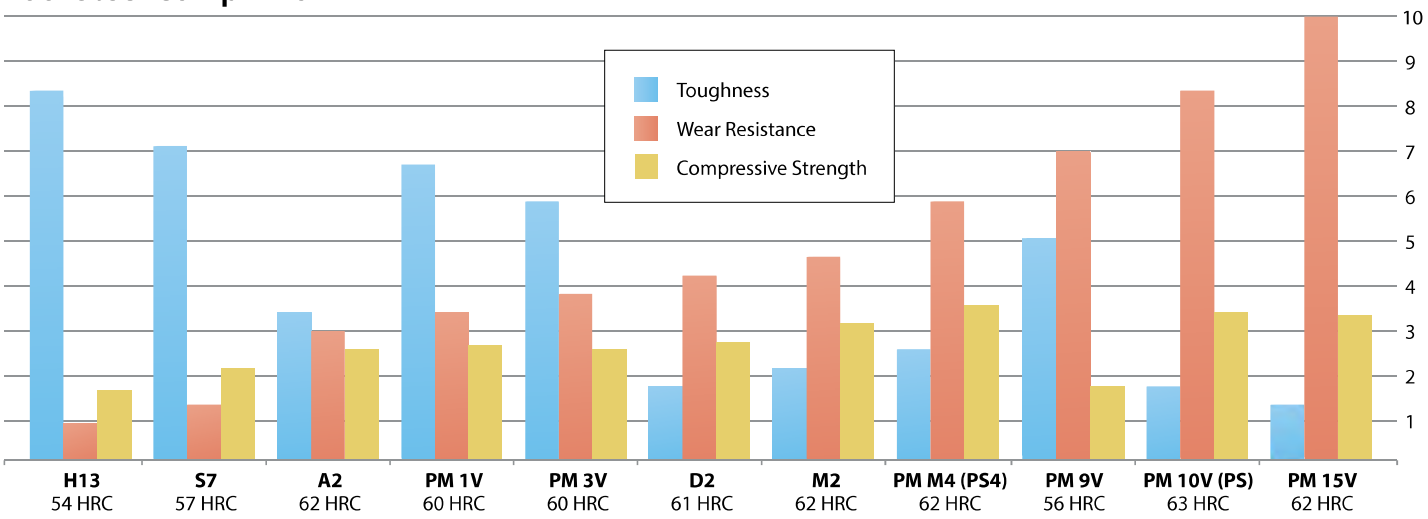
e, & Compressive Strength

Tool Steel Comparison



Note: This chart shows relative values.

Toughness

Toughness of tool steel is defined as the relative resistance to breakage, chipping, or cracking under impact or stress. Using toughness as the only criterion for selecting a tool steel, H13 or S7 (shown in the chart above) would be the obvious choice. However, all desired characteristics—and the needs of the job—must be considered when making your selection.

Tool steel toughness tends to decrease as the alloy content increases. Toughness is also affected by the manufacturing process of the steel. The PM (particle metallurgy) production process can enhance the toughness of the steel grade due to the uniformity of its microstructure.

Hardness also affects toughness. Any given grade of tool steel will have greater toughness at a lower hardness. The lower hardness, however, could have a negative effect on other characteristics necessary to achieve acceptable tool life.

Wear Resistance

Wear resistance is the ability of the tool steel to resist being abraded or eroded by contact with the work material, other tools, or outside influences such as scale, grit, etc. There are two types of wear damage in tool steels—abrasive and adhesive. Abrasive wear involves erosion or breaking down the cutting edge. Adhesive wear is experienced when the work piece material adheres to the punch point, reducing the coefficient of friction, which increases the perforating pressure.

Increased alloy content typically means increased wear resistance because more carbides are present in the steel, as illustrated in the chart.

Carbides are hard particles that provide wear resistance. The size and dispersion of the majority of carbides are formed when alloys, such as vanadium, tungsten, molybdenum, and chromium combine with carbon as the molten steel begins to solidify.

Greater amounts of carbide improve wear resistance, but reduce toughness.

Compressive Strength

Compressive strength is a little known and often overlooked characteristic of tool steels. It is a measurement of the maximum load an item can withstand before deforming or before a catastrophic failure occurs.

Two factors affect compressive strength. They are alloy content and tool steel hardness.

Alloy elements such as Molybdenum and Tungsten contribute to compressive strength. Higher hardness also improves compressive strength.

Dayton Progress provides a broad range of steels for specific, custom-designed applications.