

34—Welding and Cutting

metal is connected electrically to one side of the circuit, open circuit voltage of 150 volts may be allowed provided the following conditions are present

- 1 All equipment and circuiting are fully insulated and the operator cannot make electrical contact other than through the arc itself, while the arc is maintained
- 2 Disconnecting or voltage reducing devices operate within a time limit not exceeding one second after breaking the arc

Where neither side of the circuit is electrically connected to the work, open circuit voltage of 300 volts is allowed if controls are present to prevent the operator from touching both sides of the circuit. One hand should be used to operate control devices. Also, the voltage should be disconnected automatically by a reliable switch instantly upon breaking the arc.

For AC or DC welding under wet or humid atmospheric conditions where perspiration is a factor, a reliable automatic control device for reducing no-load voltage is recommended.

Cables

Welding cable is purchased in 50-ft lengths, and several lengths may be used in one circuit. Substantially insulated connectors, of a capacity at least equivalent to that of the cable, should be used to splice or connect cables. Cable lugs used for connections should be securely fastened together to give good electric contact. The exposed metal parts of the lugs should be completely insulated.

Welding cable is subjected to severe abuse if it is dragged over work under construction and across sharp corners, or run over by shop trucks. Special cable with high quality insulation should be used. The fact that welding circuit voltages are low may lead to laxity in keeping the welding cable in good repair. Operators and maintenance men should be instructed to see that defective cable is immediately replaced or repaired.

On large jobs, there is likely to be much loose cable lying around. Welders should keep this cable orderly and out of the way, preferably strung overhead to permit the passage of persons and vehicles. Welding cables

should not lie in water or oil, in ditches or bottoms of tanks. Rooms in which arc welding is to be done regularly should be permanently wired with enough outlets so that extension cables will not have to be strewn about.

Electrodes and holders

Arc welding is done with either a metallic or a carbon electrode. The carbon electrode is usually a solid carbon or a graphite pencil, $\frac{1}{8}$ in in diameter or larger, depending upon the amount of current used.

For gas-shielded metal arc welding, the electrode is a solid or flux-cored wire. For shielded metal arc welding, the electrode is a covered wire.

Electrode holders as used for shielded-metal arc welding (SMAW) are used to connect the electrode to the welding cable supplying secondary current. Fully insulated holders (Fig 34-7) are preferred because there is less likelihood of accidentally striking an arc with such holders, particularly in close quarters.

Electrode holders will become hot during welding operations if holders designed for light work are used on heavy welding or if connections between the cable and the holder are loose.

If a holder of the correct size for the electrode cannot be used, an extra holder should be provided so that one can cool while the other is in use. *Dipping hot electrode holders in water should be prohibited.*

On light or medium heavy work, where light, extremely flexible cables are used, holders may be attached directly to the work lead running to the machine. On heavier work, welders generally prefer a short length attached to the holder, which is more flexible than the main work lead. Properly insulated cables of weight and flexibility which will not inconvenience the welder are available.

Automatic and semiautomatic welding

Arc welding may also be done automatically or semiautomatically to increase the speed of welding and provide more uniform weld quality. Machine welding is especially efficient for long welds or where a high rate of production is involved and the work can be jugged. The rate of electrode feed and arc