MANUAL

ES700B

SELF CONTAINED MOBILE INDUSTRIAL HEATER

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Equipment Source, Inc.

SPECIFICATIONS:

Dry weight:		4600 LB [2090 KG]
	With skid 101590	5050 [2290]
	With trailer 101159	5950 [2700]
Firing Rate:	Standard	4.3 GPH [16.3 LPH]
	Minimum	3.0 GPH [11.4 LPH]
	Maximum	5.5 GPH [20.8 LPH]
Fuel Type:	ES700B	ULSD
Fuel Storage:	Capacity	240 GAL [910 L]
	Secondary containment	150%
	DOT Classification/Testing	UN IBC
Heater:	Max heat input	770,000 BTU/HR
	Heat exch. material	309S Stainless
	Burner	Carlin 301CRD
	Fan motor	3hp, 208V
	Fan capacity	4000 CFM @ 2.25 in. wg
Generator:	Engine	Kubota D1105
	Generator	Mecc Alte
	Engine continuous power	10.1 kW
	Main breaker rating	30A
	Voltage	208Y/120V
	Aux power	20A, 120V, 60Hz

1 INTRODUCTION

WARNING
Read and understand this manual before attempting to operate this machine.

1.1 GENERAL DESCRIPTION

The ES700B is an indirect oil-fired forced-air heater with a maximum firing rate of approximately 770,000 BTUs/hour. The heater is intended for outdoor use and can be mounted on a trailer or skid mounted for jobsite portability. The heater has an integral 240-gallon [910 L] fuel storage tank with secondary containment. The heater is designed to operate reliably at extremely low temperatures and has been proven on Alaska's North Slope oil fields. Large doors on all sides of the heater allow easy and safe service access in industrial environments. All heat exchanger surfaces are constructed from ANSI 309S stainless steel for extended life.

1.2 MANUAL APPLICABILITY

This manual is applicable to the following Equipment Source Incorporated (ESI) machine models:

Model	ESI No.	Description
ES700B	101160-01	Standard Heater

This manual should be kept with the machine at all times. Immediately contact Equipment Source Incorporated (manufacture) or an authorize dealer to obtain a copy of this manual if missing or damaged. Refer to www.equipmentsourceinc.com for current contact information.

1.3 MANUAL SCOPE

This manual contains basic operating and maintenance instructions for the above listed heater products. Specific information concerning trailers, skid frames or other transport provisions are not included in this manual. Refer to the manual provided with the transport accessory. For detailed service instructions concerning specific electrical or mechanical components, refer to the operation and maintenance manual provided by the manufacture of the component or contact an authorized service provider.

1.4 EQUIPMENT SOURCE INC: LIMITED WARRANTY

WARRANTY INFORMATION

Equipment Source Inc. (ESI) warrant to you, the original purchaser, that all parts (except those 3rd party components listed below) of your new ESI product purchased from an Authorized ESI Distributer or from ESI directly will be free from defects in materials or workmanship for 1 (one) year/2,000 hours (whichever occurs first) from invoice date. Additional component warranties are listed below.

Summary of major component warranties (see component sections of this manual for further details and additional warranties). Warranty periods are from invoice date. Not all of the following components are applicable to every product. All warranty time periods begin at invoice date:

1. Engine – 2 (two) years / 2,000 hours, whichever occurs first (please refer to the Kubota Engine Warranty sheet enclosed in this manual).
2. Generator and Controls – Free from defects in materials or workmanship for 1 (one) year / 2,000 hours.
3. Flagro Heater / Fire Box - 1 (one) year / 2,000 hours
4. ESI Manufactured Firebox– free from defects in materials or workmanship for 3 (three).
5. Pump – 1 (one) year (please refer to the pump warranty sheet enclosed in this manual), wear parts are not covered under warranty.
6. Buderus Boiler – 2 (two) years limited warranty, please refer to Buderus warranty sheet enclosed in this manual.

In order to obtain warranty repairs, you must deliver the product, at your expense, together with proof of purchase to 1919 Van Horn Road, Fairbanks, AK 99701 (907.458.9049) or 7780 Old Seward Highway, Anchorage, AK 99518 (907.341.2250). Call 907.458.9049 from outside Alaska. Offsite warranty may be performed if customer pays all travel and shipping expenses.

No person, agent or dealer is authorized to give any warranties on the behalf of ESI, nor is to assume for this company any other liability in connection with any of ESI's products unless made in writing and signed by an officer of ESI. This warranty supersedes and is in leu of all other warranties, expressed or implied including terms and conditions of Purchase Orders. The company must be notified within 5 (five) business days, in writing of any product failure and warranty claim.

WHAT THE WARRANTY DOES NOT COVER

This warranty **does not** cover:

1. Damage, malfunction or failures resulting from accidents, abuse, misuse, modifications, alteration, improper servicing or lack of performance of required maintenance service voids the warranty including but not limited to regularly scheduled oil changes and filter changes.
2. Damage, malfunction or failures resulting from underloading of the engine (also known as wet stacking) voids the warranty. Refer to the Operations and Maintenance manual for proper engine loading requirements.
3. Normal maintenance services or replacement of maintenance items such as light bulbs, preheater plugs, heater nozzles, filter elements, lubricants, oils, coolant, belts, tires, or other wear items.
4. This warranty does not cover cosmetic damage.
5. 3rd party parts installed on ESI products. Unauthorized modifications to the unit will void the warranty and may impair function.
6. Failure of or damage caused by ancillary systems. These include but are not limited to failures of the fuel or oil system (not provided by ESI), HVAC system, building / structure or other systems.
7. Units placed in storage must be stored out of the elements and protected from rain, snow and sunlight. The warranty will be voided for units left exposed to the elements during storage. ESI built unit enclosures provide sufficient protection when properly closed.
8. Improperly installed products. Operating the unit on or in the packing pallet or crate or improperly mounted skid generator (including installation of isolators between the skid and mounting surface) voids the warranty. Consult the product operator's manual for required installation procedures.
9. Installation of electrical components by anyone other than a licensed electrician voids the warranty.
10. Use of the unit for application other than what the product was meant for voids the warranty.
11. Warranty coverage expires whenever the client, for whatever reason, is late in payment.

12. The warranty does not cover repairs or modifications for small oil weeps on Long Run Oil Tanks (if installed). A small amounting of weeping during break in and use is expected and does not warrant repairs.

LIMITATION ON ESI's RESPONSIBILITY

Our responsibility for any and all losses and damages resulting from any cause whatsoever, including our negligence, alleged damage or defective goods, whether such defects are discoverable or latent, shall be limited to the repair or replacement of defective parts. IN NO EVENT WILL ESI BE LIABLE FOR LOSS OF USE, LOSS OF PROFITS, LOSS OF OR DAMAGE TO OTHER PROPERTY, INCONVENIENCE, COMMERCIAL LOSS, ENVIRONMENTAL CLEANUP OR OTHER SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER. ESI will in no event be liable for fuel, oil, coolant or other spills or cleanup regardless of cause or fault. Proper containment and monitoring is the sole responsibility of the end user. In no event shall ESI's liability ever exceed the purchase price of the specific unit in questions.

MONITORING REQUIREMENTS

Frequent monitoring of equipment is vital for proper operation and maintenance of the equipment. All equipment must be monitored daily by trained technicians (or more frequently if indicated in the Operation Manual). Monitoring can be achieved via electronic monitoring systems for remote installations (unless otherwise noted in the Operation Manual). The following unit conditions must be monitored on a daily basis, failure to do so will void all warranties. Additional monitoring may be required depending on site specific requirements.

- General inspection of unit to include: inspection for leaks, damage to unit, improper operation, malfunctioning equipment, error codes or other issues.
- Inspect coolant level and condition. Add coolant as needed to maintain proper coolant levels. Replace coolant if coolant condition has degraded.
- Inspect oil level and condition. Add oil as needed to maintain proper oil levels. Replace oil at recommended service intervals or if oil is found to have degraded.
- Inspect Engine temperature and engine speed.
- Inspect containment, check for leaks and presence of fluids in containment

Maintenance logs must be maintained for the unit and provided to ESI for warranty claims. ESI offers monitoring equipment for electronic monitoring.

OPERATION & SAFETY REQUIREMENTS

Failure to adhere to these requirements will void all warranties.

- Read and understand carefully all components of the Operator's Manual prior to starting or operating the unit.
- Learn how to operate and work safely. Know your equipment and its limitations. Always keep the engine in good condition.
- Do not carry out maintenance on a running or hot unit. Keep hands away from moving parts.
- Do not climb on top of the unit to perform work of any kind.
- When lifting the unit, ensure that the lifting device is rated for the unit weight. Only lift the unit with provided lifting rings or fork pockets.
- In case of emergency, shut off the engine and notify the person in responsible charge.
- Follow all applicable laws and regulations regarding operation and maintenance of the unit.
- For Trailer Mounted Units:
    - Ensure that the trailer is registered with an applicable transport authority before towing.
    - Complete a thorough walk around inspection of the unit before towing. Inspect for damage or abnormalities and repair as needed before travel.
    - Disconnect the trailer from the tow vehicle, place wheel chocks behind the wheels and level prior to running or operating the unit.
- Refer to the various component sections of the Operator's Manual for proper maintenance and service intervals.

Failure to adhere to any of the above requirements or the requirements of Installation Instructions or Operations and Maintenance Manual will void all warranties. ESI reserves the right to update or modify this warranty at time. Contact ESI for a current warranty.

1.5 24HR UNATTENDED USE

Equipment Source Inc (ESI) manufacturers a variety of mobile heaters that are designed and intended for continuous 24/7 Unattended heating applications in temporary and permanent applications. These heaters are designed, manufactured and tested for unmonitored 24/7 use. The heaters should be monitored on a daily basis but do not require continuous 24/7 monitoring. Operators should adhere to the Operations and Maintenance manual pertaining to the specific piece of equipment as well as local, state and federal laws.

ESI mobile heaters are manufactured to the highest industry standard with 110%+ fluid containment within the unit. The units are supplied with fuel from the on-board fuel tank located within the containment basin using an electric fuel pump that turns off if the unit shuts down due to failure. These heaters are manufactured with UL listed components and to UL listed standards as well as CSA standards.

ESI heaters have a long history of safe reliable use on construction sites, DOD facilities, oil and gas fields and other facilities. ESI heaters have a clean safety record with no reports of major safety incidents. They are approved for use as described above by all of the major oil companies including but not limited to BP, Conoco, Exxon, Alyeska Pipeline Service Company and Hilcorp.

TABLE OF CONTENTS

Manual Supplements:

A. Carlin 301CRD Instruction Manual
B. Kubota Diesel Engine Operator's Manual
C. GreenHeck Utility Fan Operation Manual

2 SAFETY GUIDELINES

WARNING (RISK OF DEATH OR SERIOUS INJURY)

- Never attempt to operate this machine indoors. Exhaust fumes from the engine and heater can kill.
- Read and understand the operating instructions in this manual before attempting to operate this machine

2.1 TRAINING

- Never allow untrained personnel to operate or service the machine. Take time to read the manual and discuss safe practices with jobsite personnel.
- Read and understand the operating section of this manual.
- Take time to familiarize yourself with the controls and instructional placards before operating or servicing.
- Contact Equipment Source if additional training is necessary.

2.2 OPERATING

- Some components are hot while in operation. Keep children, clothing and combustibles away.
- Wear protective clothing appropriate to the jobsite. Always wear safety glasses.
- Observe changes in the operating environment and respond accordingly.

2.3 SERVICE

- Only trained service technicians should attempt to service the machine.
- Properly shutdown the machine and let cool completely before attempting to service any component.
- Never defeat the safety devices
- Never modify the machine

3 TRANSPORTING AND STORAGE

3.1 DIMENSIONS AND WEIGHTS

Machine Weights *: Dry.....4600 LB [2090 KG]

With skid 101590.....5050 [2290]

With trailer 101159.....5950 [2700]

Trailer 101159 GVW.....7800 [3350]

Trailer 101159 Max Tongue.....600 [270]

*All weights are approximate

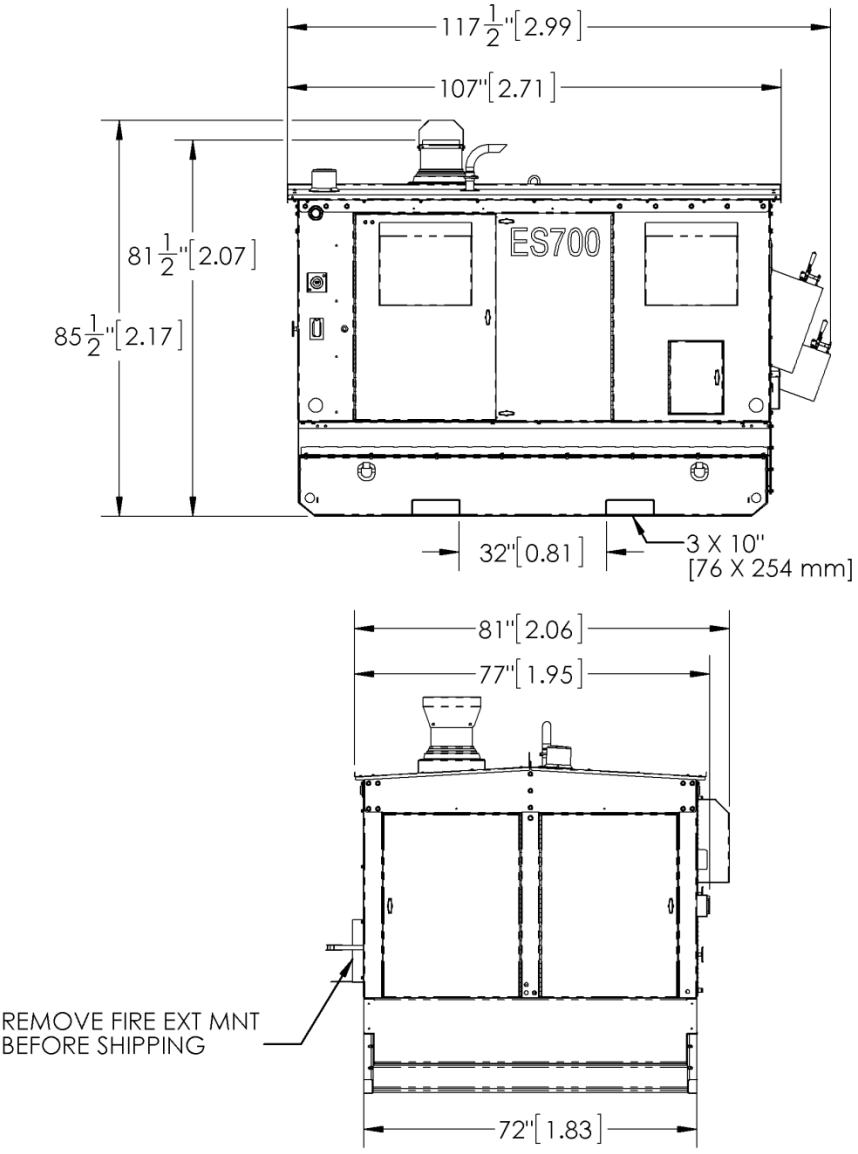

Figure 1. Machine dimensions mounted on Skid PN 101590. Dimensions are in inches [meters] unless noted.

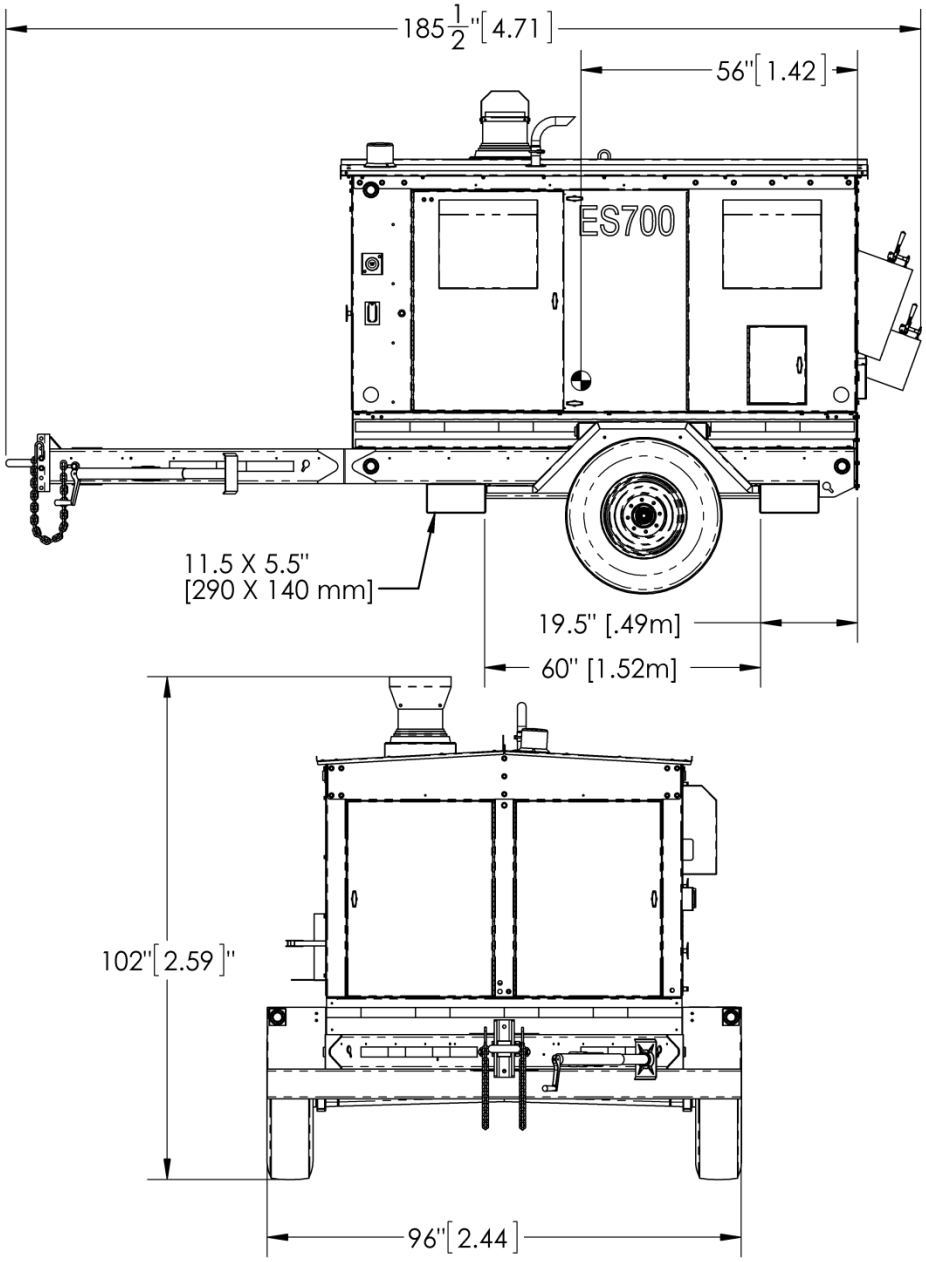

Figure 2. Machine dimensions mounted on Trailer PN 101159. Dimensions are in inches [meters] unless noted.

3.2 LIFTING

- Use an appropriately sized forklift to lift the machine using the provided fork pockets.
- A single-point lifting bale is provided on the top of the enclosure for crane hoisting. Use rigging equipment rated at 4 tons minimum.

3.3 TRANSPORTING ON A FLATBED TRUCK

1. Lift the machine following the guidelines presented in Section 3.2 *Lifting.*
2. Fully retract trailer jack stand before securing on a flatbed trailer. The trailer can be tilted to rest directly on the hitch.
3. Secure the machine using the chain slot tie-downs and the axle if equipped.
4. Ensure all doors are closed and locked.

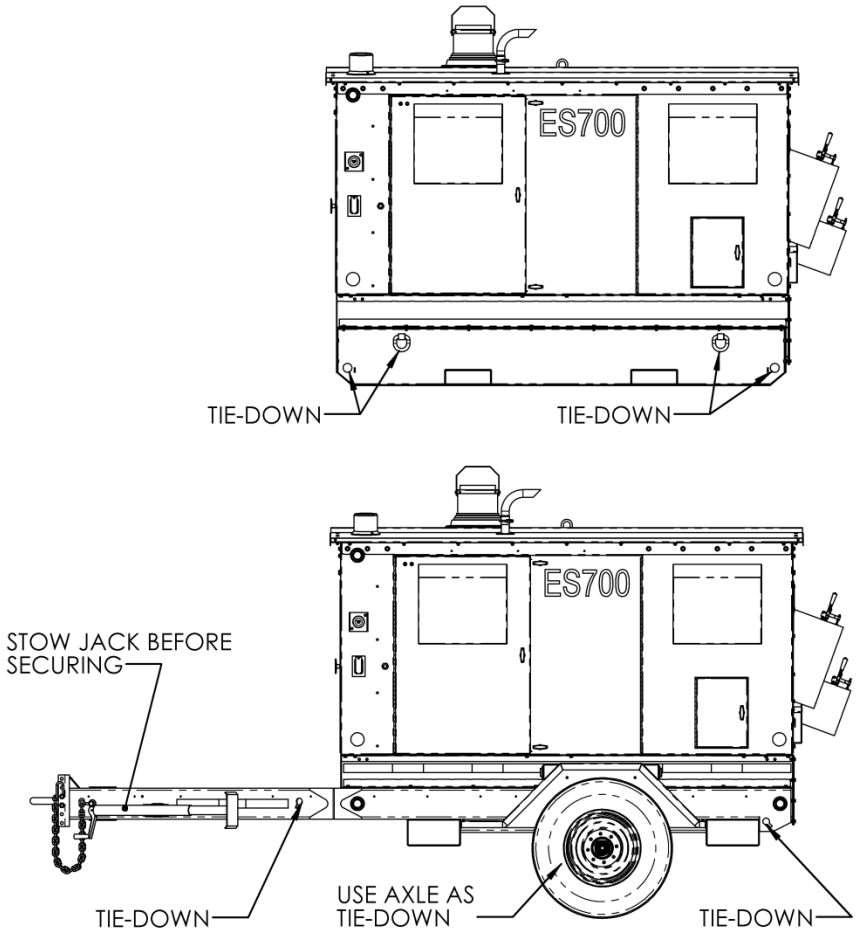

Figure 3. Machine tie-downs for shipping (Typical)

3.4 STORAGE

CAUTION
Failure to follow the shutdown procedure can cause serious damage to the burner assembly.

3.4.1 SHORT-TERM STORAGE (LESS THAN 90 DAYS)

1. Shutdown the machine using the shutdown procedure (Section 4.8 *Shutdown*)
2. Verify that main breaker and control switches are in the off position
3. Close and latch doors, stow loose accessories
4. Chock tires

3.4.2 LONG-TERM STORAGE (GREATER THAN 90 DAYS)

1. Shutdown the machine using the shutdown procedure (Section 4.8 *Shutdown*)
2. Verify that the main breaker and control switches are in the off position
3. Disconnect the battery using the master disconnect switch
4. Drain water from fuel filters
5. After the heater has cooled sufficiently, cover the chimney with a durable material to prevent animal intrusion.
6. Ensure the heater is positioned on thaw-stable ground if applicable. Add blocks to support the tongue as necessary.
7. Chock tires

3.5 PREPARING THE MACHINE FOR SEASONAL OPERATION

Follow this procedure to prepare the machine for seasonal operation or any time the machine is removed from long-term storage:

1. Remove any protective coverings from the exhaust outlets
2. Clean the inside of the enclosure to remove any debris
3. Check containment for accumulation of liquids
4. Replace the burner nozzle
5. Inspect electrical system and controls for damage
6. Inspect fuel system for wear or damage
7. Repack wheel bearings
8. Replace fuel filters
9. Verify burner electrode position
10. Verify fuel pump pressure
11. Verify combustion quality
12. Check all lights and replace as necessary
13. Check tire pressure (if applicable)
14. Run heater for 1 hour to verify operation of all components

4 OPERATION

WARNING
Always install a CO gas monitor in enclosed environments that are heated with oil burning force air heaters.

CAUTION
The correct shutdown procedure must be followed to prevent damage to the burner assembly.

Figure 4. Control panel

4.1 DUCT SELECTION

4.1.1 GENERAL GUIDELINES

The ES700B heater is an outdoor heater designed to safely heat enclosures using flexible duct connections. For efficient operation, keep duct lengths as short as possible. Excessive duct lengths will reduce air flow in the heat exchanger and cause the burner to cycle to control the outlet temperature. Excessive burner cycling shortens the life of the heat exchanger and should be avoided. Burner cycling can be controlled by reducing duct length, increasing the duct diameter, or adjusting the burn rate (see Section 4.9).

An inlet duct is not required for normal operation. It can be used to circulate warm air back from an enclosure for re-heating.

4.1.2 DUCT SIZES

Minimum inlet duct size .....20”

Minimum outlet duct size .....12”

Available outlet duct sizes ..... 2x12”, 1x16”

4.2 RECOMMENDED FUELS AND FUELING INSTRUCTIONS

CAUTION
Do not overfill tanks. Tanks should be filled to only 90% of the full volume to allow thermal expansion.

Use ULSD No.1 or ULSD No.2 for all heater models except the ES700B-ED. For continuous duty operation, a daily refilling schedule should be established.

4.2.1 ES700B-ED (AUX TANK EQUIPPED MACHINE) REFUELING INSTRUCTIONS

The ES700B-ED model has an auxiliary fuel tank for the engine. This allows locally approved heating oil to be used in the burner and ULSD fuel for the engine. Observe machine placards for fuel types and placement.

CAUTION
ES700B-ED Model: Always refill the auxiliary ULSD tank when filling the main heating oil tank to prevent engine failure while the heater is operating. Premature generator shutdown can damage the burner.

4.3 ACCESS AND CLEARANCE

Ensure all sides of the heater are easily accessible. Heater should be more than 3ft [1m] from any structure. Heater is correctly placed when the operator can walk around the perimeter of the heater with minimal obstruction. Check for placement and access of fire extinguisher.

4.4 LEVELING

Ensure heater is placed on firm ground and wheels (if equipped) are chocked. Heater should be close to level across the width (±1°). The heaters should be slightly lower in the front to maximize fuel tank capacity. For trailer mounted heaters, use the tongue jack to level the heater and then lower the tongue jack 1 to 2 inches (2.5 to 5cm).

If the heater is placed on frozen ground or ice, frequently check the heater for shifting and reposition/level as necessary.

4.5 PRE-STARTUP CHECKLIST

Use the following checklist to determine whether the machine can be safely started and operated:

1. **Heater is level and on stable ground (per Section 4.4)**
2. **Wheels are chocked**
3. **Exhaust vents are free of obstruction**
4. **3ft [1m] clearance from permanent structures on all sides**
5. **Fire extinguisher is accessible**
6. **Water is drained from fuel filters**
7. **Engine oil and coolant levels normal**
8. **Fuel tank filled with recommended fuel type**
9. **Inlet and outlet ducts are free of obstruction**
10. **Machine safeguards are connected and functioning**

4.6 STARTUP

Use the following checklist to start and operate the machine. Open the door labeled “Machine Controls” to access all required controls.

1. **Turn off the Master Disconnect Breaker and the Burner Control Switch**
2. **Turn the key switch to position I for 15 seconds**
3. **Turn the key switch to position II to engage starter**
4. **Let generator engine warm for at least 1 minute**
5. **Turn on Master Disconnect Breaker**
6. **Turn on Fan**
7. **Cycle the Burner Control Switch to provide heat as necessary**

4.7 MONITORING AND OPERATION

4.7.1 DAILY INSPECTION

- Listen for abnormal sounds
- Check fluid levels
- Observe burn quality (no smoke should be visible)
- Check if level and secure
- Check vents for icing or other obstructions
- Check fire extinguisher access.
- Observe recommended maintenance schedule

4.7.2 ADJUSTING HEAT OUTPUT

- Connect an external thermostat (see wiring diagram) to control building heat.
- Increase the outlet temperature by constricting the outlet airflow or changing the fan belt pulleys. The outlet temperature is limited to 220F and undesirable burner cycling will occur if the ducts are excessively restricted. Increasing the outlet temperature by reducing the air flow will never increase the heat output.
- Increase or decrease the outlet temperature and heat output by adjusting the firing rate (refer to Section *Adjusting the Firing Rate)*

4.8 SHUTDOWN

CAUTION
The following shutdown procedure must be observed to prevent damage to the burner.

Shutdown procedure:

1. **Shutdown burner using the control switch**
2. **Let the generator and fan run for 5 minutes**
3. **Turn off fan**
4. **Turn off generator**

4.9 ADJUSTING THE FIRING RATE

The firing rate can be adjusted by changing the nozzle size or adjusting the fuel pressure. Refer to the instruction manual supplied for the Carlin 301CRD oil burner the following Nozzle Capacity Chart when making adjustments to the firing rate and airflow. Changing the firing rate may require adjustments to the air flow.

4.9.1 STANDARD FIRING RATE

A new ES700B series heater comes equipped with a 3.5 GPH nozzle. The fuel pressure on a new machine is tuned to 150 PSI resulting in a 4.3 GPH firing rate.

4.9.2 MAXIMUM FIRING RATE

Nozzles rated up to 4.5 GPH @ 100 PSI and pressures up to 150 PSI can be safely used if additional heat is required or the outlet air temperature is low. Low outlet air temperature can also be increased by constricting the airflow in the outlet ducts or changing the belt pulleys to reduce the fan speed.

4.9.3 WHEN TO REDUCE THE FIRING RATE

The firing rate should be reduced if the burner cycles during normal operation as a result of excessive outlet temperature. Excessive burner cycling will shorten the life of the heat exchanger. The firing rate can be reduced by adjusting the fuel pressure or using a smaller nozzle. The minimum nozzle size is 3.0 GPH.

Consider shortening the duct length or increasing the size of the ducts before reducing the firing rate.

Table 1. Nozzle Capacity Chart

Rate GPM @ 100 PSI	Operating Pressure (PSI)		
	125	140	150
3.0	3.35	3.55	3.67
3.5	3.91	4.14	4.29
4.0	4.47	4.73	4.90
4.5	5.04	5.32	5.51

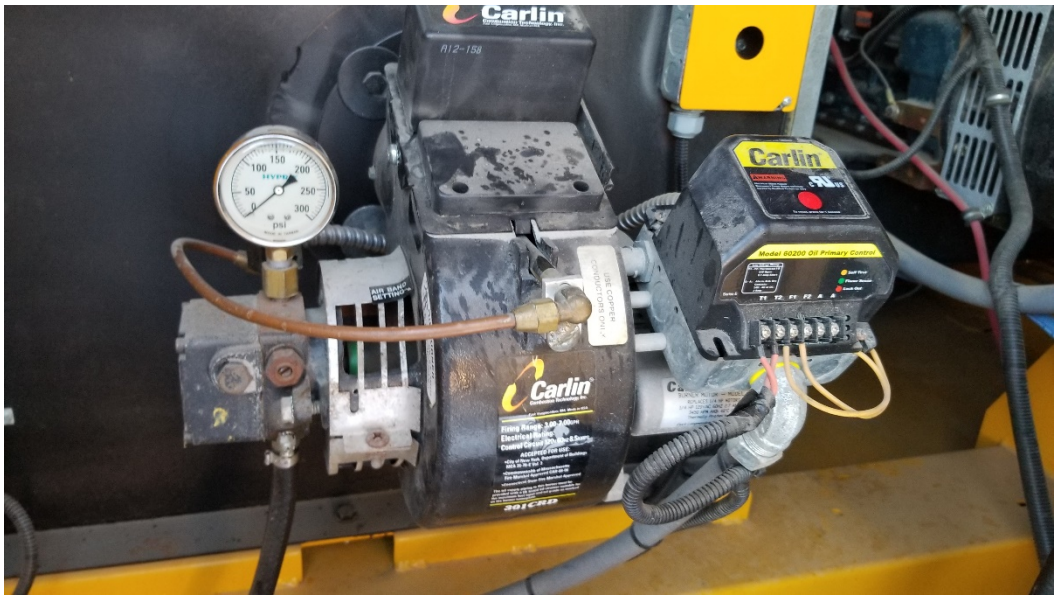

Figure 5. Burner pressure control

4.10 AUXILIARY POWER CONNECTION

All machine models are equipped with a 120V, 20A, 60Hz auxiliary (AUX) GFCI receptacle. The AUX power connection can be used to run work lights and tools as needed on a construction site while the heater is operating. The primary purpose of this product is not a jobsite generator; avoid using the AUX power connection for extended periods while the heater is not operating to prevent under-loading or "wet stacking" the engine.

5 MAINTENANCE

WARNING
Some following maintenance operations should only be completed by a trained technician. Do not attempt to access the electrical panels or service the burner unless you are a trained technician.

5.1 MAINTENANCE SCHEDULE

Table 2. Maintenance Schedule

Interval (Hours)	Maintenance Instruction	Notes
Daily	▪ Check primary fuel filters for water and drain as necessary	▪ Applies to both burner and engine filters
Every 1000 hours Or 12 months	▪ Change all fuel filters ▪ Check air filter ▪ Check engine fan belt and heater fan belt(s)	▪ Use Racor R60S Primary Filter ▪ Check air filter every 500 hours if operating in a dusty environment
Every 3000 hours Or 12 months	▪ Change oil and oil filters ▪ Change Fuel Filters ▪ Change engine fan belt ▪ Change heater fan belt(s) ▪ Lubricate fan pill block and motor bearings ▪ Replace burner nozzle and adjust electrodes	▪ Engine oil: SAE30, SAE10W-30 or 15-40 Engine oil must meet API Spec: CF, CF-4, CG-4, CH-4 or CI-4 ▪ Oil Capacity: 12 GAL [45 L] (ES700B-E_) ▪ Use Lithium NGLI Grade 2 for fan pill block and motor bearings ▪ Use Racor R60S primary filters for both engine and burner ▪ Set blower belt deflection to 3/16”
Every 6000 hours Or 3 years	▪ Change coolant	▪ Use Rottella ELC or equivalent
Every 9000 hours	▪ Injection pump service ▪ Valve clearance service	▪ Contact Kubota service rep. for valve and fuel injection service

5.2 COMMON PARTS

Generator Size	8KW
Engine Make	Kubota
Engine Model	D1105
Oil Filter (Engine)	2ea 16121-32430 (3,000 hrs)
Oil Capacity 10w30	8 Gal (3,000 hrs)
Air Filter (Engine)	15741-11083 (3,000 hrs)
Engine Fuel Filters	15221-43170 (1,000 hrs)
Engine Auxiliary Fuel Filter	R60T [10 micron] (3,000 hrs)
Fire Box Make	ESI
Fire Box P/N	100993
Burner Fuel Filter	R60T [10 micron] –or—R60P [30 micron] (3,000 hrs)
Blower Fan Belt	
Burner	Carlin 301 CRD

5.3 ENGINE SERVICE

Use engine operator's or service manual provided for further instruction on how to complete routine service or trouble shooting.

5.4 FAN SERVICE

For additional maintenance information, refer to the blower manufacture's manual.

5.4.1 BELT TENSIONING AND REPLACEMENT

Belts tend to stretch and should be periodically checked for tension and wear. The belt is properly tensioned when the belt defects approximately 3/16 in [5 mm] with moderate thumb pressure. Use the belt tensioning screws on the motor mounting plate to adjust the belt tension.

Replace belts if cracking or fraying is observed. Abnormal belt wear or rapid wear rates may be the result of pulley misalignment. Refer to the maintenance manual provided by the blower manufacture for additional adjustment information.

5.4.2 LUBRICATION

Use a high quality lithium based grease conforming to NGLI Grade 2 to lubricate the billow block bearings and motor bearings every 3000 hours of operation.

5.4.3 CLEANING/DEICING INLET SCREEN

WARNING
Do not attempt to open blower inlet access unless the machine is completely shut down and cooled

The blower fan inlet should be periodically checked for icing when operated in winter conditions. If necessary, remove the four (4) bolts **(A)** required to access the blower inlet to clear ice. Do not attempt to open the blower access door unless the machine heater is shutdown using the shutdown procedure.

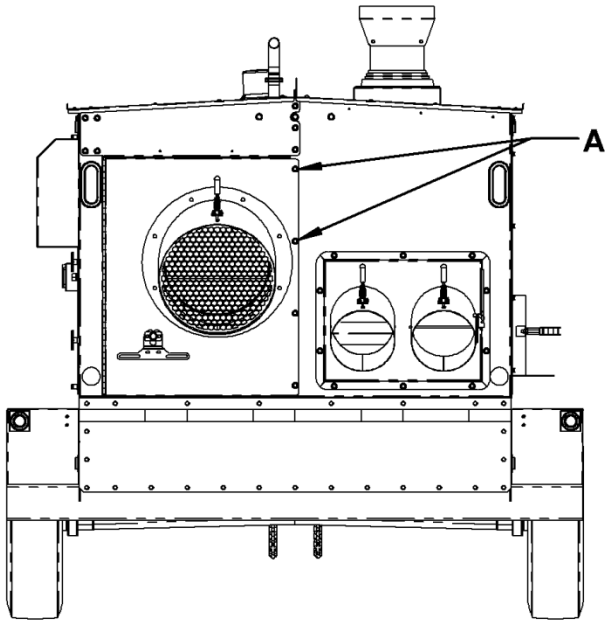

Figure 6. Blower Inlet Access

5.5 BURNER MAINTENANCE

Refer to the Carlin 301CRD Instruction Manual for further instruction on how to complete routine service or trouble shooting. Only qualified technicians should attempt to service the burner.

6 BASIC TROUBLE SHOOTING

WARNING
Some of the following trouble shooting operations should only be completed by a trained technician. Do not attempt to open electrical panels or service the burner unless you are a trained technician.

Use the following troubleshooting guidelines to resolve problems that may encountered while operating the ES700B heater. Contact your service representative or refer to the attached operations manual specific to the burner, engine or fan if the problem cannot be resolved using this guide.

6.1 BURNER TROUBLE SHOOTING

ES700s use Carlin 301CRD burners with the 60200 controller. The controller has a pre-purge of 30 seconds and a post-purge of 5 minutes. There is a low voltage continuity loop through the burner safeties to the thermostat terminals on the controller (the "TT" terminals on the burner controller). If any one of the safeties breaks continuity, the burner will not start. This greatly simplifies trouble shooting the burner.

Table 3. Burner Safeties/Controls

Safety	Purpose
Heat exchanger over temperature NOTE: This safety must be manually reset.	Air blockage safety: shuts down burner if the heat exchanger working air temperature exceeds 350F [180C].
Pressure safety	Shuts down burner if the main blower fan is not running
Enclosure over temperature	Shuts down burner if the enclosure air temperature exceeds 120F [50C]
Outlet air temperature control	Maintains output temperature between 160 to 220F [70 to 105C]

Figure 7. Burner and Safety Controls

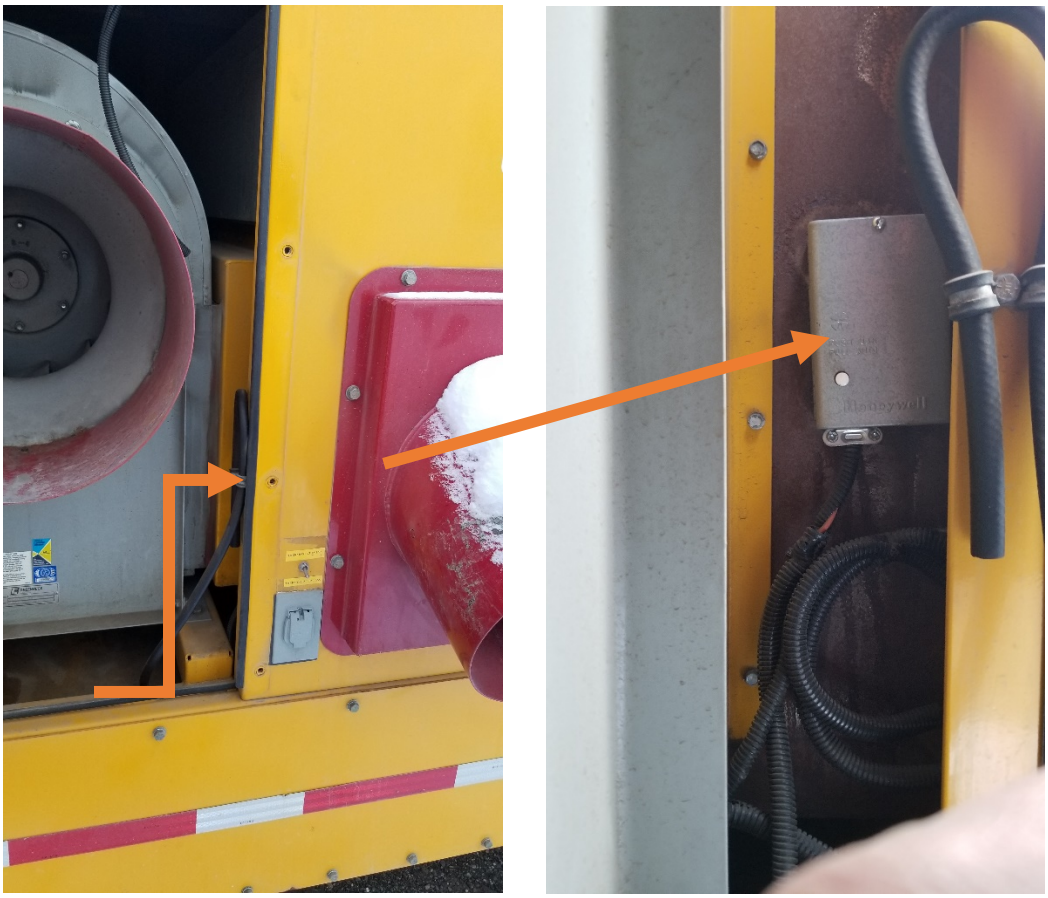

Figure 8. Outlet Air Temperature Control

Table 4. Burner Trouble Shooting Guide

Problem	Solution
Burner cycling (frequently starting and stopping during normal operation)	▪ Check for flow restrictions in the inlet or outlet ducts ▪ Reduce duct lengths or increase duct diameters ▪ Reduce the firing rate
Red LED is on	▪ The controller has been locked out because of a flame, fuel or controller failure. Press the reset button for one second to reset controller. ▪ If the burner begins running again but the fuel pressure gauge fluctuates, check fuel level and/or check for vacuum leaks in the pickup tubes. ▪ If the LED immediately returns to red, the controller may have failed. Replace with a Carlin 60200 controller.
Amber LED is blinking	▪ Momentarily disconnect one of the yellow wires connected to the "FF" terminals on the controller. ▪ If the amber light stays on, replace the controller.
Red and Amber LEDs are off but the burner fails to start NOTE: Fan must be running for burner to start	▪ Reset the reset the heat exchanger over-temperature safety. ▪ If resetting fails, test the control loop connected to the TT terminals by disconnecting one wire and testing with an Ohmmeter while the main fan is running and the burner switch is on. ▪ If continuity in the circuit is broken, check sensors and wiring. ▪ If continuity in the control circuit is OK, check the burner circuit breaker. ▪ Check power wiring and voltage if necessary.

6.2 FAN TROUBLE SHOOTING

Table 5. Fan Trouble Shooting Guide

Problem	Solution
Motor overload trips	▪ Reset motor overload and continue operation
Motor overload repeatedly trips	▪ Check and grease motor and fan bearings. Replace bearings/motor if worn or seized ▪ Check fan belt alignment ▪ Replace motor overload heaters in the motor starter box
Fan belt wears quickly	▪ Check belt alignment and tension

6.3 ENGINE TROUBLE SHOOTING

Table 6. Engine Trouble Shooting Guide

Problem	Solution
Engine controller fails (no low oil pressure light when the key switch is turned to position I)	▪ Check position of battery main disconnect ▪ Check condition of battery ▪ Reset 15A breaker on controller panel. If repeatedly tripping, refer to 12V electrical schematics and check for a ground fault ▪ Check 40A fuse near the starter terminal. Replace if necessary, and check for ground fault if repeatedly failing.
Starter fails to engage Note: Engine preheat (glow plug) timer prevents engagement of starter until the 15 second cycle is complete	▪ Check if engine controller is functioning (see "Engine controller fails") ▪ Check condition of battery ▪ Reset the 30A breaker on the control panel. If tripping repeatedly, Check for ground fault in 12V system and check cooling fan current (should be <20A). ▪ Check the 40A relays in the control panel. All three relays must be working for the system to operate.
Starter engages, but engine fails to start	▪ Check fuel level ▪ Check for water in fuel and drain completely if present. ▪ Check electric fuel pump. The pump should audibly engage when the key switch is in position **I**. ▪ If cold (less than 0F [-18C]), the engine block/oil pan heater should be plugged in for 4-hours prior to starting. ▪ Check engine preheat (glow plug) circuit. Circuit should draw 15-25A for 15 seconds when the key switch is in the **I** position. ▪ Check power supply to fuel solenoid on the engine fuel pump
Engine stops after 20 seconds	▪ Check engine oil pressure switch ▪ Extreme cold may cause the engine oil pressure switch to temporarily malfunction. Plug in engine block/oil pan heater for at least 4-hours if temperature is lower than 0F [-18C]. ▪ Check indicator lights for high temperature alarm. Check sensor for ground fault if the sensor is active when the engine is cold.
Engine fails from over temp sensor	▪ Check 12V cooling fan for correct operation. See below "12V cooling fan failed" if fan has failed. ▪ Check coolant level - CAUTION: Wait until engine has cooled completely ▪ Check coolant condition ▪ Check fan belt ▪ Check sensor for ground fault

12V cooling fan failed (Fan fails to engage when the enclosure temperature is over 70F [20C])	▪ If control panel is functioning, check 30A breaker on the engine control panel. ▪ If the engine control panel fails to start, see “Engine controller fails” ▪ Check fan thermostat circuit ▪ The fan should draw approximately 17-20A if operating correctly. ▪ Check/replace the three 40A Bosch style relays in the engine control panel. All three relays must be working for the fan to operate. ▪ Replace fan

7 ELECTRICAL SCHEMATICS

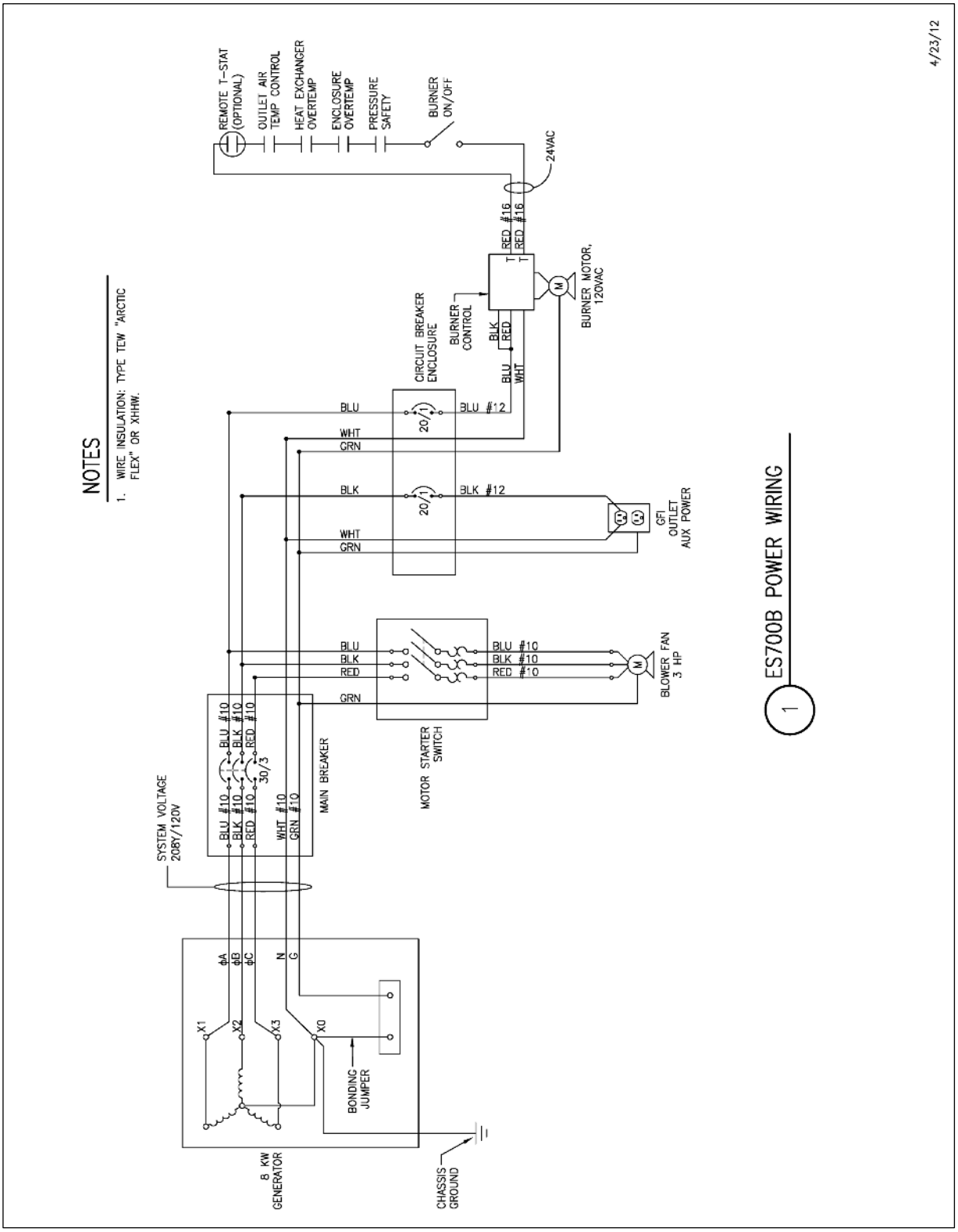

Figure 9. ES700B Power Wiring

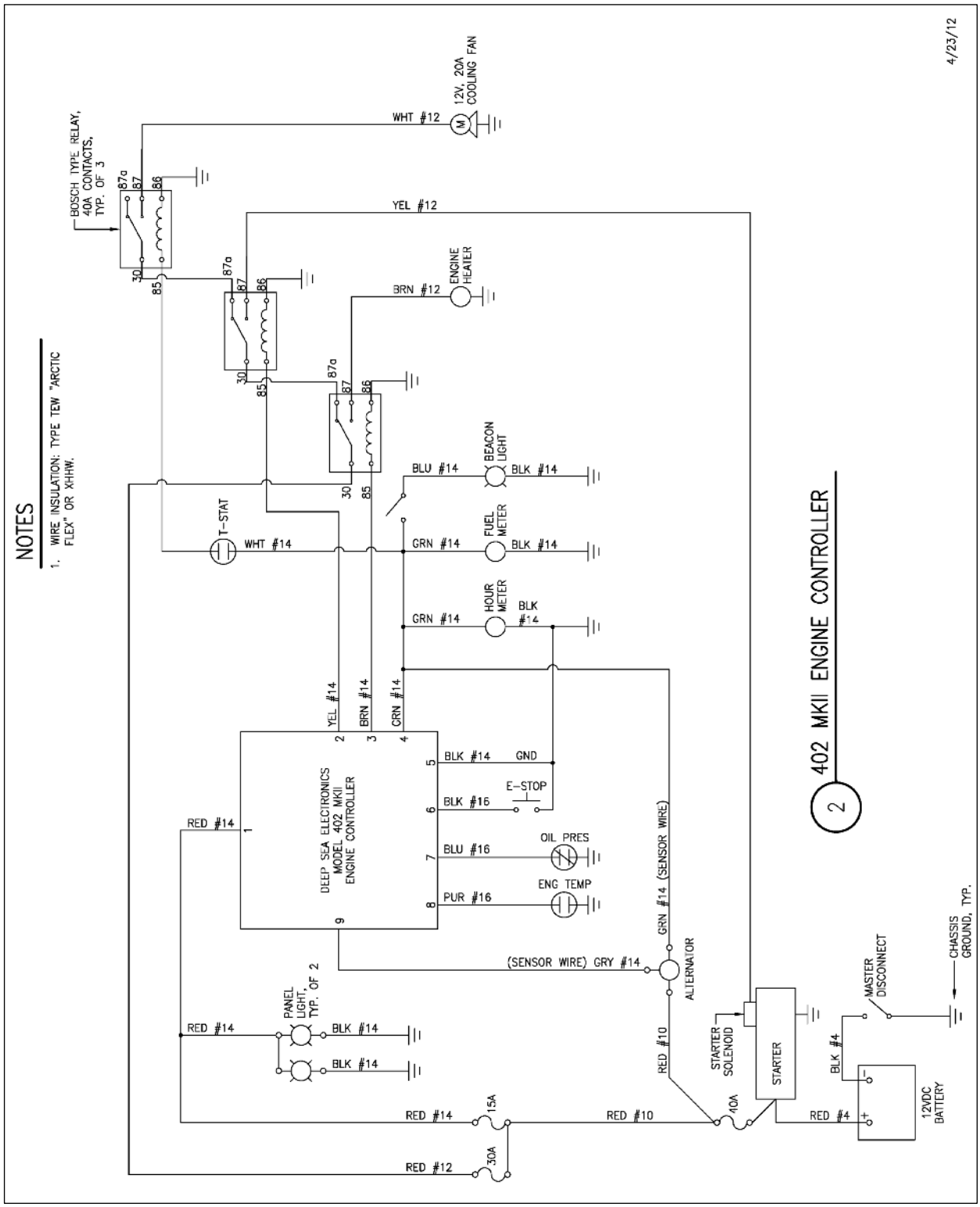

Figure 10. 12V Engine Control Schematic

8 MAINTENANCE RECORDS

Table 7. Machine Data

Machine Serial Number	
Engine Serial Number	
Generator Serial Number	
Trailer Serial Number	

Table 8. Maintenance Records

▪ Date ▪ Engine Hours ▪ Service Personnel ▪ Service Location	**Description of work completed**

