iQ Series
ULTRASONIC PRESS SYSTEM
ES
User's Manual

Press/Thrusters:
43Q215
43Q220
43Q340

Dukane Part No. 403–569-01

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ISO 9001:2000 Dukane products are manufactured in ISO registered facilities

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## Revision History

<table>
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<tr>
<td>- 00</td>
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General User Information

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

This manual provides information to set up, operate, and interface Dukane’s iQ Series ES presses.

Particular models are listed on the manual cover and in Section 11 - Specifications.

The manual consists of sections that describe in detail press specifications and functions, installation and testing procedures, and maintenance and troubleshooting steps. Each section describes press functions that are applicable to a standard press/thruster.

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

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. One of three different symbols also accompany the CAUTION and WARNING blocks to indicate whether the notice pertains to a condition or practice, an electrical safety issue or a operator protection issue.

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.
Health and Safety

Please observe these health and safety recommendations for safe, efficient, and injury-free operation of your equipment.

Proper Installation - Operate system components only after they are properly installed.

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

Keep the Cover On - Do not remove any equipment cover unless directed to do so by Dukane Corporation.

Grounded Electrical Power - Operate this equipment only with a grounded electrical connection.

(See Electrical Safety Grounding Instructions, Page 8.)

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

Use Eye Protection - Wear ANSI approved safety impact goggles.

CAUTION

At some time you may be asked to remove equipment covers by the Dukane Service Dept. personnel. Before doing so, disconnect the unit electrically from the incoming line AC power. If the unit is a press/thruster, lock the Air Lockout Valve, located on the rear panel, in its closed position. See Figure 2-6 on Page 14.
Health and Safety Continued

Acoustic Stack Hazard - When an acoustic stack (transducer, booster, horn and tip) is energized by the ultrasound signal, it presents a potential hazard. Stay clear of an energized stack.

System Abort Switch - Install a system abort switch at each operator station when ultrasonic plastic assembly equipment is used with automatic material handling equipment in an automated system.

Foot Switch - Using a foot switch in place of the optical touch finger switches (activation switches) violates OSHA regulations.

Pre-trigger Switch Adjustment - The pre-trigger switch option starts the horn vibrating before contacting the part to be welded. To ensure safe operation, adjust the pre-trigger so the ultrasound signal will not activate if the horn is more than ¼ in (7 mm) from the part to be welded.

System Electrical Cabling - Electrical power must be off when connecting or disconnecting electrical cables.
Health and Safety Continued

Do Not Wear Loose Clothing or Jewelry - They can become caught in moving parts.

Stay Alert - Watch what you are doing at all times. Use common sense. Do not operate the press when you are tired or distracted from the job at hand.

Do not Operate the Press - Your judgement or reflexes could be impaired while taking prescription medications. If so, do not operate the press. Be familiar with warning labels and recommended activity restrictions that accompany your prescription medications. If you have any doubt, do not operate the equipment.

CAUTION

When making cable connections to system equipment or disconnecting cables from system equipment, make sure electrical power to the system is turned off, and AC power cords are removed from their receptacles. After the cables have been securely connected and the connections and cable routing checked a final time, the power may be restored.
Health and Safety Continued

Special Health Notice—Plastics
Certain plastic materials, when being processed, may emit fumes and/or gases that may be hazardous to the operator’s health. Proper ventilation of the work station should be provided where such materials are processed. Inquiries should be made to the U.S. Department of Labor concerning OSHA regulations for a particular plastic prior to processing with Dukane ultrasonic equipment.

Activation Switches
The dual finger activation switches comply with OSHA safety regulations. Using a foot switch in place of the dual finger activation switches violates OSHA regulations.

Electrical Safety Grounding
The iQ Series generator provides the operating power and power returns. Make sure the generator is grounded properly.

In addition to the safety considerations, proper grounding is essential for the effective suppression of RFI (Radio Frequency Interference). Every generator contains a RFI filter which blocks noise on the AC power line from entering the generator control circuitry. This filter also prevents ultrasonic RFI from being fed back into the AC power line.

If you experience problems with RFI from the press, run an additional grounding wire from the press base grounding stud (See Figure 2-6.) to the nearest grounded metal pipe or equivalent earth ground by means of a ground clamp. Use at least 14 AWG wire for the connection to the press base.

CAUTION
If there is any question about the grounding of your receptacle, have it checked by a qualified electrician. Do not cut off the power cord grounding prong, or alter the plug in any way. If an extension cord is needed, use a three-wire cord that is in good condition. The cord should have an adequate power rating to do the job safely. It must be plugged into a grounded receptacle. Do not use a two-wire extension cord with this product.

Use a STAR configuration (illustrated below). Do not DAISY CHAIN the grounds.

CAUTION
To ensure safe and trouble-free operation, ground the generator chassis and the press/thrust.

DPC Chassis Grounding Lug

#14 Gauge Stranded or Solid Wire

Thruster or Probe Mount Grounding Lug

#14 Gauge Stranded or Solid Wire

Earth Ground
# Section 2

## Installation

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<td>11</td>
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<td>Placement</td>
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<td>Flange Template</td>
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Installing the Press System

The press system consists of a thruster, ergonomic base and support package. It is assembled at the factory for shipment.

Unpacking

The press system is secured to a wooden pallet and covered with a cardboard carton. The press sits on the pallet and is supported inside the carton by styrofoam blocks.

1. Before unpacking, it is suggested that the press be moved close to the location where it is to be installed.

2. Remove the straps from the carton.

3. Open the carton and remove the packing material and the cables.

4. Cut the tape located at the bottom corners and unfold the flaps.

5. Remove the carton, as shown in Figure 2-1, leaving the press on the shipping base.

6. Inspect the assembly for any possible damage before placing it in position.

Placement

Do not lift the press by hand. Use mechanical means to put the press into place.

To place the press on the work area, use a pallet lift platform or equivalent. Raise the assembly until the bottom edge of the base is even with the top of the work area as shown in Figure 2-2. Then, carefully slide the press system on to the work area.

CAUTION

DO NOT LIFT the press manually. Lifting and/or moving the press manually could result in personal injury. Use mechanical means to move and place the press.
Installing the Press System Without Machine Base

In this configuration, secure the flange to a rigid, level stationary structure. We recommend socket-head cap screws M12 -1.75 with a minimum length of 40 mm for securing the flange to the supporting structure. We recommend a minimum of 1 inch (25.4 mm) full thread engagement of the cap screws into the supporting structure. Depending upon the thickness and material of the supporting structure, longer screws and/or additional hardware may be required.

A full scale template is provided for locating and drilling holes in the supporting structure. The template is Figure 2-8 on Page 17.

Press Height Adjustment

The height of the thruster on the column is adjustable. Adjustment is made by first turning the two handles located on the left rear side of the press.

- To loosen the grip on the column, turn the handles counterclockwise, as shown in Figure 2-3a. The counterbalance spring on the column supports the weight of the thruster while the handles are loose. If a thruster is not installed, the unloaded column may rise up unexpectedly, so be careful to avoid injury.

- Adjust the column to the desired height.

- Turn the handles clockwise, as shown in Figure 2-3b, until tight.

- To rotate the handles out of the way without loosening or tightening, pull the handles outward, rotate and release, as shown in Figure 2-4.

CAUTION

Exercise caution if a thruster is not installed on the support housing. The counterbalance spring on the unloaded housing may cause the assembly to rise up unexpectedly when the height adjustment handles are loosened.
Installing the Thruster

Secure the thruster to a rigid stationary structure by placing the back of the thruster onto the support frame. Align the bolt holes in the thruster with the bolt slots in the support frame. Insert the two (hexhead) mounting bolts (M10-1.5 x 40mm), with flat washers, as shown in Figure 2-5. Align the thruster with the work surface in both the horizontal and vertical planes to assure parallelism. Tighten the bolts.

When mounted to a Dukane column as in the press configuration, the height of the thruster is adjustable on the column. If the height of the thruster is not adjustable in your mounting arrangement, you must consider the distance from the horn tip to the work surface when determining the position of the thruster.

The distance between the tip of the retracted horn and the parts in the fixture must be less than the maximum travelling distance (stroke) of the thruster slide assembly. If greater, the horn will be unable to contact the parts during operation. The maximum stroke distance is 177.8 mm (7 inches).

A shorter distance between the retracted horn tip and the parts in the fixture means a shorter travelling distance (stroke) during operation which results in two advantages:

- A more stable thruster when applying pressure to the parts
- A shorter duty cycle for a faster production rate

However, make certain, that there is sufficient room for the placement and removal of parts.

Figure 2-5   Example of Mounting the Thruster to a Rigid Structure
Cable Connections
Press System

The press is not equipped with its own source of compressed air, electrical power, or electrical control and monitoring. These functions are provided through the connectors located on the rear of the thruster.

(Refer to Figure 2-6):

- **Top of Stroke (J207)** - This receptacle is factory wired to a switch in the press/thruster that opens when the press/thruster slide assembly begins extending and closes when the slide assembly returns to the fully retracted (i.e. top-of-stroke) position. This contact closure is typically used in automated systems to indicate to the controlling mechanism (supplied by the end user) when the slide assembly is fully retracted. A Dukane cable (Part Number 438-528) mates with this receptacle to allow access to the switch contacts.

  **NOTE**
  Under normal usage, do not apply more than 24 VDC @ 2 Amps to the switch contacts at J207.

- **Ultrasound (J1)** - This input connects the transducer to the Ultrasound Output (J1) of the iQ Series generator, through a coaxial cable. The electrical welding signal is transmitted through this cable.

- **Operational Control (J201)** - This cable runs from J201 on the thruster to the generator’s Press Port (J5). The generator provides controls for triggering the weld, operating the thruster’s pneumatic system, and providing 24 VDC operating voltage through this cable. The press driver card in the generator also provides monitoring for these functions.

- **Air In** - This is a 1/4 NPT threaded receptacle for a compressed air supply that provides the thruster with the required pressure of 80-110 psi (5.4 - 7.5 atmospheres) to operate the pneumatic system.

  This connector is attached to an air filter on the press. The input to the filter comes from the air shut-off valve, located on the back, near the bottom of the press.
• **Encoder (Optional)** - The purpose of the encoder cable is to connect the distance encoder option to the generator's Encoder Port (J11). For details on the Encoder see Section 4: Press Options.

• **Ergonomic Base (J35)** - Connects the base controls and display to the Base/Abort Port (J7) on the generator.

The press system requires three cables for proper operation. These cables are part of the cable package that is shipped with the press. A customer-provided air hose (5/16 inch dia.) is also required.

Connect the following lines and cables to the press system:

• Connect the ultrasound coaxial cable from J1 on the generator to J1 on the thruster.

  **DO NOT** operate the generator unless this cable is connected and the transducer is installed in the thruster — Otherwise, an overload condition could occur, with possible damage to the generator.

• Connect the operational control cable from J5 on the generator to J201 on the thruster.

• Connect clean, dry air from an air source to the fitting located at the lower portion of the support package.

  Figure 2-6 shows the locations of the connections.

• Encoder cable (optional) - If the press is equipped with an encoder, the cable will already be wired in.

• Connect the nine-pin ergonomic base cable from J7 on the generator to J35 on the back of the base.

**Thruster Only**

For thrusters, the only required connections are the air line, ultrasound cable, and the operational control cable. Figure 2-7 shows the location of the thruster connections.

Because the thruster does not use a support package, the air source is connected directly to the “Air In” fitting.

Thruster systems require that Dukane's cable (Part Number 200-1546-03) is installed in the iQ generator’s J7 receptacle.

See Table 2-I.

### Table 2-I  Generator to Press/Thruster Cables

<table>
<thead>
<tr>
<th>Cable/Signal</th>
<th>Generator</th>
<th>Press</th>
<th>Thruster</th>
</tr>
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<tbody>
<tr>
<td>Ultrasound</td>
<td>J1</td>
<td>J1</td>
<td>J1</td>
</tr>
<tr>
<td>Operational Control</td>
<td>J5</td>
<td>J201</td>
<td>J201</td>
</tr>
<tr>
<td>Press Base</td>
<td>J7</td>
<td>J35</td>
<td>***</td>
</tr>
<tr>
<td>Distance Encoder</td>
<td>J11</td>
<td>Built-in</td>
<td>Built-in</td>
</tr>
<tr>
<td>Top of Stroke</td>
<td>Customer supplied control</td>
<td>J207</td>
<td>J207</td>
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*** Dukane’s cable (Part Number 200-1546-03) is installed in the iQ generator’s J7 receptacle.
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SECTION 3

Control Description

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Overview

This section describes the controls, indicators and features for the manual and electronic pressure-regulated (EPR) versions of the Press/Thruster System.

The controls on the front of the thruster can be used to manually set the parameters for a given process.

The indicators associated with the controls provide a visual indication of the control settings.

The features used on the control panel are:

- Metric measurements
- International symbols to assist in locating the proper controls and their associated indicators.

Refer to Table 3-I.

<table>
<thead>
<tr>
<th>Symbol</th>
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<td></td>
<td>Mechanical Stop</td>
<td></td>
<td>Weld Pressure</td>
</tr>
<tr>
<td></td>
<td>Down Speed</td>
<td></td>
<td>End of Weld</td>
</tr>
<tr>
<td></td>
<td>Thruster Stroke</td>
<td></td>
<td>Hold</td>
</tr>
<tr>
<td></td>
<td>Slow Speed</td>
<td></td>
<td>Direction</td>
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</tbody>
</table>

Table 3-I Thruster Symbols
Manual Controls
Refer to Figure 3-1 for the location of the controls.

Down Speed Adjustment
This control adjusts the downward velocity of the press/thruster slide assembly. Turning the knob clockwise decreases the speed. Turning it counterclockwise increases the speed of descent.

Hydraulic Slow Speed Control (optional)
This control is used to adjust the point in the downstroke where the hydraulic speed damper is engaged. The SLOW SPEED Control knob adjusts to a point along the 7 inches (177.8 mm) of total available downstroke distance that the hydraulic Speed Control engages.

Refer to Section 4: Press Options, for detailed information on the Hydraulic Slow Speed Control.

Hydraulic Slow Speed Adjustment
The hydraulic slow speed adjustment is an integral part of the optional hydraulic slow speed control. It sets the amount of velocity damping of the hydraulic unit. (See Figure 3-1.) For detailed information on this adjustment, refer to Section 4: Press Options.

Mechanical Stop Adjustment
The function of the mechanical stop is to halt the downstroke at a predetermined point. It is used in two ways:

• To stop the downstroke at a particular depth of travel relative to the fixture/anvil.

• To prevent the horn from contacting the fixture when there is no part present. This prevents possible damage to the horn and/or fixture. Never allow the horn to contact the fixture while ultrasonic power is applied to the horn. Metal-to-metal contact can void the horn and/or tooling warranty.

Pressure 1 Regulator
Pressure 1 regulator is used to set the amount of air pressure applied to the air cylinder during the press downstroke and weld cycle.

Continued
To properly set the indicator flags, adjust the control until the middle of the flag lines up with the desired setting. The example to the left is set for 2 cm.

Figure 3-1  (Manual) Press/Thruster Controls and Indicators - Models 220/340 Shown
Manual Controls Continued

Pressure 2 Regulator
In applications where welding with dual pressure is required, this pressure regulator would be set to provide a higher pressure during a portion of the weld cycle. This pressure is also maintained during the hold time.

Regulator Select Switch
The Regulator Select switch is used to select Pressure 1 regulator (Weld Pressure) or Pressure 2 regulator (Hold Pressure) to set the required pressure on each regulator and for monitoring the pressure gauge.

Pre-Trigger Control (Optional)
The pre-trigger control turns the ultrasound on at a preset point in the thruster downstroke. This control is normally used in staking and inserting applications. This control should be set for a distance of approximately 6.25 mm (.25 inch) above the part.

Trigger Control
Setting the trigger control determines the amount of preload on the part before turning on the ultrasonics.
(Numbers displayed are for reference only.)

End-of-Weld Control (Optional)
This adjustment is set at the point in the stroke of horn travel (absolute distance) where the ultrasound turns off.

NOTE
The actual amount of force applied to the part depends on the following four factors:
- The setting of the regulator(s)
- The area of the air cylinder
- The mass of the horn used
- The surface area of the horn

NOTE
The pre-trigger switch option starts the horn vibrating before contacting the part to be welded. To ensure safe operation, adjust the pre-trigger so the ultrasound signal will not activate if the horn is more than ¼ in (7 mm) from the part to be welded.
Indicators

Pressure Gauge
The pressure gauge shows the amount of air pressure applied to the upper portion of the air cylinder for the weld-and-hold operation.

Ultrasound Active Status Light
This LED indicator lights up when the generator is applying ultrasonic power to the horn.

Stroke Position Indicator Flag
The stroke position indicator flag is not preset prior to press operation. It moves with the slide assembly as the assembly moves down and up.

Mechanical Stop Indicator Flag
This setting indicates where the downstroke will end.

Slow Speed Indicator Flag (Optional)
This indicator flag is set by the Slow Speed Control. It is included as part of the Slow Speed Control option. When set, it indicates the point in the downstroke where the plunger on the hydraulic speed control is engaged.
Electronic Pressure Regulator

Refer to Figure 3-2 for the location of the controls.

The EPR (Electronic Pressure Regulator) option deletes the Pressure 1 and Pressure 2 Regulators and the Regulator Select Switch found on the manual press, and replaces them with the following:

- Electronic Pressure Regulator (EPR) that controls the pneumatic pressure on command from the generator.

- A pressure transducer that functions as the pressure gauge because it converts pneumatic pressure into an electrical signal for the generator to use for feedback control.

and optionally—

- A load cell that measures applied force. A force transducer converts the mechanical force applied to the parts into an electrical signal. This allows the generator to trigger by force.

Note that this option is only functional when used with a compatible generator. Refer to Section 4: Press Options, for detailed information.
Figure 3-2  (EPR) Press/Thruster Controls and Indicators - Model 215 Shown

To properly set the indicator flags, adjust the control until the middle of the flag lines up with the desired setting. The example to the left is set for 2 cm.
Ergonomic Base

The ergonomic base, shown in Figure 3-3, consists of a base plate, cycle activation switches (black finger switches), abort switch (red palm switch), and a status display screen. At the back of the base is a cable connector for an interface between the iQ Series generator and the base front panel.

Base Plate

The machined base plate is bolted to the top of the ergonomic base. It has drilled and tapped holes that line up with leveling screws in the fixtures to allow easy fixture leveling for alignment with the horn. For details on the alignment and leveling of the base plate, see Section 5: Stack/Fixture Setup.

Activation (Operate) Switches

Located on either side of the base are two optical (RUN) switches. These are shown in Figure 3–3. These switches use Infrared (IR) sensors. They comply with OSHA and CE safety standards. Both switches are identical.

Each optical–touch switch has a small red LED that is dimly illuminated whenever the power is on, as shown in Figure 3–4. When the operator places their finger in the tray, the LED brightens and a second LED in the opposite corner of the tray illuminates to indicate the switch has been activated as shown in Figure 3–5. Both switches must be activated simultaneously to initiate a weld cycle.
Emergency Stop (Abort) Switch

A red Emergency–Stop (E-STOP) switch is located in the center of the base as shown in Figure 3-3. The emergency stop switch must be in its reset position before the operate switches will function.

To reset the Emergency Stop, twist the large red button about 45 degrees to the right, which will cause the button to spring out. This is shown in Figure 3–6.

The abort switch applies 24 VDC power to the thruster/press. Pressing the abort switch causes the generator to:
- Immediately turn off the ultrasound,
- Remove electrical power from the press, and
- Initiate a software abort sequence.

Base Status Display

The function of the display is to indicate one of three status conditions of the press:

- **READY** - When the abort switch is pulled out, the green READY status light indicates that power is applied to the press and it is ready for operation.

- **ABORT** - When the abort switch is pushed in, the red ABORT status indicator illuminates. Press operation is no longer possible.

- **IN CYCLE** - When both activation switches are pressed, the IN CYCLE display of the status indicator is ON for the duration of the finger switch activation.
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SECTION 4

Press Options

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Overview

This section provides detailed information for the common options for press/thruster operation. These options are:

- Hydraulic Speed Control
- Distance Encoder
- Electronic Pressure Regulator

Detailed description, installation, and any applicable alignment or adjustments follow.

The optional air cylinders (1.5, 2, and 3 inches in diameter) are factory installed and do not require any field adjustments.

Additional Options

Dukane can provide high-quality automation equipment for efficient handling and assembly of parts. This equipment is tailored specifically to your needs. Some of the available options include pick and place automation, rotary tables, in-line indexing, conveyors, and walking beams.

Dukane can also provide standard and custom sound enclosures. The additional options are not covered in this manual due to their specialized applications.

Contact your local Dukane representative for more specific information.
Hydraulic Speed Control

SLOW SPEED Control and Indicator Flags

The thruster has a knob labelled SLOW SPEED near the bottom of the front panel and a SLOW SPEED indicator flag. Refer to Figure 4-1.

The knob and the indicator flag are part of the optional Hydraulic Speed Control Kit.

The purpose of the hydraulic speed control is to match the downstroke speed to the material melt flow. This will produce the strongest joint. The Slow Speed Setting knob adjusts the point along the 7 inch (177.8 mm) downstroke distance at which the hydraulic speed control will engage. It should be set to engage just before the horn contacts the part. The maximum distance over which this kit can control the downstroke speed is 1 inch (25.4 mm).

The middle of the indicator flag, when referenced to the scale beside the flag slot, shows where the 1 inch (25.4 mm) of slow speed is set to begin.

Hydraulic Speed Control Kit Operation

The hydraulic speed control kit, shown in Figure 4-2, is a combination impact absorber and hydraulic check valve.

The kit contains a sealed hydraulic cylinder with an external plunger. The cylinder is mounted to the stationary part of the thruster.

The kit also has a contact block that is mounted to the slide assembly of the thruster. When the slide assembly descends, the contact block descends until it engages the plunger of the stationary hydraulic cylinder and pushes the plunger down into the cylinder. The design of the cylinder resists the downward motion of the plunger by metering the pure silicone fluid through an adjustable internal flow aperture, resulting in a constant speed of the slide assembly.
Hydraulic Speed Control Kit Operation

The hydraulic cylinder is mounted in a clamping block. The block is threaded onto a long rod.

Turning the SLOW SPEED knob rotates the rod.

This in turn causes the contact block to ride up or down on the rod, moving the contact point closer to or further from the hydraulic cylinder at rest.

This distance determines how far the contact block, and therefore the slide assembly, must travel before the block contacts the plunger of the hydraulic cylinder.

The plunger has a maximum travelling distance of one inch (25.4 mm). The first 1/4 inch (6.4 mm) of travel decelerates the speed of the slide assembly. The remaining 3/4 inch (19.1 mm) of travel allows the slide assembly to descend at a constant slow speed set by the operator.

The slide assembly can only travel downward a maximum of one inch (25.4 mm) after the block contacts the plunger.

Hydraulic Speed Control Adjustment

Rotating this shaft adjusts the internal metering aperture which regulates the flow of the silicone fluid. There are two ways to adjust the hydraulic speed control setting. First make sure that the slide assembly is fully retracted (up position). This will uncover the hydraulic damper and shaft.

- Insert the end of a small screwdriver or similar tool into the hole (Figure 4-3) in the adjustment shaft of the hydraulic cylinder, OR,

- Locate the slot on the bottom of the cylinder (Figure 4-4). Insert a screwdriver in the slot and adjust the setting.

Just above the shaft is a scale with 30 divisions. On the adjustment shaft is a vertical groove that indicates where along the scale the speed is set. Zero (0) is the fastest setting and thirty (30) is the slowest.
Distance Encoder

Purpose
To install and calibrate the distance encoder in order to accurately measure the distance of thruster travel.

Requirements
Parts
Kit (P/N 438-783) consisting of the following:
1. Encoder (two pieces; P/N 625-18)
2. Encoder head cable cover bracket
3. Mounting screws and hardware

Tools
• Phillips-head screwdriver
• Feeler gauge set (0-.050 inches) or metric equivalent
• 6 inch ruler or metric equivalent

Installation Instructions
Dismantling
1. Facing the front of the press, remove the panel from the right side of the press. (See Figure 4-5.)

Reassembly
1. Mount the cable cover bracket from the kit and secure it with flathead screws.
2. Attach the encoder scale to the mounting screw holes in the right side of the thruster with pan-head screws. Do not tighten.
3. Remove the back panel from the press and route the encoder head cable, being careful not to interfere with the press movement.
4. Connect the encoder cable to the generator connector J-11 (Encoder).
5. Replace the rear panel on the press.
Reassembly  Continued

6. Gently slide the encoder head down until the mounting screw holes in the press support base appear in the head’s mounting slots.

7. Center the screw holes in the mounting slots. Secure the encoder head with the two pan-screws but do not tighten them yet.

Alignment

The purpose of this alignment is to set the internal reference mark for the encoder. This reference mark resets the distance register in the generator after each thruster cycle and ensures repeatable distance measurements from cycle to cycle.

1. Check the position of the encoder scale’s mounting hole slots using the 6” ruler. Measure the distance from the center of the screw to the edge of the slot in both directions. When the screws are centered horizontally, carefully tighten the screws.

2. Measure a vertical distance of 1.375 inches (34.92 mm) up from the bottom edge of the encoder scale, as shown in Figure 4-6.

3. Adjust the bottom edge of the encoder head to align to this distance and tighten the screws on the encoder head.


   Turn on the generator, and set it to measure distance.

5. Set the air pressure to the desired level.

6. Perform the following procedure to test the encoder for the proper setting:

   • Pull out the ABORT button (on the press base). Allow the thruster to return to top of stroke.

   • If the encoder position reads 0.0000, then the encoder is set correctly.

   • Secure the two screws. Proceed to Step 7.

Continued
Alignment Continued

7. Set the gap between the encoder scale and head, using the feeler gauge .039 inch (1 mm) blade.

8. Measure the gap at the top and bottom of the stroke. Allowable tolerance, as specified by the encoder manufacturer, is ±.005. This is a range of from .034 to .044 inches (.864 to 1.12 mm).

9. Tighten all the screws and check the measurements again.

10. Replace the press/thruster right side panel.
Electronic Press Controls

The electronic press controls consist of three components:

- Electronic Pressure Regulator
- Pressure Transducer, and
- Load Cell

Electronic Pressure Regulator

The electronic pressure regulator, (I/P transducer) is an electro-pneumatic replacement for the manually adjusted air regulator on the press. The I/P transducer converts the electrical signal current (I) into air pressure (P). The Electronic Regulator converts the electrical signal from the \textbf{iQ Series} generator into the programmed air pressure.

The pressure value settings, “Method 1” (P1) and “Method 2” (P2), are stored in the Process Setup under Pressure in the generator. P1 and P2 are set in pounds per square inch (PSI), or BARS.

To monitor Method 1 and Method 2 values, use the Check Pressure parameter, contained in the Operate Setup under View Parameters (on the generator).

The generator uses a pressure transducer to measure the I/P output pressures.

The I/P transducer installed in this thruster/press does not require on-site calibration. The unit is equipped with self-correcting, closed-loop circuitry.

Pressure Transducer

The pressure transducer (P/I transducer) performs the same function as the air gauge on the press. The P/I transducer converts air pressure (P) to an electrical signal current (I). It then sends the signal to the generator. The generator displays this signal as pressure.

Two sets of upper and lower limits can be monitored with the pressure transducer:

- \textbf{One set} is used to monitor the air pressure before a cycle starts. Using the bad parts limits, the unit will not begin a cycle if the air pressure is outside the pressure window that has been set. This set of limits is used to ensure that air pressure from the input line has not dropped below the required pressure for an acceptable weld force.

Continued
Pressure Transducer Continued

The other set of limits is used to monitor the air pressure when the ultrasound is turned on.

This feature can be used as an indicator when checking for a trigger or load cell malfunction.

A more precise way to monitor trigger force is to use a load cell.

The pressure transducer does not require any on-site calibration.

Load Cell

A load cell (force transducer) is a device used to measure force. A force transducer converts mechanical force into an electrical signal.

The load cell is used to monitor the force applied to the part. It sends a signal to the generator to indicate when the mechanical pressure equals the programmed Trigger Force. The trigger is the point at which the ultrasound is turned on.

The Trigger Force parameter is located on the Process Control Setup under Trigger Method on the generator. The values for this parameter are in pounds or Newtons.

A force versus time graph can be generated if a printer or a computer with iQ Explorer software is connected to the generator.

For most applications the Load Cell is calibrated at the factory, and does not need any on-site calibration.

NOTE

Some customer SOPs require equipment calibration on-site. Dukane offers on-site calibration services and certification. Contact your Dukane representative.
SECTION 5

Stack/Fixture Setup

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Overview

A Dukane press/thruster and a iQ Series generator can be used to assemble an unlimited variety of parts for every conceivable market segment, including Automotive, Medical, Appliance, Consumer, Packaging and Toy industries. Various techniques and processes, such as welding, staking, swaging, inserting, and spot welding can be used for the different applications.

This variety is made possible through the interchange of some system components. Of these components, the horn and fixture are usually custom-made for each application, and the booster that is selected for a job depends on the required horn output amplitude. Also, the press/thruster controls are specifically adjusted for each application.

This section provides instructions for setting up these components of the system in a new installation or when changing applications.
Stack Description

The stack shown in Figure 5-1 consists of three parts:

- Transducer
- Booster
- Horn

The transducer and the booster are normally shipped assembled and installed in the press. The horn and/or the fixture may be shipped separately.

The stack is easily removed from or installed in the press/thruster. This makes it possible to change the horn or booster. It also makes it easier to perform regular inspections and/or maintenance of the stack components.

Figure 5-1  Stack Components
Changing Stack Components

Stack Removal

Before removing the stack, perform the following steps:

1. Activate the Abort switch on the front of the base.
2. Power down the generator.

These two steps are necessary to ensure that no power will be accidently applied while removing the stack.

3. While supporting the stack with one hand, loosen the four socket-head bolts that secure the stack access door.
4. Pull the stack forward and down until the transducer clears the electrical contact. Refer to Figure 5-2.
5. Lift the stack out of the housing.

CAUTION

There may be an electrical charge stored in the transducer. To avoid any electrical shock, do not touch the contact button when removing the stack.

CAUTION

The stack may be hot.

NOTE

When changing or inspecting any of the stack components, ALWAYS remove the stack from the thruster.
Stack Disassembly

To separate the stack component carefully follow the instructions below:

1. Use the two spanner wrenches (wrench A and B) provided with the press. Place wrench A on the component to be removed (Refer to Figure 5-3) and wrench B on the one next to it. Turn wrench A in the direction indicated.

   Once the component is loose, it can be removed by hand.

2. To maintain structural integrity, NEVER hold a transducer by the housing or the booster by the mounting rings while separating components. Doing so will result in damage to the unit.

3. Use only the tools recommended by Dukane. NEVER clamp a horn, booster, or transducer in a vise or use tools such as pliers, visegrips, etc.. Doing so will result in scratches and/or gouges, resulting in stress areas on the surface. This condition will affect the stack operation and could lead to failure of each stack component.

Removing a Detachable Tip

If the horn has a detachable tip, do the following:

1. Use a spanner wrench to hold the horn, as shown in Figure 5-4.

2. Turn a properly sized open end wrench to loosen the tip.

   NEVER clamp the horn or use a vise to hold it.
Stack Assembly

Before assembling a stack, inspect all of the components for possible damage — especially the surfaces that are to be joined. Look for non-flat surfaces (concave, convex), stress cracks, chips, or gouges. Any of these irregularities will affect the operation of the stack and could cause further damage. Contact the Dukane Ultrasonics Tooling Department concerning a damaged component.

When the components have been inspected and are found to be free of any damage, continue with the following steps:

1. Inspect the contact surfaces for smoothness and cleanliness. Pitting or a buildup of old grease and dirt on the surface will interfere with the transfer of energy from one component to another.

2. Remove any foreign matter from the threaded stud and the mating hole. Tighten the stud in the stack component that is most distant from the transducer according to the following stud torque values:

<table>
<thead>
<tr>
<th>Stud Thread Size</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inch-lbs</td>
</tr>
<tr>
<td>1/2 in. x 20</td>
<td>12</td>
</tr>
<tr>
<td>3/8 in. x 24</td>
<td>12</td>
</tr>
<tr>
<td>M8 x 1.25</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 5-I Stud Torque Values

3. Coat one of the contact surfaces with a thin coat of high-pressure grease. A small packet is supplied with the system. We recommend Dow–Corning #4 (or #111 as an alternate).

4. Thread the components together and tighten (Refer to Table 5-II) by applying torque as follows:

<table>
<thead>
<tr>
<th>Stack kHz</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inch-lbs</td>
</tr>
<tr>
<td>15</td>
<td>540</td>
</tr>
<tr>
<td>20</td>
<td>420</td>
</tr>
<tr>
<td>30</td>
<td>216</td>
</tr>
<tr>
<td>40</td>
<td>216</td>
</tr>
</tbody>
</table>

Table 5-II Horn/Booster Torque Values

NOTE
Do not apply any grease or lubricant to the stud.
Installing a Detachable Tip

If the horn has a detachable tip, do the following:

1. Inspect the surfaces of the tip and the horn for any stress cracks, chips or gouges.

2. Coat one of the contact surfaces with a thin coat of high-pressure grease or lubricant. We recommend Dow–Corning #4 (or #111 as an alternate).

3. Thread the tip into the horn. To tighten the tip, use the open-end wrench for the tip and a spanner wrench to hold the horn, as shown in Figure 5-6.

Tighten the tip to the following specifications:

<table>
<thead>
<tr>
<th>Tip Stud Thread Size</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>inch-lbs</td>
</tr>
<tr>
<td>1/2 in. x 20</td>
<td>360</td>
</tr>
<tr>
<td>3/8 in. x 24</td>
<td>336</td>
</tr>
<tr>
<td>5/16 in. x 24</td>
<td>300</td>
</tr>
<tr>
<td>1/4 in. x 28</td>
<td>240</td>
</tr>
</tbody>
</table>

Table 5-III Replaceable Tip Torque Values

Installing the Stack

1. With the stack at the angle shown in Figure 5-7, rest the booster mounting ring on the pin of the stack housing.

2. Brace the stack at point A in Figure 5-7, and swing the stack to a vertical position. The ultrasound contact button on the transducer should snap under the electrical contact leaf of the housing.

3. While still supporting the stack in this vertical position, install the stack access door, and thread the four socket-head bolts (that hold the door closed) into their holes.

4. If the horn is not properly aligned with the fixture, rotate the stack to align the horn with the fixture.

5. Finish tightening the socket head bolts until snug.

DO NOT OVER-TIGHTEN!
Fixture Installation
There are three steps involved in installing a fixture.
• Aligning the fixture with the horn,
• Leveling the fixture to provide the necessary support., and
• Rigidly securing the fixture to the mounting surface.

Fixture Alignment
To safely align the fixture under the horn, use the following procedure. (Refer to Figure 5-8.)

1. Depress the Abort switch. This allows the acoustic stack assembly to be lowered by hand and prevents the system from accidentally cycling.
2. Turn off the power to the generator to prevent accidental ultrasound operation.
3. Place the fixture, with parts, under the horn.
4. Initially align the two slots in the fixture over two of the seven mounting holes on the base plate.
5. Install the two hold-down bolts with washers, and finger tighten.

Continued
Fixture Alignment Continued

6. Place a part in the fixture.

7. Grasping the horn firmly, pull the acoustic stack assembly down until the horn is as close to the part as necessary to align the fixture.

8. Align the fixture with the horn, and tighten the hold-down bolts, or caps crews, to prevent the fixture from moving.

9. Adjust the mechanical stop of the press so that the horn stops above the fixture. This prevents pinch points and avoids horn damage if the acoustic stack assembly descends when a part is not in the fixture.

Fixture Leveling

For most applications, the fixture must be mounted so that the contacting surfaces on the horn are parallel to the contacted surfaces on the plastic part. This ensures that a consistent, even weld will result. To level the fixture, do the following:

1. Place a part in the fixture.

2. Loosen (turn counterclockwise) the hold-down bolts or cap screws and the four leveling jack screws on the fixture plate. Refer to Figure 5-9.

3. Pull the acoustic stack assembly down to the fixture. Allow the horn and the part to align.

4. Turn the four jack screws clockwise until a slight resistance is felt. Refer to Figure 5-10.

5. Tighten the hold-down cap screws by turning them clockwise until a firm resistance is felt.

Continued

NOTE

The fixture should be flat on the base. If the fixture is equipped with leveling jack screws, adjust the screws so that they do not interfere with seating of the fixture on the base plate.

NOTE

Some applications may require the horn to be a few thousandths of an inch from contact with the fixture.

Special applications may require the Mechanical (MEC) stop to be lowered so the horn makes contact with the fixture or anvil. When this is required, a ground-detect circuit is needed to terminate the weld cycle.

NOTE

Do not overtighten the cap screws. This may flex the fixture plate.
**Fixture Leveling Continued**

6. If any readjustment is necessary, loosen the hold-down screws first. Then readjust the jack screws.

The following procedure may be helpful in leveling the fixture in some applications. To perform this procedure, use a piece of carbon paper and a piece of white paper.

1. Place a sample part in the fixture.
2. Place a piece of white paper on top of the sample part.
3. Place a piece of carbon paper, carbon side down, on top of the white paper.
4. Enter the following parameters into the generator:
   - Weld Time = 0.05
   - Hold Time = 0.00
   - Pressure = 20-40 psi

   System parameters = Use default settings. See examples on Application Setup Worksheet.
5. Set the trigger control on the thruster so that the pressure switch closes after some pressure is applied.
6. Press the ONLINE button on the generator.
7. Cycle the equipment by activating both finger switches on the base or by triggering the automation switch.

When one cycle is completed, the pressure developed between the horn and the sample part will have left marks from the carbon paper on the white paper. If the fixture is not level, the carbon markings will be darker in some areas than in others. All carbon markings will be uniform when all adjustments have been made properly.

Adjust the leveling of the fixture and repeat this procedure as necessary until you are confident that the fixture is level.
SECTION 6

System Test

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Procedure for Cycling the System ............ 59
Overview

A *iq Series* generator must be operating and connected to the press/thruster in order to test the system.

For efficient operation of a Dukane ultrasonic assembly system, the ultrasound signal from the generator must match the frequency and phase angle (vibrational characteristics) of the stack that is being driven. Each stack has unique vibrational characteristics dependent on the combination of stack components. In addition, the characteristics of a particular stack may vary slightly during operation because of temperature and loading factors.

To match the generator output signal with the characteristics of a particular stack, the generator output frequency is adjusted by Dukane’s patented phase-locked-loop Digi-Trac pulse-width modulation circuitry.

The Digi-Trac feature automatically adjusts the ultrasound signal to match the vibrational characteristics of the stack being driven. When the ultrasound turns on during each operating sequence, the Digi-Trac circuit monitors the motion of the stack on a frequency cycle-by-cycle basis and adjusts the ultrasound signal for the optimum setting. Because the Digi-Trac continuously monitors each operating sequence, it compensates for vibrational changes that occur during repeated operations due to heating of the stack components. It also compensates for changes that occur over longer time periods due to aging of the piezo electric crystals in the transducer, or possible wear of the ultrasonic horn.

The Digi-Trac feature excels in environments hostile to reliable operation, such as high duty cycles or high stress, and continuous-duty applications. In such situations, the Digi-Trac circuit compensates for the unique vibrational characteristics of each stack due to differences caused by aging, loading, temperature changes, and differences in horn configurations.
Operational Test of the Acoustic Stack

The following test procedure is suggested before starting the generator, to verify that the vibrational characteristics of the stack fall within the range of the Digi-Trac. All Dukane stack components are manufactured to tolerance specifications within this range. A non-Dukane horn, an improperly assembled stack, or a stack component that is worn or damaged, can result in vibrational characteristics outside these specifications, and will require some adjustment. This test reveals the existence of any problems and directs you to corrective action.

1. Check the following:
   a. Make sure that the correct booster and horn for the application are installed in the thruster.
   b. Check the \textit{iQ Series} system components for proper grounding.
   c. Check the ultrasound cable connections on the generator and thruster for proper seating and security.
   d. Verify that the horn is not under load (not in contact with a fixture or part).

2. Turn the \textit{iQ Series} generator power switch to ON. The power switch display will start to flash on and off for LESS THAN 20 seconds. It will then turn off. This indicates that the system is operating.

   If the power switch display stops flashing but remains on, do not go any further, there is a problem with the input circuit.

3. Using \textit{iQ Explorer}, go to the Utilities tab. Press the TEST button, and hold it for the duration of the test period. See Figure 6-1.

   a. System Power Output:
      - If the power output display remains between 10 and 20 percent and the horn frequency is (220 Press) within 19,500 Hz and 20,500 Hz, the stack is operational.
      - If the power output exceeds the 20% indication, there may be a problem with the stack.

Continued
Acoustic Stack Test

b. If an overload fault is displayed, a mismatch has occurred between the generator’s ultrasonic output signal and the stack.

Refer to Table 8-II, Page 85. Also see Figure 6-3 that shows an example of an error that caused cycling to stop.

4. While pressing the TEST button, lightly touch the side of the horn to check for ultrasonic vibrations. If any vibrations are felt, the stack is operational. If there is no vibration, there may be a problem with the stack.

If all the indicators pass their tests, the stack is within the Digi-Trac range.

The generator is operating at the optimum setting for this stack when the Watts displayed on the graph (after the test) is between 10 and 20 percent. The vibration amplitude of the horn and booster and the mass of the horn determine the amount of energy needed to vibrate the stack.

• If the system passes the tests of these four steps, proceed to the section called Procedure for Cycling the System, Page 59.

• If one or more of these tests have failed, go to the next step.

NOTE

Note the Frequency and Power values in the graph above. You have the option of saving the test data for future reference.
5. Turn the generator off. Check the stack for proper assembly, damaged components, or dirty mating surfaces. Recheck the ultrasound cable for proper connections. Repeat Steps 1 through 4. If the test still fails, go to the next step.

6. Turn the generator off, remove the stack from the thruster, and remove the horn from the stack. Reinstall the transducer-booster assembly in the thruster and turn the generator on. Repeat Steps 2 through 4. If the assembly passes with the horn removed, the horn is outside the specifications required for operation with the Digi-Trac preset range. Reassemble the horn to the stack.

The System tab of iQ Explorer has a section for Advanced Hardware. These features are designed for unique horns and applications. See Figure 6-4.

Consult Dukane Corporation before making adjustments to these settings.

If any failure indications are present with the horn removed, check the booster and the transducer for the following:

- Any visible damage
- Loose or cracked stud
- Pitted or dirty mating surfaces

Make any necessary repairs or adjustments. Go to Step 7.

7. Repeat Steps 1 through 6.

- If the failure indications disappear, reassemble the horn to the stack and repeat Steps 2 through 4.
- If any failure indications are still present, do not run this stack. Return the transducer and booster to Dukane for analysis.

![Dukane iQ Explorer System Tab - Advanced Hardware](image-url)

**Figure 6-4** iQ Explorer System Tab - Advanced Hardware
Procedure for Cycling the System

1. Check that you have correctly performed the following:
   a. Installed the stack in the thruster and bolted the stack access cover closed.
   b. Secured the fixture in place.
   c. Performed the Operational Test of the Acoustic Stack as detailed on Page 56 of this section.

2. Verify that all controls on the Press/Thruster and the generator are set as required for this operation.

3. Place a part in the fixture.

4. Cycle the system.

   Activate both opti-touch switches at the same time to start the system, and hold fingers in place until the ultrasound starts. Releasing the fingers before ultrasound starts will abort the cycle.
SECTION 7

Stack Maintenance

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Torque Values. . . . . . . . . . . . . . . . . . . . . . . . . . . . . 65
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Inspection of the Acoustic Stack Components

It is essential that the mating faces between an ultrasonic transducer/booster and a booster/horn be absolutely flat and parallel. If there is any air gap, there will be a loss in power output and efficiency. Coupling may be so poor as to prevent the startup of vibration from the stack, due to the excessive power draw at the mating surfaces.

The condition of excessive crowning, or uneven contact surfaces, is normally made evident by a burnished appearance around the bolt hole areas of the contact surfaces. This condition indicates that contact between the parts occurs only at the burnished areas and not across the full faces of the mating surfaces. (See Figure 7-1.)

The following flatness tolerances are specified for Dukane transducers, boosters, and horns used in 20 kHz applications:

- Transducer .0005 inch
- Booster .0005 inch
- Horn .0005 inch

To check if there may be a flatness problem, first disassemble the stack and look at the mating surfaces. If there are burnished areas at the periphery of a contact surface, that surface may be crowned in the center. Place a straight edge along the face. Refer to Figure 7-2. If light can be seen along the edges, it is crowned.

The surface may also be depressed in the bolt area. Refer to Figure 7-3. In this case, there will be contact only at the peripheral edges and light will be visible beneath the straight edge in the center region.
Reconditioning Stack Components

To restore the interface to the proper condition, do the following:

1. Disassemble the transducer/booster/horn stack and wipe interfaces with a clean cloth or paper towel.

2. Examine all interfaces. If any interface is corroded or shows a dark, hard deposit, it should be reconditioned.

3. If the interfaces appear to be in good condition, go to Step 11.

4. If necessary, remove the mounting studs.

5. Tape a clean sheet of #400 grit (or finer) silicon carbide wet-or-dry paper to a clean, smooth, flat surface. A piece of plate glass is usually suitable.

6. Hold the part to be conditioned at its lower end with your thumb over a spanner wrench hole. Carefully stroke the part once in one direction (toward you) across the abrasive paper, as shown in Figure 7-4. Do not apply downward pressure. The component’s weight alone provides sufficient pressure. Perform a second stroke.

   **IMPORTANT**

   Use extreme care to avoid tilting the part. Loss of flatness of interface surfaces may render the welding system inoperative.

7. Rotate the part 120° (1/3 rotation) to the next spanner wrench hole. Repeat the procedure outlined in Step 6.

8. Rotate the part the remaining 120° and repeat. Be certain to perform the same number of strokes at each orientation: Two strokes per rotation.

   **IMPORTANT**

   Use extreme care to avoid multiple strokes at each 1/3 rotation of the part. Loss of flatness and perpendicularity of the interface surface to the centering axis of the part may render the welding system inoperative.

---

NOTE

The operating efficiency of the equipment will be greatly affected if the mating interfaces of the transducer/booster/horn stack are not flat, make poor contact with each other, or become corroded. A poor contact condition wastes power output, makes tuning difficult, can affect the noise level, and can cause possible heat damage to the transducer.

---

Figure 7-4 Method of Component Resurfacing

---

Continued
Reconditioning Stack Components

Continued

9. Before reinserting a stud in any horn, perform the following for proper engagement of the threads:
   a. Visually inspect and clean the stud.
   b. Clean the threaded hole using a clean cloth or towel.
   c. Tighten the stud to the torque specifications listed in Table 7-I.

10. Reexamine the interface surface and repeat Steps 6 through 9 until most of the contaminate has been removed. This should not take more than 2 or 3 complete rotations of the part being reconditioned.

11. Reassemble and install the stack, using the procedure in Section 5 of this manual. Recheck the power supply tuning. See Section 6, System Test.

NOTE
Thread deformation may occur if the studs are overtightened. Removal of the stud could damage the threads in the horn. If this occurs, re-tap the horn threads and replace the stud with a new one. Use studs recommended by Dukane.

Torque Values
See Section 5, Stack/Fixture Setup for torque values:

Table 5-I - Stud Torque Values
Table 5-II - Horn/Booster Torque Values
Table 5-III - Replaceable Tip Torque Values

NOTE
Overtightening stack components may result in horn/booster studs loosening and unexplained overloads.
SECTION 8

Troubleshooting

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Overview
The Troubleshooting section of this manual contains a listing of problems that may occur when using this equipment along with probable causes and recommended solutions for the problems.

Regarding solutions, please note the following:

Where the solutions section refers to changing a setting for a primary weld characteristic or altering the position of the End-of-Weld limit switch, these adjustment capabilities and controls must be available on your equipment.

Primary Weld Characteristics
Primary weld characteristics refers to methods used to control the welding process. The characteristics include Time, Distance, Absolute Distance, Energy, and Peak Power.

To be functional in your system, each characteristic needs corresponding hardware/software support from the generator.

Table 8-I shows each characteristic and its equipment requirements.

<table>
<thead>
<tr>
<th>Primary Weld Characteristic</th>
<th>Equipment Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Generator with a digital timer or process controller with a time function.</td>
</tr>
<tr>
<td>Distance</td>
<td>Process controller with a distance measurement function and a press / thruster equipped with an optical distance encoder.</td>
</tr>
<tr>
<td>Absolute Distance</td>
<td>Process controller with a distance measurement function and a press/thruster equipped with an optical distance encoder, or a press/thruster with an End-of-Weld limit switch installed.</td>
</tr>
<tr>
<td>Energy, Peak Power</td>
<td>Process controller with an energy measurement function.</td>
</tr>
</tbody>
</table>

Table 8-1  Weld Characteristics and Equipment Requirements

End-of-Weld Limit Switch
The End-of-Weld limit switch is used to terminate the ultrasound power burst during a weld cycle as determined by the stroke position of the press head.

The switch is generally not used with a system that contains a process controller with a distance measurement function or a press/thruster equipped with an optical distance encoder.
**Welding**

**Problem**

Flash (*See also* Non-uniform welding)

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy director is too large.</td>
<td>Reduce the size of the energy director.</td>
</tr>
<tr>
<td></td>
<td>Reduce the weld time/primary weld characteristic.</td>
</tr>
<tr>
<td></td>
<td>Reduce the air pressure.</td>
</tr>
<tr>
<td></td>
<td>Use an interrupted energy director.</td>
</tr>
<tr>
<td>Shear interference is too great.</td>
<td>Reduce the amount of interference.</td>
</tr>
<tr>
<td>Weld time is too long.</td>
<td>Reduce the weld time.</td>
</tr>
<tr>
<td>Non-uniform joint dimensions.</td>
<td>Re-dimension the joint.</td>
</tr>
<tr>
<td></td>
<td>Redesign the joint to be a shear joint or a tongue-in-groove joint. Contact Dukane's Applications Lab.</td>
</tr>
<tr>
<td>Part fit or tolerances.</td>
<td>Loosen the part fit.</td>
</tr>
<tr>
<td></td>
<td>Loosen the part tolerances.</td>
</tr>
</tbody>
</table>

**Problem**

Misalignment of the welded assembly

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts are not self-aligning.</td>
<td>Design a means of alignment into the tooling (fixturing).</td>
</tr>
<tr>
<td></td>
<td>Add a means of alignment (e.g., pins and sockets) to the mating part halves.</td>
</tr>
<tr>
<td>Improper support in the fixture.</td>
<td>Redesign the fixture for proper support.</td>
</tr>
<tr>
<td>Wall flexure.</td>
<td>Add ribs or gussets to the part.</td>
</tr>
<tr>
<td></td>
<td>With a resilient fixture, if large sections of urethane are deflecting, add a rigid backup.</td>
</tr>
<tr>
<td>Joint design is not properly dimensioned.</td>
<td>Re-dimension the parts.</td>
</tr>
<tr>
<td>Incorrect part tolerance/poor molding.</td>
<td>Tighten the part tolerance.</td>
</tr>
<tr>
<td></td>
<td>Check the processing conditions.</td>
</tr>
</tbody>
</table>
Welding

Problem

Internal components are welding together.

Probable Cause

The internal components are made of the same material.

Solution

Make the internal components out of different materials.
Carefully lubricate the internal parts.
Use less horn amplitude by changing to a lower gain booster.

Problem

Diaphragm Damage

Probable Cause

Excessive horn amplitude.

Solution

Reduce the horn amplitude.
Dampen the welding area to absorb the amplitude.

Excessive exposure to ultrasound.

Solution

Reduce the weld time and increase the horn amplitude and/or air pressure.

Improper gate location/design/thin-wall sections.

Solution

Check gate placement.
Change the shape of the gate.
Add stiffening ribs to the part.
Increase the thickness of the material on the underside of the gate area.
If using a 20 kHz system, consider using a 30 kHz or 40 kHz system.

The type of horn and/or its placement.

Solution

Check for the proper horn/part fit.
Change the horn.

Problem

Overwelding

Probable Cause

Too much energy is being transmitted to the part.

Solution

Reduce the air pressure.
Reduce the weld time/primary weld characteristic.
Change to a lower gain booster to reduce the horn amplitude.
Reduce downstroke speed.

Continued
Welding

Problem

Internal components of work piece damaged during welding.

Probable Cause | Solution
--- | ---
Excessive horn amplitude | Reduce the horn amplitude by changing to a lower gain booster. Dampen the excess horn amplitude.
Excessive exposure to ultrasound. | Reduce the primary weld time and increase the horn amplitude by changing to a higher gain booster.
Too much energy transmitted into the part. | Reduce the horn amplitude. Reduce the air pressure. Reduce the weld time/primary weld characteristic.
The components are improperly mounted (e.g., parts are mounted too close to the joint area). | Ensure that internal components are mounted properly. Isolate internal components from the part. Move the internal components away from areas of high energy. Use an external device to dampen energy locally.

Problem

Melting or fracturing of the part (outside of the joint area).

Probable Cause | Solution
--- | ---
Sharp internal corners/thin sections. | Radius all sharp corners. Dampen motion for any damaged area, if possible.
Excessive horn amplitude. | Reduce the horn amplitude by changing to a lower gain booster.
A long weld time. | Decrease the weld time and increase the horn amplitude and/or the air pressure.
Inherent stress. | Check the molding conditions. Check the part design. Reduce the horn amplitude.
Welding

Problem

Underwelding

Probable Cause

Insufficient energy is being transmitted to the part.

Energy is being absorbed into the fixture.

Solution

Increase the air pressure.
Increase the weld time/primary weld characteristic.
Change to a higher gain booster to increase the horn amplitude.
Use a more powerful assembly system.

Change to a higher gain booster to increase the horn amplitude.
Use a more powerful assembly system.

Problem

Uneven welding

Probable Cause

Warped part(s).

The energy director varies in height.

Lack of parallelism between the horn, the fixture, and the part.

Wall flexure is occurring.

The knockout pin location is in the joint area

There is insufficient support in the fixture.

Solution

Check part dimensions.
Check the molding conditions.
Use a higher trigger pressure.
Use a higher hold pressure.

Redesign the energy director to ensure uniform height.
Use an interrupted energy director.

Make sure the thruster is perpendicular to the part.
Check the part dimensions.

Add ribs to the part.
Modify the fixture to prevent outward flexure

Redesign the part so the knockout pin is not in the joint area (Make sure knockout pins are flush with the surface)

Redesign the fixture to improve the support in critical areas.
Change to a rigid fixture.
If large sections of urethane are deflecting with a resilient fixture, add a rigid backup.

Continued
## Welding

### Probable Cause

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneven welding</td>
<td>Continued</td>
</tr>
<tr>
<td>Part dimensions are incorrect.</td>
<td>Check the part dimensions. Re-dimension the part, if necessary. Check the molding conditions.</td>
</tr>
<tr>
<td>The parts are improperly aligned.</td>
<td>Check for part shifting during welding. Check the alignment of mating parts. Check for parallelism of the horn, the part, and/or the fixture.</td>
</tr>
<tr>
<td>There is a lack of intimate contact around the joint area.</td>
<td>Check the part dimensions. Check the part tolerances. Check for knockout pin marks in the joint area. Check for misalignment of the mating part halves. Check for sinks.</td>
</tr>
<tr>
<td>Non-uniform horn contact is occurring.</td>
<td>Check the fit of the part to the horn. Check for proper support in the fixture.</td>
</tr>
<tr>
<td>Mold release is on the joint surface(s).</td>
<td>Clean the mating surfaces.</td>
</tr>
<tr>
<td>There is a non-uniform distribution of filler in the plastic material.</td>
<td>Check the molding conditions. Check the mold design.</td>
</tr>
<tr>
<td>The joint design is incorrect.</td>
<td>Redesign the joint.</td>
</tr>
<tr>
<td>There is a material or resin grade incompatibility problem.</td>
<td>Consult with the resin supplier(s).</td>
</tr>
<tr>
<td>There is a regrind problem.</td>
<td>Check with the molder. Check the molding conditions.</td>
</tr>
<tr>
<td>There is moisture in the molded parts.</td>
<td>Specify the parts to be “dry as molded”. Dry the parts by heating them prior to welding.</td>
</tr>
</tbody>
</table>
## Welding

### Problem

The parts are marking.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The horn heats up</td>
<td>Check for a loose stud, tighten if loose.</td>
</tr>
<tr>
<td></td>
<td>Loosen and then retighten the horn tip.</td>
</tr>
<tr>
<td></td>
<td>(Refer to Section 5).</td>
</tr>
<tr>
<td></td>
<td>Reduce the weld time.</td>
</tr>
<tr>
<td></td>
<td>Ensure that the horn and booster are coupling well</td>
</tr>
<tr>
<td></td>
<td>(Refer to Section 5).</td>
</tr>
<tr>
<td></td>
<td>Visually check the horn for cracks.</td>
</tr>
<tr>
<td>There are high spots in the part</td>
<td>Check the part dimensions.</td>
</tr>
<tr>
<td></td>
<td>Check the fit of the horn to the part.</td>
</tr>
<tr>
<td>Use of raised lettering.</td>
<td>Use recessed lettering or relieve the horn around the lettering.</td>
</tr>
<tr>
<td>The part does not fit the fixture properly.</td>
<td>Check the fixture for proper support.</td>
</tr>
<tr>
<td></td>
<td>Check for cavity-to-cavity variations.</td>
</tr>
<tr>
<td></td>
<td>Redesign the fixture.</td>
</tr>
<tr>
<td>Oxide from the horn is being transferred to the part.</td>
<td>Place polyethylene film between the horn and the part.</td>
</tr>
<tr>
<td></td>
<td>Use a chrome-plated horn and/or fixture.</td>
</tr>
<tr>
<td>The parts contain fillers.</td>
<td>Check the processing conditions.</td>
</tr>
<tr>
<td></td>
<td>Reduce the amount of filler in the plastic.</td>
</tr>
</tbody>
</table>

### Problem

Welding process not in control (inconsistent weld results on a part-to-part basis).

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>A mold release agent is used.</td>
<td>Clean the mating surfaces.</td>
</tr>
<tr>
<td></td>
<td>If a mold release agent is necessary, use a paintable/printable grade.</td>
</tr>
<tr>
<td>Incorrect part tolerances.</td>
<td>Tighten the part tolerances.</td>
</tr>
<tr>
<td></td>
<td>Check the part dimensions.</td>
</tr>
<tr>
<td></td>
<td>Check the molding dimensions.</td>
</tr>
<tr>
<td>There are cavity-to-cavity variations.</td>
<td>Check the part dimensions and tolerances.</td>
</tr>
<tr>
<td></td>
<td>Check for cavity wear.</td>
</tr>
<tr>
<td></td>
<td>Check the molding conditions.</td>
</tr>
</tbody>
</table>
# Welding

## Problem

Welding process not in control (inconsistent weld results on a part-to-part basis).  

## Probable Cause

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part dimensions vary due to mold cavity variations.</td>
<td>Perform a statistical study to see if a pattern develops with certain cavity combinations.</td>
</tr>
<tr>
<td>The resin contains regrind or degraded plastic.</td>
<td>Consult with the molder.</td>
</tr>
<tr>
<td></td>
<td>Check the molding conditions.</td>
</tr>
<tr>
<td></td>
<td>Reduce the percentage of regrind.</td>
</tr>
<tr>
<td></td>
<td>Improve the quality of the regrind.</td>
</tr>
<tr>
<td>Fluctuations in the AC line voltage supplied to the generator.</td>
<td>Upgrade to a generator with line regulation.</td>
</tr>
<tr>
<td>Fluctuations in the air line pressure.</td>
<td>Upgrade to a system with electronic pressure regulation.</td>
</tr>
<tr>
<td></td>
<td>Add a surge tank with a check valve to the air line.</td>
</tr>
<tr>
<td></td>
<td>Raise the compressor output pressure.</td>
</tr>
<tr>
<td>The plastic’s filler content is too high.</td>
<td>Reduce the percentage of filler in the plastic.</td>
</tr>
<tr>
<td></td>
<td>Check the processing conditions.</td>
</tr>
<tr>
<td></td>
<td>Change the type of filler (e.g., from short to long glass fibers).</td>
</tr>
<tr>
<td>The horn doesn’t fit the part correctly.</td>
<td>Check the part dimensions.</td>
</tr>
<tr>
<td></td>
<td>Check for cavity-to-cavity variations.</td>
</tr>
<tr>
<td></td>
<td>Obtain a new horn.</td>
</tr>
<tr>
<td>The weld cycle is too long.</td>
<td>Reduce the weld cycle time and increase the horn amplitude or air pressure.</td>
</tr>
<tr>
<td></td>
<td>Increase the dynamic trigger force.</td>
</tr>
<tr>
<td>There is a lack of parallelism between the horn, part, and/or fixture.</td>
<td>Check for parallelism between the horn, part, and fixture.</td>
</tr>
<tr>
<td></td>
<td>Check the horn/part fit.</td>
</tr>
<tr>
<td></td>
<td>Check the part/fixture fit.</td>
</tr>
<tr>
<td></td>
<td>Level the fixture, where necessary.</td>
</tr>
<tr>
<td>Rigid fixture reflects vibratory energy.</td>
<td>Dampen the energy by using teflon, neoprene, cork, or urethane in the nest of the fixture.</td>
</tr>
</tbody>
</table>
Insertion

**Problem**
The insert pulls out easily in use.

**Probable Cause**
- There is insufficient interference between the hole and the insert.
- The screw bottoms out in the hole.
- The insert gets pushed into the plastic before the plastic melts.
- The ultrasound remains on after insertion is complete.
- The horn retracts before the plastic around the insert is solidified.

**Solution**
- Reduce the size of the molded hole in the plastic.
- Use a shorter screw. (Applies to internally-threaded insert).
- Deepen the hole.
- Use hydraulic speed control.
- Increase the horn amplitude and/or decrease the air pressure.
- Use pre-triggering.
- Decrease the primary weld characteristic.
- Increase the hold time.

**Problem**
Inconsistent insertion of multiple inserts on the same part.

**Probable Cause**
- The plastic is not melting consistently around all inserts.
- Inserts are pushed into the plastic before the plastic has melted.
- Inserts are seated at different heights within the same part.

**Solution**
- Increase the horn amplitude.
- Use hydraulic speed control.
- Reduce the down speed.
- Use pre-triggering.
- Evaluate the support provided by the fixture. If required, re-level or shim the fixture.
- Measure the horn tip length to check for dimensional consistency. If a varying length is found, send the horn to Dukane for modification.

Continued
Insertion

Problem

The boss or the plastic around the boss cracks after insertion.

Probable Cause

The insert is pushed in before the plastic has melted.

The gauge pressure is set too high.

The boss wall is too thin.

There is too much interference between the insert and the hole.

Solution

Reduce the down speed, air pressure, and/or horn amplitude.

Use pre-triggering.

Reduce the air pressure.

Increase the thickness of the boss wall.

Increase the hole diameter.

Problem

The insert is not driven to the desired depth.

Probable Cause

The ultrasound is not on long enough.

Flash fills the hole.

(Applies to an internally-threaded insert.)

There is insufficient air pressure and/or ultrasonic power.

Solution

Increase the primary weld characteristic. Check the bottom stop setting.

Increase the depth of the hole.

Increase the air pressure, the ultrasonic power, or the horn amplitude.

Problem

The cycle time is too long.

Probable Cause

There is insufficient ultrasonic power or the generator overloads.

There is too much interference between the hole and the insert.

The area of the part being inserted is not being rigidly supported.

The down speed is slow.

Solution

If using a power control, increase the power.

Use a more powerful generator.

Increase the hole diameter, if possible.

Use a smaller insert.

Support the part directly under the boss.

Install a metal post directly under the part being inserted.

Increase the down speed.

Continued
Insertion

Problem
Plastic flows over the top of the insert.

Probable Cause Solution
The weld time is too long. Decrease the primary weld characteristic.
The insert is being driven too deep. Reset the bottom stop.
Decrease the primary weld characteristic.

There is too much interference Increase the hole diameter, if possible.
between the hole and the insert. Use smaller inserts.

Problem
Melted plastic fills the hole (Applies to internally-threaded inserts).

Probable Cause Solution
The insert is too long or the hole is Use a shorter insert or
too shallow. make the hole deeper.
There is too much interference Increase the hole diameter.
between the hole and the insert. Use smaller inserts.
The insert is being driven too deep. Reset the bottom stop.
Decrease the primary weld characteristic.
Staking

Problem
A ragged or irregularly shaped stake head is formed.

Probable Cause    Solution
The staking cavity is too large. Change to a smaller cavity in the horn.
The volume of plastic in the stud is insufficient. Increase the stud height/diameter.
The stud is melting at the base. See the problem section that follows entitled “The base is melting before the head forms”.

Problem
There is excessive flash around the stake head.

Probable Cause    Solution
The staking cavity is too small. Use a larger cavity in the horn.
The volume of plastic in the stud is excessive. Decrease the stud height and/or diameter.
The stud is not centered in the horn cavity. Center the stud under the horn cavity.

Problem
The surface below the stake head is distorted.

Probable Cause    Solution
The part is not supported directly beneath the stud being staked. Support the fixture with a metal post beneath the stud being staked.
The trigger force is too high. Reduce the trigger force. Use pre-triggering.

Problem
There is a loose fit between the staked head and the part being attached.

Probable Cause    Solution
The hole diameter relative to the stud diameter is too large. Reduce the hole diameter.

Continued
# Staking

**Problem**

There is a loose fit between the staked head and the part being attached. (continued).

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The holding force was removed before the stud head could solidify.</td>
<td>If using a dual pressure system, use Pressure 2 in the hold portion of the weld cycle (Pressure 2 should be higher than Pressure 1). Increase the hold time/distance. Increase the stud diameter. Reduce the size of the staking cavity.</td>
</tr>
<tr>
<td>Insufficient force is being applied to the staked head during the hold time.</td>
<td>Lower the bottom stop for the horn’s travel.</td>
</tr>
</tbody>
</table>

**Problem**

The stud is collapsing at its base.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a sharp corner near the base of the stud.</td>
<td>Radius the stud at the base.</td>
</tr>
<tr>
<td>The stud is not centered in the horn cavity.</td>
<td>Center the stud under the horn cavity. Use a knurled tip.</td>
</tr>
<tr>
<td>The base is melting before the head forms.</td>
<td>See the problem section below entitled “The base is melting before the head forms”.</td>
</tr>
<tr>
<td>Too much pressure is applied before the ultrasound is activated.</td>
<td>Use pre-triggering.</td>
</tr>
</tbody>
</table>

**Problem**

The base is melting before the head forms.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The trigger force is too high.</td>
<td>Reduce the trigger force. Pre-trigger the ultrasound.</td>
</tr>
<tr>
<td>The horn amplitude is insufficient.</td>
<td>Increase the amplitude.</td>
</tr>
<tr>
<td>The downstroke speed is too fast.</td>
<td>Use hydraulic speed control. Use a slower downstroke speed.</td>
</tr>
</tbody>
</table>

*Continued*
Staking

Problem

The formed stud head stays in the staking cavity as the horn retracts.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The stud head has not solidified before the horn retracts.</td>
<td>Increase the hold time.</td>
</tr>
<tr>
<td>The horn tip is heating and not allowing the stud to solidify.</td>
<td>Cool the horn tip. Use afterburst.</td>
</tr>
</tbody>
</table>

NOTE

The use of a knurled horn tip and a pointed stud can help solve many of the above problems.
## Continuous Welding

### Problem
Seal not meeting strength requirements.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material traveling too quickly.</td>
<td>Decrease speed.</td>
</tr>
<tr>
<td>Not enough horn amplitude.</td>
<td>Increase booster ratio.</td>
</tr>
<tr>
<td>Inconsistent blends of synthetic material.</td>
<td>Evaluate material.</td>
</tr>
</tbody>
</table>

### Problem
Inconsistent welding.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-uniform amplitude horn.</td>
<td>Have horn analyzed for amplitude uniformity.</td>
</tr>
<tr>
<td>Variations in anvil (fixture).</td>
<td>Check fixture design and dimensions.</td>
</tr>
<tr>
<td>Inconsistency of material.</td>
<td>Evaluate material.</td>
</tr>
</tbody>
</table>

### Problem
Seal area too great, causing flash.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material traveling too slow.</td>
<td>Increase speed.</td>
</tr>
<tr>
<td>Too much amplitude.</td>
<td>Reduce booster ratio.</td>
</tr>
<tr>
<td>Excessive air pressure.</td>
<td>Reduce air pressure.</td>
</tr>
</tbody>
</table>

### Problem
Transducer and/or horn heating up.

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not enough air flow to dissipate heat buildup.</td>
<td>Continuous duty applications require cooling air (refrigerated air, in some applications). Supply air to the stack interfaces and the horn tips.</td>
</tr>
</tbody>
</table>
Continuous Welding

Problem
Excessive horn wear.

Probable Cause
- Metal-to-metal contact between the horn and anvil.

Solution
- Use carbide inserts or have horn face carbide-coated.
- Reduce metal-to-metal contact.

Problem
Overloading generators.** See the NOTE below.

Probable Cause
- Loose stack components.
- Horn failure.
- Transducer failure.
- Booster failure.
- Stack operating frequency shifted out of tolerance.

Solution
- Disassemble, clean and reassemble stack.
- Replace horn.
- Replace transducer.
- Replace booster.
- Cool stack with air.

**
Table 8-II, on the next page, shows Pop-up Status Screens. Messages on these screens indicate generator status, and appear only on display-capable generators.
## Pop-up Status Screens

<table>
<thead>
<tr>
<th>System Status Signal</th>
<th>Status Text Displayed</th>
<th>System Status or Fault Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Overload</td>
<td>AVG OVERLOAD SIGNAL DETECTED</td>
<td>An Average Overload fault tripped. Output power exceeded rated wattage. Lower the welding pressure or amplitude. Fault will reset when next weld cycle starts.</td>
</tr>
<tr>
<td>Positive Peak Overload</td>
<td>POS OVERLOAD SIGNAL DETECTED</td>
<td>A Positive Peak Overload fault tripped. Peak IGBT transistor current exceeded. Caused by a severe frequency mismatch. Fault will reset when next weld cycle starts.</td>
</tr>
<tr>
<td>Negative Peak Overload</td>
<td>NEG OVERLOAD SIGNAL DETECTED</td>
<td>A Negative Peak Overload fault tripped. Peak flyback diode current exceeded. Caused by a severe frequency mismatch. Fault will reset when next weld cycle starts.</td>
</tr>
<tr>
<td>End of Weld</td>
<td>END OF WELD SIGNAL DETECTED</td>
<td>Automation activated End of Weld input. This ends the weld, then the old time begins. Activation prevents the start of next cycle. Status message displayed a few seconds.</td>
</tr>
<tr>
<td>End of Cycle</td>
<td>END OF CYCLE SIGNAL DETECTED</td>
<td>Automation activated End of Cycle input. This terminates the weld cycle (no hold). Activation prevents the start of next cycle. Status message displayed a few seconds.</td>
</tr>
<tr>
<td>Overtemperature Fault</td>
<td>SYSTEM OVER TEMP SIGNAL DETECTED</td>
<td>System Overtemperature fault detected. Check that cooling fan is operational. Check for dust build-up in cooling channel. Fault will reset when system cools down.</td>
</tr>
<tr>
<td>Frequency Lock Lost</td>
<td>FREQUENCY LOCK LOST SIGNAL DETECTED</td>
<td>Resonant frequency lock not found, or lost. Check for a defective stack component or assembly. Check for stack coupling to the fixture. Fault will reset when next weld cycle starts.</td>
</tr>
<tr>
<td>Current Loop Fault</td>
<td>CURRENT LOOP FAULT SIGNAL DETECTED</td>
<td>Remote Control current loop fault detected. Current loop current is less than 2MA. Check current loop wiring and loop source. this fault will set minimum amplitude level.</td>
</tr>
<tr>
<td>System Power Fault</td>
<td>SYSTEM POWER FAULT SIGNAL DETECTED</td>
<td>System power supply fault detected. Check that AC line input level is normal. Likely there will be no power for the LDC. Service is required if this fault is displayed.</td>
</tr>
<tr>
<td>Front Panel Lock</td>
<td>FRONT PANEL LOCKED KEYPAD ENTRY NOT ALLOWED</td>
<td>Front Panel Lock input is activated. Front Panel changes are not allowed. Warning pops-up if user attempts changes. Status message displayed a few seconds.</td>
</tr>
<tr>
<td>Empty Setup</td>
<td>THE CURRENT SETUP IS EMPTY AND NEEDS TO BE CONFIGURED</td>
<td>Warning text pops-up if a setup is empty. User must program a valid welding setup.</td>
</tr>
</tbody>
</table>

Table 8-II Pop-Up Status Screens
SECTION 9

Maintenance

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Six-Month Periodic Maintenance

1. Disconnect the generator AC power cord from the AC line receptacle. Then, remove the thruster left and right side covers.

2. Check that all socket-head cap screws in the press/thruster are tight. Check the air cylinder mounting.

3. Wipe or blow away all dirt and grease in the press/thruster.

4. Wipe away all excess oil and any dirt accumulation, especially at the exhaust openings in the transducer housing. There should be very little, if any, oil accumulation at the air exhaust opening. We recommend that no oil get into the press/thruster pneumatics. Regular accumulation of oil at the air exhaust opening means that some oil is getting into the pneumatics. To rectify this problem, route the air for the press/thruster through an “oil mist reclassifier”.

5. Check the press/thruster slide operation for smooth downward motion. Wipe away any accumulated grease, but do not apply any solvents. If movement is not smooth, the lower bearing may be greased with AFB lithium grease in the standard grease fitting provided.

6. Ensure that all wire and cable connections are secure in the press/thruster and are not rubbing or showing wear. If they do show wear or rubbing then reroute to eliminate the problem.

7. Remount and secure the press/thruster covers and reconnect the generator AC power cord to the AC line receptacle.
Contacting Dukane

Identify Equipment

When contacting Dukane about a service–related problem, be prepared to give the following information:

- Model number, line voltage and serial number.
- Fault/error indicators from the LCD display.
- Software version (Press INFO. With pointer at System Information, press ENTER to get this data.)
- Problem description and steps taken to resolve it.

Many problems can be solved over the telephone, so it is best to call from a telephone located near the equipment.

Ultrasonics Division

Mailing Address: Dukane Ultrasonics
2900 Dukane Drive
St. Charles, IL 60174 USA

Phone: (630) 797–4900

Fax:
  Main (630) 797–4949
  Service & Parts (630) 584–0796

Website

The website has information about our products, processes, solutions, and technical data. Downloads are available for many kinds of literature.

You can locate your local representative at:

www.dukane.com/us/sales/intsales.htm
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Section 11 - Specifications/Drawings

SECTION 11

Specifications

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Figure 11-7   Electric Schematic 215

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Figure 11-8  Electric Schematic 220 & 340
Weights

<table>
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<tr>
<th>Model Number</th>
<th>Press (includes base and column)</th>
<th>Thruster</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pounds</td>
<td>Kilograms</td>
</tr>
<tr>
<td>43Q215</td>
<td>322</td>
<td>146</td>
</tr>
<tr>
<td>43Q220</td>
<td>170</td>
<td>77</td>
</tr>
<tr>
<td>43Q340</td>
<td>170</td>
<td>77</td>
</tr>
</tbody>
</table>

Shipping: Add 10 pounds (2.3 kg) to unit weight for packing materials

Table 11-I Weights

Dimensions

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Press (includes base and column)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Height</td>
</tr>
<tr>
<td>43Q215</td>
<td>77.8 (1980) high</td>
</tr>
<tr>
<td>43Q220</td>
<td>56.94 (1450)</td>
</tr>
<tr>
<td>43Q340</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Add 4" (100 mm) behind the press/thruster for air input line and cable connections.

Table 11-II Dimensions

Operating Environment

Operate the equipment within these guidelines:

Temperature: 40°F to 100°F (+5°C to +38°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% Non–condensing @ +5°C to +30°C

Nonoperating storage guidelines:

Temperature: -4°F to 158°F (-20°C to +70°C)

Air Particulates: Keep the equipment dry.
Minimize exposure to moisture, dust, dirt, smoke and mold.

Humidity: 5% to 95% Non–condensing @ 0°C to +30°C
Compressed Air Requirements
For all press/thruster models, Dukane recommends 80-110 psi of clean, dry air.

Maximum available clamping pressure:

<table>
<thead>
<tr>
<th>Model</th>
<th>Force Generated at 110 psi (lb)</th>
<th>Standard Air Cylinder Diameter (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43Q215</td>
<td>775</td>
<td>3.00</td>
</tr>
<tr>
<td>43Q220</td>
<td>540</td>
<td>2.50</td>
</tr>
<tr>
<td>43Q340</td>
<td>190</td>
<td>1.75</td>
</tr>
</tbody>
</table>

Table 11-III  Clamping Pressure

AC Power Requirements
The press/thruster uses 24VDC @ 2 Amps, obtained from the iQ Series generator to which it is connected. The AC line voltage and current needed depend on whichever generator has been chosen for your system. See the table below.

<table>
<thead>
<tr>
<th>Operating Frequency</th>
<th>Generator Model Number</th>
<th>Overload Power Ratings (Watts)</th>
<th>Input AC Power Requirements Nominal AC Volt @ Maximum RMS Current</th>
<th>North America/ Japan AC Outlet Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>15kHz</td>
<td>15XX360-2X-XX-XX</td>
<td>3600</td>
<td>200-240V 50/60 Hz @ 25 Amps</td>
<td>30 Amps</td>
</tr>
<tr>
<td>15kHz</td>
<td>15XX480-2X-XX-XX</td>
<td>4800</td>
<td>200-240V 50/60 Hz @ 30 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX120-1X-XX-XX</td>
<td>1200</td>
<td>100-120V 50/60 Hz @ 15 Amps</td>
<td>30 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX120-2X-XX-XX</td>
<td>1200</td>
<td>200-240V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX180-2X-XX-XX</td>
<td>1800</td>
<td>200-240V 50/60 Hz @ 12 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX240-2X-XX-XX</td>
<td>2400</td>
<td>200-240V 50/60 Hz @ 15 Amps</td>
<td>30 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX360-2X-XX-XX</td>
<td>3600</td>
<td>200-240V 50/60 Hz @ 25 Amps</td>
<td>30 Amps</td>
</tr>
<tr>
<td>20kHz</td>
<td>20XX480-2X-XX-XX</td>
<td>4800</td>
<td>200-240V 50/60 Hz @ 30 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30kHz</td>
<td>30XX090-1X-XX-XX</td>
<td>900</td>
<td>100-120V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30kHz</td>
<td>30XX090-2X-XX-XX</td>
<td>900</td>
<td>200-240V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30kHz</td>
<td>30XX120-1X-XX-XX</td>
<td>1200</td>
<td>100-120V 50/60 Hz @ 15 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30kHz</td>
<td>30XX120-2X-XX-XX</td>
<td>1200</td>
<td>200-240V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>30kHz</td>
<td>30XX180-2X-XX-XX</td>
<td>1800</td>
<td>200-240V 50/60 Hz @ 12 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX060-1X-XX-XX</td>
<td>600</td>
<td>100-120V 50/60 Hz @ 8 Amps</td>
<td>5 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX060-2X-XX-XX</td>
<td>600</td>
<td>200-240V 50/60 Hz @ 5 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX090-1X-XX-XX</td>
<td>900</td>
<td>100-120V 50/60 Hz @ 15 Amps</td>
<td>8 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX090-2X-XX-XX</td>
<td>900</td>
<td>200-240V 50/60 Hz @ 8 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX120-1X-XX-XX</td>
<td>1200</td>
<td>100-120V 50/60 Hz @ 15 Amps</td>
<td>15 Amps</td>
</tr>
<tr>
<td>40kHz</td>
<td>40XX120-2X-XX-XX</td>
<td>1200</td>
<td>200-240V 50/60 Hz @ 8 Amps</td>
<td>8 Amps</td>
</tr>
</tbody>
</table>

Table 11-IV  AC Power Requirements

NOTES:
An X used above in the Model Numbers is a “wildcard” character meaning any valid character code combination.
Maximum line current requirement is specified at the minimum nominal AC line voltage and the rated power level.
Interpreting the Model Number

### iQ Series Ultrasonic Press System

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Power</th>
<th>Standard Options</th>
<th>D</th>
<th>E</th>
<th>L</th>
<th>P</th>
<th>H</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>43Q215</td>
<td>15kHz and Super 20 kHz</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43Q220</td>
<td>20kHz</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>43Q340</td>
<td>30kHz and 40kHz</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Table 11-V  Interpreting the Model Number  X = available  O = unavailable

Replacement Parts - iQ Series ES Presses

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Part Description</th>
<th>Press Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>43Q215</td>
</tr>
<tr>
<td>474-33</td>
<td>High pressure grease packet</td>
<td>X</td>
</tr>
<tr>
<td>403-569</td>
<td>User's Manual iQ Series Ultrasonic Press System ES</td>
<td>X</td>
</tr>
<tr>
<td>430-03-0026</td>
<td>iQ main valve assembly</td>
<td>X</td>
</tr>
<tr>
<td>697-113</td>
<td>Air pressure gauge (NOT needed if standard option E is installed)</td>
<td>X</td>
</tr>
<tr>
<td>721-31-00013</td>
<td>Transducer door hex key 43Q215</td>
<td>X</td>
</tr>
<tr>
<td>721-31-00056</td>
<td>Transducer door hex key 43Q220/43Q340</td>
<td>O</td>
</tr>
<tr>
<td>721-44</td>
<td>43Q340 spanner wrench</td>
<td>O</td>
</tr>
<tr>
<td>721-68</td>
<td>43Q215/43Q220 spanner wrench</td>
<td>X</td>
</tr>
<tr>
<td>804-33</td>
<td>Primary air cylinder, 2 1/2&quot; bore X 7&quot;</td>
<td>O</td>
</tr>
<tr>
<td>804-52</td>
<td>Air pressure regulator (NOT needed if standard option E is installed)</td>
<td>X</td>
</tr>
<tr>
<td>804-62</td>
<td>Primary air cylinder 3&quot; bore X 7&quot;</td>
<td>X</td>
</tr>
<tr>
<td>804-63</td>
<td>Counter balance air cylinder 9/16&quot; bore X 11&quot;</td>
<td>O</td>
</tr>
<tr>
<td>804-66</td>
<td>Primary air cylinder 1 1/2&quot; bore X 7&quot;</td>
<td>O</td>
</tr>
<tr>
<td>804-71</td>
<td>Counter balance air cylinder 1 1/16 bore X 11&quot;</td>
<td>X</td>
</tr>
<tr>
<td>430-03-0036</td>
<td>Electronic air pressure regulator (when optional E feature is installed)</td>
<td>X</td>
</tr>
<tr>
<td>625-18</td>
<td>Optical distance encoder (when optional E feature is installed)</td>
<td>X</td>
</tr>
<tr>
<td>430-03-0045</td>
<td>Dual pressure valve assembly (when optional P feature is installed)</td>
<td>X</td>
</tr>
<tr>
<td>430-03-0035</td>
<td>Dual pressure valve assembly (when optional P feature is installed)</td>
<td>O</td>
</tr>
<tr>
<td>804-18</td>
<td>Hydraulic speed control cylinder (when optional H feature is installed)</td>
<td>O</td>
</tr>
</tbody>
</table>

Table 11-VI Replacement Parts  X = available  O = unavailable
Regulatory Agency Compliance

FCC
The generator complies with the following Federal Communications Commission regulations.


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 equipment complies with the following CE requirements.

- The EMC Directive 2004/108/EC for Heavy Industrial —
  EN 61000-6-4: 2001
  EN 55011: 2003
  EN 61000-6-2: 2001
  EN61000–4–2
  EN61000–4–3
  EN61000–4–4
  EN61000–4–5
  EN61000–4–6
  EN61000–4–8
  EN61000–4–11

- The Low Voltage Directive 2006/95/EC.

- The Machinery Directive 98/37/EC.
  EN 60204-1: 2006

Effective 12/29/09:
The Machinery Directive 2006/42/EC.
EN 60204: 2006
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<td>104</td>
</tr>
</tbody>
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Dukane ISO

ISO CERTIFICATION
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.

Dukane products are manufactured in ISO registered facilities
Please refer to our website at:

www.dukane.com/us/sales/intsales.htm
to locate your local representative.