

Models
4095 Press /
4096 Actuator

I N S T R U C T I O N M A N U A L



SONICS.....

Sonics & Materials, Inc.

WARNING



SAFETY PRECAUTIONS READ BEFORE INSTALLING OR USING THE EQUIPMENT

Our systems have been designed to assure maximum operator safety. However, no design can completely protect against improper usage. For maximum safety and equipment protection, observe the following warnings at all times and read all applicable instruction manuals carefully before you attempt to operate any equipment.

- The equipment has safety devices that require both hands to be on the palm buttons until the horn contacts the work piece. Do not defeat or modify these safety devices.
- Do not use with foot switch unless alternate means of pinch-point protection is provided.
- High voltage is present in the equipment. Disconnect plug before removing cover or servicing.
- Make sure equipment is properly grounded with a 3-prong plug. Before plugging in equipment, test outlet for proper earth grounding.
- High voltage potential may be present in the converter as a result of temperature changes. Do not touch the converter contact unless you first short both pins or the button to the converter case with an insulated tool.
- Never squeeze or grab a vibrating horn.
- Do not modify horn configurations.
- Ultrasonic welders operate above normal audibility for most people. Ear protection is recommended.
- Do not affix any device to any portion of the horn.

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IMPORTANT SERVICE LITERATURE



NOTE: Please read carefully before operating the equipment, then forward to your service department.

The system supplied with this instruction manual is constructed of the finest material and the workmanship meets the highest manufacturing standards. It has been thoroughly tested and inspected before leaving the factory and when used in accordance with the procedures outlined in this manual, will provide you with many years of safe and dependable service.

MANUAL CHANGE INFORMATION

We continually strive to be at the forefront of the latest electronic developments by adding circuit and component improvements to our equipment as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we cannot incorporate these changes immediately into printed manuals. Hence, your manual may contain new change information. Change information, if any, is located in the Appendix.

We reserve the right to make any changes in the design or construction of our equipment at any time, without incurring any obligation to make any change whatsoever in units previously delivered.

The technical data and schematics in the manual are for informational purposes only and may not reflect the current configuration being shipped from our factory. Upon formal request, complete and up-to-date information can be provided from the factory free of charge.

UNPACKING AND INSPECTION



NOTE: We recommend keeping all carton(s) and packing material in case it might be necessary to move the equipment, or to ship it for repair.

Before unpacking the equipment, check the shipping carton for any visible damage. If you see any, be sure to follow the procedures described below under “Visible Loss or Damage.” Otherwise, proceed to remove the equipment from the carton. Before disposing of any packing material, check it carefully for small parts. Then perform a visual inspection of the equipment to detect any evidence of damage which might have occurred during shipment. Check the following:

1. all components against the enclosed packing list,
2. all module plug-in units,
3. all wire plug-in connections.

The equipment was carefully packed and thoroughly inspected before leaving our factory. All units are tested and checked for problems prior to shipping. It is asked that when a problem does occur that all parts and components be inspected for damage (especially when the unit is not in working order when received). Responsibility for safe delivery was assumed by the carrier upon acceptance of the shipment. Claims for loss of damage sustained in transit must therefore be made upon the carrier, as follows:

VISIBLE LOSS OR DAMAGE

Any external evidence of loss or damage must be noted on the freight bill or express receipt, and signed by the carrier’s agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier’s refusal to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

CONCEALED LOSS OR DAMAGE

Concealed loss or damage means loss or damage which does not become apparent until the merchandise has been unpacked. The contents might have been damaged in transit due to rough handling even though the container may not show external damage. When the damage is discovered upon unpacking, make a written request for inspection by the carrier’s agent within 48 hours of the delivery date. Then file a claim with the carrier since such damage is the carrier’s responsibility. The form required to file such a claim will be supplied by the carrier. Do not destroy packing materials, or move material from one location to another before the carrier makes their inspection.

If the system or any unit is damaged, notify “Sonics.” “Sonics” will arrange for repair or replacement of damaged equipment without waiting for the claim against the carrier to be settled, provided a new purchase order is issued to cover the repair or replacement costs. Should any damage, shortage or discrepancy exist, please notify us immediately.



INTRODUCTION

The models 4095 and 4096 are 40 kHz precision pneumatic actuators used for ultrasonic plastics assembly. The 4095 is a tabletop version, whereas the 4096 can be mounted on a bridge or rigid structural member for use with automated systems. Either can be supplied with the following GX-Series power supplies:

- GXTWeld by digital time
- GXEWeld by digital time and/or constant energy
- GXLWeld by digital time, constant energy and/or distance*

**Requires optional linear encoder.*

Both actuators are also compatible with E and F Series power supplies.

OVERVIEW OF ULTRASONIC PLASTICS ASSEMBLY

WHAT IS ULTRASONICS?

Ultrasonics refers to vibrational waves with a frequency above the human audible range which is usually above 18,000 cycles per second (Hz).

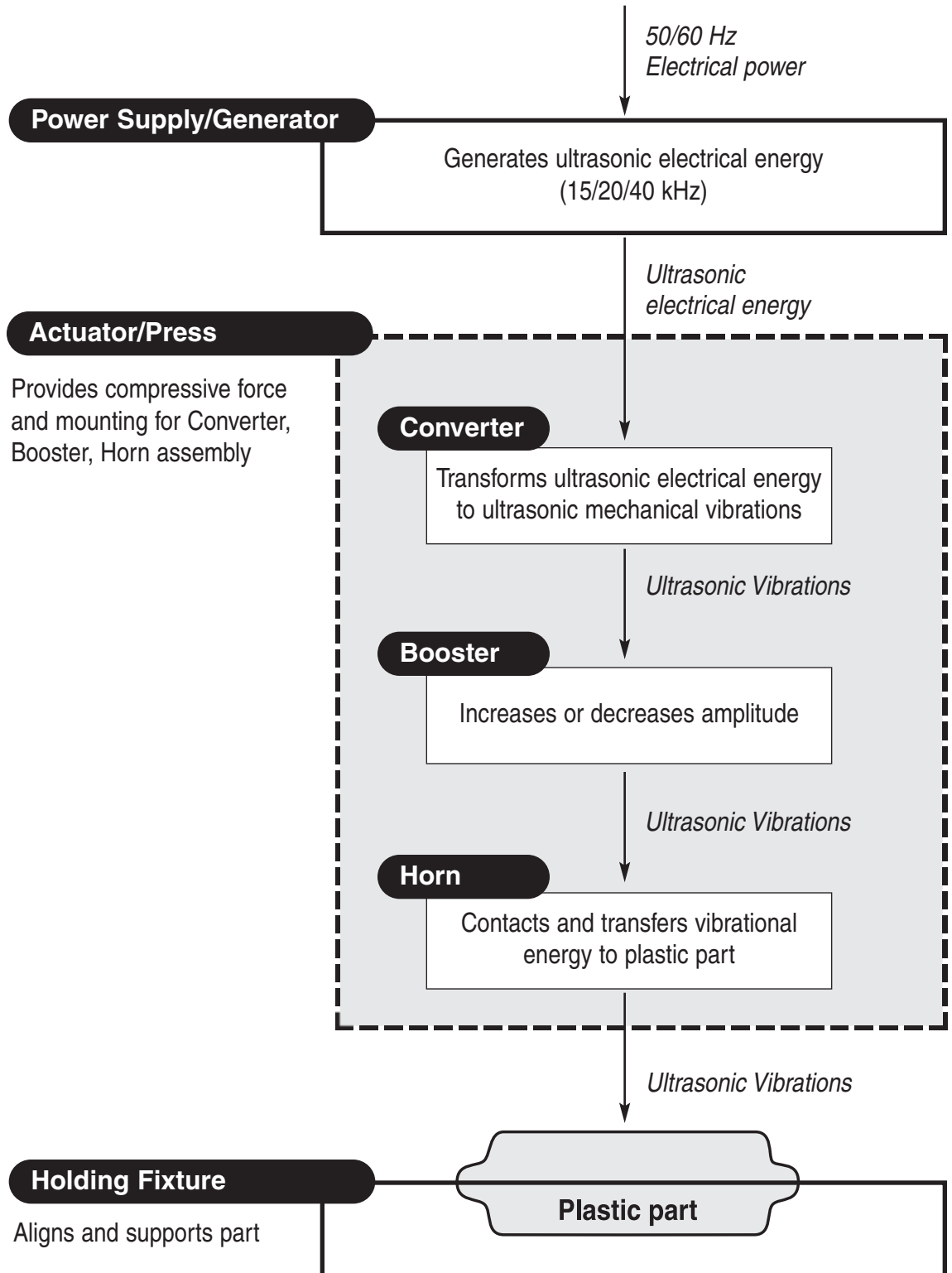
PRINCIPLE OF ULTRASONIC ASSEMBLY

The basic principle of ultrasonic assembly involves conversion of high frequency electrical energy to high frequency mechanical energy in the form of reciprocating vertical motion which, when applied to a thermoplastic, generates frictional heat at the plastic/plastic or plastic/metal interface. In ultrasonic welding, this frictional heat melts the plastic, allowing the two surfaces to fuse together; in ultrasonic staking or insertion, the controlled flow of molten plastic is used to capture or lock another material in place (staking) or encapsulate a metal insert (insertion).

ULTRASONIC ASSEMBLY SYSTEMS

“Sonics” ultrasonic assembly systems are generally composed of the following major elements: a power supply, converter, booster, horn, pneumatic press and holding fixture, as detailed in the diagram on the next page. A review of this diagram will help you understand the basic elements involved in the assembly process and their relation to each other.

“SONICS” ULTRASONIC ASSEMBLY SYSTEMS



GLOSSARY OF ULTRASONIC TERMS

POWER SUPPLY/GENERATOR – The solid state power supply converts standard 50/60 Hz electrical power to 15,000 Hz, 20,000 Hz, or 40,000 Hz (15/20/40 kHz) electrical energy.

ACTUATOR/PRESS – The pneumatic actuator provides compressive force and mounting for the converter, booster, and horn assembly. The tabletop press consists of a base assembly, column and actuator (head).

CONVERTER – The converter changes the high frequency electrical energy supplied by the power supply to high frequency mechanical vibrations.

BOOSTER – Successful ultrasonic welding often depends on having the right amplitude at the horn face. Often it is not possible to design a horn which has both the necessary shape and required gain (ratios of input amplitude to output amplitude). In such cases, a booster is placed between the converter and the horn to either increase or decrease the amplitude of the horn. In addition to changing/maintaining the amplitude, the booster provides support and alignment in the welding system. (See page 18 for booster selection.)

HORN – The horn is a tuned component of the system which comes in contact with the parts to be assembled. The horn 1) transfers the ultrasonic vibrations produced from the converter to the parts being welded, and 2) applies necessary force to the assembly while the material resolidifies.

HOLDING FIXTURE – The holding fixture or nest assures proper alignment and support of the parts being assembled.



MODEL 4096



MODEL 4095

INSTALLATION



WARNING

Do not connect the press to an air source supplied by a compressor lubricated with synthetic oils or oils containing phosphate esters or chlorinated hydrocarbons. This type of lubricant may cause the air filter to malfunction, and the plastic bowl to rupture.



NOTE: *If the power supply is to be run continuously, air cooling of the converter and horn is required. Use clean, dry compressed air filtered down to 5 microns (supplied to converter fitting).*

ELECTRICAL POWER

The press is powered by the power supply. Consult your power supply instruction manual to determine power specifications.

AIR SUPPLY

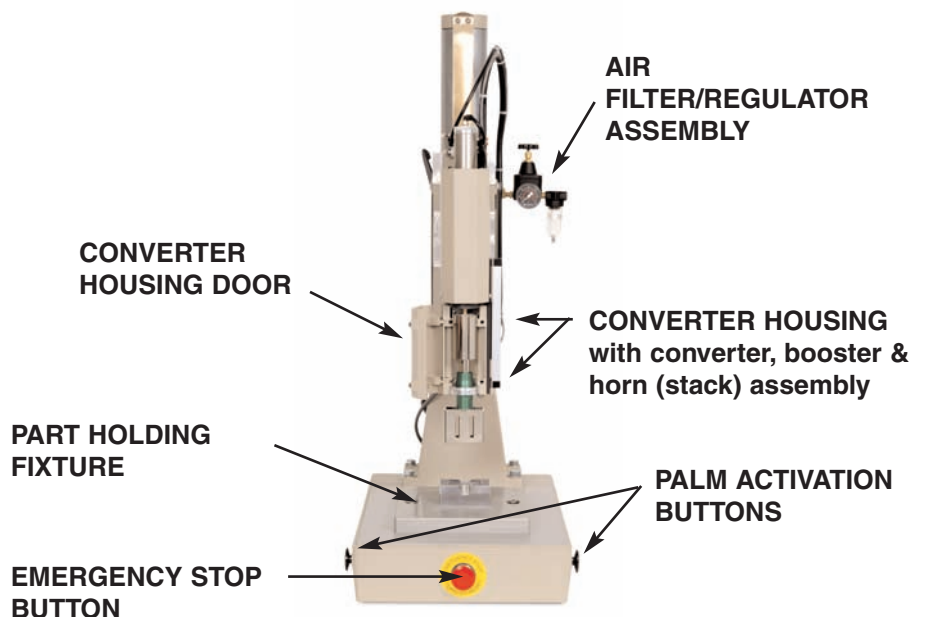
The press requires a source of dry, filtered (5 micron), oil-free, compressed air capable of supplying a constant line pressure of 85 psig. (586 kPa / 6 bar) at a minimum capacity of 2 CFM.

SETTING UP

The press should be installed in a clear, uncluttered location that is free from excessive dirt, dust, corrosive fumes, and temperature and humidity extremes. The selected installation site should be near the electrical power and air supply sources and away from any equipment that generates abnormally high electrical transients. Observe the following additional instructions when installing the press:

- a. The press should be placed on a sturdy, level table or bench capable of supporting a minimum of 500 pounds (227 kg).
- b. Allow at least 6 inches (152.4mm) at the rear of the press for cable connections.

KEY COMPONENTS





NOTE: Do not strain or kink the cables. When going around corners, allow as wide a bend as possible. Do not run the cables parallel to any power line within a distance of less than 1 foot (304.8mm).

CONNECTIONS

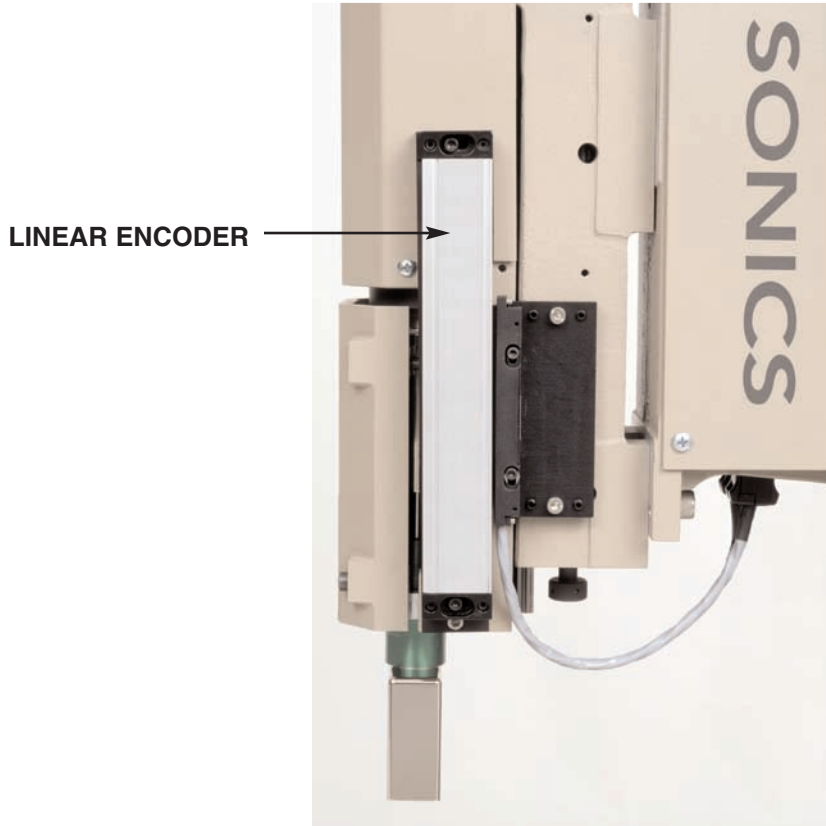
When making the initial connections, make sure all power is disconnected.

1. Connect the air supply source to the press air filter located at the right, rear of the press head, using a hose having a minimum inside diameter of 1/8 inch (6 mm).
2. Connect the RF and base (actuating) cables of the press (4095 only) to the power supply. (Consult your power supply instruction manual for details.)
3. Check with your electrician if you have any wiring questions.

OPTIONS

A Linear Encoder is available as an option for the 4095 and 4096 models. The Linear Encoder allows distance-controlled welding in incremental and absolute modes.

The Linear Encoder is supplied with a 9-pin male connector that connects to a matching 9-pin female connector on the power supply (factory installed).



INITIAL EQUIPMENT SETUP



WARNING

Never tighten the horn to the booster using the housing door as the upper wrench as this may cause damage to the booster and/or converter.

ASSEMBLING AND MOUNTING CONVERTER, BOOSTER, AND HORN

If the converter, booster, and horn are not already assembled, follow these instructions:

1. Clean the mating surfaces of the converter and booster, as well as the threaded stud and hole. Check that the stud is tight (see recommended torque requirements on page 12).
2. Hand assemble the converter and booster together. Using open-ended wrenches as shown below, tighten until snug. Then, using a torque wrench, tighten to 25-35 foot-lbs.(34-47 newton-meters). **Do not force or overtighten.**



3. Clean the mating surfaces of the booster and horn, as well as the threaded stud and hole. Check that the stud is tight. (See recommended torque requirements on next page.)
4. Hand assemble the horn to the booster. Using open-ended wrenches as shown below, tighten securely. Then, using a torque wrench, tighten to 25-35 foot-lbs. (34-47 newton-meters). **Do not overtighten.**

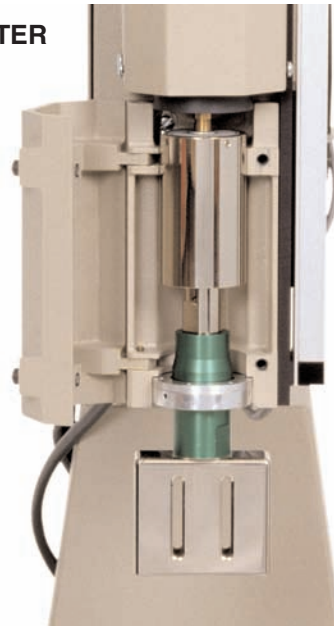




NOTE: When performing any of the operations described on this page and pages 13 and 14, DO NOT turn on the power supply.

- Using the 3/16" (4.7 mm) T-handle wrench provided, loosen (turn counterclockwise) the two cap screws on the hinged converter housing and open the door.
- Place the converter / booster / horn assembly in the housing with the horn facing down. Fit the male brass button connector on the top of converter into the female brass connector in the bottom of the interior housing, and gently push the assembly up and in so that the booster mounting ring rests on the lower support ridge.

CONVERTER / BOOSTER HORN ASSEMBLY



WARNING

Never tighten the horn to the booster using the housing door as the upper wrench as this may cause damage to the booster and/or converter.

- Close the converter housing door and tighten (turn clockwise) the two socket head cap screws just until they are snug. Do not tighten the horn to the booster using the door as the upper wrench. Hand-forcing the horn on and off in this manner can twist wires and cause a failure. If the horn is not in the correct position to make contact with your material, re-position the converter.



NOTE: If you do not close the housing door once the assembly is in place, the assembly can fall out.

RECOMMENDED TORQUE REQUIREMENTS

Component	Foot-Lbs.	Newton-Meters
Converter / Booster	25 - 35	34-47
Booster / Horn	25 - 35	34-47
Stud	45	61
Tips	25 - 35	34-47



WARNING

Support the head before releasing the column clamps so that it cannot crash down or fly up. Ignoring this warning might result in injury and/or damage to the equipment and part being welded.



WARNING

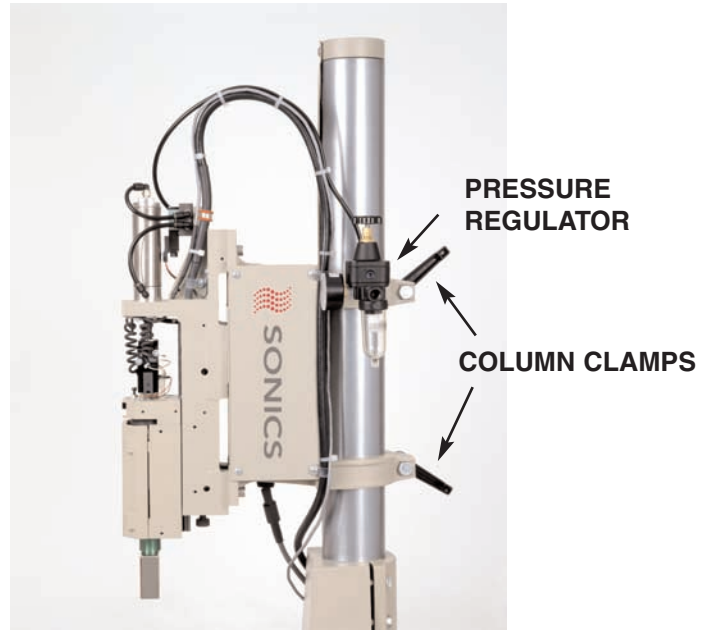
When the air pressure is decreased, the converter housing can drop down to its limit, so be sure to either support it or remove anything in its path.

HORN AND FIXTURE ALIGNMENT

For maximum productivity, the clearance between the horn and the part should be at a minimum. However, adequate clearance should be provided to enable easy loading and unloading of the part from the holding fixture. (The maximum stroke distance is 3-1/2".) Ensure that the horn does not contact the part when the head is close to the limit of its down travel distance. Otherwise, the horn may not have sufficient distance to travel downwards to achieve a full depth of weld. Set welding height as described below:

1. Position the holding fixture loosely on the base plate using 3/8-16 screws.
2. Place the part to be welded in the fixture.

HEAD ASSEMBLY



3. Before loosening the column clamps, hold onto the head assembly firmly as it can rise upwards rapidly once the clamps are released. While holding the head assembly, loosen the two column clamps (counterclockwise) and move the head up or down as required. Then tighten the column clamps.
4. Set the air pressure to zero by turning the PRESSURE regulator knob (located at the top of air filter/regulator assembly) fully counterclockwise.
5. Loosen the column clamps once again and manually lower the head until the horn contacts the part. Tighten the clamps.
6. Loosen the cap screws on the converter housing door and gently rotate the head and horn as required to ensure proper horn-to-part alignment.

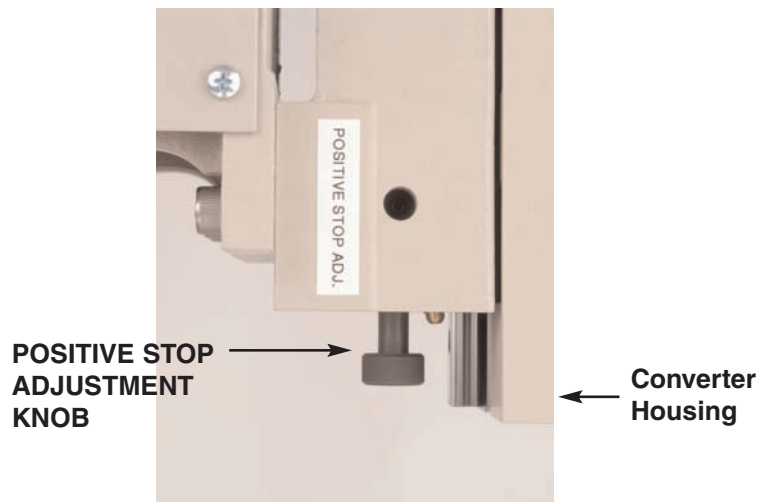
7. Lock the two column clamps, tighten the converter housing door screws, and then tighten the fixture on the base plate.
8. Check for proper mating of fixture, parts, and horn. If the horn and part are not in parallel contact, shim the fixture or adjust leveling screws as required.
9. Set the PRESSURE regulator to a reading of 20 psig (140 kPa/1.4 bar) on the pressure gauge. (Turn the PRESSURE knob clockwise.)
10. To check that the horn and parts are properly aligned, the horn needs to be lowered. Read through the Operation instructions on the next page, and then proceed to lower the horn as detailed. If the horn and parts are not sufficiently aligned, then repeat steps 4 through 8 on the preceding page. However, if you are working with small, delicate parts, then fine adjustments can be made using the positive stop adjustment knob as explained below.

POSITIVE STOP ADJUSTMENT

The positive stop is set to limit the downward travel of the horn to approximately 75%. Readjustments may be required. Coarse adjustment of the clearance between the face of the horn and part should be made using the elevation control. Fine adjustment should be made using the positive stop.



NOTE: For maximum safety and productivity, adjust the clearance between the horn and the part to a minimum that will still allow ease of loading and unloading.



The positive stop adjustment knob is located offset from the converter housing. Turning the knob clockwise will decrease downward travel distance. Turning the knob counterclockwise will increase the downward travel distance. A set screw located on the left side of the housing locks the positive stop adjustment in place. Use a 3/32 Allen wrench to lock and unlock this set screw.

OPERATION



WARNING

*The equipment has safety devices that require both hands to be on the palm buttons until the horn contacts the workpiece. **Do not defeat or modify these safety devices.***



NOTE: *Power supply cannot be shut off once the weld cycle has started. Termination of cycle can only be achieved by using the **EMERGENCY STOP** button.*



WARNING

Do not use with a footswitch unless alternate means of pinch-point protection is provided.

ACTUATION

The 4095 press is equipped with two maintained anti-repeat (non-tie-down) palm buttons, one located on the left and one on the right side of the base of the press. Both palm buttons must be pressed simultaneously to activate the press to cycle the welder. To operate the press, follow these simple steps:

1. Depress both black palm buttons simultaneously.
2. Once the horn comes in contact with the part and the ultrasonics are activated, release the palm buttons. If you release the buttons before contact is made, the head will immediately return to its “home” position.

The operation of the 4096 actuator is controlled by the automated system. A four-wire actuation cable is provided which ties into the output side of a PLC, or other system controlling device. Momentary two wire closure from a dry source will initiate the welder’s cycle. For more information, refer to the power supply manual and the included wiring diagrams.

EMERGENCY STOP

To abort the 4095 press during welding, simply press the red EMERGENCY STOP button located at the front center of the press base.

Once the EMERGENCY STOP button has been depressed, the head will retract and return to its “home” position, remaining there until the button is released. Simply rotate the EMERGENCY STOP button to the right 1/4 turn to release the press for further operation.

For the 4095 actuator, a four-wire actuation cable contains two normally closed wires which control the emergency stop function. For more information, refer to the power supply manual and the included wiring diagrams.



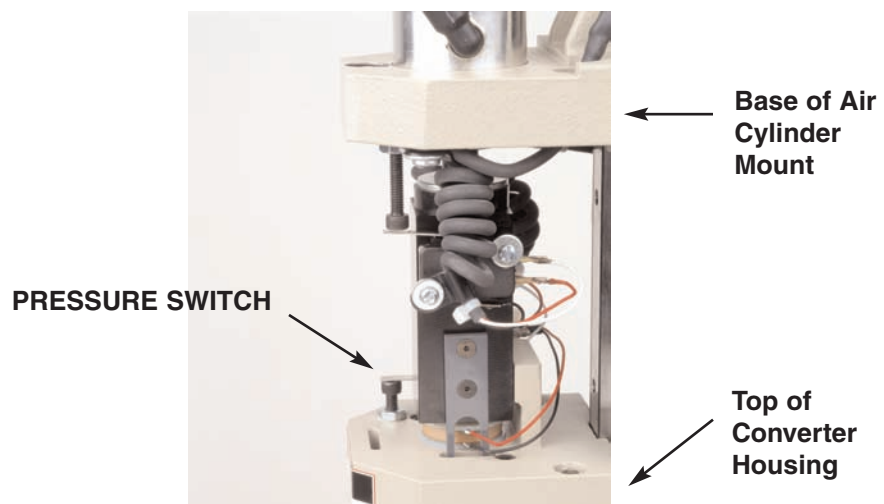
FINE ADJUSTMENTS

PRESSURE SWITCH ADJUSTMENT

For systems mounted in the normal vertical position with downward travel, no adjustment should be necessary. The minimum trigger pressure is factory set at 4-7 psig.

However, if the minimum trigger pressure requires recalibration or re-adjustment, observe the following procedure:

1. Maintain air pressure and unplug the power supply from the electrical source.
2. Remove the four screws holding the five-sided cover.
3. Loosen the jam nut holding the 8-32 cap screw in place.
4. Rotate the cap screw counter-clockwise (up) until the Pressure Switch closes.



5. Next rotate the cap screw clockwise (down) until the Pressure Switch opens.
6. Rotate cap screw clockwise (down) 1/4 turn past the Pressure Switch open position.
7. Tighten the jam nut to lock cap screw in position.
8. Replace the cover and four screws.
9. Plug the power supply into the electrical source.
10. Cycle the welder.

The press is now set to trigger at the minimum trigger pressure of 4-7 psig.

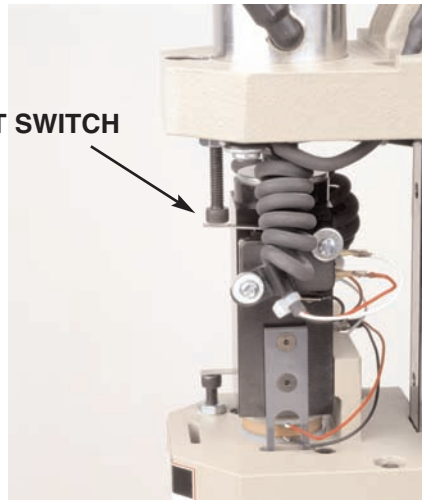
A press actuating in an upward or horizontal direction should be set to trigger at a minimum of 8-10 psig. Lower values may affect trigger performance where false triggering may be observed.

FINE ADJUSTMENTS

UPPER LIMIT SWITCH

The optional Upper Limit Switch is used as a safety interlock in automation to prevent the movement of material handling equipment (indexing) when the horn is down. It also initiates the movement of material handling equipment when the horn is up.

UPPER LIMIT SWITCH



The Upper Limit Switch is factory set and should be suitable for all applications. If for some reason you need to readjust it, observe the following procedure:

1. Maintain air pressure and unplug the power supply from the electrical source.
2. Remove the four screws holding the five-sided cover.
3. Loosen the jam nut holding the 8-32 cap screw in place.
4. Rotate the cap screw counter-clockwise (down) until the Upper Limit Switch closes.
5. Tighten the jam nut to lock cap screw in position.
6. Replace the cover and four screws.

The Upper Limit Switch is now set.



NOTE: Consult the Applications Manual or call our Applications Lab for proper booster selection.



WARNING

High gain boosters, such as silver and black in combination with high gain horns can result in the horn cracking or failing.

BOOSTER SELECTION

The first step in optimizing welding conditions is to select a booster which will provide the necessary amplitude. For parts one inch (25.4mm) in diameter or greater, start with a moderately high amplitude booster such as a gold. For smaller parts, start with a green booster. Determine optimum amplitude by welding a few parts, and repeat the procedure with boosters giving higher or lower amplitude. If there appears to be little or no difference, use the booster giving the highest amplitude.

Six standard boosters, color coded or engraved for ease of identification, are available either to increase or decrease the amplitude.

BOOSTER

Color	Part No.	Gain	Amplitude Effect
Black	BHN23TBK	2.50	Increase
Silver	BHN23TSI	2.00	Increase
Gold	BHN23GD	1.50	Increase
Brown	BHN23BR	1.25	Increase
Green	BHN23GR	0	No Change
Purple	BHN23PU	0.75	Decrease

PRESSURE

During the welding process, sufficient pressure should be applied to the part so that the mating surfaces contact each other. If the pressure is too low, the process will run inefficiently causing unnecessarily long weld time cycles, marking of the parts or poor welding. If the pressure is too high, the horn may stop vibrating, the part(s) might fracture, or the power supply might overload.



WARNING

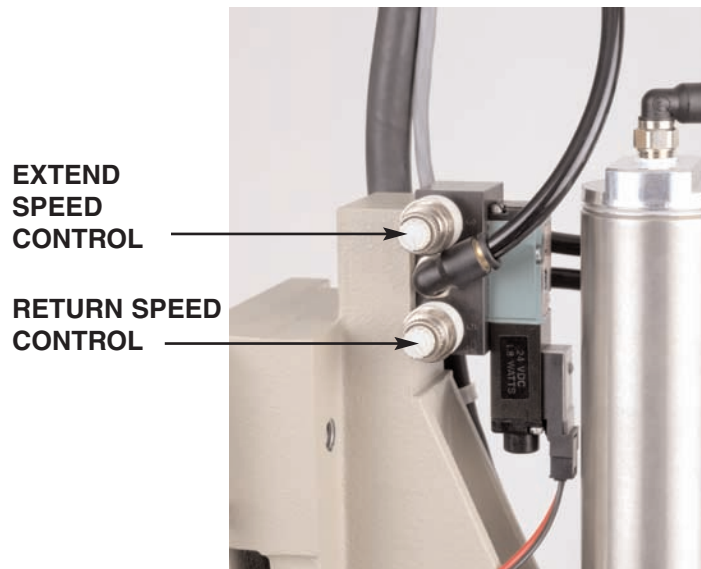
Excessive velocity may be unnecessary and harmful to the system.

STROKE SPEED ADJUSTMENT

The velocity at which the horn descends and returns can be adjusted via the speed controls. These controls are factory adjusted for average operating conditions and should not require further adjustment. However, if a minor adjustment is necessary, adjust in small degrees. Turn clockwise to slow the extend speed, and counterclockwise to increase the return speed.

The speed controls are 2 small threaded screws located at the top of the press and behind the air cylinder as shown below.

The top screw controls the extend speed – turn it clockwise to slow the speed, counterclockwise to increase the speed. The bottom screw controls the return speed – turn it clockwise to slow the speed, counterclockwise to increase speed.





NOTE: Contact between the booster and horn should be parallel. When encountering symptoms such as loud noises or tuning difficulties, examine the booster / horn interfaces for parallelism, corrosion, galling or foreign deposits. Also check the tightness of the stud.



WARNING

DO NOT use anything coarser than 400 grit emery cloth.



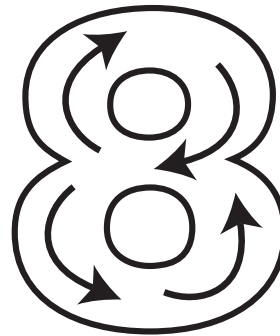
NOTE: Machining of booster / horn may alter the ability to tune the component to the system. System inoperation may occur.

RE-ESTABLISHING PROPER BOOSTER / HORN INTERFACES

To re-establish proper interfaces, follow these instructions:

1. Using open-ended wrenches, separate the booster from the horn. Clean each item and then examine interfaces for irregularities (scoring).
2. If irregularities are present, remove the stud.
3. Tape a sheet of 400 grit emery cloth to a smooth, flat surface. (Do not use coarser than 400 grit.)
4. Grasp the lower portion of the booster or horn and move it across the emery cloth. To ensure proper lapping, a) hold the part straight, b) apply light downward pressure, and c) move in one direction only in a figure 8 pattern.

Repeat the figure 8 pattern once more.



5. Then, rotate the booster or horn 1/3 of a turn in a clockwise direction and then repeat step 4.
6. Repeat step 5.
7. Using wire brush, clean stud, then replace securely. Tighten new stud to the recommended torque specifications on page 12.



MAINTENANCE



NOTE: *If packing unit for return shipment, DO NOT use styrofoam "peanuts."*

REPAIRS / SERVICE

If problems are encountered, contact our Service Department as follows:

Phone: 1-800-745-1105 • 1-203-270-4600

Fax: 1-203-270-4610

E-Mail: service@sonicsandmaterials.com

It is suggested that a system in need of repair be sent back to the factory, with a written description pertaining to the nature of the problem.

Always contact the factory for return authorization before shipping any instrument. Include date of purchase, model number, and serial number. For units not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay. Care should be exercised to provide adequate packing to insure against possible damage in shipment. The system should be sent with all transportation charges prepaid and return method of shipment indicated.

WARRANTY

Sonics & Materials, Inc., hereinafter referred to as “Sonics,” warrants its products for a period of one year from the date of shipment against defect in material and workmanship under normal installation, use, and maintenance as described in the operating instructions which accompany such equipment. During the warranty period, “Sonics” will, at its option, as the exclusive remedy, either repair or replace without charge for material and labor, the part(s) which prove upon our examination to be defective, provided the defective unit is returned to us properly packed with all transportation charges prepaid.

Ultrasonic welding horns constructed of titanium or aluminum are guaranteed against defects for a period of one year from date of shipment. “Sonics” will repair or replace a cracked or defective horn once without charge, if failure occurs within the warranty period.

Ultrasonic welding horns constructed of steel are guaranteed against defects for a period of ninety days from date of shipment. “Sonics” will repair or replace a cracked or defective steel horn once at a charge of 50% of the original purchase price, if failure occurs within the warranty period.

LIMITATION OF WARRANTY

This warranty is in lieu of any other warranties, either express, implied, or statutory. “Sonics” neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the sale of its products. “Sonics” hereby disclaims any warranty or merchantability or fitness for a particular purpose. No person or company is authorized to change, modify, or amend the terms of this warranty in any manner or fashion whatsoever. Under no circumstances shall “Sonics” be liable to the purchaser or to any other person for any incidental or consequential damages or loss of profit or product resulting from any malfunction or failure of this “Sonics” product.

This warranty does not apply to equipment which has been subject to unauthorized repair, misuse, abuse, negligence or accident. Equipment which, in our judgment, shows evidence of having been used in violation of operating instructions, or which has had the serial number altered or removed, will be ineligible for service under this warranty.

No liability is assumed for expenses or damages resulting from interruptions in operation of the product or damages to material in process.

“Sonics” equipment is designed for maximum operator safety and incorporates built-in safety devices. Any modifications to these safety features will void the warranty. “Sonics” assumes no responsibilities for consequential damages incurred due to modifications to the said equipment.

“Sonics” reserves the right not to warrant horns of unusual or experimental design which in our judgment are more likely to fail in use.

This warranty does not cover equipment used for applications requiring metal-to-metal contact with weld time in excess of 1 second.

Data supplied in the instruction manual has been verified and validated and is believed adequate for the intended use of the equipment. If the equipment or procedures are used for purposes other than those specified herein, confirmation of their validity and suitability should be obtained in writing from “Sonics.”



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