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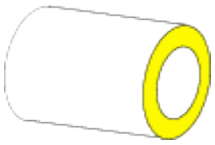
20MnV6 Hollow Bar

20MnV6 is a carbon-manganese steel micro alloyed with vanadium, generally supplied in the black hot rolled condition with a typical tensile strength range of 600 - 790 Mpa and a high typical yield strength range of 440 - 570 Mpa.

Characterized by excellent machinability due to silicon - calcium treatment and precise control of the sulphur content, excellent weldability with high yield and tensile strengths due to the micro - alloying effect of the vanadium.

The low carbon content and the vanadium addition allows surface hardening by carburising, carbonitriding or nitriding. It will also respond to high or medium frequency induction hardening and can be through hardened and tempered producing a moderate improvement in tensile and yield strength, this varying depending upon wall thickness.

20MnV6 hollow bar is used extensively by all industry sectors for a wide range of applications utilizing it's considerable saving on machining time and weight over solid bar.
Typical applications are: Bushes, Cylinders Various, Conveyor Rolls, Hollow Shafts, Hollow Parts and components, Nuts, Rings, etc.

Colour Code		
 ISO Hollow Bar Yellow Bar end	ISO Stocked Sizes ISO Chart (pdf)	32 mm to 660 mm OD
	EN Stocked Sizes EN Chart (pdf)	30 mm to 250 mm OD More Euro Norm Information
 EN Hollow Bar Magenta Bar end	Bar Finish	Cold Rolled and Hot Rolled

Related Specifications	
Europe	EN 10294-1
France	NF A49312 20MV6
Germany	W.Nr 1.5217 20MV6 W.Nr 1.8905 StE 460
Great Britain	BS4360 GR 55
USA	UNS K01907 and K12202

Chemical Composition	Min. %	Max. %
Carbon	0.16	0.22
Silicon	0.10	0.35
Manganese	1.30	1.60
Vanadium	0.08	0.15
Phosphorous	0	0.03
Sulphur	0.02	0.04

Mechanical Property Requirements - As Supplied in the Black Hot Rolled Condition

Tensile Strength Mpa Min. Wall Thickness (mm)			0.2% Yield Strength Mpa Min. Wall Thickness (mm)						Elongation $5.65\sqrt{S_0}$* % Min.	Hardness Brinell Min.
<16	<25	>25	<16	<25	<30	<40	<50	<70		
620	610	550	470	460	430	420	410	400	18	180

Typical Mechanical Properties - As Supplied in the Black Hot Rolled Condition

Tensile Strength Mpa	Yield Strength Mpa	Elongation %	Hardness HB

690	500	21	210	

Typical (Minimum) Mechanical Properties - Water Quenched at 925 °C and Tempered at 580 °C.

Tensile Strength Mpa Wall Thickness (mm) <20 <25 <30	0.2% Yield Strength Mpa Wall Thickness (mm) <20 <25 <30	Elongation % Wall Thickness <20 >20	Impact +20°C 0°C -20°C J	Hardness HB
750 700 650	650 620 570	16 17	40 32 28	220

Heat Treatment

Surface Hardening Treatments

Carbonitriding

Heat to 870 °C - 880 °C in a gaseous media consisting of carbon monoxide/hydrocarbon plus ammonia, hold for sufficient time to develop the required case depth, carbon and nitrogen content, followed by quenching in oil or water as required. Typical case hardness achieved up to Rc 60.

Tempering immediately while still hand warm at 150 °C - 200 °C will reduce stresses and improve the toughness of the case.

Carburising

Pack, salt or gas carburise at 880 °C - 920 °C, holding for sufficient time to develop the required case depth and carbon content, followed by a suitable heat treatment cycle to optimise case and/or core properties.

Typical case hardness achieved up to Rc 63.

Case Hardening

Water quench from 760 °C - 780 °C.

or Core Refining

Oil quench from 870 °C - 880 °C prior to water quench as above.

Tempering immediately following water quench at 150 °C - 200 °C will reduce stresses and improve toughness of case.

High or Medium Frequency Induction Hardening

The black hot rolled surface on 20MnV6 Hollow Bar will first require to be machined sufficiently to remove any de-carburised layer otherwise less than satisfactory results will likely be obtained. The feed material can be either in the as supplied condition or pre hardened and tempered for higher core strength.

Heat to the austenitic temperature range (870 °C - 925 °C), and required case depth, quench immediately in oil or water as required. Typical case hardness achieved up to Rc 48.

Tempering immediately at 150 °C - 200 °C will reduce stress and improve the toughness of the case.

Nitriding

20MnV6 either in the as supplied condition, or pre-hardened and tempered for higher core strength will respond successfully to nitriding due to the vanadium content. Typical case hardness achieved up to Rc 55.

Nitriding is carried out at 490 °C - 530 °C followed by slow cooling (no quench) reducing the problem of distortion.

Parts can therefore be machined to near final size, leaving a grinding tolerance only.

If pre-hardened and tempered feedstock is used always ensure that the tempering temperature employed is at least 15 °C above the nitriding temperature.

Hardening

Heat to 870 °C - 925 °C as required, hold until the temperature is uniform throughout the section, soak 10 - 15 minutes per 25mm of section and quench in oil or water as required.

Temper immediately while still hand warm.

Tempering

Re heat to 500 °C - 600 °C as required, hold until temperature is uniform throughout the section, soak for 1 hour per 25mm of section. Cool in still air.

Normalizing

Heat to 900 °C - 925 °C, hold until temperature is uniform throughout the section, soak for 30 minutes and cool in still air.

Stress Relieving Following Welding

Heat the weld area to 550 ^{o}C - 650 ^{o}C, soak for 30 minutes and cool in still air or furnace.

Notes on Heat Treatment

Heating temperatures, rates of heating, cooling and soaking times will vary due to factors such as work piece size/shape, also furnace type employed, quenching medium and workpiece transfer facilities etc.

Please consult your heat treater for best results.

Machining

20MnV6 has excellent machinability due to the silicon - calcium treatment and precise control of the sulphur content resulting in an excellent break-up of swarf, increasing feeds and speeds plus an increase in tool life for all machining operations.

Welding

20MnV6 due to it's low carbon content has excellent weldability and may be welded by all of the standard welding processes.

Welding Procedure

A pre-heat or post heat is not generally required, however a post weld stress relieve can be beneficial if this is possible as can pre-heating larger sections.

For suitable welding electrodes please consult your welding consumables supplier.