MATERIAL DATA SHEET

# STEEL GRADE

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OVAKO

## 20NiCrMo7 All

### General Information

Ovako 157 is a high cleanliness case hardening steel used for bearing and transmission components. There are three different modifications of the grade.

157C - Bearing quality (BQ) variant with low sulphur content

157D - Bearing quality (BQ) variant with low sulphur content

157G - Regulated sulphur content for improved and consistent machinability

**BQ-Steel®**

BQ-Steel® is a bearing quality clean steel optimized for fatigue strength and is also ideal for new design solutions outside the bearing industry.

### Similar designations

ASTM 4320, ASTM 4320H, ASTM 4320RH

### Chemical composition

| Variant | Cast | Weldability | | C % | Si % | Mn % | P % | S % | Cr % | Ni % | Mo % | V % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 157C | IC | CEV $0.65_{max}$ | Min | 0.17 | 0.20 | 0.55 | - | 0.002 | 0.50 | 1.65 | 0.23 | - |
| | | Pcm $0.36_{max}$ | Max | 0.22 | 0.30 | 0.65 | 0.015 | 0.005 | 0.60 | 2.00 | 0.28 | 0.014 |
| 157D | IC | CEV $0.67_{max}$ | Min | 0.17 | 0.20 | 0.55 | - | 0.002 | 0.50 | 1.65 | 0.23 | - |
| | | Pcm $0.37_{max}$ | Max | 0.22 | 0.30 | 0.65 | 0.015 | 0.005 | 0.60 | 2.00 | 0.28 | 0.100 |
| 157G | IC | CEV $0.7_{max}$ | Min | 0.20 | 0.20 | 0.70 | - | 0.010 | 0.55 | 1.70 | 0.25 | - |
| | | Pcm $0.38_{max}$ | Max | 0.22 | 0.35 | 0.80 | 0.020 | 0.020 | 0.65 | 1.80 | 0.30 | 0.100 |

## Mechanical Properties

| Variant | Condition | Format | Dimension [mm] | Yield strength min [MPa] | Tensile strength [MPa] | Hardness |
|---|---|---|---|---|---|---|
| 157C | +QT | Round bar | 25 typical | 1200 | 1300 typical | 360 HB typical |
| 157D | +QT | Round bar | 25 typical | 1200 | 1300 typical | 360 HB typical |

$Rp_{0.2}$ * $R_{eh}$, ** $R_{el}$

## Transformation temperatures

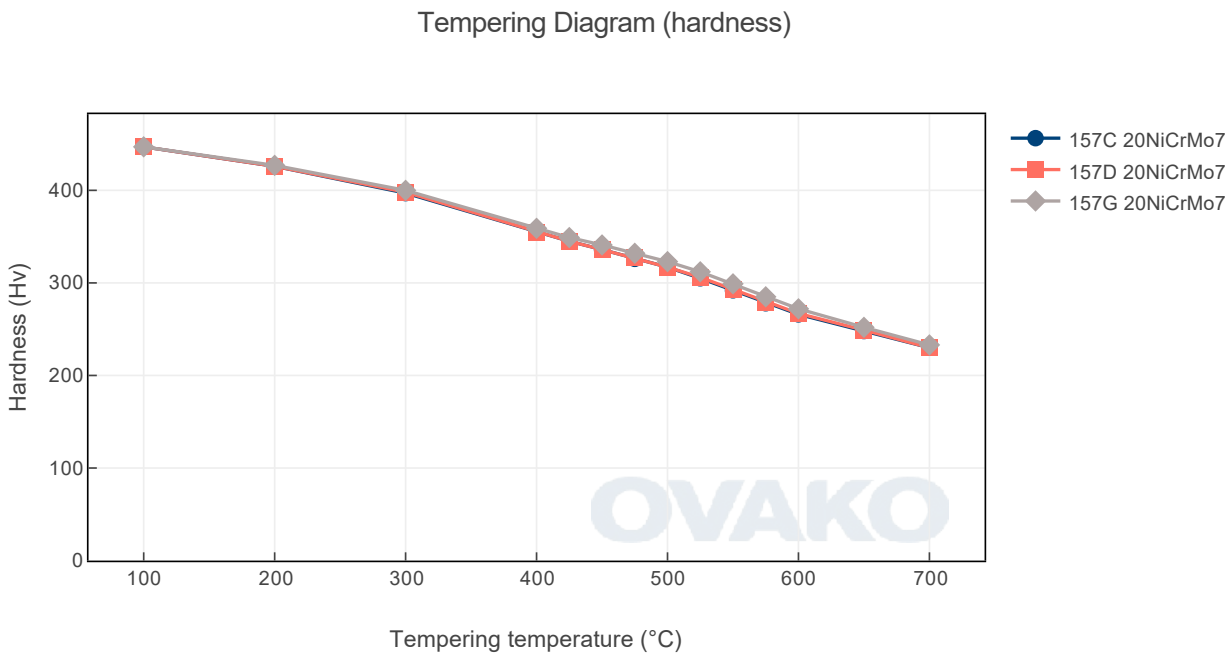
| | Temperature °C |
|---|---|
| MS | 400 |
| AC1 | 704 |
| AC3 | 806 |

## Heat treatment recommendations

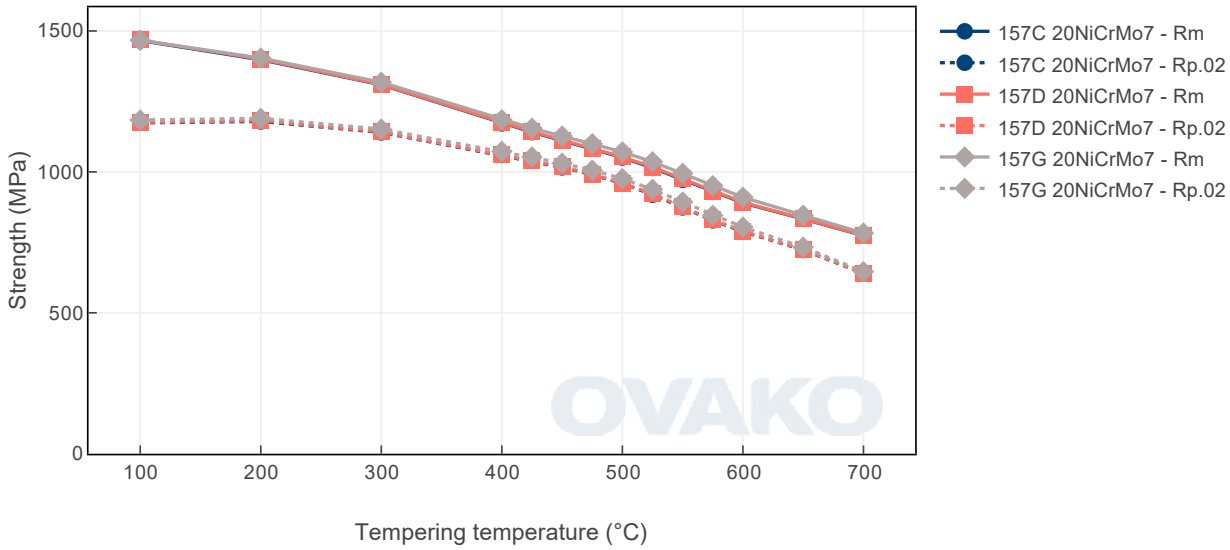
| Treatment | Condition | Temperature cycle | Cooling/quenching |
|---|---|---|---|
| Hot forging | +U | 800-1200C | In air |
| Normalizing | +N | 860-890C | In air |
| Soft annealing | +A | 600-670/2h | In air |
| Quench & Tempering | +QT | 840-890C | In oil |
| Quench & Tempering | +QT | 780-830C Hardening of as-carburized components | In oil |
| Tempering | +T | 160-250C | In air |

## Heat Treatment Guide generated Graphs

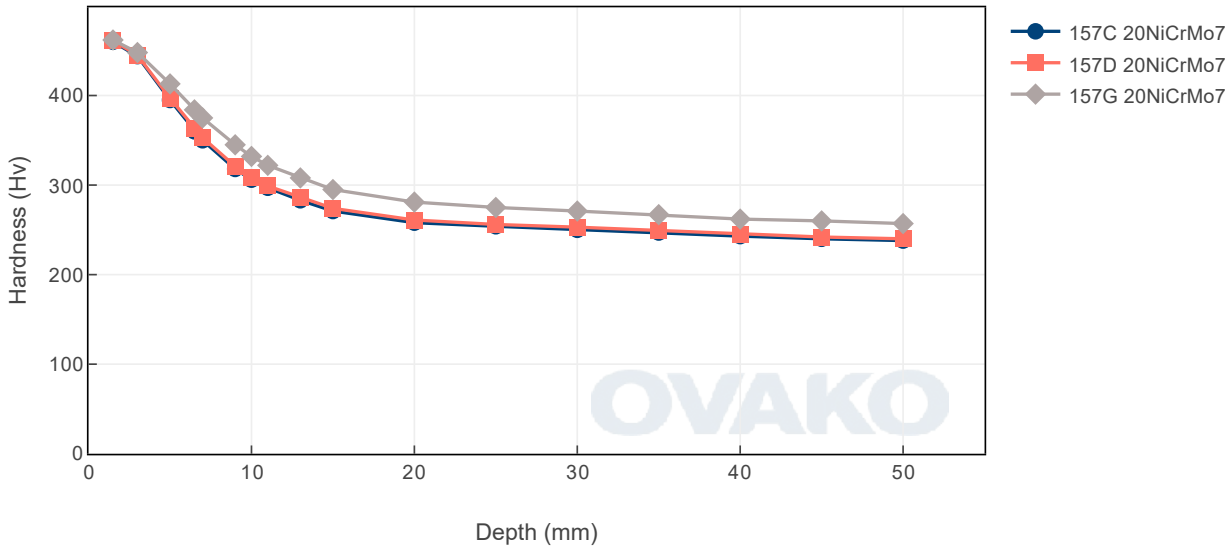
The following graphs are generated from a theoretical model. For further info see the Heat treatment guide module. Select a specific grade version for individual display.



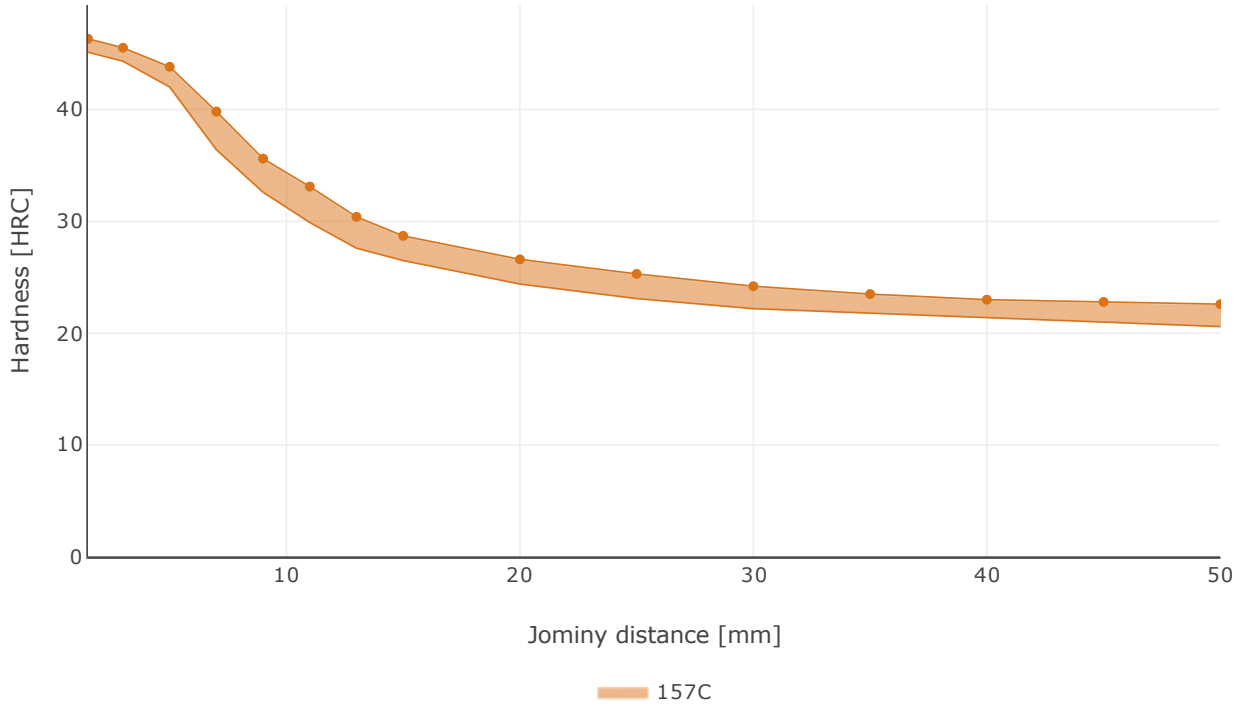
## Tempering Diagram (strength)



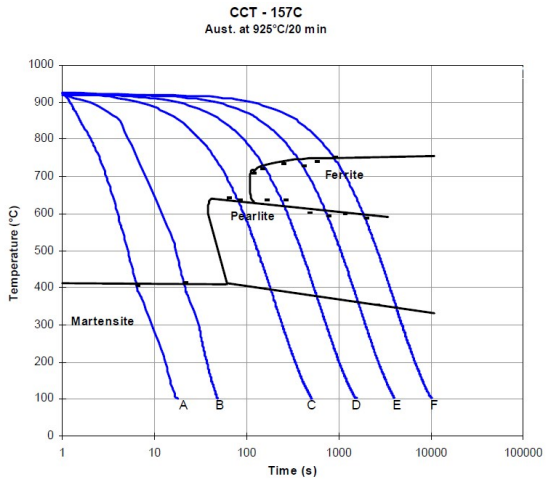
# Jominy


Hardness (Hv)
400
300
200
100
0
0
10
20
30
40
50
Depth (mm)
157C 20NiCrMo7
157D 20NiCrMo7
157G 20NiCrMo7
OVAKO

## Hardenability

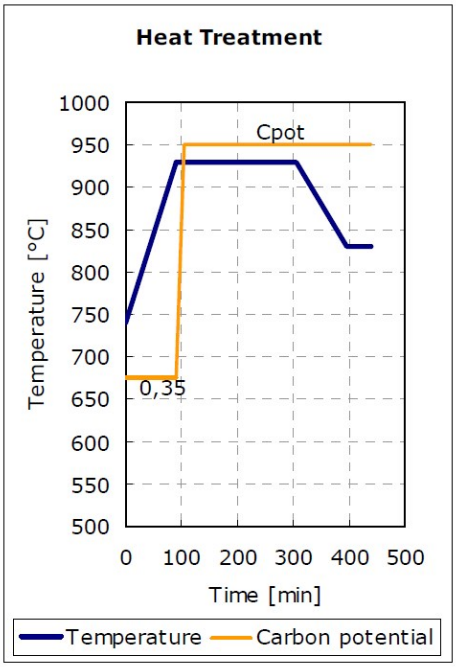


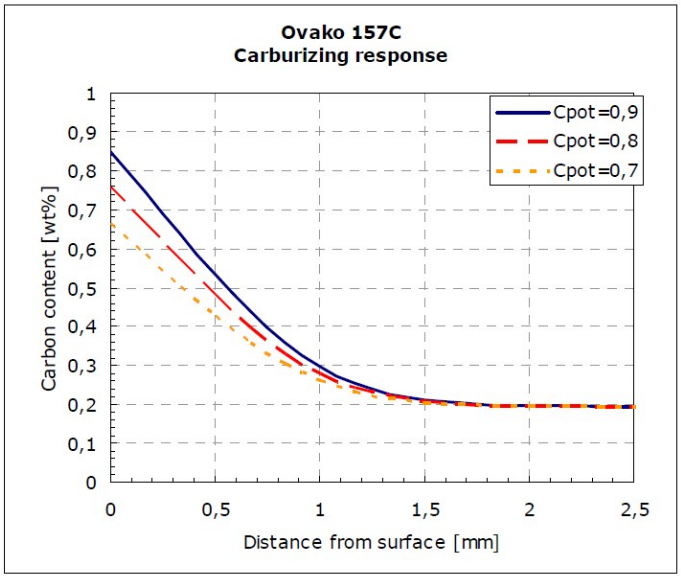

## CCT - Ovako 157C




| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| $t_{8-5}$ [s] | 3 | 10 | 100 | 300 | 800 | 2000 |
| $Hv_{30}$ | 459 | 421 | 256 | 219 | 212 | 192 |

## Carburizing response - Ovako 157C




Carburization response for Ovako 157C for the cycles shown in the left figure. Response of 157D and 157G similar.

## Steel cleanliness - Ovako 157D

| Micro inclusions - BQ | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Applied standard | ASTM E45 | | | | | | | |
| Sampling | ASTM A295 | | | | | | | |
| Maximum average limits | A | | B | | C | | D | |
| | Th | He | Th | He | Th | He | Th | He |
| | 2,0 | 1,5 | 0,8 | 0,1 | 0 | 0 | 0,5 | 0,4 |

| Macro inclusions - BQ | |
|---|---|
| Applied standard | ISO 3763<br>(Blue fracture) |
| Sampling | Statistical testing on billets. |
| Limits | < 2,5 mm/dm$^2$ |

## SUSTAINABILITY-ENVIRONMENTAL IMPACT DATA

At Ovako sustainability and reduction of our environmental impact is a major focus in everything we do.
Further information is found here.

| Steel works | Hofors | Smedjebacken | Imatra |
|---|---|---|---|
| CO2e/kg | 120 | 62 | 76 |

To get the full picture of our products environmental impact we have to look at all of our $CO_2$ emission sources.
Not only the steel work Scope 1-2 itself, but all operations downstream in our production, heating and heat treatment furnaces etc (full scope 1-2) as well as all the emission from input material, eg. alloys, scope 3.

| Steel Grade | Format | Condition | Scope 1-3 (CO2e kg /1000 kg steel) | Climate compensated Net emission = Scope 3 (CO2e kg /1000 kg steel) Scope 1 - 2 = 0 (compensated) |
|---|---|---|---|---|
| 157 | Round bar | +AR | 888 | 489 |
| 157 | Round bar | +FP | 894 | 493 |
| 157 | Tube,wall | +AR | 935 | 532 |
| 157 | Tube,wall | +FP | 938 | 540 |

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## Other properties (typical values)

| Youngs module (GPa) | Poisson´s ratio (-) | Shear module (GPa) | Density (kg/m3) |
|---|---|---|---|
| 210 | 0.3 | 80 | 7800 |
| **Average CTE 20-300°C (µm/m°K)** | **Specific heat capacity 50/100°C (J/kg °K)** | **Thermal conductivity Ambient temperature (W/m°K)** | **Electrical resistivityAmbient temperature (µΩm)** |
| 12 | 460 - 480 | 40 - 45 | 0.20 - 0.25 |

### Contact us

Would you like to know more about our offers? Don´t hesitate to contact us:

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Via telephone: +46 8 622 1300

For more detailed information please visit http://www.ovako.com/en/Contact-Ovako/