



WEATHERIZATION:

Mobile Home Measures

PRESENTED BY PROACTION OF STEUBEN AND YATES, INC.

ENERGY PROGRAMS



- Mobile homes comprise at least **25%** of the households that qualify for Weatherization nationwide.
- In Steuben and Yates Counties, they account for over **30%** of our weatherization projects.



The Federal Manufactured Housing and Construction Standards (24 CFR 3280), administered by the U.S. Department of Housing and Urban Development (HUD), went into effect on June 15, 1976.

The HUD Code sets a standard for strength and durability, transportability, fire resistance, energy efficiency and quality of manufactured homes. It also sets performance standards for the heating, plumbing, air conditioning, and thermal and electrical systems.

Mobile homes built before 1976 consume **1.5 to 2 times more energy** than a site-built home.

Why?

- ▶ Low thermal mass (thin and poorly insulated floors, walls, and ceilings)
- ▶ Conductive materials (metal windows and door frames)
- ▶ Large open areas and penetrations in the floor system
- ▶ High surface-to-floor area ratio
- ▶ Poor duct design, components, and installation



Photo courtesy of the US Department of Energy

Energy Audit Process

- An instrumented audit of the mobile home will be conducted by a trained energy auditor. The auditor will evaluate the unit and based on existing conditions and completed test results, make recommendations to improve the efficiency of the home, as well as address any existing health and safety issues.
- All measures are entered into NY state approved audit software to guide the auditor as to which measures will show a positive savings to investment ratio (SIR). Energy retrofit measures that receive an SIR of 1 or greater can be considered for inclusion in the final workscope. There is no SIR needed for health and safety measures.

Tools of the Instrumented Audit

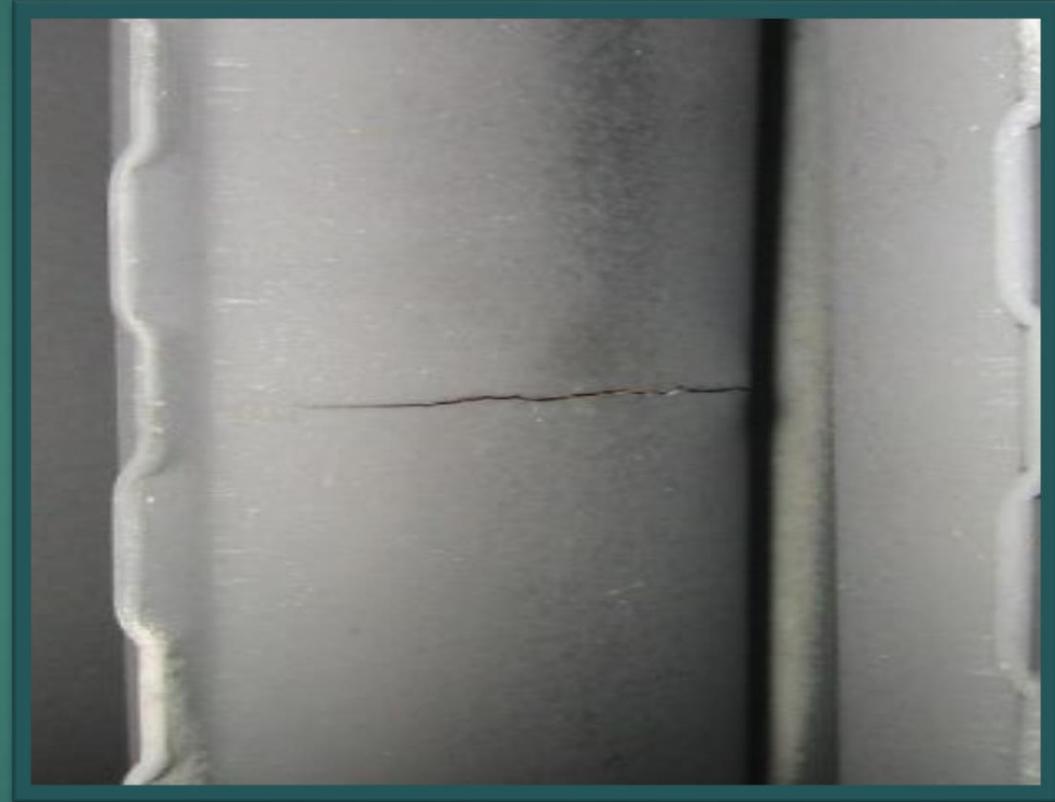


Our approach to weatherizing a mobile home has 5 major components:

1. Cleaning, tuning up, repairing or replacing the heating system.

The heating system will be visually checked for:

- Dirt and debris
- Burner alignment
- Soot, evidence of flame roll out
- Condition of the heat exchanger
- Vent pipe and roof termination
- Gas or oil leaks
- Condition of the wiring
- Condition of the air filter



Typically, a mobile home furnace with a steady state efficiency of 80% or lower, can be replaced with a new high efficiency unit with an efficiency of 95% or greater, resulting in an efficiency improvement of 15% or more. This could result in the highest potential savings for the homeowner.

Out with
the old...



Photo courtesy of WV GOEO

...In with
the new.



2. Repairing and sealing of the duct system.

The duct system will be visually inspected to identify:

Blockages

Disconnects

Missing end caps

Other catastrophic leaks

A pressure pan, in combination with the blower door, will be used to identify the location and estimate the magnitude of the duct leakage.

A heating system is only as effective as its delivery system. The ductwork can be a significant source of air infiltration and heat loss in the mobile home.



Identified leaks in ductwork will be sealed with tin, screws and duct mastic. Mesh tape can be used to cover seams, and duct mastic applied over top to create a durable, air-tight seal. Sealed ducts will be insulated with a minimum of R-11 insulation. Damaged floor registers will be replaced.



Photos courtesy of the US Department of Energy



Photos courtesy of the US Department of Energy

3. Insulating the Underbelly.

After the ductwork has been repaired and sealed, the underbelly insulation measures can be addressed. Underbelly insulation is the most challenging measure that will be addressed on a mobile home workscope, but if done correctly, we can:

Increase thermal performance of the floor and ductwork

Reduce air leakage paths - 25-50% reductions possible

Improve the overall comfort of the occupants

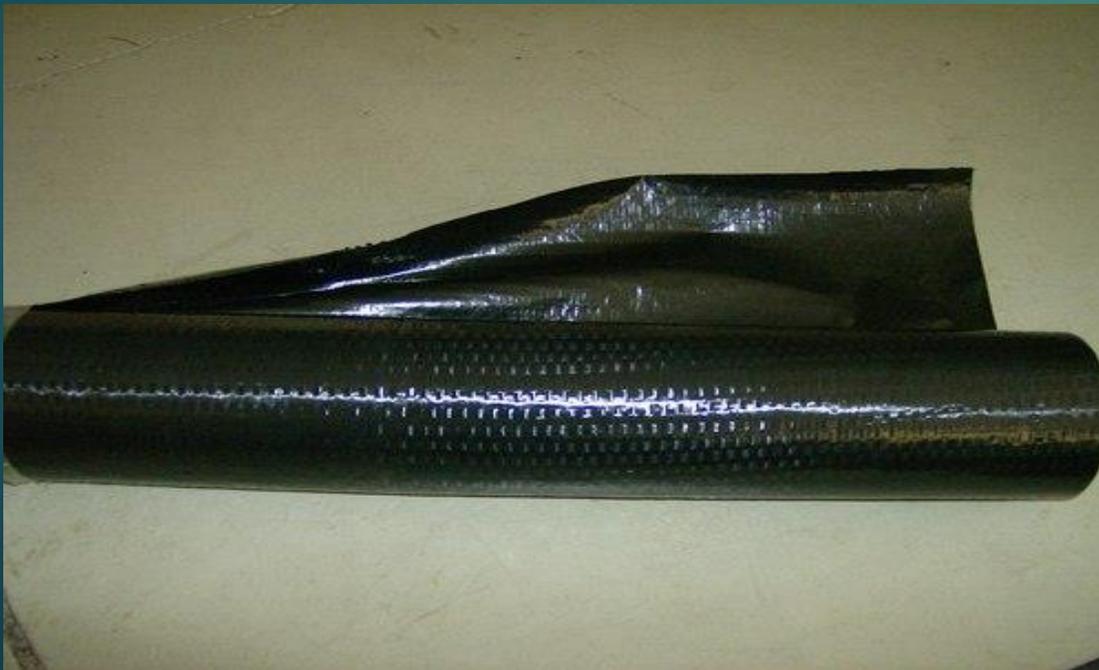


Photo courtesy of PA WTC

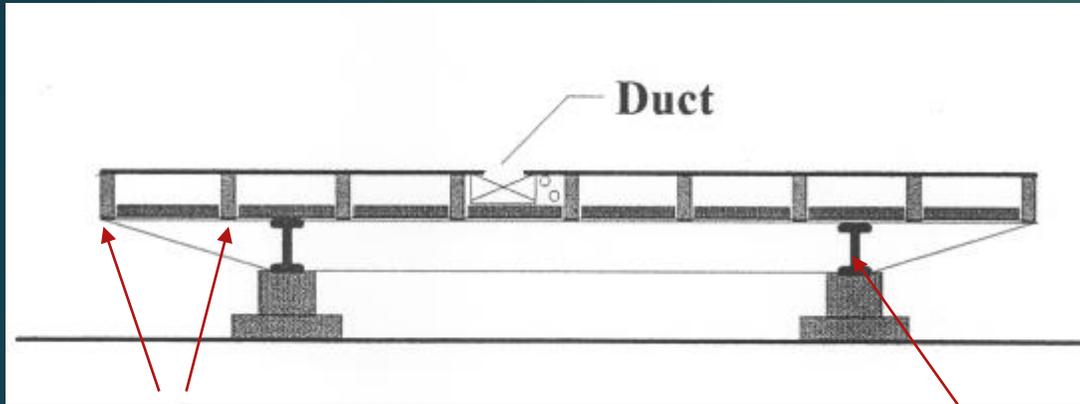
Before insulation work can begin, all penetrations in the mobile home floor must be sealed for 2 reasons:

1. To make the floor an effective air barrier.
2. To prevent insulation from entering the living space and making a mess.

It may be necessary to replace the rodent barrier with mobile home bottom board, secured with firing strips to the floor joists. This will create a new bottom barrier ready to receive new insulation.

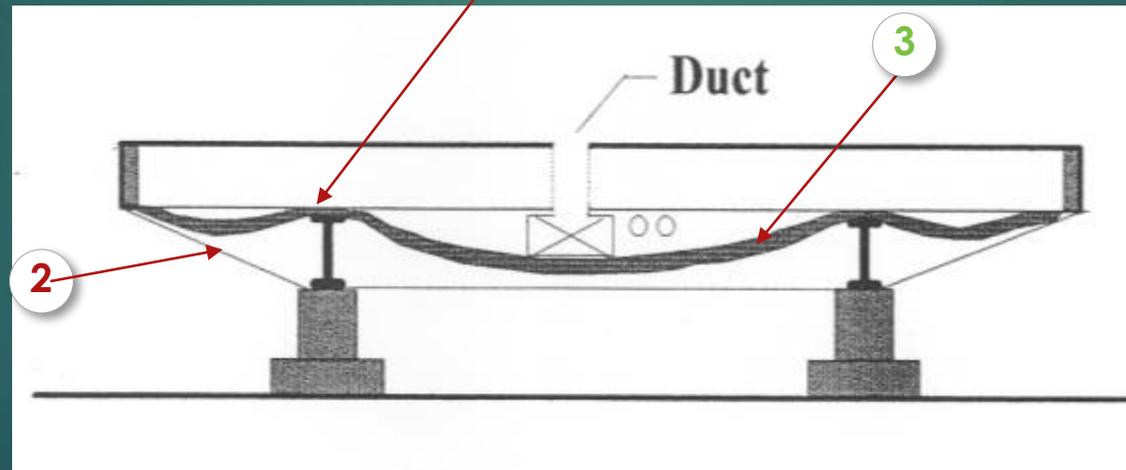


Cross-section of mobile home underbelly



4 Lengthwise Floor Joist System

1. Main beam
2. Outrigger beam
3. Rodent barrier
4. Floor joists



Crosswise Floor Joist System

Mobile Home Underbelly In Need Of Repair



Photos courtesy of PA WTC

Doing the dirty
work...



Photos courtesy of PA WTC

This is what a proper underbelly retrofit should look like.



Photo courtesy of WV GOEO

4. Window and Door Replacement

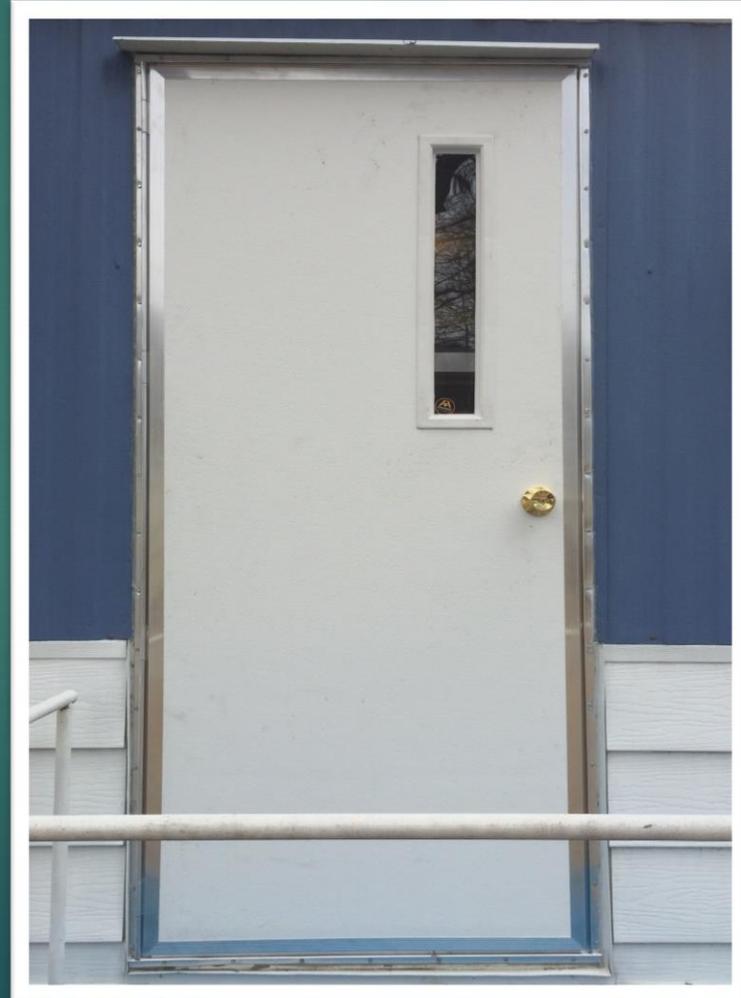
Mobile home windows that are single pane glass, with aluminum frames are generally the coldest surface in the mobile home building shell. Since water vapor collects on the coldest surface in the form of condensation, this could cause water droplets and frost to form on the glass, causing moisture damage to the wood framing of the window opening.

Single pane mobile home windows will typically be replaced with properly sized, thermal-pane vinyl windows, as long as an SIR of 1 is reached.



Exterior mobile home doors are often a maintenance problem because they get so much use and are exposed to the weather. Frequently, they are un-insulated as well.

Mobile home doors that are beyond repair, and/or have significant infiltration problems can be considered for replacement. Candidates that receive an SIR for replacement should be replaced with properly sized mobile home replacement doors.



5. Health and Safety Measures

Moisture

The average person gives off four pints of water into the air through breathing and perspiration, daily. Showers, cooking, and housecleaning can add another 3 pints per person. Evaporation of ground moisture into the mobile home shell and unvented clothes dryers will also add unwanted moisture to indoor air. The effects of tightening the home through weatherization will compound existing indoor air quality issues, if they are not mitigated properly. Moisture should be mitigated at the source.

Moisture Source Mitigation Methods

A ground vapor barrier, consisting of 6 mil. poly, should be installed on the ground under the entire mobile home, if accessible.

Clothes dryers found to be unvented, should be vented to daylight, out through the skirting of the mobile home.

Local ventilation fans should be installed in the bathroom and kitchen. These fans should be used while cooking and showering, and the occupants should be educated on their use.

Clothes dryer not vented out through skirting

Vapor barrier installed under mobile home



Kitchen Range Hood



Bathroom Ventilation



Examples of local ventilation

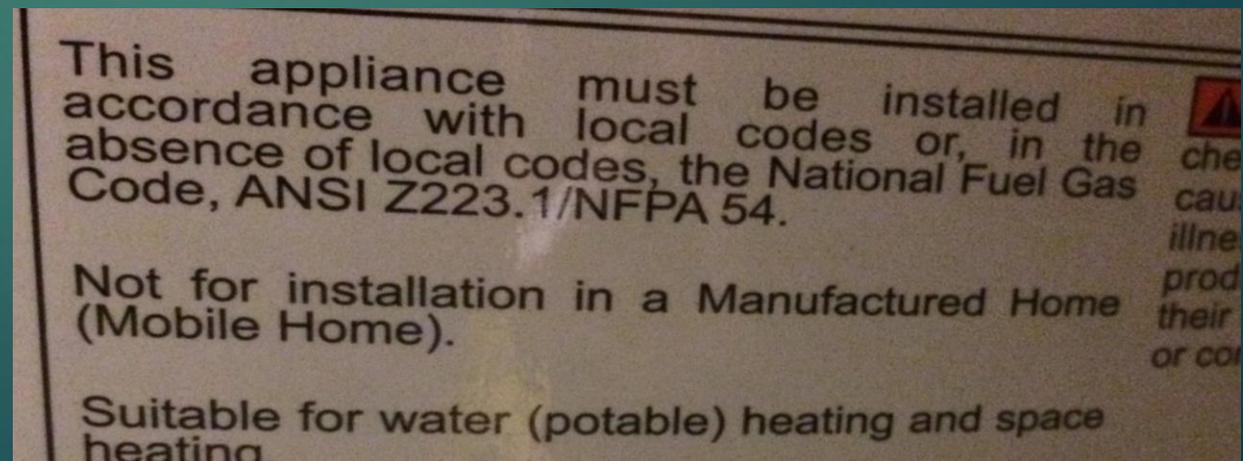
Other Health and Safety Concerns

Only sealed combustion appliances are approved for use in a mobile home. This means that the burner compartment is sealed and the unit draws its combustion air from outside of the mobile home. Often we encounter gas water heaters that are not sealed combustion and replace them with mobile home approved units. The intended use of a specific water heater can be found on the side of the water heater.

Mobile home approved



Not mobile home approved



Testing and Re-testing

The following tests are mandatory for every weatherization project. They are completed by the energy auditor at the initial audit, the weatherization crew during the work, and the quality control inspector at the completion of the weatherization project.

Blower Door Testing - to identify air leakage and determine reductions between pre and post.

Gas Leak Detection - to identify any gas leaks so that they can be repaired.

Combustion Appliance Zone Testing - to ensure that mechanical ventilation will not cause combustion appliances to backdraft.

Combustion Appliance Testing - to determine steady state efficiency, carbon monoxide levels, and draft of combustion appliances.

Carbon Monoxide - in addition to the furnace and water heater, the oven, clothes dryer, and ambient air will be checked for CO levels.

Exhaust Fan Flow - Ventilation fans will be checked for volume of air movement.

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END

Resources:

E3a4u.info – Exploring Energy Efficiency and Alternatives

wxtvonline.org

Energy.gov

Waptac.org – Weatherization Assistance Program Technical
Training Center

Thank you for being patient!