GSS 98.13 METALLURGY FOR GUNSMITHS

Overview:

This course is an introduction to metals, with classroom lectures and hands-on shop techniques. Topics covered include the fundamentals of metals, heat treating, and the various forms of mild, alloy and stainless steels, as well as non-ferrous metals like aluminum, copper and brass.

Course Objectives:

At the conclusion of this course, the student will have gained an understanding of

1. Extraction and refining of steel, steel classifications, terminology, physical and chemical properties, and performance measurements (strength, hardness and ductility).
2. How carbon content and other alloying elements affect the performance characteristics of steel, and the use of phase diagrams.
3. How crystalline structure is affected by temperature; work hardening; annealing and normalizing.
4. The fundamentals of heat treatment, use of isothermal transformation diagrams and how tempering can be used for obtaining desired post-heat treat properties.
5. How welding affects various metals.
6. The types and characteristics of non-ferrous metals like aluminum, copper, and brass; and how precipitation hardening is used to gain desired properties in these materials

Student-supplied Tools, Equipment and Material List:

- Notebook, pens, pencils
- Protective Clothing (for working in the shop area)
  - Long pants
  - Shirt that breaks the shoulder (ie no tank tops)
  - Close-toed shoes (leather boots preferred, no sandals)
  - Welding gloves (either lightweight leather or heavy SMAW gloves)
  - Safety glasses with side shields (goggles OK but uncomfortable for long use)
  - Gas welding goggles with number 5 lens
  - N95 disposable dust mask
- Lockable Tool Box
- Mill file, 8 inch or larger with handle
- Hammer, ball pein
- Steel rule (6 or 12 inch) or tape measure
- Side cutting pliers
- Needle nose pliers
- Propane torch and cylinder (plus striker if necessary)
Old metal cake pan or similar that will hold 1 inch depth of water
A few shop rags
Old paint brushes for clean-up, large (3 or 4 inch) and small (1/2 or 1 inch)
Marking pen (Sharpie)
Hacksaw and blades
Scribe
Center punch
Fractional Drill Index

Old chisel to practice sharpening, and sharpening stone.
Old screwdrivers to practice shaping (Stanley 100 or Craftsman brand are good)

Materials

Drill Rod, oil hardening, 1/8 and ½ inch diameter sizes, 36 inch length
Surface-Hardening Compound, one pound can (brand name “Cherry Red” or equal.
See www.use-enco.com, product number 328-1122 for an example)
Steel wire or tie wire for holding parts while heating
Dextron Automatic Transmission Fluid (any inexpensive brand for heat treating)
Old metal coffee can or one gallon metal can with top removed to hold ATF
Old brass bottleneck cartridge cases **WITH THE PRIMERS REMOVED**
Flat stock for practice bending into a Vee spring configuration (either low carbon 1018 steel rectangle, 1/8x1/2x36; or Brownell’s No 149 Spring Assortment, part number 025-149-000WB)
Any mild steel round stock, 3/16 or ½ inch diameter to case harden and 1/8 or smaller diameter to practice tempering. Low carbon alloy steel such as 1018 or similar will work.
Kerosene or honing oil
Breakfree (small container)
Cloth backed sandpaper or emery cloth, 220 and 320 grit

Optional Tools and Equipment

2 padlocks (for either bench locker and/or gun locker)
Cordless drill
Small portable bench vise

Sources of tools and materials:

Brownells.com
MSCdirect.com
Use-ENCO.com