



State of Ohio
Weatherization Program
Standards

Section **MOBILE HOME MECHANICAL
SYSTEMS INSTALLATION**

Subject **Heating Units**

TUNE-UPS AND REPAIRS 701-1.1

A tune-up involves a visual inspection, some testing procedures, cleaning and adjustments to improve the combustion and seasonal efficiency of the heating system.

tune-up
701-1.1a

Repairs involve the replacement or reconstruction of defective or unsafe parts for the purpose of ensuring the safe operation of the heating system.

repairs
701-1.1b

NON-OPERATIONAL UNITS 701-1.2

Repair or replace non-operational heating units.

repair/replace
701-1.2a

Replacements of heating units using weatherization funds must be cost justified using an approved mobile home audit.

cost-effectiveness
701-1.2b

All replacement units must be UL listed for use in a mobile home.

UL listed units
701-1.2c

Switching from the existing fuel source to a different fuel source for use by the heating unit is prohibited without the prior written approval of OEE. Requests for fuel switching must describe the technical reasons for the decision and include cost justification and written authorization from the party responsible for fuel payments.

fuel switching
701-1.2d

All new units shall carry a minimum one (1) year warranty on workmanship. Each customer shall receive all manufacturer's product warranty information, clear maintenance instructions, educational information as necessary and a local phone number of who to contact for warranty problems.

warranty
701-1.2e

All units shall be installed in conformance with manufacturer's instructions, local codes, and/or NFPA manuals as required.

local codes
701-1.2f

*FUEL SUPPLY 701-1.3***repair/replace supply lines**

701-1.3a

Repair or replacement of fuel supply lines shall be restricted to the length between the fuel storage tank and the heating unit, or in the case of metered fuels, the length between the meter and the heating unit. Repair leaks in the fuel supply lines. Replacement fuel lines shall meet the applicable NFPA material code for the fuel type being serviced.

fuel filters, oil

701-1.3b

Change, clean or add fuel filters in oil fired systems.

oil nozzle & electrodes

701-1.3c

Replace the oil nozzle in oil-fired heating units according to the size on the unit data plate or by performing a post-weatherization condition heat loss calculation to determine the new nozzle size. Readjust or replace and adjust the electrodes.

gas/oil pressure

701-1.3d

Use a manometer to check the manifold gas pressure and adjust according to manufacturer's instructions. If unable to locate manufacturer's recommended pressures, it is possible to use 11" water column for LP/propane and 3.25-3.75" water column inches for natural gas. Set oil pump pressure to PMI. With oil burners it is too important to give a range.

Btu input

701-1.3e

Verify the Btu input of metered-fuel units by clocking the meter. If the unit is over- or under-fired, adjust the gas pressure. Replace orifices in propane and natural gas units with the proper sized orifice, if necessary.

*ELECTRICAL POWER SUPPLY 701-1.4***main power supply**

701-1.4a

Repair or replace an unsafe power supply to the unit.

dedicated circuit

701-1.4b

Install a properly sized and fused dedicated circuit for the heating unit if one is necessary based on wire condition, a history of circuit failure, or a new unit is to be installed.

hazardous wiring

701-1.4c



Replace any wiring in, or connected to, the heating unit that is charred, frayed, or has damaged insulation. Correct loose or improper wiring connections. Repair or replace defective wiring in, or leading to, the heating unit in accordance with NFPA 70, the National Electric Code.

HEATING UNIT CLEARANCES 701-1.5

Ensure that the unit is located so that clearances from combustible materials is PMI.

**heating unit
clearances**
701-1.5a

VENT SYSTEM INTEGRITY 701-1.6

Repair or replace sections of the venting system that are corroded, rusted, clogged or blocked, contain cracks or holes, or are unsealed, loose or disconnected.

damaged/corroded
701-1.6a

Ensure that all venting materials meet clearances from combustible materials in accordance with the applicable NFPA code. Correct any instances where vent clearances are not met.

clearances
701-1.6b

Securely fasten vent-to-roof jack connections. Ensure that the connection of the ceiling and the roof jack is completely sealed.

vent connections
701-1.6c

Repair or replace any vent system parts necessary so that there are no elbows in the vent system.

vent elbows
701-1.6d

Clean solid fuel chimneys that contain creosote, soot, scale or other debris.

solid fuel chimneys
701-1.6e

DRAFT 701-1.7

Perform a draft test on all vented, combustion-type appliances in accordance with the Table 701-1.7 and correct any draft and venting problems.

draft test
701-1.7a

Table 701-1.7 Draft Test Locations and Acceptable Readings

Heating Unit Type	Draft Gauge Probe Placement	Worst Case Acceptable Draft Readings at Listed Outdoor Temperatures (F)				
		<20	21-40	41-69	61-80	>80
Gas Atmospheric Appliances (Furnace, Space Heater, Boiler Floor Furnace)	Flue (after diverter)	-5 Pa -.02 wc'	-4 Pa -.016 wc"	-3 Pa -.012 wc'	-2 Pa -.008 wc"	-1 Pa -.004 wc"
Gas Fan-Assisted	Flue (1 1/2 times the diameter of the flue from the flue collar or elbow)	-5 Pa -.02 wc'	-4 Pa -.016 wc"	-3 Pa -.012 wc'	-2 Pa -.008 wc"	-1 Pa -.004 wc"
Oil Burners	Flue (before Barometric Damper)	-15 Pa -.06 wc'	-13 Pa -.053 wc"	-11 Pa -.045 wc'	-9 Pa -.038 wc"	-7 Pa -.03 wc"
Gas 90+ Furnace	Exhaust Pipe	PMI	PMI	PMI	PMI	PMI

draft, "worst case"
701-1.7b

Perform the "worst case scenario" draft test (see 1506-4).

draft, furnace
701-1.7c

Start the heating unit. Insert the draft probe into the appropriate location listed in Table 701-1.7. Measure and record the draft at two minutes. Determine whether the draft reading is within the acceptable ranges identified in Table 701-1.7. If draft is not within acceptable limits, determine the reason and correct.

COMBUSTION SAFETY AND EFFICIENCY 701-1.8

clean burners
701-1.8a

Clean gas burners of dirt and rust. Repair or replace them if necessary.

clean combustion chamber
701-1.8b

Clean the combustion chamber on oil-fired units, replace or repair any defects in the combustion chamber, and seal the area around the air (blast) tube, inspection port and other areas to reduce uncontrolled, excess air.

gas power burners
701-1.8c

Seal openings around gas power burners.

Insert the sampling probe of a calibrated digital combustion analyzer into the location listed in Table 701-1.8d.i. Adjust the heating unit so that it is within the acceptable combustion gas levels in Table 701-1.8d.ii.

combustion testing
701-1.8d

Table 701-1.8d.i CO and Combustion Analyzer Probe Placement Locations

Heating Unit Types	Probe Location
Oil-fired Central Furnaces and Direct Heating Equipment	Vent pipe before barometric damper
Sealed Combustion Units	Exhaust vent pipe

Table 701-1.8d.ii Acceptable Combustion Test Analysis Measurements

Heating Unit Type	(O ₂) Oxygen	Stack Temp.	Smoke Test	(CO) Carbon Monoxide Max. ppm
GAS (Natural Gas, Propane)	4-9%	300-600 F	N/A	100
Fan Assisted	4-9%	300-480 F	N/A	100
Condensing	PMI	PMI	N/A	100
Standard Power Burner	4-9%	275-550 F	N/A	100
OIL				
Standard Oil Burner	4-9%	325-600 F	1 or less	100
Flame Retention	4-7%	325-600 F	1 or less	100
Condensing	PMI	PMI	1 or less	100

With the heating unit operating, insert the sampling probe into the appropriate location listed in Table 701-1.8d.i. Measure and record the amount of CO in the flue gasses. More than 100 ppm in the flue is not permitted. If the cleaning and tuning work does not reduce the CO level below 100 ppm in the unit, repeat the procedures outlined above and retest. If the CO levels are still not below 100 ppm, consult with an OEE representative.

carbon monoxide (CO) 701-1.8e

HEAT EXCHANGER 701-1.9

Clean the heat exchanger. Remove soot and debris. Reseal with appropriate materials.

clean heat exchanger
701-1.9a

If cracks or holes exist in the heat exchanger, replace the heat exchanger if a new one can be located, or have the unit replaced. No weatherization work can be performed until the replacement or repair is completed.

heat exchanger, cracks or holes
701-1.9b



TEMPERATURE RISE 701-1.10

Perform temperature rise test, and take corrective action if the temperature rise is not within the acceptable range listed in the manufacturer's specifications. (Refer to Table 701-1.10a.i and 701-1.10a.ii.)

corrective action
701-1.10a

Table 701-1.10a.i Typical Solutions for High Temperature Rise

PROBLEM:	CHECK FOR:	REMEDY:
High Temperature Rise [>90°/PMI]	<ul style="list-style-type: none"> • Fan speed too slow • Obstruction in duct work • Inadequate return/distribution ductwork • Blower belt/filter/AC coil defective or dirty • Unit overfired • Dirty or defective blower 	<ul style="list-style-type: none"> • Set fan speed higher or replace motor • Remove obstruction • Install proper ductwork • Clean or replace belt/filter/AC coil • Adjust fuel pressure, change orifices • Clean or replace blower

Table 701-1.10a.ii Typical Solutions for Low Temperature Rise

PROBLEM:	CHECK FOR:	REMEDY:
Low Temperature Rise [<60°/PMI]	<ul style="list-style-type: none"> • Fan speed too fast • Excessive air flow from blower • Unit underfired • Low stack temperature (PMI) • Cycling on high limit 	<ul style="list-style-type: none"> • Set fan speed slower or replace motor • Adjust air flow or replace blower • Adjust fuel pressure or change orifices • Resize the vent pipe • Clean or replace blower, install more or larger duct work

CONTROLS 701-1.11

Replace defective fan/limit controls and test the new control after putting the unit into operation.

fan/limit control
701-1.11a

Move improperly located thermostats to an area free from drafts or heat from the heating system, lights, or appliances.

thermostat location
701-1.11b

Replace defective thermostats or thermostats that are mercury bulb activated.	thermostat replacement 701-1.11c
Adjust the heat anticipator in the thermostat to match the amp draw of the system controls.	heat anticipator 701-1.11d
<i>AUTOMATIC FUEL SAFETY SHUT-OFF 701-1.12</i>	
Test gas valves to ensure that, in the event of a pilot outage, the flow of gas to the burners is interrupted. For gas valves with 100% safety shutoff, ensure that the flow of gas to the pilot is also interrupted in the event of a pilot outage. Ensure that the tip of the thermocouple is enveloped by the pilot flame. Replace defective gas valves and thermocouples.	test gas valve 701-1.12a
Perform a safety check of the primary control and cad cell in oil fired units. Replace defective primary controls or cad cells.	safety check 701-1.12b
<i>ELECTRIC FURNACES 701-1.13</i>	
Check for proper sequencing and operation of elements. Replace defective elements and other defective components.	sequencing 701-1.13a
Check for adequate line voltage and correct as necessary.	line voltage 701-1.13b
<i>DISTRIBUTIONS SYSTEM 701-1.14</i>	
Clean dirty blower motors, fans and belts. Inspect the blower for excessive free play and correct as necessary. Inspect the pulleys and drive assembly for wear, alignment and proper tension and correct as necessary. Inspect the motor bracket for tightness and alignment and correct as necessary. Lubricate the motor and motor bearing cups if necessary.	forced air and gravity systems 701-1.14a
Test the fan control to ensure that it is functioning properly. Set the fan "on" control to 110° F and the fan "off" control to 90° F after determining that the customer's life-style or this particular installation will permit these settings. Replace defective fan controls.	fan control 701-1.14b
Seal all leaks and/or openings in the supply duct, especially at the ends of the duct and the base/duct interface in typical mobile homes. Seal additional sites at the crossover ducts in a complex mobile home duct system.	supply air ducts 701-1.14c

Repair or replace any missing, loose fitting, blocked, leaky, or unsealed blower compartment or return air ducts and seal with compatible duct sealing materials. Belly return systems shall be eliminated. Seal all return air registers, and provide sufficient return air opening area at the furnace closet door by installing a louvered door.

return air ducts
701-1.14d

Install or replace missing or dirty return air filters. Instruct the customer on filter replacement.

air filters
701-1.14e

CEE

Insulate uninsulated duct work passing through non-conditioned areas so that the duct is completely covered and the insulation is not compressed. Terminate duct insulation at the floor register boots in such a manner that the register boot is completely covered and the duct insulation fits snugly against the floor. Secure sections of duct insulation with staples, straps, or wires and tape any exposed fiberglass.

insulate ducts
701-1.14f

Vacuum the heat transfer fins on electric baseboard units.

electric baseboard
701-1.14g

CERTIFICATION 701-1.15

Once the unit has been serviced, the installer must place a sticker on the heating unit, in plain view, certifying that the system has been properly serviced. The sticker shall indicate the date of service, name of the service contractor and the phone number of the service contractor.

**identification
sticker**
701-1.15a