

CASE-HARDENING  
STEELS

SPECIAL  
STEELS

STEELS FOR QUENCHING  
AND TEMPERING

STEELS FOR SURFACE  
HARDENING



**Rodacciai**<sup>®</sup>

SINCE 1959 ALL OVER THE WORLD

# CASE-HARDENING STEELS

## SPECIAL STEELS

### STEELS FOR QUENCHING AND TEMPERING

### STEELS FOR SURFACE HARDENING





## STEEL FOR CASE-HARDENING

With low carbon content, Carburized steels combine **internal toughness** with **high surface hardness**. After mechanical processing and the **carburization treatment**, these steels are ideal for gears, pins, bushings, shafts, and any other parts necessary for the transmission of motion.

The **heat treatments** available for this type of steel, to be confirmed on a case-by-case basis according to customer requirements and material specifications are: hot rolled, annealed, isothermal annealed, globular annealed, normalized, and quenched and tempered.

	Execution	Profile	Range (mm)	Finish	Tolerances
<b>Bars</b>	Hot rolled	Round	20÷200	Raw, rough peeled	-
	Drawn	Round	3÷70	Polished	ISA h9-h10-h11
		Hexagonal Square	3÷70 4÷60		
	Peeled - rolled	Round	20÷100	Polished	ISA h9-h10-h11
Ground	Round	3÷100	Polished	ISA h6-h7-h8-h9-h10-h11	
<b>Coils</b>	Drawn	Round	2÷22	Polished, phosphated	ISA h9-h10-h11 EN 10218-2 T1-T2-T3-T4-T5
		Hexagonal Square	3÷12 4÷12		



## NON-ALLOY STEELS FOR SURFACE HARDENING

These case hardening steels **do not contain specific alloying elements** other than carbon. They are often tempered in water and are therefore only suitable for the production of pieces with simple shapes and applica-

tions that are not demanding, such as some pins and bushings. Some steels are offered with the addition of lead to enhance machinability, such as R10Pb.

EN ISO 683-3:2018 EN 10277:2018	N°	AISI	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Other Elements
<b>KV10</b>	C10E	1.1121 (1010)	0,07÷0,13	0,15÷0,40	0,30÷0,60	≤0,025	≤0,035	≤0,40	≤0,40	≤0,10	≤0,30	-
<b>R10S</b>	C10R	1.1207 (1010)	0,07÷0,13	0,15÷0,40	0,30÷0,60	≤0,025	0,020÷0,040	≤0,40	≤0,40	≤0,10	≤0,30	Al= 0,020÷0,050
<b>R10PB</b>	C10 +Pb	1.1207 (10L10)	0,07÷0,13	0,15÷0,40	0,30÷0,60	≤0,025	0,020÷0,040	≤0,40	≤0,40	≤0,10	≤0,30	Pb=0,15÷0,30 Al= 0,020÷0,050
<b>KV15</b>	C15E	1.1141 (1015)	0,12÷0,18	0,15÷0,40	0,30÷0,60	≤0,025	≤0,035	≤0,40	≤0,40	≤0,10	≤0,30	-
<b>R15PB</b>	C15R +Pb	1.1140 (10L15)	0,12÷0,18	0,15÷0,40	0,30÷0,60	≤0,025	0,020÷0,040	≤0,40	≤0,40	≤0,10	≤0,30	Pb=0,15÷0,30 Al= 0,020÷0,050

## ALLOY STEEL FOR CASE-HARDENING

The addition of alloying elements allows for varied mechanical characteristics dependent on the application and customer specification. After machining, carburizing and tempering the result is **heightened surface hardness** and **notable internal toughness**.

The temper-ability increases with the addition of alloying elements.

Higher levels of chromium will increase core hardness, while the addition of nickel improves toughness and resistance to impact. Some alloy steels are also available with the addition of lead, which **facilitates improved chip removal during machining**.

	Nome	N°	AISI	C	Si	Mn	P (Max)	S	Cr	Al	Other Elements
<b>RM16</b>	16MnCrS5 <sup>1</sup>	1.7139	(5117)	0,14÷0,19	0,15÷0,40	1,00÷1,30	0,025	0,020÷0,040	0,80÷1,10	0,020÷0,050	Cu=0,40
<b>RM16PB</b>	16MnCrS5 + Pb <sup>1</sup>	1.7139	(51L17)	0,14÷0,19	0,15÷0,40	1,00÷1,30	0,025	0,020÷0,040	0,80÷1,10	0,020÷0,050	Pb=0,15÷0,30 Cu=0,40
<b>RM20</b>	20MnCrS5 <sup>1</sup>	1.7149	(4820)	0,17÷0,22	0,15÷0,40	1,10÷1,40	0,025	0,020÷0,040	1,00÷1,30	0,020÷0,050	Cu=0,40
<b>RM20PB</b>	20MnCrS5 + Pb <sup>1</sup>	1.7149	(48L20)	0,17÷0,22	0,15÷0,40	1,10÷1,40	0,025	0,020÷0,040	1,00÷1,30	0,020÷0,050	Pb=0,15÷0,30 Cu=0,40
<b>RN0</b>	12NiCr3 <sup>3</sup>	-	-	0,09÷0,15	0,15÷0,40	0,30÷0,60	0,035	0,020÷0,035	0,40÷0,70	0,020÷0,050	Mo≤0,10 Ni=0,50÷0,80
<b>RN0PB</b>	12NiCr3 + Pb <sup>3</sup>	-	-	0,09÷0,15	0,15÷0,40	0,30÷0,60	0,035	0,020÷0,035	0,40÷0,70	0,020÷0,050	Pb=0,15÷0,30 Mo≤0,10 Ni=0,50÷0,80
<b>RN2</b>	16NiCrS4 <sup>2</sup>	1.5715	-	0,13÷0,19	≤0,40	0,70÷1,00	0,025	0,020÷0,040	0,60÷1,00	0,020÷0,050	Ni=0,80÷1,10
<b>RN2PB</b>	16NiCrS4 + Pb <sup>2</sup>	1.5715	-	0,13÷0,19	≤0,40	0,70÷1,00	0,025	0,020÷0,040	0,60÷1,00	0,020÷0,050	Ni=0,80÷1,10 Pb=0,15÷0,30
<b>RN3</b>	20CrNi4 <sup>3</sup>	-	-	0,18÷0,23	0,15÷0,40	0,80÷1,10	0,035	0,020÷0,035	0,90÷1,20	0,020÷0,050	Mo≤0,10 Ni=0,90÷1,20
<b>RG2</b>	16NiCr11 <sup>4</sup>	(1.5752)	-	0,12÷0,18	0,15÷0,40	0,30÷0,60	0,035	0,020÷0,035	0,60÷0,90	0,020÷0,050	Mo≤0,10 Ni=2,50÷3,00
<b>RCO'S'</b>	20NiCrMoS2-2 <sup>1</sup>	1.6526	(8620)	0,17÷0,23	0,15÷0,40	0,65÷0,95	0,025	0,020÷0,040	0,35÷0,70	0,020÷0,050	Mo=0,15÷0,25 Ni=0,40÷0,70 Cu=0,40
<b>RC2</b>	17NiCrMoS6-4 <sup>2</sup>	1.6569	-	0,14÷0,20	≤0,40	0,60÷0,90	0,025	0,020÷0,040	0,80÷1,10	0,020÷0,050	Mo=0,15÷0,25 Ni=1,20÷1,50
<b>RC2 PB</b>	17NiCrMoS6-4 + Pb <sup>2</sup>	1.6569	-	0,14÷0,20	≤0,40	0,60÷0,90	0,025	0,020÷0,040	0,80÷1,10	0,020÷0,050	Pb=0,15÷0,30 Mo=0,15÷0,25 Ni=1,20÷1,50
<b>20MNV6</b>	20MnV6	1.5217	K0313	0,16÷0,22	0,10÷0,50	1,30÷1,70	0,035	≤0,035	-	-	V=0,10÷0,25

<sup>1</sup> EN ISO 683-3:2018/EN 10277:2018    <sup>2</sup> EN 10084:2008 / EN 10277-4:2008    <sup>3</sup> UNI 7846-78    <sup>4</sup> UNI5331-64

## SPECIAL STEELS

Rodacciai's production range is complemented by specialty steels produced to **specification for targeted applications**. The most commonly produced specialty steels are listed in our table, however several other types are produced upon request.

The heat treatments available for this type of steel, **to be confirmed on a case-by-case** basis according to customer requirements and material specifications are: hot rolled, annealed, isothermal annealed, globular annealed, normalized, and quenched and tempered.


	Execution	Profile	Range (mm)	Finish	Tolerances
<b>Bars</b>	Hot rolled	Round	20÷200	Raw, rough peeled	-
	Drawn	Round	3÷70	Polished	ISA h9-h10-h11
		Hexagonal	3÷70		
		Square	4÷60		
Peeled - rolled	Round	20÷100	Polished	ISA h9-h10-h11	
	Ground	Round	3÷100	Polished	ISA h6-h7-h8-h9-h10-h11
<b>Coils</b>	Drawn	Round	2÷22	Polished, phosphated	ISA h9-h10-h11 EN 10218-2 T1-T2-T3-T4-T5
		Hexagonal	3÷12		
		Square	4÷12		



## SPECIAL STEELS FOR STRUCTURAL USES

Steels destined for structural uses are produced in accordance with applicable US ASTM standards and European standard EN 10025. For welded, bolted, and riveted structures in the building sector.


In addition to the base steel Re37 (ASTM A284C), the Re52D (ASTM A656GR.50) type is used at low temperatures, while the Re60S (ASTM A656GR.50) type is sulfur enhanced for improved machinability.

	EN ISO 683-1:2018 EN 10025-2 EN 10277:2018	N°	AISI	C	Si	Mn	P	Cu	S	N	Al
RE60S	(E335+S) (E335GC)	(1.0060) (1.0543)	-	0,37÷0,45	≤0,50	≤1,40	≤0,045	-	0,080÷0,120	≤0,012	-
RE37	S235JR S235JRC	1.0038 1.0122	(K02502)	0,17	-	≤1,40	≤0,035	≤0,55	≤0,035	≤0,012	-
RE52D	S355J2 S355J2C	1.0577 1.0579	(K0311) (K0314)	0,20	≤0,55	≤1,60	≤0,025	≤0,55	≤0,025	-	0,020÷0,060

## SPECIAL STEELS FOR COLD FORMING AND STEELS FOR BEARINGS

Specialty steels for cold deformation which are low carbon and a balance of other elements which improve the characteristics to obtaining cold forged pieces even with large deformations.


Although there are many applications, specialty steels in Rodacciai's production range are most commonly used for production of ball bearings, rollers, and bearing races.

	NORMA	N°	AISI	C	Si	Mn	P	S	Al	Other Elements
SB4	EN 10263-2:2018 C4C	1.0303	-	0,02÷0,06	≤0,10	0,20÷0,40	≤0,020	≤0,025	0,020÷0,060	-
CB10FF	EN 10263-2:2018 (C10C)	1.0214	(1012)	0,08÷0,12	≤0,10	0,30÷0,50	≤0,025	≤0,025	0,020÷0,060	-
32CrB4	EN 10263-4:2018 32CrB4	1.7076	-	0,30÷0,34	≤0,30	0,60÷0,90	≤0,025	≤0,025	0,020÷0,060	Cr=0,90÷1,20 Cu=0,25 B=0,0008-0,005
36CrB4	EN 10263-4:2018 36CrB4	1.7077	-	0,34÷0,38	≤0,30	0,70÷1,00	≤0,025	≤0,025	0,020÷0,060	Cr=0,90÷1,20 Cu=0,25 B=0,0008-0,005
100CR6	EN ISO 683-17:2014 100Cr6	B1	(52100L3)	0,93÷1,05	0,15÷0,35	0,25÷0,45	≤0,025	≤0,015	≤0,050	Cr=1,35÷1,60 Mo=≤0,10

## SPECIAL STEELS CONFORMING TO THE ASTM AMERICAN STANDARDS

Specialty steels for this product line are both non-alloyed and alloyed steels adhering to ASTM standards and API specs. They are used in the production of flanges, fittings and linkages for the oil and gas industry.

Alloyed steels are generally supplied in the quenched and tempered state, with specific mechanical characteristics for each application or to customer specification.

	ASTM	C	Si	Mn	P	S	Cr	Mo	Al	Other Elements
A105 K105	A105	≤0,35	0,10÷0,35	0,60÷1,05	≤0,035	≤0,040	≤0,30	≤0,12	0,020÷0,050	Ni=≤0,40 V=≤0,08 Cu=≤0,40
A193-B7 A193-B7M	B7 B7M	0,38÷0,48	0,15÷0,35	0,75÷1,00	≤0,035	≤0,040	0,80÷1,10	0,15÷0,25	0,020÷0,050	-
A193 B16	B16	0,36÷0,47	0,15÷0,35	0,45÷0,70	≤0,035	≤0,040	0,80÷1,15	0,50÷0,65	≤0,015	V=0,25÷0,35
A320-L7 A320-L7M	L7 L7M	0,38÷0,48	0,15÷0,35	0,75÷1,00	≤0,035	≤0,040	0,80÷1,10	0,15÷0,25	0,020÷0,050	-

## QUENCHED AND TEMPERED STEELS

With a chemical composition specifically designed to guarantee superior performance, quenched & tempered steels are hard and tough. This makes them suitable for use in severe conditions and extreme applications.

The quench and tempering treatment is typically carried out on finished pieces during the final stages of production. **Rodacciai can offer these products in the quenched and tempered state.** Our heat treatment is carried out on the rolled semi-finished product before the drawing or peeling finishing operations. The delivered product has the appearance and

surface characteristics of a cold finished product.

The complete range of quenched and tempered steels, diversified in terms of chemical composition and therefore temper-ability, allow for all **metal-lurgic or mechanical specifications to be satisfied.**


The heat treatments available for this type of steel – to be confirmed on a case-by-case basis according to customer requirements are: hot rolled, annealed, isothermal annealed, globular annealed, normalized, and quenched and tempered

	Execution	Profile	Range (mm)	Finish	Tolerances
Bars	Hot rolled	Round	20÷200	Raw, rough peeled	-
	Drawn	Round	3÷70	Polished	ISA h9-h10-h11
		Hexagonal Square	3÷70 4÷60		
	Peeled - rolled	Round	20÷100	Polished	ISA h9-h10-h11
Ground	Round	3÷100	Polished	ISA h6-h7-h8-h9-h10-h11	
Coils	Drawn	Round	2÷22	Polished, phosphated	ISA h9-h10-h11 EN 10218-2 T1-T2-T3-T4-T5
		Hexagonal Square	3÷12 4÷12		

## NON-ALLOY STEELS FOR QUENCHING AND TEMPERING

These various types of non-alloyed steels (without the addition of alloying elements) differ from each other by the percentage of carbon content. **The higher the carbon content, the greater the hardness after a quench and tempering heat treatment.** Non-alloyed quenched

and tempered steels have a limited temper-ability and do not allow for well transformed grain structure to be obtained on pieces with a heavy cross-section.

	Nome	N°	AISI	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Other Elements
<b>KV20</b>	C22E <sup>1</sup>	1.1151	(1020-1023)	0,17÷0,24	≤ 0,40	0,40÷0,70	≤0,030	≤0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>R20Pb</b>	C22R + Pb <sup>1</sup>	1.1149	(1020-1023)	0,17÷0,24	≤ 0,40	0,40÷0,70	≤0,030	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050 Pb = 0,15÷0,30
<b>KV30</b>	C30E <sup>1</sup>	1.1178	(1030)	0,27÷0,34	0,10÷0,40	0,50÷0,80	≤0,025	≤ 0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>R30S</b>	C30R <sup>1</sup>	1.1179	(1030)	0,27÷0,34	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050
<b>KV35</b>	C35E	1.1181	1035	0,32÷0,39	0,10÷0,40	0,50÷0,80	≤0,025	≤ 0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>R35Pb</b>	C35R + Pb	1.1180	10L35	0,32÷0,39	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050 Pb = 0,15÷0,30
<b>KV40</b>	C40E	1.1186	(1040)	0,37÷0,44	0,10÷0,40	0,50÷0,80	≤0,025	≤ 0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>R40S</b>	C40R	1.1189	(1040)	0,37÷0,44	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050
<b>R40Pb</b>	C40R + Pb	1.1189	(10L40)	0,37÷0,44	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050 Pb = 0,15÷0,30
<b>KV45</b>	C45E	1.1191	(1045)	0,42÷0,50	0,10÷0,40	0,50÷0,80	≤0,025	≤ 0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>C48TI</b>	C45R	1.1201	(1045)	0,42÷0,50	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050
<b>R45Pb</b>	C45R + Pb	1.1201	(10L45)	0,42÷0,50	0,10÷0,40	0,50÷0,80	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	Al = 0,020÷0,050 Pb = 0,15÷0,30

EN ISO 683-3:2018/EN ISO 683-2:2018 / EN 10277:2018

<sup>1</sup> EN10083-1+A1:1996



Icon	Nome	N°	AISI	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	Other Elements
<b>KV50</b>	C50E	1.1206	1050	0,47÷0,55	0,10÷0,40	0,60÷0,90	≤0,025	≤0,035	≤0,40	≤0,10	≤0,40	≤0,30	-
<b>R55</b>	C55 <sup>1</sup>	1.0535	1055	0,52÷0,60	≤0,40	0,60÷0,90	≤0,030	0,020÷0,040	≤0,40	≤0,10	≤0,40	-	-
<b>C60R</b>	C60R	1.1223	1060	0,57÷0,65	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	≤0,40	≤0,10	≤0,40	≤0,30	-

EN ISO 683-3:2018/EN ISO 683-2:2018 / EN 10277:2018<sup>1</sup> EN10083-1+A1:1996

## ALLOYED STEELS FOR QUENCHING AND TEMPERING

Alloyed quenched and tempered steels **contain alloying elements** (manganese, chromium, nickel, molybdenum) in variable quantities and proportions that allow for desired temper-ability to be achieved. Larger pieces can be produced with grain structures transformed to the core and suitable to the most demanding applications. Alloying elements are chosen as a function of the desired metallurgic and mechanical characteristics. For example:

**Chromium** improves hardness and toughness.

**Nickel** has beneficial effects on impact resilience and resistance to fatigue.

**Molybdenum** reduces the phenomenon of fragility upon tempering.

**Manganese** slows the rate of cooling which enhances heat treatability. These steels are usually **quenched and tempered in oil** which allows for the production of finished products in basic and complex shapes. The fields of application are quite varied: shaft components, gears, linkages, fasteners and mechanical components of all types.

Icon	Nome	N°	AISI	C	Si	Mn	P	S	Cr	Al	Mo	Cu	Other Elements
<b>34Cr4</b>	34Cr4	1.0733	(5132)	0,30÷0,37	0,10÷0,40	0,60÷0,90	≤0,025	≤0,035	0,90÷1,20	0,020÷0,050	-	≤0,40	-
<b>34CrS4</b>	34CrS4	1.0737	(5132)	0,30÷0,37	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	-	≤0,40	-
<b>37CrS4</b>	37CrS4	1.7038	(5135)	0,34÷0,41	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	-	≤0,40	-
<b>RK4</b>	41Cr4	1.0735	(5140)	0,38÷0,45	0,10÷0,40	0,60÷0,90	≤0,025	≤0,035	0,90÷1,20	0,020÷0,050	-	≤0,40	-
<b>RK4S</b>	41CrS4	1.0739	(5140)	0,38÷0,45	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	-	≤0,40	-
<b>RKS</b>	36CrMnS <sup>2</sup>	-	-	0,33÷0,40	0,15÷0,40	0,80÷1,10	≤0,035	≤0,035	1,00÷1,30	0,020÷0,050	-	-	-
<b>RKS Pb</b>	36CrMnS + Pb <sup>2</sup>	-	-	0,33÷0,40	0,15÷0,40	0,80÷1,10	≤0,035	≤0,035	1,00÷1,30	0,020÷0,050	-	-	Pb = 0,15÷0,30
<b>RK0</b>	30CrMo4 <sup>4</sup>	-	(4130)	0,27÷0,34	0,15÷0,40	0,40÷0,70	≤0,035	≤0,035	0,80÷1,10	0,020÷0,050	0,15÷0,25	-	-
<b>RK0S</b>	25CrMoS4	1.7213	-	0,22÷0,29	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	-
<b>RK0S Pb</b>	25CrMoS4 + Pb	1.7213	-	0,22÷0,29	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	Pb = 0,15÷0,30
<b>RD6</b>	34CrMoS4	1.7226	(4135)	0,30÷0,37	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	-
<b>RD6 Pb</b>	34CrMoS4 + Pb	1.7226	(4135)	0,30÷0,37	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	Pb = 0,15÷0,30
<b>RK1</b>	42CrMoS4	1.7227	(4140-4142)	0,38÷0,45	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	-
<b>1.7225</b>	42CrMo4	1.7225	(4140-4142)	0,38÷0,45	0,10÷0,40	0,60÷0,90	≤0,025	≤0,035	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	-
<b>RK1 Pb</b>	42CrMoS4 + Pb	1.7227	(4140)	0,38÷0,45	0,10÷0,40	0,60÷0,90	≤0,025	0,020÷0,040	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	Pb = 0,15÷0,30
<b>50CrMo4</b>	50CrMo4	1.7228	(4147)	0,46÷0,54	0,10÷0,40	0,50÷0,80	≤0,025	≤0,035	0,90÷1,20	0,020÷0,050	0,15÷0,30	≤0,40	-
<b>RB2</b>	39NiCrMo3 <sup>1</sup>	1.6510	-	0,35÷0,43	≤0,40	0,50÷0,80	≤0,025	≤0,035	0,60÷1,00	0,020÷0,050	0,15÷0,25	-	Ni = 0,70÷1,00
<b>RB2 Pb</b>	39NiCrMo3 + Pb <sup>1</sup>	1.6510	-	0,35÷0,43	≤0,40	0,50÷0,80	≤0,025	≤0,035	0,60÷1,00	0,020÷0,050	0,15÷0,25	-	Pb = 0,15÷0,30 Ni = 0,70÷1,00
<b>34CrNiMo6</b>	34CrNiMo6	1.6582	-	0,30÷0,38	0,10÷0,40	0,50÷0,80	≤0,025	≤0,035	1,30÷1,70	0,020÷0,050	0,15÷0,30	≤0,40	Ni = 1,30÷1,70
<b>30CrNiMo8</b>	30CrNiMo8	1.6580	-	0,26÷0,34	0,10÷0,40	0,50÷0,80	≤0,025	≤0,035	1,80÷2,20	0,020÷0,050	0,30÷0,50	≤0,40	Ni = 1,80÷2,20
<b>L43</b>	(43CrNiMo6)	(1.6582)	4340-L43	0,38÷0,43	0,15÷0,35	0,60÷0,90	≤0,035	≤0,040	0,70÷0,90	-	0,20÷0,30	-	Ni = 1,65÷2,00
<b>46CrB2</b>	46CrB2	1.7075	-	0,42÷0,50	0,15÷0,40	0,60÷0,90	≤0,035	0,020÷0,040	0,30÷0,60	-	-	-	Ni = ≤0,30 B = 0,001÷0,005
<b>31CRMOV9</b>	31CrMoV9 <sup>3</sup>	1.8519	-	0,27÷0,34	≤0,40	0,40÷0,70	≤0,025	≤0,035	2,30÷2,70	-	0,15÷0,25	-	V=0,10÷0,20
<b>51CRV4</b>	51CrV4	1.8159	(6150)	0,47÷0,55	0,10÷0,40	0,60÷1,00	≤0,025	≤0,025	0,80÷1,10	-	-	≤0,40	V=0,10÷0,25
<b>21CRMV5.7</b>	21CrMoV5.7 <sup>4</sup>	1.7709	-	0,17÷0,25	≤0,40	0,40÷0,80	≤0,025	≤0,030	1,20÷1,50	≤0,030	0,55÷0,80	-	Ni=≤0,60 V=0,20÷0,35
<b>27MNCRB5-2</b>	27MnCrB5-2 <sup>1</sup>	1.7182	-	0,24÷0,30	≤0,40	1,10÷1,40	≤0,025	≤0,035	0,30÷0,60	-	-	-	B=0,0008÷0,005
<b>20MnV6</b>	20MnV6 <sup>1</sup>	1.5217	-	0,16÷0,22	0,10÷0,50	1,30÷1,70	≤0,035	≤0,035	-	-	-	-	V=0,10÷0,20

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## STEELS FOR SURFACE HARDENING

The series of carbon steels for surface tempering includes four types of materials with an increasing carbon content. The hardness obtained on the surface with this treatment is **directly proportional to the steel's carbon content**.

All of these special steels have a balanced chemical composition that allows for **good machinability** ( $S = 0.020 - 0.040$ ). Another benefit is **excellent repeatability of the heat treatment** due to the constant austenitic

grain ( $Al = 0.020 - 0.050$ ). The required hardness values can only be obtained with certainty after the removal of the bar's surface layer to eliminate any decarburization.

The heat treatments available for this type of steel – to be confirmed on a case-by-case basis according to customer requirements and material specifications are: hot rolled, annealed, isothermal annealed, globular annealed, normalized, and quenched and tempered.


	Execution	Profile	Range (mm)	Finish	Tolerances
<b>Bars</b>	Hot rolled	Round	20÷200	Raw, rough peeled	-
	Drawn	Round	3÷70	Polished	ISA h9-h10-h11
		Hexagonal	3÷70		
		Square	4÷60		
Peeled - rolled	Round	20÷100	Polished	ISA h9-h10-h11	
	Ground	Round	3÷100	Polished	ISA h6-h7-h8-h9-h10-h11
<b>Coils</b>	Drawn	Round	2÷22	Polished, phosphated	ISA h9-h10-h11 EN 10218-2 T1-T2-T3-T4-T5
		Hexagonal	3÷12		
		Square	4÷12		



## NON-ALLOY STEELS FOR SURFACE HARDENING

Non-alloyed steels may contain traces of alloying elements, present in the scrap used to melt the steel.

The carbon content of these steels defines the resulting mechanical properties and the applications.

	AISI	C	Si	Mn	P (Max)	S	Cr	Ni	Cu	Al	Other Elements
<b>R33S</b>	(1035)	0,30÷0,36	0,10÷0,40	0,60÷0,90	0,035	0,020÷0,040	≤ 0,25	≤ 0,25	≤ 0,40	0,020÷0,050	-
<b>R43TI</b>	(1040)	0,40÷0,46	0,10÷0,40	0,60÷0,80	0,030	0,020÷0,035	≤ 0,25	≤ 0,25	≤ 0,40	0,020÷0,050	-
<b>R43Pb</b>	(10L40)	0,40÷0,46	0,10÷0,40	0,60÷0,80	0,030	0,020÷0,035	≤ 0,25	≤ 0,25	≤ 0,40	0,020÷0,050	Pb=0,15÷0,30
<b>R48TI</b>	(1045)	0,45÷0,52	0,10÷0,40	0,50÷0,80	0,030	0,020÷0,035	≤ 0,40	≤ 0,40	≤ 0,40	0,020÷0,050	Mo=≤0,10
<b>R53TI</b>	(1050)	0,52÷0,57	0,10÷0,40	0,60÷0,80	0,030	0,020÷0,035	≤ 0,20	≤ 0,25	≤ 0,40	0,020÷0,050	Mo=≤0,050

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