Linear Vibration Welder
Model VWB-3500/3700/3900

User’s Manual
# Revision History

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- Key Vibration Welder Features

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Important User Information

Read This Manual First
Before operating the Linear Vibration Welder, read this User’s Manual to become familiar with the system. This will ensure correct and safe operation. The manual is organized to allow you to learn how to safely operate this system. The examples given are chosen for their simplicity to illustrate basic setup procedures.

Notes and Tips
Throughout this manual we use NOTES to provide information that is important for the successful application and understanding of the system. A NOTE block is shown to the right.

Cautions and Warnings
In addition, we use special notices to make you aware of safety considerations. These are the CAUTION and WARNING blocks as shown here. They represent increasing levels of important information. These statements help you to identify and avoid hazards and recognize the consequences. Different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a general condition or practice, an electrical safety issue, a hand protection issue or other condition.

Drawings and Tables
The figures and tables are identified by the section number followed by a sequence number. The sequence number begins with one in each section. The figures and tables are numbered separately. The figures use arabic sequence numbers (e.g. –1, –2, –3) while the tables use roman sequence numerals (e.g. –I, –II, –III). As an example, Figure 3–2 would be the second illustration in section three while Table 3—II would be the second table in section three.
Linear Vibration Welder Overview

The vibration welder excels at joining large assemblies and parts made from glass–filled and high performance plastics. The VWB3x00 (Vibration Welder 3500/3700/3900) family is Dukane’s second generation of linear vibration welder. These new systems all share the same basic mechanical components, software and electronic controls.

The VWB3X00 differences are in the size of tooling they can accommodate. The tooling capacity for each model is:

- VWB3500 ......... 38-inches wide by 18-inches deep
  \[ 965 \text{ mm wide by } 457 \text{ mm deep} \]
- VWB3700 .......... 52-inches wide by 24-inches deep
  \[ 1320 \text{ mm wide by } 610 \text{ mm deep} \]
- VWB3900 .......... 72-inches wide by 24-inches deep
  \[ 1830 \text{ mm wide by } 610 \text{ mm deep} \]

All VWB3x00 models have the same vertical clearance of 26 inches (660 mm) between the lift table and upper springs, and a 20–inch (508 mm) stroke. Unlike competing machines, the upper vibration spring is not held in place by a swing frame. It incorporates a frameless design which has less vibrating mass to accommodate heavier tooling and provide additional tooling clearance.

The hydraulic system uses a commercial, readily-available, self-contained system to allow customer replacement and minimize costly field service calls. The new and larger color operator interface is also a commercial unit containing Dukane’s field–tested and proven control software and interface. Every subassembly has been selected to provide the maximum reliability with a long and economical service life. The electrical cabinet has been redesigned to increase reliability, minimize emissions and meet the applicable CE regulations.
Key VWB3x00 Features

• **Color Touch–Screen Display** uses Color Active Matrix Thin–Film Transistors (TFT) for high contrast and wide viewing angle even under high ambient–lighting conditions. The 128 touch–cells, 10 programmable function keys plus keypad and field–replaceable backlight provide high performance in a reliable interface.

• **English or Spanish** menus shorten training time, reduce operator errors and broaden the usefulness of the machine.

• **Built In Help Menus** accelerate the learning process. Command explanations and process assistance can be immediately accessed through the touch screen.

• **Built In Diagnostics** minimize down time. Custom automation outputs are a standard feature.

• **Tooling Automation Capability** options include pick–and–place systems, conveyor pass–through and/or part feed systems. Control for automation can be added to the core software.

• **Digital Auto–Tuning** accurately and automatically adjusts the frequency of the magnetic drivers to within 0.1 Hz. This provides optimum performance for each separate tooling assembly.

• **Eliminating the Swing–Frame** reduces the mass of the upper tooling bridge. This permits the welder to handle a wider range of tooling weights. It also provides more clearance for tooling.

• **Optimized Magnetic Drive Heads** enable the welder to handle heavier tooling at higher frequencies than competing units, with resulting shorter weld times.

• **Commercial Subassemblies** are used ensure a longer and more economical service life, than units built with proprietary components. These readily available items also lessen the need for expensive field service calls.

• **Reinforced Subframe** and four ultra–rigid guide rails resist side loads and provide greater stability. This results in more accurate and repeatable lift table positioning.

(continued on next page)
• **Digital Linear Encoder** is directly attached to the lift table to accurately measure and control the table’s position to within 0.01mm (0.0004 inch).

• **Hydraulic Lift/Clamp System** is self-contained. Uses standard off the shelf components for ease of maintenance.

• **Weld By Time or Distance** is standard (either absolute or meltdown). Built in sensors give you the choice of triggering by position or by force.

• **Parameter Monitoring** with programmable upper and lower limits of time, distance, amplitude and force.
Safety Considerations

- General Safety Tips
- Plastics Health Notice
- Electrical Safety
- Pneumatic Safety
- Operational Safety
- Hydraulic Safety

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Health and Safety Tips

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your welder. In this manual, the term *welder* and/or *machine* both refer to the *Linear Vibration Welder*.

**Proper Installation** - Only operate the welder after all tooling is installed, and the hydraulic, pneumatic and electrical systems are properly checked out.

**No Unauthorized Modifications** - Do not modify your welder in any way unless authorized to do so by Dukane Corporation. Unauthorized modifications may cause injury to the operator and/or equipment damage. In addition, unauthorized modifications will void the equipment warranty.

**Keep the Service Doors Closed** - Do not bypass or remove any interlocks unless specifically directed to do so by Dukane Corporation. The magnetic drivers produce high electrical voltages which could cause injury or death.

**Grounded Electrical Power** - Operate this equipment only with a properly grounded electrical connection. Refer to the NEMA L16–30 wiring diagram in Figure 2–2 on the next page. If there is any question about the grounding of your AC power, have it checked by a qualified electrician.

**Comply with Regulations** - You may be required to add accessories to bring the system into compliance with applicable OSHA regulations for machine guarding and noise exposure.

**Operate Safely** – Do not operate the welder if under the influence of alcohol or drugs. Read the warning labels on prescriptions to determine if your judgement or reflexes are impaired while taking drugs. If there is any doubt, do not operate the machine.

IMPORTANT

Never operate the Vibration Welder with any of the service doors open. This is an unsafe practice and can result in injury.
Plastics Health Notice

Before using any Dukane welding system, be sure you are familiar with OSHA regulations from the U.S. Department of Labor about the particular type of plastic(s) you are using.

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.

Electrical Safety

AC Power Receptacle

The power cord used on the Dukane Vibration Welder has a three–pole, four–blade, grounding type plug designed for 3–Phase 480 VAC at 30 Amps. The 480 VAC 3–Phase plug configuration is shown in Figure 2–1. It is designed to be plugged into a 480 VAC, 3–Phase, 30 Amp, NEMA type L16–30R receptacle as shown in Figure 2–2. Do not alter the plug or receptacle in any way. Do not use an extension cord. If there is any question about the grounding or phasing of your AC power, have it checked by a qualified electrician. See custom input voltage note in Section 13 – Specifications/AC Power.

AC Power Disconnect

Always turn off the AC Power at the Disconnect Switch before opening any of the service doors or attempting any maintenance on the welder. The recommended practice is to also tag and lockout the disconnect switch. The CE–compliant AC disconnect is standard. Turn the switch to the off position as shown, then pull the center horizontal bar out to insert a lockout as shown in Figure 2–3. The handle–style AC disconnect, which is also available, is shown in Figure 2–4 with a lockout a tag.

Electrical Cabinet Door

The electrical cabinet service door is mechanically interlocked to the CE–compliant AC power disconnect. The cabinet door cannot be opened without first turning off the AC power.
Pneumatic Safety

Always isolate and lockout the compressed air before performing any maintenance on the vibration welder. The isolation and lockout device is shown in Figure 2–5. The safety isolation device is installed externally, and is in series with the internal compressed air filter. When activated, this device will isolate the compressed air supply from the air filter and pneumatic actuators in the welder. This device complies with OSHA regulations.

Compressed air can develop a considerable amount of force. The force is large enough to inflict serious injury. The Vibration Welder uses two air cylinders which convert the air pressure to mechanical movement for opening and closing the front access door.

With the rear service doors open, you can see the compressed air filter and pressure regulator on the left side. This is shown in Figure 2–6. The filtered air is fed to the air distribution manifold and pneumatic valves. Refer to Section 11 – Maintenance for information on, and the procedure for replacing the filter element.

IMPORTANT
Never operate the Vibration Welder with the electrical service door open. This is an unsafe practice and can result in injury.
Operational Safety

The service doors are interlocked to prevent access while the welder is energized. If either of the hydraulic doors are opened, the vibration welder will shut down. The electrical cabinet service door is shown in Figure 2–7. It cannot be opened without first turning off the CE-compliant AC disconnect. The rear hydraulic service doors are identified in Figure 2–8.

The front loading area is protected by a sliding access door. This door is operated by two air cylinders which are driven by compressed air. The door raises at the start of a welding cycle to prevent access to the tooling and lift table. The door also serves as part of the sound enclosure. Sensors on the access door will stop the welder if the compressed air fails and allows the door to open partially during a weld cycle.

The safety light–curtains prevent any access to the loading area once the machine cycle has started and before the access door is fully closed. Breaking the light beam while the door is in transition will cause the hydraulic system to shut down and the machine to halt operation. The light curtains are identified in Figure 2–7.
Hydraulic Safety

The hydraulic system is self-contained. It normally operates at between 1,000 and 1,200 p.s.i. It is however capable of operating up to 2,000 p.s.i. It is unsafe to attempt to bypass the interlocks and operate the welder with the rear service doors open. The interlocks are located at the top of the electrical and both hydraulic service doors. Figure 2–9 shows a door interlock device and the mating receptacle in the cabinet.

The Vibration Welder may be shipped with the hydraulic fluid reservoir full or drained, depending on whether the destination is local or international. Before operating the welder, hydraulic fluid must be added to the reservoir if it is empty. This is covered in the next Section 3 – Unpacking and Setup.

Figure 2–8 Rear Hydraulic Service Doors

IMPORTANT

Never operate the Vibration Welder with the rear service doors open. This is an unsafe practice and can result in injury. The rear service doors also serve as acoustic shields.

Figure 2–9 Rear Service Door Interlocks
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Unpacking & Setup

- Unpacking
- Welder Placement
- AC Power
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Unpacking

The Vibration Welder is normally shipped on a skid with tie–down boards inserted through the forklift channels and bolted to the skid (see Figure 3–1). If tooling was ordered, it may be left installed if the alignment is complex. If the tooling is heavy, it may be removed from the welder and packaged separately. The welder may be shipped with the hydraulic fluid reservoir full or drained, depending on whether the destination is local or international. The operating manual is located in a pocket at the inside bottom of the door of the electrical service cabinet (see Figure 3–2). Store the manual here for safe keeping and future reference. The forklift channel cover plates are also in a box in the electrical cabinet.

Welder Placement

Ventilation

When plastic materials are being processed, they may emit fumes and/or gases that could be hazardous. Make sure you have adequate ventilation whenever these plastics are processed.

Part Handling Considerations

Allow space on either side of the Vibration Welder for material handling, work pieces and fixtures. Consider whether the operator is sitting or standing. The operator should be at a comfortable height relative to the activation switches to prevent operator fatigue. Provide ample room so the movement of the operator does not interfere with part handling. Also allow room for future expansion of automation equipment or pass–through conveyor systems.

Energy Sources

The Vibration Welder requires 480 Volts AC, 3–Phase, 30–Amp electrical power. The welder also requires a supply of clean, dry, compressed air at 75 to 90 psi (0.52 to 0.62 MegaPascal or 5.1 to 6.1 Bar).
Floor Area

The floor area required for the Vibration Welder depends on the model number and capacity of the machine. Detailed dimensions are given in Section 13 – Specifications. The left side of the welder does not require access and can be placed close to a wall if desired. The front of the welder should have a minimum clear space of at least 36–inches for the operator work area. The total minimum recommended floor area is listed in Table 3—I.

<table>
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<tr>
<th>MODEL NO.</th>
<th>WIDTH</th>
<th>DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>VWB3500</td>
<td>125 inches</td>
<td>105 inches</td>
</tr>
<tr>
<td></td>
<td>3.18 meter</td>
<td>2.67 meter</td>
</tr>
<tr>
<td>VWB3700–1 w/24-inch Rear Service Doors</td>
<td>143 inches</td>
<td>112 inches</td>
</tr>
<tr>
<td></td>
<td>3.63 meter</td>
<td>2.84 meter</td>
</tr>
<tr>
<td>VWB3700–2 w/29-inch Rear Service Doors</td>
<td>143 inches</td>
<td>117 inches</td>
</tr>
<tr>
<td></td>
<td>3.63 meter</td>
<td>2.97 meter</td>
</tr>
<tr>
<td>VWB3900</td>
<td>163 inches</td>
<td>127 inches</td>
</tr>
<tr>
<td></td>
<td>4.14 meter</td>
<td>3.23 meter</td>
</tr>
</tbody>
</table>

Table 3—I Minimum Floor Area By Model Number

Forklift Channels

The Vibration Welder has built–in forklift channels. Cover plates for the front and rear channels are supplied. The front channels are shown in Figure 3–3. Directly above the channels the red stenciling reads LIFT HERE. The rear forklift channels are shown in Figure 3–4 without the cover plates installed. During shipping, tie–down boards are inserted through these channels to secure the welder to the skid as shown in Figure 3–1. To determine the forklift requirements, refer to Section 13 – Specifications, for the approximate weight of the machine.

Once the welder is positioned in its final location, secure the four cover plates over the front and rear forklift channels. The cover plates have 1.5 inches of sound–absorbing foam on their back to act as acoustic dampers to reduce the reverberations emitted from the forklift channels. The covers are shown in Figure 3–5. The covers must be installed so the vibration welder will meet the specified sound emission requirements of 80 dBA during operation.

**IMPORTANT**
Do not operate the Vibration Welder without the front and rear forklift channel cover plates. These plates serve as acoustic dampers to reduce the reverberations from the steel channels.
Leveling
The Vibration Welder is leveled at the factory. The feet are self-leveling to an extent. If your floor is close to level, no adjustment should be required. You should however check the lift table with a 3–foot carpenters level to verify the trueness of the machine’s level. We recommend that the Vibration Welder be leveled to within one–half degree. One–half of a degree corresponds to approximately five–sixteenths of an inch vertical deviation across 36–inches or 9mm over 1000mm \((\tan 0.5^\circ = 0.00873)\). If any adjustment is required, the feet have lock nuts on threaded studs to level the welder.

AC Power

AC Requirements
The Vibration Welder requires a grounded 480 Volt AC, 3–Phase, 30–Amp NEMA L16–30R style outlet. Refer to Figure 2–2 for the receptacle wiring configuration. The power cord supplied is approximately 14–feet long, and exits from the top rear of the welder cabinet, so the 480 VAC outlet needs to be close to the machine. Consult your local electrical guidelines to determine if the machine can be operated with a power cord plugged into an outlet, or if it needs to be hardwired to a 480 Volt circuit. For safety and reliability considerations, the machine should be permanently wired inside electrical conduit to a 480 Volt circuit. A minimum of 10–Gauge wire is recommended to safely handle the 30-Amp welder current.

**IMPORTANT**
Always turn off the AC power at the main disconnect switch before servicing or working on the welder. Failure to turn off the AC power is an unsafe practice and can result in injury or death.
AC Disconnect Switch

The AC power cord is directly connected internally to the AC disconnect switch. To turn the AC power OFF, twist the red circular knob counterclockwise ⦿ until it is pointing left to the Green OFF position as shown in Figure 3–6.

To turn the AC power ON, twist the red knob clockwise ⦿ until it is pointing up as shown in Figure 3–7.

Disengaging Switch Coupling

To open the electrical cabinet, the CE–compliant disconnect switch must in the OFF position as shown in Figure 3–6. First, unlock the door handle if it is locked. Pull the door handle out and then twist it to the left ⦿. This will release the door latch. Then, press the yellow tab on the disconnect housing against the red knob while keeping the switch in the OFF position as shown in Figure 3–8. This will release the knob coupling from the disconnect shaft and allow you to pull the door open.

To close the door, press the yellow tab on the disconnect housing against the red knob while keeping the switch in the OFF position. This opens the coupling lock. Push the door closed to engage the coupling, but do not force the it. When the shaft coupling is engaged, release the yellow tab. Then, twist the door handle back to the right and push the handle in to latch the door securely.
Compressed Air

The welder requires a supply of clean, dry, compressed air at 75 to 90 psi. The connection is made using 1/2 inch O.D. tubing at the pneumatic lockout device shown in Figure 2–5 and 7–1. The filter and regulator are inside the hydraulic cabinet and are shown in Figure 3–9.

The compressed air from the pneumatic lockout enters from the left. The filtered air exits to the right. The embossed arrow on the housing, below the pressure gauge indicates this airflow direction. The filtered air is fed up to the air distribution manifold above the filter (see Figure 2–6), which contains the pneumatic control valves. Each pneumatic device has its own remotely-controlled valve unit and flow controls. Adjusting the valves and flow controls is covered in Section 9 – Optimizing Performance.

The pressure gauge displays the pressure of the filtered air out. It is calibrated in psi. To adjust the pressure, lift the adjustment knob until the orange band is visible at the base of the knob. Turning the knob clockwise (when viewed from above) will increase the pressure. Push the knob back down to its locked position to prevent an changes in the setting.

The front cover of the gauge can be removed to adjust the set points. Twist the cover counterclockwise ( ) about 1/8 th of a turn and gently pull to remove the cover. Position the two green pointers at the desired lower and upper limits. They are normally set at the factory to about 75 psi and 85 psi (5.1 bar and 5.7 bar respectively). These pointers are only visual indicators, and do not override the regulator setting.

The canister below the pressure gauge contains the air filter and moisture trap. The air filter is self-draining of any accumulated moisture by means of a drain hose which exits the bottom of the machine. Keep this in mind if moisture draining to the floor could cause a problem. The filter has an internal float, and will empty under pressure when approximately 25 cm³ = 25 ml (0.85 ounce) of water has accumulated. Refer to Section 11 – Maintenance, for complete information on and the instruction for replacing the filter element.

Figure 3–9 Compressed Air Filter and Regulator

WARNING

Never attempt to remove the filter housing while the compressed air is on. Turn off the compressed air using the pneumatic lockout device and make sure the pressure gauge reads zero.
Hydraulic Drive
Self–Contained System
The lift table is raised and lowered by hydraulic pressure. The hydraulic system has its own motor, pump, filter, reservoir, cooling system and programmable regulator. The valves and pressure regulator are controlled by parameters contained in a setup file and controlled by the welder’s PLC. The drive unit is shown in Figure 3–10. The hydraulic pump is capable of generating a maximum of 1,500 psi (102 bar). The pressurized fluid drives a hydraulic cylinder which is located under the table and has a maximum stroke of 20–inches (508 mm). The maximum lift or clamp force available at the piston is a function of the hydraulic cylinder diameter. The specifications for each model are given in Table 3—II. The maximum programmable force is less than the available force. The program limits are given in Section 6 – Touch Screen Menus.

![Figure 3-10 Hydraulic Drive Unit](image)

Table 3—II  Lift/Clamp Force By Model Number

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Hydraulic Cyl. Dia.</th>
<th>Scale Factor</th>
<th>Maximum Available Lift Force At Piston</th>
</tr>
</thead>
<tbody>
<tr>
<td>VWB3500</td>
<td>2.0 in</td>
<td>3.14 x</td>
<td>4,710 lbs 2,052 Kg 20,950 Nt</td>
</tr>
<tr>
<td>VWB3700</td>
<td>2.5 in</td>
<td>4.91 x</td>
<td>7,360 lbs 3,338 Kg 32,740 Nt</td>
</tr>
<tr>
<td>VWB3900</td>
<td>2.5 in</td>
<td>4.91 x</td>
<td>7,360 lbs 3,338 Kg 32,740 Nt</td>
</tr>
</tbody>
</table>

1 lb = 0.4536 Kg; 1 lb = 4.448 Nt; 1 Nt = 1 Joule/meter
Adding Hydraulic Fluid

The Vibration Welder may be shipped with the hydraulic fluid reservoir full or completely drained, depending on whether the destination is local or international. Before operating the welder, hydraulic fluid must be added to the reservoir if it is low or empty. The reservoir has a capacity of 20 U.S. gallons (75.7 liters). Normal operating level is about 18.5 gallons (70 liters). This corresponds to a sight-glass reading of 50%. The pump manufacturer recommends Mobil DTE® 24 Hydraulic Fluid or equivalent for normal use. However, we prefer DTE® 25 because it has a higher temperature breakdown rating. Refer to Table 11—I for hydraulic fluids equivalent to DTE® 25.

To fill the reservoir, unscrew the filler cap shown in Figure 3–11. Pull out the strainer/filter. Add hydraulic fluid until the sight-glass level gauge reads 50% as shown in Figure 3–12. There will still be fluid in the hydraulic cylinder so it is not necessary to completely fill the reservoir. Replace the strainer/filter and screw the filler cap back on. After the table has been cycled a few times, recheck the fluid level. It may be necessary to add more hydraulic fluid if the sight-glass level has dropped below 50%.

**IMPORTANT**

Hydraulic fluid level should be maintained so that it always shows in the fluid level sight glass. This is important to prevent condensation from collecting on the inside of the reservoir and the heat exchanger tubes.
Display and Controls

- Control Panel Layout
- Touch Screen Display
- Indicator Lights
- Mode Switches
- Operate Switches
- E-Stop Switch
- Light Curtain

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Control Panel Layout
The control panel contains all of the switches, indicator lights and the display necessary to setup the vibration welder for operation. The control panel is shown in Figure 4–1.

A Touch Screen Display
The touch screen is a 6-inch TFT active-matrix color display with 320 x 234 pixel resolution. It contains an integrated touch screen with 128 touch-sensitive cells. Below the display are 10 function keys. To the right of the display is the numeric keypad and cursor control keys. The combination of touch cells and function keys allows keypad, touch screen or both to be used for operator input. Some operations such as opening and closing the front safety door can only be accessed from the touch screen. The display contains an internal clock that has a battery backup and is accurate to ±2 minutes per month. A screen saver dims the screen after a preset time (factory set to 5 minutes). This can be changed by the operator if desired.

B Function Keys
Below the touch screen are ten function keys labeled F1 through F10. These are used to access the HELP, RUN and MODE screens.

C Numeric Keypad
To the right of the touch screen is the numeric keypad used to enter specific numeric values. This consists of the number keys 0 through 9, the decimal point, the minus sign (to enter negative values), the BACKSPACE key [ ] and the ENTER key [ ]. Some operations such as entering a time or distance value can only be performed with the keypad.

D Cursor Control Keys
Below the numeric keypad are four cursor control keys. They are the UP key [ ], DOWN key [ ], LEFT key [ ] and RIGHT key [ ] used for menu navigation.

NOTE
• The BACKSPACE [ ] and ENTER [ ] keys are only active when the Numeric keypad is active.
• The Function keys are not active when the Numeric Keypad is enabled.
**Indicator Lights**

**POWER Light**
The yellow **POWER-ON** light indicates the +24V control power supply is ready. Turning the main AC switch on energizes the power supply which causes the power light to become illuminated.

**IN–CYCLE Light**
The green **IN–CYCLE** light is illuminated whenever the Vibration Welder mode switch is in the **RUN** position. The light begins flashing when the welder has started a weld cycle. When the weld cycle is completed, the green light stops flashing and remains illuminated. The light goes out when the welder is switched to **SETUP** position.

**ALARM Light**
The red **ALARM** light flashes during any type of alarm condition such as the E–Stop switch being pushed or a service door open. The **ALARM** light will flash in either the **RUN** or **SETUP** mode, until the fault condition has been cleared.

**Mode Switches**

**RUN–SETUP Switch**
The mode switch has two positions. It must be in the **RUN** position (see Figure 4–2) to start a weld cycle. The switch must be in the **SETUP** position to load or change welding parameters and to manually raise or lower the lift table.

**TABLE UP–DOWN Switch**
This is a spring–loaded, momentary switch with a center–off position. Hold the switch in the desired position (see Figure 4–3) while in **SETUP** mode to manually raise or lower the lift table. The hydraulics must be on and one operate switch activated to move the lift table.
Operational Switches

**K HYDRAULICS–ON Switch**

The hydraulic system is turned on by pushing in the green button. When the hydraulic pump is activated, the center of the switch is illuminated green. When the hydraulics are off, the center of the green button is dark. The lift table cannot be moved if the hydraulics are off. This is a push–on only switch. The hydraulic pump is turned off by:

1. Pushing the Emergency Stop button in.
2. Breaking the light curtain during a weld cycle before the front door has closed completely.
3. Opening the rear service doors.
4. Turning off the AC power.

**L Opti–Touch Operate Switches**

Located directly in front and below the sliding access door are two small mounting boxes which each contain an optical OPERATE switch. These are shown in Figure 4–4. These switches use Infrared (IR) sensors. They comply with OSHA and CE safety standards. Both switches are identical. However the inclusion of the light curtain enables the operator to initiate a weld cycle using either the left or the right switch alone.

Each optical–touch switch has a small red LED in the left front illuminated whenever the power is on, as shown in Figure 4–5 and 4–6. When the operator places his finger in the tray, a second LED at the right rear also illuminates to indicate the switch has been activated.

**M Reset Button**

The right mounting box also contains the RESET button. Pressing the button enables the operator to reset the welder when it is initially turned on or to clear an aborted cycle caused by:

1. Pushing the Emergency Stop button (E–STOP).
2. Opening the rear service doors.
3. Breaking the light curtain when the front access door is opening.

---

Figure 4–4 Operate, Reset, E-Stop Switches and Light Curtains

Figure 4–5 Right Operate and Reset Switch
**Emergency Stop Switches**

The left mounting box contains an emergency stop (E–STOP) switch next to the left OPERATE switch as shown in Figure 4–6. There is also an E–STOP switch directly below the MODE switch on the control panel as shown in Figure 4–1. Both of these switches function the same, and pressing either switch will halt the weld cycle and freeze the lift table in its current position. Both emergency stop switches must be in their reset position before the lift table can be lowered and the welder restarted.

**Light Curtain**

The light curtains are identified in Figure 4–4. The beam must be broken at least once before the start of each weld cycle. This is normally done during removal of the welded parts and/or the insertion of a new set of parts. Until the beam is broken, a new weld cycle cannot be initiated. This safety feature is designed to prevent the accidental operation of the welder without having parts in the tooling. Once the beam has been broken, the weld cycle can be initiated by momentary activating only one of the operate switches.

The right light curtain (receiver) contains four status LEDs at the top of the housing. A single green LED (Run State), shown in Figure 4–7, indicates the area protected by the light curtain is clear.

If the protected area is not clear, the right receiver unit will actively display where the beam is broken (see Figure 4–8) and the red Stop LED will light up. The light curtain can be programmed to ignore selected fixed areas of the detection zone which are obstructed by permanent fixtures or tooling. Refer to the “Light Curtain Operating Manual” which is located in the operating manual storage pocket (refer to Figure 3–1).
If the light curtain beam is broken before the front access door has completely closed, the welder will halt. You cannot resume the welding cycle by momentarily activating one of the operate switches again because the system has shutdown due to a fault. Recovering from a light-curtain fault is covered in Section 8 – Machine Operation, Resetting Machine.

**AC Utility Outlet**

An AC utility outlet is provided on the front control panel (see Figure 4–4). The duplex outlet is a standard feature and has snap–close covers. For machines intended for use in North America, the outlets are rated at 4 Amps total at 120 Volts AC. For machines configured for use outside North America, the outlets are wired for the voltage appropriate for use in the intended country of installation. The 4 Amp rating is the maximum combined current that should be drawn from the outlets. The utility outlet has its own circuit breaker in the electrical cabinet. Refer to Figure 10–3 for the location of the AC outlet breaker inside the electrical cabinet.

![Figure 4-8](image)
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Normal Weld Cycle

- Parts Loaded
- Initiate Cycle
- Clamping Phase
- Welding Phase
- Hold Phase
- Release Phase

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Parts Loaded

Both Parts in Lower Tooling
The most common arrangement places both parts in the lower tooling, with the part designed to mate with the upper tooling placed on top. Some parts are self-alignment, some have small tabs or break-away pins and sockets. These are ideally suited to be loaded together into the lower tooling.

Upper Part in Upper Tooling
Trying to place two parts that are not self-aligning in the lower tooling in a production environment, can result in crushed parts if they are not accurately positioned. Parts which are not self-aligning or present alignment problems require the upper part to be held in the upper tooling. The upper tooling may have an optional vacuum retention feature to hold the part in place. This configuration is shown in Figure 5–1. The button to activate the vacuum retention is located either in place of the left operate switch or on a separate switch housing next to the right operate switch and reset button.

Initiate Weld Cycle
Once the parts have been placed in the tooling, the light curtain beam (ο in Figure 4–4) will have been broken at least once. The operator then presses either Opti-Touch operate switch to initiate a weld cycle. The green IN-CYCLE indicator (ο in Figure 4–1), lights up and the welder executes the currently loaded setup file. Each setup file determines the weld mode, vibration amplitude, weld pressure and contains values for all the required parameters.

Access Door Closes
As soon as the green IN-CYCLE indicator lights, the front access door starts to close. As the door slides up, hydraulic pressure causes the lift table to begin rising. During the access door transition, the area protected by the light curtain beam cannot be broken. If this protected area is penetrated before the door-closed sensor is activated, the door will immediately stop and must be reset. Recovering from a light-curtain fault is covered here and in Section 8 – Machine Operation.

Figure 5–1  Parts Loaded In Tooling

LIGHT CURTAIN FAULT RESET
1. Move mode switch to Setup position.
2. Restart the Hydraulic Pump.
3. Press F1 to display the HELP screen.
4. Press the MACHINE RESET touchcell.
5. Press and hold the HOME touchcell while activating the right safety switch until the welder is reinitialized.
6. Press the RUN MODE touchcell.
7. Move mode switch to RUN mode.
If the compressed air supply is not turned on, the door will not be able to move. In this case, the lift table will begin to move, but will stop after a short time because the door–open sensor has not been released. Again the welder will stop and must be reset.

**Clamping Phase**

As the access door begins to close, the lift table rises until it reaches either the preset trigger position or the programmed trigger force is achieved (depending on whether trigger–by–position or trigger–by force is selected). This is illustrated in Figure 5–2. If the access door is not completely closed before the lift table reaches the slowdown position, the lift table stops until the door has completely closed. The table then continues to slowly rise until the trigger point is reached.

**Welding Phase**

When the table reaches the trigger point, the magnetic drive heads are energized for the programmed time (typically a few seconds) or until the programmed collapse distance is achieved. This is illustrated in Figure 5–3. The drive head vibrates the upper part against the fixed lower part, under relatively high pressure which results in frictional heating. This heating melts the joint surfaces and continues until the melt layer has sufficiently penetrated the material. The frequency of vibration is between 200 and 240 Hz, and the total vibration amplitude can be set to between 0.040 and 0.070 inches (1.0 to 1.8mm). The weld cycle can be set to run for a predetermined time (0.01 to 8.00 seconds) or until a specified collapse distance (0.10 to 8.00mm) is achieved.

**Hold Phase**

After the welding phase is complete, the parts are held together under pressure for the hold time (typically three to five seconds). This allows the molten plastic to fuse together and solidify. Clamping under pressure while the bond hardens also corrects any warping problems by forcing the parts into the proper geometry. The hold pressure is specified separately from the welding pressure to control flash and produce a stronger weld by reducing shear thinning.
Release Phase

The lift table now lowers to its starting or load position as illustrated in Figure 5–4. At the same time, the access door begins to open. Again, the area protected by the light curtain cannot be penetrated until the access door is fully open. If the protected area is penetrated during the door transition (until the door–open sensor is activated and the IN–CYCLE light goes out), the welder will immediately stop and must be reset.

Parts Removed

Once the access door is fully open and the table is at the load position, the IN–CYCLE light extinguishes. Now the assembled part can be removed as illustrated in Figure 5–5. A new set of parts is installed in the tooling, and the weld cycle can be started again.
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Touch Screen Menus

- STARTUP Screen
- SETUP Mode
- VIEW Mode
- HELP Menu
- RUN Mode
- PROGRAM Mode
- UTILITIES Menu

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STARTUP Screen

Before turning the welder for the first time, follow the steps in Chapter 7 – Initial Machine Startup.

When the welder is first turned on, a splash screen (see Figure 6-1) displays the self-test startup message. Once the initial test is passed, the STARTUP mode screen displayed as shown in Figure 6–2.

Screen Layout

The STARTUP screen has the same basic layout for the header and lower portion as the SETUP and RUN mode screens. The large center portion of the various screens displays information specific to that screen and will be different for each screen.

Header

At the top left, the screen name is displayed. The currently loaded setup file is shown at the top center and the upper right displays the Job ID number associated with the loaded setup file. Setup file number and Job ID are covered later in this section when we program an actual setup file.

Set Date and Time

The center area of the startup screen contains the welder model number and the current date and time. To set the date/time, simultaneously press both the LEFT arrow and RIGHT arrow keys on the keypad (in Figure 4–1). This displays the CONFIGURATION MODE screen shown in Figure 6–3. Use the UP and DOWN arrow keys to select DATE/TIME, then press the enter key. A new window appears for entering the year, month, day, hour, minute and second. When you have finished, press the EXIT touch cell in the lower right or press the F10 function key. This returns you to the CONFIGURATION MODE screen. Press the RUN MODE cell in the lower left or F2 to return to the STARTUP screen. Do not change any other parameters, or you may cause communication problems between the screen and PLC.

Next Screen Touch Cells

The blue square touch cells in the lower left and lower right of the STARTUP screen (Figure 6–2) can be activated by either pressing the lit active area or the appropriate function key (F6 for RUN mode or F5 for
SETUP/VIEW mode). These are normally the next logical menus to choose for setup and operation.

**Alarm/Fault Message Area**

The center banner at the bottom in Figure 6–2 is the message area. This displays any alarm (red) or fault messages (yellow) that prevent the welder from operating. If no alarms or faults exist, the mode switch position (룩 in Figure 4–2) is displayed. In this case, the red alarm message indicates either the rear service door is open or an emergency stop switch has been pressed. Clear the fault by closing the service doors and/or resetting the emergency stop switch. Now press the reset button (_contrib in Figure 4–5). When all faults have been reset, the red ALARM light (G in Figure 4–1) will stop blinking and go out.

The message box now changes state to a flashing yellow which indicates the hydraulic system is off. Figure 6–4 shows the startup screen with the fault reset waiting for the hydraulics to be turned on. The yellow HYDRAULICS OFF message flashes until the hydraulic system is turned on (K in Figure 4–1).

Once the hydraulic system is on, the screen displays either RUN MODE (green background) or SETUP MODE (yellow background) depending on the position of the mode switch. The screen is shown in Figure 6–5 with the mode switch in its setup position. From the STARTUP screen, the next screen normally selected is either the RUN screen or the SETUP screen.

**SETUP Mode**

**Header**

To get to the SETUP mode screen, flip the mode switch to the SETUP position and press the active area in the lower right of the screen labeled SETUP MODE (or press F5). Figure 6–6 shows the SETUP screen and identifies the layout. Note that there are two sections of the screen that are labeled SETUP MODE. The upper left area is the screen name. The bottom message area displays the mode switch position.

The currently loaded SETUP file number (the file with the welding time, distance, mode, etc.) is shown at the top center. A JOB ID is associated with each setup file to help determine the customer or part number for each setup.
Mode/Alarm Message Area
The bottom message area displays alarms, faults, or machine status. Alarms have the highest priority followed by faults. A status message has the lowest priority and appears only when there are no alarms or faults. The status message displays the position of the SETUP/RUN mode switch (in Figures 4–2 and 4–3). If the mode switch is in the SETUP position, the message area is yellow and displays SETUP MODE. If the switch is in the RUN position, the message area is green and displays RUN MODE. Color is used as a visual indicator to the type of message:
- Alarm .................. red
- Fault .................... flashing yellow
- Mode/Status ............ steady yellow for SETUP and AUTOTUNE modes
- green for RUN mode

VIEW Mode
LOAD and VIEW Setup
The center area gives access to all ten setup files. To load a particular setup file, press the desired touch cell. The active area will turn yellow and display LOADING. Figure 6–7 shows two setup files programmed and SETUP 1 is loaded. The operator has just touched the active area for SETUP 2 (which happens to have a JOB ID of 00125 associated with it), and that file is in the process of loading. As soon as the file is loaded, the header will update and display SETUP:02 JOB:00125.

If we now press the active area for SETUP 1, we will reload SETUP FILE 1. Now your screen looks like the screens shown here (except for Job ID and parameter values). The large touch cell in the center labeled VIEW SETUP allows you to view the welding parameters for each setup file. The JOB ID numbers are shown next to each setup file. Pressing the VIEW SETUP cell displays the VIEW MODE screen shown in Figure 6–8.

The VIEW MODE screen allows you to display the welding parameters of any of the stored setup files. Pressing the active area for VIEW SETUP 1 displays the stored parameters as shown in Figure 6–9. Your values will be different from those shown. Looking
at the first two field labels, we can see that the setup is for a weld–by–distance mode since the WELD DIST is 1.00 mm and there is a TIME LIMIT of 20 seconds to reach the collapse distance of 1.00 mm. If the setup was for a weld–by–time mode, the first two labels would read – DIST OFF and WELD TIME. The remainder of the welding parameter labels are the same for either weld mode.

**Next Screen Touchcells**

As discussed earlier, the touch cells for RUN or SETUP screens are in the lower left and lower right corners respectively. The RUN mode touch cell (F6) is by default at the lower left and the SETUP or VIEW touch cell (F5) is at the lower right. You can use either the touch cells or the function keys to select the screen.

**HELP Menu**

If you look carefully at Figure 6–2, you will notice below the screen name, that the HELP screen is available by pressing the F1 function key. It is also stenciled under the left side of the touchscreen frame. Note that the mode switch must be in the SETUP position. Press F1 and the main HELP screen appears as shown in Figure 6–10. There are 22 topics listed. At the bottom center, the green GOTO RUN MODE SCREEN cell is the exit path that always returns you to the RUN MODE screen. The dark blue HELP area in the upper left is the screen title and is not active. Pressing any of the other cells brings up information regarding that topic.

For example, pressing the MACHINE STATUS option in the top row, displays a new window, shown in Figure 6–11. This shows the four status messages that can appear in the message area. Pressing any one of the cells then displays a detailed description of the four possible states as shown in Figure 6–12. To return to the main HELP screen, press the RETURN cell in the lower right–hand corner twice (once to return to the MACHINE STATUS screen and once more to return to the HELP screen).
SETUP Flowchart

Let’s look at a flowchart of the screens we have discussed so far. This will help lay the foundation for the RUN mode and allow you to understand the logic behind the screen navigation. The flowchart for the SETUP mode is shown in Figure 6–13. We start with the splash screen shown in Figure 6–1. Then the STARTUP screen from Figures 6–2, 6–4 and 6–5. The SETUP screen (Figures 6–6 and 6–7) is displayed by pressing the touch cell or F5. The VIEW mode screen is reached by the VIEW SETUP touch cell (Figure 6–8), and the actual values from SETUP # can then be displayed. We also saw that the HELP screen is available at any time by simply pressing F1.

RUN Mode

To get to the RUN MODE screen from the STARTUP screen or the SETUP MODE screen, press the active area in the lower right labeled RUN MODE or press F6. You can also flip the mode switch to the RUN position ( in Figure 4–2) to immediately display the RUN screen. Figure 6–14 shows the RUN screen and identifies the layout. The header has the screen name in the top left, which is RUN MODE. The message area at the bottom center indicates the welder mode switch is still in the SETUP position.

The center region displays the measured results from the last welding cycle. The TOTAL COLLAPSE distance is always shown, even for a weld–by–time mode. If the setup was for a weld–by–time mode, the second parameter would display the actual WELD TIME. The ACTUAL welding force is displayed below the programmed WELD and HOLD force.

In the right column, the actual table position (rest or load position) is displayed. There will always be some overshoot lowering the table, so the value will be less than the programmed value. The WELD POSITION is the trigger position. PART COUNT shows the total number of parts welded and SUSPECT indicates the number which are out of limits. The tolerance values are set by the LIMITS screen (F2).
SLIDING DOOR

There are two additional touchcells which were not present on the SETUP MODE screen (Figure 6–6). Just above the SETUP MODE cell in the lower right is the SLIDING DOOR touchcell. This displays a screen to manually open and close the front access door as shown in Figure 6–15. Follow the instructions on the top of the screen. To close the door, the FRONT DOOR OPEN message should be green and the FRONT DOOR NOT CLOSE should be red. To open the door, the colors are reversed. Press the RETURN touchcell or the F5 key to return to the RUN MODE screen.

VIEW SETUP Screen

The message area of the RUN Screen has a shortcut to view the current setup. This is labeled VIEW SETUP F3. By pressing the touchcell or F3, the values of the current setup are displayed as shown in Figure 6–16. This is similar to the screen shown in Figure 6–9, except there is no touch cell in the lower right corner. Also, the difference between the values shown here and in Figure 6–9 is that Figure 6–9 shows the values stored in the current setup file. When a setup file is loaded (Figure 6–7) the values are copied to the working memory. These working values can be changed by using the ALTER SETUP key to temporarily modify the values without changing the file. In this case however, they are the same, so VIEW SETUP F3 shows the same values. To return, press the RUN MODE cell or F6.

ALTER SETUP Screen

The lower left corner touch cell of the RUN MODE screen (Figure 6–14) shows ALTER SETUP F6 instead of RUN MODE (because we are already in the Run Mode screen). This allows us to modify the values used by the current setup. To change the values, we must first place the mode switch (99 in Figure 4–2) in SETUP so that the message area displays SETUP MODE. You can modify values only when the mode switch is in the SETUP position.

The ALTER SETUP screen is shown in Figure 6–17. In the center are ten touchcells. The five on the left which display the numerical data plus the Amplitude cell on the right, enable direct modification of
the setup values. The other four cells on the right with the parameter names, access secondary screens. These secondary screens contain the instructions for obtaining and setting the values.

Pressing the touchcell for HOLD TIME displays a floating data-entry window as shown in Figure 6–18. A data-entry window will always appear with the default value of zero regardless of the minimum value. Each data-entry window displays the range of permissible values for that parameter. These values are listed in Table 6—I along with the resolution (smallest incremental change). Here, the window indicates that hold time can range from 0 to 20 seconds.

First we will try to enter a value out of range. We choose a value of 22 seconds by pressing the key twice and then pressing the Enter key. A new window appears which displays an error message as shown in Figure 6–19. Press any key on the keypad or screen to remove the error message.

We will now change the hold time from 2 to 2.25 seconds by pressing the keys in sequence. The window should look like Figure 6–20. If you make a mistake, you can clear the entered digits by pressing the Backspace key. To accept the entered value, press the Enter key.

The display now reflects the new value as shown in Figure 6–21. The display suppresses any trailing zeros to the right of the decimal point so the previous value of 2.00 sec was displayed as just 2 sec. Now since there nonzero values to the right of the decimal point, they are displayed. We press F6 to return to the RUN MODE screen (Figure 6–22). Notice that the screen name area upper left–hand corner now has a flashing box with the message SETUP ALTERED. Since the center region displays the measured values from the last weld cycle, nothing has changed.

If we now press F3 to view the setup (Figure 6–16), we see the working value for HOLD TIME has been altered to 2.25 seconds, but the setup file from which these values were copied has not changed. You can verify this by going back to RUN MODE F6 (Figure 6–14), press F5 for SETUP MODE, then press VIEW SETUP (Figure 6–7), then press VIEW SETUP 1 (Figure 6–8) and examine the value for hold time (Figure 6–9).
The four touch cells on the right of the ALTER SETUP screen (see Figure 6–21) named TABLE LOAD POSITION, TRIGGER METHOD, AUTOTUNE MODE and COUNTER SETUP, display secondary screens that contain instructions for setting the parameter values.

**TABLE LOAD POSITION**
The TABLE LOAD POSITION screen is shown in Figure 6–23. It displays the actual Table Position and the Programmed position. To change the programmed position, press the touchcell with the programmed value. A data entry window, like that in Figure 6–20, appears for you to enter a value using the keypad and the Enter key. Press the ENTER touchcell when you are finished to return to the ALTER SETUP screen.

**RUN MODE Flowchart**
The flowchart for the SETUP and RUN mode is shown in Figure 6–24. This builds on the flowchart shown in Figure 6–13. The SETUP MODE is on the right and the RUN MODE is on the left. Of the four secondary screens, only the TABLE LOAD POSITION screen is depicted. The other three branch off the ALTER SETUP screen.

**TRIGGER METHOD**
The TRIGGER METHOD touchcell does not allow you to change the trigger method from ALTER SETUP. This must be done by changing the method in PROGRAM MODE. The TRIGGER METHOD touchcell displays either a SET WELD POSITION or SET TRIGGER FORCE screen that allows you to alter the trigger point that is consistent with the trigger method of the current setup file. Depending of the trigger method, the trig-

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<table>
<thead>
<tr>
<th>Table 6—I Programmable Ranges and Resolution Of The Welding Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter Name</strong></td>
</tr>
<tr>
<td>WELD TIME</td>
</tr>
<tr>
<td>HOLD TIME</td>
</tr>
<tr>
<td>MAX TIME</td>
</tr>
<tr>
<td>LOAD POSITION</td>
</tr>
<tr>
<td>WELD DISTANCE</td>
</tr>
<tr>
<td>WELD AMPLITUDE</td>
</tr>
<tr>
<td>FREQUENCY</td>
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<tr>
<td>WELD FORCE</td>
</tr>
<tr>
<td>HOLD FORCE</td>
</tr>
<tr>
<td>HOLD FORCE</td>
</tr>
</tbody>
</table>

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**NOTE**
- Use the BACKSPACE key to clear the entered digits.
- When the data–entry screen displays 0, Use the BACKSPACE key to return to the previous screen without altering the parameter value.
- Use the ENTER key to accept the entered numeric value.
Figure 6–23  SET LOAD POSITION Screen

Figure 6–24  RUN and SETUP Mode Flowchart

Figure 6–15  Open & Close Door Instructions

Figure 6–16  Working Setup Data Values

Figure 6–9  SET UP Mode

Figure 6–17 & 6–21  ALTER SETUP

Figure 6–14 & 6–22  Figures 6–14 & 6–22

Figure 6–20  Setup/Run Mode

Figure 6–21  VIEW WORKING SETUP

Figure 6–22  Setup/Run Mode

Figure 6–18  VIEW MODE

Figure 6–19  Setup/Run Mode

Figure 6–11  VIEW SETUP

Figure 6–10  Setup/Run Mode

Figure 6–12  VIEW SETUP

Figure 6–13  Setup/Run Mode

Figure 6–17  SETUP/Run Mode

Figure 6–18  Setup/Run Mode

Figure 6–19  Setup/Run Mode

Figure 6–20  Setup/Run Mode

Figure 6–21  VIEW WORKING SETUP

Figure 6–22  Setup/Run Mode

Figure 6–23  SET LOAD POSITION Screen

Figure 6–24  RUN and SETUP Mode Flowchart

Figure 6–25  AUTOTO TEST and A-B SPLASH SCREENS

Figure 6–26  Turn on AC Power switch

Figure 6–27  LOAD SETUP #1 – 10

Figure 6–28  RUN SETUP MODE

Figure 6–29  CLOSEDOOR

Figure 6–30  VIEW SETUP

Figure 6–31  Working Setup

Figure 6–32  Data Values

Figure 6–33  SETUP

Figure 6–34  RUN

Figure 6–35  Mode
The trigger point is determined by either the preset table height, or the upward force applied to the lift table. The SET WELD POSITION screen is shown in Figure 6–25. It displays the current Table Position and the Programmed Trigger Position. To change the trigger point, press the touchcell which displays the current programmed value. A data entry window, like that in Figure 6–20, appears for you to enter a new value by using the numeric keypad. Commit the value with the Enter key. Press the ENTER touchcell when you are finished to return to the ALTER SETUP screen.

The SET TRIGGER FORCE screen is shown in Figure 6–26. The screen text is self explanatory. The slowdown point referred to is automatically set by the software to approximately two inches (50mm) below the welding position. At the slowdown position, the table lift rate is reduced to about 25% of maximum.

The trigger method and welding method terminology may cause some initial confusion because the trigger methods are either by position or by force, but the weld methods are by distance or by time. Keep this difference in mind when setting or changing setup files. You can however, select the trigger method and weld method independently.

**AUTOTUNE MODE**

The AUTOTUNE screen is shown in Figure 6–27. There are no parameters to enter here. The tooling must be securely in place and the amplitude set to the desired welding value. The transducer drive circuitry will energize the coils and measure the resulting amplitude to determine the resonant frequency. Simply turn on the Hydraulics and activate both Operate Switches ( in Figure 4–1), and the Autotune process will begin automatically. The yellow horizontal bar tracks the progress of the sweep frequency. When the process is completed, the resonant value is displayed in the upper left-hand corner of the screen. Press the bright blue touchcell at top center to test the welder. Press the RETURN touchcell at the lower right to return to the ALTER SETUP screen.

**COUNTER SETUP**

The COUNTER SETUP screen is shown in Figure 6–28. There are four operations that can be performed from this screen plus one read-only display value.
1. COUNTING UP or COUNTING DOWN is selected by toggling the Counter Direction touchcell, ①.

2. COUNTER ON or COUNTER OFF is selected by toggling the Counter Enable touchcell, ②. If the counter is turned off, the value is retained by the accumulator, and when the counter is later turned on, the count will resume from the last value.

3. The counter can be reset by pressing the RESET COUNTER touchcell, ③. If the counter is set to count up, it sets the counter to zero. If the counter is set to count down, RESET COUNTER sets the counter to the PRESET VALUE, ④.

4. To count weld cycles, the counter must be preset to a value. To enter a count, press the PRESET VALUE touchcell, ④. The maximum preset value is 32,767. The preset determines the number of weld cycles that can be performed with the counter turned on. When the counter is on and the preset value is reached, operation will halt and a message screen appears asking you to either ignore the counter or reset the counter. This screen is shown in Figure 6–29. You have to acknowledge this screen in order to return to the RUN screen. Remember that you can only initiate a weld cycle from the RUN screen. Choosing IGNORE resets the counter and turns it off. Choosing RESET sets the counter to zero or the preset value.

   There is no difference between resetting the counter to zero and counting up to the preset, or presetting the counter and counting down to zero. Both yield the same count. You determine whether you want to know how many parts you have welded, or how many parts remain to be welded.

   The current part count is displayed on the RUN screen in the right hand column (see Figure 6–30). The screen displays the values from the last cycle. The part count was 35. The counter is now reset to zero and on the next cycle, the part count will display 1, and if the part is within limits, the suspect part count will be 0. During operation, the real-time values of distance, time, force and position are updated. The weld and hold force are the programmed values. The actual force is the resting pressure currently applied to the lift table. If the counter is set to count down, the RUN screen

Figure 6–28 COUNTER SETUP Screen

Figure 6–29 PART COUNT ACHIEVED Screen

Figure 6–30 RUN Screen After Part Count Achieved
will display the preset count minus one on the next cycle, and decrement to zero. Normally part count and weld cycles are the same, but some tooling has two or three cavities to handle multiple part assemblies per weld cycle. Keep this in mind when setting the counter preset.

5. **TOTAL MACHINE CYCLES** cannot be reset. This tracks the total number of cycles the machine has on it from its inception. It has a maximum value of 999,999,999,999.

## PROGRAM Mode

So far we have discussed changing values in an existing setup file. We will now cover the procedure for creating a new setup file. From the RUN screen (Figure 6–30) press the SETUP touchcell or F5, or just flip the mode switch to the SETUP position if it is in RUN position. The screen changes to display the SETUP MODE screen (Figure 6–31). Now press the PROGRAM touchcell or F5 and the PROGRAM MODE screen (Figure 6–32) is displayed.

We can tell immediately that setup file number one is being displayed because the Job ID is 00122. If a setup file is loaded which had been erased or had no previous parameter values, the numerical values will all display zero and the weld mode defaults to WELD BY TIME, as shown in Figure 6–33.

### TABLE LOAD POSITION

The flashing message area at the bottom of the screen, MOVE TABLE TO POSITION, is requesting us to set the initial load position. Press the touchcell labeled TABLE LOAD POSITION. This displays a new screen, shown in Figure 6–34, with instructions for setting the load position of the table. The minimum value is 1.00mm, not 0mm, so you must enter a positive, nonzero value.

With the hydraulics turned on, place your left finger in the operate switch and flip the table position switch up and/or down until the desired load position is reached. Read the value from the low right portion of the screen and press the PROGRAM button at the lower center. Use the keypad to enter the value. Confirm the value with the Enter key.

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**TOTAL MACHINE CYCLES**

If you ran 6 weld cycles per minute, for 60 minutes every hour, for 24 hours a day, for 365 days, you would have operated the welder 3,153,600 times in one year. At this rate it would take 317,098 years to accumulate 999,999,999,999 machine cycles.
Then press the ENTER touchcell to leave the screen and return to the PROGRAM MODE screen.

**DEFINITION**

**TABLE LOAD POSITION** – The height at which the table is positioned before the weld cycle begins. This is the height at which the parts are loaded and the level to which the table returns after the weld cycle is finished. The load position is normally set near the bottom of travel so parts don’t have to be lifted as high. Setting a higher load position, closer to the top, will reduce the cycle time.

2 **JOB ID**

Next, we should set a JOB ID for the file so we don’t have to remember what the setup number is. You can use the product number, your work ID, the date, weld force or any other number to help you remember the values you have programmed. The only restriction is that the number must be between 0 and 65535. Press the JOB:00000 touchcell in the upper right. Using the keypad enter the Job ID in the data Entry Screen and confirm it using the Enter key. Later, when we have finished programming all the values, we will store them in a setup file.

3 **TRIGGER METHOD**

Decide if triggering by position or trigger by force is better suited to your application and press the TRIGGER METHOD touchcell. This displays the TRIGGER METHOD selection screen shown in Figure 6–35. Press one of the buttons at the bottom to select the desired method. The default method is the last selected method. The trigger method parameter is not stored in the setup file so it will not be imported when you load that setup file. You will notice if you examine the RUN screen in Figure 6–30 or the VIEW SETUP screen in Figure 6-16, that trigger method is not displayed as one of the setup file parameters. However, all the other required parameters including the weld method and its associated value of weld distance or weld time is stored in the setup file.

The best choice is to select trigger by force and weld by (collapse) distance. This generally provides better control over the welding process. A change in
the parameter produces a more consistent and predictable response in the process variable.

**Trigger Force**

Trigger force is the applied hydraulic pressure that triggers the weld cycle to begin. The trigger force is measured by a pressure transducer in the hydraulic system. This is only meaningful if the trigger method is set to FORCE. It is normally used with the WELD BY DISTANCE mode. The trigger force screen is shown in Figure 6–26. The measured force includes the force required to overcome the weight of the table and the weight of the lower tooling. The table in the Model 3500 weighs 435 pounds. The table in the Model 3700 weighs 630 pounds and the Model 3900 table weighs 750 pounds. Subtract this value and the weight of the lower tooling from the programmed force to determine the actual trigger force. Or conversely, add the table weight and the lower tooling weight to the desired trigger force to determine the value to program. The minimum value is 1000 pounds. A good starting value is to set trigger force somewhat less than the hold force. If the trigger force is not reached, an error screen, shown in Figure 6–36, provides the instructions for recovering from the error.

**Trigger Position**

Trigger position is the point at which the table position encoder triggers the weld cycle to begin. This is only meaningful if the trigger method is set to POSITION. It is normally used with the WELD BY TIME mode. The screen is named SET WELD POSITION and is shown in Figure 6–37. The trigger position is normally set to about 0.5mm below the point where the parts to be welded are fully clamped. The maximum value is 508.00mm. the value under the ACTUAL label is the current table position.

**Amplitude**

Amplitude is the total peak–to–peak distance of horizontal oscillation of the upper tooling per cycle during the weld time. The upper tooling is driven from center, half of the amplitude in one direction, then returns to center and is driven half the amplitude in the other direction before returning to center. So an amplitude of 1.0mm results in one cycle of 0.5mm movement to the left and back to center.
then 0.5mm to the right and return to center. This vibration cycle is repeated at the driver frequency (200 to 240 times per second) for the duration of the weld cycle. The amplitude can be set from 0.1mm to 8.0mm with a resolution of 0.1mm.

5 AUTOTUNE Mode

The autotune screen is shown in Figure 6–27. It will automatically determine the resonant frequency of the vibrating mass, including the upper tool for this particular tooling set. Its function is described in the text accompanying the figure. The frequency range is between 200Hz and 240Hz with a resolution of 0.1Hz.

6 WELD BY Distance/Time Mode

Decide if welding by distance or time is better suited to your application and toggle the WELD BY TIME/WELD BY DISTANCE touchcell at the bottom center of the screen until the desired method is displayed. Figure 6–38 shows both screens and how the title and first two parameter labels change.

WELD BY TIME maintains the frictional vibration until the preset time has elapsed. WELD BY DISTANCE measures the distance travelled as the parts collapse while the joint is melting, and stops the welding process when the specified collapse is achieved.

7 WELD Distance/Time

Note that the parameter values remain unchanged when welding modes are switched. Only the parameter labels change as shown in Figure 6–38 above. When either the WELD DIST touchcell is pressed in WELD BY DISTANCE, or the WELD TIME touchcell is pressed in WELD BY TIME, a standard data entry window (see Figure 6–18) appears. It displays the range of values allows and enables you to enter a value using the keypad. Enter the number and press Enter [Enter] to accept the value or the Backspace [←] key to cancel.

Figure 6–38 Weld Mode Screens
**MAX TIME**

This parameter is the maximum time the vibrations are maintained. It only applies to the WELD BY DISTANCE mode. It stops the welding cycle when this time limit is reached, and passes control to the hold time process. When the MAX TIME touchcell is pressed, a standard data entry window appears showing a valid range. Enter a value using the keypad and press Enter [→] key to accept the value or the Backspace [←] key to cancel.

**HOLD TIME**

This is the time the parts are held clamped together after they are welded. The clamping force is determined by the hold force parameter and is applied during the hold time. When the HOLD TIME touchcell is pressed, a standard data entry window appears showing a valid range. Enter a value using the keypad and press Enter [→] to accept the value or the Backspace [←] key to cancel. The largest value permitted for both HOLD TIME and MAX TIME is 20 seconds.

**WELD FORCE**

The welding force is measured by a pressure transducer in the hydraulic system. The measured force includes the force required to overcome the table weight and the weight of the lower tooling. The table in the Model 3500 weighs 435 pounds. The table in the Model 3700 weighs 630 pounds and the Model 3900 table weighs 750 pounds. Subtract this value and the weight of the lower tooling from the programmed force to determine the actual clamping force. Or conversely, add the table weight and the lower tooling weight to the desired welding force to determine the value to program in. When the WELD FORCE touchcell is pressed, a standard data entry window appears showing a valid range. Enter a value using the keypad and press Enter [→] to accept the value or the Backspace [←] key to cancel. Refer to Table 6—I for the maximum weld and hold force for the Model 3500, 3700 and 3900 welders.

**EXAMPLE**

Our lower tooling for a 3500 Vibration Welder weighs 120 pounds. We want 1250 pounds of welding force. What WELD FORCE do we program in?

\[
\begin{align*}
1250 \text{ lbs } & \text{ Desired Force} \\
+ & 435 \text{ lbs } \text{ Table Weight} \\
+ & 120 \text{ lbs } \text{ Tooling Weight} \\
\hline
1805 \text{ lbs } & \text{ WELD FORCE}
\end{align*}
\]
HOLD FORCE

The hold force is also measured by the pressure transducer. The measured force includes the force required to overcome the weight of the table and the lower tooling. This force is applied for the duration of the hold time. When the HOLD FORCE touchcell is pressed, a standard data entry window appears showing a valid range. Enter a value using the keypad and press Enter \( \leftarrow \) to accept the value or the Backspace \( \leftrightarrow \) key to cancel.

STORE SETUP Screen

The last and most important step is to save our parameters in a setup file. Press the STORE SETUP touchcell in the lower right of the PROGRAM MODE screen or press the F5 function key. A STORE SETUP screen appears as shown in Figure 6–39. Compare this to Figure 6–31. Here, the screen title in the upper left reads STORE SETUP. The remaining information across the top shows the file number and Job ID of the currently loaded setup. Press the touchcell of the location where you wish to store the file. The cell turns yellow and displays SAVING as shown in Figure 6–39.

If you do not save the file, the parameters you entered will be used instead of the loaded setup values. However, the values will be overwritten the next time you load a new setup. If you press RUN MODE F6, you will see that the setup file number has not changed on the RUN screen, but some of the new parameter values have replaced the currently loaded setup values (WELD FORCE, HOLD FORCE, JOB ID and WELD POSITION). Also the SETUP ALTERED message flashes in the upper left corner of the RUN screen as shown in Figure 6–40. This message is flashed until the file is saved and then loaded, or until another setup is loaded. The other data are the measured values from the last weld cycle.

To load the setup file you just saved, you must return to the RUN (F6) screen and then branch to the SETUP (F5) screen. Press the touchcell for the location you saved the setup file. The touchcell momentarily displays LOADING (see Figure 6–7). Now return to the RUN (F6) screen.

Figure 6–39 STORE SETUP Screen

Figure 6–40 RUN Screen With Values From New Setup
The flowchart for the program mode screens have been added to the software flowchart as shown in Figure 6–41.

**Figure 6–41** RUN, SETUP and PROGRAM Mode Flowchart
Utilities Menu

The PROGRAM MODE screen contains a touchcell (3), for accessing the Utilities menu shown in Figure 6–42. There are eleven touchcells for resetting and initializing functions or for accessing secondary screens.

PROGRAM PASSWORDS Screen

There are three levels of password protection available. Pressing the touchcell displays a new password selection screen shown in Figure 6–43. The three touchcells in the lower half of the screen, toggle the password protection off and on. These are shown with lock symbols on the flowchart in Figure 6–41. The A is for ALTER SETUP MODE, P for PROGRAM MODE and the S for SETUP MODE. The three touchcells at the right in the top half of the screen, permit access to password entry screens for each of the three modes. Enter a value and press Enter key to accept the value or the Backspace key to cancel. The passwords must be a numeric value between 1 and 65535. The touchcell at the upper right returns to the Utilities screen. The touchcell at the upper left branches to the Run Mode screen.

START SCREEN

This touchcell is a shortcut to return you to the startup screen which is named START MODE. See Figures 6–2 and 6–3 for illustrations. The startup screen is also depicted near the top of the flowcharts shown in Figures 6–13, 6–24 and 6–41. If password protection is on for all three levels, you can only reach the run mode, and no changes to the parameters can be made without password access.

AUTO–SAVE–ON

The AUTO–SAVE option either updates the current setup file with the new values before loading a new setup file (AUTO–SAVE–ON) or discards any changes made when we load a different setup (AUTO–SAVE–OFF). Press the touchcell to toggle it to the desired state.
LIMITS

The limits screen allows you to set an alarm for the high and low limits of the four welding process variables. These are weld time, collapse distance, welding force and vibration amplitude. The upper limit touchcells are in the top row and the lower limits are in the second row. If the value of both the upper and lower limit of a process variable is zero (initial default), that variable is not checked for out of range conditions. The measured variable must be less than the upper limit and greater than the lower limit. An alarm occurs if the measured variable equals or exceed the limit. The upper limit must be greater than the lower limit otherwise an error message appears at the bottom as shown in Figure 6–44.

The LATCH ON SUSPECT PART touchcell toggles between YES and NO. If it is set to NO (red cell) when a limit condition occurs, the weld cycle is completed and an alarm screen appears (Figure 6–45) which must be cleared with the CLEAR ALARM F5 touchcell in the lower right. In this case, the message area at the bottom center will be blank.

If the latch is set to YES (green cell) when a limit condition occurs, then the alarm screen appears with the door open instructions, and the sliding access door remains closed. The alarm screen must be cleared and then sliding door can be opened by activating both operate switches.

RESET PART COUNTER

This touchcell resets the suspect part counter to zero, or to the preset value. If the counter is set to count up, it sets the counter to zero. If the counter is set to count down, the preset value is loaded. Refer to the text accompanying Figure 6–28, subsection 3 for more details on the counter.
ERASE SETUPS Screen

Pressing this touchcell displays a new setup selection screen as shown in Figure 6–46. You can erase any one of the setups by pressing the corresponding touchcell, or all the setups at once with the center touchcell.

Prior to erasing the file(s), a confirmation window appears to verify the setup(s) should be erased. This is shown in Figure 6–47. Press the ERASE F2 touchcell on the left to delete the file or the CANCEL F5 touchcell on the right to return.

If you press ERASE, the window closes and selected cell in the ERASE SETUPS screen turns yellow and displays ERASING SETUP as shown in Figure 6–48. You can erase another file, return to the UTILITIES screen by pressing the utilities touchcell, return to RUN or to PROGRAM mode by pressing their touchcells.
RESET INVERTER Screen

Resetting the inverter drive circuit only needs to be performed when the RUN screen displays a red drive error message in the bottom message area. A Run screen with one of the messages is shown in Figure 6–49. The four possible error messages are:

1. DRIVE FAILURE
2. DRIVE OVERLOAD VOLTAGE
3. DRIVE OVERLOAD CURRENT
4. DRIVE OVERLOAD VOLTAGE AND CURRENT

Pressing the RESET INVERTER touchcell on the UTILITIES screen resets the electronic drive circuit. The cell momentarily flashes yellow and the legend displays INVERTER RESETTING. This is depicted in Figure 6–50. You can then return to the run mode screen.

COUNTER SETUP Screen

This touchcell is a shortcut to the counter setup discussed earlier. The text accompanying Figures 6–28 and 6–29 explain the counter function in detail.

CALIBRATION–XDUC Screen

This touchcell allows you to recalibrate the vertical table position encoder. Figure 6–51 shows this calibration screen. Calibration only need to be performed if the vertical position encoder is replaced. The black message block on the left flashes to remind you to remove the tooling before calibrating the position transducer so you can achieve the complete range of table lift.

Move the table all the way to the top using the manual table lift control (7 in Figure 4–2). Note that the readout in the upper left gives a real-time display of the table position and the encoder count output. The encoder count should be close to zero as the table reaches its maximum lift. Press the touchcell in the upper right to accept the encoder value.

Now move the table all the way down until it bottoms out against the mechanical stop. This time the encoder count should be close to maximum (32,767) and the distance near zero. Press the touchcell in the middle right to finish calibration. It flashes yellow and displays OK to indicate the value has been accepted.
USER OPTIONS Screen

The USER OPTIONS screen provides a method of setting up optional or user–installed pneumatic valves used for clamp, eject and slide systems and part–in–place sensors. If you do not have optional pneumatic valves, the TRIGGER METHOD should be set to OFF as shown in Figure 6–52. If you do not have sensors, make sure the bottom two cells display BYPASS SENSOR in red, as shown. To activate the valves, select a trigger method other than OFF. To activate the sensors, toggle the cell(s) so that they are green and display SENSOR 1 ACTIVE and/or SENSOR 2 ACTIVE, depending upon your configuration.

You can select the trigger method to actuate or close each valve (A side), and a stop method to open the valve (B side). The stop method also has a timer associated with opening the valve. If you select EJECT as a trigger method, it has a separate EJECT TIMER for operating the valve. If you select SLIDE as a trigger method, it has a separate SLIDE TIMER on the TEST VALVES screen (Figure 6–54) for operating the valve. Use the RIGHT arrow [▶] and LEFT arrow [◀] keys to select one of the four lists. The selected list has a vertical white bar in front of it. In Figure 6–52, VALVE 1 TRIGGER METHOD is selected. Use the UP arrow [▲] and DOWN arrow [▼] keys to move the pointer to the desired method in the list. Then press the Enter key [►] to highlight the selected method. Figure 6–53 shows the RUN screen with both the sensors activated and both the valves set to a trigger method. Make sure the sensors are bypassed and the valves are off if your configuration does not support them. The welder will not operate if they are enabled, but not installed.

TEST VALVES Screen

The TEST VALVES screen (Figure 6–54) provides a method of testing the optional pneumatic valves used for clamp, eject and slide systems and vacuum part retention. Pressing each touchcell activates the corresponding valve. The cell momentarily turns yellow. The SLIDE DELAY timer is part of the SLIDE trigger method on the USER OPTIONS screen (Figure 6–52). Press RETURN to get back to the Utilities menu.
Tooling Installation

- Initial Machine Startup
- Installing the Tooling
- Machine Shutdown
- Torque Mounting Bolts
- Tuning Magnetic Drivers

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Initial Machine Startup

Inspection
Check the hydraulic fluid level to ensure it is at the correct level as shown in Figure 7–1. Refer to Section 3 for specifications on the hydraulic fluid, the fluid cap, strainer and the correct fluid level. Check for any leaks on the floor or under the cabinet. Make sure both the hydraulic system service doors and the electrical cabinet service doors are closed. The hydraulic system service doors are interlocked to prevent machine operation with the doors open. Figure 2–9 shows a typical door interlock device and the mating receptacle in the cabinet.

Apply Power
AC Power
Plug in the AC power cord to a 480 Volts AC, 3–Phase, 30 Amp, NEMA type L16–30R receptacle as shown in Figure 2–2. Turn on the AC power switch as shown in Figure 3–7.

Machine Air
The welder requires a supply of clean, dry, compressed air at 75 to 90 psi. The connection is made using 1/2 inch O.D. tubing at the pneumatic lockout device. Turn the valve to the right as shown in Figure 7–2 to open the valve and apply the compressed air. The air is used to raise and lower the front access door and for any optional vacuum part–retention or pneumatic clamping and ejection features.

Hydraulic System
Clear Emergency Stop & Reset Welder
Reset both of the Emergency Stop Switches (referred to as E–Stops in menu screens) by turning clockwise and pulling up. These are identified in Figure 7–3 by the dashed lines and also in Figure 4–6. Then press the reset button (dotted circle), and the alarm light (solid circle) will stop flashing and go out. If the alarm light does not go out, make sure the rear service doors are securely closed and the interlocks engaged.
Activate Hydraulic Pump

Turn on the hydraulic pump by pressing the green pushbutton. It will illuminate when the pump is activated. The RUN screen should indicate about 500 pounds of lift force. This is indicated in the left column next to the label ACTUAL FORCE. The hydraulic pump produces from about 140psi to 170psi unloaded (nominal 150psi).

The Model 3500 has a 2–inch bore cylinder whose piston area is 3.14 sq. inches. The hydraulic pressure applied to this area then produces from 440 lbs to 535 lbs of lift force unloaded. Figure 7–4 shows 526 pounds of lift force at idle.

The Model 3700 and 3900 have a 2.5–inch bore cylinder whose piston area is 4.91 sq. inches. This results in an unloaded lift force between 685 lbs to 835 lbs.

Initiate HOME Procedure

The HOME procedure instructions can be found in the HELP menu under the machine reset cell. The instructions are shown here in Figure 7–5. You should already have completed the first three steps. Make sure the mode switch (F6 in Figure 4–1 and 4–2), is in SETUP position. If both of the message cells in the lower left are green, the machine is already at home position and nothing will happen. Here the message cell indicates the table is not at home position (appears in red on the display). Now press the HOME touchcell at the bottom center of the screen with your right finger, and activate the closest operate switch with your left finger. The table will move down to its home position, the message will change to TABLE IN HOME POSITION and the cell turns green. Press the RUN MODE F5 cell to return to the RUN screen.

![Figure 7-4 RUN Screen With Normal Hydraulic Pressure](image)

LIFT FORCE

The hydraulic pump produces pressure which is measured in Force per Unit Area (FL-2). This pressure is applied to the surface of a piston inside the hydraulic cylinder which is measured in units of Area (L^2).

Dimensional analysis shows that Pressure (FL-2) applied to an Area (L^2) results in a Force (F) given by:

\[
\text{Force} = \frac{\text{Pounds}}{\text{Sq Inch}} \times \frac{\text{Sq Inch}}{\text{Pounds}} = \text{Pounds}
\]

e.g. Model 3500 with a 2–inch piston and 140 lbs psi

Piston Area = \( \pi r^2 = 3.14 \times 1^2 = 3.14 \) inch \(^2\)

Force = \( \frac{140 \text{ lbs}}{\text{sq. inch}} \times 3.14 \text{ sq. inch} = 439.6 \) lbs

![Figure 7-5 HOME Procedure Instructions](image)
Install Tooling Assembly

Place the aligned upper and lower tooling assembly on the lift table (the tooling stanchion alignment pins should be extended). Loosely install the lower tooling mounting bolts (M12–1.75) with washers (7/16” Grade 8) into the table. With the mode switch still in the setup position, use the closest operate switch and the table up control (in Figure 4–2) to raise the table. Raise the table until the upper tooling is almost in contact (within 2mm or 0.1 inch) with the spring frame, but not touching.

Position Upper Tooling

Welder Shutdown

Press one (or both) of the E-Stop switches. The hydraulic pump will stop, the illuminated green light will extinguish and the red Alarm lamp will flash.

Power Shutdown

Turn off and lockout the AC Power. Close and lockout the compressed air. Refer to Figures 2–3, 2–4 and 2–5 for photos of correctly locked–out energy sources.

Mounting Bolts

Loosely install the upper tooling bolts (M12–1.75) with washers (7/16” Grade 8) in the upper spring frame. The bolt patterns for each of the lift tables are shown in Figure 7–6, 7–7 and 7–8.

Tighten Upper Tooling

1. Turn on the AC power.
2. Apply the compressed air.
3. Clear all the E-Stops.
4. Press the Reset switch.
5. Turn on the Hydraulics.
6. Use one activation switch and the table control to raise the lift table until the tooling is direct contact with the spring bridge.
7. Check final alignment of the tooling.
8. Finger tighten all accessible upper and lower mounting bolts.

TOOLING BOLT LENGTH

The M12 x 1.75 bolts used to secure the tooling must have a minimum of three and one–half (3-1/2) threads engaged in the table or spring threads (one times bolt diameter or 6mm). We strongly recommend that the bolts be long enough to engage at lease five (5) threads (1-1/2 times bolt diameter or 9mm).
Figure 7-6 Model 3500 Upper and Lower Tooling Bolt Patterns
Figure 7-7  Model 3700 Upper and Lower Tooling Bolt Patterns
**Figure 7–8  Model 3900 Upper and Lower Tooling Bolt Patterns**
**Torque Mounting Bolts**

1. Press E-Stop
2. Disconnect and lockout the AC power.
3. Close and lockout the machine air
4. Tighten the upper tooling to spring bridge with a torque wrench to 100 ft-lbs.
   NOTE: 100 ft-lbs = 13.83 Kg-m = 136 Nt-m
5. Tighten the lower tooling bolts to the table with a torque wrench set to 100 ft-lbs.
6. Attach and secure any air lines or sensor wiring to the tooling.

**Final Tooling Prep**

1. Turn on the AC power.
2. Apply the compressed air.
3. Clear the E-Stops.
4. Press the Reset switch.
5. Turn on the Hydraulics.
6. Load the program for the currently installed tooling. Refer to Figure 6–7 and Section 8 – Machine Operation, Selecting A Weld File.
7. Initiate a HOME procedure (see Figure 7–5).
8. Retract tooling stanchion alignment pins (see Figure 7–9).
9. Remove any protective parts from tooling.
10. Install any mounting bolts that were inaccessible with the tool closed. Torque them to 100 ft-lbs.

**Tune Drive To Tooling**

During the Autotune process, the machine seeks the operating frequency that optimizes the drive to the load presented by the upper tooling assembly. If an Autotune is not performed, the driver will be fighting the natural resonance of the tooling which results in wasted energy and possibly poor welding quality. Energy cannot be created or destroyed, only be changed. This wasted energy shows up as excessive heating, usually in the magnetic drive coils. Overheated coils will fail prematurely resulting in unnecessary downtime and expense.
Use all the bolts, torqued to the specified value, to attach the upper tooling, unless some part of the tooling obstructs a hole. Failure to install all the mounting bolts may result in the upper tooling becoming acoustically decoupled from the springs, possibly resulting in damage to the tooling or machine. Acoustic coupling is the tendency for a multipart mass to vibrate as if it were one piece. Insufficient or loose bolts can cause acoustic decoupling where part of a piece to vibrates at a different frequency or out of phase relative to the other pieces. A loose lower tool assembly will result in poor welding and can also cause damage to the tooling or the welder.

1. Perform the Autotune procedure (refer to Figure 6–27).
2. Run Autotune each time tooling is changed. Refer to Section – 10 Troubleshooting if the Autotune procedure fails.
3. Switch the mode switch to RUN.
4. Break the light–curtain beam to stop flashing.
5. The welder is now ready to load parts and begin welding.

**IMPORTANT**
Use all bolts (unless some part of the tooling obstructs a hole), torqued to the specified value, to secure the upper and lower tooling.
Machine Operation

- Specifying A Weld File
- Load Parts Into Tooling
- Starting A Weld Cycle
- Stopping The Weld Cycle

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Machine Startup

A detailed startup procedure is given at the beginning of Section 7 – Tooling Installation. A condensed version is given here for your convenience.

1. AC Power
Plug in the AC power cord to a 480 Volt AC, 3–Phase, 30 Amp receptacle and turn on the AC power switch. The yellow power light will illuminate.

2. Compressed Air
Connect the welder to a supply of clean, dry, compressed air at 75 to 90 psi. Turn the lockout valve to the right to open the valve. The air is used to raise and lower the front access door and for any optional vacuum part–retention or pneumatic clamping and ejection features.

3. E-Stops & Reset
Reset both of the emergency stop buttons by turning clockwise and pulling out (or up). Then press the reset button and the alarm light will stop flashing and go out. If the alarm light does not go out, make sure the rear service doors are securely closed and the interlocks engaged.

4. Hydraulic Pump
Turn on the hydraulic pump (refer to Figure 8–8) by pressing the start button. It will illuminate green when the pump is activated. The RUN screen should indicate between 440 lbs to 535 of lift force for a Model 3500. The Model 3700 and 3900 should indicate between 685 lbs to 835 lbs of lift force.

5. HOME Procedure
Make sure the mode switch is in SETUP position. If both of the message cells in the lower left are green, the machine is already at home position and nothing will happen. If the message cell indicates the table is not at home position (see Figure 8–1), press the HOME touchcell at the bottom center of the screen with your right finger, and activate the closest operate switch with your left finger. The table will move down to its home position, the message will change to TABLE IN HOME POSITION and the cell turns green. Press the RUN MODE (F5) cell to return to the RUN screen.

IMPRESS
Never operate the Vibration Welder with the electrical service door open. This is an unsafe practice and can result in injury.

LIFT TABLE WILL NOT MOVE
If the indicated hydraulic force is near zero, refer to Section 10 – TROUBLESHOOTING, Hydraulics, Lift Table Will Not Move on page 96.

Dukane Manual Part No. 403-548-01
**Selecting A Setup File**

Load An Existing File

Instructions for loading an existing setup file are given in Section 6 – Touch Screen Menus in the section VIEW Mode, LOAD and VIEW Setup. A condensed version is given here for your convenience:

1. From the RUN screen (Figure 8–2), press the active area in the lower right of the screen labeled SETUP MODE (or press F5).

2. The SETUP screen, shown in Figure 8–3, appears. From here you can load the desired setup file or examine the parameters of a file by pressing the VIEW SETUP cell.

3. Load the desired SETUP file by pressing the touchcell as shown in Figure 8–4. Then press RUN MODE (F6) to return.

4a. To examine the parameter values of a setup file before loading, press VIEW SETUP to access the VIEW MODE screen shown in Figure 8–5. Press the touchcell of the desired file to view the parameter values.

4b. Press the VIEW MODE (F5) cell to return to the SETUP screen (Figure 8–3) to load the file.

4c. To change any of the parameters, return to the RUN screen (F6) and press ALTER SETUP.

**Programming A New File**

Detailed instructions for setting up a new file are given in Section 6 – Touch Screen Menus in the section PROGRAM Mode which begins with Figure 6–32.

**Set Limits and Parts Counter**

Instructions for setting the limits and activating the counter are given in Section 6 – Touch Screen Menus in the sections under UTILITIES Menu, LIMITS (Figure 6–44) and ALTER SETUP Screen, COUNTER SETUP (Figure 6–28).
Starting A Weld Cycle

To begin a weld cycle once the parts are loaded, turn the mode switch to **RUN** as shown in Figure 8–8. The green machine IN–CYCLE lamp should be lit. The message area should now be flashing red displaying LIGHT CURTAIN as shown in Figure 8–6. Loading the parts into the tooling fixture will break the light–curtain beam and place the welder in full **RUN** mode.

Load Parts In Tooling

Once the parts are loaded into the tooling fixtures, the flashing red LIGHT CURTAIN message will change to a steady green **RUN MODE** as shown in Figure 8–7.

Self–Aligning Parts

Upper and lower parts which are self–aligning (e.g. have pins or grooves to keep them aligned) can be loaded together into the bottom tooling fixture.

Vacuum Part Retention

Parts which are not self–aligning will have to be placed into their respective tooling. The lower part is held in place by gravity. The upper part is placed in the fixture and the vacuum retention feature engaged.

Activate Operate Switch

The **RUN** screen should show the Setup file number of the loaded file at the top of the screen and the message area at the bottom show display **RUN MODE** as shown in Figure 8–7. Place one finger of your left hand on the operate switch and the welding cycle will begin. The door closes, the parts are welded and the door opens. Remove the assembled part and repeat the cycle.
Stopping The Weld Cycle

E–Stop Switches
To stop a weld cycle, press one of the two Emergency Stop switches. The welder stops immediately and the hydraulic pump stops. The green Pump light and the green In–Cycle light will both extinguish and the red Alarm lamp will flash.

Light Curtain
You can also stop the weld cycle while the front access door is in motion by interrupting the light curtain. This will immediately stop the door and turn off the hydraulics. The ALARM light will also be flashing.

Resetting Machine
Stopping the welder with the light curtain or the E–Stop switch halts all operations and de–energizes the lift table, drive heads and front access door. To reset the welder, place the mode switch in SETUP position and press F1 to display the HELP screen (see Figure 6–10). Then press the MACHINE RESET touchcell (see Figure 7–5) and follow the instructions.
1. Move mode switch to Setup position.
2. Clear all E–stops.
3. Press the Reset button.
4. Restart the Hydraulic Pump.
5. Press F1 to display the HELP screen.
6. Press the MACHINE RESET touchcell.
7. Press and hold the HOME touchcell while activating the right safety switch until the welder is reinitialized.
8. Press the RUN MODE touchcell.
9. Move mode switch to RUN mode.

LIGHT CURTAIN FAULT
If the light curtain beam is interrupted when the front access door is opening, the E-STOP module is engaged. The Reset button must be pushed to disengage the module.

If the light curtain beam is interrupted when the front access door is closing, the E-STOP module is not affected and steps 2 and 3 can be skipped.
Optimizing Performance

- Weld Time
- Weld Pressure
- Hydraulic Flow
- Pneumatic Pressure
- Pneumatic Flow

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Pneumatic Flow ............................................ 85
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Welding Parameters

There are five key parameters that affect the quality of the weld. They are –
- Frequency
- Time
- Melt Penetration
- Amplitude
- Force

Frequency is adjusted automatically by the system during the Autotune process. Weld time is a trade off between fast cycle times and deep melt penetration. A deeper melt penetration increases weld strength. The amplitude and force determine how quickly the weld phases progress. These in turn are determined by the type of plastic and the part geometry. The four phases are depicted graphically in Figure 9–1. With welding parameters held constant, cycle time increases with wall thickness.

Weld Time

The strongest welds are produced using the longest weld time because this allows the melt flow to penetrate deeper into the parts and eliminates any voids.

Weld Distance

Depending on the part configuration, the material displaced will generally range from 0.75mm to 1.25mm (0.019 to 0.032 inch). This is only a broad estimate and your application may require a different value. The amount of displacement required is affected by the flatness of the welding interface. The greater the warpage, the more material that needs to be displaced, therefore the longer the weld cycle. The strength of the weld can be a function of the weld distance for some thermoplastics and relatively insignificant for others as shown in Figure 9–3. Do not confuse weld distance which is the collapse distance with weld penetration which is how deep the melt flow penetrates.

WELDING PHASES

There are four phases in the vibration welding cycle.

PHASE 1: Vibration creates Kinetic friction, which generates heat at the joint interface. No penetration takes places in Phase 1.

PHASE 2: The glass transition (or crystallization) temperature is reached and viscous flow occurs. Heat is generated by viscous dissipation in the molten polymer. Lateral flow in the polymer allows the penetration to occur.

PHASE 3: Both melt and flow reach a steady state wherein the heat loss through the wall due to flash equals the heat being generated. The melt is flowing laterally and weld penetration increases linearly with time. The penetration required to reach a steady state condition increases with the wall thickness, but decreases with the welding pressure.

PHASE 4: Vibrations are halted, but weld penetration continues because the clamping pressure causes the molten polymer to flow until it solidifies. The parts are held clamped in the final position while they cool sufficiently to withstand handling.
**Weld Amplitude**

The amplitude has less effect upon the weld strength than the weld time. Figure 9–2 shows the relationship of weld strength for generic POM as a function of weld force for a fixed weld depth and two different amplitudes. Higher weld strength occurs at lower clamping pressures because the weld time is longer and the penetration distance greater. However as clamping pressure increases to shorten the weld time, the weld strength decreases more rapidly for the low amplitude weld joint. Figure 9–3 shows the relationship of weld strength of different thermoplastics as a function of weld depth (collapse distance) for a fixed weld amplitude and weld pressure.

**Weld Force**

Increasing the weld force increases the collapse but not the weld penetration. The welding force required for different materials is determined by a combination of the polymer’s melt flow index, the glass transition or crystallization temperature and molecular weight. The approximate melt index range for some common thermoplastics and their welding pressure range are given in Table 9–I. Since there is such a wide range of melt flow rates for even common polymers, depending upon their molecular structure, the welding pressure required can initially only be estimated. The optimal values must be determined experimentally.

Pressure is force per unit area, so the weld force setting is the desired welding pressure multiplied by the total effective joint area. Remember to keep the units of measurement consistent (pounds and inch², Megapascals or newtons and meter²) when calculating the desired weld pressure.

**Hold Force**

Clamping under pressure while the bond hardens, corrects warping problems by forcing the parts into the proper geometry. Decreasing the welding pressure at the beginning of the hold cycle can reduce the flow of molten material and thus reduce the size of the weld bead or flash. In addition, this can reduce shear thinning to create stronger welds. The hold time

---

**Table 9—I**  Approximate Welding Pressure For Common Thermoplastics

<table>
<thead>
<tr>
<th>Thermoplastic</th>
<th>Abbr</th>
<th>Chemical Name</th>
<th>Trade Name</th>
<th>Melt Flow Rate</th>
<th>Welding Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Acrylonitrile Butadiene Styrene</td>
<td>Lustran</td>
<td>2–50</td>
<td>145–290</td>
<td>1.0–2.0</td>
</tr>
<tr>
<td>PA6</td>
<td>Polycapro lactam</td>
<td>Nylon 6</td>
<td>18–110</td>
<td>145–290</td>
<td>0.5–3.0</td>
</tr>
<tr>
<td>PA66</td>
<td>Polyhexamethylene- adipamide</td>
<td>Nylon-6/6</td>
<td>10–180</td>
<td>72–435</td>
<td>0.5–3.0</td>
</tr>
<tr>
<td>PC</td>
<td>Polycarbonate</td>
<td>Lexan</td>
<td>3–12</td>
<td>145–290</td>
<td>1.0–2.0</td>
</tr>
<tr>
<td>HDPE</td>
<td>High Density Polyethylene</td>
<td>Chevron</td>
<td>0.1–80</td>
<td>72–1160</td>
<td>0.5–8.0</td>
</tr>
<tr>
<td>PMMA</td>
<td>Polymethyl Methacrylate</td>
<td>Lucite</td>
<td>1–25</td>
<td>145–290</td>
<td>1.0–2.0</td>
</tr>
<tr>
<td>POM</td>
<td>Polyoxymethylene</td>
<td>Delrin, Acetal</td>
<td>1–40</td>
<td>145–580</td>
<td>1.0–4.0</td>
</tr>
<tr>
<td>PP</td>
<td>Polypropylene</td>
<td>Herkulon</td>
<td>1–100</td>
<td>72–580</td>
<td>0.5–4.0</td>
</tr>
<tr>
<td>PPE+SB</td>
<td>Polyphenylene Ether + Styrene/Butadiene</td>
<td>8–270</td>
<td>145–870</td>
<td>2.0–6.0</td>
<td></td>
</tr>
<tr>
<td>PS</td>
<td>Polystyrene</td>
<td>Styron</td>
<td>3–25</td>
<td>145–580</td>
<td>1.0–4.0</td>
</tr>
<tr>
<td>SAN</td>
<td>Styrene–Acrylonitrile</td>
<td>Lustran</td>
<td>8–25</td>
<td>145–290</td>
<td>1.0–2.0</td>
</tr>
</tbody>
</table>

1 psi = 6.895x10⁻³ MPa;  1 MPa = 1.450x10² psi;  1 MPa = 1x10⁶ Nt m⁻²
must be long enough however, so that the temperature of the weld seam is below the glass transition or crystallization temperature. A holding time of between one and five seconds is usually sufficient.

**Hydraulic Flow**

There are no mechanical adjustments for the hydraulic system. Hydraulic pressure is controlled by the WELD FORCE and HOLD FORCE settings in the setup file. A pressure transducer provides constant feedback to ensure proper control. Figure 9–4 identifies the transducer and control valves. Do not attempt to perform any mechanical adjustments to the hydraulic system.

**Pneumatic Pressure**

Compressed air is used to raise and lower the front safety door, provide vacuum part retention and actuate any optional pneumatic clamping or ejection features. As long as the air pressure is within the specified range of 75 to 90 psi, the regulator should never require any adjustment. If the pneumatically operated mechanisms are operating too slowly, check that you do not have a restriction upstream and that you have sufficient air flow into the welder.

**Pneumatic Flow**

The front safety access door uses compressed air to raise and lower the door. The flow rate of the air controls the speed of the door. These are set at the factory for fast enough operation yet slow enough to avoid slamming the door into the stops. Excessive door speed can result in damage. If they ever require adjustment, loosen the locking rings and make small changes to the flow control. Turn the locking rings back down to prevent changes in the settings. The door flow control valves are identified in Figure 9–5. They are also labeled on the top of the distribution manifold.
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Common FAQs ............................................. 97
Electronics Control

PLC Backup Battery

If the Run Mode screen displays the message **Low PLC battery replace**, you have approximately 2 hours of reserve capacity (Allen-Bradley specs) after you power down before you loose your stored setup files. This screen is shown in Figure 10–1. If you do not have a spare battery and want to keep your setup files, you will have to leave the AC power on until the battery is replaced.

The first step in preventing data loss is to always have a written copy of your setup files. The second step is to have a spare battery on hand. The battery is a 3 V Lithium CR14250SE or equivalent. The battery is inside the Programmable Logic Controller module.

The interior of the electrical cabinet is shown in Figure 10–3 with the major components identified. Turn off the AC power before opening the electrical service cabinet. Figure 10–2 shows a close-up of the PLC rack and indicates the upper and lower release latches on the PLC module. Make sure you are properly grounded before removing the PLC from its chassis to prevent static discharge and potential damage to the PLC. Open the PLC front access cover and disconnect the serial data cable from the upper chassis connector as shown. Remove the cable from its restraint to facilitate removing the PLC module. Press in both the upper and lower release latches and pull the PLC module out of the rack.

The location of the 3 Volt Lithium battery is identified in Figure 10–4. Since the battery has soldered leads, it may be placed in the battery holder either direction. The battery holder does not have an electrical connection to the board. The battery connector however is polarized and should be oriented as shown with the red positive battery lead closest to the outside edge of the board. The white wire is the negative lead and goes to the center pin of the connector.

Each battery contains **0.23 grams of Lithium. Do not incinerate or dispose of lithium batteries in general trash collection. Explosion or violent rupture is possible.** The lithium material may be considered toxic, reactive or corrosive. The person dis-
Figure 10-3  Interior Of Electrical Cabinet With Major Components Identified
posing of the material is responsible for any hazard created in doing so. State and local regulations may exist regarding the disposal of these materials.

**PLC Processor Errors**

There are six rectangular LEDs on the front of the PLC module. The only two that should be on are the RUN and DH485 LEDs as shown in Figure 10–5. Table 10—I can be used to help troubleshoot the PLC should the need ever arise. They can help to determine whether the cause of the problem is related to hardware failure or a software fault. Table 10—I lists the status codes for each LED.

There is a 3A fuse inside the PLC power supply. This is located behind the hinged panel in the area to the left of the controller (see Figure 10–6) which contains the red power supply LED. If the power LED is not lit, it indicates there was an overload in the power supply, possibly a short.

Note that the key on the front of the PLC module should be in the RUN position, which is at the 10 o’clock position. If the key is in the PROG position at 2 o’clock, the PLC will not run. If the key is in the REM position at 12 o’clock, the system should run OK. However, we recommend operating the welder with the key to the RUN position.

<table>
<thead>
<tr>
<th>LEDs Indicate</th>
<th>The Following Error Exists</th>
<th>Probable Cause</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All LEDs Off&lt;br&gt; • Status of any Communication LED does not matter</td>
<td>Inadequate System Power</td>
<td>No Line Power</td>
<td>1. Verify proper line voltage and connections on the power terminals.&lt;br&gt;2. Verify proper 120/240 power supply jumper selection.</td>
</tr>
<tr>
<td>RUN</td>
<td></td>
<td>FORCE</td>
<td></td>
</tr>
<tr>
<td>FLT</td>
<td></td>
<td>DH485</td>
<td></td>
</tr>
<tr>
<td>BATT</td>
<td></td>
<td>RS232</td>
<td></td>
</tr>
<tr>
<td><strong>LEGEND</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON–Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON–Green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON–Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLASHING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DONT CARE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Table 10—I</strong></td>
<td>PLC Processor Errors and Recommended Actions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| • Fault LED On<br> • All Other LEDs Off<br> • Communication LEDs do not matter | Inadequate System Power | Improper line power voltage selection | 1. Verify proper 120/240 power supply jumper selection. |
| RUN || FORCE| | |
| FLT || DH485| | |
| BATT || RS232| | |
| • Fault LED On<br> • All Other LEDs Off<br> • Communication LEDs do not matter | Inadequate System Power | Improper line power voltage selection | 1. Verify proper 120/240 power supply jumper selection. |

![Figure 10–4 3V Lithium Battery in the PLC Module](image)

![Figure 10–5 Status LEDs On PLC Front Panel](image)
<table>
<thead>
<tr>
<th>LEDs Indicate</th>
<th>The Following Error Exists</th>
<th>Probable Cause</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Power LED On</td>
<td>Processor not in run mode</td>
<td>Either improper mode selected or program logic error</td>
<td>1. If the keyswitch is in the REM or PROG position, toggle the key to the RUN position.</td>
</tr>
<tr>
<td>• All Other LEDs Off</td>
<td></td>
<td>Line power out of operating range</td>
<td>1. Check proper 120/240 power supply jumper selection and incoming power connections. 2. Monitor for proper line voltage at the incoming power connections.</td>
</tr>
<tr>
<td>• Status of any Communication LED does not matter</td>
<td></td>
<td>Improper seating of power supply and/or processor in the chassis</td>
<td>1. Turn off power and inspect the power supply and processor chassis connections. 2. Reinstall the devices and reapply power. IMPORTANT – The processor only operates in the first slot of the chassis.</td>
</tr>
<tr>
<td>RUN G</td>
<td>FORCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLT G</td>
<td>DH485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATT G</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power LED On</td>
<td>System inoperable. No major CPU faults detected.</td>
<td>Defective I/O devices or I/O wiring</td>
<td>1. Test inputs and outputs following standard troubleshooting procedures.</td>
</tr>
<tr>
<td>• Run LED On</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• All Other LEDs Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communication LEDs do not matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RUN G</td>
<td>FORCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLT R</td>
<td>DH485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATT R</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power LED On</td>
<td>CPU fault</td>
<td>CPU memory error</td>
<td>1. Cycle power</td>
</tr>
<tr>
<td>• Fault LED On</td>
<td></td>
<td>Faulty memory module</td>
<td>1. Turn off power and then remove the memory module from the processor 2. Reinstall the processor and reapply power. If steady Fault LED changes to flashing, replace the memory module.</td>
</tr>
<tr>
<td>• All Other LEDs Off</td>
<td></td>
<td>Faulty processor or power supply</td>
<td>1. Place the processor in another chassis and cycle the power. If steady Fault LED reappears, replace processor. 2. If Fault LED clears, monitor the power going to the power supply in existing system. Replace existing power supply if line power checks OK.</td>
</tr>
<tr>
<td>• Communication LEDs do not matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RUN G</td>
<td>FORCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLT R</td>
<td>DH485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATT R</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power LED On</td>
<td>System is not operating per programmed forces</td>
<td>User programmed forces are not enabled</td>
<td>1. Enable appropriate forces and test system conditions again. Once forces are enabled, the Force LED turns on steady.</td>
</tr>
<tr>
<td>• Run LED On</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Force LED Flashing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• All Other LEDs Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communication LEDs do not matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RUN G</td>
<td>FORCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLT R</td>
<td>DH485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATT R</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Power LED On</td>
<td>CPU major error with Low or No battery backup</td>
<td>Loss of RAM during powerdown</td>
<td>1. Verify the battery is connected. 2. Replace the battery if you want RAM battery backup. 3. Refer to processor major fault recommended action steps.</td>
</tr>
<tr>
<td>• Fault LED Flashing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Batt LED On</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• All Other LEDs Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communication LEDs do not matter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RUN G</td>
<td>FORCE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLT R</td>
<td>DH485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BATT R</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 10—II  PLC Status Codes for LEDs

<table>
<thead>
<tr>
<th>Processor LED</th>
<th>When It Is</th>
<th>Indicates That –</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN (Green)</td>
<td>ON (Steady)</td>
<td>The processor is in RUN mode – normal operating mode.</td>
</tr>
<tr>
<td></td>
<td>FLASHING (During Operation)</td>
<td>Processor is transferring a program from RAM to the working memory module.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>The processor is in a mode other than RUN.</td>
</tr>
<tr>
<td>FAULT (Red)</td>
<td>FLASHING (At Powerup)</td>
<td>The processor has not been configured.</td>
</tr>
<tr>
<td></td>
<td>FLASHING (During Operation)</td>
<td>The processor detects a major error either in the processor, expansion chassis or memory.</td>
</tr>
<tr>
<td></td>
<td>ON (Steady)</td>
<td>A fatal error is present (no communications).</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>There are no errors – normal operating mode.</td>
</tr>
<tr>
<td>BATTERY (Red)</td>
<td>ON (Steady)</td>
<td>The battery voltage has fallen below a threshold level, or the battery (or battery jumper) is missing or not connected.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>The battery is functional, or the battery jumper is present – normal operating mode.</td>
</tr>
<tr>
<td>FORCE (Yellow)</td>
<td>FLASHING</td>
<td>One or more input or output addresses have been forced to an ON or OFF state, but the forces have not been enabled.</td>
</tr>
<tr>
<td></td>
<td>ON (Steady)</td>
<td>The forces have been enabled.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>No forces or present or enabled – normal operating mode.</td>
</tr>
<tr>
<td>DH485 (Green)</td>
<td>ON (Steady)</td>
<td>The Communications Active Bit (S:1/7) is set in the System Status file and the processor is actively communicating over the DH485 network – normal operating mode.</td>
</tr>
<tr>
<td></td>
<td>FLASHING</td>
<td>There are no other active nodes on the network.</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>A fatal error is present (no communications).</td>
</tr>
<tr>
<td>RS232 (Green)</td>
<td>ON (Flashing)</td>
<td>The SLC 5/03 is actively transmitting over the RS232 network (used when communicating with the PLC using the RS232 port).</td>
</tr>
<tr>
<td></td>
<td>ON (Steady)</td>
<td>The Communications Active Bit (S:1/7) is set in the System Status file and the processor is actively communicating over the RS232 network (used for uploading programs to the PLC via laptop computer).</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>The SLC 5/03 is not transmitting over the RS232 network – normal operating mode.</td>
</tr>
</tbody>
</table>

![Figure 10-6 3 Amp Fuse In PLC Power Supply](image)
Electrical Power

Internal Fuses
The interior of the electrical cabinet is shown in Figure 10–3. Inside the electrical cabinet below the base of the AC disconnect switch is a fuse block containing three 25 Amp fuses. These are wired in series between the AC disconnect switch and the circuit breaker. To gain access to the fuses, pinch the top and bottom of the clear cover as shown in Figure 10–7, and pull the cover off. There are four locking tabs that must be released which are identified in Figure 10–8. Each fuse has its own red removal tab. Pull the tab to remove the fuse. Note that the fuses are asymmetrical and have a flanged lip on the bottom.

Circuit Breakers
Below the fuse block is a circuit breaker which is wired in series with the fuse block. The breaker is a ganged, 480 Volt AC, 3–Phase, 25–Amp unit. The breaker is shown in its ON position in Figure 10–7.

The AC utility outlet on the front panel (Fig. 10–4), is protected by a circuit breaker which is identified in Figure 10–3. The maximum current that can be safely drawn from the utility outlets is 4 Amps total, independent of whether the outlets are wired for 110 Volts AC or 220 Volts AC.

The location of the hydraulic–pump motor breaker is identified in Figure 10–3. The breaker is shown in detail in Figure 10–8. This breaker should never trip under normal operating conditions.

Error Messages

Hydraulic Overload
If the circuit breaker for the hydraulic–pump motor (Figure 10–9) trips, the RUN screen displays an error message as shown in Figure 10–10. The message reads HYDRAULIC OVERLOAD, and means the pump motor has overloaded. Try and determine the cause of the overload before resetting the breaker.

1. Check that the hydraulic fluid is clear (not cloudy or dark) with a slight yellow tint. The fluid level sight glass should be at 50%.
2. Verify that the suction gauge (see Figure 3–12) is in the safe operating region (green area) when the pump is running.

3. Unscrew the filler cap (see Figure 3–11 or Figure 11–3), pull the basket and filter and check for any blockage or foreign material.

4. Verify the heat exchanger is cooling properly and the hydraulic fluid is below 150°F.

5. Check for any leaking hydraulic fluid from the hose fittings on the floor of the cabinet and underneath the welder.

If the cause of the overload is determined to be one of the five items above, do not operate the machine until the problem has been corrected. Do not increase the trip point on the circuit breaker as this may burn out the pump motor. The motor is designed to draw 4.3 Amps at 480 V AC when delivering its rated 3 HP.

**Inverter Overload**

If you get an inverter overload error message on the RUN screen (see Figure 6–49), check that the tooling is securely attached to the upper frame using all the bolts and torqued to specifications. Check that the weight of the tooling is within the specified range:

- Model 3500: 45 – 90 lbs (20 – 41 kg)
- Model 3700: 90 – 150 lbs (41 – 68 kg)
- Model 3900: 110 – 200 lbs (50 – 91 kg)

The four possible error messages relating to an inverter overload are:

1. DRIVE FAILURE
2. DRIVE OVERLOAD VOLTAGE
3. DRIVE OVERLOAD CURRENT
4. DRIVE OVERLOAD VOLTAGE AND CURRENT

If the upper tooling is in the correct weight range and is torqued to the proper values, you may need to increase the voltage, current or feedback delay. Increase the value according that corresponds to the error message. We strongly recommend that you consult Dukane prior to changing these values.

These parameters are contained in the DRIVER LIMITS screen shown in Figure 10–11. The default values are 2.00 seconds for each parameter. This screen can be accessed from the UTILITIES menu by select-
Hydraulics

Lift Table Moves Too Slowly
1. Check that the weld pressure is not set too low. It must be greater than the table weight, lower tooling weight and static table friction load.
2. Check that the hold pressure is not set too low.
3. Check that the hydraulic pressure is correct by verifying that the ACTUAL FORCE on the RUN screen (Figure 10–12) is between approximately 440 and 580 lbs for the Model 3500 and between about 680 and 850 pounds for the Model 3700 and Model 3900.
4. The hydraulic flow valves can be adjusted. Refer to Section 9 – Optimizing Performance, Hydraulic Flow Adjust.

Lift Table Will Not Move
1. Check that the Hydraulic pump is turned on. The HYDRAULIC PUMP ON light will be illuminated green and the ACTUAL FORCE on the RUN screen should be within the normal unloaded range.
2. If the hydraulic pump will not turn on, check that the Hydraulic breaker is not tripped. See Figure 10–3 for the breaker location and Figure 10–9 for the normal operational settings.
3. Is the hydraulic pump motor rotating in the wrong direction? If the RUN screen indicates almost zero lift force when the pump is on, check that your 480 Volt AC, 3-Phase line is correctly wired. If any of the phases leads are switched, the pump motor will rotate backwards. The welder has built-in diagnostics, and the RUN screen will display an error message indicating reverse rotation as shown in Figure 10–13. The welders are checked with a phase meter during assembly to ensure the phases are wired correctly and the pump is rotating in the proper direction. The polyphase pump motor is bidirectional and proper rotation can be established by reversing two power leads. To correct the problem, have an electrician...
· swap any two of the high voltage power leads feeding power to the main breaker of the welder.

4. Check that the fluid level in the sight glass is at 50%. The fluid should be clear (not cloudy or dark) with a slight yellow tint.

5. If none of these actions correct the problem, there may be something wrong with your hydraulic unit.

Common FAQs

Q: Do I need to service the hydraulic unit?
A: Yes, but thankfully not that often. You should replace the filter every one to two years, and change the fluid every (or at most every other) filter replacement, depending on the total operational hours on the hydraulic unit.

Q. The pump makes noise and a crackle sound. What is causing this?
A. Pump noise and crackle is most often caused by air entering the pump suction fitting. Tightening the suction fitting (refer to Figure 10–14) will usually eliminate such problems. If the pump fails to prime, vent the pump discharge to atmosphere to reestablish fluid flow.

Q: What should I do with the eight grease zerks on the machine?
A: We recommend you grease the zerks once or twice a year (in severe environments you might want to do it more often) with a good general-purpose industrial grease.

Q: There's a red box on the screen that says EMERGENCY STOP OR ACCESS DOOR OPEN and I've checked all the doors and cleared the E-Stops and it still won't go off, and I can't run a cycle. What is the problem?
A: If your machine is equipped with a RESET button, you have to push the reset button to clear any kind of alarm. If this does not clear the problem, it is possible that one of the E-Stop or door interlock switches needs replacement.
Q: There's a red box that says SENSOR 1 (or SENSOR 2) on my screen and it won't go away, and I can't run a cycle. What do I do now?
A: If you are using part-in-place detection, the part-in-place sensor is not detecting a part loaded into the tooling. If there are no part-in-place sensors in your tooling, go to the USER OPTIONS menu (from the UTILITIES menu) and put the sensors in BYPASS mode.

Q: What does it mean when I get an autotune error after the door has closed, the machine has made the vibrating sound, and the door has opened back up?
A: There is either a serious problem with the machine, there is some decoupling occurring between the machine and tool or within the upper tool or, more likely, the upper tool is outside of the weight range of the machine.

Q: There are a lot of tooling bolts. How many do I really HAVE to install?
A: The best answer to that question is ALL of them. There are some cases where you can use fewer. The only legitimate reason for not using all of the bolts is that some part of the tooling obscures some of the holes. You must also torque the bolts to 100 foot-pounds (136 Nt-m). If you do not, the upper tool can become decoupled from the springs, resulting in possible damage to the tool or machine. Similarly, a loose lower tool will result in poor welding and can damage the tooling or machine.

Q: What do you mean by acoustically coupled?
A: Acoustic coupling is a term we use to describe the tendency of a multipart mass to vibrate as though it were one piece. If the upper vibration tool has some loose bolts in it, the individual pieces can vibrate relative to each other, which causes significant problems. The tooling is then said to be decoupled from the springs. Both the machine and tooling can be damaged if this condition exists for a prolonged period.
Q: Why do I have to autotune the tooling?
A: 1. During an autotune the machine seeks the optimal operating frequency for that particular upper tool/spring assembly. If an autotune procedure is not done, the machine will be fighting the natural resonance of the tooling/frame assembly, which may result in poor and/or inconsistent weld quality.

2. Fighting the natural resonance of the tooling/frame assembly results in wasted energy. Since you cannot create or destroy energy, only change its form, this wasted energy shows up as heat, especially in the coils. Overheated coils will fail prematurely, resulting in unnecessary downtime and expense.

Q: The machine has two cycle activation switches, so why do I only have to activate one to start a cycle?
A: Machines equipped with light curtains are not required to be equipped with two-hand anti-tie-down cycle actuation, so as a convenience we allow the operator to use either of the switches to start the cycle.

Q: This machine is much louder than 80db. What can I do about it?
A: If the machine is slightly louder than 80db, it is probably running an application with a higher basic sound level than we tested the machine for in our factory. If you buy a Dukane machine with tooling, we always check the total noise of the machine and tooling together. Our standard sound insulation package is designed to deal with the majority of vibration welding applications. Consult Dukane about the possible addition of custom sound insulation. If the machine is significantly louder than 80db, you probably have not installed the fork tube covers that came with the machine (see Figures 3–4 and 3–5). When we ship a machine, the covers are shipped in a corrugated box in the bottom of the electrical cabinet.
Q: When I push the test button on the autotune screen (Figure 6–27), what am I supposed to hear?

A: You should hear a loud, clear, single-note tone similar to that of a boat horn. If you hear any raspy or buzzing sounds, or if you hear anything like a wow or wow-wow-wow-wow sound, check the security of ALL bolts and other fasteners in the upper tool, including the ones securing it to the springs. If the strange sound persists, call Dukane and ask us to listen to it over the telephone.

Q: I've installed a tool, done the autotune, the control screen indicates everything is OK, but when I push the button to start a cycle, the machine just sits there. What is the problem?

A: You have probably not connected the machine to an air line. The only part of the machine itself that needs pressurized air is the sliding door.

Q: When I try to autotune the machine nothing happens, and then after some period of time I get an autotune error. What is the problem?

A: You have probably not connected the machine to an air line. The only part of the machine itself that needs pressurized air is the sliding door.

Q: The front sliding door is open, but the screen still shows a DOOR OUT OF POSITION error, and nothing else will work. What is the problem?

A: Try pushing the RESET button if your machine has one, and/or manually reset the machine by depressing one of the E-Stop buttons and following the on-screen directions. It is also possible that your door-open limit switch is either out of adjustment or needs replacement.

Q: Why do I have to reset the machine every cycle, or quite often?

A: The most common cause of this is the operator breaking the light curtain just prior to the sliding door becoming completely open. Make sure the door has lowered completely before breaking the light curtain.
Q: Why do I get a light curtain error message until I break the light curtain when I put the machine in run mode?

A: You have to break and then clear the light curtain prior to every machine cycle for two reasons. First, we want the machine to check to make sure the light curtain is not damaged or defeated. Second, it can serve as a reminder to the operator that the part in the machine they are trying to cycle has already been welded.

Q: What happens if I accidentally run a cycle with the stanchion pins extended?

A: Hopefully nothing. The stanchion assemblies might survive a couple of cycles with the pins extended, but they are not necessarily designed to resist damage in this condition. You could damage the tooling or the machine if you do this. Get into the habit of retracting the stanchion pins immediately upon setting down the wrench after tightening the tooling bolts. Also, habitually looking specifically for retracted stanchion pins prior to initiating the autotune sequence and prior to initiating the first cycle with a freshly installed tool will give you two more chances to discover extended stanchion pins before you risk damage by cycling the machine with the pins extended.

Q: What happens if I accidentally cycle the machine with no parts in the tooling?

A: That depends to a large extent on the construction of the tooling. All production-ready Dukane tools have stanchions that act as stops to prevent the tool being damaged if the machine is cycled with no parts in the tool. We cannot always construct the tool such that it would not be damaged if some portion of the assembly is in the tool and some portion is not. We see many tools built by others that have no form of safety stops at all, and would be destroyed if this were to occur.
Q: The lift table surface and/or springs of the machine are starting to rust. What should I do?

A: Do not scrape or abrade the surfaces in an attempt to remove the rust. Spray the springs and lift table surface with a water displacement solvent like WD–40 or a corrosion protector like LPS–2 to prevent further damage. If you are in an environment where caustics are present, or where it is very humid, you should do this as regularly as you would with any bare steel surface. If the problem is severe and/or persistent, try LPS–3 corrosion inhibitor or contact Dukane.

Q: It is a problem that the coils are getting hot?

A: Yes. The bottom surface of the coils should not be too hot to touch. It probably indicates that the machine has not been autotuned, the upper tool is outside of the weight range for the machine, or there is something loose in the upper tool. If you have checked all of these issues and the problem persists, contact Dukane.
Maintenance

- Touchscreen Display
- Pneumatic System
- Hydraulic System
- Mechanical System

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Touchscreen Display
Do not use any solvents or abrasive cleaners on the front panel. Do not spray cleaner directly onto the front panel. Apply a small amount of computer cleaner to a soft towel first. Clean the panel with the moistened towel. Do not allow any liquid to collect around the AC power switch.

Pneumatic System
Compressed Air Filter
Under normal operating conditions, the filter (5 micron element) should only need to be replaced every two years or when the pressure drop exceeds 15psi (0.1MPa) whichever comes first. Replacement filters are available from SMC Corporation of America (Part No. AF30P-060S). Before attempting to replace the filter, turn off the compressed air supply, and then disconnect the air supply from the filter inlet. The metal canister and polycarbonate bowl must be removed to gain access to the filter element. Carefully remove the water drain line from the bottom of the housing before removing the filter canister. The hose fitting can be easily snapped off if bent too far.

To remove the canister, pull and hold the spring-load black release tab down as shown in Figure 11-1. Turn the canister 45° either to the left or right, then pull straight down. The filter element is installed under the regulator housing. Twist the filter retainer 90° (see Figure 11-2) and pull it down to remove the filter. Install a new filter element and replace the retainer. Reinstall the filter canister by holding the black release tab down and inserting the housing vertically, but rotated 45° off center. Still holding the spring-loaded tab down, push the canister up as far as it will go. Turn the canister 45° until the locking tab is under the alignment mark. Release the tab and it will click into the locked position. Carefully reinstall the water drain hose.

Moisture Trap
The metal cage below the pressure gauge covers the polycarbonate moisture trap. The moisture trap features a normally closed float and is self-drain-
ing of accumulated water. A drain hose is attached to the bottom of the filter housing which exits at the bottom of the machine. Keep this in mind if moisture draining to the floor could cause a problem. The total drain line length should be less than 16.5 ft (5 m). The internal float will open under pressure above 22 psi (0.15 MPa) when approximately 25 cm³ = 25 ml (0.85 ounce) of water has accumulated.

**Hydraulic System**

**Hydraulic Pressure**
The pump is set to deliver up to 1500psi at a maximum operating temperature of 150°F. After an extended period of use, the hydraulic reservoir, pump, motor and heat exchanger can become very hot. Use caution to avoid burning yourself. Let the unit cool down to a safe temperature before attempting any maintenance or adjustments.

**Hydraulic Fluid Level**
The reservoir has a capacity of 20 U.S. gallons or 75.7 liters. The fluid level should be maintained so it always is at the center of the sight gauge. This corresponds to about 18.5 gallons or 70 liters. If you have to add fluid after use, you obviously have a leak somewhere. Do not operate the machine until the hydraulic leak has been identified and repaired.

**Hydraulic Fluid Change**
Under light to normal operating conditions, the fluid should be changed every four years or 10,000 operational hours, which ever occurs first. If the fluid starts to darken or appear cloudy, it should be changed immediately. Deteriorated hydraulic fluid reduces component life and is a potential danger to operating personnel. Hydraulic fluid is not expensive and fresh fluid is good insurance against having to replace a costly hydraulic pump.

To drain the hydraulic fluid, unscrew the filler cap shown in Figure 11–3 and remove the filter element and basket. Use a hand pump or electric pump inserted into the filler opening to empty the fluid into a...
safe storage container. Do not use the drain plug at the bottom of the reservoir. This will create a mess of used hydraulic fluid in the floor of the cabinet because the drain plug does not have a shut–off valve.

After draining the reservoir, some fluid will remain in the hydraulic cylinder and lines so it will take less than 18.5 gallons to refill. Add new fluid until the sight–glass level is at 50% (see Figure 11–4). Again it is best to use a pump to fill the reservoir to prevent spillage. We also recommend filtering the fresh fluid to avoid the possibility of any contaminants entering the hydraulic system. You may want to attach a high–capacity filter to your pump to speed up the process.

The pump manufacturer recommends Mobil DTE® 24 Hydraulic Fluid or equivalent for normal use. However, we prefer Mobil DTE® 25 because it has a higher temperature breakdown rating. There is very little price difference and the cost of replacing components in the hydraulic system dictates good maintenance procedures and quality fluid.

When the fluid is changed, install a new filter element. Contact Flodyne/Hydradyne Inc, Hanover Park, IL 60103 USA, (630) 563–5468. The replacement element is Part No. 0075R010BN3HC. After refilling the reservoir, place the new filter in the basket and reinstall them. Screw the filler cap back on making sure the O–ring seats properly. Tighten the cap securely using a wrench to create a positive seal around the O–ring and prevent any fluid leaks. After the system has been cycled a few times, recheck the fluid level. It may be necessary to add more hydraulic fluid if the sight–glass level has dropped below 50%.

Safely dispose of used hydraulic fluid following all federal, state and local environmental regulations applicable to your area. The person disposing of the material is responsible for any hazard created.

**Back Pressure Gauge**

The suction gauge shown in Figure 11–4, should always remain in the green safe operating area, which is between 0 and 35 on the dial face. Once the back pressure increases and enters the yellow region of the gauge (35 to 43), it is time to replace the hydra-

<table>
<thead>
<tr>
<th>Brand</th>
<th>Temperature 25°C Ambient</th>
<th>Ambient Temp. 30°C to 50°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGIP/Tutela</td>
<td>OSO 46</td>
<td>OSO 68</td>
</tr>
<tr>
<td>Atlantic</td>
<td>Ideal AW 46</td>
<td>Ideal AW 68</td>
</tr>
<tr>
<td>Castrol</td>
<td>Hyspin AWS 46</td>
<td>Hyspin AWS 68</td>
</tr>
<tr>
<td></td>
<td>Hyspin HDX 46</td>
<td>Hyspin HDX 68</td>
</tr>
<tr>
<td>ESSO</td>
<td>Nuto H 48</td>
<td>Nuto H 68</td>
</tr>
<tr>
<td>Ipiranga</td>
<td>Ipitur AW 46</td>
<td>Ipitur AW 68</td>
</tr>
<tr>
<td>Mobil Oil</td>
<td>Mobil DTE 25</td>
<td>Mobil DTE 26</td>
</tr>
<tr>
<td>Petrobras</td>
<td>Lubrax Industrial</td>
<td>Lubrax Industrial</td>
</tr>
<tr>
<td></td>
<td>HR–46 EP</td>
<td>HR–68 EP</td>
</tr>
<tr>
<td>Renolub (Fuchs)</td>
<td>Renolin B 15</td>
<td>Renolin B 20</td>
</tr>
<tr>
<td></td>
<td>Renolin MR 15</td>
<td>Renolin MR 20</td>
</tr>
<tr>
<td>Shell</td>
<td>Tellus 46</td>
<td>Tellus 68</td>
</tr>
<tr>
<td></td>
<td>Tellus T 46</td>
<td>Tellus T 68</td>
</tr>
<tr>
<td>Texaco</td>
<td>Rando Oil HD46</td>
<td>Rando Oil HD68</td>
</tr>
</tbody>
</table>

**Table 11—I Equivalent Hydraulic Fluids For Normal And Elevated Temperatures**
lic filter. Do not operate the welder if the pressure is in the red area (greater than 43 psi). We recommend that you replace the hydraulic fluid whenever you install a new filter. For a replacement filter, contact Flodyne/Hydradyne Inc, Hanover Park, IL 60103 USA, (630) 563–5468. The filter element is Part No. 0075R010BN3HC. Also check the air–vent filter by pushing in the cap and twisting CCW. Replace the air filter if it needs it.

**Mechanical System**

**Grease Fittings**

We recommend you grease the zerks once or twice a year with a good general-purpose industrial grease. In severe environments you might want to do it more often. The fittings are located on the top of each of the guide bearings. Figure 11–5 shows the location (looking from the front) of the eight fittings on a partially assembled chassis. Numbers 4, 7 and 8 are accessible from the rear of the chassis. Figure 11–6 shows a detailed view of the front lower right grease fitting (No. 6). Keep the guide rails clean from any dirt or contaminants.

**Table Position Encoder**

The linear position encoder is shown in Figure 11–7. The device is rated for industrial use, but since it has a resolution of 0.01mm, it is quite sensitive to mechanical impact. Make sure the encoder shaft is kept clean and able to move freely. Do not lubricate the shaft. If the encoder readout is not accurate measuring the table position, check that the encoder is firmly attached to the table and properly calibrated by use of the CALIBRATION–XDUC screen (refer to Figure 6–51).

**Tooling Care**

Tooling left unused and open to the air may develop surface corrosion. Spray the surface of the tooling with a rust inhibitor like WD–40 or a corrosion solvent like LPS–2 to protect it. For long term storage, spray the surface of the tooling with LPS–3 corrosion inhibitor and wrap in plastic.
Contacting Dukane

• Local Support
• Headquarters
• 24–Hour Service
• Training Center
• Warranty

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Contacting Dukane

Identify Equipment
When contacting Dukane about a service–related problem, be prepared to give the following information:
• VWB Model number, and serial number
• Any error indicators from the Touch Screen Display
• Description of the problem and steps taken to resolve it
Some problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Local Support
Your local Dukane representative has received factory training and can answer all of your questions regarding Dukane equipment.

Main Office & Training Center
Mailing Address: Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174 USA
Main Phone: (630) 797–4900
Sales: (630) 797–4918
Main Fax: (630) 797–4949
Service & Parts Fax: (630) 584–0796

Department Phone Numbers
You can reach each department by dialing directly.
Application Support (630) 797–4930
For applications and/or process technology questions.
Engineering (630) 797–4950
For engineering of standard and customized systems.
Service & Parts (630) 762–4090
For equipment servicing or replacement parts.
Tooling (630) 797–4930
For information on tooling and fixtures.

Department email Addresses
Applications: usapps@dukcorp.com
Engineering: useng@dukcorp.com
Service & Parts: usservice@dukcorp.com
Tooling: ustoolling@dukcorp.com

Internet Website
Dukane Ultrasonics is on the internet at:
www.dukcorp.com/us
and then go to your area of interest.

INTERNET
At our website you can:
• Get an introduction to a variety of plastic joining technologies.
• Learn about our products and view layout drawings.
• Order literature.
• Download design worksheets
• View a calendar of current training seminars.
• Purchase parts and accessories through our online store.
Division eMail Addresses

Applications: usapps@dukcorp.com
Engineering: useng@dukcorp.com
International Sales: usintl@dukcorp.com
Marketing: usmktg@dukcorp.com
Sales: ussales@dukcorp.com
Support/Service & Parts: usservice@dukcorp.com
Technical Writing: ustechnical@dukcorp.com
Tooling: ustooling@dukcorp.com
Training: ustraining@dukcorp.com

Division Phone Numbers

Application Support (630) 797–4930
For applications and/or process technology questions.

Engineering (630) 797–4950
For engineering of standard and customized systems.

International (630) 797–4915
For questions about international locations, support, etc.

Marketing (630) 797–4906
For product literature, and trade show information.

Sales (630) 797–4918
Your local Dukane representative is the main source of product and order information, however you may have a need to contact Sales.

Service & Parts (630) 762–4090
For equipment servicing or replacement parts.

Technical Writing (630) 797–4907
For information and comments about user’s manual content.

Tooling Support (630) 797–4930
For information about tooling, horns, and fixturing.

Training Hotline (630) 797–4904
We offer a curriculum of educational programs at our corporate headquarters in St. Charles, Illinois. Please call the Dukane Ultrasonics Training Hotline for a free Education Catalog or with any questions you may have.

24-hour Emergency Service
(630) 797–4987
**DUKANE CORPORATION**

**NORTH AMERICAN WARRANTY POLICY**

Subject to the terms, limitations and exclusions set forth below, Dukane Corporation IAS Division (Dukane) warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Equipment Warranty Duration</th>
<th>Other Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Systems</td>
<td>12 months on all Dukane designed and built content that is not part of our standard product.</td>
<td>Dukane standard product included in custom systems are covered by the applicable product warranty.</td>
</tr>
<tr>
<td>Hot Plate Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Laser Welder</td>
<td>For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.</td>
<td>All internal laser optics and external beam delivery optics are warranted for only 30 days.</td>
</tr>
<tr>
<td>Spin Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Thermal Press</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>Ultrasonic Welder</td>
<td>36 months</td>
<td>See WARRANTY EXCLUSIONS OR EXCEPTIONS below.</td>
</tr>
<tr>
<td>Vibration Welder</td>
<td>24 months</td>
<td>None</td>
</tr>
<tr>
<td>All Production</td>
<td>12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)</td>
<td>None</td>
</tr>
<tr>
<td>Tooling</td>
<td>All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles.</td>
<td>Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.</td>
</tr>
<tr>
<td>Prototype Tooling</td>
<td>All other prototype tooling is warranted as described in each specific proposal.</td>
<td></td>
</tr>
</tbody>
</table>

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane’s written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America is subject to contact with Dukane. All other prototype tooling is warranted as of Dukane.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipment of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

**EQUIPMENT WARRANTY EXCLUSIONS OR EXCEPTIONS:**

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as “Experimental” is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The forgoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.
DUKANE CORPORATION

INTERNATIONAL WARRANTY POLICY

Subject to the terms, limitations and exclusions set forth below, Dukane Corporation IAS Division (Dukane) warrants to the original Purchaser, unless otherwise expressly agreed to in writing by Dukane, that all equipment and tooling designed and built by Dukane will be free from defects in material or workmanship. Normal wear items are not covered by this warranty. Warranty duration shall be defined as documented herein and in conjunction with any exceptions or exclusions in the accompanying Dukane quotation to the Purchaser.

All Dukane warranties commence on the date of the original shipment of the equipment or tooling, and duration is based upon a single shift per day, five day per week operation. The warranty period on rentals of new equipment that are converted to a purchase are deemed to have commenced on the initial date of rental.

These warranties are limited to equipment and tooling operated and maintained per Dukane’s written instructions, and used under normal operating conditions. These warranties do not include normal wear or normal wear items, and do not cover damage attributable to misuse, improper installation, faulty repair, unauthorized alteration or modification, neglect, or accident. Misuse includes operation of equipment with tooling that is not qualified for the equipment or properly installed on the equipment.

The warranty on all Dukane equipment and tooling purchased and installed in North America is a parts and labor warranty only. Equipment installed outside of North America, regardless of where it was purchased, is covered by Dukane’s International Warranty Policy. In all cases, when on-site service is required, Travel & Living (T&L) expenses will be billed at cost. Warranty service labor (including travel time) at the customer’s site is provided on a Monday through Friday (excluding holidays), 7 a.m. to 7 p.m. basis. Any warranty service requested outside of these hours is available on a charge basis equal to 150% of Dukane’s prevailing rate for technical service work.

Any equipment or tooling that proves to be defective in material or workmanship during the stated warranty period will be repaired or replaced at the sole discretion of Dukane Corporation when Dukane is promptly notified in writing. During the warranty period, defective equipment, components, or tooling that are returned properly packed with all transportation charges prepaid will be repaired or replaced and returned to the end-user without charge. Shipment of warranty parts will be via standard, non-expedited delivery service. Expedited shipment requests are subject to freight charges to the Purchaser.

Computers, PLCs, CRTs, LCDs, touch screens, and keyboards separate and/or incorporated as an integral part of a system will carry a one (1) year warranty from the date of shipment when used under normal operating conditions, and not subjected to misuse, abuse, or neglect. For all other equipment, components, or parts included in equipment or systems from Dukane, but not manufactured by Dukane or its affiliates, this warranty shall be limited in time and extent to the warranty given to Dukane by the OEM.

EQUIPMENT WARRANTY EXCLUSIONS OR EXCEPTIONS:

When specified in our quotation, a limited warranty may apply to certain components of the equipment, and/or for certain types of applications of the equipment, including those noted below.

- This warranty is void if the ultrasonic welder and/or tooling [i.e., horn(s) and fixture(s)] are used for applications requiring metal-to-metal contact, when the ultrasonic exposure period (weld cycle) exceeds 250 milliseconds.
- Ultrasonic Equipment and tooling used in continuous duty cycle modes such as, but not limited to, continuous cut and seal, and food processing are warranted for 2000 hours or 12 months from shipment, whichever occurs first.
- Any ultrasonic horn or tool quoted and sold as “Experimental” is not warranted.
- This warranty does not cover failures of equipment and components attributable to improper cooling or overheating of the transducer.
- Ultrasonic Horn Analyzers have a 12-month warranty.
- Ultrasonic Transducers have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

The foregoing warranty is the sole and exclusive warranty and is made in lieu of all other warranties, express, implied or statutory, including without limitation any warranties of merchantability, fitness for a particular purpose, description, quality, productiveness or any other warranty. The remedy set forth in this warranty policy is the sole and exclusive remedy of Purchaser and in no event shall Dukane be liable for any compensatory, consequential, special, punitive or contingent damages or for damages arising from any delay in performance by Dukane under this warranty.

<table>
<thead>
<tr>
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<th>Other Comments</th>
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<td>Dukane standard product included in custom systems are covered by the applicable product warranty.</td>
</tr>
<tr>
<td>Hot Plate Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Laser Welder</td>
<td>For all laser sources, Original equipment manufacturer (OEM) warranty is applicable.</td>
<td>All internal laser optics and external beam delivery optics are warranted for only 30 days.</td>
</tr>
<tr>
<td>Spin Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Thermal Press</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>Ultrasonic Welder</td>
<td>12 months</td>
<td>See WARRANTY EXCLUSIONS OR EXCEPTIONS below.</td>
</tr>
<tr>
<td>Vibration Welder</td>
<td>12 months</td>
<td>none</td>
</tr>
<tr>
<td>All Production Tooling</td>
<td>12 months, one-time replacement. (6-month, one-time replacement for carbide tipped horns)</td>
<td>none</td>
</tr>
<tr>
<td>Prototype Tooling</td>
<td>• All tooling made from Renshape 460 (Renwood) are only warranted for 200 part-cycles.</td>
<td>Prototype Renshape 460 (Renwood) tools employ reusable content, and therefore remain the property of Dukane.</td>
</tr>
<tr>
<td></td>
<td>• All other prototype tooling is warranted as described in each specific proposal.</td>
<td></td>
</tr>
</tbody>
</table>

Ultrasonic Horns

- Ultrasonic Horns have a one-time replacement warranty.
- Normal wear items and consumables excluded from any warranty coverage include, but are not limited to, filters, fuses, light bulbs, lubricants, gaskets and seals, cast urethane fixture components, laser flashlamps, laser beam delivery optics, and lasing gases.

Dukane Manual Part No. 403-548-01
Specifications

• Tooling Specifications
• Power Requirements
• Operating Environment
• Space Requirements
• Regulatory Compliance

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Tooling Specifications

Tooling Size & Weight

Table 13—I gives the minimum and maximum weight and lateral dimension for the upper tooling for each model. The weight is critical since the drive heads are designed to drive a mass within a specific range. The length of the upper tooling is specified because you should completely cover the longitudinal spread of the spring frame to ensure acoustic coupling. However, you do not want more than about three inches of lateral (in direction of vibration) overhang on each end. More than three inches overhang will allow the unsupported ends to vibrate at their own resonant frequency. The minimum depth (front to back distance) of the upper tooling is dictated by the bolt holes spacing. There is no concern about overhang in the direction orthogonal to vibration.

The lower tooling can be as light as you want as long as it has the necessary strength to rigidly hold the lower part in place and covers the lower bolt hole pattern. Conversely, the lower tooling can be as heavy as you want, as long as the combined weight of the table and lower tool allow enough clamping force to be exerted on the part assembly during welding. Table 13—I also gives the lift table size, weight and lift force for each model. The lift table dimensions are effectively the largest rectangular tooling that can normally be accommodated.

Approx. Weight

The vibration welder is designed to be lifted and moved with a heavy-duty fork lift. The welder is tied down and shipped on a pallet as shown in Figure 13–1. The fork lift should have a rated capacity greater than the shipping weight of the welder listed in Table 13—II. These weights are approximate and do not include tooling or hydraulic fluid.
Power Requirements

AC Power

The Vibration Welder requires 480 Volts AC, 3–Phase, 30–Amp electrical power. The power cord uses a three–pole, four–blade, grounding type plug designed for 3–Phase 480 VAC at 30 Amps. The 480 VAC 3–Phase plug configuration is shown in Figure 13–1. It is designed to be plugged into a 480 VAC, 3–Phase, 30 Amp, NEMA type L16–30R receptacle as shown in Figure 13–2.

The power cord supplied is approximately 14–feet long, and exits from the top rear of the welder cabinet, so the 480 VAC outlet needs to be close to the machine. Do not alter the plug or receptacle in any way. Do not use an extension cord. If there is any question about the grounding or phasing of your AC power, have it checked by a qualified electrician.

Consult your local electrical guidelines to determine if the machine can be operated with a power cord plugged into an outlet, or if it needs to be hardwired to a 480 Volt circuit. For safety and reliability considerations, the machine should be permanently wired inside electrical conduit to a 480 Volt circuit. A minimum of 10–Gauge wire is recommended to safely handle the 30–Amp welder current.

Compressed Air

The welder requires a supply of clean, dry, compressed air at 75 to 90 psi (0.52 to 0.62 MPascal or 5.1 to 6.1 Bar).

Operating Environment

Operate the Vibration Welder within these guidelines:

- **Temperature:** 40°F to 95°F (+5°C to +35°C)
- **Altitude:** 4570 m (15,000 ft)
- **Air Particulates:** Keep the Vibration Welder dry. Minimize exposure to moisture, dust, dirt, smoke and mold.
- **Humidity:** 5% to 95% Non-condensing @ +5°C to +30°C

**NOTE**

If your machine is equipped with a custom input voltage kit, a separate sheet detailing the connections will be provided in the electrical cabinet (see Figure 3–2).
Figure 13–3  Model 3500B Floor Space Requirements
Figure 13–4  Model 3700B–1 Floor Space Requirements  
(24–Inch Rear Service Doors)
Figure 13–5 Model 37008–2 Floor Space Requirements
(29–Inch Rear Service Doors)

Electrical and Air Drops in This Area
KEEP CLEAR

Total Minimum Recommended Clear Area (143" W x 117" D)
Clear Area For Front Panel Controls (21" W x 2" D)
Clear Area For Light Curtain In (56.5" W x 2" D)
Clear Area For Optional Overhead External Work Light (51" W x 19" D)
Clear Area For Optional Overhead External Work Light (51.5" W x 36" D)

Recommended Minimum Clear Area For Tool Change (51.5" W x 36" D)

Dimensions are in inches
Multiply by 25.4 for millimeters

FLOOR LAYOUT - SUBJECT TO CHANGE WITHOUT NOTICE

LAST REVISED 29 MAY 2003

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Figure 13–6  Model 3900B Floor Space Requirements
Regulatory Agency Compliance

CE Marking  

This mark on your equipment certifies that it meets the requirements of the EU (European Union) concerning interference causing equipment regulations. CE stands for Conformité Européenne (European Conformity). The Vibration Welder complies with the following CE requirements.

- The EMC Directive 89/336/EEC for heavy industry — EN55011 and EN50082 using
  - EN61000–4–2
  - EN61000–4–3
  - EN61000–4–4
  - EN61000–4–5
  - EN61000–4–6
  - EN61000–4–8
  - ENV50204

- The Low Voltage Directive 73/23/EEC.


CAUTION

DO NOT make any modifications to the Vibration Welder. The changes may result in violating one or more regulations under which this equipment is manufactured.
Joint Design Guidelines

- Flange Butt Joints
- Tongue & Groove
- Flash Traps
- High Strength Joint
- Welding Problems

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Joint Designs

Joint design is critical to the success of friction welding processes where flexing in the walls of the components can result in a reduction of the relative interfacial motion needed to produce friction heating. To eliminate this problem, it is important to include features such as stiffening ribs and U–flanges in the component wall around the weld area. The U–flange (also called a tongue–and–groove joint) is particularly important since it is designed to lock the component wall to the component tooling, thus preventing wall flexing. Wall flexing is a problem when the vibrations occur transverse to the wall of the component unless suitable measures are implemented. Figure A–1 shows a simple butt joint with a flange added to increase the weld surface area.

Figure A–2 shows the same joint with a tongue–and–groove added to permit the pieces to be self–aligning. The tongue has about a 0.5mm (0.020–inch) total clearance from the groove. The tongue is also about 1mm deeper than the groove which is the typical collapse distance.

Figure A–3 shows a thin–wall design with a flange added for increase surface area and a return lip to increase wall strength.
Figure A–4 shows a thin–wall butt joint with a flange return and a flash trap.

Figure A–5 shows medium–wall butt–joint with a return flange and dual flash traps.
Figure A–6 shows a high–strength version of the return flange butt weld with flash traps. The joint surface is no longer a butt interface. Instead one surface is about 10% narrower and concave (dished) about 0.4.

The butt–weld joints can be replaced by a tongue– and–groove joint for alignment. This is more important for internal walls and ribs. The external walls are held in place by the tooling.

All the designs shown are examples. Proper joint design involves many factors including application requirements and material. Call Dukane’s Application Lab for addition information. We are plastic welding scientists and engineers and experts in plastic assembly. We are your problem solvers and technical advisors.

## Welding Problems and Solutions

Some of the faults associated with vibration welding are caused by joint design and some are due to improper weld parameter settings. Table A—I lists some of the more common problems, the causes and solutions.

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<td>Weld Time Too Long</td>
<td>Reduce Weld Time.</td>
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<td>Final Dimensions Of Component Are Too Small</td>
<td>Weld Distance Too Large</td>
<td>Reduce Weld Distance.</td>
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<tr>
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<tr>
<td></td>
<td>Final Dimensions Of Component Are Too Large</td>
<td>Weld Distance Too Small</td>
<td>Increase Weld Distance.</td>
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<td></td>
<td>Material Difficult To Weld Due To Low Friction Coefficient</td>
<td>Degrease Joint Interface To Remove Mold Release Agent. Consider Changing Material (i.e. avoid PTFE).</td>
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<tr>
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<td>Excessive Weld Flash</td>
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<tr>
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<td>Uneven Weld Interface</td>
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<td>Shim Fixture Where Necessary. Check That Tooling Is True To Table.</td>
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<tr>
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<td>Poor Part Alignment Of Parts In Fixture</td>
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<tr>
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Dukane chose to become ISO 9001:2000 certified in order to demonstrate to our customers our continuing commitment to being a quality vendor. By passing its audit, Dukane can assure you that we have in place a well-defined and systematic approach to quality design, manufacturing, delivery and service. This certificate reinforces Dukane's status as a quality vendor of technology and products.

To achieve ISO 9001:2000 certification, you must prove to one of the quality system registrar groups that you meet three requirements:
1. Leadership
2. Involvement

The ISO 9001:2000 standard establishes a minimum requirement for these requirements and starts transitioning the company from a traditional inspection-oriented quality system to one based on partnership for continuous improvement. This concept is key in that Dukane no longer focuses on inspection, but on individual processes.

Dukane's quality management system is based on the following three objectives:
1. Customer oriented quality. The aim is to improve customer satisfaction.
2. Quality is determined by people. The aim is to improve the internal organization and cooperation between staff members.
3. Quality is a continuous improvement. The aim is to continuously improve the internal organization and the competitive position.

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Dukane products are manufactured in ISO registered facilities.
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We are plastic welding technologists. We are scientists. We are employees and businessmen. We are instructors. We are engineers. We are specialists in electronics and experts in plastic assembly. We are salesmen. We do basic research and we manufacture machines. We are problem solvers and we are technical advisors.

We Are Your Partners.

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