ATT 2367 PLUS

VTMPLUS

SIMILAR STANDARDS

ATT 2367 PLUS is a selectively modified hot work tool steel produced according to ISOMAX process. This steel is an alternative to AISI H13 or 1.2367 for higher hardness.

GENERAL INFORMATION

ATT 2367 PLUS is a hot work tool steel developed by Villares Metals, for application in high performance warm and hot forging tools.

MAIN CHARACTERISTICS

Typically, ATT 2367 PLUS presents a martensitic matrix with a few primary carbides. Its microstructure combines higher hardness, hot wear resistance and thermal stability, keeping a good toughness level, which are characteristics that ensure the resistance to thermal fatigue and failures at high temperatures.

CHEMICAL COMPOSITION

Typical Analysis (Weight Percent)

C	Si	Mn	Cr	Mo	V
0.50	0.30	0.30	3.80	3.00	0.55

STANDARD PRODUCTION RANGE

Production Route	Production Range	Finishing
Rolled Products	Thickness between 8 to 152 mm with width between 38.10 to 320mm Round 12.70-152.40mm	Centerless ground Peeled Turned
Forged Products	Round 152.40 – 570 mm Thickness up to 350mm with width up to 760mm	Turned Peeled Milled

*Other dimensions and conditions are available upon inquiry.

DELIVERY CONDITION

ATT 2367 PLUS is usually supplied in the soft annealed condition with maximum hardness of 250 HB. This steel can also be supplied in the hardened and tempered condition.

HEAT TREATMENT

Soft Annealing

Soft annealing should be carried out by heating between 840 and 860°C for 2 hours, followed by cooling with cooling rate between 10 and 20°C per hour until 650°C and, then, by air cooling. In this treatment, the use of protective atmosphere is important to avoid surface oxidation and decarburization.

Stress Relief

Stress relief heat treatment aims to reduce the residual stress of the part and it shall be employed after machining and before hardening. It shall be applied in parts with draws and profiles, in which the machining removal has been higher than 30%, in other to minimize distortions after hardening.

Stress relief heat treatment consists in a slowly heating to 650°C, holding 2h in temperature and furnace cooling until 200°C and then free cooling in air. In case that this heat treatment is applied after hardening and tempering, the stress relief shall employ a temperature 50°C lower than that of the last tempering temperature.

Hardening

Preheat the part to 600 - 850°C in two steps, until the temperature from center to surface is equal in each step. The austenitizing temperature should be between 1030 and 1050°C.

For better toughness performance, it is indicated 1030°C and for better heat resistance response 1050°C can be applied. The choice of the ideal temperature should also consider aspects of design and finishing details of the parts.

After austenitization, the quenching can be performed in different quench media as:

⇒ Pressurized vacuum furnace with pressure higher than 5 bar

⇒ Warm oil, 40 - 70°C

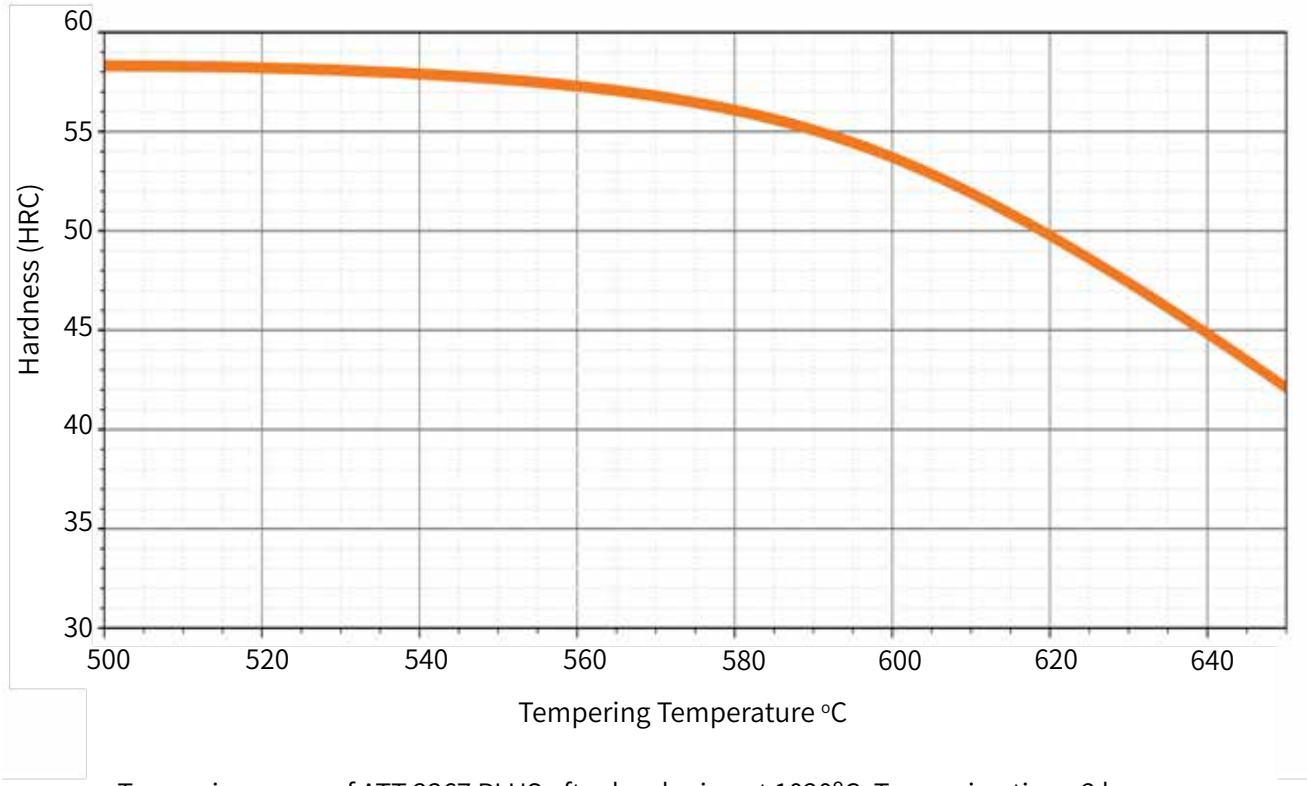
⇒ Salt or fluidized bed between 450 - 550°C

Tempering

After quenching, the parts shall be tempered immediately after quenching, i.e. as soon as they reach 60°C. It is necessary, at least, double tempering. After each tempering, parts shall be slowly cooled to room temperature.

Tempering temperatures are generally between 540-620°C, depending upon the desired hardness. The time of each tempering cycle shall be at least 2 hours in temperature.

For parts with thickness larger than 70 mm, the time at temperature should be calculated according to their size, being a reference for calculation about one hour for each inch of thickness.



Tempering curve of ATT 2367 PLUS after hardening at 1020°C. Tempering time: 2 hours
Curve obtained from specimens with cross section of 20 mm x 20 mm

MAIN APPLICATIONS

The physical and mechanical properties of ATT 2367 PLUS make possible its use in many applications. Some typical application are:

⇒ Warm and hot forging dies and punches

⇒ Complex shaped die-casting dies and inserts

⇒ Hot shearing blades

⇒ Long run plastic molds

⇒ Molds with high level of polishability

⇒ Cold work applications that demand toughness

MACHINABILITY

ATT 2367 PLUS can be conventionally machined in the annealed condition. Care need to be taken in the selection of the tool and the speed in order to allow a good machinability. In order to avoid distortions on the part during the hardening and tempering heat treatments, it is recommended to perform a stress relief heat treatment before hardening, if it was removed more than 30% of part weight in machining operations.

Electro-erosion process can be employed in heat treated dies or molds. After electro-erosion machining it is recommended to remove the superficial layer thru fine grinding wheel and perform a tempering heat treatment in a temperature around 50°C lower than the last tempering temperature.

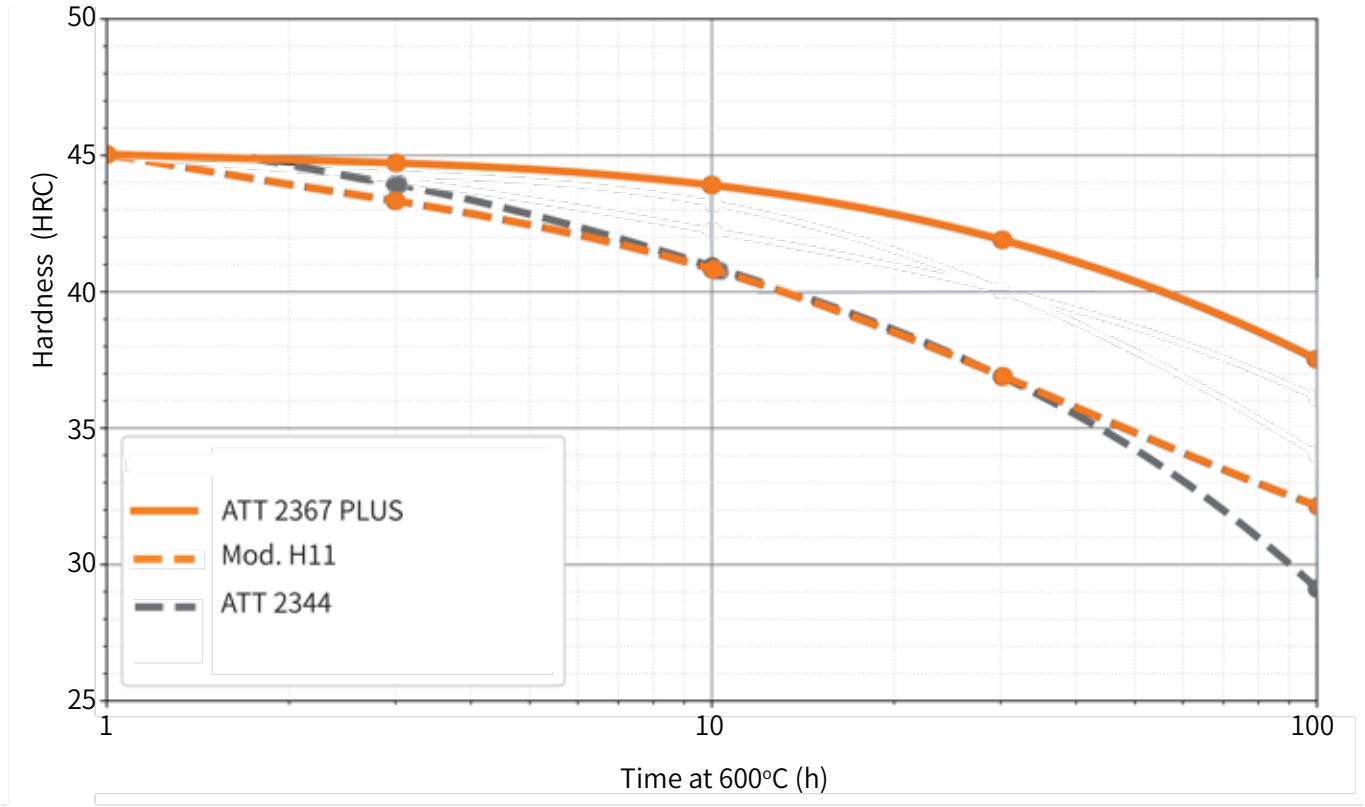
WELDING

It is not recommended to perform welding operations on ATT 2367 PLUS steel. Welding operations will produce Heat Affected Zones (HAZ), which will reduce the performance of the steel in the application. HAZ produced during arc welding operation are harder and brittle, with risk of cracking unless great care is exercised. In exceptional cases and always considering that, the welding would be a temporary solution ATT 2367 PLUS might be welded using special procedures to minimize the HAZ.

The sequence of operations for repair welding ATT 2367 PLUS depends upon its prior heat treatment. As a general guideline, it is recommended to: (a) preheat, (b) weld with appropriate filler metal, (c) perform a stress relief heat treatment, (d) machine, (e) quench and temper if in the annealed condition or stress relief if already hardened and (f) grind to final dimensions. The qualification of a specific welding procedure for repair is the key point to obtain the desired quality. The skill and experience of the welder is also a vital ingredient in obtaining satisfactory results.

MECHANICAL PROPERTIES

ATT 2367 PLUS shows higher resistance to softening at elevated temperatures in comparison with typical hot work tools steels.



ATT 2367 PLUS resistance to softening.
Curve obtained from specimens with cross section of 20 mm x 20 mm.

IMPROVEMENT OF TOOL LIFE

Before starting operation, pre-heat slowly between 200-300°C, to obtain thermal homogenization of core and surface. Periodic stress relieving during the use of tools is recommended to improve the tool life.

PHYSICAL PROPERTIES

Density

Temperature	g/cm^3	lb/in^3
20°C (68°F)	7.57	0.273

Thermal Conductivity

Temperature	W/(m · K)	Btu.in/(h.ft².°F)
100°C (212°F)	25.4	176
200°C (392°F)	26.2	181
300°C (572°F)	27.6	191
400°C (752°F)	28.7	198
500°C (932°F)	30.0	208
600°C (1112°F)	31.9	221

Specific Heat

Temperature 20 °C to (68°F to)	J/kg.K	Btu/lb.°F
100°C (212°F)	460	0.110

Advanced Tooling Tek (Shanghai) Co. Ltd. (ATT), established in 2001, is a trusted supplier of premium mold steel for China' s manufacturing sector. With more than two decades of industry experience, ATT has built a strong reputation for reliability, technical expertise and customer-focused service.

Serving a wide range of industries, including automotive, electronics, home appliances and packaging, ATT offers a comprehensive portfolio of premium tool steels, including hot work tool steel, cold work tool steel and primarily plastic mold steel. To meet diverse customer requirements, ATT provide processing services such as sawing, milling, grinding, and heat treatment, ensuring efficient turnaround and consistent quality.

To further enhance its product range and technical strength, ATT collaborates closely with its group mill, Villares Metals. Headquartered in Sumaré, São Paulo, Brazil, Villares Metals has been a leader in specialty steels and alloys since 1944, supplying high-performance solutions to industries such as automotive, railway, energy, medical, oil and gas, aerospace and agriculture across the Americas and globally.

Through this collaboration, ATT offers customers access to world-class materials, international metallurgical expertise and innovative steel technologies. From mold manufacturers to component users and end product producers, ATT supports every stage of the value chain with dependable products, technical guidance and responsive service.

ATT is dedicated to being your preferred partner for high-performance tool steel solutions.

Advanced Tooling Tek（Shanghai）Co., Ltd.

Tel: +86 21 3373 8146 / +86 21 3373 8148
Email：info@att-metal.com
Address：1F-A, 2F-A, No.1, Lane 499, Xin Miao San Rd., Xinqiao Town, Songjiang Dist., Shanghai China

Website

WeChat