PLASMA & LASER CUTTING/FUME EXTRACTION

There are several types of thermal cutting processes typically used in the market today to cut steel and other metals of different thicknesses (or sometimes other materials). The three primary processes used in thermal cutting are oxy-fuel cutting (oxyacetylene), plasma cutting and laser cutting. Oxy-fuel cutting is the oldest technology and is rapidly being replaced by plasma and laser cutting to achieve the increased performance and capabilities which industry demands today.

Plasma cutting utilizes a high velocity plasma gas jet formed by an arc and inert gas flow to create extremely high temperatures which melts the targeted material and forces the molten metal through the back side of the cut. Laser cutting utilizes a high intensity light beam to melt or vaporize materials and may incorporate a gas jet, which blows away the molten metal. The most common CNC controlled thermal cutting tables utilize either plasma cutting or laser cutting technologies to improve the cut quality of the material.

Some of the key benefits from plasma and laser air filtration:

- Worker health protection and minimized potential long term liability
- Energy savings and conservation through recirculated conditioned air
- Extended machine life
- Improved part / product quality
- Reduced housekeeping
- OSHA & EPA regulation compliance

Contaminant Characteristics

The fume generation rates from plasma and laser cutting will vary with the process parameters such as cut rates, total cutting time and material thickness. Additionally the cutting consumables, surface coatings, base metals or any other contaminants present within the atmosphere will also be part of the fume make-up. However, without proper filtration and / or other dust collection measures the fume and smoke generation can be significant. In plasma cutting the vast majority of the particulate can be less than 10.0 microns in size whereas in laser cutting a high concentration of the particulates can be less than 1.0 micron in size. In both cases, the fume or particulate is considered to be fine and somewhat agglomerative when allowed to cool.

Plasma Cutting Fume Extraction Hazards

Exposure to plasma cutting fumes and gases over time and in sufficient concentrations have been linked to numerous respiratory and health related illnesses. Plasma cutting processes on base metals such as stainless steel, low alloy steels, hard facing materials and other alloys may release materials that contain manganese, chromium, cadmium, lead, nickel or other known hazardous substances which have tightly controlled PEL (Permissible Exposure Limits) established by local and national government agencies. In addition to health risks, uncontrolled thermal cutting fumes result in reduced worker productivity, product quality problems, factory maintenance issues and environmental concerns.

Recommended Approaches for Fume and Gas Air Filtration

- **Source Capture.** Capturing thermally generated fumes at their source is the best way to collect and control them. However this can be challenging due to cross drafts or other factory air currents in addition to the natural thermal rise of the cutting fume resulting from high cutting temperatures or the varying design of the thermal cutting tables. On laser cutting and/ or plasma cutting tables where the thermal cutter is stationary and the materials move, it is possible to use a small canopy hood to capture the thermally rising fumes. However, some of the thermally cut fumes that are pushed under the table may still need to be captured.
- **Downdraft Containment.** On other thermal cutting tables the laser cutter and / or plasma cutter is mobile and the material is stationary. Since the gas jet used in both plasma and laser cutting pushes the slag and much of the generated fumes to the backside of the material being cut, enclosing the volume immediately below the material is essential to controlling and capturing these fumes. Once this volume is enclosed, extraction point(s) are positioned, where possible, along the longest side(s) of the table. In some cases, the required air extraction can be reduced for the cutting table surface into smaller zones depending on the size and configuration of the laser cutting or plasma cutting table. In general, the downdraft velocity required must be sufficient enough to overcome the rising thermally generated fume thus containing the fume under the table.