51CrV4

Quenched and tempered steels

Material no.	1.8159
according to	DIN EN ISO 683-2
Tensile strength class	D

General

According to DIN EN ISO 683-2, the steel grade 51CrV4 (or 50CrV4) belongs to the group of quenched and tempered steels.

This steel group is particularly being used for components subject to high stress, thus when a combination of high strength (wear resistance) and good toughness is crucial.

The material receives its special characteristics through quenching and tempering. The processors need to make sure that their calculation method, design technique and processing procedure are aligned with the material. Precise temperature control is crucial for the part's characteristics. Therefore, the temperature needs to be adjusted according to the respective purpose of the material.

Chemical composition[1)2)]

(in percent by weight)

	min. in %	max. in %
C	0.47	0.55
Si[3)]	0.10	0.40
Mn	0.60	1.00
P[4)]		0.020
S[4)]		0.008
Cr	0.80	1.10
Cu		0.40
V	0.10	0.25

1) Heat analysis

2) Reference analysis

3) Steels may be supplied with lower silicon content. In this case, other materials must be used to kill the steels.

4) According to DIN EN ISO 683-2 the following is applicable: P ≤ 0.025 % und S ≤ 0.035 %

Mechanical properties[5)]

Test direction	Yield strength $R_{p0.2}$ in MPa
longitudinal	630 – 1,070
transversal	650 – 1,300

Test direction	Tensile strength R_m in MPa
longitudinal	980 – 1,250
transversal	900 – 1,300

Test direction	Total elongation A_{80}[6)] in %
longitudinal	7 – 15
transversal	5 – 14

Test direction	Total elongation A_5[6)] in %
longitudinal	8 – 18
transversal	7 – 17

5) The mechanical properties are not standardized for the condition of delivery of the hot-rolled coils.

The values in the table above are mainly from coil ends. Slightly lower values are to be expected in the middle of the coil.

6) The following applies to the nominal thickness e:

e < 3 mm: A_{80}

e ≥ 3 mm: A_5

Available dimensions

Hot-rolled coils unpickled, mill edge

Thickness in mm	Width in mm
2.00 – 2.24	900 – 1,300
2.25 – 2.99	900 – 1,350
3.00 – 3.99	900 – 1,450
4.00 – 4.99	900 – 1,500
5.00 – 5.99	900 – 1,650
6.00 – 15.00	900 – 1,700

Thicknesses ≤ 25 mm and < 2 mm on request.

Widths ≤ 2,000 mm on request

Hot-rolled coils unpickled, mill edge

Thickness in mm	Width in mm
2.00 – 2.99	900 – 1,300
2.25 – 2.99	900 – 1,350
3.00 – 3.99	900 – 1,450
4.00 – 4.99	900 – 1,500
5.00 – 9.99	900 – 1,530
10.00 – 10.99	900 – 1,400
11.00 – 11.99	900 – 1,250
12.00 – 12.50	900 – 1,150

Thicknesses < 2 mm and > 12.70 mm on request.

Trimmed edge material on request.

Hot-rolled coils, slit lengthwise

Thickness in mm	Width in mm
2.50 – 2.99	100 – 640
3.00 – 4.60	100 – 690
4.61 – 6.00	140 – 740

Widths < 100 mm on request.

Thicknesses > 6 mm on request.

Microstructure

Hot-rolled, the 51CrV4 typically develops a ferritic-pearlitic microstructure. At times, portions of bainite can be found at both ends of the coil. The typical grain size is >8, according to ASTM E45.

ung. (100 : 1)

Degree of purity:	SS	OA	OS	OG
	0.1	-	-	8.1

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HNO_3 (500 : 1)

10 % Ferrit, 90 % Perlit

Ferrit grain size: ~ 13

Decarburization:	Upper side	20 µm
	Lower side	10 µm

Characteristics

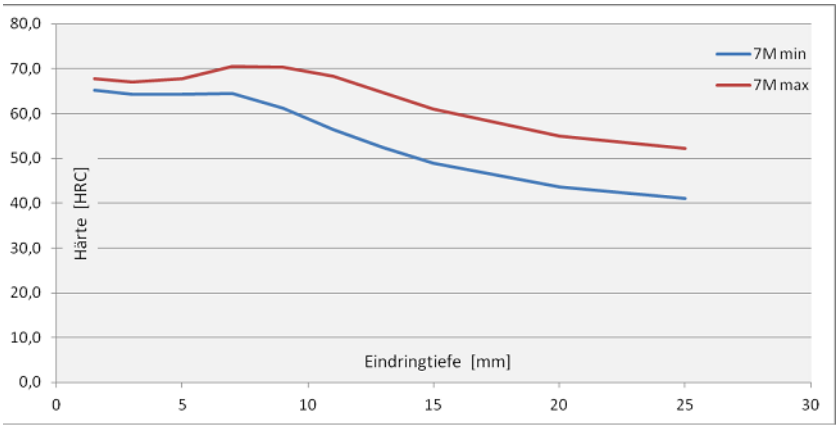
Due to the analytics of the material, a direct hot processing is imperative in order to prevent cracks or fractions when the slab cools down. The high strength of this steel grade can lead to high internal stress which may have an impact on the processing abilities. Therefore, problems may arise during threading or reeling in the pickling process. At customers' sites, fractions along the width at the end of decoiling are not unusual. Before any further processing, annealing is recommended, although internal stress may still exist afterwards. Moreover, CrV steel grades are prone to developing casting shells.

Heat treatment:

Hardening:	820 - 860 °C (Oil)
Soft annealing:	680 - 720 °C
Normalization:	850 - 880 °C

Hardening

Subject to appropriate conditions of annealing and quenching, the material can reach strength of up to 72HRC. The following graph shows the hardenability dependant on indentation depth, calculated according to SEP 1664.



For information only

Examples of use

This steel grade is used in the automotive sector for high tensile parts with good toughness, such as disc springs, clutch plates and spring hinge/hose clamps. Further examples for the use of this steel grade are clamping sleeves, clamping rings, and mower blades in agriculture.

Mower blade

Clamping sleeves

Hose clamp

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