outokumpu
high performance stainless steel

Dura
High hardness

Heat treatable for greater hardness and strength

Outokumpu Dura range datasheet

General characteristics and properties

The Dura range contains high hardness martensitic and precipitation hardening (PH) stainless steels.

Martensitic stainless steels are basically Fe-Cr alloys with higher carbon content than ferritics, which enables them to harden on cooling in air, oil, or water. Depending on the product and intended use, ductility is improved by tempering. Precipitation hardening products have a higher alloy content than martensitic stainless steels. They contain nickel and, in order to achieve hardening by aging, additions of copper, aluminum, titanium, niobium, and molybdenum. Depending on the chemical composition, their microstructure after final heat treatment is austenitic, semiaustenitic, or martensitic.

Outokumpu is supplying these products usually in solution annealed condition. Depending on the application a variety of grades are available as to obtain the optimum combination of hardness, toughness and corrosion resistance after final heat treatment of the fabricated component.

Dura range products are used for applications like high-quality knives, scalpels, and aircraft landing gear.

Chemical composition

Table 1

Dura

Heat treatable steels for greater hardness and strength.

Outokumpu Pro family

Steel designations				Performance		Typical chemical composition, % by mass					
		ASTM			Grade family						
Outokumpu name	EN	Type	UNS	HRC [1]		C	Cr	Ni	Mo	N	Others
Dura 420/4021	1.4021	420	S42000	44 – 50 [2]	M	0.20	13.0	–	–	–	–
Dura 420/4028	1.4028	420	S42000	45 – 51 [2]	M	0.30	12.5	–	–	–	–
Dura 420/4031	1.4031	420	S42000	47 – 53 [2]	M	0.38	13.5	–	–	–	–
Dura 420/4034	1.4034	420	S42000	49 – 55 [2]	M	0.45	13.7	–	–	–	–
Dura 410/4006	1.4006	410	S41000	–	M	0.12	12.0	–	–	–	–
Dura 4024	1.4024	–	–	–	M	0.16	13.2	–	–	–	–
Dura 4120	1.4120	–	–	49	M	0.21	13.3	–	1.0	–	–
Dura 4419	–	–	–	46 – 52 [2]	M	0.38	13.3	–	0.9	–	–
Dura 4122	1.4122	–	–	47 – 53 [2]	M	0.41	16.1	–	1.0	–	–
Dura 4110	1.4110	–	–	50 – 56 [2]	M	0.5	14.8	–	0.6	–	–
Dura 4116	1.4116	–	–	–	M	0.5	14.4	–	0.6	–	V
Precipitation hardening											
Dura 17-7PH	1.4568	631	S17700	38 – 41 [3]	PH	0.08	17.0	7.0	–	–	Al

Grade family: M = martensitic, PH = precipitation hardening. [1] Achievable Rockwell hardness after final heat treatment of the fabricated part. [2] Hardness range according to EN 10088-2. [3] Hardness range according to ASTM A564 (minimum values for different heat treatment conditions).

Products

Table 2

Outokumpu name	Typical applications	Product forms
Dura 420/4021 (EN 1.4021/UNS S42000) The most common martensitic stainless steel with medium-hardness that is corrosion resistant in fresh water and steam.	• Professional kitchen knives and cutting utensils • Surgical instruments • Press plates • Brake discs • Measuring tools • Wear-resistant mechanical parts • Flanges • Values	• Cold rolled coil and sheet • Hot rolled coil and sheet • Semi-finished
Dura 420/4028 (EN 1.4028/UNS S42000) A martensitic stainless steel with medium-hardness that is corrosion resistant in fresh water and steam.		• Cold rolled coil and sheet • Hot rolled coil and sheet • Semi-finished
Dura 420/4031 (EN 1.4031/UNS S42000) A martensitic stainless steel with medium-high hardness that is corrosion resistant in fresh water and steam.		• Cold rolled coil and sheet • Hot rolled coil and sheet • Semi-finished
Dura 420/4034 (EN 1.4034/UNS S42000) A high-hardness martensitic stainless steel that is corrosion resistant in fresh water and steam.		• Cold rolled coil and sheet • Hot rolled coil and sheet • Semi-finished
Dura 410/4006 (EN 1.4006/UNS S41000) A martensitic stainless steel that is corrosion resistant in fresh water and steam. Mainly supplied as plate or long product for mechanical engineering applications.	• Valves • Flanges • Axles • Pump parts • Brake discs • Press plates	• Cold rolled coil and sheet • Hot rolled coil and sheet • Plate • Semi-finished
Dura 4024 (EN 1.4024/UNS –) A martensitic stainless steel with slightly better hardenability than Dura 410/4006 that is corrosion resistant in fresh water and steam.	• Mechanical engineering applications • Surgical instruments	• Cold rolled coil and sheet • Hot rolled coil and sheet
Dura 4120 (EN 1.4120/UNS –) Similar to Dura 420/4021 but with improved corrosion resistance and high-temperature strength.	• Press plates • Mechanical parts such as shafts • Water and steam turbine blades • Beater blades (especially in the paper industry)	• Cold rolled coil and sheet • Hot rolled coil and sheet
Dura 4419 (EN –/UNS –) Similar to Dura 420/4028, but with improved corrosion resistance and high-temperature strength.	• Mechanical engineering applications	• Cold rolled coil and sheet • Hot rolled coil and sheet • Precision strip
Dura 4122 (EN 1.4122/UNS –) Outokumpu's most corrosion-resistant martensitic stainless steel. Good resistance in moderately corrosive, low-chloride environments and very good mechanical properties and wear resistance. Medium-high hardness.	• Surgical instruments • Food processing equipment • Mechanical parts • Machine and pump construction	• Cold rolled coil and sheet • Hot rolled coil and sheet • Semi-finished
Dura 4110 (EN 1.4110/UNS –) A high-hardness martensitic stainless steel with improved corrosion and wear resistance compared to Dura 420/4034.	• Knife blades • Scissors • Surgical cutting tools • Measuring tools • Pump construction • Valves	• Cold rolled coil and sheet • Hot rolled coil and sheet
Dura 4116 (EN 1.4116/UNS –) Similar to Dura 4110 but with elevated wear resistance.		• Cold rolled coil and sheet • Hot rolled coil and sheet
Dura 17-7PH (EN 1.4568/UNS S17700) A precipitation hardening stainless steel with high strength and hardness, good corrosion resistance, and satisfactory formability (depending on heat treatment/condition).	• Retaining rings • Springs • Valves and flanges • Gears • Aircraft parts	• Cold rolled coil and sheet • Semi-finished

Performance

Product performance comparison

Table 3

Outokumpu name	Steel designations			Product performance [1]			
	EN	ASTM		Hardness	Toughness	Wear resistance	Corrosion resistance
		Type	UNS				
Dura 420/4021	1.4021	420	S42000	★★	★★	★★	★★
Dura 420/4028	1.4028	420	S42000	★★★	★★	★★★	★★
Dura 420/4031	1.4031	420	S42000	★★★	★★	★★★	★
Dura 420/4034	1.4034	420	S42000	★★★★	★★	★★★★	★
Dura 410/4006	1.4006	410	S41000	★★	★★★	★★	★★
Dura 4024	1.4024	–	–	★★	★★★	★★	★★
Dura 4120	1.4120	–	–	★★	★★★	★★	★★★
Dura 4419	–	–	–	★★★	★★	★★★	★★★
Dura 4122	1.4122	–	–	★★★	★★	★★★★	★★★★
Dura 4110	1.4110	–	–	★★★★	★★	★★★★	★★
Dura 4116	1.4116	–	–	★★★★★	★★	★★★★★	★★
Precipitation hardening							
Dura 17-7PH	1.4568	631	S17700	★	★★★★★	★	★★★★★

[1] Indication of relative performance characteristics after heat treatment typically used for each grade.

Corrosion resistance

Corrosion resistance of Dura range martensitic stainless steels

In general, the corrosion resistance of martensitic stainless steels varies considerably depending on chemical composition, surface finish, and especially heat treatment. Smooth polished surfaces experience higher resistance than rougher finishes. In terms of heat treatment, the hardened condition is more favorable. Tempering may lead to carbide precipitation, which impairs corrosion resistance.

Precipitation hardening stainless steels have higher corrosion resistance than heat-treatable martensitic stainless steels.

Physical properties

In Tables 4–5 physical properties are given for Dura range grades.

Metric values

Table 4

Outokumpu name	Density [kg/dm³]	Modulus of elasticity at 20 °C [GPa]	Coefficient of thermal expansion 20–100 °C [10⁻⁶/K]	Thermal conductivity at 20 °C [W/(m*K)]	Thermal capacity at 20 °C [J/(kg*K)]	Electrical resistivity at 20 °C [Ω*mm²/m]
Dura 420/4021	7.7	215	10.5	30	460	0.60
Dura 420/4028	7.7	215	10.5	30	460	0.65
Dura 420/4031	7.7	215	10.5	30	460	0.55
Dura 420/4034	7.7	215	10.5	30	460	0.55
Dura 410/4006	7.7	215	10.5	30	460	0.60
Dura 4024	7.7	215	10.5	30	460	0.60
Dura 4120	7.7	215	10.5	30	460	0.65
Dura 4419	7.7	215	10.5	30	460	0.65
Dura 4122	7.7	215	10.4	15	430	0.80
Dura 4110	7.7	215	10.5	30	460	0.65
Dura 4116	7.7	215	10.5	30	460	0.65
Precipitation hardening						
Dura 17-7PH	7.8	200	13.0	16	500	0.80

Imperial values

Table 5

Outokumpu name	Density [lbm/in³]	Modulus of elasticity [psi]	Coefficient of thermal expansion 68–212 °F [µin / (in x °F)]	Thermal conductivity [BTU/(hr x ft x °F)]	Thermal capacity [BTU/(lbm x °F)]	Electrical resistivity [µΩ x in]
Dura 420/4021	0.278	31 x 10^6	5.8	17.3	0.110	23.62
Dura 420/4028	0.278	31 x 10^6	5.8	17.3	0.110	25.59
Dura 420/4031	0.278	31 x 10^6	5.8	17.3	0.110	21.65
Dura 420/4034	0.278	31 x 10^6	5.8	17.3	0.110	21.65
Dura 410/4006	0.278	31 x 10^6	5.8	17.3	0.110	23.62
Dura 4024	0.278	31 x 10^6	5.8	17.3	0.110	23.62
Dura 4120	0.278	31 x 10^6	5.8	17.3	0.110	25.59
Dura 4419	0.278	31 x 10^6	5.8	17.3	0.110	25.59
Dura 4122	0.278	31 x 10^6	5.8	8.7	0.103	31.50
Dura 4110	0.278	31 x 10^6	5.8	17.3	0.110	25.59
Dura 4116	0.278	31 x 10^6	5.8	17.3	0.110	25.59
Precipitation hardening						
Dura 17-7PH	0.282	29 x 10^6	7.2	9.2	0.119	31.50

Fabrication

Martensitic and precipitation hardening stainless steels are heat treatable and can therefore provide a wide range of different hardnesses and strengths. For workability purposes they are supplied in a solution-annealed condition. The downstream manufacturer performs final heat treatment to achieve the required mechanical properties.

Note: Aging will cause slight dimensional changes.

Welding

Traditional martensitic steels with carbon content greater than 0.20% are difficult to weld and assistance is advised. The hardenable high-carbon grades are not suitable for welding.

If thinner gauges of martensitic steel are occasionally welded, the use of low-hydrogen methods (MAG or TIG) is preferred to avoid cold cracking. Any electrodes used must be of the basic type. Martensitic steels must be preheated to temperatures above MS (typically 250–400 °C/480–750 °F). The interpass temperature should be in the same range, and heat input should not be too high or too low (0.5–1.5 kJ/mm).

Austenitic fillers are the most commonly used. This avoids the need for the post-weld heat treatment necessary when compositionally matched filler is used. Much depends on the composition of the steel and the degree of restraint employed. When there is no preheating, post-weld heat treatment is necessary; however, it may be possible to weld very thin gauges without preheating.

Welding of precipitation hardened grades is possible, but some limitations might have to be taken into account depending on the grade.

Outokumpu assists users and fabricators in the selection, qualification, installation, operation, and maintenance of Dura range products. Technical personnel, supported by our research laboratory, can draw on years of field experience with Dura range products to help you choose the most appropriate materials for your specific application.

Contact us at **outokumpu.com/contacts** for more information.

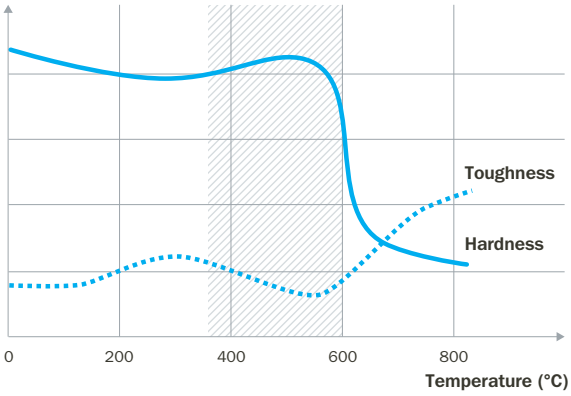

Fig. 1. Heat treatment of Dura martensitic grades: solution annealing + quenching (+ tempering) – possibilities to influence the property profile.

Products and dimensions

To find the minimum and maximum thickness and width by surface finish for a specific product in the Dura range, please visit **steelfinder.outokumpu.com**

Standards, specifications and approvals

For a list of international standards by product, see **steelfinder.outokumpu.com**

For a list of certificates and approvals by mill, see **outokumpu.com/certificates**

Own notes

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Working towards a world that lasts forever

We work with our customers and partners to create long lasting solutions for the tools of modern life and the world's most critical problems: clean energy, clean water, and efficient infrastructure. Because we believe in a world that lasts forever.

outokumpu classic			outokumpu pro					
Moda	Core	Supra	Forta	Ultra	Dura	Therma	Prodec	Deco
Mildly corrosive environments	Corrosive environments	Highly corrosive environments	Duplex & other high strength	Extremely corrosive environments	High hardness	High service temperatures	Improved machinability	Special surfaces

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