



Characteristics

Grade 253 MA® combines excellent service properties at high temperatures with ease of fabrication. It provides superior service to Grade 310. The inclusion of high silicon, nitrogen and cerium contents gives the steel good oxide stability, high elevated temperature strength and excellent resistance to sigma phase precipitation. Optimal performance is achieved at 850-1100°C, and the scaling temperature is 1150°C. Its specific characteristics are:

- Austenitic micro structure
- High mechanical strength at elevated temperatures
- Low sensitivity to form sigma phase
- High resistance to:
 - oxidation
 - high temperature corrosion
 - creep
- Good ductility and weldability

Dimensions

Tubular products in grade 253 MA® are not stock standard, but can be manufactured in most common sizes within Outokumpu Stainless Tubular Products product range.

Tubes, Pipes and Butt Weld Fittings

- OD: 17.2-1219.0 mm
- WT: 1.5-25.4 mm
- Lengths: up to 12 m

Heat exchanger tubes

- OD: 12.0-114.3 mm
- WT: 0.6-4.0 mm
- Lengths: up to 15 m

Executions

Tubes, Pipes and Butt Weld Fittings

- Welded with- or without filler metal
- Unannealed, pickled
- Solution annealed and pickled
- With- or without BCW (Bead Cold Worked)
- Bevelled ends according to standards

Heat exchanger tubes

- No BCW for laser welded tubes, h max = 0.15 mm
- Tig welded tubes are BCW
- Solution annealed and pickled

Heat and corrosion resistance

A common feature of Outokumpu high temperature steels is that they are designed primarily for use at temperatures exceeding ~550°C, i.e. in the temperature range where creep strength as a rule is the dimensioning factor and where HT corrosion occurs. Optimising steels for high temperatures has meant that their resistance to wet corrosion has been limited.

For more details about 253 MA® please see Outokumpu Datasheet 1011 EN-GB:4 "High Temperature Austenitic Stainless Steel". Also see Outokumpu Corrosion Handbook for more information.

Product standards

Europe

- EN 10296-2 Welded SS tubes for general purposes

USA

- ASTM A 249 Welded Austenitic SS Heat Exchanger Tubes
- ASTM A 312 Welded and seamless Austenitic SS Pipes
- ASTM A 358 EF Welded Austenitic Pipe with filler metal
- ASTM A 409 Large Diameter Welded Pipes

Pressure vessel approvals

Europe

No approvals for welded tubes as present.

Outside Europe

Pressure vessel regulations are authorized to ASME. ASME Section VIII, Division 1, Table UHA-23, shows design values for tube and pipe manufactured and tested according to ASME SA-249, SA-312 and SA-358 respectively. Creep strength values for 253 MA® are shown in the table on next page.

Fabrication

Welding

Common welding methods for tubular products are:

- MMA, SMAW (Shielded Metal Arc Welding)
- TIG, GTAW (Gas Tungsten Arc Welding)
- MIG, MAG, GMAW (Gas Metal Arc Welding)
- FCAW (Flux-Cored Arc Welding)
- PAW (Plasma Arc Welding)
- SAW (Submerged Arc Welding)

General filler recommendation for steel grade 253 MA® can be found in the table below. Welding without filler metal not followed by post weld heat treatment, will reduce the corrosion resistance of the weld, and is therefore not recommended. The base of the shielding and welding gases should consist of pure Ar with additions of 2-3 % Hydrogen, in order to get optimal penetration and corrosion resistance.

Cold forming

Excellent cold forming properties. The same properties as for other standard austenitic stainless steels.

Heat treatment

Normal annealing temperature is 1020-1100°C followed by rapid cooling.

Applications

Heat exchanger tubes and pipes in processes for:

- Exhaust system
- Furnace rolls
- Furnaces for drying
- Heat recovery, carbon black
- Hydrocarbon gases, painting
- Flue gas and synthetic graphite
- Production of Aluminium Sulphate
- Production of mineral wool
- Pyrometer
- Recuperators
- Waste combustion
- Waste incineration

Design

The creep strength is much higher than those for similar high temperature austenitic steels. This means that the possibility of designing thinner walls can save costs in material, transport, welding and maintenance.

General filler recommendation for High temperature austenitic stainless steel

Outokumpu	EN	ASTM / UNS	Welding consumables	
			Covered electrodes ISO 3581 / ISO 14172	Wires ISO 14343 / ISO 18274
4948	1.4948	304H	19 9	308
153 MA™	1.4818	S30415	21 10 N or 253 MA-NF*	21 10 N
4833	1.4833	309S	22 12 or 253 MA-NF*	21 10 N
253 MA®	1.4835	S30815	21 10 N or 253 MA-NF*	21 10 N
4845	1.4845	310S	25 20 or 21 10N	25 20

* Avesta Welding designation

Chemical composition, %

Grade	C	Cr	Ni	Si	N	Ce
253 MA®	0.05-0.10	20.0-22.0	10.0-12.0	1.4-2.0	0.14-0.20	0.03-0.08
EN 1.4835	0.05-0.12	20.0-22.0	10.0-12.0	1.4-2.5	0.12-0.20	0.03-0.08
UNS S30815	0.05-0.10	20.0-22.0	10.0-12.0	1.4-2.0	0.14-0.20	0.03-0.08

Design

Temp. °C	EN 10095					
	min R _{p1.0} MPa	R _m MPa	R _{km 10 000} MPa	Rk _{m 100 000} MPa	R _{A1 10 000} MPa	R _{A1 100 000} MPa
50	315	630	-	-	-	-
100	265	585	-	-	-	-
200	215	545	-	-	-	-
300	200	535	-	-	-	-
400	190	530	-	-	-	-
500	180	495	-	-	-	-
550	175	470	250	160	230	150
600	170	445	157	88	126	80
650	162	400	98	55	74	45
700	155	360	63	35	45	26
750	-	-	41	22	28	16
800	-	-	27	15	19	11
850	-	-	18	11	14	8
900	-	-	13	8	10	6
950	-	-	9.5	5.5	7	4.5
1000	-	-	7	4	5	3
1050	-	-	5.5	3	3.5	2
1100	-	-	4	2.3	2.5	1.2

Mechanical properties

At 20°C	EN 1.4835	ASTM/UNS S30815
min R _{p0.2} (MPa)	310	310
min R _{p1.0} (MPa)	350	-
min R _m (MPa)	650	600
Elongation A ₅ %	40	35
Hardness HB _{max}	210	RB 95

Physical properties

	Temperature°C	20	600	800	1000
Density	kg/dm	7.8			
Modulus of elasticity	Gpa	200	155	135	120
Linear expansion	(20-t)x10 ⁻⁶ /°C		18.5	19.0	19.5
Thermal conductivity	W/m,°C	15.0	22.5	25.5	29.0
Thermal capacity	J/kg,°C	500	600	630	660
Electric resistivity	nΩm	0.85	1.37	1.43	1.45

Outokumpu is a global leader in stainless steel with the vision to be the undisputed number one. Customers in a wide range of industries use our stainless steel and services worldwide. Being fully recyclable, maintenance-free, as well as very strong and durable material, stainless steel is one of the key building blocks for sustainable future.

What makes Outokumpu special is total customer focus – all the way, from R&D to delivery. You have the idea. We offer world-class stainless steel, technical know-how and support. We activate your ideas.

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