Visible Defects
Heat Exchanger Inspection Kit

- Better visual inspection of gas heat exchangers as instructed by the International Fuel and Gas Code “for cracks, openings, or excessive corrosion”
- Fluorescent penetrant and UV light make it easy to find potentially dangerous cracks in heat exchangers
- Penetrant is non-toxic, low odor, metal safe, and non-smoke generating
- Can be used to evaluate clamshell, serpentine and tubular design heat exchangers in standard efficiency furnaces (non-condensing types)
- Perfect tool for annual clean and check programs

Description

The Visible Defects Heat Exchanger Inspection System enables the technician to better evaluate the integrity of combustion cells in aged furnaces by better visualizing a crack if it exists. The components in the kit allow the technician to inspect clamshell/serpentine designs by applying the non-toxic, low odor, and non-smoke generating fluorescent penetrant on the air side of the heat exchanger. With using the supplied UV flex light, the integrity of each combustion chamber is thoroughly evaluated for any sign of penetration through the chamber wall – a potential source of a defect. The indicator MUST be secondarily proven before condemning the combustion cell. For tubular heat exchanger designs, the solution is sprayed inside the combustion chamber and the inspected with a UV flex light on the air side from the blower compartment.

The Visible Defects Kit includes: high volume sprayer assembly, a quart of Visible Defects Crack Finder solution, 22″ sprayer wand, 12″ extender/injector, LED UV flex light and batteries, UV protective glasses, a set of instructions, and customer handouts. Replacement quarts of Visible Defects Crack Finder solution are sold separately. Kit components available separately upon request.

Packaging

Visible Defects Kit	**4385-00**
Visible Defects Crack Finder Solution	**4385-06**

Application

Heat exchangers are made of one or more chambers called cells. Depending on the design, cells are formed from two fairly thin metal ‘shells’, sealed around the edges, with two openings, one for the fire to enter, the other to exhaust the fire’s combustion gases. The two most common failures to the heat exchanger are holes and cracks. Holes are caused by moisture-laden exhaust gases, which are acidic and can corrode the metal wall of the heat exchanger over time. Moisture can originate from a number of sources such as the moisture in the fuel itself and/or the relative humidity in the home. Cracks are usually caused by stresses that occur during the heating cycle - caused by constantly expanding and contracting of the metal walls. This continuous flexing back and forth, like bending a paper clip, eventually causes the metal to crack and the heat exchanger to fail a safety inspection.

There are a number of methods available for the technician to check the integrity of a heat exchanger, none more thorough than the unique Visible Defects Inspection System. Inspecting the heat exchanger with a standard flashlight and mirror method is quick; however, this method reveals a limited amount of surface area on modern heat exchangers. A flame disturbance test also has the same limitations in that it only reveals a limited amount of surface area of the device. The smoke bomb method or formulated spray that may affect the color of the flame both reveal catastrophic issues with the heat exchanger, at best. Using a tracer gas test is a good method for evaluating tubular type heat exchangers; but they are time consuming and require specialized and calibrated test equipment. Also, the tracer gas is lighter than air, making it only useful for finding holes in the top section of a heat exchanger. Lastly, a CO meter is an excellent tool to own to use in tandem with the Visible Defects System since an elevated level of CO does not necessarily equate to a potentially dangerous cracked heat exchanger; it could be caused by a pressure imbalance in the dwelling - which also would need to be addressed.

The Visible Defects Kit is an essential tool that supplements other diagnostic methods to better evaluate the integrity of the heat exchanger by enhancing the visibility of a potentially dangerous flaw. The Visible Defects approach addresses common field issues where cracks are difficult to depict with the naked eye by providing a better visual audit with the use of a UV penetrant on heat exchanger surfaces that can't been viewed easily.

Clamshell Style

Serpentine Style

Directions for Use

Standard Efficiency Furnaces with Clamshell/ Serpentine Heat Exchangers:

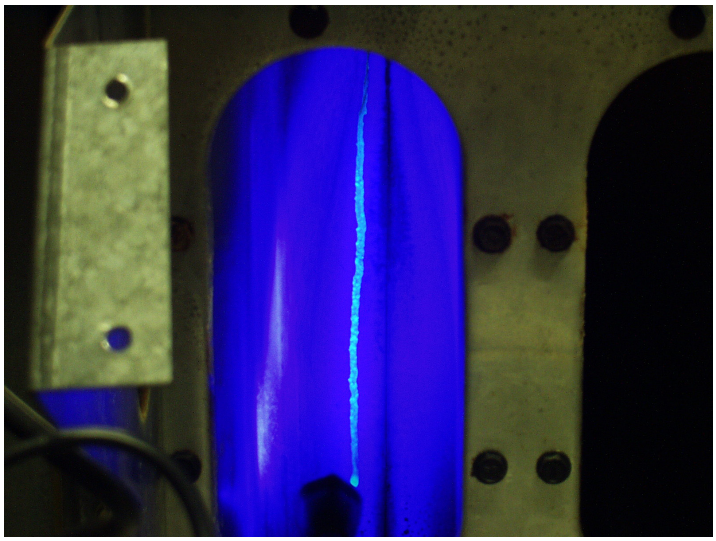
1. Turn off power to furnace. Make sure the furnace is cool before doing any of the below steps. If the furnace was in operation, run ONLY the blower for 15 minutes to dissipate heat from the area.
2. Remove blower assembly from the furnace and place a towel in the blower compartment to absorb any Crack Finder penetrant that may drip out of furnace.
3. Remove insertion limit from cabinet, plus burner shields and burners from cell entrances. Inspect the visible parts of the heat exchanger with a flashlight and mirror for any defect that may easily detected in these ports.
4. To further evaluate each cell, remove cap from quart bottle of Crack Finder penetrant and assemble sprayer head assembly to bottle and then assemble the 22″ spray wand.
5. Locate access holes that are available on the front panel. The insertion hole is obvious access point to test the middle cells; but also all the sheet metal screw holes that are available with the removal of the screws along the perimeter of the front panel. If necessary, access ports can be developed with the addition of a hole from sheet metal screw; which would be left in place after the inspection.
6. Wear UV block safety glasses. Completely insert 22 inch spray wand into holes in the front panel. After inserting, spin the wand between your fingers and slowly move it in and out as you pump the sprayer. Continue spraying and slowly remove the spray wand up to where the tip is almost out of the hole. Repeat between and alongside each cell. If the furnace is too deep, the 12″ extender/ injector can be added to spray wand.
7. Inspect the combustion side of each cell of the heat exchanger with the UV flex light and specially developed mirror; looking for any evidence of the Visible Defect's Crack Finder may have penetrated a crack or defect in the heat exchanger.

Technician applying Visible Defects Crack Finder penetrant on to a combustion cell with the sprayer wand through an existing hole in the front panel.

Caution: Some crimped style heat exchangers may weep a trace amount of penetrant between the crimped seams that adjoin the cell halves. This may be NORMAL, and it is NOT a reason to condemn a heat exchanger (since this seam seals when the cell is heated). In these circumstances, a small, barely visible amount of penetrant is seen at the seam. Any evidence of penetrant from areas not at the crimped seam, requires further investigation to prove a potential defect.

8. If any cracks or defects are suspected, they must be found, verified and PROVEN to the owner of the furnace. We recommend turning off the fuel valve, turning off the power at the disconnect switch and leaving a customer a signed copy of a hazardous appliance tag with the customer.
9. If no defects are found, reassemble the furnace, dry up any residual Visible Defects Crack Finder in the blower compartment and continue with your normal safety inspection.

   Caution: Run blower for a minimum of 10 minutes after applying the Crack Finder penetrant to the heat exchanger before allowing the furnace to cycle again.
10. **Important:** When finished with the inspection, disassemble the sprayer top from bottle, reassemble the quart bottle's original leak-proof cap. Pump sprayer head assembly dry to prevent a freeze related issue with the plastic assembly. Note: The Crack Finder penetrant is freeze/thaw stable; it merely needs to thaw for reuse if advertently stored in a harsh environment.



The supplied UV flex light illuminates the solution as it penetrates the combustion cell, indicating a potentially hazardous defect.

Directions for Use

Standard Efficiency Furnaces with Tubular Style Heat Exchangers:

1. Turn off power to furnace. Make sure the furnace is cool before doing any of the below steps. If the furnace was in operation, run ONLY the blower for 15 minutes to dissipate heat from the area.
2. Remove blower assembly from the furnace and place a towel in the blower compartment to absorb any Crack Finder penetrant that may drip out of furnace.
3. Remove insertion limit from cabinet, plus burner shields and burners from cell entrances. Inspect with a flashlight and mirror the visible parts of the heat exchanger for any defect that may easily detected in these visible ports.
4. To further evaluate each cell, remove cap from quart bottle of Crack Finder penetrant and assemble sprayer head assembly to bottle and then assemble the spray wand with the 12 inch extender/injector or just the extender/injector.
5. Wear UV block safety glasses. Visible Defects Crack Finder is injected **into** the combustion chambers of all the tubular cells of the heat exchanger.
6. The heat exchanger is then inspected from the air side looking upward from the blower compartment with the UV flex light for any signs of penetrant along the tubular walls. Also examine the insertion limit hole with the UV light and inspection mirror for any visible signs of the penetrant on the air side of the heat exchanger.
7. If any cracks or defects are suspected, they must be found, verified and PROVEN to the owner of the furnace. We recommend turning off the fuel valve, turning off the power at the disconnect switch and leaving a customer a signed copy of a hazardous appliance tag with the customer.
8. If no defects are found, reassemble the furnace, dry up any residual Visible Defects Crack Finder in the blower compartment and continue with your normal safety inspection.

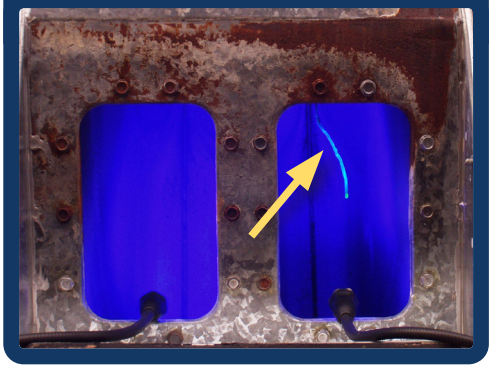
   Caution: Run blower for a minimum of 10 minutes after applying the Crack Finder penetrant to the heat exchanger before allowing the furnace to cycle again.
9. **Important:** When finished with the inspection, disassemble the sprayer top from bottle, reassemble the quart bottle's original leak-proof cap. Pump sprayer head assembly dry to prevent a freeze related issue with the plastic assembly. Note: The Crack Finder penetrant is freeze/thaw stable; it merely needs to thaw for reuse if advertently stored in a harsh environment.

Tubular Style

Can You See The Crack?

Entrance view of clamshell style combustion cells of an aged gas furnace.

Now You Can!



Same view, potentially dangerous crack easily observed with the Visible Defects Inspection Kit

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