementary requirement S5 shall apply as amended by this MDS.

NDE requirement	Pilot casting	Production casting						
	(section 4.8)	Valve castings <sup>a</sup>				Other pressure containing castings <sup>b</sup>		
Frequency <sup>c</sup>	100 %	NPS	DN		Pressu	re class	1	100 %
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method			ASME I	BPVC Se	ec. V, Arti	cle 2		•
Extent	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			100 % <sup>d</sup>				
Acceptance criteria		ASME	BPVC,	Sec. VII	I, Div. 1,	Appendix	(7	•

NOTE N/R means not required, unless specified otherwise by the purchaser.

- <sup>a</sup> Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



Material Data S	heet	MDS No. IM106 / IN	<b>M106S</b> <sup>a</sup>	Rev. 01		
TYPE OF MATERIA	L: Martensitic stainless	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A217	CA15 (UNS J91150)	-	ASTM A217 S4, S5, S21, S52.6		
				ASTM A703 S14, S20		
		Page 3 of 3				
Repair of defects		d in ASTM A217, section 9.4 sh rdance with ASTM A703 S20.2	•	ajor repairs shall be		
	The repair welding p	rocedure shall be qualified in a	ccordance with ASTM A488 or	ISO 11970 and this MDS.		
	<ul> <li>Welding procedu production.</li> </ul>	re shall be qualified on casting	or plate of the same cast mate	rial grade as used in		
	<ul> <li>Testing methodology and acceptance criteria shall be in accordance with the requirements of this MDS for the parent material.</li> </ul>					
	Weld repairs are not acceptable for castings that leak during pressure testing.					
	Stress relieving PWHT shall be required after all major weld repairs at a minimum temperature of 621 °C (1 150 °F).					
	If a minor cosmetic repair is required to a semi-finished or finished cast component, PWHT may be omitted provided the welding procedure meets all the test requirements of this data sheet in the as-welded condition.					
Sour service (additional	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and this MDS.					
metallurgical, manufacturing,	Hardness testing					
testing and	Supplementary requirement ASTM A217 S13 shall apply with the following additions:					
certification requirements)ª	Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the pilot casting and one casting per heat and heat treatment charge thereafter.					
	The maximum hardness shall be 22HRC from three readings taken in close proximity.					
	The material shall be	e traceable in accordance with I	SO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.		
Marking	The castings shall be	e marked to ensure full traceab	ility to heat and heat treatment	lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection docu	ments shall include the followin	g information:			
	Heat treatment conditions including final tempering temperature.					



## **Table A.106 — MDS IM107**

Material Data Sh	neet	MDS No. IM10	<b>7</b> a	Rev. 01	
TYPE OF MATERIAL	L: Martensitic stainless steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bars	ASTM A276	410 (UNS S41000)	-	-	
	ASTM A479	410 (UNS S41000)	-	-	
	•	Page 1 of 1	•	•	
Scope	This MDS defines applica specification.	ble options and/or requiren	nents that supplement or ame	nd the referenced standard	
Manufacturing		•	ximum diameter of 300 mm (1 or polishing (singly or in combinat	,	
Heat treatment		ch a way as to ensure free ng possible quenching ope	circulation around each compration.	ponent during the heat	
Hardness testing	Production hardness testi	Hardness of the finished bar shall be in the range 200HBW-275HBW.  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the end surface of one bar per lot.			
Tensile testing		oth directions is required by ed standard specification in	y this MDS, all tensile tests sh both directions.	all meet the specified	
Test sampling	distance equal to the bar of the centreline of tensile standard ASTM A370, Annex A.  Valve parts manufactured	The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be located at a distance equal to the bar outside diameter or 100 mm (4 in), whichever is the lesser, from the end of the bar. The centreline of tensile specimen shall be located at a distance from the bar surface in accordance with ASTM A370, Annex A.  Valve parts manufactured from bar  For bars with outside diameter ≥ 100 mm intended for machining of valve parts, tensile testing shall be taken			
Non-destructive testing		manufactured from bar sha	II be according to the applicabents in this MDS shall apply.	le valve specification. If a	
Repair of defects	Weld repair is not permitte	ed.			
Marking	The bars shall be marked	to ensure full traceability to	heat and heat treatment lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment conditions including tempering temperature.				
<sup>a</sup> Material shall not be	used in sour service.				



## **Table A.107 — MDS IM127**

Material Data Sh	aterial Data Sheet MDS No. IM127 a			Rev. 01	
TYPE OF MATERIAL	L: Martensitic stainless steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bars	ASTM A276	420 (UNS S42000)	-	-	
		Page 1 of 1			
Scope	This MDS defines applicab specification.	ole options and/or requirem	nents that supplement or ame	nd the referenced standard	
Manufacturing	Bars shall be hot or cold fir	nished cylindrical shaped v	vith maximum diameter of 300	0 mm (12 in).	
Heat treatment	Bars shall be placed in suc treatment process.	ch a way as to ensure free	circulation around each comp	ponent during the heat	
Hardness testing			OHBW-275HBW.Production h CTM A370/A1058 on the end s		
Tensile testing	Where tensile testing in bo properties of the reference		this MDS, all tensile tests sh both directions.	all meet the specified	
Test sampling	distance equal to the bar o end of the bar.	utside diameter or minimu	transverse) tensile specimens m of 100 mm (4 in), whicheve	er is the greater, from the	
	The centreline of tensile sp ASTM A370, Annex A.	pecimen shall be located at	t a distance from the bar surfa	ace in accordance with	
	Valve parts manufactured				
	in both the longitudinal and		r machining of valve parts, te	nsile testing shall be taken	
Non-destructive	NDT valve parts manufacti	ured from bar			
testing			l be according to the applicab nts in this MDS shall apply.	le valve specification. If a	
Repair of defects	Weld repair is not permitte	d.			
Marking	The bars shall be marked t	to ensure full traceability to	heat and heat treatment lot.		
Certification	The material manufacturer quality requirements stand		m certified in accordance with aser.	ISO 9001 or another	
		The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.			
	The inspection documents	· ·			
		ons including tempering ter	nperature.		
<sup>a</sup> Material shall not be	used in sour service.				



## Table A.108 — MDS IU604 / IU604S

Material Data Sheet		MDS No. IU604 /	IU604S <sup>a</sup>	Rev. 01	
TYPE OF MATERIAL	: Martensitic stainless steel,	precipitation-hardened			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A705	630 (UNS S17400)	-	-	
	•	Page 1 of 1		•	
Scope	This MDS defines applicate specification.	ole options and/or requir	ements that supplement or ame	nd the referenced standard	
Metal making	Electric furnace (EF) melt vacuum arc remelting (VA	,	or VOD followed by electro slage refining methods.	remelting (ESR) or	
Heat treatment	Forgings shall be supplied Forgings shall be placed ir treatment process includin	n such a way as to ensu	re free circulation around each c	omponent during the heat	
Hardness testing			e readings taken in close proxim accordance with the requiremen		
Impact testing / toughness testing	Impact testing is required the test temperature shall the minimum absorbed er	be minus 29 °C (-20 °F	·	age, 20 J (15 ft lbf) single.	
Non-destructive testing	Valve forgings NDT Inspection shall be accord the requirements in this M		ve specification. If a QSL is not s	specified by the purchaser,	
Repair of defects	Weld repair is not permitte	d.			
Sour service (additional metallurgical,			he purchaser, the material shall 17945/NACE MR0103, and the		
manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be trace	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.			
Surface treatment and finish	Finished forgings shall be	pickled. Machined surfa	ces do not require pickling.		
Marking	The forgings shall be mark	ked to ensure full traceal	pility to heat and heat treatment	ot.	
Certification	The material manufacturer quality requirements stand	shall have a quality systard accepted by the pure	stem certified in accordance with chaser.	ISO 9001 or another	
	compliance with this speci	fication.	with ISO 10474 /EN 10204 Type	3.1 and shall confirm	
	The inspection documents		ng information:		
	Heat treatment condition	ons.			
The supplementary surrequirements for sour		te a material delivered in ac	cordance with the MDS plus the add	itional supplementary	



## Table A.109 — MDS IU607 / IU607S

Material Data Sho	eet MDS	No. IU607 / IU607S a		Rev. 01	
TYPE OF MATERIAL	: Martensitic stainless steel,	precipitation-hardened			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bars	ASTM A564	630 (UNS S17400)	-	-	
		Page 1 of 2			
Scope	This MDS defines applical specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.			
Metal making		shall be refined by AOD or V (AR) or equivalent multiple r		remelting (ESR)	
Manufacturing	<ul><li>Bar forgings as defined</li><li>Hot or cold finished cylimm (5 in).</li></ul>	d to the following requirement in ASTM A788 and certified ndrical shaped bar manufact restricted to turning, grinding or	I to ASTM A705; or tured to ASTM A564 with m		
Heat treatment		ondition H1150D or H1150M h a way as to ensure free ci quenching operation.		uring the heat treatment	
Tensile testing		Where tensile testing in both directions is required by this MDS, all tensile tests shall meet the specified properties of the referenced standard specification in both directions.			
Hardness testing	The maximum hardness shall be 33HRC from three readings taken in close proximity.  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the end surface of one bar per lot.				
Impact testing / toughness testing	The test temperature shall The minimum absorbed en	be minus 29 °C (-20 °F). ergy for full size specimens	shall be 27 J (20 ft lbf) aver	age, 20 J (15 ft lbf) single.	
Test sampling	The mid-length of axial (longitudinal) and tangential (transverse) tensile specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar.  The centreline of tensile specimen shall be located at a distance from the bar surface in accordance with ASTM A370, Annex A.				
Non-destructive	NDT valve parts manufactu	ured from bar			
testing		anufactured from bar shall to purchaser, the requirement		le valve specification. If a	
Repair of defects	Weld repair is not permitted	d.			
Sour service (additional metallurgical, manufacturing, testing and	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirement to the MDS.				
testing and certification requirements) a  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable with ISO 15156-3/NACE MR0175-3, section 7.2 and the material shall be traceable with ISO 15156-3/NACE MR0175-3/NACE MR0175-3/NACE MR0175-3/NACE MR0175-3/NACE MR0175-3/NACE MR0175-3/NACE					
Surface treatment and finish	Finished bars shall be pick	led. Machined or peeled sur	faces do not require pickling	J.	
Marking	The bars shall be marked t	o ensure full traceability to h	neat and heat treatment lot.		



Material Data Sh	laterial Data Sheet MDS No. IU607 / IU607S <sup>a</sup>					
TYPE OF MATERIAL: Martensitic stainless steel, precipitation-hardened						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A564	630 (UNS S17400)	-	-		
	•	Page 2 of 2	·			
Certification		acturer shall have a quality syst standard accepted by the pure		ISO 9001 or another		
	The inspection documents shall be in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection docu	ments shall include the following	g information:			
	<ul> <li>Heat treatment</li> </ul>	conditions.				
The supplementary su	compliance with this The inspection docu  Heat treatment  uffix "S" shall be used to describe the second shall be used to	specification. ments shall include the followin	g information:			



## **Table A.110 — MDS IL101**

Material Data Sh	Material Data Sheet MDS No. IL101 <sup>a</sup> Rev. 01					
TYPE OF MATERIAL	L: 3.5 % Nickel alloy steel					
PRODUCT FORM	STANDARD	GRADE		ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Seamless pipes	ASTM A333	3		-	-	
	•	Page 1	of 1		•	
Scope	This MDS defines applicat specification.	ole options and/or r	equirement	ts that supplement or ame	nd the referenced standard	
Heat treatment	During the heat treatment each pipe including any qu	Products shall be delivered in the normalized or normalized and tempered condition.  During the heat treatment process, pipes shall be placed in such a way as to ensure free circulation around each pipe including any quenching operation.  For products delivered in the tempered condition, the minimum tempering temperature shall be 615 °C (1 139 °F).				
Impact testing / toughness testing	thickness shall govern. The test temperature shall	The test temperature shall be minus 101 °C (-150 °F).  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf)				
Test sampling	Test specimens shall be p	repared and tested	after simul	ated PWHT in accordance	e with the product standard.	
Repair of defects	Weld repair is not permitte	d.				
Marking	The pipes shall be marked	to ensure full trace	eability to h	eat and heat treatment loa	id.	
Certification	The material manufacturer quality requirements stand				ISO 9001 or another	
	The inspection documents confirm compliance with the		accordance	e with ISO 10474 /EN 1020	04 Type 3.1 and shall	
	The inspection documents	shall include the fo	ollowing info	ormation:		
	- Heat treatment condition	on. For tempered co	ondition, te	mpering temperature shall	be stated.	
<sup>a</sup> Material shall not be	used in sour service.					



## **Table A.111 — MDS IL102**

Material Data Sh	neet	MDS No. IL	.102 <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	L: 3.5 % Nickel alloy steel			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Welded pipes	ASTM A671	CFE 70	Cl. 22, Cl. 32, Cl. 42	ASTM A671 S2, S7, S14
		Page 1 of	1	
Scope	This MDS defines applicable specification.	ole options and/or req	uirements that supplement or ame	nd the referenced standard
Manufacturing	The longitudinal weld shall Welds shall be made using			
Heat treatment	For products delivered in the (1 139 °F).	ne tempered condition	n, the minimum tempering tempera	ature shall be 615 °C
Impact testing / toughness testing	thickness shall govern. The test temperature shall	be minus 101 °C (-15	(0.236 in); for pipes with a weld encomes 50 °F). cimens shall be 27 J (20 ft lbf) aver	
Extent of testing	Impact testing per ASTM A per lot.  ASTM A671 supplementar Impact test samples for ba	y requirement S14 sh		s MDS, shall be carried out
Test sampling			ter simulated PWHT at 600 °C with erature not exceeding 315 °C (600	
Non-destructive testing	ASTM A671 supplementar	y requirement S7 sha	ll apply.	
Repair of defects	Weld repair of the base ma	aterial is not permitted	l.	
	Repairs to weld metal are a the requirements of the or		ance with the standard specification weld.	n and shall meet
Marking	The pipes shall be marked	to ensure full traceat	pility to heat and heat treatment loa	nd.
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.			
	The inspection documents  - Heat treatment condition	shall include the follo	wing information: ions, the stress relieving temperate	ure or tempering
	temperature shall be stated			
a Material shall not be	used in sour service.			



## **Table A.112 — MDS IL103**

Material Data Sh	neet	MDS No. IL	<b>_103</b> <sup>a</sup>	Rev. 01	
TYPE OF MATERIAL	L: 3.5 % Nickel alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A420	WPL3	-	ASTM A960 S51, S53, S59, S69	
	ASTM A420	WPL3W	-	ASTM A960 S51, S53, S59, S69	
		Page 1 of	2		
Scope	This MDS defines applica specification.	ble options and/or req	uirements that supplement or ame	nd the referenced standard	
Manufacturing	Fittings shall be made fro MDSs of this specification Caps shall be seamless.		ded pipe, forging or plate (for caps	only) compliant with the	
Welding	An electric fusion welding permitted.	process shall be used	d with the addition of filler metal. Au	utogenous welding is not	
Heat treatment	During the heat treatment each fitting including any All hot formed or forged fi	Fittings shall be delivered in the normalized or normalized and tempered condition.  During the heat treatment process, fittings shall be placed in such a way as to ensure free circulation around each fitting including any quenching operation.  All hot formed or forged fittings, including those manufactured by locally heating a portion of the fitting stock, shall be heat treated after manufacture. ASTM A960 supplementary requirement S59 shall apply.			
Tensile testing	Test sampling shall be ma	ASTM A960 supplementary requirement S51 shall apply as amended by this MDS.  Test sampling shall be made from an actual fitting, from a prolongation thereof, or if not possible, a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents.			
Impact testing / toughness testing	shall govern.  The test temperature sha	ll be minus 101 °C (-1	(0.236 in); for fittings with a weld en 50 °F).  cimens shall be 27 J (20 ft lbf) aver		
Extent of testing	Impact testing and tensile	testing shall be carrie	d out for each heat and heat treatr	nent load.	
Non-destructive testing	UT is not acceptable in-lie  Magnetic particle testing ASTM A960 supplementa		nd S69 shall apply as amended by	this MDS.	
	NDE requirement		Wrought fittings		
	Frequency <sup>a</sup>		10 %		
	Method		ASME BPVC, Sec. V, Article 7	,	
	Extent <sup>b</sup>		100 %		
	Acceptance criteria	A	SME <i>BPVC</i> , Sec. VIII, Div. 1, Appe	endix 6	
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.				
<ul> <li>For random examination (10 %), a minimum of one item per lot in any postable shall be as defined for mechanical testing.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>				all be examined. The test lot	
Repair of defects	Weld repair of the base m Repairs to weld metal are chemistry requirements o	acceptable in accorda	ance with the standard specification	n and shall meet the	



Material Data Sh	neet	Rev. 01					
TYPE OF MATERIAL: 3.5 % Nickel alloy steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Wrought fittings	ASTM A420	WPL3	-	ASTM A960 S51, S53, S59, S69			
	ASTM A420	WPL3W	-	ASTM A960 S51, S53, S59, S69			
	•	Page 2 c	f 2	•			
Marking	The fittings shall be	marked to ensure full trace	eability to heat and heat treatment lo	oad.			
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.						
	The inspection docu	ments shall include the fo	lowing information:				
	- Heat treatment of	condition including temperi	ng temperature.				
a Material shall not be	used in sour service.						



## **Table A.113 — MDS IL104**

Material Data Sheet MDS No. IL104 <sup>a</sup> Rev.				Rev. 01	
TYPE OF MATERIAL	.: 3.5 % Nickel alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Forgings	ASTM A350	LF3	Class 2	ASTM A961 S55	
		Page 1 of 1			
Scope	This MDS defines applies specification.	cable options and/or require	ments that supplement or ame	nd the referenced standard	
Heat treatment	During the heat treatme		malized and tempered conditions placed in such a way as to en		
Impact testing / toughness testing	Impact testing is require shall govern.	ed for thickness ≥ 6 mm (0.2	36 in); for forgings with a weld	end, the weld end thickness	
Extent of testing	A test lot shall not exce	· ·	II be carried out for each heat a rgings with as forged weight up pht > 50 kg (110 lb).		
Non-destructive testing	<u>Visual inspection</u> VT shall be carried out on each forging in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing				
	Magnetic particle testing ASTM A961 supplementary requirement S55 shall apply as amended by this MDS.				
	NDE requirement		Forgings		
	Frequency <sup>a</sup>		10 %		
	Method	,	ASME BPVC, Sec. V, Article 7		
	Extent <sup>b</sup>		100 %		
	Acceptance criteria	ASME	BPVC, Sec. VIII, Div. 1, Apper	ndix 6	
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.				
	<ul> <li>For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>				
Valve forgings NDT Inspection shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not perm	itted.			
Marking	The forgings shall be m	arked to ensure full traceabi	lity to heat and heat treatment	load.	
Certification	The material manufactu	rer shall have a quality systematical accepted by the purc	em certified in accordance with haser.	ISO 9001 or another	
	The inspection docume confirm compliance with		lance with ISO 10474 /EN 1020	04 Type 3.1 and shall	
	·	nts shall include the followin lition including tempering ter	•		
a Material shall not be	used in sour service.				



## **Table A.114 — MDS IL105**

Material Data Sheet MDS No. IL105 a							
TYPE OF MATERIAL	.: 3.5 % Nickel alloy steel						
PRODUCT FORM	STANDARD	ANDARD GRADE ACCEPTANCE CLASS SUPPLEMENTARY REQUIREMENT					
Plates	ASTM A203	D, E	-	ASTM A20 S5			
	•	Page 1 of 1	•				
Scope	This MDS defines applicable specification.	ole options and/or requireme	ents that supplement or ame	nd the referenced standard			
Impact testing / toughness testing	ASTM A20 supplementary requirement S5 shall apply as amended by this MDS.  Impact testing is required for thickness ≥ 6 mm (0.236 in) after final heat treatment.  The test temperature shall be minus 101 °C (-150 °F).  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.  The test specimen shall be taken at mid-thickness in the longitudinal orientation to the final direction of rolling final heat treatment.						
Non-destructive testing	Visual inspection  VT shall be carried out on each plate in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  Valve plates NDT  Inspection of plates for valve parts shall be according to the applicable valve specification.  If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.						
Repair of defects	Weld repair is not permitte	d.					
Marking	The plates shall be marked	d to ensure full traceability to	heat and heat treatment loa	ad.			
Certification	quality requirements stand The inspection documents confirm compliance with th	ard accepted by the purchas shall be issued in accordan is specification. shall include the following in	ce with ISO 10474 /EN 1020				
a Material shall not be	used in sour service.						



## **Table A.115 — MDS IL106**

Material Data Sh	eet	MDS No. IL106	1	Rev. 0	
TYPE OF MATERIAL	.: 3.5 % Nickel alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A352	LC3 (UNS J31550)	-	ASTM A352 S4, S5 ASTM A703 S8, S14, S20	
		Page 1 of 3		•	
Scope	This MDS defines applica specification.	able options and/or requireme	ents that supplement or ame	nd the referenced standard	
Heat treatment	each casting including po	t process, castings shall be possible quenching operation. temperature shall be 615 °C		sure free circulation aroun	
Impact testing / toughness testing	The test temperature sha The minimum absorbed e single.	ASTM A703 supplementary requirement S8 shall apply.  The test temperature shall be minus 101 °C (-150 °F).  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.  Specimens shall be removed from mid-thickness.			
Extent of testing	ASTM A703 supplementa	ary requirement S14 shall ap	ply.		
Test sampling	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.  Thickness of the test block shall be equal to the thickest part of the casting represented up to a maximum thickness of 100 mm (4 in). For flanged components, the largest flange thickness is the ruling section.  Dimensions of test blocks and location of test specimens within the test blocks are shown in the 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.				
Non-destructive testing	<u>Visual inspection</u>		l .		
	NDE requirement	Pilot casting (section	-	duction casting	
	Frequency	Each pilot casting		production casting	
	Method		ANSI/MSS SP-55		
	Extent	100 % of all ac	ccessible surfaces including	welding ends	
	Acceptance criteria  NOTE The testing shall be testing.	carried out after machining, if ap	ANSI/MSS SP-55 plicable. Non-machined surfaces	shall be cleaned prior to the	



Material Data Sho	eet	MDS No. IL106	6 <sup>a</sup>	Rev. 01
TYPE OF MATERIAL	: 3.5 % Nickel alloy stee	I		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A352	LC3 (UNS J31550)	-	ASTM A352 S4, S5 ASTM A703 S8, S14, S20

#### Page 2 of 3

# Non-destructive testing (continued)

#### Magnetic particle testing

ASTM A352 supplementary requirement S4 shall apply as amended by this MDS.

-				
NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>		
Frequency <sup>b</sup>	100 %			
Method	ASME BPVC, Sec. V, Article 7			
Extent <sup>c</sup>	100 %			
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7			

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- <sup>a</sup> Production valve castings, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- <sup>b</sup> Frequency of inspection 100 % means that each item shall be examined.
- c All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A352 supplementary requirement S5 shall apply as amended by this MDS.

NDE requirement	Pilot casting	Production casting						
	(section 4.8)	pi				Other pressure containing castings <sup>b</sup>		
Frequency <sup>c</sup>	100 %	NPS	DN		Pressu	re class		100 %
				≤ 300	600	900	≥ 1500	
		< 2	< 50	N/R	N/R	N/R	N/R	
		≥ 2	≥ 50	N/R	5 %	5 %	5 %	
		≥ 6	≥ 150	N/R	5 %	5 %	100 %	
		≥ 10	≥ 250	5 %	5 %	5 %	100 %	
		≥ 16	≥ 400	5 %	5 %	100 %	100 %	
		≥ 20	≥ 500	5 %	100 %	100 %	100 %	
Method			ASME E	BPVC, Se	ec. V, Art	icle 2		L
Extent	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							
Acceptance criteria		ASMI	∃ BPVC,	Sec. VII	I, Div. 1,	Appendix	<b>۲</b>	

NOTE N/R means not required, unless specified otherwise by the purchaser.

- Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



<b>Material Data Sh</b>	neet	MDS No. IL10	6 <sup>a</sup>	Rev. 01
TYPE OF MATERIA	L: 3.5 % Nickel alloy ste	eel		
PRODUCT FORM	STANDARD	STANDARD GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A352	LC3 (UNS J31550)	-	ASTM A352 S4, S5 ASTM A703 S8, S14, S20
		Page 3 of 3		
Repair of defects	ASTM A703 suppler	nentary requirement S20 shall a	apply with the following addition	nal requirements:
	<ul> <li>Repairs as described in ASTM A352, sections 9.3 and 9.4 shall be considered major repairs and shall documented in accordance with A703 S20.2.</li> <li>The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this data sheet using a cast plate.</li> </ul>			
	_	not acceptable for castings tha	t leak during pressure testing.	
	<ul> <li>Examination of m</li> </ul>	najor repair welds on pressure o	containing parts shall also inclu	ıde RT.
Marking	The castings shall be	e marked to ensure full traceab	ility to heat and heat treatment	load.
Certification		acturer shall have a quality systems standard accepted by the purc		ISO 9001 or another
The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 are confirm compliance with this specification.				
	The inspection docu	ments shall include the followin	g information:	
	<ul> <li>Heat treatment c</li> </ul>	ondition including tempering ter	mperature shall be stated.	
a Material shall not be	used in sour service.			



## **Table A.116 — MDS IL108**

Material Data Sh	eet	MDS No. IL108 a		Rev. 01	
TYPE OF MATERIAL	.: 3.5 % Nickel alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Tubes	ASTM A334	3	-	-	
		Page 1 of 1	•		
Scope	This MDS defines applica specification.	ble options and/or requirem	ents that supplement or ame	nd the referenced standard	
Heat treatment	Products shall be delivered in the normalized or normalized and tempered condition.  For products delivered in the tempered condition, the minimum tempering temperature shall be 615 °C (1 139 °F).  During the heat treatment process, tubes shall be placed in such a way as to ensure free circulation around each tube including any tempering operation.				
Impact testing / toughness testing	single.	energy for full size specimen	s shall be 27 J (20 ft lbf) aver	age and 20 J (15 ft lbf)	
Repair of defects	Weld repair is not permitte	ed.			
Marking	The tubes shall be marke	d to ensure full traceability to	heat and heat treatment lot.		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection document	s shall include the following	information:		
	Heat treatment condition including tempering temperature shall be stated.				
a Material shall not be	used in sour service.				



## Table A.117 — MDS IT101 / IT101S

Material Data Sh	neet	MDS No. IT101 /	IT101S a	Rev. 01			
TYPE OF MATERIA	L: Titanium grade 2						
PRODUCT FORM	STANDARD	GRADE ACCEPTANCE CLASS SUPPLEMENTAR REQUIREMENT					
Seamless pipes	ASTM B861	2 (UNS R50400)	-	-			
		Page 1 of 1	-				
Scope	This MDS defines applied specification.	cable options and/or require	ements that supplement or ame	nd the referenced standard			
Qualification			II be qualified in accordance with eet the requirements of this MDS				
Repair of defects	Repair welding is not pe	ermitted.					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.						
testing and certification requirements) <sup>a</sup>	production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1 one length of pipe per lot. The maximum hardness shall be 100HRB from three readings taken in close proximity at each location.						
Certification			ISO 15156-3/NACE MR0175-3, tem certified in accordance with				
Ceruncation		andard accepted by the pur		130 9001 of another			
		The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection docume	nts shall include the followi	ng information:				
	<ul> <li>MPS identification o</li> </ul>	r MCPR/QTR number used	<b>1</b> .				
The supplementary s requirements for source.		nate a material delivered in ac	cordance with the MDS plus the add	itional supplementary			



## Table A.118 — MDS IT102 / IT102S

Material Data Sheet		MDS No. IT102/	IT102S a	Rev. 0		
TYPE OF MATERIAL	L: Titanium grade 2					
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLE REQUIR					
Welded pipes	ASTM B862	2 (UNS R50400)	-	ASTM B862 S1.1		
	1	Page 1 of 1	1	1		
Scope	This MDS defines applic specification.	able options and/or requir	ements that supplement or ame	nd the referenced standard		
Qualification			all be qualified in accordance with eet the requirements of this MDS			
Welding	Welding procedures sha	Il be qualified in accordan	ce with ASME BPVC, Sec. IX or	ISO 15614-5.		
Non-destructive testing		criteria for penetrant testi uirement S1.1 shall apply	ng shall be to ASME <i>BPVC</i> , Sec	. VIII, Div. 1, Appendix 8.		
Repair of defects	Repair welding of base material is not permitted.  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).					
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.					
manufacturing, testing and certification requirements) <sup>a</sup>			d in accordance with the requirer			
	weld metal shall be 100HRB from three readings taken in close proximity at each location.					
			nufacturing and any repair weldir 3, section 6.2.2, with a maximum			
	The material shall be tra	ceable in accordance with	ISO 15156-3/NACE MR0175-3	section 7.2 and this MDS		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
MPS identification or MCPR/QTR number used.						



## Table A.119 — MDS IT103 / IT103S

Material Data Sh	Data Sheet MDS No. IT103 / IT103S a			Rev. 01		
TYPE OF MATERIAL	.: Titanium grade 2					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM B363	WPT2 / WPT2W (UNS R50400)	-	ASTM B363 S1		
	<u> </u>	Page 1 of 2				
Scope	This MDS defines applica specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Qualification		anufacturing process shall be alification testing shall meet t				
Heat treatment	Annealed condition unles condition.	s the tensile properties in the	referenced standard can be	achieved in the as formed		
Extent of testing	Tensile test specimens sl	hall be taken from each heat	and heat treatment lot, for ea	ach type and size.		
Non-destructive testing	Liquid penetrant testing ASTM B363 supplementa	ary requirement S1 shall appl	y as amended by this MDS.			
	NDE requirement		Nominal Thickness			
		Seamless fittings	Wel	ded fittings <sup>a</sup>		
	Frequency <sup>b</sup>	10 %		100 %		
	Method	AS	ME BPVC, Sec. V, Article 6			
	Extent <sup>c</sup>		100 %			
	Acceptance criteria		PVC, Sec. VIII, Div. 1, Apper			
	testing.	e carried out after machining, if ap	plicable. Non-machined surfaces	s shall be cleaned prior to the		
	specified, a minimum of mechanical testing.	ection 100 % means that each item shall be examined. When random examination (10 %) is um of one item per lot in any purchase order shall be examined. The test lot shall be as defined				
Repair of defects	Repair welding of base m	naterial is not permitted.				
		equirements for production weiginal production weld (if appl		ir WPS. Repair welds shall		
Sour service (additional metallurgical, manufacturing,		ements are specified by the p 56/NACE MR0175 or ISO 179				
testing and	<u>Hardness testing</u>					
certification requirements) <sup>a</sup>	- Seamless fittings:					
	<ul> <li>Production testing shall be performed in accordance with the requirements in ASTM A370/A1058 on one fitting per lot. The maximum hardness shall be 100HRB from three readings taken in close proximity.</li> </ul>					
	<ul> <li>Welded fittings:</li> <li>Welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-3/ISO 15156-3, section 6.2.2 with a maximum hardness of 70.8HR 15N or 250HV.</li> </ul>					
	one fitting per lot.	shall be performed in accord The maximum hardness of the gs taken in close proximity at	e base material, HAZ and w			
		from three readings taken in close proximity at each location.  e material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and the				



Material Data Sheet		MDS No. IT103 / IT	MDS No. IT103 / IT103S <sup>a</sup>			
TYPE OF MATERIAL: Titanium grade 2						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM B363	WPT2 / WPT2W (UNS R50400)	-	ASTM B363 S1		
	<u> </u>	Page 2 of 2	<u> </u>	<u>.</u>		
Certification		cturer shall have a quality system standard accepted by the purch		ISO 9001 or another		
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
<ul> <li>MPS identification or MCPR/QTR number used.</li> </ul>						
a The supplementary s requirements for sou		esignate a material delivered in acco	rdance with the MDS plus the add	ditional supplementary		



## Table A.120 — MDS IT104 / IT104S

Material Data Sheet MDS No. IT104 / IT104S <sup>a</sup>							
.: Titanium grade 2							
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
ASTM B381	F2 (UNS R50400)	-	-				
	Page 1 of 1	1	1				
This MDS defines applica specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.						
Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.							
	s shall be taken from each heat and heat treatment lot, with a maximum deviation from is of $\pm 10$ mm ( $\pm 0.4$ in).						
Visual inspection							
VT shall be carried out on each forging in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be pickled prior to the testing.							
Liquid penetrant testing							
NDE requirement		Forgings					
Frequency <sup>b</sup>	10 %						
Method	ASME BPVC, Sec. V, Article 6						
Extent <sup>c</sup>	100 %						
NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.							
a Parts of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one item per lot in any purchase order shall be examined. The test lot shall be as defined for mechanical testing.							
All accessible internal and external surfaces shall be examined.							
<u>Valve forgings NDT</u>							
Valve forgings inspection shall be according to the applicable valve specification.							
If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.							
Repair welding is not permitted.							
When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.							
Hardness testing							
Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one forging per lot. The maximum hardness shall be 100HRB from three readings taken in close proximity at each location.							
The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS							
The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.							
The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.							
The inspection documents shall include the following information:							
			- MPS identification or MCPR/QTR number used.				
	This MDS defines applicate specification.  Manufacturers and the manufacturers and the material manufacturers and the materi	STANDARD  ASTM B381  F2 (UNS R50400)  Page 1 of 1  This MDS defines applicable options and/or requires specification.  Manufacturers and the manufacturing process shand NORSOK M-650. The qualification testing shall metest block thickness of ±10 mm (±0.4 in).  Visual inspection  VT shall be carried out on each forging in accordant performed after machining, if applicable, and non-reliquid penetrant testing  NDE requirement  Frequency b  Method  Extent c  Acceptance criteria  ASMINOTE The testing shall be carried out after machining, testing.  a Parts of size DN > 50 (NPS > 2). b For random examination (10 %), a minimum of one it shall be as defined for mechanical testing. c All accessible internal and external surfaces shall be valve forgings inspection shall be according to the If a QSL is not specified by the purchaser, the requirements of ISO 15156/NACE MR0175 or ISO requirements to the MDS.  Hardness testing  Production hardness testing shall be performed in one forging per lot. The maximum hardness shall the each location.  The material shall be traceable in accordance with The material manufacturer shall have a quality sysquality requirements standard accepted by the purchaser in accordance with The material manufacturer shall have a quality sysquality requirements standard accepted by the purchaser in accordance with The material manufacturer shall have a quality sysquality requirements standard accepted by the purchaser in accordance with this specification.	STANDARD  GRADE  ACCEPTANCE CLASS  ASTM B381  F2 (UNS R50400)  -  Page 1 of 1  This MDS defines applicable options and/or requirements that supplement or ame specification.  Manufacturers and the manufacturing process shall be qualified in accordance with NORSOK M-650. The qualification testing shall meet the requirements of this MDS  Tensile test specimens shall be taken from each heat and heat treatment lot, with the test block thickness of ±10 mm (±0.4 in).  Visual inspection  VT shall be carried out on each forging in accordance with the product standard. T performed after machining, if applicable, and non-machined surfaces shall be pick  Liquid penetrant testing  NDE requirement  Frequency b  ACCEPTANCE CLASS  ASME BPVC, Sec. VI, Article 6  Extent c  ACCEPTANCE CLASS  ASME BPVC, Sec. VIII, Div. 1, Apper  NOTE The testing shall be carried out after machining, if applicable. Non-machined surface testing.  ACCEPTANCE CLASS  ACCEPTANCE CLASS  NOTE The testing shall be carried out after machining, if applicable. Non-machined surface testing.  ACCEPTANCE CLASS  ACCEPTANCE CLAS				



## Table A.121 — MDS IT105 / IT105S

Material Data Sheet		MDS No. IT105 /	MDS No. IT105 / IT105S a		
TYPE OF MATERIAL: Titanium grade 2					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Plates, sheets, strips	ASTM B265	2 (UNS R50400)	-	-	
		Page 1 of 1	-		
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Qualification	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.				
Repair of defects	Repair welding is not permitted.				
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.				
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A one plate per lot. The maximum hardness shall be 100HRB from three readings taken in close peach location.				
	The material shall be tra	ceable in accordance with	h ISO 15156-3/NACE MR0175-3	, section 7.2 and this MDS.	
Certification		rer shall have a quality syndard accepted by the pu	stem certified in accordance with rchaser.	ISO 9001 or another	
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	- MPS identification or MCPR/QTR number used.				



## Table A.122 — MDS IT106 / IT106S

Material Data Sh	terial Data Sheet MDS No. IT106 / IT106S a Rev				
TYPE OF MATERIAL	L: Titanium grade 2				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM B367	C2 (UNS R52550)	-	ASTM B367 S1, S2, S5, S7	
		Page 1 of 2		•	
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Qualification	Manufacturers and the manufacturing process shall be qualified in accordance with ISO 17782 or NORSOK M-650. The qualification testing shall meet the requirements of this MDS.				
Manufacturing	All castings shall be subject to hot isostatic pressing (HIP).				
Heat treatment	All castings, which due to HIP operation is applied,	size limitations cannot be H this shall be in accordance v	IP, shall be heat treated and rith ASTM A1080.	I radiographed. When the	
	Size of the test block sha  T = 22 mm (0.86 in) for the control of	0 mm (1.18 in) < t ≤ 60 mm	h and 80 mm (3 in) in heigh  2.36 in)  stings, the largest flange thickn  IIP and any heat treatment,	t with thickness (T): ess is the ruling thickness.	
Non-destructive testing	Visual inspection				
-	NDE requirement	Pilot casting (section	n 4.8) Pro	oduction casting	
	Frequency	Each pilot casting	g Each	production casting	
	Method	ANSI/MSS SP-55			
	Extent	100 % of all accessible surfaces including welding ends			
	Acceptance criteria	MSS SP-55			
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.				
	Liquid penetrant testing				
	NDE requirement	Pilot casting (section	n 4.8) Pro	duction casting <sup>a</sup>	
	Frequency <sup>b</sup>		100 %		
	Method	ASME BPVC, Sec. V, Article 6			
	Extent <sup>c</sup>	100 %			
	Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7			
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be pickled prior to the testing.				
	<ul> <li>Production valve castings, PT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.</li> <li>Frequency of inspection 100 % means that each item shall be examined.</li> <li>All accessible internal and external surfaces shall be examined.</li> </ul>				



Material Data Sh	neet	MDS No. IT10	6 / IT106	S a			Rev. 01	
TYPE OF MATERIAL	L: Titanium grade 2							
PRODUCT FORM	STANDARD	GRADE		ACCEPTANCE CLASS		s	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM B367	C2 (UNS R525	50)	-			ASTM B367 S1, S2, S5, S7	
		Page	2 of 2					
Non-destructive testing (continued)	Radiographic testing							
	NDE requirement	Pilot casting		Production casting				
		(section 4.8)		Valve castings <sup>a</sup>		Other pressure containing castings b		
	Frequency <sup>c</sup>	100 %	NPS	DN	Pressure clas	_	100 %	
			NES	DIN	≤ 150 300	3		
			< 10	< 250	N/R N/R			
			≥ 10	≥ 250	5% 5%			
	Method	A			VC, Sec. V, Artic		400 0/ d	
	Extent	at abrupt chan	by ASME B16.34 for special class valves, anges in sections and at the junctions of s, gates or feeders to the casting				100 %	
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 7							
	NOTE N/R means not required, unless specified otherwise by the purchaser.							
	<ul> <li>Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.</li> <li>Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.</li> </ul>							
Repair of defects	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.  Weld repairs are not acceptable for castings that leak during pressure testing.  The repair welding procedure shall be qualified in accordance with ASME BPVC IX or ISO 15614-5 and this MDS.							
Sour service (additional metallurgical,	Material covered by this MDS is not referenced in ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103.  Use of this material in sour service shall require separate qualification according to ISO 15156-3/NACE MR0175-3 or ISO 17945/NACE MR0103, as applicable.							
manufacturing, testing and	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.							
certification requirements) <sup>a</sup>	The inspection documents required in this MDS shall also include the qualification test reports.							
Surface treatment and finish	For castings manufactured to this MDS alfa-case in the casting surface shall be completely removed at the foundry from the following locations:							
	All surfaces, which shall be machined.  All surfaces, which shall be machined.							
			<ul> <li>All weld bevels including an area of 20 mm (0.8 in) on each side of the bevel.</li> <li>All highly stressed areas including areas prone to fatigue.</li> </ul>					
		=		atique				
Certification	All highly stressed at  The material manufacture	reas including areas	s prone to fa	certified	I in accordance	with I	SO 9001 or another	
Certification	All highly stressed and The material manufacturing quality requirements stated. The inspection documents.	reas including areas rer shall have a quandard accepted by hits shall be issued i	s prone to fa ality system the purchas	certified ser.				
Certification	All highly stressed at  The material manufactur quality requirements sta	reas including areas rer shall have a quandard accepted by this shall be issued in this specification.	s prone to fa ality system the purchas n accordance	certified ser. ce with	ISO 10474 /EN			
Certification	All highly stressed at The material manufactur quality requirements stated The inspection document confirm compliance with	reas including areas rer shall have a quandard accepted by this shall be issued in this specification.	s prone to fa ality system the purchas n accordance following in	certified ser. ce with	ISO 10474 /EN			



# Table A.123 — MDS IT107 / IT107S

Material Data Sheet		MDS No. IT107 / IT107S a			
TYPE OF MATERIAL	.: Titanium grade 2				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bars	ASTM B348	2 (UNS R50400)	-	-	
		Page 1 of 1		1	
Scope	This MDS defines appli specification.	cable options and/or requi	rements that supplement or ame	nd the referenced standard	
Qualification			all be qualified in accordance with		
Extent of testing	Tensile test specimens	shall be taken from each I	heat and heat treatment lot.		
Non-destructive testing					
	NDT valve parts manufactured from bar Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.				
Repair of defects	Repair welding is not pe	ermitted.			
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.				
testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A105 the end surface of one bar per lot. The maximum hardness shall be 100HRB from three readings taken in close proximity.				
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection docume confirm compliance with		ordance with ISO 10474 /EN 1020	04 Type 3.1 and shall	
	The inspection docume  - MPS identification of	ents shall include the follow	_		



# Table A.124 — MDS IT108 / IT108S

Material Data Sheet		MDS No. IT108 / IT108S <sup>a</sup> Rev.			
TYPE OF MATERIAL	L: Titanium grade 2				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Tubes	ASTM B338	2 (UNS R50400)	-	-	
	•	Page 1 of 1	•	•	
Scope	This MDS defines applicat specification.	ole options and/or requirem	ents that supplement or ame	nd the referenced standard	
Qualification			e qualified in accordance with		
Non-destructive testing	Method and acceptance co	Method and acceptance criteria for penetrant testing shall be to ASME BPVC VIII, Div. 1, Appendix 8.			
Repair of defects	Repair welding of base material is not permitted.  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).				
Sour service (additional metallurgical,			purchaser, the material shall 945/NACE MR0103 and the		
manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 cone tube per lot. The maximum hardness shall be 100HRB from three readings taken in close proximity.  The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS				
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
		shall include the following	information:		
	<ul> <li>MPS identification or M</li> </ul>	ICPR/QTR number used.			



# Table A.125 — MDS IU100 / IU100S

Material Data Sheet		MDS No. IU100 / IU100S <sup>a</sup> Rev				
TYPE OF MATERIAL	: Precipitation-Hardened St	ainless Steel				
PRODUCT FORM	STANDARD GRADE ACCEPTANCE CLASS SUPPLEMENTARY REQUIREMENT					
Bolting	ASTM A453	Grade 660 (UNS S66286)	Class D	-		
	•	Page 1 of 1	•			
Scope	This MDS defines applica specification.	able options and/or requ	irements that supplement or ame	nd the referenced standard		
Manufacturing	Threading of studs, bolts heat treatment.	and screws may be dor	ne by machining or rolling. Thread	rolling shall be done after		
	Threads in nuts shall be r	nachined.				
Heat treatment	Heat treatment shall be ca	arried out after the final	hot forming operation.			
Impact testing / toughness testing		Impact testing shall be carried out at minus 101 °C (-150 °F). The minimum absorbed energy shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single, the lateral expansion shall be 0.38 mm (0.015 in).				
Proof load testing	Proof load testing shall be according to ASTM A962 and the load shall comply with ASTM A194 Grade 7.					
Non-destructive testing	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.					
Repair of defects	Weld repair is not permitte	ed.				
Sour service (additional metallurgical,	When sour service require requirements of ISO 1515 requirements to the MDS.	56/NACE MR0175 or IS	the purchaser, the material shall O 17945/NACE MR0103 and the	conform to the following additional		
manufacturing, testing and	Hardness testing					
certification requirements) <sup>a</sup>		Hardness testing Production hardness testing shall be performed in accordance with the requirements in ASTM A453. The maximum hardness shall be 35HRC from three readings taken in close proximity.				
	The material shall be traceable in accordance with ISO 15156-3/NACE MR0175-3, section 7.2 and this MDS.					
Marking	Each bolt and nut shall be marked on the end/head to ensure full traceability to heat and heat treatment lot.					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection document		•			
	Heat treatment condition	ion (solution annealing	and annealing temperature) shall	be stated.		



# Table A.126 — MDS IX100 / IX100S

Material Data Sheet		MDS No. IX100 / IX100S <sup>a</sup> Rev. 0			
.: Low alloyed steel fas	steners (HDG)				
STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
ASTM A320	L7, L7M, L43	-	-		
ASTM A194	7 or 7M	-	ASTM A194 S3, S4, S5		
•	Page 1 of	1	•		
This MDS defines applicable options and/or requirements that supplement or amend the referenced stan specification.					
treatment.	Threading of studs and bolts may be done by machining or rolling. Thread rolling shall be done after heat				
Nuts to ASTM A194	: S3 shall apply.				
Nuts to ASTM A194	: S4 shall apply.				
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.					
The zinc coating on	threads shall not be subject				
(UNC series)  - Nuts:  • Nuts shall be	and 8 pitch thread series for ASME heavy HEX-series, of	or 1% in and larger. double chamfered.			
quality requirements S5 shall apply for nu The inspection docu confirm compliance The inspection docu	s standard accepted by the puts to ASTM A194.  Imments shall be issued in activity with this specification.  Imments shall include the following the standard standar	ourchaser. cordance with ISO 10474 /EN 1020			
	ASTM A320 ASTM A194  This MDS defines a specification.  Threading of studs a treatment. Threads in nuts shall be comply with required.  When sour service in the material shall be comply with required.  All studs, bolts, nuts the material shall be comply with required.  All studs, bolts, nuts the material shall be comply with required.  All studs, bolts, nuts the zinc coating on tapped after galvanice.  Studs and bolts:  Threading shall be Nuts shall be Nut threads shall be nuts shall produced the inspection docuconfirm compliance. The inspection docuconfirm compliance the inspection docuconfirm compliance.	STANDARD  GRADE  ASTM A320  ASTM A194  Page 1 of  This MDS defines applicable options and/or req specification.  Threading of studs and bolts may be done by m treatment.  Threads in nuts shall be machined.  Nuts to ASTM A194: S3 shall apply.  All products shall be 100 % visually examined in comply with requirements specified in ASTM F7  When sour service is specified by the purchase The material shall be traceable in accordance with A194: All studs, bolts, nuts and washers shall be hot of the zinc coating on threads shall not be subject tapped after galvanizing.  All studs, bolts, nuts and washers shall be hot of the zinc coating on threads shall not be subject tapped after galvanizing.  Studs and bolts:  Threading shall be in accordance with A1 (UNC series) and 8 pitch thread series for Nuts:  Nuts shall be ASME heavy HEX-series, or Nut threads shall be oversized to fit study.  The material manufacturer shall have a quality squality requirements standard accepted by the purchase the standard accepted by the purchase shall apply for nuts to ASTM A194.  The inspection documents shall be issued in acconfirm compliance with this specification.	STANDARD  GRADE  ACCEPTANCE CLASS  ASTM A320  LT, L7M, L43  - ASTM A194  7 or 7M  -  Page 1 of 1  This MDS defines applicable options and/or requirements that supplement or ame specification.  Threading of studs and bolts may be done by machining or rolling. Thread rolling streatment.  Threads in nuts shall be machined.  Nuts to ASTM A194: S3 shall apply.  Nuts to ASTM A194: S4 shall apply.  All products shall be 100 % visually examined in all areas of threads, shanks and I comply with requirements specified in ASTM F788 for bolts/studs and ASTM F812  When sour service is specified by the purchaser, only Grade L7M/7M is acceptable. The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2  All studs, bolts, nuts and washers shall be hot dip spun galvanized according to At The zinc coating on threads shall not be subject to cutting, rolling or finishing tool of tapped after galvanizing.  — Studs and bolts:  • Threading shall be in accordance with ASME B1.1, class 2A fit for diameter (UNC series) and 8 pitch thread series for 1½ in and larger.  • Nuts:  • Nuts shall be ASME heavy HEX-series, double chamfered.  • Nut threads shall be oversized to fit studs/bolts dependent of specified coat  The material manufacturer shall have a quality system certified in accordance with quality requirements standard accepted by the purchaser.  S5 shall apply for nuts to ASTM A194.  The inspection documents shall be issued in accordance with ISO 10474 /EN 1020 confirm compliance with this specification.  The inspection documents shall include the following information:		



# Table A.127 — MDS IX109 / IX109S

<b>Material Data Sh</b>	eet	MDS No. IX109 / IX109S <sup>a</sup> Rev. 0 <sup>a</sup>			
TYPE OF MATERIAL	.: Low alloyed steel faster	ners (black/uncoated)			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bolting	ASTM A320	L7, L7M, L43	-	-	
	ASTM A194	7 or 7M	-	ASTM A194 S3, S4, S5	
	•	Page 1 of	1		
Scope	This MDS defines appli specification.	icable options and/or requ	uirements that supplement or ame	nd the referenced standard	
Manufacturing	Threading of studs and treatment. Threads in nuts shall be	, ,	achining or rolling. Thread rolling s	shall be done after heat	
Impact testing / toughness testing	Nuts to ASTM A194: S	3 shall apply.			
Proof load testing	Nuts to ASTM A194: S	4 shall apply.			
Non-destructive testing	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.				
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a	'		, only Grade L7M/7M is acceptabl ith ISO 15156-2/NACE MR0175-2		
Dimensional tolerances	(UNC series) ar  - Nuts:  • Nuts shall be AS	nd 8 pitch thread series fo SME heavy HEX-series, o	•		
Certification  a The supplementary	quality requirements st. S5 shall apply for nuts The inspection docume confirm compliance wit The inspection docume Steel manufacturer Heat treatment con-	andard accepted by the parto ASTM A194.  The A	cordance with ISO 10474/ EN 102	04 Type 3.1 and shall	



# Table A.128 — MDS IX110 / IX110S

Material Data Sheet		MDS No. IX110 / IX110S a Rev. 0				
TYPE OF MATERIA	L: Low alloyed steel fas	teners (black/uncoated)				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bolting	ASTM A193	B7, B7M	-	-		
	ASTM A194	2H, 2HM	-	-		
		Page 1 o	f 1	•		
Scope	This MDS defines ap specification.	oplicable options and/or re	quirements that supplement or ame	nd the referenced standard		
Manufacturing	treatment.	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.				
Non-destructive testing	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.					
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a		When sour service is specified by the purchaser, only Grade B7M/2HM is acceptable.  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.				
Dimensional tolerances	<ul> <li>Studs and bolts:</li> <li>Threading shall be in accordance with ASME B1.1, class 2A fit for diameters 1 in and smaller (UNC series) and 8 pitch thread series for 1 % in and larger.</li> <li>Nuts:</li> <li>Nuts shall be ASME heavy HEX-series, double chamfered.</li> </ul>					
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 2.2 as minimum.					



# Table A.129 — MDS IX120 / IX120S

Material Data Sheet		MDS No. IX120 / IX120S a Rev. 0		
TYPE OF MATERIA	L: Low alloyed steel fas	teners (HDG)		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Bolting	ASTM A193	B7, B7M		-
	ASTM A194	2H, 2HM	-	-
	•	Page 1 of	1	•
Scope	This MDS defines ap specification.	plicable options and/or red	quirements that supplement or ame	nd the referenced standard
Manufacturing	Threading of studs a treatment. Threads in nuts shall	, ,	nachining or rolling. Thread rolling s	shall be done after heat
Non-destructive testing			n all areas of threads, shanks and h 788 for bolts/studs and ASTM F812	
Carry as maiss		161 11 11		
(additional metallurgical, manufacturing, testing and certification			er, only Grade B7M/2HM is acceptal with ISO 15156-2/NACE MR0175-2	
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a  Surface treatment and finish	The material shall be	e traceable in accordance vertices and washers shall be hot chreads shall not be subject		, section 9 and this MDS.  STM F2329 or ISO 10684.
(additional metallurgical, manufacturing, testing and certification requirements) a	All studs, bolts, nuts The zinc coating on t tapped after galvaniz  - Studs and bolts:  • Threading sha series) and 8  - Nuts:  • Nuts shall be	and washers shall be hot chreads shall not be subjecting.  all be in accordance with A pitch thread series for 1 1/2	dip spun galvanized according to Aset to cutting, rolling or finishing tool of SSME B1.1, class 2A fit for diameter is in and larger.	STM F2329 or ISO 10684. operation. Nuts may be
(additional metallurgical, manufacturing, testing and certification requirements) a Surface treatment and finish	All studs, bolts, nuts The zinc coating on t tapped after galvaniz  - Studs and bolts:  • Threading sha series) and 8  - Nuts:  • Nuts shall be • Nut threads sl	and washers shall be hot otherads shall not be subjecting.  all be in accordance with A pitch thread series for 1 1/2  ASME heavy HEX-series, hall be oversized to fit study standard accepted by the	with ISO 15156-2/NACE MR0175-2.  dip spun galvanized according to AS et to cutting, rolling or finishing tool of the cutting and larger.  double chamfered.  ds/bolts dependent of specified coat system certified in accordance with	section 9 and this MDS.  STM F2329 or ISO 10684.  Operation. Nuts may be  s 1 in and smaller (UNC



# Table A.130 — MDS IX124 / IX124S

Material Data Sh	eet	MDS No. IX12	4 / IX124S a	Rev. 01		
TYPE OF MATERIAL	.: High strength low alloy	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A694	F52	-	-		
	ASTM A694	F60	-	-		
	ASTM A694	F65	-	-		
		Page 1 o	f 2			
Scope	This MDS defines appli specification. This MDS applies to pre-		quirements that supplement or ame of valves only.	nd the referenced standard		
Chemical composition	C ≤ 0.20 %, S ≤ 0.020 °	%, P ≤ 0.025 %, Ti ≤ 0.0	05 %, Nb ≤ 0.04 %, (V + Nb + Ti) ≤ 0	0.10 %, CE ≤ 0.43 %.		
Heat treatment	620 °C (1 148 °F).	d in such a way that fre	mpered condition the minimum tem ee circulation around each forging is			
Impact testing / toughness testing	Impact testing shall be carried out at -46 °C (-50 °F). One set of three samples shall be tested. Test samples shall be taken from the same location and have the same orientation as tensile test specimens. Mid-length of the test piece shall be a distance T or minimum 100 mm (4 in) from any second surface, whichever is greatest where T is the ruling thickness.  The minimum absorbed energy for full size specimens shall be 27 J (20 ft lbf) average and 20 J (15 ft lbf) single.					
Extent of testing	nominal thickness and l defined as all plates he A test lot shall not exce	Impact test, tensile test, hardness test and micrographic examination shall be carried out for each heat, nominal thickness and heat treatment load. For heat treatment in continuous furnace a heat treatment load is defined as all plates heat treated continuously in the same furnace, of the same heat and nominal thickness. A test lot shall not exceed 2 000 kg (4 400 lb) for forgings with as forged weight ≤ 50 kg (110 lb), and 5 000 kg (11 000 lb) for forgings with as forged weight > 50 kg (110 lb).				
Non-destructive	Visual inspection					
testing			in accordance with the product stan ion-machined surfaces shall be clea			
			es shall be according to the applical uirements in this MDS shall apply.	ble valve specification. If a		
Repair of defects	Weld repair is not perm	itted.				
Sour service (additional metallurgical, manufacturing,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103 and the following additional requirements to the MDS.					
testing and certification requirements) a	<u>Chemical composition</u> Ni < 1.0 %					
requirements)	Hardness testing					
	two forgings per lot. Wh	nen only one part is pro	d in accordance with the requirement duced, it shall be hardness tested a taken in close proximity.			
	The material shall be tra	aceable in accordance	with ISO 15156-2/NACE MR0175-2	, section 9 and this MDS.		
Marking	The forgings shall be m	arked to ensure full tra	ceability to melt and heat treatment	lot.		
	1					



Material Data Sheet		MDS No. IX12	MDS No. IX124 / IX124S a			
TYPE OF MATERIAL: High strength low alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A694	F52	-	-		
	ASTM A694	F60	-	-		
	ASTM A694	F65	-	-		
	•	Page 2 o	of 2			
Certification			y system certified in accordance witl e purchaser.	n ISO 9001 or another		
		quality requirements standard accepted by the purchaser.  The inspection documents shall be in accordance with EN 10204 /ISO 10474 Type 3.1, unless specified otherwise by the purchaser.				
	The inspection documents shall include the following information:					
	<ul> <li>Steel manufactu</li> </ul>	rer, melting and refining p	ractice.			
	<ul> <li>Heat treatment c</li> </ul>	ondition. For tempered co	ndition, tempering temperature and	holding time shall be stated.		
The supplementary s requirements for sou		designate a material delivered	in accordance with the MDS plus the ad	ditional supplementary		



# Table A.131 — MDS IX127 / IX127S

Material Data Sheet		MDS No. IX127	MDS No. IX127 / IX127S <sup>a</sup> Rev. 0			
TYPE OF MATERIAL	: High strength low alloy	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A29	4140	-	-		
	ASTM A694	F52	-	-		
	ASTM A694	F60	-	-		
	ASTM A694	F65	-	-		
		Page 1 of	2			
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced ASTM standard specification.  Valve parts machined from bar covered by this MDS are restricted to pressure controlling parts only.					
Manufacturing	<ul><li>bar forgings as def</li><li>hot rolled/wrought</li><li>all bars shall be su</li></ul>	Bars shall be manufactured to the following requirements:  - bar forgings as defined in ASTM A788 and certified to ASTM A694; or  - hot rolled/wrought bars with a maximum outside diameter 250 mm (10 in); or  - all bars shall be supplied in heat treatment condition as specified below.  NOTE Cold finishing shall be restricted to turning, grinding or polishing (singly or in combination); cold drawing or cold				
Chemical composition	Grade 4140: $S \le 0.020$ %, $P \le 0.025$ % Grade F52, F60, F65: $C \le 0.20$ %, $S \le 0.020$ %, $P \le 0.025$ %, $P \ge 0.025$ %, $P \ge 0.025$ %, $P \le 0.025$ %, $P \ge 0.025$ %, $P \ge$					
Heat treatment	shall be 650 °C (1 202 Grade F52, F60, F65: temperature shall be 6 Bars shall be placed in	Grade 4140: for products delivered in quenched and tempered condition the minimum tempering temperature shall be 650 °C (1 202 °F).  Grade F52, F60, F65: for products delivered in the quenched and tempered condition the minimum temperint temperature shall be 620 °C (1 148 °F).  Bars shall be placed in such a way that free circulation around each bar is ensured during the heat treatment process, including quenching.				
Tensile testing	Grade 4140:  - Minimum yield strength: ≥ 515 MPa (75 ksi)  - Minimum tensile strength: ≥ 690 MPa (100 ksi)  - Minimum elongation: ≥ 15 %					
Impact testing / toughness testing	Impact testing shall be carried out at -46 °C (-50 °F). One set of three samples shall be tested.  Acceptance criteria:  Grade 4140, minimum 45 J (33 ft lbf) average and 35 J (26 ft lbf) single for full size specimens.  Grade F52, F60, F65, minimum 27 J (22 ft lbf) average and 20 J (15 ft lbf) single for full size specimens.					
Extent of testing	Impact test, tensile test and hardness test shall be carried out for each heat, nominal thickness and heat treatment load. For heat treatment in continuous furnace a heat treatment load is defined as all bars heat treated continuously in the same furnace, of the same heat and nominal thickness. A test lot shall not exceed 2 000 kg (4 400 lb) for bars with weight ≤ 50 kg (110 lb), and 5 000 kg (11 000 lb) for forgings with weight > 50 kg (110 lb).					
Test sampling	Valve parts manufactured from bar					
		mens for bars intended fo all comply with the follow	or machining pressure controlling p ing requirements:	arts of valve DN 100		
	The mid-length of t diameter or minimum.	he axial tensile test spec um of 100 mm (4 in), which	imen shall be located at a distance chever is the greater, from the end at a minimum distance of OD/4 from	of the bar, and the		
			specimen shall be located at a mini specimens at a minimum of 100 mm			
	- The notch of the in	npact test specimen shall	be located perpendicular to the ba	r surface.		



Material Data Sheet		MDS No. IX127	7 / IX127S <sup>a</sup>	Rev. 01		
TYPE OF MATERIAL	.: High strength low alloy	steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A29	4140	-	-		
	ASTM A694	F52	-	-		
	ASTM A694	F60	-	-		
	ASTM A694	F65	-	-		
		Page 2 of	2			
<b>Test sampling</b> (continued)	For bar with outside diameter < 100 mm (4 in): one tensile and one set impact test specimens shall be taken. For bar with outside diameter ≥ 100 mm (4 in): one tensile and one set impact test specimens shall be taken in axial direction of the bar. 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 100 mm (4 in) from the end of the bar.  The specified minimum tensile strength of the referenced standard specification and impact energies specified in this data shoot shall be most in both directions.					
Non-destructive testing	in this data sheet shall be met in both directions.  Visual inspection  VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  NDT of valve parts manufactured from bar  Inspection of valve parts manufactured from bar shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.					
Repair of defects	Weld repair is not pern	nitted.				
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	Weld repair is not permitted.  Grade 4140 bar  Grade 4140 material is not referenced in ISO 15156/NACE MR0175 nor ISO 17945/NACE MR0103.  NOTE Use of Grade 4140 in sour service shall require separate qualification according to ISO 15156-2/NACE MR0175-2 ISO 17945/NACE MR0103, as applicable.  The inspection documents required in this MDS shall also include the qualification test reports.  Grade F52, F60, F65 bar  When sour service requirements are specified by the purchaser, Grade F52, F60, F65 bar material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.					
	Chemical composition Ni < 1.0 %					
		Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 on the end surface of one bar per lot. The maximum hardness shall be 22HRC from three readings taken in close				
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.					
Marking	The bars shall be mark	ked to ensure full traceab	ility to melt and heat treatment lot.			
Certification	quality requirements s	tandard accepted by the	system certified in accordance with purchaser. ce with EN 10204 /ISO 10474 Typ			
	otherwise by the purch The inspection docum  - Steel manufacturer	naser. ents shall include the folk r, melting and refining pra	owing information:	·		
The supplementary s requirements for sour		· · · · · · · · · · · · · · · · · · ·	n accordance with the MDS plus the add			



# Table A.132 — MDS IV101 / IV101S / IV101K

Material Data Sheet MDS No. IV101 / IV101S a / IV101K b Rev. 01						
TYPE OF MATERIAL	.: 11/4 Cr 1/2 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Seamless pipes	ASTM A335	P11 (UNS K11597)	-	S2		
		Page 1 of	1			
Scope	This MDS defines applies specification.	cable options and/or requ	uirements that supplement or ame	end the referenced standard		
Metal making	For pipes with governin to fine grain practice.	g thickness 50 mm (2 in)	and greater, the steel shall be va	cuum degassed and made		
Chemical composition	For pipes with governin	g thickness 50 mm (2 in)	and greater, the requirements of	API 934-C shall apply.		
Heat treatment	Minimum tempering ten	nperature shall be 725 °C	C (1 337 °F).			
Tensile testing	Supplementary requirer removed from mid-thick		ne specimen per finished pipe per	lot. Specimen shall be		
Hardness testing	Hardness testing shall b	pe made on one finished	pipe per lot and shall not exceed	225 HBW.		
Extent of testing	Product analysis shall b	Product analysis shall be carried out in accordance with the standard.				
Repair of defects	Weld repair is not permitted.					
Sour service (additional metallurgical, manufacturing, testing and	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Chemical composition					
certification requirements) <sup>a</sup>	S ≤ 0.010 %					
	Hardness testing  Production hardness testing shall be performed in accordance with the requirements in ASTM A370/A1058 or one length of pipe per lot.					
	The material shall be tra	aceable in accordance w	ith ISO 15156-2/NACE MR0175-2	2, section 9 and this MDS.		
Hydrogen service (additional	When hydrogen service following additional requ	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.				
metallurgical, manufacturing,	Products shall be delive	ered in the normalized an	d tempered or quenched and tem	pered condition.		
testing and certification requirements) <sup>b</sup>	Tensile testing and imp	act testing shall be carrie	d out in accordance with API 934	-C.		
Marking	The pipes shall be mark	ked to ensure full traceab	ility to melt and heat treatment lot	·.		
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	confirm compliance with	n this specification.	cordance with ISO 10474 /EN 102	04 Type 3.1 and shall		
	•	nts shall include the follo	ŭ	all ba atata d		
	<ul> <li>Heat treatment cond</li> </ul>	aition including tempering	temperature and holding time sh	ali de stated.		

b The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.133 — MDS IV102 / IV102S / IV102SH / IV102K

Material Data Sh	neet MDS No.	IV102 / IV102S a / IV1	02SH b/ IV102K c	Rev. 01				
TYPE OF MATERIAL	L: 1¼ Cr ½ Mo alloy steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Welded pipes	ASTM A691	1 ¼ CR (UNS K11789)	Class 22 or Class 42	S3, S7, S12				
		Page 1 of 2						
Scope	This MDS defines applica specification.	ble options and/or requirem	ents that supplement or ame	nd the referenced standard				
Metal making		Starting plate material shall comply with ASTM A387 Grade 11 Class 1.  For pipes with governing thickness 50 mm (2 in) and greater, the steel shall be vacuum degassed and made to fine grain practice.						
Manufacturing	The longitudinal weld sha Welds shall be made usin	· ·						
Chemical composition	For pipes with governing	thickness 50 mm (2 in) and	greater, the requirements of A	API 934-C shall apply.				
Heat treatment	conditions.		ormalized and tempered or o	uenched and tempered				
		hall be minimum 725 °C (1	,					
Hardness testing	Supplementary requirementary requirementary	ent S3 shall apply on one fin	ished pipe per lot .					
Extent of testing	Mechanical testing shall tapply for lot definition.	oe carried out on one finishe	d pipe per lot. Supplementary	requirement S12 shall				
Non-destructive testing	Supplementary requirementary	n shall be performed after he ent S7 shall apply. Acceptan ination shall be performed a	ce criteria shall be according	to ASME BPVC, Sec. VIII,				
Repair of defects	Weld repair of the base m	naterial is not permitted						
		e acceptable in accordance of the original manufacturing	with the standard specification weld.	n and shall meet the				
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a, b</sup>	Class 42 pipes shall be used in sour service.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  Chemical composition S ≤ 0.003 %							
	Hardness testing In addition to the production hardness requirement in the MDS, welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 235HV.							
	The material shall be trac	eable in accordance with IS	O 15156-2/NACE MR0175-2	, section 9 and this MDS.				
	<ul> <li>HIC testing and UT examination</li> <li>When suffix SH applies, one plate per lot shall be tested as follows.</li> <li>HIC testing: <ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT examination:</li> </ul> </li> </ul>							
	• ASTM A691, S10	shall apply.						



Material Data Sheet MDS No. IV102 / IV102S a / IV102SH b/ IV102K c Rev. 01  TYPE OF MATERIAL: 11/4 Cr ½ Mo alloy steel							
							PRODUCT FORM
Welded pipes	ASTM A691	1 1/4 CR (UNS K11789)	Class 22 or Class 42	S3, S7, S12			
		Page 2 of 2	_	•			
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements)°	following additional requ Products shall be delive	requirements are specified by irements to the MDS. red in the normalized and ten act testing shall be carried out	npered or quenched and temp	pered condition.			
Marking	The pipes shall be marked to ensure full traceability to melt and heat treatment lot.						
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.						
	•	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documer	The inspection documents shall include the following information:					
		<ul> <li>Heat treatment condition including stress relieving PWHT temperature or tempering temperature and holding time shall be stated.</li> </ul>					
	•						

<sup>&</sup>lt;sup>a</sup> The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

b The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.134 — MDS IV103 / IV103S / IV103SH / IV103K

Material Data Sh	eet MDS No. I	V103 / IV103S a / IV1	03SH b / IV103K c	Rev. 01			
TYPE OF MATERIAL	.: 1¼ Cr ½ Mo alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Wrought fittings	ASTM A234	WP11	Class 1 or Class 2	ASTM A960 S51, S53, S69			
	ASTM A234	WP11W	Class 1 or Class 2	ASTM A960 S51, S53, S69			
		Page 1 of 2					
Scope	This MDS defines applicate specification.	ole options and/or requiren	nents that supplement or ame	nd the referenced standard			
Metal making	For fittings with governing to fine grain practice.	thickness 50 mm (2 in) an	d greater, the steel shall be va	acuum degassed and made			
Chemical composition	For fittings with governing	thickness 50 mm (2 in) an	d greater, the requirements of	API 934-C shall apply.			
Heat treatment	All hot formed or forged fitt shall be heat treated after	Tempering temperature shall be minimum 725 °C (1 337 °F).  All hot formed or forged fittings, including those manufactured by locally heating a portion of the fitting stock, shall be heat treated after manufacture.  During the heat treatment process, fittings shall be placed in such a way as to ensure free circulation around					
Hardness testing		Hardness testing shall be carried out on two fittings for each test lot, including parent material, weld and HAZ.					
Tensile testing	Tensile testing shall be cal specimens is not possible	ASTM A960 supplementary requirement S51 shall apply as amended by this MDS.  Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.					
Non-destructive testing		to ASME <i>BPVC,</i> Sec. VIII, ter final machining or calib	69 shall apply as amended by Div. 1, Appendix 6. Examinat ration.				
Repair of defects	Weld repair of the base material is not permitted.						
		Repairs to weld metal are acceptable in accordance with the standard specification and shall meet the chemistry requirements of the original manufacturing weld.					
Sour service (additional metallurgical,		When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional					
manufacturing, testing and certification requirements) <sup>a, b</sup>		<u>Chemical composition</u> - S ≤ 0.003 % for WP11W fitting made from flat-rolled products  - S ≤ 0.007 % for WP11 fitting made from forging					
	qualification testing for ma	nufacturing and any repair	dness requirement in the MDS welding shall meet the requir Vickers method, with a maxim	ements of			
	The material shall be trace	eable in accordance with IS	O 15156-2/NACE MR0175-2	section 9 and this MDS.			



				Rev.	
TYPE OF MATERIAL	L: 1¼ Cr ½ Mo alloy ste	eel			
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A234	WP11	Class 1 or Class 2	ASTM A960 S51, S53, S69	
	ASTM A234	WP11W	Class 1 or Class 2	ASTM A960 S51, S53, S69	
		Page 2 o	f 2		
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a, b</sup> (continued)	<ul> <li>HIC testing and UT examination</li> <li>When suffix SH applies, one finished WPBW fitting made from flat-rolled products per lot shall be tested as follows.</li> <li>HIC testing: <ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> </ul> </li> <li>UT testing of flat-rolled product before manufacture: <ul> <li>ASTM A578, S1, S2.1 shall apply.</li> </ul> </li> </ul>				
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements)°	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Impact testing  Impact testing shall be carried out in accordance with API 934-C.				
Marking	The fittings shall be r	marked to ensure full trace	eability to heat and heat treatment lo	t.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment condition including tempering temperature and holding time.				

requirements for sour service.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



#### Table A.135 — MDS IV104 / IV104S / IV104K

Material Data Sh	eet MDS	S No. IV104 / IV104S	1/ IV104K b	Rev. 01				
TYPE OF MATERIAL	.: 1¼ Cr ½ Mo alloy steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Forgings	ASTM A182	F11	Class 2	ASTM A961 S55				
		Page 1 of 1						
Scope	This MDS defines applicate specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.						
Metal making		Forgings with governing thickness 50 mm (2 in) and greater shall be manufactured from steel vacuum degassed and made to fine grain practice.						
Chemical composition	For forgings with governing	g thickness 50 mm (2 in) ar	d greater, the requirements	of API 934-C shall apply.				
Heat treatment	Tempering temperature sh	nall be minimum 725 °C (1	337 °F).					
	During the heat treatment each fitting including any c		laced in such a way as to en	sure free circulation around				
Non-destructive testing	ASTM A961 supplementary requirement S55 shall apply. Acceptance criteria shall be according to ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 6. Examination shall be performed after final heat treatment and final machining.							
	Valve forgings NDT							
	•	ing to the applicable valve s	•					
	If a QSL is not specified by	the purchaser, the require	ments in this MDS shall appl	y.				
Repair of defects	Weld repair is not permitte	d.						
Sour service (additional metallurgical,			purchaser, the material shall 945/NACE MR0103, and the					
manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be trace	eable in accordance with IS	O 15156-2/NACE MR0175-2	, section 9 and this MDS.				
Hydrogen service (additional	When hydrogen service re following additional require		the purchaser, the material	shall conform to the				
metallurgical, manufacturing,		nall be delivered in the normalized and tempered or quenched and tempered condition.						
testing and		=	in accordance with API 934-					
certification requirements) <sup>b</sup>	test specimens.	ned showing type, and size	of test samples and location	for extraction of				
Marking	The forgings shall be mark	ed to ensure full traceability	to heat and heat treatment	lot.				
Certification		shall have a quality systen ard accepted by the purcha	n certified in accordance with	ISO 9001 or another				
		shall be in accordance with	n ISO 10474 /EN 10204 Type	e 3.1 and shall confirm				
		shall include the following						
		ons including tempering tem	perature and holding time;					
	<ul> <li>Sketches for test samp</li> </ul>	uiig.						

<sup>&</sup>lt;sup>a</sup> The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.136 — MDS IV105 / IV105S / IV105SH / IV105K

Material Data She	eet MDS No. I'	V105 / IV105S a / IV10	5SH b / IV105K c	Rev. 01					
TYPE OF MATERIAL:	: 1¼ Cr ½ Mo alloy steel								
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT					
Plates	ASTM A387	Grade 11 (UNS K11789)	Class 1 or Class 2	ASTM A387 S53					
		Page 1 of 2							
Scope	This MDS defines applicab specification.	le options and/or requireme	nts that supplement or amer	nd the referenced standard					
Metal making	Steel plate with thickness 5 practice.	50 mm (2 in) and greater sha	all be vacuum degassed and	I made to fine grain					
Chemical composition	For plate with thickness 50	mm (2 in) and greater, the	requirements of API 934-C s	hall apply.					
Heat treatment	During the heat treatment p	Fempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation around each fitting including any quenching operation.							
Hardness testing	Hardness testing shall be on not exceed 197HBW.	carried out on in accordance	with ASTM A370 on one pla	ate per lot. Hardness shall					
Test sampling	Supplementary requirementary requirement	nt S53 shall apply. Specimen	ns shall be oriented transver	se to the final rolling					
Non-destructive testing			o the applicable valve specinents in this MDS shall apply						
Repair of defects	Weld repair is not permitted	d.							
Sour service (additional metallurgical,	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.								
manufacturing, testing and certification requirements) <sup>a, b</sup>	<u>Chemical composition</u> - S ≤ 0.003 %								
requirements)	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.								
	HIC testing and UT examination								
	When suffix SH applies, one plate per lot shall be tested as follows.								
	HIC testing:     HIC testing in accordance with NACE TM0284, using Test Solution A.								
	•		≤ 15 %, CTR ≤ 5 %, CSR ≤	2 %.					
	·	crack length shall be repor							
	<ul> <li>UT examination:</li> </ul>	,							
	ASTM A387 supple	mentary requirement S8 sha	all apply.						
Hydrogen service (additional metallurgical,	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.								
manufacturing,									
testing and certification requirements) <sup>c</sup>	rensile testing and impact	testing shall be carried out i	Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-C.						



Material Data Sh	neet MDS	No. IV105 / IV105S a / IV10	Rev. 01			
TYPE OF MATERIAL	L: 1¼ Cr ½ Mo alloy ste	eel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Plates	ASTM A387	Grade 11 (UNS K11789)	Class 1 or Class 2	ASTM A387 S53		
		Page 2 of 2	<u> </u>	<u>.                                      </u>		
Certification		The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	- Heat treatment co	ndition. Tempering temperature s	hall be stated.			

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.137 — MDS IV106 / IV106S / IV106K

Material Data Sh	neet MD	OS No. IV106 / IV106S	a / IV106K b	Rev. 01				
TYPE OF MATERIAL	L: 1¼ Cr ½ Mo alloy steel							
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT				
Castings	ASTM A217	WC6 (UNS J12072)	-	ASTM A217 S4, S5, S21, S52.2 ASTM A703 S14, S20				
		Page 1 of 3	<u>.</u>	•				
Scope	This MDS defines applic specification.	cable options and/or requiren	nents that supplement or ame	and the referenced standard				
Chemical composition	Supplementary requiren	nent ASTM A217 S52.2 shall	l apply.					
Heat treatment		Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, castings shall be placed in such a way as to ensure free circulation around each item.						
Extent of testing	ASTM A703 supplemen	tary requirement S14 shall a	pply.					
Test sampling	ASTM A703 supplementary requirement S14 shall apply.  For castings with a weight of 250 kg (551 lb) 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.  Thickness of the test block shall be equal to the thickest part of the casting represented up to a maximum thickness of 100 mm (4 in). For flanged components, the largest flange thickness is the ruling section.  Dimensions of test blocks and location of test specimens within the test blocks are shown in the 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.							
Non-destructive testing	<u>Visual inspection</u>	<u>Visual inspection</u>						
	NDE requirement	Pilot casting (section	on 4.8) Pro	duction casting				
	Frequency	Each pilot castir	ng Each	production casting				
	Method		ANSI/MSS SP-55					
	Extent	100 % of all a	accessible surfaces including	welding ends				
	Acceptance criteria		ANSI/MSS SP-55					
	NOTE The testing shall be testing.	be carried out after machining, if	applicable. Non-machined surface	es shall be cleaned prior to the				



Material Data Sh	eet	MDS No. IV106 / IV106S	Rev. 01	
TYPE OF MATERIAL	: 1¼ Cr ½ Mo alloy s	teel		
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A217	WC6 (UNS J12072)	-	ASTM A217 S4, S5, S21, S52.2 ASTM A703 S14, S20

#### Page 2 of 3

# Non-destructive testing (continued)

#### Magnetic particle testing

ASTM A217 supplementary requirement S4 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>			
Frequency <sup>b</sup>	100 %				
Method	ASME BPVC, Sec. V, Article 7				
Extent <sup>c</sup>	100 %				
Acceptance criteria	ASME BPVC, Sec. VIII, Div. 1, Appendix 7				

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- <sup>a</sup> Production valve castings, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- <sup>b</sup> Frequency of inspection 100 % means that each item shall be examined.
- c All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A217 supplementary requirement S5 shall apply as amended by this MDS.

Pilot casting Production casting							
(section 4.8)	Valve castings <sup>a</sup>				Other pressure containing castings <sup>b</sup>		
100 %	NPS DN Pressure class				100 %		
			≤ 300	600	900	≥ 1500	
	< 2	< 50	N/R	N/R	N/R	N/R	
	≥ 2	≥ 50	N/R	5 %	5 %	5 %	
	≥ 6	≥ 150	N/R	5 %	5 %	100 %	
	≥ 10	≥ 250	5 %	5 %	5 %	100 %	
	≥ 16	≥ 400	5 %	5 %	100 %	100 %	
	≥ 20	≥ 500	5 %	100 %	100 %	100 %	
		ASME I	3PVC, Se	ec. V, Art	icle 2		
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					100 % <sup>d</sup>		
	ASM	E BPVC,	Sec. VII	I, Div. 1,	Appendix	x 7	
	Areas defined changes in sec	(section 4.8)  100 %  NPS  < 2  ≥ 2  ≥ 6  ≥ 10  ≥ 16  ≥ 20  Areas defined by ASME changes in sections and	(section 4.8)  NPS DN	NPS	(section 4.8)	NPS	Valve castings a         Valve castings a         NPS       DN       Pressure class         ≤ 300       600       900       ≥ 1500         < 2

NOTE N/R means not required, unless specified otherwise by the purchaser.

- <sup>a</sup> Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- b Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



Material Data Sh	neet	MDS No. IV106 / IV106	6S a / IV106K b	Rev. 0			
TYPE OF MATERIAL	L: 1¼ Cr ½ Mo alloy ste	eel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Castings	ASTM A217	WC6 (UNS J12072)	-	ASTM A217 S4, S5, S2 <sup>2</sup> S52.2 ASTM A703 S14, S20			
		Page 3 of 3		A31W A703 314, 320			
Repair of defects	documented in acco The repair welding p - Welding procedu production; - Testing methodo	Repairs as described in ASTM A217, section 9.4 shall be considered major. All major repairs shall be documented in accordance with ASTM A703 S20.2.  The repair welding procedure shall be qualified in accordance with ASTM A488 or ISO 11970 and this MDS:  Welding procedure shall be qualified on casting or plate of the same cast material grade as used in					
	the parent material.  Weld repairs are not acceptable for castings that leak during pressure testing.  Stress relieving PWHT shall be required after all major weld.  If a minor cosmetic repair is required to a semi-finished or finished cast component, PWHT may be omitted provided the welding procedure meets all the test requirements of this data sheet in the as-welded condition and preheat is applied according to the standard.  The weld metal composition shall comply with the following requirement:  − 10P + 5Sb + 4Sn + As ≤ 1500 (values in mg/Kg)						
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	Hardness testing  - Production hardness testing shall be performed in accordance with the requirements in						
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.						
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements) <sup>b</sup>	following additional r	equirements to the MDS.	ed by the purchaser, the material				
Marking	The castings shall be	e marked to ensure full tracea	ability to melt and heat treatment	lot.			
Certification	quality requirements The inspection docu- confirm compliance of The inspection docu-	standard accepted by the pu	ordance with ISO 10474 /EN 1020 ving information:				

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.138 — MDS IV107 / IV107S / IV107K

Material Data Sheet MDS No. IV107 / IV107S a / IV107K b Rev. 01							
TYPE OF MATERIAL	.: 1¼ Cr ½ Mo alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
Bars	ASTM A739	B11	-	-			
		Page 1 of 2					
Scope	specification. This MDS includes addition	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  This MDS includes additional requirements for valve parts DN 100 (NPS 4) and under manufactured from bars, when permitted by the valve specification.					
Metal making	For bar thickness 50 mm ( practice.	2 in) and greater the steel sh	nall be vacuum degassed ar	nd made to fine grain			
Chemical composition	- 10P + 5Sb + 4Sn + As	2 in) and greater, the followi ≤ 1500 (values in mg/kg) %, S ≤ 0.007 %, Cu ≤ 0.20 %					
Heat treatment		all be minimum 725 °C (1 3 process, bars shall be place enching operation.	•	e free circulation around			
Hardness testing	Hardness testing shall be of The maximum hardness sl	carried out on in accordance hall not exceed 207HBW.	with ASTM A370 on the en	d surface of one bar per lot.			
Test sampling	<ul> <li>Valve parts manufactured from bar</li> <li>Sampling of test specimens for bars intended for machining of valve parts shall comply with the following requirements:         <ul> <li>The mid-length of the axial tensile specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar, and the centreline of the specimen shall be located at mid thickness (1/2 OD).</li> <li>The centreline of the tangential tensile specimens shall be located at mid thickness (1/2 OD) and the midpoint of the specimens at a minimum of 100 mm (4 in) from the end of the bar.</li> <li>For bar with outside diameter &lt; 100 mm (4 in): one tensile specimen and one set of impact test specimens shall be taken.</li> <li>For bar with outside diameter ≥ 100 mm (4 in): one tensile specimen and one set of impact test specimens shall be taken in axial direction of the bar. In addition, one tensile test specimen and one set of impact test specimens shall be taken in tangential direction of the bar.</li> <li>The specified minimum tensile strength of the referenced standard shall be met in both directions.</li> </ul> </li> </ul>						
Non-destructive testing	after machining, if applicate  NDT of valve parts manufate  Inspection shall be according	ed out on each bar in accordance with the product standard. The testing shall be performed if applicable, and non-machined surfaces shall be cleaned prior to the testing.  Its manufactured from bar be according to the applicable valve specification.  Decified by the purchaser, the requirements in this MDS shall apply including magnetic					
	NDE requirement Part manufactured from bar						
	Frequency <sup>a</sup>		10 %				
	Method	AS	SME BPVC, Sec. V, Article 7	7			
	Extent <sup>b</sup>		100 %				
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 6						
	NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.						
	For random examination shall be as defined for me     All surfaces shall be exam	·	per lot in any purchase order sha	all be examined. The test lot			



Material Data Sheet MDS No. IV107 / IV107S a / IV107K b Rev. 01						
TYPE OF MATERIAL	.: 1¼ Cr ½ Mo alloy st	teel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A739	B11	-	-		
	•	Page 2	of 2	•		
Repair of defects	Weld repair is not p	ermitted.				
Sour service (additional metallurgical,	requirements of ISC	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
manufacturing, testing and certification requirements) <sup>a</sup>	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.					
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements) <sup>b</sup>	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-C.					
Marking	The bars shall be m	narked to ensure full trace:	ability to melt and heat treatment lot.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	'	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	·	uments shall include the fo	· ·			
	Heat treatment condition including tempering temperature shall be stated.					

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



#### Table A.139 — MDS IV201 / IV201S / IV201K

Material Data Sheet MDS No. IV201 / IV201S a / IV201K b Rev.						
TYPE OF MATERIAL	.: 21/4 Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Seamless pipes	ASTM A335	P22 (UNS K21590)	-	-		
	Page 1 of 1					
Scope	This MDS defines applicable specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Metal making	For pipes with governing the fine grain practice.	nickness 50 mm (2 in) and g	reater, Steel shall be vacuur	m degassed and made to		
Chemical composition	For pipes with governing th	nickness 50 mm (2 in) and g	reater, the requirements of A	API 934-A shall apply.		
Heat treatment	Minimum tempering tempe	erature shall be 725 °C (1 33	7 °F).			
Hardness testing	Hardness testing shall be r	made on one finished pipe p	er lot and shall not exceed 2	235 HBW.		
Extent of testing	Product analysis shall be o	arried out in accordance wit	h the standard.			
Repair of defects	Weld repair is not permitte	d.				
Sour service (additional metallurgical,	(additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional					
manufacturing, testing and	Chemical composition					
certification requirements) <sup>a</sup>	S ≤ 0.010 %					
requirements	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.					
Hydrogen service (additional	When hydrogen service re- following additional require		the purchaser, the material	shall conform to the		
metallurgical, manufacturing,	Products shall be delivered	d in the normalized and temp	pered or quenched and temp	pered condition.		
testing and certification requirements) <sup>b</sup>	Tensile testing and impact testing shall be carried out in accordance with API 934-A.					
Marking	The pipes shall be marked	to ensure full traceability to	melt and heat treatment lot.			
Certification		shall have a quality system ard accepted by the purcha	certified in accordance with ser.	ISO 9001 or another		
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents	The inspection documents shall include the following information:				
	Heat treatment condition	n including tempering tempe	rature and holding time shal	I be stated.		

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.140 — MDS IV202 / IV202S / IV202SH / IV202K

Material Data Sh	neet MDS No. I	V202 / IV202\$ a / IV20	2SH <sup>b</sup> / IV202K <sup>c</sup>	Rev. 01		
TYPE OF MATERIAL	.: 2¼ Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A691	2 ¼ CR (UNS K21590)	Class 22 or 42	S3, S7, S12		
	_	Page 1 of 2				
Scope	This MDS defines applicate specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Metal making	For pipes with thickness 50 grain practice.	For pipes with thickness 50 mm (2 in) and greater, the steel shall be vacuum degassed and made to fine grain practice.				
Manufacturing	The longitudinal weld shall Welds shall be made using	· ·				
Chemical composition	For pipes with governing the	nickness 50 mm (2 in) and g	reater, the requirements of A	API 934-A shall apply.		
Heat treatment	conditions.	•	ormalized and tempered or q			
	Stress relieving PWHT ten	nperature and tempering ten	nperature shall be minimum	725 °C (1 337 °F).		
Hardness testing	Supplementary requirement	nt S3 shall apply on one finis	shed pipe per lot.			
Extent of testing	Mechanical testing shall be apply for lot definition.	Mechanical testing shall be carried out on one finished pipe per lot. Supplementary requirement S12 shall apply for lot definition.				
Non-destructive testing	Radiographic examination shall be performed after heat treatment.  Supplementary requirement S7 shall apply. Acceptance criteria shall be according to ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 6. Examination shall be performed after calibration.					
Repair of defects	Weld repair of the base ma	aterial is not permitted				
		acceptable in accordance w the original manufacturing v	rith the standard specification veld.	n and shall meet the		
Sour service (additional metallurgical,			ourchaser, the material shall 945/NACE MR0103, and the			
manufacturing, testing and certification						
requirements) <sup>a, b</sup>	Hardness testing					
	- In addition to the production hardness requirement in the MDS, welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 225HV.					
	The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MDS.					
	HIC testing and UT examin	nation				
	When suffix SH applies, or	ne plate per lot shall be teste	ed as follows.			
	- HIC testing:	idence with NACE TMOSS 4	uning Toot Columbia - A			
	•	dance with NACE TM0284, ner specimen shall be CLR	•	2 %		
<ul> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> </ul>						
	UT examination:					
	ASTM A691, S10 s	hall apply.				
Hydrogen service (additional metallurgical, manufacturing, testing and	following additional require Products shall be delivered	ements to the MDS.  If in the normalized and tem	the purchaser, the material pered or quenched and tem in accordance with API 934-	pered condition.		
certification requirements)°						



Material Data SI	neet MDS N	lo. IV202 / IV202S a / IV20	02SH b / IV202K c	Rev. 01		
TYPE OF MATERIAL: 21/4 Cr 1 Mo alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Welded pipes	ASTM A691	2 1/4 CR (UNS K21590)	Class 22 or 42	S3, S7, S12		
	•	Page 2 of 2				
Marking	The pipes shall be	The pipes shall be marked to ensure full traceability to melt and heat treatment lot.				
Certification	quality requirement	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.					
	The inspection documents shall include the following information:					
	<ul> <li>Heat treatment holding times sh</li> </ul>	condition including stress relievinall be stated.	ng PWHT temperature or te	mpering temperature and		

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

b The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.141 — MDS IV203 / IV203S / IV203SH / IV203K

Material Data Sh	neet MDS No.	IV203 / IV203S a / IV20	3SH <sup>b</sup> / IV203K <sup>c</sup>	Rev. 01		
TYPE OF MATERIAL: 21/4 Cr 1 Mo alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Wrought fittings	ASTM A234	WP22 Class 1 or Class 3		ASTM A960 S51, S53, S69		
	ASTM A234	WP22W Class 1 or Class 3		ASTM A960 S51, S53, S69		
	_	Page 1 of 2				
Scope	This MDS defines applica specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Metal making	For fitting thickness 50 m practice.	m (2 in) and greater, the stee	I shall be vacuum degassed	I and made to fine grain		
Chemical composition	For fittings with governing	g thickness 50 mm (2 in) and	greater, the requirements of	API 934-A shall apply.		
Heat treatment	All hot formed or forged f shall be heat treated afte During the heat treatmen	Tempering temperature shall be minimum 725 °C (1 337 °F).  All hot formed or forged fittings, including those manufactured by locally heating a portion of the fitting stock, shall be heat treated after manufacture.  During the heat treatment process, fittings shall be placed in such a way as to ensure free circulation around				
Hardness testing		each fitting including any quenching operation.  Hardness testing shall be carried out on two fittings for each test lot, including parent material, weld and HAZ.				
Tensile testing	carried out on specimens possible due to the size of	ASTM A960 supplementary requirement S51 shall apply as amended by this MDS. Tensile testing shall be carried out on specimens cut from a fitting where dimensions permit. When removal of specimens is not possible due to the size of the fitting, a prolongation or a length of starting material that has been heat treated in the same heat treatment load as the fittings it represents shall be used.				
Non-destructive testing	criteria shall be according final heat treatment and a	ASTM A960 supplementary requirement S53 and S69 shall apply as amended by this MDS. Acceptance criteria shall be according to ASME <i>BPVC</i> , Sec. VIII, Div. 1, Appendix 6. Examination shall be performed after final heat treatment and after final machining or calibration.				
	NDT shall be carried out	after final heat treatment.				
Repair of defects	Weld repair of the base n	naterial is not permitted.				
		e acceptable in accordance wind the original manufacturing was a constant of the original manufacturing was a constant or cons		n and shall meet the		
Sour service (additional metallurgical,	requirements of ISO 151	When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.				
manufacturing, testing and	Chemical composition					
certification requirements) <sup>a, b</sup>	- S ≤ 0.003 % for WP22W fitting made from flat-rolled products					
,	- S ≤ 0.007 % for WP22	2 fitting made from forging				
	qualification testing for m	Hardness testing  For WP22W fittings, in addition to the production hardness requirement in the MDS, welding procedure qualification testing for manufacturing and any repair welding shall meet the requirements of NACE MR0175-2/ISO 15156-2, section 7.3.3, using Vickers method, with a maximum hardness of 225HV.				
	The material shall be trac	ceable in accordance with ISC	) 15156-2/NACE MR0175-2	, section 9 and this MDS.		



Material Data Sheet MDS No. IV203 / IV203S $^{\rm a}$ / IV203SH $^{\rm b}$ / IV203K $^{\rm c}$ Rev. 01					
TYPE OF MATERIAL: 21/4 Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Wrought fittings	ASTM A234	WP22 Class 1 or Class 3		ASTM A960 S51, S53, S69	
	ASTM A234	WP22W Class 1 or Class 3		ASTM A960 S51, S53, S69	
	•	Page 2 of 2			
(additional metallurgical, manufacturing, testing and certification requirements) <sup>a, b</sup> (continued)	follows.  - HIC testing:  • HIC testing in  • Acceptance cr  • Maximum indir  - UT testing of flat-r	<ul> <li>HIC testing:</li> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT testing of flat-rolled product before manufacture:</li> </ul>			
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements) °	following additional re Products shall be deli	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.			
Marking	The fittings shall be n	narked to ensure full traceability to	o heat and heat treatment lo	t.	
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.  The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.  The inspection documents shall include the following information:  Heat treatment condition including tempering temperature and holding time.				

requirements for sour service.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional supplementary requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



#### Table A.142 — MDS IV204 / IV204S / IV204K

Material Data Sh	eet MD	S No. IV204 / IV	/204S a / IV204K b	Rev. 01		
TYPE OF MATERIAL	: 2¼ Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Forgings	ASTM A182	F22	Class 3	ASTM A961 S55		
	_	Page 1	of 1			
Scope	This MDS defines applica specification.	able options and/or re	equirements that supplement or an	nend the referenced standard		
Metal making	For forgings with governi fine grain practice.	For forgings with governing thickness 50 mm (2 in) and greater, steel shall be vacuum degassed and made to ine grain practice.				
Chemical composition	For forgings with governi	ng thickness 50 mm	(2 in) and greater, the requirement	s of API 934-A shall apply.		
Heat treatment	Tempering temperature s	shall be minimum 72	25 °C (1 337 °F).			
	During the heat treatmen each fitting including any		hall be placed in such a way as to a.	ensure free circulation around		
Non-destructive testing	ASTM A961 supplementary requirement S55 shall apply. Acceptance criteria shall be according to ASME BPVC, Sec. VIII, Div. 1, Appendix 6. Examination shall be performed after final heat treatment and final machining.					
	<u>Valve forgings NDT</u>					
	Inspection shall be accor					
	If a QSL is not specified I	by the purchaser, the	e requirements in this MDS shall ap	pply.		
Repair of defects	Weld repair is not permitt	ted.				
Sour service (additional metallurgical,	When sour service requirequirements of ISO 151 this MDS.	rements are specified 56/NACE MR0175 o	d by the purchaser, the material shart ISO 17945/NACE MR0103, and the	all conform to the he additional requirements of		
manufacturing, testing and certification	Chemical composition					
requirements) <sup>a</sup>	S ≤ 0.025 %					
	The material shall be trac	ceable in accordance	with ISO 15156-2/NACE MR0175	-2, section 9 and this MDS.		
Hydrogen service (additional			ecified by the purchaser, the materi	al shall conform to the		
metallurgical,	following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.					
manufacturing, testing and	Tensile testing and impact testing shall be carried out in accordance with API 934-A.					
certification requirements) <sup>b</sup>	Sketches shall be established showing type, and size of test samples and location for extraction of test specimens.					
Marking	The forgings shall be ma	rked to ensure full tra	aceability to heat and heat treatmen	nt lot.		
Certification	The material manufacture quality requirements star		y system certified in accordance weet	ith ISO 9001 or another		
	compliance with this spec	cification.	ance with ISO 10474 /EN 10204 Ty	pe 3.1 and shall confirm		
	The inspection document		_			
	<ul> <li>Heat treatment condit</li> </ul>	tions including tempe	ering temperature and holding time.			

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.143 — MDS IV205 / IV205S / IV205SH / IV205K

Plates ASTM A387 Grade 22 (UNS K21590) Class 2 ASTM A387 S53  Page 1 of 2  Scope This MDS defines applicable options and/or requirements that supplement or amend the referenced star specification.  Metal making Steel plate with thickness 50 mm (2 in) and greater shall be vacuum degassed and made to fine grain practice.  Chemical composition  Heat treatment Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing Hardness testing and Understand the carried out on in accordance with ASTM A370 on one plate per lot. Hardness into exceed 1971HBW.  Test sampling Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Non-destructive testing If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Weld repair is not permitted.  Sour service (additional metallurgical, manufacturing, testing and Certification requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements or ISO 45156/NACE MR0175 or ISO 15156-2/NACE MR0175-2, section 9 and this MI HIC testing:  HIC testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  Hich testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  UT examination:  ASTM A387 supplementary requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered	Material Data Sh	eet MDS No. I	V205 / IV205S a / IV20	5SH <sup>b</sup> / IV205K <sup>c</sup>	Rev. 01			
Plates ASTM A387 Grade 22 (UNS K21590) Class 2 ASTM A387 S53  Page 1 of 2  Scope This MDS defines applicable options and/or requirements that supplement or amend the referenced star specification.  Metal making Steel plate with thickness 50 mm (2 in) and greater shall be vacuum degassed and made to fine grain practice.  Chemical composition For plate with thickness 50 mm (2 in) and greater, the requirements of API 934-A shall apply.  Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing Hardness testing shall be carried out on in accordance with ASTM A370 on one plate per lot. Hardness not exceed 1971BW.  Test sampling Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Non-destructive testing if a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Weld repair is not permitted.  Sour service (additional metallurgical, manufacturing, testing and UT examination When suffix SH applies, one plate per lot shall be care as Sollows.  HIC testing and UT examination When suffix SH applies, one plate per lot shall be CLR ≤ 15 %, CR ≤ 5 %, CSR ≤ 2 %.  Hardness testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CR ≤ 5 %, CSR ≤ 2 %.  Hardness testing and the following additional requirements:  Hydrogen service (additional metallurgical, manufacturing, testing and the following additional requirements are specified by the purchaser, the material shall conform to the following additional requirements of the MDS.  ASTM A387 supplementary requirement S8 shall apply.  Hydrogen service (additional metallurgical, manufacturing, testing and fine plate per lot shall be carried out in accordance with API 934-A.	TYPE OF MATERIAL	.: 2¼ Cr 1 Mo alloy steel						
This MDS defines applicable options and/or requirements that supplement or amend the referenced star specification.  Metal making  Steel plate with thickness 50 mm (2 in) and greater shall be vacuum degassed and made to fine grain practice.  Chemical composition  For plate with thickness 50 mm (2 in) and greater, the requirements of API 934-A shall apply.  Tendering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing  Hardness testing shall be carried out on in accordance with ASTM A370 on one plate per lot. Hardness not exceed 197HBV.  Test sampling  Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Valve plates NDT Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of the MDS.  Chemical composition  S 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MC HC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows.  - HIC testing and UT examination  When suffix SH applies, one plate per lot shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MC HC testing and UT examination:  - Maximum individual crack length shall be reported for each section.  - UT examination:  - ASTM A387 supplementary requirements as specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  ASTM A387 supplementary requirem	PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT			
This MDS defines applicable options and/or requirements that supplement or amend the referenced star specification.  **Metal making**  Steel plate with thickness 50 mm (2 in) and greater shall be vacuum degassed and made to fine grain practice.  **Chemical composition**  Tempering temperature shall be minimum 725 °C (1 337 °F).  **During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  **Hardness testing**  Test sampling**  Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  **Non-destructive testing**  Non-destructive testing**  Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  **Weld repair is not permitted.**  **When sour service requirements are specified by the purchaser, the material shall conform to the requirements of 150 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional metallurgical, manufacturing, testing and certification or plate per lot shall be tested as follows.  **HIC testing in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this ME HIC testing in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this ME HIC testing in accordance with NACE TM0284, using Test Solution A.  **Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  **Maximum individual crack length shall be reported for each section.  **Universal to the MDS.**  **Padrogen service (equirements are specified by the purchaser, the material shall conform to the following additional requirements of the MDS.**  **Province (additional metallurgical, manufacturing, testing and the policy of the purchaser, the material shall conform to the following additional requirements of the MDS.**	Plates	ASTM A387	Grade 22 (UNS K21590)	Class 2	ASTM A387 S53			
Specification.  Steel plate with thickness 50 mm (2 in) and greater shall be vacuum degassed and made to fine grain practice.  Chemical composition  For plate with thickness 50 mm (2 in) and greater, the requirements of API 934-A shall apply.  Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing  Hardness testing shall be carried out on in accordance with ASTM A370 on one plate per lot. Hardness inclexceed 197HBW.  Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Valve plates NDT  Inspection of plates for valve parts shall be according to the applicable valve specification.  If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Weld repair is not permitted.  Sour service (additional metallurgical, manufacturing, testing and certification requirements to the MDS.  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MC HIC testing in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MC HIC testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  UT examination:  ASTM A387 supplementary requirements are specified by the purchaser, the material shall conform to the requirement service (additional metallurgical, manufacturing), and metallurgical, manufacturing, and metallurgical, and and and tempered or quenched and tempered condition. Tensile testing and impact testing shall be carried out in accordance with API 934-A.			Page 1 of 2	•				
Practice.	Scope		This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.					
Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing Hardness testing shall be carried out on in accordance with ASTM A370 on one plate per lot. Hardness in the exceed 197HBW.  Test sampling Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Non-destructive testing Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Repair of defects Weld repair is not permitted.  Sour service (additional metallurgical, manufacturing, testing and certification requirements) **. **  **Demical composition**  S ≤ 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MI HIC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows.  — HIC testing:  — HIC testing:  — HIC testing in accordance with NACE TM0284, using Test Solution A.  — Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  — Maximum individual crack length shall be reported for each section.  — UT examination:  — ASTM A387 supplementary requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Hydrogen service (additional metallurgical, manufacturing, and the following additional requirements to the MDS.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.	Metal making		50 mm (2 in) and greater sha	all be vacuum degassed and	d made to fine grain			
During the heat treatment process, plates shall be placed in such a way as to ensure free circulation are each fitting including any quenching operation.  Hardness testing  Hardness testing shall be carried out on in accordance with ASTM A370 on one plate per lot. Hardness is not exceed 197HBW.  Test sampling  Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Non-destructive testing  Valve plates NDT Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Repair of defects  Weld repair is not permitted.  When sour service requirements are specified by the purchaser, the material shall conform to the requirements to the MDS.  Chemical composition  S ≤ 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MD HIC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows.  HIC testing:  HIC testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  UT examination:  ASTM A387 supplementary requirements 8 shall apply.  When hydrogen service requirements to the MDS.  Tendical conform to the following additional requirements to the MDS.  When service (additional materiallurigical, manufacturing, testing and		For plate with thickness 50	mm (2 in) and greater, the	requirements of API 934-A s	shall apply.			
Test sampling  Supplementary requirement S53 shall apply. Specimens shall be oriented transverse to the final rolling direction.  Non-destructive testing  Walve plates NDT Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  Weld repair is not permitted.  Sour service (additional metallurgical, manufacturing, testing and certification requirements)   **Demical composition**  Chemical composition  S ≤ 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MI HIC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows.  - HIC testing:  - HIC testing in accordance with NACE TM0284, using Test Solution A.  - Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  - Maximum individual crack length shall be reported for each section.  - UT examination:  - ASTM A387 supplementary requirements are specified by the purchaser, the material shall conform to the following additional metallurgical, manufacturing, testing and different in the normalized and tempered or quenched and tempered condition. Tensile testing and impact testing shall be carried out in accordance with API 934-A.	Heat treatment	During the heat treatment	process, plates shall be place		ure free circulation around			
Mon-destructive testing   Valve plates NDT   Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.    Repair of defects   Weld repair is not permitted.	Hardness testing		carried out on in accordance	with ASTM A370 on one pl	ate per lot. Hardness shall			
Inspection of plates for valve parts shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this MDS shall apply.  **Repair of defects**  **Weld repair is not permitted.**  **Weld repair is not permitted.**  **Weld repair is not permitted.**  **When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  **Chemical composition**  **S ≤ 0.003 %*  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MID HIC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows. — HIC testing:  **HIC testing:*  **HIC testing:*  **HIC testing in accordance with NACE TM0284, using Test Solution A.*  **Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.*  **Maximum individual crack length shall be reported for each section.*  **UT examination:*  **ASTM A387 supplementary requirement S8 shall apply.*  **When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.*  **Products shall be delivered in the normalized and tempered or quenched and tempered condition.*  **Tensile testing and impact testing shall be carried out in accordance with API 934-A.*	Test sampling							
Sour service (additional metallurgical, manufacturing, testing and certification requirements) a. b  When sour service requirements are specified by the purchaser, the material shall conform to the requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements) a. b  Chemical composition S ≤ 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MID HIC testing and UT examination When suffix SH applies, one plate per lot shall be tested as follows.  HIC testing: HIC testing in accordance with NACE TM0284, using Test Solution A. Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %. Maximum individual crack length shall be reported for each section.  UT examination: ASTM A387 supplementary requirement S8 shall apply.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS. Products shall be delivered in the normalized and tempered or quenched and tempered condition. Tensile testing and impact testing shall be carried out in accordance with API 934-A.		Inspection of plates for val	· ·					
requirements of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  ### Description of ISO 15156/NACE MR0175 or ISO 17945/NACE MR0103, and the following additional requirements to the MDS.  #### Chemical composition    S ≤ 0.003 %	Repair of defects	Weld repair is not permitte	d.					
Chemical composition s ≤ 0.003 %  The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MI  HIC testing and UT examination When suffix SH applies, one plate per lot shall be tested as follows.  HIC testing:  HIC testing:  HIC testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  UT examination:  ASTM A387 supplementary requirement S8 shall apply.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.	(additional metallurgical,	requirements of ISO 15156	ments are specified by the p S/NACE MR0175 or ISO 179	ourchaser, the material shall 945/NACE MR0103, and the	conform to the following additional			
The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and this MI  HIC testing and UT examination  When suffix SH applies, one plate per lot shall be tested as follows.  HIC testing:  HIC testing in accordance with NACE TM0284, using Test Solution A.  Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  Maximum individual crack length shall be reported for each section.  UT examination:  ASTM A387 supplementary requirement S8 shall apply.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.	testing and certification							
When suffix SH applies, one plate per lot shall be tested as follows.  - HIC testing:  • HIC testing in accordance with NACE TM0284, using Test Solution A.  • Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.  • Maximum individual crack length shall be reported for each section.  - UT examination:  • ASTM A387 supplementary requirement S8 shall apply.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.	requirements) ***	The material shall be trace	able in accordance with ISC	) 15156-2/NACE MR0175-2	, section 9 and this MDS.			
<ul> <li>HIC testing:         <ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT examination:                  <ul></ul></li></ul></li></ul>		HIC testing and UT examin	nation					
<ul> <li>HIC testing in accordance with NACE TM0284, using Test Solution A.</li> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT examination:         <ul> <li>ASTM A387 supplementary requirement S8 shall apply.</li> </ul> </li> <li>Hydrogen service (additional metallurgical, manufacturing, testing and</li> <li>When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.</li> <li>Products shall be delivered in the normalized and tempered or quenched and tempered condition.</li> <li>Tensile testing and impact testing shall be carried out in accordance with API 934-A.</li> </ul>		When suffix SH applies, or	ne plate per lot shall be teste	ed as follows.				
<ul> <li>Acceptance criteria per specimen shall be CLR ≤ 15 %, CTR ≤ 5 %, CSR ≤ 2 %.</li> <li>Maximum individual crack length shall be reported for each section.</li> <li>UT examination:         <ul> <li>ASTM A387 supplementary requirement S8 shall apply.</li> </ul> </li> <li>Hydrogen service (additional metallurgical, manufacturing, testing and</li> <li>When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.</li> <li>Products shall be delivered in the normalized and tempered or quenched and tempered condition. Tensile testing and impact testing shall be carried out in accordance with API 934-A.</li> </ul>			rdamaa with NACE TM0004	voice Test Calvilies A				
Maximum individual crack length shall be reported for each section.      UT examination:     ASTM A387 supplementary requirement S8 shall apply.  Hydrogen service (additional metallurgical, manufacturing, testing and  Maximum individual crack length shall be reported for each section.  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.			•	J	2 %			
<ul> <li>UT examination:         <ul> <li>ASTM A387 supplementary requirement S8 shall apply.</li> </ul> </li> <li>Hydrogen service (additional metallurgical, manufacturing, testing and</li> <li>When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.         <ul> <li>Products shall be delivered in the normalized and tempered or quenched and tempered condition.</li> <li>Tensile testing and impact testing shall be carried out in accordance with API 934-A.</li> </ul> </li> </ul>		· · · ·						
Hydrogen service (additional metallurgical, manufacturing, testing and  When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.  Products shall be delivered in the normalized and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.			J					
service (additional metallurgical, manufacturing, testing and metallurgical and tempered or quenched and tempered condition.  Tensile testing and impact testing shall be carried out in accordance with API 934-A.		ASTM A387 supple	mentary requirement S8 sha	all apply.				
manufacturing, testing and manufacturing shall be carried out in accordance with API 934-A.	service (additional							
testing and Tensile testing and impact testing shall be carried out in accordance with API 934-A.		pered condition.						
requirements)°	manufacturing, testing and certification  Tensile testing and impact testing shall be carried out in accordance with API 934-A.							
Marking The plates shall be marked to ensure full traceability to melt and heat treatment lot.	Marking	The plates shall be marked	d to ensure full traceability to	melt and heat treatment lot				



Material Data Sh	eet MDS No. IV205 / IV205S a / IV205SH b / IV205K c			Rev. 01	
TYPE OF MATERIAL: 2½ Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Plates	ASTM A387	Grade 22 (UNS K21590)	Class 2	ASTM A387 S53	
		Page 2 of 2	•		
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.				
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and shall confirm compliance with this specification.				
	The inspection documents shall include the following information:				
	- Heat treatment co	ndition. Tempering temperature a	and holding time shall be sta	ited.	

The supplementary suffix "S" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for sour service.

The supplementary suffix "SH" shall be used to designate a material delivered in accordance with the MDS including the additional requirements for sour service plus HIC testing and UT examination.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.144 — MDS IV206 / IV206S / IV206K

Material Data Sheet MDS No. IV206 / IV206S a / IV206K b Rev.						
TYPE OF MATERIAL	L: 2¼ Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Castings	ASTM A217	WC9 (UNS J21890)	-	ASTM A217 S4, S5, S21, S52.3, S53 ASTM A703 S14, S20		
		Page 1 of 3		7.67 66 67 ., 626		
Scope	This MDS defines appl specification.	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.				
Chemical composition	Supplementary require	ment ASTM A217 S52.3 and	d S53 shall apply with a J-fac	otor ≤ 100.		
Heat treatment	Tempering temperature shall be minimum 725 °C (1 337 °F).  During the heat treatment process, castings shall be placed in such a way as to ensure free circulation around each item.					
Extent of testing	ASTM A703 supplement	ntary requirement S14 shall	apply.			
Test sampling	casting and shall accorstress relieving.  Thickness of the test bit thickness of 100 mm (4 Dimensions of test bloc for integral and gated to from end of test specim	is with a weight of 250 kg (551 lb) or more, the test blocks shall be integrally cast or gated onto the shall accompany the castings through all heat treatment operations, including any post weld ving.  of the test block shall be equal to the thickest part of the casting represented up to a maximum of 100 mm (4 in). For flanged components, the largest flange thickness is the ruling section, as of test blocks and location of test specimens within the test blocks are shown in the figure below and gated test block. The test specimens shall be taken within the cross hatched area. Distance if test specimen to end of test block shall minimum be T/4.				
Non-destructive testing	Visual inspection	T				
	NDE requirement	Pilot casting (sec		roduction casting		
	Frequency	Each pilot cas	<u> </u>	ch production casting		
	Method	400.07 ( )	ANSI/MSS SP-55	an control of the second of		
	Extent	100 % of al	accessible surfaces includir	ig welding ends		
	Acceptance criteria  NOTE The testing shall testing.	be carried out after machining, i	ANSI/MSS SP-55 f applicable. Non-machined surfa	aces shall be cleaned prior to the		



Material Data Sh	eet	MDS No. IV206 / IV206S a / IV206K b		Rev. 01	
TYPE OF MATERIAL: 21/4 Cr 1 Mo alloy steel					
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Castings	ASTM A217	WC9 (UNS J21890)	-	ASTM A217 S4, S5, S21, S52.3, S53 ASTM A703 S14, S20	

#### Page 2 of 3

# Non-destructive testing (continued)

#### Magnetic particle testing

ASTM A217 supplementary requirement S4 shall apply as amended by this MDS.

NDE requirement	Pilot casting (section 4.8)	Production casting <sup>a</sup>	
Frequency <sup>b</sup>	100	) %	
Method	ASME BPVC, Sec. V, Article 7		
Extent <sup>c</sup>	100 %		
Acceptance criteria	ASME BPVC, Sec. V	III, Div. 1, Appendix 7	

NOTE The testing shall be carried out after machining, if applicable. Non-machined surfaces shall be cleaned prior to the testing.

- <sup>a</sup> Production valve castings, MT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- <sup>b</sup> Frequency of inspection 100 % means that each item shall be examined.
- <sup>c</sup> All accessible internal and external surfaces shall be examined.

#### Radiographic testing

ASTM A217 supplementary requirement S5 shall apply as amended by this MDS.

Pilot casting Production casting							
(section 4.8)			Valve o	astings	a		Other pressure containing castings <sup>b</sup>
100 %	NPS	DN		Pressu	re class		100 %
			≤ 300	600	900	≥ 1500	
	< 2	< 50	N/R	N/R	N/R	N/R	
	≥ 2	≥ 50	N/R	5 %	5 %	5 %	
	≥ 6	≥ 150	N/R	5 %	5 %	100 %	
	≥ 10	≥ 250	5 %	5 %	5 %	100 %	
	≥ 16	≥ 400	5 %	5 %	100 %	100 %	
	≥ 20	≥ 500	5 %	100 %	100 %	100 %	
		ASME	BPVC, S	Sec. V, A	rticle 2		
		at the ju	inctions o				100 % <sup>d</sup>
	ASM	IE <i>BPV</i> C	C, Sec. V	III, Div. 1	, Append	ix 7	
	Areas defined changes in sec	100 %  NPS  < 2  ≥ 2  ≥ 6  ≥ 10  ≥ 16  ≥ 20  Areas defined by ASMI changes in sections and	100 %    NPS   DN     < 2	100 %    NPS   DN     ≤ 300	100 %  NPS DN Pressur \$\leq 300  600\$  < 2 < 50 N/R N/R  \( \geq 2 \) \$\geq 50 N/R 5 \\  \text{S} \ \text{S} \\  \text{S} \ \text{S} \\  \text{S} \\  \text{S} \\	NPS   DN   Pressure class   $\leq 300   600   900  $   $< 2   < 50   N/R   N/R   N/R  $   $\geq 2   \geq 50   N/R   5 \%   5 \%  $   $\geq 6   \geq 150   N/R   5 \%   5 \%  $   $\geq 10   \geq 250   5 \%   5 \%  $   $\geq 16   \geq 400   5 \%   5 \%  $   $\geq 16   \geq 400   5 \%   5 \%  $   $\geq 16   \geq 400   5 \%   5 \%  $   $\geq 100   \geq 250   5 \%   100 \%  $   $\geq 20   \geq 500   5 \%   100 \%  $   ASME BPVC, Sec. V, Article 2   Areas defined by ASME B16.34 for special class valves, a changes in sections and at the junctions of risers, gates or the casting   ASME BPVC, Sec. VIII, Div. 1, Appendix   ASME BPVC, Sec	NPS   DN   Pressure class   ≤ 300   600   900   ≥ 1500

NOTE  $\,$  N/R means not required, unless specified otherwise by the purchaser.

- Production valve casting, RT shall be according to the applicable valve specification. If a QSL is not specified by the purchaser, the requirements in this table shall apply.
- <sup>b</sup> Production casting other than valve casting.
- Frequency of inspection 100 % means that each item shall be examined. When random examination (5 %) is specified, a minimum of one item per lot of each pattern in any purchase order shall be examined.
- Production casting other than valve casting, inspection shall include other critical areas as defined in the purchase order and/or applicable product specification or standard. Sketches of the areas to be tested shall be established and agreed with the purchaser.



TYPE OF MATERIAL: 21/4 Cr 1 Mo alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT
Castings	ASTM A217	WC9 (UNS J21890)	-	ASTM A217 S4, S5, S21 S52.3, S53 ASTM A703 S14, S20
	1	Page 3 of 3		
Repair of defects	documented in accor The repair welding pr - Welding procedur production Testing methodol the parent materia Weld repairs are not Stress relieving PWH If a minor cosmetic re provided the welding and preheat is applie	dance with ASTM A703 S20.2 rocedure shall be qualified in a re shall be qualified on casting ogy and acceptance criteria sial.  acceptable for castings that left shall be required after all mepair is required to a semi-finis procedure meets all the test red according to the standard.	accordance with ASTM A488 or or plate of the same cast mate nall be in accordance with the r ak during pressure testing.	r ISO 11970 and this MDS: erial grade as used in equirements of this MDS for the thick that is the second that the as-welded condition
Sour service (additional metallurgical, manufacturing, testing and certification requirements) <sup>a</sup>	requirements of ISO requirements to the M  Hardness testing Production hardness 4370/A1058 on the 22HRC from three	15156/NACE MR0175 or ISO MDS.  ess testing shall be performed the pilot casting and one casting e readings taken in close prox	ne purchaser, the material shall 17945/NACE MR0103, and the lin accordance with the require g per lot thereafter. The maximimity.  ISO 15156-2/NACE MR0175-2	e following additional ements in ASTM num hardness shall be
Hydrogen service (additional metallurgical, manufacturing, testing and certification requirements) <sup>b</sup>	When hydrogen serv following additional re	ice requirements are specified equirements to the MDS.	by the purchaser, the material but in accordance with API 934	shall conform to the
Marking	The castings shall be	marked to ensure full traceat	ility to melt and heat treatment	lot.
Certification	quality requirements  The inspection docur	standard accepted by the pure	tem certified in accordance with chaser. dance with ISO 10474 /EN 102	

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Table A.145 — MDS IV207 / IV207S / IV207K

Material Data Sh	eet MD	S No. IV207 / IV207S a	/ IV207K b	Rev. 01	
TYPE OF MATERIAL	TYPE OF MATERIAL: 2¼ Cr 1 Mo alloy steel				
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT	
Bars	ASTM A739	B22	-	-	
	1	Page 1 of 2			
Scope	This MDS defines applicable options and/or requirements that supplement or amend the referenced standard specification.  This MDS includes additional requirements for valve parts DN 100 (NPS 4) and under manufactured from bars, when permitted by the valve specification.				
Metal making	For bar thickness 50 mm	(2 in) and greater, steel shall	be vacuum degassed and r	made to fine grain practice.	
Chemical composition	For bar thickness 50 mm	(2 in) and greater, the require	ements of API 934-A shall ap	oply.	
Heat treatment		nall be minimum 725 °C (1 3 process, bars shall be place enching operation.	,	e free circulation around	
Hardness testing	Hardness testing shall be The maximum hardness s	carried out on in accordance hall not exceed 207HBW.	with ASTM A370 on the en	d surface of one bar per lot.	
Non-destructive	<ul> <li>Valve parts manufactured from bar</li> <li>Sampling of test specimens for bars intended for machining of valve parts shall comply with the following requirements:         <ul> <li>The mid-length of the axial tensile specimens shall be located at a distance equal to the bar outside diameter or minimum of 100 mm (4 in), whichever is the greater, from the end of the bar, and the centreline of the specimen shall be located at mid thickness (1/2 OD).</li> <li>The centreline of the tangential tensile specimens shall be located at mid thickness (1/2 OD) and the midpoint of the specimens at a minimum of 100 mm (4 in) from the end of the bar.</li> <li>For bar with outside diameter &lt; 100 mm (4 in), one tensile specimen and one set of impact test specimens shall be taken.</li> <li>For bar with outside diameter ≥ 100 mm (4 in), one tensile specimen and one set of impact test specimens shall be taken in axial direction of the bar. In addition, one tensile test specimen and one set of impact test specimens shall be taken in tangential direction of the bar.</li> <li>The specified minimum tensile strength of the referenced standard shall be met in both directions.</li> </ul> </li> </ul>				
testing	VT shall be carried out on each bar in accordance with the product standard. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing.  NDT of valve parts manufactured from bar Inspection shall be according to the applicable valve specification.  If a QSL is not specified by the purchaser, the requirements in this MDS shall apply including magnetic particle testing according to the following table.			the testing.	
	NDE requirement Part manufactured from bar				
	Frequency <sup>a</sup>	<u> </u>	10 %		
	Method	AS	SME BPVC, Sec. V, Article 7	,	
Extent b 100 %					
	Acceptance criteria ASME BPVC, Sec. VIII, Div. 1, Appendix 6				
	testing.	carried out after machining, if ap			
	<ul> <li>For random examination shall be as defined for m</li> <li>All surfaces shall be examination</li> </ul>	· ·	er lot in any purchase order sha	all be examined. The test lot	
Repair of defects	Weld repair is not permitte	ed.			



Material Data Sheet MDS No. IV207 / IV207S a / IV207K b Rev. 0						
TYPE OF MATERIAL: 2¼ Cr 1 Mo alloy steel						
PRODUCT FORM	STANDARD	GRADE	ACCEPTANCE CLASS	SUPPLEMENTARY REQUIREMENT		
Bars	ASTM A739	B22	-	-		
		Page 2 of	2	•		
Sour service (additional metallurgical,		15156/NACE MR0175 or I	by the purchaser, the material shall ISO 17945/NACE MR0103, and the			
manufacturing, testing and certification requirements) <sup>a</sup> The material shall be traceable in accordance with ISO 15156-2/NACE MR0175-2, section 9 and accordance wit				, section 9 and this MDS.		
Hydrogen service (additional	When hydrogen service requirements are specified by the purchaser, the material shall conform to the following additional requirements to the MDS.					
metallurgical, manufacturing,	Products shall be delivered in the normalized and tempered or quenched and tempered condition.					
testing and	Tensile testing and impact testing shall be carried out in accordance with API 934-A.					
certification requirements) <sup>b</sup>						
Marking	The bars shall be ma	rked to ensure full traceab	oility to melt and heat treatment lot.			
Certification	The material manufacturer shall have a quality system certified in accordance with ISO 9001 or another quality requirements standard accepted by the purchaser.					
	The inspection documents shall be issued in accordance with ISO 10474 /EN 10204 Type 3.1 and confirm compliance with this specification.					
	The increation decur	ments shall include the foll	owing information			
	The inspection docur	nents shall include the foll	ownig information.			

requirements for sour service.

The supplementary suffix "K" shall be used to designate a material delivered in accordance with the MDS plus the additional supplementary requirements for hydrogen service.



# Annex B (normative) Element data sheets

The element data sheets listed in Table B.1 cover requirements for special processes, where the process shall be qualified and controlled as specified in the applicable EDS to ensure products are manufactured consistently to the appropriate quality.

Table B.1 — List of element data sheets

Special process description	EDS No.	EDS Rev.
Hard facing by overlay welding	IH001	01
Hard facing by thermal spraying of tungsten carbide	IH002	01
Electroless nickel coating	IH004	01
Solid tungsten carbide material	IH005	02
Alloy 625 corrosion resistant overlay welding	IO001	01



# B.2 IOGP element data sheets

#### Table B.2 — EDS IH001

Element Data Sho	eet EDS No. IH001 Rev.	01
Type of Special proce	ess: Hard facing by overlay welding	
	Page 1 of 2	
Scope	This EDS specifies requirements for hard facing by overlay welding of piping and valve parts.	
Welding	Welding process	
•	The hard facing shall be made by a suitable weld overlay process such as PTAW (plasma transferred arc welding), GTAW (gas tungsten inert gas welding) or LBW/EBW (laser/electron beam welding).  Welding consumable	
	For general and hydrocarbon service the welding consumables shall be of type E/ERCoCr-A (UNS R30006) e.g. Stellite 6 or equivalent, or type 13Cr (ER410).	)
	For other services, except for seawater service the use of E/ERCoCr-B (UNS R30012) or E/ERCoCr-E (UNS R30021) should be considered subject to purchaser approval.	
	For seawater service, the consumable shall be subject to agreement with the purchaser.	
Procedure qualification testing	General  The hard facing shall be carried out using welding procedures qualified in accordance with ASME BPVC IX ISO 15614-7 modified as follows:	or
	<ul> <li>The test plate dimensions shall be the minimum required by the welding standard sufficient to allow all required tests to be carried out. The minimum qualified parent material thickness shall be the thickness the test plate.</li> </ul>	of
	<ul> <li>The qualification shall be carried out on base material of same specification and grade as used in production.</li> </ul>	
	<ul> <li>The testing shall be carried out according to ASME BPVC IX or ISO 15614-7 and the requirements in the EDS.</li> </ul>	is
	A stringer bead technique is recommended. If weaving is used, the width shall be within the qualified range taking into consideration the risk of overheating of the material and cracking.	
	The temperature of the components shall be checked during welding. The interpass temperature during har facing of duplex stainless steels shall not exceed 150 °C (302 °F).	
	The thickness of the hard facing shall be measured and be minimum 1.6 mm (0.06 in) after final machining.	
	Hardness testing Hardness testing shall be carried out on base material, heat affected zone and weld metal. Vickers hardnes HV5 or HV10 shall be used. The examination of the HAZ shall be carried out with maximum 0.5 mm (0.02 ir distance between the indentations from fusion line, through HAZ into the unaffected base material. The hardness for HAZ and unaffected base material shall not exceed the maximum values specified in ISO 15156 /MR0175 or ISO 17945 /NACE MR0103 and for type 22Cr and 25Cr duplex base materials the hardness shall not exceed 310HV average, 320HV individual single value.	
	Metallographic examination	
	Metallographic examination shall be carried out for the following materials: 22Cr and 25Cr duplex, type 6Mc austenitic stainless steels and Alloy 625. For type 22Cr and 25Cr duplex the ferrite content in the heat affected zone shall be determined in accordance with ASTM E562 and shall be in the range of 30 % to 70 %	
	<u>Corrosion testing</u>	
	Corrosion testing shall be carried out for 25Cr duplex, Super austenitic materials (UNS S34565 or equivaler Alloy 625 and 6Mo substrates. The testing shall be carried out according to ASTM G48, method A, and for 2 h exposure time at 40 °C (104 °F). The acceptance criteria shall be no pitting at 20x.	
	magnification and maximum weight loss shall be 4 g/m². The sample shall include the cross section from the overlay surface into the unaffected base material. The hard facing may be removed, but any buffer layer and heat affected zone in the base material shall be exposed in the corrosion test.	
	<u>Macro section</u> The macro section for the qualification shall show no cracking and complete fusion between base material and the hard facing layer.	
Procedure	Impact testing	
qualification testing	The qualification testing shall include Charpy V-notch impact testing for materials that require impact testing by the applicable ASTM standard or MDS. The test conditions and acceptance criteria shall be as stated in the ASTM standard or MDS (the MDS requirements prevail). One set of impact testing shall be carried out with specimens located in the base material 2 mm (0.08 in) below the fusion line between the hard facing ar base material. The notch shall be perpendicular to the hard faced surface.	



Element Data Sho	eet EDS No. IH001 Rev. 01
Type of Special proce	ess: Hard facing by overlay welding
	Page 2 of 2
Heat treatment	Heat treatment after hard facing shall be carried out, as necessary, to meet specified properties. Components to be exposed to H2S containing environment shall be heat treated as required in ISO 15156 /NACE MR0175 or ISO 17945 /NACE MR0103, as applicable.
	Overlaying low alloy steels and martensitic stainless steels (13% Cr, 13% Cr 4% Ni) shall be followed by stress relieving at a minimum temperature of 620 °C (1 148 °F).
Non-destructive	Visual inspection
testing	VT shall be carried out on each 100 % of the weld overlay according to ASME <i>BPVC</i> , Sec. V, Article 9 or ISO 17637. The testing shall be performed after machining, if applicable, and non-machined surfaces shall be cleaned prior to the testing. Porosity, slag inclusions are not permitted on and within 50 mm (2 in) of sealing surfaces.
	Liquid penetrant testing
	All deposited surfaces shall, after final machining, be penetrant tested in accordance with ASME, Sec. V, Article 6 with acceptance criteria according to ASME <i>BPVC</i> VIII, Div. 1, Appendix 8, except on sealing surfaces where no indication is acceptable (actual sealing surface areas to be defined by purchaser).
Repair of defects	Repairs may be local or total when non-conforming conditions are found. Defects in excess of acceptance standard shall be removed by reducing weld overlay thickness and shall be repaired by re-welding.
	All excavations shall be dye penetrant inspected prior to the start of repair welding in order to confirm the complete removal of defects.
	Repair by re-welding shall be performed in accordance with a written procedure. The following information must be given in these procedures:
	Method of removing defects.
	Requirements related to the shape of the excavation.
	Inspection of repair prior to re-welding.
	Applicable welding procedure and qualification tests.
	<ul> <li>Inspection after welding.</li> </ul>



# Table B.3 — EDS IH002

Element Data Sho	eet EDS No. IH002	Rev. 01
Type of Special proce	ess: Hard facing by thermal spraying of tungsten carbide	
	Page 1 of 2	
Scope	This EDS specifies requirements for hard facing by thermal spraying of tungsten carbide of parts.	piping and valve
Process	General The hard facing shall be carried out using high velocity oxygen fuel (HVOF) or equivalent processing composition The coating shall be of cermet type based on tungsten carbide (WC) and a metallic binder. The bebased on Co and/or Ni which shall be alloyed with Cr or Cr and Mo. Pure Co or Ni binder accepted.  Coating thickness The coating thickness shall be in the range 0.15 mm to 0.25 mm (0.006 in to 0.01 in) after glapping, unless specified otherwise by the purchaser.  Surface preparation The components shall be cleaned for removal of oil by a cleaning agent (acetone or similar) blasting with aluminium oxide. The surface roughness before spraying shall be within the rai (160 μin to 320 μin) Ra. All edges shall be chamfered or rounded.  Balls shall be spherical within 0.05 mm (0.002 in).	The binder shall is are not rinding and before grit
	The components shall be at a temperature minimum 10 °C (50 °F) above dew point and be blasted in warm condition. Any oil, dust or particles shall be removed by suitable means before the component shall be coated immediately after grit blasting, while the component still is a above the dew point.  All thermal spraying shall be carried out under optimal conditions and accordance with estable qualified procedures to ensure that the coating on all areas fulfil the specified requirements. For valves all seating area shall be coated. For ball valves the complete spherical part of the coated. For gate valves all surfaces sliding against the seats during valve opening and closic coated.  Sealing  All coated surfaces shall be sealed when carbon or low alloy steel is the base material. If se type of sealer and testing requirements shall be agreed with the purchaser and be specified Finishing  All coated parts shall be ground and lapped to a mirror like finish and maximum roughness of (6 µin).	t a temperature  blished and  ball shall be  ng shall be  aler is used, the in the procedure.
Procedure qualification testing	General  The thermal spray procedure shall be supported by a qualification test and the following ess shall apply to each procedure:  - the type of equipment used;  - nozzle length;  - fuel and gas flow rate, ±5 %;  - spray distance, ±5 %;  - spray rate, ±5 %;  - grade of powder;  - powder supplier;  - sealer type (if used).  The procedure shall be re-qualified if any of the above is changed outside given allowable rather than the qualification test shall be made at test samples of sufficient size for extraction the requires specimens. Each procedure qualification shall be tested as specified in the following sections.	ange. red test
Procedure qualification testing	Bonding test The bonding strength shall be tested in accordance with ASTM C633 or ISO 4624. Not less of a type shall be tested. Acceptance criteria: minimum bond strength shall be 60 MPa (8.7 ksi).	



Element Data Sh	eet EDS No. IH002 Rev. 01
Type of Special proc	ess: Hard facing by thermal spraying of tungsten carbide
	Page 2 of 2
Procedure qualification testing (continued)	Bending test  Three coupons, with size 20 mm x 100 mm x minimum 1.5 mm shall be tested. The coupons shall be bent 90' over a mandrel with diameter 25 mm (1.0 in).
	Acceptance criteria: no spalling is acceptable. However, cracking in the coating and chipping on the edge of the test specimen is acceptable.
	<u>Hardness test</u> A minimum of 3 indentations shall be made on a cross section for metallographic examination.
	Acceptance criteria: The average hardness shall be minimum 1000HV0.3 with minimum single value not lower than 900HV0.3.
	Porosity test
	One piece shall be prepared for cross section metallographic examination. An area of minimum 1.0 mm <sup>2</sup> shall be examined.
	Acceptance criteria: the porosity shall be less than 1 % by area.
	Surface finish test
	The surface roughness of the finished component shall be tested.
	Acceptance criteria: The roughness value shall be Ra $\leq$ 0.15 $\mu$ m (6 $\mu$ in).
Production testing	Finished polished hard facing thickness and surface roughness of all parts shall be tested and shall fulfil the requirements specified above.
	Production testing shall be carried out on regular basis as minimum twice per week and on every new batch of powder or on changing grade of powder. The test shall be similar to a procedure qualification test and the applicable testing shall consist of hardness and porosity test according to the requirements stated above in the EDS.



# Table B.4 — EDS IH004

Element Data Sh	eet EDS No. IH004 Rev.	01
Type of Special proc	ess: Electroless Nickel Coating	
	Page 1 of 1	
Scope	This EDS specifies additional requirements to the referenced standard for hard facing for electroless nickel coating for valve trim components intended for severe service and wear applications.	l
Reference standard	ASTM B733 The coating shall comply with type V (10 % P), service condition SC4 and heat treatment Class 2.	
Process	General  Stabilizers used in the plating bath shall be basically organic stabilisers and shall be free of cadmium, bism and sulphur. Lead may be present but at a maximum concentration of 2 mg/kg (2 ppm by mass).  Peening shall not be applied.  Surface preparation  The support surface shall be prepared by abrasive blasting to SA 3. The roughness shall be:  For round shape surfaces: Rt ≤ 2 μm (79 min) and Ra ≤ 0.4 μm (16 min).  For other surfaces: Rt ≤ 60 μm (2360 min) and Ra ≤ 12.5 μm (490 min).	uth
Heat treatment	Heat treatment to Class 2 shall be applied in inert atmosphere.	
Production testing	Hardness test  The hardness of the plating shall be measured using the Knoop method in accordance with ASTM B578. Thardness shall be within the range of 800HK100 to 900HK100.  Adhesion tests  To ensure satisfactory adhesion of the coating a bend tests to ASTM B733 and B571 and an impact test to B733 shall be carried out.  Alloy composition  A chemical analysis shall be carried out to verify the composition of the coating. The phosphorus content slibe within 9 % to 11 % by mass balanced with nickel and maximum 0.05 % other elements.  Porosity  A ferroxyl test to B733 shall be carried out. The coating shall be free of pores, cracks or other throughthickness imperfections.	)
Test sampling	Sampling for non-destructive testing shall be carried out in accordance with ASTM B602, Table 1, Level I. Sampling for destructive testing shall be carried out in accordance with ASTM B602, Table 4. Test coupons of the base material plated simultaneously in the same bath may be used as an alternative to testing of actual article to comply with the required tests.	<b>o</b>
Non-destructive testing	Acceptance requirements for coating as applied to articles shall comply with ASTM B733 section 7. The sampling for testing shall as specified above.  Visual inspection  All components shall be examined. Coating shall be smooth, adherent and free from visible blisters, pits, nodules, porosity and other defects. Slight discoloration resulting from heat treatment shall not be cause for rejection.  Thickness  Plating thickness shall be checked by the magnetic method as described in ASTM B499 (this method is only suitable for use with magnetic substrates).	



# Table B.5 — EDS IH005

Element Data S	Sheet EDS No. IH005 Rev. 02
Type of Special proc	ess: Solid tungsten carbide material
	Page 1 of 1
Scope	This EDS specifies requirements for solid tungsten carbide for use in piping and valves parts.
Composition	The binder shall be of Co or Ni base.  Co base materials shall be alloyed with Cr and Ni or Cr, Ni and Mo to be corrosion resistant in well stream service.  Ni base materials shall be alloyed with Cr or Cr and Mo. Ceramic materials may be used subject to purchaser approval.
Process	The material shall be produced by sintering with a subsequent hot isostatic pressing (HIP) or produced by a combined sinter/HIP process.  The manufacturer shall establish detailed manufacturing procedure to ensure that the requirements of this EDS are satisfied. The manufacturing procedures shall include tolerances on all essential variables.
Production testing	Hardness test  The minimum hardness shall be 1600HV30, measured by the Vickers method according to ISO 6507-1.  Fracture toughness  The fracture toughness shall be minimum W = 9.5 MNm <sup>-3/2</sup> measured by the Palmqvist (Vickers indentation − crack length) method according to ISO 28079.  Metallographic examination  The WC grain size shall be of type "Fine" or smaller measured according to ISO 4499-2. The carbides shall be homogeneously distributed in the binder phase.  No eta-phase (h-phase) shall be present, and porosity/uncombined carbon levels shall be ≤ A02/B00/C00 in accordance with ISO 4499-4.
Extent of testing	Testing shall be performed on one sample per powder batch and HIP batch.
Non-destructive testing	Visual inspection  All components shall be examined and be free from visible porosity, cracks and other defects.  Liquid penetrant testing  Fluorescent penetrant testing shall be performed according to ISO 3452 or ASTM E165 on each component after final grinding/polishing to confirm that the material is free from any surface indication. 100 % of all accessible internal and external surfaces shall be examined.



# Table B.6 — EDS IO001

Element Data Sho	eet EDS No. IO001	Rev. 01
Type of Special proce	ess: Alloy 625 corrosion resistant overlay welding	
	Page 1 of 1	
Scope	This EDS specifies requirements for corrosion resistant overlay welding for piping and val	ve parts.
Welding	Welding process	
	Slag-forming welding processes are not permitted for overlay welding of sealing surfaces. A minimum of two layers of weld metal shall be deposited for all processes, while only one for the electro slag weld process.	e layer is acceptable
	Thickness of the overlay deposit for corrosion protection after final machining shall be min required on applicable design drawing.  Welding consumable	imum 3.0 mm or as
	The welding consumable for the weld overlay shall comply with UNS N06625.	
	Welders, operators qualification	
	The welder or welding operators shall be qualified to ASME BPVC IX, ISO 9606 or ISO 14	1732.
Procedure qualification testing	<u>General</u>	
	The welding procedures shall be qualified in accordance with ASME <i>BPVC</i> IX or ISO 156 follows. The weld qualification test shall be carried out on base material of same grade as production.	
	Qualification testing shall be carried out according to ASME BPVC IX or ISO 15614-7 and additional requirements.	the following
	Chemical composition  The weld overlay deposit shall comply with UNS N06625 with a maximum iron content of	10 % by mass
	measured at the minimum qualified thickness, unless a lower value of 5 % iron by mass is purchaser.	
	Hardness testing	
	Hardness testing shall be carried out on base material, heat affected zone and weld metal HV5 or HV10 shall be used. The examination of the HAZ shall be carried out with maximu distance between the indentations from fusion line, through HAZ into the unaffected base	m 0.5 mm (0.02 in)
	Testing of HAZ shall be carried out with maximum 0.5 mm (0.02 in) distance between the fusion line, through HAZ into unaffected base material. The hardness for HAZ and unaffected shall not exceed 350 HV.	
	When sour service is specified by the purchaser, the hardness of the weld overlay, HAZ a material shall not exceed the maximum values specified in ISO 15156 /NACE MR0175 or ISO 17945 /NACE MR0103. The hardness of finished machined overlay surface shall not Alloy 625.	
Heat treatment	Heat treatment after overlay welding shall be carried out, as necessary, to meet specified	properties
Non-destructive testing	Visual inspection	
	VT shall be carried out on each 100 % of the weld overlay according to ASME BPVC Sec. ISO 17637. The testing shall be performed after machining, if applicable, and non-machinic cleaned prior to the testing. Porosity, slag inclusions are not permitted on and within 50 mill surfaces.	ed surfaces shall be
	Liquid penetrant testing	
	All deposited surfaces shall, after final machining, be penetrant tested in accordance with Article 6 with acceptance criteria according to ASME <i>BPVC</i> VIII, Div. 1, Appendix 8, exception surfaces where no indication is acceptable.	
	<u>Thickness of weld overlay</u>	
	The weld overlay thickness shall be measured at minimum three locations for each components with complicated geometry the manufacturer shall establish a procedure for t	
Repair of defects	Repairs may be local or total when non-conforming conditions are found. Defects in excess standard shall be removed by reducing weld overlay thickness and shall be repaired by re	-welding.
	All excavations shall be dye penetrant inspected prior to the start of repair welding in orde complete removal of defects.	r to confirm the
	Repair by re-welding shall be performed in accordance with a written procedure. The followant be given in these procedures:	wing information
	Method of removing defects.  Providence and related to the phase of the properties.	
	Requirements related to the shape of the excavation.	
	I - Inspection of tenalt bilot to te-melana	
	<ul> <li>Inspection of repair prior to re-welding.</li> <li>Applicable welding procedure and qualification tests.</li> </ul>	

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