

Operating Manual

200 SERIES

S220 & S223

Equipped With HATZ 3H50TIC or 4H50TIC Diesel Engine

(US EPA Tier 4 Final)

Self-Contained Refractory Walled Air Curtain Burner



“Better Environmentally - Better Economically”

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WARNING:

Should any repairs become necessary that require welding on your FireBox, you **MUST** first physically remove the Electronic Control Module (ECM) from the computer controlled Diesel engine.

Follow the instructions below.

**ECM Removal Steps**

1. Unsnap Latches 1 and 2
2. Remove Bolts A1 and A2
3. Unplug both connectors
4. Remove Bolts B1, B2, B3 and B4
5. Remove the two brackets
6. The ECM can now be removed and stored away
7. Re-install all in reverse order.



INDEX

WELDING REPAIR WARNING	Page i
PRINCIPLE OF AIR CURTAIN INCINERATION	Page 1
GENERAL DESCRIPTION OF S-SERIES	Page 2
SAFETY CONSIDERATIONS	Page 5
HOW TO SET UP THE MACHINE	Page 8
SITE PREPARATION	Page 13
LOADING AND STARTING THE FIREBOX	Page 16
HOW TO FEED A FIRE	Page 20
SHUTDOWN	Page 21
ASH REMOVAL	Page 22
TROUBLESHOOTING	Page 24
MAINTENANCE AND CARE	Page 25
PTO MAINTENANCE (WPT).....	Page 27
PTO MAINTENANCE (TWIN DISC).....	Page 28
SERVICING SPECIFICATIONS	Page 31
LIFTING POINTS	Page 32
CHECKING COUPLING ALIGNMENT	Appendix A



**200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine
OPERATING MANUAL**



S-220

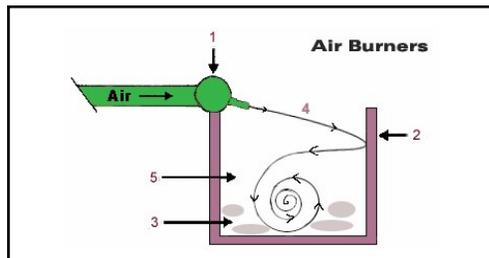


S220

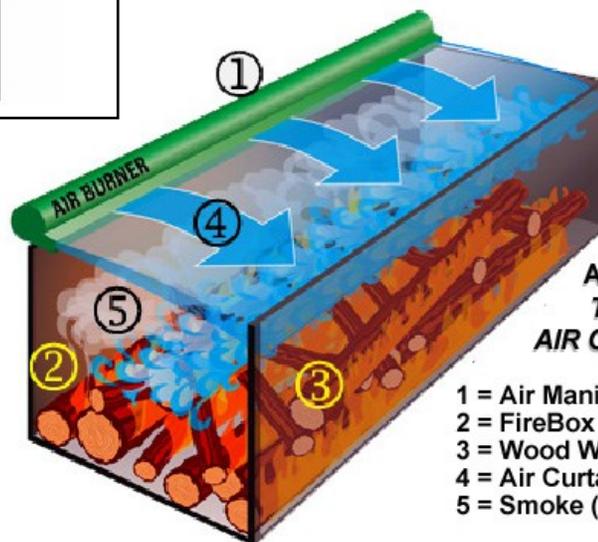
PRINCIPLE OF AIR CURTAIN INCINERATION

OPERATION

Air curtain incinerators 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 thermo-ceramic lined FireBox. 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) 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 under the air curtain where the temperatures may exceed 1,800° F. These machines do not inject any fuels into the fire, the fire is sustained only by adding more wood waste. The air from the air curtain is not heated. The only fuel used in the continuous operation is that of the diesel engine driven fan.



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)



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

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 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 table below shows the approximate dimensions.

Above-Ground Air Curtain Burner Dimensions					
Model	Overall Size L x W x H	FireBox L x W x H	Weight lbs.	Fuel* gal/hr.	Average Thru-put tons/hr.
S330	40' 4" x 11' 10" x 9' 6"	30' 2" x 8' 5" x 8' 1"	59,000	3.0	11-13
S327	37' 4" x 11' 10" x 9' 6"	27' 2" x 8' 5" x 8' 1"	54,600	3.0	9-11
S223	33' 3" x 8' 6" x 8' 6"	22' 11" x 6' 2" x 7' 1"	40,250	2.0/2.5	7-9
S220	30' 1" x 8' 6" x 8' 6"	19' 8" x 6' 2" x 7' 1"	36,650	2.0/2.5	5-7
S119	27' 3" x 7' 2" x 7' 4"	19 x 5' x 6'	30,100	1.9/2.1	3-5
S119R**	27' 6" x 7' 2" x 8' 3"	19 x 5' x 6'	39,900	1.9/2.1	3-5
S116	24' 7" x 7' 2" x 7' 4"	16' x 5' x 6'	27,500	1.9/2.1	2-4
S116R**	24' 11" x 7' 2" x 8' 3"	16' x 5' x 6'	36,300	1.9/2.1	2-4
T24	19' 8" x 7' 8" x 5' 8"	12' x 4' x 4'	9,983	0.56	½-1

* 200 Series & 100 Series machine fuel consumption is engine model dependent; read as: 3H50/4H50

** Cable-hoist version; Hook-lift version is 5" shorter

- Diesel Engine Version:** S330 & S327: HATZ 4H50TIC (Tier 4 Final) or equivalent engine.
S223, S220, S119 & S116: HATZ 3H50TIC (Tier 4 Final) or equivalent engine.
- Drive System:** PTO & mechanical direct coupling drive.
- 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;
Drive System: Direct drive.
- Options:** Ash clean-out rake - price will be quoted for plain faceplate (S300) or universal quick disconnect (S200 & S100); Steel floor: Ember screen (S200 & S100 only); Rough-terrain removable dolly.
- Fuel Consumption:** Indicated fuel consumption rates approximated.
- 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.



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

GENERAL DESCRIPTION S-SERIES

When delivered to a job site, the S-Series machine is ready for use as soon as it is off-loaded. 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 a four cylinder diesel engine, a 58 gallon fuel tank, the direct drive system and 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 back of the FireBox is fitted with refractory lined doors that allow ash removal and access to the (only when it is empty) firebox.

The diesel engine is coupled through a clutch drive PTO (Power Take-Off) that turns the fan. 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 box and then reflected down into the combustion zone.

The curtain of air acts as a top over the FireBox, 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.

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 through-put. Additionally, it will reduce the machine's ability to meet air quality minimum 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 creating more smoke (carbon dioxide and nitrogen enriched). This will begin a circular effect of further reducing the oxygen and further reducing combustion efficiency. The result is your through-put drops and smoke increases.
- 2) Increasing the air flow beyond design standards will over pressurize the Fire-Box 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.



**200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine
OPERATING MANUAL**



S327 FireBox in Operation



S327 FireBox Rear Doors (Open)

IMPORTANT:

Notice how dirt is placed all around the inside bottom to close any openings under the skids that may be caused by uneven terrain. This will prevent smoke from escaping.



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 S-Series unit, 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:

1) The unit should be placed on cleared, level ground.

The unit should be placed on level ground to facilitate loading, dumping and moving of the unit. The rear doors weigh approximately 2,000 lbs. each and should not be opened if the unit is inclined on any axis more than 5 degrees.

2) The unit should be placed such that no combustible material is within a minimum 100 foot clearance in any direction.

The S-Series units do not have a bottom and should not be located over combustibles such as dry grass or peat moss. In addition *hot embers* will escape from the unit and, depending on the wind, will land on the ground around the unit. The unit should not be located within 100 feet of any stored combustible materials. The waste material to be burned during the day's operation can be staged within the 100 foot perimeter to facilitate loading. The operator must monitor the loading pile to insure 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 foot perimeter or in accordance with the chart on page 6 of this manual which suggests adjustments for wind speed.

3) 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.

DANGER:
Watch for the danger notices throughout this manual.



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

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 box 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.

DANGER: Falling into the FireBox will cause serious injury or death.

6) Shut the unit down in an emergency.

Stop loading the unit, stop the air flow by either disengaging the PTO or by shutting down the engine. 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.

WIND SPEED VS. SAFE DISTANCE			
	Approximate Safe Distance for:		
Wind Speed (MPH)	Structures (Houses, etc.)	Woods/Trees	Stored Brush Piles
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 authorities.

7) Personal Safety

Operators need to be aware of the following potential hazards:

- A) Flying hot embers** being released from the fire. Operators or anyone within the 100 foot radius of the fire should wear appropriate fire resistant clothing. The ideal outwear 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 the 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 machines.** 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. Caution should be taken to insure operator and visitors do not come in contact with these hot areas.
- D) Ash and dust** can be released during the operation and during cleaning. Operators should wear appropriate breathing masks to protect themselves from inhaling the dust and ash.



DANGER: You must insure debris does not build up on the equipment front deck. It must be keep clean at all times during operation to prevent a fire that would damage or destroy the engine and accessories.



HOW TO SET UP THE MACHINE

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 and to move the unit around the site. The weights of the various units are given in the General Description section. 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: When you tow (drag) the S-Series units, especially in soft soil, watch that the dirt does not build up under the panels and lift the panels off the rails. Never walk inside the box when it is being towed. 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.

B) PRE-OPERATION CHECKS:

1. Air filter for cleanliness (VERY IMPORTANT)
2. Engine oil level
3. Engine coolant level and antifreeze rating
4. Diesel fuel level



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

HOW TO SET UP THE MACHINE (MBW Panel)

C) STARTING

PRE-CHECKS

1. Check all belts and fluids.
2. **Make sure PTO (clutch) is disengaged (the lever in the LEFT position).**

Note:

The key can only be removed from the key switch in the OFF position. Turning the key left to the Auto position is not functional and is not used for your HATZ engine.

STARTING Engine

1. Turn key switch right to ON (1) position. The display will be activated.
2. Wait for automatic PREHEAT to complete.
3. Turn key to START, release, once engine is running.
4. Wait for speed to level off at 900 RPM (*Idle*).
5. Press Throttle Button UP, wait for speed to level off at 1400 RPM (*Engage Clutch*).
6. Engage PTO now by pushing lever RIGHT until it snaps into place.
7. Press Throttle Button UP again to set speed at 2200 RPM (S220) or 2300 RPM (S223) (*Operating Low*).
8. Press Throttle Button UP again to set speed at 2400 RPM (S220) or 2500 RPM (S223) (*Operating High*).



Electronic Control Panel
(Lockable Cover Open)



Throttle Button UP & DOWN

WARNING: Your HATZ Diesel Engine is an EPA Tier 4 FINAL certified computer controlled engine. Do not attempt to re-program the ECM by pressing buttons at random on the control panel. Contact Air Burners Customer Support Department for help, if any errors have occurred. Call 772-220-7303. Note: The engine does not require DEF.

HOW TO SET UP THE MACHINE (Murphy Panel)

C) STARTING

PRE-CHECKS

1. Check all belts and fluids.
2. **Make sure PTO (clutch) is disengaged (the lever in the LEFT position).**

Note:

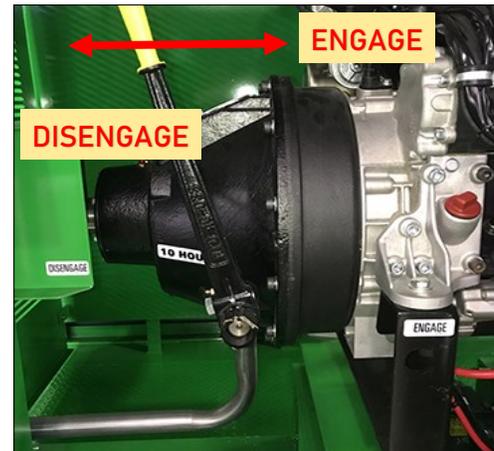
The key can only be removed from the key switch in the OFF (O) position. Turning the key left to the unmarked position is not functional and is not used for your HATZ engine.

STARTING Engine

1. Turn key switch right to ON (1) position. The display will be activated.
2. Wait for PREHEAT to complete.
3. Turn key to START (⊞), release, once engine is running.
4. Press THROTTLE UP button (lower right), wait for speed to level off at 900 RPM (*Idle*).
5. Press THROTTLE UP button (lower right), wait for speed to level off at 1400 RPM (Engage Clutch)
6. Engage PTO by pushing lever RIGHT until it snaps into place.
7. Press THROTTLE UP button (lower right), wait for speed to level off at 2200 RPM (S220) or 2300 RPM (S223) (*Operating Low*).
8. Press THROTTLE UP button (lower right), wait for speed to level off at 2400 RPM (S220) or 2500 RPM (S223) (*Operating High*).



Control Panel



PTO Lever

WARNING: Your HATZ Diesel Engine is an EPA Tier 4 FINAL certified computer controlled engine. Do not attempt to re-program the ECM by pressing buttons at random on the control panel. Contact Air Burners Customer Support Department for help, if any errors have occurred. Call 772-220-7303. Note: The engine does not require DEF.

HOW TO SET UP THE MACHINE (MBW Panel)

SHUT-DOWN

SHUT-DOWN WARNING:

Do not switch off engine with PTO engaged. This can cause serious damage to driveline.

1. Press Throttle Button DOWN twice from *Operating High* and once from *Operating Low* to set speed at 1400 RPM (Cool Down).
2. Disengage PTO now by pushing lever LEFT.
3. Press Throttle Button DOWN again and wait for speed to level off at 900 RPM (*Idle*).
4. Turn key to OFF position.



Electronic Control Panel
(Lockable Cover Open)

WARNING:

Call the Factory for support if the Control Panel throws any fault codes. Call 772-220-7303

WARNING:

Your HATZ Diesel Engine is an EPA Tier 4 FINAL certified computer controlled engine. Do not attempt to re-program the ECM by pressing buttons at random on the control panel. Contact Air Burners Customer Support Department for help, if any errors have occurred. Call 772-220-7303. Note: The engine does not require DEF.



Throttle Button UP & DOWN



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

HOW TO SET UP THE MACHINE (Murphy Panel)

SHUT-DOWN

SHUT-DOWN WARNING:

Do not switch off engine with PTO engaged. This can cause serious damage to driveline.

1. Press Throttle DOWN BUTTON (lower 2nd from right). From *Operating High* first wait for speed to level off at *Operating Low*.
2. From *Operating Low* press Throttle DOWN BUTTON and wait for speed to level off at 1400 RPM (*Cool Down*).
3. Disengage PTO now by pushing lever LEFT.
4. Press Throttle DOWN BUTTON again and wait for speed to level off at 900 RPM (*Idle*).
5. Turn key to OFF (O) position.

RUNNING

Engine RPM's (air-fan speed) is preprogrammed and fixed at positions *Idle*, *Cool Down*, *Operating Low* and *Operating High*.

WARNING:

Your HATZ Diesel Engine is an EPA Tier 4 FINAL certified computer controlled engine.

Do not attempt to re-program the ECM by pressing buttons at random on the control panel. Contact Air Burners Customer Support Department for help, if any errors have occurred.

Call 772-220-7303

The engine does not require DEF.



Fuel Tank - Open Side Door



Engine Compartment & Controls
(Layout May Vary)



SITE PREPARATION

THE GOALS TO GOOD SITE PREPARATION ARE:

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

When locating the FireBox, consider access for your truck and trailer to load and unload the FireBox. Ensure there is enough room to maneuver your truck and trailer.

Consider where the waste piles will be located. We generally recommend two waste piles (explained in next section).

Consider the predominate wind direction. Hot embers will be escaping from the Fire-Box during all burning operations.

Consider where and how you will empty the FireBox. If you are going to 'drag' the Fire-Box to empty it, ensure there is room and the soil conditions are not too soft. If you are going to excavate the ash out, then consider where you will dump it. In most cases cold ash can be reapplied to the land. Check your local ordinances.

Once the box is in position, it is important to place dirt around the inside bottom of the FireBox 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 (engine side) wall. Any openings under the panels or forward skid will allow heat from the fire to reach the area below the engine deck. This could cause the engine deck to become hot enough to burn the paint and be a hazard to someone standing on the deck.

Never dig a pit in the center of the FireBox. This will make it hard to seal the inside of the box 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 and will void the Air Burners Warranty.

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 two or three times 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 and leaves and 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 Fire-Box, 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."

"If it's burning clean it's burning hot; if there is smoke, you're losing money."



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 debris pile throughout the day, he 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.

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 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 insure 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 engine and accessories.

LOADING AND STARTING THE FIREBOX

LOADING AN S-SERIES UNIT

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 AN S-SERIES UNIT ARE:

- To achieve an even fire across the length of the box.
- To start the fire from the bottom of the initial pile.
- 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 days burn.

COLD START

Unit should be on level ground and the AIR should be off, but the engine can be running to bring it up to operating temperature.

To prevent smoke from escaping under the box, 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. As burning continues the ash will build up and seal off the bottom of the unit as well.

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. Insure that the entire bottom area of the FireBox is covered. If you are using diesel fuel to assist in the lighting. Spray it (approximately 10 gallons) across the top of this first load of wood. Be sure to get some diesel 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 insure 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.



LOADING AND STARTING THE FIREBOX

Once you have this smaller material loaded and your accelerant added (if used), load some larger, heavier material 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. 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 materials 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.

If you are using diesel fuel as a 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 box 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.

DANGER: NEVER stand on the machine as you may fall in causing serious 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 and the engine should be running, but the PTO should be disengaged.
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 using 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 at 1400 RPM. As the fire burns stronger, increase the air up to maximum.

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 RPM and let the fire "catch-up." Once it clears up you can slowly increase the air again.

Sometimes it is helpful to "fan" the fire during the start-up phase. You accomplish this by increasing the RPM for 3 to 8 minutes, then decreasing it (i.e. 1400 RPM up to 2200 RPM (S220) or 2300 RPM (S223) and back down to 1400 RPM). 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.



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, insure there are enough coals remaining to generate enough heat to get the new waste materials burning. You CANNOT add an accelerant if the waste materials do not light as that would be 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 an accelerant for a Hot Start, as it may ignite unexpectedly and cause 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. Engage the fan at 1400 RPM. This should help fan the flames and spread the fire. If you experience heavy smoke then reduce the RPM or disengage the fan. Be cautious not to "blow out" the fire.
3. As the fire begins to heat up, increase the RPM.



200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

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 engine RPM is run at full throttle (preset at the factory). If the fire is burning very hot with no smoke the RPM can be reduced to save fuel, 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 turn the RPM’s down 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 box too quickly causing hot embers to be thrown from the unit.
5. If you have an area in the box 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 box 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 bucket 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 box should not go higher than the bottom of the manifold. If the material is piled higher, it will begin to break the air curtain and more smoke will escape.

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 through-put 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.”



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. 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, 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 shut the engine and air down. Make sure the fire is extinguished before you leave the job site. The best way is to load dirt or sand into the box, **but do not spray the refractory walls with water as this will damage them.**

When the burning materials in the FireBox have burnt down to ash, reduce engine RPM to 1400 RPM and disengage the PTO. Move the key switch to the OFF position to shut down the engine. Never shut off the engine with the PTO still engaged. That can cause damage to the drivetrain and is not covered under your warranty.

Some local authorities allow the FireBox to be secured and the embers to smolder all night. There is generally no smoke from this smoldering. Insure 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 the fire inside is completely out. If it is still burning or smoldering you can either drag the FireBox forward and water down the embers or you can use sand or dirt to cover the remaining hot spots. Ensure the fire is out and the job site secure before you leave.

DANGER: Falling into the FireBox will cause serious injury or death.



ASH REMOVAL HOW TO EMPTY THE S-SERIES UNITS

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 box will operate with up to 3 feet 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 box should not be run with over 3 feet of ash inside.

There are generally three ways to empty the ash: (1) by use of Air Burners' Ash Rake, (2) by excavating it out and (3) by dragging the unit forward.

ASH RAKE

Air Burners offers an ash removal implement (ash rake) designed for each model Fire-Box as pictured below. The ash rake is fitted with a universal quick connect faceplate or blank faceplate for installation on your machine.



You can remove some or all of the ash by reaching in through the rear doors with the ash rake and dragging the ash out. **Remember to use the appropriate breathing apparatus, and be cautious of the remaining hot embers.** It is not required to remove all the ash if you are planning on a 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: When removing ashes from the FireBox, make sure that no hot ashes, embers, burning or hot materials are carried by the wind to places where they could start a fire! Wear appropriate PROTECTIVE GEAR.



ASH REMOVAL

HOW TO EMPTY THE S-SERIES UNITS

EXCAVATING

Excavating the ash out is a common method for daily operations as it allow you to maintain the ember base for restarting a new day's burning operations.

You can remove some or all of the ash by reaching in through the rear doors with an excavator and scooping the ash out. **Remember to use the appropriate breathing apparatus, and be cautious of the remaining hot embers.** It is not required to remove all the ash if you are planning on a restart, generally just a "scoop" or two from an excavator 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.

An excavator 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: When removing ash from the FireBox, be aware of the wind direction and insure all operators wear appropriate face masks to prevent inhaling the ash.

DRAGGING

Dragging the unit will allow you to remove all the ash for repositioning or when a job is complete, but it will not allow you to maintain the embers for a "hot start."

Open the back doors and cover the ash with a thin layer of dirt to minimize fly ash. Connect appropriate strength cables or chains to the pad eyes or the pull block on the front of the machine and pull the FireBox forward. The ash will pile up and fall out the back of the unit. Be cautious for the remaining hot embers. Wet the ash pile down, remove unburned chunks of wood and then mix the ash into the native soil or otherwise dispose of it as required by local ordinance.

DANGER: When removing ashes from the FireBox, make sure that no hot ashes, embers, burning or hot materials are carried by the wind to places where they could start a fire!



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 box or loaded the box too fast. Example: if you only have 1 ton of material burning you can not load in 3 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 box is less than 3 feet deep you may need to turn the air down by reducing the engine RPM.

4. Smoke from one area of the box

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 box 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

WARNING:

Should any repairs become necessary that require welding on your FireBox, you MUST first physically remove the Electronic Control Module (ECM) from the computer controlled Diesel engine. Follow the instructions on the inside cover page (Page i) of this Operating Manual.

Consult the supplied HATZ Engine Service Manual, the Electronic Control Panel Manual and the Service Manual of the PTO Manufacturer, such as WPT Power or NACD.

1. Daily Check List:

- A. Oil level (top off as needed)
- B. Engine coolant level (top off as needed)
- C. Diesel fuel level in fuel tank
- D. Tap dirt out of air intake housing and check for excessive dirt
- E. Clean debris off radiator
- F. If Twin Disc PTO, lubricate per page 28

2. Periodic Maintenance

- A. Change oil and oil filter
- B. Clean/replace fuel filters as needed
- C. Clean and inspect air filter and replace as needed
- D. Grease both (inside and outside) air fan bearings every 2 - 4 months
(Do NOT over-grease)
- E. Adjust and grease PTO per supplied PTO Service Manual
- F. Inspect adjustment of coupler hubs and realign by re-adjusting the engine isolators (motor mounts) as needed^{*)}
- G. Check alternator V-belt and adjust as needed

^{*)} For instructions see Appendix A

The HATZ engine does not require DEF.
Contact Air Burners, Inc., should you require assistance with any of these necessary maintenance tasks. Send Email to support@airburners.com, call 772-220-7303 or 888-566-3900 (Customer Support)



THERMO-CERAMIC PATCHING COMPOUND

For minor repair of S-Series refractory panels and doors.

Air Burners Part # 6900-1003 Thermo-Ceramic Wet Pre-Mix

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

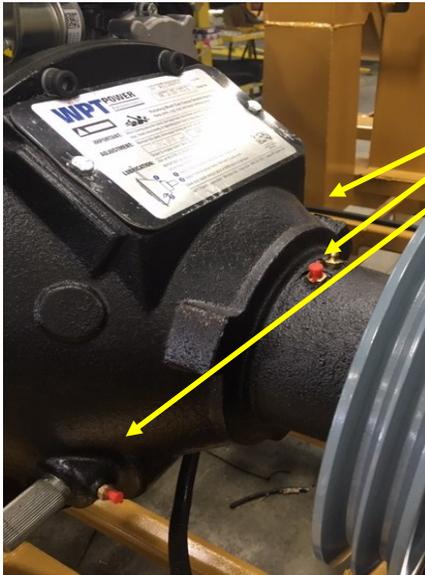
Directions:

- 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 Thermo-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.

**Contact Air Burners, Inc., should you require assistance with
this maintenance tasks. Send Email to support@airburners.com,
call 772-220-7303 or 888-566-3900
(Customer Support)**

PTO MAINTENANCE (Power Take-off)

The WPT manufactured PTO requires grease every 100 hours and the clutch engagement force needs to be checked and adjusted if necessary. See also the WPT manual shipped with each FireBox, if you need additional instructions.



Grease at both sides of the engagement shaft and on top.

The maintenance steps described on this page are mandatory. Neglecting to properly service your PTO as required will void your Warranty. The installed PTO Model is WPT C108. The PTO ID Plate states WTD-08-142E.

If you need technical support, call Air Burners Customer Service at 772-220-7303. To download the official WPT PTO Manual [CLICK HERE](#).

(This Manual is © WPT Power Corporation. Air Burners, Inc. is not responsible for the contents of this publication.)

Check PTO Engagement Force Every 100 Hours

Check first 10 to 20 hours on a new machine, every 100 hours after that

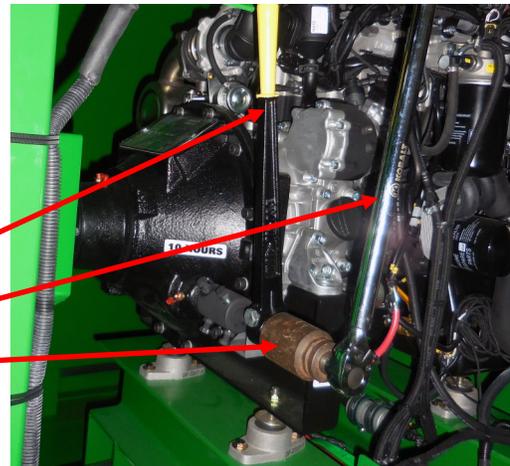
If the engagement force is not maintained, the clutch will slip during operation and damage the clutch plates causing the unit to overheat. This is not covered under Warranty, as it is a maintenance issue.

The C108 PTO engagement force is 71 to 94 ft/lbs on the torque wrench. Using the torque wrench and socket, pull to torque wrench to check engagement force. If the clutch engages before the torque wrench “click”, see [WPT Manual](#) for adjustment instructions.

Engagement Shaft

Torque Wrench

Socket





200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine OPERATING MANUAL

MAINTENANCE AND ADJUSTMENT OF TWIN DISC PTO M CA110IL4

LUBRICATION

Refer to Engineering Drawings for location of fittings. Use NLGI Grade 2 grease with a minimum 300° F (149° C) drop point for all lubrication.

Operating Shaft Fittings

Apply 1 cc of grease (one shot from a grease gun) monthly or every 100 hours of operation at the rear of the housing to both fittings.

Throwout Collar

Apply 1 cc of grease (one shot from a grease gun) daily before start-up through the fitting on the collar trunnion under the instruction plate. Lubricate the ball bearing type of collar every 100 hours of operation. Sealed-for-life ball bearing collar needs no further lubrication.

Main Bearings

Sealed-for-life bearings should be inspected every 4000 hours or two years. To inspect, rotate clutch shaft. If bearings feel smooth and seals look okay, continue to use. If bearings feel rough or seals show sign of aging, replace sealed-for-life bearings.

Pilot Bearing

The pilot bearing supplied with the PTO is pre-lubricated and sealed for life. No maintenance is required. Inspection is recommended every two years or when the PTO is removed from the driving component for servicing.

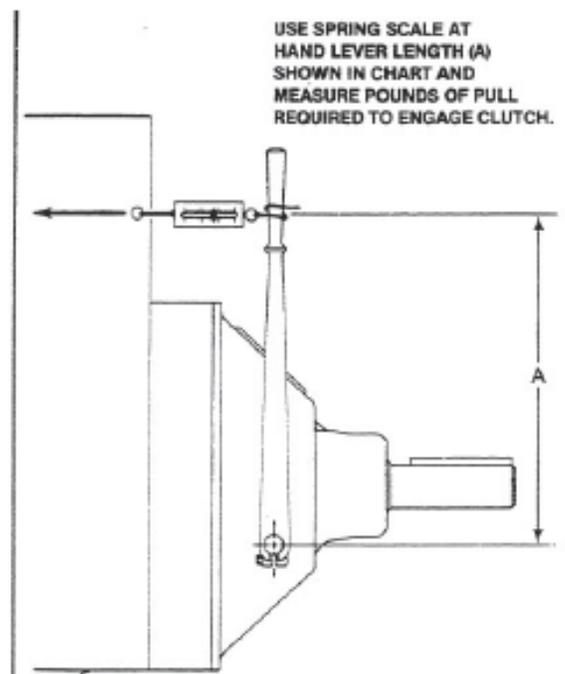
MAINTENANCE AND ADJUSTMENT OF TWIN DISC PTO M CA110IL4

CLUTCH ADJUSTMENT (Page 1)

Note: New PTO's must have clutch adjustment checked before being placed into service and after the first 10 hours of operation. This includes any PTO's with new driving plates. New plates have a wear in period and the clutch may require several adjustments before the new plates are worn in.

The clutch must be adjusted if it overheats, does not pull, or the operating lever jumps from the engaged position.

Adjustment measurements are made by fitting a torque wrench with a 1 1/2" socket over the hex end located at the bottom of the hand lever. Grasp only the torque wrench when making measurements. An optional method for measuring the operating shaft lever torque is to use a spring scale to measure the engaging effort at a fixed distance from the shaft centerline as shown below.



MAINTENANCE AND ADJUSTMENT OF TWIN DISC PTO M CA110IL4
CLUTCH ADJUSTMENT (Page 2)

Clutch Model	Operating Shaft Torque				Hand Lever Effort				Hand Lever Dim. A	
	(LB-FT)		(Nm)		(LB)		(N)		(Inches)	(mm)
	Min	Max	Min	Max	Min	Max	Min	Max	Nominal	Nominal
CA110	88	116	119	158	78	102	347	454	13.6	345
CA210	88	116	119	158	78	102	347	454	13.6	345

Figure 8. Alternate Clutch Adjustment Measurement

1. Disconnect any power engagement devices from the operating shaft if so equipped.

 WARNING

Be sure engine is off before removing instruction plate for adjusting the clutch. Adjusting the clutch with the engine running may result in personal injury and/or damage to equipment.

2. Remove the hand hole plate from the housing and turn the clutch shaft assembly until the adjusting ring lock pin can be reached.
3. Disengage the adjusting ring lock pin and insert a cotter pin, a piece of wire, or a small nail in the cross-drilled hole of the pin to hold it in the disengaged position.
4. Turn the adjusting yoke or ring to the right (or clockwise when looking at the flywheel) until the operating shaft requires a peak torque as shown on the instruction plate (If the instruction plate is missing, use the values listed in Figure 8) to engage the clutch.
5. Remove the cotter pin, wire, or nail that is keeping the adjusting lock pin disengaged, and engage the lock pin.
6. Verify that the engaging hand lever is vertical when the clutch is fully engaged. If not, reposition the engaging hand level.



**200 Series Air Curtain Burner Equipped with HATZ 3H50 or 4H50 Diesel Engine
OPERATING MANUAL**

**Parts List for Routine Service of
HATZ 3H50TIC or 4H40TIC Industrial Diesel Engine (Tier 4 Final)
Refer to Engine Manufacturer's Service Manual for Engine Service Details
(Engine must be serviced after first 50 hours, then every 500 hours of operation or as needed)**

Description	Air Burners P/N	Manufacturer's P/N	Service Interval
Air Filter (Main Element H50)	5000-2338	HATZ 50638200	500 Hours
Air Filter (Secondary Element H50)	5000-2339	HATZ 50638300	500 Hours
Oil Filter H50	5000-2340	HATZ 50638800	500 Hours
Oil Separator H50 (Crank Case Vent)	5000-2341	HATZ 50640500	500 Hours
Fuel Filter H50	5000-2342	HATZ 50638100	500 Hours
Pre-Fuel Filter	5000-2343	HATZ 50638000	500 Hours
Poly-V-Belt (Engine) H50	5000-2344	HATZ 50629401	500 Hours
Fuel/Water Separator Filter (Optional)	5000-1297	RACOR R20P	As needed
Battery, 12V, Max 120 Ah; Max. CCA 800; Min. CCA 750; RC 130	5000-2472	Interstate Batteries 24M-XHD	As needed

Diesel Fuel	Ultra Low Sulfur Fuel Only
Engine Oil	10W40 Diesel Grade - Ultra-Low Sulfur (Most Regions)
Engine Radiator Protection Fluid *)	Coolant Fluid must be approved by HATZ, i.e. Havoline XLC (OF02), Havoline XLC+B, Castrol Radicool SF, Exxon Mobil Delvac ELC Coolant
Bearing Lubricant	NLGI Grade 2
DEF and DPF **)	Not required (Engine meets US EPA Tier 4 Final and EU 97/68 Stage 3 B)
Fuel Tank Capacity	Minimum 58 Gallons (220 Liters)

Consult FireBox Operating Manual for PTO and engine-to-air fan coupler service and adjustment.

*) Contact Air Burners Customer Service Dept. for complete list of HATZ approved Radiator Protection Fluids.

***) DEF = Diesel Exhaust Fluid DPF= Diesel Particulate Filter

**Contact Air Burners, Inc., should you require assistance with any maintenance task.
Email: support@airburners.com
Phone: 772-220-7303 or 888-566-3900
(Customer Support)**

LIFTING POINTS



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*.

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 Fire-Box is placed into service.



APPENDIX A CHECKING COUPLING ALIGNMENT

This Technical Memorandum covers FireBox Models equipped with Dodge Raptor Couplings. The S-27 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.



SHAFT HUB ELEMENT HUB PTO

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

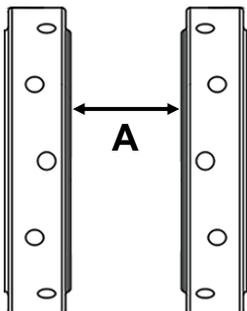
WEAR PROTECTIVE GEAR

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 engine by adjusting the four engine isolators until the measurements of Steps 2, 3 and 4 are achieved.

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:

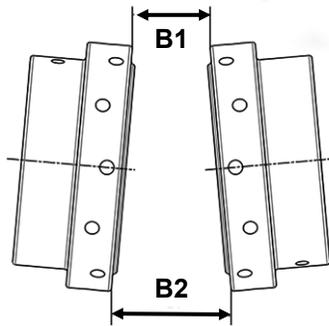


GAP MEASUREMENT "A"		
E20	2.46"	62mm
E30	2.55"	65mm

APPENDIX A

CHECKING COUPLING ALIGNMENT

Step 3 Verify Angular Alignment of Hubs

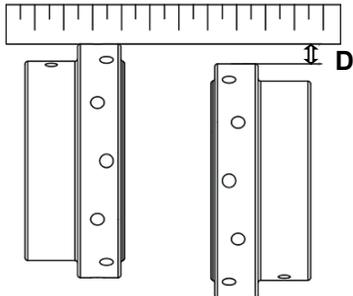


$$C=B2-B1$$

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 engine isolators 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 engine isolators 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