INSTRUCTIONS for UNIONMELT TRADE MARK

FLEXIBLE WELDING ATTACHMENT
(01E30-10 Foot)
(01E28-17 Foot)

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IMPORTANT NOTE

Early versions of the Flexible Attachment (Serial Numbers 2E5200 or lower*) use a hopper assembly distinguishable by its curved nozzle tube, composition-flow control lever, and spring-secured hopper cover (see sketch). The information in this book does NOT cover old-style hopper assemblies. Flexible Attachments using these hoppers must be modernized by ordering the new Hopper 29V17 (see Figure 10).

* Flexible Attachment Serial Numbers are stamped on the Busbar Adaptor 18N01. (The NEW Flexible Attachment Serial Numbers begin with 1F1001.)
I. Introduction

The Flexible Attachment is designed to further increase the wide range of application of the UNIONMELT Welding Process. With the Flexible Attachment added to a standard welding head, hand-guided UNIONMELT welds can be made. It permits the operator to make welds which cannot be handled with automatic equipment.

The Flexible Attachment consists principally of a flexible tube and a combination hopper and nozzle assembly.

The tube is available in 10- and 17-foot lengths. It consists of an outer rubber covering in which are a wire transfer tube and two welding current cables. One end of the tube is designed to be attached, by means of an adaptor, to a standard welding head. As the welding wire emerges from the wire feed mechanism on the welding head, it feeds into the flexible tube, and emerges at the outer end through a curved nozzle. The nozzle passes through a small aluminum hopper which contains UNIONMELT Welding Composition. This granular composition feeds by gravity down around the nozzle to the weld. The nozzle keeps the wire centered as it emerges, allowing the UNIONMELT composition to disperse itself evenly around the wire. Control of the flow is provided by raising and lowering the hopper. A swivel joint in the flexible tube near its free end provides for limited rotation of the nozzle and hopper assembly with respect to the tube.

A current relay, ordered with the attachment, enables the operator to start his welds independently of the controls on the welding head. The weld is started by scratching the welding wire on the work, and stopped by withdrawing the wire from the weld puddle. A toggle switch on the relay box renders the relay inoperative when the welding head is to be used without the Flexible Attachment. This makes it unnecessary to install or remove the relay when changing the mode of operation. NOTE: This relay is supplied with the UWM-2. Consequently, when the Attachment is used with the UWM-2, the current relay need not be ordered.

II. Installation

A. Installation on "DS" or "DSH" Welding Head

(The following applies to installations using either the "US" or the "DS" voltage control.)

The end of the flexible tube is designed to fit directly into the busbar clamp on the "DS" or "DSH" Welding Head. It is necessary only to insert the tube into the clamp, then tighten the clamp screw. The pilot in the end of the flexible tube is not removed.

1. Remove the nozzle and wire guide from the busbar assembly on the welding head. Insert the end of the flexible tube into the busbar. Tighten the clamp screw.
2. Mount the relay permanently in a place near the welding head busbar. Thread one welding current cable through the relay. For welding currents of 500 amperes or less, use only this one cable; disconnect all others. For welding currents greater than 500 amperes, an additional cable should be used. However, this extra cable does not pass through the relay.

3. Disconnect the welding voltage lead from the busbar on the head, and connect it to one of the terminals on the relay. (The welding voltage lead is designated YY1 on the circuit diagram.) (See Fig. 1.)

4. Connect an insulated wire from the other relay terminal to the welding head busbar.

If the welding head is equipped with a high-frequency starter, the starter should be rendered inoperative when the Flexible Attachment is used. The most practical method of doing this is to install a single-pole, single-throw switch in the lead which connects terminal 6 on Plug T to the 115-volt line (refer to HP Circuit Diagram). The switch should be turned to the OFF position when using the Flexible Attachment. The relay ordered with the attachment would in this case be connected as follows:

Disconnect from the welding current cable the lead which runs to terminal 3 of Plug T on the high-frequency starter. Connect this lead to one of the terminals on the current relay. Then connect an insulated wire from the other terminal on the relay to the welding cable.

B. Installation on Type "UE" or "US" Welding Head

(Using Adaptor Assembly 19V87 ordered separately)

1. Remove the contact jaws (or Bracket 15W84) from the busbar on the head.
2. Mount wire guide 18N11, containing Liner 18N13, on the busbar.
3. Screw Adaptor Clamp 18N12 into the bottom of the Adaptor.
4. Remove the pilot from the end of the Flexible Attachment tube. (The pilot is held in place by a setscrew, which must be withdrawn.)
5. Insert the end of the flexible tube into the Adaptor Clamp. Tighten the clamping screw. This must be a solid joint, since any looseness will result in poor electrical contact.
6. Mount the relay permanently in a place convenient to the operator. Thread one welding current cable through the relay. For welding currents of 500 amperes or less, use only this one cable; disconnect all others. For welding currents greater than 500 amperes, an additional cable should be used. However, this extra cable does not pass through the relay.

(Continued on page 5)
7. Disconnect the welding voltage pickup lead from the stationary gear housing. Connect it to one of the terminals on the relay. (See Fig. 1 or Fig. 2.)

8. Connect an insulated wire from the other terminal on the relay to the stationary gear housing on the welding head.

When using a "UE" Voltage Control, short out contacts 5 and 6 on the Voltage Control Current Relay. (This is the pair of contacts which are connected to terminal 3 of Plug V on the Control, and to the main contactor relay at the power source.) The terminals can be shorted by connecting a short jumper wire across them. To facilitate the changeover from manual to automatic operation, it is suggested that a single-pole, single-throw switch be connected in the jumper wire.

If a "UE" welding head is equipped with a high-frequency starter, the starter should be rendered inoperative when the Flexible Attachment is used. The most practical method of doing this is to install a single-pole, single-throw switch in the lead which connects terminal 6 of receptacle T (on the starter) to the 115 volt line. The switch should be turned to the OFF position when using the Flexible Attachment. The relay ordered with the attachment would then be connected as follows:

Disconnect from the welding current cable the lead which runs to terminal 7 of the Inching Button in the Switch Box and Remote Control Unit shown on the "UE" HF circuit Diagram (Form 9179). Connect the lead to one of the relay terminals. Then connect an insulated wire from the other relay terminal to the welding cable.

If a "US" Head with an HF Starter is used, refer to paragraph A on Page 3.

C. Installation on UWM-2

The UWM-2 is completely assembled before it is shipped, except for the Flexible Attachment and the welding and control cables. To install the Flexible Attachment, simply insert the end of the hose through the opening in the UWM-2 cabinet. Secure the attachment in the busbar clamp and tighten the clamp screw. For location of these parts, see Figure 2, "Instructions and Parts List for the UNIONMELT UWM-2 Portable Flexible Welder," Form 9239.

D. Installation on UEH-1, UEH-2, & USH-2 (Using Pilot 376580 ordered separately)

Replace the pilot on the Flexible Attachment with pilot 376580 and then insert the end of the flexible tube into the busbar.

E. It is possible to mount the hopper on a standard OXWELD Machine Carriage for occasional mechanized operation. As shown in Figure 9, the hopper may be mounted on a CM-45 carriage by 24-in. Torch Rigging Assembly (16V90), Casing (24Z10), Rack Assembly (50Y04), four 35Z11 screws, and a customer-built holder assembly.

F. Replacement of Tips, Nozzle Tube Assembly, and Wire Pilot

The Flexible Attachment is supplied with:

1. Nozzle Tube Assembly 29V19 for use with 3/32 and 5/64 inch wire. (Nozzle Tube Assembly 29V20 for use with 1/8 inch wire may be ordered as an accessory.)

2. Tip 20N65 for use with 3/32 inch wire. (Tips 21N62 and 20N66 for 5/64 and 1/8 inch wire respectively may be ordered as accessories.

3. Wire Pilot 21N63 for use with 3/32 and 5/64 inch wire. (Not used with "UE" or "US" Heads. Wire Pilot 18N02 for use with 1/8 inch wire may be ordered as an accessory.)

These components must be changed in accordance with the wire size to be used.

To Change or Replace a Tip:

1. Remove the clamp from the bottom of the hopper assembly. (See Figure 8.)

2. Remove the guard.

3. Unscrew and remove the tip and spider.

4. Place the spider in position on the replacement tip. Then screw the tip into the nozzle.

5. Replace the guard and the clamp.

To Change or Replace the Nozzle Tube Assembly:

1. Remove the two screws on the handle of the hopper. (See Figures 3 and 8.)

2. Slide back the handle.

3. Unscrew the cable.

4. Remove the jam nut.

5. The insulator comes out and the Nozzle Tube Assembly may be removed.

To Change or Replace the Wire Pilot merely loosen the set-screw which holds the pilot to the flexible attachment tube. (See Figure 8.)

III. Operation

A. Preparing the Equipment for Welding

1. Blow out the Flexible Tube with compressed air. This should be done every time wire is inserted. Blowing not only removes fine particles of metal which may have been milled from the wire by the feed roll, but also dirt, rust, and particles of welding composition which may have entered the tube while it was empty.

2. Place the switch on the current relay box in the MANUAL position. Figures 1 and 2 show the current
relay connections when the Flexible Attachment is used with the "US" or "UE" Voltage Control. This current relay is not required when the Attachment is used with the UWM-2.

3. Make sure that the Flexible Attachment contains the correct Tip for the wire size to be used.

(Worn feed rolls have a tendency to slip and should be replaced.)

4. The drive mechanism pressure roll should be set to give maximum positive drive. Insufficient pressure results in slipping; excessive pressure will burr the wire surface making passage through the Flexible Attachment tip difficult.

5. Sufficient pressure should be applied to the brake screw on the hub of the wire reel to keep the wire from unwinding or spreading by itself. Excessive pressure should be avoided since it will put additional load on the feed motor.

6. Carefully ROUND OFF THE END OF THE WELDING WIRE WITH A FILE. This is extremely important since a sharp end may damage the flexible tube. The welding wire should not be dirty or rusty. Even a small amount of rust is sufficient to greatly increase the force required to push the wire through the tube. If allowed to accumulate in sufficient quantity, eventually particles of rust may make the tube unusable.

7. Thread the wire through the Motor Feed Rolls and Flexible Attachment Pilot. The hose should be laid out as straight as possible. In fact, it is a good idea to keep the hose assembly straight at all times, even when not in use. Excessive twists may cause binding and overload the feed motor. If excessive friction retards the movement of the wire through the tube, the first few feet of wire may be lubricated with Molykote or powdered graphite. SUCH LUBRICANTS SHOULD BE USED VERY SPARINGLY, NEVER USE GREASE OR OIL ON THE WELDING WIRE OR TUBE ASSEMBLY.

8. Fill the hopper with UNIONMELT Welding Composition. Use only CLEAN UNIONMELT Welding Composition. All UNIONMELT composition should be screened before being placed in the hopper. Used UNIONMELT composition contains fused particles, and new UNIONMELT welding composition may have accumulated cigarette butts or other trash while standing in an open container in the shop. These materials must be removed, to avoid clogging of the nozzle.

B. Making the Weld

1. PRESS the Inching Button and hold it until 3/4-in. of wire extends from the nozzle. If the wire over-travels, put the "feed - retract" switch in the retract position and press the "inching" button. If you must clip off the end of the wire, be sure the contactor switch is off.

2. Place the Feed-Retract in the FEED position and place the Contact Switch in the ON position.

3. Hold the hopper in a horizontal position over the starting point of the weld. Then bring it to a vertical position to allow the UNIONMELT composition to cover the starting point. When starting the weld, it is not necessary or desirable to have more than 3/4-in. of wire extending from the nozzle. The less wire showing, the less chance there is of the wire weaving during welding. Each time the weld is interrupted, it is necessary to remove any fused welding composition or metal globules remaining on the tip of the wire. This procedure facilitates starting the next time the machine is used.

4. Scratch the wire lightly against the workpiece to start the arc, then proceed with the weld.

5. During welding, the hopper assembly should be held in a natural and comfortable position. This is accomplished by grasping the handle just before it enters the hopper assembly with the tip almost perpendicular to the seam to be welded. In other words, it should be held very much like a hammer. See Figure 4. The composition depth may be varied by merely lifting or lowering the hopper with respect to the workpiece.

C. Welding Techniques

1. Drag Technique

There are some techniques the operator may find useful on some specific jobs. Foremost is the "drag" technique wherein the end of the guardshoe rests on and is dragged along the work. Thus, when making a fillet weld or a butt weld in a prepared vee, the guardshoe can be laid in the joint, and it is only necessary for the operator to drag the assembly at a predetermined speed along the seam. This is illustrated in Figure 5. This technique removes some of

FIG. 4 - Hopper Position During Butt Welding

FIG. 5 - Welding with the "Drag" Technique
the weight of the hopper from the operator's hand and makes it much easier to follow the seam. (When using the drag technique, it will be necessary to incline the top of the hopper 15 degrees in the direction of welding—a little more than usual to keep the nozzle out of the puddle and the molten UNIONMELT composition.)

2. Selection of Welding Composition

Any grade of UNIONMELT composition may be used, dependent upon the properties desired in the finished weld. The larger particle sizes (coarsest welding composition mesh sizes) have often given the best performance, although they also result in the most flashing. With smaller particle size compositions, however, the welding composition becomes harder to remove, particularly from fillet welds.

Any grade of UNIONMELT composition can be used; however, smoother welds will be obtained using grade 50. In those instances where, due to confined working areas or poor ventilation, the operator complains of fuming during welding, the fuming can be eliminated by using Grade 20 for single pass work and 30 for multipass work at the expense of a somewhat rougher weld.

3. Arc Voltage Selection

The arc voltage also has a great effect on the weld. A voltage that is too high will flatten out the bead, sometimes to the point of making it concave. A high voltage can also cause undercutting. Conversely, a voltage too low for the job will cause a narrow, high bead. In most cases, low voltage will cause the wire to stick to the work because of the short arc involved. If the weld is narrow and high, the voltage is the first thing to check. If this is satisfactory, the speed of welding is probably too high. The arc voltage will vary slightly with the inclination of the hopper. The lowest voltage will be obtained by positioning the hopper vertically and, as the angle of inclination to the workplace in the direction of welding is decreased, the voltage will increase slightly. A slightly flatter bead will be obtained under these circumstances and undercutting may result. The best position for most welds is with the hopper inclined about 10 to 15 degrees in the direction of welding. Maximum penetration will be directly in line with the electrode, regardless of the technique employed.

4. Bead Appearance

Bead appearance is also dependent on the welding composition depth. Too much composition will flatten the weld by its weight, while too little composition will allow atmospheric influence to cause porosity, etc. Only enough composition to cover the arc and protect the bead from the air is required. Welding composition must be clean and free of foreign matter. Moist composition and rusty welding wire will cause extreme porosity.

5. Adjustment of Current and Speed

When it is apparent that insufficient metal is being deposited and the rate of welding speed is known to be in a reasonable range, the current must be increased. The highest current that can be used on a job is recommended since it will usually produce the soundest welds at the highest speeds. Increasing or decreasing the current will also increase or decrease the arc voltage, so this value should be reset when a current change is necessary. When the current is known to be high enough for a particular application and the deposit is lumpy or stringy, it is an indication that the welding speed should be decreased.

6. Non-Positioned Fillet Welds

Non-positioned fillet welds are the most difficult to make properly. If the fillet shows undercutting, the primary cause will be high voltage. Improper positioning of the electrode will cause some undercutting, but more often will result in a scarcity of metal on one side or the other. If the metal shows a tendency to roll to the low side, it can be caused by too high a current or too slow a speed, usually the latter. Insufficient penetration will result from too low a current or a travel speed which is not right for the current being used.

7. Welding Difficulties

A bad weld may be caused by mechanical or electrical troubles as well as by the process variables. For example, a weaving welding wire will cause the deposit to have uneven edges, bumpiness and uncertain width. By the same token, these manifestations could be caused by a faulty positioner, erratic handling of the hopper, a worn tip or even by fluctuations in the welding power source. When all variables are properly adjusted and controlled, the weld shown in Figure 6 can be obtained.

If starting trouble is encountered when using the flexible attachment with a "UE" Head and control, it may be overcome by removing the retract start tube from the control.

NOTE: Slight chattering may be heard in the flexible tube assembly while welding. This is due to the ridges formed on the welding wire by the feed rolls. These ridges cause chattering as they pass through the reverse bend nozzle. Such chattering is normal and should be disregarded.

8. Stopping the Weld

To stop welding, lift the wire out of the weld puddle. When the weld is completed shut off the flow of UNIONMELT composition by laying the hopper on its side. Clip off the end of the welding wire about one inch from the hopper.

D. Operational Hints

Observance of the procedures outlined in Paragraphs A, B and C will result in excellent manual welds. In summation, the following operational hints
will be a definite aid in obtaining the best performance out of the Flexible Attachment.

When welding with the Flexible Attachment ALWAYS:

1. Use the proper tip for the wire size in use.
2. Use the proper nozzle and pilot for the wire and tip in use.
3. Keep the flexible hose clean and dry. Blow it out frequently with compressed dry air.
4. Use only standard spare parts and accessories.
5. Set the reel braking assembly tight enough to keep the reel from unwinding by itself but not tight enough to overload the feed motor. This is critical.
6. Set the pressure roll at the minimum pressure that will ensure positive feeding action.
7. Keep the voltage setting which maintains the arc in the 30-35 volt range.
8. Use maximum current possible for the application.
9. When inching, feed carefully but steadily. (Do not jog inching button.)
10. Keep the contacts on the current relay clean.
11. Use proper cable and wire sizes, and make sure that the ground and voltage connections are clean and tight.
12. Keep the pressure roll lubricated to ensure easy turning and avoid the sliding friction caused by binding.
13. Brush slivers and foreign matter from the feed roll periodically.
14. Round the end of the wire off before inserting it in the tube.
15. Cut off the fused end of the wire after welding to facilitate the next start.
17. Remove all fused composition before welding over another bead.
18. At the finishing end of a weld, come back about 1 in. to fill the crater and eliminate crater cracks.
19. Keep the flexible hose as straight as possible at all times, but especially when threading a new coil of wire.

REMEMBER

When welding with the Flexible Attachment observe the following precautions:

1. Don't be rough when starting to weld. A light scratch or touch will suffice.
2. Don't have more than 3/4 in. of wire protruding from the tip of the attachment.
3. Don't use wire sizes other than 3/32, 5/64 or 1/8 inch.
4. Don't use 1/8 in. unless the desired current cannot be obtained with 5/64 or 3/32 inch wire.
5. Don't use rusty or extremely dirty wire or wet welding composition.
6. Don't retract the wire into the tip without cutting the fused end off.

IV. Typical Welding Conditions

Welding current and welding voltage limitations depend upon the size of the welding wire and the maximum wire feed speed available. The maximum welding currents available are as follows:

<table>
<thead>
<tr>
<th>&quot;DS&quot; Welding Head Gears</th>
<th>1/8-inch Wire</th>
<th>5/32-inch Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Speed (12 rpm Feed Roll)</td>
<td>600 amps.</td>
<td>400 amps.</td>
</tr>
<tr>
<td>Double-Speed (24 rpm Feed Roll)</td>
<td>800 amps.</td>
<td>600 amps.</td>
</tr>
<tr>
<td>Triple-Speed (36 rpm Feed Roll)</td>
<td>800 amps.</td>
<td>600 amps.</td>
</tr>
<tr>
<td>Four-Speed (48 rpm Feed Roll)</td>
<td>-</td>
<td>800 amps.</td>
</tr>
</tbody>
</table>

*Triple-speed gears provide lower welding voltage at 600 amperes.*

Not all welding voltages are obtainable at these maximum currents. When high currents are used, the minimum available welding voltage may also be high. Welding voltage obtainable depends on the welding head feeding wire fast enough to balance the rate of melting. A feed motor operating from the welding voltage (series type control), obviously receives less power when the voltage is lower than when it is higher. When the maximum currents indicated above are used, the minimum voltage available will be in the neighborhood of 40 to 45 volts. The range of available welding voltage becomes higher and narrower as the welding current is increased.

The current rating of this equipment is based upon an average duty cycle of 50 per cent or less. It is also assumed that the equipment will not be in continuous operation for more than a few minutes at a time. With higher duty cycles, or with long periods of continuous operation, as might occur in build-up work, the maximum rating of the equipment will be lowered by excessive heating. Since 1/8-in. wire is much stiffer than 3/32-in. and decreases the flexibility of the attachment as well as increases the load on the feed motor, it is recommended that 3/32 or 5/64 in. wire always be used except when the welding current required exceeds its listed current range.

Welding conditions for various plate thicknesses and joint types are shown in Tables I through V. These conditions are designed to allow for normal
variations in the operator's technique within a reasonable range. Controlled speed of movement along the weld — i.e., fairly constant speed — is required.

The data tables are based on the use of DCRP. They are approximately correct for alternating current. Maximum currents were used in all cases within the limitations imposed by good appearance of the weld. The average wire to welding composition consumption ratio was about 1 to 1.5, A UWM-2 was used in the compilation of these results.

When applying these conditions the following general information may be helpful:

A. When butt welding, the hopper assembly should be perpendicular to the seam with the top of the hopper slightly in the direction of welding. In veed butts, a better appearance results from positioning the electrode almost directly in the vertical rather than at an inclination. See Figure 4.

B. When butt welding into a steel backing strip, the drag technique seems to give the best results. The top of the hopper should be positioned about 15 degrees off the vertical in the direction of welding.

C. When fillet welding the hopper should be positioned directly into the seam, or root, about 40 to 45 degrees from the vertical member and the top should be inclined about 10 degrees in the direction of welding. The drag technique is excellent for most fillet welds. See Figure 5.

D. The recommended position of the hopper for lap welding is an inclination of 15 degrees from the vertical and a tilt of 15 degrees in the direction of welding. The drag technique may be used here, also.

E. In the repair of simulated casting defects, gouges were made in a steel plate with these dimensions 4 to 6 in. long, 1-in. wide, and 3/4 to 1 in. deep. The sides were 5 degrees or less from the vertical. To fill these gouges required 2 to 6 oz. of wire and 6 to 15 oz. of UNIONMELT Composition for each. The time required for welding was from 30 to 90 seconds on each. This was arc time using the weave technique which completely filled the gouge in one pass. The stringer technique was temporarily abandoned after a few attempts due to the difficulty of removing the fused composition from the gouge. In the course of these tests, the coarsest mesh of all grades was tried. The wire-to-composition ratio was slightly out of proportion due to some of the gouges being completely through the simulated casting, necessitating filling in the hole prior to filling in the gouge. A wire-composition ratio of 1 to 2 is more accurate for practical purposes. The best conditions used were 380 to 400 amps, 31 volts, weaving the wire from side to side. The position of the hopper is shown in Figure 7.

V. Disassembly and Maintenance

IMPORTANT: Do not attempt to repair, or disassemble, or shorten the wire tube. Defective wire tubes should be returned to the factory for repair.

A. To Disassemble the Hopper and Nozzle

1. Remove the clamp from the bottom of the hopper assembly. (See Figure 8.)
2. Remove the guard.
3. Unscrew and remove the tip and spider.
4. Place the spider in position on the replacement tip. Then screw the tip into the nozzle.
5. Replace the guard and the clamp.

To change or replace the Nozzle Tube Assembly -
1. Remove the two screws on the handle of the hopper. (See Figure 3.)
2. Slide back the handle.
3. Unscrew the cable.
4. Remove the jam nut.
5. The insulator comes out and the Nozzle Tube Assembly may be removed.

B. Maintenance Suggestions

For dependable operation, it is essential that the Flexible Attachment wire tube be kept free of foreign material. Dirt and wire particles will eventually cause the working wire to jam, unless they are systematically removed. For this reason, the wire tube should be blown out with compressed air each time before inserting the working wire. In addition, the hopper and nozzle assembly should be dismantled periodically, as explained above, and the parts given a thorough cleaning. No oil or grease should be used in the tube or on the working wire. Such materials on the wire will increase the amount of dirt and other foreign material introduced into the tube.

The current drawn by the drive motor on the Type "DS" Head should not exceed 8 to 9 amperes. Currents substantially in excess of this are indicative of excessive friction in the wire tube or at some other point in the drive system. Pos-
sibly the wire is tangled on the reel, thereby adding to the load on the motor. In any event, if trouble is experienced with feeding the wire, the current taken by the drive motor should be measured. If it is in excess of the above values, locate the source of the extra load.

If the wire tends to chatter excessively or "machinegun," it is usually an indication of dirt or other obstruction in the tip. It is advisable to replace the tip with a new one unless it can be thoroughly cleaned. This condition is particularly apt to develop if the end of the tip becomes overheated as a result of being too close to the work, or if a small particle of fused welding composition should adhere to the end of the tip. If replacement of the tip does not correct the difficulty, then it would be well to replace the nozzle also.

If the flow of welding composition is inadequate, it may be due to particles of fused material partly obstructing the opening through the guard. In the latter case, it may be necessary to remove the guard and the spacer between the tip and the nozzle. The flow will also be seriously restricted by particles of fused material which may adhere to the inside of the guard if the tip is brought too close to the working surface. A very small quantity of fused material at this point has a relatively large effect on the flow. The remedy is to clean out the fused material, using a knife or other tool.

If the hopper becomes electrically "hot," it is probably because a short length of wire or other metallic particle has become lodged in the passage between the nozzle and the aluminum tube. This is an unsafe condition and should be investigated immediately by disassembling the hopper until the particle is found and removed. Such a condition will also be apparent by a slight inching of the wire feed motor when the contactor is closed.

If the wire feed motor inches slightly when the contactor is closed and the hopper is not electrically "hot," then the condition is probably caused by sticking of the current relay contacts. These contacts should be checked and thoroughly cleaned periodically.

VI. Precautionary Information

As in all electric welding apparatus, there are certain parts of the UNIONMELT equipment exposed to contact by the operator which are "live" and at the welding voltage potential. The parts are never at a higher potential than the open-circuit welding voltage. This does not exceed the ordinary house lighting voltage of 115 volts which generally is not considered dangerous.

Under some circumstances, however, low voltages can cause serious injury when the resistance of the electrical path through the human body is low. Such, for example, is the case when the skin of a person is wet, from perspiration or otherwise, and when the body of such person is in contact with the ground or a grounded steel plate. In addition, a shock can lead to other injuries caused by the uncontrolled physical reaction which results. Every operator should be aware of the "live" parts of the machine and should read and observe the recommended operating procedures and precautionary information.

The busbar and contact jaw assembly, the wire feed and pressure rolls, welding wire, metal wire reel frames, and sometimes the frame supports in all UNIONMELT machines are at welding-voltage potential. The gear housing and motor frame of the Type "U" Head are also at welding-voltage potential. Therefore, do not touch any of these parts unless the welding current contactor switch is "off.

The operator should be cautious in cutting off the wire end when the wire over-travels. If at all possible, he should turn the contactor switch "off," and he should always use the insulated wire cutter (Part No. 91W51) provided with the attachment. Furthermore, he should not position the machine or move it by hand or crane until the contactor switch is "off." He should form the habit of opening the main contactor as soon as he stops welding.

The conductors between the head and the control box are rubber covered and are connected inside the switch or control boxes where they cannot be contacted. Nevertheless, failure of an electrical part is possible. To prevent shocks from this cause, the control cases, switch boxes, and machine frames should be well grounded.
### VII. Table of Welding Conditions

The tables which follow have been designed as a guide in selecting and developing suitable welding voltages, currents, and speeds. Variations from the conditions given are certainly permissible and often desirable because of the characteristics of a particular application. It is recommended, however, that the edge preparations shown in the tables be followed quite closely since slight variations can have a considerable effect on the making of the welds and the results achieved with the selected welding conditions.

#### Table No. 1

**MANUAL SUBEMERGED ARC WELDING DATA**

FOR SQUARE GROOVE WELDS

<table>
<thead>
<tr>
<th>Joint Thickness (T)</th>
<th>Pass</th>
<th>Current Amps</th>
<th>Arc Voltage 4-Speed &amp; 3-Speed</th>
<th>Speed IPM 4-Speed &amp; 3-Speed</th>
<th>Speed IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/16 in.</td>
<td>1</td>
<td>340</td>
<td>30</td>
<td>30-38</td>
<td>30-38</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>460</td>
<td>33</td>
<td>30-38</td>
<td>30-38</td>
</tr>
<tr>
<td>1/4 in.</td>
<td>1</td>
<td>400</td>
<td>31</td>
<td>29-36</td>
<td>29-36</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>500</td>
<td>33</td>
<td>27-34</td>
<td>27-34</td>
</tr>
<tr>
<td>5/16 in.</td>
<td>1</td>
<td>500</td>
<td>33</td>
<td>26-32</td>
<td>26-32</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>540</td>
<td>33</td>
<td>22-28</td>
<td>22-28</td>
</tr>
<tr>
<td>3/8-in.</td>
<td>1</td>
<td>520</td>
<td>32</td>
<td>24-30</td>
<td>24-30</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>550</td>
<td>32</td>
<td>19-24</td>
<td>19-24</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>1</td>
<td>600</td>
<td>35</td>
<td>24-30</td>
<td>24-30</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>660</td>
<td>35</td>
<td>27-35</td>
<td>27-35</td>
</tr>
<tr>
<td>5/8-in.</td>
<td>1</td>
<td>650</td>
<td>37</td>
<td>22-27</td>
<td>20-25</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>675</td>
<td>37</td>
<td>25-29</td>
<td>20-25</td>
</tr>
<tr>
<td>3/4-in.</td>
<td>1</td>
<td>700</td>
<td>37</td>
<td>26-25</td>
<td>26-25</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>700</td>
<td>38</td>
<td>22-27</td>
<td>22-27</td>
</tr>
</tbody>
</table>

*All wire 3/32-in. dia.*

---

#### Table No. 2

**MANUAL SUBEMERGED ARC WELDING DATA**

FOR LAP WELDS

<table>
<thead>
<tr>
<th>THICKNESS OF LAPPING PIECES (T₁, T₂)</th>
<th>CURRENT AMPS</th>
<th>ARC VOLTAGE</th>
<th>SPEED IPM</th>
<th>LEG SIZE INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁-1/4 in. T₂-1/4 in.</td>
<td>460</td>
<td>30</td>
<td>19-24</td>
<td>1/4 in.</td>
</tr>
<tr>
<td>T₁-1/4 in. T₂-3/8 in.</td>
<td>480</td>
<td>30</td>
<td>16-20</td>
<td>5/16 in.</td>
</tr>
</tbody>
</table>

*All wire 3/32 in. dia.*

3-Speed or 4-Speed
### Table No. 3

**MANUAL SUBLERGED ARC WELDING DATA FOR SQUARE GROOVE WELDS WITH STEEL BACKING**

<table>
<thead>
<tr>
<th>JOINT THICKNESS &amp; GAP (T,G)</th>
<th>CURRENT AMPS</th>
<th>ARC VOLTAGE</th>
<th>SPEED IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4-Speed</td>
<td>3-Speed</td>
<td>4-Speed &amp; 3-Speed</td>
</tr>
<tr>
<td>T-10 GA G-3/32 in.</td>
<td>500</td>
<td>500</td>
<td>30</td>
</tr>
<tr>
<td>T-3/8 in. G-5/32 in.</td>
<td>750</td>
<td>600</td>
<td>35</td>
</tr>
<tr>
<td>T-3/8 in. G-3/16 in.</td>
<td>750</td>
<td>600</td>
<td>35</td>
</tr>
</tbody>
</table>

All wire 3/32 in. dia.

### Table No. 4

**MANUAL SUBLERGED ARC WELDING DATA FOR SINGLE & DOUBLE VEE GROOVE WELDS**

<table>
<thead>
<tr>
<th>JOINT THICKNESS (T) NOSE (N) &amp; ANGLE (A)</th>
<th>PASS</th>
<th>CURRENT AMPS</th>
<th>ARC VOLTAGE</th>
<th>SPEED IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4-Speed</td>
<td>3-Speed</td>
<td>4-Speed &amp; 3-Speed</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>700</td>
<td>600</td>
<td>35</td>
</tr>
<tr>
<td>DOUBLE VEE T-1 in. N-1/4 in. A-60°</td>
<td>1</td>
<td>700</td>
<td>600</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>700</td>
<td>600</td>
<td>37</td>
</tr>
</tbody>
</table>

All wire 3/32 in. dia.
Table No. 5

<table>
<thead>
<tr>
<th>POSITION &amp; THICKNESS(T)</th>
<th>PASS</th>
<th>CURRENT AMPS</th>
<th>ARC VOLTAGE</th>
<th>SPEED IPM</th>
<th>LEG SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORIZONTAL 3/16 in.</td>
<td>1</td>
<td>460</td>
<td>30</td>
<td>29-35</td>
<td>3/16 in.</td>
</tr>
<tr>
<td>HORIZONTAL 1/4 in.</td>
<td>1</td>
<td>460</td>
<td>30</td>
<td>19-24</td>
<td>1/4 in.</td>
</tr>
<tr>
<td>HORIZONTAL 3/8 in.</td>
<td>1</td>
<td>480</td>
<td>30</td>
<td>12-15</td>
<td>3/8 in.</td>
</tr>
<tr>
<td>HORIZONTAL 1/2 in.</td>
<td>1</td>
<td>500</td>
<td>31</td>
<td>16-20</td>
<td>5/8 in.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>500</td>
<td>31</td>
<td>16-20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>500</td>
<td>31</td>
<td>16-20</td>
<td></td>
</tr>
<tr>
<td>FLAT 3/4 in.</td>
<td>1</td>
<td>600</td>
<td>38</td>
<td>8-10</td>
<td>1/2 in.</td>
</tr>
<tr>
<td>FLAT 3/4 in.</td>
<td>#2</td>
<td>620</td>
<td>37</td>
<td>10-12</td>
<td>11/16 in.</td>
</tr>
</tbody>
</table>

*Weaving*

All wire 3/32 in. dia.

---

**FIG. 9** — Suggested Mounting of Hopper on OXWELD CM-45 Carriage
FIG. 10 — UNIONMELT Flexible Welding Attachment

01E28 (17 Ft.)
01E30 (10 Ft.)
Hardware List

FOR
FLEXIBLE WELDING ATTACHMENT
PART NOS. 01E30 (10 Ft.)
PART NOS. 01E28 (17 Ft.)

<table>
<thead>
<tr>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6110-5850</td>
<td>Screw No. 6-32 x 5/16&quot; LG Binding Head Brass Machine (2 Used)</td>
</tr>
<tr>
<td>6130-1876</td>
<td>Screw 8-32 x 1/4&quot; Round Head Machine</td>
</tr>
<tr>
<td>6130-2111</td>
<td>Screw 5/16&quot; x 18 x 1/2&quot; Oval Head Machine (2 Used)</td>
</tr>
<tr>
<td>6130-2851</td>
<td>Screw No. 6-32 x 1-3/8&quot; Oval Head Steel Machine</td>
</tr>
<tr>
<td>6133-0975</td>
<td>Screw 10-24 x 1-8&quot; Socket Headless Cup Point Setscrew</td>
</tr>
<tr>
<td>6310-0862</td>
<td>Hex Brass Nut No. 6-32 (2 Used)</td>
</tr>
<tr>
<td>6314-0184</td>
<td>Hex Brass Jam Nut 1/2&quot; x 20</td>
</tr>
<tr>
<td>6320-0868</td>
<td>Hex Nut No. 8-32</td>
</tr>
<tr>
<td>6420-7712</td>
<td>Lock Washer No. 6 Shakeproof Type No. 1106 (2 Used)</td>
</tr>
<tr>
<td>6520-0106</td>
<td>Drive Rivet No. 38-105-04-11 South Co.</td>
</tr>
<tr>
<td>6520-0580</td>
<td>Drive Rivet No. 38-105-16-11 South Co.</td>
</tr>
</tbody>
</table>

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DIVISION OF UNION CARBIDE CORPORATION
General Office: New York
Offices in Principal Cities

In Canada: UNION CARBIDE CANADA LIMITED, Linde Gases Division, Toronto
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