Introducing Professional
Heat Treatment
Equipment for Bed Bug
Infestations:

THE
MODULAR HEAT
INJECTOR SYSTEM

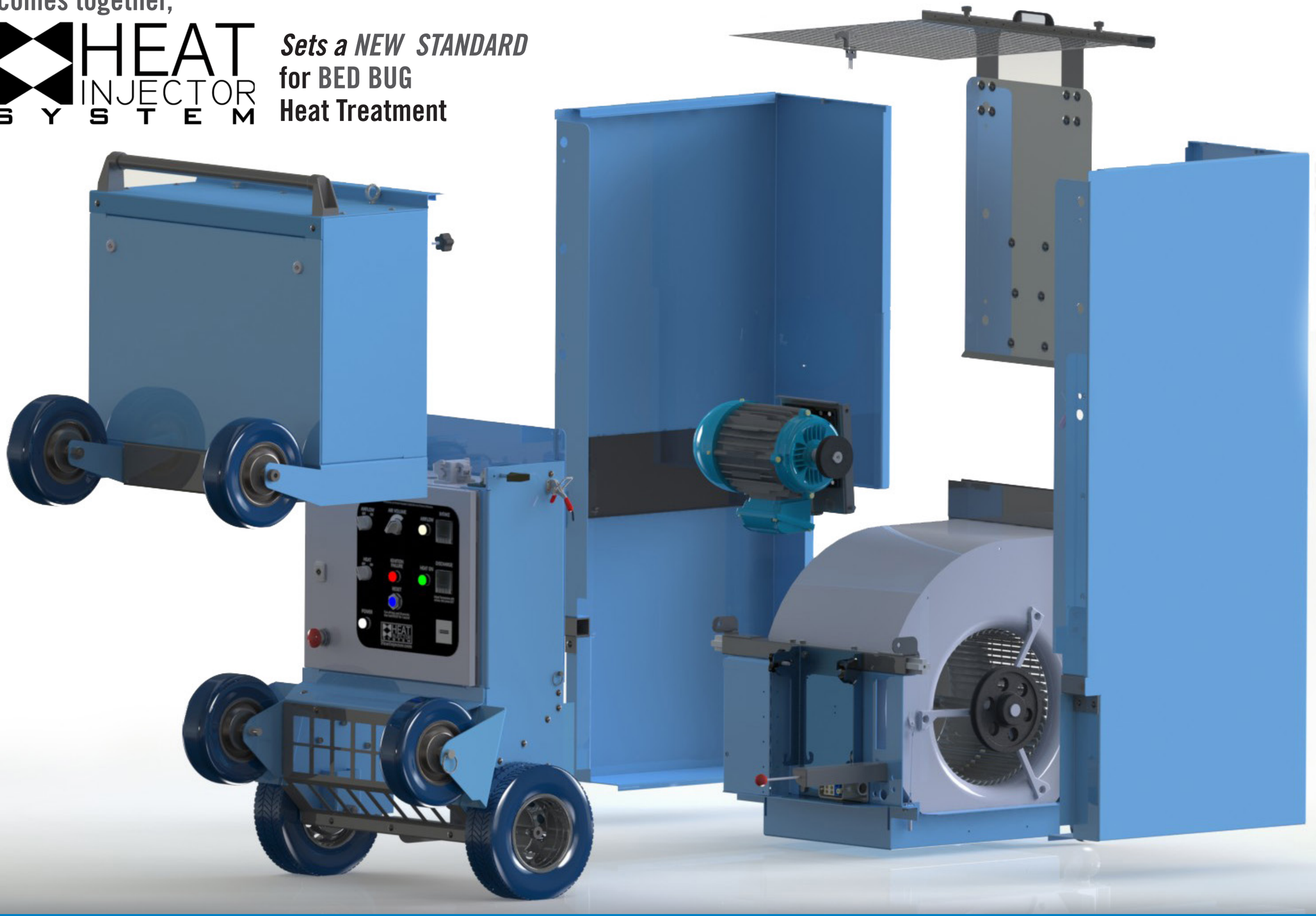
# HEAT INJECTOR SYSTEM

U.S. Patents: 7,360,534 and 9,459,022

Safe
Simple
Effective
Heat Treatment
System for Bed Bugs

When it all comes together,
the HEAT INJECTOR SYSTEM

***Sets a NEW STANDARD***
**for BED BUG**
**Heat Treatment**



**EASY ON-SITE ASSEMBLY**

**DESIGNED WITH THE USER IN MIND**

# The Modular Heat Injector

## DESIGNED WITH THE USER IN MIND

### SAFE

The Heat Injector plugs into any standard home outlet. The electrical controls are UL Listed. The Flame Management System starts the burner and continuously monitors the flame. The Temperature Control System modulates the gas to achieve the desired discharge temperature.

### SIMPLE

A switch enables the airflow, another switch enables the heat, and then it operates automatically. The discharge temperature is continuously monitored and automatically controlled to achieve the operator's chosen discharge temperature.

### EFFECTIVE

The Heat Injector uses a unique method to thoroughly heat the structure and its contents. When the temperature is above the lethal temperature for bed bugs, the pressurization process is engaged to force heated air through electrical sockets and any openings in the structure.

***Newly issued U.S. Patent 9,459,022,*** defines the **Modular Heat Injector** and the unique heat treatment process which is more efficient and effective than any other system on the market today! The recirculated airflow is heated and managed to optimize its thermal transfer as it passes through the area to be heated. When all the air within the space is above lethal temperatures for bed bugs and their eggs, the space is pressurized with heated air. This unique product and process sets a new standard for heat treatment!

### ENERGY EFFICIENT

The Heat Injector allows the main airflow to be recirculated and puts 100% of the heat into the space. Only a small volume of outside air is used for combustion and during the pressurization process. Please see the energy comparison graphs...the method used to perform a heat treatment makes a big difference in the effective use of energy.

### POWERFUL

The Heat Injector System puts more heat into a heat treatment than the largest electrical system or the tube style heaters that consume significantly more fuel. The discharge temperature is adjustable from the Control Panel, with a range up to 160°F.

### DISCRETE

The Heat Injector System is positioned within an outside doorway or can be placed inside the heated environment with the use of the Air Shell. There is no generator or external duct which would draw attention to your client.

HEAT INJECTOR SYSTEM

**www.HeatInjector.com**

SAFE SIMPLE EFFECTIVE

# RECIRCULATED *AIRFLOW*

The Heat Injector System utilizes a dedicated combustion blower to supply a small amount of fresh air, specifically for combustion (75 cfm). With this patented concept, the air volume within the heat treatment can be recirculated to effectively apply the heat. This unique feature, along with the power of an industrial blower, allows the heated airflow to be recirculated through the heat treatment area.

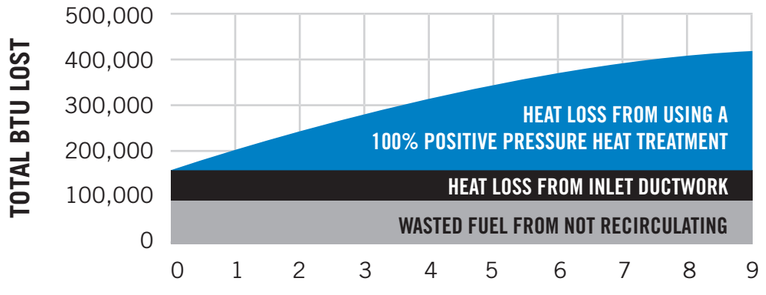
The heated airflow is discharged through a flexible duct to locations within the structure farthest from the Air Intake. The Air Intake draws air from the heated environment which creates an airflow through the space, from the high pressure at the discharge toward the low pressure on the intake. This airflow transfers the heat through the structure without the use of additional fans. This is a proven concept in the HVAC industry.

With the traditional gas-fired heaters there is a constant cost to heat outside air, a continual heat loss from the exposed duct, and the loss from the airflow being forced out when the heated air from outside is forced into the heat treatment.

With the Heat Injector's patented recirculated airflow technology, these losses are eliminated, and fuel consumption decreases as the heat treatment progresses.

***The following graph shows the losses that are experienced with the traditional gasfired heaters. The wasted fuel from not recirculating is directly affected by the outside air temperature. As you can see from the graph, the loss from the exhausted air increases as the space is heated.***

**HEAT LOSS FROM FORCING A HEATED AIR EXHAUST**

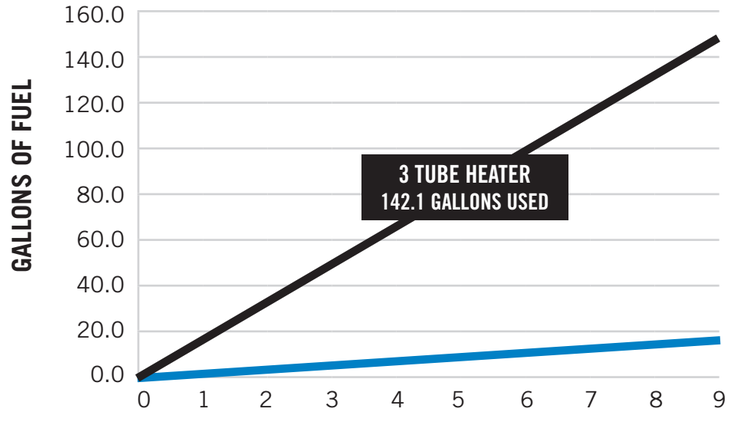



***This table shows the fuel consumption during a typical heat treatment to highlight the difference in the heating concepts; the traditional gas-fired heater compared to The Heat Injector with recirculated airflow.***

| TUBE STYLE HEATER | | | | HEAT INJECTOR SYSTEM | | |
|---|---|---|---|---|---|---|
| HOURS | INTAKE TEMP | DISCHARGE | BTU USED | INTAKE TEMP | DISCHARGE | BTU USED |
| 1 | 40°F | 180°F | 500,000 | 65°F | 140°F | 291,600 |
| 2 | 40°F | 180°F | 500,000 | 76°F | 140°F | 250,020 |
| 3 | 40°F | 180°F | 500,000 | 87°F | 140°F | 208,440 |
| 4 | 40°F | 180°F | 500,000 | 95°F | 140°F | 178,200 |
| 5 | 40°F | 180°F | 500,000 | 103°F | 140°F | 147,960 |
| 6 | 40°F | 180°F | 500,000 | 111°F | 140°F | 117,720 |
| 7 | 40°F | 180°F | 500,000 | 119°F | 140°F | 87,480 |
| 8 | 40°F | 180°F | 500,000 | 126°F | 140°F | 61,020 |
| 9 | 40°F | 180°F | 500,000 | 130°F | 140°F | 191,700 |
| TOTAL BTU USED | | | 4,500,000 | TOTAL BTU USED | | 1,534,140 |
| AMOUNT OF PROPANE USED | | | 208.3# | AMOUNT OF PROPANE USED | | 70.3# |

**When a larger space is to be heated multiple tube style heaters are used because the fans can not push the airflow far, and it is difficult to move heat around corners.**

**PROPANE USAGE COMPARISON**




***This graph reflects the fuel consumption with the Heat Injector as compare to 3 tube style heaters to do a 3000 sq. ft. home on a 40 degree day.***

# INTEGRATED CONTROL PANEL

**The Control Panel for the Heat Injector System houses the Flame Management System and the Temperature Control System. These systems are interlocked with the airflow to ensure safe operation.**

Temperature sensors on the Air Intake and Discharge continuously monitor the heated airflow and display it on the Control Panel. The Air Intake temperature reflects the level of heat that has not been absorbed by the structure and its contents .


*Heat Injector Controls

# AUTOMATICALLY CONTROLLED DISCHARGE TEMPERATURE

The on-board Temperature Control System is critical to the safe operation of the Heat Injector. The discharge temperature is continuously monitored and the gas control is automatically modulated to achieve the desired discharge temperature. The desired temperature is maintained even when the airflow is manually adjusted or becomes restricted during the heat treatment.

The traditional gas-fired heaters manually modulate the gas to control the discharge temperature. If the airflow is reduced for some reason, the temperature can spike to hazardous levels.

***The following table reflects the effect upon the discharge temperature that might come from closing the exhaust door/window or a restriction on the heated inlet duct.***

**CHANGES IN DISCHARGE TEMPERATURE WITH MANUAL GAS CONTROL**

| | AIRFLOW (CFM) | OUTSIDE AIR TEMPERATURE | BURN RATE (BTU) | TEMPERATURE RISE (CALCULATED) | DISCHARGE TEMPERATURE (CALCULATED) |
|---|---|---|---|---|---|
| FULL AIRFLOW | 3,300 | 40°F | 409,860 | 115°F | 155°F |
| 30% REDUCTION IN AIRFLOW | 2,200 | 40°F | 409,860 | 172.5°F | 212.5°F |
| 50% REDUCTION IN AIRFLOW | 1,650 | 40°F | 409,860 | 230°F | 270°F |

# THE PRESSURIZATION PROCESS

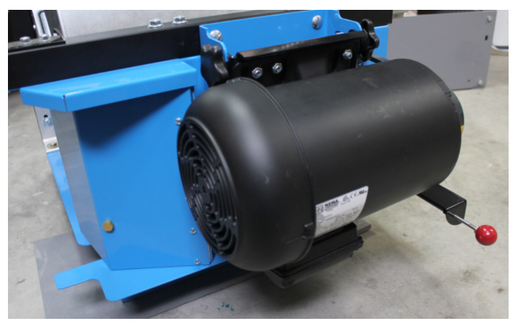
**A unique and patented feature of the Heat Injector System is the ability to pressurize the structure with a heated airflow to ensure a thorough heat treatment. This pressure forces heated air within the space through electrical outlets, cracks and any space bed bugs may have found harborage.**

When the heated space is pressurized, additional air is drawn in through the air inlet used by the combustion blower. The additional air from out-side, and less air from within the heat treatment, causes the space to be pressurized. The volume of pressurization air is adjustable with the Heat Injector System.

During the pressurization process, the Temperature Control System modulate the gas to inject enough heat into the recirculated airflow to cause the blended discharge temperature to achieve set-point.

The process is simple and effective. As the heat treatment progresses, the heat migrates through the area, from the discharge locations toward the Air Intake. When the Air Intake temperature is in excess of the lethal temperature for bed bugs and their eggs (about 125° F), the Pressurization Process can begin. The pressurization process is typically done for the last hour of the heat treatment, but can be done longer given the specific situation, to ensure a successful heat treatment.


The Heat Injector is transitioned to the Pressurization Mode by pulling a red knob to open an internal door to access air from outside the heat treatment. The volume of pressurization air is controlled by the engagement of the Modulated Air Damper. As the damper restricts recirculated air-flow, more air is drawn from outside the heat treatment. The volume of pressurization air can be increased to about 1500 cfm by rotating the damper.



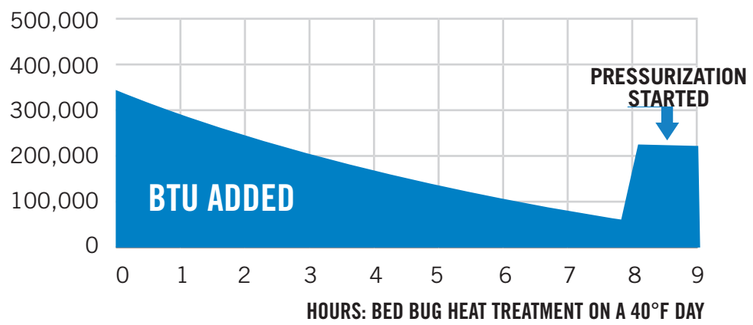
**The Heat Injector System and the method to perform a heat treatment for bed bugs with the Pressurization Process was awarded a U.S. patent in 2016**

# EFFECTIVE USE OF ENERGY

**The Heat Injector System recirculates the heated airflow within the heat treatment, so there is no external duct and no heated discharge. The heated space is enclosed and pressurized with heated air to ensure a thorough heat treatment.**

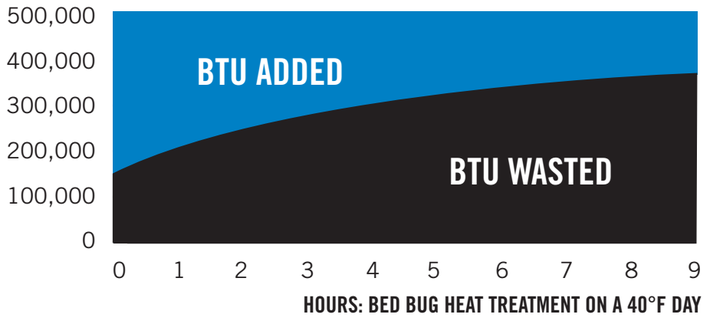
*As you can see from the graph, the fuel consumption is reduced as the space is heated. When transitioned to the Pressurization Mode, the fuel consumption increases to heat the additional outside air.*

**BTU CONSUMED HEAT INJECTOR SYSTEM**




The traditional gas-fired heaters have a continual heat loss in the external duct; and there is a continual heat loss when heated air from outside is forced into the heat treatment. When the air is forced in, a door or window has to be opened as an exhaust to allow the heated air to enter.

**BTU CONSUMED TUBE STYLE PROPANE HEATER**

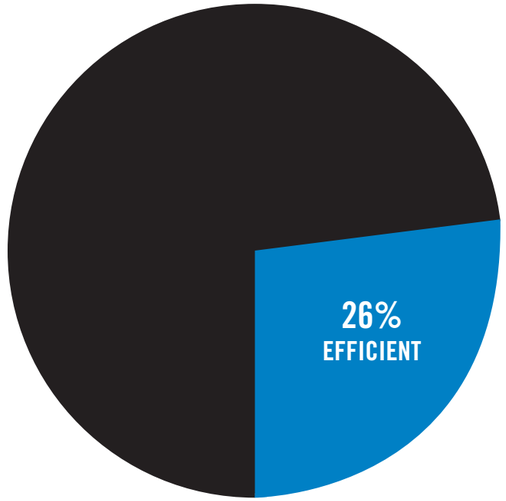



*As you can see from this graph, the fuel consumption of the traditional gas-fired heater remains the same throughout the heat treatment. The effectiveness of the heat becomes less as the heat treatment progresses due to the increase in wasted energy.*

When significant heat is required, the electrical heaters use gas/diesel powered generators to produce the electrical power. These generator systems have multiple levels of inefficiency. The engine converts the fuel to a mechanical force and the mechanical force is converted to electrical energy. The power is transmitted to the heaters through long extension cords with multiple contact points, then the electrical power is converted to heat.

**EFFICIENCY OF A 40KW ELECTRIC SYSTEM WITH A GENERATOR**

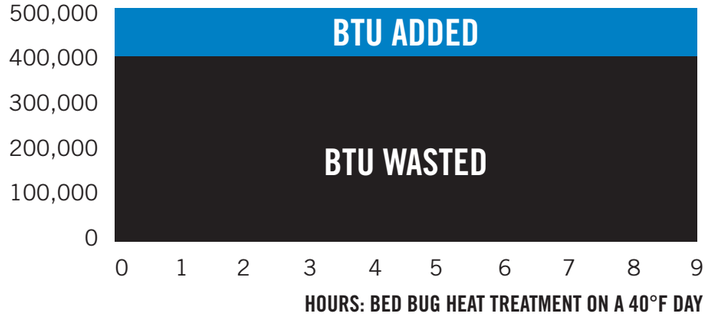
*The pie chart reflects the compounded losses and the overall fuel efficiency of the generator powered heating systems.*




Other methods are used for heat treatments which include the transfer of heat through a thermal transfer fluid. With this system, there is a 135-gallon hot water tank with a big burner in a trailer, along with an onboard generator to power the pumps which circulate the fluid from the parking lot to the location of the heat treatment through long lengths of hose. Multiple radiators are plugged into recirculated fluid lines. This process has multiple levels of inefficiency which are compounded to produce an overall low efficiency for a heat treatment...the trailer weights over 6000 pounds.

Both the electrical heat option and the process of heating through thermal transfer fluid requires a significant time period to produce heat at lethal temperatures for bed bugs. Both require fans to move the heat away from the heat source, while the Heat Injector System creates a heated airflow at lethal temperatures immediately, and fans are only required to improve the thermal transfer into the structure and its contents.

**BTU CONSUMED ELECTRIC SYSTEM WITH 40KW GENERATOR**




*This graph reflects the inefficient use of energy when using a 40KW electrical system.*

# POWERFUL PERFORMANCE

**The Heat Injector is not only more energy efficient, it is significantly more powerful than the largest generator powered systems.**

With the patented concept of a dedicated combustion blower, there is no restriction from the burner in the airflow; so the Heat Injector uses all the power to effectively move air.

The industrial blower with the HP Boost™ feature automatically compensates for load changes with different configurations of flexible duct attached to the discharge. When the load changes, the HP Boost automatically adjusts the motor's speed to use all the power available from a standard 15 amp circuit to maximize the volume of air for every heat treatment.

The Heat Injector controls the heat to achieve the desired discharge temperature. The modulated gas control has the potential to heat an airflow of up to 4000 cfm from 3°F to 100°F to achieve the setpoint temperature, while the limited power of the electric systems cause the discharged airflow to gradually approach lethal temperatures.

Smaller electrical systems draw electrical power from the site with each heater requiring several separate circuits. These heaters are limited to small areas because they draw significant power from the site.

***The following chart shows the Heat Injector output with a comparison to the number of generator powered heaters and electrical circuits to produce the same amount of heat.***

## THE HEAT INJECTOR SYSTEM COMPARED TO ELECTRIC HEATERS

| Hours of Treatment | BTU Added with Heat Injector | Comparable # of 7KW Heaters | Comparable # of Site-Powered Circuits |
|---|---|---|---|
| 1 | 291,600 | 12.2 | 98 |
| 2 | 250,020 | 10.5 | 84 |
| 3 | 208,440 | 8.7 | 70 |
| 4 | 178,200 | 7.5 | 60 |
| 5 | 147,960 | 6.2 | 50 |
| 6 | 117,720 | 4.9 | 39 |
| 7 | 87,480 | 3.7 | 29 |
| 8 | 61,020 | 2.6 | 20 |
| 9 | 29,700 | 1.2 | 10 |

# LOW COST TO MAINTAIN ELEVATED TEMPERATURES

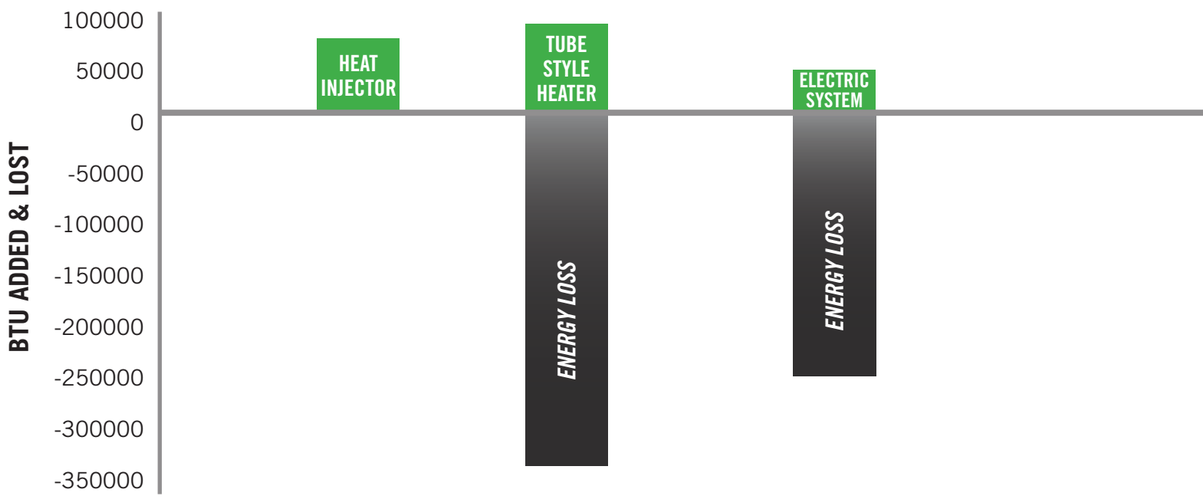
A successful heat treatment requires an elevated temperature to be maintained until the heat saturates deep within the structure and its contents. With the Heat Injector System all the heat goes into the heat treatment. With recirculated airflow the Air Intake temperature increases as the heat treatment progresses causing less fuel to be consumed.

For the traditional gas-fired heaters, the fuel consumption remains the same and losses increase as the heat treatment progresses.

The generator powered heating systems have an overall fuel efficiency that is about 26%. As the inlet temperatures on the heaters reach their limit, the heaters cycle off which unloads the generator and the causes the overall fuel efficiency to fall below 20%.

***The following graph reflects the cost of fuel consumed on a 40° day to maintain the heat treatment at elevated temperatures. The black indicates the amount of fuel consumed that was not effectively used due to the losses and the ineffective method used to apply the heat.***

## FUEL COST TO MAINTAIN ELEVATED TEMPERATURES



# SIMPLE SETUP

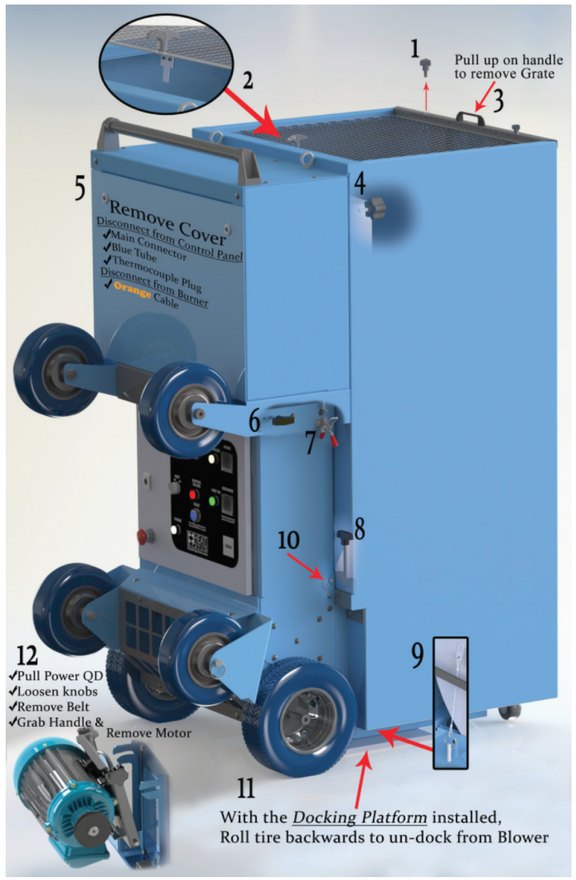
## LESS PREP FOR YOUR CLIENTS

The Heat Injector System utilizes flexible Mylar duct with a variety of fabric duct connectors to create the distribution system for the heated airflow. The heated airflow is discharged into multiple locations within the structure. These locations receive the heated airflow which will migrate through the structure toward the Air Intake.

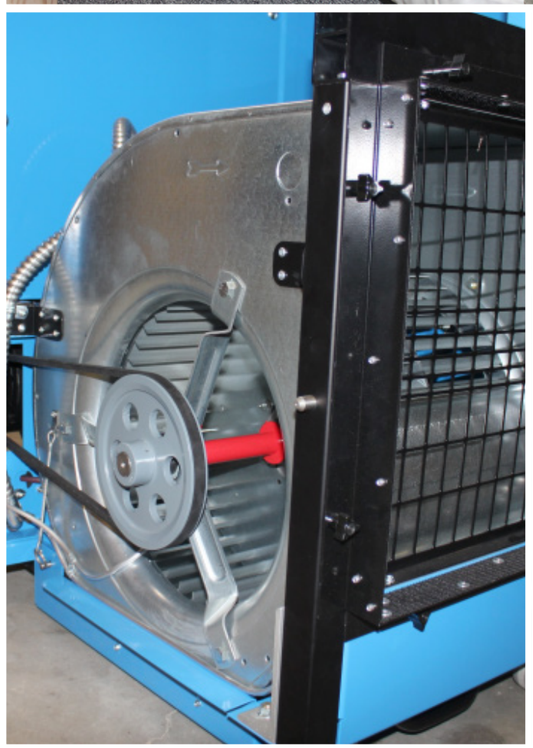
A 3-port fabric duct connector is attached to the Discharge with Velcro to connect up to 3 individual distribution legs. Fabric duct connectors link additional lengths of duct and adjust the length of the flexible duct section (normally 25') by holding a segment from extending. Each of the 3 distribution legs can be split into 2 or 3 legs to allow multiple distribution locations within the heat treatment. The fabric duct connectors are also used as end-of-duct restrictions to balance the heated airflow.

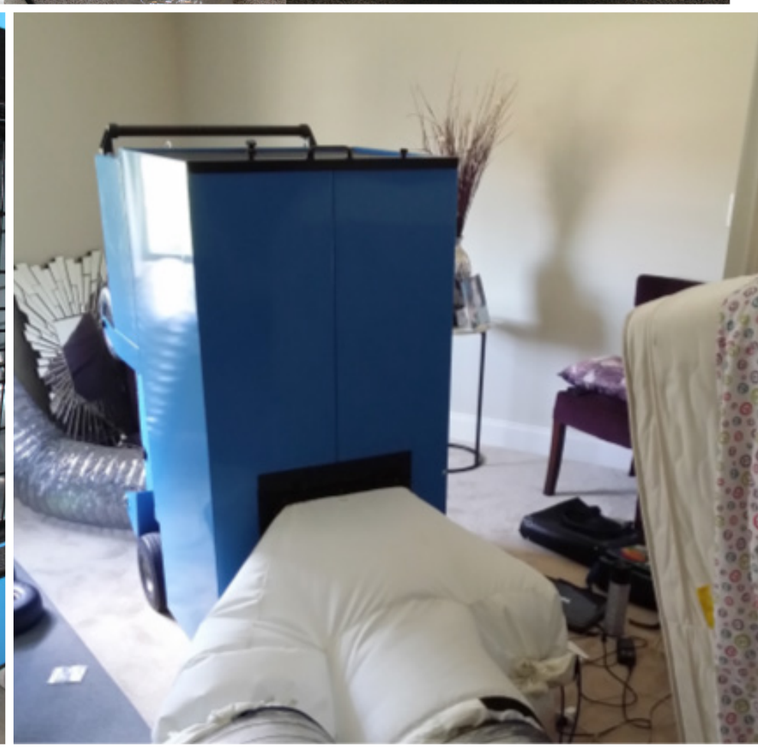
The DC-90 is a fabric duct used to discharge the heated airflow through 90 inches of openings which forces the heated air under heavy furniture and against the baseboard areas to ensure thorough heat penetration.

The fabric duct connectors and flexible duct are easy to install. The flexible duct can be moved during the heat treatment and clutter doesn't present a problem. This method was designed to be easy to set up, teardown and transport.




## DESIGNED WITH THE USER IN MIND





# KEY FEATURES

## DESIGNED WITH THE USER IN MIND

### PORTABLE

The Modular design allows the Heat Injector System to go where the bed bugs are. It fits in almost any elevator and can be moved to any location that is handicap accessible. When required, the Modular Design allows the Heat Injector to be broken down, moved to hard to reach locations as Modules, and reassembled.

### RELIABLE

The Heat Injector is designed for long life with low maintenance. The foam filled tires, automatic overload protection, and automatic resets ensure reliable performance. The Modular design allows the belt to be tightened and makes access for repairs easy.

### HEAT TREATMENT STATUS

The Air Intake temperature reflects the status of the overall heat treatment with the unique concept of recirculated airflow. The Control Panel displays the Intake and Discharge temperatures. An Hour Meter indicates the accumulated heating hours.

### NO DISTANCE CONSTRAINT

The Heat Injector was designed to be moved to where the heat is needed with a single gas hose that connects to the Gas Manifold. The propane tanks can be moved close to the heat treatment. The hoses are typically 25 to 100 feet but can be up to 400 feet. A UNION assembly allows gas hoses to be spliced.

### DUAL GAS REGULATORS

A Gas Regulator on each propane tank allows all the fuel to be used before the tank is changed. The Thumbwheel connector goes to the tank with the male QD to the Manifold.

### GOOF PROOF GAS CONNECTION

Propane is supplied to the Heat Injector with a single gas hose with Quick Disconnects (QD's) on each end to eliminate the possibility of a gas leak. When the QD is removed it automatically closes to trap gas in the hose. The male connections have a ball valve near each connection to prevent any gas leakage on site.

### DUAL TANK GAS MANIFOLD

A gas regulator on each tank is attached to the Gas Manifold. The gas gauge informs the operator of the supply pressure feeding the gas hose to the Heat Injector.

### QD GAS GAUGE

The optional QD Gas Gauge is installed at the Heat Injector to inform the Operator of fuel pressure at the Heat Injector.

### 2 YEAR WARRANTY

The Heat Injector has a 2 year warranty on everything, except the flexible duct. Training and Troubleshooting Videos are available to give Operators 24/7 assistance.

### HEAT INJECTOR SPECIFICATIONS:

- Maximum Heating Output: 400,000 BTU
- Maximum Airflow: 4,000 CFM
- Main Airflow Blower Motor: 1.5 HP powered by Variable Frequency Drive (VFD)
- Combustion Air Blower Motor: 1/12 HP
- Power Consumption: 15 amps from standard outlet
- Control Panel: Water tight, UL Listed
- Maximum Gas Pressure: 5 PSI
- Internally Regulated Gas Pressure: 6.5" W.C.
- FM Approved Flame Management: Fireye with Flame Rod Detection

# THE HEAT TREATMENT PROCESS

**The Modular Heat Injector System has the ability to be completely disassembled and reassembled at the heat treatment location.**

The process used to perform a heat treatment with the Heat Injector System is unique because it utilizes recirculated airflow and has the ability to pressurize the heated space.

The Heat Injector draws air from the space and injects heat into the air being discharged into remote locations within the heat treatment area through flexible duct. This method produces an airflow through the structure, from the discharge locations toward the Air Intake on the Heat Injector. Heat is continuously injected into the recirculated airflow to achieve the desired discharge temperature. The heated airflow brings the structure and its contents up to a lethal temperature for bed bugs and their eggs. The low emission heat that can be recirculated to perform the heat treatment without exceeding the acceptable Carbon Monoxide levels for a work environment.

When the heat treatment is finished, the Heat Injector has the ability to purge the heated air from the space, makes it easier for the operator to pack up, and not so hot for the client when they return.

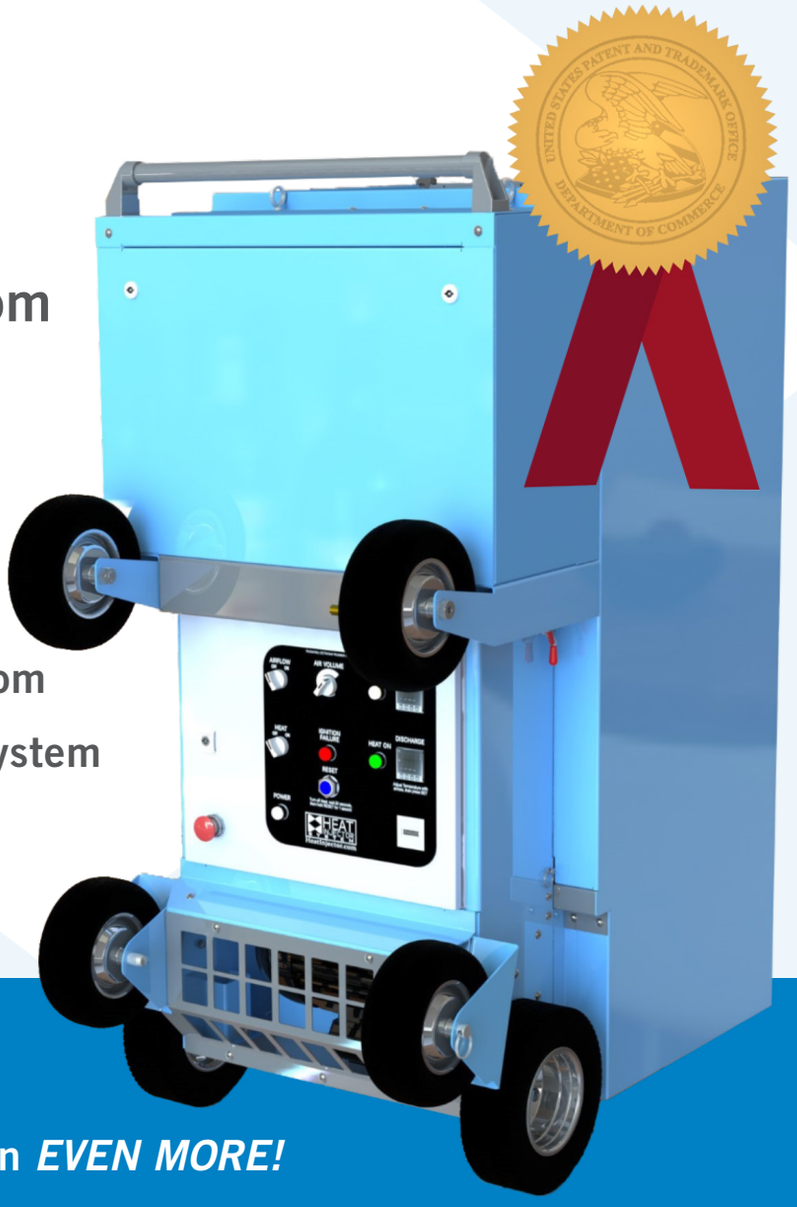

## 12 STEPS TO PERFORM A SUCCESSFUL HEAT TREATMENT

1. Move the Heat Injector to the location of the bed bug infestation and position it within an outside doorway or within the heated space, with the Air Shell installed to isolate the motors and controls from the heated air.
2. Plug the Heat Injector into any standard outlet.
3. Attach flexible duct to the discharge of the Heat Injector with fabric connectors and establish the discharge ductwork to transfer the heat into the remote locations (see pictures on fabric cinches on following pages). Test the duct with maximum air volume.
4. Attach the gas hose to the Heat Injector using the quick disconnect (QD) fitting, with the other end attached to the Gas Manifold. Gas regulators, with thumb wheel connections, are attached to dual tanks to supply the Gas Manifold. If the Heat Injector is inside the heated area, the gas hose runs through the flexible duct that supplies an outside air access.

   **NOTE:** ***To test the gas connections, pressurize the line and observe pressure gauge on the manifold when the gas is shut off. An optional Gas Gauge Assembly allows the operator to see the gas pressure at the machine.***
5. Turn on the Airflow switch and the Heat switch, set the desired discharge temperature, and adjust the airflow to maximum.
6. After the heat has been started, install doorway drapes to manage the airflow leaving the rooms that receive the heated discharge. The drapes cause the coolest air to exit the room at the floor.
7. Install the Doorway Air Barrier to close-off the space around the Heat Injector when it is positioned in an outside doorway.
8. At this point, it is automatic; the heated airflow will continue to be pushed into the infested areas with the heat migrating toward the Air Intake. Monitor the Air Intake temperature to determine the overall status of the heat treatment.
9. Place sensors in the heated area and monitor them to ensure all areas are thoroughly heated.
10. During the periodic inspections, manage the heated airflow by moving the flexible duct to different discharge locations. Optional fans circulate the stratified heat to increase the thermal transfer into the contents and to shorten the heat treat time.
11. When the Air Intake exceeds about 125°F, begin the pressurization process by opening the Gate and dropping the Damper to force heated air through cracks and openings within the structure where bed bugs might find harborage.
12. Heat until the structure and its contents have reached lethal temperatures for bed bugs and their eggs.

# HEAT INJECTOR SYSTEM

## Sets a New Standard for BED BUG *Heat Treatment!*



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