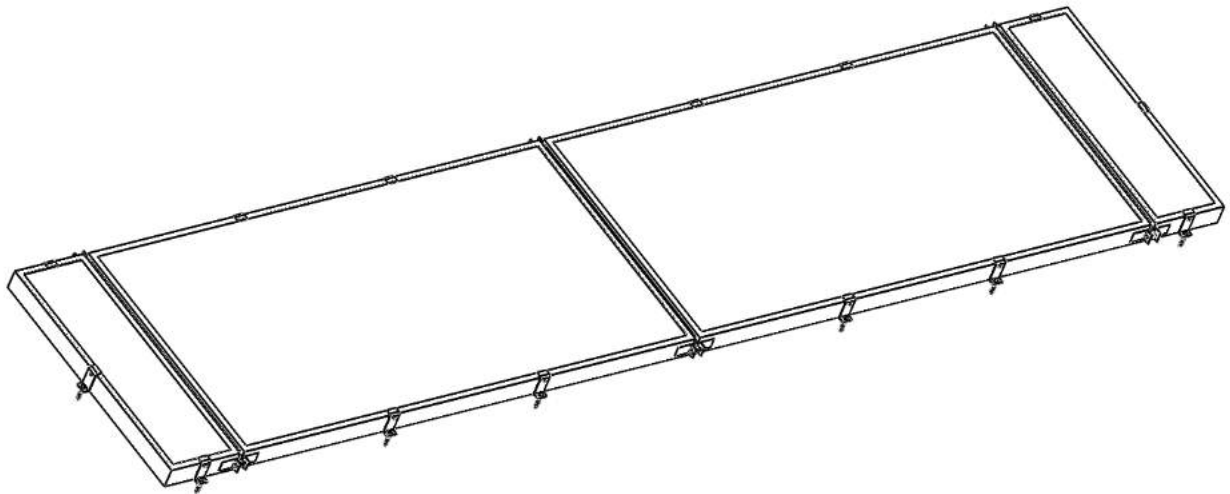




## 4000 (4k) Series, Gen 1

### Solar Air Heater / Solar Furnace Owner's Manual

*This manual can also be referenced for the 2000 (2k) Series system. All instructions are the same except the 2000 (2k) system uses only 1x 2000 series panel vs 2x 2000 series panels in the 4k system*



V1, Released 04.03.2022 to print

Questions? Issues?

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Thank you for purchasing the Arctica Solar 4000 Series Solar Air Heater / Solar Furnace, Gen 1 design.

This heater is a simple product, and with proper installation and maintenance should bring you years of free, renewable, supplemental heating to the adoptive space. Under full sunlight it can generate close to 3,600 W / 12,000 BTU / hr of space heating.

This manual will guide you through the following Sections with regards to your new solar air heater.

*We recommend you read the entire owner's manual and install guidance before attempting to install your new heater. Careful installation is the number one factor in ensuring a long, successful heater lifetime!*

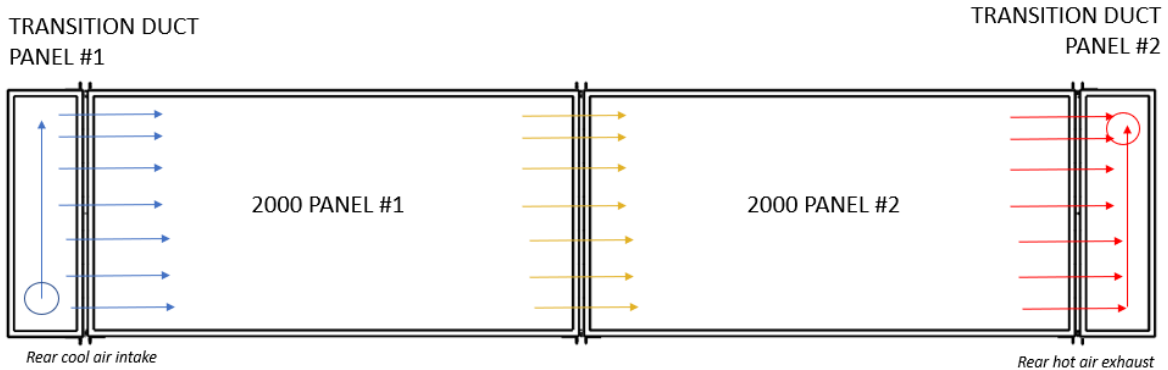
## Sections:

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## Section 1.0 - Items Included and *not* Included with the Heater

The following items are included with your heater shipment:

- 2x 2000 SERIES SOLAR AIR HEATER PANELS, GEN 1 & 2x TRANSITION DUCT PANELS – The 4000 series system is a connection of 2x Transition duct units and 2x 2000 series panels connected via foam seals and compression joints on the short end of the panels as shown below. Air intake is at the rear of the intake transition duct through the 4.5” diameter intake collar. Air is heated as it passes through the 7x channels of the 2x 2000 PANELS, and heated air is exhausted through the 4.5” diameter exhaust collar at the rear of the exhaust transition duct. A side picture of the 2000 Series panel and a side picture of a transition duct and compression seal are below.



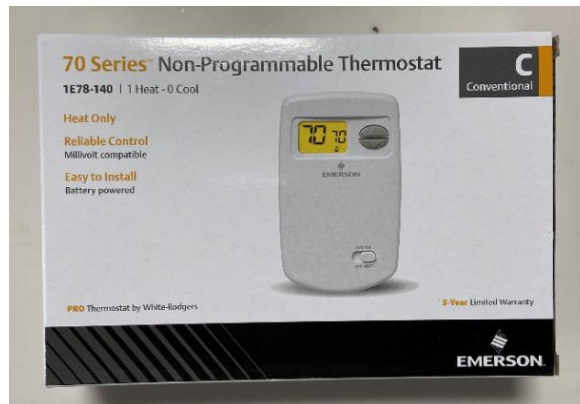
- 6X M8, 50mm LONG MACHINE BOLT, WASHER, SPRING WASHER AND NUT - For clamping transition ducts and 2000 panels to create seal between panel units.



- 12X WALL MOUNTING BRACKETS, 12x 2.5" STAINLESS LAG BOLTS & WASHERS, 12X HEX, STAINLESS, #8 x 1/2" SELF DRILLING SCREWS – For wall attach of mounting brackets supporting the heater and securing mounting brackets to heater side wall. Each transition duct uses 2x mounting brackets, and each 2000 series heater panel uses 2x top and 2x bottom (4x total) mounting brackets.



- 1X HEAT ONLY THERMOSTAT – for optional use. Must be configured into the same circuit as the blower motor either directly through the Rh / W relay OR in conjunction with a separate 120V AC / 24V DC electromechanically relay such as the Aube Technologies RC840T-120 (not included with purchase, but available here: <https://www.amazon.com/Technologies-RC840T-120-Electromechanical-Relay-Built/dp/B00D5LY2G>). Integration to an AC line blower fan should be completed by a licensed electrician or HVAC technician.



- 1X WASHABLE FOAM INTAKE COLLAR FILTER – to filter the intake air stream before it enters the heater



- 1x INLINE FAN BLOWER (optional) – The 4000 series heater works best with 150 – 175 CFM airflow. As an optional part of your heater, Arctica may provide a inline AC fan as shown below. The model shown below is a variable speed model with max 190 CFM output, so the customer can set the optimal fan speed after install based upon initial performance testing in the application. Transition from the 4” outline and inlet to the 4.5” intake and exhaust collars must be stepped with a transition duct or duct tape during the install.



Items Not Included:

These items are likely needed to complete your installation but are not provided with the heater itself. They are typically in stock inventory at nearly all big box hardware stores (Lowes, Home Depot, ect)

- 4”- 5” ducting / flexible insulated ducting (available from all big box hardware stores)



- 2x (one for intake, one for exhaust) indoor duct cover / air duffers, more styles available online. Bath drain covers can also make for stylish intake and exhaust duct covers (right most picture).



- Metalized duct tape & weather stripping – for sealing heater back against the wall and other air gaps



- Silicone adhesive (GE Silicone #1) or sealant for airtight intake and exhaust collar attach or other sealing of air gaps post installation.



## Section 2.0 – Tools required for heater preparation and installation

These are the tools likely required for preparation and installation of your heater in your application.

Tools:

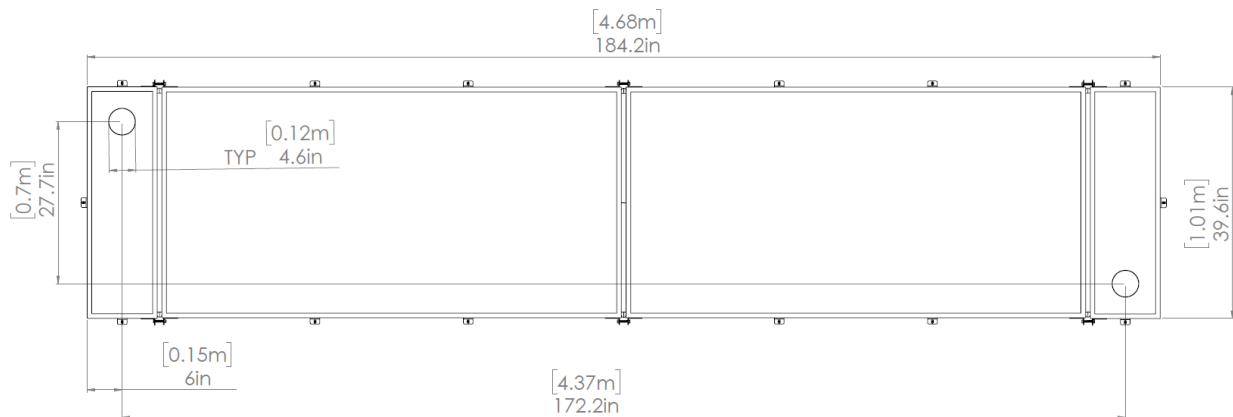
- For *clothes dryer style non-insulated duct routing* – Cordless drill, a 4.5”-5” hole drill bit – available at most hardware stores.
- For *insulated / insulated flexible ducting* – Cordless drill, a 6 3/8” hole drill bit – available at most hardware stores in electrical section, common tool for recessed lighting installation.
- For *prepping the heater* – Snip pliers, box knife with 1” blade, impact driver with Philips bit OR Philips head screwdriver.
- For *mounting* – Bubble level, Cordless drill, common drill bits (including 5/32” pilot bit for stud mounting), caulking gun, impact driver with hex (including long ¼” hex socket, a 7/16” hex socket and a 13mm socket for clamp joints) & Philips bits OR Philips head screwdriver.

## Section 3.0 – Preparation of the heater for installation

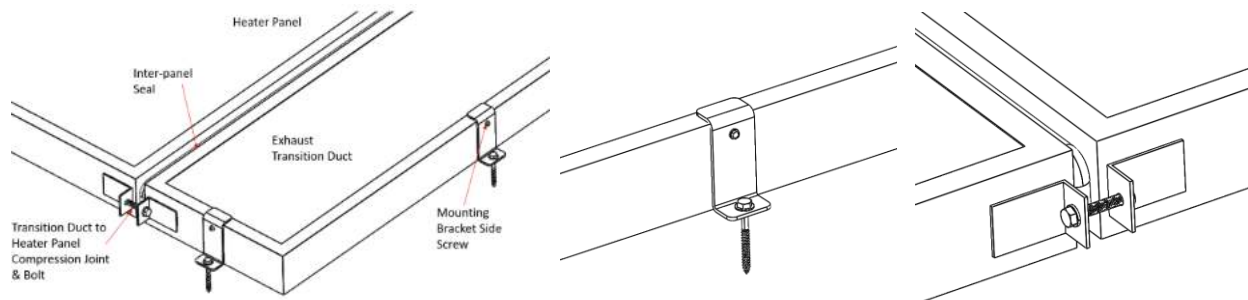
Let us review some overall details and physical dimensions of the heater. Figure 1 shows the assembled heater physical size dimensions from the front which may be useful in sizing its permanent location or deciding how many heaters are needed in your application. Figure 2 shows from the rear of the 4000 series heater assembly the exhaust transition duct, the 2x 2000 heater panels and the intake transition duct with callout of the intake duct and exhaust duct locations. (Figure 2a). Figure 3 shows close labeled views of the transition duct to 2000 heater panel compression joint and bolt / nut hardware, the heater panel and transition duct mounting brackets and the inter-panel compression joint + bolt.



**Figure 1:** 4000 Series, Gen 1 Heater Specifications and Overall Dimensions



**Figure 2:** 4000 Series, Gen 1 Heater Critical Dimensions, from the rear of the heater. (Left) exhaust duct and (right) intake duct are shown.



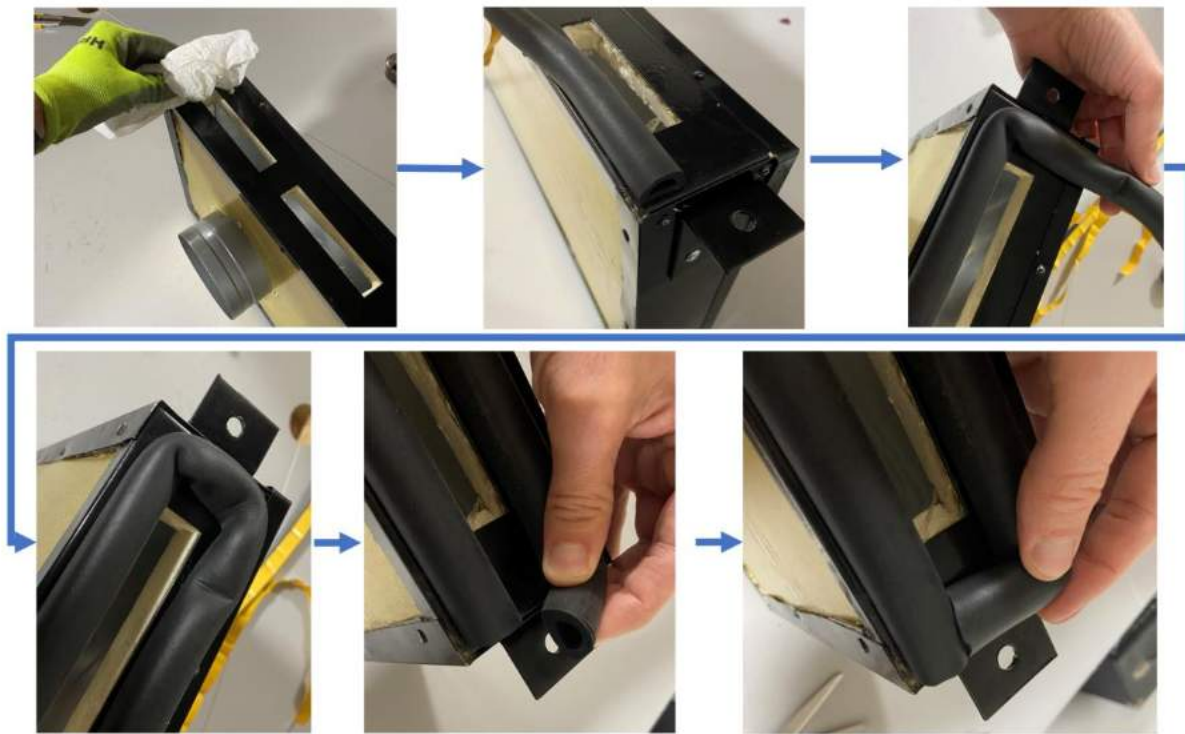
**Figure 3:** Views of heater mounting bracket interfacing (Left to Right): Exhaust Transition Duct to Heater Panel interface detail, close up of Mounting Bracket (4x per Heater Panel, 3x per Transition Duct), close up of inter-panel compression joint + bolt.

### 3.1. Preparing your heater for mounting

The 4000 Series heater is a linear assembly of 4x pieces, starting with a Transition Duct (intake), then a 2000 Series Heater panel, then another 2000 Series Heater Panel, and a final Transition Duct (exhaust).

3.1.1. The first step in preparing the heater for installation is applying the inter-panel gasket material to the proper pieces. First, clean the Transition Duct seal attach area by wiping it with isopropyl alcohol. Using an 83" length of the provided "D" cross section EPDM inter-panel sealing material backed with "Pressure Sensitive Adhesive" (PSA), remove the plastic stripping from the PSA and seal it to each Transition Duct as shown in the images below. Take care to form the gasket properly in the corners. If excess material is left, cut using scissors and abut the end of the gasket to the start of the gasket as shown in the final image.

Repeat this process for the second Transition Duct and 1x of the Heater Panels as shown in Figure 2.



*Figure 3.1.1 – (1) Clean foam seal glue interface with isopropyl alcohol applied to a clean towel. (2) Start the seal at one corner of the panel (3) Form first corner with the seal (4) Form second corner with the seal (5) Apply seal to top long end of the panel and return to the seal starting position, cutting the seal to length of needed (6) Abut the end of the seal to the start of the seal as shown, trimming the end of the seal to match the contour of the starting seal side was as needed to ensure a good mating fit.*

3.1.2. If the 4000 Series heating is being used with an internal heater thermal switch, the thermal switch wiring harness must be inserted 2-3" into the exhaust Transition Duct. The ducting is then placed over the thermal switch wire leads, and the thermal switch can be connected to the application control circuit for the inline fan and heat-only thermostat. A common AC inline fan control circuit to be used



with the 4000 Series heater is shown in Figure 3.1.2.2 and a common DC fan control circuit is shown in Figure 3.1.2.3.

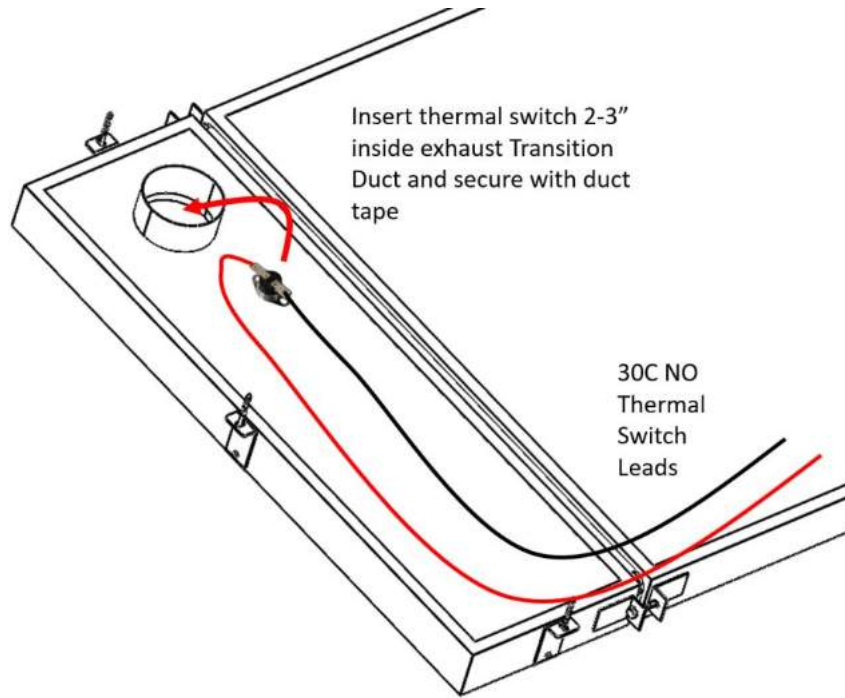


Figure 3.1.2.1 – If a thermal switch is used in the application control circuit, then place the thermal switch into the exhaust collar of the exhaust transition duct 2-3" deep and secure with duct tape. Route exhaust ducting ovetop of the switch wire harness. Secure loose wire harness leads with duct tape against the back of the heater panels.

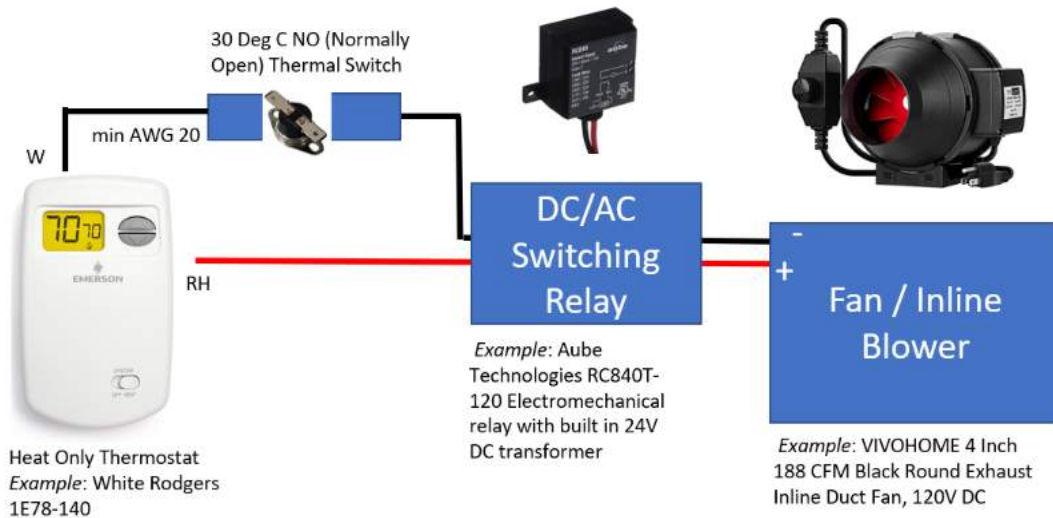


Figure 3.1.2.2 – A control circuit for air handing using an AC inline blower fan.

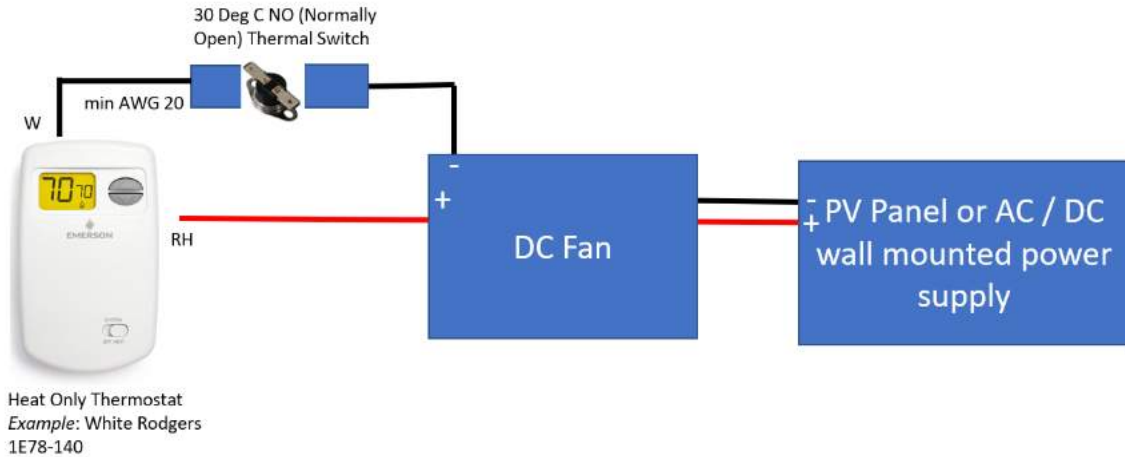


Figure 3.1.2.3 – A control circuit for air handling using a DC fan and PV panel or AC/DC wall mounted power source.

With the Transition Duct seals installed, a seal installed on 1x of the 2x Heater panels, and the proper air handling and control circuit identified, we are now ready to identify where the heater will be mounted.

Using dimensions from Figure 2, the intake and exhaust collars must be located 172.2” from each other, with the exhaust collar located above the intake collar. Care should be taken to ensure the intake and exhaust collars are not interfering with adoptive building structure, such as studs or roofing joists.

## Section 4.0 – South facing vertical wall installation (recommended)

The 4000 Series heater can be mounted on a SW/S/SE facing wall in a vertical configuration (recommended) or on a roof mounting using direct attach or using commercial off the shelf (COTS) roof mounting hardware for Photovoltaic (PV) solar panel systems, such as mounting products from K2 Systems (<https://k2-systems.com>)

### 4.1. Making intake and exhaust holes and routing of ducting into the space

An exhaust (**hot air**) hole and intake (**cool air**) hole must be added to the adoptive structure. Be sure to avoid placing planned intake and exhaust locations overtop wall studs. **For the 4000 series heater, it is strongly recommended that an initial duct hole is made (intake or exhaust) for mounting the first transition duct, and then the second duct hole is made only after Step 3.3.3, as part of Step 3.3.4. Dimensions provided in Figure 1 & 2 may not be accurate enough for all heater panels to allow for intake and exhaust duct hole placement prior to heater panel installation.**

*If routing through a wall with no vapor barrier and no need for insulation of ducting:*

The process can be done in two ways. First is like the installation of a dryer duct, as seen in videos referenced below. Locate wall studs prior to drilling to ensure that they will not interfere with the path of the heater ducting. **It is best to mount the heater closest to the point of use as possible** to cut down on heat loss through the transport of air to the use space, and fan pressure head loss due to long duct runs. However, depending on the location of the heater fan, some ducting may help mitigate fan noise.

These videos can serve as reference to this part of the installation process:



YouTube: [How to install fume hood – link: https://youtu.be/9egwOazPJis](https://youtu.be/9egwOazPJis)



YouTube: [How to install dryer duct – link: https://youtu.be/HjK2ybx8-14](https://youtu.be/HjK2ybx8-14)

*If routing through a wall where sealing the vapor barrier is required:*

The use of insulated ducting is recommended. We recommend using a 6" ABS riser pipe / tube installed as a conduit for the flexible insulated ducting as seen in the process below.





Use a 6 3/8" hole bit to place a through hole on the exterior wall and opposite interior wall. Create holes such that there is a slight downward angle from interior to exterior to discourage moisture from entering the exterior hole and flowing inwards. Feed a 6" ABS tube and cut leaving 1/4" proud of the interior wall and exterior wall. Seal to interior wall and exterior wall (or vapor barrier) with a vapor barrier membrane or silicone sealant. Secure the conduit physically to the wall as needed. This tube will act as the conduit for the flexible ducting.



Route 4-5" insulated ducting into the conduit. Secure the inner membrane of the interior side ducting to the end of a 6" air diffuser with duct tape as shown.



A 6" interior air diffuser can now fit snugly into the 6" PVC conduit. Cut the exterior insulated ducting to the wall thickness (red arrow) but allow for extra interior ducting (which will compress back into the wall) to make connecting to the heater intake and exhaust collars easier.

4.2. *Connecting the ducting to the heater exhaust transition duct and intake transition duct collars*

Heater exhaust and intake collars interface with 4"-5" ducting. Secure the duct to the collar using a screw clamp or duct tape. Once connected slide insulation and vapor barrier back over the clamp and wrap with duct tape or an additional screw clamp to secure in place. Transition duct collars are 4.5" in diameter, so 4" ducting will have to be joined with an expander joint or duct tape, a 5" duct compressed down to 4.5" diameter.



Connect the 4" insulated ducting inside liner to the heater intake and exhaust using screw clamps as shown above



Slide duct insulation and foil external cover over the intake and exhaust collars and secure with duct tape or additional screw clamps

#### *4.3. Mounting the heater to the wall – must be installed horizontally*

The 4k series heater must be installed such that air is moving horizontally through the heater. It is not designed for vertical mounting as there is no place to interface the mounting brackets to the heater without interfering with the inter-panel foam air seal.

Before securing elements to the wall, we recommend placing a strip of appropriately thick weather stripping along the perimeter of the back surface of each transition duct and heater panel. This will discourage dust, debris, moisture, ect from accumulating between the heater and the install wall during its lifetime. Select the thickness of weather stripping appropriate for your mounting wall texture or type. Not required but recommended.

##### *4.3.1 Secure first exhaust transition duct OR intake transition duct to install location*

Start with installing the intake transition duct into its proper location and interface with intake ducting. As shown in Figure 2 & 3 secure the intake duct with 1x mounting bracket on top, bottom and side. If possible, bolt all mounting brackets into building studs, otherwise use proper wall anchors to support mounting bolts. Use bolts as guided by Figure 3.3.5.1.

##### *4.3.2 Secure first heater panel to install location & intake transition duct*

Take care to properly align and install 2x bottom wall mounts so that the first heater panel mounts parallel to the intake transition duct from 4.3.1. Insert heater panel with inter-panel gasket installed on the right side of the panel, and push flush with foam inter-panel seal on the intake transition duct. Use an impact driver and socket wrench with 13mm hex to install bolt and nut to create compression between the first heater panel and the intake transition duct, as shown. The heater panel will slide slightly towards the intake transition duct to accommodate the needed compression of the seal. *Black duct tape may be applied between the intake transition duct frame and the adjacent heater panel to*

*offer further protection of the seal during the lifetime of the heater and further resistance to unwanted air loss during operation.*



#### *4.3.3 Secure second heater panel to install location and first heater panel*

Repeat 4.3.2 for the second heater panel, joining the short edge in proper parallel alignment with the inter-panel compression seal installed on the first heater panel previously mounted.

#### *4.3.4 Drill exhaust duct hole and install exhaust transition duct to install location and second heater panel*

Using a cardboard template as a guide, properly locate the needed exhaust duct hole for the exhaust transition duct. Drill the hole into the structure as guided in Section 4.1 with a 5" hole saw or larger, allowing play of the duct in the duct hole for proper compression of the exhaust transition duct seal to the second heater panel.

Secure the exhaust transition duct to the second heater panel as guided by 4.3.2. Secure the exhaust transition duct to the install location using mounting brackets as guided by 4.3.1.

#### *4.3.5 Insert heater mounting bracket side rail screws*

Using an impact driver, install side rail screws on each mounting bracket. Side rail screws prevent the heater from sliding left to right in its mounting brackets. Before the self-tapping hex screws are fully seated, apply a bead of silicone sealant between the under-side of the screw head and the heater body, then fully seat the screw with an impact driver. The silicone will provide a seal against water intrusion for the hole made by each side rail screw. See figure for guidance on screw sizing, socket sizing and needed pilot holes.

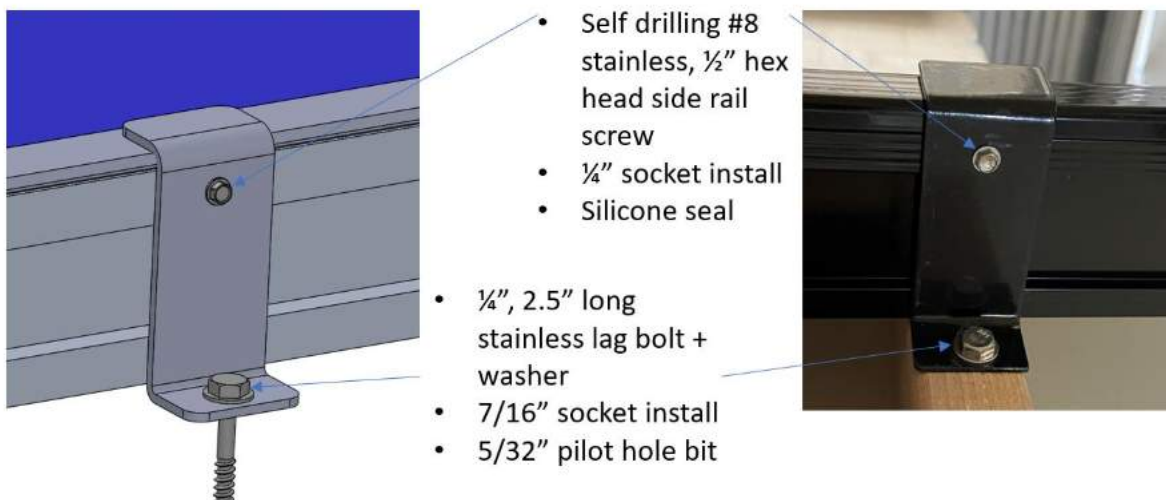


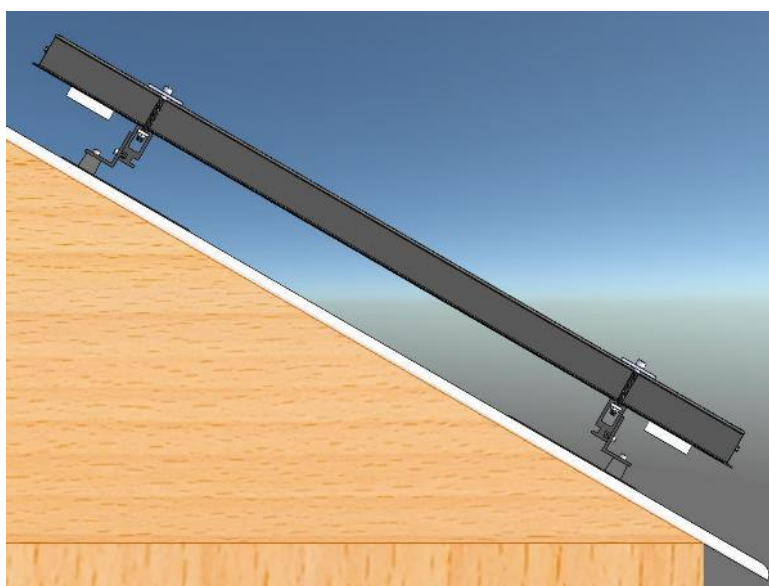
Figure 4.3.5.1 Heater mounting bracket screw sizes and specifications.

#### Other mounting options

The 4000 series heater must be mounted horizontally and is recommended for vertical wall mounting but may also be mounted (1) on a roof or (2) exterior off-structure plenum.

##### 1. Roof mounting

Roof mounting is uncommon and comes with concerns of the heater glass being frequently soiled due to its mounting angle and difficulty in reaching it for regular cleaning, and concerns with water leakage through the ducting roof penetrations. We recommend roof mounts be completed by a licensed HVAC or roofing contractor to ensure best practice during the mounting and routing of ducting. Roof mounting can also use commercially available PV (photovoltaic) solar mounting rails and hardware if desired.





## 2. Mounting on an exterior plenum / frame construction

Some users of the product elect to mount the heaters to a custom exterior plenum or framing commonly made from wood or other construction materials. These plenums are commonly not mounted to the adoptive structure, instead sitting adjacent the structure on the south or southwest side of the heated space. We recommend mounting the panels at a tilt angle ideal for your latitude solar in the winter, which can be determined from a calculator such as this one:

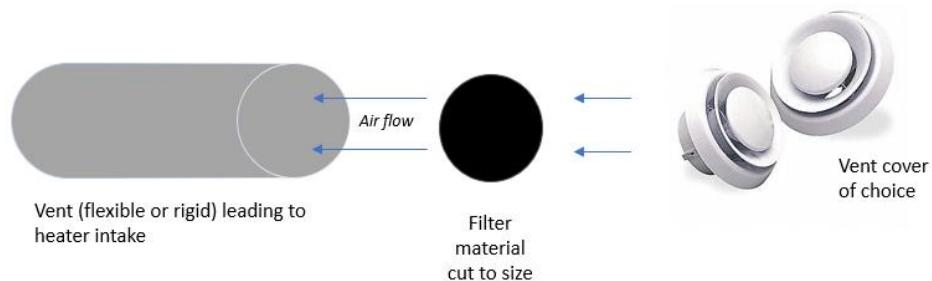
<http://www.solarelectricityhandbook.com/solar-angle-calculator.html>



Figure 4.4.1 Off-structure plenum mounting of the Arctica 1500 Series heater product, also possible with the 4000 series heater.

## Section 5.0 – Interior vent covers and intake air filtration

The heater is provided with a small, washable intake air filter which we recommend placing downflow of the intake collar, as seen below. This filter can be placed behind the interior intake vent collar for ease of access during the heater's lifetime. We recommend washing the filter every 3 months to ensure a flow of clean air into the heater. Not filtering the air prior to intake into the heater may lead to excessive fouling of the interior of the heater which may require a physical removal of the glass and deep interior cleaning (not recommended).



Different indoor intake and exhaust grill options exist at local big box hardware stores and online retailers. New filter material such as is shown below can also be purchased at local and online retailers as well as directly from Arctica Solar.



## Section 6.0 – Connection to the Heat-Only Thermostat

The heater has the option to be controlled by a heat-only thermostat provided with the heater, as guided by Figure 3.1.2.2 and Figure 3.1.2.3.

Route the thermostat wire leads through the back of the thermostat backplate. Connect one wire to terminal **RH**. Connect the other to terminal **W**. The color of the wire to each terminal does not matter. Mount the thermostat backplate to the wall and reattach the front plate with the provided batteries installed.



Set the thermostat to the desired room temp. If part of the control circuit, the heater is activated by the thermal switch now internal to the exhaust collar of the heater – Figure 3.1.2.1. When the inside of the heater reaches above 30 C / 86 F the heater will activate and start delivering warm air into the living

space if the desired temperature is greater than the thermostat room temperature. Be careful to mount the thermostat a suitable distance from the exhaust of the heater.

If you want the heater to run continuously whenever it is above 30 C, or do not want to use the thermostat, twist the red and black leads from the thermostat wire together to short the circuit.

## **Section 7.0 – Heater lifetime care guide and suggestions**

With proper maintenance, your 4000 Series Solar Air Heater should bring you years of free and renewable supplemental space heating. Here are suggestions for caring for the heater over its lifetime.

### *7.1. Washing intake air filter – every 3-6 months*

With the heater installed, intake air should be filtered through the provided washable filter material. This prevents buildup of dust and debris inside the heater which can reduce performance over time. We recommend positioning the filter material between the intake grill and the ducting leading to the intake / fan collar and hand washing this material every 3-6 months.

### *7.2. Cleaning of heater front glass – every 3-6 months or as needed*

If the heater is mounted in the vertical wall position, it should not need frequent cleaning of the front glass. But cleaning of the glass at regular intervals, like that of home windows, will increase lifetime performance.

We recommend cleaning the front heater glass every 3 – 6 months while the heater is NOT in full sunlight. Clean it during cloudy days, or at dawn or dusk to reduce stress on the glass and potentially cause damage from rapid cooling.

Glass can be cleaned with Windex (or equivalent) and a lint-free rag or wipe, or with soapy water and then wiped clean and dry. Or use a soft sponge to scrub the glass, clean water to rinse and a squeegee and lint free towel to wipe dry.

### *7.3. Preparing your heater for the Summer (off) Season – every 12 months*

Care must be taken to set up your heater during the off season as to not cause unwanted heating even with the thermostat off. Summer exposure will not damage the heater. We recommend the following steps:

7.3.1. Install into your system an inline duct damper, such as the Neverest RKI 4"- Backdraft Damper. A spring-loaded backdraft damper will prevent airflow in the duct when the heater fan is not on.



7.3.2. If possible, cover the glass of the heater with an off-season cover such as a piece of cardboard / plywood / ect to prevent collection of sunlight onto the panel.

7.4. *Cleaning of heater ducting – every 12 months or as needed*

Periodically the indoor intake and exhaust grills should be removed from the ducting and a shop vacuum used to vacuum out any collected dust in the ducting. Clean ducting will ensure clean air circulation inside of the heater and reduce dust fowling of the absorber rear surface.

In extreme soiling cases, the heater may need to be removed from the wall, intake and exhaust collars removed and vacuuming out of the interior of the heater itself with proper shop vacuum attachments or vacuum snake.

The front of the absorber is sealed off from airflow, so it should not require removal and cleaning. If however the absorber becomes heavily soiled, the glass can be removed (See 8.6) and the absorber serviced or replaced (not recommended).

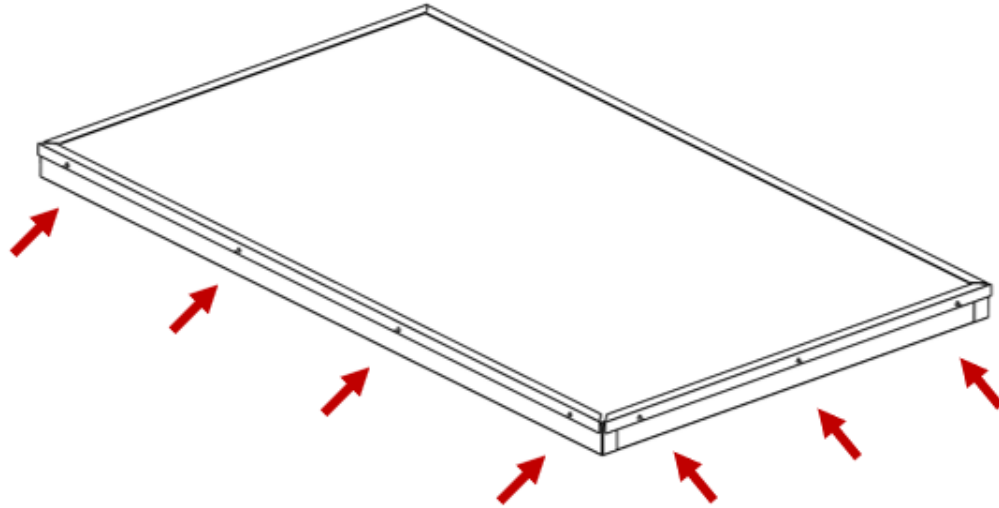
7.5. *Removal and replacement of the heater front glass (not recommended)*

The heater is designed such that the absorber surface is not in the air exchange path to minimize soiling of the absorber surface and the air cavity between the absorber and the front cover glass during its lifetime. Therefore, during a normal heater lifetime the glass should never have to undergo a removal from the heater unit. *There is a high probability of the glass breaking during attempted removal!*

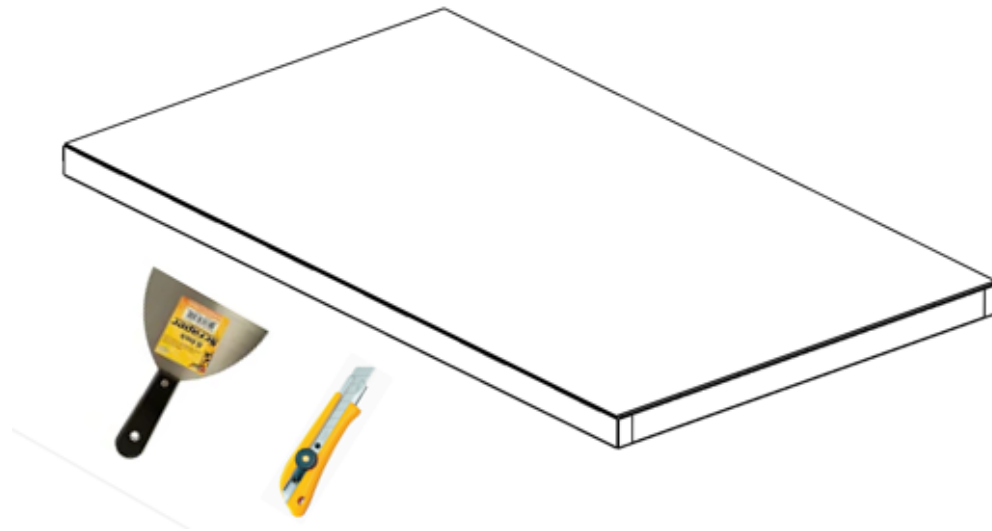
However, if the glass is broken during service, or if the interior of the glass or absorber surface becomes soiled to the point of serious performance degradation, then removal of the glass for deep cleaning of the interior of the heater may be required. This is not a normal service item, but Arctica is providing guidance for removal of the heater glass in the case where it should be so necessary.

7.5.1. First, remove the heater from its installation position and place it on a flat work bench or table with the glass side up. If the glass is broken, vacuum or remove any loose glass. The heater glass is tempered, so if it does break it will shatter into many small pieces. Take care to avoid direct contact with the front absorber surface as it is a delicate coating and will damage easily from physical contact.

7.5.2. Using a handheld drill and a drill bit of appropriate size, remove the rivet heads of each of the surrounding rivets (shown with red arrows) holding the top rails to the heater body. Carefully remove the long and short top rails and save for re-installation later. Do not bend the rails to remove them.



7.5.4. In most cases the glass is adhered to the body of the heater with silicone adhesive. If the glass is NOT broken, use a box knife or razor knife to carefully cut the silicone seal between the glass and the heater body on all sides of the glass, and carefully remove the glass with two people. If the glass is broken use a hand scraper or razor to remove all broken glass and residual silicone adhesive. In both cases use a razor scraper to remove as much of the existing silicone from the glass and the heater body as possible.



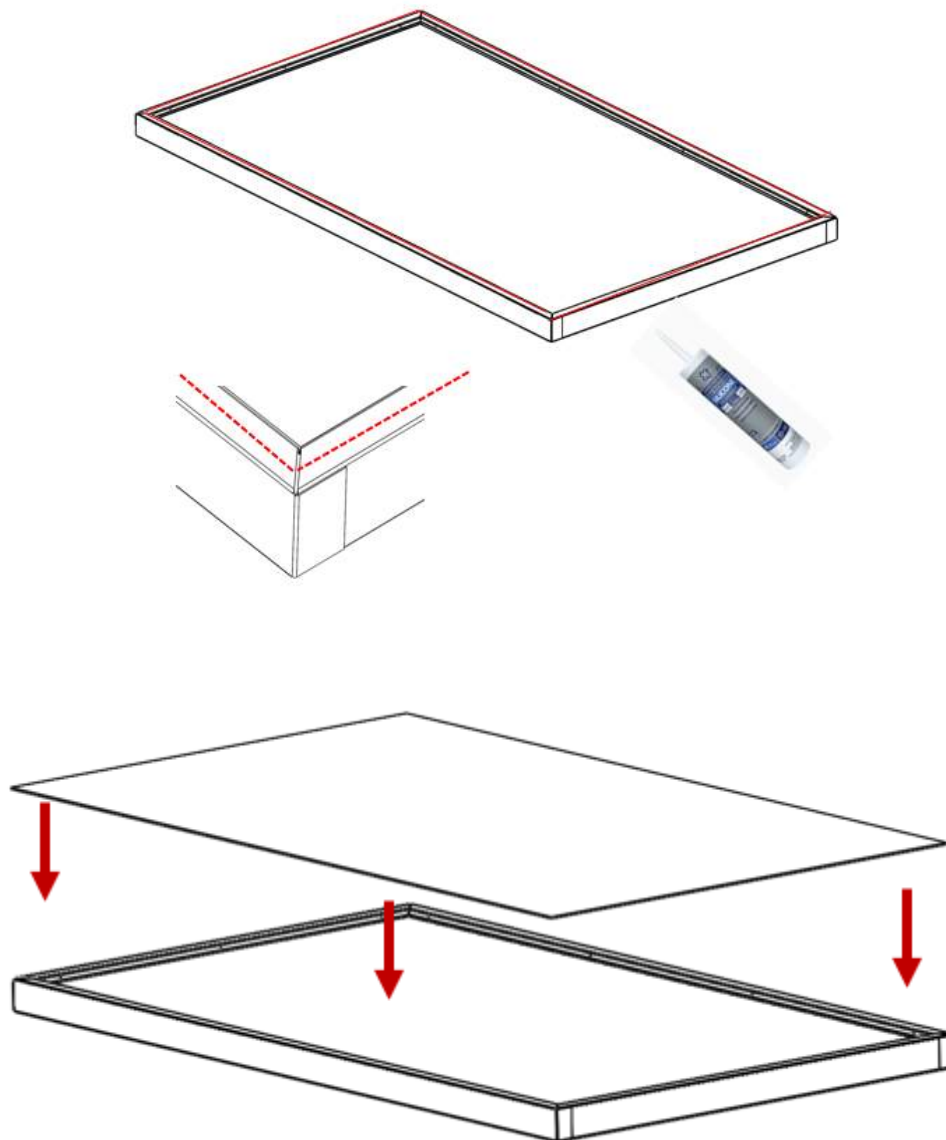
7.5.5. With the glass removed, **DO NOT** touch or rub the absorber surface to clean it. Blow it clean with compressed air. If the absorber is damaged or dirty beyond use, you can paint it black with “high heat black” paint such as Rust-Oleum 248903.

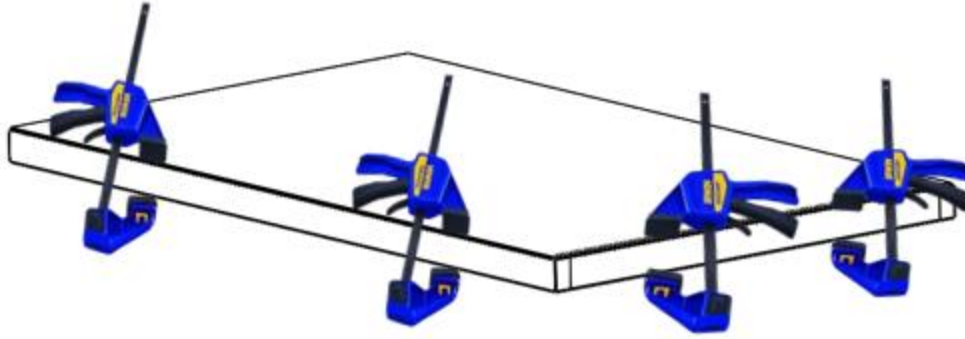
7.5.6 If the glass is not broken and with all existing silicone removed to the greatest extent possible, take this opportunity to thoroughly clean both sides of the glass with glass cleaner, or scrub clean and squeegee and lint-free clothe wipe dry multiple times to ensure a crystal-clear glass surface prior to glass re-install. If the glass is broken, purchase a new piece of 1/8” thick tempered glass sheet to the proper sizing from a local glass shop.

7.5.7. From a local big box hardware store, get 1x tube of GE Silicone #1 adhesive, clear.

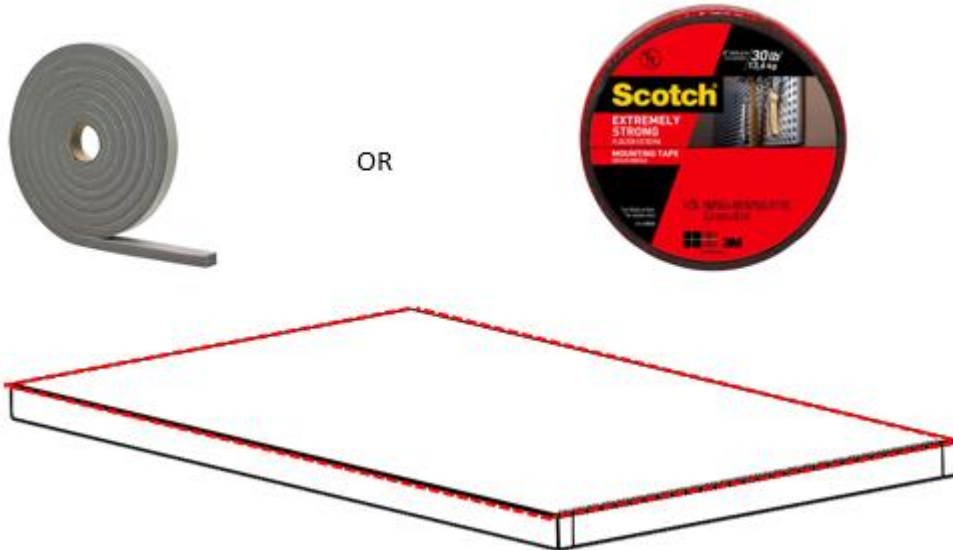


7.5.8. Using a caulking gun, place a bead of silicone around the perimeter of the heater on all 4x sides. With two people, place the glass on top of the furnace frame, and the use 2-4x hand clamps per side to hold the glass in place against the frame for no less than 24 hrs so the adhesive can fully cure.

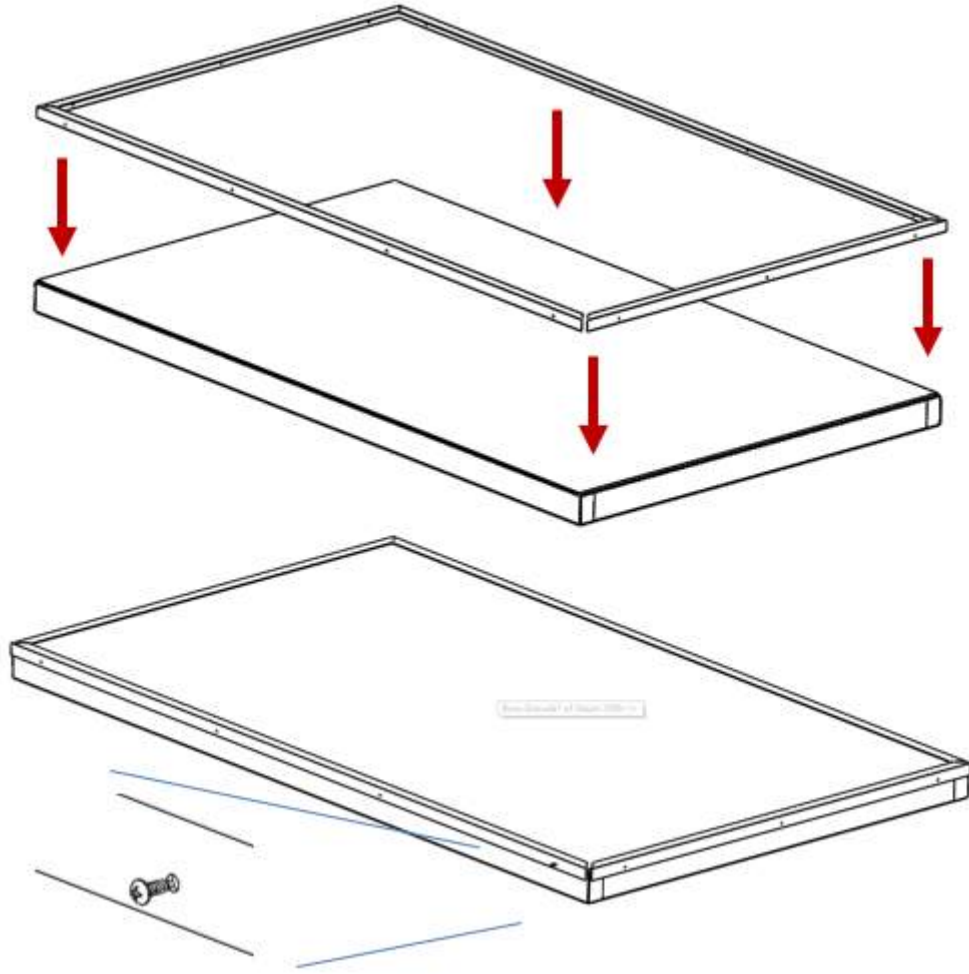




7.5.9. After 24 hrs, remove the hand clamps and place weather stripping or VHB tape along the edge and outer perimeter of the glass. This provides protection for the glass against the reinstallation of the aluminum top rails.



7.5.10. Place the 4x top rails back into position over the glass and the furnace. Use hand clamps if needed to re-align the holes with the existing rivet holes. Reconnect the rails with self-tapping stainless-steel screws, #4, 3/8" length, 0.112" diameter (#4 screws size). If this screw size does not retain due to the hole being too big in the heater body, use the next larger screw size.



7.5.11. Remount the heater per the original mounting instructions (Section 4.3). Take care to mount the heater to a flat surface, not to overly bend, curve or deflect the heater during mounting. Doing so may overly stress and break the glass. Careless installation is the number one cause of damage to the heater during its lifetime!



