HEAT RECOVERY SYSTEM (HRS)

Installation Manual

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66683 Rev 2

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1 HEALTH AND SAFETY

This manual provides instructions for the safe installation of the Global Power Technologies (GPT) Heat Recovery System (HRS).

In the event of unforeseen or special problems, it is not permitted to take unauthorized remedial action. In such cases, contact the GPT customer service department to obtain the necessary information to proceed.

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!**	Do not block air flow to duct openings. Doing so may result in over-temperature as well as damage the TEG.
	**WARNING!**	If the HRS Assembly is being mounted to a wooden exterior, then a sheet metal barrier must be installed between the generator cooling fins and the wall surface.
	**WARNING!**	Wear appropriate gloves and personal protective equipment. Sharp edges may exist on some of the sheet metal components.

2 THEORY OF OPERATION

The HRS System is designed to capture waste heat from the cooling fins of a Thermoelectric Generator (TEG) for the purpose of warming an interior space. A convection loop is formed between the HRS duct and the building interior. Cool air enters the HRS duct from the lower building cutout, where it is then warmed by the TEG fins before recirculating back through the upper building cutout.

Amount of convection airflow is controlled by a thermostat, actuator, and duct dampers to keep the interior at a desired temperature. A distribution fan helps disperse the warm air throughout the building interior. The HRS Control Panel connects together the thermostat, actuator, distribution fan, and TEG Power and Voltage Sensing Relay (VSR) outputs. The VSR connection ensures that an HRS system with a connected station battery will not open the damper doors if the TEG is offline.

3 INTRODUCTION

The HRS System comes partially pre-assembled. Do not disassemble any pre-assembled parts. Throughout this manual, refer to the HRS Assembly Diagram, Figure 6, and Parts List at the end of the document.

The vent duct and hood extend upwards past the intersection of the exterior wall and roof. There is very little horizontal clearance in this location so there can be no roof overhang in this area.

The mounting frame for this system is designed to attach to an exterior wall. The system design permits attachment to walls of virtually any construction type. The wall must be reasonably flat, and the exterior finish should not have any significant profile. Fasteners specific to the type of wall are required for attaching the HRS and are not supplied with the system. Should wood frame construction be used, the frame is designed for 16-inch on center mounting.

Ensure the inside of the wall the HRS is to be mounted upon provides unblocked air circulation to both the top and bottom duct openings. Space any equipment a minimum of 6" away from the duct openings. Do not allow materials to be stacked against the wall blocking duct openings during operation.

The HRS System electrical components consume a maximum of 13W (10W nominal) of TEG output power when energized. Remaining TEG power is available for customer site loads.

4 RECOMMENDED INSTALLATION HARDWARE

- Fasteners to attach the HRS system to the wall, suitable for the wall type. Minimum Quantity: 12 required. Mounting holes are 5/16" diameter generally suited for nominal 1/4" diameter fasteners.
- Carpenter's square for checking level of assembly.
- Tools suitable for cutting holes in the wall material as required.
- 24 V_{DC} Power Supply (minimum 6W).

5 UNCRATING

1. Remove the lid from the crate.
2. Remove the actuator cover screws and the Actuator Cover (Item H15, Figure 6). Store in a safe area.
3. Remove screws securing complete assembly to the crate.
4. Carefully lift the HRS Major Assembly from the crate.
5. Remove the distribution fan assembly from the crate and store in a safe area.

6 CREATING THE WALL OPENINGS

The assembly should be mounted as high as possible on the exterior wall while ensuring the upper cutout is located below the interior ceiling of the building. Additionally, the upper end of the frame cannot extend past the intersection of the roof and the exterior wall.

Cut out the wall openings for the HRS Assembly as per Figure 1. Typical cutouts are 12" (305mm) wide and 14" (1209mm) tall. Conduit entries are sized per customer application. Ensure that the upper wall cutout has a minimum of 10" clearance from the interior ceiling for distribution fan mounting.

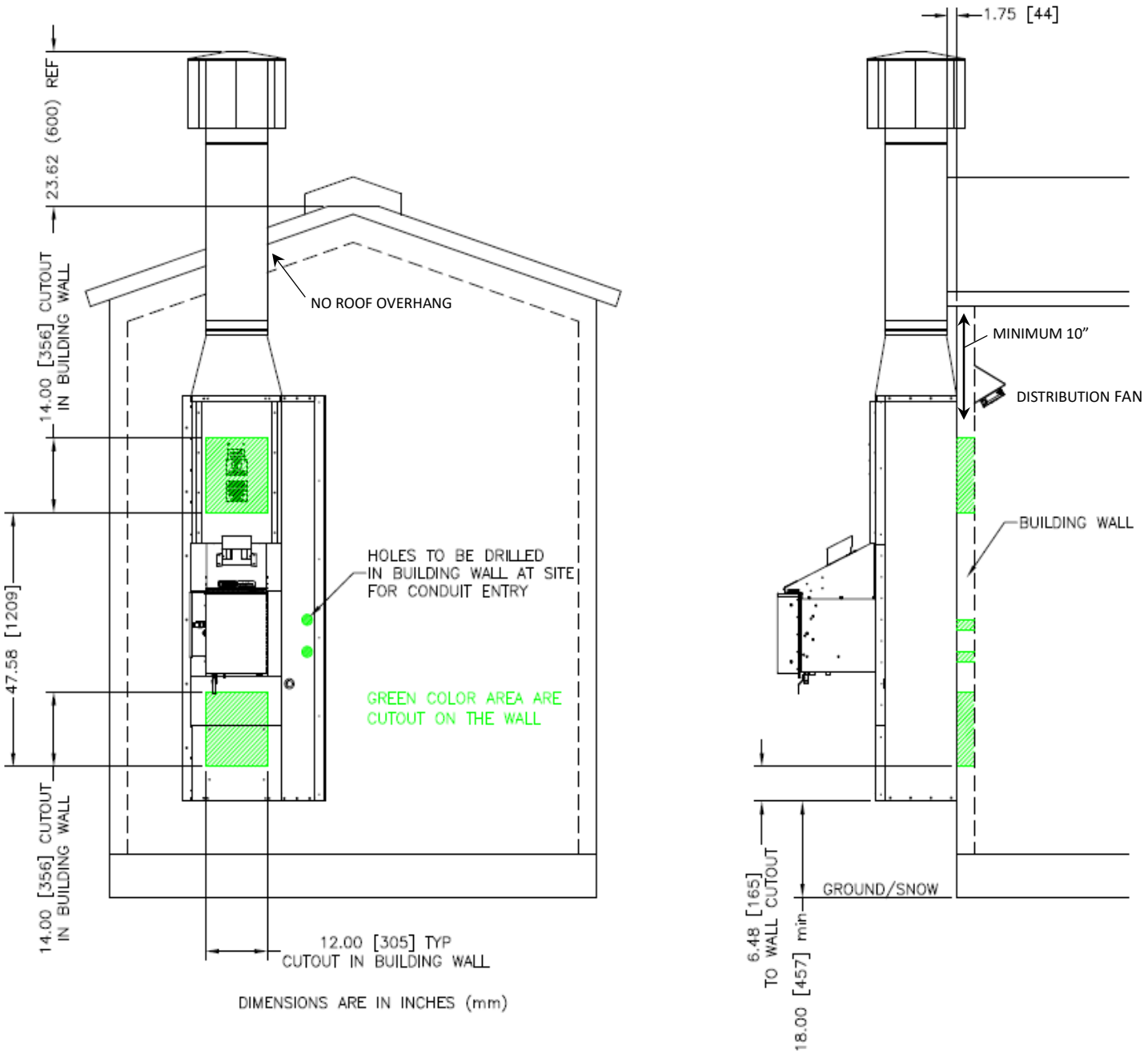


Figure 1 - Building cutout dimensions

7 MOUNTING THE HRS MAJOR ASSEMBLY

1. After wall cutouts are completed, locate the HRS Major Assembly, shown in Figure 2 below. Do not disassemble this assembly.
2. Level the HRS Major Assembly in the correct location and secure to the building exterior through the frame's pre-drilled holes. Holes are 5/16" diameter and spaced at 16" O.C and are suited for nominal 1/4" fasteners. These fasteners are not supplied as they are dependent on the type of wall to which the HRS is being attached (i.e.: wood, masonry, metal).
3. Seal any gaps between the building wall and the HRS Major Assembly with the supplied caulking.

Figure 2 – HRS Major Assembly (do not disassemble)

8 ATTACHING A MODEL P-5050/P-5100 TEG TO THE HRS MAJOR ASSEMBLY

This section is only applicable to P-5050 & P-5100 model TEG. See the next section for the model 5220 TEG.

1. If it came pre-installed, temporarily remove the Heat Shield Cover (Item H18, Figure 6) from the front of the front of the HRS Major Assembly. It should now look like Figure 2 above.
2. Remove the model P-5050/P-5100 thermoelectric generator from the crate by undoing the 4 bolts holding the TEG to the crate.
3. Remove and retain the temporary shipping legs from the generator.

4. Identify the HRS mounting bars installed on each side of the generator.
5. Install two of the provided 1/4 x 2" hex screws into the bottom two empty holes on each mounting bar, leaving the topmost hole empty for now.
6. Fully engage these screws, and then loosen them by 6 full turns.
7. Lift and position the TEG so that the loosened screws drop into the slotted holes in the sides of the HRS frame.
8. Install the topmost screw on each side of the generator.
9. Level the TEG using a carpenter's square, then fully tighten all six hex head screws to secure the TEG to the mounting frame.

9 ATTACHING A MODEL 5220 TEG TO THE HRS MAJOR ASSEMBLY

This section is only applicable to the 5220 model TEG. See the previous section for P-5050 & P-5100 model TEGs.

1. Remove the model 5220 thermoelectric generator from the crate by undoing the 4 bolts holding the TEG to the crate.
2. Note that there are fragile electronic components located on the underside of the TEG cabinet, so use care to ensure they are not damaged. Once the shipping legs are removed, the TEG may be safely placed on its end with the cooling fins downwards.
3. Remove and retain the temporary shipping legs from the generator.
4. Identify the HRS mounting bars installed on each side of the generator.
5. Install two of the provided 1/4 x 2" hex screws into the top and bottom empty holes on each mounting bar, leaving the middle hole empty for now.
6. Fully engage these screws, and then loosen them by 6 full turns.
7. Lift and position the TEG so that the loosened screws drop into the slotted holes in the sides of the HRS frame.
8. Install the middle screw on each side of the generator.
9. Level the TEG using a carpenter's square, then fully tighten all six hex head screws to secure the TEG to the mounting frame.

10 INSTALLING THE WARM AIR EXHAUST

1. Install the square-to-round transition duct (Item H6, Figure 6) to the top of the HRS assembly using the supplied #8 X 1/2 hex screws (3 per each of the 3 sides). Ensure this transition fits over the wrapper to prevent water ingress.
2. Use the supplied caulking materials to seal the contact area between the wall and the transition.
3. Determine the length of the 12" diameter warm air exhaust tube (Item H4, Figure 6) required to clear the building rooftop, as shown in Figure 1. Adjust the tube as required and install using the supplied #8 X 1/2 hex screws.
4. Attach the AeroFoil Ventilator (Item H5, Figure 6) to the top of the exhaust tube using supplied #8 X 1/2 hex screws.

11 FINISHING THE FRONTSIDE INSTALLATION

1. If it was removed in prior steps or came uninstalled, locate the Heat Shield Cover (Item H18, Figure 6) with the warnings and logo. Install this to the front of the HRS Assembly using the supplied #8 X 3/8" Philips sheet metal screws. See Figure 3 below for reference with generator models P-5050/P-5100.
2. Install the left-side upper opening cover (Item H16, Figure 6) using the supplied #8 X 9/16" screws.
3. Next, position the right-side upper opening cover (Item H17, Figure 6) but do not screw it in, as the side screws would interfere with the actuator cover later in the installation.
4. Install both filler covers (Items H8, Figure 6) using the supplied #8 X 9/16" screws overtop of the left and right upper covers. These filler covers will hold the right-side cover in place by fastening it to the left-side cover.

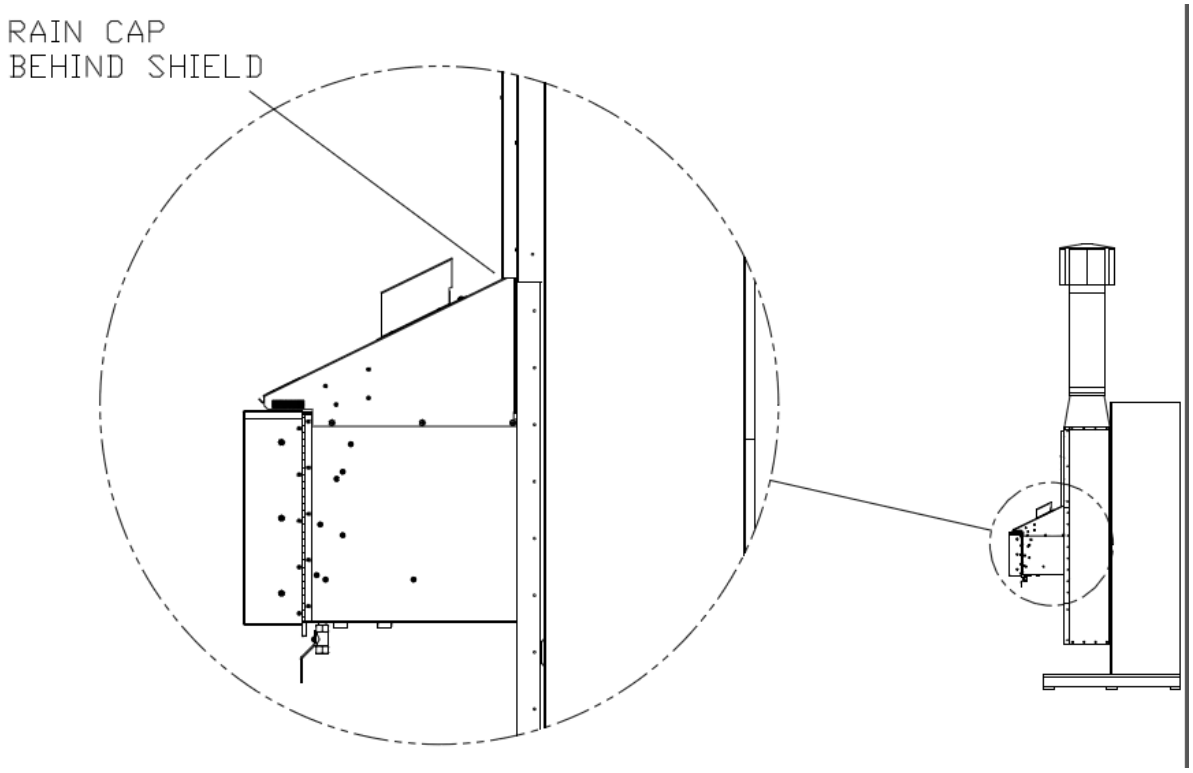


Figure 3 – P-5050 & P-5100 Rain Cap Position in Heat Recovery System

12 DAMPER DOOR AND LINKAGE ADJUSTMENT

The assembly arrives with the actuator link and damper doors preconfigured for normal operating conditions, but a verification test must be performed before running the system with heat applied. The below steps can also be followed if adjustment is required during routine maintenance.

1. With both damper doors closed, verify the control arms on the damper and actuator shaft are at an angle of 45° from the duct walls. See Figure 4 below.
2. With the actuator fully disconnected electrically, connect the 24 V_{DC} power supply to the actuator motor leads. Turn the power supply on and observe the door movement from closed to open. Turn off the supply and observe the doors close.
3. Adjust the control arms and linkages if necessary, to obtain full closure and opening of the damper doors. They should slightly touch the insulation at the far side of the duct when open.

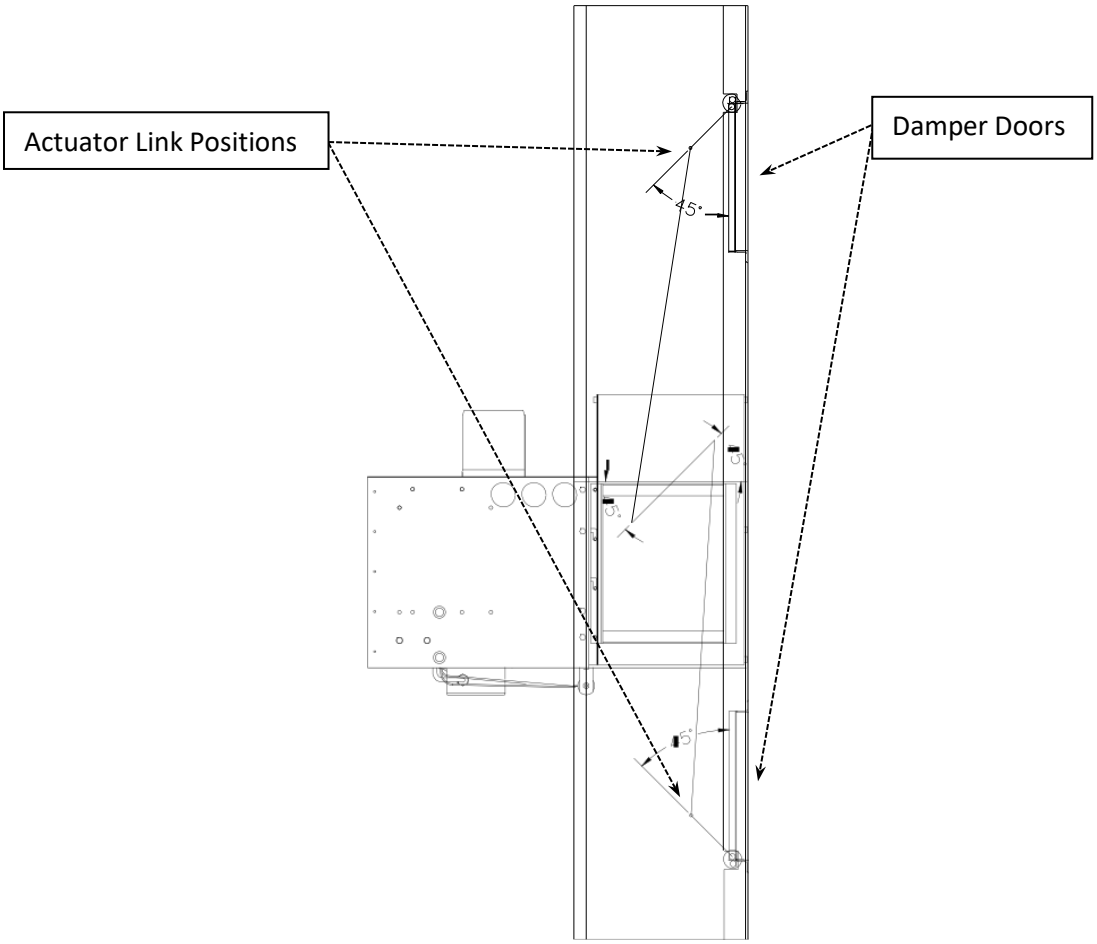


Figure 4 – Linkage adjustment; dampers shown in closed position

13 HRS CONTROL PANEL INSTALLATION

The HRS Control Panel enclosure is IP66 / NEMA 4X rated and may be mounted on either the building exterior or interior. Choose a central mounting location that best suits the site, knowing that the HRS Control Panel will need to connect to the thermostat, distribution fan, actuator, and TEG.

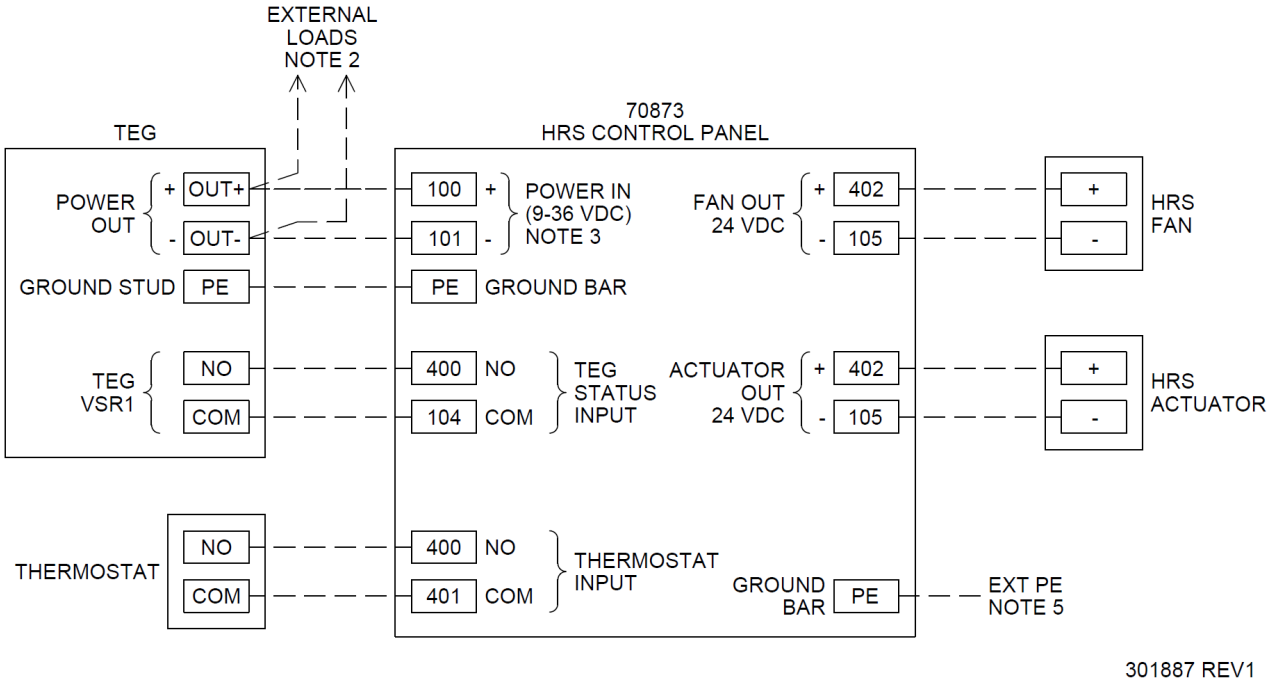
Mounting hole dimensions: 7.024" X 11.206"

14 THERMOSTAT AND DISTRIBUTION FAN INSTALLATION

1. Mount the thermostat in the desired position on the inner building wall away from both warm and cold drafts.
2. Adjust the thermostat temperature setpoint to the desired level for the building.
3. Mount the hot-air distribution fan in the desired interior position on the wall above the upper wall cutout. Ensure the direction of fan air flow is pointing downwards.

15 HRS SYSTEM WIRING

1. Refer to the Wiring Diagram in Figure 5 throughout this section. System wiring is not supplied with the HRS Assembly.
2. Holes should be drilled in the bottom of the HRS Control Panel enclosure to accommodate system wiring as required.
3. Refer to the TEG Operating Manual as required for the location of the TEG POWER OUT connections and GROUND STUD.
4. Refer to the TEG Operating Manual for the location of the TEGs VSR1 connection point. The VSR should be left at factory settings for an HRS system (set to trigger at 11.5V for a 12V TEG, or 23V for a 24V TEG). Connect the NO / COM terminals from the TEG VSR to the NO / COM inputs on the Control Panel. For TEG models with dual VSRs, connect to VSR1 and *not* VSR2.



NOTES:

1. INTERCONNECT CABLES SUPPLIED BY OTHERS UNLESS OTHERWISE INDICATED.
2. EXCESS TEG POWER AVAILABLE FOR SITE LOADS.
3. WIRE SIZE RANGE FOR HRS CONTROLLER PANEL POWER INPUT TERMINALS IS 10 AWG TO 20 AWG.
4. WIRE SIZE RANGE FOR HRS CONTROLLER PANEL CONTROL TERMINALS IS 14 AWG TO 26 AWG
5. WIRE SIZE RANGE FOR GROUND BAR IS 4 AWG TO 14 AWG, GROUNDING AS PER SITE REQUIREMENTS.

Figure 5 – Wiring Diagram Heat Recovery System

16 COMPLETING THE INSTALLATION

1. Position the actuator cover (Item H1, Figure 6) over the actuator assembly and linkages, then attach to the HRS Assembly using the supplied #8 X 9/16” screws.
2. Connect the fuel supply to the TEG manual shutoff valve (TEG fitting is 1/4" Female NPT) using the thread sealant provided with the TEG. Leak-check the complete fuel system from the fuel supply line to the burner inlet using a commercial leak detector fluid such as Snoop®.
3. Connect any external site loads to the TEG power output terminals as required.
4. Perform the steps in Sections 2.2 & 2.3 in the TEG Operating Manual for starting and tuning your TEG.

17 SYSTEM CHECKLIST

Once all other installation actions have been completed, populate this checklist with details from the installation.

Completion and return of this checklist to GPT is required to activate the warranty on HRS Systems.

Installation Requirement	Confirmation
Are both top and bottom duct openings clear of obstructions?	YES / NO
Measured dimensions of top duct opening, width X height:	_____ X _____
Measured dimensions of bottom duct opening, width X height:	_____ X _____
Least measured distance between either interior duct opening and any interior mounted equipment:	_____
If the HRS is attached to a wooden exterior, is a sheet metal barrier installed between the exterior and the cooling fins?	YES / NO / N/A
Confirm mesh inlet screen at the bottom of the duct is undamaged:	YES / NO
Measured distance from snow or ground level to mesh inlet screen at the bottom of the duct:	_____
Measured distance from roof peak to top of HRS duct rain cap:	_____
TEG fuel system leak-check completed with no leaks observed:	YES / NO
---------- HRS System Test ----------	
1. TEG is able to start up and produce correct power for the present ambient temperature and altitude.	1. V_{SET}: _____ T_{AMB}: _____
2. Set the thermostat setpoint *above* the current ambient temperature and confirm the damper doors fully open without binding.	2. YES / NO
3. Confirm the air distribution fan operates when dampers are actuated.	3. YES / NO
4. Set the thermostat setpoint *below* the current ambient temperature and confirm the damper doors fully close without binding.	4. YES / NO

18 HRS ASSEMBLY DIAGRAM AND PARTS LISTS

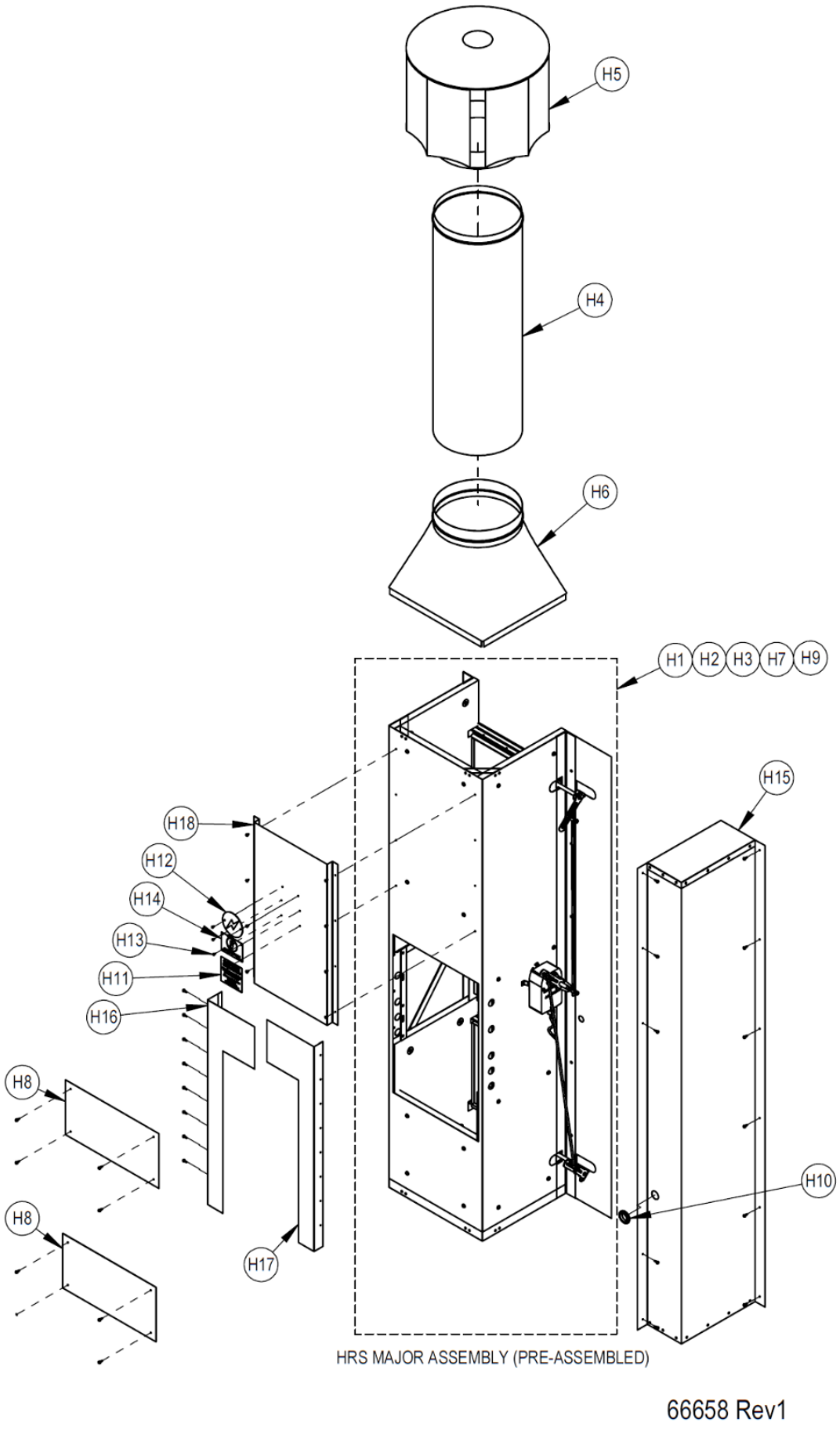


Figure 6 – Heat Recovery System Assembly, exploded view

Item	Part No.	Description	HRS ASSEMBLY PARTS LIST
H1	65700	DUCT WRAPPER, W/ INSULATION, 16" DEEP HRS, P-5050/P-5100/5220	
H2	65701	DUCT FRAME WELDMENT, 16" DEEP HRS, P-5050/P-5100/5220	
H3	65811	DAMPER WELDMENT, TOP & BOTTOM, 16" DEEP, P-5100 HRS	
H4	21061	TUBE, 12" DIA. X 36" LG, GALV. STEEL, HRS	
H5	1165	VENTILATOR, AERO-FOIL	
H6	65720	TRANSITION, 18" X 16" TO 12" DIA., 15" DEEP HRS	
H7	21065	ACTUATOR ASSEMBLY, HRS	
H8	65721	FILLER, DUCT, HRS, P-5050/P-5100/5220	
H9	65722	SCREEN, INLET, 16" DEEP HRS, P-5050/P-5100/5220	
H10	6939	GROMMET, SPAENAUR RB-106	
H11	684	LABEL, CAUTION, HOT SURFACES	
H12	683	LABEL, GLOBAL	
H13	393	RIVET, POP, 1/8 DIA, .063-.125 GRIP, 305 SS	
H14	6609	LABEL, CAUTION, HOT	
H15	65876	COVER, ACTUATOR ASSY, 16" DEEP HRS	
H16	66641	COVER, UPPER OPENING, HRS, P-5050/P-5100/5220, LEFT	
H17	65719	COVER, UPPER OPENING, HRS, P-5050/P-5100/5220, RIGHT	
H18	65875	HEAT SHIELD, HRS	

Part No.	Description	HRS SYSTEM PARTS LIST
352	CAULKING GUN	
353	SEALANT, DOW 732-CL, 300 ML	
21050	FAN ASSY, HRS	
58427	TSTAT, WALL MOUNT, HONEYWELL T822K1034	
65725	SCREW, HEX HD, 1/4 X 2 1/2, SS	
70873	HRS CONTROL PANEL	

For parts and service please contact Global Power Technologies' Customer Service Department at:

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