

WMC MAX-DIE HOT WORK

(800)621-1228
FAX:(330)656-5970

WMC MAX-DIE is a premium quality hot work die steel manufactured for high demanding tooling requirements. MAX-DIE is a modified version of AISI H-13 to promote both added heat resistance and toughness when compared with H-13. This chromium-molybdenum-vanadium alloyed tool steel is characterized by these general properties.

- High temperature strength
- Very good toughness and ductility
- Resistance to thermal shock and fatigue
- Easy heat treatment
- Good machinability

TYPICAL ANALYSIS

Carbon	0.39
Manganese	0.35
Silicon	0.25
Chromium	5.10
Molybdenum	1.90
Vanadium	0.65

IMPROVED MANUFACTURING

WMC MAX-DIE is manufactured to standards of very high tooling quality for optimum service performance. Material is produced with excellent cleanliness, structure uniformity and mechanical properties. Steel manufacture includes:

- Special steel melting and refining
- Very precise chemistry control
- Heavy forging reductions
- Special mill thermal treatment
- Manufacturer certified testing and quality assurance

TYPICAL APPLICATIONS

WMC MAX-DIE is used in die casting die applications where a higher level of heat resistance along with good toughness and ductility are required. WMC MAX-DIE is manufactured to meet the demanding criteria of NADCA #207, Chrysler NP2080, GM DC-9999-1 and other specifications for premium material quality.

WMC MAX-DIE is also used in most other hot work applications such as hammer die inserts, press dies and inserts, HERF dies and punches, extrusion tooling components as well as plastic molds and in critical cold and hot knife, punch or holder applications and required hardness levels are required. Typical applications and required hardness levels are:

Walter Metal Corporation
793 Seasons Rd. - P.O. Box 207
Hudson, Ohio 44236

DIE-CAST TOOLING

Part	Typical Hardness (HRC)
Spruce Parts	46-48
Cores	46-50
Fixed Inserts	46-50
Dies	42-48

FORGING DIES

Work Material	Typical Hardness (HRC)
Aluminum	44-52
Copper Alloys	44-52
Steel	40-50

EXTRUSION TOOLING

Component	Aluminum	Copper	Steel
	HRC	HRC	HRC
Dies	46-50	44-48	44-48
Liners Stems	42-50	42-48	42-48

PHYSICAL PROPERTIES

Density, lbs/cu.in.

70F	0.281
750F	0.277
1450F	0.272

Coefficient of Thermal Expansion

70 - 450F	0.0000070
70-1450F	0.0000077

Thermal Conductivity

Temp. F*	Btu in/ft ft hr F
70F	180
750F	185
1450F	195

Modulus of Elasticity, psi

70F	29,400,000
750F	29,500,000

Continued on Page 2

WMC MAX-DIE HOT WORK-CON'T

MECHANICAL PROPERTIES

Typical Tensile Data vs. Hardness at RT

	52 HRC	46 HRC
Tensile Strength, psi	260,000	205,000
0.2% Yield Strength, psi	220,000	185,000
% RA	46	56
% Elongation	10	12

Typical elevated temperature tensile properties of material hardened and tempered at 46 HRC.

Test Temp F	Yield Strength Psi	Tensile Strength Psi	RA %
1000	110,000	140,000	60
1100	85,000	115,000	70
1200	45,000	70,000	80
1300	20,000	30,000	90

THERMAL PRACTICE

Critical Temperatures

Ac1	-	1560F
Ac3	-	1740 F
Ms	-	570F

ANNEALING: With a protective atmosphere or vacuum furnace, heat slowly to 1560F. Equalize and hold one hour per inch of thickness. Cool in the furnace at 20F/hr to 1100F and equalize. Cool freely in air to room temperature. Hardness will be 229 HB max.

STRESS RELIEVING: After rough machining of an annealed component, heat the part to 1200F, equalize and hold 1-2 hours. Furnace cool to 900F and then air cool to room temperature.

HARDENING: Protect against decarburization and oxidation during austenitizing.

PREHEATING: Heat to 1200F and equalize. Continue heating to 1550F and equalize. Complete heating to hardening temperature.

HARDENING: Typical austenitizing range is 1850-1900F. Hardening temperature can be adjusted to develop added heat resistance. A hardening temperature of 1870F is normally used for most applications.

Hardening Temperature	Hold Time*	As Quenched Hardness, HRC
1870F	30 min	53 +/- 2
1900F	15 min	54 +/- 2

*Hold time = time at temperature after toll is fully heated through.

QUENCHING: Should be performed as rapidly as possible without promoting excessive movement or cracking. Typical quenching media include: High speed gas with sufficient positive pressure in vacuum furnace, Circulating air/atmosphere, Martempering bath or fluidized bed at 575-1020F, then cool in air Warm oil

TEMPERING: Temper as soon as quenching temperature reaches 120-150F. Temper immediately after quenching to about 150F. Temper a minimum of two times with intermediate cooling to room temperature.

Choose the tempering temperature to develop required hardness. WMC MAX-DIE should be heated to the desired tempering temperature and held a minimum of two hours. Air cool to room temperature. Check hardness and adjust temperature for additional tempering operation(s). Repeat for added tempers.

Typical tempering temperature responses follow. Do not temper in the range of 800-975F to avoid temper embrittlement.

Tempering*	HRC 1870F	HRC 1900F
	HRC	HRC
480F	52	53
1000F	53	54
1050F	51	53
1100F	46	49
1150F	42	46
1200F	35	37

SURFACE TREATMENTS

Surfaces of MAX-DIE can readily be chrome plated, nitrocarbonized or nitrided by all commercial processes. Care must be taken to avoid hydrogen embrittlement in chrome plating. Temper at 400F for 4 hours after plating.

Avoid excessive concentrations of nitrogen during various nitriding processes to avoid white layer and excessive network. Generally, case depths greater than 0.010" are not recommended for hot work applications.