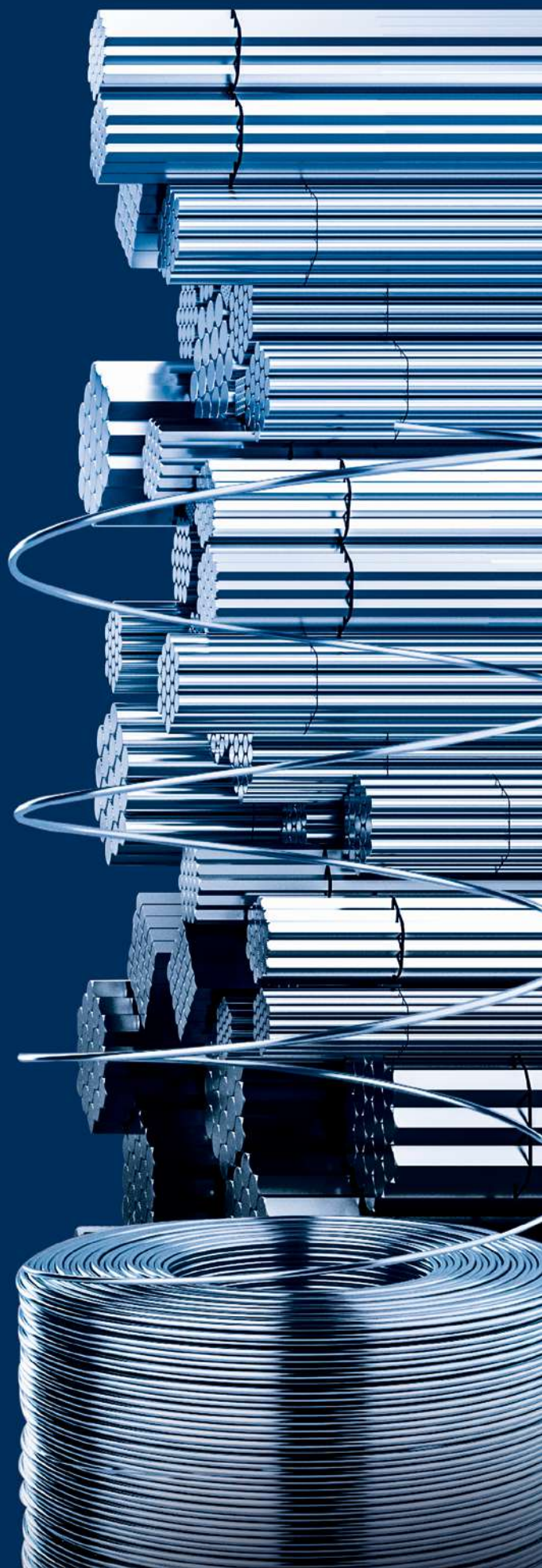
EN

STAINLESS STEEL SOLUTIONS FULL BOOK



Rodacciai®

STAINLESS STEEL SOLUTIONS FULL BOOK

Rodacciai®

BARS

HMP

WIRE

REBAR

WELDING

COMPANY PROFILE

ALMOST 70 YEARS OF EXPERIENCE IN STEEL BUSINESS

Today the Rodasteel Group is an international leader in the production and processing of steel.
Our production and sales locations on three continents (Europe, Asia and America) provide Rodasteel with a widespread sales network to distribute finished products in stainless steels, alloy steels and carbon steels all over the world. The secret of this success is based on an extensive and diversified range of high quality products, on paying attention to the customers, on the ability to innovate continuously and on the experience of Rodasteel people, who know how to identify upcoming market shifts and opportunities.

1956
Foundation of Trafileria Roda &. C. by Giuseppe Roda

1960
Introduction of lead alloy steel processing, considered to be the best in the world

1971
Construction of the new plant in Bosisio Parini

1981
Construction of the Sirone plant, with the rolling mill

1984
Trafileria Roda & C becomes Roda Acciai company

Rodacciai was born in Pusiano (Como) in 1956, when Trafileria Roda & C. was founded by the charismatic and innovative entrepreneur Giuseppe Roda.
Started as a small local company for steel bar cold drawing, in 1960 Trafileria Roda & C. embarked on a path of production verticalisation along the steel processing chain. Thanks to the installation of a hot-working plant, the company expanded its original offer beyond semi-finished cold pressed products, becoming, during the years, an international group in the steel processing sector.
The group is made by two companies: Rodacciai S.p.A. (Italy) and Aceros Inoxidables Olarra S.A. (Spain).
Trasparency, integrity and passion are the main values for the entire group, based on them every decision and action are taken. These principles drive all Rodasteel activities and are the basis of the group's Code of Ethics.

1994

Acquisition of the company Olarra Aceros Inodixables

1995-2005

Expansion of the commercial network in Europe and acquisition of smaller companies

2007-2016

Investments for production expansion

2024

Today, Rodasteel Group is a benchmark in the steel production and processing sector

8 covered nations

27 distribution centres

EUROPE

Rodacciai
Country: Italy
N° of distribution centres: 6
Cities: Bosisio Parini, Torino, Bergamo,Brescia, Padova, Bologna

Rodastahl
Country: Germany
N° of distribution centres: 3
Cities: Deisslingen, Hagen, Oelsnitz

Rodastal PL
Country: Poland
N° of distribution centres: 1
City: Gliwice

Rodacciai S L
Country: Spain
N° of distribution centres: 1
City: Barcelona

BİMEKS ÇELİK
Country: Turkey
N° of distribution centres: 3
Cities: Istanbul, Ankara, Izmir

Euroda Aciers
Country: France
N° of distribution centres: 2
Cities: Cluses, Chasse sur Rhône

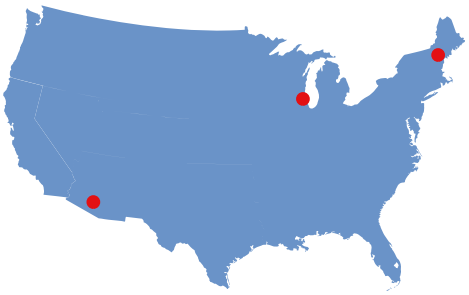
CESI
Country: Italy
N° of distribution centres: 1
City: Piacenza

ALIPER
Country: Italy
N° of distribution centres: 1
City: San Giuliano Milanese

ISM
Country: Germany
N° of distribution centres: 3
Cities: Mulhem, Vaihingen, Francoforte

OLARRA
Country: Spain
N° of distribution centres: 1
City: Bilbao

USA



OLARRA - Italia
Country: Italy
N° of distribution centres: 1
City: Brescia

OLARRA U.K LTD
Country: Great Britain
N° of distribution centres: 1
City: Cleobury Mortimer

Roda Specialty Steel
Country: USA
N° of distribution centres: 3
Cities: Los Angeles, Chicago, New Jersey


Rodacciai

DINAMICITY, INNOVATION AND RESILIENCE

The vertical integration achieved over the years by Rodasteel Group, thanks to the acquisition of Olarra and the implementation of the production facilities, offers an important competitive advantage: indipendency along the entire value chain, which can be translated in our slogan "from the scrap to the finished product".

ACEROS INOXIDABLES OLARRA

Olarra,
Bilbao *(steel mill)*

Rodacciai,
Bosisio Parini *(cold finishing plant)*

Rodacciai,
Sirone *(rolling mill)*

ALL IN HOUSE CONTROL STRATEGY & BUSINESS PROCESS REENGINEERING

The strategic choices, made in the past, have been allowing the Group to differentiate itself over the time.
It is precisely starting from these choices that the company is today a leader in the cold finished steel market.
Our strategy is composed by: ALL-IN-HOUSE, to guarantee our customers continuous product and process improvement. Each phase is monitored and tracked.

Business Process Reengineering logic identifies 8 phases, including the redefinition of processes, identification of the levels for change, the development of concrete objectives and actions for continuous improvements.
Rodacciai LAB, an important investment in our laboratory and R&D Dept., creates a high value for both the above explained strategy, helping the company to continuous monitoring the products in each singular step.


TORQUE
Nikon
ECLIPSE
L150

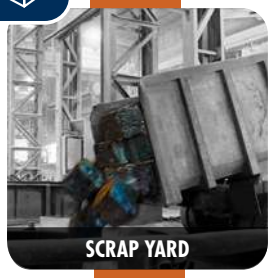
QUALITY CONTROL SYSTEM

Rodacciai works with innovative machinery and optimized production processes to guarantee constant and repeatable high quality products over time.
Since 1990 the company has obtained the ISO 9001 system certification, which certifies full compliance with the standards relating to the Quality Management Systems. In the continuous development of its Quality Policy, Rodacciai, through its production lines, is able to comply with all the necessary certifications for its products.

LABORATORY & CONTROL QUALITY

Rodacciai | LAB

Rodacciai LAB is a recent and big investment, dedicated to the R&D and to the continuous improvement of the products. It is composed by a laboratory fully furnished with all the necessary equipment and testing machines calibrated in accordance with the requirements of ISO 9001 standards. This allows to produce the majority of tests and reports inside the company.


SCRAP YARD

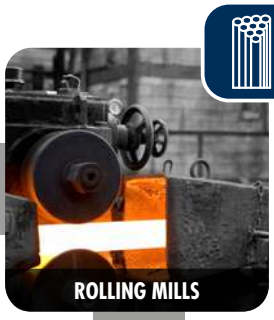

BARS


HEAT TREATMENT


ELETRIC ARC FURNACE


WIRE ROD


AOD CONVERTER


ROLLING MILLS


HOR. CONTINUOUS CASTING

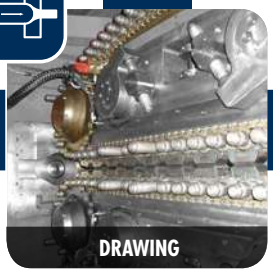

BILLETS


FURNACE

STAINLESS STEEL SOLUTIONS
ALL IN HOUSE
FROM THE SCRAP TO THE FINISHED PRODUCT


PEELING


GRINDING


DRAWING

Rodasteel Corporation has always distinguished itself through a unique production philosophy and the choice to have a complete vertical cycle for stainless steel products.

The ALL IN HOUSE strategy, from the scrap to the finished product, can guarantee constant monitoring of each step of the production cycle and provides a unique production flexibility and responsiveness. This aspect is always accompanied by a continuous focus on quality and the certification of products and processes.

Rodacciai, Bosisio Parini *(cold finishing plant)*
Rodacciai, Sirone *(rolling mill)*

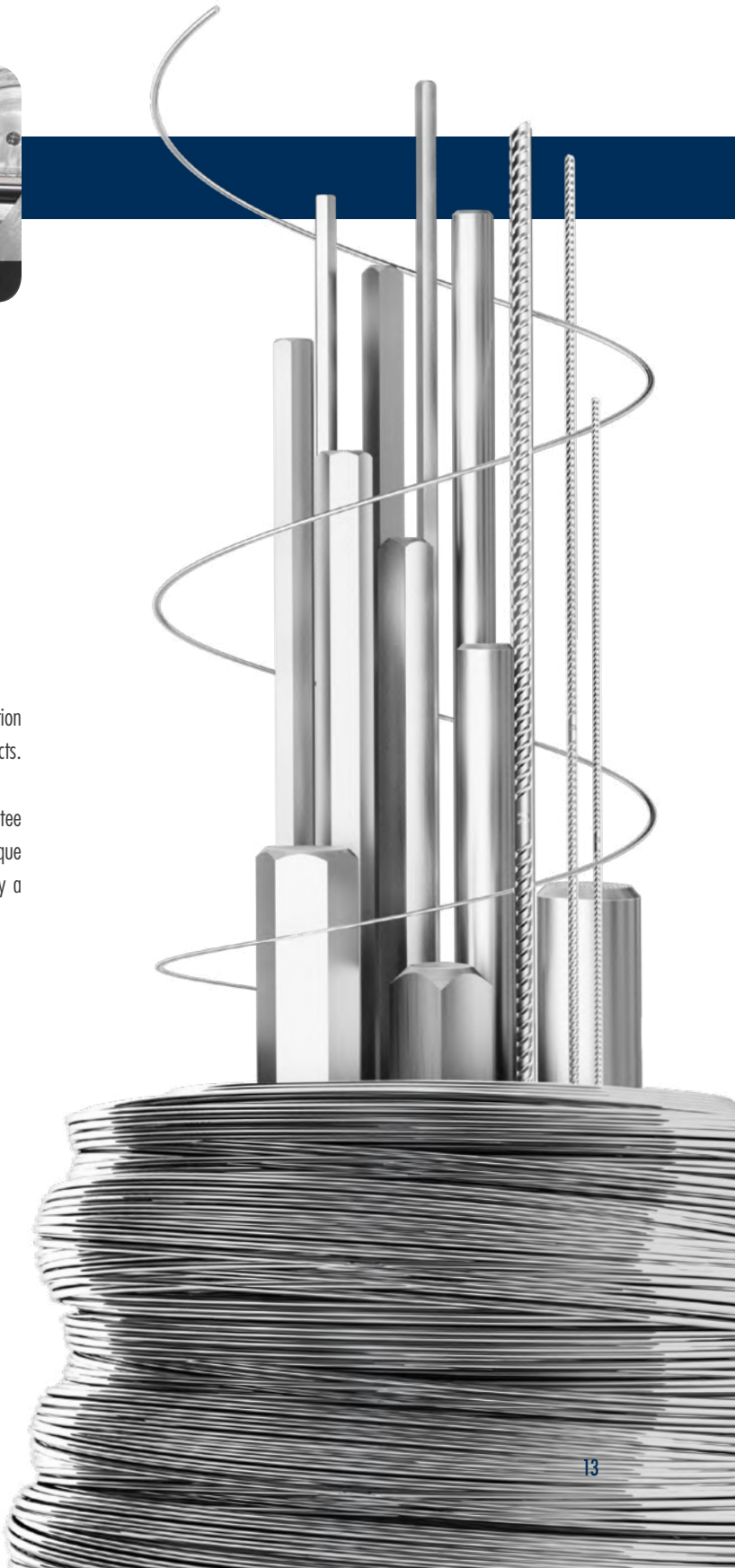
ACEROS INOXIDABLES OLARRA **Olarra, Bilbao** *(steel mill)*

STEEL MILL

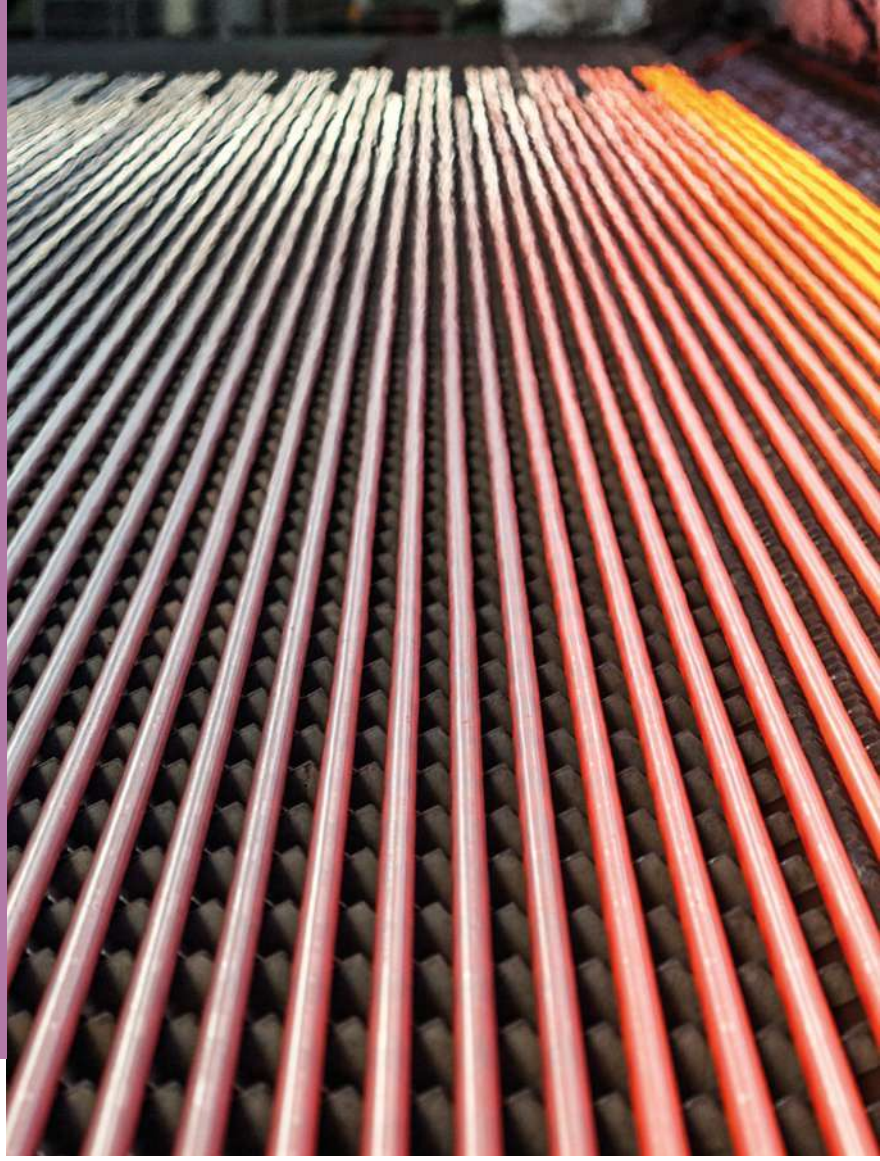
ROLLING MILL

COLD FINISHING

FURTHER PRODUCTION PROCESSES (IF NECESSARY)



COLD FINISHED BARS



Rodasteel Group, producing 80.000 tonnes of stainless steel bars yearly, has developed a high quality product range, including all the main steel grades and finishings.
The Group proposes on the market all the main standard grades and a wide range of tailor made products, studied on customer's specific requirements.
The stainless steel bars can be supplied in hot rolled or cold finished execution, in all the main commercial grades, customizing the surface finishing.
All the heat treatments are made internally and the most common are: annealing, solution annealing (for austenitic stainless steel or precipitation hardening steels), quenching and tempering and precipitation hardening.
Rodacciai produces and sells stainless steel bars for all the main market applications and in a variety of shapes and sizes.

PRODUCTION RANGE AND EXECUTIONS

	Condition	Profile	Range (mm)	Finish	Tolerances
Bars	Hot rolled	Round	20÷100	As rolled, rough peeled	-
	Cold-drawn	Round Hexagonal Square Special	2÷40 4÷65 4÷55	Bright	ISA h9-h10-h11
	Smooth-turned / peeled	Round	20÷80	Smooth and bright	ISA h9-h10-h11
	Ground	Round	3÷80	Smooth and bright	ISA h6-h7-h8-h9-h10-h11

Different tolerances can be evalueted.

COLD FINISHED BARS APPLICATIONS

AUTOMOTIVE | OIL & GAS | HYDRAULIC & FLUID | FASTENERS

AUSTENITIC STAINLESS STEEL BARS

These steels are used in a field that requires material with good corrosion resistance property. The addition of a small amount of sulphur makes the material easily machined and suitable for the production of turned parts with complex machining operations.

FERRITIC STAINLESS STEEL BARS

These qualities are ideal for the production of grilles, household appliances components and in the automotive industry.

MARTENSITIC STAINLESS STEEL BARS

They are used in many fields thanks to the high mechanical properties that can be achieved; e.g. in the oil industry and for the manufacture of components for pumps and valves.

DUPLEX (AUSTENITIC-FERRITIC) STAINLESS STEEL

These materials are perfect in contexts where the action of salt and corrosive agents is particulary marked, they are also used in heat exchangers where an excellent corrosion resistance is important.

HEAT-RESISTANT STAINLESS STEEL BARS

They find application for components of heat treatment furnaces, heat pumps and chemical industry.

PRECIPITATION HARDENING STAINLESS STEEL BARS

These steels are typical where a combination of strenght, corrosion resistance and mild toughness is required.
Some examples of applications can be Oil&Gas, nuclear power generarions and chemical plants.

AUSTENITIC STAINLESS STEEL BARS

300 SERIES

Corrosion resistant, non-magnetic steels

In addition to chromium (the common element of all stainless steels), austenitic stainless steels contain high level of nickel, which significantly improves the steels resistance to corrosion. Adding different alloy elements - such as molybdenum, titanium, niobium, copper etc. – it is possible to achieve specific design properties and performances. Cold drawing allows the possibility to achieve slight residual magnetism on the bars, which is not present on the hot rolled condition.

Austenitic stainless steels are used in a great variety of applications, such as cold heading and automotive parts. The steels of the PLUS series are calcium treated and include sulphur for improved machinability.

In order to satisfy the growing market demand for the material with an excellent machinability, R&D department developed a new quality: "304HF".

STANDARD REFERENCE:
A313 / A313M
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 1654-5: 89)		(NF A 35-574-90)	(BS 3111 pt.2 -79)	AISI
Name	ISO Number		Werkstoff	N°			
X8CrMnCuN17-8-3	4597-204-76-I	-	-	-	-	-	204Cu - S 20430

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N	Cr	Cu	Mo / max	Ni
0,10	1,00	6,50÷9,00	0,040	0,030	0,10÷0,25	15,50÷17,50	2,00÷3,50	1,00	1,50÷3,00

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	245	270	305	560÷780	40	100	YES	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X10CrNi18-8 - Nr. 1.4310

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products) | **EN 10263-5: 2017** (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X10CrNi18-8	4310-301-00-I	X 2 CrNi 17 07	-	-	Z11 CN 18 - 08	302S31	302

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo / max	Ni
0,05÷0,15	2,00	2,00	0,045	0,015	0,10	16,0÷19,0	0,80	6,0÷9,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	230	195	230	500÷750	40	NO	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	760	60
> 5 ≤10	660	65	890	-	680	65	730	60
> 10 ≤ 25	660	65	850	-	660	65	-	-
> 25 ≤ 50	660	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1100

X8CrNiS18-9 Nr. 1.4305

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X8CrNiS18-9	4305-303-00-I	X 10 CrNiS 18 09	X8CrNiS18-09	1.4305	Z8 CNF 18 - 09	303S31	303

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Cu / max	Ni
0,10	1,00	2,00	0,045	0,15÷0,35	0,10	17,0÷19,0	1,00	8,0÷10,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	230	190	225	500÷750	35	-	NO	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)0	A_5 (%) min*
≤ 10	400	600÷950	15
> 10 ≤ 16	400	600÷950	15
> 16 ≤ 40	190	500÷850	20
> 40 ≤ 63	190	500÷850	20
> 63 ≤ 100	190	500÷750	35

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

MARK RODACCIAI

303PLUS

X6CrNiCuS18-9-2 - Nr. 1.4570

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X6CrNiCuS18-9-2	4570-303-31-I	-	-	-	Z8 CNUF 18 - 09	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N / max	Cr	Cu	Mo / max	Ni
0,08	1,00	2,00	0,045	0,15÷0,35	0,10	17,0÷19,0	1,40÷1,80	0,60	8,0÷10,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	215	185	220	500÷710	35	NO	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*
≤ 10	400	600÷950	15
> 10 ≤ 16	400	600÷950	15
> 16 ≤ 40	185	500÷910	20
> 40 ≤ 63	185	500÷910	20
> 63 ≤ 100	185	500÷710	35

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1020÷1100

X5CrNi18-10 - Nr. 1.4301

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X5CrNi18-10	4301-304-00-I	X 5 CrNi 18 10	X5CrNi18-10	1.4301	Z7 CN 18 - 09	304S15	304

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Ni
0,07	1,00	2,00	0,045	0,030	0,10	17,50÷19,50	8,0÷10,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	190	225	500÷700	45	100	YES	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷950	25	-
> 10 ≤ 16	400	600÷950	25	-
> 16 ≤ 40	190	600÷850	30	100
> 40 ≤ 63	190	580÷850	30	100
> 63 ≤ 100	190	500÷700	45	100

* Values valid only for size ≥5 mm

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	700	60	750	60
> 5 ≤10	650	65	820	-	650	65	700	60
> 10 ≤ 25	650	65	780	-	650	65	-	-
> 25 ≤ 50	650	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNi18-9 Nr. 1.4307

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X5CrNi18-10	4307-304-03-I	X 5 CrNi 18 10	X5CrNi18-10	1.4301	Z7 CN 18 - 09	304S15	304

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Ni
0,07	1,00	2,00	0,045	0,020÷0,030	0,10	17,50÷19,50	8,0÷10,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	190	225	500÷700	45	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷930	25	-
> 10 ≤ 16	380	600÷930	25	-
> 16 ≤ 40	175	500÷830	30	100
> 40 ≤ 63	175	500÷830	30	100
> 63 ≤ 100	175	500÷700	45	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

304HF

X2CrNi18-9 Nr. 1.4307

MECHANICAL PROPERTIES - Bars for cold heading

Spessore mm	As Treated (+AT) or Peeled(+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	800	-	630	68	680	63
> 10 ≤ 25	630	68	760	-	630	68	-	-
> 25 ≤ 50	630	68	740	-	630	68	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNi18-9 Nr. 1.4307

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4307-304-03-I	-	-	-	Z3 CN 19 - 09	304S15	304L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Ni
0,030	1,00	2,00	0,045	0,020÷0,030	0,10	17,50÷19,50	8,0÷10,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	210	500÷700	45	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷930	25	-
> 10 ≤ 16	380	600÷930	25	-
> 16 ≤ 40	175	500÷830	30	100
> 40 ≤ 63	175	500÷830	30	100
> 63 ≤ 100	175	500÷700	45	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

304PLUS

X2CrNi18-9 Nr. 1.4307

MECHANICAL PROPERTIES - Bars for cold heading

Spessore mm	As Treated (+AT) or Peeled(+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	800	-	630	68	680	63
> 10 ≤ 25	630	68	760	-	630	68	-	-
> 25 ≤ 50	630	68	740	-	630	68	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNi19-11 Nr. 1.4306

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X2CrNi19-11	4306-304-03-I	X 2 CrNi 18 11	X2CrNi19-11	1.4306	Z3 CN 19 - 11	304S11	304L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Ni
0,030	1,00	2,00	0,045	0,030	0,10	18,0÷20,0	10,0÷12,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	180	215	460÷680	45	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷930	25	-
> 10 ≤ 16	380	600÷930	25	-
> 16 ≤ 40	180	460÷830	30	100
> 40 ≤ 63	180	460÷830	30	100
> 63 ≤ 100	180	460÷680	45	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

304ST

X2CrNi19-11 Nr. 1.4306

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	780	-	630	68	680	63
> 10 ≤ 25	630	68	740	-	630	68	-	-
> 25 ≤ 50	630	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X3CrNiCu18-9-4 Nr. 1.4567

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 1654-5: 89)		(NF A 35-574-90)	(BS 3111 pt.2 -79)	AISI
Name	ISO Number		Werkstoff	N°			
X3CrNiCu18-9-4	4567-304-30-I	-	X3CrNiCu18-9	1.4567	Z3 CNU 18 - 10	394S17	302HQ

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Cu	Ni
0,04	1,00	2,00	0,045	0,030	0,10	17,0÷19,0	3,0÷4,0	8,5÷10,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	210	450÷650	45	-	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷850	25	-
> 10 ≤ 16	340	600÷850	25	-
> 16 ≤ 40	175	450÷800	30	100
> 40 ≤ 63	175	450÷800	30	100
> 63 ≤ 100	175	450÷650	40	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

304CU

X3CrNiCu18-9-4 Nr. 1.4567

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	600	68	650	63
> 5 ≤10	590	68	740	-	590	68	640	63
> 10 ≤ 25	590	68	700	-	590	68	-	-
> 25 ≤ 50	590	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X5CrNiMo17-12-2 Nr. 1.4401

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X2CrNi18-9	4401-316-00-I	X 5 CrNiMo 17 12	X5CrNiMo17-12-2	1.4401	Z7 CND 17 - 11 - 02	316S31	316

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo	Ni
0,07	1,00	2,00	0,045	0,030	0,10	16,5÷18,5	2,00÷2,50	10,0÷13,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	NO

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷950	25	-
> 10 ≤ 16	380	580÷950	25	-
> 16 ≤ 40	200	500÷850	30	100
> 40 ≤ 63	200	500÷850	30	100
> 63 ≤ 100	200	500÷700	40	100

* Values valid only for size ≥5 mm

X5CrNiMo17-12-2 Nr. 1.4401

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	690	65	720	60
> 5 ≤10	660	65	830	-	670	65	700	60
> 10 ≤ 25	660	65	790	-	670	65	-	-
> 25 ≤ 50	660	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1120

X6CrNiMoTi17-12-2 Nr. 1.4571

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X2CrNi18-9	4571-316-35-I	X 6 CrNiMoTi 17 12	X5CrNiMo17-12-2	1.4571	Z6 CNDT 17 - 12	316S31	316Ti

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni	Ti
0,08	1,00	2,00	0,045	0,020÷0,030	16,5÷18,5	2,00÷2,50	10,5÷13,5	5x%C÷0,70

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷950	25	-
> 10 ≤ 16	380	580÷950	25	-
> 16 ≤ 40	200	500÷850	30	100
> 40 ≤ 63	200	500÷850	30	100
> 63 ≤ 100	200	500÷700	40	100

* Values valid only for size ≥ 5 mm

MARK RODACCIAI

316TISL

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	770	60
> 5 ≤10	680	65	850	-	680	65	730	60
> 10 ≤ 25	680	65	810	-	680	65	-	-
> 25 ≤ 50	680	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1120

X2CrNiMo17-12-2 Nr. 1.4404

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMo17-12-2	4404-316-03-I	X 2 CrNiMo 17 12	X2CrNiMo17-12-2	1.4404	Z3 CND 17 - 11 - 02	(316S11)	316L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Mo	Ni
0,030	1,00	2,00	0,045	0,020÷0,030	0,10	16,5÷18,5	2,00÷2,50	10,0÷13,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷930	25	-
> 10 ≤ 16	380	580÷930	25	-
> 16 ≤ 40	200	500÷830	30	100
> 40 ≤ 63	200	500÷830	30	100
> 63 ≤ 100	200	500÷700	40	100

* Values valid only for size ≥ 5 mm

MARK RODACCIAI

316PLUS

X2CrNiMo17-12-2 Nr. 1.4404

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	670	68	720	63
> 5 ≤10	650	68	780	-	650	68	700	63
> 10 ≤ 25	650	68	750	-	650	68	-	-
> 25 ≤ 50	650	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1120

X3CrNiCuMo17-11-3-2 Nr. 1.4578

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 4954:2021		(UNI 6900: 71)	(DIN 1654-5:89)		(NF A 35-574-90)	(BS 3111-79)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X3CrNiCu-Mo17-11-3-2	4578-316-76-E	-	-	-	-	396S17	(316CU)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni	Mo	Cu
0,04	1,00	2,00	0,045	0,015	0,10	16,5÷17,5	10,0÷11,0	2,00÷2,50	3,0÷3,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	-	450÷650	45	-	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷850	20	-
> 10 ≤ 16	340	600÷850	20	-
> 16 ≤ 40	175	450÷800	30	-
> 40 ≤ 63	175	450÷800	30	-
> 63 ≤ 100	1750	450÷650	45	-

* Values valid only for size ≥ 5 mm

MARK RODACCIAI

316CU

X3CrNiCuMo17-11-3-2 Nr. 1.4578

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	630	68	680	63
> 5 ≤10	610	68	760	-	610	68	660	63
> 10 ≤ 25	610	68	720	-	610	68	-	-
> 25 ≤ 50	610	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1000÷1100

X6CrNiTi18-10 Nr. 1.4541

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4541-321-00	X 6 CrNiTi 18 11	X6CrNiTi18-10	1.4541	Z6 CNT 18 - 10	321S31	(321)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Ni	Ti
0,08	1,00	2,00	0,045	0,020÷0,030	17,0÷19,0	9,0÷12,0	5x%C÷0,70

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	190	225	500÷700	40	100	YES	YES

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation.

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷950	25	-
> 10 ≤ 16	380	580÷950	25	-
> 16 ≤ 40	190	500÷850	30	100
> 40 ≤ 63	190	500÷850	30	100
> 63 ≤ 100	190	500÷700	40	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

321SL

X6CrNiTi18-10 Nr. 1.4541

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	770	60
> 5 ≤10	680	65	850	-	680	65	730	60
> 10 ≤ 25	680	65	810	-	680	65	-	-
> 25 ≤ 50	680	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNiMo18-14-3 Nr. 1.4435

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products) | **EN 10263-5: 2017** (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMo18-14-3	4435-316-91-I	X 2 CrNiMo 17 13	X2CrNiMo18-14-3	1.4435	Z3 CND 18-14-03	316S13	316L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo	Ni
0,030	1,00	2,00	0,045	0,030	0,10	17,0÷19,0	2,50÷3,00	12,5÷15,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance ** The maximum HB values may be raised by 100HB or the tensile strenght value may be raised by 200 MPa and the minimum A% value may be lowered to 20% for Wire of ≤35 mm

MECHANICAL PROPERTIES - Cold drawn or peeled (2H, 2B) and ground bars (2H-2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	400	600÷950	25	-
> 10 ≤ 16	400	600÷950	25	-
> 16 ≤ 40	235	500÷850	30	100
> 40 ≤ 63	235	500÷850	30	100
> 63 ≤ 100	235	500÷700	40	100

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1120

MARK RODACCIAI

1.4435

X6CrNiNb18-10 Nr. 1.4550

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X6CrNiNb18-10	550-347-00-I	X 6 CrNiNb 18 11	X6CrNiNb18-10	1.4550	Z6 CNNb 18 - 10	347S31	347H

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Nb	Ni
0,04÷0,08	1,00	2,00	0,045	0,015	17,0÷19,0	10x%C÷1,00	9,0÷12,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	230	205	240	510÷740	40	100	YES	YES

* Only for guidance ** The maximum HB values may be raised by 100HB or the tensile strenght value may be raised by 200 MPa and the minimum A% value may be lowered to 20% for Wire of ≤35 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1020÷1120

AUSTENITIC HEAT-RESISTING STEEL BARS

300 SERIES

Corrosion resistant and high temperatures application steels

These steels have been created to be used in environments characterized by high temperatures - such as heat treatment ovens and resistors of radiating elements.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
310	X8CrNi25-21	46
314	X15CrNiSi25-21	47
1.4828	X15CrNiSi20–12	48

X8CrNi25-21 Nr. 1.4845

STANDARD REFERENCE:
EN 10095: 1999 (Heat resisting steels and nickel alloys)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014 (wire standard)		(UNI 6900: 71)	-		(NF A 35-578-91)	(BS 1501 pt. 3-80)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X8CrNi25-21	4845-310-08-E	X 22 CrNi 25 20	–		Z 8 CN 25 - 20	310S16	310 S

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,10	1,50	2,00	0,045	0,015	0,11	24,0÷26,0	19,0÷22,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min** ***	$Rp_{1,0}$ (MPa) min** ***	R_m (MPa)	A_5 (%) min***
100	192	210	250	500÷700	35

*Only for guidance **For rods, only the tensile strength values apply
*** The maximum HB values may be raised by 100HB or the tensile strenght value may be raised by 200 MPa and the minimum A% value may be lowered to 20% for Wire of ≤35 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X15CrNiSi25-21 Nr. 1.4841

STANDARD REFERENCE:
EN 10095: 1999 (Heat resisting steels and nickel alloys)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	-		(NF A 35-578-91)	(BS 1501 pt. 3-80)	AISI
Name	Number		Werkstoff	N°			
-	-	X 16 CrNiSi 25 20	–	–	Z 15 CNS 25 - 20	-	314

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,20	1,50÷2,50	2,00	0,045	0,015	0,11	24,0÷26,0	19,0÷22,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the solution annealed condition

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	$Rp_{1,0}$ (MPa) min*	R_m (MPa) **	A_5 (%) min**
100	223	230	270	550÷700	30

* Only for guidance ** The maximum HB values may be raised by 100HB or the tensile strenght value may be raised by 200 MPa and the minimum A% value may be lowered to 20% for Wire of ≤35 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X15CrNiSi20-12 Nr. 1.4828

STANDARD REFERENCE:
EN 10095: 1999 (Heat resisting steels and nickel alloys)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 4955:2016		-	-		NF A 35-578	-	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X15CrNiSi20–12	4828–305–09-I	-	X 15 CrNiSi 20 12	1.4828	Z17CNS20-12	309S24	309

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,20	1,50÷2,50	2,00	0,045	0,015	0,11	19,00÷21,00	11,00÷13,00

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
75	223	230	270	550÷750	30	-	-	-

* Only for guidance ** The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20% for sections and bars of ≤ 35 mm thickness having a final cold deformation.

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1050÷1150

MARK RODACCIAI

1.4828

FERRITIC STAINLESS STEELS BARS

400 SERIES

Corrosion-resistant, non-hardenable steels

Ferritic stainless steels can not be heat treated and quenched. However, their mechanical properties can be increased by work hardening through cold drawing.
The corrosion resistance is ensured by the chromium content and further increased by the addition of molybdenum. Sulphur is added to enhance machinability. These steels are magnetic and commonly used in automotive applications, as well as in a variety of industrial uses.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
430	X6Cr17	52
430NB	X3CrNb17	54
1.4105	X6CrMoS17	55
434	X6CrMo17-1	56

X6Cr17 Nr.1.4016

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16343-2:2014		(UNI 6900: 71)	(DIN 17440 - 86)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X6Cr17	4016-430-00-I	X 8 Cr 17	X6Cr17	1.4016	Z 8 C 17	430S17	430

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr
0,08	1,00	1,00	0,040	0,030	16,0÷18,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	240	400÷630	20	YES	NO

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*
≤ 10	320	500÷750	8
> 10 ≤ 16	300	480÷750	8
> 16 ≤ 40	240	400÷700	15
> 40 ≤ 63	240	400÷700	15
> 63 ≤ 100	240	400÷630	20

* Values valid only for size ≥5 mm

X6Cr17 Nr.1.4016

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Soft Annealed + Skin Passed (+A +LC)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	560	63	620	61
> 5 ≤10	560	63	660	60	560	63	600	61
> 10 ≤ 25	560	63	640	60	560	63	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air))
°C	800÷1100	750÷850

X3CrNb17 Nr.1.4511

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 8317: 81)	(DIN 17441 - 86)		(NF A 35-573-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X3CrNb17	511-430-71-I	X 6 CrNb 17	X6CrNb17	1.4511	Z 4 CNb 17	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Nb
0,05	1,00	1,00	0,040	0,030	16,0÷18,0	12xC÷1,00

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
50	200	200	420÷620	20	YES	YES

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*
≤ 10	320	500÷750	8
> 10 ≤ 16	300	480÷750	10
> 16 ≤ 40	240	400÷700	15
> 40 ≤ 50	240	400÷700	15

* Values valid only for size ≥5 mm

MARK RODACCIAI

430NB

X6CrMoS17 Nr.1.4105

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
EN 10088-3: 2005		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	Number		Werkstoff	N°			
X6CrMoS17	1.4105	X 10 CrS 17	X6CrMoS17	1.4105	Z 8 CF 17	-	430F

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	Cr	Mo
0,08	1,50	1,50	0,040	0,15÷0,35	16,0÷18,0	0,20÷0,60

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Durezza HB max*	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	200	430÷630	20	NO	NO

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Spessore max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*
≤ 10	330	530÷780	7
> 10 ≤ 16	310	500÷780	7
> 16 ≤ 40	250	430÷730	12
> 40 ≤ 63	250	430÷730	12
> 63 ≤ 100	250	430÷630	20

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	800÷1100	750÷850

X6CrMo17-1 Nr. 1.4113

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 -90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X6CrMo17-1	4113-434-00-I	X 8 CrMo 17	X6CrMo17-1	1.4113	Z 8 CD 17-01	434S20	434

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo
0,08	1,00	1,00	0,040	0,030	16,0÷18,0	0,90÷1,40

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	280	440÷660	18	YES	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn (2H, 2B) and ground bars (2G) in the solution annealed condition

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*
≤ 10	340	540÷700	8
> 10 ≤ 16	320	500÷700	12
> 16 ≤ 40	280	440÷700	15
> 40 ≤ 63	280	440÷700	15
> 63 ≤ 100	280	440÷660	18

* Values valid only for size ≥5 mm

X6CrMo17-1 Nr. 1.4113

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	600	60	660	58
> 5 ≤10	600	60	710	57	600	60	640	58
> 10 ≤ 25	600	60	690	57	600	60	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	800÷1100	750÷850

MARTENSITIC STAINLESS STEELS BARS

400 SERIES

Corrosion-resistant, hardenable steels

Martensitic stainless steels typically have increased chromium content as well as higher carbon levels. These steels are suitable to be heat treated, quenched and tempered.
They can be offered in the annealed condition with good machinability, enhanced by the addition of sulphur or in the quenched and tempered condition for increasing mechanical properties and corrosion resistance.
High surface hardness can be achieved for these steels by induction hardening. Typical applications include high strength components for pumps and valves.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
410	X12Cr13	60
416	X12CrS13	61
420A	X20Cr13	62
420B	X30Cr13	63
420C	X39Cr13	64
420C1	X46Cr13	65
430F	X14CrMoS17	66
1.4122	X39CrMo17-1	67
431	X17CrNi16-2	68
420C F	X46CrS13	69
1.4112	X90CrMoV18	70
1.4418	X4CrNiMo16-5-1	71

X12Cr13 Nr. 1.4006

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY	FRANCE	UK	USA
ISO 16143-2:2014	(UNI 6900: 71)	(DIN 17440 - 85)	(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI

Name	ISO number		Werkstoff	N°			
X12Cr13	4006-410-00-I	X 12 Cr 13	X12Cr13	1.4006	Z 10 C 13	410S21	410

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni / max
0,08÷0,15	1,00	1,50	0,040	0,030	11,5÷13,5	0,75

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	220	-	730 max	-	-
	Quenched + Tempered (+QT 650)	-	450	650÷850	15	25

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	880	280	Quenched + Tempered (+QT 650)	550	700÷1000	9	-
> 10 ≤ 16	880	280		500	700÷1000	9	-
> 16 ≤ 40	800	250		450	650÷930	10	25
> 40 ≤ 63	760	230		450	650÷880	10	25
> 63 ≤ 100	730	220		450	650÷850	15	25

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

MARK RODACCIAI

410

X12CrS13 Nr. 1.4005

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X12CrS13	4005-416-00-I	X 12 CrS 13	-	-	Z 11 CF 13	416S21	416

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Mo / max
0,06÷0,15	1,00	1,50	0,040	0,15÷0,35	12,0÷14,0	0,60

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	Ricotto (+A)	220	-	730 max	-
	Bonificato (+QT 650)	-	450	650÷850	12

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered			
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**
≤ 10	880	280	Quenched + Tempered (+QT 650)	550	700÷1000	8
> 10 ≤ 16	880	280		500	700÷1000	8
> 16 ≤ 40	800	250		450	650÷930	10
> 40 ≤ 63	760	230		450	650÷880	10
> 63 ≤ 100	730	220		450	650÷850	12

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X20Cr13 Nr. 1.4021

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY	FRANCE	UK	USA
ISO 16143-2:2014	(UNI 6900: 71)	(DIN 17440 - 85)	(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI

Name	ISO number		Werkstoff	N°			
X20Cr13	4021-420-00-I	X 20 Cr 13	X20Cr13	1.4021	Z 20 C 13	420S29 - 420S37	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,16÷0,25	1,00	1,50	0,040	0,030	12,0÷14,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	230	-	760 max	-	-
	Quenched + Tempered (+QT 700)	-	500	700÷850	13	25
	Quenched + Tempered (+QT 800)	-	600	800÷950	12	20

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	910	290	Quenched + Tempered (+QT 700)	600	750÷1000	8	-
> 10 ≤ 16	910	290		550	750÷1000	8	-
> 16 ≤ 40	850	260		500	700÷950	10	25
> 40 ≤ 63	800	250		500	700÷900	12	25
> 63 ≤ 100	760	230		500	700÷850	13	25

* For reference only ** values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 700)	Tempering (QT 800)
°C	900÷1100	745÷825	950÷1050	600÷750	600÷700

MARK RODACCIAI

420A

X30Cr13 Nr. 1.4028

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 - 90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X30Cr13	4028-420-00-I	X 30 Cr 13	X30Cr13	1.4028	Z 33 C 13	420S45	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,26÷0,35	1,00	1,50	0,040	0,030	12,0÷14,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 850)	-	650	850÷1000	10	12

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	950	305	Quenched + Tempered (+QT 850)	700	900÷1150	7	-
> 10 ≤ 16	950	305		650	900÷1150	7	-
> 16 ≤ 40	900	280		650	850÷1100	9	15
> 40 ≤ 63	840	260		650	850÷1050	9	15
> 63 ≤ 100	800	245		650	850÷1000	10	15

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 850)
°C	900÷1100	745÷825	950÷1050	625÷675

X39Cr13 Nr. 1.4031

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 - 90)	AISI
Name	ISO number		Werkstoff	N°			
-	-	X 40 Cr 14	X38Cr13	1.4031	(Z 44 C 14)	420S45	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,36÷0,42	1,00	1,00	0,040	0,030	12,5÷14,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 800)	-	650	800÷1000	10	12

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	950	305	Quenched + Tempered (+QT 800)	700	850÷1100	7	-
> 10 ≤ 16	950	305		700	850÷1100	7	-
> 16 ≤ 40	900	280		650	800÷1050	8	12
> 40 ≤ 63	840	260		650	800÷1000	8	12
> 63 ≤ 100	800	245		650	800÷1000	10	12

* for reference only ** values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 800)
°C	900÷1100	750÷850	950÷1050	650÷700

MARK RODACCIAI

420C

X46Cr13 Nr. 1.4034

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	ISO number		Werkstoff	N°			
-	-	(X 40 Cr 14)	X46Cr13	1.4034	Z 44 C 14	-	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,43÷0,50	1,00	1,00	0,040	0,030	12,5÷14,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 800)	-	650	800÷1000	10	12

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	950	305	Quenched + Tempered (+QT 850)	700	900÷1150	7	-
> 10 ≤ 16	950	305		700	900÷1150	7	-
> 16 ≤ 40	900	280		650	850÷1100	8	12
> 40 ≤ 63	840	260		650	850÷1000	8	12
> 63 ≤ 100	800	245		650	850÷1000	10	12

* for reference only ** values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 800)
°C	900÷1100	750÷850	950÷1050	650÷700

X14CrMoS17 Nr. 1.4104

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014	(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
-	-	X 10 CrS 17	X14CrMoS17	1.4104	Z 13 CF 17	-	430F

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S	Cr	Mo
0,10÷0,17	1,00	1,50	0,040	0,15÷0,35	15,5÷17,5	0,20÷0,60

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	Annealed (+A)	220	-	730 max	-
≤ 60	Quenched + Tempered (+QT 650)	-	500	650÷850	12
> 60 ≤ 100	Quenched + Tempered (+QT 650)	-	500	650÷850	10

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered			
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**
≤ 10	880	280	Quenched + Tempered (+QT 650)	580	700÷980	7
> 10 ≤ 16	880	280		530	700÷980	7
> 16 ≤ 40	800	250		500	650÷930	9
> 40 ≤ 63	760	230		500	650÷880	10
> 63 ≤ 100	730	220		500	650÷850	10

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	750÷850	950÷1070	550÷650

MARK RODACCIAI

430F

X39CrMo17-1 Nr. 1.4122

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(SEW 400 : 1973)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X39CrMo17-1	4122-434-09-I	-	X 35 CrMo 17	1.4122	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni / max
0,33÷0,45	1,00	1,50	0,040	0,030	15,5÷17,5	0,80÷1,30	1,00

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	280	-	900 max	-	-
60	Quenched + Tempered (+QT 800)	-	550	750÷950	12	15

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	1000	340	Quenched + Tempered (+QT 750)	650	800÷1050	8	-
> 10 ≤ 16	1000	340		600	800÷1050	8	-
> 16 ≤ 40	980	310		550	750÷1000	10	14
> 40 ≤ 63	930	290		550	750÷950	12	14
> 63 ≤ 100	900	280		550	750÷950	12	10

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 650)
°C	800÷1100	750÷850	980÷1060	650÷750

X17CrNi16-2 Nr. 1.4057

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY	FRANCE	UK	USA
EN 10088-3: 2005	(UNI 6900: 71)	(DIN 17440 - 85)	(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI

Name	ISO number		Werkstoff	N°			
X17CrNi16-2	4057-431-00-X	X 16 CrNi 16	X17CrNi16-2	1.4057	Z 15 CN 16 - 02	431S29	431

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni
0,12÷0,22	1,00	1,50	0,040	0,030	15,0÷17,0	1,50÷2,50

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	295	-	950 max	-	-
≤ 60	Quenched + Tempered (+QT 800)	-	600	800÷950	14	25
> 60 ≤ 100	Quenched + Tempered (+QT 800)	-	600	800÷950	12	20
≤ 60	Quenched + Tempered (+QT 900)	-	700	900÷1050	12	16
> 60 ≤ 100	Quenched + Tempered (+QT 900)	-	700	900÷1050	10	15

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	1050	330	Quenched + Tempered (+QT 800)	750	850÷1100	7	-
> 10 ≤ 16	1050	330		700	850÷1100	7	-
> 16 ≤ 40	1000	310		650	800÷1050	9	25
> 40 ≤ 63	950	295		650	800÷1000	12	25
> 63 ≤ 100	950	295		650	800÷950	12	16

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 800)	Tempering (QT 900)
°C	900÷1100	680÷800	950÷1050	750÷800 + 650÷700	600÷650

MARK RODACCIAI

431

X46CrS13 Nr. 1.4035

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	ISO number		Werkstoff	N°			
-	-	-	-	-	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,33÷0,45	1,00	2,0	0,040	0,15÷0,35	12,5÷14,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
63	Annealed (+A)	245	-	800	-

* Only for guidance ** For rods, only the tensile strenght values apply

MECHANICAL PROPERTIES - Cold drawn (2H, 2B) and ground bars (2G) in the heat-treated condition

Size (mm)	Annealed	
	R_m (MPa) max	R_m (MPa) max
≤ 10	880	280
> 10 ≤ 16	880	280
> 16 ≤ 40	800	250
> 40 ≤ 63	760	250

* For reference only

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	900÷1100	750÷850

X90CrMoV18 Nr. 1.4112

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	SEW 400: 1973		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	ISO Number		Werkstoff	N°			
-	-	-	X 90 CrMoV 18	1.4112	-	-	(440B)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo	V
0,85÷0,95	1,00	1,00	0,040	0,030	17,0÷19,0	0,90÷1,30	0,07÷0,12

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rm (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	265	-	-	-	-		

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	800÷1100	780÷840

MARK RODACCIAI

1.4112

X4CrNiMo16-5-1 Nr. 1.4418

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY	FRANCE	UK	USA
ISO 16143-2:2014	-	-	(NF A 35-574-90)	-	AISI

Name	ISO number		Werkstoff	N°			
X4CrNiMo16-5-1	4418-431-77-E	-	X 4 CrNiMo 16 5	1.4418	Z6 CND 16-05 -01	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni	N /min
0,06	0,70	1,50	0,040	0,015	15,0÷17,0	0,80÷1,50	4,0÷6,0	0,020

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	320	-	1100 max	-	-
≤ 160	Quenched + Tempered (+QT 760)	-	550	760÷960	16	90
≤ 160	Quenched + Tempered (+QT 900)	-	700	900÷1100	16	80

* Only for guidance

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Annealed		Quenched + Tempered				
	R_m (MPa) max	HB max*	Heat treatment	$Rp_{0,2}$ (MPa) min	R_m (MPa) max	A_5 (%) min**	KV (J) min
≤ 10	1150	380	Quenched + Tempered (+QT 900)	750	900÷1150	10	-
> 10 ≤ 16	1150	380		750	900÷1150	10	-
> 16 ≤ 40	1100	320		700	900÷1100	12	80
> 40 ≤ 63	1100	320		700	900÷1100	16	80
> 63 ≤ 100	1100	320		700	900÷1100	16	80

* For reference only ** Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 760)	Tempering (QT 900)
°C	900÷1150	600÷650	950÷1050	590÷620	550÷620

DUPLEX STAINLESS STEELS BARS

AUSTENITIC-FERRITIC

Duplex (austenitic-ferritic) stainless steel, suitable for aggresive environments

Duplex stainless steels (Austeno-ferritic) have two-phase microstructure containing ferrite and austenite.
Despite lower nickel content, they show excellent corrosion resistance and they can achieve high mechanical properties through cold drawing. These steels are suitable for marine and off-shore oil exploration. They are magnetic, can be welded but can not be heat treated and quenched. Duplex steels are still undergoing research and development to fully explore new uses and applications.

X2CrNiN23-4 Nr. 1.4362

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	USA	USA
ISO 16143-2:2014		(UNI 6900-71)	(DIN 17440-86)		(NF A 35-574-90)	ASTM A 182	AISI
Name	ISO Number						
X2CrNiN23-4	4362-323-04-I	-	-	-	-	F51 - S31803	2304

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Cu	Mo	N	Ni
0,03	1,00	2,00	0,035	0,015	22,0÷24,5	0,10÷0,60	0,10÷0,60	0,05÷0,20	3,5÷5,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max	$Rp_{0,2}$ (MPa) min	Rm	A5 (%) max	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
160	260	400	600÷830	25	100	YES	YES

MARK RODACCIAI

2304

X3CrNiMoN27-5-2 Nr. 1.4460

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	ISO Number		Werkstoff	N°			
X3CrNiMoN27-5-2	4460-312-00-I	-	-	-	Z5 CND 27 - 05 AZ	-	(329)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N	Cr	Mo	Ni
0,05	1,00	2,00	0,035	0,030	0,05÷0,20	25,0÷28,0	1,30÷2,00	4,5÷6,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max* **	Rp $_{0,2}$ (MPa) min	Rm (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	260	450	620÷880	20	85	YES	YES

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	610	770÷1030	12	-
> 10 ≤ 16	560	770÷1030	12	-
> 16 ≤ 40	460	620÷950	15	85
> 40 ≤ 63	460	620÷950	15	85
> 63 ≤ 100	460	620÷880	20	85

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	950÷1200	1020÷1100

X2CrNiMoN22-5-3 Nr. 1.4462

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMoN22-5-3g	4462–318–03-I	-	-	-	Z3 CND 22 - 05 AZ	318 S 13	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N	Cr	Mo	Ni
0,030	1,00	2,00	0,035	0,015	0,10÷0,22	21,0÷23,0	2,50÷3,5	4,5÷6,5

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max* **	Rp $_{0,2}$ (MPa) min	Rm (MPa)**	A5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	270	450	650÷880	25	100	YES	YES

* Only for guidance ** The maximum HB values may be raised by 100HB or the tensile strenght value may be raised by 200 MPa and the minimum A% value may be lowered to 20% for Wire of ≤35 mm

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	650	850÷1150	12	-
> 10 ≤ 16	650	850÷1100	12	-
> 16 ≤ 40	450	650÷1000	15	100
> 40 ≤ 63	450	650÷1000	15	100
> 63 ≤ 100	450	650÷880	25	100

* Values valid only for size ≥5 mm

MARK RODACCIAI

2205

X2CrNiMoN22-5-3 Nr. 1.4462

MECHANICAL PROPERTIES - Bars for cold heading

Size mm	as Treated (+AT) o Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	880	55	-	-	950	55	1010	50
> 5 ≤10	880	55	1020	-	900	55	970	50
> 10 ≤ 25	880	55	1000	-	880	55	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1100

X2CrMnNiN21-5-1 Nr. 1.4162

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrMnNiN21-5-1	4162-321-01-E	-	-	-	-	-	UNS 32101

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn	P / max	S / max	N	Cr	Mo	Ni	Cu
0,040	1,00	4,0÷6,0	0,040	0,015	0,20÷0,25	21,0÷22,0	0,10÷0,80	1,35÷1,90	0,10÷0,80

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Hardness HB max	$Rp_{0,2}$ (MPa) min	Rm (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	290	400	650÷900	25	60	YES	YES

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	500	700÷1050	15	-
> 10 ≤ 16	500	700÷1050	20	-
> 16 ≤ 40	500	700÷1050	20	-
> 40 ≤ 100	450	650÷840	30	60

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1100	1020÷1080

MARK RODACCIAI

2101

PRECIPITATION HARDENING STAINLESS STEELS BARS

Steels for surface hardening by induction

Precipitation hardening steels can reach very high performances of strength and hardness. Alloy elements such as Al, Ti, Nb, Mo and Cu produce, during ageing, precipitates able to raise the mechanical properties of these steels. Based on chemical balance and following heat treatments, steel can achieve an austenitic, martensitic or austenitic-ferritic structure.

These steels are suitable for applications where a combination of strength, corrosion resistance and mild toughness is required. Typical fields of applications are Oil&Gas, nuclear power generation and chemical plants.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Patented grade	
17-4PH	X5CrNiCuNb16-4	82
631M	X7CrNiAl17-7	84

X5CrNiCuNb16-4 Nr. 1.4542
17-4PH - UNS S17400

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
ASTM A564/A564M (Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X5CrNiCuNb16-4	4542-174-00-I	-	-	-	Z7 CNU 17 - 04	-	630

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Nb	Cr	Mo	Ni	Cu
0,07	0,70	1,50	0,040	0,030	5xC÷0,45	15,0÷17,0	0,60	3,0÷5,0	3,0÷5,0

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Steel designation		Thickness T or diameter D mm max	Heat treatment condition	Hardness HBW max	0,2 % proof strength $Rp_{0,2}$ (MPa) min	Tensile strength R_m (MPa)	Elongation after fracture A% min (long.)	Impact energy (ISO-V) KV_2 J min (long.)
Name	**Number**							
X5CrNiCuNb16–4	1.4542	100	+AT	360	-	max 1200	-	-
			+P800	-	520	800 to 950	18	75
			+930	-	720	930 to 1100	16	40
			+960	-	790	960 to 1160	12	-
			+1070	-	1000	1070 to 1270	10	-

X5CrNiCuNb16-4 Nr. 1.4542
17-4PH - UNS S17400

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Steel designation			Annealed		Precipitation hardened				
Name	Number	Thickness T or diameter D mm max	R_m (MPa) max	HB max	Heat treatment condition	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min (long.)	KV_2 J min (long.)
X5CrNiCuNb16–4	1.4542	≤ 10	1200	360		600	900 to 1100	10	-
		10 < t ≤ 16	1200	360		600	900 to 1100	10	-
		16 < t ≤ 40	1200	360	+P800	520	800 to 1050	12	75
		40 < t ≤ 63	1200	360		520	800 to 1000	18	75
		63 < t ≤ 100	1200	360		520	800 to 950	18	75
		≤ 100	-	-	+P930	720	930 to 1100	12	40
		≤ 100	-	-	+P960	790	960 to 1160	10	-
		≤ 100	-	-	+P1070	1000	1070 to 1270	10	-

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Steel designation		Hot formin		Heat treatment symbol	Solution annealing		Precipitation hardening
Name	Number	Temp °C	Type of cooling		Temperature °C	Type of cooling	Temperature °C
X5CrNiCuNb16–4	1.4542	1150 to 900	furnace, air	+AT	1030 to 1050	oil, air	-
				+P800	1030 to 1050		2 h 760 °C/air + 4 h 620 °C/air
				+P930	1030 to 1050		4 h 620 °C/air
				+P960	1030 to 1050		4 h 590 °C/air
				+P1070	1030 to 1050		4 h 550 °C/air

X7CrNiAl17-7 Nr. 1.4568

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	ISO number		Werkstoff	N°			
X17CrNi16-2	4568-177-00-I	-	-	-	Z 9 CNA 17-07	-	631

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni
0,12÷0,22	1,00	1,50	0,040	0,015	15,0÷17,0	1,50÷2,50

MECHANICAL PROPERTIES - Hot Rolled (1C) - Rough turned (1X) in the annealed condition

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Solution Annealed (+AT)	255	-	850 max	-	-

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	900÷1150	1060÷1080

MARK RODACCIAI

631M

SOFT MAGNETIC FERRITIC STEELS

The chemical analysis and production cycles of this ferritic stainless steel family make possible to obtain materials with excellent magnetic characteristics (high magnetic permeability, low coercive force).
Thanks to Rodacciai specific chemical analysis, these steels have also good corrosion resistance combined with high machinability.
The special magnetic properties of these grades make them suitable for applications where a rapid magnetisation and demagnetisation of components is required, e.g. insolenoid valves.

PRODUCTION RANGE AND EXECUTIONS

Stainless steel solenoid valves are ideal for being used in environments where corrosion resistance is required.
Ferritic stainless steels for solenoid applications must provide the component manufacturer with the following main characteristics:
- High magnetic response in the relevant hysteresis cycle;
- Suitable corrosion resistance depending on the operating environment;
- High performance in machining.

ROUND BARS

Possible solutions:

1) In the annealed+drawn condition (with magnetic annealing to be performed on machined parts)
2) In the annealed+drawn condition, magnetically annealed, ground

Range: 7,50 mm - 25,40 mm

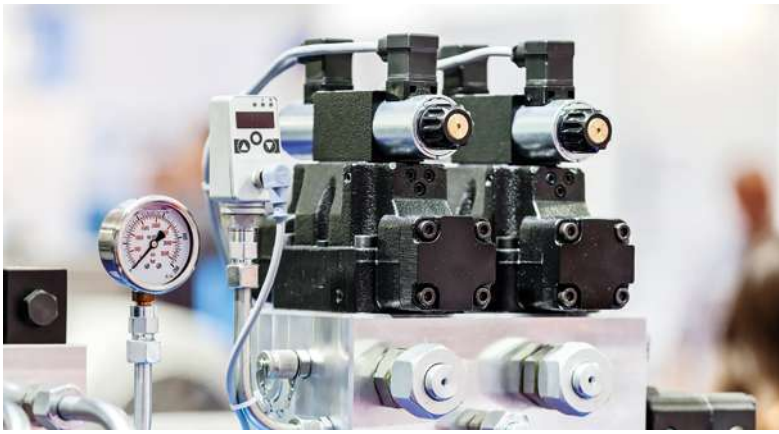
Different sizes of magnetically annealed drawn round, hexagons and squares options.

SOFT MAGNETIC FERRITIC STEELS APPLICATIONS

HYDRAULIC & FLUID | WIND ENERGY | MEDICAL PHARMA | SOLENOID VALVES | AUTOMOTIVE | OIL & GAS | FOOD & BEVERAGE | CHEMICAL INDUSTRY

There are a lot of applications, for example: injectors, irrigation valves, valves for coffee machines, steam systems (boilers), medical, professional cleaning, sanitary applications, beverage dispensing machines, filtration systems and valves for the industrial sector.

Rodacciai HMP range of products covers all the needs required by manufacturers of solenoid valves and solenoid injectors.
That is possible thanks to different steel chemistry formulations that optimise the required performance parameters.



SOFT MAGNETIC FERRITIC STEEL BARS

Soft magnetic stainless steel

Soft Magnetic Stainless Steel offers unmatched magnetic properties combined with exceptional corrosion resistance. With its unique composition and outstanding performance, this material opens up a world of possibilities for engineers, designers, and manufacturers. Special properties: high magnetic permeability, low coercivity force, high electrical resistivity and corrosion resistance.

High permeability and excellent magnetic induction, making it ideal for applications that require efficient magnetic flux and minimal energy losses.
Soft Magnetic Stainless Steel finds its application in a wide range of industries, including electrical engineering, automotive, telecommunications, aerospace, and more. Its versatility makes it suitable for transformers, motors, magnetic shielding, sensors, actuators, and beyond.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
1.4105 HMP	X7CrS17	90
1.4106 HMP	-	91
1.4114 HMP	-	92

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
ASTM A838-18 (Free-Machining ferritic stainless soft magnetic alloy bar for relay applications)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO EUROPE		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	ASTM A838
Name	**ISO Number**		**Werkstoff**	**N°**			
X7CrS17	4004-430-20-I	X 10 CrS 17	X6CrMoS17	1.4105	Z 8 CF 17	-	ALLOY 2

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si	Mn / max	P / max	S	Cr	Ni / max	Mo	N / max
0,030	1,20÷1,50	0,80	0,030	0,25÷0,35	17,0÷18,0	0,50	0,20÷0,40	0,4

TYPICAL MECHANICAL PROPERTIES

Hardness HR B	$Rp_{0,2}$ (MPa)	R_m (MPa)	A (%)	Z (%)
80÷90	300 - 450	450 - 550	Min 25	Min 40

MAGNETIC AND ELECTRICAL PROPERTIES

Magnetic Permeability (μ)	Coercive Field (HC)	Residual Induction (Br)	Saturation Induction (Bs)
Min 1400	Max 200 A/m	Max 0.85 T	Typically about 1.5 T

Typical Magnetic Permeability

MARK RODACCIAI

1.4105 HMP

STANDARD REFERENCE:

ASTM A582 (Free-Machining Stainless Steel Bars)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO EUROPE		ITALY	GERMANY		FRANCE	UK	USA
-		(UNI 6900: 71)	-		(NF A 35-574-90)	(BS 970 pt.3 -91)	ASTM A838
Name	**ISO Number**		**Werkstoff**	**N°**			
-	-	-	X2CrMoSiS18-2-1	1.4106	-	-	(ALLOY 2+Mo)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si	Mn / max	P / max	S	Cr	Ni / max	Mo	N / max
0,020	1,20÷1,50	0,60	0,030	0,25÷0,35	17,80÷18,80	0,40	1,50÷2,40	0,40

TYPICAL MECHANICAL PROPERTIES

Hardness HR B	$Rp_{0,2}$ (MPa)	R_m (MPa)	A (%)
80÷90	300 - 450	400÷550	Min 25

MAGNETIC AND ELECTRICAL PROPERTIES

Magnetic Permeability (μ)	Coercive Magn. Field intensity (Hc)	Residual Flux Density (Br)	Saturation Flux Density (Bs)
Min 1300	Max 200 A/m	Max 0.80 T	Typically about 1.6 T

Typical Magnetic Permeability

X 6 CrMoS 19-2 Nr. 1.4114

STANDARD REFERENCE:

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		FD A 35-570-96	BS 1501 pt.3 -90	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
-	-	-	X 6 CrMoS 19-2	1.4114	Z8CDF 19-2	-	XM-34 – S182000

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si	Mn / max	P / max	S	Cr	Mo	Ni / max
0,03	0,70	0,50	0,25	0,015÷0,30	17,5÷18,5	1,5÷2,0	0,30

TYPICAL MECHANICAL PROPERTIES

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)*	A_5 (%) min
100	Annealed (+A)	-	240	430÷630	14
* Only for guidance					

ELECTRICAL PROPERTIES

Eletrical Resistivity 20°C
0,60 Ω mm2/m

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	1000÷1100	770÷850

MARK RODACCIAI

1.4114 HMP

COLD DRAWN WIRE

The cold drawn stainless steel wire production is an historical division of Rodasteel group, which has been subsequently extended to reach the current annual production capacity of 75.000 tonnes.
The ALL IN HOUSE strategy allows to control each step of the production cycle guaranteeing a high quality level and studying solutions based on customer's needs. The surface treatments, performed internally, improve the finishing of the product, making it cleaner and ready for further production steps.
The heat treatments allow to balance the structure of the wire rods and to reduce internal tensions, increasing the deformability of the product. The heat treatments made in house are: Quenching and Tempering (+QT), Soft annealing (+A), Solution annealing (+AT). It is possible to customize the surface of the wire.
Rodacciai produces and sells cold drawn wire for all the main market applications.

PRODUCTION RANGE AND EXECUTIONS

	Condition	Profile	Range (mm)	Surface finishing	Tolerances
Coil	Cold-drawn	Round Hexagonal Square Special	1÷22 3÷12 4÷12 Rated on request	Bright Coated	ISA h9-h10-h11 EN 10218-2 T1-T2-T3-T4-T5

Different tolerances can be evalueted.

COLD DRAWN WIRE APPLICATIONS

AUTOMOTIVE FASTENERS FOOD & BEVERAGE CHEMICAL INDUSTRY

AUSTENITIC STAINLESS STEEL WIRE

There are several markets for this kind of material - such as automotive,food & beverage, chemical industry and cold forging for screws. Some other materials allow to achieve high mechanical properties and they are suitable for springs and spokes productions.

FERRITIC STAINLESS STEEL WIRE

These qualities are ideal for the production of scourers for cleaning and components for catalytic converters for cars.

MARTENSITIC STAINLESS STEEL WIRE

The series 420, thanks to cold forging process followed by quench and tempering phase, is used in screw production.

STAINLESS STEEL WIRE HEAT-RESISTANT

The most common application is for carpet in the heat treatments furnaces and in the food & beverage machineries.

DUPLEX (AUSTENITIC-FERRITIC) STAINLESS STEEL

Duplex stainless steel wire finds applications in various industries, including oil and gas, chemical processing, desalination plants, pulp and paper, and offshore structures.

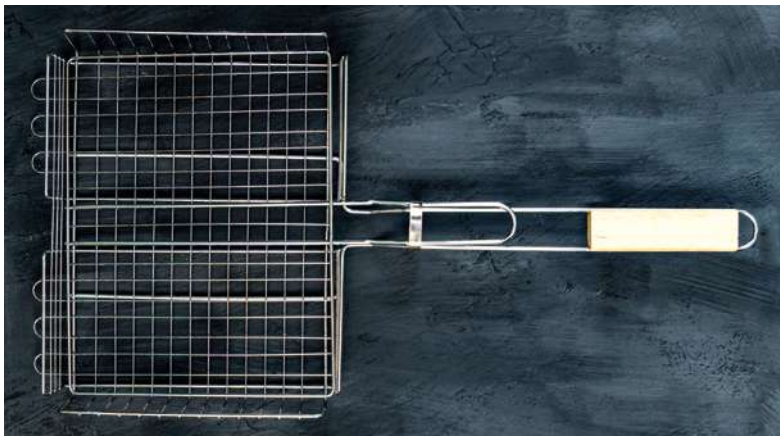
Typical uses include wire ropes, springs, fasteners, welding consumables and other components that require a combination of strength, corrosion resistance and durability.

PRECIPITATION HARDENING STAINLESS STEELS WIRE

Stainless steel precipitation hardening wire is commonly used in applications that require high strength, corrosion resistance, and good mechanical properties.

It finds applications in industries such as aerospace, oil and gas, automotive, and medical.

Some common uses of precipitation hardening wire include springs, fasteners, shafts, valves, and components for high-stress environments.



AUSTENITIC STAINLESS STEEL WIRE

300 SERIES

Corrosion resistant, non-magnetic steels

Austenitic stainless steel are characterised by high percentage of chromium and nickel that allows a good resistance to the corrosion. This property can be even increased by adding other chemical elements such as molybdenum, titanium and niobium. There is also the possibility to use the Plus series that has a good workability thanks to sulphur.
Some examples are 304 - 1.4301 - 304L - 1.4307 - 316 - 1.4401 - 316L - 1.4404 - 321 - 1.4541 - 316Ti - 1.4571, used in several sectors as fasteners, food & beverage and automotive.

Another material of this steel famil y is AISI 302, which is characterized by good cold forming properties that allows high mechanical characteristics. For this reason it is perfect for the production of springs and spokes. Austenitic stainless steel wire can be used also for application as fasteners and cold heading wires. An examples are 304Cu and 316Cu

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
204CU	X8CrMnCuN17-8-3	98
347H	X6CrNiNb18-10	99
302	X10CrNi18-8	100
303PLUS	X8CrNiS18-9	102
GVR	X6CrNiCuS18-9-2	103
304	X5CrNi18-10	104
304HF	X2CrNi18-9	106
304PLUS	X2CrNi18-9	108
304ST	X2CrNi19-11	110
304CU	X3CrNiCu18-9-4	112
316	X5CrNiMo17-12-2	114
316TI	X6CrNiMoTi17-12-2	116
316L	X6CrNiMoTi17-12-2	118
316CU	X3CrNiCuMo17-11-3-2	120
1.4435	X2CrNiMo18-14-3	121
321	X6CrNiTi18-10	122

STANDARD REFERENCE:
A313 / A313M
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 1654-5: 89)		(NF A 35-574-90)	(BS 3111 pt.2 -79)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X8CrMnCuN17-8-3	4597-204-76-I	-	-	-	-	-	204Cu - S 20430

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N	Cr	Cu	Mo / max	Ni
0,10	1,00	6,50÷9,00	0,040	0,030	0,10÷0,25	15,50÷17,50	2,00÷3,50	1,00	1,50÷3,00

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	245	270	305	560÷780	40	100	YES	NO

* Only for guidance

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

MARK RODACCIAI

204CU

X6CrNiNb18-10 Nr. 1.4550

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X6CrNiNb18-10	550-347-00-I	X 6 CrNiNb 18 11	X6CrNiNb18-10	1.4550	Z6 CNNb 18 - 10	347S31	347H

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Nb	Ni
0,04÷0,08	1,00	2,00	0,045	0,015	17,0÷19,0	10x%C÷1,00	9,0÷12,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	230	205	240	510÷740	40	100	YES	YES

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1020÷1120

MARK RODACCIAI

347H

X10CrNi18-8 Nr. 1.4310

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN ISO 6931-1: 2020 (Stainless steel for springs)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17224-82)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X10CrNi18-8	4310-301-00-I	X 2 CrNi 17 07	X 12CrNi 17 7	1.4310	Z11 CN 18 - 08	302S31	302

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo / max	Ni
0,05÷0,15	2,00	2,00	0,045	0,015	0,10	16,0÷19,0	0,80	6,0÷9,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	230	195	230	500÷750	40	NO	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600	+C 1800
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900	1800÷2100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MARK RODACCIAI

302

X10CrNi18-8 - Nr. 1.4310

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	760	60
> 5 ≤10	660	65	890	-	680	65	730	60
> 10 ≤ 25	660	65	850	-	660	65	-	-
> 25 ≤ 50	660	65	-	-	-	-	-	-

MECHANICAL PROPERTIES - Wire for springs

Nominal diameter mm	Normal tensile strength (NS)		High tensile strength (HS)	
	MPa min	MPa max	MPa min	MPa max
0,80 < d ≤ 1,00	1900	2190	2050	2360
1,00 < d ≤ 1,25	1850	2130	2000	2300
1,25 < d ≤ 1,50	1800	2070	1950	2250
1,50 < d ≤ 1,75	1750	2020	1900	2190
1,75 < d ≤ 2,00	1700	1960	1850	2130
2,00 < d ≤ 2,50	1650	1900	1750	2020
2,50 < d ≤ 3,00	1600	1840	1700	1960
3,00 < d ≤ 3,50	1550	1790	1650	1900
3,50 < d ≤ 4,25	1500	1730	1600	1840
4,25 < d ≤ 5,00	1450	1670	1550	1790
5,00 < d ≤ 6,00	1400	1610	1500	1730
6,00 < d ≤ 7,00	1350	1560	1450	1670

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1100

X8CrNiS18-9 Nr. 1.4305

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO	ITALY	GERMANY	FRANCE	UK	USA
ISO 16143-3:2014	(UNI 6900: 71)	(DIN 17440-85)	(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI

Name	ISO number		Werkstoff	N°			
X8CrNiS18-9	4305-303-00-I	X 10 CrNiS 18 09	X8CrNiS18-09	1.4305	Z8 CNF 18 - 09	303S31	303

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Cu / max	Ni
0,10	1,00	2,00	0,045	0,15÷0,35	0,10	17,0÷19,0	1,00	8,0÷10,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	230	190	225	500÷750	35	-	NO	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

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X6CrNiCuS18-9-2 - Nr. 1.4570

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X6CrNiCuS18-9-2	4570-303-31-I	-	-	-	Z8 CNUF 18 - 09	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N / max	Cr	Cu	Mo / max	Ni
0,08	1,00	2,00	0,045	0,15÷0,35	0,10	17,0÷19,0	1,40÷1,80	0,60	8,0÷10,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	215	185	220	500÷710	35	NO	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1020÷1100

X5CrNi18-10 Nr. 1.4301

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**
EN ISO 6931-1: 2020 (Stainless steel for springs)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X5CrNi18-10	4301-304-00-I	X 5 CrNi 18 10	X5CrNi18-10	1.4301	Z7 CN 18 - 09	304S15	304

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Ni
0,07	1,00	2,00	0,045	0,015	0,10	17,50÷19,50	8,0÷10,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	190	225	500÷700	45	100	YES	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

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304

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	700	60	750	60
> 5 ≤10	650	65	820	-	650	65	700	60
> 10 ≤ 25	650	65	780	-	650	65	-	-
> 25 ≤ 50	650	65	-	-	-	-	-	-

MECHANICAL PROPERTIES - Wire for springs

Nominal diameter mm	Normal tensile strength (NS)	High tensile strength (HS)	MPa max
	MPa min	MPa min	
0,80 < d ≤ 1,00	1775	1850	2050
1,00 < d ≤ 1,25	1725	1750	1990
1,25 < d ≤ 1,50	1675	1750	1930
1,50 < d ≤ 1,75	1625	1650	1870
1,75 < d ≤ 2,00	1575	1650	1820
2,00 < d ≤ 2,50	1525	1550	1760
2,50 < d ≤ 3,00	1475	1550	1700
3,00 < d ≤ 3,50	1425	1450	1640
3,50 < d ≤ 4,25	1400	1450	1610
4,25 < d ≤ 5,00	1350	1350	1560
5,00 < d ≤ 6,00	1300	1350	1500
6,00 < d ≤ 7,00	1250	1300	1440

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1020÷1100

X2CrNi18-9 Nr. 1.4307

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4307-304-03-I	X 5 CrNi 18 10	X5CrNi18-10	1.4301	Z7 CN 18 - 09	304S15	304L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N	Cr	Ni
0,03	1,00	2,00	0,045	0,020÷0,030	0,10	17,50÷19,50	9,0÷10,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	210	500÷700	45	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	800	-	630	68	680	63
> 10 ≤ 25	630	68	760	-	630	68	-	-
> 25 ≤ 50	630	68	740	-	630	68	-	-

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304HF

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNi18-9 - Nr. 1.4307

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4307-304-03-I	-	-	-	Z3 CN 19 - 09	304S15	304L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	N/ max	Cr	Ni
0,030	1,00	2,00	0,045	0,020÷0,030	0,10	17,50÷19,50	8,0÷10,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max* **	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)**	A_5 (%) min**	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	210	500÷700	45	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Classe di resistenza	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled(+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	800	-	630	68	680	63
> 10 ≤ 25	630	68	760	-	630	68	-	-
> 25 ≤ 50	630	68	740	-	630	68	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X2CrNi19-11 Nr. 1.4306

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi19-11	4306-304-03-I	X 2 CrNi 18 11	X2CrNi19-11	1.4306	Z3 CN 19 - 11	304S11	304L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Ni
0,030	1,00	2,00	0,045	0,015	0,10	18,0÷20,0	10,0÷12,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	180	215	460÷680	45	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

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304ST

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	680	68	730	63
> 5 ≤10	630	68	780	-	630	68	680	63
> 10 ≤ 25	630	68	740	-	630	68	-	-
> 25 ≤ 50	630	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X3CrNiCu18-9-4 Nr. 1.4567

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 1654-5: 89)		(NF A 35-574-90)	(BS 3111 pt.2 -79)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X3CrNiCu18-9-4	4567-304-30-I	-	X3CrNiCu18-9	1.4567	Z3 CNU 18 - 10	394S17	302HQ

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Cu	Ni
0,04	1,00	2,00	0,045	0,015	0,10	17,0÷19,0	3,0÷4,0	8,5÷10,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	210	460÷650	45	-	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

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304CU

X3CrNiCu18-9-4 Nr. 1.4567

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	600	68	650	63
> 5 ≤10	590	68	740	-	590	68	640	63
> 10 ≤ 25	590	68	700	-	590	68	-	-
> 25 ≤ 50	590	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

X5CrNiMo17-12-2 Nr. 1.4401

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**
EN ISO 6931-1: 2020 (Stainless steel for springs)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO Number		Werkstoff	N°			
X2CrNi18-9	4401-316-00-I	X 5 CrNiMo 17 12	X5CrNiMo17-12-2	1.4401	Z7 CND 17 - 11 - 02	316S31	316

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo	Ni
0,07	1,00	2,00	0,045	0,015	0,10	16,5÷18,5	2,00÷2,50	10,0÷13,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

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316

X5CrNiMo17-12-2 Nr. 1.4401

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	690	65	740	60
> 5 ≤10	660	65	830	-	670	65	720	60
> 10 ≤ 25	660	65	790	-	670	65	-	-
> 25 ≤ 50	660	65	-	-	-	-	-	-

MECHANICAL PROPERTIES - Wire for springs

Nominal diameter mm	Normal tensile strength (NS)	High tensile strength (HS)
	MPa min	MPa min
0,80 < d ≤ 1,00	1575	1820
1,00 < d ≤ 1,25	1550	1790
1,25 < d ≤ 1,50	1500	1730
1,50 < d ≤ 1,75	1450	1670
1,75 < d ≤ 2,00	1400	1610
2,00 < d ≤ 2,50	1350	1560
2,50 < d ≤ 3,00	1300	1500
3,00 < d ≤ 3,50	1250	1440
3,50 < d ≤ 4,25	1225	1410
4,25 < d ≤ 5,00	1200	1380
5,00 < d ≤ 6,00	1150	1330
6,00 < d ≤ 7,00	1125	1300

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1120

X6CrNiMoTi17-12-2 Nr. 1.4571

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4571-316-35-I	X 6 CrNiMoTi 17 12	X5CrNiMo17-12-2	1.4571	Z6 CNDT 17 - 12	316S31	316Ti

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni	Ti
0,08	1,00	2,00	0,045	0,015	16,5÷18,5	2,00÷2,50	10,5÷13,5	5x%C÷0,70

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Spessore	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MARK RODACCIAI

316TI

X6CrNiMoTi17-12-2 Nr. 1.4571

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	770	60
> 5 ≤10	680	65	850	-	680	65	730	60
> 10 ≤ 25	680	65	810	-	680	65	-	-
> 25 ≤ 50	680	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1120

X2CrNiMo17-12-2 Nr. 1.4404

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMo17-12-2	4404-316-03-I	X 2 CrNiMo 17 12	X2CrNiMo17-12-2	1.4404	Z3 CND 17 - 11 - 02	(316S11)	316L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo	Ni
0,030	1,00	2,00	0,045	0,015	0,10	16,5÷18,5	2,00÷2,50	10,0÷13,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

MARK RODACCIAI

316L

X2CrNiMo17-12-2 Nr. 1.4404

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	670	68	720	63
> 5 ≤10	650	68	780	-	650	68	700	63
> 10 ≤ 25	650	68	750	-	650	68	-	-
> 25 ≤ 50	650	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1120

X3CrNiCuMo17-11-3-2 Nr. 1.4578

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products) | **EN 10263-5: 2017** (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 4954:2021		(UNI 6900: 71)	(DIN 1654-5:89)		(NF A 35-574-90)	(BS 3111-79)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X3CrNiCu-Mo17-11-3-2	4578-316-76-E	-	-	-	-	396S17	(316CU)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni	Mo	Cu
0,04	1,00	2,00	0,045	0,015	0,10	16,5÷17,5	10,0÷11,0	2,00÷2,50	3,0÷3,5

MECHANICAL PROPERTIES - Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	175	-	450÷650	45	-	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	630	68	680	63
> 5 ≤10	610	68	760	-	610	68	660	63
> 10 ≤ 25	610	68	720	-	610	68	-	-
> 25 ≤ 50	610	68	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1150	1000÷1100

MARK RODACCIAI

316CU

X2CrNiMo18-14-3 Nr. 1.4435

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products) | **EN 10263-5: 2017** (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440-85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMo18-14-3	4435-316-91-I	X 2 CrNiMo 17 13	X2CrNiMo18-14-3	1.4435	Z3 CND 18-14-03	316S13	316L

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N/ max	Cr	Mo	Ni
0,030	1,00	2,00	0,045	0,015	0,10	17,0÷19,0	2,50÷3,00	12,5÷15,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min*	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	200	235	500÷700	40	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1120

X6CrNiTi18-10 Nr. 1.4541

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products) | **EN 10263-5: 2017** (Wire rods, bars and wire for cold heading products)
EN 10272: 2016 (Stainless steel bars for pressure purposes) **P.E.D. 2014/68/EU**

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014 ISO 4954:2021		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNi18-9	4541-321-00	X 6 CrNiTi 18 11	X6CrNiTi18-10	1.4541	Z6 CNT 18 - 10	321S31	(321)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Ni	Ti
0,08	1,00	2,00	0,045	0,015	17,0÷19,0	9,0÷12,0	5x%C÷0,70

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
100	215	190	225	500÷700	40	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 600	+C 700	+C 800	+C900	+C 1000	+C 1100	+C 1200	+C 1400	+C 1600
Rm (MPa)	600÷800	700÷900	800÷1000	900÷1100	1000÷1250	1100÷1350	1200÷1450	1400÷1700	1600÷1900

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1050	1000	950	900	850	800
A (%) min	20	30	30	30	35	35

Note: If skin passed, Rm might be increased by up to 50 MPa

X6CrNiTi18-10 Nr. 1.4541

MECHANICAL PROPERTIES - Bars, wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	720	65	770	60
> 5 ≤10	680	65	850	-	680	65	730	60
> 10 ≤ 25	680	65	810	-	680	65	-	-
> 25 ≤ 50	680	65	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1000÷1100

AUSTENITIC HEAT-RESISITING STEELS WIRE

300 SERIES

Steels resistant to corrosion and high temperatures

The specific needs of parts that operate at very high temperatures have led to create stainless steels able to withstand these very particular conditions: this is, for example, the case of steels designed to be used into heat treatment ovens or as resistors of radiating elements.

Thanks to the addition of chromium and nickel in high quantities and to a balanced analysis, the steels in this category are particularly suitable for retaining good mechanical characteristics at high temperature; they can therefore remain in service for a long time in environments at high temperature and with chemical aggressiveness.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
310	X8CrNi25-21	126
314	X15CrNiSi25-21	127
1.4828	X15CrNiSi20–12	128

X8CrNi25-21 Nr. 1.4845

STANDARD REFERENCE:
EN 10095: 1999 (Heat resisting steels and nickel alloys)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	-		(NF A 35-578-91)	(BS 1501 pt. 3-80)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X8CrNi25-21	4845-310-08-E	X 22 CrNi 25 20	–		Z 8 CN 25 - 20	310S16	310 S

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,10	1,50	2,00	0,045	0,015	0,11	24,0÷26,0	19,0÷22,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	$Rp_{1,0}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	192	210	250	500÷700	35

*Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X15CrNiSi25-21 Nr. 1.4841

STANDARD REFERENCE:
EN 10095: 1999 (Heat resisting steels and nickel alloys)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	-		(NF A 35-578-91)	(BS 1501 pt. 3-80)	AISI
Name	Number		Werkstoff	N°			
-	-	X 16 CrNiSi 25 20	–	–	Z 15 CNS 25 - 20	-	314

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,20	1,50÷2,50	2,00	0,045	0,015	0,11	24,0÷26,0	19,0÷22,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	$Rp_{1,0}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	223	230	270	550÷700	30

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X15CrNiSi20-12 Nr. 1.4828

STANDARD REFERENCE:

EN 10095: 1999 (Heat resisting steels and nickel alloys)
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 4955:2016		-	-		NF A 35-578	-	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X15CrNiSi20–12	4828–305–09-I	-	X 15 CrNiSi 20 12	1.4828	Z17CNS20-12	309S24	309

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	N / max	Cr	Ni
0,20	1,50÷2,50	2,00	0,045	0,015	0,11	19,00÷21,00	11,00÷13,00

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	Rp $_{1}$ (MPa) min*	R_m (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
							in the delivery condition	in the welded condition
75	223	230	270	550÷750	30	-	-	-

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1050÷1150

MARK RODACCIAI

1.4828

FERRITIC STAINLESS STEELS WIRE

400 SERIES

Corrosion-resistant, non-hardenable steels

AISI 430 – 1.4016 is one of the most common qualities of ferritic stainless steel. It is typically used in production of meshes, in the clean industry and in the automotive sector.

Another application of this steel family is for the production of screws, in this case the recommended quality is AISI 434. For these materials the resistance of the corrosion is lower than austenitic stainless steels.

	EUROPEAN OR INTERNATIONAL	PAGE
MARK RODACCIAI	Steel grade	
430	X6Cr17	132
430NB	X3CrNb17	134
1.4105	X6CrMoS17	135
434	X6CrMo17-1	136
1.4763	X8Cr24	138

X6Cr17 - Nr. 1.4016

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

EUROPE		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 86)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	ISO number		Werkstoff	N°			
X6Cr17	4016-430-00-I	X 8 Cr 17	X6Cr17	1.4016	Z 8 C 17	430S17	430

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr
0,08	1,00	1,00	0,040	0,015	16,0÷18,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	240	400÷630	20	YES	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	900	850	850	800	750	700
A (%) min	10	15	15	15	15	20

Note: If skin passed, Rm might be increased by up to 50 MPa

MARK RODACCIAI

430

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Soft Annealed + Skin Passed (+A +LC)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	560	63	620	61
> 5 ≤10	560	63	660	60	560	63	600	61
> 10 ≤ 25	560	63	640	60	560	63	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	800÷1100	750÷850

X3CrNb17 Nr.1.4511

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

EUROPE		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 8317: 81)	(DIN 17441 - 86)		(NF A 35-573-90)	(BS 970 pt.3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X3CrNb17	511-430-71-I	X 6 CrNb 17	X6CrNb17	1.4511	Z 4 CNb 17	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Nb
0,05	1,00	1,00	0,040	0,015	16,0÷18,0	12xC÷1,00

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
50	200	200	420÷620	20	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MARK RODACCIAI

430NB

X6CrMoS17 Nr.1.4105

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

EUROPE		ITALY	GERMANY		FRANCE	UK	USA
EN 10088-3: 2005		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt.3 -91)	AISI
Name	**Number**		**Werkstoff**	**N°**			
X6CrMoS17	1.4105	X 10 CrS 17	X6CrMoS17	1.4105	Z 8 CF 17	-	430F

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S	Cr	Mo
0,08	1,50	1,50	0,040	0,15÷0,35	16,0÷18,0	0,20÷0,60

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Durezza HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	200	430÷630	20	NO	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	900	850	850	800	750	700
A (%) min	10	15	15	15	15	20

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	800÷1100	750÷850

X6CrMo17-1 Nr. 1.4113

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

EUROPE		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 -90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X6CrMo17-1	4113-434-00-I	X 8 CrMo 17	X6CrMo17-1	1.4113	Z 8 CD 17-01	434S20	434

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo
0,08	1,00	1,00	0,040	0,030	16,0÷18,0	0,90÷1,40

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	Resistance to intergranular corrosion	
					in the delivery condition	in the welded condition
100	200	280	440÷660	18	YES	NO

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,10 ≤ d ≤ 0,20	0,20 ≤ d ≤ 0,50	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	900	850	850	800	750	700
A (%) min	10	15	15	15	15	20

Note: If skin passed, Rm might be increased by up to 50 MPa

X6CrMo17-1 Nr. 1.4113

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	As Treated (+AT) or Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	600	60	660	58
> 5 ≤10	600	60	710	57	600	60	640	58
> 10 ≤ 25	600	60	690	57	600	60	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	800÷1100	750÷850

X8Cr24 Nr. 1.4763

STANDARD REFERENCE:

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

EUROPE		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	-		NF A 35-578-91	BS 1501 pt. 3-80	AISI
Name	ISO number		Werkstoff	N°			
-	-	-	X8Cr24	1.4763	-	-	S44600

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N / max	Cr
0,10	1,00	1,00	0,035	0,015	0,10	23,0÷26,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,1}$ (MPa) min*	$Rp_{0,2}$ (MPa) min*	R_m (MPa) min*	A_5 (%) min*
100	-	280	-	480	20

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	800÷1100	750÷850	950÷1000	680÷780

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1.4763

MARTENSITIC STAINLESS STEELS WIRE

400 SERIES

Corrosion-resistant, hardenable steels

The main feature of this kind of steel is their suitability to heat treatment (for example the quenching and tempering). These steels can be used in many sectors thanks to the higher mechanical characteristics that they can reach. The most known grade is AISI 430F – 1.4104, which is used in oil & gas industry, automotive sector and for the construction of pumps and valves.

X12Cr13 Nr. 1.4006

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X12Cr13	4006-410-00-I	X 12 Cr 13	X12Cr13	1.4006	Z 10 C 13	410S21	410

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni / max
0,08÷0,15	1,00	1,50	0,040	0,030	11,5÷13,5	0,75

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	220	-	730 max	-	-
	Quenched + Tempered (+QT 650)	-	450	650÷850	15	25

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

MARK RODACCIAI

410

X12Cr13 Nr. 1.4006

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	+A or +A +PE		Cold Drawn (+A +C)		Cold Drawn + Annealed (+A +C +A)		Cold Drawn + Annealed + Skin passed (+A +C +A +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	-	-	-	-	600	60	660	58
> 5 ≤10	600	60	720	57	600	60	640	58
> 10 ≤ 25	600	60	700	57	600	60	-	-
> 25 ≤ 50	590	60	-	-	-	-	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

X12CrS13 Nr. 1.4005

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X12CrS13	4005-416-00-I	X 12 CrS 13	-	-	Z 11 CF 13	416S21	416

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Mo / max
0,06÷0,15	1,00	1,50	0,040	0,15÷0,35	12,0÷14,0	0,60

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	Ricotto (+A)	220	-	730 max	-
	Quenched + Tempered (+QT 650)	-	450	650÷850	12

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	745÷825	950÷1000	680÷780

MARK RODACCIAI

416

X20Cr13 Nr. 1.4021

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X20Cr13	4021-420-00-I	X 20 Cr 13	X20Cr13	1.4021	Z 20 C 13	420S29 - 420S37	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,16÷0,25	1,00	1,50	0,040	0,015	12,0÷14,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	230	-	760 max	-	-
	Quenched + Tempered (+QT 700)	-	500	700÷850	13	25
	Quenched + Tempered (+QT 800)	-	600	800÷950	12	20

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 700)	Tempering (QT 800)
°C	900÷1100	745÷825	950÷1050	600÷750	600÷700

X30Cr13 Nr. 1.4028

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 - 90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X30Cr13	4028-420-00-I	X 30 Cr 13	X30Cr13	1.4028	Z 33 C 13	420S45	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,26÷0,35	1,00	1,50	0,040	0,030	12,0÷14,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 850)	-	650	850÷1000	10	12

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 850)
°C	900÷1100	745÷825	950÷1050	625÷675

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420B

X39Cr13 Nr. 1.4031

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 1554 - 90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
-	-	X 40 Cr 14	X38Cr13	1.4031	(Z 44 C 14)	420S45	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,36÷0,42	1,00	1,00	0,040	0,015	12,5÷14,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 800)	-	650	800÷1000	10	12

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 800)
°C	900÷1100	750÷850	950÷1050	650÷700

X46Cr13 Nr. 1.4034

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
-	-	(X 40 Cr 14)	X46Cr13	1.4034	Z 44 C 14	-	420

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr
0,43÷0,50	1,00	1,00	0,040	0,015	12,5÷14,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	Rp $_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	245	-	800 max	-	-
	Quenched + Tempered (+QT 800)	-	650	800÷1000	10	12

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)	Quenching in air or oil	Tempering (QT 800)
°C	900÷1100	750÷850	950÷1050	650÷700

MARK RODACCIAI

420C1

X14CrMoS17 Nr. 1.4104

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
-	-	X 10 CrS 17	X14CrMoS17	1.4104	Z 13 CF 17	-	430F

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S	Cr	Mo
0,10÷0,17	1,00	1,50	0,040	0,15÷0,35	15,5÷17,5	0,20÷0,60

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
100	Annealed (+A)	220	-	730 max	-
≤ 60	Quenched + Tempered (+QT 650)	-	500	650÷850	12
> 60 ≤ 100	Quenched + Tempered (+QT 650)	-	500	650÷850	10

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 650)
°C	900÷1100	750÷850	950÷1070	550÷650

X39CrMo17-1 Nr. 1.4122

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(SEW 400 : 1973)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X39CrMo17-1	4122-434-09-I	-	X 35 CrMo 17	1.4122	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni / max
0,33÷0,45	1,00	1,50	0,040	0,015	15,5÷17,5	0,80÷1,30	1,00

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	280	-	900 max	-	-
60	Quenched + Tempered (+QT 800)	-	550	750÷950	12	15

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

* For reference only Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 650)
°C	800÷1100	750÷850	980÷1060	650÷750

MARK RODACCIAI

1.4122

X17CrNi16-2 Nr. 1.4057

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X17CrNi16-2	4057-431-00-X	X 16 CrNi 16	X17CrNi16-2	1.4057	Z 15 CN 16 - 02	431S29	431

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni
0,12÷0,22	1,00	1,50	0,040	0,030	15,0÷17,0	1,50÷2,50

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	295	-	950 max	-	-
≤ 60	Quenched + Tempered (+QT 800)	-	600	800÷950	14	25
> 60 ≤ 100	Quenched + Tempered (+QT 800)	-	600	800÷950	12	20
≤ 60	Quenched + Tempered (+QT 900)	-	700	900÷1050	12	16
> 60 ≤ 100	Quenched + Tempered (+QT 900)	-	700	900÷1050	10	15

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)	Quenching in air or oil	Tempering (QT 800)	Tempering (QT 900)
°C	900÷1100	680÷800	950÷1050	750÷800 + 650÷700	600÷650

X46CrS13 Nr. 1.4035

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3 -91)	AISI
Name	ISO number		Werkstoff	N°			
-	-	-	-	-	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S	Cr
0,43÷0,50	1,00	2,0	0,040	0,15÷0,35	12,5÷14,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min
63	Annealed (+A)	245	-	800	-

* Only for guidance ** For rods, only the tensile strenght values apply

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (air)
°C	900÷1100	750÷850

MARK RODACCIAI

420C F

X90CrMoV18 Nr. 1.4112

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		-	SEW 400: 1973		NF A 35-574-90	((BS 1501 pt.3 -90)	AISI
Name	ISO number		Werkstoff	N°			
-	-	-	X 90 CrMoV 18	1.4112	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Mo	V
0,85÷0,95	1,00	1,00	0,040	0,015	17,0÷19,0	0,90÷1,30	0,07÷0,12

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rp_{1} (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
63	Annealed (+A)	245	-	800	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	800÷1100	780÷840

X4CrNiMo16-5-1 Nr. 1.4418

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X4CrNiMo16-5-1	4418-431-77-E	-	X 4 CrNiMo16 5	1.4118	Z6 CND 16-05 -01-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Mo	Ni	N /min
0,06	0,70	1,50	0,040	0,015	15,0÷17,0	0,80÷1,50	4,0÷6,0	0,020

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Annealed (+A)	320	-	1100 max	-	-
≤ 100	Quenched + Tempered (+QT 760)	-	550	760÷960	16	90
≤ 100	Quenched + Tempered (+QT 900)	-	700	900÷1100	16	80

* Only for guidance

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	800÷1100	780÷840

MARK RODACCIAI

1.4418


12
12
11
11
10

DUPLEX STAINLESS STEELS WIRE

AUSTENITIC-FERRITIC

Duplex (austenitic-ferritic) stainless steel, suitable for aggresive environments

Duplex stainless steels (Austeno-ferritic) have two-phase microstructure containing ferrite and austenite. Despite lower nickel content, they show excellent corrosion resistance and they can achieve high mechanical properties through cold drawing.

These steels are suitable for marine and off-shore oil exploration. They are magnetic, can be welded but can not be heat treated and quenched. Duplex steels are still undergoing research and development to fully explore new uses and applications.

X2CrNiN23-4 Nr. 1.4362

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	USA	USA
ISO 16143-3:2014		(UNI 6900-71)	(DIN 17440-86)		(NF A 35-574-90)	ASTM A 182	AISI
Name	ISO Number						
X2CrNiN23-4	4362-323-04-I	-	-	-	-	F51 - S31803	2304

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Cr	Cu	Mo	N	Ni
0,03	1,00	2,00	0,035	0,015	22,0÷24,5	0,10÷0,60	0,10÷0,60	0,05÷0,20	3,5÷5,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max	$Rp_{0,2}$ (MPa) min	Rm	A5 (%) max	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
160	260	400	600÷830	25	100	YES	YES

MECHANICAL PROPERTIES - Tensile strength of wire 2H condition

Level of resistance	R_m (MPa)
+ C 800	800÷1000
+ C 900	900÷1100
+ C 1000	1000÷1250
+ C 1100	1100÷1350
+ C 1200	1200÷1450
+ C 1400	1400÷1700
+ C 1600	1600÷1900
+ C 1800	1800÷2100

MECHANICAL PROPERTIES - Wire and coils solubilized condition +AT

Size max (mm)	R_m (MPa)	A_5 (%) min*
> 0,50 ≤ 1,00	1050	20
> 1,00 ≤ 3,00	1000	20
> 3,00 ≤ 5,00	950	25
> 5,00 ≤ 16,00	900	25

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2304

X3CrNiMoN27-5-2 Nr. 1.4460

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X3CrNiMoN27-5-2	4460-312-00-I	-	-	-	Z5 CND 27 - 05 AZ	-	(329)

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N	Cr	Mo	Ni
0,05	1,00	2,00	0,035	0,030	0,05÷0,20	25,0÷28,0	1,30÷2,00	4,5÷6,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max	$Rp_{0,2}$ (MPa) min	Rm (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	260	450	620÷880	20	85	YES	YES

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	950÷1200	1020÷1100

X2CrNiMoN22-5-3 Nr. 1.4462

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
EN 10263-5: 2017 (Wire rods, bars and wire for cold heading products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrNiMoN22-5-3g	4462–318–03-I	-	-	-	Z3 CND 22 - 05 AZ	318 S 13	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	N	Cr	Mo	Ni
0,030	1,00	2,00	0,035	0,015	0,10÷0,22	21,0÷23,0	2,50÷3,5	4,5÷6,5

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max*	$Rp_{0,2}$ (MPa) min	Rm (MPa)	A5 (%) min	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	270	450	650÷880	25	100	YES	YES

* Only for guidance

MECHANICAL PROPERTIES - Wire and coils for cold heading

Size mm	as Treated (+AT) o Peeled (+AT+PE)		Cold Drawn (+AT +C)		Cold Drawn + Solution annealed (+AT +C +AT)		Cold Drawn + Solution annealed + Skin passed (+AT +C +AT +LC)	
	R_m (MPa) max	Z (%) min	R_m (MPa) max	Z (%) min	R_m (MPa)max	Z (%) min	R_m (MPa) max	Z (%) min
≥2 ≤ 5	880	55	-	-	950	55	1010	50
> 5 ≤10	880	55	1020	-	900	55	970	50
> 10 ≤ 25	880	55	1000	-	880	55	-	-

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2205

X2CrNiMoN22-5-3 Nr. 1.4462

MECHANICAL PROPERTIES - Wire for springs

Nominal diameter mm	Normal tensile strength (NS)		High tensile strength (HS)	
	MPa min	MPa max	MPa min	MPa max
0,80 < d ≤ 1,00	1800	2070	2140	2470
1,00 < d ≤ 1,25	1800	2070	2090	2410
1,25 < d ≤ 1,50	1700	1960	2090	2410
1,50 < d ≤ 1,75	1700	1960	2000	2300
1,75 < d ≤ 2,00	1700	1960	2000	2300
2,00 < d ≤ 2,50	1550	1790	1900	2190
2,50 < d ≤ 3,00	1550	1790	1860	2140
3,00 < d ≤ 3,50	1550	1790	1850	2050
3,50 < d ≤ 4,25	1450	1670	1750	1950
4,25 < d ≤ 5,00	1450	1670	1700	1900
5,00 < d ≤ 6,00	1350	1560	-	-
6,00 < d ≤ 7,00	1350	1560	-	-

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1200	1020÷1100

X2CrMnNiN21-5-1 Nr. 1.4162

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		-	-		(NF A 35-574-90)	(BS 1501 pt.3 -90)	AISI
Name	**ISO Number**		**Werkstoff**	**N°**			
X2CrMnNiN21-5-1	4162-321-01-E	-	-	-	-	-	UNS 32101

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn	P / max	S / max	N	Cr	Mo	Ni	Cu
0,040	1,00	4,0÷6,0	0,040	0,015	0,20÷0,25	21,0÷22,0	0,10÷0,80	1,35÷1,90	0,10÷0,80

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Hardness HB max	$Rp_{0,2}$ (MPa) min	Rm (MPa)	A_5 (%) min	KV (J) min	Resistance to intergranular corrosion	
						in the delivery condition	in the welded condition
100	290	400	650÷900	25	60	YES	YES

MECHANICAL PROPERTIES FOR BRIGHT BARS - Cold drawn or Peeled conditions 2H or 2B or Ground bars 2G

Size max (mm)	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min*	KV (J) min
≤ 10	500	700÷1050	15	-
> 10 ≤ 16	500	700÷1050	20	-
> 16 ≤ 40	500	700÷1050	20	-
> 40 ≤ 100	450	650÷840	30	60

* Values valid only for size ≥5 mm

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Solution annealing (water, air)
°C	900÷1100	1020÷1080

MARK RODACCIAI

2101

PRECIPITATION HARDENING STAINLESS STEELS WIRE

Stainless steel precipitation hardening, unparalleled strength and durability

Stainless steel precipitation hardening wire, also known as PH stainless steel wire, is a type of stainless steel wire that undergoes a process called precipitation hardening to achieve improved strength and hardness. The most common type of stainless steel used for precipitation hardening wire is known as PH 17-4 stainless steel, which belongs to the 17-4 PH stainless steel family. It contains approximately 17% chromium and 4% nickel, along with other alloy elements such as copper and niobium.
The addition of these elements helps to promote the precipitation of fine particles during the heat treatment process.

Stainless steel precipitation hardening wire is commonly used in applications that require high strength, corrosion resistance and good mechanical properties. It finds applications in industries such as aerospace, oil & gas, automotive and medical. Some common uses of precipitation hardening wire include springs, fasteners, shafts, valves and components for high-stress environments.

X7CrNiAl17-7 Nr. 1.4568

STANDARD REFERENCE:
EN 10088-3: 2014 (Hot-rolled and bright products)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-2:2014		(UNI 6900: 71)	(DIN 17440 - 85)		(NF A 35-574-90)	(BS 970 pt. 3-91)	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X17CrNi16-2	4568-177-00-I	-	-	-	Z 9 CNA 17-07	-	631

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C	Si / max	Mn / max	P / max	S / max	Cr	Ni
0,12÷0,22	1,00	1,50	0,040	0,015	15,0÷17,0	1,50÷2,50

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Size max (mm)	Heat treatment	Hardness HB max*	$Rp_{0,2}$ (MPa) min	R_m (MPa)	A_5 (%) min	KV (J) min
100	Solution Annealed (+AT)	255	-	850 max	-	-

* Only for guidance

MECHANICAL PROPERTIES - Cold drawn wire and coils (2H)

Tensile strength levels	+C 500	+C 600	+C 700	+C800	+C900
Rm (MPa)	500÷700	600÷800	700÷900	800÷1100	900÷1100

Note: the desired tensile strength level shall be evaluated depending on diameter required

MECHANICAL PROPERTIES - Cold drawn wire and coils in the solution annealed condition (2D)

Size	0,50 ≤ d ≤ 1,00	1,00 ≤ d ≤ 3,00	3,00 ≤ d ≤ 5,00	5,00 ≤ d ≤ 16,00
Rm (MPa) max	1100	1050	1000	950
A (%) max	10	10	10	15

Note: If skin passed, Rm might be increased by up to 50 MPa

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631M

X7CrNiAl17-7 Nr. 1.4568

MECHANICAL PROPERTIES - Wire for springs

Nominal diameter mm	MPa min	MPa max
0,80 < d ≤ 1,00	1800	2070
1,00 < d ≤ 1,25	1750	2020
1,25 < d ≤ 1,50	1700	1960
1,50 < d ≤ 1,75	1650	1900
1,75 < d ≤ 2,00	1600	1840
2,00 < d ≤ 2,50	1550	1790
2,50 < d ≤ 3,00	1500	1730
3,00 < d ≤ 3,50	1450	1670
3,50 < d ≤ 4,25	1400	1610
4,25 < d ≤ 5,00	1350	1560
5,00 < d ≤ 6,00	1300	1500
6,00 < d ≤ 7,00	1250	1440

WORKING TEMPERATURES RECOMMENDED

Operation	Hot forgings deformation	Annealing (furnace, air)
°C	900÷1150	1060÷1080

X5CrNiCuNb16-4 Nr. 1.4542
17-4PH - UNS S17400

STANDARD REFERENCE:

EN 10088-3: 2014 (Hot-rolled and bright products)
ASTM A564/A564M (Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel)

RODACCIAI REFERENCES AND COMPARABLE STANDARDS

ISO		ITALY	GERMANY		FRANCE	UK	USA
ISO 16143-3:2014		-	-		NF A 35-574-90	BS 1501 pt.3 -90	AISI
Name	**ISO number**		**Werkstoff**	**N°**			
X5CrNiCuNb16-4	4542-174-00-I	-	-	-	Z 9 CNA 17-07	-	630

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

C / max	Si / max	Mn / max	P / max	S / max	Nb	Cr	Mo / max	Ni	Cu
0,07	0,70	1,50	0,040	0,015	5xC÷0,45	15,0÷17,0	0,60	3,0÷5,0	3,0÷5,0

MECHANICAL PROPERTIES – Rods Hot Rolled (1C - 1E)

Steel designation		Thickness T or diameter D mm max	Heat treatment condition	Hardness HBW max	0,2 % proof strength Rp 0,2 (MPa) min	Tensile strength R_m (MPa)	Elongation after fracture A% min (long.)	Impact energy (ISO-V) KV2 J min (long.)
Name	**Number**							
X5CrNiCuNb16–4	1.4542	100	+AT	360	-	max 1200	-	-
			+P800	-	520	800 to 950	18	75
			+930	-	720	930 to 1100	16	40
			+960	-	790	960 to 1160	12	-
			+1070	-	1000	1070 to 1270	10	-

WORKING TEMPERATURES RECOMMENDED

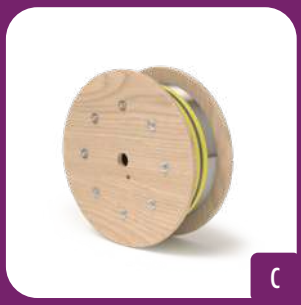
Steel designation		Hot forming		Heat treatment symbol	Solution annealing		Precipitation hardening
Name	**Number**	**Temperature °C**	**Type of cooling**		**Temperature °C**	**Type of cooling**	**Temperature °C**
X5CrNiCuNb16–4	1.4542	1150 to 900	furnace, air	+AT	1030 to 1050	oil, air	-
				+P800	1030 to 1050		2 h 760 °C/air + 4 h 620 °C/air
				+P930	1030 to 1050		4 h 620 °C/air
				+P960	1030 to 1050		4 h 590 °C/air
				+P1070	1030 to 1050		4 h 550 °C/air

STANDARD WIRE PACKAGING

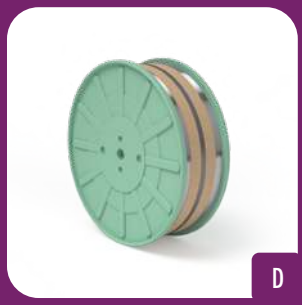
Here below our standard options for wire packaging:

A

B



C



D

There is always the possibility to customise other options according to the requirements of the customer.

DIVISION FOR DIAMETERS:

FROM Ø 1,2 UP TO Ø 9 >> possible solutions
- wooden or metallic spools 250kg - 4,00 mm max
- former 300 - 600 kg max
- drum 180 liters - Ø 1,80 mm max
- drum 280 liters - from 2,00 to 4,00 mm
- coils on wooden pallets 500kg - 1000kg - from 1,20 to 9,00

FROM Ø 9 UP TO Ø 15 >> possible solutions
- coils on wooden pallets 500kg -1000kg
- coils 500kg - 1000kg

FROM Ø 15 UP TO Ø 34
coils on wooden pallets 1000kg -2000lg

STAINLESS STEEL REINFORCING BARS FOR CONCRETE

Rodinox® is a complete range of reinforcing products for concrete, in bars and rolls, available in all the most important stainless steel types.
In situations where the environment is aggressive, these bars are the perfect solution to avoid corrosion.
The use of Rodinox® enhances durability on concrete structures compared with usual carbon rebar. Rodinox® can be processed in the same way as carbon steel bars, with the only caution to avoid contamination of stainless surface by using accurately with clean machines.

PRODUCTION RANGE AND EXECUTIONS

THE SIZE RANGE RODINOX® It is available in rolls in the range from 6 to 16 mm and in bars in the range from 6 to 40 mm.
RODINOX® GRADES In order to meet the various needs, Rodinox® is manufactured in the following types:

GRADE	TYPE	REFERENCE STEEL	
RODINOX® R1	austenitic in Cr - Ni	304L / 304LN	1.4307 / 1.4315
RODINOX® R2	austenitic in Cr - Ni - Mo	316L / 316LN	1.4404 / 1.4406
RODINOX® R3	austenitic in Cr - Ni - Mo	316HMo / 316LNMo	1.4436 / 1.4429
RODINOX® R4	duplex	2304	1.4362
RODINOX® R5	duplex	2205	1.4462

APPLICATIONS OF RODINOX BARS

HIGH TEMPERATURE | SEISMIC ZONES | LOW MAGNETIC PERMEABILITY | LOW TEMPERATURE | MARINE ENVIRONMENT

MARINE ENVIRONMENT AND SALT

Structures exposed to marine environment are at risk: above all, the stainless steel reinforcing bars must be used on the parts close to the surface when the structure is alternatively wet and dry.
The concrete cover can be reduced in comparison with the usual cover, necessary when chlorides are present in the environment.

LOW TEMPERATURE HIGH MOUNTAINS AND DE-ICING SALT

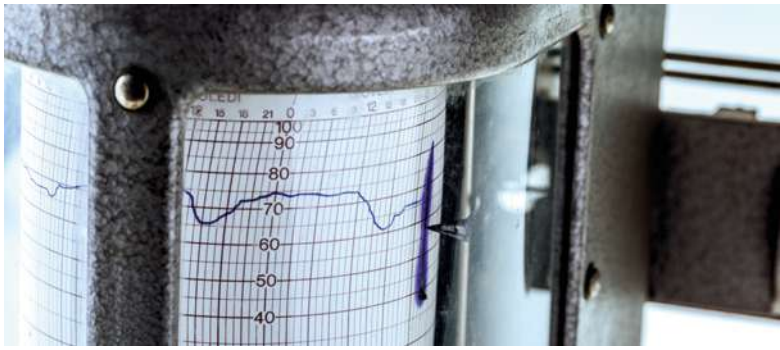
Rodinox® bars can be used in high mountains roads and constructions, because low-temperature toughness eliminates the risk of brittle structures even when the climate is rigid. For the same reason, its use is recommended for cryogenic applications.
Rodinox® is resistant to accurately salt, so it can be applied also where de-icing salt must be used.

LOW MAGNETIC PERMEABILITY

Rodinox® is suitable for use when very low magnetic permeability is required: for example it can be provided in structures where special electronic equipment are located, but also in other particular situations such as operating rooms of the hospitals, where there are magnetic resonance equipment or the control towers of the airports.

SEISMIC ZONES

Thanks to its high plasticity and fatigue limit, all Rodinox® stainless steel reinforcing bars last longer than the common steel rebar, showing also a lower brittleness: for these reasons its use is recommended in seismic areas, to reduce the risk of collapse of buildings and skyscrapers in case of earthquakes.



HIGH TEMPERATURE RESISTANCE

Rodinox® is not only resistant to low and very low temperatures: it shows a very good performance also at high and very high temperatures.
A feature that makes it suitable for a long resistance also in case of fire, giving the time for limiting the damage to the buildings and making them safer for people.

APPLICATIONS OF RODINOX BARS

Rodinox® is the solution for reinforcing bars when environmental aggression is a priority and a special durability of the structure is needed.
It can be used in structures coupled with carbon steel rebar without altering its performances: that is why a good design should provide stainless steel reinforcing bars only in appropriate positions.

SALT

MARINE ENVIRONMENT AND SALT

Structures exposed to marine environment are at risk: above all, the stainless steel reinforcing bars must be used on the parts close to the surface when the structure is alternatively wet and dry.
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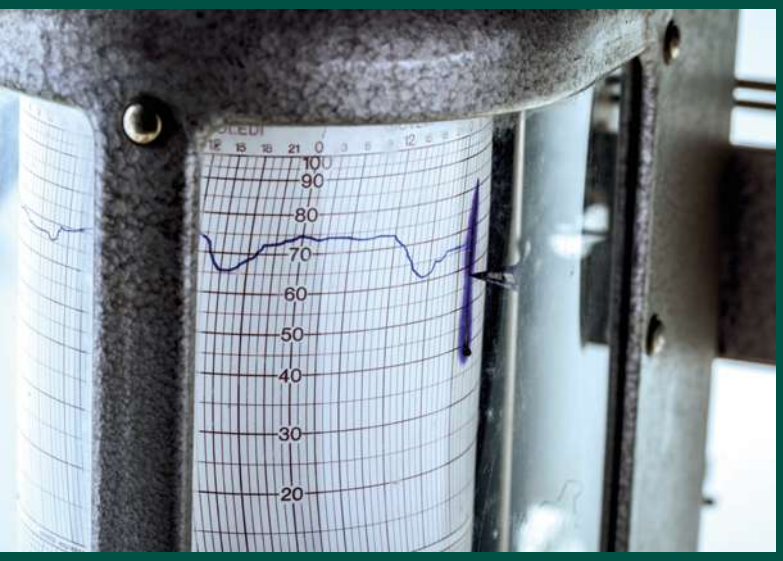
SALT

LOW TEMPERATURE HIGH MOUNTAINS AND DE-ICING SALT

Rodinox® bars can be used in high mountains roads and constructions, because low-temperature toughness eliminates the risk of brittle structures even when the climate is rigid. For the same reason, its use is recommended for cryogenic applications. Rodinox® is resistant to accurately salt, so it can be applied also where de-icing salt must be used.

LOW MAGNETIC PERMEABILITY

Rodinox® is suitable for use when very low magnetic permeability is required: for example it can be provided in structures where special electronic equipment are located, but also in other particular situations such as operating rooms of the hospitals, where there are magnetic resonance equipment or the control towers of the airports.



SEISMIC ZONES

Thanks to its high plasticity and fatigue limit, all Rodinox® stainless steel reinforcing bars last longer than the common steel rebar, showing also a lower brittleness: for these reasons its use is recommended in seismic areas, to reduce the risk of collapse of buildings and skyscrapers in case of earthquakes.

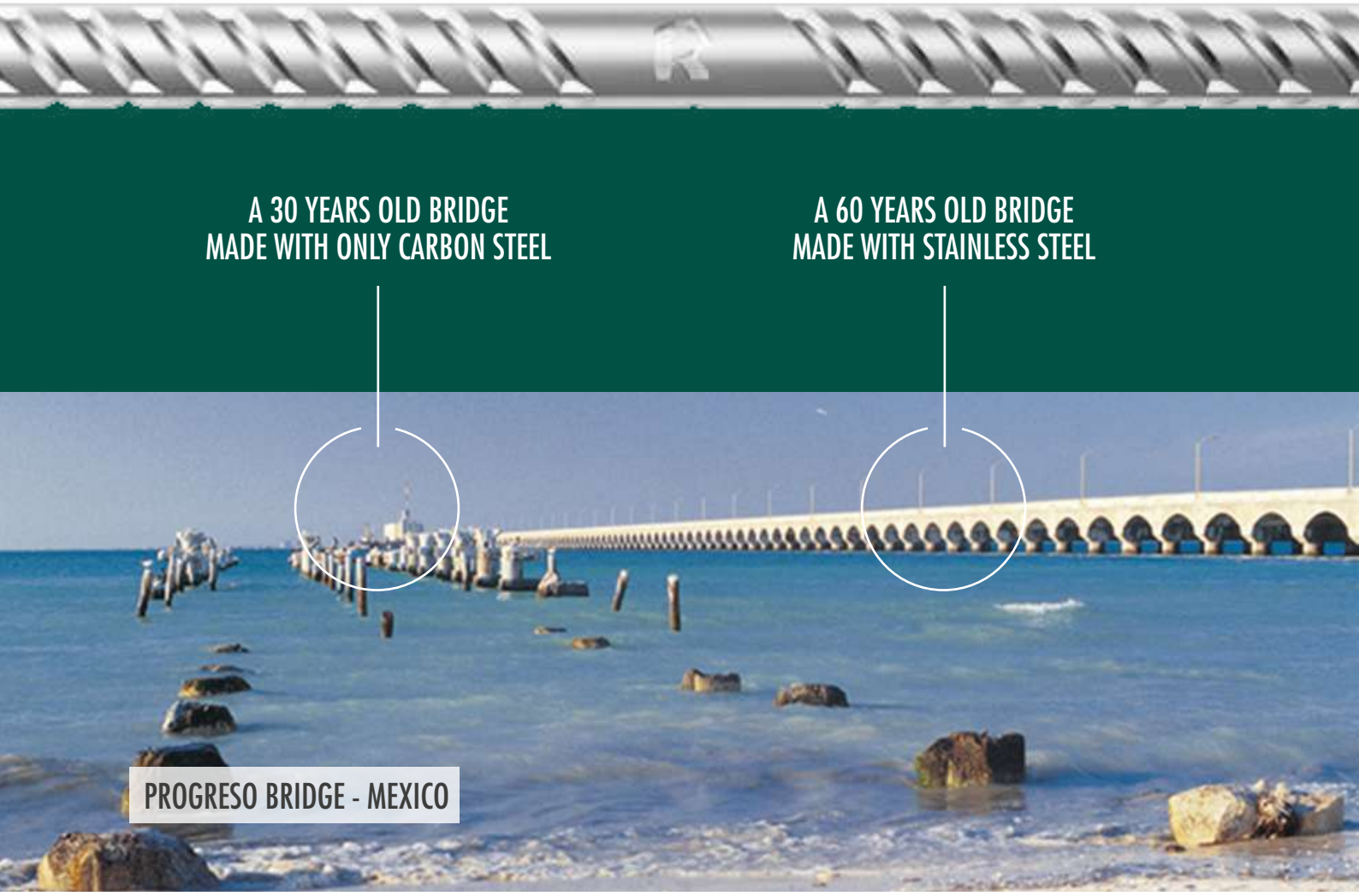
HIGH TEMPERATURE RESISTANCE

Rodinox® is not only resistant to low and very low temperatures: it shows a very good performance also at high and very high temperatures.
A feature that makes it suitable for a long resistance also in case of fire, giving the time for limiting the damage to the buildings and making them safer for people.

LIFE CYCLE COST: DURABILITY THROUGH YEARS

The Life Cycle Cost of structures and buildings can be greatly reduced by using stainless steel reinforcing bars in appropriate positions. The best deal is to use Rodinox® bars in contact with water and salt, while leaving the carbon steel rebars for the parts where the risk of chloride contamination tends to zero, such as the inner parts.

Using this mix of materials the initial investment may increase by 3%, but the cost of maintenance during the year can be reduced. There is an increasing demand for artifacts that have to last longer, even hundreds of years, requiring a very low maintenance: the only possible approach to these kind of requests is the use of Rodinox®, so that the costs due to the maintenance of reinforcing bars is pratically eliminated since the beginning.



INITIAL COST

20% RODINOX® + 80% CARBON STEEL

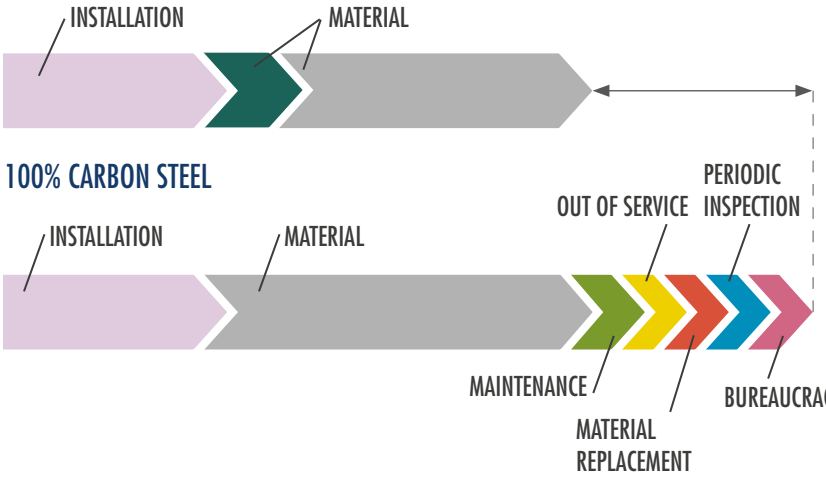
100% CARBON STEEL

+3%

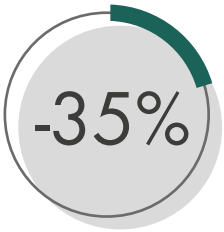
AVERAGE INCREASE OF THE CONSTRUCTION'S COST BY USING RODINOX INSTEAD OF CARBON STEEL

90 YEARS COST OF THE ARTIFACT (BRIDGE)

20% RODINOX® + 80% CARBON STEEL



100% CARBON STEEL



REDUCTION OF THE COST OF THE ARTIFACT IN 90 YEARS **USING RODINOX**

LIFE OF SERVICE

RODINOX®

CARBON STEEL

INCREASES THE LIFE OF SERVICE, I.E. THE YEARS WITHIN THE EXTRAORDINARY MAINTENANCE IS NOT REQUIRED

CONCRETE REDUCTION THANKS TO RODINOX®

RODINOX®

CARBON STEEL

WITHOUT **RODINOX®**

IT ALLOWS THE **REDUCTION** OF **50%** CONCRETE COVERS

STAINLESS STEELS REINFORGING BARS

Rodinox® round with improved adherence for the reinforcement of concrete

Rodinox® is the answer to concrete reinforcement problems when high durability is required under severe climatic and environmental conditions.

In these situations, in fact, concrete reinforcement with carbon steel is not sufficient and it is therefore opportune to use stainless steel, whose characteristics are optimally exploited in the construction field as:
- it is suitable for use in seismic areas thanks to high plasticity, a high fatigue limit and the absence of fragility;
- it resists to low temperatures without brittleness phenomena;
- it resists to high temperatures, including flame and fires;
- it is suitable for use in the hospitals and in the airport control towers thanks to a very low magnetic permeability so that it does not alter the operation of sensitive electronic equipment.

THE SIZE RANGE RODINOX® It is available in rolls in the range from 6 to 16 mm and in bars in the range from 6 to 40 mm.
RODINOX® GRADES In order to meet the various needs, Rodinox® is manufactured in the following types:

GRADE	TYPE	REFERENCE STEEL	
RODINOX® R1	austenitic in Cr - Ni	304L / 304LN	1.4307 / 1.4315
RODINOX® R2	austenitic in Cr - Ni - Mo	316L / 316LN	1.4404 / 1.4406
RODINOX® R3	austenitic in Cr - Ni - Mo	316HMo / 316LNMo	1.4436 / 1.4429
RODINOX® R4	duplex	2304	1.4362
RODINOX® R5	duplex	2205	1.4462

CHEMICAL COMPOSITION

The average chemical composition of Rodinox® is as follows:

GRADE	C	Mn	Si	S	P	Cr	Ni	Mo	N	Cu
RODINOX® R1	0,02	1,6	0,5	<0,010	0,04	18,5	8,1	-	0,20	-
RODINOX® R2	0,02	1,6	0,5	<0,010	0,04	18,0	10,1	2,1	0,20	-
RODINOX® R3	0,02	1,6	0,5	<0,010	0,04	17,1	11,1	2,6	0,20	-
RODINOX® R4	0,02	0,8	0,5	<0,010	0,04	23,2	4,1	0,2	0,10	0,30
RODINOX® R5	0,02	0,8	0,5	<0,010	0,04	22,8	5,2	3,1	0,20	-

* conforms to BS 6744 standard

THE SIZE RANGE RODINOX®

The average chemical composition of Rodinox® is as follows:

GRADE	Ministerial Decree 14.01.2008 Technical Standards for Construction class B450C		BS 6744: 2016	
RODINOX® R1	Rotoli 6 - 14 mm	Barre 6 - 32 mm	Rotoli 6 - 16 mm	Barre 6 - 32 mm
RODINOX® R2	Rotoli 6 - 14 mm	Barre 6 - 32 mm	-	
RODINOX® R3	Rotoli 6 - 14 mm	Barre 6 - 32 mm	Rotoli 6 - 16 mm	Barre 6 - 32 mm
RODINOX® R4	Barre 6 - 32 mm		Rotoli 6 - 16 mm	Barre 6 - 40 mm
RODINOX® R5	-		6 - 32 mm	

* conforms to BS 6744 standard

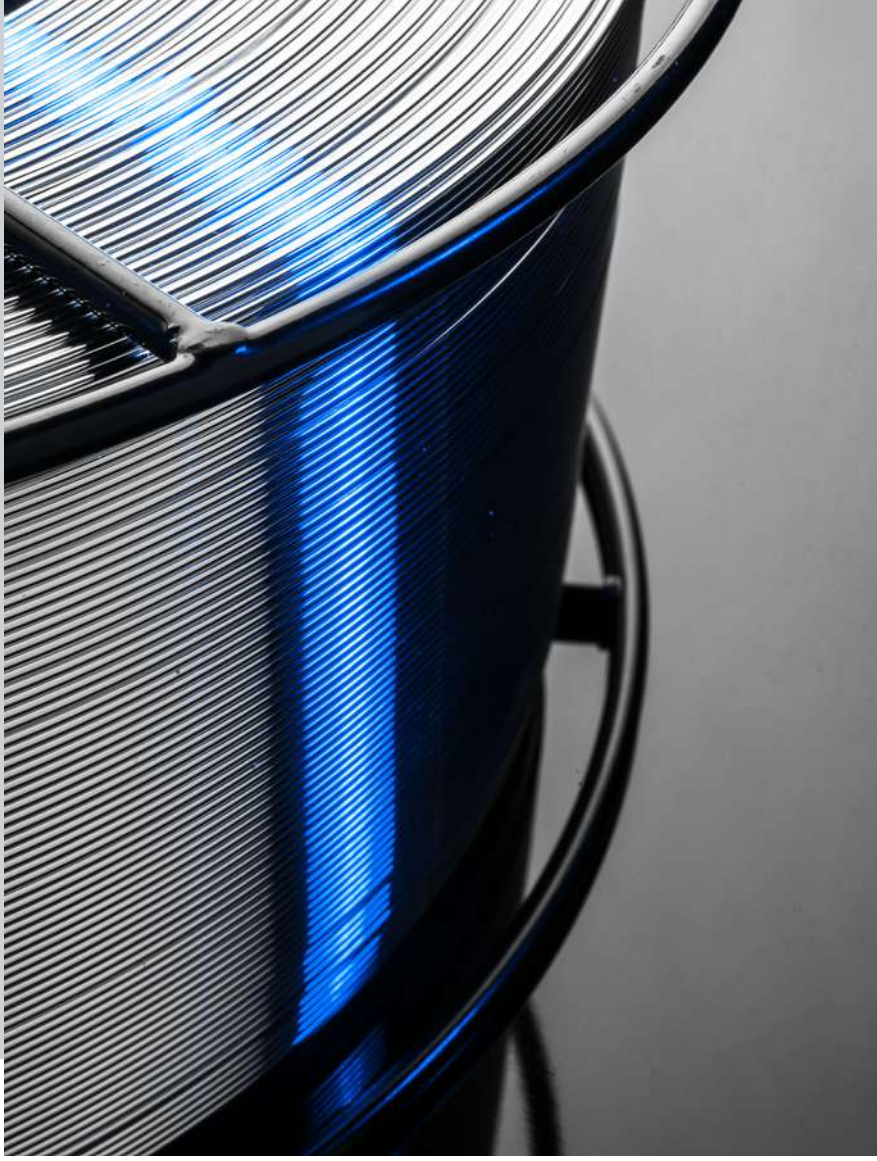
RODINOX® REFERENCE STANDARDS

Mass per linear meter as a function of the type of steel (units kg/m)

GRADE	Ø nom. mm	5	6	7	8	10	12	14	16	18	20	22	24	25	26	32	40
	sezione mm²	19,6	28,3	38,5	50,3	78,5	113,1	153,9	201,1	254,5	314,2	380,2	452,4	490,9	531,0	804,2	1256,6
RODINOX® R1		0,155	0,224	0,304	0,397	0,620	0,893	1,216	1,589	2,011	2,482	3,003	3,574	3,878	4,195	6,353	9,927
RODINOX® R2		0,157	0,226	0,308	0,402	0,628	0,905	1,231	1,609	2,036	2,514	3,041	3,620	3,927	4,248	6,434	10,053
RODINOX® R3		0,157	0,226	0,308	0,402	0,628	0,905	1,231	1,609	2,036	2,514	3,041	3,620	3,927	4,248	6,434	10,053
RODINOX® R4*		0,153	0,221	0,300	0,392	0,612	0,882	1,200	1,569	1,985	2,451	2,965	3,529	3,829	4,142	6,266	9,790
RODINOX® R5*		0,153	0,221	0,300	0,392	0,612	0,882	1,200	1,569	1,985	2,451	2,965	3,529	3,829	4,142	6,266	9,790

* conforms to BS 6744 standard

STAINLESS STEELS FOR WELDING



Rodacciai WELDING

Stainless steel wire and rods of various types are used as welding filler materials for the production of electrodes, MIG, TIG and Submerged Arc welding.
According to customers' requirements, it is possible to provide austenitic, martensitic, ferritic or austenitic-ferritic (duplex - super duplex) stainless steels.

The use of selected wire rods, with controlled impurity levels, guarantees an optimal weld, both from the point of view of the mechanical strength and in terms of the presence of delta ferrite, i.e corrosion resistance.
Furthermore, the chemical composition of the materials applies to all principals international standards, including the European standard EN ISO and American standard AWS.

Thanks to the quality of its stainless steel welding wire products, Rodacciai supplies all the major welding houses and electrode manufacturers all over the world.
The company offers a variety of different kind of packaging (spools and drums) and the possibility to customize each of them.
During the years Rodacciai achieved several certifications such as TÜV/CE (Europe), DB (Germany) and CWB (Canada).

Recently the stainless steel welding products have been approved and used by the major car manufacturers worldwide and in the construction of nuclear power plants.

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	N	Nb	Ti
RW 307	min	-	5,00	-	-	-	17,0	7,0	-	-	-	-	-
	max	0,08	8,00	0,50	0,030	0,030	20,0	10,0	0,30	0,30	-	-	-
RW 307L	min	-	5,00	0,30	-	-	17,0	7,0	-	-	-	-	-
	max	0,05	8,00	0,70	0,030	0,030	20,0	10,0	0,30	0,30	-	-	-
RW 307SI	min	-	5,00	0,65	-	-	17,0	7,0	-	-	-	-	-
	max	0,10	8,00	1,00	0,030	0,030	20,0	10,0	0,30	0,30	-	-	-
RW 308L	min	-	1,00	-	-	-	19,5	9,0	-	-	-	-	-
	max	0,03	2,50	0,20	0,020	0,030	21,0	11,0	0,30	0,30	-	-	-
RW 308LAWS	min	-	1,00	0,30	-	-	19,5	9,0	-	-	-	-	-
	max	0,03	2,50	0,65	0,020	0,030	21,0	11,0	0,30	0,30	-	-	-
RW 19-9-L	min	-	1,00	0,30	-	-	19,5	9,0	-	-	-	-	-
	max	0,03	2,50	0,65	0,030	0,030	22,0	11,0	0,75	0,75	-	-	-
RW 308LSI	min	-	1,00	0,65	-	-	19,5	9,0	-	-	-	-	-
	max	0,03	2,50	1,00	0,020	0,030	21,0	11,0	0,30	0,30	-	-	-
RW 308H	min	0,04	1,00	0,30	-	-	19,5	9,0	-	-	-	-	-
	max	0,08	2,50	0,65	0,020	0,030	21,0	11,0	0,30	0,30	-	-	-
RW 309L	min	-	1,00	0,30	-	-	23,0	12,0	-	-	-	-	-
	max	0,03	2,50	0,65	0,020	0,030	25,0	14,0	0,30	0,30	-	-	-
RW 309SI	min	-	1,00	0,65	-	-	23,0	12,0	-	-	-	-	-
	max	0,12	2,50	1,00	0,030	0,030	25,0	14,0	0,75	0,75	-	-	-
RW 309LSI	min	-	1,00	0,65	-	-	23,0	12,0	-	-	-	-	-
	max	0,03	2,50	1,00	0,020	0,030	25,0	14,0	0,30	0,30	-	-	-
RW 309LMO	min	-	1,00	0,30	-	-	21,0	11,0	2,00	-	-	-	-
	max	0,03	2,50	0,65	0,020	0,030	25,0	15,5	3,50	0,30	-	-	-
RW 309H	min	0,04	1,00	0,30	-	-	23,0	12,0	-	-	-	-	-
	max	0,15	2,50	0,65	0,030	0,030	24,0	14,0	0,50	0,30	-	-	-
RW 310	min	0,08	1,00	0,30	-	-	25,0	20,0	-	-	-	-	-
	max	0,15	2,50	0,65	0,020	0,030	27,0	22,0	0,30	0,30	-	-	-
RW 312	min	-	1,00	0,30	-	-	28,0	8,0	-	-	-	-	-
	max	0,15	2,50	0,65	0,020	0,030	32,0	10,5	0,30	0,30	-	-	-
RW 316L	min	-	1,00	-	-	-	18,0	11,0	2,50	-	-	-	-
	max	0,03	2,50	0,20	0,020	0,030	20,0	14,0	3,00	0,30	-	-	-
RW 316LAWS	min	-	1,00	0,30	-	-	18,0	11,0	2,50	-	-	-	-
	max	0,03	2,50	0,65	0,020	0,030	20,0	14,0	3,00	0,30	-	-	-
RW 316LSI	min	-	1,00	0,65	-	-	18,0	11,0	2,50	-	-	-	-
	max	0,03	2,50	1,00	0,020	0,030	20,0	14,0	3,00	0,30	-	-	-

CHEMICAL COMPOSITION (CAST ANALYSIS) (%)

		C	Mn	Si	S	P	Cr	Ni	Mo	Cu	N	Nb	Ti
RW 316H	min	0,04	1,00	0,30	-	-	18,0	11,0	2,00	-	-	-	-
	max	0,08	2,50	0,65	0,020	0,030	20,0	14,0	3,00	0,30	-	-	-
RW 317LAWS	min	-	1,00	0,30	-	-	18,5	13,0	3,00	-	-	-	-
	max	0,03	2,50	0,65	0,020	0,030	20,0	15,0	4,00	0,30	-	-	-
RW 318SI	min	-	1,00	0,65	-	-	18,0	11,0	2,50	-	-	10xC	-
	max	0,08	2,50	1,00	0,020	0,030	20,0	14,0	3,00	0,30	-	1,00	-
RW 347	min	-	1,00	0,30	-	-	19,0	9,0	-	-	-	10xC	-
	max	0,08	2,50	0,65	0,020	0,030	21,0	11,0	0,30	0,30	-	1,00	-
RW 347SI	min	-	1,00	0,65	-	-	19,0	9,0	-	-	-	10xC	-
	max	0,08	2,50	1,00	0,020	0,030	21,0	11,0	0,30	0,30	-	1,00	-
RW 385	min	-	1,00	-	-	-	19,5	24,0	4,20	1,20	-	-	-
	max	0,025	2,50	0,50	0,020	0,020	21,5	26,0	5,20	2,00	-	-	-
RW 2209	min	-	0,50	-	-	-	21,5	7,5	2,50	-	0,10	-	-
	max	0,03	2,00	0,90	0,020	0,030	23,5	9,5	3,50	0,30	0,20	-	-
RW 409CB	min	-	-	-	-	-	10,5	-	-	-	-	10xC	-
	max	0,08	0,80	1,00	0,020	0,030	13,50	0,6	0,50	0,75	-	0,75	-
RW 410	min	-	-	-	-	-	12,0	-	-	-	-	-	-
	max	0,12	0,60	0,50	0,020	0,030	13,5	0,5	0,50	0,40	-	-	-
RW 410NIMO	min	-	-	-	-	-	11,0	4,0	0,40	-	-	-	-
	max	0,05	0,60	0,50	0,020	0,030	12,5	5,0	0,70	0,30	-	-	-
RW 4122	min	0,33	-	-	-	-	15,5	-	0,90	-	-	-	-
	max	0,43	1,00	0,70	0,020	0,030	17,5	1,0	1,20	-	-	-	-
RW 420	min	0,30	-	-	-	-	12,0	-	-	-	-	-	-
	max	0,40	0,60	0,50	0,030	0,030	14,0	0,6	0,75	0,75	-	-	-
RW 420C	min	0,38	0,30	-	-	-	12,0	-	-	-	-	-	-
	max	0,43	0,60	0,50	0,030	0,030	14,0	0,6	0,75	0,75	-	-	-
RW 430	min	-	-	-	-	-	16,0	-	-	-	-	-	-
	max	0,10	0,60	0,50	0,030	0,030	17,0	0,6	0,75	0,75	-	-	-
RW 430LNB	min	-	-	-	-	-	17,8	-	-	-	-	0,05+ 7(C+N)	-
	max	0,02	0,80	0,50	0,020	0,030	18,8	0,5	0,30	0,30	0,02	0,5	-
RW 430LNBTI	min	-	-	-	-	-	17,5	-	-	-	-	8xC	10xC
	max	0,03	1,50	1,00	0,030	0,030	19,5	0,5	0,50	0,50	0,02	0,80	0,50
RW 2594	min	-	-	-	-	-	24,0	8,0	2,50		0,2	-	-
	max	0,03	2,50	1,00	0,020	0,030	27,0	10,5	4,50	1,5	0,3	-	-

RODACCIAI'S DENOMINATIONS EQUIVALENT

	EN ISO 14343-A: 2017 Nominal Composition	EN ISO 14343-B: 2017 Alloy Type	AWS A5.9-2017 Alloy Designation	AWS A5.9-2017 Nominal Composition Designation	DIN Werkstoff Nr.
RW 307	18 8 Mn	-	-	18 8 Mn	1.4370
RW 307L	18 8 Mn	-	-	18 8 Mn	1.4370
RW 307SI	18 8 Mn	-	-	18 8 Mn	1.4370
RW 308L	19 9 L	-	-	19 9 L	-
RW 308LAWS	19 9 L	SS308L	ER308L	19 9 L	1.4316
RW 19-9-L	19 9 L	SS308L	ER308L	19 9 L	1.4316
RW 308LSI	19 9 L Si	SS308LSi	ER308LSi	19 9 L Si	1.4316
RW 308H	19 9 H	SS308H	ER308H	19 9 H	-
RW 309L	23 12 L	SS309L	ER309L	23 12 L	1.4332
RW 309SI	-	SS309Si	ER309Si	-	(1.4829)
RW 309LSI	23 12 L Si	SS309LSi	ER309LSi	23 12 L Si	1.4332
RW 309LMO	23 12 2 L	-	-	23 12 2 L	(1.4459)
RW309H	22 12 H	SS309	ER309	22 12 H	-
RW 310	25 20	SS310	ER310	25 20	(1.4842)
RW 312	29 9	SS312	ER312	29 9	1.4337
RW 316L	19 12 3 L	-	-	19 12 3 L	1.4430
RW 316LAWS	19 12 3 L	SS316L	ER316L	19 12 3 L	1.4430
RW 316LSI	19 12 3 L Si	SS316LSi	ER316LSi	19 12 3 L Si	1.4430
RW 316H	19 12 3 H	SS316H	ER316H	19 12 3 H	-
RW 317LAWS	18 15 3 L	SS317L	ER317L	18 15 3 L	-
RW 318SI	19 12 3 Nb Si	-	(ER318)	19 12 3 Nb Si	1.4576
RW 347	19 9 Nb	SS347	ER347	19 9 Nb	1.4551
RW 347SI	19 9 Nb Si	SS347Si	ER347Si	19 9 Nb Si	1.4551
RW 385	20 25 5 Cu L	SS385	ER385	20 25 5 Cu L	-
RW 2209	22 9 3 N L	SS2209	ER2209	22 9 3 N L	(1.4462)
RW 409CB	-	SS409Nb	ER409Nb	-	-
RW 410	13	SS410	ER410	13	-
RW 410NIMO	13 4	SS410NiMo	ER410NiMo	13 4	-
RW 4122	-	-	-	-	1.4122
RW 420	-	SS420	ER420	-	-
RW 420C	-	(SS420)	(ER420)	-	1.4031
RW 430	(17)	SS430	ER430	(17)	1.4016
RW 430LNB	18 LNb	(SS430LNb)	(ER430LNb)	18 L Nb	1.4511
RW 430LNBTI	18 L Nb Ti	-	-	-	-
RW 2594	25 9 4 N L	SS2594	ER2594	25 9 4 N L	-


Rodacciai
WELDING
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WELDING
WARNING
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WELDING

PRODUCTION RANGE AND FINISHING

<table>
<tr><th>WELDING PROCESSES</th><th></th><th>SIZE</th><th>PACKAGING</th></tr>
<tr><td>MIG</td><td>mm

inches</td><td>0,80 - 0,90 - 1,00 - 1,14 - 1,20 - 1,60

0.030 - 0.035 - 0.045 - 1/16</td><td>
Plastic spool D200
- size: width 55 mm
- outside diameter: 200 mm
- spindle hole diameter: 51,5 mm
w- weight: 5 kg

Plastic spool D300
- size: width 100 mm
- outside diameter: 300 mm
- spindle hole diameter: 51,5 mm
- weight: 12,5 kg (for diameter ≤0,8 mm)
15 kg (for diameters >0,8 mm)

Blue metallic wire basket BS300
- size: width 100 mm
- outside diameter: 300 mm
- inside diameter: 51,5 mm
- weight: 15 kg

Bulk spool / wooden / metallic
- size: width 285 mm
- outside diameter: 750 mm
- spindle hole diameter: 41 mm
- weight: 250 kg

Drum for robotic welding
<table>
<tr><td>- wire diameter (mm):</td><td>0,8</td><td>0,9</td><td>1,0</td><td>1,2</td><td>1,6</td></tr>
<tr><td>- height of drum (mm):</td><td>670</td><td colspan="3">790</td><td>790</td></tr>
<tr><td>- outside diameter (mm):</td><td>510</td><td colspan="3">520</td><td>580</td></tr>
<tr><td>- weight (kg):</td><td>150</td><td colspan="3">250-400</td><td>250-400</td></tr>
</table>
</td></tr>
<tr><td>TIG</td><td>mm

inches</td><td>0,80 - 0,90 - 1,00 - 1,14 - 1,20 - 1,60
2,00 - 2,40 - 3,20 - 4,00

0.030 - 0.035 - 0.045 - 1/16
3/32 - 1/8 - 5/32</td><td>
Rods
- length 1000 mm (Ø in mm)/36 inches (Ø in inches)
- stamped with AWS and W.Nr. ref.
- packed boxes or cardboard tubes
- weight: 5 kg
</td></tr>
<tr><td>SUBMERGED ARC</td><td>mm

inches</td><td>1,60 - 2,00 - 2,40 - 3,20 - 4,00

1/16 - 5/64 - 3/32 - 1/8 - 5/32</td><td>
Metallic wire basket K415
- size: width 100 mm
- outside diameter: 415 mm
- inside diameter: 300 mm
- weight: 25 kg

Drum
- wire diameter: 2,0 - 4,0 mm
- height of drum: 850 mm
- outside diameter: 660 mm
- weight: 300 kg
</td></tr>
<tr><td>CORE WIRE IN CUT LENGTHS OR IN COILS</td><td>mm

inches</td><td>1,60 - 2,00 - 2,50 - 3,25 - 4,00 - 5,00

1/16 - 5/64 - 3/32 - 1/8
5/32 - 3/16</td><td>
Core wires in cut lengths
- length 250 - 450 mm (9 - 18 inches)
- packed in wooden crates
sizes:
- 800 - 1.000 kg, base 750x800 mm - height 500 mm
- 500 - 650 kg, base 820x570 mm - height 580 mm

Core wires in coils
- size: internal diameter: 380 mm
- weight: 500/800 kg
</td></tr>
</table>

SUSTAINABILITY
PRESERVING THE FUTURE

"SUSTAINABILITY', A STRATEGIC ELEMENT OF RODASTEEL

Based on the guidelines given by the United Nation Climate Conferences, Rodacciai coined its own three pillars: people, planet and performances.

PEOPLE

It is important for Rodasteel to create a work environment that attracts more and more talented individuals and retains those already present

PLANET

Rodasteel places environmental conservation as a fundamental aspect of its production activities and growth objectives

PERFORMANCE

Rodasteel pays particular attention to the efficiency and reduction of its energy consumption

2030

PEOPLE

Since people are the basis of our success, it is important for Rodasteel to create a work environment that attracts more and more talented individuals and retains those already present for as long as possible.

For this reason, Rodacciai invests in people trainings represented by two main projects: Rodacciai Academy and Rodajob.

Rodacciai Academy: inaugurated in 2015, it deals with the development and skills of the company's human resources in collaboration with stakeholders and the local area. The goal is the transmission and development of knowledge and professional experience, with specific programs dedicated to employees, school and university students and unemployed.

Roadjob: inaugurated in 2019, it is a non-profit foundation composed of 26 other companies and 11 training institutions. The main activity consists in the provision of professionalizing training courses, mainly dedicated to unemployed, precarious young people and high school students. Rodasteel offers and guarantees equal opportunities to all its employees regardless of gender, geographic origin, disability or any other difference. Respect for diversity and combating discrimination are also central to the Rodacciai Code of Ethics, alongside other social topics such as the promotion and support of human rights.

Moreover, Rodacciai supports its employees by investing in welfare services. Rodacciai Welfare is a platform aimed at promoting people health and safety.

This tool gives people the access to special services in order to improve their work-life balance and possibilities.

HIRING RATE

Hiring rate increase (expressed in percentage)

TRAINING RATE

Total training hours per employee (expressed in hours per capita)

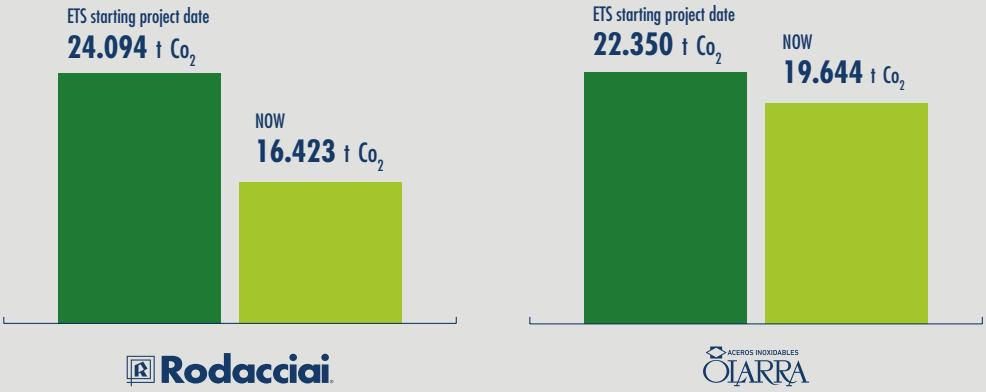
PLANET

Rodasteel places environmental conservation as a fundamental aspect of its production activities and growth objectives. The company is committed to continuously monitoring and evaluating its environmental impacts to identify winning strategies and innovative solutions to mitigate and reduce them. Responsible **management of raw materials** is a fundamental point for Rodacciai environmental strategy plan. Even though steel is originally created from virgin ferrous minerals, nowadays it can be considered both durable and permanent. In fact, the most used raw material is scrap metal that is 100% recyclable and capable of being remelted without ever losing any of its characteristic properties. For this reason, Rodasteel is gradually reducing the consumption of virgin raw materials and limiting the production of waste through recovery and reuse.

Waste management is extremely important for a company that aspires to monitor and consequently reduce its environmental impacts. According to that aspect, in line with the Group's principle of implementing circular economy initiatives, Olarra concluded in 2021 the project aimed at enhancing the waste produced and reducing the consumption of virgin materials: the Tarcinox project. The initiative aimed at recovering three of the main types of waste produced by Olarra: slag and dust in steelworks and sludge produced in rolling mills. The project is a continuation of an earlier industrial waste initiative (PIVASI) and the starting point of a new plan for the next period, focused on the recovery of the metals contained in the settling sludge as well as in the search for alternatives for the management and valorisation of steel slag. This path demonstrated the continuous improvements and developments put in place by the corporation.

GREENHOUSE GAS (GHG) EMISSIONS

Values of greenhouse gas emissions (expressed in Co_2 tonnage). The reference period is from the ETS (Emission Trading System) starting project date for the production plant to today.



Rodasteel pays particular attention to the efficiency and reduction of its **energy consumption**. With this purpose, Rodacciai carried out maintenance activities on the heating system of the furnace used for billet processing. In addition, the upgrade of lighting systems with LED lamps was promoted. For the Group it is also important the monitoring of **pollutants emissions** into the atmosphere. In order to obtain an annual estimate of air emissions for each pollutant the Group first carried out sampling at each site and then multiplied the average concentrations measured at each chimney by the average flows recorded at the time of sampling and by the yearly operating hours of the systems.

Moreover, in order to reduce its **greenhouse gas (GHG) emissions** and to improve the environmental impact the Group made the following investments:

- Burners were revamped (Sirone Plant);
- Construction of a regasifier for the use of biogas (Sirone plant);
- Improvement of two heat treatment furnaces (Olarra plant);
- The purchase and installation of a new bell furnace for roll treatment (Olarra plant);

With an on going perspective, Rodasteel Group, as a member of ETS is defining its road map with the aim of reducing atmospheric emissions and using resources increasingly from renewable sources, in accordance to the goal defined by the European community.

As for **electricity consumption**, the installation of solar panels in all production halls and the office building continues.

Responsible management of **water resources** is another important objective for environmental sustainability within the steel industry.

Therefore, Rodasteel Group adopted a global strategy with specific projects for all its production sites. For instance, about 346 thousand cubic meters of water were withdrawn in 2022, a 16% decrease from the previous year (-7% from 2020).

PERFORMANCES

The environmental sustainability of production processes is a priority for the industrial world and Rodacciai's mission is to accompany its customers in the sustainable steel supply chain.

With this purpose, the Group has planned a path based on some key points:

- Definition of a Sustainability and Decarbonisation Committee
- Increasing the energy efficiency of production processes
- Conservation of water resources
- Sourcing from renewable or more sustainable sources
- Optimisation of waste management
- Development of an automatic performance monitoring system
- Development of the fifth sustainability report for 2023
- Launch of a decarbonisation plan to 2030
- Maintaining the ISO 14001 standard

REDUCTION PROJECT

SCOPE 1

- Rolling Mill Furnace fuel supply: a new regasifier for BioGNL
  It will supplement the energy needs of the billet heating furnace reducing the consumption of natural gas.
- Forklift fuel supply: turning from Diesel to Biodiesel.
  Thanks to this project, implemented in the first two months of 2024, it is possible to use Biodiesel fuel for forklifts.
- GOs: Green Energy Procurements.
  The group favors the supply of natural gas, which guarantees the lowest possible carbon footprint.
- Efficiency improvement.
  Continous upgrading of productions facilities.

SCOPE 2

- Renewable power generation and self-consumption: Solar Power plants
  Since 2013 the company has been accommodating solar power plants that produce renewable power for the national grid. Moreover, it is planned to install other solar power plants for the self-consumption.
- PPA e GO: green power procurement.
  The group is planning to gradually increase the consumption of renewable electrical energy trough PPA contracts or equipped with Guarantees of Origin guaranteeing the lowest possible carbon footprint.
- Efficiency improvement.
  Continous upgrading of productions facilities.

SCOPE 3

- Multimodal goods transport : Road – Rail – Sea
  The company selects the transport service providers verifying that they adopt multi-modal solutions that guarantee excellent performance in terms of Co_2- equivalent reduction.
- Truck fuel supply: turning from Diesel to Biodiesel
  The group has engaged one of main road transport service partners to ensure the use of Biodiesel to power the vehicles used to transport our goods.

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