



MICROTEC[®] STEEL TECHNOLOGY

IMPROVE MACHINABILITY, MINIMIZE DISTORTIONS WITH MICROTEC STEEL TECHNOLOGY

As a leader in microalloy steel research and application, we design MicroTec[®] steels for applications requiring moderate levels of strength and ductility.

Through extensive research, we learned that by carefully changing the proportions of various elements in the chemical composition of our MicroTec steels, we can enhance specific characteristics of the steel. That research—combined with our superior chemistry control—has led to the availability of over 20 grades of high-quality vanadium microalloyed steels.

Our MicroTec steels help improve machinability, minimize distortions and reduce costs by eliminating heat treatment and streamlining processing.

We supply MicroTec steels as machining bar, forging bar, seamless mechanical tubing and value-added components. Common applications include crankshafts for passenger cars and light- and heavy-duty trucks, axles, hydraulic cylinder components, broadcast towers and transmission races.

THE SAVINGS ADD UP

Microalloy steels attain higher strength in an as-rolled, as-pierced or as-forged condition than standard and many low-alloy steels. We offer an array of medium-carbon microalloy steels, which help manufacturers increase productivity by eliminating conventional quench-and-temper heat-treatment operations.

Benefits include:

- Saving money by eliminating costly fixtures that prevent warping and reduce requirements for inspection, testing and reporting. There are no quenching distortions.
- Achieving hardness uniformity throughout a cross-section of larger parts surpassing that of heat-treated carbon steel parts.
- Improving machinability over that of quench-and-temper steels with comparable hardness levels.
- Increasing weldability over non-heat-treated steels by lowering the carbon equivalent while maintaining the strength of the base steel.

CRITICAL PROPERTIES BRING VALUE

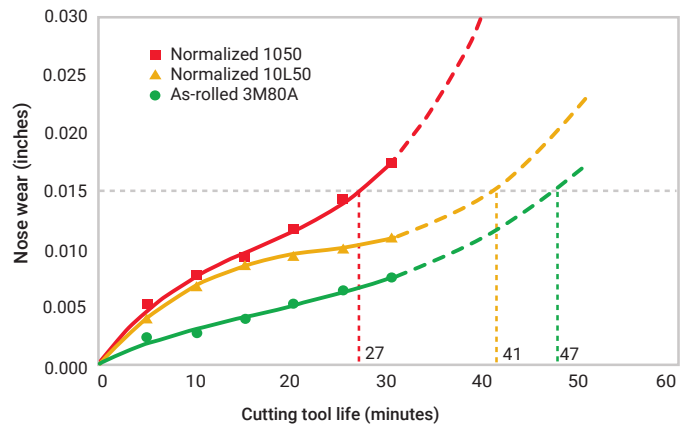
MicroTec steels also provide several advantages for use in parts traditionally produced as castings. The higher strength-to-weight ratio and stiffness of MicroTec steels permit the use of lighter, smaller parts in place of heavier, bulkier castings.

MicroTec steels also help manufacturers:

- Reduce cycle or lead times;
- Reduce floor usage;
- Lower in-process inventory costs;
- Eliminate inspection operations needed for detecting quench cracks; and
- Increase productivity through improved machinability.

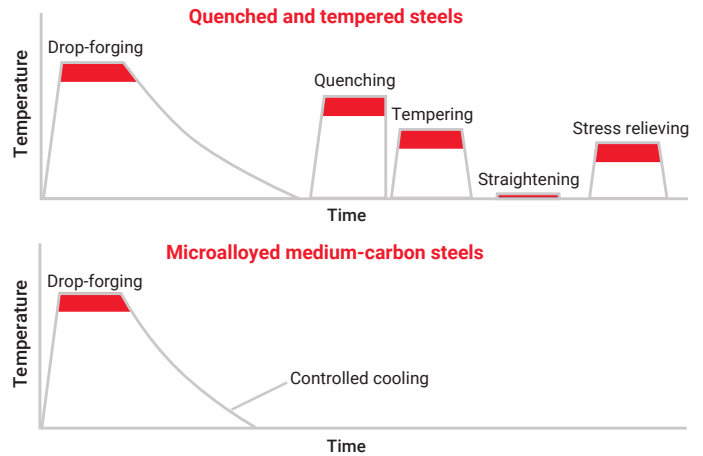
MACHINABILITY – TURNING TOOL WEAR

Curves for KC9010 on Various Steels

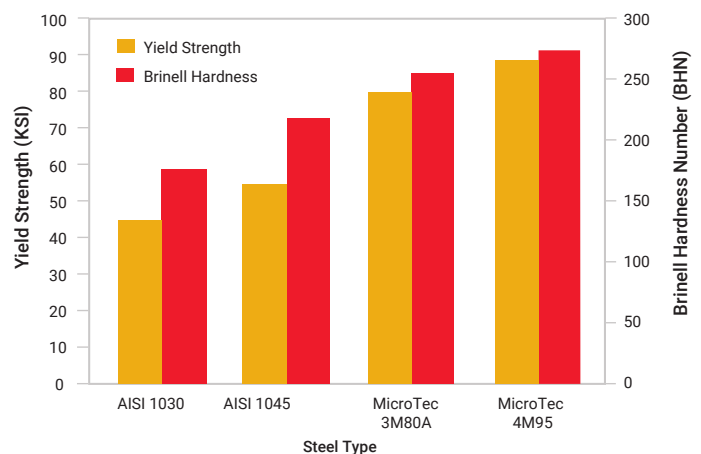


At equivalent hardness levels, machinability of MicroTec steels improves over plain carbon steels. Here, MicroTec 3M80A exhibits reduced tool wear versus normalized 1050 and 10L50 steels at a hardness of approximately 223 BHN. The horizontal line shows that cutting tool life can significantly increase.

THE KEY ADVANTAGE: REDUCED PROCESSING WITH MEDIUM-CARBON MICRO-ALLOY STEELS



BRINELL HARDNESS AND YIELD STRENGTH COMPARISON FOR HOT ROLLED 6.00" ROUND BAR



AN ENGINEERING PARTNERSHIP

Working in tandem with manufacturers, our engineers determine precise requirements for essential product characteristics, including strength, hardness, ductility, toughness, machinability, overall processability and weldability. We work with you to meet your individual requirements by selecting or customizing one of our microalloy grades.

We can also assist you with your forging operation, helping you choose the most effective methods of processing MicroTec steel.

MICROTEC® STEEL CHARACTERISTICS

Designation	Typical Yield Strength (ksi) ¹	Nominal Ceq ²	Relative Machinability	Approximate Achievable Induction Hardness ³
"W" (Weldable) Series				
MicroTec 2W60	60	0.45	●	40 HRc
MicroTec 2W65	65	0.47	●	42 HRc
MicroTec 2W70	70	0.50	●	42 HRc
MicroTec 2W75	75	0.52	◐	43 HRc
MicroTec 3W70	70	0.58	◐	50 HRc
MicroTec 3W75	75	0.56	◐	48 HRc
MicroTec 3W75A	75	0.56	◐	50 HRc
"M" (Machinable) Series				
MicroTec 3M80	80	0.63	◐	50 HRc
MicroTec 3M80A	80	0.61	●	50 HRc
MicroTec 3M80B	80	0.65	○	52 HRc
MicroTec 3M80C	80	0.65	○	52 HRc
MicroTec 3M85	85	0.63	◐	51 HRc
MicroTec 4M85	85	0.67	◐	54 HRc
MicroTec 4M90	90	0.66	◐	54 HRc
MicroTec 4M90A	90	0.67	◐	54 HRc
MicroTec 4M95	95	0.68	◐	54 HRc
MicroTec 4M95A	95	0.73	◐	56 HRc
"H" (Highest Hardness) Series				
MicroTec 5H85	85	0.76	◐	62 HRc
MicroTec 5H90	90	0.78	○	62 HRc
MicroTec 5H95	95	0.84	○	62 HRc
MicroTec 5H95A	95	0.84	○	62 HRc

● Best ◐ Very Good ◑ Good ○ Fair

¹ Typical yield strength, based upon a 2" round bar, air cooled following hot working.

² We base ceq (Carbon Equivalent) calculations upon nominal values of the chemistry range, and we calculate typical residual (tramp) element contents per the generally accepted equation recommended by the International Institute of Welding, IIW Doc IX-537-67 (1967): $Ceq = C + Mn/6 + (Ni + Cu)/15 + (Cr + Mo + V)/5$.

³ Hardnesses assume 99.9% martensite, per Hodge, J.M., and Orehoski, M.A., "Hardenability Effects in Relation to the Percentage of Martensite" Trans. AIME, 1946, v. 167, pp. 627-642. In many instances, we can achieve higher hardness with induction hardening.

This table is a relative guideline only. The characteristics of each steel, including mechanical properties, machinability, induction hardenability and weldability, will vary based upon the specific processing and processing parameters. Please contact your Metallus representative for more specific information.

MICROTEC® STEEL CHARACTERISTICS

Designation	C	Mn	V	Other
"W" (Weldable) Series				
MicroTec 2W60	.10/.18	1.20/1.60	.05/.10	
MicroTec 2W65	.16/.20	1.20/1.40	.06/.10	
MicroTec 2W70	.16/.20	1.40/1.60	.07/.11	
MicroTec 2W75	.16/.22	1.30/1.70	.10/.20	
MicroTec 3W70	.28/.33	.90/1.30	.07/.18	
MicroTec 3W75	.26/.30	1.00/1.30	.13/.23	
MicroTec 3W75A	.28/.32	.90/1.20	.13/.18	
"M" (Machinable) Series				
MicroTec 3M80	.28/.33	1.30/1.60	.08/.18	N = .008/.015
MicroTec 3M80A	.28/.33	1.30/1.50	.08/.18	S = .025/.050, N = .008/.015
MicroTec 3M80B	.32/.36	1.35/1.45	.06/.10	S = .010 max., Si = .40/.50, Cr = .10/.20, Cu = .25 max., Al = .015/.035
MicroTec 3M80C	.32/.36	1.35/1.45	.07/.09	S = .005/.020, Si = .20/.30, Cr = .10/.20, Cu = .25 max., Al = .015/.035, N = .007/.013
MicroTec 3M85	.31/.35	1.30/1.50	.10/.14	S = .030/.050
MicroTec 4M85	.36/.40	1.20/1.40	.04/.10	S = .030/.050, Si = .30/.50
MicroTec 4M90	.36/.41	1.10/1.30	.10/.18	
MicroTec 4M90A	.36/.41	1.10/1.30	.10/.18	S = .030/.050
MicroTec 4M95	.36/.40	1.30/1.50	.08/.12	P = .015 max., S = .045 max., Si = .50/.70, Cr = .10/.20, Al = .010/.030, N = .012/.018
MicroTec 4M95A	.38/.43	1.35/1.45	.08/.12	S = .030/.045, Si = .50/.65, Cr = .10/.20, Ni = .20 max., Mo = .05 max., Al = .010/.030, N = .012/.018
"H" (Highest Hardness) Series				
MicroTec 5H85	.53/.57	.70/.85	.08/.12	S = .020/.035, N = .009/.014
MicroTec 5H90	.52/.57	.70/1.00	.05/.20	S = .025/.035, Si = .15/.35
MicroTec 5H95	.52/.57	1.05/1.25	.08/.18	S = .040/.060, Si = .45/.65, Cr = .15/.25
MicroTec 5H95A	.52/.57	1.15/1.35	.10/.20	S = .040/.060, Si = .45/.65, Cr = .15/.45, N = .014 min.

Unless specified: P = .040 max., S = .040 max., Si = .15 / .35, Cr = .20 max., Ni = .25 max., Mo = 0.06 max., Cu = 0.35 max.

ANSWERING CUSTOMERS' TOUGHEST CHALLENGES

We customize every product and service we deliver to meet customers' specific needs. Our focus is on improving performance by addressing the toughest challenges, whether that requires a special bar quality (SBQ) steel bar or seamless mechanical tube, a value-added component, honing, drilling or thermal-treatment services or a supply chain solution.

Our engineers are experts in materials, processing and applications, so we can work closely with each customer to deliver flexible solutions related to our products as well as their applications and supply chains. We believe few others in our industry can consistently deliver this kind of breadth, customization and responsiveness.



Visit [METALLUS.COM](https://www.metallus.com) or call us at 866.284.6536 (USA),
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