WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS:

• Do not try to light any appliance.
• Do not touch any electrical switch; do not use any phone in your building.
• Immediately call your gas supplier from a neighbour’s phone. Follow the gas supplier’s instructions.
• If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

WARNING: For Outdoor Use Only.
AVERTISSEMENT: Si l’information de ce manuel n’est pas suivie exactement, un incendie ou une explosion peut résulter entraînant des dégâts matériels, des blessures ou la perte de vie.

Ne pas entreposer ou utiliser de l’essence, d’autres liquides ou vapeurs inflammables à proximité de cet appareil ou d’aucun autre appareil.

QUE FAIRE SI VOUSSENTEZ LE GAZ:

• N’allumez aucun appareil.
• Ne touchez aucun commutateur électrique; n’utilisez pas le téléphone de votre bâtiment.
• Appelez immédiatement votre fournisseur de gaz d’un téléphone dans un bâtiment voisin, si possible. Suivez les instructions du fournisseur de gaz.
• Si vous ne pouvez pas atteindre votre fournisseur de gaz, appelez le service d’incendie.

L’installation et le service doivent être effectués par un installateur qualifié, une agence de service ou le fournisseur de gaz.

AVERTISSEMENT: L’installation inexacte, l’ajustement, le changement, le service ou l’entretien peuvent causer des dommages ou des dégâts matériels. Lisez les instructions d’installation, d’opération et d’entretien complètement avant d’installer ou entretenir cet équipement.

AVERTISSEMENT: Pour l’Usage Extérieur Seullement.
NOTICE TO INSTALLER: These instructions shall be left with the consumer to retain them for future reference.
Table of Contents

1 HEALTH AND SAFETY .................................................................................................................. 5
  1.1 ADVISORY TEXT ...................................................................................................................... 5
  1.2 GENERAL INFORMATION ...................................................................................................... 9
  1.3 TERMS & DEFINITIONS ....................................................................................................... 10

2 INSTALLATION .................................................................................................................................. 11
  2.1 SITE PREPARATION .............................................................................................................. 11
  2.2 CONNECTING THE PROTECTIVE CONDUCTORS ............................................................... 12
  2.3 CONNECTING THE FUEL SUPPLY ....................................................................................... 13
  2.4 FUEL CONSIDERATIONS .................................................................................................... 15
  2.5 STANDARD SPECIFICATION FOR GASEOUS FUEL ......................................................... 15
  2.6 CONNECTING CUSTOMER LOAD
      2.6.1 OPENING THE ELECTRICAL ENCLOSURE ........................................................................ 17
      2.6.2 CUSTOMER WIRING CONNECTIONS ............................................................................... 20
      2.6.3 SETTING VOLTAGE SENSE RELAY SETPOINTS ............................................................ 22
      2.6.4 CLOSING THE ELECTRICAL ENCLOSURE ..................................................................... 23
  2.7 INTERNAL BATTERY (OPTIONAL) ............................................................................................ 23
  2.8 BATTERY INSTALLATION & REPLACEMENT ......................................................................... 24

3 OPERATION ........................................................................................................................................ 25
  3.1 BEFORE STARTING ............................................................................................................... 25
  3.2 TARGET POWER CALCULATION
      3.2.1 DATA PLATE POWER .................................................................................................. 26
      3.2.2 TEMPERATURE CORRECTION FACTOR ...................................................................... 27
      3.2.3 ALTITUDE CORRECTION FACTOR ............................................................................... 28
  3.3 TEG START-UP
      3.3.1 COLD WEATHER START-UP ........................................................................................ 29
  3.4 HMI OPERATION
      3.4.1 READING FAULT CONDITIONS .................................................................................. 31
      3.4.2 Resets the TEG ........................................................................................................... 31
      3.4.3 Displaying electrical readings ..................................................................................... 31
      3.4.4 Adjusting the output voltage ....................................................................................... 32
      3.4.5 Customer load switch ................................................................................................. 32

3.5 AIR/FUEL ADJUSTMENT ........................................................................................................ 32
  3.6 CUSTOMER POWER AVAILABLE ......................................................................................... 34
  3.7 LEAVING THE SITE ............................................................................................................. 35
  3.8 SHUT-DOWN ........................................................................................................................ 36

4 PERIODIC BASIC MAINTENANCE ................................................................................................. 37
  4.1 FUEL SYSTEM MAINTENANCE .............................................................................................. 37
  4.2 FUEL FILTER REPLACEMENT ............................................................................................. 38
  4.3 FUEL ORIFICE INSPECTION ................................................................................................. 38
  4.4 BURNER MAINTENANCE ....................................................................................................... 40
  4.5 AIR FILTER REPLACEMENT ............................................................................................... 40
  4.6 FLAME ARRESTOR MAINTENANCE AND INSPECTION
      4.6.1 INLET FLAME ARRESTOR .......................................................................................... 42
      4.6.2 EXHAUST FLAME ARRESTOR .................................................................................... 44
  4.7 SPARK ELECTRODE CHECK ............................................................................................... 45
  4.8 BATTERY CHECK ................................................................................................................ 46
  4.9 COOLING SYSTEM ............................................................................................................... 46
  4.10 FLAME JOINT TORQUE SPECIFICATIONS ....................................................................... 46
5 TROUBLESHOOTING ................................................................................................. 47
6 APPENDICES ........................................................................................................... 49

APPENDIX A – TECHNICAL SPECIFICATIONS ................................................................. 49
APPENDIX B – ELECTRICAL WIRING DIAGRAMS ......................................................... 54
APPENDIX C – REPLACEMENT PARTS ........................................................................ 57
APPENDIX D – PERFORMANCE LOG (S-1100) .......................................................... 58
1 HEALTH AND SAFETY

This manual provides instructions for the safe operation and maintenance of the GPT S-1100 Thermoelectric Generator (TEG).

In the event of unforeseen or special problems, it is not permitted to take unauthorized remedial action. In such cases, contact the responsible Customer Service department to obtain the necessary information.

All agreements, assurances, and legal relationships, as well as all obligations of GPT, shall be governed by the respective valid purchase contract which is not influenced by the content of this document.

WARNING!

The installation must conform with local codes or, in the absence of local codes, with the CSA-B149.1, Natural Gas and Propane Installation Code and CSA-B149.2, Propane Storage and Handling Code.

WARNING!

Before any work begins on the S-1100 Thermoelectric Generator, please read this Operating Manual thoroughly.

1.1 ADVISORY TEXT

Throughout this manual there will be advisory text with the word “NOTE”, “WARNING!” or “CAUTION!”. These indicate important instructions or information that should be understood by the user prior to proceeding.

WARNING!

This symbol and the word “WARNING” indicate a situation that may cause personal injury, death, and possible damage to the equipment if the instructions are not followed.

CAUTION!

This symbol and the word “CAUTION” indicate a situation that may cause damage to the equipment if the instructions are not followed.
WARNING!  The S-1100 TEG is not intended to be used in underground mines. Do not use the TEG in underground mines.

WARNING!  The TEG, when installed, must be electrically grounded in accordance with local codes or, in the absence of local codes, with the Canadian Electrical Code, CSA C22.1.

CAUTION!  The TEG and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures more than 3.5 kPa (1/2 psi).

The TEG must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 3.5 kPa (1/2 psi).

WARNING!  This TEG is certified for use in Class 1 Zone 1 or Class 1 Division 1 hazardous locations however any maintenance or opening of the enclosure will negate any hazardous location certification while maintenance is underway. Ensure no gas hazards are present during maintenance.

WARNING!  Do not use this TEG if any part has been under water. Immediately call a qualified service technician to inspect and to replace any part of the control system, gas control and generator which has been under water.
WARNING!
The TEG is designed to combust gaseous fuels which will result in combustion products of heat, carbon dioxide and water vapor. It may contain traces of Carbon Monoxide, unburnt Hydrocarbons and Nitrous Oxides. Emissions from combustion will depend on generator set-up and operation as well as the composition of the gas feed. It is imperative that these instructions be followed, and that gas supplied meets Global Power Technologies’ gas specification.

WARNING!
The TEG must be mechanically installed according to the instructions contained within this manual. The Generator must be securely bolted to a mounting pad or platform when assembled.

WARNING!
Installation and repair should be performed by a qualified service person. The TEG should be inspected before use and at least annually by a qualified service person. More frequent cleaning may be required as necessary. It is imperative that control compartment, burners, flame arrestors and circulating air passageways of the appliance be kept clean.

WARNING!
Repair of flame paths is not intended. If any flame path or flame joint is damaged, the damaged part must be replaced.

WARNING!
This device contains electrical and gas related safety devices as identified throughout this manual. Tampering or rendering inoperative any of these safety devices may result in personal injury or death and possible damage to the equipment and is not permitted under any circumstances.
WARNING! Inspect and check all gas connections for leaks using a commercially available liquid leak detection fluid after installation or service to any part of the fuel system. Remedy any fuel system leaks prior to starting the TEG.

WARNING! Keep the TEG area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Maintain minimum clearances specified in this manual.

CAUTION! The TEG consists of some parts constructed from sheet metal. Every effort is made to ensure that edges have been deburred when manufactured, however sharp edges may still exist. Caution must be exercised when handling and use of gloves is advised.

WARNING! Any guard or other protective device removed for servicing the TEG must be replaced prior to operating the appliance.

WARNING! The TEG consists of sub-systems that combust gaseous fuel and others that consume excess power through resistors, all of which can pose high surface temperature hazards. Operators and service personnel should avoid exterior areas of the generator to avoid burns or clothing ignition when in operation or cooling down.


1.2 GENERAL INFORMATION

This manual provides instructions for the installation, operation, performance, basic maintenance and troubleshooting of the model S-1100 TEG, a device that produces electrical power through the direct conversion of heat energy to electrical energy.

For any technical issues or questions:

Global Power Technologies – Head Office
#16, 7875 – 57 Street S.E.
Calgary, AB, Canada T2C 5K7
Phone: 1-403-236-5556
Fax: 1-403-236-5575

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Liability

The user is expressly warned to consider and adopt all safety precautions that might be indicated by the activities herein and to avoid all potential hazards. The user assumes all risks in connection with such instructions. GPT shall not be liable for any special, consequential, exemplary or other damages resulting, in whole or part, from the user’s use of, or reliance upon this material.

Comments

GPT has compiled this publication with care, but GPT does not warrant that the information in this publication is free of errors. Comments, criticisms, and suggestions regarding the subject matter are invited. Any errors or omissions in the data should be brought to the attention of GPT. If required, affected pages will be revised and issued.
## 1.3 TERMS & DEFINITIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEG</td>
<td>Thermoelectric Generator.</td>
</tr>
<tr>
<td>GPT</td>
<td>Global Power Technologies.</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gasses include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene, butanes (normal butane or isobutane and butylene).</td>
</tr>
<tr>
<td>Limiter/Converter</td>
<td>Power Electronics that manage the TEG output.</td>
</tr>
<tr>
<td>Orifice</td>
<td>The opening in an orifice cap, orifice spud or other device whereby the flow of gas is limited and through which gas is discharged.</td>
</tr>
<tr>
<td>Power Unit (PU)</td>
<td>The hermetically sealed portion of the TEG that contains the thermoelectric materials.</td>
</tr>
<tr>
<td>Rated Output Power</td>
<td>Model S-1100 TEG produces 100 W (available to the customer) when operating in an ambient temperature of 20°C (68°F).</td>
</tr>
<tr>
<td>Target Power</td>
<td>The power generated by the Power Unit when it is correctly tuned to compensate for altitude and temperature at the installation site.</td>
</tr>
<tr>
<td>HMI</td>
<td>Human Machine Interface. Used to interact with the TEG. Located on the front door of the electrical enclosure.</td>
</tr>
<tr>
<td>NO</td>
<td>Normally Open.</td>
</tr>
<tr>
<td>NC</td>
<td>Normally Closed.</td>
</tr>
<tr>
<td>POT</td>
<td>Potentiometer.</td>
</tr>
<tr>
<td>VSR</td>
<td>Voltage Sense Relay.</td>
</tr>
<tr>
<td>SI</td>
<td>Spark Ignition.</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode. Used as indicator lights.</td>
</tr>
<tr>
<td>SV</td>
<td>Solenoid Valve.</td>
</tr>
</tbody>
</table>
2 INSTALLATION
Sites where TEGs are placed are unique and can vary greatly. The following instructions are for the installation of a single S-1100 model TEG. Please contact your GPT representative for more information on custom solution installations.

2.1 SITE PREPARATION
The site should be prepared in advance of the arrival of the TEG. The Model S-1100 is designed for Hazardous Location use and Outdoor Applications. No shelter is required for operation of this TEG. Mount the TEG to a level and sturdy stable base capable of supporting the 178 Kg (393 lb.) mass of the TEG. Bolt down the TEG using 4 x M8 x 1.25 bolts suitable for the environment. See Figure 1 below for the location of mounting holes.

Inspect the TEG for damage which may have occurred during shipping. Report any damage as soon as possible. Some damage may make the generator inoperable. Consult with GPT before operating a damaged TEG.

WARNING!
Maintain a minimum clearance horizontally of 10 cm (4 inches) from the TEG on all four sides to combustible walls and 18 cm (7 inches) from the roof.

--

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>Mounting Holes x 4 for M8 x 1.25 Bolts</td>
</tr>
</tbody>
</table>

WARNING!
Inspect the TEG for damage which may have occurred during shipping. Report any damage as soon as possible. Some damage may make the generator inoperable. Consult with GPT before operating a damaged TEG.
2.2 CONNECTING THE PROTECTIVE CONDUCTORS

To connect the external Protective Conductor, follow the instructions below:

1. Connect the Protective Conductor to the enclosure using the outer earth connection terminal shown below.
2. Insert the cable lug, place a washer above and below the cable lug. Ensure the cable lug mounting hole is sized for an M8 fastener.
3. Secure the screw with a lock washer.
4. Connect all bare, non-energized metal parts to the protective conductor system.
5. Run and fix the cable near the TEG.

NOTE: The cable lug, washers and lock washer must be stainless steel to prevent corrosion.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>Protective Conductor M8 x 1.25 x 20 mm</td>
</tr>
</tbody>
</table>

Internal protective conductor connections are described in 2.6 CONNECTING CUSTOMER LOAD
2.3 CONNECTING THE FUEL SUPPLY

To connect the fuel supply to the 1/4-inch female NPT fuel inlet manual shutoff valve:

1. Remove the protective cap or plugs.
2. Apply thread sealant to the fuel line threads as shown in Figure 3.
3. Connect the fuel line and test all joints for leaks using a commercial leak detector fluid such as Snoop®.
4. Inspect the fuel lines and fittings to be sure they are free of foreign material.
5. Purge fuel lines of all air.

![Diagram showing thread sealant application](image)

*Figure 3 - Thread Sealant Application*
Figure 4 - Fuel Shut Off Valve

**NOTE:** Thread sealant is recommended. Sealant must be approved for use with gaseous fuels. Tape is not recommended.

**CAUTION!** Do not exceed the data plate pressure rating. If the fuel supply pressure will vary greatly, the use of an additional primary regulator is recommended to hold the input pressure relatively constant.

**NOTE:** Ensure the fuel hose is not impeding walkways or in areas where it may be subject to accidental damage.
2.4 FUEL CONSIDERATIONS

Fuel must be either natural gas or propane vapor specified by the model ordered. Check the TEG Data Plate affixed to the S-1100 TEG for the fuel type. Do not use a different type of fuel than indicated.

2.5 STANDARD SPECIFICATION FOR GASEOUS FUEL

NOTE: Fuel considered is for standard, non-custom S-1100 TEG and fuel system configurations.

Gaseous fuel supplied to GPT’s TEGs:

1. Shall not contain any particulates larger than 30 μm diameter, including but not limited to sand, dust, gums, crude oil, and impurities.
2. Shall have a hydrocarbon dew point of < 0 °C (32 °F) at 170 kPa (25 psig).
3. Shall have < 115 mg/m³ (approx. 150 ppm) of H₂S.
4. Shall have less than 60 mg/m³, (approximately 88 ppm) of Mercaptan Sulphur.
5. Shall have less than 200 mg/m³ (approximately 294 ppm) of total Sulphur.
6. Shall have less than 10% CO₂ and/or N₂ by volume, nor vary more than +/- 1% CO₂ and/or N₂ during operation.
7. Shall have less than 120 mg/m³ (5 g/100 cu.ft.) of water vapor.
8. Shall have less than 1% by volume of free oxygen.
9. Shall have a nominal gross heating value of:
   Natural Gas: 37 MJ/m³ (1000 BTU/cu.ft.)
   Propane: 93 MJ/m³ (2500 BTU/cu.ft.)
10. Fuel temperature of less than 60 °C (140 °F) at 1 atm and 15 °C (59 °F) ambient temperature.

---

<table>
<thead>
<tr>
<th>Propane/LPG Location</th>
<th>Propane/LPG tanks and cylinders must be located outdoors in a well-ventilated area, at least 3 meters (10 ft.) from the TEG unless directed otherwise by the local authority having jurisdiction.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>Each tank or cylinder must be set on a firm, level, waterproof base, located on firm ground at grade level. The base must extend at least 300 mm (1 ft.) from all sides of the tank or cylinder, must be designed to support the weight of the tank or cylinder and is subject to approval by the local authority having jurisdiction. To prevent remote cylinders from tipping over, they shall be secured by brackets, straps, or carriers designed and manufactured to withstand calculated loading in any direction equal to at least four times the weight of the filled cylinder.</td>
</tr>
<tr>
<td>Connection</td>
<td>Tanks and cylinders are to be equipped with flexible connections to offset any movement affecting the piping or tubing.</td>
</tr>
</tbody>
</table>
2.6 CONNECTING CUSTOMER LOAD

Remove the plastic shipping plug from the customer cable entry port. Bring the customer load wires through the provided conduit entry (1) nearest to the terminal block in the bottom of the Electrical Enclosure using 1” NPT Cable Connector for the wire or cable being used. Allow enough wire to connect to the terminal block. The connected cable gland and wire must be in accordance with the standards prescribed by the Authority Having Jurisdiction.

![Figure 5 - Connecting Customer Load](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>1” NPT Customer Load Portal</td>
</tr>
<tr>
<td>2</td>
<td>N/A</td>
<td>1” NPT Cable Entry Reserved for future use</td>
</tr>
</tbody>
</table>

**NOTE:**

Equipment is intended for use with IECEx approved Ex db IIA Gb minimum cable glands.

Equipment is intended for use with IECEx approved Ex db IIA Gb minimum blanking elements.
### 2.6.1 OPENING THE ELECTRICAL ENCLOSURE

The Electrical Enclosure of the S-1100 must be opened to make the customer connections. The Electrical Enclosure is an Ex db flame proof enclosure and must only be serviced by qualified personnel.

1. To open the door, remove the 18 hex head bolts and washers holding the door closed. Save the bolts and washers as they will be needed to close the door after the customer wiring is connected.
2. Swing the door open.
3. Remove the Barrier (2) by loosening its fasteners and lifting upwards.
4. All customer wiring is connected to the User Connection PCBA. The User Connection PCBA is located at the front of the Electrical Enclosure as shown in Figure 7.
5. The internal Protective Conductor terminal is located at the front of the Electrical Enclosure as shown Figure 7. The Protective Conductor terminal is sized for 4 AWG to 14 AWG wire.

---

**WARNING!**

Ensure that no explosive gas hazard is present prior to opening the Electrical Enclosure or servicing the S-1100 TEG. The S-1100 enclosure must not be opened when an explosion or gas hazard may be present.
### Figure 6 - Electrical Enclosure Door

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69255-X</td>
<td>18x Hex Head Cap Bolts (M10 x 1.5 x 50, 316 SS, A4-70) with washers</td>
</tr>
<tr>
<td>2</td>
<td>69267</td>
<td>Barrier</td>
</tr>
</tbody>
</table>

**WARNING!**

The flange surfaces between the Electrical Enclosure door and the Electrical Enclosure form a flame joint. It is an important part of the system of protection of the product and these surfaces must not be damaged. It is imperative that these surfaces are not damaged or scratched. Fire or explosion can occur if these surfaces are damaged. Do not return the product to service if these surfaces are damaged.
CAUTION!

Do not damage the O-ring gasket located in the Electrical Enclosure. This O-ring gasket prevents rain and other moisture from entering the Electrical Enclosure. Replace the O-ring gasket if it is damaged.

Figure 7 - Electrical Enclosure

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69934</td>
<td>User Connection PCBA</td>
</tr>
<tr>
<td>2</td>
<td>68711</td>
<td>Seal, Electrical Enclosure Door, O-Ring Gasket</td>
</tr>
<tr>
<td>3</td>
<td>57600</td>
<td>Protective Conductor terminal</td>
</tr>
</tbody>
</table>
2.6.2 CUSTOMER WIRING CONNECTIONS

CAUTION!

There are no other customer wiring points in the S-1100 other than those described in the table below. Do not alter or modify the wiring in any way or damage to the S-1100 may occur.

Figure 8 shows the signals on the User Connection PCBA available for customer wiring. The accompanying table describes the signals and how to connect to them.

<table>
<thead>
<tr>
<th>Signal Group</th>
<th>Signal Name</th>
<th>Max Wire Size</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output</td>
<td>OUT+, OUT-</td>
<td>16 mm² – Solid Conductor 16 mm² – Stranded Conductor with ferrule without plastic sleeve 10 mm² – Stranded Conductor with ferrule with plastic sleeve</td>
<td>Output power from the S-1100. OUT+ is the positive output. OUT- is the negative output. The output of the S-1100 is equipped with an OR-ing diode which prevents reverse current flow into the S-1100 if there is voltage connected to the output terminals which exceeds the S-1100’s output setpoint voltage. This allows multiple pieces of equipment such as TEG’s, batteries, solar panels, etc. to be connected in parallel without driving reverse current into the S-1100. Note: The S-1100 has been tested to 1600 VAC isolation between the power output terminals and the chassis. Either 12VDC or 24VDC output must be selected at time of ordering. Voltage ranges: 23.0V to 31.0V for a 24V S-1100 TEG, adjustable through the HMI. 11.5V to 15.5V for a 12V S-1100 TEG, adjustable through the HMI.</td>
</tr>
<tr>
<td>Signal Group</td>
<td>Signal Name</td>
<td>Max Wire Size</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>External Startup Power</td>
<td>EXT. START+</td>
<td>2.5 mm² – Solid Conductor</td>
<td>External startup voltage to start the S-1100. Operating range 10V – 30V input. Do not exceed 30V input. Note: It is only necessary to use this input to start the S-1100 if there is no internal battery pack installed and there is no station battery connected to OUT+, OUT-. The S-1100 can be started if a charged station battery is connected to OUT+ and OUT-. There is no need to connect EXT. START+ and EXT. START- in parallel with OUT+ and OUT-.</td>
</tr>
<tr>
<td></td>
<td>EXT. START-</td>
<td>1.5 mm² – Stranded Conductor without plastic sleeve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 mm² – Stranded Conductor with ferrule without plastic sleeve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 mm² – Stranded Conductor with ferrule with plastic sleeve</td>
<td></td>
</tr>
<tr>
<td>4 – 20 mA Output #1</td>
<td>I1+</td>
<td>2.5 mm² – Solid Conductor</td>
<td>This 4-20 mA output can represent either the output voltage between OUT+ and OUT- or the power unit output power. The function of this output is determined by the position of SWDP2 on the MCU board. See the table below for DIP switch settings Voltage range: 0V (4 mA) to 33V (20 mA) Power range: 0W (4mA) to 200W (20mA) Note: This output is powered by the S-1100. An external source of loop power is not required and should not be used. Note: This output is sized to drive a single input or one resistor load of up to 250Ω. Do not connect multiple inputs in series. Do not exceed 250Ω load resistance.</td>
</tr>
<tr>
<td></td>
<td>I1-</td>
<td>1.5 mm² – Stranded Conductor without plastic sleeve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 mm² – Stranded Conductor with ferrule without plastic sleeve</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5 mm² – Stranded Conductor with ferrule with plastic sleeve</td>
<td></td>
</tr>
<tr>
<td>4 – 20 mA Output #2</td>
<td>I2+</td>
<td>2.5 mm² – Solid Conductor</td>
<td>This 4-20 mA output can represent either the output current from OUT+ or the power unit output power. The function of this output is determined by the position of SWDP2 on the MCU board. See the table below for DIP switch settings Current range: 0A (4 mA) to 15A (20 mA) Power range: 0W (4mA) to 200W (20mA) Note: This output is powered by the S-1100. An external source of loop power is not required and should not be used. Note: This output is sized to drive a single input or one resistor load of up to 250Ω. Do not connect multiple inputs in series. Do not exceed 250Ω load resistance.</td>
</tr>
<tr>
<td></td>
<td>I2-</td>
<td>1.5 mm² – Stranded Conductor without plastic sleeve</td>
<td></td>
</tr>
<tr>
<td>Signal Group</td>
<td>Signal Name</td>
<td>Max Wire Size</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Voltage Sense Relay #1</td>
<td>NC COM NO</td>
<td>2.5 mm² – Solid Conductor 1.5 mm² – Stranded Conductor 1.5 mm² – Stranded Conductor with ferrule without plastic sleeve 1.5 mm² – Stranded Conductor with ferrule with plastic sleeve</td>
<td>Dry contact output. This relay output is activated when the output voltage exceeds the voltage sense setpoint. Voltage Sense Relay #1 and #2 are set independently of each other. See below for instructions on adjusting the voltage sense setpoint. Do not exceed 30VDC or 1A current. 22.5V to 29.0V for a 24V S-1100 TEG, adjustable through a POT. 11.0V to 15.0V for a 12V S-1100 TEG, adjustable through a POT. Default setting for VSR1 is 11.5 on 12V TEG, 23.5V on 24V TEG. Default setting for VSR2 is 14.5V on 12V TEG, 29.0V on 24V TEG.</td>
</tr>
</tbody>
</table>

**DIP Switch SWDP2 Settings for 4-20 mA outputs**

<table>
<thead>
<tr>
<th>SWDP2 Settings (lower, upper)</th>
<th>4-20mA channel 1</th>
<th>4-20mA channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF, ON</td>
<td>Vout</td>
<td>Ppu</td>
</tr>
<tr>
<td>ON, OFF</td>
<td>Ppu</td>
<td>Iout</td>
</tr>
<tr>
<td>ON, ON</td>
<td>Vout</td>
<td>Iout</td>
</tr>
<tr>
<td>OFF, OFF</td>
<td>Vout</td>
<td>Iout</td>
</tr>
</tbody>
</table>

**2.6.3 SETTING VOLTAGE SENSE RELAY SETPOINTS**

To adjust the Voltage Sense Relay #1 (VSR1) setpoint, open the load switch using the HMI. Set the output voltage to the desired setpoint and adjust RV1 until VSR1 changes state. When the output voltage is greater than the VSR1 setpoint, the relay will be energized, and the NO contacts will close while the NC contacts will open.

To adjust the Voltage Sense Relay #2 (VSR2) setpoint, open the load switch using the HMI. Set the output voltage to the desired setpoint and adjust RV2 until VSR2 changes state. When the output voltage is greater than the VSR2 setpoint the relay will be energized, and the NO contacts will close while the NC contacts will open.
**WARNING!**

Disconnecting or altering the electronics can result in conditions which can cause damage to the S-1100 and/or the customer load. Prolonged open circuit conditions at the power unit can also lead to permanent damage of the power unit due to overheating of the internal components. The electronics should never be tampered with and if damage is suspected, contact GPT for replacement parts and service instructions.

### 2.6.4 CLOSING THE ELECTRICAL ENCLOSURE

Once the customer wiring has been connected the Electrical Enclosure must be closed. Ensure that the wire barrier has been installed and that all wires are to the inside side of it. Then, to close the Electrical Enclosure, gently swing the door closed on its hinges ensuring that no wiring is pinched between the Electrical Enclosure Door and the Electrical Enclosure. Once the door has been fully closed, apply anti-seize compound to the 18 M10 bolts, insert the bolts and washers in the holes and torque to 21 lb-ft [28 N·m]. Bolts must be M10 x 1.5 x 50, 316SS, A4-70 and M10 washers must be installed.

### 2.7 INTERNAL BATTERY (OPTIONAL)

If no external power source is available for start-up, an optional internal battery is available (GPT part number 69059). The battery is manufactured by GPT, has a nominal voltage of 6.4V and has a rated capacity of 15 Ah. The battery uses Type L cells per IEC 60086-1. The internal battery is installed in the Electronics Enclosure.

![Optional Internal Battery](image)

*Figure 9 - Optional Internal Battery*

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69059</td>
<td>GPT Internal Battery</td>
</tr>
<tr>
<td>2</td>
<td>69975</td>
<td>Screw, Socket Head Cap, M4 x 0.7 x 8, 316 SS</td>
</tr>
</tbody>
</table>
2.8 BATTERY INSTALLATION & REPLACEMENT

To install the optional internal battery, follow the instructions below:

1. Open the Electronics Box as described in section 2.6.1 Opening the Electrical Enclosure.
2. Insert the Internal Battery onto the support hooks.
3. Fasten the Battery to the TEG with the 2 screws (2) as per Figure 8 - User Connection Terminals.
4. Connect the 2 wires, one into each plug, from Battery to the User Connection Board as pictured in Figure 10.

**WARNING!**
Ensure that no explosive gas hazard is present prior to opening the Electrical Enclosure or servicing the S-1100 TEG. The S-1100 enclosure must not be opened when an explosion or gas hazard may be present.

![Figure 10 - User Connection Board](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N/A</td>
<td>GPT Internal Battery Connection</td>
</tr>
</tbody>
</table>
3 OPERATION

3.1 BEFORE STARTING
The operator should familiarize themselves with the major sub-systems and location of key components, understand the TEG Specifications and have read the manual prior to starting the TEG. Also:

1. Inspect the TEG for mechanical damage and if damage is found, contact GPT.
2. Ensure the fuel system connections are tight and have been checked for leaks.
3. Confirm the fuel type is correct for the model of S-1100 being installed.
4. Ensure the electrical connections to the customer terminal block are tight and correctly connected.
5. Ensure the TEG has been properly grounded and bonded to the site ground.
6. Inspect the air inlet screw or optional air filter for cleanliness and open the air shutter adjustment to 50%.
7. Ensure that startup power is available to the TEG. This can be a partially charged station battery with at least 10V available, a voltage source connected to the EXT. START+/EXT.START- terminals or an optional internal battery.

3.2 TARGET POWER CALCULATION
The target power is needed to make air/fuel adjustments and must be calculated prior to performing any air/fuel adjustments to the TEG. Each TEG is unique and the target power must be calculated using the data plate power, the current ambient temperature and the altitude above sea level. Do not make any air/fuel adjustments without first determining the target power.

The following information must be collected to calculate target power:

1. Data Plate Power. (Located on the lower left of the data plate under the words “POWER AT TEMP. OF:”. See Figure 11.
2. Temperature Correction Factor.
3. Altitude Correction Factor.

Target power increases as temperature decreases due to increased temperature differential across the power unit. Although it is possible to have a target power over 130W in cold temperatures, in order to maximize the longevity of the TEG it is not recommended to use a target power above 130W.

**Target Power =**
(Data Plate Power) x (Temperature Correction Factor) x (Altitude Correction Factor)

See Sections 3.2.1, 3.2.2 and 3.2.3 for how to determine Data Plate Power, Temperature Correction Factor and Altitude Correction Factor.

**Example Calculation**
Data Plate Power = 120W (read from data plate of specific TEG)
Current Ambient Temperature = 35°C
Temperature Correction Factor = 0.975 (See Section 3.2.2)
Altitude = 0m above sea level
Altitude Correction Factor = 1.05 (See Section 3.2.3)
Target Power = 120W x 0.975 x 1.05
Target Power = 122W
3.2.1 DATA PLATE POWER

The Model is S-1100
It is available with fuel and Voltage options:
N= Natural Gas or L= Propane, 12VDC or 24VDC
S1100 (N or L) – (Voltage) – (SI Spark Igniter) – (SO – Auto Shut Off)

Power at Temp of:
Shows the rated power unit power and temperature recorded by the factory during acceptance testing. This is the maximum power unit power that can be expected from the TEG under similar conditions.

Voltage:
Voltage shows the nominal power unit voltage recorded during factory acceptance testing.

Burner Fuel Pressure:
Burner fuel pressure recorded during factory acceptance testing.

Fuel Type:
N (Natural Gas) or L (Liquid Propane Gas or Propane).

Nominal Input Rating:
Nominal energy content of the fuel expressed in kilowatts.

Max Inlet Pressure:
Maximum permitted fuel supply pressure in kilopascals.

Design Altitude (Up To):
Maximum permitted altitude the TEG should be operated at in meters.
3.2.2 TEMPERATURE CORRECTION FACTOR

As temperature increases, power output could drop by about 0.25% per °C above 25°C. The chart shown in Figure 12 is used to determine the temperature correction factor for the current ambient temperature. Record the current ambient temperature and Ambient Temperature Performance Factor in the Performance Log in Appendix D of this document.

![Figure 12 - Temperature Correction Factor](image-url)
3.2.3 ALTITUDE CORRECTION FACTOR

With increasing altitude, the air becomes less dense and the ability of the cooling system to transfer heat to the air less effective. Further adjustments will need to be made to the air intake shutter, opening more with increased altitude, to provide sufficient oxygen to the burner for full combustion of the fuel. GPT’s manufacturing facility sits at 750 m above sea level. Performance will increase at lower altitudes. At sea level, the performance could improve by about 5%. At 3000m, the performance may be up to 15% lower. The chart in Figure 13 - Altitude Correction Factor shows the Altitude Correction Factor as a function of altitude above sea level.

For example, the Altitude Correction Factor for an S-1100 located at sea level (0m elevation) is 1.05. Record the altitude and altitude correction factor in the Performance Log in APPENDIX D – PERFORMANCE LOG (S-1100) of this document.

Figure 13 - Altitude Correction Factor
3.3 TEG START-UP

1. Supply fuel and open the manual shut-off valve. Opening the manual shut-off valve causes the Spark Ignition (SI) module to spark and the gas solenoid valve to open.

2. Observe the fuel pressure at the pressure gauge. Refer to the data plate for the nominal fuel pressures for Natural Gas and Propane. Unless otherwise instructed, the TEG should be started at the nominal fuel pressure shown on the data plate. Pressure may be adjusted to rated values by turning the screw on the pressure regulator.

3. The SI module will make three ignition attempts. If unsuccessful on all three attempts, the SI will go into Lockout mode which is indicated by a flashing red SI LED and an unlit Solenoid Valve LED. If ignition is successful, the Solenoid Valve LED will be solid green. The OK LED will flash green once the TEG comes up to operating temperature and the electronics become energized.

4. To reset the S-1100 after a Lockout, activate the Reset button on the HMI using the magnetic stylus.

The TEG will now begin to heat up and start to produce power. It can take up to 1 hour for the TEG to produce full power. In order to allow the TEG to start up in a predictable fashion, the Customer Load Switch is not enabled until the TEG is producing at least 75W. Once the power unit output exceeds 75W, the load switch will be enabled, and the customer load can be connected. This only occurs on initial startup. Once the TEG power exceeds 75W and the load switch operation is independent of the power generated. See 3.4.5 CUSTOMER LOAD SWITCH for more information.

---

**WARNING!** Incorrect air shutter setting may result in power loss, unburnt hydrocarbons, and/or carbon monoxide emissions greater than 50ppm. Soot may be visible on the exhaust and rain cap.

---

3.3.1 COLD WEATHER START-UP

The exhaust flame arrestor will need to be heated with an external heat source such as a blowtorch if the S-1100 is started in temperatures below -30 °C. Before heating the exhaust flame arrestor, remove the rain shield.

---

**WARNING!** Ensure that all necessary precautions are observed for using a blowtorch in a hazardous or classified area (e.g. hot work permit, declassify area, etc.)
3.4 HMI OPERATION

The Human Machine Interface (HMI) consists of a set of LEDs’ and 6 magnetic buttons as shown in Figure 14 and Figure 15. There is a magnetic stylus clipped to the right-hand side of the Electrical Enclosure and it is secured with a cable to prevent it from getting lost. There is no need to open the Electrical Enclosure to operate the HMI. The HMI is completely contained inside the flame proof enclosure and can be operated while in a hazardous environment.

When the burner is lit the Solenoid Valve Status LED will be solid green. The OK LED will flash green when the electronics are energized and operational.

If the load switch is closed, the Load Switch Status LED will be solid green. If the load switch is open, the Load Switch Status LED will flash red.

To operate a button on the HMI, hold the magnetic stylus in the associated indentation.

Figure 14 - HMI LED Icons

Figure 15 - HMI Magnetic Buttons
3.4.1 READING FAULT CONDITIONS

Hold the magnetic stylus up to the View Fault button to view if there has been a spark ignitor lockout. An SI lockout will be indicated by a red flashing SI LED. A spark ignitor lockout occurs after the SI module makes 3 unsuccessful attempts to ignite the TEG. The TEG must be manually reset once an SI lockout occurs.

Battery power (either from a station battery or the optional internal battery) is required to display fault conditions. Fault conditions are only displayed while the magnetic stylus is held up to the View Faults button.

3.4.2 RESETING THE TEG

Hold the magnetic stylus up to the Reset button to reset the Spark Ignitor and other fault conditions. The TEG will attempt to restart if there is fuel pressure.

Note that the fault condition indicator will be cleared when the Reset button is activated. Fault conditions cannot be read after the reset button is activated.

3.4.3 DISPLAYING ELECTRICAL READINGS

The HMI can display customer output voltage, customer output current, power unit power, power unit voltage and power unit current. Pressing the Display Parameters button will cause the LED to display these 5 parameters in order. The Meter LED is solid green when customer output parameters are being displayed and is blinking green when power unit parameters are being displayed. The display will go blank a few moments after the last button press.
3.4.4 ADJUSTING THE OUTPUT VOLTAGE

Use the Output Voltage Adjust buttons to adjust the customer output voltage. Hold the magnetic stylus up to the Output Adjust buttons to adjust the voltage up or down.

It is recommended that the load switch be opened or that any external circuit breaker connecting the S-1100 to the customer load be opened when adjusting the S-1100 output voltage.

While making changes to the output voltage, the set LED will blink green. The voltage setting will be displayed on the numerical display. After making the desired change, the display will go blank after a few moments.

3.4.5 CUSTOMER LOAD SWITCH

The S-1100 is equipped with an internal electronic load switch that can be used to disconnect the customer load. To change the state of the load switch, hold the stylus up to the Load ON/OFF button. The Load Switch Status LED will begin blinking, the numerical display will show “L.HLd” and the Load Switch Status LED will blink for a short period of time until the load switch changes state. The stylus must be held up against the Load ON/OFF button until the load switch changes state. If it is removed too early, the change will be canceled, and the load switch state will not be changed.

Once the load switch changes state, the numerical display will briefly show either “L.ON” or L.OFF” to indicate whether the load switch is on or off.

The Load Switch Status LED is solid green when the customer load is connected (ON) and blinking red when the customer load is disconnected (OFF).

The load switch is closed (customer load connected) by default when the S-1100 powers up.

3.5 AIR/FUEL ADJUSTMENT

It is necessary to adjust the air/fuel settings to ensure proper combustion and operation of the S-1100. The air/fuel settings should be adjusted when the TEG is first installed, as part of regular maintenance and whenever installation or fuel conditions change.

Calculate the Target Power as described in Section 3.2 prior to beginning the air/fuel mixture adjustment process. It is necessary to know the Target Power to properly adjust the air/fuel settings. Target Power depends on the current ambient temperature and should be calculated each time the air/fuel settings are adjusted.

Use the following procedure to adjust the air/fuel settings:

1. Disconnect the customer load, either by opening the customer load circuit breaker or by setting the S-1100 load switch to the OFF setting.
2. Set the air shutter to 50%.
3. Set the fuel pressure to the nominal fuel pressure shown on the data plate.
4. Start the TEG (if it is not already running) and let the temperature stabilize. It will take approximately 1 hour for the temperature to stabilize.
5. Decrease the air shutter opening until the maximum power unit output is observed. Use the HMI meter display to read the power unit power. Allow the TEG to stabilize between air shutter adjustments, approximately 15 minutes. Lock the air shutter in place with the wing-nut once the maximum power has been reached.
6. Once the maximum power has been reached, adjust the fuel pressure until the Target Power is reached. Do not exceed the Target Power (i.e. “POWER UNIT POWER AT TEMP OF:...”) on the data plate.
NOTE: Optimum air shutter adjustment results in a peak point in power. Any adjustments from this point will result in a decrease of power and increase in emissions. The power falls off quicker if the combustion is fuel rich compared to fuel lean, therefore it is better to be slightly fuel lean.

WARNING! Exceeding the Target Power setting can damage the TEG and may cause it to exceed certified maximum safe operating parameters. Do not exceed the Target Power.

WARNING! Incorrect air shutter setting may result in power loss, unburnt hydrocarbons, and/or carbon monoxide emissions greater than 50ppm. Soot may be visible on the exhaust and rain cap.

WARNING! Under no circumstances adjust fuel pressure to achieve power greater than the target set up power.
3.6 CUSTOMER POWER AVAILABLE

The S-1100 electronics consume approximately 18W of power. The power available to the customer will be approximately Target Power minus 18W.

The voltage and current supplied to the customer load will be limited by the available power. The behavior of the electrical output is shown in Figure 16 for 24V models and in Figure 17 for the 12V models. The output voltage will initially follow the setpoint configured by the customer. The TEG will operate in constant voltage mode until the output current climbs to the point where maximum power that can be supplied is reached. As output current increases, the TEG will operate in constant power mode and the output voltage will drop as current increases. The TEG can operate indefinitely in either constant voltage or constant power mode.

The maximum amount of power available will depend on the TEG setup, ambient temperature, altitude as well as the age and condition of the power unit.

![Figure 16 - 24V TEG Electrical Output](image)

In order to protect the customer equipment, when the output voltage reaches 14V for a 24V TEG or 8V for a 12V TEG, the load switch will open and the HMI will display "E.SOL" (Error – System Over Load). The TEG will attempt to reconnect the load once per minute for 24 hours. If the overload condition is corrected in this time period, the TEG will resume normal operation. If the overload condition persists for 24 hours, the load switch will remain open, further retries will not be attempted and the "E.SOL" error will remain on the display until the Load switch is toggled manually. The TEG
will remain operational with the burner lit while the “E.SOL” overload error condition is present. Although the electrical output will be disconnected, the TEG will not shut itself down automatically when an “E.SOL” overload error occurs, and the burner will continue to operate.

The output current is limited to 6.5A for 24V models and 13A for 12V models.

**NOTE:** Unintended or unpredictable behavior may occur if a battery charge controller is connected between the TEG and a battery. It is not recommended that battery charge controller be connected in between the TEG and a battery.

### 3.7 LEAVING THE SITE

1. Make sure the TEG performance is as required for the load and that the TEG is operating normally.
2. Make sure that the customer load switch has been enabled and that the Load Switch Status LED is illuminated.
3. Make sure the Customer Load circuit breaker is in the “ON” position.
4. Ensure that all flame-proof openings have been properly closed and that the torque specifications for all bolts and covers have been met.
3.8 SHUT-DOWN

Close the manual fuel shut-off valve (1) as shown in Figure 18.
The Solenoid Valve Status LED will turn off indicating that the gas supply to the burner has been shut off. The OK LED and the Load Switch Status LED will remain illuminated until the TEG power unit has cooled enough that power output has been lost and the electronics lose power. The output will remain energized while the Load Switch Status LED is illuminated.
The TEG will remain hot for several hours after it has been shut down.

Figure 18 - Manual Shutoff Valve
4 PERIODIC BASIC MAINTENANCE

The TEG requires periodic basic maintenance to provide the expected continuous and steady operation. The maintenance interval depends on the site conditions (fuel purity, environment, etc.) and must be established based on-site records. Based on field experience, recommended periodic basic maintenance interval is once a year.

In addition, a power output evaluation should be performed and recorded based on Section 3.2 TARGET POWER CALCULATION prior to basic periodic maintenance. Additional maintenance might be required if the output power is significantly lower than the target power in which case contact the Customer Service Department at GPT. The following sections explain the required basic maintenance for TEG subsystems.

4.1 FUEL SYSTEM MAINTENANCE

Follow these steps to drain the Sediment Bowl:

1. Shut off the fuel supply and allow TEG to cool; approximately 3 hours.
2. Open the regulator drain cock, any impurities will drain through the cock.
3. Close drain cock.
4. Leak check the drain cock.

![Diagram of fuel system components](image)

*Figure 19 - Fuel System*
4.2 FUEL FILTER REPLACEMENT

To remove the Fuel Filter, follow the steps below and reference:

Fuel filter servicing:
1. Shut off the fuel supply and allow TEG to cool 3 hours.
2. Drain the sediment bowl by opening the drain cock.
3. Remove the four screws from the bottom of the regulator.
4. Remove the filter, and gasket.

Follow these steps to install a new fuel filter:
1. Install the filter, and gasket onto the sediment bowl.
2. Carefully replace the bottom of the regulator making sure the filter and gasket are in their proper position. Align the sediment bowl with the regulator body, replace the four screws and tighten.
3. With the fuel pressure on, leak check all regulator joints and fuel connections using a commercial leak detector.

4.3 FUEL ORIFICE INSPECTION

Refer to Figure 20 and follow these steps to inspect the fuel orifice:
1. Shut off the fuel supply and allow TEG to cool for approximately 3 hours. All components must be cool prior to performing disassembly and inspection.
2. Remove the access cover, remembering to first loosen its locking set screw.
3. Remove nuts from the retainer plate. (1).
4. Disengage tubing union from the fuel line. (2).
5. Pull out the venturi tube (4). It will still have the tubing attached.
6. Remove the orifice fitting from the venturi (3). The orifice is threaded into the venturi tube.
7. Visually check the orifice hole and venturi. They should be free from any obstructions. Use compressed air to clean or replace if necessary.
8. Thread the orifice fitting and tubing back into the venturi tube. The orifice fitting needs to be finger tight when reassembling the parts.
9. Carefully re-insert the venturi tube into the exhaust cooler. The venturi tube must be fully inserted such that the thick portion of the venturi tube is fully engaged in the mounting hole. Do not force the venturi tube into place as it can be damaged and burner efficiency and emissions will be impaired.
10. Reattach nuts on retaining plate. (1).
11. Connect the fuel line to the tubing union (2).
12. Leak check all connections using a commercial leak detector.
13. Replace the Access Cap and tighten set screw.
<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69261</td>
<td>Nut, Wing, M4 x 0.7 316 SS</td>
</tr>
<tr>
<td>2</td>
<td>21169</td>
<td>Union, ¼” TB</td>
</tr>
<tr>
<td>3</td>
<td>380</td>
<td>Orifice</td>
</tr>
<tr>
<td>4</td>
<td>69037</td>
<td>Venturi Tube</td>
</tr>
</tbody>
</table>

**CAUTION!** Always use the same size orifice as was removed. #10 – Natural gas, #6 – Propane. The orifice size is stamped on the orifice fitting.

**WARNING!** Check for fuel leaks after any fuel system service.
4.4 BURNER MAINTENANCE

Burner internals are maintenance free for most applications. If the required power still cannot be achieved after servicing the fuel system, air filter and checking the cooling fins then it may be necessary to check the burner screen for debris or build-up.

**NOTE:** To view the burner screen, remove the venturi as instructed above. The hole where the venturi sits gives access to see the burner screen.

4.5 AIR FILTER REPLACEMENT

Air Filter inspection and replacement frequency will vary based on the TEG’s environment. Check the air filter at regular intervals.

**NOTE:** When the air filter requires replacement, replace with Global Power Technologies part number 56024.

To inspect or change the air filter follow the instructions below:
1. Turn the fuel valve to the off position.
2. Loosen the thumb screw (4) attaching the Air Filter Box to the base of the TEG.
3. Remove Air Hose by loosening the top Hose Clamp (3) and pulling the hose off the TEG air inlet.
4. Slide the Air Filter Box out from the between the TEG legs.
5. The bottom of the Air Filter Box will have a screen (8).
6. Remove the screws (1) from the screen. Remove the screen. The Air Filter (6) will now be accessible.
7. Inspect Air Filter. If required, replace.
8. To re-install the filter, follow the above instructions in reverse order.
### Figure 21 - Air Filter Assembly

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69238</td>
<td>Screw, Panhead Philips M4 x 0.7 x 12, External-Tooth Lock Captive Washer</td>
</tr>
<tr>
<td>2</td>
<td>66365</td>
<td>Washer, Flat, M6 Screw, 6.4mm ID, 12mm OD, 1.6 Thick, 316SS</td>
</tr>
<tr>
<td>3</td>
<td>69203</td>
<td>Hose Clamp, 2”, Spiral Duct</td>
</tr>
<tr>
<td>4</td>
<td>69262</td>
<td>Screw, Thumb, M6 x 1.0 x 16 Knurled Plastic Head, 18-8SS</td>
</tr>
<tr>
<td>5</td>
<td>68885</td>
<td>Air Hose, Anti-Static</td>
</tr>
<tr>
<td>6</td>
<td>56024</td>
<td>Air Filter, Flat</td>
</tr>
<tr>
<td>7</td>
<td>69052</td>
<td>Air Filter Enclosure Assembly</td>
</tr>
<tr>
<td>8</td>
<td>69057</td>
<td>Filter Holder and Screen Assembly</td>
</tr>
</tbody>
</table>

**NOTE:** Inspect the Air Hose before each use. If there is evidence of excessive abrasion, wear, or the hose is damaged, replace the hose prior to further use.
4.6 FLAME ARRESTER MAINTENANCE AND INSPECTION

The Flame Arrestor will require regular inspection for debris and build up. The frequency of inspection will vary based on the TEG’s environment. At minimum, the Flame Arrestor should be inspected once per year.

4.6.1 INLET FLAME ARRESTER

![Figure 22 - Inlet Flame Arrestor](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68889</td>
<td>Locking Set Screw, Set Screw, Cup Point, M6 x 1.0 x 10 316SS, &amp; Screw Flat Head Phillips M4 x 0.7 x 16 316SS</td>
</tr>
<tr>
<td>2</td>
<td>N/A</td>
<td>Pin Wrench Sockets</td>
</tr>
<tr>
<td>3</td>
<td>69379</td>
<td>Air Inlet Subsystem Cover</td>
</tr>
<tr>
<td>4</td>
<td>69254-X</td>
<td>Outer Screw, Hex Head Cap, M8 x 1.25 x 35, 316SS</td>
</tr>
<tr>
<td>5</td>
<td>69689</td>
<td>Locking Ring Assembly, Flame Arrestor</td>
</tr>
</tbody>
</table>
Inspect the Inlet Flame Arrestor by following the instructions below:

1. Remove Cover (3).
2. Remove Set Screw (1). Do not remove Outer Screws (4).
3. Using a Pin Wrench in the Pin Wrench Sockets (2), remove the Flame Arrestor (5).
4. Remove Flame Arrestor (5) and inspect for debris, build-up or wear.
5. Clean or Replace Flame Arrestor.
6. Reinstall the Flame Arrestor (5) and torque to 25 lb·ft [34 N·m].
7. Reinstall the Set Screw (1).
8. Replace Cover (3).

---

**CAUTION!**

Do not damage the O-ring gasket. Replace the O-ring if it is damaged.
### 4.6.2 EXHAUST FLAME ARRESTOR

![Exhaust Flame Arrestor Diagram](image)

**Figure 23 - Exhaust Flame Arrestor**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68889</td>
<td>Locking Set Screw, Set Screw, Cup Point, M6 x 1.0 x 10 316SS, &amp; Screw Flat Head Phillips M4 x 0.7 x 16 316SS</td>
</tr>
<tr>
<td>2</td>
<td>N/A</td>
<td>Pin Wrench Sockets</td>
</tr>
<tr>
<td>3</td>
<td>69254-X</td>
<td>Outer Screw, Hex Head Cap, M8 x 1.25 x 35, 316SS</td>
</tr>
<tr>
<td>4</td>
<td>69965</td>
<td>Rain Cap Assembly</td>
</tr>
<tr>
<td>5</td>
<td>69689</td>
<td>Locking Ring Assembly, Flame Arrestor</td>
</tr>
</tbody>
</table>

Inspect the Exhaust Flame Arrestor by following the instructions below:

1. Remove Rain Cap (4).
2. Remove Set Screw (1). Do not remove Outer Screws (3).
3. Using a Pin Wrench in the Pin Wrench Sockets (2), remove the Flame Arrestor (5).
4. Remove Flame Arrestor (5) and inspect for debris, build-up or wear.
5. Clean or Replace Flame Arrestor.
6. Reinstall the Flame Arrestor (5) and torque to 25 lb·ft [34 N·m].
7. Reinstall the Set Screw (1).
8. Replace the Rain Cap (4).

4.7 SPARK ELECTRODE CHECK

Inspect the Spark Electrode by following the steps below:
1. Turn fuel off (See Figure 15– Fuel Shut Off Valve).
2. Unscrew the Access Cap (1).
3. Remove the wire connector from the Tab Electrode (2).
4. Loosen the fitting nut (3) at the base of the electrode.
5. Gently pull the electrode out all the way.
6. Inspect the electrode for any cracks in the ceramic rod. If any cracks are found the electrode must be replaced.
7. If no cracks are found, fully insert the electrode gently until it bottoms inside the burner.
8. Pull back the ceramic rod (4) by 0.115” – 0.125” (2.92mm – 3.175mm).
9. Tighten the fitting nut only until it is snug. Ensure the ceramic rod remains at the previously specified distance.
10. Replace the ignition wire connector and Access Cap (1).

Figure 24 - Spark Electrode Check

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69674-X</td>
<td>Access Cap</td>
</tr>
<tr>
<td>2</td>
<td>58496</td>
<td>Electrode Assembly</td>
</tr>
<tr>
<td>3</td>
<td>69046</td>
<td>Connector, Ignitor, 316SS</td>
</tr>
<tr>
<td>4</td>
<td>N/A</td>
<td>Ceramic Rod and Spark Post Fitting</td>
</tr>
</tbody>
</table>
4.8 BATTERY CHECK

Follow the steps below to check the battery:
1. Begin with the TEG turned off and the battery attached, with no external power source.
2. Start the TEG.
3. If the TEG starts, then the battery still has power.
4. If the TEG does not start, then the battery may require replacement.

4.9 COOLING SYSTEM

For optimum performance, make sure the top of the cooling fins remains free of debris, such as leaves, that would prevent air flow. Should the fins become caked with dust or mud, it may be necessary to remove the dust and mud by the most appropriate method at hand, such as using compressed air, a long soft brush or use of water spray.

4.10 FLAME JOINT TORQUE SPECIFICATIONS

It is not necessary to dismantle flame joints other than those described above during normal maintenance procedures. If a fastener holding together a flame joint is replaced, the following torque specifications are to be followed:
1. M8 (Flange Bolts) Torque 11 lb·ft [15 N·m]
2. M10 (Flange Bolts) Torque 21 lb·ft [28 N·m]
3. Flame Arrestor Lock Ring 25 lb·ft [34 N·m]
# 5 TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem</th>
<th>Probable Cause</th>
<th>Possible Solution</th>
<th>Lookup Section</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Burner does not ignite</strong></td>
<td>Air in fuel line</td>
<td>Purge fuel lines of air or attempt restarting the TEG.</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td>Supply gas pressure too low</td>
<td>Increase the gas supply pressure to the TEG</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td>Fuel filter dirty</td>
<td>Drain the regulator sediment bowl.</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel pressure adjustment incorrect</td>
<td>Adjust the TEG fuel pressure</td>
<td>Operation &amp; Performance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice plugged</td>
<td>Replace the fuel orifice</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice size incorrect</td>
<td>Replace the fuel orifice</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Air shutter adjustment incorrect</td>
<td>Adjust the air-shutter</td>
<td>Operation &amp; Performance</td>
</tr>
<tr>
<td></td>
<td>SI system faulty</td>
<td>Call GPT Customer Service</td>
<td>Maintenance</td>
</tr>
<tr>
<td><strong>Burner will ignite but will not continue to burn</strong></td>
<td>Supply gas pressure too low</td>
<td>Increase the gas supply pressure to the TEG</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td>Fuel filter dirty</td>
<td>Drain the regulator sediment bowl</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel pressure adjustment incorrect</td>
<td>Adjust the TEG fuel pressure</td>
<td>Operation &amp; Performance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice plugged</td>
<td>Replace the fuel orifice</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice size incorrect</td>
<td>Replace the orifice with one of the correct size</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Air shutter adjustment incorrect</td>
<td>Adjust the air-shutter</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Optional internal battery is discharged</td>
<td>Replace optional internal battery</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td>SI system faulty</td>
<td>Call GPT Customer Service</td>
<td>Performance</td>
</tr>
<tr>
<td></td>
<td>Exhaust Flame Arrestor Icing, Occurs when starting TEG in below -30°C</td>
<td>Heat Flame Arrestor prior to starting TEG</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Problem</td>
<td>Probable Cause</td>
<td>Possible Solution</td>
<td>Lookup Section</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Low output power</td>
<td>Setup power incorrect</td>
<td>Determine required setup power for present ambient</td>
<td>Performance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>temperature at site and adjust</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Airflow past cooling fins</td>
<td>Clean the cooling fins of any debris</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>insufficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel filter dirty</td>
<td>Drain the regulator sediment bowl</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice plugged</td>
<td>Replace the fuel orifice</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel orifice size incorrect</td>
<td>Replace the orifice</td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td>Fuel pressure adjustment</td>
<td>Adjust TEG fuel pressure</td>
<td>Operation &amp;</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td></td>
<td>Performance</td>
</tr>
<tr>
<td></td>
<td>Air-shutter adjustment</td>
<td>Adjust air-shutter</td>
<td>Performance</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Power unit damaged</td>
<td>Contact GPT</td>
<td>Contact GPT</td>
</tr>
<tr>
<td>Output power is</td>
<td>Fuel pressure adjustment</td>
<td>Adjust the TEG fuel pressure</td>
<td>Operation &amp;</td>
</tr>
<tr>
<td>too high</td>
<td>incorrect</td>
<td></td>
<td>Performance</td>
</tr>
<tr>
<td>Output voltage is</td>
<td>Output Voltage adjustment</td>
<td>Adjust output voltage with HMI</td>
<td>Installation</td>
</tr>
<tr>
<td>too high</td>
<td>incorrect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low output</td>
<td>Limiter Converter damaged</td>
<td>Contact GPT</td>
<td>Contact GPT</td>
</tr>
<tr>
<td>voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output Voltage adjustment</td>
<td>Adjust output voltage with HMI</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td>incorrect</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overloaded TEG</td>
<td>Reduce customer load</td>
<td>Performance</td>
</tr>
</tbody>
</table>
6 APPENDICES

APPENDIX A – TECHNICAL SPECIFICATIONS

Standard Features
- Automatic Spark Ignition (SI)
- Automatic Fuel Shut-off (SO)
- Fuel Filter
- Low Voltage Alarm Contacts
- Output voltage and current 4-20 mA signal
- Digital Volt and Amp Meter
- Flame Arrestors

Certifications
- IECEx, ATEX
  - II 2 G Ex db IIA T3 Gb
  - -20 °C to +60 °C
  - -18 °C to +40 °C with battery option installed
- CSA
  - Class 1 Div 1 Group D T3
  - -40 °C to +60 °C
  - CSA TIL R-10
- UL
  - Class 1 Zone 1 AEx db IIA T3 Gb
  - -20 °C to +60 °C
  - -18 °C to +40 °C with battery option installed

Optional Features
- Intake Air Filter
- Start-up battery
- Bench stand

Power Specifications
- Power Rating at 20 °C
  - 100 Watts at 12 Volts
  - 100 Watts at 24 Volts

Electrical
Adjustment: 12V 11.5 - 15.5 Volts
24V 23.0 - 31.0 Volts

Output current limited to 13A for 12V models and 6.5A for 24V models.

Reverse current protection included
Isolated outputs

Output: Terminal block which accepts up to 6 AWG wire. Opening for three 1” NPT ports in the electrical housing.
Fuel
Natural Gas: 8.4 m³/day (295 Sft³/day)
1000 BTU/Sft³ (37.7 MJ/Sm³) gas
Max 115 mg/Sm³ (~170 ppm) H₂S
Max 120 mg/Sm³ H₂O
Propane:
10.8 L/day (2.85 US gal/day)
2500 BTU/Sft³ (93 MJ/Sm³)
Max Supply Pressure: 172 kPa (25 psi)
Min Supply Pressure: 103 kPa (15 psi)
Fuel Connection: ¼” MNPT

Environmental
Ambient Operation Temperature:
Without the battery option installed:
Max +60 °C,
Min -40 °C (IECEx, ATEX and UL certifications apply down to -20 °C)
With the battery option installed:
Max +40 °C,
Min -18 °C
Operating Conditions:
Unsheltered operation, certified for use in hazardous areas.
Operating Altitude: up to 3000 m

Materials of Construction
Enclosures: Cast Aluminum
Cooling Type: Natural Convection
Fuel System: Aluminum and Stainless Steel
Cabinet: Stainless Steel
Table 1 - Overall Dimensions, Weight and Anchor bolt pattern.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth</strong></td>
<td>977 mm (38.5 in.)</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>385 mm (15.2 in)</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>1098 mm (43.2 in)</td>
</tr>
<tr>
<td><strong>Net Weight</strong></td>
<td>178 kg (393 lbs)</td>
</tr>
<tr>
<td><strong>Mounting Holes</strong></td>
<td>338.6 mm × 457.2 mm (13.33 in × 18.00 in)</td>
</tr>
<tr>
<td>PARAMETER</td>
<td>LIMIT</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Fuel Supply Pressure</td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td>Minimum (Natural Gas)</td>
</tr>
<tr>
<td></td>
<td>Minimum (Propane)</td>
</tr>
<tr>
<td>Ambient Temperature (Operation)</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature (Storage)</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind Loading</td>
<td>Maximum</td>
</tr>
<tr>
<td>Altitude above sea level (ASL)</td>
<td>Maximum</td>
</tr>
<tr>
<td>Load Current</td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Transient</td>
<td>&lt;30%</td>
</tr>
<tr>
<td></td>
<td>&lt;50%</td>
</tr>
<tr>
<td>Design Life</td>
<td>&gt;15 Years</td>
</tr>
<tr>
<td>Start Cycles</td>
<td>&gt;150</td>
</tr>
</tbody>
</table>

Table 2 - Absolute Maximum & Minimum Ratings.

---

**CAUTION!** Under severe wind loading conditions some damage to metal parts can be expected. In such cases, inspect for damage prior to being returned to operation. If excessive damage is found contact GPT.
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage Regulation</td>
<td>&lt;1%</td>
<td>% of Full Scale in constant voltage mode. See section 3.6 CUSTOMER POWER AVAILABLE for more detail</td>
</tr>
<tr>
<td>Output Voltage Temperature Drift</td>
<td>+/- 0.03%/°C</td>
<td></td>
</tr>
<tr>
<td>Output Voltage Ripple</td>
<td>&lt;1%</td>
<td>% of Full Scale</td>
</tr>
<tr>
<td>Load Transient</td>
<td>&lt;30%</td>
<td>50% load step</td>
</tr>
<tr>
<td>Fuel Consumption</td>
<td>8.4 m³/day (295 scf/day)</td>
<td>Natural Gas</td>
</tr>
<tr>
<td></td>
<td>10.8 liters/day (2.85 US gal/day)</td>
<td>Propane</td>
</tr>
<tr>
<td>Fuel Connection</td>
<td>1/4” Female NPT</td>
<td></td>
</tr>
<tr>
<td>Voltage Sense Relay (VSR)</td>
<td>Two</td>
<td>Each with single Normally Open (NO), Normally Closed (NC) contacts, 14-24 AWG Wire</td>
</tr>
<tr>
<td>VSR Contact Rating</td>
<td>1 A</td>
<td>@ 30 VDC</td>
</tr>
<tr>
<td>Voltage Measurement Accuracy</td>
<td>+/- 1.5%</td>
<td>% of Full Scale</td>
</tr>
<tr>
<td>Current Measurement Accuracy</td>
<td>+/- 2.5%</td>
<td>% of Full Scale</td>
</tr>
<tr>
<td>Power Measurement Accuracy</td>
<td>+/- 3.0%</td>
<td>% of Full Scale</td>
</tr>
<tr>
<td>Emissions</td>
<td>&lt;50 ppm CO</td>
<td>Nominal correct air / fuel set-up</td>
</tr>
<tr>
<td></td>
<td>&lt;30 ppm NOx</td>
<td></td>
</tr>
<tr>
<td>Acoustic Signature</td>
<td>&lt;75 dB(A)</td>
<td>@ 1 m distance</td>
</tr>
<tr>
<td>Humidity</td>
<td>100% Condensing</td>
<td>Up to 10 mm/min</td>
</tr>
<tr>
<td>Primary Materials of Construction</td>
<td>Enclosure: Cast Aluminum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fuel System: Aluminum &amp; Stainless Steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cabinet: Stainless Steel</td>
<td></td>
</tr>
</tbody>
</table>

*Table 3 - Absolute Maximum & Minimum Ratings (24V model).*
APPENDIX C – REPLACEMENT PARTS

The following replacement parts assemblies can be purchased through Global Power Technologies or through your local Global Power Technologies distributor.

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>70989</td>
<td>S1100, FIELD REPLACEMENT, Electrical Enclosure Assembly</td>
</tr>
<tr>
<td>70990</td>
<td>S1100, FIELD REPLACEMENT, Burner Assembly</td>
</tr>
<tr>
<td>70991</td>
<td>S1100, FIELD REPLACEMENT, External Fuel Assembly</td>
</tr>
<tr>
<td>70992</td>
<td>S1100, FIELD REPLACEMENT, Internal Fuel Assembly</td>
</tr>
<tr>
<td>70993</td>
<td>S1100, FIELD REPLACEMENT, Lube Kit</td>
</tr>
<tr>
<td>70994</td>
<td>S1100, FIELD REPLACEMENT, Bolt Kit</td>
</tr>
<tr>
<td>70995</td>
<td>S1100, FIELD REPLACEMENT, Power Unit Assembly</td>
</tr>
</tbody>
</table>

*Table 4 – Replacement Parts*
# APPENDIX D – PERFORMANCE LOG (S-1100)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Ambient Temp °C</th>
<th>Ambient Temp Correction Factor</th>
<th>Altitude</th>
<th>Altitude Correction Factor</th>
<th>Voltage (V)</th>
<th>Current (A)</th>
<th>Fuel Pressure (psi)</th>
<th>Target Power (W)</th>
<th>Air Shutter Setting</th>
<th>Maintenance Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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