

# HEAT TREATMENT RECOMMENDATION

## Z-M4 PM<sup>®</sup>

### STANDARD VACUUM



#### GRADE

Z-M4 PM<sup>®</sup>

#### METHOD

Standard Vacuum (4 Bar Minimum Quench Recommended)

#### RACKING

Parts should be placed in basket with adequate spacing to allow even heating and good exposure to quench gas. Long thin parts should be held in vertical position to maintain flatness/straightness.

#### HEATING

Use of staged preheating recommended:

- \_ Ramp furnace to 1250±50°F and equalize temperature.
- \_ Use convective heating if possible
- \_ Ramp furnace to 1550±50°F and equalize temperature.
- \_ Ramp furnace to 1950±50°F and equalize temperature.
- \_ Advance to high heat

#### HARDENING

	for toughness	for wear resistance
High heat set point	2070 °F	2165 °F
Acceptable batching range	2050/2090 °F	2150/2180 °F
Soaking time in min.	15 - 20 min.	7 - 12 min

#### QUENCHING

- \_ Back fill to positive pressure (minimum 4-6 bar ideal), and fan quench
- \_ Cool at maximum possible rate until load temperature < 1300°F
- \_ Continue cooling load to room temperature (<120°F)
- \_ Parts should be tempered within 4 hours

#### TEMPERING

Select tempering temperature based on hardness specification:

	After 2075 °F	After 2165 °F
1000 °F	63-65	-
1020 °F	62-64	64-66
1040 °F	61-63	63-65
1060 °F	60-62	62-64
1080 °F	59-61	60-62
1100 °F	58-60	59-61

Optimum tempering range is 1020 to 1040 °F

#### TRIPLE TEMPER REQUIRED, THIRD TEMPER RECOMMENDED

1st temper	Heat parts to selected temperature, equalize and soak 2 hours. Cool parts completely to room temperature (<120°F)	Can use vacuum /inert gas or air (depending on finish); Use convective heating and fan cooling
2nd and 3rd temper	Repeat first temper cycle	-
Stress relieve	Heat parts to 950/975 °F, equalize and soak 1 hour	Stress relieve can be performed after hard finishing and/or EDM operations (vacuum methods preferred on finished tools)

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Last revision: February 2019