

## Notes on Heat Treating Fasteners

Steel fasteners are heat treated to develop the fastening strengths their material structure is capable of reaching. The iron, carbon, manganese and other elements which form the grains of steel are transformed during heat treating to a structure capable of greater load carrying. The as-heat treated hardness, and tensile strength, are two of several metallurgical measures of the finished heat treated fastener.

Heat treating is a "three box" process: *Harden-Quench-Temper*. The raw fasteners travel into the hardening furnace where a

high temperature and an atmosphere with a metered amount of carbon molecules alter the fasteners' microstructure. Once "soaked" in and transformed in this environment, the fasteners are rapidly cooled, or "quenched" to shift the fastener metal into the martensitic microstructure right for fastening. To relieve the stresses from the rapid temperature changes needed to quench properly, the final step, tempering, draws the fasteners back to their final hardness and tensile strength using a temperature lower than used in hardening. By hardening, quenching and tempering a steel fastener, the finished product develops the mechanical properties to provide fastening ability.