Home Inspection Curriculum Outline

I. Home Inspection Business Practices

A. Who, What, Why?

1. What is home inspection?
2. Who are home inspectors?
3. What do home inspectors do?
4. Who are the clients?

B. The Initial Conference

1. Home Inspection Components
2. Conducting the Conference

C. Performing the Inspection

1. What Are Safety Hazards?
2. What Are Functional Defects?
3. What Are Durability Concerns?
4. What Are Value Detriments?
5. What Are Cosmetic Issues?

D. Writing the Report

1. Preparing the Written Report
2. Report Formats
3. The Checklist Report
4. The Written Narrative
5. The Narrative Report Combined with a Checklist
6. Reports on Promulgated Forms
7. Additional Advice for Written Reports

E. Legal Issues

1. Industry Regulation
2. Insurance Requirements
3. Types of Insurance
4. The Elements of a Contract

F. Building a Home Inspection Business

1. Advertising

a. Yellow Pages
b. Newspapers
c. Internet
d. Flyers
e. Direct Mail
f. Signs

2. Referrals

G. Tools of the Trade

1. Checklist
2. Office Supplies
3. Maps/Atlases
4. Photographic Equipment
5. Protective Clothing
6. Flashlight
7. Tape Measure
8. Level
9. Screwdriver/Handpick/Awl
10. Termite Sniffer
11. Pliers/Prying Tools
12. Binoculars
13. Utility Knife
14. Telescopic Mirror
15. Tool Pouch/Tool Box
16. Ladder(s)
17. Thermometer
18. Multimeter
19. Circuit Analyzer
20. Gas Tracer
21. Carbon Monoxide Tester
22. Radon Testers
23. Moisture Meter

II. Structural Components

A. Intro to Footings/Foundations

1. Understanding Footings
2. Types of Footings
    a. Spread Footings
    b. Pad Footings
    c. Piles
    d. Piers
3. Foundation Materials
    a. Poured Concrete
    b. Concrete Block
    c. Pre-cast Concrete
    d. Brick
    e. Wood

B. Foundations and Drainage

1. Types of Foundations
    a. Basements
    b. Crawl Spaces
    c. Slab-on-grade
2. Understanding Water and Drainage
3. Improving Drainage
4. Damp-proofing and Waterproofing

C. Soils and Structural Concepts

1. Understanding Soils
2. Understanding Structural Concepts
    a. Load
    b. Tension and Compression
    c. Shear
    d. Bending

D. Recognizing Footing and Foundation Problems

1. Footing Problems
2. Common Foundation Defects
3. Defects of Exposed Pier Foundations

E. Foundation Movement

1. Horizontal Movement
2. Vertical Movement
3. Multiple Forces
4. Evaluating Cracks
5. Monitoring Crack Movement
6. Detecting Foundation Movement by Examining Framing Members

F. Foundation Repairs

1. Repairing Cracks
2. Restraining Horizontal Movement
3. Repairing Settlement and Restraining Vertical Movement

G. Floor Structures

1. Floor Structure Materials
2. Floor System Components
3. Sills and Rim Joists
    a. Common Problems and Defects
4. Floor Supports
    a. Beams
        (i) Common Problems and Defects
5. Floor Supports
    a. Columns
        (i) Common Problems and Defects
6. Floor Joists
    a. Common Problems and Defects
    b. Wood I-Joists
7. Floor Trusses
8. Bridging and Bracing
9. Girder Floor Systems
10. Subflooring and Underlayment
    a. Common Problems and Defects
        (i) Deflection
11. Cantilevers
    a. Common Problems and Defects

12. Stairwell Openings
    a. Common Problems and Defects
13. Concrete Floors
    a. Common Problems and Defects

H. Masonry Walls

1. Overview of Wall Framing
2. Materials and Construction
3. Common Problems and Defects
    a. Cracks
    b. Bulging, Leaning, and Bowing

I. Wood-Framed Walls

1. Types of Wall Framing
    a. Balloon Framing
    b. Post and Beam Framing
    c. Platform Framing
2. Components of Wood Framed Walls
3. Lateral Stability
    a. Lateral Bracing
    b. Sheathing
    c. Shear Walls
4. Common Problems and Defects

J. Masonry Veneer Walls

1. Construction and Components
2. Flashing
3. The Rain Screen Principle
4. Thin Brick Veneer
    a. Adhered Veneer
    b. Prefabrication
    c. Modular Panels
    d. Advantages and Disadvantages
5. Common Problems and Defects

K. Parapets, Arches, and Lintels

1. Parapet Walls

a. Common Problems and Defects

2. Arches
    a. Common Problems and Defects
3. Lintels
    a. Common Problems and Defects

L. Ceiling Joists, Roof Structure

1. Rafters and Joists
2. Trusses
3. Joists Alone
4. Sheathing
5. Ceiling Joists
    a. Common Problems and Defects
6. Types of Roofs
    a. Flat Roofs
7. Roof Components
    a. Valleys and Hips
    b. Eaves, Rakes, Soffits, and Fascias

M. Stick-Framed Roofs

1. Simple Span and Triangulated Roofs
2. Roof Openings for Dormers, Chimneys, and Skylights
3. Collar Ties, Purlins, and Knee Walls
4. Common Problems and Defects

N. Truss-Framed Roofs

1. Construction and Materials
2. Building with Truss-Framed Roofs
3. Bracing Truss-Framed Roofs
4. Roof Openings for Dormers, Chimneys, and Skylights
5. Common Problems and Defects
    a. Truss Uplift

O. Roof Sheathing and High Wind Precautions

1. Roof Sheathing
    a. Solid Roof Sheathing and Open Roof Sheathing
    b. Tongue and Groove Decking

c. Installing Roof Sheathing
d. Fire-retardant Treated (FRT) Plywood
e. Common Problems and Defects

2. High Wind Precautions

III. Exteriors

A. Lot, Landscape, Retaining Walls

1. Lot Grading
    a. Window Wells
2. Landscaping
3. Retaining Walls
    a. Types
        (i) Gravity Walls
        (ii) Cantilevered Walls
        (iii)Piles
        (iv)Wood Walls
        (v) Pre-fabricated Walls
        (vi)Gabions
    b. Common Problems and Defects

B. Driveways, Patios, Walkways

1. Driveways
    a. Unpaved and Gravel Driveways
    b. Asphalt Driveways
        (i) Common Problems and Defects
    c. Concrete Driveways
        (i) Installation
        (ii) Common Problems and Defects
2. Patios and Walkways
    a. Common Problems and Defects

C. Decks, Porches and Balconies

1. Decks
    a. Common Problems and Defects
2. Porches

a. Materials and Construction
b. Sun Porches
c. Common Problems and Defects

3. Balconies
    a. Common Problems and Defects
4. Stairs
    a. Size and Proportion
    b. Common Problems and Defects
5. Stoops

D. Exterior Siding

1. Introduction
2. Stucco
    a. Traditional Stucco
    b. One-Coat Stucco
    c. Common Problems and Defects
    d. EIFS
        (i) Identifying and Inspecting EIFS
3. Wood Siding
    a. Siding Styles
    b. Installation
    c. Shingles
    d. Plywood
    e. Composition Board
    f. Common Problems and Defects
4. Vinyl Siding
    a. Installation
    b. Common Problems and Defects
5. Metal Siding
    a. Common Problems and Defects
6. Fiber Cement Siding
    a. Installation
    b. Common Problems and Defects
7. Asbestos Cement Siding

E. Exterior Doors

1. Framing Door and Window Openings
2. Parts of a Door
3. Materials
4. Types of Doors
5. Door Installation
6. Common Problems and Defects
7. Screen and Storm Doors
    a. Common Problems and Defects

F. Windows

1. Parts of a Window
2. Types of Windows
3. Window Materials
    a. Energy Efficiency
4. Window Installation
5. Common Problems and Defects
6. Skylights
    a. Common Problems and Defects

IV. Roofing System

A. The Roof System

1. Roof Inspection

B. Roof Terminology

1. Slope, Run, and Rise
2. Determining Slope
3. Roof Style
4. General Roofing Terms

C. Roof Inspection—The Big Picture

1. Exterior Inspection–Roof Style and Structure
2. Exterior Inspection–Roof Drainage Systems
3. Exterior Inspection–Skylights, Chimneys, and Other Roof Penetrations
4. Interior Inspection–The Attic Space and Interior Ceiling and Walls

D. Roofing Materials

1. Steep Slope Roofs
2. Low Slope Roofs

E. Roof Covering Materials—Asphalt Shingles

1. Typical Installation
2. Typical Installation—Ridges and Valleys
3. Typical Defects
4. Maintenance and Repair

F. Roof Covering Materials—Wood Shingles and Shakes

1. Typical Installation—Shingles
2. Typical Installation—Shakes
3. Typical Installation—Ridges and Valleys
4. Typical Defects
5. Maintenance and Repair

G. Roof Covering Materials—Slate

1. Typical Installation
2. Typical Defects
3. Maintenance and Repair

H. Roof Covering Materials—Clay and Concrete Tiles

1. Typical Installation
    a. Ridges and Valleys
2. Typical Defects
3. Maintenance and Repair

I. Roof Covering Materials—Metal

1. General Installation Information
2. Architectural Systems
3. Structural Systems
4. Typical Installation of Architectural Systems
5. Typical Installation of Structural Systems
6. Fasteners for Metal Roofing Systems
7. Types of Metal Roofing
8. Typical Installation
    a. Ridges and Valleys
9. Typical Defects

10. Maintenance and Repair

J. Roof Covering Materials—Roll

1. Typical Installation
    a. Ridges and Valleys
2. Typical Defects
3. Maintenance and Repair

K. Roof Covering Materials—Built-up Roofs

1. Typical Installation
2. Typical Defects
3. Maintenance and Repair

L. Roof Covering Materials—Modified Bitumen

1. Typical Installation
2. Typical Defects
3. Maintenance and Repair

M. Roof Covering Materials—EPDM

1. Typical Installation
    a. Ballasted
    b. Mechanically Attached
    c. Fully Adhered
2. Typical Defects
    a. Lap Failures
    b. Membrane Shrinkage
    c. Tears, Splits, and Punctures
    d. Fastener Back-out
3. Maintenance and Repair

N. Roof Covering Materials—PVC

1. Typical Installation
    a. Fully Adhered
    b. Mechanically Attached
    c. Ballasted
2. Typical Defects
3. Maintenance and Repair

O. Roof Drainage Systems—Gutter and Downspout

1. System Components
2. Gutter Types
    a. Metal
    b. Plastic and Vinyl
    c. Wood
    d. Built-in
3. Typical Installation
4. Maintenance
5. Typical Defects and Their Repair
    a. Leaking Downspouts
    b. Missing or Inadequate Downspouts
    c. Damaged or Missing Gutter Sections
    d. Leaking Gutter Sections
    e. Rusted Gutters
    f. Gutters Pulled Away From House
    g. Sagging Gutter Sections
    h. Improperly Sized Gutters
    i. Clogged Gutters or Downspouts

P. Roof Drainage Systems—Interior and Peripheral

1. System Components
2. Types
    a. Interior
    b. Peripheral
3. Typical Installation
    a. Peripheral Systems
    b. Interior Systems
4. Typical Defects and Their Repair

Q. Roof Flashing—Introduction

R. Roof Flashing—Penetrations

1. Chimneys
    a. Flashing Installation
        (i) Apron Flashing
        (ii) Step Flashing

(iii)Channel (or Pan) Flashing

(iv)Cricket and Backer Flashing

(v) Counter Flashing

b. Typical Defects

2. Skylights
    a. Typical Defects
3. Vents, Pipes, and Other Penetrations
    a. Typical Defects

S. Flashing—Roof Edges

1. Valleys
    a. Open Valleys
    b. Closed-cut Valleys
    c. Woven Valleys
    d. Typical Defects
2. Hips and Ridges
    a. Asphalt Roofs
    b. Metal Roofs
    c. Wood Roofs
    d. Tile Roofs
    e. Slate Roofs
        (i) Mitered Hip
        (ii) Fantail Hip
        (iii)Metal Hip
    f. Typical Defects
3. Drip Edges
    a. Typical Defects

T. Flashing—Roof-to-Wall Intersections and Low Slopes

1. Pitched Roofs
2. Low Slope Roofs
3. Typical Defects
4. Low Slope Roofs
    a. Types of Flashing
        (i) Membrane Base Flashing

(ii) Metal

b. Typical Defects

c. Types of Flashing

(i) Membrane Base Flashing

(ii) Metal

d. Typical Defects

U. Flashing—Common Materials and Typical Problems

1. Common Materials

a. Membrane Flashing

(i) Mineral Surface Roll Roofing

(ii) Ice and Water Barriers

(iii)Other Types of Membranes

(iv)Asphalt Mastics

b. Sheet Metal

(i) Copper

(ii) Aluminum

(iii)Galvanized Steel

(iv)Sheet Metal

2. Typical Problems and Their Repair

V. Insulation and Ventilation

A. Thermal Insulation

1. Heat and Heat Transfer

a. Definitions

b. Mechanisms of Heat Transfer

(i) Convection

(ii) Conduction

(iii)Radiation

c. Heat Loss and Heat Gain

2. Types of Insulation

a. Loose-fill

(i) Cellulose

(ii) Fiberglass

(iii)Mineral Woods

b. Batts or Blankets

c. Rigid Boards

(i) Expanded Polystyrene Foam

(ii) Extruded Polystyrene Foam

(iii)Polyurethane and Polyisocyanurate

d. Foamed-in-place

e. Other Insulation Materials

(i) Vermiculite

(ii) Perlite

(iii)Urea-formaldehyde

B. Vapor Retarders and Air Barriers

1. Moisture Movement in Homes
2. Blocking Moisture Movement in Homes
    a. Vapor Retarders
    b. Air Barriers
3. Typical Defects

C. Inspection of Insulation and Barriers

1. Foundations
    a. Slab-on-grade
        (i) Exterior Insulation
        (ii) Floating Slab with Interior Insulation
    b. Basement
        (i) Exterior Insulation
        (ii) Interior Insulation
        (iii)Insulated Concrete Forms
    c. Crawl Spaces
2. Walls
3. Floors Over Unheated Areas
4. Attics

D. Attic Ventilation

1. Types of Attic Ventilation
    a. Ridge and Soffit System

b. Wind Turbines
c. Gable Vents
d. Static Vents
e. Forced Air Systems

2. Cathedral Ceilings and Flat Roofs

E. Ventilation of Conditioned Spaces

1. Indoor Ventilation Basics
2. Types of Ventilation Systems
    a. Exhaust Only Ventilation Systems
        (i) Exhaust Fans
        (ii) Exhaust Fan Inspection
    b. Supply Ventilation Systems
    c. Balanced Ventilation Systems
        (i) Heat Recovery Ventilators
        (ii) Energy Recovery Ventilators
        (iii)Inspection
3. Controls

VI. Garages

A. Garages

1. Attached Garages
2. Detached Garages
3. Common Problems and Defects
4. Garage Doors
    a. Garage Door Openers
    b. Common Problems and Defects

VII. Interiors

A. Walls

1. Drywall
    a. Special Types
        (i) Greenboard
        (ii) Concrete Backerboard
        (iii)Type X

(iv)Blueboard

b. Installation

c. Common Problems and Defects

2. Plaster

a. Installation

b. Common Problems and Defects

3. Paneling

a. Installation

b. Common Problems and Defects

4. Concrete, Brick, and Stone

B. Ceilings

1. Drywall Ceilings

a. Installation

b. Common Problems and Defects

2. Plaster Ceilings

a. Common Problems and Defects

3. Ceiling Tiles and Panels

a. Suspended Ceilings

(i) Installation

b. Tile Ceilings

(i) Installation

c. Common Problems and Defects

d. Plank Ceilings

(i) Installation

(ii) Common Problems and Defects

C. Flooring

1. Floor Construction

2. Tile Floors

a. Installation

b. Common Problems and Defects

3. Carpet

a. Installation

b. Common Problems and Defects

4. Resilient Flooring
    a. Vinyl
        (i) Sheet Vinyl Installation
        (ii) Vinyl Tile Installation
    b. Cork
    c. Linoleum
        (i) Installation
    d. Common Problems and Defects
5. Wood Floors
    a. Installation
    b. Common Problems and Defects
6. Laminate Flooring
    a. Installation
7. Concrete Flooring
    a. Common Problems and Defects
8. Radiant Heated Floors

D. Interior Doors and Trim

1. Framing Door Openings
2. Types of Interior Doors
    a. Single Hinged Doors
        (i) Hollow Core
        (ii) Solid Core
        (iii)Solid Wood
        (iv)Installation
    b. Pocket Doors
        (i) Installation
    c. Bifold Doors
        (i) Installation
    d. Multifold Doors
    e. Bypass Doors
        (i) Installation
    f. Common Problems and Defects
3. Interior Trim

a. Common Problems and Defects

E. Interior Stairs

1. Stair Components
2. Stair Configuration
3. Stair Structure
4. Common Problem and Defects
5. Pull-Down Stairs
    a. Common Problems and Defects

F. Cabinets, Countertops, and Appliances

1. Cabinets
2. Countertops
    a. Materials
        (i) Laminate
        (ii) Tile
        (iii)Stone
        (iv)Quartz
        (v) Solid surfacing
        (vi)Wood
        (vii) Stainless Steel
        (viii) Concrete
        (ix)Fiber Cement
3. Common Problems and Defects
4. Appliances

G. Basements

1. Inspecting Finished Basements
2. Basement Water Problems
    a. Recognizing Basement Water Problems
    b. Identifying Sources of Basement Water Problems
    c. Solving Basement Water Problems

VIII. Electrical

A. Overview of Electricity

1. Resistance

2. Circuits
    a. Parallel Circuits
    b. Series Circuits
3. Load
4. Voltage and Amperage
5. Power, Watts, and Kilowatt-hours
    a. Ohm's Law
6. National Electrical Code

B. Service Entrance

1. Service Drop
    a. Minimum Clearance
    b. Service Entrance Conductors
    c. Service Mast
    d. Weatherhead
    e. Meter Base
    f. Service Panel
2. Service Lateral

C. Service Equipment and Grounding

1. Service Equipment
2. Service Voltage
3. Service Size
4. Grounding
    a. Service Grounding
    b. Equipment Grounding

D. Service Panels and Subpanels

1. Service Panels
    a. Overcurrent Devices
        (i) Fuse Service Panels
        (ii) Breaker Service Panels
        (iii)Combination Service Panels
    b. The Main Disconnect
    c. Branch Circuit Wiring
2. Subpanels

E. Wiring

1. Branch Circuit Wiring
    a. Insulation Codes
    b. Wiring Material
        (i) Copper
        (ii) Copper-clad Aluminum
        (iii)Aluminum
2. Wiring Methods
    a. Knob and Tube
    b. Armored Cable
    c. Non-metallic Sheathed Cable
    d. Conduit
        (i) Flexible Metal Conduit

F. Devices and Lighting Fixtures

1. Devices
    a. Switches
    b. Receptacles
2. Lighting Fixtures

IX. Plumbing

A. Public Water Supply

1. Water Supply System
    a. Public Water Source
        (i) Potential Problems
        (ii) Types of Valves
        (iii)Water Meters
    b. Inspection Procedures

B. Private Water Supply

1. Sources of Private Water Supply
2. Wells
    a. Types of Wells
        (i) Shallow and Deep Wells
    b. Well Construction

(i) Drilled Wells
(ii) Driven Wells
(iii) Dug Wells
(iv) Washed Down (Jetted) Wells

c. Well Pumps
(i) Reciprocating or Piston
(ii) Centrifugal
(iii) Centrifugal (Jet)
(iv) Centrifugal (Submersible)

d. Storage Tanks
(i) Pressure Tanks
(ii) Non-pressurized Tanks
(iii) Measuring Pressure

e. Water Main Shut-off Valves

3. Inspection Procedures

C. Water Supply Piping

1. Piping Terms
2. Piping Material
   a. Lead
   b. Galvanized Steel
   c. Copper
   d. Brass
   e. Plastic
3. Water Supply Systems
   a. Interior Piping
      (i) Leaking
      (ii) Freezing
      (iii) Sweating
      (iv) Water Hammer
      (v) Damage from Exposure
      (vi) Cross Connection

D. Plumbing Fixtures

1. Sinks

2. Basins
3. Toilets
    a. Toilet Components
    b. How Toilets Operate
    c. Inspection Procedures
4. Bidets
5. Laundry Tubs
6. Bathtubs
7. Whirlpools (Jetted Tubs)
    a. Inspection Procedures
8. Showers

E. Faucets

1. Types of Faucets
2. Indoor Faucets
    a. Compression (Washer)
    b. Washerless
        (i) Ball
        (ii) Cartridge
        (iii)Ceramic Disk
3. Inspecting Indoor Faucets
4. Outdoor Faucets
    a. Hose Bibbs, Sill Cocks, and Hydrants
        (i) Inspection Procedures

F. Drainage, Waste, and Vent Systems 1: Piping Materials

1. Piping Material
2. Types of DWV Pipes
3. The DWV Process
4. Inspection Procedures
5. Fittings

G. Drainage, Waste, and Vent Systems 2: Drainage Traps

1. How Traps Work
2. Types of Traps
3. Components of a Trap

4. Floor Drains
    a. Inspection Procedures

H. Drainage, Waste, and Vent Systems 3: Indirect Waste Piping

1. What is Indirect Waste Piping?
2. Types of Indirect Waste Piping
    a. Air Gap
    b. Air Break
3. Why Indirect Waste Piping is Important
4. Inspection Procedures

I. Drainage, Waste, and Vent Systems 4: Vent Systems

1. Overview of the Vent System
2. Types of Vents
3. Inspection Procedures
4. Public and Private Sewer Systems
    a. Public Sewer Systems
    b. Private Sewer Systems
        (i) Septic Systems

J. Drainage Pumps

1. Sewage Ejector Pumps
2. Sump Pumps
    a. Conventional Installation
    b. Grey Water Installation
    c. Submersible Pumps
    d. Pedestal Pumps
    e. Inspection Procedures
3. Laundry Tub Pumps
    a. Inspection Procedures

K. Water Heater Storage Tanks

1. Tank Components
    a. Insulated Cylinder Tank
    b. Cold Water Piping
    c. Hot Water Piping – Outlet Pipe
    d. Temperature and Pressure Relief Valve

e. Discharge Tube
f. Thermostat
g. Sacrificial Anode Rod
h. Drain Valve and Pan

2. Inspection Procedures

L. Storage Tank Efficiency

1. Tank Size
2. Tank Capacity
    a. Energy Factor
        (i) Recovery Rate
        (ii) Standby Loss
        (iii)Cycling Loss
3. First Hour Rating
4. Sediment Build-up

M. Electric Water Heater Tanks

1. Tank Components
2. Tank Operation
3. Tank Efficiency
4. Advantages
5. Inspection Procedures

N. Gas-Fired Water Heater Tanks

1. Tank Operation and Components
    a. Combustion Air Ventilation
    b. Venting
2. Tank Efficiency
3. Advantages
4. Disadvantages
5. Inspection Procedures

O. Oil-Fired Water Heater Tanks

1. Tank Components and Operation
    a. Combustion Air Ventilation
    b. Venting Combustion Material
    c. Oil Storage Tanks

2. Advantages and Disadvantages
3. Efficiency
4. Inspection Procedures

P. Venting Fuel-Fired Water Heaters

1. Vent Material
2. Vent Requirements
3. Standard-Vented Systems
4. Power-Vented Systems
5. Direct-Vented Systems

Q. Alternative Water Heating Methods

1. Tankless Coil Water Heaters
2. Combination (Apollo or Hydro) Systems
3. Demand Water Heaters
4. Indirect Water Heating
    a. Advantages
5. Inspection Procedures
6. Recirculating Systems

X. HVAC

A. Introduction to Heating Systems

1. The Purpose of Residential Heating Systems
2. Types of Heating Fuel
    a. Coal
    b. Fuel Oil
    c. Natural Gas
    d. Propane (Liquid Petroleum Gas)
    e. Electricity
    f. Wood
3. Types of Heating Systems
    a. Warm Air
    b. Water
    c. Steam
    d. Electricity

4. The Fire Triangle
5. Heat Transfer
    a. Radiation
    b. Convection
    c. Conduction

B. Gas-fired Forced-air Furnaces—Exterior Components

1. "Dissecting" a Furnace
2. Fuel Supply System
    a. Dirt Leg (Sediment Trap)
    b. Gas Shutoff Valve
3. Flue Pipe
4. Vent Connector
5. Vent Damper
6. What is Spillage?
7. Draft Hood (Draft Diverter)
8. Dilution Draft Vent
9. Heat Switch (Spillage Switch)
10. Return Plenum
11. Supply Plenum
12. Summer Switch
13. Power Switch
14. Thermostat
    a. Location

C. Gas-fired Forced-Air Furnaces—Interior Components

1. Air Filter
2. Blower
3. Fan Compartment Interlock Switch
4. Furnace Configuration
    a. Upflow Furnace
    b. Downflow Furnace
    c. Horizontal Furnace
    d. Lowboy

5. Combination Control Valve
6. Thermocouple
7. Pilot
8. Burners
9. Heat Shield
10. Direct vs. Indirect Gas Furnaces
11. Heat Exchanger
12. Inducer Fan (Blower) and Fan Switch
13. Limit Switch

D. Operation & Safety of a Gas-fired Furnace

1. The Flow of a Furnace
2. Safety Issues
3. Furnace Life Expectancy

E. Inspecting Gas-Fired Forced-air Furnaces 1

1. Limitations During Inspections
2. Furnace Inspection Tools
3. To Turn On or Not to Turn On…
    a. …the smell of gas
    b. …missing or damage flue sections
    c. ...missing or damaged gas shut off valve
    d. ...damaged thermocouple
4. Furnace Information
5. Ductwork
6. Gas Meters
7. Gas Piping
8. Combustion Air
9. Pilot Flame
10. Gas Burners
    a. Backdraft
    b. Other Indicators of Problems
11. Combustion Chamber
12. Heat Shields
13. Heat Exchangers

14. Cabinets
15. Blower
16. Mechanical Air Filters
17. Electronic Air Cleaners
18. Humidifiers
19. Fan/Limit Switches
20. Thermostats
21. Venting Systems (Vent Connectors)
22. Mid and High-Efficiency Gas Furnaces
23. Combination Systems
24. Hurricane/Seismic Issues

F. Oil-fired Forced Air Exterior Components

1. Petroleum Oil
2. Fuel Supply System
    a. Oil Storage Tank
    b. Fill Pipe
    c. Vent Pipe
    d. Oil Feed Line
    e. One pipe vs. two pipe systems
    f. Shut-off Valve
    g. Oil Filter
    h. Above-ground tanks
    i. Oil piping
3. Vents and Plenums
4. Barometric Damper

G. Oil-fired Forced Air Interior Components

1. Burner Assembly
    a. Burner Motor
    b. Nozzle
    c. Flame Retention Head
    d. Fuel Unit
2. Electrodes
3. Ignition Transformer

4. Primary Control (Burner Control)
5. Blower
6. Limit Switch/Fan Switch
7. Combustion Chamber
8. Heat Exchanger

H. Oil Furnace Operation & Safety

1. Sequence of Operation of a Furnace
2. Safety Issues
    a. Oil Leaks
    b. Carbon Monoxide
    c. Furnace Life Expectancy

I. Inspecting Oil-Fired Furnaces

1. Components of an Oil-Fired System
2. Oil Tanks
3. Vent and Fill Pipes
4. Oil Supply Line
5. Oil Filters
6. Burners
7. Refractory Fire Pot (Combustion Chamber)
8. Heat Exchangers
9. Barometric Dampers (Draft Regulators)

J. Introduction to Hydronic Heating

1. Hot Water and Steam Boilers
2. Open vs. Closed Systems
3. High and Low Pressure Systems
4. Operation of a Hot Water Boiler
5. Advantages of Hydronic Heating Systems
6. Disadvantages of Hydronic Heating Systems

K. Hydronic Heating Exterior Components 1

1. External Components
2. Air Vents
3. Piping System
    a. A Dimension

   b. Wet vs. Dry Return
   c. Vacuum/Vapor Systems
   d. Hartford Loop
   e. Boiler feed pump
4. Drain Valve
5. Upfeed vs. Downfeed
6. Circulating Pump
7. Pressure Gauge
8. Diverting Valve
9. Mixing Valve (Tempering Valve)
10. External Components
11. Outdoor Air Thermostat
12. Backflow Preventer
13. Blow-Down Valve (Blow-Off Valve)
14. Radiators
15. Convectors
16. Low Radiant Heating
17. Condensate Pump
18. Automatic Air Vent (Air Elimination Vent)
19. Indirect Water Heater
20. Side Arm Heater
21. External Safety Features
   a. Pressure Relief Valve
   b. Automatic Water Makeup (Pressure Reducing Valve)

L. Hydronic Heating Interior Components

1. Components
2. Heat Exchanger
3. Boiler
4. Condensing Boiler
5. Internal Components
   a. Tankless Coil
   b. Burners/Combustion Chamber
6. Air Separator (Air Scoop)

7. Safety Features
    a. Aquastat
    b. High Pressure Limit Switch
    c. Low Water Cutout (Low Water Cutoff)

M. Boiler Operation & Safety

1. Sequence of Operation of a Hot Water Boiler
2. Sequence of Operation of a Steam Boiler
3. Safety Issues
    a. Scalding and Burns
    b. Asbestos
    c. Explosion
    d. Carbon Monoxide
4. Boiler Life Expectancy

N. Inspecting Hydronic Heating

1. Components of Hydronic Heating Systems
2. Pipes
3. Radiant Heat
4. Air Vents
5. Outdoor Air Thermostats
6. Pressure Gauge
7. Pressure Reducing Valve (Water Make Up)
8. Pressure Relief Valve
9. Aquastat and Controls
10. Low Water Cutouts
11. Backflow Preventer
12. Tankless Coils

O. Introduction to Electric Heating

1. Types of Electrical Heating Systems
    a. Furnaces
    b. Staged Furnaces
    c. Boilers
    d. Space Heaters
    e. Radiant Systems

(i) Space Heaters

(ii) Installed Heaters

f. Duct Heating

g. Plenum Heating

2. Electricity Requirements
3. Electrical Heating vs. Forced-Air Heating
    a. Advantages
    b. Disadvantages
4. Health and Safety Issues
5. Life Expectancy

P. Components of Electric Heating

1. Heating Elements
2. Thermal Cut-Outs/Fusible Links
3. Sequencer
4. Sail Switch
5. Relay
6. Safe Fill Switch
7. The Operation of an Electric Furnace
8. The Operation of an Electric Boiler
9. Operation of a Space Heater
    a. Baseboard Heaters
    b. Portable Heaters
10. The Operation of Radiant Heaters

Q. Inspecting Electric Heating

1. Components of Electric Heating Systems
2. Electric Furnaces
    a. Installation
    b. Thermostats
    c. Cabinets
    d. Blower
    e. Limit Switch
    f. Air Filter
    g. Mechanical air filters

h. Electronic air cleaners
i. Humidifier
j. Air Vents

3. Electric Boilers
    a. Pressure reducing valve
    b. Pressure relief valve
    c. Low water cutout
4. Hurricane/Seismic Issues
5. Baseboards and Wall Heaters
6. Radiant Heating Systems

R. Space Heaters

1. Types of Space Heaters
2. Vented and Unvented Space Heaters
3. Wall Furnaces
4. Floor Furnaces
5. Wall and Floor Furnace Components
    a. Burners and Heat Exchanger
    b. Safety Pilot
    c. Safety Limit Control
    d. Vision Cap
    e. Draft Diverter
    f. Millivolt Control Assembly
    g. Spark Ignition
6. Health and Safety Issues
7. Life Expectancy

S. Fireplaces

1. The Components of a Fireplace
2. Zero-Clearance Fireplaces
3. Fireplace Insert
4. Direct-Vent Fireplaces
5. Gas Log Fireplaces
    a. Vented vs. Unvented
6. Wood-burning Stoves

7. Life Expectancy

T. Inspecting Space Heaters & Fireplaces

1. Inspecting Space Heaters
    a. Location
    b. Ductwork
    c. Heat Exchanger
    d. Cabinets
    e. Blower
    f. Burners
    g. Grille (Floor Furnace)
    h. Thermostats
2. Inspecting Wood-Burning Fireplaces
3. Inspecting Gas-Log Fireplaces
4. Inspecting Wood-Burning Stoves
    a. Clearance
    b. Flue Pipe
    c. Damper
    d. Catalytic converter

U. Introduction to Heat Pumps

1. Types of Heat Pumps
    a. Air-to-air
    b. Air-to-water
    c. Air-to-ground
2. Heat Sink
3. Heat Pump Efficiency
    a. Coefficient of Performance (COP)
    b. Heating Season Performance Factor (HSPF)
    c. Balance Point
4. Health and Safety Issues
5. Life Expectancy

V. Heat Pump Components

1. Refrigerant
2. Heat Pump Coils

3. Four-Way Valve (Reversing Valve)
4. Compressor
    a. Compression Ratio
    b. Accumulator
5. Expansion Device (Metering Device)
6. Refrigerant Lines
7. Liquid Line Filter Drier
8. Suction Line Filter Drier
9. Thermostat Controls
10. Defrost Controls
    a. Defrost thermostat
    b. Defrost time clock
    c. Defrost high pressure control
    d. Defrost Relay
11. Low Ambient Lockout
12. Condensate Pan (Tray)/Condensate Drain Line
13. Defrost Cycle
    a. Auxiliary heat
14. Air Handlers
    a. Indoor Fan
    b. Outdoor Fan
15. Fair Weather Switch
16. Mild Weather Switch
17. The Operation of Heat Pumps
    a. Cooling mode
    b. Heating mode

W. Inspecting Heat Pumps

1. Components of a Heat Pump
2. Capacity
3. Location
4. Outside Unit
5. Compressor

6. Expansion Devices (Metering Devices)
7. Indoor/Outdoor Fans
8. Indoor/Outdoor Coils
9. Condensate Systems
10. Refrigerant Lines
11. Thermostats
12. Emergency (Auxiliary) Heater
13. Hurricane/Seismic Issues

X. Furnace Efficiency

1. Furnace Terminology
2. Efficiencies
    a. Conventional Systems
    b. Mid-Efficiency Systems
    c. High-Efficiency Systems

Y. Warm Air Distribution Systems

1. Supply Air/Return Air
2. Distribution System Configurations
    a. Conventional System
    b. Perimeter System
3. Distribution System Components
    a. Duct System
        (i) Radial System
        (ii) Extended Plenum System
    b. Pipes and Ducts
        (i) Plenum and Ductboard
        (ii) Round Pipe
        (iii)Rectangular Ducts
        (iv)Insulated Flexible Ducts
        (v) Duct Support
        (vi)Insulation
    c. Registers and Diffusers
4. Zone Control Dampers
5. Humidifiers

6. Return Air System Components
    a. Grilles
    b. Air Filter
    c. Electric Air Cleaner

Z. Inspecting Warm Air Distribution Systems

1. Health and Safety Issues
    a. Air Pollutants
    b. Asbestos
    c. Inspection Hazards
2. Components
3. Duct System
    a. Insulation
4. Registers
5. Grilles
6. Zone Control Dampers

AA. Hydronic Distribution Systems

1. Hot Water Systems
    a. Open vs. Closed System
    b. Components
2. Piping System
3. Circulation Pump
4. Flow Control Valves
5. Expansion Tank
    a. Bladder Type
6. Radiators/Baseboards/Convectors
7. Radiator Control Valve
8. Isolating Valves
9. Radiator Bleed Valve
10. Air Vents
11. Steam Traps
12. F and T Traps
13. Zone Controls

BB. Inspecting Hydronic Distribution

1. Health and Safety Issues
2. Components
3. Expansion Tanks
4. Circulation Pumps
5. Flow Control Valves
6. Pipes
7. Radiators/Convectors/Baseboards
8. Isolating Valves
9. Bleed Valves
10. Steam Traps/F and T Traps
11. Zone Controls

CC. Radiant Heat Distribution Systems

1. Radiant Heat
2. Types of Radiant Heat Distribution Systems
3. Electric Radiant Systems
4. Components
    a. Tubing
    b. Installation
    c. Manifold
    d. Zone Valves
    e. Balancing Valves
    f. Isolation Valves (Sealing Valves)
    g. Air Vents and Hose Bib
5. The Operation of Radiant Heating Systems
6. Advantages and Disadvantages of Radiant Heat Systems
7. Health and Safety Issues of Radiant Heaters
8. Life Expectancy of Radiant Heating Systems
9. Inspecting Radiant Heating Systems

DD. Chimney & Venting Systems

1. Types of Fireplaces
2. Components
    a. Chimney
        (i) Offsets

b. Minimum Height and Draft
c. Metal Chimneys
    (i) Lateral Support
d. Class A Chimney
e. Super Chimney
f. Flue and Flue Liner
    (i) Shared Flues
g. Chimney vs. Flue
h. Footing and Foundations
i. Crown (Cement Wash)
j. Raincap and Spark Arrestor
k. Ash Dump and Ash Pit Cleanout
l. Vent and Vent Connector
m. Type B vents
n. Type L vents
o. Firestopping

EE. Inspecting Chimneys and Venting

1. Components
2. Chimneys
    a. Clearances
3. Inspection
    a. Liners/Flues
4. Caps
5. Vents and Vent Connectors
6. Firestops
7. Ash Pit/Ash Dump

FF.Cooling Systems

1. The Air Conditioning Process
2. Cooling Principles
3. Components
    a. Refrigerant
    b. Compressor
    c. Reciprocating Compressor

d. Scroll Compressor
e. Accumulator
f. Crankcase Heater
g. Suction Line
h. Discharge Line
i. Condenser Coil
j. Expansion Device (Metering Device)
k. Thermostatic Expansion Valve
l. Liquid Line
m. Liquid Line Filter/Drier
n. Sight Glass
o. Evaporator Coil
    (i) Dry/Direct Expansion vs. Flooded
    (ii) I-coil vs. A-coil
p. Condensate
q. Capillary Tube
r. Fans

4. The Air Conditioning Cycle
5. High Pressure/Low Pressure Refrigerant Sides
6. Water-Cooled Air Conditioning
7. Air Conditioning Configurations
8. Cooling Alternatives
9. Evaporative Coolers (Swamp Coolers)
    a. Advantages and Disadvantages
10. Heat Pumps
11. Spray Coolers
12. Attic Fans
13. Distribution Systems
14. Life Expectancy

GG. Inspecting Cooling Systems

1. Capacity
2. Components
    a. Filters

    b. Condenser Coils
    c. Evaporator Coils
    d. Compressors
    e. Condensate Systems
    f. Refrigerant Lines
    g. Expansion Devices
    h. Condenser Fans/Evaporator Fans
    i. Thermostats
3. Hurricane/Seismic Issues
4. Water-Cooled Air Conditioners
5. Evaporative Coolers
6. Humidifiers
7. Attic Fans
8. Distribution Systems
9. Duct System
    a. Insulation
10. Registers
11. Grilles
12. Zone Control Dampers