# City of Youngstown
# Community Development Agency
# HOUSING REHABILITATION HANDBOOK

## RESIDENTIAL REHABILITATION STANDARDS (RRS)

**EFFECTIVE DATE:**

**January 1999**

**ACKNOWLEDGMENTS**

The City of Youngstown Community Development Agency would like to thank the Ohio Department of Development's Office of Housing and Community Partnerships for providing us with their Residential Rehabilitation Standards on disk and ready to go, from which these standards evolved.

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## INTRODUCTION

### BACKGROUND

The Ohio Office of Housing and Community Partnership developed the Residential Rehabilitation Standards (RRS) as the standard for existing dwellings being rehabilitated by grantees participating in OHCP-funded housing programs. OHCP provided us with a computer disk of those standards that we could copy and add to for the City of Youngstown. We have modified the original format and added those items specific to Youngstown. The RRS is intended to be the primary document for ensuring rehabilitation results in dwellings which are safer, healthier, more durable, more energy efficient, more affordable and more habitable.

### READER ADVISORY

The RRS cannot be viewed as the only resource necessary for rehabilitation work.
The RRS is not detailed enough to describe all of the codes, standards and practices which apply to rehabilitation. You need to have copies of the various codes and standards referenced in the RRS and a working knowledge of how to meet them.

The reproduction and distribution of the RRS so that local program administrator staff, contractors and other parties actively involved in rehabilitation have copies is encouraged.

Personnel who have questions about the RRS should seek clarification from City and CDA Housing Inspectors or further research the codes and standards referenced in the RRS.

As mentioned above, the RRS does not provide sufficient detail to describe the techniques and materials needed to meet the standards or provide a standard for every deficiency a dwelling can have.

## CHAPTER ONE

## ADMINISTRATION

1.1 INTENT OF THE RESIDENTIAL REHABILITATION STANDARDS (**RRS**)

1.1.1 The intent of the RRS is to establish standards and requirements to which each rehabilitated dwelling must comply and to promote sound rehabilitation practices and greater consistency.

1.1.2 The intent of the City of Youngstown's Community Development Agency (CDA), funded rehabilitation is to correct sub-standard conditions in Youngstown's existing housing stock so that dwellings are safer, healthier, more durable, more affordable, more energy efficient and more habitable.

1.2 SCOPE OF THE RRS

The RRS integrates provisions of the OHCP Housing Rehabilitation Handbook, Part II, Residential Rehabilitation Standards and Commentary, Sixth Edition, July 199; the City of Youngstown Housing Code Ordinance No. 85226, Section 8 Housing Standards, and the CABO Codes and supersedes all other standards.

1.3 AUTHORITY

1.3.1 The City of Youngstown CDA, Housing Division shall ensure that the provisions of the RRS are applied to each dwelling that is rehabilitated with financial assistance provided in whole or in part from City of Youngstown CDA. Contractor and/or sub-grantees shall not waive any provision of the RRS without prior written approval from CDA.

1.3.2 CDA will ensure that any required rehabilitation measure installed by an owner, occupant, contractor, or other agency or program, is completed in a manner consistent with the RRS and is completed prior to considering the rehabilitation project finished.

1.3.3 Dwellings that cannot be made to comply with the provisions of the RRS shall not be rehabilitated.

1.3.4 Those sub-grantees and/or programs who are funded with the CDA funds specifically for providing emergency and minor repairs have approval, based on their contract with CDA, to waive those provisions within the RRS that would compromise their ability to service the customer.

1.4 ENFORCEMENT

Failure to comply with the RRS and/or failure to follow the actions required by CDA to correct the non-compliance shall be considered a violation of the contract and/or grant agreement. Continued non-compliance and/or continued failure to follow the corrective actions shall be considered grounds for CDA to modify, suspend or terminate the contract and/or grant agreement.

1.5 EFFECTIVE DATE

The latest edition of the RRS shall become effective on or after the effective date noted on the RRS title page.

1.6 REVISIONS

The RRS may be revised to reflect changes in state or federal program policies and regulations, changes to the codes referenced in the RRS or changes in rehabilitation techniques and materials. Revisions due to changes in state or federal program regulations or significant changes to the referenced codes shall become effective immediately upon written notification from CDA.

1.7 CLASSIFICATIONS OF REHABILITATION MEASURES

1.7.1 SUB-STANDARD CONDITION

A sub-standard condition is an existing or incipient defect in the dwelling's structural system, mechanical systems, site, design or environmental condition as noted in the RRS, or a violation of a section of code referenced in the RRS.

1.7.2 AMENITY

An amenity is an unnecessary item or measure intended solely for convenience or increasing property value. An amenity is an enhancement that does not directly relate to or result from correcting a sub-standard condition.

1.7.3 COSMETIC IMPROVEMENT

A cosmetic improvement is an item or measure intended to solely enhance visual appearance or perceived value. A cosmetic improvement is also an unnecessary enhancement to an existing adequate condition, or an item that unnecessarily exceeds the standard specification for correcting a sub-standard condition.

1.8 PRIORITIZATION OF REHABILITATION MEASURES

1.8.1 In order to control costs and meet the intent of the rehabilitation program, grantees shall limit rehabilitation measures to those that correct sub-standard conditions. Amenities and cosmetic improvements, defined in 1.7.2 and 1.7.3 above, shall not be paid from funds provided by CDA.

1.9 QUALIFICATIONS AND WORKERS

1.9.1 CDA and its sub-grantees shall ensure that all persons involved in applying provisions of the RRS to a rehabilitation project shall be qualified for their tasks. If an owner or an occupant performs rehabilitation work, the grantee shall ensure that the person is qualified. If the nature of the work requires personnel to be licensed or otherwise certified to perform the work, the CDA, its contractors and its sub-grantees shall ensure that the personnel meet the requirements.

1.9.2 CDA, its contractors and its sub-grantees shall ensure that the mechanical execution of the rehabilitation work is performed in a manner consistent with the material manufacturer's installation instructions, applicable codes and current accepted industry practice.

## 1.10 MATERIAL STANDARDS

1.10.1 New material shall meet the specifications identified in the RRS or meet the specifications established by the nationally recognized authority for the type of material installed.

1.10.2 Used material shall not be installed unless the material is sound, safe, effective and original to the dwelling being rehabilitated.

Material taken from dwellings other than the one being rehabilitated shall not be installed unless specifically prescribed for the purposes of historical preservation of the home, or to maintain the integrity of an existing system with in the home.

## 1.11 BUILDING PERMIT POLICY

The City of Youngstown requires that permits be obtained for projects that involve construction, alteration or repairs to a building. All plumbing and electrical repairs, alterations or replacements require a permit. Installation or major changes to the HVAC system require a permit.

1.11.1 Ordinary, (nonstructural), repairs do not require a permit. These include painting, plaster repair, interior door replacement or repair, replacement and repairs of cabinetry.

## 1.12 ENVIRONMENTAL SITE SPECIFIC REVIEW (ATTACHMENT I)

A site specific review shall be done with the corresponding forms completed for each house rehabilitated. The review must be submitted to the CDA Environmental Review Officer.

The agent responsible for the rehabilitation project must submit the Site Specific Review prior to beginning work on a project. Once the Review Officer grants clearance the project may proceed.

## CHAPTER TWO

## BUILDING STRUCTURE

### 2.1 FOUNDATIONS, BASEMENTS, CRAWLSPACES AND CELLARS

#### 2.1.1 CONCRETE OR MASONRY FOUNDATION WALLS

Concrete or masonry walls shall be structurally sound and without missing or deteriorated masonry, lintels or mortar joints which weaken the foundation's ability to safely support the load.

#### 2.1.2 PIERS AND COLUMNS

Piers and columns shall be structurally sound, without missing or broken supports, and without supports that are deteriorated or otherwise unable to safely support the load. Supports shall be of sufficient number, size, construction and location to safely support the load.

#### 2.1.3 WOOD FOUNDATIONS

Wood foundations shall be structurally sound, without missing or broken supports, and without supports that are decayed, deteriorated or otherwise unable to safely support the load.

#### 2.1.4 FOUNDATION WINDOWS AND ACCESS DOORS

Openings through foundation walls (e.g. windows, doors and accesses) that are necessary for egress or ventilation shall be functional, weather tight and structurally sound. Exposed wood or other exposed materials that are subject to weathering shall be primed and painted or covered with a durable weather-resistant material.

#### 2.1.5 FOUNDATION DRAINAGE AND MOISTURE CONTROL

Grading shall be sloped away from the foundation and without depressions or other conditions that allow water to pool or drain towards the foundation or the neighboring foundation. If possible, earth shall be a minimum of 6 inches away from wood framing members. Where feasible, site drainage adjacent to the foundation shall conform to CABO Section 401.3.

#### 2.1.6 CRAWLSPACE VENTILATION AND ACCESS

Crawlspaces shall be ventilated and accessible. Where there is a dirt floor a vapor barrier should be installed.

Ventilation and access should conform to CABO Section 409.

EXCEPTION: Enclosed crawlspaces that do not have sufficient height (i.e. 24 inches or less of continuous clearance) to allow for the installation of a vapor retardant or access are not required to have a ground vapor retardant or an access.

### 2.1.7 BASEMENT AND CELLAR FLOORS

Floors in basements or cellars which are regularly used by the occupant shall be concrete and without serious deterioration or conditions that present falling or tripping hazards to the occupant. Where feasible, replacement concrete floors shall conform to CABO Section 505. Dirt floors in cellars or basements which are not regularly used by the occupant, shall, to the extent practicable, be covered with an approved moisture vapor retardant.

## 2.2 FLOOR CONSTRUCTION AND FLOOR COVERINGS

### 2.2.1 FLOOR FRAMING AND SUB-FLOORS

Floors (including framing, sheathing and underlayment) shall be structurally sound and without decay or deterioration that would weaken the floor's ability to safely support the load. Floors shall provide a reasonably flat and horizontal surface to the interior of the dwelling. Where feasible, repairs shall conform to CABO Section 502. New sheathing installations shall conform to CABO Section 503 or the manufacturer's installation instructions.

### 2.2.2 FLOOR COVERINGS

Floor covering materials shall be appropriate to the use of the space and without defects that present tripping or other safety hazards to the occupants. New floor coverings should only be installed because the existing covering is a hazard, obviously ineffective, or because the sub-flooring has been replaced.

Replacement floor covering materials for kitchens, bathrooms, above grade laundry/utility rooms and other rooms with plumbing fixtures should be impervious to water. New floor covering materials shall be installed according to the manufacturer's installation instructions.

## 2.3. WALL CONSTRUCTION AND WALL COVERINGS

### 2.3.1 FRAME AND MASONRY WALL CONSTRUCTION

Wall framing shall be structurally sound and without missing, broken, decayed or deteriorated framing members which weaken the wall's ability to safely support the load. Masonry walls shall be structurally sound and without missing sections, deteriorated mortar joints or other defects which weaken the wall's ability to safely support the load.

Repairs to wood framed walls should, where possible, conform to CABO Section 602 and repairs to masonry walls should, where possible, conform to CABO Sections 604, 605, 606 and 607.

2.3.2 EXTERIOR WALL COVERINGS

Exterior wall coverings shall be structurally sound, secure and weather tight without broken, missing or deteriorated surfaces. Exposed wood or other exposed wall covering and trim materials which are subject to decay shall be primed and painted or covered with a durable weather-resistant material.

Only quality coatings which have a high resin to pigment ratio should be used. When repainting existing surfaces, care must be taken to thoroughly prepare the surface to ensure good adhesion to the substrate. Weather and temperature conditions must be appropriate as painting when rain is likely or when air temperature falls below 50 degrees F during the curing process must be avoided.
Replacement wall covering materials shall be installed to conform to CABO Section 703 or the manufacturer's installation instructions.

2.3.3 INTERIOR WALL AND CEILING COVERINGS

Interior wall and ceiling coverings shall form a continuous durable surface without large holes or significant cracks penetrating through the covering, without severe deterioration and without missing sections of window, door and floor casing or trim. Raw plaster, wallboard and joint compound shall be primed or sealed to protect the surface. Surface cracks, uneven surfaces and other minor defects on otherwise solid walls and ceilings do not need to be repaired. Wall and ceiling surfaces that have been replaced in high moisture areas, such as bathrooms containing bathing/shower spaces, shall be moisture retardant, (perm rate of less than 1).

Repair materials shall be compatible in composition and finished appearance to the original surrounding materials. New interior wall and ceiling covering materials shall be installed to conform to CABO Section 702 or the manufacturer's installation instructions.

2.4 WINDOWS

Each habitable room shall have at least one window that is operable and is capable of being held in an open position by the window hardware. Operable windows shall be fitted with functioning security hardware and insect screens.

Each bedroom or sleeping room shall have a window which meets the egress requirements of RRS Section 6.6.1. All windows shall be structurally sound, secure and weather tight, without deteriorated components (e.g. sashes, jambs, sills, trim, etc.), and without missing, broken or severely cracked glazing. Where required by CABO Section 308.4, glazing shall be approved safety glazing. Exposed wood and other exposed materials which are subject to decay shall be primed and painted or covered with a durable weather-resistant material.

When windows are replaced, the new windows should be double insulated or thermopanes, having a lower U-value and lower air infiltration rate than the old windows. Accordingly, storm windows shall not be installed over replacement window units.

Exception: Where the new window would not match the other windows in the room then a standard, single glazed, window with a storm window would be acceptable.

Replacement window units shall be installed according to the manufacturer's installation instructions.

## 2.5. DOORS

### 2.5.1 EXTERIOR DOORS

Passageways between the interior conditioned spaces of the dwelling and the outside shall have an exterior-rated door. All exterior doors shall be structurally sound, easily operable, weather tight and fitted with functioning hardware that tightly latches and securely locks the door. Locks **shall not** require a key for exiting from the interior. Exposed wood and other exposed materials which are subject to decay shall be primed and painted.
Where extra security is warranted metal doors are an acceptable replacement.

All replacement doors shall be installed according to the manufacturer's installation instructions.

### 2.5.2 INTERIOR DOORS

Bathrooms, bedrooms, utility rooms/enclosures which contain fuel-burning non-direct vent space heating or water heating equipment, and passageways leading to unconditioned spaces within the dwelling (e.g. attics, basements, enclosed porches, etc.) shall have a door. All interior doors shall be structurally sound, easily operable and fitted with functioning hardware that tightly latches the door. Doors to unconditioned spaces shall be weatherstripped. Newly installed doors shall be finished in a manner compatible with the existing doors.

## 2.6. ROOF AND CEILING CONSTRUCTION

### 2.6.1 ROOF AND CEILING FRAMING

The roof/ceiling structural system shall safely support the load. Framing members and sheathing shall be structurally sound, properly fastened together and secured to the walls, and form a sound base for attaching the roof covering material. The roof/ceiling structural system shall be designed and constructed so that drainage slopes towards a perimeter edge of the dwelling into a controlled water collection and discharge system.

Roof structures incapable of safely supporting the load or providing adequately sloped drainage shall be repaired or replaced. Repairs and replacements shall, where possible, conform to CABO Sections 802, 803 and 804.

2.6.2 ATTIC VENTILATION

Ventilation in attic spaces (including enclosed attics, enclosed attic rafter cavities and insulated attics), shall conform to CABO Section 806.

2.6.3 **ATTIC ACCESS**

Where possible attic spaces with a clear height of over 30 inches that do not have a means for entrance shall be provided with an access measuring at least 14 inches by 24 inches.

2.7. ROOF COVERINGS, GUTTERS AND DOWNSPOUTS

2.7.1 ROOF COVERINGS

Roof coverings shall provide a waterproof barrier protecting the roof/ceiling structural system and the interior building surfaces from moisture damage. Roof coverings, including valley flashing and flashing against walls, chimneys, stacks and pipes shall be watertight, durable and free from excessive wear and obvious defects in materials and workmanship.

Roof covering repairs and replacements must conform to the manufacturer's installation instructions and to CABO Chapter 9 (including Section 910, Reroofing). In addition roofing shall be installed according to the following conditions.

a Metal flashing material should be not less that .019 gauge aluminum coil stock or 28 gauge galvanized corrosion resistant sheet metal. Flashing against side-walls should be stepped and flashing against chimneys should be stepped and kerfed into sealed mortar joints.

b. Metal drip edge should be installed along all eaves and rakes, using full length pieces.

c. Where necessary, multiple layer underlayment or other specialty materials should be used to protect against ice and water damage as outlined in CABO Section 903.3.

d. Asphalt shingles shall be 235 lb., 3 tab, square butt, self sealing asphalt/fiberglass strip shingles with a 25 year warranty.

2.7.2 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be properly sized, positioned, connected and secured with strap hangers under the roof shingles, so that roof drainage is collected and discharged without obstruction.

Gutters shall be seamless aluminum with a minimum gauge of .027.

Downspouts should be connected to or directed in an approved manner to the public storm sewer. If storm sewer is not readily available, drainage shall be suitably controlled and directed to an acceptable alternate means of disposal in order to prevent excessive erosion, water accumulation or damage, and shall not create a nuisance condition on said premises or on other public or private property.

Downspouts shall be .023 minimum gauge, aluminum.

Extensions or splash blocks shall be used only when unable to drain by other methods and must direct the water away from the foundation for a distance as close to 3 to 5 feet as possible.

Repairs and replacements must conform to the manufacturer's installation instructions.

## 2.8 BUILDING SHELL ENERGY EFFICIENCY

The thermal boundary of the dwelling shall be insulated and the pathways which exchange conditioned and unconditioned air shall be sealed.

### 2.8.1 VENTILATION AND AIR MOVEMENT

Holes, gaps, chase ways and other paths connecting the conditioned spaces of the dwelling to its unconditioned spaces, or to the outside, shall be sealed in order to reduce the uncontrolled movement of air into and out of the conditioned spaces.

Dryers must be equipped with exhaust ventilation to the outdoors, and shall conform to CABO Section 1801.
Range hoods shall conform to CABO Section 1802.

Bathroom mechanical ventilation systems shall conform to CABO Section 303.3.

All mechanical ventilation devices shall be installed in conformance to manufacturer's installation specifications and must vent to the outside.

2.8.2 CEILING INSULATION

Ceilings located between conditioned and unconditioned spaces shall be insulated to the following standards:

| LOCATION | INSULATION VALUE | TYPE OF INSULATION |
|---|---|---|
| Open Joist Cavities (floor, collar beam and drop soffit areas) | R-38 | All Types |
| Enclosed Joist Cavities, or Enclosed Rafter Cavities, or Enclosed Kneewall Cavities | 3.25 to 3.75 lbs/cu.ft. or 1.6 lbs/cu.ft. | Blown Cellulose or Blown Mineral/Glass |
| Open Kneewall Cavities, or drop soffit walls | R-11 to R-19 | Batt |
| Access Hatch Covers | R-38 | Batt or Rigid Board |
| Access Doors | R-11 to R-19 | Batt or Rigid Board |

EXCEPTION: Ceilings with existing insulation values of at least R-19 for horizontal areas and at least R-11 for vertical areas) are not required to be insulated to the above values if they provide uniform and complete coverage.

Ceiling insulation shall be installed according to the manufacturer's installation instructions and shall provide complete and uniform coverage. In addition insulation shall be installed according to the following practices:

a. Remove items stored in the attic before insulating. Covering items with insulation is not acceptable.

b. Mark or flag electrical junction boxes above the level of the insulation so that they can be easily located.

c Block around heat producing devices to prevent contact with the insulation. For example, blocking should be installed around vent fans, non-IC rated recessed light fixtures and active chimneys and flues.

d. Block or dam around horizontal attic accesses with rigid materials to prevent insulation from entering the access opening. The dam should be constructed of materials capable of supporting the weight of an adult and extend above the level of the insulation.

e. Install baffles or chutes to prevent insulation from contacting the roof deck or blocking eave/cornice vents.

2.8.3 SIDEWALL INSULATION

Sidewalls separating conditioned spaces from the outside or from unconditioned spaces shall be insulated as close as possible to the following standards.

| LOCATION | INSULATION VALUE | TYPE OF INSULATION |
|---|---|---|
| Enclosed Wall Cavities | 3.25 to 3.75 lbs/cu.ft. or 1.6 lbs/cu.ft. | Blown Cellulose or Blown Mineral/Glass |
| Open Wall Cavities | R-11 to R-19 | Batt |

Sidewall insulation shall be installed according to the manufacturer's instructions. In addition insulation shall be installed according to the following practices:

a. Drilling through wood shakes, fiberboard, steel, aluminum or vinyl exterior wall covering materials is unacceptable. Drilling through wood lap siding is acceptable but not recommended. Instead of drilling through exterior wall covering materials, the materials which can be feasibly removed should be removed prior to accessing the wall cavity and then re-installed after insulating. If removal is not practical, interior wall surfaces should be drilled and then repaired after insulating.

b. If each wall cavity is drilled with one hole per story, the insulation should be installed through a tube to ensure that it reaches the top and the bottom of the cavity. If two holes per cavity are drilled, tubing is not necessary. However, the distance between the holes should not exceed 5 feet. In either case, each cavity should be probed to locate fire stops or other obstructions and additional holes drilled as needed.

c. The insulation must be installed to achieve "compaction" or a density sufficient to prevent the insulation from settling and to prevent air movement within the cavity. Insulating at 3.5 PSI is recommended.

d. If interior-generated moisture is a concern, pathways that may allow warm moist air to enter the wall cavities should be sealed and interior perimeter wall surfaces should be painted with an approved vapor diffusion retardant paint.

2.8.4 FLOOR INSULATION

Floors above open crawlspaces and unconditioned enclosed crawlspaces spaces shall be insulated as close as possible to R-19.

The insulation shall be installed according to the manufacturer's installation instructions. There should be complete coverage, particularly around cross bracing, and the insulation should be firmly supported but not overly compressed.

2.8.5 FOUNDATION INSULATION

Crawlspace foundations and basement foundations should be insulated to an R-value that is determined to be cost-effective following the methodology outlined in RRS Appendix D.

2.9 ATTACHED STRUCTURES: EXTERIOR PORCHES, BALCONIES, AND UNHABITABLE ADDITIONS

Foundations, walls, floors and roofs of attached porches, balconies and unhabitable additions which are in disrepair presenting a threat to the safety of the occupant shall be made to meet the requirements of the appropriate section of the RRS. Severely deteriorated attached structures that are not critical to the occupant's use of the dwelling and that demolition would not violate the historical or architectural integrity of the dwelling may be demolished.

Porches, balconies or raised floors located more than 30 inches above the floor or grade shall have guardrails. Where feasible, guardrail details and size shall conform to CABO Section 315.

2.10 INTERIOR AND EXTERIOR STAIRS

All stairs shall be safe and structurally sound. Existing stairs with four or more risers or with open portions more than 30 inches above the grade below shall conform to the requirements of **BOCA NPMC Section 702.9.** New stairs shall conform to CABO Sections 314 and 315.

If four or more risers are present, a handrail is required on at least one side. Guardrails are required if the open ends of the stairs are more than 30 inches above grade.

2.11 NEW CONSTRUCTION

New room additions or new dwellings constructed on the site shall conform to the requirements of all of the applicable chapters and sections of CABO.

New manufactured dwellings, transported and installed on the site, shall meet the applicable requirements of CABO Appendix A.

# CHAPTER THREE

# HEATING, VENTING AND COOLING SYSTEMS

## 3.1 CHIMNEYS (SOLID FUELS)

All active solid fuel burning equipment shall be connected to a safe chimney. Masonry and factory-built chimneys connected to active fireplaces or stoves shall be structurally sound and form an unobstructed and continuous flue to safely conduct combustion byproducts to the outside. Chimney flues venting solid fuel burning equipment shall not also vent gas or liquid fuel burning equipment. Factory built chimneys shall conform to the conditions of their listing and the manufacturer's installation instructions. Chimneys connected to active solid fuel fireplaces or stoves shall be free of creosote accumulation.

Repairs and replacements should conform to CABO Sections 1001 and 1002 and the manufacturer's installation instructions.

### 3.1.1 FIREPLACES AND FIREPLACE STOVES

Active masonry and factory-built fireplaces and fireplace stoves shall be structurally sound, capable of safely combusting the appropriate fuel and connected to a safe chimney. Factory-built fireplaces and fireplace stoves shall conform to the conditions of their listing and manufacturer's installation instructions.

Repairs and replacements shall conform to CABO Sections 1004, 1005 and 1006 and CABO Sections 2102.3 and 2105 and the manufacturer's installation instructions.

It is recommended that active solid fuel burning fireplaces and fireplace stoves that cannot be made safe or that cannot be connected to a safe chimney should be removed and the chimney vent connection should be permanently sealed. If no other primary heat source is present, an alternative heating system and fuel source shall be installed.

## 3.2 CHIMNEYS AND VENTS (NATURAL GAS, PROPANE, OIL)

All gas or oil burning heating equipment shall be connected to a safe chimney or vent. Masonry chimneys, factory-built chimneys and all vent system components, including draft hoods, vent dampers, draft regulators, vent connectors and vents shall be structurally sound and properly connected to form an unobstructed continuous flue to safely conduct combustion gases to the outside.

Repairs and replacements shall conform to CABO Sections 2101, 2102, 2103, 2104 and 2105 and/or the manufacturer's installation instructions.

## 3.3 HEATING EQUIPMENT (ALL FUELS)

Heating equipment shall meet the following conditions:

a. The heating system shall be capable of maintaining a room temperature of 68 degrees at a point 3 feet above the floor in all habitable rooms. (CABO Section 303.6)

b. The equipment shall be designed and listed for the type of fuel which it utilizes.

c. The equipment shall be designed and listed for the location in which it is installed.

d. The equipment shall be accessible for inspection, service, repair and replacement without removal of permanent construction.

e. The equipment shall be properly clear from combustible materials. Where feasible, clearances shall conform to CABO Section 1306 or the manufacturer's installation instructions.

f. Replacement heating equipment shall be properly sized in accordance with the ACCA's Manual J or other recognized methodology. Data for heat load/loss calculations shall be based on post-rehabilitation conditions, and shall be documented.

g. Replacement heating equipment shall be 80+ efficiency and installed to conform to CABO Chapters 13, 14, 15, 16, 20, and 23, NFPA 54, NFPA 31 or NEC Articles 422 and 424, as appropriate to the fuel source, and/or the manufacturer's installation instructions.

h. Equipment located in enclosed rooms, attics and crawlspaces shall have a permanent electrical receptacle and a lighting fixture provided near the equipment which shall be controlled by a switch located at the passageway entrance.

i. Fuel-burning equipment shall be properly connected to a safe chimney or vent. Unvented fuel-burning primary heating equipment shall not be permitted.

j. Fuel-burning equipment shall be provided with sufficient combustion air drawn from proper locations in conformance to CABO Chapter 20 and the manufacturer's installation instructions.

k. Fuel-burning equipment shall combust fuel safely and operate as close to the designed Annual Fuel Utilization Efficiency (AFUE) as possible. Flue gases (oxygen and carbon monoxide), stack temperature and smoke shall be within acceptable limits.

## 3.4 COOLING EQUIPMENT (AIR CONDITIONING)

The repair of existing or installation of new cooling equipment is not required and should not be installed unless specifically required for the health of the occupant(s) by a licensed physician. Documentation, signed by the physician, must be maintained in the case file.

Cooling equipment newly installed by the rehabilitation program shall operate safely and efficiently, and shall be properly sized according to the ACCA's Manual J or other recognized methodology. It shall be installed to conform to CABO Chapter 24, NEC Article 440 and the manufacturer's installation instructions.

Leaks shall be repaired by an EPA-certified technician. Repairs shall conform to the manufacturer's installation instructions.

## 3.5 HEATING AND COOLING DISTRIBUTION SYSTEM

The distribution system shall be appropriate for the type of heating equipment to which it is connected, shall provide an adequate supply of heat to each habitable room and provide an adequate return to the heating equipment. Ducted (gravity or forced air) and piped (hydronic) distribution systems shall be properly sized, located, sealed, secured, protected and insulated to provide for the efficient unobstructed flow of supply and return heat.

If components are repaired or replaced the work must conform to the manufacturer's installation instructions and to CABO Chapters 19 and 25.

## 3.6 WATER HEATING EQUIPMENT (ALL FUELS)

Water heating and storage equipment shall meet the following conditions:

a. The equipment shall be capable of meeting the requirements of BOCA NPMC Section PM-506.4. Water heating and storage equipment which is not an obvious candidate for replacement shall be inspected to ensure safe and efficient operation.

b. The equipment shall be designed and listed for the location in which it is installed. Fuel-fired water heater equipment located in garages shall be placed a minimum of 18 inches above the floor and be protected from damage by vehicles as noted in NFPA 54 Part 5.1.9.

c. The equipment shall be accessible for inspection, service, repair and replacement without removal of permanent construction.

d. The equipment shall be properly connected to the hot and cold water supply lines. A readily accessible fullway valve shall be installed in the cold-water supply pipe at or near the water heater, (CABO Section 3408.2). Repairs and replacements of water supply lines shall conform to RRS Chapter 5. As required in OPC Section 606.21, a dielectric union or non-conductive connector must be used when dissimilar metals are joined.

e. The equipment shall have approved (rated & stamped) pressure and temperature relief valve as required in CABO Sections 3408.2 and 3408.5. The equipment shall be equipped with a safety discharge of rigid, pressure and temperature approved pipe which terminates with an air gap and comes to within 6 inches of the floor, or empties into a plumbing fixture, floor drain or some other approved point of discharge as required in CABO Section 3408.5.

f. Replacement water heaters shall be properly sized to the needs of the household. Sizing calculations shall, at a minimum, conform to CABO Table 3301.2 or the water heater sizing calculation outlined in the GAMA Consumers Directory of Certified Efficiency Ratings.

To provide an adequate supply of hot water, the water heating equipment must be capable of heating water to such a temperature as to permit an adequate amount of water to be drawn at every required sink, lavatory basin, bathtub, shower, and laundry facility or other similar unit, at a temperature of not less than 110 degrees Fahrenheit at any time needed under normal usage.

g. Repairs and replacements shall conform to the manufacturer's installation instructions. In addition, repairs and replacements to fuel-gas water heating equipment controls shall also conform to NFPA 54, Parts 6.30.4, 6.30.5 and 6.30.6; and, for oil-fired water heating equipment, to NFPA 31 Section 4-3.

h. Fuel-burning equipment shall be properly clear from combustible materials. Clearances shall conform to CABO Chapter 13, NFPA 54 Part 6.30.3, or the manufacturer's installation instructions. If the fuel-fired water heater equipment is located in proximity to the storage of flammable liquids or materials, it shall be placed a minimum of 18 inches above the floor.

i. Fuel-burning equipment shall be safely connected to an approved venting device directly to outside air. Vents shall be free of obstructions, cracks and holes, and provide sufficient draft to safely exhaust heat and combustion gases to the outside. Vents and chimneys shall be properly sized to the number and type of heating appliances. Where feasible, repairs or replacements to venting system components shall conform to CABO Sections 2101, 2102, 2103, 2104 and 2105 and the manufacturer's installation instructions.

j. Fuel-burning equipment shall be provided with an adequate supply of combustion air in accordance with CABO Chapter 20.

k. Fuel-burning equipment shall combust fuel safely and efficiently. Flue gases (oxygen and carbon monoxide), stack temperatures and smoke shall be within acceptable limits.

l. Repairs and replacements of fuel supply lines shall conform to CABO Chapters 26 and 27; NFPA 54, Parts 2, 3 and 4; and NFPA 31, Chapter 3. Repairs and replacements of electrical circuitry shall conform to the appropriate sections of NEC.

m. Fuel-burning water heating equipment shall not be located in areas prohibited by CABO Section 3301.3 or by NFPA 54, Part 6.30.1. Specifically, fuel-burning water heaters shall not be located in storage closets, bedrooms, bathrooms or other occupied rooms usually kept closed, unless in a sealed enclosure which prevents combustion air from being taken from the living space or the equipment is a direct-vent model.

n. It is recommended that a cost-benefit approach to selecting replacement water heaters be taken. In other words, the "cost" of the equipment should consider not only its installation cost but also its long-term operating cost. Often the incremental increase in the cost of high Energy Factor (EF) rated equipment is off-set within a few years by the fuel savings achieved over low EF rated equipment. Methodology for selecting properly sized water heaters and for comparing the cost-effectiveness of various equipment models is outlined in the GAMA Consumer's Directory of Certified Energy Ratings and in RRS Appendix E.

## 3.7 FUEL-GAS PIPING

The fuel-gas piping system shall consist of fittings and valves between the outlet of the gas meter (or in the case of LPG systems, from the outlet of the first stage pressure regulator) and the equipment that they operate. The fuel-gas piping system shall be free of leaks, properly sized for all of the appliances connected to it and properly installed using approved materials.

a. All fuel-gas piping shall be inspected visually.

b. All leaks found as a result of the inspection shall be repaired.

c. Each fuel-gas operated appliance shall have a shut-off valve within six feet of the appliance (and must be in same room as appliance), as required in CABO Section 2606.3.

d. All fuel gas piping shall be properly supported, as required in CABO Section 2608.2.6.

e. The fuel-gas piping shall be properly sized for all of the appliances connected to it, as required in CABO Sections 2609, 2610 and 2611.

e. 6) All gas piping and fittings used in any new installations or repairs shall be of approved type, and all work shall conform to the appropriate section of CABO Chapter 26. Unused and disconnected fuel-gas piping located in accessible areas (e.g. basements) should be removed.

# CHAPTER FOUR

# ELECTRICAL SYSTEM

## 4.1 GENERAL REQUIREMENTS

Each dwelling shall have an electrical system which provides a safe, adequate, and convenient source of electrical power.

Safety is the fundamental and essential aspect of any adequate wiring installation. The National Electric Code (NEC) points out that the purpose of the code is for "the practical safeguarding of persons and property from hazards arising from the use of electricity." Fire and electric shock hazards must be minimized.

Capacity is the second aspect to consider in the electrical system. Unsafe conditions often occur because the initial wiring system was not properly planned and outlets added later overload the existing circuits. The system shall be made to permit expansion without overloading the circuits and to meet post-rehabilitation needs.

Convenience is the third electrical system consideration. There should be enough switches, fixtures and receptacles and they should be located so that the occupants will not have to walk in the dark or use extension cords on a regular basis. An electrical system should consider the placement of switches for handicapped occupants, the relocation of service equipment for ready access by the elderly/disabled.

### 4.1.1 REPLACEMENT, ALTERATION OR REPAIR TO ELECTRICAL SYSTEM

When an electrical system is replaced, altered or repaired, the portion of the system which has been replaced, altered or repaired shall conform to NEC and CABO standards.

The City of Youngstown requires that modifications or installations to the electrical system including rewiring, repairing and updating of the existing electrical system shall be performed by a electrician licensed in the City of Youngstown. A permit for such work must be taken and submitted when requesting payment

All material and equipment used in electrical installations shall be listed or labeled by a qualified electrical products testing laboratory such as "UL" or "CSA" as required by NEC Article 90-7 and installed per the manufacturer's instructions as required by NEC Article 110-3 (b). All listed equipment shall be installed for its intended use and location.

Existing portions of the electrical system which are safe, adequate and functional and consequently are not being re-wired, repaired or upgraded do not have to comply with the codes.

## 4.2 SYSTEM INSPECTION

All electrical systems shall be inspected to evaluate the safety of the service. Inspect the grounding protection; condition of existing wiring, fixtures and equipment to determine potential hazards. Determine the capacity of the service necessary to meet the anticipated usage demand and convenience needs of the occupants.
( Refer to System Inspection in Appendix F).

## 4.3 SYSTEM PROTECTION AND GROUNDING

All electrical systems shall consist of a single phase three wire grounded neutral service and shall provide system grounding and equipment grounding protection. The service panel shall be connected to the grounding electrode system and the panel shall meet the bonding requirements per NEC Article 250.

### 4.3.1 SERVICE PANEL GROUNDING

The service panel shall be connected to the grounding electrode system and the panel shall meet the bonding requirements per NEC Article 250.

It is required that the electric system be grounded to an 8' galvanized or copper clad steel ground rod and a second grounding electrode as per NEC Article 250.

For additional guidance, see NEC Article 250-81.

### 4.3.2 SERVICE CONDUCTORS

Service conductors shall not be frayed, worn or bare. The service conductors, including the service drop, service lateral and service entrance shall be out of reach or properly buried, properly connected and anchored to the home.

Where feasible, clearances shall conform to CABO Section 4104.

### 4.3.3 SYSTEM SAFETY & SERVICE CALCULATION

Each dwelling shall have an adequate and safe electric service. All electric services shall be properly grounded and a load calculation of the housing unit shall be done to determine the adequacy of the service.

To meet safety, capacity and convenience needs remember that the code states the minimum requirements and that it is less expensive to install a service with greater capacity than currently needed when altering or upgrading the system than it is to increase capacity later.

4.3.4 MINIMUM SERVICE SIZE

The minimum service for a dwelling (usage or load) shall be 100 amperes with a three wire, 120/240 volt, single-phase with a grounded neutral service. Service shall be properly sized for after rehabilitation capacity. CABO Minimum Service Load Calculation Table 4102.2. shall be used to calculate the load.

The list below is provided as a guide to determining the number of branch circuits needed; however, as a general rule, individual appliances listed below draw enough current to warrant a dedicated circuit:

| | |
|---|---|
| Range | 50 amp circuit |
| Laundry | 20 amp circuit |
| Clothes dryer | 30 amp circuit |
| Bathroom | 20 amp circuit |
| Water heater | 30 amp circuit |
| Garbage disposal | 20 amp circuit |
| Furnace | 15 amp circuit |
| Microwave oven | 20 amp circuit |
| Air conditioner | Varies |
| Dishwasher | 20 amp circuit |
| Water & sump pumps | 20 amp circuit |
| Septic aerators | 20 amp circuit |

Homes equipped with all electric appliances such as: electric water heater, electric range, electric clothes dryer, central air conditioning, and electric heat shall be equipped with no less than a 200 amp service.

All nominal 240 volt appliances or equipment, except individual baseboard heating units, shall be on separate circuits. Each 240 volt circuit shall be sized to match the needs of the appliance for which it is intended.

4.4 SERVICE PANEL/EQUIPMENT

4.4.1 SERVICE DISCONNECT

Each occupant shall have ready access to the disconnect serving the dwelling unit in which they reside. The disconnect shall be clearly marked as a service disconnect and shall be installed at a readily accessible location either outside the building or inside at the nearest point of entrance of the service conductors as required in CABO Section 4101.6.

4.4.2 SERVICE PANEL SIZE AND CONDITION

All service panels shall have a minimum rating of 100 amperes with circuit breaker type over current protection. The panel shall be in proper working condition with no evidence of overheating, arcing, corrosion or failure. The panel must bear the UL label and must be marked as suitable for service equipment.

The number of circuits installed shall not exceed the rating on the panel. Full size single pole or double pole breakers are recommended.

Tandem breakers are permissible only in panels designed for such and installed per the NEC. Panels with evidence of malfunction or deterioration shall be replaced.

4.4.3 SERVICE PANEL ATTACHMENT AND CONNECTIONS

All existing or new service panels shall be securely fastened to the dwelling. All panel boxes shall be enclosed in 16 gauge or code sheet steel cabinets with doors and catches. All panel circuits shall be clearly and permanently labeled with tags provided and all unused openings shall be properly plugged, capped or sealed with listed material. Conductors entering the service shall have proper connectors and shall be securely attached at terminals. All connections shall be torqued to required specifications.

Proper installation shall include following the manufacturers installation instructions or other instructions as required by NEC Article 110-3(b).

4.4.4 OVERCURRENT DEVICES

Panel board over current devices shall be circuit breaker type and shall be properly sized in accordance with CABO Section 4202. Service equipment containing fuse over current protection devices shall be replaced with properly rated circuit breaker type over current protection devices.

4.4.5 SERVICE PANEL ADD-ONS

Add-on boxes or disconnects to existing services for additional circuits shall be allowed only if the existing service equipment is listed and designed for such extension and the installation is in compliance with the NEC.

4.5 PREMISES WIRING SYSTEM

4.5.1 CIRCUIT LOADS

All circuit wiring shall be properly sized to serve the load. The loads shall be evenly divided among various circuits to attain a close balance of probable or calculated load as per NEC Article 220-4 (d).

All nominal 240 volt appliances or equipment, except individual baseboard heating units, shall be on separate circuits. Each 240 volt circuit shall be sized to match the needs of the appliance for which it is intended.

4.6 WIRING METHODS

4.6.1 MATERIAL AND EQUIPMENT

All material and equipment used in electrical installations shall be listed or labeled by a qualified electrical products testing laboratory as defined by NEC Article 90-7. Listed materials shall be installed per the intended use and location and per the manufacturer's instructions as required by NEC Article 110-3 (b). All terminations shall be made in accordance with the manufacturers' instructions provided on the equipment.

4.6.2 EXISTING WIRING AND FIXTURES

Existing wiring and equipment shall be in proper operating condition free of taped splices, loose connections, missing insulation, short circuits or unapproved grounds or service connectors.

4.6.3 WIRE SPLICES

All splices shall be placed in accessible, approved junction boxes which are properly covered as required by NEC Article 370.

4.6.4 CONSTRUCTION PROTECTION

All connections of electrical cables, raceways and equipment shall comply with rules pertaining to grounding continuity and shall provide for protection against physical damage of exposed electrical equipment during and after construction.

4.6.5 EXTERIOR WIRING

All wiring which supplies power to outside post lights, detached garages, etc. shall be sunlight resistant UF or installed in approved conduit.

4.6.6 KNOB AND TUBE WIRING

All frayed or damaged knob-and-tube wiring located in open cavities (e.g. open joist attics, basements) shall be replaced.

4.6.7 UNUSED OPENINGS

Any unused openings in outlet, device, pull and junction boxes, conduit bodies and fittings, raceways, cabinets, auxiliary gutters, equipment cases or housings shall be effectively closed with knockout seals.

4.6.8 UNUSED SWITCHES, RECEPTACLES, FIXTURES AND CONDUCTORS

All unused switches, receptacles, fixtures and conductors shall be removed.

4.7 FIXTURES

4.7.1 MATERIALS AND INSTALLATION

All replacement fixtures shall be listed or labeled by a qualified electrical products testing lab and installed per the manufacturer's instruction. Switches located in wet locations shall be weatherproof and the wiring shall be run in boxes, conduit, and fittings listed for wet locations as required by CABO Section 4405.11.

4.7.2 FIXTURE LOCATION

A permanently installed lighting fixture controlled by a wall switch shall be required to be located in each bathroom, kitchen, laundry room, furnace room, each room of a basement, at all exterior doors, common hallways, common stairways, and attached and detached garages with existing electric power. All wall switches shall be located for convenient and readily accessible use.

All light fixtures installed in closets must be fixtures with enclosed lamps unless a fluorescent fixture is used. Closet fixtures shall be installed on the wall 6 inches away from any storage as required by NEC Article 410-8.

It is recommended that fixtures and lamps (bulbs) installed in areas lighted for long periods (e.g. several hours per day) be selected for energy efficiency. Fixtures that accommodate electronic ballast compact fluorescent lamps (CFL) should be considered for kitchens, hallways and stairways. Also, CFL fixtures that are photo-cell controlled should be considered for outside porch and door lighting. For additional information on electric lighting standards, see RRS Section 6.2.1 and RRS Appendix F.

4.8 RECEPTACLES

4.8.1 MATERIALS AND INSTALLATION

All replacement receptacles shall be listed or labeled by a qualified electrical products testing lab and installed per the manufacturer's instruction. All boxes shall be properly sized, mechanically secure and have attached cover plates installed. Receptacles located in damp or wet areas shall be weatherproof and the wiring shall be run in boxes, conduit and fittings listed for wet locations as required by CABO Section 4405.11.

4.8.2 AMPERE RATINGS OF RECEPTACLES

Receptacles installed on a branch circuit shall have the same ampere rating as the branch circuit itself. All newly installed 15 amp and 20 amp 120 volt receptacles shall be of the grounding type as required by NEC Article 210-7(a).

4.8.3 GFCI PROTECTION

All receptacles located within six feet of a sink, located in a bathroom, laundry room, kitchen, garage, unfinished basement, or located outside shall be GFCI protected as required by NEC Article 210-8 (a).

See RRS Appendix F for a summary of required locations.

4.8.4 RECEPTACLE LOCATION

All receptacles located in the floor shall be either installed in an approved box listed and labeled for such use or shall be moved to the wall. Metal plates shall be used to cover the floor opening.

All habitable spaces, occupiable spaces, laundry rooms and basements shall have receptacles as required by NEC Article 210-52. In each family room, dining room, living room, parlor, library, den, sun room, bedroom, recreation room, or similar room or area of dwelling units, receptacle outlets shall be installed so that at a minimum each wall has an outlet.

Receptacles shall not be installed above electric baseboard heaters, unless provided for by the exception noted in NEC Article 210-52 a.

4.9 SMOKE DETECTORS

Each dwelling shall have at least one smoke detector installed in the immediate vicinity of each sleeping area and one on each additional story, including basements and cellars, but excluding unoccupied attics or crawl spaces. Smoke detectors shall draw their primary power from the building wiring, with battery backup, and without interruption except for that required for over current protection. Power shall be 120 volts.

It is recommended that the wiring should be interconnected when possible so that all detectors sound the alarm when any one senses smoke. The preferred method is to wire directly across two wires, un-switched and choose a circuit used often such as a bathroom so that if the circuit fails it is noticed immediately.

# CHAPTER FIVE

# PLUMBING

## 5.1 GENERAL REQUIREMENTS

The plumbing system shall provide for a safe, adequate supply of potable water to the premises and provide for a safe, sanitary method of disposing of liquid and solid waste.

The plumbing system includes water supply lines; drain, waste, and vent pipes; plumbing fixtures such as faucets, hot water heaters, sinks, lavatories, toilets, bathtubs, showers and any devices which are permanently or temporarily connected to the water distribution system of the premises and demand a supply of water or discharge waste water, liquid-borne waste materials or sewage either directly or indirectly to the drainage system of the premises, or which require either a water supply connection or a connection to the drainage system of the premises. All piping, fittings, devices, faucets, vessels, containers and receptacles that are used to supply, distribute, receive or transport potable water or liquid or solid wastes are considered as plumbing.

### 5.1.1 REPLACEMENT OR REPAIR OF PLUMBING SYSTEM

When a plumbing system is replaced or partially replaced, the system used for the replacement portion shall be designed, constructed and installed in conformity with the Ohio Plumbing Code (OPC) using accepted engineering practice and workmanship.

Older houses may make use of materials and methods which differ in certain ways from those in common use today. Yet current methods of good workmanship and new standards should apply to any new work that is being done.

### 5.1.2 STRUCTURAL INTEGRITY

Supply, drain, waste, and vent lines shall not run through structural members in such a way that will interfere with their ability to sustain the imposed loads. Where feasible, drilling and notching of structural members shall conform to OPC Section 308.2.

When in the process of installing or repairing any part of the plumbing and drainage system, the finished floors, walls, ceilings, tile work and/or any other part of the building or premises must be changed or replaced, it shall be left in a safe structural condition in accordance with OPC Section 308.1.

### 5.1.3 INSPECTION GUIDELINES

Prior to choosing a contractor to undertake rehabilitation and as a part of the process of determining the extent of rehabilitation work, a thorough inspection shall be done to determine the scope of the plumbing that is not in compliance with the RRS.

To the extent feasible, all parts of the plumbing system shall be inspected to ascertain whether they are functioning properly and adequately, are free of leaks and are otherwise following the guidelines set out in the RRS and the principles listed in BOCA NPMC Chapter 5. Clear and detailed work specifications shall be written for all work to be completed and given to contractors prior to submission of bids.

## 5.2 SUPPLY

### 5.2.1 WATER SOURCE

All water service entry lines shall be properly connected to either a public water supply system or an approved private water supply system in conformity with CABO Section 3102.1. When connected to a private system an analysis of water by the local health department shall be done to determine the bacterial content for safety and appropriate corrective measures implemented. Newly installed water supply lines shall be flushed out in accordance with OPC Section 611.

### 5.2.2 PIPE PROTECTION

All water lines shall enter and exit the house below grade and shall not be exposed to the outside. All new exterior water lines shall be a minimum of 4' below grade and comply with all requirements in OPC (note particularly Section 307 on trenching, excavation, and backfill). To the extent feasible all interior water distribution lines in unheated areas or in exterior walls shall be moved to heated areas or insulated to avoid freezing as required in OPC Section 306.6.

### 5.2.3 FROST PROTECTION OF HOSE BIBS

All hose bibs in unheated or exterior locations shall be frost proof and designed so that they extend into a heated area through the building insulation or the water line to the hose bib shall be equipped with an accessible shut-off valve located within a heated area.

### 5.2.4 QUANTITY AND PRESSURE

Supply lines and fixtures shall be capable of performing the function for which they are designated. Interior water distribution lines shall at all times supply water to the plumbing fixtures in sufficient volume and at a pressure adequate to enable them to function satisfactorily. New water supply lines shall be sized and installed according to accepted engineering practice (see RRS Appendix G or OPC Appendix E for supply piping size guidelines).

5.2.5 VALVES

5.2.5.1 SERVICE VALVE

All main water lines shall have a service shut-off valve located near the entrance of the water service into the house that meets the requirements of OPC Section 607.1 (2).

5.2.5.2 FIXTURE SHUT-OFF VALVES

All water supply lines feeding sinks, lavatories, bathtubs, showers, toilets, water heaters and other plumbing fixtures shall be equipped with accessible shut-off valves on all hot and cold water supply lines.

5.2.6 AIR GAPS

A one inch minimum vertical air gap is required between the flood rim of a fixture and the lowest end of a water supply outlet in conformity with OPC Section 609.

5.2.6.1 HOSE BIBS

Exterior hose bibs shall be of the vacuum breaker type and meet the requirements of OPC Section 609.14.4.2.

5.2.7 SUPPORT OF PIPING

All supply lines shall be properly supported and meet the requirements of OPC Section 309.

5.2.8 JOINTS BETWEEN DISSIMILAR METALS

All joints between dissimilar metal pipes shall be made with dielectric fittings in conformity with OPC Section 606.21.

5.3 FIXTURES

All plumbing fixtures shall be made of materials that are impervious to water, easily cleanable, and shall not have leaks or defects which interfere with their function and shall meet the requirements of OPC Section 403.1.

Plumbing fixtures include water closets (toilets), urinals, bidets, faucets, lavatories, sinks, showers, bathtubs, floor drains and drinking fountains.

5.3.1 INSTALLATION OF FIXTURES

It is recommended that the use of water and energy conserving fixtures and equipment whenever it is practical. Fixtures shall conform to the following guidelines in terms of how they are constructed and installed:

a. All Replacement plumbing fixtures shall comply with the ASSE/ANSI standards listed in CABO Section 3201, Table 3201.1 plumbing fixtures.

b. All replacement water closets shall be water conserving low consumption (not to exceed 1.6 gallons per flush) and shall conform to OPC Section 421.1.

c. All replacement sink faucets shall be that of a water conserving type which deliver a maximum flow rate of 2.2 g.p.m. at 60 psi in compliance with OPC 425.1.

d. All replacement bathtub and shower fixtures shall use anti-scald control valves. The control valves of the pressure balancing, thermo-static mixing or the combination pressure balancing/thermostatic mixing valve types shall be controlled and designed to limit water temperature change to a maximum setting of 120 degrees in compliance with OPC Section 425. Where feasible, access panels shall be provided to these valves.

e. All fixtures shall be rigidly supported and securely attached in a manner consistent with normal installation procedures and meet the requirements of CABO Section 3206.1.

f. All faucets installed shall have the hot water connected to the left side of the faucet being installed according to OPC Section 608.4.

g. All tail pieces shall not be less than 2 inches O.D. (outside diameter) for showers, 1 1/2 inches O.D. for kitchen sinks, dishwashers, laundry tubs, bathtubs and not less than 1 1/4 inches O.D. for lavatories and similar fixtures in compliance with OPC Chapter 4.

h. All plumbing fixtures other than toilets shall be provided with approved strainers in conformity with OPC Section 305.2.

i. If a garbage disposal is present, it must be in good working order. If not, it shall be removed or repaired.

j. Water softener equipment, if present, shall be in operable condition and free from leaks or possible contamination through back flow of sewer or other sources. If not, it shall be repaired or replaced. New equipment shall be installed in accordance with the manufacturer's instructions.

k. All plumbing fixtures and appliances shall be free of leaks or shall be repaired or removed. It is the responsibility of the owner to maintain their appliances in working order.

l. Water heaters shall be in good condition and properly installed. See RRS Section 3.6.

## 5.4 SANITARY DRAINAGE

All fixtures shall be connected to an approved sewage disposal system in compliance with CABO Section 3102.1.

### 5.4.1 INSTALLATION DETAILS

All new installations of drainage systems or repairs shall meet all applicable OPC codes and all preexisting drainage systems shall conform to the following:

a. All drainage system repairs or replacements shall be done with approved fittings that conform to the pipe being used and are in conformity with OPC Section 703.4 and provide for a smooth drainage flow.

b. All drainage systems shall provide a free flowing waterway and maintain a

continuous slope.

c. All plastic DWV (drain/waste/vent) pipes shall be ABS or PVC - DWV Schedule # 40 and other materials shall comply with OPC Section 703.1

d. All waste stacks shall be provided with an accessible clean out located on the stack closest to where the waste pipe exits the house in accordance with OPC Section 709.3.4 and 709.3.5.

e. Sizing of drainage systems may be accomplished using OPC Chapter 7 or CABO Sections 3505 and 3506.

5.4.2 TRAPS

All fixtures shall be trapped and all traps shall conform to the following specifications:

a. All waste outlets shall be separately trapped by a water seal trap as near to the fixture as possible, but in no case more than 24 inches from the fixture in compliance with OPC Section 1003.1 Also see exceptions listed under this section.

b. All traps shall be set level with respect to their water seals and shall be protected from frost and freezing weather as stated in OPC Section 1003.7.

c. All plumbing fixtures must be trapped with a water seal not less than 2 inches or more than 4 inches and shall meet the requirements of OPC Section 1003.4.

d. Traps shall be of standard design and self-cleaning. Bell traps, “S” traps and Drum traps are prohibited as noted in OPC Section 1003.3

e. Fixture trap size shall be sufficient to drain the fixture rapidly and in no case less than 1 1/4 inches O.D. for lavatories; 1 1/2inches O.D. for tubs, kitchen sinks, washers, and dishwashers; 2 inches O.D. for showers and floor drains; and shall be in conformity with OPC Section 1003.5.

f. No trap shall be larger than the drainage pipe into which it discharges as stated in OPC Section 1003.5.

g. Where feasible access panels shall be provided for all fixtures with concealed traps as in CABO Section 3205.1.

5.4.3 VENTS

Plumbing systems shall be designed to prevent sewer gases from entering the house and to allow waste to adequately drain into an approved sewer system and shall conform to the following venting guidelines:

a. Buildings shall have at least one 3 inch diameter soil stack running from the drain up through the building and terminating outdoors on the roof and installed in conformity with OPC Section 904.1.

b. All plumbing vent systems shall be used only for the purpose of venting the plumbing system in compliance with OPC Section 901.4.

c. Vent extensions above the roof shall terminate at least 6 inches above the highest point in conformity with OPC Section 905.1.

d. All vent pipes shall be installed so that they are sloping back to the waste pipe to allow for moisture and condensation to drain back to the main drain line and in conformity with OPC Section 906.

e. All vent pipes which run along the side of the house, terminate in the attic, or are near a window shall be replaced and be in conformity with OPC Section 905.5.

f. All new installations of plumbing vents shall meet the requirements of OPC Chapter 9.

# CHAPTER SIX

# ENVIRONMENT

## 6.1 PREMISES CONDITION

Each dwelling and the property on which it is located shall provide a safe, sanitary and satisfactory environment for the occupant(s) and the neighborhood.

Prioritization should be given to the correction of sub-standard premises conditions that most directly affect the health and safety of the occupants and the structural integrity of the dwelling.

Owners are required to clear the property of accumulated rubbish, motor vehicles and other unsanitary or unsightly conditions or violations of the zoning codes of the City of Youngstown prior to receiving financial assistance.

## 6.1.2 UNATTACHED GARAGES

Unattached garages shall be free of hazards to the occupant's health and safety. Existing electrical wiring, fixtures and receptacles shall be safely and properly installed. Unattached garages which significantly detract from the overall appearance of the property or neighborhood may be repaired, provided the repairs are minimal in cost.

Unsafe and non-repairable accessory structures if deemed necessary may be demolished.

## 6.1.3 DRAINAGE

The premises shall be free from depressions that routinely collect stagnate water and free from improper grading that causes erosion.

## 6.1.4 PAVED SURFACES

Sidewalks, driveways, patios and other paved surfaces on the premises shall present a reasonably flat and horizontal surface so that pedestrians are free from hazards such as tripping and falling. Paved surfaces adjacent to the foundation shall not slope towards the structure so that water collects or drains towards the foundation.

## 6.1.5 RUBBISH AND GARBAGE

The premises and the dwelling shall be free from excessive accumulations of rubbish and/or garbage that present health and safety hazards to the occupant or to the persons employed by the rehabilitation program and its contractors.

Accumulations of rubbish and garbage must be removed from the exterior premises and from the interior of the dwelling prior to rehabilitation.

### 6.1.6 EXTERMINATION OF VERMIN AND INSECTS

The premises shall be free from infestations of vermin and/or wood-boring insects. Inspections and treatment shall be performed by qualified persons in an approved manner prior to rehabilitation.

### 6.1.7 TREES AND SHRUBS

The premises shall be free from trees and shrubs that are damaging the dwelling.

## 6.2 LIGHTING, VENTILATION AND OCCUPANCY LIMITATIONS

### 6.2.1 ARTIFICIAL LIGHTING (ELECTRIC LIGHTING)

All habitable rooms (i.e. rooms for living, sleeping, eating or cooking), all occupiable spaces (including; bathrooms, toilet rooms, stairways, hallways, storage and utility rooms, and spaces containing appliances or equipment requiring safe operation and maintenance), and all exterior entrances shall be provided with electric light. Illumination shall be appropriate to the purpose of the room and sufficient to meet the needs of the occupant. Interior and exterior stairway illumination shall comply with CABO Section 303.4.

In areas where illumination is required for long periods of time, such as outdoor security lights, hallways and stairways, it is recommended that energy efficient hard-wired fixtures and lamps (e.g. compact fluorescent type lighting) be installed.

### 6.2.2 VENTILATION

All habitable rooms (i.e. rooms for living, sleeping, eating or cooking), that have a window, shall have at least one openable window. The total open able area of the window shall be equal to at least 45% of the minimum glazed area. All bathrooms and toilet rooms shall be provided with a means for natural or mechanical ventilation. Refer to RRS, chapter 2.8.1

### 6.2.3 OCCUPANCY LIMITATIONS

Where feasible, occupancy limitations shall conform to BOCA NPMC Section PM-405.

## 6.3 HABITABLE SPACES

### 6.3.1 KITCHENS

Each dwelling shall have adequate space for food preparation and storage, including space for a refrigerator, a range/stove/oven, a sink plumbed with hot and cold water, an adequate number of cabinets and an adequate amount of counter top surface. Cooking equipment must be safe and properly connected to the fuel supply.

### 6.3.2 BEDROOMS

Each dwelling unit shall have the number of bedrooms (i.e. sleeping rooms) sufficient to provide the occupants with privacy. When feasible, bedrooms shall be arranged so that persons do not have to pass through one bedroom to enter another bedroom or another habitable space. Kitchens and unhabitable spaces shall not be used as bedrooms. Each bedroom or sleeping area shall have a means of emergency egress as required in RRS Section 6.6.1.

### 6.3.3 LIVING ROOMS, DINING ROOMS AND OTHER HABITABLE SPACES

Rooms routinely used for living shall meet the appropriate standards outlined in the structural, electrical and environmental sections of the RRS.

COMMENTARY: Although most dwellings have space designated for more than cooking and sleeping, OHCP has not established a standard for the number or type of habitable spaces required for each dwelling unit. In other words, OHCP is not requiring that dwellings have living rooms and dining rooms, etc. Existing homes have the number of habitable rooms they have and OHCP is not requiring additional habitable rooms. Instead, the appropriate structural, electrical and environmental standards shall apply for those rooms the occupants normally inhabit for the purpose of living in the unit.

## 6.4 OCCUPIABLE SPACES

### 6.4.1 BATHROOM/TOILET ROOM

Each dwelling shall contain adequate and private space designated for bathing and for the elimination of bodily wastes. Each space designated for bathing shall contain a safe functional bathtub, shower or combination bathtub/shower plumbing fixture. Each space designated for waste elimination shall contain a safe and functional water closet and lavatory plumbing fixture. Bathroom/toilet rooms shall not be located so as to provide the only passageway to a hall, other space or to the exterior.

When an occupant is handicapped or disabled, the location and configuration of the bathroom/toilet room and its plumbing fixtures should comply with the applicable construction standards in the Uniform Federal Accessibility Standards. When an occupant is elderly and/or frail, OHCP recommends installing grab bars (properly secured to reinforced wall supports), easily operable faucets (i.e. faucets that do not require tight grasping, pinching or twisting of the wrist) and plumbing fixtures designed to accommodate accessibility.

### 6.4.2 STORAGE AND UTILITY ROOMS

Storage and utility rooms shall meet the appropriate standards outlined in the structural, electrical and environmental sections of the RRS.

## 6.5 ACCESSIBILITY

Rehabilitation measures specifically intended to improve accessibility shall meet the construction requirements outlined in the applicable sections of the Uniform Federal Accessibility Standards.

## 6.6 FIRE SAFETY

### 6.6.1 EGRESS

All dwellings shall provide a safe, continuous and unobstructed exit from the interior directly to the outside. The exit path shall not pass through other dwellings or rooms within the dwelling that are likely to be locked, such as bathrooms, toilet rooms or bedrooms. Egress doors shall be easily openable from the inside without the need for keys. Each bedroom or sleeping area shall have a means of emergency egress provided by a window or a door. If provided by a window, at least one window shall be openable, large enough to allow passage and without security bars or grilles which must be unlocked with keys or removed from the exterior. Emergency escape exits shall be provided for bedrooms or sleeping areas located in basements as required by BOCA NPMC Section PM-7.12.

If an emergency egress window must be created, OHCP recommends following the requirements outlined in CABO Section 310.2.1.

### 6.6.2 SMOKE DETECTORS

Each dwelling shall have smoke detection devices located and installed as required in RRS Section 4.9. All smoke detectors shall be approved and listed by a recognized independent testing laboratory and placed as directed by the manufacturer.

6.6.3 STORED FLAMMABLE MATERIALS

Flammable materials (e.g. paint, solvent fluids, paper, rags, etc.) shall not be stored or accumulated in an unsafe or unapproved manner while the rehabilitation is in progress.

6.6.4 FOAM PLASTIC, FLAME SPREAD AND SMOKE DENSITY

Foam plastic materials, wall and ceiling finish materials and insulation materials that are installed with financial assistance from the rehabilitation program shall meet the requirements of CABO Sections 317, 318 and 319.

6.7 LEAD-BASED PAINT HAZARDS

All rehabilitation projects shall comply with applicable current federal, state and local regulations and laws. Special precautions and procedures should include testing for the presence of lead-based paint, protecting the occupants from the hazards, cleaning the areas where dust and debris were present, clearance testing the home to ensure that no unacceptable lead levels exist after rehabilitation and proper disposal of lead contaminated construction waste.

6.7.1 All units shall have a risk assessment performed in conjunction with the rehabilitation specifications. The risk assessment must be performed by a qualified Lead Risk Assessment technician.

6.7.2 No rehabilitation work should be done until the risks identified have been addressed per the risk assessment recommendations. The hazard reduction portion of the rehabilitation work must follow the HUD “Guidelines For The Evaluation Of Lead-Based Paint In Housing” (published in June, 1995) and the applicable requirements established by the EPA, OSHA and the ODH.

6.8 ASBESTOS

All work to remove, contain or encapsulate asbestos shall comply with applicable federal, state and local regulations and laws. Special precautions and procedures should include inspection for the presence of asbestos, protecting the occupants and workers from the hazards, proper removal, if called for, by trained asbestos contractor.

6.8.1` Initial inspection of the home shall note presence of asbestos, shall determine if the rehabilitation work will disturb the asbestos, and shall write specifications for the removal if necessary.
In cases where the asbestos containing material is not to be disturbed by rehabilitation, specifications shall note that it shall not be disturbed.

6.8.2 The removal of the asbestos containing material must be done properly by a trained asbestos contractor and in accordance with applicable regulations and law.

## 6.9 INDOOR AIR QUALITY

The Dwelling shall be free of pollutants that are known to exist at levels which threaten the health of the occupants. When an indoor air quality problem is suspected, the cause must be investigated so that measures designed to correct or mitigate the problem can be built into the rehabilitation scope of work.

## 6.10 WATER SUPPLY

All dwellings shall have adequate, safe and potable water supplied through a safe plumbing system to all fixtures. Water drawn from private sources (privately owned wells) shall be tested by a local health department to determine the bacterial content prior to beginning the rehabilitation work.

## 6.7.5 SANITARY DRAINAGE

All plumbing fixtures (e.g. sink, lavatory, bathtub, shower, toilet, etc.) and all other water consuming appliances (e.g. dishwasher, clothes washing machine, etc.) shall be properly connected to either a public sanitary drainage system or to an approved private sanitary drainage system. Private sanitary drainage systems shall be inspected to ensure that they are properly and adequately functioning.

## 6.11 HISTORIC PRESERVATION

The rehabilitation of dwellings subject to the Section 106 Review Process of 36 CFR Part 800 shall comply with the findings and recommendations issued by the Ohio Historic Preservation Office.

6.11.1 Prior to rehabilitation of a structure, pictures and specifications of the work to be done must be approved by the Ohio Historic Preservation Office.

6.11.2 Where the Ohio Historic Preservation Office requires the rehabilitation scope of work to preserve or protect the historic character of the structure their guidelines for accomplishing the preservation or protection must be followed.

## APPENDIX A

## GUIDELINES FOR CALCULATING HEATING LOAD

Selecting the proper size heating equipment can be an important factor to help minimize fuel usage and to ensure a comfortable environment. The first step in the selection process is calculating the home's heating load. The heating load calculations will determine the output or "size" requirement for the equipment. There are several methodologies for calculating load. Some are more sophisticated and exact than others. OHCP recommends using the ACCA's Manual J or another recognized valid method. At a minimum, heating load calculations must be consistent with the steps outlined in this guideline.

The following information must be known and collected in order to complete the steps:

1. The R-value (measurement of heat flow resistance) of the materials comprising the building shell component - walls, windows, ceilings and floors, etc. Note: R-values must be based on post-rehabilitation conditions. In other words, if insulation is planned, then the increased R-value must be used.

2. The U-value (measurement of heat flow) of the materials comprising the building shell component. U-value is the reciprocal of R-value and represents the number of BTUs per hour per square foot flowing through the material.

3. The square foot area for each building shell component.

4. The design temperature for the locality. Design temperature is that temperature equaled or exceeded 97.5% of the time during December, January and February.

5. The amount of air moving through the building, or the general condition of the building and number of people living there.

STEP 1: Calculating Heat Load by Transmission

a. For a building shell component, multiply its U-value times its total surface area times the temperature difference (i.e. difference between 65 F and outside design temperature). The result is the number of BTUs per hour per square foot flowing through that component.

The formula is: $U \times A \times T = q$

Where: U = the U-value of the building component (BTUs/hr./sq.ft.)
A = the Area of the building component (sq.ft.)
T = the Temperature difference (65 F minus the design temp.)
q = the total amount of transmission heat load (BTUs/hr)

b. Repeat the calculation for each component.

c. Add the results to find the total number of BTUs per hour per square foot flowing through all components.

STEP 2: Calculating Heat Load by Air Movement

a. Measure or estimate the number of cubic feet of air that moves through the building per hour. This can be measured by a blower door; however, most heating load calculation forms estimate this based on the construction and condition of the home. The minimum air exchange rate should meet ASHRAE's standard of 15 cubic feet per minute (or 900 cfm/hr.) per occupant or 0.35 air changes per hour.

b. Multiply the air flow rate times 0.018. This is the heat capacity of air - 0.018 BTUs per cubic foot per 1 degree F.

c. Multiply the result by temperature difference as in step 1. The result is the total number of Btus per hour flowing through the building by air movement.

The formula is: $0.018 \times F \times T = q$

Where: 0.018 = the air heating capacity in BTUs/cu.ft./1F. This is a constant.

F = the number of cu.ft. of air flowing per hour.
T = the temperature difference (65 F minus the design temperature).
q = the total amount of air exchange heat load (BTUs/hr).

STEP 3: Calculating Heating Equipment Output and Input

a. Add the results of Step 1 and Step 2. Combining the transmission load and the air exchange load provides the total heating load for the building. This is the number of BTUs/hr. that are required to heat the building to the design temperature for the climate in which it is located. This is also the output rating required for the heating equipment. In other words, the heating equipment selected to heat the building must provide (output) at least that many BTUs/hr. of heat to the distribution system.

b. Divide the output rating by the heating equipment AFUE %. The result is the input rating for the heating equipment. This is the "size" of the equipment required to provide the required amount of heat to the building. In other words, the selected heating equipment must be able to produce (input) that amount of BTUs/hr. and, based on its AFUE (output), provide the required amount of BTUs/hr. to heat the building. Note that the higher the AFUE, the more efficiently the equipment converts the heat that is generated by combustion into heat that is delivered to the distribution system.

## APPENDIX B

## GUIDELINES FOR COMPARING HEATING EQUIPMENT OPERATING COSTS AND CALCULATING PAYBACK

Once the right "size" heating equipment is determined, the next important step towards ensuring efficiency and affordability is selecting a cost effective model. This guideline, which is based on the procedure outlined in the GAMA Consumer's Directory of Certified Energy Ratings, is intended to help in the selection process. It is useful in comparing the fuel consumption operating costs of models using the same type of fuel or a different type of fuel. In order to complete the steps, several things must be known:

1. The Design Heating Requirement (DHR). This is the BTU/hr. heating load for the building (as calculated in Appendix A).

2. The Heating Load Hours (HLH). This is the number of hours per year that the equipment is expected to operate. For most of Ohio, there are 2,500 HLH. Parts of extreme northern Ohio have 3,000 HLH.

3. The BTU/hr. input rating and the AFUE of the various equipment models to be compared. This is published by GAMA for those manufacturers participating in the certification program.

4. The BTU content of the fuel. The BTU content of the following fuels are:

| | |
|---|---|
| Natural gas | 1,000 BTUs per cu./ft. or 1,000,000 BTUs per therm |
| Propane | 92,000 BTUs per gal |
| Fuel Oil | 139,000 BTUs per gal |
| Electricity | 3,413 BTUs per kWh |

5. The cost of the fuel. This should be readily available from the utility or fuel supplier.

STEP 1: Calculating the Equipment Operating Hours

Complete the following formula:

.77 x HLH x DHR/1,000 x A = Operating Hours

Where:.77 = the adjustment factor constant recommended by the US DOE.
HLH = the Heating Load Hours for the locality.
DHR/1000 = the Design Heating Requirement divided by 1,000.
A = 100,000 divided by the result of multiplying the equipment's Btu/hr input rating by the equipment's AFUE %.

STEP 2: Calculating the Estimated Annual Energy Consumption (EAEC)

Multiply the equipment's BTU/hr. input rating times the number of operating hours from Step 1.

STEP 3: Calculating the Estimated Annual Operating Cost (EAOC)

Complete the following formula:

EAEC x 1 divided by the BTU content of the fuel x the fuel cost = EAOC

Where: EAEC = the result of Step 2
BTU content = the number of Btus per unit of fuel (gal., therm, kWh, etc.)
Fuel cost = dollars or cents per unit of fuel (dollars per gal., cents per therm, etc.)

STEP 4: Repeat the above three steps for each model or fuel type for the heating equipment being considered. After the EAOC for each model or fuel type has been calculated, the results can be compared to determine which is the most cost-effective.

STEP 5: Calculating Payback

a. Subtract the additional cost of installing the higher AFUE equipment from the cost of installing the lower AFUE equipment. This is the amount of additional cost required to buy and install the more efficient equipment.

b. Subtract the EAOC of the higher AFUE equipment from the EAOC of the lower AFUE equipment. This is amount of money the higher AFUE will save each year of operation over the cost of the lower AFUE equipment.

c. Divide the annual savings (from 5b) into the additional cost (from 5a). The result is the number of years before the savings generated by the higher AFUE equipment will off-set the increased cost of installing the higher AFUE equipment. After that time, the savings will accrue to the owner.

## APPENDIX C

## TABLES FOR ACCEPTABLE FLUE GAS MEASUREMENTS

### Table C-1: Flue Gas Measurements for Space Heating Equipment

Measuring the flue gas for content and temperature is a direct means of determining the equipment's combustion performance. Measurements that are within the ranges listed below indicate that the equipment is operating acceptably. Measurements that are outside of these ranges indicate that combustion is less than optimal and that adjustments are needed. The following measurements are taken from the ODOD Weatherization Program Standards which use the industry standards as accepted by ANSI and manufacturer installation instructions (PMI).

| Heating Equipment Type | Oxygen (O2) | Net Stack Temperature | Smoke Test | Carb. Monoxide (CO) max. ppm |
|---|---|---|---|---|
| Gas Atmospheric | 4% - 9% | 300F - 600F | N/A | 100 ppm |
| Gas Fan Assisted | 4% - 9% | 300F - 480F | N/A | 100 ppm |
| Gas Condensing | PMI | PMI | N/A | 100 ppm |
| Space Heater | 5% - 15% | 300F - 650F | N/A | 100 ppm |
| Gas Power Burner | 4% - 9% | 275F - 550F | N/A | 100 ppm |
| Oil Standard Burner | 4% - 9% | 325F - 600F | 1 or less | 100 ppm |
| Oil Flame Retention | 4% - 7% , or CO2 11% + | 325F - 600F | 1 or less | 100 ppm |
| Oil Condensing | PMI | PMI | 1 or less | 100 ppm |

**Table C-2: Flue Gas Measurements For Water Heating Equipment**

As with space heating equipment, measuring the flue gas content and temperature of water heaters is a means of determining the equipment's combustion performance. Measurements that are within the ranges listed below indicate acceptable performance. Measurements that are outside of these ranges indicate that combustion is less than optimal and that adjustments are needed. The measurements are taken from the ODOD Weatherization Program Standards which use the industry standards as accepted by ANSI.

| DHW Unit Type | (O2) Oxygen | Net Stack Temperature | Smoke Test | (CO) Carbon Monoxide Max. Ppm |
|---|---|---|---|---|
| GAS (natural gas, propane, Atmospheric | 4 - 9 % | 300-600 degrees Fahrenheit | N/A | 100 |
| Fan Assisted | 4 - 9% | 300- 480 degrees Fahrenheit | N/A | 100 |
| OIL<br>Standard Oil burner | 4 - 9% | 325 - 600 degrees Fahrenheit | 1 or less | 100 |
| Flame Retention | 4 - 7 % | 325- 600 degrees Fahrenheit | 1 or less | 100 |

## APPENDIX D

## CALCULATIONS FOR DETERMINING SEASONAL HEAT LOSS AND PAYBACK

This appendix is intended to provide a mechanism for determining the cost-effectiveness of installing insulation in cases when there is doubt. In most cases, insulation is cost-effective and the RRS has set standards for attic, wall and floor R-values. However, there may be instances when the cost-effectiveness of adding insulation is not clear. For example, there may be a question whether adding more insulation to an already insulated space is economically worthwhile. Or, the same doubt may exist when any one of a number of factors exist, such as: low fuel cost, high installation cost, small area, etc.

Several things must be known before the calculation can be completed:

1, The R-value (measurement of heat flow resistance) of the materials in the area in question;

2. The U-value (measurement of heat flow) of the materials in the area in question. U-value is the reciprocal of R-value and represents the number of BTUs/hr./sq. ft. flowing through the material;

3. The Heating Degree Days (HDD) for the locality. HDDs represent the number days the outdoor temperature is below 65 F times the number of degrees difference between 65 F and the actual outdoor temperature. HDDs are generally averaged over 30 years and are available for large cities. For Ohio, Cincinnati has approximately 4,410 HDDs, Columbus approximately 5,660 HDDs, Cleveland approximately 6,351 HDDs, Akron approximately 6,037 HDDs, Dayton approximately 5,622 HDDs, Mansfield approximately 6,403 HDDs, Toledo approximately 6,491 HHDs and Youngstown approximately 6,417 HDDs;

4. The size (square foot area) of the area in question; and

5. The cost of the fuel per unit (dollars per gal, cents per therm, cents per kWh, etc.).

STEP 1: Calculating Seasonal Heat Loss Without Insulation

Complete the following formula:

$$U \times A \times T \times 24 = Q$$

Where: U = the U-value of the building materials (Btus/hr/sq.ft.)
A = the surface area of the building materials (sq.ft.)
T = HDDs
24 = the number of hours in one day
Q = the total annual amount of heat loss (Million Btus or therms)

STEP 2: Calculating Seasonal Heat Loss With Insulation

Repeat the formula in Step 1 using the U-value that would exist assuming the building component is insulated.

STEP 3: Calculating Energy Savings and Dollar Savings

a. Subtract the amount of annual heat loss calculated after insulation (the result of Step 2) from the amount of annual heat loss calculated before insulation (result of Step 1). The result is the amount of energy that will be saved each year (Million Btus or therms).

b. Multiply the amount of energy saved by its cost. The result is the amount of money that will be saved each year.

STEP 4: Calculating Payback and Annual Return

a. Multiply the cost to install one square foot of insulation by the total number of square feet of area to be insulated. The result is the total cost of the insulation work.

b. Divide the amount of money saved (the result of Step 3, b) into the total cost of the insulation work (the result of Step 4, a). The result is the number of years it will take for the annual savings achieved by the insulation to off-set the additional cost to install it. After that time, the savings will accrue to the owner.

c. For the annual rate of return, divide the cost of the insulation work by the money saved.

## APPENDIX E

## GUIDELINES FOR SIZING WATER HEATERS AND CALCULATING PAYBACK

This appendix is offered as a guide for selecting an appliance which will meet the needs of the household efficiently and economically. Two approaches are offered. One approach is to simply use Table 3301.2 in CABO Chapter 33. Table 3301.2 provides recommended water heater storage capacity, BTU/hr input, draw and recovery rates based on the number of bathrooms and bedrooms present in the home. A sample portion of the information found in Table 3301.2 is provided below:

Dwellings with 1 to 1 and 1/2 Bathrooms

| Type of Fuel | Gas | Electric | Oil | Gas | Electric | Oil |
|---|---|---|---|---|---|---|
| Number of Bedrooms | 2 | 2 | 2 | 3 | 3 | 3 |
| Storage (gals) | 30 | 30 | 30 | 30 | 40 | 30 |
| Input (BTU/hr or kw) | 36K | 3.5 | 70K | 36K | 4.5 | 70K |
| Draw (gph) | 60 | 44 | 89 | 60 | 58 | 89 |
| Recovery (gph) | 30 | 14 | 59 | 30 | 18 | 59 |

Dwellings with 2 to 2 and 1/2 Bathrooms

| Type of Fuel | Gas | Electric | Oil | Gas | Electric | Oil |
|---|---|---|---|---|---|---|
| Number of Bedrooms | 3 | 3 | 3 | 4 | 4 | 4 |
| Storage (gals) | 40 | 50 | 30 | 40 | 50 | 30 |
| Input (BTU/hr or kw) | 36K | 5.5 | 70K | 36K | 5.5 | 70k |
| Draw (gph) | 70 | 72 | 89 | 72 | 72 | 89 |
| Recovery (gph) | 30 | 22 | 59 | 32 | 22 | 59 |

Another approach is to use the procedure outlined in the GAMA Consumer's Directory of Certified Energy Ratings. This approach is more exact in that it considers estimated water usage to determine the right "size" equipment. Also, it includes methodology for estimating and comparing the operating costs of equipment in order to select the most cost-effective appliance. Before completing the steps, there are several things that must be known:

1. The number of plumbing fixtures in the dwelling

2. The number of occupants in the household and their general use patterns. This is critical in order to establish the time of day and the frequency that hot water is used. For example, when are baths or showers taken, clothes washed and dishes washed? The purpose of this is to establish the peak demand for the first hour of usage.

3. The Energy Factor (EF) of the models of water heaters being considered for installation. This information is available in the GAMA directory for those manufacturers participating in the certification program.

4. The cost to install the models of water heaters being considered.

STEP 1: Estimating Peak Hour Demand (Sizing the Water Heater)

a. Multiply the number of activities using hot water during the busiest hour of the day times the estimated average number of gallons used per activity. Some activities and estimated average usages are; bath/shower - 20 gals., shaving - 2 gals., hand/face washing - 4 gals., shampooing - 4 gals., hand dishwashing - 4 gals. and automatic clothes washing - 32 gals.

b. Add the estimated average usages for the first hour. The result is the household's peak first hour demand.

c. Select models of water heaters that have a peak first hour demand rating that is close (give or take 2 gals./hr) to the peak first hour demand for the household. This information is available in the GAMA directory.

STEP 2: Calculating Payback

a. Determine the water heater's estimated annual operating cost by using the chart provided in the GAMA directory. Find the chart for the appliance's fuel. Find the column for the appliance's EF. Find the row for the appropriate fuel cost. Follow the row across to the intersection of the EF column. The result is the appliance's estimated annual fuel operating cost. Repeat for each model to be considered.

b. Subtract the installation cost of the higher EF model from the installation cost of the lower EF model. This is the amount of additional costs required to buy and install the higher EF model.

C. Subtract the annual estimated operating cost of the higher EF model from the estimated annual operating cost of the lower EF model. This is the amount of money the higher EF model will save each year of operation over the lower EF model.

d. Divide the annual savings (from Step 2, c) into the additional costs (from Step 2, b). The result is the number of years before the savings generated by the higher EF model will off-set the increased cost of installing the higher EF model. After that time, the savings will accrue to the owner.

# APPENDIX F

## SUMMARY OF ELECTRICAL REQUIREMENTS

This appendix is provided as a quick reference for fixture and receptacle location, GFCI receptacle location, mechanical execution of work requirements and a general description of what constitutes the electrical system. It is provided only as a supplement to the requirements outlined in the RRS, CABO and the NEC. OHCP advises grantees to refer to the codes for a detailed description of the requirements.

### Fixture and Receptacle Location Requirements

Kitchen

1. All kitchen receptacles shall be on a three wire grounded 20 amp circuit and shall be GFCI protected unless for a dedicated appliance on a dedicated circuit (see NEC Article 210-8(a)(5)b).

2. Receptacle outlets shall be installed at each kitchen wall counter space 12 inches or wider and shall be installed so that no point along the counter line is more than 24 inches from a receptacle outlet in that space (see NEC Article 210-52)

3. Two 20 amp small appliance branch circuits serving only the kitchen are required. The number of small appliances shall be taken into consideration when planning the circuit loads and placement of the outlets to avoid overloading and the use of extension cords or temporary multiplex outlets.

4. A permanently installed overhead lighting fixture controlled by a wall switch is required.

5. Appliance outlets installed for a specific appliance, such as a refrigerator, must be installed within 6 feet of the specific appliance.

Bathroom

1. The bathroom shall be required to have at least one receptacle outlet, which shall be GFCI protected, and shall be located at least thirty (30) inches and not more than 48 inches above the floor adjacent to the lavatory and not more than four feet from the lavatory and at least twelve inches from the outer rim of any bathtub or shower opening.

2. A permanently mounted switch controlled ceiling or wall lighting fixture is required which is not to be power from the dedicated bathroom 20 amp circuit. No hanging fixture or lighting track can be located over the tub unless it is over 8 feet and cannot be located within 3 feet of the outside of tub.

3. Exhaust fans shall include a closure device that seals the duct when the fan is not operating. Ducts shall lead directly to the outside air (see ducting requirements noted in RRS Section 2.8.1.

A fan/light combo shall operate independently of each other, each having a separate grounded control switch. New exhaust fans shall be properly sized to change the volume of air in the bathroom every 12 minutes. Exhaust fans should be certified to operate at a Cubic Feet per Minute (CFM) capacity to sone rating of no lower than 10 CFM per sone.

Laundry Room/Area

1. Every laundry room or laundry area shall have a receptacle outlet on a separate 20 amp circuit (see NEC Article 220-4c). Note that the clothes dryer is not considered part of the laundry circuit, the dryer requires an independent appliance circuit.

2. The laundry room/area shall have a lighting fixture controlled by a wall switch.

Unfinished Basement and Garage

1. Outlets installed in unfinished basements and or crawl spaces shall be GFCI protected (see NEC Article 210-8 (a) (4). Exception- a receptacle located in a dedicated space for an appliance, such as a washing machine, or receptacles not readily accessible. A GFCI receptacle is required in the unfinished basement in addition to the laundry outlet.

2. Every basement shall have at least one switch controlled light fixture and one general purpose outlet. When installing a new light fixture safety should be a prime consideration, and the fixture should provide a means of protection for the bulb.

3. Every attached garage (and detached garages with power), shall have at least one receptacle outlet which is to be GFCI protected. Existing wiring in garages shall be free of Electrical hazards. Placement of outlets in garages at least 48" above floor is recommended.

Attic and Crawlspace

A permanent electric light fixture and outlet shall be installed when access to equipment, such as furnaces, is needed. The light shall be controlled by a switch located at the passageway opening.

Equipment

1. Furnaces and Air Conditioning equipment should have their own electrical disconnects which are within sight of and readily accessible from equipment for which it is intended and are of correct amperage and installed in accordance with all relevant NEC provisions. Thermostats for heating and cooling equipment shall be operable and properly wired to equipment with all wires properly concealed. Wiring for room air conditioners shall conform to NEC Article 440-60 thru 64.

2. A permanent electrical receptacle and lighting fixture shall be provided near all heating appliances located in enclosed rooms, attics and crawlspaces.

3. Electrical circuits for well pumps (jet pumps or submersible pumps), sump pumps, and septic aerators shall be in accordance with NEC requirements.

## Ground Fault Circuit Interrupter Protection Required per NEC Article 210-8(a)

All 15 amp and 20 amp receptacles installed in the locations specified below shall have ground-fault circuit interrupter (GFCI) protection for personnel.

1. Bathrooms

2. Garages. (except inaccessible receptacles such as door openers or dedicated space for appliance that in normal use is not easily moved such as a freezer or refrigerator.)

3. Unfinished Basements. (Except inaccessible receptacles, and a single or duplex receptacle for two appliances located within dedicated space for each appliance that in normal use is not easily moved from one place to another, and that is cord and plug connected in accordance with Article 400-7 (a) (6), (a) (7), or (a) (8).

   Receptacles installed under exceptions to Section 210-8 (5) shall not be considered as meeting the requirements of Section 210-52 (g) which states that at least one receptacle outlet, in addition to any provided for laundry equipment, shall be installed in each basement and in each attached garage, and in each detached garage with power.

4. Outdoors

5. Crawlspaces. (at or below grade level)

6. Kitchens. Receptacles installed to serve counter top surfaces.

7. Wet bar sinks

## MECHANICAL EXECUTION OF WORK

Section 110-12 of the NEC covers the " Mechanical Execution of Work" and requires a neat and workmanlike installation of all electric equipment. "Equipment includes materials, fittings, devices, appliances, fixtures, apparatus, and the like used as part of, or in connection with an electrical installation". Some examples of mechanical execution of work include the following:

1. Effective closing of unused openings in outlet, device, pull and junction boxes, conduit bodies and fittings, raceways, auxiliary gutters, cabinets, equipment cases or housings.

   Note: Any unused opening must be effectively closed with knockout seals or other materials that will provide substantial protection that is equivalent to that of the wall of a box or piece of equipment, for example.

2. Conductor insulation not damaged, including nicked wires at the ends of their terminations.

3. Cable assemblies not kinked or with excessive bends that are sharper than the permitted radius.

   Note: Bends in cable assemblies must not have a radius that is less than five times the diameter of the cable. See NEC Sections 338-8 and 336-14.

4. Staples used to secure cables assemblies not driven too tightly, In some cases insulate types of staples may provide better protection against damage.

5. All terminations made in accordance with the manufacturers' instructions provided on the equipment.

6. Use of proper tools for bending raceways.

7. Making sure all equipment is cleaned both inside and outside before it is energized.

8. Verifying that connections of all metal electrical cables, raceways, and equipment will result in compliance with rules pertaining to grounding continuity.

9. Protection against physical damage for exposed electrical equipment during and after construction.

   Note: NEC Section 110-12C requires that electrical equipment be protected from damage by other trades during construction.

## ELECTRICAL SYSTEM COMPONENTS

## ELECTRIC SERVICE

An electric service is required for all buildings containing an electrical system and receiving electrical energy from a utility company. The main electrical power line to your house is called the service

Exterior Service and Meter**:** From the transformer, the power company brings electricity into a home via overhead wires or underground cables. In most localities the exterior service from the pole to the meter, including the meter and base, belongs to the power company and is maintained by the power company. The overhead wiring that swings from the utility pole to the house is called the service drop or triplex (three wires spice into the service cable). The power company and local inspectors will have specific requirements for the location and placement of the service drop and the point of attachment, therefore, coordination and preplanning will be required to meet these requirements.

Service Entrance: The utility's wires are spliced to the service entrance wires, which are usually encased in metal tubing called conduit, or combined in a thick insulated wire called service entrance (SE) cable. In an overhead service entrance, the utility's wires may be attached directly to the house with nonconductive insulators (porcelain) or to an approved mast, which is a galvanized pipe that rises above the roof and continues downward to the meter. There should be a weather head/goose neck or service head and loosely draped wires (drip loop). In both types of installation the entrance head is higher than the incoming wires to prevent water from draining into the electrical system. From the service head, the wires pass through the meter, which records the electricity usage, and into the main service panel. The service entrance always ends at the service panel.

Service Panel: The panel board or load center is the distribution point for all electrical power brought into the house. The service panel is also known as the fuse box, circuit breaker panel, main, or service equipment. Branch circuits in the service panel provide power for three types of circuits-20 amp general lighting circuits, 20 amp small appliance circuits, and 20-70 amps for individual appliances or special circuits. Branch circuits are designed to carry only a certain amperage. Each circuit is protected at the service panel by an overcurrent protection device, either a fuse or a circuit breaker which stops the flow of current by tripping or blowing when this rating is exceeded. All new installations of service panels or modifications to existing panels shall conform to NEC Article 230.

Premises Wiring System: The premises wiring system begins at the load end of the service drop (drip loop or service head) or the load end of the underground service lateral and ends at the outlet. This includes interior and exterior wiring, outside branch circuits and feeders installed on or between buildings that supply energy to motors, lighting and controls, and signal circuit wiring that are combined or used with any hardware, fittings, and wiring devices that may be temporarily or permanently installed.

## APPENDIX G

## GUIDELINES FOR SIZING PLUMBING SUPPLY LINES

Following is a simplified procedure for helping to determine the adequacy of existing water supply lines and in the sizing of new water supply lines. For this method to be reasonably accurate the water pressure at the main shut-off valve where the water comes into the building must be within the range specified in 5.2.2.1 (40-80 psi) and the elevation of the highest fixture above the service valve must be less than 25 feet. For more detailed, more accurate methodology or for systems outside the above parameters the following references might be useful: OPC Appendix E, CABO Appendix C; Practical Plumbing Engineering by Cyril M. Harris, and Do-It-Yourself Plumbing by Max Alth (see the bibliography for complete listings). Other variables such as age of piping, number and type of fittings, and design of fixtures also affect the pressure. For this reason no formula or procedure can account for all variables and be fully relied upon to fit every situation, but must be augmented with actual field testing and experience. However, this procedure can serve as a basic guideline for proper sizing of water supply piping. Following are the steps in the process:

1. For each pipe interval, determine the fixture load that it carries using Table G1 (for multiple fixtures use the guidelines set out below).

   A. Only count hose bibs at 50% when adding to the total load.
   B. When combining three or more fixtures (not fixture groups), multiply by .9.
   C. When combining one or more fixtures with a fixture group, multiply by .9.
   D. When combining two fixture groups multiply by .8.
   E. When combining three or more fixture groups or two or more fixture groups + one or more fixtures multiply by .7.
   F. Use fixture groups when possible.

### TABLE G1

| Water Demand of Fixtures and Fixture Groups in Gallons Per Minute | | | |
|---|---|---|---|
| Fixture Type Or Group | Total | Hot | Cold |
| Lavatory Faucet | 2 | 1.5 | 1.5 |
| Bathtub Faucet Or Shower Head | 5 | 4 | 3.5 |
| Toilet Tank | 3 | | 3 |
| Kitchen Sink | 4 | 3 | 3 |
| Dishwasher | 4 | 4 | |
| Laundry Tub | 5 | 3.25 | 3.25 |
| Washing Machine | 5 | 3.5 | 4 |
| Hose Bib | 5 | | 5 |
| | | | |

| Water Demand of Fixtures and Fixture Groups in Gallons Per Minute | | | |
|---|---|---|---|
| Kitchen Group (Sink and Dishwasher) | 7 | 5.5 | 3* |
| Laundry Group (W. M. And L. Tub) | 8 | 6 | 6.5 |
| 1/2 Bath Group (Lavatory and Toilet) | 4.5 | 1.5* | 4 |
| Full Bath Group (Lav., Toilet, Tub/Sh.) | 8 | 5.5 | 7 |
| 1 1/2 Bath Group | 9.5 | 7 | 7.5 |
| 2 Bath Group | 12 | 9.5 | 8.5 |
| 2 1/2 Bath Group | 13 | 10 | 9 |
| 3 Bath Group | 15 | 11.5 | 10 |

* Really a single fixture and not a fixture group.

2. Determine the type of piping that was or is to be used.

3. Using Table G2 below determine the size of the piping necessary to carry the amount of demand from the calculations above.

**TABLE G2**

**PIPE SIZING BASED ON VELOCITY LIMITATION[i]**

| Flow of pipe in gallons per minute[ii] | | | | | |
|---|---|---|---|---|---|
| Nominal Pipe Size (Inches) | Copper Water Tube[iii] | | | CPVC[iv] or Polyethylene[v] | Steel Pipe[vi] |
| | Type K | Type L | Type M | | |
| 1/2 | 5.4 | 5.8 | 6.3 | 7.6 | 7.6 |
| 3/4 | 10.9 | 12.1 | 12.9 | 13.3 | 13.3 |
| 1 | 19.4 | 20.6 | 21.8 | 21.5 | 21.5 |
| 1 1/4 | 30.3 | 31.3 | 32.6 | 37.3 | 37.3 |

1. Pipe sizing based on velocities of 8 feet per second to avoid excessive noise in system; shock damage to pipe, fittings, and equipment; and accelerated corrosion.

2. Actual flow also depends on the roughness of the pipe and the amount of mineral deposition inside the pipes, which will vary with the age of the pipe and the water quality, especially with galvanized pipe.

3. Flow rates are based on copper water tube which conforms to ASTM B 88.

4. Flow rates are based on chlorinated polyvinyl chloride pipe, schedule 40, which conforms

to ASTM F 441.

5. Flow rates based on polyethylene pipe, schedule 40, which conforms to ASTM D 2447.

6. Flow rates based on galvanized steel pipe, schedule 40, which conforms to ASTM A 53.

# APPENDIX H

## MINIMUM POST-REHABILITATION CONDITIONS AND REQUIRED INSPECTIONS

This appendix summarizes the condition a dwelling must be in after it has been rehabilitated. It also lists the specialized inspections that are required. This appendix is not intended as a detailed checklist of specific items which an inspector would use to determine compliance with the RRS or as a prioritized ranking of rehabilitation measures.

### Minimum Post-Rehabilitation Conditions

1. The foundation shall be structurally sound. The foundation walls, piers and columns, and the basement shall be free of significant deterioration, severe moisture accumulation or other conditions which threaten the stability of the dwelling. Foundation walls, including basement windows and doors, shall be weather tight. Enclosed crawlspaces shall be ventilated.

2. The floors shall be structurally sound, reasonably flat and horizontal. In habitable spaces, floor covering materials should be safe, durable and easy to maintain. In kitchens and bathrooms, floor covering materials should be safe and impervious to water.

3. The exterior walls shall be structurally sound. The exterior wall covering materials shall be securely fastened to the wall, weather tight and free of significant deterioration. Exterior wood materials which are subject to decay shall be painted.

4. The windows and exterior doors shall be structurally sound, weather tight and functional. Exterior wood materials which are subject to decay shall be painted.

5. The interior wall and ceiling surfaces shall be durable and free of significant defects or deterioration. The interior doors shall be structurally sound and functional.

6. The roof shall be structurally sound and properly pitched. The roof covering materials shall be durable and watertight. The gutters and down spouts shall effectively collect and drain water.

7. The walls, ceilings and floors separating the conditioned and unconditioned spaces shall be insulated and free from pathways allowing significant uncontrolled exchange of conditioned and unconditioned air.

8. The structures attached to the dwelling (e.g. porches, balconies, unhabitable additions, etc.) shall be safe and reasonably structurally sound. Exterior wood materials which are subject to decay shall be painted.

9. The stairs shall be safe and structurally sound.

10. The chimney shall be structurally sound and provide a safe and unobstructed flue to conduct combustion by-products to the outside.

11. The heating system (i.e. heating equipment and heat distribution system) shall be safe, efficient and able to provide adequate heat to all conditioned spaces within the dwelling.

12. The electrical system shall be safe and provide adequate service for the occupants. This includes an adequately sized service (minimum 100 amp) with the proper number of circuits and the proper number and location of switches, receptacles, lighting fixtures and smoke detectors. The electrical system shall be free of hazards and defects, including but not limited to; over-loaded circuits, improper over-current protection, improper grounding, improper or unsafe conductors and splices, and other improper or unsafe materials and installations.

13. The plumbing system shall be safe, functional and provide adequate service for the occupants. This includes a safe and adequate supply of potable water to all fixtures; sanitary and functional fixtures; a safe and adequate water heating appliance; and a safe and effective drain, waste and vent system. The plumbing system shall be free of hazards and defects, including but not limited to; contamination, leaks, corrosion, improper materials and installations, and conditions which subject the system to backflow, damage or freezing.

14. The premises shall be reasonably safe, sanitary and free of an excessive accumulation of rubbish, insect and rodent infestation, and other conditions which constitute a hazard or a blight to the property or the neighborhood. The interior environment shall be free of known hazards to the occupant's health.

15. The interior shall provide adequate space for cooking and eating, sleeping, bathing and other general living activities. The amount of living space, lighting, ventilation, access, and storage shall be adequate for the occupants. Safe egress shall be provided. The kitchen must have a properly functioning sink, adequate space for cooking and refrigeration equipment, and adequate space for food preparation and storage. The bathroom/toilet room must provide privacy and have a properly functioning lavatory, toilet and tub or tub/shower. Bedrooms must provide privacy.

## Required Inspections and Tests

1. The dwelling shall be inspected for evidence of wood-boring insect infestation and damage.

2. If potable water is supplied from a private well located on the premises, a test to determine the quality of the water shall be performed by qualified personnel.

3. If sewage is treated by a private system located on the premises, an inspection to determine the effectiveness of the sewage treatment system shall be performed by qualified personnel.

4. The plumbing system (supply and DWV) shall be inspected for evidence of leaks, hazardous conditions, improper materials, improper installations and inadequate service.

5. The electrical system shall be inspected for evidence of hazardous conditions, improper materials, improper installations and inadequate service.

6. The heating equipment (i.e. space heating equipment and water heating equipment) and the fuel supply lines and venting systems to which they are connected, shall be inspected for evidence of hazardous conditions, improper materials and improper installations. In addition, fuel-fired heating equipment shall be tested for operational safety and efficiency.

7. The fuel-gas system shall be tested for evidence of leaks and inspected for improper sizing, improper materials and improper installations.

# APPENDIX I

## ABBREVIATIONS

**ACCA** Air Conditioning Contractors of America

**ANSI** American National Standards Institute

**ASHRAE** American Society of Heating, Refrigeration & Air Conditioning Engineers

**ASSE** American Society of Safety Engineers

**ASTM** American Society for Testing and Materials

**BOCA NPMC** Building Officials & Code Administrators of America, National Property Maintenance Code

**CABO** Council of American Building Officials, One and Two Family Dwelling Code

**CABO MEC** Council of American Building Officials, Model Energy Code

**CSA** Canadian Standard Approval

**EPA** Environmental Protection Agency (includes federal and state agencies)

**FEMA** Federal Emergency Management Agency

**GAMA** Gas Appliance Manufacturers Association

**HUD** U.S. Department of Housing and Urban Development

**NFPA** National Fire Protection Association

**ODH** Ohio Department of Health

**OHCP** Office of Housing & Community Partnerships

**OHPO** Ohio Historic Preservation Office

**OPC** Ohio Plumbing Code

**OSHA** Occupational Safety & Health Administration

**UFAS** Uniform Federal Accessibility Standards

**UL** Underwriter's Laboratory

## APPENDIX J

## DEFINITIONS

**Attic** That portion of a building which is between the roof and the ceiling of the top floor. In 1 1/2 story buildings, the attic includes the area behind the kneewall.

**Basement** That portion of a building which is partly or completely below grade. Basements are enclosed by the foundation walls and may be habitable or unhabitable. In general, basements have sufficient headroom to enter and move about.

**Bathroom** A room containing plumbing fixtures including a bathtub, shower or combination bathtub/shower. In most single-family residential dwellings, the bathroom will also contain a toilet (water closet) and a lavatory. However, in the context of the RRS, a room containing a toilet and a lavatory (i.e. a "toilet room") shall also be considered a bathroom.

**Bedroom** A room designated for sleeping. In most single family residential dwellings, bedrooms are separate rooms used exclusively for sleeping. However, in the context of the RRS, other habitable rooms (e.g. living room, dining room, parlor, den, etc.) which are used for sleeping shall be considered bedrooms.

**Blower Door** A calibrated device consisting of a high velocity fan, pressure sensitive gauges and a simple computer used to pressurize (or de-pressurize) a dwelling and therefore quantify and locate air movement.

**Building Shell** The building's wall, ceiling and floor assemblies that make up the exterior boundaries. Regarding energy efficiency measures, the building shell refers to the boundaries between the conditioned and unconditioned spaces (i.e. thermal boundaries).

**Cellar** A basement space which is unfinished and unhabitable. In many cases, cellars have dirt, stone or brick floors.

**Combustion Equipment** Equipment or appliances that produce heat by the on-site burning of gaseous, liquid or solid fuel. Examples of combustion equipment include; furnaces, space heaters, fireplaces, water heaters, ranges, cook top stoves and clothes dryers. Combustion equipment may also be referred to as fuel-burning equipment.

**Conditioned** Those portions of a building in which the air is heated (or **Space** cooled)to maintain comfort for the occupant and/or to protect the building's systems, such as protecting water lines from freezing. In the context of the RRS, conditioned spaces are generally spaces which are intentionally heated (or cooled) and therefore are within the building's thermal boundary. Spaces which are unintentionally conditioned, such as a furnace room or a basement with ducts running through it, shall be considered unconditioned.

| | |
|---|---|
| **Crawlspace** | The space between the floor of the building and the grade below. Crawlspaces may be enclosed by the foundation walls or open the outside. |
| **Direct-Vent Equipment** | High energy efficient space and water heating equipment that, with the aid of draft inducing fans, receive combustion air directly from the outside, burn fuel within a sealed combustion chamber and vent combustion by-products horizontally through the sidewall. |
| **Dwelling or Dwelling Unit** | A single unit providing complete independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking and sanitation. |
| **Electrical System** | In the context of the RRS, the electrical system shall include all components of the dwelling and premises wiring system, from the load end of the service drop (or underground lateral) to the receptacle or fixture. This includes the service entrance, the service panel and over-current protection devices, the wiring circuitry and the fixtures. |
| **Functional** | **I**n the context of the RRS, functional means that a thing operates or fulfills the purpose for which it was designed and intended. Functional implies that the thing is in good repair and works without problems. |
| **Fuel-Burning Equipment** | See "combustion equipment". Generally refers to furnaces and water heaters. |
| **Habitable Space** | Space within a dwelling designated for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, storage or utility rooms, halls, and similar spaces are not considered habitable spaces. |
| **Heating Distribution System** | The ducts or piping which conduct the heated air or fluid from the heating equipment to the space and back to the heating equipment. Warm-air distribution systems include the plenum, supply and return ducts, connectors, the fan and air handler components, registers and dampers. Hydronic distribution systems include supply and return piping, connectors, pumps, valves, expansion tanks and radiators. |
| **Heating Equipment** | In the context of the RRS, heating equipment refers to appliances designed and used exclusively for heating the space within the dwelling. Examples include furnaces, space heaters, boilers and baseboard heaters. Heating equipment may be fuel-burning or electric and stationary or portable. Other appliances that produce heat, but are not designed for space heating, such as kitchen ranges and cooktop stoves, are not considered heating equipment. |
| **Hydronic System** | Hot water or steam heating equipment and distribution system. |
| **Kitchen** | A room designated for preparing food. In most single-family residences, a kitchen is a separate room or distinct part of a room used exclusively for cooking. In the context of the RRS, a kitchen must have adequate space for a cooking appliance and a refrigerator, a sink and adequate storage and counter top space. |

| | |
|---|---|
| **Kneewall** | A short stud wall connecting the floor and the roof framing members which separates a room from an attic area. |
| **Occupiable Space** | Space within a dwelling other than that designated for living, sleeping, eating or cooking. Occupiable spaces include areas such as bathrooms, toilet rooms, closets, halls, storage and utility rooms. |
| **Primary Heating Equipment** | Heating equipment used as the main source for space heating. Generally, primary heating equipment is permanent and stationary. Portable space heaters are generally secondary heat sources used as back up or in emergencies. |
| **Plumbing System** | In the context of the RRS, the plumbing system shall include all components of the water supply and sanitary disposal system in the dwelling unit and on the premises. The water supply system includes the supply (if a well is present), supply piping, connectors, water heater, valves and fixtures. The sanitary disposal system includes the drain, waste and vent pipes, traps, sewer connections and septic (if present). |
| **Qualified Person** | Person demonstrating the knowledge, skill and experience required to perform the work in accordance with the RRS or referenced code. Regarding electrical, plumbing and HVAC work, qualified may mean a person who is certified or licensed, or whose primary occupation is in those residential trades. |
| **Unconditioned Space** | Those portions of a building which are not heated (or not cooled). In the context of the RRS, these areas are generally those which are intentionally not heated (or cooled). |
| **Unhabitable Space** | The spaces in a building or a structure on the premises which are not designed or built for habitation and therefore are inappropriate for residential living. Generally, unhabitable spaces are outside of the dwelling's thermal boundaries. Examples of unhabitable spaces include; unfinished attics and basements, garages, porches, sheds and other out-buildings. |
| **Vapor Retardant** | A material that retards the passage of water vapor. Vapor retardants must have a permeance rated at not greater than 1 perm. Commonly used vapor retardants include, 6 mil polyethylene sheeting and specialty paints. |

## APPENDIX K

## CODE REFERENCES


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