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)

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Gas Forced Air High Boy
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

- Heat Exchanger
- Fire box
- Burner
- Blower
Components of a Boiler
When do I Replace?

• Price of repair exceeds value of furnace
• Major health and safety concern
  – Cracked Heat Exchanger
What is a Cracked Heat Exchanger?
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
  – \( O_2 / CO_2 \)
    • Increase in \( O_2 \) (or decrease in \( CO_2 \)) 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 ¼” 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
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
• NYSERDA-EmPower and Home Performance
  – Efficiency repairs eligible
  – Generally does not have funds for replacement unless coordinated
Questions?
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