BOHLER UDDEHOLM
AUSTRALIA

ultIMate-4140

Improved machinabilty high tensile

Typical Analysis (Ave. values %)	C	Si	Mn	Ni	Cr	Mo	S	P	
	0.4	0.2	0.8	-	1.0	0.2	0.025	0.025	

NEAREST STANDARD	AS	DIN	BS	AISI
	4140	1.7225 41CrMo4	EN19A	4140

INTRODUCTION	Traditional Steel making techniques have utilised the addition of sulphur and other elements to improve machinability characteristics. Whilst improving machinability, the additions of these elements can, and often do adversely affect other desirable properties *eg* mechanical properties. Newly developed steelmaking techniques have enabled us to dramatically improve the machinability, without the need to add deleterious elements. Therefore machinability is increased without reducing other desirable elements of the steel. Conventional steelmaking practices produce steels containing a number of inclusions that have a negative impact on machinability. Our steelmakers have refined the process to minimise the impact. During steelmaking process, calcium is added to the melt in the ladle furnace in a precise sequence, and at exacting temperatures, along with a number of other standard elements. This precise time/temperature sequence transforms hard aluminium oxide, which is the main cause of tool wear, into plastic calcium aluminates with an outer layer of calcium sulphide. The calcium aluminates “melt” at the tool/steel interface during machining to form a lubricating layer between the cutting tool and the manufactured component, resulting in improved machinability and cutting life. Additionally, the sulphides tend to encapsulate any untransformed hard oxides, therefore protecting the cutting tool from coming into contact with these high wear generating elements, further extending cutting tool life. The combination of these factors provides ASSAB Ultimate range of steels, previously unobtainable machinability figures.

BENIFITS	➢ Uniformity of Quality. ➢ Superior Surface Finish. ➢ Longer Tool Life. ➢ Higher Cutting Speeds. ➢ Better Chip Formation. ➢ Lower Cutting Forces. ➢ Longer saw Blade Life. ➢ Improved Mechanical Properties.

MACHINING	Rough turning	In rough turning the aim should be to maximise machining speed while prolonging tool life. This is achieved by maintaining maximum chip flow while sacrificing surface finish. The three critical factors are depth of cut, feed rate and cutting speed
	Cutting depth	Choose the cutting depth, which will minimise the number of, passes required before the finishing cut.
	Feed rate	Choose the maximum feed rate possible relative to the strength and stability of the machine and the availability horsepower.
	Cutting speed	The appropriate speeds can be found in the table below. These speeds are indicative only, and may be varied up or down depending on the machine tool suitability, the tooling being used and the experience of the operator. The cutting speeds below are based on machining a pre-turned surface and the material is 4140 ASSAB Ultimate H&T to HB 270-290.

	Cutting depth		
	<2	2-5	>5
Feed rate mm/r	Cutting speed m/min.		
0.25	350	310	270
0.35	300	280	250
0.40	270	240	220
0.50	240	220	200
0.60	215	200	180
0.80	180	160	140

APPLICATIONS	**ASSAB ultIMate 4140** is the most commonly used of the high tensile steels with a wide range of applications in automotive, Gear and Engine construction, Crankshafts, Steering knuckles, Connecting rods, Spindles, Intermediate gears, Pump and Gear shafts. Axles, Nuts and Bolts.

HEAT TREATMENT	Forge	850-1050°C. Cool in furnace.
	Normalize	840-880°C. Air cool.
	Anneal	680-720°C. Cool slowly in controlled furnace.
	Stress relieve	In the quenched and tempered condition, about 30-50°C below the tempering temperature. Air cool. In the annealed condition, 600-650°C. Air cool.
	Harden	830-860°C Oil quench.
	Temper	540-680°C hold for 1 hour min. at temperature, air cool.
	Nitride	Suitable for both liquid and gas nitriding.

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MECHANICAL PROPERTIES Heat Treated Condition	Ruling section mm	Tensile Strength MPa	Yield Strength MPa	Elong. %	Brinell Hardness
	<100	980-1080	700 min.	12	270-320

PHYSICAL PROPERTIES		
	Density (kg/dm^3)	7.85
	Modulus of elasticity 10^3 N/mm^2	210
	Thermal conductivity W/(m.K)	42
	Electric resistivity Ohm.mm^2/m	0.19
	Specific heat capacity J/(kg.K)	460
	Modulus of elasticity 10^3 N/mm^2	205
	Thermal expansion 10^6 m/(m.K)	11.1

WELDING

Parts should be welded in the hardened and tempered condition. Strength properties of the joint will not be the same as the base metal.
Preheat 300-400ºC. Temper after welding to about 35-50ºC below the recommended tempering temperature.
Filler metal: - Fox CM2-KB electrodes or CM2-IGwire.
For advice in connection with difficult welding, please consult our engineers.

LOCATIONS

Bohler Uddeholm Australia Pty Ltd ABN 15000013052

Sydney	129-135 McCredie Rd Guildford	2161	Ph (02) 8724 5554	Fax (02) 8724 5555
Newcastle	3 Pavilion Pl Cardiff	2285	Ph (02) 4954 6611	Fax (02) 4956 5773
Albury	1 Eames St Albury	2640	Ph (02) 6041 3399	Fax (02) 6041 1820
Wollongong	40 Doyle Ave Unanderra	2526	Ph (02) 4272 6544	Fax (02) 4272 7563
Marayong	1/21 Binney Rd Marayong	2148	Ph (02) 9831 4431	Fax (02) 9671 1682
Melbourne	282-290 Greens Rd Dandenong	3175	Ph (03) 9767 5554	Fax (03) 9767 5555
Bayswater	4 Amsted Rd Bayswater	3153	Ph (03) 9739 8022	Fax (03) 9739 8033
Adelaide	1 Williams Cir Pooraka	5095	Ph (08) 8368 4554	Fax (08) 8368 4555
Brisbane	12-18 Limestone St Darra	4076	Ph (07) 3712 9554	Fax (07) 3712 9555
Townsville	9-11 Caldwell St Garbutt	4814	Ph (07) 4479 4800	Fax (07) 4725 1316
Perth	29-33 Gauge Cir Canningvale	6155	Ph (08) 9455 8672	Fax (08) 9455 8673
Kewdale	5 Beete St Welshpool	6106	Ph (08) 9350 9582	Fax (08) 9350 9683
Launceston	20 Murphy St Invermay	7248	Ph (03) 6334 3542	Fax (03) 6331 4001

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