

# *SPECIALTY HEAT TREAT, INC.*

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## HEAT TREAT PROCESS DEFINITIONS

**Normalizing** - A treatment consisting of heating uniformly to temperature at least 100°F above the critical range and cooling in still air at room temperature. The treatment produces a recrystallization and refinement of the grain structure and gives uniformity in hardness and structure to the product.

**Annealing** - A treatment consisting of heating uniformly to a temperature, within or above the critical range and cooling at a controlled rate to a temperature under the critical range. This treatment is used to produce a definite microstructure, usually one designed for best machinability, and /or to remove stresses, induce softness, and alter ductility, toughness or other mechanical properties. When applied to nonferrous alloys, the term "annealing", without qualification, implies full anneal. When applied to nonferrous alloys, the term *annealing* implies a heat treatment designed to soften a cold worked structure by recrystallization or subsequent grain growth or to soften an aged-hardened alloy by causing a nearly complete precipitation of the second phase in relatively coarse form. Any process of annealing will usually reduce stress, but if the treatment is applied for the sole purpose of such relief, it should be designated stress relieving.

**Austenitizing** - Forming austenite by heating uniformly to temperature at least 100°F above the critical range and cooling in still air at room temperature. The treatment produces a recrystallization and refinement of the grain structure and gives uniformity in hardness and structure to the product.

**Quenching** - a treatment consisting of heating uniformly to a predetermined temperature and cooling rapidly in air or liquid medium to produce a desired crystalline structure.

**Tempering** - A treatment consisting of heating uniformly to some predetermined temperature under the critical range, holding at that temperature a designated period of time and cooling in air or liquid. This treatment is used to produce one or more of the following end results:

- To soften material for subsequent machining or cold work,
- To improve ductility and relieve stress resulting from prior treatment or cold working,
- To produce the desired mechanical properties or structure in the second step of a double treatment.

**Stress Relieve Temper** - A thermal treatment to restore elastic properties and to minimize distortion on subsequent machining or hardening operations. This treatment is usually applied to material that has been heat treated (quenched and tempered). Normal practice would be to heat to a temperature of 100°F lower than the tempering temperatures used to establish mechanical properties and hardness. Ordinarily, no straightening is performed after stress relieve temper.

**Age Hardening** - A change in properties of certain metals and alloys that occurs at ambient or moderately elevated temperatures after hot working, cold working, or heat treating. The change in properties is often, but not always, due to a phase change (precipitation), but never involves a change in chemical composition of the metal or alloy.

**Induction Hardening** - A surface-hardening process in which only the surface layer of a suitable ferrous workpiece is heated by electromagnetic induction to above the upper critical temperature and immediately quenched.

**Carburizing and Hardening** - A treatment consisting of dissolving carbon into the surface of steel by heating to above the transformation range in the presence of carburizing compounds. A form of *case hardening* that

produces a carbon gradient extending inward from the surface, enabling the surface layer to be hardened either by quenching directly from the carburizing temperature or by cooling to room temperature, then re-austenitizing and quenching.

**Nitrocarburizing** - Any of several processes in which both nitrogen and carbon are absorbed into the surface layers of a ferrous material at temperatures below the lower critical temperature and, by diffusion, create a concentration gradient. Nitrocarburizing is done mainly to provide an anticuffing surface layer and to improve fatigue resistance.

**Gas Nitriding** - A treatment consisting of introducing nitrogen into the surface layer of solid ferrous alloys by holding at suitable temperature in contact with ammonia or molten cyanide of appropriate composition to produce extremely hard "skins".

**Carbonitriding** - A case hardening process in which a suitable ferrous material is heated above the lower transformation temperature in a gaseous atmosphere of such composition as to cause simultaneous absorption of carbon and nitrogen by the surface and, by diffusion, create a concentration gradient. The process is completed by cooling at a rate that produces the desired properties in the workpiece.