HEATING SYSTEMS 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

For FREE
Operating
Instructions
Call
Mobil
heating oil

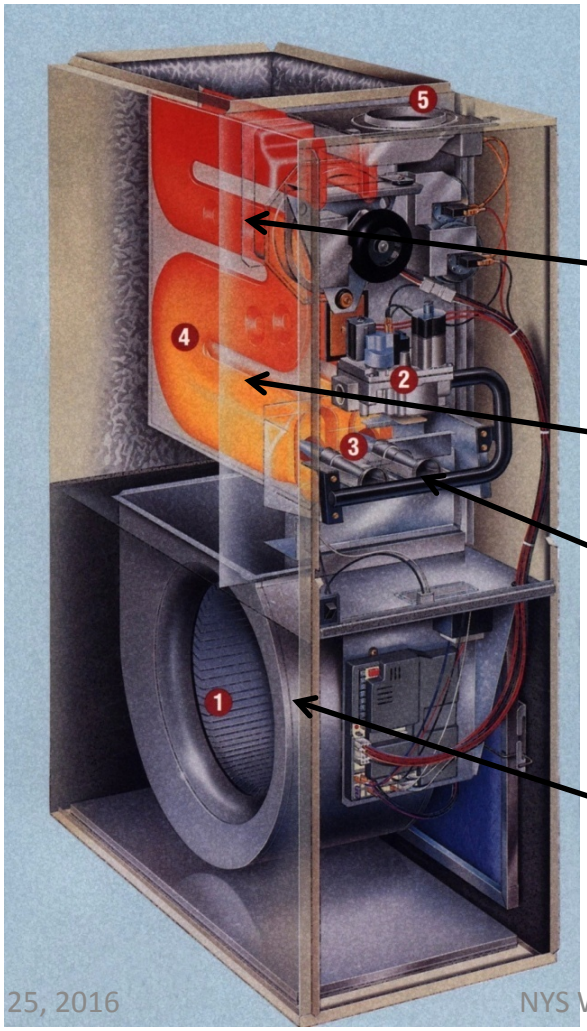
Oil Fired Boiler

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



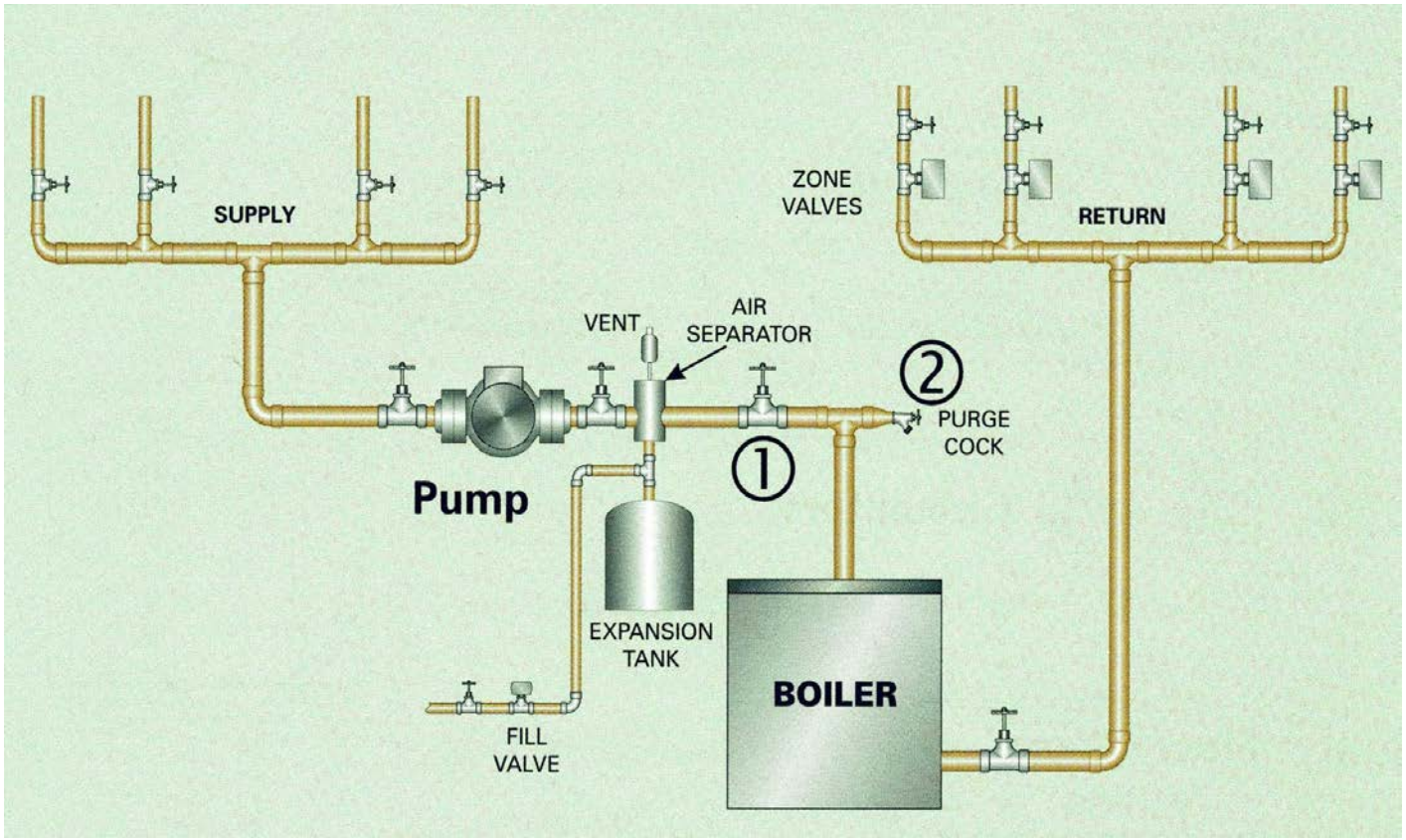
Heat Exchanger

Fire box

Burner

Blower

Components of a Boiler



When do I Replace?

- Non-functioning and;
  - 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

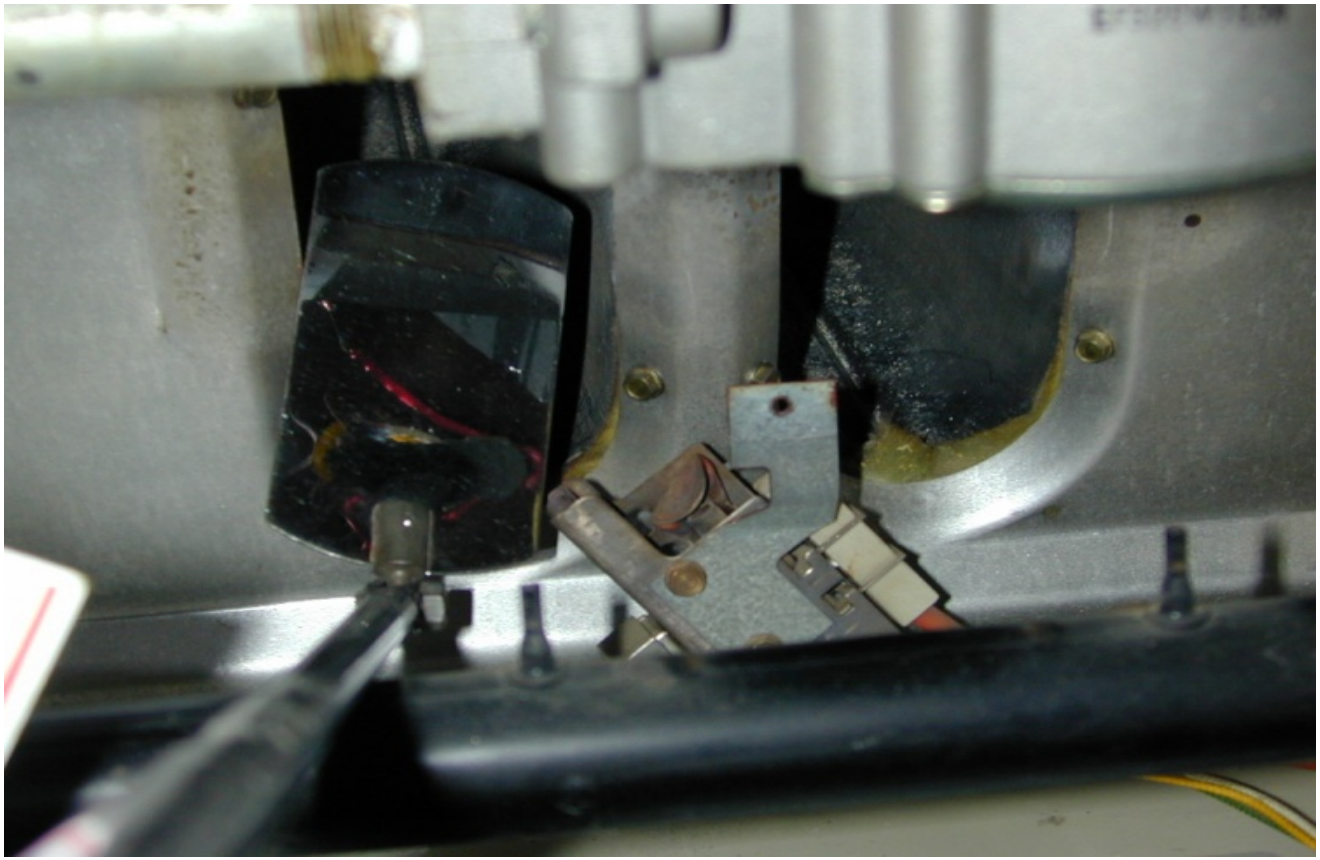
- Visual Inspection of Heat Exchanger
  - From the Top
    - Through humidifier
    - Remove Plenum
  - From the Bottom
    - Remove blower and inspect through blower compartment
- Smoke Bomb
- Oil of Wintergreen

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

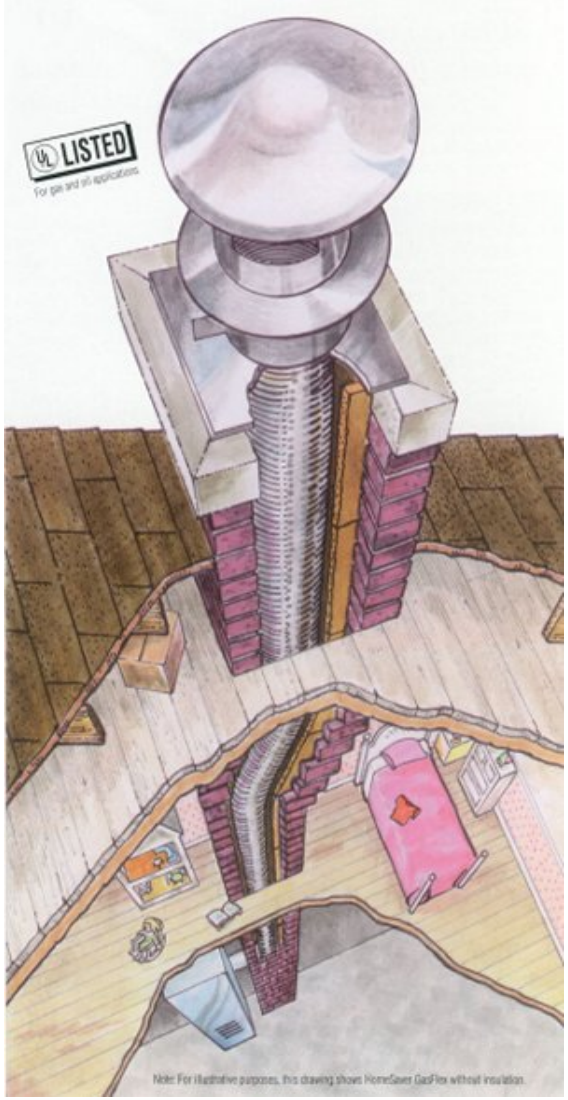
- Positive pressure condensing appliances, joints must be sealed
- 90%+ AFUE
- Appliances are designed to dispose of flue condensate as well as condensate formed within the secondary heat exchanger through condensate drain
- Must be 4 feet from any doors or windows

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 instructions
  - 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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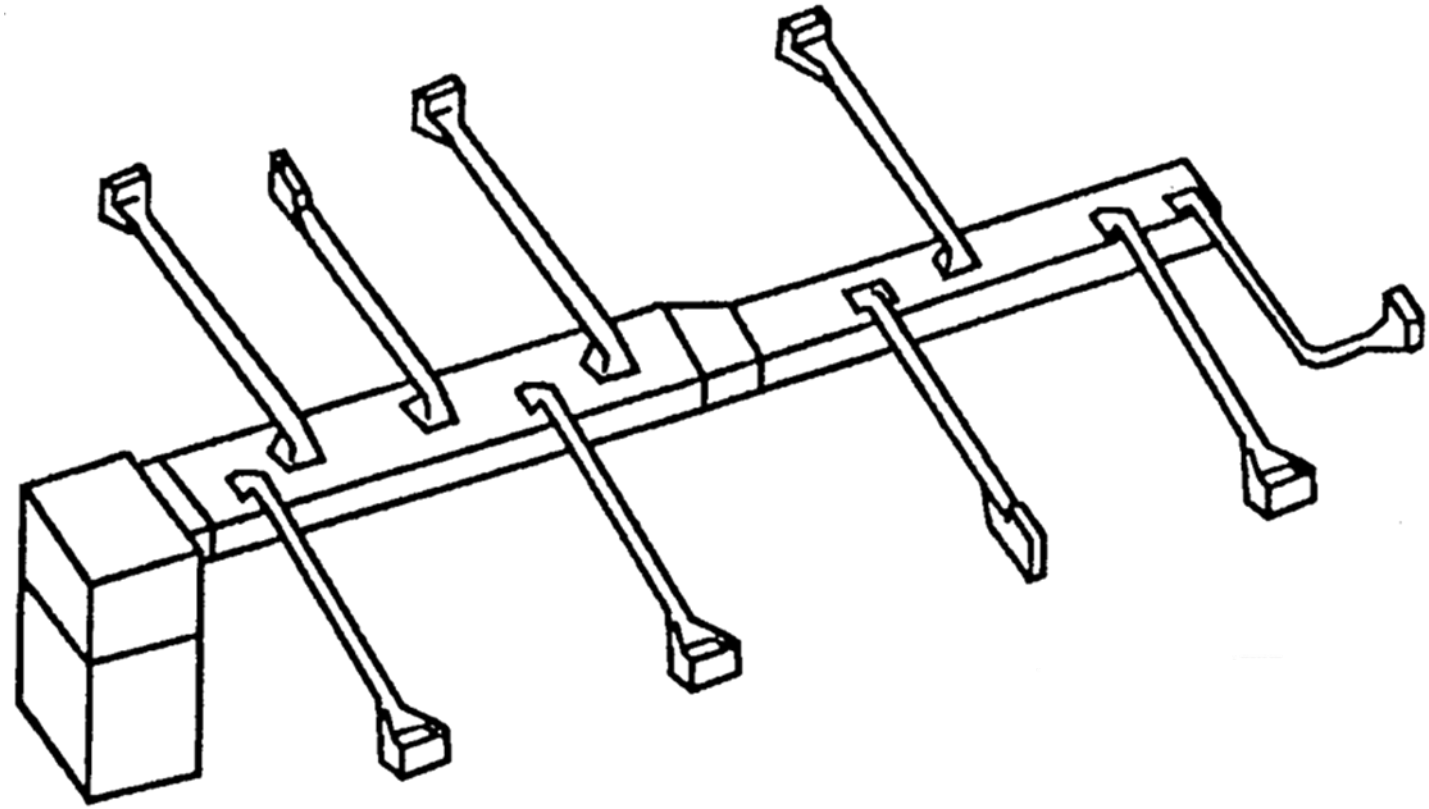
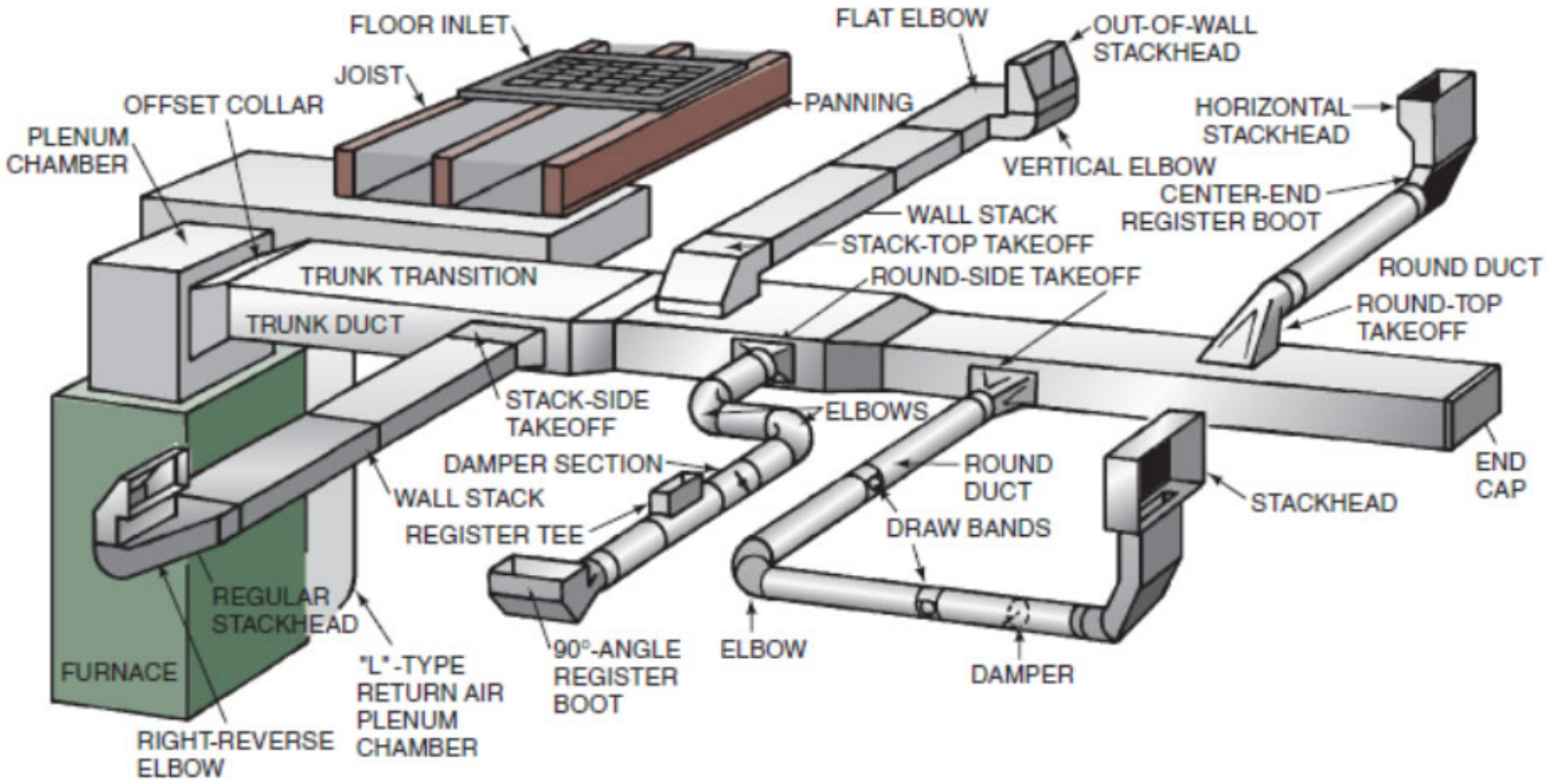
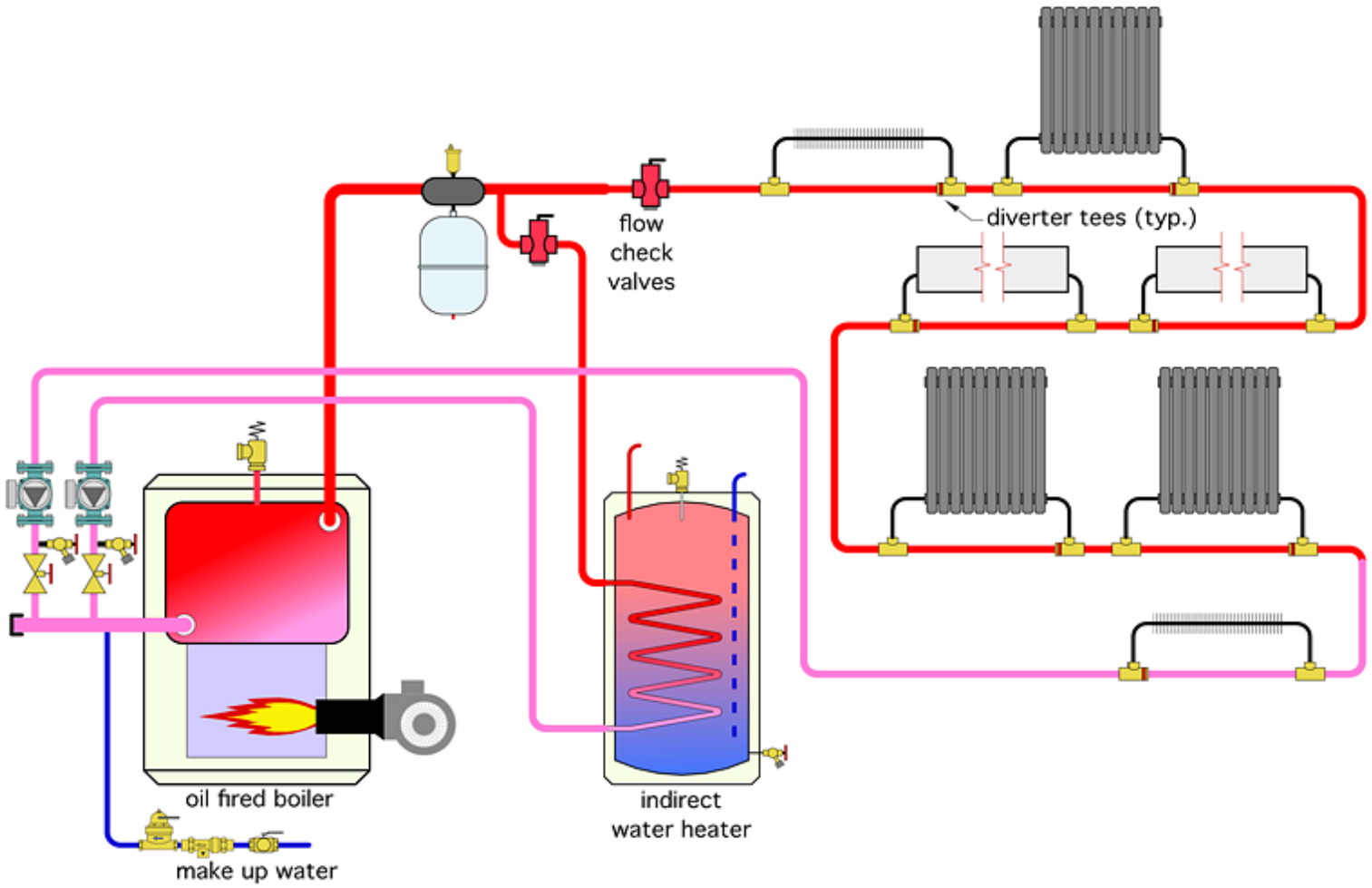
Forced Air Distribution Systems




FLOOR INLET
JOIST
OFFSET COLLAR
PLENUM CHAMBER
PANNING
FLAT ELBOW
OUT-OF-WALL STACKHEAD
HORIZONTAL STACKHEAD
VERTICAL ELBOW
CENTER-END REGISTER BOOT
WALL STACK
STACK-TOP TAKEOFF
ROUND-SIDE TAKEOFF
ROUND DUCT
ROUND-TOP TAKEOFF
TRUNK TRANSITION
TRUNK DUCT
STACK-SIDE TAKEOFF
ELBOWS
DAMPER SECTION
WALL STACK
REGISTER TEE
ROUND DUCT
DRAW BANDS
STACKHEAD
END CAP
REGULAR STACKHEAD
FURNACE
"L"-TYPE RETURN AIR PLENUM CHAMBER
90°-ANGLE REGISTER BOOT
ELBOW
DAMPER
RIGHT-REVERSE ELBOW

Forced Air Connections

Boiler Distribution


flow
check
valves
diverter tees (typ.)
oil fired boiler
indirect
water heater
make up water

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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