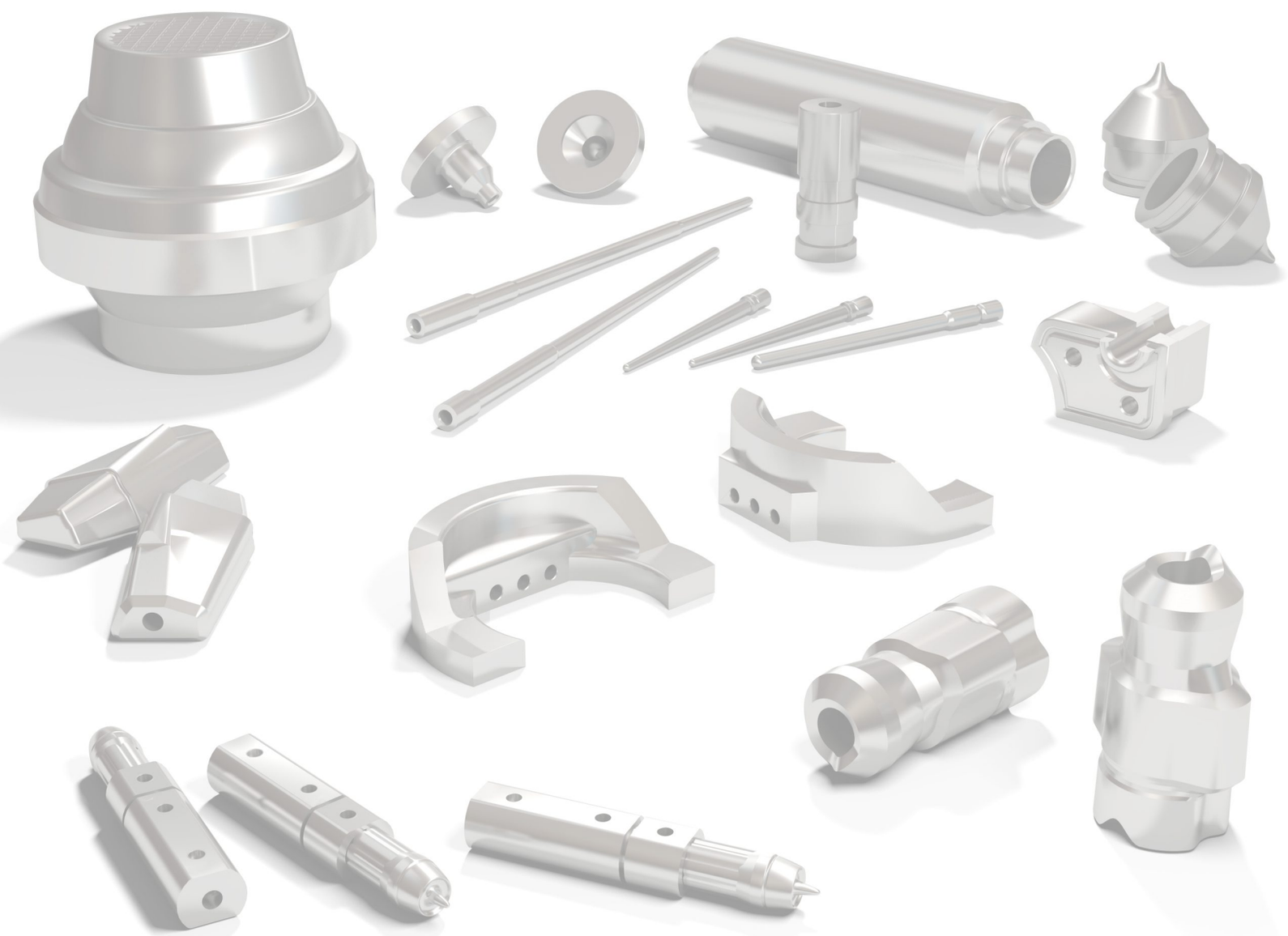
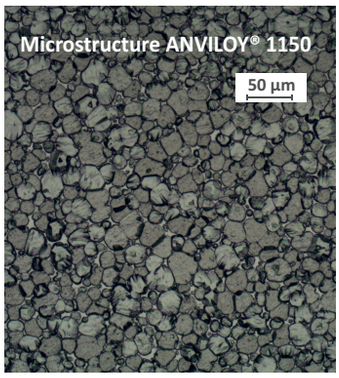
ANVILOY® PRODUCTS

SPECIAL PRODUCTS FOR DIECASTING



ANVILOY® Metals for casting light alloys



Corrosion and heat cracks are the most often occurring damages of casting tools. The product quality can be influenced additionally by adhering or by insufficient heat dissipation caused changes of the microstructure.

ANVILOY® metals containing tungsten and molybdenum are well known solutions to these problems. These metals greatly resist the load caused by frequent temperature changes and the aggressive solution attack by liquid light alloy or copper melts.

The use of ANVILOY® Tungsten alloys during the foundry process can both improve quality and lower operating costs. In conventional forms, erosion caused by solution and erosion processes is inevitable. Also cracking due to thermal fatigue is noticed often. Significant maintenance costs and loss of production time is the consequence. At the same time increased re-machining expenditure costs can result from re-machining and wear of the die.

The solution is ANVILOY®

ANVILOY® is the brand name for a group of tungsten based alloys exclusively developed by a team of metal experts of the former US tungsten producer CMW and its partner Weldstone Group.

Today the Weldstone Group is the exclusive producer of ANVILOY® products and owner of the brand. ANVILOY® products are distributed by Weldstone and its US sister company Astaras , Inc. located in Florida. The most commonly used high-tech materials in the Die Casting Industry are ANVILOY®1050, ANVILOY®1150 and ANVILOY®1350.

The characteristics of ANVILOY®

·High resistance against dilution
·High hardness at high temperature
·High strength at high temperature
·Good thermal conductivity
·Good tempering resistance
·Can form separation layers
·Easy to machine

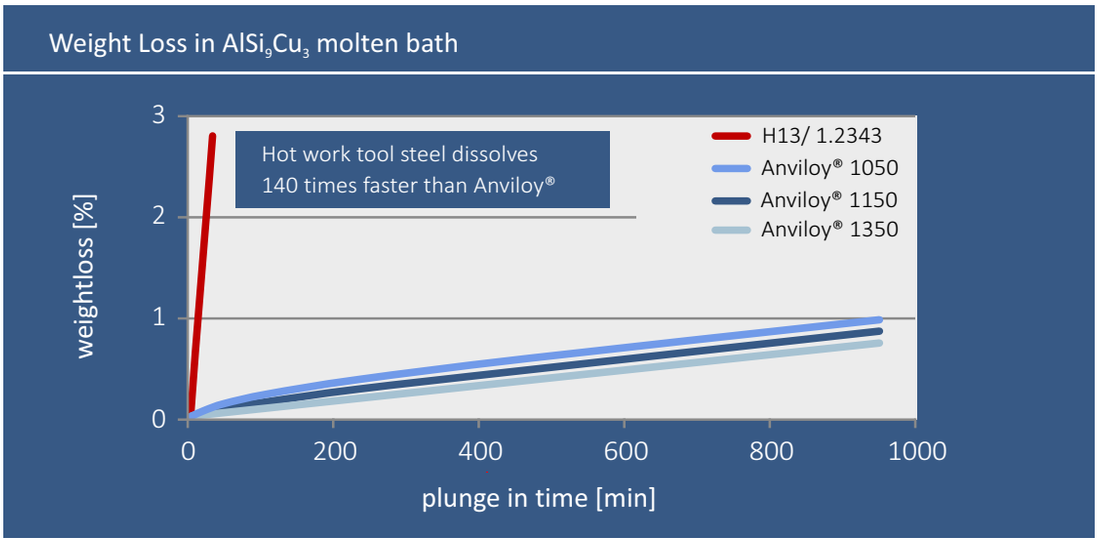
The benefits of ANVILOY®

·Reduces corrosion and erosion
·Increases form stability
·Improves stability of dimensions
·Removes heat quickly
·Minimizes heat checks
·Reduces soldering
·Various shapes possible

Dilution behavior (corrosion)

The ANVILOY® material group is highly resistant against many molten metals, especially aluminum and copper alloys. Tools made of ANVILOY® alloys last therefore 10 to 1000 times longer compared with those of hot work tool steel at the usual casting temperatures.

This becomes clear in the following illustration:



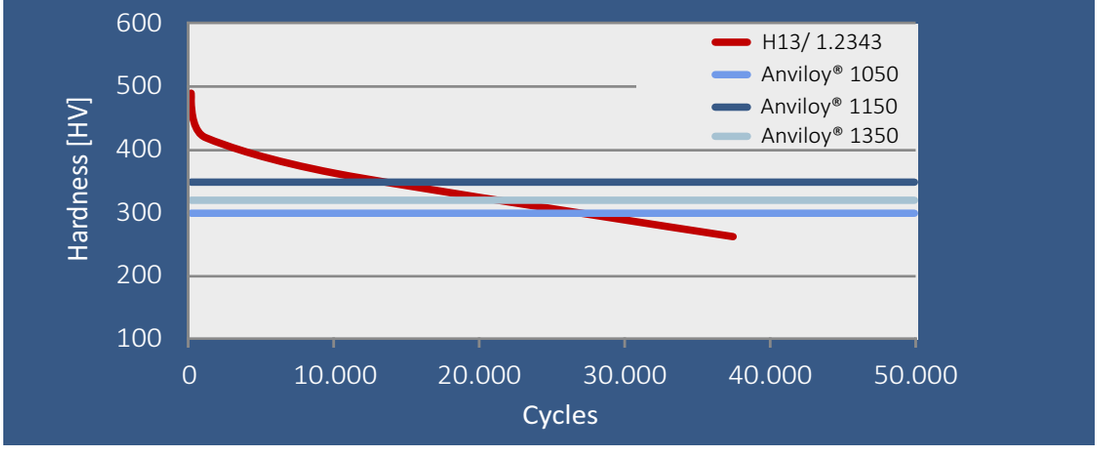
At the same time, the small affinity of ANVILOY® metals to the formation of alloy as well as the building of natural separation layer prevents sticking of the products to the mold. This improves the service life and the product quality. These special characteristics increase the constructional options and for example help to reduce releasing angles of molds.

Hardness and strength

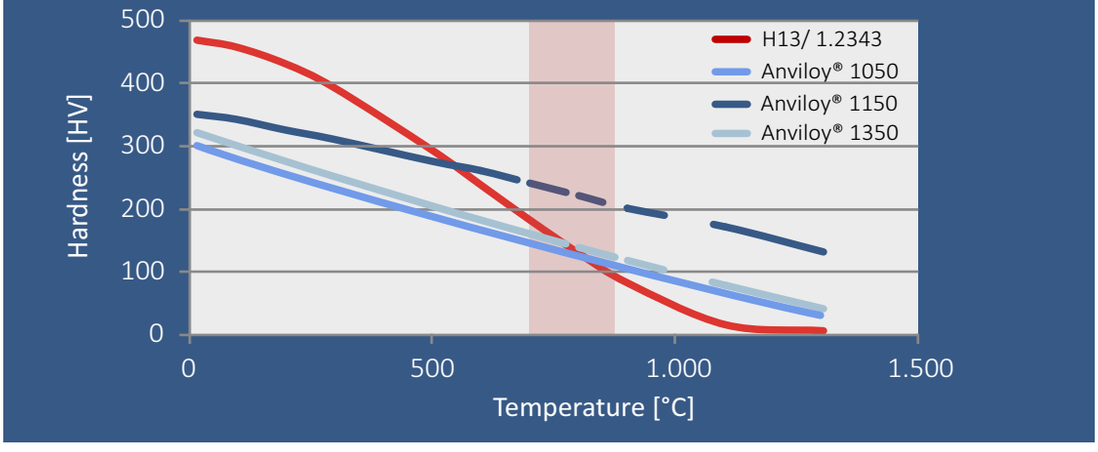
ANVILOY® alloys are applied with their “natural hardness”. Thermal treatments, which always carry the danger of deformation, are not necessary. For the same reason ANVILOY® materials cannot lose hardness over time by tempering during the process. ANVILOY® materials play this advantage particularly well with large production numbers of the same products. While hot work tool steels suffer under constant degradation of their characteristics, those of the Anviloy® alloys remain stable. Likewise in this case nitrating treatments or coatings are not necessary.

As it is the case for every other material, hardness and strength of ANVILOY® materials are reduced with rising temperatures. However, contrary to hot work tool steels, these characteristics diminish more slowly. The allotropic transformation of the hot work tool steels within the range of the casting temperatures of aluminum alloys let their hardness reduce rapidly. In this temperature range ANVILOY® alloys are superior to hot work tool steel regarding hardness and strength.

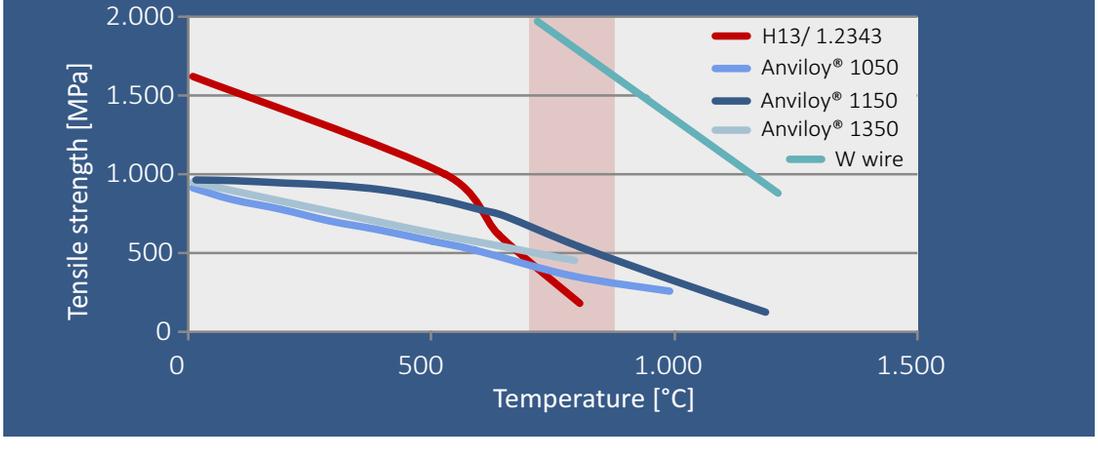
Tempering resistance



Hot hardness



High temperature strength



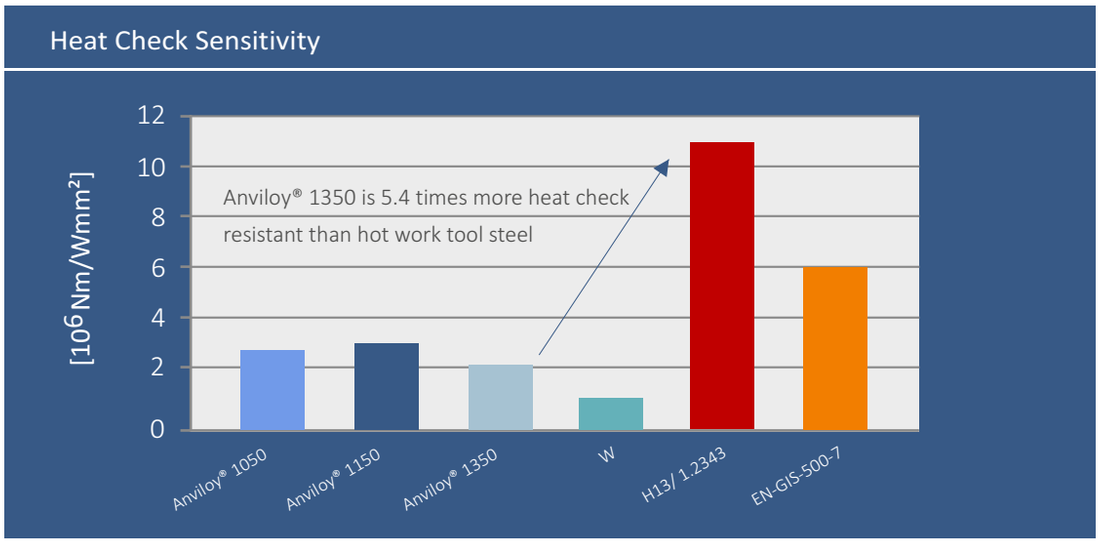
Heat check resistance / thermal fatigue resistance

Heat cracks are one of the main failure causes of pressure die casting tools. Heat cracks result from thermal fatigue due to constantly changing tensile and compressive stress. This stress is the larger the higher the thermal expansion coefficient is and the smaller the thermal conductivity is.

Heat Check Sensitivity $\tau = \frac{E \cdot \alpha}{\lambda}$

α: Thermal expansion coefficient
λ: Thermal conductivity
E: Young's modulus

Especially at these characteristics, ANVILOY® materials are clearly better than hot work tool steels. Their heat conductivity is 3- to 5- times higher and showing at the same time half of thermal expansion. Accordingly the temperature gradient, which develops in the tool, becomes smaller and the tensions become less. Because also the expansion is smaller at the same time, the effect strengthens and significantly smaller tensions develop. The reduced stress, which the tools are exposed to, increases their stability against thermal alternating stress. The heat crack danger is shown in the following chart.



Affinity to sticking

Another problem with which casters are faced is welding and/or backing. Usually this is prevented by using separation coatings. The protection is, however, only of limited duration and increases the heat crack danger with liquid application of the coat layer. Besides that, an even and safe protection cannot always be ensured.

Materials, which do not weld together with the casting metals and are still machinable, would be desirable. This makes ANVILOY® materials an ideal solution. Due to their high melting points these alloys prevent a welding connection to other materials. Accordingly difficult is the sticking of caking. The natural separation layer of ANVILOY® materials is helpful. These characteristics can also be used constructional as smaller releasing angles of the mold become possible.

Economy

Productivity and profitability of the foundry process are the result of many factors. Apart from raw material costs, tooling expenses, process time, and the loss of production time are to be considered. Looking at tool cost per unit, the costs of material, production, maintenance and of course their service life, play an important role. Here ANVILOY® metals show their special advantages resulting from their dramatically longer service life. The expenditure for re-machining, cleaning and coating can be lowered significantly. By using the high thermal conductivity of these materials, cycle times can be lowered and the product quality can be improved. That is reached by the forming of a finer grain and smaller porosity.

ANVILOY® alloys are applied particularly in areas of gravity die casting and pressure die casting where the mold is exposed to its highest stress. These areas are for example pins, cores and gates.

Gravity casting
by the example cylinder head

GGG 50 150 – 250 casts

Anviloy® 1050 320.000 casts

Low-pressure casting
by the example alu wheel

H-13/ 1.2343 3.000 wheels
without maintanance

Anviloy® 1050 45.000 wheels
without maintanance

Diecasting
by the example damper

H-13/ 1.2343 1.500 Shots
at 2 maintanances

Anviloy® 1050 67.500 Shots
without maintanance

break-even at double service life

Technical Data

	Anviloy® 1050	Anviloy® 1150	Anviloy® 1350	EN/DIN1.2343 AISI H13	EN-GIS-500-7
Hardness [HV10]	300	350	310	380 - 480	180 - 230
Density [g/cm³]	17	17,3	18,7	8 ± 0,1	7,1 ± 0,1
UTS R_m [MPa]	> 900	965	920	1230 - 1570	500
Elongation A_5 [%]	> 20	> 10	> 10	up to 40	7
Yield Strength $R_{p0.2}$ [MPa]	600	640	620	~ 1200	320
Youngs-Modulus [GPa]	330	360	370	210	169
Thermal Expansion (20°-400°C) [* 10^{-6} 1/K]	6,2	5,6	5,1	11	12,5
Heat Conductivity λ (20°-400°C) [W/mK]	70	65	90	23	35,2

All values are typical values without guarantee. Binding are the characteristics mentioned in our order confirmations.

MACHINABILITY

Turning

All turning tasks - inside and outside - can be accomplished with common tools made from tungsten carbide listed in the ISO groups of machine cuttings K 05 to K 20. Using tungsten carbide turning tools, cuts without chamfer with a setting angle of 6° and a face angle of 6° - 12° should be selected. For cutting, positive plates are to be preferred with chip breaker without chamfers. Cutting speeds of 80- 120 m/min can be achieved. Also High speed Turning is possible. Cooling agents are not necessary.

Drilling

For this treatment are drills made from high-speed steel (preferably material NR. 1.3342 or 1.3343) or tungsten carbide of the ISO group of machine cuttings K 10 suitably. The tip angle of the drill should be 120°. Depending on the choice of the tool material cutting speeds from 20 to 80 m/min are possible. Since no cooling agent is used, the drilling made of high-speed steel needs often to be ventilated, in order not to let cutting edge of the drill rise to a temperature over 550°C.

Milling

Knife heads with positive indexable inserts made from tungsten carbide of the groups of ISO machine cuttings of K 10 K 20 and/or P 20 to P 30 proved to be very suitable. With an angle of the major cutting edge of 80° the face angle of the indexable insert should be 6° - 10°. Likewise the angles of inclination should be 6° and the setting angle 6°. As cutting speed 80 - 120 m/min is recommended. High speed Milling is possible. No cooling agent is used.

Grinding

For sharpening Tungsten alloys ceramically bound grinding wheels made of silicon carbide can be used. With a granulation of 50 - 120 the degree of hardness of the disk should be H to K. For cooling of the disk and reliable clearing of the splinters the grinding area must be rinsed with a strong cooling agent jet. The cooling agent can be a mixture of water and a commercial additive.

Electrical discharge machining (EDM)

Generally all here mentioned metals can be machined by spark eroding. To machine these high melting metals you have to use high melting electrode materials. We recommend W80Cu20 and W90NiCu which can be ordered from us. Please take care that the electrode is used as a cathode.

Bonding

All Anviloy® alloys can be well hard brazed. As silver solder the silver solder 8427 with 840°C and 8449 with 690°C work temperature work satisfactorily. In special cases Anviloy® alloys can be connected also by friction welding with steel, copper, aluminum and their alloys.

Repair

ANVILOY® products can be repaired by using ANVILOY® Weld Rod. ANVILOY® Weld Rod is a tungsten-based TIG-welding filler metal, available as rod or as wire. It is used to repair cracks, breaks and washouts. For more information please check the last page.

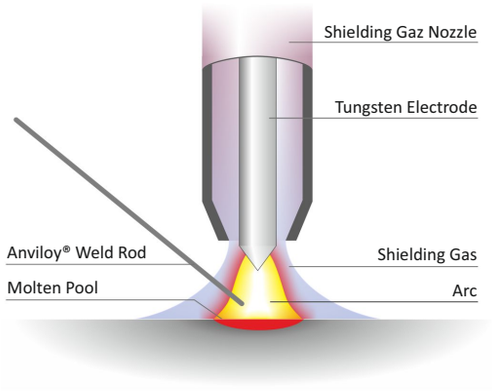
ANVILOY® Weld Rod

ANVILOY® Weld Rod

ANVILOY® is a tungsten-based TIG-welding filler metal available as rod or wire.

Applicable to the following materials

- Hot work tool steels such as 1.2343 / H13
- Tungsten Alloys



Major Applications

- Repair of cracked or broken dies
- Reconstruction of outbreaks and washouts
- Armor, strengthen or recoat areas where heat transfer needs to be enhanced
- Armor, strengthen or recoat areas exposed to high erosion or corrosion

Advantages

- Increase the resistance to thermal wear and heat checking
- Increase erosion and / or corrosion resistance
- Reducing the tendency to soldering
- Remove heat faster from die casting components

Distributed by:
PRODUCTION ENGINEERING
1344 Woodman Drive
Dayton, Ohio 45432

888-654-WELD (9353)
sales@productionengineering.com

www.resistanceweldsupplies.com