TATA STEEL

TATA

Conveyance & Pressure Product Family
Technical Document (Tata Steel Tubes - TST41)

Inflow and **Inline**, our new family of multi-certified HFI (High Frequency Induction) welded tubes; delivering a rationalised, simplified and convenient range of dedicated products, to satisfy the widest range of conveyance and pressure tube requirements.

Tata Steel is the UK's largest steel manufacturer with many decades of experience in the production of robust and reliable conveyance and pressure tube products.

By manufacturing to the widest range of aligned standards, even historic ones, we provide the ability to satisfy project specifications, and service different market requirements from a rationalised range.

This document (TST41:PDF:UK:03/2012) provides additional data to support the new product family offering, and is to be used in conjunction with the appropriate published **Inflow** and **Inline** technical product brochures, and applicable product test certificates.

Technical delivery conditions

Tata Steel Tubes new **Inflow** and **Inline** branded conveyance products satisfy all the technical delivery conditions of the primary product standard(s) contained in the product definition, except where otherwise stated at the discretion of Tata Steel.

Please reference Annex A of this document for full product definitions related to the new **Inflow** and **Inline** product offering.

In addition to primary product standard(s), the product definition(s) includes secondary product standards to which the product is also deemed generally equivalent.

For generally equivalent, we are stating that the product has equivalent performance to the secondary product standards with respect to mechanical properties, pressure rating, formability, weldability, and is inspected and tested to such equivalent standards at the discretion of Tata Steel.

Any technical differences are highlighted within the relevant section of this document.

The primary standard and key grade for each product offering is listed below, along with all other standards that each product is also fully compliant with.

Please reference next section of this document for details of seamless equivalents

Note: products marked # come with additional inspection/test requirements and these need to be specified at time of order.

Inflow CDC (235)
Primary standard and grade:
EN10217-1 P235 TR1
Also compliant with:
EN10219-1/2 S235JRH (Note: S275JOH for sizes ≥OD219.1mm)

Inflow Plus (235)
Primary standard and grade:
EN10217-2 P235GH TC1
(Including Boiler# and Low.Temp.# options).
Also compliant with:
EN10217-1 P235 TR1 and TR2

Inflow Plus (355)
Primary standard grade:
EN10217-3 P355NH TC1

Inline (265)
Primary standard grade:
EN10217-2 P265GH TC1
Also compliant with:
EN10217-1 P265 TR1and TR2
EN10208-1 L245GA
ISO3183 L245
API 5L Grade B (PSL1)
API 5L X42 (PSL1) ≥OD219.1mm only

Inline Plus (360)
Primary standard grade:
EN10208-2 L360NB
Also compliant with:
EN10217-3 P355 NH TC1
EN10208-2 L245GA
ISO3183 L360N (M ≥OD219.1mm)
API 5L X52N (PSL2) (M≥OD219.1mm)

Seamless equivalent

Inflow Plus (235/355), Inline (265) and **Inline Plus (360)** products are aligned with comparable seamless standards, and are therefore interchangeable, and an ideal substitution for comparable hot-finished carbon steel seamless products.

Delivering real benefit, and providing end users with the flexibility to service both welded and seamless market requirements from the same product stock.

The following products are aligned with the following seamless standards or product options:

Inflow CDC (235)
EN10216-1 P235 TR1

Inflow Plus (235)
EN10216-2 P235GH TC1
ASTM A106 Grade B
ASTM A53 Grade B
BS3601 Grade 360 min. tensile
BS3601 Grade 360 min. tensile
DIN1629 St37.0N
BS3059-2 360 min. tensile*
DIN1630 St37.4N*
DIN17175 St35.8N*
* Applicable to **Inflow Plus (235) Boiler** product only - to be specified at time of order.

Inflow Plus (355)
EN10216-3 P355NH TC1
DIN1629 St52.0N
DIN1630 St52.4N
DIN17179 WStE355

Inline (265)
EN10216-2 P265GH TC1
ASTM A106 Grade B
ASTM A106 Grade C
ASTM A53 Grade B
ISO3183 L245
EN10208-1 L245GA
API 5L Grade B PSL1

Inline Plus (360)
EN10208-2 L360NB
EN10216-3 P355NH TC1
ISO3183 L360N
EN10208-1 L360GA
API 5L X52 PSL2
DIN1629 St52.0N

Chemical composition

Chemical composition (ladle analysis, and product analysis, where applicable) shall conform to the primary product standard, unless otherwise stated.

For **Inline** and **Inline Plus** products, for sizes up to and including OD168.3mm, only one product analysis (one per cast) will be undertaken as standard.

A product analysis will continue to be carried out as standard and certified on all Hartlepool manufactured products, i.e. for sizes ≥OD219.1mm.

Mechanical properties

Mechanical properties shall conform to the primary product standard unless otherwise stated. The following exceptions apply:

For **Inflow CDC (235)** products, tensile strengths are in accordance with the structural grade certified (S235JRH for sizes ≤ OD193.7mm and S275JOH for sizes ≥OD219.1mm).

For **Inflow Plus (235)** products an enhanced minimum yield strength of 245N/mm^2 is supplied. For sizes OD219.1mm and above, supplied in the WLA (Weld Line Annealed) condition, the maximum tensile strength is 560N/mm^2.

For **Inline (265)** products uti OD193.7mm, an enhanced minimum yield strength of 275N/mm^2 (equivalent to ASTM A106 grade C) is supplied. For sizes ≥OD219.1mm, supplied in the WLA condition, an enhanced minimum yield strength of 290N/mm^2 (equivalent to API 5L grade X42) is supplied.

On sizes OD219.1mm and above the properties published are based on WLA products only, subsequent normalizing may influence mechanical properties.

Please contact one of our Account or Customer Technical Services Managers for further assistance.

Testing

Test methods shall be in accordance with those stated in the primary product standard or the latest EN ISO specifications, at the discretion of Tata Steel.

Except where the primary product standard specifies a specific type of yield strength measurement (EN 10208-2, ISO 3183 / API 5L), the certified yield strength (R_e) shall be either the upper yield (R_{eH}) or 0.5 % total elongation ($R_{t0.5}$), at the discretion of Tata Steel.

Charpy impact V-notch tests are not carried out on products with a nominal thickness below 6.0mm.

All Charpy impact test V-notch specimens shall be longitudinal body and tested at a temperature of –20°C.

For **Inline Plus (360)** products, where the nominal outside diameter exceeds Dmin = (T-5) + (756.25 / (T-5)) in accordance with EN 10208-2 clause 9.3.2.3 a. a transverse weld-line Charpy tests at 0°C may be requested at time of order.

Certain test restrictions may apply, Please contact one of our Account or Customer Technical Services Managers for further assistance.

The striker radius used in the Charpy test shall be 2mm in accordance with ISO 148-1, unless a different striker radius is agreed and stated on the inspection document.

Test unit sizes for the purposes of mechanical testing and inspection shall be in accordance with the primary product standard based on either specified numbers of tubes in the test unit or equivalent total metreage, at the discretion of Tata Steel.

For Weld Factor V=1.0, tube weld seams are 100% longitudinally ultrasonically tested to BS EN ISO 10893-11 U3 for longitudinal defects/imperfections.

Dimensions

Dimensional tolerances shall conform to the primary product standard unless otherwise stated.

For **Inline (265)** products, these shall be supplied with the tighter outside diameter tolerances in accordance with ISO3183 / API 5L specifications.

Leak tightness

For **Inflow CDC (235)** and **Inflow Plus (235)** products:, proof of leak tightness for Corby sizes (uti OD193.7mm) shall be by eddy current testing only, in accordance with EN ISO 10893-1, unless otherwise stated on the inspection document.

All **Inflow CDC (235)** and **Inflow Plus (235)** Hartlepool sizes (OD ≥ 219.1mm) shall be hydrotested as standard.

For **Inline (265)** products, proof of leak tightness for sizes uti OD114.3mm shall be by eddy current testing in accordance with EN ISO 10893-1 only.

Hydrotesting is carried out on all **Inline (265)** products ≥168.3mm OD.

Hydrotesting is carried out on all sizes of **Inline Plus (360)** products.

When hydrotesting applies, the minimum test pressure and hold time shall be based on that required by API 5L / ISO 3183 for **Inline (265)** and EN 10208-2 for **Inline Plus (360)**, except that sizes up to including OD168.3mm shall be limited to a maximum test pressure of 360 Bar.

Retrospective statement

Tata Steel Tubes previously supplied to the UK and Irish markets a triple certified pressure product to API-5L Grade B/EN10217-1 P265TR1/ISO3183.

This product has now been superseded by the **Inline (265)** product offering, delivering improved flexibility as a function of additional multi-certification.

These new additional multi-certified options can be retrospectively applied to the triple certified product previously supplied due to the process routes and testing methodologies adopted at the time of production meeting the criteria of the new branded product.

All previously supplied triple certified pressure products satisfy the new **Inline (265)** requirements.

Specific customer statements

Please reference Annex B of this document that provides details of any specific customer statements to support any additional customer requirements, applicable to the new product family offering.

For customers wishing to have specific statements, or reference to a customer's own technical specification added to this document.

Please contact one of our Account or Customer Technical Services Managers for further assistance.

Bending radii

Inflow and **Inline** products are suitable for bending, as long as bending is carried out in accordance with best practice, using suitable equipment and formers etc.

When bending material greater than 355MPa or sizes ≥OD219.1mm, the weld seam must be located along the neutral axis of the bend.

For cold bending the minimum bending radii = 5D (5x tube outside diameter), for hot bending the minimum bending radii = 3D (3x tube outside diameter).

Galvanised tubes cannot be hot bent without damaging the coating.

For galvanised material we recommend cold bending, with a minimum bending radii = 8D (8x tube outside diameter).

Any damage during bending to galvanised coatings shall be repaired to ensure that service life is not compromised (reference EN ISO 1461).

Bevelled ends

For products supplied with bevelled ends, the angle of bevel is 30 degrees +5-0 degrees, and the root face is 1.6mm +/-0.8mm, unless otherwise stated on the inspection document.

Additional information

For any additional product information, please contact one of our Account or Customer Technical Services managers for assistance.

Document control

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Annex A: Product descriptions

The following product descriptions are as will be shown on order acknowledgement and test certificates. Additional product information, showing the full specifications covered, is also provided in the appropriate product technical brochure.

Inflow CDC (235) - Cold Dual Cert
INFLOW CDC 235 HFI WELDED COLD FORMED TUBE TO EN 10217-1:2002+A1:2005 P235TR1 & EN 10219:2006 S235JRH. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. IF TESTED MATERIAL AMBIENT PROPERTIES PED 97/23/EC ANNEX I SECTION 7.5 ARE GUARANTEED.

Inflow Plus (235)
(Sizes ≤OD193.7mm)
INFLOW PLUS 235 HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360, DIN1626 ST37.0N & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN. AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inflow Plus (235)
(Sizes ≥OD219.1mm)
INFLOW PLUS 235 HFI WELDED WLA TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360, DIN1626 ST37.0N/G & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T≥6.0MM LONG.BODY CHARPY MIN. AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inflow Plus (235) Boiler
(To be specified at time of order)
(Sizes ≤OD193.7mm)
INFLOW PLUS 235 BOILER HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360, DIN1626 ST37.0N, DIN1628/30 ST37.4N & DIN17175/7 ST35.8N/ST37.8N & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN. AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inflow Plus (235) Boiler
(To be specified at time of order)
(Sizes ≥OD219.1mm)
INFLOW PLUS 235 BOILER HFI WELDED WLA TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360, DIN1626 ST37.0N/G, DIN1628/30 ST37.4N/G & DIN17175/7 ST35.8N/ST37.8N & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T≥6.0MM LONG.BODY CHARPY MIN. AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inflow Plus (235) Low.Temp.
(To be specified at time of order)
(Sizes ≤OD193.7mm)
INFLOW PLUS 235 LOW.TEMP. HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360 & DIN1626 ST37.0N & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. LONG.BODY CHARPY IMPACT PROPERTIES 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -40 DEG C GUARANTEED WITHOUT VERIFICATION.

Inflow Plus (235) Low.Temp.
(To be specified at time of order)
(Sizes ≥OD219.1mm)
INFLOW PLUS 235 LOW.TEMP. HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P235GH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B/A53-B, BS3059-2/3601&2-360 & DIN1626 ST37.0N/G & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. LONG.BODY CHARPY IMPACT PROPERTIES 27J AT REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -40 DEG C GUARANTEED WITHOUT VERIFICATION.

Inflow Plus (355)
(Sizes ≤OD193.7mm)
INFLOW PLUS 355 HFI WELDED NORMALISED TUBE TO EN 10217-3:2002+A1:2005 P355NH TC1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO DIN1626 ST52.0N, DIN1628 ST52.4N & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN. AV 40J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inflow Plus (355)
(Sizes ≥OD219.1mm)
INFLOW PLUS 355 HFI WELDED WLA TUBE TO EN10217-3:2002+A1:2005 P355NH TC1, PED97/23/EC & AD2000-W4. EQUIVALENT TO DIN 1626 ST52.0N/G, DIN1628 ST52.4N/G, DIN1629 ST52.0N, DIN1630 ST52.4 & OTHERS. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T≥6.0MM LONG.BODY CHARPY MIN. AV 40J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inline (265)
EC test in lieu of hydrotest
(Sizes ≤OD114.3mm)
INLINE 265 HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P265GH TC1, PED97/23/EC & AD2000-W4, EN10208-1:2009 L245GA & ISO3183:2007 L245/API 5L 44TH.ED GRADE B PSL1 EXCEPT EDDY CURRENT TEST IN LIEU OF HYDROTEST. GENERALLY EQUIVALENT TO ASTM A106-B&C/A53-B & OTHERS. REF TST41:PDF:UK 03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN.AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inline (265)
Hydrotest as standard
(Sizes OD168.3mm)
INLINE 265 HFI WELDED NORMALISED TUBE TO EN10217-2:2002+A1:2005 P265GH TC1, PED97/23/EC & AD2000-W4, EN10208-1:2009 L245GA & ISO3183:2007 L245/API 5L 44TH.ED GRADE B PSL1. GENERALLY EQUIVALENT TO ASTM A106-B&C/A53-B & OTHERS. REF TST41:PDF:UK 03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN.AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inline (265)
(Sizes ≥OD219.1mm)
INLINE 265 HFI WELDED WLA TUBE TO EN10217-2:2002+A1:2005 P265GH TC1 & ISO 3183:2007 L245/API 5L 44TH.ED GRADE B/X42 PSL1, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO ASTM A106-B&C/A53-B & EN10208-1 L245GA. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. LONG.BODY CHARPY ≥6.0MM MIN. AV 27J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inline Plus (360)
(Sizes ≤OD193.7mm)
INLINE PLUS 360 HFI WELDED NORMALISED TUBE TO EN10208-2:2009 L360NB & EN10217-3:2002+A1:2005 GRADE P355NH TC1, PED97/23/EC & AD2000-W4, ISO3183:2007 L360N/API 5L 44TH.ED X52N PSL2. GENERALLY EQUIVALENT TO DIN 1626 ST52.0N. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. FOR T ≥ 6.0MM LONG.BODY CHARPY MIN. AV 60J REDUCED PRO-RATA WITH SPECIMEN WIDTH AT -20 DEG C.

Inline Plus (360)
(Sizes ≥OD219.1mm)
INLINE PLUS 360 HFI WELDED WLA TUBE TO EN10208-2:2009 L360MB EXCLUDING WELD CHARPY, & EN10217-3:2002+A1:2005 GRADE P355NH TC1/ISO3183:2007 L360M/API 5L 44TH.ED X52M PSL2, PED97/23/EC & AD2000-W4. GENERALLY EQUIVALENT TO DIN 1626 ST52.0G. REF TST41:PDF:UK:03/2012. WELD FACTOR V=1.0. CHARPY AT 0 & -20 DEG C.

Annex B: Customer statements

No statements listed at this time.

Annex C: References

EN10255	Non-alloy steel tubes suitable for welding and threading — Technical delivery conditions
EN10217-1	Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties
EN10219-1/2	Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 1: Tech delivery conditions; Part 2: Tolerances, dimensions and sectional properties
EN10217-2	Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties
EN10217-3	Welded steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes
EN10208-1	Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 1: Pipes of requirement class A
EN10208-2	Steel pipes for pipelines for combustible fluids - Technical delivery conditions - Part 2: Pipes of requirement class B
ISO3183	Petroleum and natural gas industries - Steel pipe for pipeline transportation systems
API5L	Specification for Line Pipe - ANSI/API Specification 5L – 44th Edition, Oct 1, 2007
ASTM A106	Standard specification for - Seamless carbon steel pipe for high-temperature service
ASTM A53	Standard specification for - Pipe, steel, black and hot-dipped, zinc-coated, welded and seamless
EN10216-1	Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 1: Non-alloy and alloy steel tubes with specified room temperature properties
EN10216-2	Seamless steel tubes for pressure purposes - Technical delivery conditions - Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties
EN10216-3	Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 3: Alloy fine grain steel tubes
BS3059-2	Steel boiler and super heater tubes - Part 2. Specification for carbon, alloy and austenitic stainless steel tubes with specified elevated temperature properties
BS3601	Specification for carbon steel pipes and tubes with specified room temperature properties for pressure purposes
BS3602	Steel pipes & tubes for pressure purposes - Carbon & carbon manganese steel with specified elevated temp. props. - Part 1: Spec. for seamless & electric resistance welded
DIN 1626	Welded circular tubes of non-alloy steels with special quality requirements - Technical delivery conditions
DIN 1628	Welded circular tubes of non-alloy steels with very high quality requirements - Technical delivery conditions
DIN 1629	Seamless circular tubes of non-alloy steels with special quality requirements - Technical delivery conditions
DIN 1630	Seamless circular tubes of non-alloy steels with very high quality requirements - Technical delivery conditions
DIN 17175	Seamless tubes of heat resisting steels
DIN17177	Electric pressure (resistance or induction) welded steel tubes for elevated temperature service - Technical delivery conditions
DIN 17178	Welded circular tubes of fine grain steels with special quality requirements - Technical delivery conditions
DIN 17179	Seamless circular tubes of fine grain steels with special quality requirements - Technical delivery conditions
PED	Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment
AD 2000	Merkblatt W 4 Materials for pressure vessels, piping and accessories - Tubes made from non-alloy and alloy steels

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