



NESSteel Inc.

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Alloy Steel AISI 4140 PH

AISI 4140 PH is a quenched and tempered chrome-moly steel, typically supplied at 262-321 Brinell.

Typical analysis is shown in the chart below:

Carbon	Manganese	Chromium	Molybdenum
0.38% - 0.43%	0.75% - 1.00%	0.80% - 1.10%	0.15% - 0.25%

AISI 4140 PH is used in applications requiring good machinability, good tensile strength, and where parts would be subject to unacceptable distortion if heat treated after machining. Typical applications are:

- Spindles
- Rods
- Shafts
- Studs
- Axles
- Arbors
- Gears
- Fixture bases
- Machine parts
- Inexpensive tooling
- Short run stamping dies

Heat Treatment

Stress Relief

- Heat 4140 PH slowly and uniformly to 900°F.
- Allow piece to soak 1 hour/inch of section thickness.
- Air or furnace cool to room temperature.

Annealing

- Prior to rehardening, anneal 4140 PH at 1450°-1550°F for 4 hours.
- Cool slowly (50°F/hr) to 1200°F, then air cool.

Hardening

- For higher strength, pre-heat to 1250°F for one hour.
- Heat to 1525°F/1625°F, soak for 30 minutes after steel is at temperature.
- Oil quench to handheld temperature; temper immediately.

Tempering

Temper 1 hour/inch of section thickness to desired hardness. Refer to the following tempering chart.

Tempering Temperature, °F	Hardness, Rc
400	42
500	41
600	40
700	39
800	37
900	36
1000	34
1100	29
1200	25

Average Physical Properties - Heat Treated

One inch section - Heated to 1525°F - Oil Quenched

Draw	Tensile Strength, psi	Yield Point, psi	Elong. 2"	Reduction of Area	Rockwell C	Brinell
800°F	200,000	180,000	14%	50%	45	429
1000°F	165,000	150,000	17%	54%	36	341
1200°F	130,000	106,000	20%	60%	29	277

Physical Properties

Test results on sections heat treated in .540" rd. and tested in .505" rd x 2" long, Heated to 1550°F - Oil Quenched

Draw	Tensile Strength, psi	Yield Point, psi	Elong. 2"	Reduction of Area	Brinell
600°F	225,000	207,000	10%	42%	444
800°F	180,000	164,000	13%	49%	363
1000°F	145,000	128,000	19%	58%	293
1200°F	125,000	105,000	24%	68%	255
Hot Rolled Annealed	90,000	63,000	28%	58%	183
Annealed & Cold Drawn	110,000	100,000	17%	45%	212

Effect of Mass
Oil Quenched

Size	Draw	Tensile Strength, psi	Yield Point, psi	Elong . 2"	Reduction of Area	Brinell
1 inch	1000* F	140,000	121,000	19%	58%	293
3 inch	1000* F	138,000	118,000	20%	59%	277
5 inch	1000* F	121,000	105,000	18%	60%	262
1 inch	1200* F	120,000	105,000	24%	68%	255
3 inch	1200* F	115,000	96,000	26%	69%	248
5 inch	1200* F	112,000	92,000	23%	65%	241

End-Quench Hominy Hardenability
Tabulation of Band Limits

"J" Distance	Minimum	Maximum
1	60	53
2	60	53
3	60	52
4	59	51
5	59	51
6	58	50
7	58	48
8	57	47
9	57	45
10	56	42
11	56	40
12	55	39
13	55	38
14	54	37
16	53	35
18	52	34
20	51	33
24	48	32
28	46	31
32	44	30

4140 PH Machinability Rating

Based on AISI 1212 as 100%

- Rating - 66
- Surface Ft./Min - 110

Machining Data
Normalized and Tempered; Brinell 262 - 321

Operation	Depth of Cut, in.	High Speed Tooling		Carbide Tooling	
		Speed, fpm	Feed, in./rev.	Speed, fpm	Feed, in./rev.
Drilling	1/8	45	.002		
	1/4	45	.004		
	1/2	45	.006		
	1	45	.009		
	2	45	.015		
Gun Drilling	1/4			165	.005
	1/2			165	.008
	1			165	.0015
	2			165	.002
Single Point Turning	.040	90	.007	440	.007
	.150	70	.015	340	.015
	.300	55	.020	270	.020
Cut Off	.062	55	.0013		
	.125	55	.0016		
	.250	55	.002		
Face Milling	.040	105	.006*	485	.006*
	.150	85	.009*	375	.008*
	.300	65	.012*	290	.010*

*Feed in inches per tooth