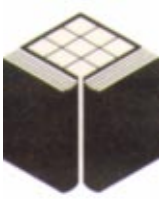

FROM THE FOUNDATION

This is the second half of a two-part series on welding lightweight steel framing.

Welding Lightweight Steel Framing Members

By Kathy B. Sedgwick, Executive Director

This article originally appeared in the June 1988 Foundation *Updates* and has been updated to reflect current developments in the field of welding lightweight steel framing. *Updates* is published by the Foundation of the Wall and Ceiling Industry.

A Comparison of SMAW and GMAW

While both GMAW and SMAW processes provide high quality welds, each is best suited for certain applications. Criteria for selecting an appropriate welding method include: location of the welding, equipment costs, efficiency, and welder skill requirements.

SMAW is probably used most frequently for field work, while GMAW is preferred for shop use.

SMAW equipment typically costs less than GMAW because it does not require special hoses to carry shielding gas. In addition, SMAW equipment which uses AC is available, eliminating the need for a rectifier.

The SMAW electrode—a short rod or stick—is more portable than GMAW's continuous feed wire spools. However, the continuous feed method is far more efficient.

SMAW requires wirebrushing after each pass to remove the slag covering the bead. In contrast, GMAW wire doesn't produce slag, thus allowing multiple welding passes without interruption, another efficiency advantage.

Generally, SMAW is harder to master than GMAW because the heat is more difficult to control, requiring almost constant adjustment as job and weather conditions change. For this reason, operator skill is a limiting factor in SMAW and requires more training than GMAW.

Producing Good Welds in the Field

Producing good welds requires considerable skill. The welder must move the electrode across the base metal at a constant height and rate of travel in order to maintain a continuous arc and at the same time keep the weld in place, the proper consistency and uniform in size.

Achieving weld consistency and uniformity is not a simple matter. A truly skilled welder takes pride in producing a neat weld, properly fused, of correct dimension and good appearance.

Pre- and post-weld cleaning techniques are important for producing high quality welds. Before welding begins, the steel framing component must be free of paint, excess moisture, dirt, oil and rust. After welding (SMAW only) the cooled bead should be wirebrushed to remove excess slag. Welds on galvanized steel should be coated with a rust inhibitive, zinc rich paint, as specified by most steel framing manufacturers.

Common Welding Problems

Certain problems seem to recur when welding lightweight steel framing. These problems include freezing, distortion, arc blow, porosity and surface holes. Welder skill is an important factor in avoiding these common welding problems.

One of the first skills a welder must acquire is striking a clean arc. Sometimes the electrode accidentally comes into direct contact with a framing section, creating an instantaneous fusion of the electrode and the work surface. This fusion or freeze can be corrected by firmly twisting the electrode holder.

Another problem, distortion, usually occurs when large light gage steel sections are welded, requiring welds at frequent intervals. The base metal becomes twisted out of its original design so that the two components no longer fit. Distortion occurs most often with SMAW which heats the welded component to a greater degree than in GMAW and GMAW-S. The only solution to severe distortion is to cut the components apart and refabricate the panel.

When stray magnetic fields cause the arc to wander from its intended path, this problem is called an "arc blow." To correct the problem, switch to AC welding, if possible. Use lower currents and smaller electrodes, reduce the arc length, and weld in the direction of the blow.

Another common welding problem, surface holes and porosity, is not always visible to the naked eye. These holes are formed by gas trapped in the weld during cooling and solidification.

To avoid this problem, the welder should be sure the component being welded is clean. Remove rust, paint, moisture or dirt from the area to be joined. Keep the puddle molten longer, allowing the gas bubbles to boil out before the molten puddle begins to harden.

Safety Aspects of Welding

The basic elements necessary to the welding process also create potential hazards to the worker. Welders should be aware of the hazards of radiation, heat, and dangerous gases and fumes, and their training should include the selection and use of personal protective equipment and how to avoid endangering themselves and others.

Radiation. The radiation generated by most welding processes falls into three major categories: visible, infrared (IR) and ultraviolet (UV).

The presence and intensity of ultraviolet light is not immediately detectable by the senses; therefore, it is considered more dangerous than infrared and visible light. UV is the most frequent cause of injury to the eyes, but IR and visible radiation can also damage the eyes.

Welders should be aware of the hazards of radiation, heat, and dangerous gases and fumes.

Radiation exposure should be carefully avoided because even brief exposure can cause a condition commonly called "arc eye" or "welder's eye." The symptoms, irritation and inflammation, may not be noticed for several hours, but when the damage finally makes itself known, the pain can be excruciating.

To treat "arc eye," apply ice packs immediately. If the pain persists, the victim should receive medical attention as soon as possible.

The welder is not the only person at risk from radiation! Anyone near the welding site could be endangered.

Published studies have shown that many cases of eye damage can be attributed to another welder's equipment. For this reason, arc welding operations should be isolated to avoid exposing others to direct or reflected rays. In the shop, all exposed inner surfaces should have a dull finish of non-reflective paint; portable, fire-resistant screens, similarly painted, or fire resistant curtains should be used.

Eye damage is the most common injury sustained by welders, and care should be taken to shield the eyes from bums, light, and heat.

The best eye protection is provided by safety glasses or goggles and welding hoods which can be worn with safety hats. The glasses should have specially tinted lenses designed to filter out dangerous rays and side shields to protect against flying sparks and chips.

Eye damage is the most common injury sustained by welders.

Heat. Hot metal is always present in welding: the melting electrode, the molten pool, as well as the base metal which becomes heated during the welding process. For this reason, welders must remain constantly alert to the dangers of heat.

Heat can cause skin burns, hyperthermia (heat stroke) and heat stress, in which the body temperature rises to a very high level. Unconsciousness and death can result if immediate medical assistance is not rendered.

Control heat by a combination of engineering methods, personal protec-

tive equipment, and welder caution. Engineering methods include: cooling fans to increase the air flow over the worker; mechanical air conditioning systems in conjunction with the make up air system; and increased general exhaust ventilation at points of high heat production. Air should flow across the worker from one side for optimum control.

Appropriate personal clothing plays a vital role in protecting the welder from heat. Protective clothing must be fire retardant, (no polyester or doubleknit) with sleeves rolled down, pocket flaps closed and trouser cuffs turned down to avoid catching sparks and slag. In addition, the welder should wear steel-toed shoes, and heavy leather gauntlet-type gloves.

Fumes and Gases. Health hazards are created by two types of gases present during the welding process: toxic gases and asphyxiants.

Although toxic gases are never used as fuel or to shield the arc, such gases may be produced by welding. Common examples include carbon monoxide and the nitrogen oxides (nitric oxide and nitrogen dioxide). Carbon monoxide may be produced when carbon dioxide in the shielding gas breaks down to produce carbon monoxide and oxygen.

$$CO_2 \rightarrow CO + O$$

Fumes and gases concentrate in what is called the fume plume, a column of hot gases which flows upward from the arc. Welders should avoid welding with their faces in the plume.

Welders should be made aware that the gases used in GMAW — argon, helium, carbon dioxide, nitrogen, hydrogen and fuel gases — can cut off the supply of oxygen to the body tissues. Humans require 16 to 21 percent oxygen in the air to survive. Simple asphyxiants dilute the oxygen present in the air to levels below this required percentage. An oxygen deficiency (below 16%) will cause unconsciousness and death (asphyxiation).

Chemical Contaminants. Many of the chemical contaminants present in the welding work area are capable of damaging body organs and systems. For example, inhaling cadmium, copper, flourides, lead, magnesium, zinc oxide or nitrogren oxide may produce a condition called "metal fume fever." Symptoms include a high fever and shaking chills which occur anywhere from 4 to 12 hours after inhaling excessive quantities of fumes.

Some welders experience nausea when welding galvanized steel. TO avoid inhaling the fumes, welders may wear respirators—anywhere from simple canister type respirators to fully air-pressurized masks, as appropriate. Airborne contaminants generated during welding processes are usually controlled with a combination of dilution ventilation (air changes) or local exhaust ventilation. Dilution ventilation reduces the airborne contaminants in the shop while local exhaust ventilation captures the contaminants close to the weld and then carries them away.

Welding booths should provide circulation or air at the floor level. Be certain that removal of contaminants from the welding area does not merely transfer them into an adjacent area of operations or the general workplace atmosphere.

Specialized safety equipment has been developed to cope with the problem of hazardous fumes and smoke in the welding area. Smoke and fume removal units are available as separate equipment or as a vacuum attachment on some larger welding units. Floor ventilating systems, which draw fumes downward away from the welder, are also available.

Welder Training and Certification

Training is available from a variety of organizations, including community colleges, vocational schools, and commercial training centers.

Certain state and local government agencies have established certification requirements for welders. In order to receive written certification, welders must perform specific weld tests that meet standards prescribed by these agencies. These tests are normally performed at, and evaluated by, an accredited testing center.

The American Welding Society recently published ANSI/AWS D1.3-89 *Structural Welding Code: Sheet Steel* which outlines methods for establishing a welding procedure for the qualification of welders on lightweight steel framing. The document includes sample recordkeeping forms and lists tests which can be completed in-house by the contractor's welding employee under the supervision of a previously qualified welder.

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