

Operating Manual

S-Series Air Curtain Burner

Equipped With
Electric Motor and VFD Speed Control
S116E S119E S220E S223E, S327E S330E

Above Ground Self-Contained Refractory Walled FireBox



“Better Economically - Better Environmentally”

MADE IN THE USA

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Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD
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CAUTION:

All electrical connections and installations must be made by a licensed local electrician according to respective codes and regulations by the local competent authorities.

The installation must include a properly sized grounding rod to earth connected to the provided grounding stud on the FireBox. Before each use of the machine ensure that the grounding connection is properly in place and has not been compromised.

WARNING:

The electrical FireBox Control Panel must only be opened for service or any other reason by a locally licensed electrician. It contains no user serviceable parts or functions. Coming in contact with an electrical voltage may cause an accident resulting in injury or death.

PERSONAL PROTECTIVE EQUIPMENT (PPE) & WOOD ASH CAUTION:

Always wear appropriate Personal Protective Equipment (PPE) while working with the FireBox, especially a breathing apparatus like a respirator while removing wood ash from the firebox (burn chamber) and while handling the wood ash. See also Page 7.

IMPORTANT WARNING ABOUT BURNING OF PALLETS

Wooden Pallets, especially spent pallets, burn extremely hot. DO NOT load the FireBox above approximately 3/4 of the height of the firebox (burn chamber). Heat damage to the manifold and other structure may occur which would not be covered under your Limited Factory Warranty.

WARNING:

Please, read and understand all Caution and Warning Notices and Operating Instructions before working with the FireBox and always follow them diligently. Disregarding these important Notices may lead to an accident that may result in property damage, serious personal injury, or death.

Contact Air Burners, Inc. Customer Service should you require any assistance. Send Email to support@airburners.com, call 772-220-7303 or 888-566-3900.



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CUSTOMER SUPPORT:

Contact Customer Support at Air Burners, Inc., should you require assistance with any maintenance task or should you have any questions regarding the setup or operation of your FireBox.

Email: support@airburners.com Phone: 772-220-7303 or 888-566-3900



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S220E Electric Series FireBox



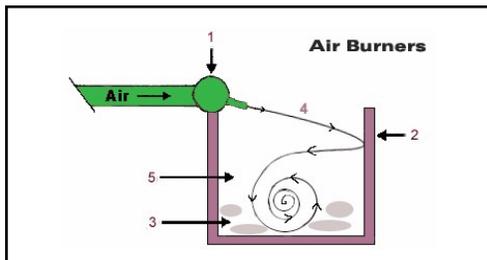
S327 FireBox

PRINCIPLE OF AIR CURTAIN INCINERATION

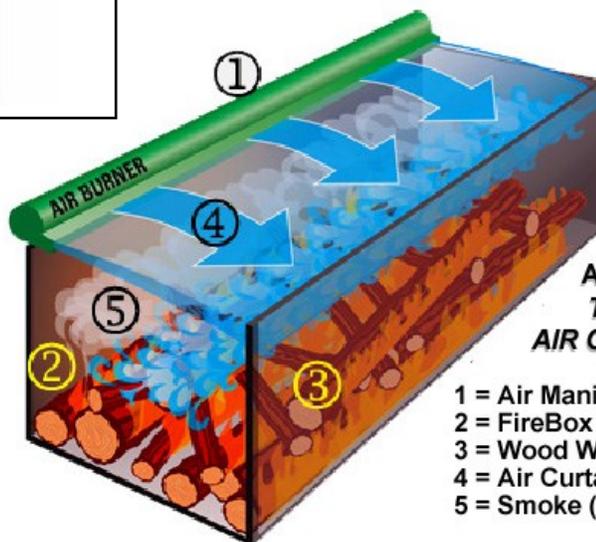
OPERATION

Air curtain incinerators (also called air curtain burner or FireBox) are designed primarily as a pollution control device. Using a Diesel engine driven fan, these machines generate a curtain of air with a very particular mass flow and velocity. This curtain of air acts as a trap over the top of an earthen trench or thermal-ceramic lined firebox (burn chamber). The wood debris is dumped into the trench or firebox and then ignited (usually with a propane torch or with a small amount of diesel fuel where permitted) just as you would light any other pile of wood you intended to burn. Once the fire has gained strength the air curtain is turned on.

The air curtain traps most of the smoke particles and causes them to re-burn directly under the air curtain where the temperatures can exceed 1800° F (≈1000° C). These machines do not inject any fuels into the fire, the fire is sustained only by adding more wood feedstock. The air from the air curtain is not heated. In the continuous operation of the FireBox, the only fuel used is to power the Diesel engine for standard portable machines or the electric power for the semiportable electric FireBoxes.



[Click Here](#) or Scan
for Video
“Open Pile Burning
vs FireBox Burning”



AIR BURNERS, INC. THE PRINCIPLE OF AIR CURTAIN BURNING

- 1 = Air Manifold
- 2 = FireBox Refractory Wall
- 3 = Wood Waste or Wood Fuel
- 4 = Air Curtain (left to right)
- 5 = Smoke (PM or Black Carbon)



**Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD
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GENERAL DESCRIPTION S-SERIES

The self-contained refractory walled air curtain system is manufactured as an over-the-road transportable combustion system designed to reduce clean wood waste and vegetative growth to ash in a safe, controlled burning process without excessive particulate emissions. The firebox or burn chamber is open to the ground, except for the Roll-off versions; they have a floor to accommodate the roll-off rail system. The standard S-Series machines are offered in several sizes. The smallest is the S116 (16 ft. firebox) and the largest is the S330 (30 ft. firebox).

The T26 CharBoss is a trailer-mounted street-legal Biochar processor designed do optimize production of high-grade Biochar. The self-propelled T28 TrackBoss is similar to the T24 BurnBoss, however, with the trailer frame replaced by a remotely controlled track system.

Above-Ground Air Curtain Burner Dimensions (Electric Motor)						
Model	Overall Size L x W x H	Firebox L x W x H	Weight lbs.	3-Phase Power In V	Motor kW	Average Thru-put* tons/hr.
S330E	40' 4" x 11' 10" x 9' 6"	30' 2" x 8' 5" x 8' 1"	59,000	480	56	11-13
S327E	37' 4" x 11' 10" x 9' 6"	27' 2" x 8' 5" x 8' 1"	54,600	480	56	9-11
S223E	33' 3" x 8' 6" x 8' 6"	22' 11" x 6' 2" x 7' 1"	40,250	480	22.4	7-9
S220E	30' 1" x 8' 6" x 8' 6"	19' 8" x 6' 2" x 7' 1"	36,650	480	22.4	5-7
S119E	27' 3" x 7' 2" x 7' 4"	19 x 5' x 6'	30,100	480	22.4	3-5
S116E	24 7" x 7' 2" x 7' 4"	16' x 5' x 6'	27,500	480	22.4	2-4

* Approximate values. Achievable through-put depends on nature of waste stream and other factors.

On-Board Power Diesel Engine Version: S330 & S327: HATZ 4H50TIC (Tier 4 Final) or equivalent engine.
S223, S220, S119 & S116: HATZ 4H50TIC or optionally HATZ 3H50TIC (Tier 4 Final) or equivalent engine.

Diesel Engine Drive System: Fluid Coupling (Automatic Clutch) & mechanical direct coupling drive. Manual PTO as option.

On-Board Power Electric Motor Version: Motor: 3-Phase, heavy-duty, with enclosed pre-programmed variable frequency speed controller (VFD); Power in: Three Phase 480V, 50Hz or 60Hz, or selected other voltages, i.e. 415V or 400V;
Drive System: Direct drive.

Options: Ash clean-out rake - price will be quoted for plain faceplate (S300) or universal quick disconnect(S200 & S100).

Through-Put: Through-put depends on many factors, such as nature and type of wood waste, its moisture content, prescribed opacity limits, operator skills, elevation of location, etc. The figures stated here are guidelines only. If more specific information is required, please contact the Factory.

NOTES: All weights and dimension are approximate. Dimensional drawings can be provided on request.
Subject to change without notice.

GENERAL DESCRIPTION S-SERIES (E-VERSION)

When delivered to a job site, the S-Series machine is ready for use as soon as it is off-loaded and properly connected to an appropriate electrical power source. The entire system is built on a skid type base frame which is designed for easy movement over the ground. The forward equipment deck supports an Electric Motor and a Variable Frequency Speed Controller (VFD). The motor is directly coupled with the fan. When viewed from the front of the unit, the patented air disbursement manifold is mounted on the left top side of the combustion chamber. The firebox is lined with proprietary thermal-ceramic refractory panels. The panels are cured prior to installation at the factory to drive out any moisture to ensure they are stable at first use in the field. The back of the firebox is fitted with refractory lined doors that allow ash removal and access to the firebox (only when it is empty).

The electric motor that turns the fan is controlled by the VFD unit housed securely behind the front deck enclosure in a NEMA IV housing. The high velocity air is sent down the manifold through the vanes and directed to the outlet nozzles. A balanced and distributed air flow is directed across the top of the firebox and then reflected down into the combustion zone.

The curtain of air acts as a top over the firebox (burn chamber), trapping a large percentage of the escaping particulate matter (smoke) and causing it to burn down even further under the curtain before finally escaping through the curtain as a hot gas. The air from the nozzles travels across the FireBox creating the air curtain effect; then it reflects off the far side thermo-ceramic wall adding oxygen to the combustion zone helping to generate a hotter more complete fire. This additional agitation helps prevent the fire from starving for oxygen as the ash builds up during burning operations.

NOTICE:

All of this is carefully engineered to provide the correct amount of air at the correct velocity. It is sometimes thought that more air flow will actually increase the burn rate. This is INCORRECT. Modifying the air flow will actually have the opposite effect and reduce the machine's throughput. Additionally, it will reduce the machine's ability to meet minimum air quality standards. There is a maximum rate at which wood can burn. Trying to exceed that rate by adding more air to an air curtain burner causes two major problems:

1. It will cool the fire reducing combustion efficiency which will create more smoke (enriched with more carbon dioxide and oxides of nitrogen). This will begin a circular effect of further reducing the oxygen and further reducing combustion efficiency. The result is your throughput drops and smoke increases.
2. Increasing the air flow beyond design standards will over pressurize the firebox causing larger sized particles to be ejected from the firebox. Besides violating the EPA limits for PM (particulate matter) the larger hotter embers ejected will pose a much greater fire hazard.



S327 FireBox in Operation



S327 FireBox Rear Doors (Open)

IMPORTANT:

Notice how dirt is placed all around the inside bottom rails to close any openings under the skids that may be the result of uneven earthen terrain? This will prevent smoke from escaping. The FireBox must be placed on well-leveled soil (dirt), never on surfaces like concrete slabs, gravel, crushed stones or asphalt.



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SAFETY CONSIDERATIONS

READ ALL SECTIONS OF THIS MANUAL BEFORE YOU BEGIN BURNING OPERATIONS

The S-Series machine operator is dealing with fire on a daily basis; it is very important that each and every individual involved with the machine be alert and practice very rigid safety precautions.

When you are running the FireBox, you are responsible for assuring that it is operated in the safest possible manner at all times. If you notice something wrong, correct it immediately. If you cannot correct it, find someone who can and/or shut down the machine.

Basic Safety Points:

- The unit must be placed on cleared, level ground.**
The unit should be placed on level ground directly on the soil surface to facilitate loading, dumping and moving of the unit. The rear doors weigh approximately 2,000 lb. each and should not be opened if the unit is inclined on any axis more than 5 degrees.
- The unit should be placed such that no combustible material is within a minimum 100 ft. clearance in any direction and never on a concrete pad or gravel stones.**
The S-Series units do not have a bottom and must not be located over combustibles such as dry grass or peat moss which may cause a fire to spread to other areas. It is equally important not to place the FireBox on anything other than earthen soil, never on a concrete pad, on gravel or crushed stones. There is a good reason for this warning. Concrete or gravel can contain water which the heat in an operating firebox could vaporize quicker than it can be drawn out. This could result in increased vapor pressure that can cause the concrete or stones to explode. Fragments could possibly fly out of the firebox and cause injury or death to persons nearby.

In addition *hot embers* will escape from the firebox and, depending on the wind, will land on the ground around the unit. The unit should not be located within 100 ft. of any stored combustible materials. The waste material to be burned during the day's operation can be staged within the 100 ft. perimeter to facilitate loading. The operator must monitor the loading pile to ensure embers do not ignite the loading pile. The combustible materials to be stored for burning at a later date must be stored outside the 100 ft. perimeter or in accordance with the chart on page 6 of this manual which suggests adjustments for wind speed.
- The unit should not be operated when the wind speeds reach 20 MPH as the potential to carry hot embers is significantly increased.**
As an operator you should always be aware of wind speed and direction. Increased wind speed will affect the integrity of the “air curtain” and will cause hot embers to travel farther. See the wind speed chart regarding suggested set back on page 6.

WARNING:

Watch for, read, and understand the CAUTION and DANGER NOTICES you will find throughout this operating manual. Failure to heed these warning notices could result in an accident causing property damage and serious personal injury or death.



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- 4. **NEVER use highly combustible materials to light the unit.**
Highly combustible materials such as gasoline, refined spirits, etc. ignite at an explosive rate which may cause serious injury or death. The safest method to start the fire in the firebox is to use materials such as paper and kindling wood. In the absence of these materials or when starting materials with a high moisture content use diesel fuel oil as an acceptable option.
- 5. **NEVER climb on the unit to view or light the fire.**
Use the ladder built into the unit and never go beyond the top step, or use a step ladder or similar platform located at a safe distance from the unit. Do not stand along the rails or on top of the S-Series unit under any circumstance.
- 6. **Shut the unit down in an emergency.**
Stop loading the unit, stop the air flow by shutting down the motor and turn off the electric power at the main breaker. Dump dirt or sand on to the fire. Water should only be used as a last resort, as it will likely damage the refractory panels.

DANGER:

Do not sit or stand on the roof of the equipment deck or the rails of the FireBox. Falling off the machine or into the firebox will cause an accident resulting in serious injury or death.

WIND SPEED VS. SAFE DISTANCE			
Wind Speed mph	Approximate Safe Distance for:		
	Structures (Houses, etc.) ft.	Woods/Trees ft.	Stored Brush Piles ft.
10	300	150	100
12	300	150	100
14	300	200	150
16	400	250	150
18	400	250	200
20	500	250	200

DANGER:

The above distances serve as a GUIDELINE ONLY! You MUST ALWAYS observe the down range area regardless of the wind speed.

You must always observe local fire ordinances and directives from the local fire department or other competent authorities.

7. Personal Safety (Personal Protective Equipment – PPE)

Operators must be aware of the following potential hazards:

- a. **Flying hot embers** being released from the fire. Operators or anyone within a 100 ft. radius of the fire should wear appropriate Personal Protective Equipment (PPE) including fire resistant clothing. The ideal outerwear for an operator would include a Nomex jacket, leather gloves, eye protection, hard hat, cotton work jeans and steel toe boots. Operators should never wear synthetic material (i.e., polyester) around a fire as this type of material can melt and cause injury. Additionally, some synthetic materials will support combustion and could be very dangerous around fire. One hundred percent cotton materials would be the minimum, cotton treated with a fire retardant would be better and fire proof materials like Nomex would be best.
- b. **Noise: Ear protection is recommended around the FireBox.** It is a good practice to wear approved ear protection when working in close proximity to the fan and engine.
- c. **Hot Panels:** The backs of the thermo-ceramic panels and parts of the steel structure can reach temperatures as high as 500°F (260°C). Caution should be taken to ensure operator and visitors do not come in contact with these hot areas.
- d. **Wood Ash and Dust will be released** during the FireBox operation, especially during firebox ash cleanout. Operators must wear appropriate Personal Protective Equipment (PPE) like suitable body suits, eye protection, gloves, boots, etc. and in particular face masks like respirators to keep ash that may be suspended in the air from entering their lungs. It must be understood that all persons near an operating FireBox must protect themselves from dust and wood ash as it may be harmful if wood ash and dust enters their airways which may result in injury or death.



Even with proper Personal Protective Equipment (PPE) a person must not step into a firebox without first removing all wood ash residues, embers and unburned feedstock; otherwise an accident may occur which may result in injury or death. There may be hot embers and hot coals hidden within the ash bed and wood ash may be suspended in the air from stirring up the ash bed. This may make it difficult to breathe.

PERSONAL PROTECTIVE EQUIPMENT (PPE) & WOOD ASH CAUTION:

Always wear appropriate Personal Protective Equipment (PPE) while working with the FireBox, especially a breathing apparatus like a respirator while removing wood ash from the firebox and while handling the wood ash.

DANGER: Operators must ensure debris does not build up on the front equipment deck. It must be kept clean at all times during operation to prevent a fire that would damage or destroy the motor and accessories which could result in injury or death to persons nearby.



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HOW TO SET UP THE FIREBOX

A. POSITIONING THE UNIT

The S-Series units are totally self-contained and ready to use upon delivery to the job site. The S-Series units are built on a skid base that is designed to facilitate dragging the unit into position. The weights of the various units are given in the table on Page 2. Ensure that lifting or tow cables are certified for these weights.

With respect to the prevailing wind direction, the unit should be positioned such that the wind comes over the back of the manifold. This is the preferred position. It is also acceptable to have the wind blow into the manifold. It is discouraged, however, to have the wind come from either end of the machine, as this will tend to disrupt the air curtain.

DANGER:

If you drag the FireBox to its permanent location at the work site, be careful, especially in soft soil, that the dirt does not build up under the panels and lift the panels off the rails. That is why a person must never walk inside the FireBox when it is being towed. A dislodged panel could fall on a person inside the firebox which will result in serious injury or death.

Typically, the softer soils will require a longer cable. If the rear of the unit sinks into soft soil while it is being towed, use another vehicle to follow and carry some of the load. If you are still having trouble dragging the unit, try a different length of tow cable. Always stay clear of the tow cable while the dragging operation is underway and wear Personal Protective Gear (PPE).

B. PRE-OPERATION CHECKS:

1. Check ground wire connection from grounding stud on FireBox front deck to earth grounding rod and arrange for repairs if needed, before turning on power at main breaker switch.
2. Check intake air filter of cooling fan on control housing (lower left side) for cleanliness (open small access door, setup may vary); do not open the front door of the control panel (See Warning on page i).
3. Make sure Fan Speed Switch is set to OFF Position before turning main breaker switch to ON.

WARNING:

PINCH POINT HAZARDS

Be mindful of Pinch Point Hazards. Keep your hands clear from all moving parts and hot parts of the FireBox while it is being set up or in operation.

HOW TO SET UP THE E-FIREBOX

C. STARTING/SHUT-DOWN

Electric Motor and VFD

Starting:

1. Ensure that an appropriate ground wire is properly connected to the grounding stud (See Page 23) and the earth grounding rod.
2. Ensure that the power on external breaker or switch (i.e., on power pole) is turned on.
3. Ensure that the FAN SPEED SWITCH is placed in Position OFF.
4. Ensure the red POWER BUTTON is OFF (pushed in).
5. Set the MAIN POWER SWITCH to the ON position; this will connect power to the unit. Wait 15 seconds for the VFD to boot up before going to the next step.
6. Pull out the red POWER BUTTON (ON Position).
7. Load firebox and start fire per Page 13.
8. Set AIR CURTAIN FAN SPEED CONTROLLER to Position NORMAL 2. Once the machine is fully operational, you may select Position NORMAL 1 for energy conservation, as long as this does not result in excessive particulate (smoke) release.

Shut-down:

1. Turn AIR CURTAIN FAN SPEED CONTROLLER to OFF. Wait 15 seconds for the VFD to boot down before going to the next step.
2. Push in the red POWER BUTTON to turn off power to Motor.
3. Set MAIN POWER SWITCH to OFF.
4. Turn off power at external breaker or switch (i.e., on power pole).



Control Panel
 Placement of Decals May Vary



Control Switches (Main Power Button in Center),
 Indicator Lights & Hour Meter



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SITE PREPARATION

THE GOALS TO GOOD SITE PREPARATION ARE:

- To place the wood piles for easy access.
- To sort the waste wood pile.
- To organize the inflow of new wood waste.

When locating the E-FireBox:

1. Consider access for your truck and trailer to load and unload the FireBox. Ensure there is enough room to maneuver your truck and trailer.
2. Consider where the waste piles will be located. We generally recommend two waste piles (explained in next section).
3. Consider the predominate wind direction. Hot embers will be escaping from the FireBox during all burning operations.
4. Consider the available 480V three-phase power pole connection and underground feed to the FireBox from there. Power must be supplied pursuant to Local Code and the FireBox must also be properly grounded by a grounding rod to earth pursuant to local code. The power connection must be performed by a licensed local electrician.
5. Once the FireBox is in position, it is important to place dirt around the inside bottom of the firebox (burn chamber) to close any openings under the skids that may be caused by uneven terrain as shown on Page 4. This will prevent smoke and heat from escaping. Pay particular attention to the seal for the forward (motor deck side) wall. Any openings under the panels or forward skid will allow heat from the fire to reach the area below the motor deck. This could cause the motor deck to become hot enough to burn the paint and be a hazard to someone standing on the deck.

DANGER: Never dig a pit in the center of the firebox. This will make it hard to seal the inside of the firebox and the walls of the pit can deteriorate during operation allowing smoke and heat to escape from the firebox or reach the area below the engine deck creating a hazard for anyone standing on the deck. This will void your Air Burners Factory Warranty.

DANGER: Never place the FireBox on combustibles like peat moss or dry grass, and never position it on a concrete pad, gravel or crushed stones or asphalt. For more details, see [Page 7](#).

DANGER: This machine DOES NOT prevent hot embers from escaping. This machine is designed primarily as a pollution control device to reduce the smoke generated from burning clean wood waste.

SITE PREPARATION

Faster operation through staging the wood piles

Air Burners FireBoxes were designed primarily as a pollution control device, but operated correctly they will burn clean wood significantly faster than open burning. To achieve the best throughput, the fire must remain at the highest temperature possible. You achieve this by remembering three rules:

1. Don't smother the fire with a huge load or a load of very dense material.
2. Load “less more often” smaller bucket loads more often.
3. Sort out a pile of your best burnable wood, use it to create a hot fire.

The basic principle of operation is not too different from a campfire. You use your best wood to get it started, and if the fire dies down you add some more “Good Wood” to bring it back up. The big difference is that on your campfire you are probably not adding root balls, leaves or pine needles. These are the high moisture content and dense materials that bring the fire temperature down.

The temperature drops (smoke increases) and your burn rate slows down, if you overload the machine with materials that have high moisture content, such as tree branches with leaves and needles, or green branches such as palm fronds. While these are certainly ok to burn in the firebox, you want to add them to a hot fire so they dry out and ignite quickly.

To keep the temperature up and to maintain the highest throughput of waste, you should mix the very burnable wood with the less burnable materials throughout the course of the burning operation. The most common way to accomplish this is to stage a pile of the most burnable materials or what we call the “Two Pile System.”



FireBox Loading Over Manifold

“If it’s burning clean, it’s burning hot. If there is smoke, you’re losing money.”



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SITE PREPARATION

The “Two Pile System”

For an efficient operation you would have two piles:

The first pile or “Main Debris” Pile, is the material being generated from the land clearing or forest clearing operation and is located away from the ember path, but with good access to your loading machinery.

The second pile or “Good Wood” Pile is your best and most burnable wood. When you first setup the site, the operator should spend some time sorting through the main debris pile pulling out what appears to be your best, most burnable materials. This is the material with which you will start the fire and this material will give you a good hot burning base fire. You will also draw from the “good wood” pile throughout the day if you should need to stoke up the fire (more on this in the following sections).

As the FireBox operator is drawing from the main wood debris pile throughout the day, he or she should continue to replenish the “Good Wood” pile as necessary. The “Good Wood” pile only needs to be enough material to stoke-up the fire if needed and enough material to get you started the next day if a “Hot Start” is contemplated.

IMPORTANT WARNING ABOUT BURNING OF PALLETS:

Wooden Pallets, especially spent pallets, burn extremely hot. DO NOT load the machine above approximately 3/4 of the height of the firebox (burn chamber). Heat damage to the manifold and other structure may occur which would not be covered under your Limited Factory Warranty.

DANGER:

You must ensure debris does not build up on the equipment front deck. It must be kept clean at all times during operation to prevent a fire that would damage or destroy the motor and accessories and may cause an accident resulting in injury or death to persons standing on the deck.

LOADING AND STARTING THE FIREBOX

LOADING THE FIREBOX

You can load the FireBox from either side, but we recommend loading from the manifold side because (1) it is safest and (2) it tends to increase the life of the manifold, as it reduces the chance for it to be accidentally damaged.



THE GOALS IN STARTING A FIREBOX ARE:

1. To achieve an even fire across the length of the firebox.
2. To start the fire from the bottom of the initial load of wood waste.
3. To build a hot base fire.

There are two methods for lighting the unit: a *cold start* and a *hot start*. A cold start means the FireBox is clean and has no hot coals left from a previous burn. A hot start uses heat from the coals of the previous day’s burn.

COLD START

1. The unit should be on level ground and the engine should be off, as the fluid clutch would spin the air fan which would make it more difficult to light the fire and the fire may even be blown out. Ensure, though that you have started the Diesel engine and warmed it up before switching it off for the light up.
2. To prevent smoke from escaping under the firebox, shovel dirt along the inside bottom edges of the panels. It will only need a couple inches to prevent the smoke from escaping underneath the unit. This is generally only a concern on hard ground, and it usually only lasts for the first hour of burning. After burning for a while the ash will build up and seal off the bottom of the firebox.
3. Load your most burnable material (materials from the “Good Wood” pile as discussed in the previous section) which is the smaller, dryer and cleaner wood, into the firebox to a level about half way up. Ensure that the entire bottom area of the firebox (burn chamber) is covered.
4. If you are permitted to use diesel fuel to assist in the lighting, spray it (approx. 10 gal.) across the top of this first load of wood. Be sure to get some diesel fuel on the wood near the lighting holes in the firebox side and on the wood towards the back. This will help make it easier to light.

DANGER:

If you are using an accelerant, first ensure there are NO HOT COALS remaining in the FireBox.

DANGER:

DO NOT use highly volatile accelerants such as gasoline or kerosene, to light the fire. These fluids ignite almost explosively and may cause injury or death.



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LOADING AND STARTING THE FIREBOX

Overview

Once you have the smaller material loaded and your accelerant added (if used), load some larger, heavier feedstock on top such as logs or big branches. Load these heavier materials (also from your “good wood” pile) to a height just below the manifold nozzles or approximately $\frac{3}{4}$ height for machines burning pallets. This heavier material will help compress the smaller material which will give you a better light-off. If there are large air spaces between the wood debris in the firebox the heat will not build up as quickly and the fire may be more difficult to light.

Once burning, this material will become your hot base fire to support continued burning. Use your best and driest materials (“Good Wood”) for startup as this will form a strong base for continued burning, plus it will start quicker and burn hotter. If you will be burning stumps, it is best to load them after the first hour of burning when the fire is up to full temperature.

The level of material in the firebox for light-off should be kept just below the manifold nozzles, except for units burning pallets which should only be loaded up to approximately $\frac{3}{4}$ of the firebox height. Pallets burn extremely hot and loading them to a higher level would tend to warp or destroy the manifold. This heat damage would not be covered by your Limited Factory Warranty.

If you are using diesel fuel as an igniter, it is sometimes helpful to add a second coat to the top load again. ENSURE THERE ARE NO HOT COALS REMAINING IN THE UNIT before adding the accelerant.

Your goal is to develop a good hot base fire and to maintain a good hot fire throughout your burning operation. This will give you the cleanest burn and the most throughput.

There is always smoke on start-up as all of the material in the firebox contains moisture, compared to later in the burn operation when only the new material you are loading contains moisture. Plus, the air curtain cannot be fully engaged until the fire has strengthened, or you run the risk of blowing out the fire.

IMPORTANT WARNING ABOUT BURNING OF PALLETS:

Wooden Pallets, especially spent pallets, burn extremely hot. DO NOT load the firebox above approximately $\frac{3}{4}$ of the height of the burn chamber. Heat damage to the manifold and other structure may occur which would not be covered under your Limited Factory Warranty.

DANGER:

NEVER stand on the FireBox like on the front deck roof, air fan or the upper rails, as falling down or into the firebox will cause a serious accident resulting in injury or death.

LOADING AND STARTING THE FIREBOX

To minimize start-up smoke you can:

- Use your driest materials.
- Ensure your materials do not retain dirt or sand.
- Use diesel fuel to accelerate the light up.

COLD START LIGHTING

1. The air should be off. The main power switch should be ON with the Speed Controller set to OFF and Red Push Button OFF (pushed in).
2. For best results and quickest light up, start the fire from the bottom because fire will spread upwards much better than it will spread downwards.
3. Use a propane torch (like a weed burner) or oil soaked rags on poles to light the fire.
4. The fire must be started from the access doors in the panels on the manifold side of the unit.



Access Door for Lighting

If you are allowed to use diesel fuel as a starter, let the fire burn until you begin to see wisps of white smoke replacing the wisps of black smoke from the diesel fuel, or if you are using propane torches wait until the fire has strengthened and flames are reaching the top of the firebox. Then engage the air setting the speed controller to *Position Normal 1*. As the fire burns stronger increase the air by switching to *Position Normal 2*.

Don't increase the air too quickly as you can “blow” the fire out. If you add air and the smoke gets heavy then reduce the fan speed and let the fire “catch-up.” Once it clears up you can increase the air again.

Sometimes it is helpful to “fan” the fire during the start-up phase. You accomplish this by increasing the air fan RPM's for 3 to 8 minutes, then decreasing them (i.e. *Position Normal 1* up to *Position Normal 2* and back down to *Position Normal 1*). This sometimes helps to spread the fire throughout the material. How much air to add and when to add it during startup will vary with the type of materials being burned.

WARNING:

PINCH POINT HAZARDS

Be mindful of Pinch Point Hazards. Keep your hands clear from all moving parts and hot parts of the FireBox while it is being set up or in operation.



Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD
OPERATING MANUAL

LOADING AND STARTING THE FIREBOX

HOT START

A hot start uses the coals from the previous day’s burning operation. Depending on how much ash is in the unit, a hot start can be done once or twice before the unit will need to be emptied. The more ash in the firebox that you start with, the LESS room you have for burning new materials.

First, ensure there are enough coals remaining to generate enough heat to get the new waste materials burning. You CANNOT and MUST NOT add an accelerant if the waste materials do not light as that would be much too dangerous. You can use propane torches in the lighting holes if you have trouble with a hot start. If the material does not light, the firebox must be emptied before trying a cold start with the use of an accelerant.

DANGER:

Do not use any kind of accelerant for a Hot Start, as it may ignite unexpectedly and cause an accident resulting in injury or death.

HOT START LIGHTING

Similarly to a cold start you begin with your best and most burnable materials.

1. Load the firebox to about one third or half way with the “Good Wood”. The wood should begin burning as soon as you start loading.
2. Set the fan speed at *Position Normal 2*. This should help fan the flames and spread the fire. If you experience heavy smoke then reduce the RPM’s by switching to *Position Normal 1* or disengage the air fan altogether by switching to *Position OFF*. Be cautious not to “blow out” the fire.
3. As the fire begins to heat up, increase the RPM’s to the maximum *Position Normal 2*.

DANGER:

NEVER stand on the FireBox like on the front deck roof, air fan or the upper rails, as falling down or into the firebox will cause a serious accident resulting in injury or death.

HOW TO FEED A FIRE

It will generally take 30 minutes for the fire to build to a point where the temperatures are sufficient for the unit to be operating with minimal smoke.

1. Add material from your “Good Wood” pile slowly for the first hour. It takes about an hour for the fire to reach minimum temperature. Your goal is to achieve an even and hot fire across the unit.
2. For continuous operation the motor RPM is run at full speed (*Normal 2*). If the fire is burning very hot with no smoke the RPM can be reduced to *Normal 1* to save power, but that is very dependent on the waste material.
3. If you get excessive smoke and ash when you load the wood waste while dropping the load through the air curtain, then you may need to lower the RPM’s temporarily as you load. This is most likely earlier in the burn operation.
4. Take caution when loading the unit that the material to be burned is not “dumped” in the firebox too quickly causing hot embers to be thrown from the unit.
5. If you have an area in the firebox that is smoking, this indicates the temperature is low in that area. Add material from the “Good Wood” pile to get the fire temperature up. Once that area is burning, add some of the heavier material.
6. The rate at which you load the unit varies depending on moisture content of the materials and the temperature of the fire. If you overload the firebox you will notice an increase in white smoke. White smoke is an indication that the temperature is dropping. If the smoke increases stop loading until the fire has caught-up. You can also bring the temperature up by adding materials from the “Good Wood” pile.
7. For the highest throughput, load “*LESS MORE OFTEN.*” Smaller loads more often will give the materials a better chance to ignite and will result in your highest throughput of material. Oversized bucket loads may smother the fire for a short period before it ignites; this will slow the burning down and reduce your daily throughput.
8. The load in the firebox should not go higher than the bottom of the manifold (except approximately $\frac{3}{4}$ firebox height for machines burning pallets). If the material is piled higher, it will begin to break the air curtain and more smoke will escape.
9. The fire should be loaded continuously throughout the day, in order to maintain operating temperatures. If the fire is not loaded continuously, the temperature will drop, the throughput will go down and more smoke will escape.

“If it’s burning clean, it’s burning hot, If there is smoke, you’re losing money.”



Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD OPERATING MANUAL

SHUTDOWN

HOW TO BURN THE FIRE DOWN FOR SHUTDOWN

All loading should stop one or two hours before you intend to put the fire out.

As the fire burns down, maintain the air speed until the firebox begins to smoke. As the smoke increases reduce the air speed in increments to *Positions Normal 1* and the *Cool Down Position*. This will help to reduce the smoke.

The air in the manifold needs air flow, both to accelerate the burn-down and to protect the manifold from warping due to excessive heat. **DO NOT shut off the air flow (turn off the motor) while there are still flames within 24 inches of the manifold.** Doing so may cause elevated temperatures to warp the manifold, nozzle assembly, etc. Your warranty does NOT cover damage due to excessive heat.

Once the fire has burned down to about one or two feet and flames are not visible near the manifold, it will be safe to turn the SPEED SWITCH to the *COOL-DOWN mode*. After appropriate burn-down time, turn the SPEED SWITCH to *OFF* and push the RED POWER BUTTON to *OFF*. Finally, turn the Main FireBox Fan Switch counterclockwise to the horizontal OFF position.

Make sure the fire is contained as necessary to comply with your local regulations. **Do not spray the refractory walls with water, as this will damage them.**

Some local authorities allow the FireBox to be secured and the embers to smolder all night. There is generally no smoke from this smoldering. ensure the work site is secured or has a constant security guard to prevent any people or animals from getting near the FireBox. The inside temperatures of the FireBox will remain very high most of the night.

If you are not allowed to smolder through the night, then verify that the fire inside is completely out. If it is still burning or smoldering you can use sand or dirt to cover the remaining hot spots. **Do not spray the refractory walls with water as this will damage them.** Ensure the fire is out and the job site secure before you leave.

DANGER:

NEVER CLIMB ON THE FIREBOX TO VIEW OR LIGHT THE FIRE

Use the ladder built into the FireBox and firmly grasp the provided handle. Never step beyond the top rung. If you use a step ladder or similar platform, locate at a safe distance from the FireBox. Do not stand along the rails or on top of the FireBox (like the front deck roof or air fan) under any circumstance.

Falling into the firebox or from the machine will cause an accident resulting in serious injury or death.

All persons must always wear suitable Personal Protective Equipment (PPE) while near an operating FireBox and during ash clean out and ash handling.

ASH REMOVAL

HOW TO EMPTY THE FIREBOX

We recommend removing the ash every morning before burning operations begin. This will give you maximum capacity in the firebox and the ash will be easier to handle.

The firebox will operate with up to 3 ft. of ash inside, but as the ash gets deeper the efficiency of the unit goes down. Three feet of ash would represent approximately 20 hours of burning. The FireBox should not be run with over 3 ft. of ash inside.

There is only one way to empty the ash out of the electrically powered FireBox, namely, by excavating it out best with an Air Burners ash rake but an excavator could also be used.

ASH RAKE

Air Burners offers an ash removal implement (ash rake) as pictured to the right. It has been designed for each model FireBox. The ash rake is fitted with a universal quick connect faceplate or a blank faceplate for installation on your unique machine (weld it yourself).

You can remove some or all of the ash by reaching in through the rear doors with the ash rake or an excavator and dragging the ash out.

Remember to use Personal Protective Equipment (PPE) including a breathing apparatus (i.e., a respirator), otherwise an accident may occur resulting in injury or death. Be also cautious of the remaining hot embers in the ash bed.

It is not required to remove all the ash, if you are planning on a hot restart, generally just a scoop or two with the ash rake is all that is required. This will leave a very hot ember base from which you begin the new day with a “hot start” as explained previously.



DANGER: Ash and dust will be released during the FireBox operation, especially during firebox ash cleanout. Operators must wear appropriate Personal Protective Equipment (PPE) like suitable body suits, eye protection, gloves, boots, etc. and in particular face masks like respirators to keep ash that may be suspended in the air from entering their lungs. It must be understood that all persons near the FireBox must protect themselves from dust and ash as it may be harmful if wood ash and dust enters their airways which may result in injury or death.

Even with proper PPE a person must not step into a firebox without first removing all wood ash residues, embers and unburned feedstock, otherwise an accident may occur which may result in injury or death. There may be hot embers and hot coals hidden within the ash bed and wood ash may be suspended in the air from stirring up the ash bed. This may make it difficult to breathe.

TROUBLESHOOTING

1. Fire will not start.

Material in firebox has too much air space. To correct, load heavy material such as stumps to make the lower material pack down. Use torches and light from the bottom so the fire burns up.

2. Fire burning at one end.

Load heavy materials directly on top of the burning area. This causes the flames to fan out in an effort to reach the top of the pile. As the fire begins to spread, keep material piled on top of the flames until the entire firebox is burning.

3. Fire smoking too much.

The most common reason for a smoking fire is too much dirt or dense materials going into the firebox and reducing the heat. You must make sure the wood waste material is free from large amounts of dirt. Load from your “Good Wood” pile to bring the temperature back up

You may have overloaded the firebox or loaded the firebox too fast. Example: if you only have one ton of material burning you can not load in three tons of material. The new material will smother the fire. Stop loading and let the fire catch up. The material you are loading may have a very high moisture content. You can either load at a slower rate or mix the wetter material with dryer material.

If you are letting the fire burn down or the load in the firebox is less than 3 ft. deep you may need to turn the air down by reducing the electric motor RPM.

4. Smoke from one area of the firebox.

The area is probably not burning well. Add smaller material from your “Good Wood” pile to this area to help build the fire. As the smoke clears add heavier material.

5. Smoke from under the base rails or bottom of panels.

Loose dirt was not properly shoveled around inside of fire firebox to seal between panel bottoms and the ground. To fix, shovel dirt around the outside where the smoke is escaping. Once the ash inside builds up this will stop.

MAINTENANCE AND CARE

A. Daily Check List:

1. Ensure that the ground wire is properly connected to the FireBox grounding lug and the grounding rod to earth and that the wire gauge meets AWG of local code.
2. Ensure that the VFD cooling fan intake air filter is clean (lower left; to remove filter reach under rain hood (if so equipped) and loosen two (2) thumbscrews holding filter access door. (Position and type may vary).
3. Insure that the external power grid from the power company is providing proper power to the pole (480V balanced three-phase). Brown-outs (voltage deficiency or under voltage) or excessive voltage spikes can cause default shut-downs by the VFD protective circuitry. Such default shut down requires the powering off of the VFD to initiate an automatic reset of the unit. As the air fan would not be supplying air to the manifold for the reset period of time, such shut down should be absolutely avoided, once there is a fire in the firebox to prevent warping of the manifold. Do not operate the FireBox S-Series (Electric), if weather conditions may indicate a possible interruption of power during the workday.
4. Do not wash down the NEMA IV enclosure with a water hose, as water may enter through the cooling fan vents.



Cooling Fan Rain Hood
(Position, type or cover may vary)

B. Periodic Maintenance

1. Grease the electric motor bearings (very sparingly, consult supplied electric motor booklet/manual).
2. Grease both (inside and outside) air fan bearings every 2-4 months on models with fan-to-motor coupling where the air fan is not coupled directly to the motor (motor and fan or not on a single shaft). *Do NOT over-grease.*
3. For FireBox models equipped with a coupling connecting the air fan to the motor, inspect the adjustment of the coupler hubs and realign them by re-adjusting the motor mounts as needed. See Appendix A for details.

WARNING:

ALWAYS INSURE THAT THE ELECTRIC FIREBOX UNIT IS PROPERLY GROUNDED TO EARTH. CHECK GROUND CONNECTION AT GROUNDING LUG AND GROUNDING ROD. CHECK GROUND WIRE AND GROUD WIRE GAUGE (AWG). FOLLOW LOCAL CODES.



Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD OPERATING MANUAL

VFD SERVICING SPECIFICATIONS

Other than as indicated under Periodic Maintenance, **there are no user-serviceable parts**. Should the VFD require attention or re-programming, a qualified licensed technician should be engaged to perform this work.

There are no supply voltage (480V) circuit breakers or fuses inside the NEMA control housing, only three internal control circuit fuses. Technicians should call Customer Support for programming assistance, if needed.

WARNING:

All electrical E-FireBox connections and installations must be made by a licensed local electrician according to respective codes and regulations by the competent authorities.

MOTOR / VFD WIRING

Standard Power (US Versions):

480V balanced three-phase, 60Hz into control box from power pole (grid) and min. 460V three-phase out from control box to electric motor. The motor is rated at 460V to allow for a voltage drop of up to approximately 20V by the VFD.

Models S330E and S327E are fitted with a 75 hp (56 kW) and models S223E, S220E, S119E and S116E are fitted with a 30 hp (22.4 kW) premium three-phase motor.

Air Fan Rotation:

Fan Rotation is clockwise as viewed from the motor end or counter-clockwise as seen from the outside of the FireBox. The motor rotation is set at the factory and the VFD is programmed also at the factory for the proper speed settings (Positions are 0-1-2-3).

Series “E” Refractory Walled Air Curtain Burner Powered by Electric Motor and VFD OPERATING MANUAL

Default Shut-Down of VFD and Motor / VFD Wiring (Continued)

The external power lead of proper gauge (AWG) must be connected to the power distribution block in the upper left corner (see right photo; (VFD model and connection block may vary).

The unit may be shipped without a NEMA housing cutout for the external power lead feedthrough. It may have to be positioned and provided by the local licensed electrician.

A main breaker or fuse switch (not supplied) must be installed externally per local code, i.e., at the power pole.

Ensure proper grounding of the unit per local code and connect an earth grounding rod to the grounding lug on the front deck near the main air curtain fan (position may vary). Use proper wire gauge.

NOTE:

The VFD is set to “Coast-to-Stop”. That means the power to the motor is not turned off when setting the Fan Speed Control Switch to OFF, but the speed is reduced to 0 by the frequency settings. The fan may continue to rotate slowly. Always push in the red STOP BUTTON to completely shut off the power to the motor/fan, then turn off the MAIN POWER SWITCH. See also the Start/Stop instructions on Page 9.



View inside the NEMA IV Housing (door open)
Components shown may vary.



Grounding Stud
(Location may vary)

NOTICE:

All electrical connections, installations and repairs must be made by a licensed local electrician according to respective codes and regulations by the competent authorities.



THERMAL-CERAMIC PATCHING COMPOUND

FOR MINOR REPAIR OF AIR BURNERS REFRACTORY PANELS AND DOORS.

Air Burners Part # 6900-1003 “Thermal-Ceramic Wet Pre-Mix”

*NOTE: This is an air cured product. Reseal unused portion immediately.
Once opened the shelf life is one (1) year.*

Directions:

1. Cracking of the panels is normal as they flex in the heat. Filling the cracks every 6 months or as needed will extend the life of your Thermal-Ceramic Panels.
2. Air Burners patching compound is pre-mixed and ready to use (may require some stirring).
3. Storage: Compound should be stored indoors in a frost-free location.
4. Preparation: the area in and around the damaged area to be patched must be cleaned and brushed to provide the best surface for the compound to adhere. Remove all loose refractory and debris from the area to be patched.
5. Wet the cleaned surface with a light spray or damp cloth.
6. Installation: Using a trowel or similar tool, pack the refractory compound material into cracks and into areas where the refractory is missing. To achieve proper thickness, trim off the excess material using a sharp, flat blade or the side of the trowel.
7. Allow the material to harden overnight before placing the FireBox back into service. After the compound has hardened, operate the FireBox under normal conditions.

NOTE:
This is an air cured product. Reseal unused portion immediately.

WEAR PERSONAL PROTECTIVE EQUIPMENT (PPE):

Always wear appropriate Personal Protective Equipment (PPE) while working with the thermal ceramic patching compound repairing the refractory panels or while performing any other maintenance task on your FireBox.

LIFTING POINTS & STAIR GUARD



WARNING:

There are four designated lifting pad eyes for lifting all FireBox units by crane, two on each side. **Only lift by attaching straps or cables to these four pad eyes.** Their locations are marked with yellow lifting point labels with *up-arrows*).

WARNING:

The Stair Guard is shipped in place secured with a bolt and nut (red circle in photo to right). The bolt should be replaced with a suitable padlock, before the FireBox is placed into service.

Only authorized personal must be allowed to remove the stair guard and persons wearing suitable Personal Protective Equipment (PPE) using the built-in stairs must hold firmly onto the handle and never step beyond the top rung.



APPENDIX A CHECKING COUPLING ALIGNMENT

This Technical Memorandum covers FireBox Models equipped with Dodge Raptor Couplings. The S327 and S330 use Size E30 (Air Burners Replacement Part Number 5000-2120) and all other FireBox models use Size E20 (Air Burners Replacement Part Number 5000-5123). Certain FireBoxes equipped with electric motors are also fitted with Dodge Raptor couplings. The general coupling information in this Technical Memorandum applies to them also.



FAN SHAFT HUB ELEMENT HUB

The coupling shown above is an E20 with the protective guard removed.

TOOLS REQUIRED

Coupling hubs should be aligned using straight edges or calipers. Laser alignment tools, or other precision alignment equipment can be used but are not required.

Tools

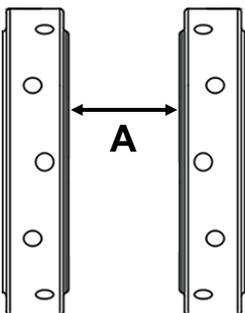
1. Two open-end wrenches, 3/4”
2. Torque wrench
3. Sockets/wrenches, 9/16” & 7/16”
4. Straight Edge Ruler or Calipers

WEAR SUITABLE PERSONAL PROTECTIVE EQUIPMENT (PPE).

Step 1 Preparation

1. Lock out engine/motor to prevent accidental start which could cause injury.
2. Remove the protective metal guard (Not shown in image above) from fan.
3. Take off the element by removing the Grade A bolts holding the two halves together. Bolts should be used only one time. All bolts use thread locking patches.
4. If any coupling adjustments are required, be prepared to realign the motor until the measurements of Steps 2, 3 and 4 are achieved. Shims may be required.

Step 2 Verify Gap Between Hubs

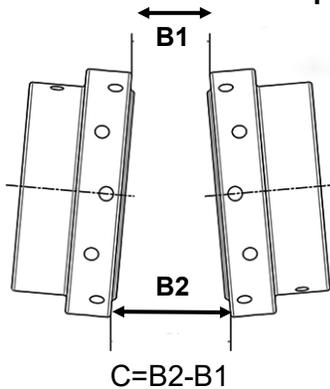


1. Measure the distance “A” between the hubs with calipers or other appropriate tool
2. If needed, set distance “A” as follows:

GAP MEASUREMENT “A”		
E20	2.46”	62mm
E30	2.55”	65mm

APPENDIX A CHECKING COUPLING ALIGNMENT

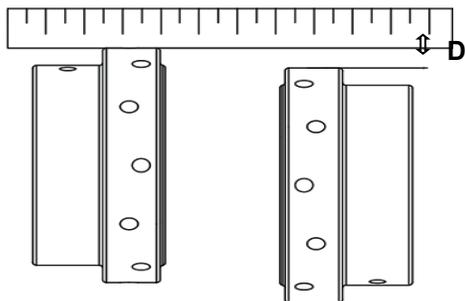
Step 3 Verify Angular Alignment of Hubs



1. Measure the distance “B” between the hubs with calipers or other appropriate tool at four places on the outer diameter of the hub 90° apart.
2. Use the “B2” and “B1 ” measurements to calculate “C” by subtracting the smaller measurement from the larger number, and do this for each of the 90° apart planes .
3. Adjust the motor by shimming until the “C” measurements of both planes do not exceed these Angular Values:

ANGULAR VALUE “C”		
E20	0.235”	6mm
E30	0.284”	7.2mm

Step 4 Verify Parallel Alignment of Hubs



D is the distance between straight edge and lower outer hub edge

1. Check parallel misalignment by placing a straight edge across the outside diameter of the hubs and measuring the gap between the straight edge and the hub at four locations 90° apart.
2. Adjust the motor by shimming until the “D” measurements do not exceed these Parallel Values.

PARALLEL VALUE “D”		
E20	0.188”	4.8mm
E30	0.188”	4.8mm

Step 5 Element Installation

1. Place first element half on hubs and hand-tighten the flange head bolts. When tightening the bolts, start at the center bolt hole and then install the bolts on the neighboring holes.
2. Place the second half of the element on the hubs and follow the same procedure. Hand-tighten the flange head bolts.
3. Use a torque wrench to tighten all fasteners for the E20 and E30 to these torque values (same for both):

ELEMENT BOLT TORQUE VALUES				
	Bolt Size	In-lbs	ft-lbs	Nm
E20 & E30	3/8	502	42	57