

# GNB200

## Type analysis

Single figures are nominal except where noted.

<b>Iron</b>	Balance	<b>Nickel</b>	3.00–3.80 %	<b>Molybdenum</b>	1.10–1.90 %
<b>Chromium</b>	1.20–1.80 %	<b>Vanadium</b>	0.20–0.40 %	<b>Carbon</b>	0.21–0.27 %
<b>Copper</b>	max 0.10 %	<b>Manganese</b>	max 0.10 %	<b>Silicon</b>	max 0.10 %
<b>Columbium/Niobium</b>	0.005–0.030 %	<b>Aluminum</b>	max 0.02 %	<b>Phosphorus</b>	max 0.005 %
<b>Sulfur</b>	max 0.002 %				

## Forms manufactured

Bar

## Description

GNB200 is a premium melted alloy steel specially formulated for high temperature applications requiring high mechanical strength combined with very high toughness at -40°F. The clean microstructure produced by ARC/AOD melting followed by Vacuum ARC refining allows for the development of very tough properties. The high tempering temperature makes GNB200 suitable for applications that see temperatures up to 1000°F. The toughness at -40°F makes GNB200 suitable for applications in very cold environments. GNB200 can be supplied in either the annealed condition or full hard condition. The full hard condition is conducive to the cold hammer forging process.

### Key Properties:

- High strength
- High toughness
- Magnetic
- High- and low-temperature

### Markets:

- Aerospace
- Consumer
- Defense
- Industrial

### Applications:

- Thin-walled pressure vessels
- Rifle barrels
- Bolts
- Shafts

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### Corrosion resistance

GNB200 is not a corrosion resistant alloy and will require protection to mitigate corrosion.

#### IMPORTANT NOTE:

The following 4-level rating scale (Excellent, Good, Moderate, Restricted) is intended for comparative purposes only and is derived from experiences with wrought product. Additive manufactured material may perform differently; corrosion testing is recommended. Factors that affect corrosion resistance include temperature, concentration, pH, impurities, aeration, velocity, crevices, deposits, metallurgical condition, stress, surface finish, and dissimilar metal contact.

#### Humidity

Restricted

### Physical properties

PROPERTY	At or From	English Units	Metric Units
DENSITY	—	0.284 lb/in <sup>3</sup>	—

### Typical mechanical properties

FORM	ORIENTATION	0.2% YIELD STRENGTH		ULTIMATE TENSILE STRENGTH		ELONGATION IN 4D or 2IN	REDUCTION OF AREA
		ksi	MPa	ksi	MPa	%	%
		1150°F temper	Longitudinal	164	1131	175	1207
1160°F temper	Longitudinal	157	1082	168	1158	21	70

FORM	CHARPY V-NOTCH		HARDNESS
	FT-LBS	J	HRC
	1150°F temper	68 @ -40°F	92 @ -40°F
1160°F temper	110 @ -40°F	149 @ -40°F	36

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**Heat treatment**

<b>Annealing</b>	Subcritical anneal 1200–1250°F to soften, as annealed hardness will be ~295 HB.
<b>Hardening</b>	1600–1700°F, 1–4 hours, fan cool or faster to room temperature.
<b>Normalizing</b>	1787°F, air cool to room temperature.
<b>Stress relieving</b>	100°F below tempering temperature.
<b>Tempering</b>	1120–1170°F, 2–4 hours, air cool to room temperature.

**Workability**

<b>Forging</b>	GNB200 is readily forged in the temperature range of 1750–2250°F.
<b>Hot working</b>	GNB200 is readily hot worked in the temperature range of 1750–2250°F.
<b>Machinability</b>	GNB200 machines similar to 4340 at similar hardness.

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Typical feeds and speeds for quenched and tempered ~38 HRC

The feeds and speeds in the following charts are conservative recommendations for initial setup. Higher feeds and speeds may be attainable depending on machining environment.

TURNING — SINGLE-POINT AND BOX TOOLS							
DEPTH OF CUT, IN	HIGH-SPEED TOOLS			CARBIDE TOOLS			
	SPEED, FPM	FEED, IPR	TOOL MATERIAL	SPEED, FPM		FEED, IPR	TOOL MATERIAL
				BRAZED	THROW AWAY		
.040	65	.005	T-15, M-42	240	375	.007	C-7
.150	50	.010	T-15, M-42	190	300	.015	C-6

TURNING — CUT-OFF AND FORM TOOLS									
SPEED, FPM	FEED, IPR							TOOL MATERIAL	
	CUT-OFF TOOL WIDTH, IN			FORM TOOL WIDTH, IN				HIGH-SPEED TOOLS	CARBIDE TOOLS
	1/16	1/8	1/4	1/2	1	1-1/2	2		
30	.0011	.0014	.0018	.0014	.0011	.0009	.0007	T-15, M-42	C-6
95	.0011	.0014	.0018	.0014	.0011	.0009	.0007	T-15, M-42	C-6

ROUGH REAMING									
HIGH-SPEED TOOLS		CARBIDE TOOLS		FEED, IPR, REAMER DIAMETER, IN					
SPEED, FPM	TOOL MATERIAL	SPEED, FPM	TOOL MATERIAL	1/8	1/4	1/2	1	1-1/2	2
30	T-15, M-42	?	?	.002	.004	.005	.006	.007	.008
?	?	45	C-2	.004	.006	.008	.010	.011	.012

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Typical feeds and speeds for quenched and tempered ~38 HRC (continued)

DRILLING — HIGH-SPEED TOOLS									
SPEED, FPM	FEED, IPR								TOOL MATERIAL
	NOMINAL HOLE DIAMETER, IN								
	1/16	1/8	1/4	1/2	3/4	1	1-1/2	2	
25	-	.002	.003	.004	.006	.008	.008	.010	T-15, M-42

MILLING — END PERIPHERAL												
DEPTH OF CUT, IN	HIGH-SPEED TOOLS						CARBIDE TOOLS					
	SPEED, FPM	FEED, IN PER TOOTH				TOOL MATERIAL	SPEED, FPM	FEED, IN PER TOOTH				TOOL MATERIAL
		CUTTER DIAMETER, IN						CUTTER DIAMETER, IN				
		1/4	1/2	3/4	1-2			1/4	1/2	3/4	1-2	
.02	65	.0005	.0015	.003	.004	M-2	260	.001	.0015	.003	.005	C-5
.06	55	.0005	.0015	.004	.005	M-3	200	.0015	.003	.005	.006	C-5

BROACHING — HIGH-SPEED TOOLS		
SPEED, FPM	CHIP LOAD, IPT	TOOL MATERIAL
10	.002	T15, M42

**For additional information, please  
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