INSTRUCTIONS FOR THE
OPERATION AND MAINTENANCE
of the

Oxweld
Trade-Mark

CMA-37-J
UNIVERSAL STRESS-RELIEVING
MACHINE ATTACHMENT

(Part Number 2A-216949)

CMA-37-J
STRESS-RELIEVING

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I. GENERAL

Description

When steel plates are welded, residual welding stresses of high magnitude develop in or near the welded seams. Low-Temperature Stress-Relieving is a process to reduce or eliminate these stresses. The CMA-37-J Attachment, mounted on an OXWELD CM-37 Machine Carriage, is a complete Stress-Relieving Machine for the controlled, mechanized application of the process.

This Stress-Relieving Machine can be used to stress-relieve butt and fillet welds in all positions. In shipbuilding, for example, it can be used for ship bottoms, gunwales, sides, hulls, and bilges. It can be used for the down-hand stress-relieving of flat plates. It can also be adjusted for the stress-relieving of positions below the level of the machine.

The main body of the Stress-Relieving Machine consists of two tube assemblies, one of which is a blowpipe supporting tube and the other a carrier-extension tube. Acetylene and oxygen lines lead to an OXWELD V-27 Quick-Acting Shutoff Valve mounted on the base of the machine. OXWELD W-40 Machine Welding Blowpipes—equipped with special mixer stems and E-6 Stress-Relieving Heads—mount in adjustable blowpipe holders. Hand wheels enable the blowpipes and tube assemblies to be adjusted as may be desired.

Stress-Relieving Temperatures

The application of Low-Temperature Stress-Relieving to remove residual welding stresses consists of:

1. Heating a narrow zone (6-in. wide with the centerline of the heated area 5-in. from the centerline of the weld) on each side of the weld to about 300 deg. F., above the original temperature of the steel. The temperature of the weld itself remains at or near its original temperature during treatment.

2. Using water cooling 6 to 8 in. back of the advancing flames to bring the steel back to normal temperature.

A temperature difference of about 300 deg. F., between ambient* and maximum heated-zone temperatures gives satisfactory stress relief. Therefore, in stress relieving during warm or hot weather, the maximum heated-zone temperature should range from 350 to 400 deg. F. During cold weather, however, when the ambient temperature may drop to below 40 deg. F., the maximum heated-zone temperature should be between 300 and 350 deg. F. In all cases, the desired stress-relieving temperature is obtained by adjusting the rate of machine travel—not by altering the position or height of the stress-relieving heads or by changing the gas flow.

Temperature Measurements

"Templasts" (temperature-indicating crayons) are used to determine temperatures of heated zones.

"Templasts" (paint-like materials) may be used for the same purpose. Generally 350, 400, and 450-deg. F. "Templasts" or "Templas" are required.

Apply the required "Templastik" or "Templas" at right angles to and across the heated zone on the side opposite to the surface being heated if at all possible. If the temperature indicators melt, measure the lengths of the melted sections. The measured lengths should correspond to the widths of the temperature bands listed in Table 1.

It may be difficult to measure the temperatures of the plate on the side opposite the surface being heated. If so, protect the hands and without stopping the machine place an asbestos or transit board (about 6 or 8 in. square) immediately behind one heating head and in a plane square to the plate in order to momentarily blanket off the flame from the area it has just passed over. Next, quickly strike the now protected heated surface with 350, and 400-deg. F., "Templastik." Quickly measure or estimate the heated bands. Another method consists of momentarily shutting off the flames without stopping the forward motion of the machine and, at the same time, quickly determining the temperature of the heated area with "Templastik."

Adjustments of the Stress-Relieving Machine to Different Positions

The Stress-Relieving Machine is easy to operate. Its ease of operation, however, calls for an understanding of all the mechanical adjustments which are possible. All such adjustments can be quickly learned by assembling the Stress-Relieving Machine for vertical stress-relieving (see Figures 1 and 2) and referring to the following:


(a) Parts Affecting Frame-Shaft Movements

Carrier-Extension Tube Assembly (A)—supports blowpipe-supporting tube assembly (B).

Tube Assembly (B)—supports blowpipes, stress-relieving heads and quench heads.

Holder (C)—positions tube assembly (A) relative to the cross-slide mounting plate (E). Movement is provided in a plant perpendicular to the lengthwise axis of the cross-slide assembly.

Holder (D)—attached tube assembly (B) to carrier-extension tube (A).

Plate (E)—supports carrier-extension tube (A). Plate (E) is bolted to a standard cross-slide assembly for a CM-37 Machine Carriage. The cross-slide is moved at right angles to the machine carriage by means of a crank on one end of the cross-slide.

Handwheels (1 and 2)—control the movement of tube assembly (B) relative to carrier-extension tube (A).

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*Ambient temperature is the original temperature of the steel (or the temperature of the surrounding air) just before stress-relieving is carried out.

**Table I indicates conditions necessary to maintain desired temperature differences.

The term "Oxweld" is a registered trade-mark of Union Carbide and Carbon Corporation.
Large nuts on holders (C and D) when loosened permit a pivoting action of the holders. As a result, tube assembly (B) as seen in Figure 1 can swing down and out from carrier-extension tube (A) when nut (3) is loosened. Carrier-extension tube (A), on the other hand, can be swung downwards through 180 deg. arc parallel to the track for the CM-37 Machine Carriage. Carrier-extension tube (A) can be removed from holder (C) after loosening the clamping screws of the holder.

Plate (E) can be mounted on the cross-slide at right angles to its position in Figures 1 and 2.

(b) Typical Tube-Assembly Arrangements

The tube assemblies can be arranged to meet the needs of many different stress-relieving operations. Many of the arrangements which are possible will be suggested by a close study of the illustrations in this book and of the machine itself.

When changing the arrangement of the tube assemblies to meet the needs of different stress-relieving operations, precautions must be taken to prevent:

c. The arrangement from restricting the proper adjustment of the blowpipes, stress-relieving heads and quench heads or spray.


Handwheels (4 and 5) control the movement of the E-6 Stress-Relieving Heads (6). Handwheels (4) move the individual E-6 Heads across the weld area so they can be positioned 10 in. between centers.

Handwheels (5) move the E-6 Heads in and out from the plate in a direction perpendicular to the plate surface. Handwheel (2) moves tube assembly (B) and thereby aligns the two E-6 Heads with respect to the lengthwise axis of the weld.

3. Adjustment of the Water Spray and Quench Heads.

The water spray (7) is used only in vertical (or side) stress-relieving. For all other stress-relieving operations, quench heads—ones behind each E-6 Head—must be used. (See Figure 4—quench heads are directly behind the E-6 Heads.)

The water spray (7) is attached to the water tube (8). Clamp (9) which is attached to the blowpipe mixer tube (10) supports the water tube. Nut (11), when loosened, allows the water spray to be properly aligned with respect to the E-6 Heads (6).

To install the two quench heads as shown in Figure 4, do the following:

(a) Remove the water spray (7) shown in Figure 1, after loosening nut (11).
(b) Use a clamp, similar to (9) in Figure 1, to mount a water tube on the lower mixer tube in the same way that the upper water tube (8) mounts on mixer tube (10).
(c) Screw the two water-quench heads in the two water tubes. The water-quench heads must be parallel to the E-6 Heads.

Assembly of the Stress-Relieving Machine

The easiest way to assemble the Stress-Relieving Machine is to refer from the respective parts, as they are unpacked, to the different illustrations in this book. The illustrations are keyed for ready reference. Visual comparison of the parts and of these same parts as illustrated will indicate how they should be assembled with respect to the position desired.

II. AUXILIARY EQUIPMENT, GAS, AND WATER SUPPLY

Auxiliary Equipment

1. CM-37 MACHINE CARRIAGE

The CM-37 Standard Machine Carriage, Part No. 01E16, and the Cross-Slide Assembly, Part No. 20X73, and the tracks (see below) on which the CM-37 Machine Carriage runs must be ordered separately. The CM-37 Machine Carriage has a speed range from 4 to 50 in. per minute. It operates on 115 volts 60 cycles a.c.

2. TRACKS

Three or four 6-ft. sections of track are needed. These tracks should be manually aligned with the weld being stress relieved to minimize transverse and vertical adjustment during treatment.

Gases

1. ACETYLENE

Either generator or cylinder acetylene may be used. In either case, a minimum pressure of 9 psi is required at the machine after lighting the stress-relieving heads. The flow should approximate 250 cfm.

When cylinders are used, at least 5 cylinders must be manifolded to a single outlet for each Stress-Relieving Machine.

3/8-in. supply hose is satisfactory unless supply hose lengths exceed 100-ft. One-half inch hose is recommended for lengths exceeding 100-ft. When several hundred feet of hose are to be used with generated acetylene, not more than 50-ft. of 3/8-in. hose are to be connected to the machine. The rest is to be 3/4-in. hose.

2. OXYGEN

Pipe-line or cylinder oxygen may be used. When cylinders are used, at least two cylinders should be manifolded together for each machine. 3/8-in. supply hose is satisfactory.

Water

About 300 gallons of water per hour are required to supply two quench heads per Stress-Relieving Machine.

*For hand-propelled stress relieving (see setup illustrated in Figure 4) an air-water spray is recommended. This will reduce the amount of water used, and a fine mist will be directed down and back, 6 to 8-in behind the advancing flames so that water will not prematurely run ahead into the heated area. This can be done by ordering 3 extra oxygen "Y" connections, Part No. 3798, and an oxygen needle valve, Part No. 3395, and hooking up a 3/8-in. oxygen hose line to the air supply and connecting to the water stems (8).
III. PREPARATION FOR OPERATION

Gas-Supply Lines
(See Figure 2 for Connections.)

1. Attach acetylene supply line to acetylene connection (12).
2. Remove oxygen plug (13) and attach oxygen line.
3. Connect acetylene hose from (14) to (15) and from (16) to (17).
4. Connect oxygen hose from (18) to (19), from (20) to (21), and from (22) to (23).

NOTE: The acetylene gauge (24) indicates acetylene pressure at the machine, and an OXWELD R-37 Oxygen Regulator (25) controls and indicates oxygen pressures. During operation, the OXWELD V-27 Quick-Acting Shutoff Valve (28) is used to turn the gas on and off. The throttle valves (27 and 28) are used to equalize the gas flow to each head and to make minor adjustments to the flame length. The minimum length of hose leading from the throttle valves to the W-40 Blowpipes (29) is 30 inches.

Water-Spray Hook-Up

1. Attach the water supply line to the water inlet pipe (30).
2. Connect points (31) and (32) with 3/8-in. standard black air-water hose.
3. When two quench heads are used, open the plugged valve water outlet (33) and connect with a suitable length of standard black hose, to the inlet of the second water tube.

NOTE: Globe Valve (34) controls the flow of water to the water spray (7).

FIGURE 1
A—Carrier-Extension-Tube Assembly
B—Tube Assembly
C—Holder
D—Holder
E—Plate
1-Handwheel
2-Handwheel
3-Nut
4-Handwheel
5-Handwheel
6-E-6 Stress-Relieving Head
7-Water Spray
8-Water-Tube
9-Clamp
10-Blowpipe Mixer Tube
11-Nut

FIGURE 2
12-Acetylene Connection
13-Oxygen Plug
14-Acetylene Connection
15-Acetylene Connection
16-Acetylene Connection
17-Acetylene Connection
18-Oxygen Connection
19-Oxygen Connection
20-Oxygen Connection
21-Oxygen Connection
22-Oxygen Connection
23-Oxygen Connection
24-Acetylene Throttle Valve
25-R-37 Oxygen Regulator
26-V-27 Shutoff Valve
27-Oxygen Connection
28-Oxygen Throttle Valve
29-W-40 Blowpipe Body
30-Water Inlet Pipe
31-Water Connection
32-Water Connection
33-Water Outlet
34-Globe Valve
### Table I
OPERATING DATA FOR STRESS-RELIEVING WITH E-6 HEADS; OXYGEN AND ACETYLENE PRESSURES ARE 11-12 PSI

<table>
<thead>
<tr>
<th>Plate Thickness (in.)</th>
<th>Speed (IPM)</th>
<th>Heating Head Centerline Distance (in.)</th>
<th>Temperature Band*</th>
<th>Width (in.)</th>
<th>Plate Underside</th>
<th>Plate Top</th>
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<tr>
<td>1/2</td>
<td>24</td>
<td>10</td>
<td>350</td>
<td>4</td>
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<td>None</td>
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<tr>
<td>5/8</td>
<td>20</td>
<td>10</td>
<td>350</td>
<td>5</td>
<td>None</td>
<td>None</td>
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<tr>
<td>3/4</td>
<td>16⅔</td>
<td>10</td>
<td>350</td>
<td>Trace</td>
<td>None</td>
<td>None</td>
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<tr>
<td>7/8</td>
<td>13</td>
<td>10</td>
<td>350</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>10</td>
<td>350</td>
<td>5⅔</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>1-1/4</td>
<td>9</td>
<td>10</td>
<td>350</td>
<td>5</td>
<td>None</td>
<td>None</td>
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</table>

*Maximum temperature of heat bands are for summer and moderate atmospheric temperature conditions. For winter, reduce maximum temperature approximately 10 deg. F.

**Note:** Paint or heavy rust such as exists on ship decks that have been in service must be removed for at least 8-in. on each side of the weld. Chipping hammer should be used, if necessary. Ordinary mill scale on new plates need not be removed as this does not interfere with the proper heating.

### IV. Operating Procedures

To Light E-6 Stress-Relieving Heads

1. Adjust the acetylene supply pressure so that the acetylene pressure at gauge (24) is at least between 11-12 psi.
2. Adjust the R-37 Oxygen Regulator so that the oxygen pressure at the regulator is between 11-12 psi.
3. Adjust the acetylene throttle valves (27) wide, and open the oxygen valves (28) only slightly. Open the V-27 shutoff valve (26) and quickly light the stress-relieving heads (with a gas flame, if necessary). Immediately open the oxygen throttle valves (28) until the flames are neutral.
4. For maximum heating efficiency, flames must show a slight tendency to "blow off"—that is, there must be a very slight line of separation visible between some of the flames and the flame ports. If, after adjusting the flames to neutral (see Step 3), the flames do not show a tendency to "blow off," increase the acetylene and oxygen supply pressures until "blow off" is secured.
5. If the flames "blow off" excessively after first lighting the heads (see Step 3), close down throttle valves (27 and 28) just enough to obtain the desired condition. The acetylene and oxygen pressures must be at no less than 9 psi when the heads are burning.

**Initial Procedures**

1. Mount the Stress-Relieving Machine on the CM-37 Machine Carriage and connect suitable outlets to power, water, and gas-supply sources. Observe all practices recommended for the safe handling of oxygen and acetylene equipment.
2. To avoid overheating the structure being treated during flame adjustment, place a piece of 1/2-in. or 1/4-in. steel under the E-6 Stress-Relieving Heads. An alternative is to adjust tube assembly (B) so that flame from E-6 Heads (6) is directed away from welded surface.
3. Light the E-6 Heads and adjust the acetylene and oxygen pressures until there is a slight tendency for the flame to "blow off." (See instructions, TO LIGHT E-6 STRESS-RELIEVING HEADS, on this page.)
4. Use the V-27 Quick-Acting Shutoff Valve (26) to turn off gases—flames will be properly adjusted on relighting.
5. Test water spray (7) for volume and direction. (See Figure 1.) If quench heads are used instead (as illustrated in Figure 4), the water spray should impinge 6 to 8 in. behind the E-6 Heads.
6. Adjust E-6 Heads so that skid is about 1/4-in. from the welded plate.
7. Check the position of the E-6 Heads. The blow-pipes to each E-6 Head should be 10-in. apart, also equally and symmetrically spaced on each side of the weld.
8. Adjust water spray (7).
9. Check the speed of the CM-37 Machine Carriage. Refer to Table 1 for the proper speed corresponding to the plate thickness being treated.
10. Check to see that the water will not run ahead of the quench heads into the heated area.

### Actual Operation

1. Light the E-6 Heads.
3. Turn on the water quench.
4. Lift air hoses, welding cables, electric lines, etc., from the path of the Stress-Relieving Machine.
5. Do not allow supply hoses to slow down the Stress-Relieving Machine—if necessary, manually support supply hoses to prevent drag on the CM-37 Machine Carriage.
6. Periodically check speeds using a watch and ruler. Also check temperatures using "Templists" or "Templiases." See Table 1 for speeds necessary for satisfactory stress-relieving.
7. If it is necessary to interrupt stress-relieving operations, turn off the burning gases but allow the machine to travel until the quench has cooled the heated zones.
8. When restarting the operation after an interruption, overlap the area previously treated by 4 to 6 inches. Also overlap when tying into a portion of a seam previously treated.
V. MAINTENANCE

CAUTION: Do NOT allow oil or grease to come in contact with oxygen or acetylene connections, hose, or E-6 Stress-Relieving Heads.

E-6 Stress-Relieving Heads

The E-6 Stress-Relieving Heads must always be clean and in good working condition. An extra set of clean heads is recommended to keep work interruptions at a minimum. To clean heads, use:

1. Only the proper size cleaning drills.*
2. OXWELD nozzle cleaning compound periodically.

When cleaning the head, place it in a 40 to 1 solution of the OXWELD nozzle cleaning compound for eight hours. The solution can be prepared by mixing one portion of the compound with 40 portions of water in a glass or crock container. After cleaning the head in this solution, be sure to rinse it thoroughly in clear water. Failure to rinse the head thoroughly may cause the cleaning compound to precipitate as a salt inside the head or flame ports and thereby cause clogging.

Water Spray

1. Clean plugged holes immediately.
2. If the supply water is unreasonably dirty, install a strainer in the water-inlet line.

Lubrication Of CM-37 Machine Carriage

See Instruction Book which accompanies CM-37 Machine Carriage.

*The sketch below shows cleaning drill sizes.

![Diagram showing drill sizes](image)

NOTE: Do not use wire to ream flame ports. Use air flowing through the head to blow loose particles of dirt from the head. Never force a drill into a flame port; use a smaller size drill if necessary. Be careful not to bell-mouth the flame ports.
VI. PARTS AVAILABLE FOR REPLACEMENT

<table>
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<th>Ref. No.</th>
<th>Description</th>
<th>Part No.</th>
<th>Ref. No.</th>
<th>Description</th>
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<td>(See Fig. 4)</td>
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<td>1</td>
<td>E-6 Low-Temperature Stress-Relieving Head</td>
<td>21X46</td>
<td>37</td>
<td>1/2-in. Std. Mall. Iron Elbow- Banded</td>
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<td>2</td>
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<td>1/2-in. Std. Steel Pipe Galv.</td>
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<td>1/4-in. Std. Mall. Iron Tee- Banded</td>
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<td>5</td>
<td>Quench Head (Water Spray, Part No. C-216948, is used for vertical stress-relieving)</td>
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<td>1/4-in. Std. Steel Pipe Nipple-- 3-in. lg. Black</td>
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<td>7</td>
<td>Water Spray Bracket</td>
<td>D-153378</td>
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<td>5/8-in.-18 Hex. Nut, Steel</td>
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<td>Blowpipe Adjusting Rack Assembly (R. H.)</td>
<td>D-153393</td>
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<td>5/8-in. Std. S.A.E. Plain Washer</td>
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<td>Blowpipe Holder Assembly</td>
<td>D-216942</td>
<td>48</td>
<td>1/4-in. Std. Steel Lock Washer</td>
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<td>Mixer Tube Assembly</td>
<td>16Y89</td>
<td>49</td>
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<td>3395</td>
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<td>89A72</td>
<td>51</td>
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<td>87A02</td>
<td>52</td>
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<td>V-27 Quick-Acting Shutoff Valve</td>
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<td>26Y14</td>
<td>-</td>
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<td>Oxygen Hose Connection (with Plug)</td>
<td>8697</td>
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*See Instruction Book (F-3053) for R-37 Regulator Replacement Parts.*
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<td>90-deg. ‘B’ Size Oxygen Elbow</td>
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<td>90-deg. ‘B’ Size Acetylene Elbow</td>
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<td>(Cut to Suit)</td>
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</tr>
</tbody>
</table>