



State of Ohio
Weatherization Program
Standards

Section	MECHANICAL SYSTEMS FINAL INSPECTION
Subject	Heating Units

OPERATIONAL UNITS 401-1.1

Ensure that primary heating unit is operational.

**operational heating
unit**
401-1.1a

FUEL SUPPLY 401-1.2

Ensure that fuel is available (except for solid fuel units) to begin final inspection.

fuel availability
401-1.2a

Ensure that all solid fuel units are free from heat exchanger leakage, excessive corrosion, and unsafe or improper wiring (when applicable). Ensure that venting for all fuel types meet safety and clearance requirements in accordance with the applicable NFPA code for the fuel type (#54 for gas, #31 for fuel oil, #211 for solid fuel).

solid fuels
401-1.2b

Use a combustible gas leak detector to ensure that there are no propane or natural gas leaks.

fuel leakage, gas
401-1.2c

Visually ensure that there are no kerosene or fuel oil leaks.

fuel leakage, oil
401-1.2d

Ensure that the heating units are not under- or over-fired. Clock the meter on natural gas units. On propane units, take a gas pressure test, measure the orifice, and calculate the actual Btu input.

Btu input
401-1.2e

ELECTRICAL POWER SUPPLY 401-1.3

Ensure that the main electrical power supply to the heating unit is safe.

**main electrical power
safety**
401-1.3a

If called for, ensure that the electrical line to the unit is a dedicated circuit that is properly sized and fused. Note: Each new unit shall have a dedicated electrical circuit.

dedicated circuit
401-1.3b

safe wiring

401-1.3c

Ensure that all the wiring in or at the heating unit is properly insulated and in good condition, and that there are no improper or loose connections.

*HEATING UNIT CLEARANCES 401-1.4***heating unit clearances**

401-1.4a

Ensure that clearances from combustibles are in accordance with the applicable NFPA code for the fuel type (#54 for gas, #31 for fuel oil, #211 for solid fuel) for venting requirements.

*VENT SYSTEM VISUAL INSPECTION 401-1.5***vent system visual inspection**

401-1.5a

Ensure that the vent system extends from the heating unit to the outside of the dwelling, extends to the proper height, and has no cracks, holes, or loose, unsealed, or disconnected sections. Ensure that there is no excessive corrosion or rust.

vent connections

401-1.5b

Ensure that the vent/chimney connection is securely fastened and properly sized and installed.

vent slope

401-1.5c

Ensure that the vent connector is installed with no dips or sags, and rises at least 1/4" per foot of run.

vent elbows

401-1.5d

Ensure that the number of elbows does not exceed that allowed by the NFPA code for the fuel type (#54 for gas, #31 for fuel oil, #211 for solid fuel) for venting requirements.

chimney condition

401-1.5e

Ensure that any chimney in use is in sound condition, including liner, bricks, blocks and mortar.

chimney liner

401-1.5f

If a new chimney liner was to be installed, ensure that it has been properly sized and installed PMI.

*DRAFT TESTING 401-1.6***draft, "worst case"**

401-1.6a

Set up and perform the "worst case scenario" for draft testing (see 1506-4). Refer to Table 401-1.6 for proper probe placement. Ensure that draft is within the acceptable range.

Table 401-1.6 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

COMBUSTION SAFETY AND EFFICIENCY TESTING
401-1.7

With the heating unit operating, collect a flue gas sample, according to the location in Table 401-1.7a. Ensure that the CO reading is less than 100 ppm.

carbon monoxide (CO)
401-1.7a

With the heating unit operating, use a combustion analyzer to measure and record O₂, and net stack temperature. Refer to Table 401-1.7a for probe placement. Ensure that readings are within the limits in Table 401-1.7b.

combustion analysis
401-1.7b

Table 401-1.7a CO and Combustion Analyzer Probe Placement Locations

Heating Unit Types	Probe Location
Gas-fired Central Furnaces and Direct Heating Equipment	Heat exchanger ports
Oil-fired Central Furnaces and Direct Heating Equipment	Vent pipe before barometric damper
Gas-fired Boilers	Vent pipe before draft diverter
Sealed combustion units/Fan-assisted appliances	Exhaust vent pipe

Table 401-1.7b Acceptable Combustion Test Analysis Measurements

Heating Unit Type	(O ₂) Oxygen	Stack Temp.	Smoke Test	(CO) Carbon Monoxide Max. ppm
GAS (Natural Gas, Propane) Atmospheric	4-9%	300-600° F	N/A	100
	Fan-assisted	300-480° F	N/A	100
	Condensing	PMI	N/A	100
Space Heaters	5-15%	300-650° F	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
	Flame Retention	4-7%	325-600° F	1 or less
Condensing	PMI	PMI	1 or less	100

combustion air
401-1.7c

Ensure that the combustion air requirements are in accordance with the applicable NFPA code for the fuel type (#54 for gas, #31 for fuel oil, #211 for solid fuel).

HEAT EXCHANGER INTEGRITY 401-1.8

visual inspection
401-1.8a

Ensure that the heat exchanger is free of deterioration, cracks, or holes. Ensure that boilers are free of water leakage

carbon monoxide (CO)
401-1.8b

Test the distribution system and ambient air for CO, and ensure that combustion appliances are not producing CO.

oxygen fluctuation, forced air systems
401-1.8c

During the combustion efficiency test on forced air systems, ensure that there is no fluctuation in the O₂ reading during blower operation. If fluctuation is observed, use an approved method to confirm the existence of a cracked heat exchanger.

Ensure that a cracked heat exchanger has been replaced with a new heat exchanger or a new furnace or heating unit.

cracked heat exchanger
401-1.8d

TEMPERATURE RISE 401-1.9

Measure the temperature rise of the unit to ensure that it is between 60°-90° F, or PMI.

measurement
401-1.9a

CONTROLS 401-1.10

Ensure that the fan control properly activates the fan.

fan control, forced-air units
401-1.10a

Ensure that the high limit setting is within code limits and proper for the unit, or PMI.

high limit control, forced air units
401-1.10b

Ensure that the blower motor, belt, and fan are clean and operating properly.

blower, forced-air system
401-1.10c

Ensure that the boiler aquastat works properly.

aquastat, boiler
401-1.10d

Ensure that the boiler water pump works properly.

water pump, boiler
401-1.10e

Ensure that the thermostat is operating properly and is located in a position so as to work effectively.

thermostat
401-1.10f