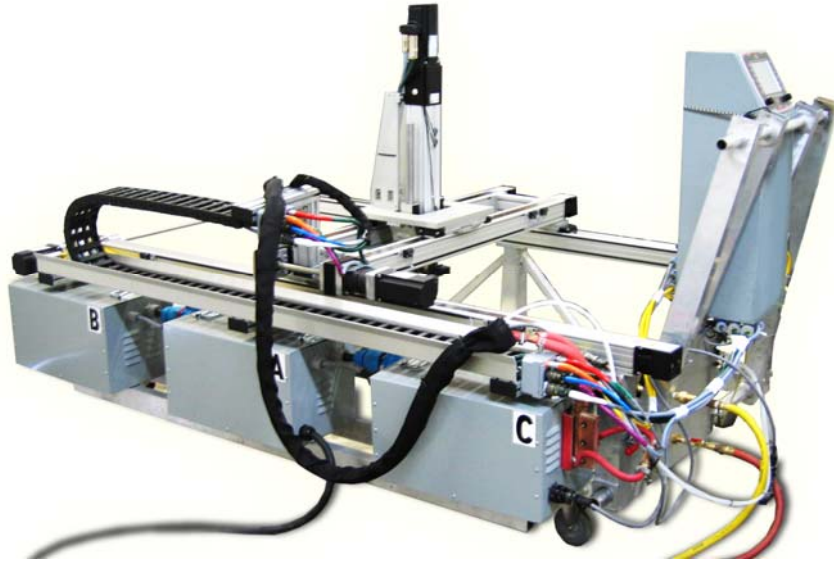


PAS

Portable Automated Straightener



Welcome to the Portable Automated Straightener (PAS)

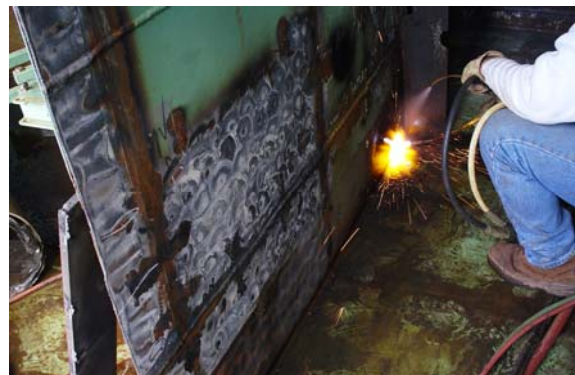


- **Machine Overview** – (for: Operators, Supervisors, Maintenance)

The PAS system was developed by NA Tech for Northrop Grumman Ship Building Systems to straighten deck-plate faster and more efficient than the current acetylene torch method. The PAS machine effectively scans the deck-plate, then determines how far out of spec it is. Through induction heating and pressurized water, PAS then heats and cools the plate, straightening the deck plate until it meets naval specifications.

- **A more efficient Tool**

With this new tool, shipbuilders will be able to straighten deckplate faster and with greater comfort. No longer will straighteners have sit on their hands and knees or on a bucket with a torch that releases a great amount of heat into the surrounding area. PAS allows the worker to comfortably straighten faster with a process that releases less heat into his/her environment.





- Straightening Using Induction Heating

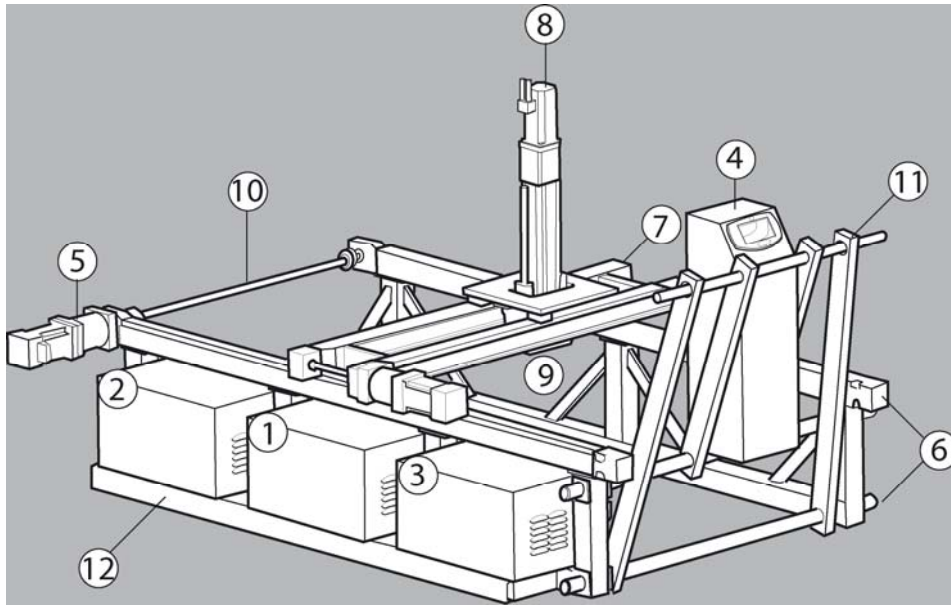
When an alternating electrical current is applied to a coil, an alternating magnetic field is created. Faraday's Law of electromagnetic induction states that if a piece of metal is located within the magnetic field created by the coil, an electric current will be induced in the metal.

In the thermal forming induction heating setup, a high frequency power supply supplies an AC current through a copper coil, and the part to be heated is placed near the coil. The coil serves as a transformer primary and the part to be heated becomes a short circuit secondary. When the metal part enters the magnetic field, circulating eddy currents are induced within the part. These currents flow against the electrical resistance of the metal, generating precise and localized heat without any direct contact between the part and the coil.

The PAS system uses this technology to rapidly and precisely heat localized areas of the deck plate. Additionally, the induction heating head provides an atomized water cooling spray to rapidly cool the heated surface. This rapid heating and cooling serves to physically contract the deck plate and reducing the out of fairness.

- System Components, Basic Operation

The PAS System breaks down into 13 easy to assemble pieces.

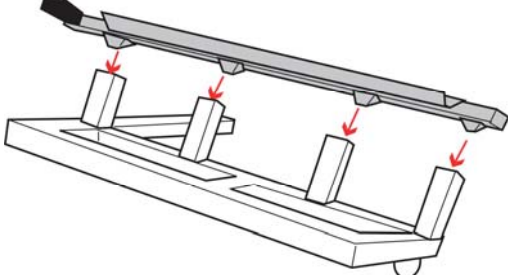
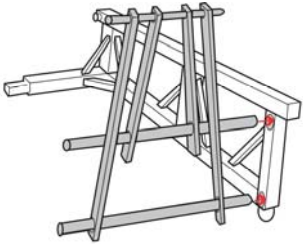
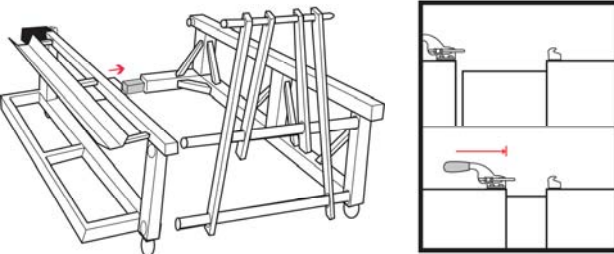
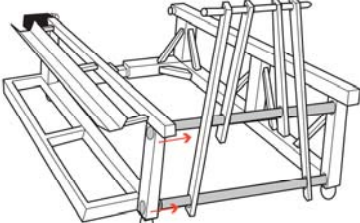
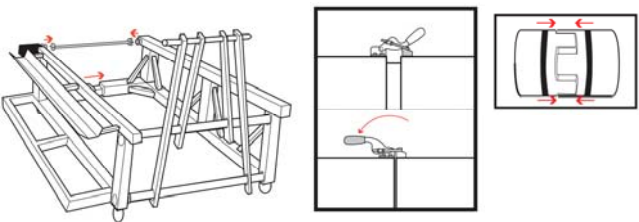


- | | |
|------------------------------------------|--------------------------------|
| 1 – Power Supply A | 8 – Z Axis |
| 2 – Power Supply B | 9 – Induction Station |
| 3 – Power Supply C | 10 – Drive Shaft |
| 4 – Controller | 11 – Handle/ Manifold |
| 5 – Y Actuator/ Tray | 12 – Cart: Side 1 |
| 6 – Y Prime Actuator/ Cart Side 2 | 13 – Cables/ Connectors |
| 7 – X Axis | |

9 of the 12 pieces weigh less than 50 pounds for easy single person lifting. 3 pieces weigh less than 80 pounds and are intended to be carried by two people at once. The system breaks down into easy to assemble and carry pieces so it can be taken into all areas of the ship.

PAS comes with a container to give it safe storage and allow it to be easily picked up by the crane or forklift and moved onto the deck of the ship. This way the machine does not always need to be disassembled to be transported.

- Handling and Assembly

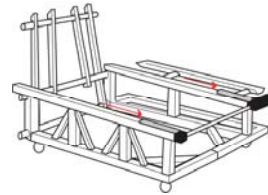
<p>Step 1) Insert "cable tray/Y-actuator" into side of cart marked 1. Make sure the bottom of the Y-actuator is flush with the top of the 3 posts on the cart.</p>	
<p>Step 2) Insert the 2 ends of the "handle" partially into the holes of side 2.</p>	
<p>Step 3) While one person keeps the handle and side 2 steady, the other should align side 1 and insert the handle into side 1 halfway. On the back end of the cart, slide side 2 over side 1 only halfway, if inserted completely the handle and cart "jam" and won't slide all the way in.</p>	
<p>Step 4) Slide the handle into the cart holes and push the two together.</p>	
<p>Step 5) While one person holds the drive shaft in-place (make sure the teeth of the drive shaft and the motors line up) then the other person should push both sides of the cart together. Finish by latching the two halves together at the front and back. Make sure the drive shaft teeth line up with that of the motor.</p>	

latch each one to the cart.

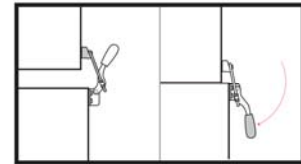
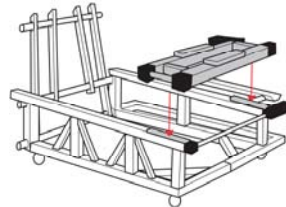
PAS

Portable Automated Straightener

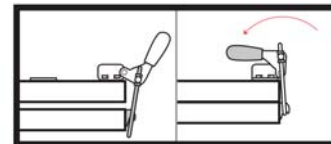
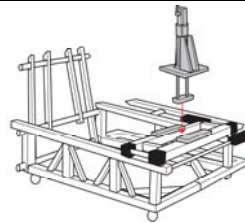
Step 6) Important: Slide the plates attached to the Y axis away from the handle until they reach end of the slides. This prevents the X axis from being installed crooked.



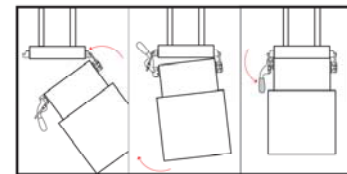
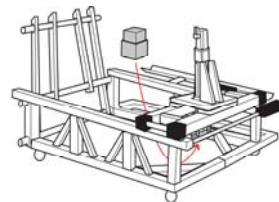
Step 7) Using two people to lift the X-axis, with the metal plates on the end side facing down, lower it down over the pegs on the Y-actuator and Y-prime. Important: Make sure the motor on the X-axis is on side 1. Then latch down both sides of the X-axis.



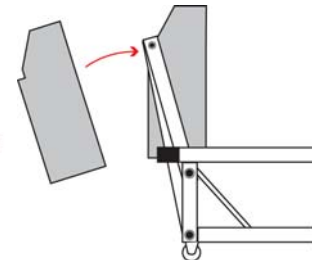
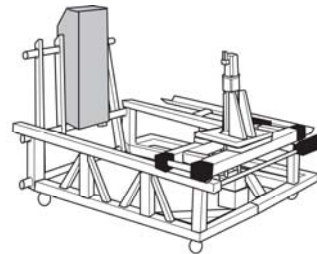
Step 8) Make sure the arrow on the Z-axis is facing the same way as the arrow on the X-axis and insert the Z-axis through the plate on the X-axis. Latch the Z axis to the X axis as shown, making sure the plates line up correctly.



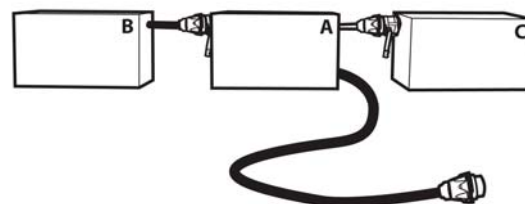
Step 9) Installing the Induction Station. Move the U-bolt on the induction station over the hooks located on the bottom arm of the Z-axis. Then latch the other side of the Induction station to the Z-axis.

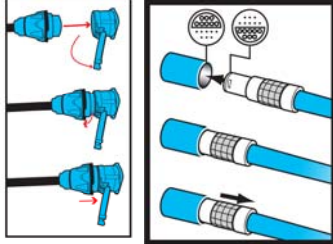
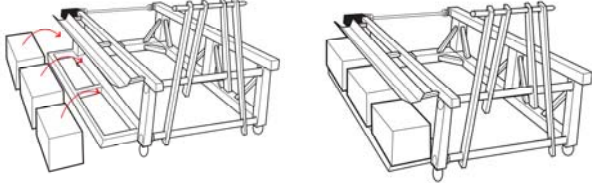


Step 10) Move the Controller Unit in place on the Handle
This is done by sliding the controller unit through the two center posts of the handle. Make sure the bottom of the controller sits on the support base and then latch the controller to the handle on both sides.



Step 11) Assemble the power supply in the order shown.



<p>Plug each box into each other as shown.</p> <p>All connectors align and connect by lining up the red dots. The large blue connectors must be lined up, and then twist to push.</p>	
<p>Then using 1-2 people lift the assembled power supply onto the lower shelf of side 1.</p> <p>Then on the back of the power supply boxes</p>	

- Facilities –

Before proceeding on to connecting the machine, be sure the following are available. (for: Operators, Supervisors, Maintenance)

- Air, Water, Electrical Power

For proper operation, PAS requires facility connections of:

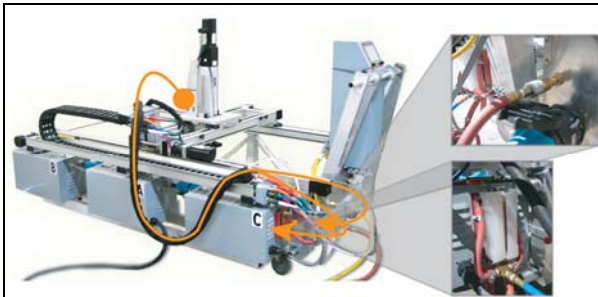
Air: greater than 70 psi via crow's foot connection

Water: water via crow's foot connection

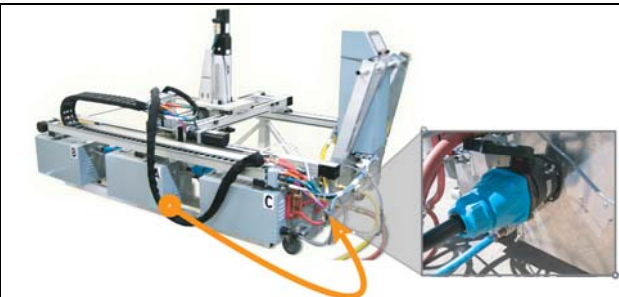
3 Prong Power: 120 volt AC

Power: 480 volt via four pole reefer

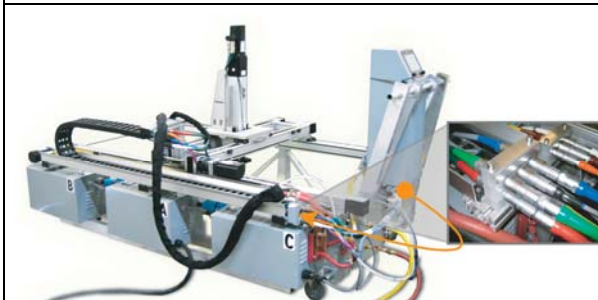
Connections: Be sure the following are connected to each other before proceeding



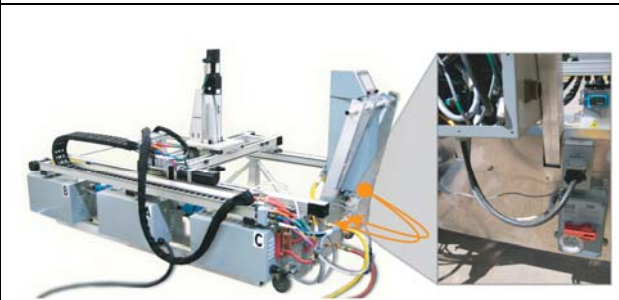
Z-axis to power supply C and Manifold



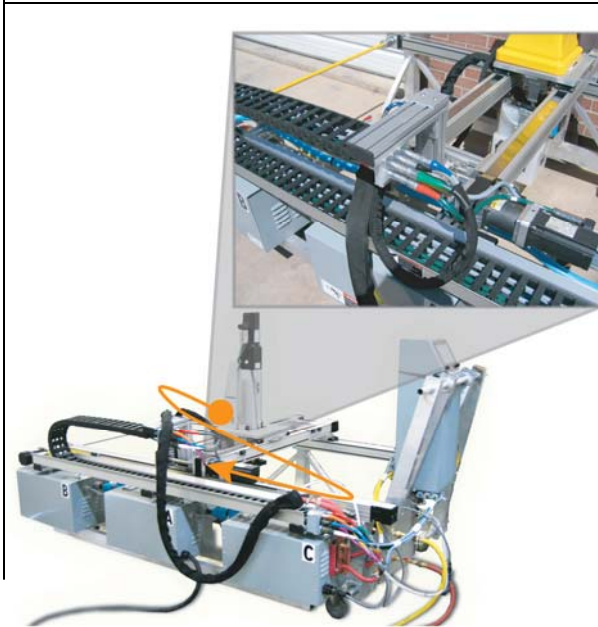
Power supply A to manifold



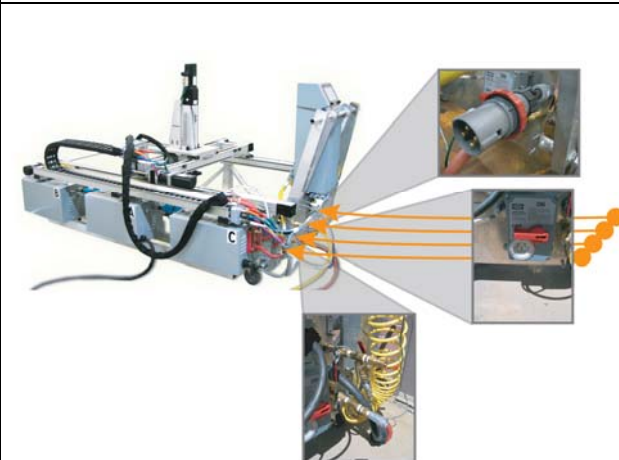
Controller to end of Cable Tray



Controller to Manifold



Z-axis to Cable Tray



Facility connections: 480 V power
 Water
 Air 90 psi
 120 V power

Connected to Manifold

- **Safety Overview** – (for: Operators, Supervisors, Maintenance)

- Lockout/ Tag-out Procedures

If the machine needs to be serviced or the operator needs to leave the machine unattended, be sure to Lockout/ Tag-out the machine. The system lockout is located on the manifold next to the air, water, and power connections. Turn the red switch toward the off position, and then place a lock through the side of this switch. This ensures the machine cannot be turned on.

- Pinch Points

Keep all body parts and loose clothing away from moving parts. Common pinch points are located on the track slides and the cable tray. Do not sit or stand on any part of the machine, and do not enter the thermal forming area unless the machine has been Locked out.

- Laser Sensors

Laser sensors are located within the induction station. These lasers can be dangerous to your vision, so be sure to be aware of them while servicing the induction station.

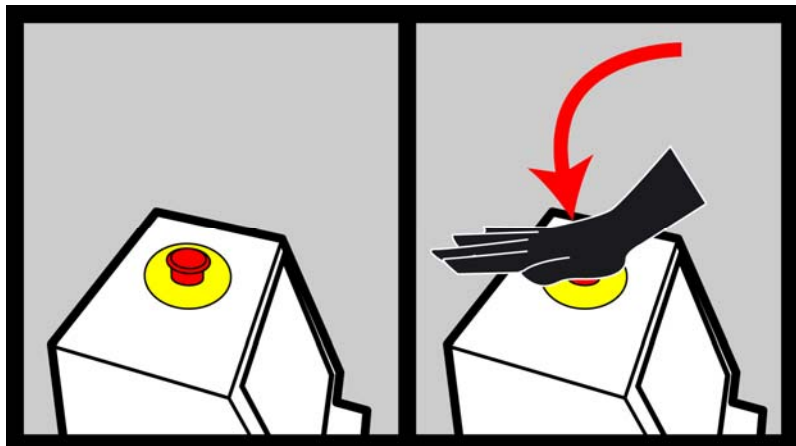
- Induction System

Induction heating uses electromagnetic energy to raise the temperature of metal in fractions of a second. Keep all metal jewelry and equipment away from the induction head. Even though water is used to cool the metal, the steel may still be dangerously hot, so use caution when examining formed deckplate.

- Emergency Stop

Emergency Stop Buttons (E-Stops) are for emergency situations only. By pressing them it will shut down all movement and heating. Before using or plugging in PAS, be sure to know the location and how to use all Emergency Stop Buttons (E-Stop Buttons).

The emergency stop buttons are located on both ends of the machine and will disable all operations when depressed. The buttons, once depressed, must be manually reset. The following diagrams show the location and how to use the E-Stop Buttons. Be sure to press hard and firm.



- **Maintenance Procedures** – (for: Maintenance)

PM-ET01/USA

Cleaning (Weekly) page 14 of PM-ET01/USA MANUAL

Adjusting Timing Belt Tension (As needed) page 15 of PM-ET01/USA MANUAL

Lubricants, Motor Coupler and Pulley Spacing (Every six months) page 16 of PM-ET01/USA MANUAL

HLP A

clean Linear actuator (Weekly) chapter 5.11.1.2 of the HLP A MANUAL

check Timing Belt (Every six months) chapter 5.2 of the HLP A MANUAL

check the Carriage play (Every six months) chapter 5.4.2 of the HLP A MANUAL

check for wear on Plastic Rollers (Every six months) chapter 5.4.4 of the HLP A MANUAL

lubricate guide on Steel Rollers (Every six months) chapter 5.5 of the HLP A MANUAL

Electro-Thrust Cylinder

lubricate the ball screw assembly (Monthly) page 12 of the Electro-Thrust Cylinder User Guide

Arrow Filter

Cleaning (Weekly) Arrow Filter Sheet

Power Supply Ajax

Clean and tighten output connections. Repair or replace cracked cables and cords (Every three months) page 35 of Ajax manual

Replace damaged or unreadable labels. Blow out or vacuum inside. (Every six months) page 35 of Ajax manual

- Heating Head
- Power Supply
- Controller
- Mechanical / Electrical

Operations and Maintenance (On-Site Instruction)

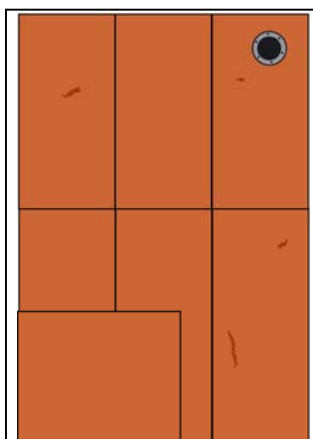
- Getting Ready – (for: Operators, Supervisors)

- Graphical Interface

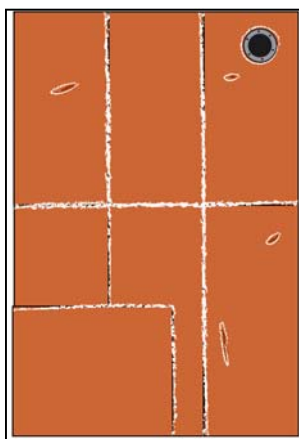
Identifying Stiffeners

Before starting to scan or straighten plate, be sure to find the section to straighten. Then with a piece of soap stone, mark where the stiffeners are. Finally mark lines around obstacle and protrusions in the plate. Failure to identify the location of obstacles can result in system failure and broken parts along with personal injury.

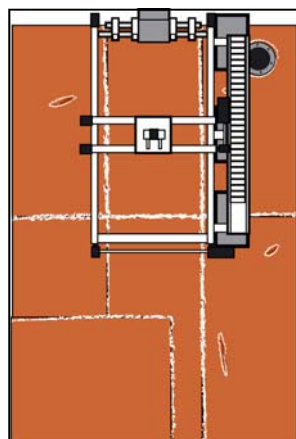
After finishing marking stiffeners and obstacles, position the PAS machine over plate so it runs parallel to the stiffeners. Make sure it is on crooked or perpendicular to the stiffeners.



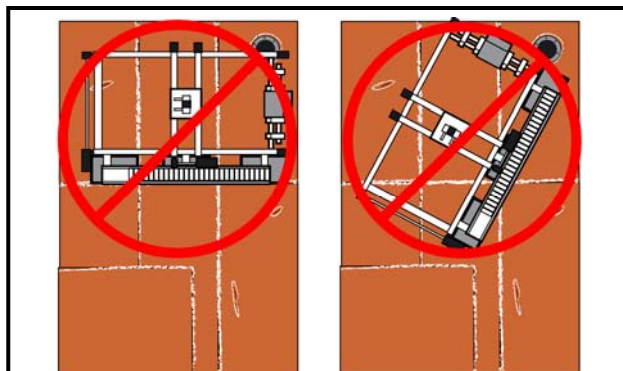
Pick desired area to be straightened



Identify stiffeners using chalk/ soapstone lines



Move the PAS machine over the desired area so both stiffeners are within the thermal forming area and the machine is aligned and parallel to them.



Examples of improper machine placement

How to use the Graphical User Interface (GUI):



The Graphical Interface has a touch screen in which items and buttons can be selected by tapping that section of the screen.



Scrolling and number adjustment is done by twisting the side buttons.

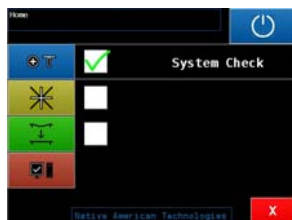


Press the button in to enter amounts and buttons.

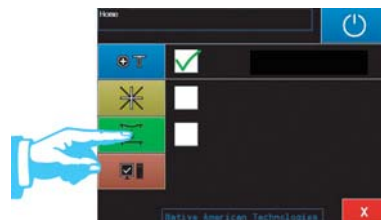
PAS operation is controlled from a simple and easy to use touch screen. Buttons can be selected by pressing on the screen, as well as using the scroll buttons to change and select information.

To protect the touch screen it is very important to keep the protective cover over the screen whenever it's not in use. This will prevent sun damage, dust, and potential scratches and breaks.

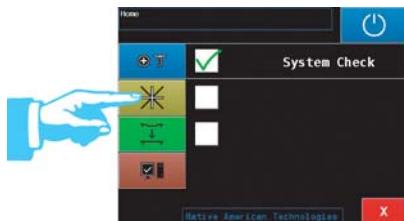
Main Menu



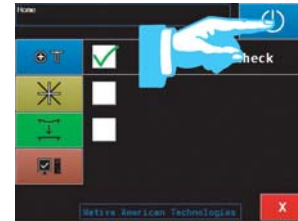
System Check



Straightening

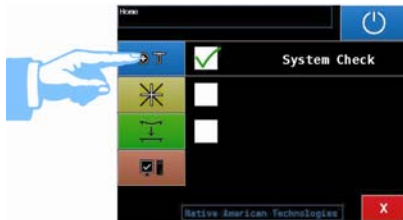


Reference Machine

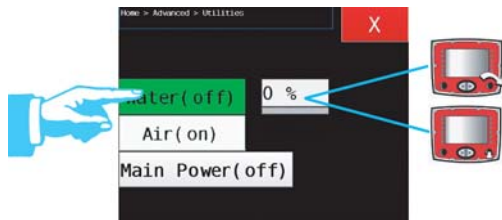


Shut Down

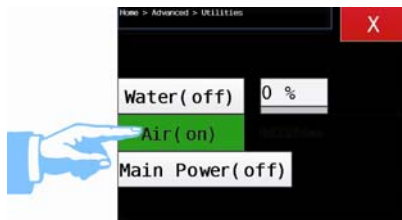
System Check



Begin by pressing the blue "system check" button

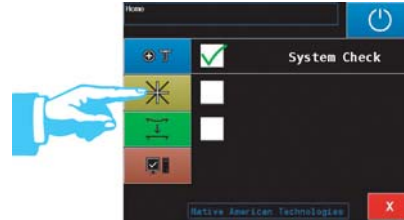


Check the water by pressing the water button and turning the right knob to adjust the flow



Check the air flow by pressing the "air" button. Be sure to turn both the water and air off by pressing the buttons again. If the button turns green it means that it's on

Reference the Machine



Begin by pressing the blue "reference machine" button

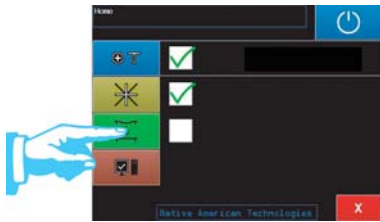


Press the "OK" button to reference the machine

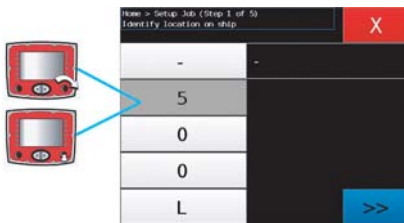


Press the "OK" button to return to the main menu

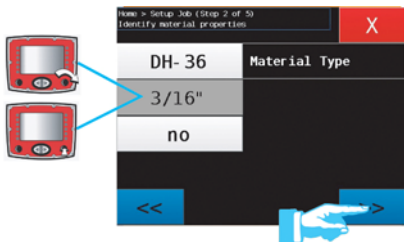
Job Set-up



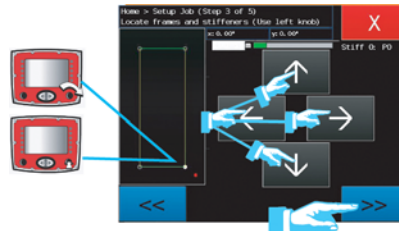
Press the green "Setup Job" button



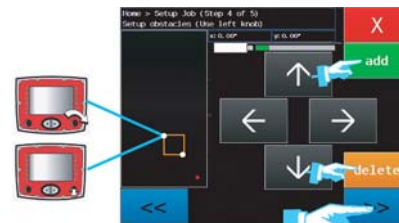
Adjust each selection to match the position on the ship.



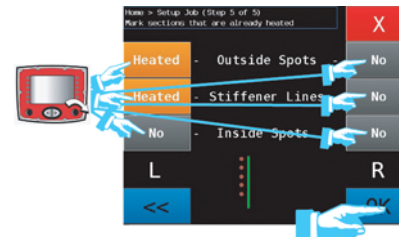
Adjust each selection to match the material type that's being straightened



Define the frame and stiffener points by scrolling to highlight and pressing in to travel to that point. Then adjust the position with the direction arrows

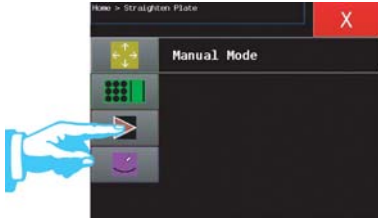


Define obstacles on the plate by pressing the "add" button and adjusting the points to create a barrier around the obstacle



Examine the plate and select which frames and stiffeners have already been heated

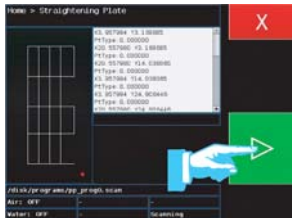
Straightening



Press the "Automatic" button



After reading the warning press "OK"

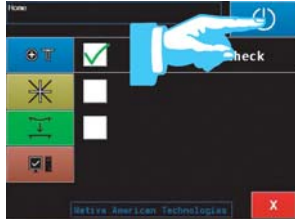


Press the green button to begin the scan program

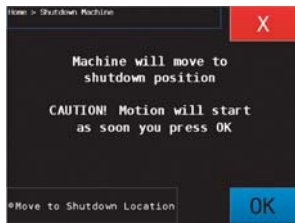


Press the "OK" button

Shut Down/ Restart



From the main menu press the blue shut down button



Press the blue "OK" button



At this point shut off the machine or restart it

PAS
Portable Automated Straightener

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