How to Harden 4140 Steel

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Hardening steels involves the basic process of heating the steel to organize the crystalline structure in a uniform way and then rapidly cooling it by quenching it to lock the molecular make-up of the steel. However, different steels have different hardening steps to follow. Some of the most difficult steels to harden are tool steels. ANSI 4140 is a tool steel with relatively high amounts of elemental additives. It requires specific steps to produce a hard edge.

Things You'll Need

- Heat treat oven
- Trough of mineral oil
- Protective equipment

Step 1

Heat the steel to 1,675 degrees Fahrenheit in a heat treat furnace or forge and hold it at that temperature for approximately 30 minutes per inch of length to normalize the steel. Normalizing removes any stresses within the steel that could create cracks when hardened.

Step 2

Remove the normalized steel from the heat treat furnace and allow it to cool in the air until it reaches room temperature.

Step 3

Heat the steel a second time to 1,550 degrees, allowing 30 minutes per inch to ensure a consistent temperature through the core of the steel.

Step 4

Remove the steel from the heat treat oven and immediately submerge the steel in a trough of mineral oil to quench it, setting the hardness within the steel.

Tip

Allow more time per inch for thicker sections of steel, those with more than an inch in diameter, and less time for thinner pieces of steel.

References & Resources:

- Dave Smucker: Heat-Treating Tool Steels
- UC Davis: The Heat Treatment of Steel
- Engineers Edge: Steel Specifications and Review