

1.1 General, Types of steel

What Is the History of Steel?

The history of steel begins with the history of iron. Iron's discovery and rise to prominence in what we now call the Iron Age began in about the 12th century BCE (though it varies depending on geographical location). It is only considered to have started in Europe around the 5th century BCE. Early steels (iron with added carbon to increase strength) were made in China around that time but generally had too low an iron content to be considered true steel. It was in India around 400 BCE that true steel was created by melting iron and charcoal together in small crucibles.

Variations of steel and cast iron (which have a higher carbon content) were developed throughout the world during medieval times and into modern history. A significant step forward was discovered by Benjamin Huntsman in England in 1751 when he used geologically-sourced coal rather than charcoal from timber to heat the crucibles. An even bigger breakthrough was made by Henry Bessemer, who was awarded a British patent in 1855 for a steel-manufacturing process. His process blew air directly through the molten iron (and its additives). This became fundamental to modern commercial steel production.

It wasn't until about 1912-1914 that stainless steel was first created with the addition of chromium and nickel. These materials were gradually developed and refined through the end of World War Two.

What Is Steel Made of?

Fundamentally, steel is made of iron and carbon, but many other alloying elements also get added to create thousands of different grades of steel. Mild steel, or carbon steel, is generally more than 99% iron, containing less than 0.25% carbon, similar amounts of manganese, and traces of phosphorus and sulfur. By contrast, a common

grade of stainless steel (304) has only about 70% iron with a minimum of 18% chromium and 8% nickel. Manganese, silicon, phosphorus, and of course carbon are also present in varying amounts within this type of steel. Other alloying elements for different steels include molybdenum, vanadium, and boron. Multiple grades of each type of steel exist, with variations in their composition meant to produce different characteristics.

What Are the Characteristics of Steel?

The common characteristics of steel are listed below:

1. **Strength:** Steel is a high-strength material, particularly in tension, and can be used for structural loads.
2. **Durability:** Steel is highly durable with a potential lifespan of over 100 years. It does not swell or creep, instead remaining very rigid.
3. **Versatility:** Steel is an incredibly versatile material. Its many grades can be applied to thousands of uses.
4. **Machinability:** Most steel is easily machinable, depending on the grade. Some specific grades of steel (free-cutting steels) are highly machinable.
5. **Weldability:** Most grades of steel are easily weldable, although some need specialized welding procedures.
6. **Corrosion Resistance:** Steel can be alloyed with other elements such as chromium, nickel, and molybdenum to better resist corrosion.
7. **Conductivity:** Steel generally has lower thermal and electrical conductivity compared to other metals. It can be employed as a strong and heat-resistant shielding material.

8. **Recycling:** Steel can be completely recycled, and due to its value, a large portion (>60%) of steel globally is recycled.

What are the Different Types of Steel?

There are several different types of steel, each defined by the type and amounts of alloying elements. These are listed below:

1. Stainless Steel

Broadly speaking, stainless steel is defined by chromium in its composition. The austenitic stainless steels (18/8 and 18/10, or 304 and 316) are the most popular and contain chromium and nickel. However, there are also martensitic and duplex stainless steels with particular engineered properties. Stainless steels are valued primarily for their excellent corrosion resistance, which also makes them easy to clean. When coupled with their temperature resistance and strength, they are central to some industries. For instance, the dairy industry and other food and beverage industries use [stainless steel](#) for nearly all their processing equipment.

2. Carbon Steel

Carbon steel generally refers to the simplest steel alloys of carbon and iron, with small amounts of manganese, phosphorus, and sulfur present. The key defining factor for each grade is the carbon content within the steel. This can range from as low as 0.05% to as high as 2%. The carbon percentage influences many properties such as the strength, brittleness (ductility), and weldability of each grade of carbon steel. [Carbon steel](#) can be used for structures, automotive components, and many other applications.

3. Alloy Steel

Alloy steel is a broad term applied to steel that contains additional alloying elements (over and above carbon) such as: chromium, nickel, molybdenum, manganese, boron, silicon, and vanadium. The alloying elements can make up 1% to 50% of the alloy. Low-alloy steel is generally considered to have below 8% alloying elements and high-alloy steel contains more than 8% alloying elements. [Alloy steel](#) is a very wide category. Its grades are used in many different applications, such as stainless steel for dairy producers, or advanced high-strength steel in the automotive industry.

4. Tool Steel

Tool steel is a range of steel grades carefully developed to function well as tools. It is extremely hard, durable, and abrasion-resistant. There are different grades of tool steel, but they generally contain between 0.7% and 1.5% carbon, are low in manganese, and are heat treated. [Tool steel](#) is used for the manufacture of jackhammer bits and forging dies, for example.

5. Weathering Steel

Weathering steel is a low-alloy steel designed to resist corrosion in outdoor applications (i.e. it is considered weather-resistant). The steel is alloyed with small amounts of chromium, nickel, and copper to improve corrosion resistance. The corrosion mechanism builds a passive oxidized layer on the surface of the steel, which inhibits further corrosion. Weathering steel is commonly employed as structural members for bridges and other structures, where it requires very little maintenance for a useful life of over 100 years.

6. Electrical Steel

Electrical steel is alloyed with silicon (generally in the range of 2-3.5%) and has uniform magnetic properties. These alloys go into electrical components such as electric motors and transformers.

7. High-Speed Steel

High-speed steel is a subcategory of tool steel specifically formulated for fast-moving tools such as rotating saw blades. The steel includes tungsten and molybdenum as alloying elements and is heat treated to create an ultra-hard surface. High-speed steel is valued for its excellent hardness and abrasion resistance.