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HEATING SYSTEM 101

Objective

- Provide non-heating personnel with a basic understanding of heating systems:
 - Types of Heating Systems
 - Identification of Components and Basic Operation
 - When do I Replace?
 - Specifications for Installation
 - Installation
 - Venting
 - Health and Safety Concerns
 - Partnerships

Fuels

- Fossil
 - #2 Fuel Oil–home heating interior tank
 - Kerosene–exterior tank (mobile homes)
- Gas
 - Natural Gas
 - Propane
- Solid Fuels
 - Wood
 - Pellets
- Electric

Types of Equipment

- Oil Fired
 - Power Gun Burner (Mid Efficiency)
- Gas/Propane Fired
 - Atmospheric-Cat I (Mid Efficiency)
 - Induced Draft-Cat III (Slightly Higher Efficiency)
 - Condensing-Cat IV (High Efficiency)

Forced Air

High boy
Low Boy
Octopus
Counter-flow

Hydronic (Boiler)

Fin Baseboard
Radiators

Gas Forced Air High Boy





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Oil Fired Boiler



Mobile Home-Counterflow

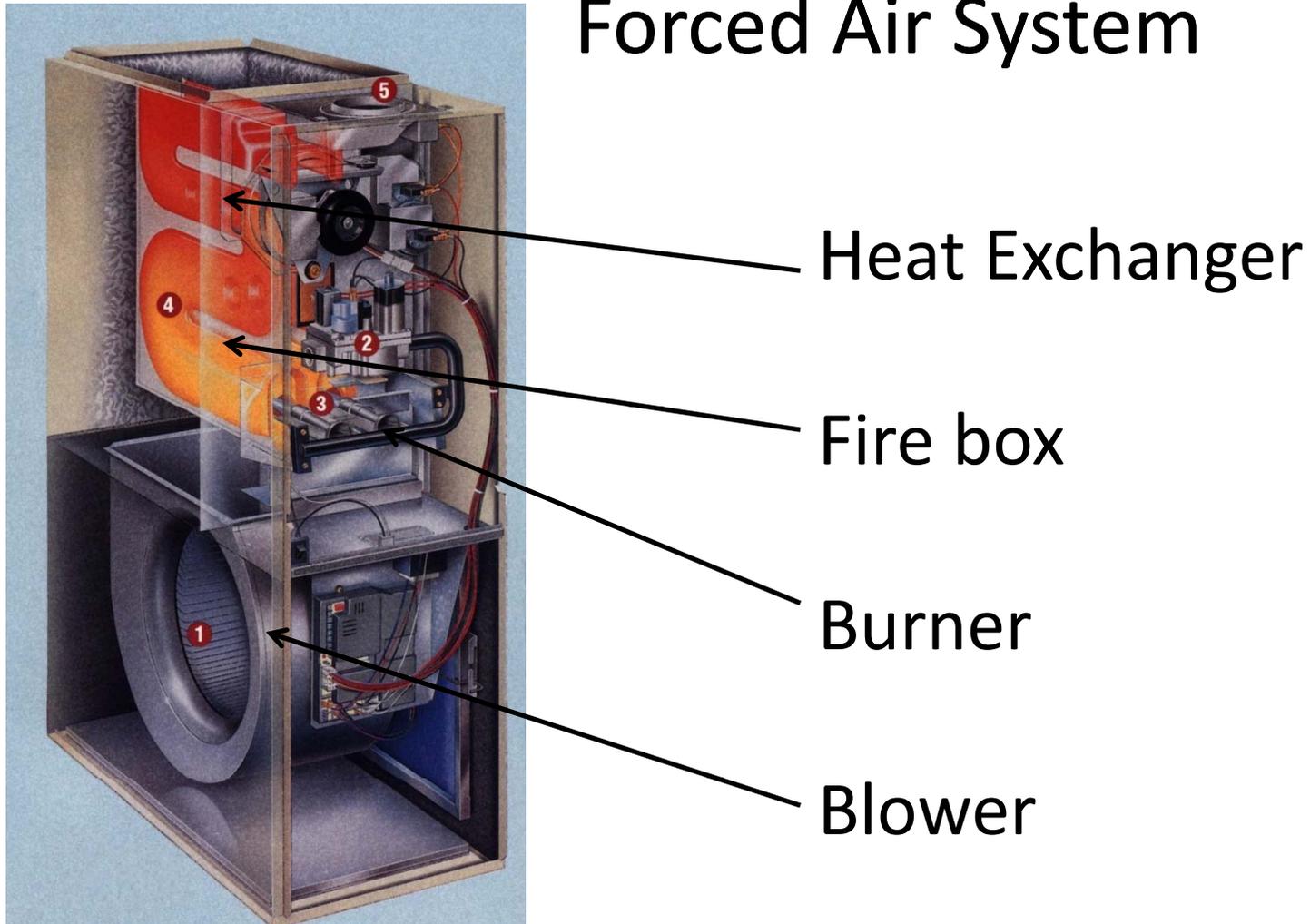




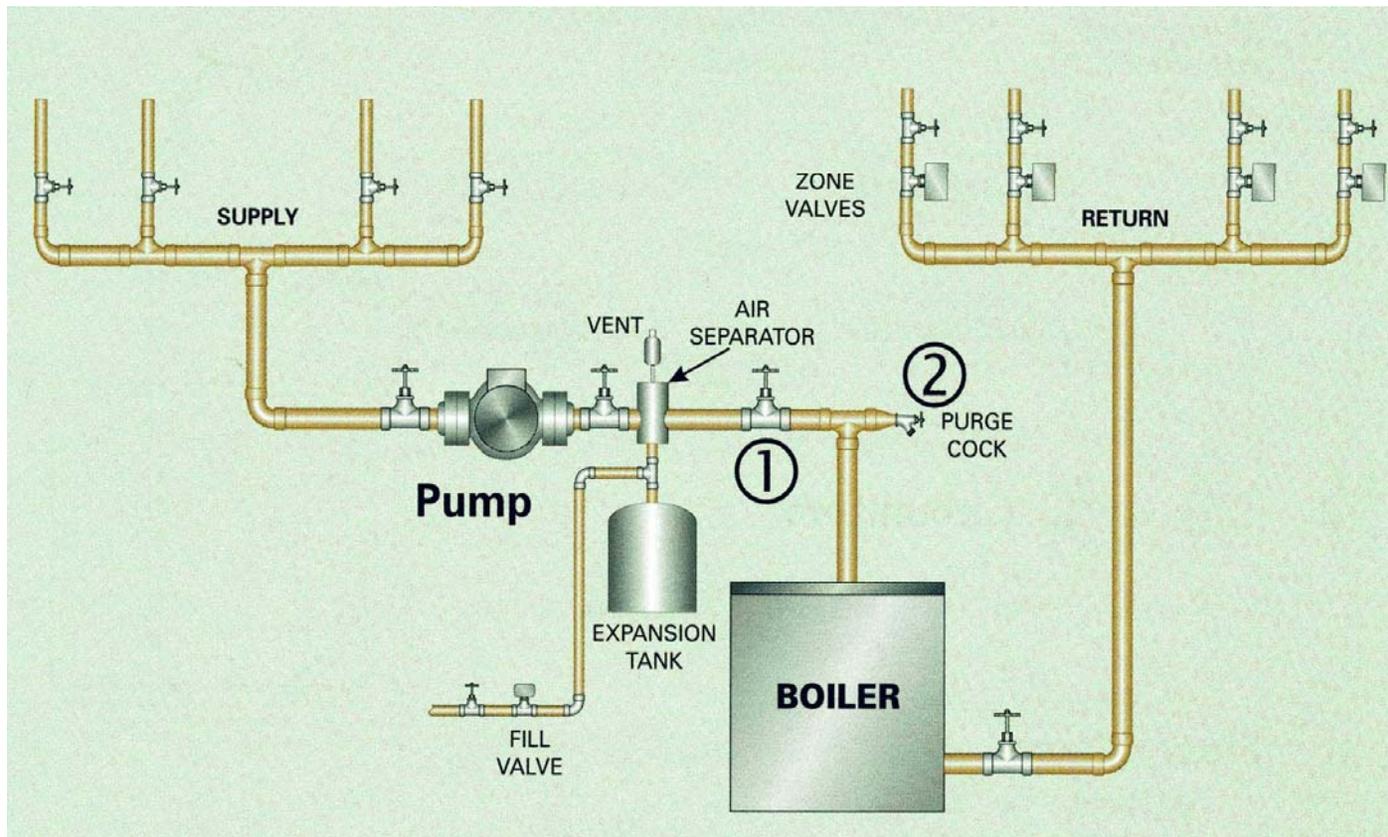
Heating System Components

- Burner
- Fire box
- Heat Exchanger
- Distribution System
 - Forced Air
 - Blower, Plenums-hot and cold air, Ductwork
 - Boiler
 - Circulator Pump, Piping, Radiators or Baseboard
- Basic Controls
- Safety switches

Components of a Gas Fired Forced Air System



Components of a Boiler



When do I Replace?

- Price of repair exceeds value of furnace
- Major health and safety concern
 - Cracked Heat Exchanger



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What is a Cracked Heat Exchanger?





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Testing for a Cracked Heat Exchanger

- Visual Inspection of Heat Exchanger
 - From the Top
 - Through humidifier
 - Remove Plenum
 - From the Bottom
 - Remove blower and inspect through blower compartment
- Smoke Bomb
- Oil of Wintergreen

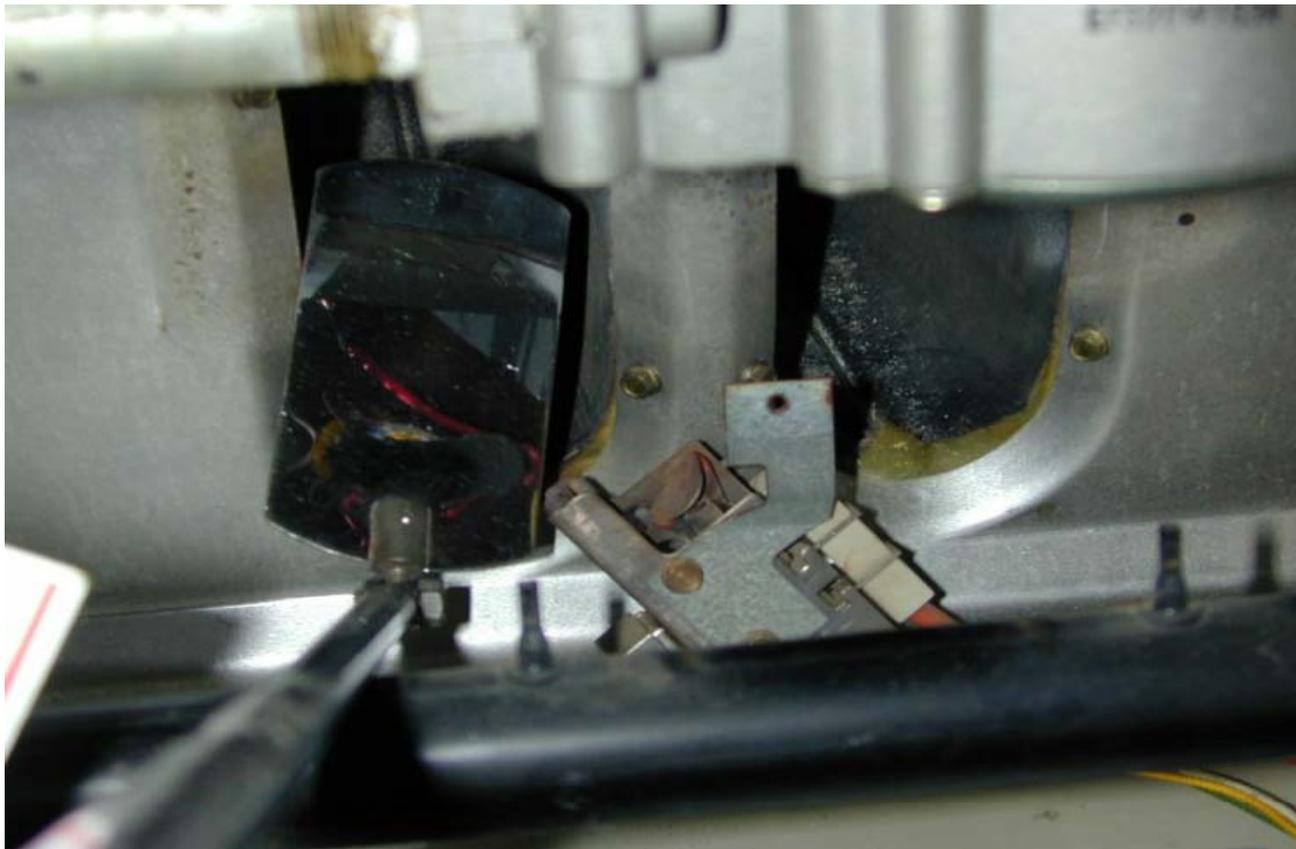
Additional Heat Exchanger Inspections

- Performed when the blower energizes
 - Draft
 - Should stay consistent, before blower and after blower energizes
 - O₂ / CO₂
 - Increase in O₂ (or decrease in CO₂) after blower energizes indicates additional air is entering the combustion process
 - Visual flame examination
 - Should not waver when blower energizes

Visual Inspection with Light



Visual Inspection with Mirror



Vents and Chimneys



Venting – Category I



- Negative pressure, non-condensing
- Materials
 - Masonry - solid fuels, oil, *gas
 - Outside masonry chimneys may need to be lined to accommodate replacement gas heating appliances
 - B-vent – gas
 - Approved for installation within the envelope only
 - L-vent - oil
 - All fuel - solid fuel, oil, gas
- Ensure termination is per manufacturer specification

Venting - Category IV

- Positive pressure, condensing
- PVC vented directly outdoors
 - Proper support and pitch are essential





Category IV

- Positive pressure condensing appliances, joints must be sealed
- 90%+ AFUE
- Appliances are designed to dispose of flue condensate as well as condensate formed within the secondary heat exchanger through condensate drain
- Must be 4 feet from any doors or windows

Category IV

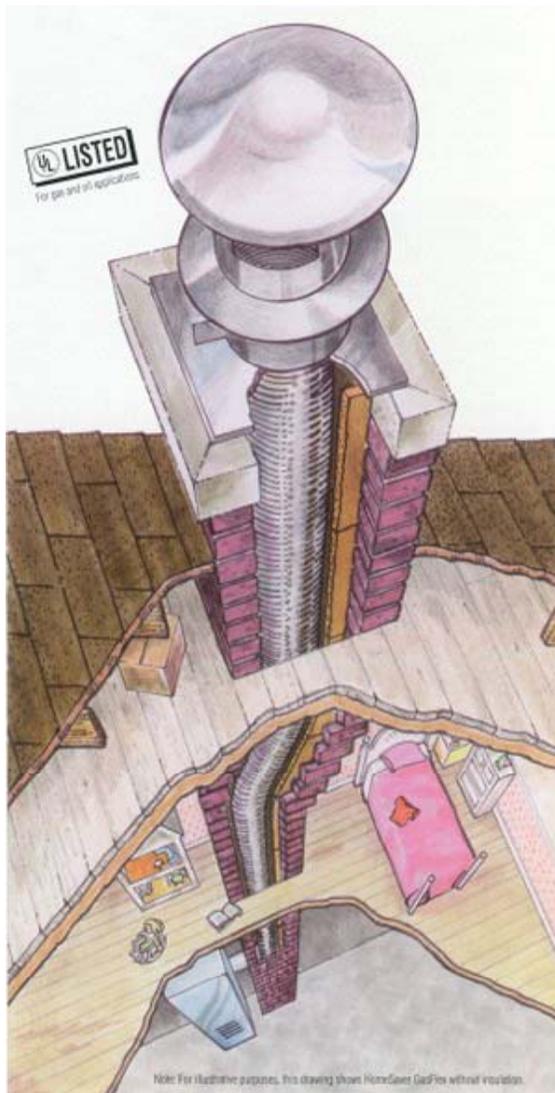
- PVC
 - Low cost
 - Sealed joints
 - Must be provided with adequate hanging support
 - Pitch – back to appliance $\frac{1}{4}$ " per Ft.
- CPVC
 - Higher operating temperatures than PVC
- Follow manufacturer
 - Manufacturer specific
 - Sealed Joints



Orphaned GAS Hot Water

- When removing a heating appliance from an existing Category I flue the hot water heater may become stranded or “orphaned” in a vent that is oversized.
- Problem-Potential Backdrafting
- Solution (IF the unit IS backdrafting):
 - Reline if a masonry chimney with a flexible liner or “B” vent
 - Power Vent
 - Replace water heater
 - Direct vent
 - Electric

Chimney Liner



- Flexible Chimney Liner
- Liner diameter is based on:
- Total, simultaneous input,
- Chimney height,
- Length of vent connector(s),
- Natural draft and/or fan assisted



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System Sizing

- What is a (BTU)?
 - British Thermal Unit
 - The amount of heat energy required to raise 1 pound of water 1 degree Fahrenheit
- Heat Load Calculations
 - Volume of House
 - Insulation Values-Walls, Ceiling, etc...
 - Windows and Doors
 - Air infiltration
 - Distribution System

Reading and Writing Proposals and Specifications

- Should be as complete as possible and indicate:
 - Installation per manufacturers instructions
 - All local codes will be followed
 - System size
 - Warrantee for parts and labor
 - Timeframe for completion

Installation Guidelines

- Appliance installed on solid blocks above the floor
- Installed per manufacturer specifications
- Venting per NFPA (National Fire Protection Association)
- Distance to combustibles per NFPA
- Ensure adequate combustion air
- Electric (neat connection following electric code)
- Fuel (In-line filter should be installed on oil)
- Duct transitions should be neat and sealed
- Balance of ductwork should be sealed
- Complete filter carriage (with cover) on forced air
- System tested for proper draft (when possible)
- Combustion efficiency test (when possible)

Managing Your Contractor

- What are you folks doing now?

Partnerships

- HEAP Emergency Repair and Replacement Program
 - Only during heating season
 - Emergency response to “no heat”
- Weatherization Assistance Program
 - Efficiency is primary goal
 - Last resort when responding to emergency
- NYSFRDA-FmPower and Home Performance
 - Efficiency repairs eligible
 - Generally does not have funds for replacement unless coordinated



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Questions?



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