Installation and Maintenance Manual
Please retain this manual for future reference.

S405
Construction
Heater

For your safety: Do not use this heater in a space where gasoline or other liquids having flammable vapors are stored.
IMPORTANT INFORMATION! READ FIRST

The heater is designed for use as a construction heater under ANSI Z83.7a-1993. The primary purpose of construction heaters is to provide temporary heating of buildings under construction, alteration, or repair and to provide emergency heat. Properly used, the heater provides safe, economical heating. Products of combustion are vented into the area being heated.

The heater **IS NOT** designed as an Unvented Gas Fired Room Heater under ANSI-Z21.11.2 and **SHOULD NOT** be used in the home.

ANSI A119.2(NFPA 501C)-1987 Recreational Vehicle Standard prohibits the installation or storage of LP-gas containers even temporarily inside any recreational vehicle. The standard also prohibits the use of Unvented Heaters in such vehicles.

NFPA-58 1989 STANDARD FOR THE STORAGE AND HANDLING OF LIQUEFIED PETROLEUM GASES

Use of the heater must be in accordance with this Standard and in compliance with all governing state and local codes. Storage and handling of propane gas and propane cylinders must be in accordance with NFPA 58 and all local governing codes.

We cannot anticipate every use which may be made for our heaters. **CHECK WITH YOUR LOCAL FIRE SAFETY AUTHORITY IF YOU HAVE QUESTIONS ABOUT LOCAL REGULATIONS.**

Other standards govern the use of fuel gases and heat producing products in specific applications. Your local authority can advise you about these.

FOR YOUR SAFETY

**DO NOT USE THIS HEATER IN A SPACE WHERE GASOLINE OR OTHER LIQUIDS HAVING FLAMMABLE VAPORS ARE STORED OR USED.**

CONSTRUCTION HEATER GENERAL HAZARD WARNING:

Failure to comply with the precautions and instructions provided with this heater, can result in death, serious bodily injury and property loss or damage from hazards of fire, explosion, burn, asphyxiation, carbon monoxide poisoning, and/or electrical shock.

Only persons who can understand and follow the instructions should use or service this heater.

If you need assistance or heater information such as an instruction manual, labels, etc. Contact your local Heat Wagon dealer or the manufacturer.

**WARNING**

Fire, burn, inhalation, and explosion hazard. Keep solid combustibles, such as building materials, paper or cardboard, a safe distance away from the heater as recommended by the instructions. Never use the heater in spaces which do or may contain volatile or airborne combustibles, or products such as gasoline, solvents, paint thinner, dust particles or unknown chemicals.

Not for home or recreational vehicle use!
Installation and Maintenance Manual
Model S405
Construction Heater

Table of Contents:

Specifications .......................................................... 4
Installation ............................................................... 5
Proper Set Up ........................................................... 6
On-site Safety Problems & Operating Instructions ................. 7
Preventative Maintenance ............................................ 8
Trouble Shooting ....................................................... 9
Parts Breakdown ....................................................... 10
Wiring Diagrams ....................................................... 11-14

WARRANTY
All new Heat Wagon and Sure Flame heaters and fans are guaranteed against defective materials and workmanship for one (1) year from Heat Wagon invoice date.

Warranty repairs may be made only by an authorized, trained and certified Heat Wagon dealer. Warranty repairs by other entities will not be considered. Warranty claims must include model number and serial number.

LIMITATIONS
Warranty claims for service parts (wear parts) such as spark plugs, igniters, flame rods will not be allowed. Diagnostic parts such as voltage meters and pressure gauges are not warrantable.

Evidence of improper fuel usage, fuel pressures outside of manufacturer’s specification, poor fuel quality, and improper electric power, misapplication or evidence of abuse may be cause for rejection of warranty claims.

Travel time, mileage and shipping charges will not be allowed. Minor adjustments of heaters are dealers’ responsibility. Defective parts must be tagged and held for possible return to the factory for 60 days from date of repair. The factory will provide a return goods authorization, (RGA) for defective parts to be returned.

No warranty will be allowed for parts not purchased from Heat Wagon.

heatwagon

342 N. Co. Rd. 400 East • Valparaiso, IN 46383
219-464-8818 • 888-432-8924 • Fax 800-255-7985
www.heatwagon.com
DESIGN RELATED SAFETY FEATURES

1. Locking position for LPG on gas selector lever: Units used with LPG while the gas selector valve is positioned for Natural Gas will throw significantly more heat than the rated Btu/h. This is definitely a safety hazard.

2. Low Skin Temperature: Sure Flame Heaters are designed to have a low skin temperature. This provides added safety in the workplace.


In order to maintain the highly efficient combustion of the Sure Flame Heater, the combustion chamber must remain as manufactured. Any change or distortion could alter the fuel/air mixture and create unwanted gases.

SAFETY FEATURES

Servicing of Sure Flame Construction Heaters normally involves one of several built-in safety features. The Model S405 incorporates devices to detect the following:

1. LOSS OF FLAME  Gas supply is shut off if flame is lost to prevent raw gas from leaving heater
2. OVERHEATING  a) Thermal overload protection in the motor  b) High temperature limit switch in the control box
3. LOSS OF POWER  Total shutdown with manual reset required. Any one of the safety devices will create a loss of power situation
4. BLOCKED AIR SUPPLY  An airflow switch detects the differential pressure in the combustion chamber and shuts down when insufficient

SPECIFICATIONS

Model No. S405

Designed to ANSI Z83.7a-1993 Construction Heater

Gases: Natural or Propane Vapor
Capacity: 400,000 Btu/h maximum
Orifice Size: 42 DMS (x18)
Blower: 2,000 CFM
Electrical Rating: 115V 60Hz 12 amps, single phase
Minimum Temperature Rating: Minus 40 degrees F

<table>
<thead>
<tr>
<th>Gas Supply</th>
<th>Inlet Pressure</th>
<th>Manifold Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propane</td>
<td>Max W.C. 14”</td>
<td>Min W.C. 7” W.C. 1.3”</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Max W.C. 14”</td>
<td>Min W.C. 7” W.C. 4.0”</td>
</tr>
</tbody>
</table>

(Minimum inlet pressure is for purpose of input adjustment)

Inlet Connection: Model S405 1” NPT

Weight (approximate): 100 lbs.
The Sure Flame S405 is a direct fired gas heater intended to be used primarily for the temporary heating of buildings under construction, alteration, or repair. Since all the products of combustion are released into the area being heated, it is imperative that adequate ventilation is provided. The flow of supply air and combustion gases must not be obstructed in any way. Do not use the heater with ductwork as this will restrict the flow supply air.

1. Install the heater in a horizontal position and allow the following clearances from any combustible material or fuel containers:

   | Front Outlet: | 12 feet | Sides: | 2 feet |
   | Intake:       | 2 feet  | Top:   | 5 feet |

Front outlet must not be directed at any LP-Gas container within 20 feet. Also make sure that no flammable vapors are present in the space where the heater is being used.

2. When connecting the heater to a natural gas or propane supply line ensure that the pressure at the heater inlet is within the specified range. Please refer to Propane and Natural Gas installation sections on page 6. Excessive pressure (over 1/2" psig) will damage the controls and void the warranty.

3. Visually inspect the hose assembly and ensure that it is protected from traffic, building materials, and contact with hot surfaces. If it is evident that there is excessive abrasion or wear, or the hose is cut, it must be replaced.

4. After installation, check the hose assembly for gas leaks by applying a water and soap solution to each connection.

5. Connect the heater to an adequate 115 volt electrical supply and in compliance with the National Electrical Code ANSI/NFPA 7.0. For protection against shock hazard the supply cord should be plugged directly into a properly grounded three-prong receptacle.

6. In all applications, install the heater in such a manner that it is not directly exposed to water spray, rain, and/or dripping water.
PROPER SET-UP

1) When installing the heater for use with propane gas, set the gas selector to “Propane” and lock in position.

2) The supply container must be equipped with an LP Gas Regulator that complies with ANSI/UL 144 Standard for Pressure Regulating Valves for LP Gas. Another regulator must be installed on the heater to reduce the pressure from this regulator down to a maximum inlet pressure of 1/2 psig.

3) Arrange the cylinder supply system to provide for vapor withdrawal from the operating cylinder. Supplying liquid propane to the heater is dangerous and will damage the components.

4) Ensure that for the surrounding temperature the size and capacity of the propane supply cylinder is adequate to provide the rated BTU/H input to the heater.

5) Turn off the propane supply valve at the cylinder when the heater is not in use.


7) When the heater is to be stored indoors the propane cylinder must be disconnected from the heater and the cylinder moved away and stored in accordance with Chapter 5 of the above National Standard.

INSTALLATION USING NATURAL GAS APPLICATIONS

1) When installing the heater for use with natural gas, set the gas selector valve to the “Natural” position.

2) A regulator must be installed on the heater only if the line pressure to the heater is greater than 1/2 psi.

3) The installation of this heater to a natural gas supply must conform with all applicable local codes or, in the absence of local codes, with the National Fuel gas Code, ANSI Z223.1/NFPA 54.

COMMON INSTALLATION AND OPERATIONAL PROBLEMS

1) LOW VOLTAGE AT THE HEATER
   This is one of the most common problems and is usually the result of the supply cord having too small a wire gauge for its length, or low voltage at the power source. Low voltage results in the motor overheating, burnt relay contacts, or a relay that will not make contact. Check supply voltage at heater.

2) GAS SUPPLY LINE UNDERSIZED

3) INSUFFICIENT VAPORIZATION AT SUPPLY
   Normally caused by undersized supply tank.
ON SITE SAFETY PROBLEMS & OPERATING INSTRUCTIONS

1) Set the **gas selector valve** for fuel being used. The conversion shall be done by the owner or lessor of the equipment.

   **NOTE:** When using Propane Gas the Selector Valve **MUST** be locked in the “ON” position.

2) Ensure the **manual shut-off valve** (valve nearest the burner) is in the “ON” position.

3) Connect power supply (115 volt). Check voltmeter to confirm voltage (min 105 required).

4) Slowly open shut-off valve at gas meter or propane tank. Check for leaks.

5) Push **START** button

6) Set **thermostat** for desired room temperature.

7) To stop turn gas off.

The appliance area should be kept clear and free from combustible materials, gasoline, and other flammable vapors and liquids.

Ensure that the flow of supply air and combustion gases is not obstructed.

The installation and operation of this heater shall comply with the code requirements specified by the authorities having jurisdiction.

General criteria for the use of construction heaters may be found in the applicable sections of American National Standard A-10.10-1987, Safety Requirements for Temporary and Portable Space Heating Devises and Equipment Used in the construction industry.

**THE INSTALLATION AND MAINTENANCE OF THE HEATER MUST BE ACCOMPLISHED BY A QUALIFIED SERVICE PERSON.**
ON-SITE SAFETY PROBLEMS

1) SHORTING OUT OF DEFECTIVE COMPONENTS
   This is a very common problem which saves short term expense at the risk of a large future cost. Any heaters found in this condition should be removed immediately.

2) IMPROPER ENCLOSURES
   When heaters are installed partially to the outside for fresh air intake, strict adherence must be made to the minimum clearance to combustibles given on the instruction plate. Wood framing around a heater can cause a safety hazard.

3) SUPPLYING LIQUID PROPANE TO HEATER
   This problem has occurred from time to time. To minimize the damage, shut off the gas supply and let the heater run until all of the liquid in the lines had been consumed.

PREVENTIVE MAINTENANCE

Sure Flame construction heaters are built to withstand the rigors of operating on construction sites, for mining applications, and a multitude of other locations where heaters are used. To maintain the reliable performance required it is necessary to do a certain amount of regular maintenance.

A) VISUAL CHECKS
   The following items should be checked for excessive wear or damage:
   1) Wheels (if installed)
   2) Cords and Connectors
   3) Wiring and Conduit
   4) Heater shell (including heat shield) and control box
   It is recommended that units purchased as spares be rotated periodically, so that each unit will be placed in operation at least once every 90 days.

B) BURNER
   Flame rod and insulator - Clean with soap and water or solvent on a routine basis. Any build up on burner should also be removed at this time.
   Spark Plug - Clean with solvent and check spark gap, approximately .070 to .085

C) CONTROL BOX
   The inside of the control box should be cleaned using a dry cloth or by blowing compressed air. Do not use any liquid or aerosol spray cleaners. Also check that all electrical connections are snug and tight.

D) MOTOR
   The electric motor on the S405 heater is fitted with sealed bearings and no oiling required. Keep the motor clean by blowing or wiping off dust or dirt in order to prevent the motor from overheating.

F) FAN
   Check for dust or dirt build up on fan blades. Check the tightness of the set screws and run the heater to check for fan vibration.
# TROUBLE SHOOTING

<table>
<thead>
<tr>
<th>SEQUENCE</th>
<th>PROBLEM</th>
<th>CHECK</th>
<th>CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Press START - Power relay closes indicated by a “click” sound (adjust thermostat clockwise for S405 and S400T Off/On model only)</td>
<td>Relay does not close</td>
<td>-If no power between L1, L2&lt;br&gt;-If no power at limit switch&lt;br&gt;-If no power at transformer&lt;br&gt;-If no power at relay coil&lt;br&gt;-If power at relay coil</td>
<td>-No power at plug&lt;br&gt;-Faulty stop/start switch&lt;br&gt;-Faulty limit switch&lt;br&gt;-Faulty ignition control&lt;br&gt;-Faulty Relay</td>
</tr>
<tr>
<td>Fan motors starts</td>
<td>Motor does not start</td>
<td>If no power between T1,T2&lt;br&gt; -If power between T1, T2</td>
<td>-Faulty relay contacts&lt;br&gt;-Faulty Motor</td>
</tr>
<tr>
<td>2. Ignition control produces spark</td>
<td>No spark</td>
<td>-If power between <strong>Power</strong> and <strong>GND</strong> on ignition control&lt;br&gt;-If NO power between <strong>Power</strong> and <strong>GND</strong> on ignition control</td>
<td>-Faulty ignition control or spark plug&lt;br&gt;-Faulty transformer</td>
</tr>
<tr>
<td>Short delay until fan reaches full RPM</td>
<td></td>
<td>-If NO power at air switch</td>
<td>-Insufficient air pressure differential to close air switch or faulty air switch&lt;br&gt;-Faulty solenoid</td>
</tr>
<tr>
<td>Air switch closes</td>
<td></td>
<td>-If power at air switch</td>
<td></td>
</tr>
<tr>
<td>Safety shut-off gas valve open indicated by “click” sound</td>
<td>Valve does not open, no gas</td>
<td>-Recheck sequence #2</td>
<td>-Insufficient gas pressure&lt;br&gt;-Check gas supply</td>
</tr>
<tr>
<td>3. Gas ignites, flame is proven</td>
<td>No flame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Light ON</td>
<td></td>
<td>-Press STOP button to reset return to Sequence #1 above</td>
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</table>

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*heat wagon*
<table>
<thead>
<tr>
<th>Ref.</th>
<th>Part No.</th>
<th>Description</th>
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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>SFP 405V01</td>
<td>Strainer (S400-80)</td>
<td>20A</td>
<td>SFP 3337G</td>
<td>On Switch (Green)</td>
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<tr>
<td>2</td>
<td>SFP 2524</td>
<td>Low Pressure Regulator</td>
<td>21</td>
<td>SFP 5768</td>
<td>Terminal Block</td>
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<td>3</td>
<td>SFP 4514</td>
<td>Solenoid Shut Off Valve 24V</td>
<td>22</td>
<td>SFP S400-2</td>
<td>Heat Shield</td>
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<td>4</td>
<td>SFP 405V04</td>
<td>Gas Selector Valve (S400-73)</td>
<td>23</td>
<td>SFP S400-57</td>
<td>Front Leg Assembly</td>
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<tr>
<td>5</td>
<td>SFP 2538</td>
<td>Manual Shut Off Valve 3/4” valve</td>
<td>24</td>
<td>SFP S400-47</td>
<td>Rear Leg Assembly</td>
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<tr>
<td>6</td>
<td>SFP 2430</td>
<td>Motor 1/4 H.P.</td>
<td>25</td>
<td>SFP 4517</td>
<td>Control Box Lid</td>
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<td>7</td>
<td>SFP 2420</td>
<td>Fan Blade</td>
<td>26</td>
<td>SFP SC400-38</td>
<td>Valve Train Cover</td>
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<td>8</td>
<td>SFP 405B26</td>
<td>Burner</td>
<td>27</td>
<td>SFP S400-53</td>
<td>Heater Body Includes 22, 23 &amp; 29</td>
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<tr>
<td>9</td>
<td>SFP 2142</td>
<td>Spark Plug</td>
<td>28</td>
<td>SFP SFP3859</td>
<td>Motor Mount (with screen &amp; rear legs)</td>
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<tr>
<td>10</td>
<td>SL11B86</td>
<td>Flame Rod</td>
<td>29</td>
<td>SFP S400-3</td>
<td>Nose Cone</td>
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<td>11</td>
<td>SFP 7465</td>
<td>24VAC 5-Second Delay-ON-Break Timer</td>
<td>30</td>
<td>ACC-SWK1</td>
<td>Wheel Kit (Optional)</td>
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<td>12</td>
<td>SFP 4519</td>
<td>Control Relay 24V</td>
<td>31</td>
<td>ACC-405V06</td>
<td>Regulator (Optional)</td>
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<td>13</td>
<td>SFP 4510</td>
<td>Transformer 24V</td>
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<td>14</td>
<td>SFP 5943</td>
<td>Direct Spark Ignition Control</td>
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<td>SFP 5124</td>
<td>Air Switch</td>
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<td>SFP 2446</td>
<td>Hi Limit Thermoswitch</td>
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<td>SFP 4518</td>
<td>Indicator Light 24V</td>
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S405 CONSTRUCTION HEATER
WIRING DIAGRAM

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