WMC MAX-DIE HOT WORK

Walter Metals LLC
1616 Commerce Drive
Stow, Ohio 44224
(800) 621-1228
FAX: (330) 688-0531

WMC MAX-DIE is a premium quality hot work die steel manufacured 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			
C	0.39	Cr	5.10
Mn	0.35	Mo	1.90
Si	0.25	V	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 chemisty control
- ⋆ Heavy forging reductions
- ⋆ Special mill thermal treatment
- ⋆ Manufacturer certified testing and quality assurance

TYPICAL APPLICATIONS

WMC MAX-DIE is used in forging applications where a higher level of heat resistance along with very good toughness and ductility are required. ***WMC MAX-DIE*** would be an upgrade to H-13 for increased service performance and to solve problems experienced with H-13. This grade is used in forging applications such as press dies and inserts, hammer die inserts, HERF dies and punches and others.

FORGING DIES

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

WMC MAX-DIE is also used in other hot work applications and in particular die cast dies. ***WMC MAX-DIE*** is manufactured to meet the demanding criteria of NADCA 207, GM DC-9999-1 and other leading specifications for the highest level of material quality.

PHYSICAL PROPERTIES

Density, lbs/cu in

70F.....0.281
750F.....0.277
1450F.....0.272

Thermal Conductivity, Btu in./ft² hr F

70F.....180
750F.....185
1450F.....195

Coefficient of Thermal Expansion, in/in/F

70F.....0.0000070
750F.....0.0000077

Modulus of Elasticity, psi

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

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 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

WMC MAX-DIE HOT WORK

Walter Metals Corporation
793 Seasons Rd.-P.O. Box 207
Hudson, Ohio 44236
(800) 621-1228
FAX: (330) 656-5970

THERMAL TREATMENTS

CRITICAL TEMPERATURES

Ac1.....1560F
Ac3.....1740F
Ms.....570F

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.

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.

HEAT TREATMENT

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 for additional tempering operations(s). Repeat for added tempers.

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

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

SURFACE TREATMENTS

Surfaces of ***WMC MAX-DIE*** can readily be chrome plated, nitrocaronized 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.