

NJCP Heating and Cooling System Repair and Replacement Procedures

Covering: Furnaces, Boilers, Heat Pumps, Room Air Conditioners and Central Air Conditioners

The New Jersey Comfort Partners Program (NJCP) recognizes the energy reduction benefits as well as the health and safety implications of assessing primary heating systems and air conditioning systems for proper and efficient operation. The following procedures are incorporated into the program to be used to evaluate sites for potential heating and air conditioning system repairs and replacements.

NJCP Technicians will be responsible for identifying operational problems with space conditioning equipment and determining whether repairs or replacements are appropriate. In some cases the repair may be made by the NJCP technician on site or by another NJCP technician at a later time. In other cases, a subcontractor may be called to make the repair.

In all cases where a replacement is being made, a qualified HVAC subcontractor will be assigned to implement the installation, using the replacement standards, and a pre-approved vendor list.

Replacements of heating and central air conditioning systems will be permissible for the owner occupied sites only. The program will not be responsible for the replacing heating and central air conditioning systems on sites where the occupants are renting.

This procedure is divided into three sections:

1. Primary Heating Systems
2. Central Air Conditioning and Heat Pumps
3. Room Air Conditioners

Section 1 and 2 contain two parts:

1. Assessing the system to determine if it requires repair or replacement
2. Verifying that the system qualifies for replacement

Section 3 contains one part:

1. Verifying that the system qualifies for replacement.

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Section 1

Primary Heating Systems

This section refers to natural gas furnaces, natural gas boilers, electric furnaces and electric resistance baseboard systems. Propane, oil fired and other fuel type space heating equipment are not eligible for replacement.

Part 1. Assessing the System for Repair or Replacement

Step 1. What is the nature of the system problem(s)?

The technician on site must make a preliminary evaluation of the operational condition of the primary heating system, based on customer information, testing and observations during the audit process to determine the needs for repair or replacement. The technician must answer these questions:

1. Does an emergency health or safety condition exist due to improper system operation or non-operation?
 2. Is the primary heating system operating properly?
 3. What is the nature of the system problem?
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1. Is the primary heating system operating properly?
 - 1.1 Is the home being heated effectively?
 - 1.1.1. Does the customer report no heat or uneven heating of the home?
 - 1.1.2. Does the customer report inefficient system operations?
 - 1.2 Compare the heating fuel usage with an estimated heat load.
 - 1.2.1. Multiply the heated space (square footage) by 70. That will be the baseline BTU consumption per square foot per year standard for the site.
 - 1.2.2. Multiply the annual actual used therms by 100,000.
 - 1.2.3. Divide that number by the heated space square footage. This result will be the actual BTU consumption per square foot per year for the site.
 - 1.2.4. Compare the two numbers. Is the actual BTU consumption per square foot per year equal to or greater than the baseline number?
 - 1.2.5. Does the heating fuel usage otherwise exceed what should be expected, given the site conditions and temperature settings (Are there probable and sufficient end uses to account for the higher usage?).
 2. Is there an emergency health and safety condition due to improper system operation or non-operation?
 - 2.1 Does a CO test indicate excessive CO in the flue or ambient air in the living area?
 - 2.2 Does a draft test indicate poor draft and existing or potential spillage?
 - 2.3 Are adequate home temperatures able to be maintained?

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- 2.4 Is the customer using an unsafe supplemental heater (gas oven, kerosene space heater)?
 - 2.5 If the unit is inoperable evaluate the safety of the unit and ability to repair/replace.
3. What is the nature of the system problem(s)?
- 3.1 Is the system operating properly?
 - 3.1.1 Is the emergency switch on and is it energizing when in the on position?
 - 3.1.2 Is the thermostat functioning?
 - 3.1.2.1 Check voltage at the thermostat leads
 - 3.1.2.2 Check voltage at the transformer
 - 3.1.2.2.1 Is there 24 volts on the thermostat side and 120 volts in the breaker side?
 - 3.1.3. Will the burner ignite?
 - 3.1.3.1. Do the burner(s) cycle on and off too often?
 - 3.1.3.2. Are the burners cycling on the high limit control?
 - 3.1.4. Is the indoor blower or circulating pump(s) functioning properly?
 - 3.1.4.1 Let the system run through at least one cycle and listen for the fan or the pump to operate. Sometimes it is necessary to touch the pump to feel it vibrating.
 - 3.1.5. Is the distribution system functioning properly?
 - 3.1.5.1 Feel radiators, are they warm?
 - 3.1.5.2 Is there air flow at the registers?
 - 3.1.5.3 Check air filter and water level on boilers.

Step 2. What is the source of the system problem(s)?

Once the nature of the problem(s) has been established and documented, the technician on site must answer this question:

1. Can the source if the system problem(s) be diagnosed further by the technician on site, another NJCP technician or by a subcontractor?
 - 1.1 If the technician on site can further diagnose the source of the system problem(s) he must document the problem(s) and make appropriate recommendations.
 - 1.2 If not, another NJCP technician or a subcontractor will be assigned to make the determination.

Step 3. Can the system problem(s) be repaired?

If the source of the problem(s) has been established and documented by the technician on site, they must answer these questions:

1. Can the system problem(s) be repaired by the technician on site, another NJCP technician or by a subcontractor?
2. If the problem(s) cannot be repaired by the technician on site, can another NJCP technician or by a subcontractor?
 - 2.1 If the problem is related to the thermostat, the technician on site can address the problem.

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- 2.2 If the problem is due to something other than the thermostat, the technician on site must document the problem(s) and make the appropriate recommendation. Either another NJCP technician or a subcontractor will be assigned to address the problem(s).
- 2.3 If the system operation is causing a health or safety problem which cannot be resolved, it must be reported to the supervisor at the time of his visit so a proper course of action can be executed and documented.
3. If the technician on site has not been able to diagnose the source of the problem(s), the NJCP technician or subcontractor assigned to diagnose the source of the system problem(s) will determine whether the problem(s) can be repaired. If it can, he will make the repair while on site.

Note: Consideration should be taken as to the cost and longevity of the repair as it related to a system replacement cost and efficiency improvement.

Part 2. Verifying that the system qualifies for replacement

Step 1. Is the system replacement justified?

Once it has been determined that the system problem(s) cannot be repaired or the repair price is prohibited, it must be determined if the system replacement is justified. The Case Management team must determine if at least one of the three general conditions that would justify a replacement are met:

1. Operation of the existing heater causes a health and safety condition that poses an immediate threat to home occupants.
 2. The non-functioning, existing heater causes either a potentially unsafe condition and /or high energy usage due to alternative heating sources.
 3. Replacement of the existing heater with high efficiency system can be justified by direct energy savings.
1. Operation of the existing heater causes a health and safety condition that poses an immediate threat to home occupants, In those cases:
 - 1.1 The details requiring replacement must be reviewed with the supervisor and the case manager to determine the necessity and appropriateness of the replacement
 - 1.2 Energy savings are not required to justify a replacement, but if energy saving can be claimed, they should be documented.
 2. The non-functioning, existing heater causes either a potentially unsafe condition and/or high energy usage due to alternative heat source usage.
 - 2.1 The technician must identify and document the potentially unsafe condition(s). The details must be reviewed with the Supervisor and the Case manager to determine the necessity and appropriateness of replacement.
 - 2.2 Where the non-functioning, existing heater causes high supplemental energy usage the energy savings opportunity must be documented. The source and amount of the energy savings must be documented, e.g. electric space heaters the will be retired.

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3. Replacement of the existing heater with high efficiency system can be justified by direct energy savings.
 - 3.1 A Combustion Efficiency Test (CET) must be performed to help estimate the overall system efficiency. Additional system efficiency losses are listed in the table below, and can be subtracted from the CET to estimate overall system efficiency.

System Components	Efficiency Loss
Standing Pilot Light	4%
Gravity feed distribution	10%

Example: A gas fired furnace has a CET of 74%. It has a standing pilot light and no circulation fan.

Pilot light	4%
Gravity Feed Distribution	<u>10%</u>
	14%

CET rating 74% minus 14% equals 60%. The existing overall system efficiency is 60% Convert the CET to AFUE by using the following calculation **Combustion Efficiency Test (CET) X .85 = approximate AFUE**)

- 3.2 If the system efficiency is 68% AFUE or less a replacement may be further considered
- 3.3 Follow the appropriate (Hot Air Furnace / Steam and Hot Water Boiler) decision tree to complete the evaluation of replacement feasibility. Starting at step six after assuring the previous steps have been considered.
- 3.4 If the Return on investment (ROI) is within the guidelines take the AFUE and related notes and documentation and review with the Case Management Team.
- 3.5 Once approved by the Case Management Team, the Case Manager will forward an installation work order to the most appropriate (backlog/geography) network HVAC subcontractor for installation in accordance with the standard pricing agreement.
- 3.6 All associated replacement costs do not go against the seasonal spending guideline for the premise but should be used in the ROI calculation.
(Setback thermostats would not be part of the replacement cost)
- 3.7 Utility final approval must be obtained.

Note: Only 90% plus AFUE forced hot air furnaces, 85% plus efficiency boiler, and 80% or better Steam Boiler are to be installed for efficiency improvement pilot. Any exception will be needed to be explained to the Utility representative prior to any replacement.

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Section 2

Central Air Conditioners and Heat Pumps

This section refers to electric central air conditioners.

Part 1. Assessing the system for repair, maintenance or replacement.

Step 1. What is the nature of the system problem(s)?

The technician on site must make a preliminary evaluation of the operational condition of the central air conditioning system, based on customer information, testing and observations. The technician must answer two questions:

1. Is the central air conditioning system operating properly?
 2. What is the nature of the system problem?
1. Is the central air conditioning system or heat pump operating properly?
 - 1.1 Is the home being cooled and or heated effectively?
 - 1.1.1 Does the customer report no cooling, and/or heating or uneven cooling and /or heating?
 - 1.1.2 Does the customer report inefficient system operation?
 - 1.2 Compare the cooling and /or heating electricity load with the expected cooling and or heating load.
 - 1.2.1 Does the cooling and /or heating fuel usage exceed what should be expected; given the site conditions? (Are there probable and sufficient end uses to account for the high usage?)
2. What is the nature of the system problem(s)?
 - 2.1 Is the system operating properly?
 - 2.1.1 **Do not operate the air conditioning system for testing purposes when the outdoor temperature is below 60 degrees.** If there are indications that the system is not operating properly, document those findings and put the site on hold until system testing can be performed.
 - 2.1.2 Is the thermostat functioning?
 - 2.1.2.1 Check voltage at the thermostat
 - 2.1.2.2 Check voltage at the transformer.
 - 2.1.2.2.1 Expect 24 volts on the thermostat side and 120 volts on the breaker side of the transformer.
 - 2.1.3 Will the compressor energize?
 - 2.1.3.1 Listen for the relay to engage and the compressor to come on. The compressor will be located in the exterior condenser cabinet.
 - 2.1.4 Is the indoor blower fan functioning?
 - 2.1.4.1 Let the system run through at least one cycle listen for the fan running.
 - 2.1.5 Is the distribution system functioning properly?
 - 2.1.5.1 Is there air flow at the registers?
 - 2.1.6 Is the copper line set frozen?

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Step 2. What are the sources of the system problem(s)?

Once the nature of the problem(s) has been established and documented, the technician on site must answer this question:

1. Can the source of the system problem(s) be further diagnosed by the technician onsite, another NJCP technician or by a subcontractor?
1. Can the source of the system problem(s) be further diagnosed by the technician onsite, another NJCP technician or by a subcontractor?
 - 1.1 If the technician on site can further diagnose the source of the system problem(s) they must document the problem(s) and make the appropriate recommendation.
 - 1.2 If not, another NJCP technician or a subcontractor will be assigned to make the determination.

Step 3 Can the system problem(s) be repaired or resolved through a maintenance procedure?

If the source of the problem(s) has been established and documented by the technician on site, they must answer this question:

1. Can the system problem(s) be repaired by the technician on site, another NJCP technician or by a subcontractor?
 - 1.1 If the Central Air Conditioning system problem(s) is related to the thermostat, the technician on site can address the problem.
 - 1.2 If the heat system problem(s) is related to the thermostat, the technician on site must document the problem(s) and make the appropriate recommendation.
 - 1.3 If the problem is due to something other than the thermostat, the technician on site must document the problem(s) and make the appropriate recommendation. Either another NJCP technician or a subcontractor will be assigned to address the problem(s).
 - 1.4 If the technician on site has not been able to diagnose the source of the problem(s), the NJCP technician or subcontractor assigned to diagnose the source of the system problem(s) will determine whether the problem(s) can be repaired or if a maintenance procedure can resolve the problem. If it can, he will make repair while on site.

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Part 2. Verifying that the Central A/C and or Heat Pump System Qualifies for Replacement

Step 1. Is the system replacement justified?

Once it has been determined that the system problem(s) cannot be repaired and maintenance procedures will not resolve it, it must be determined if the system replacement is justified. The Case Management Team must determine if the system meets the replacement guidelines below. If it is determined that the replacement guidelines have been met, Utility approval must be obtained. All coolant will be removed in accordance with applicable local, state and federal laws.

1. Replacement Guidelines

- 1.1 The existing central air conditioning and the replacement central air conditioner must meet the following energy rating guidelines:
 - 1.1.1 Existing central air conditioner must be **SEER 8 or lower.**
 - 1.1.2 The replacement central air conditioner must be **SEER 13 or higher.**
- 1.2 The existing heat pump AND the replacement heat pump must meet the following energy rating guidelines:
 - 1.2.1 Existing heat pump must be **SEER 9 or lower.**
 - 1.2.2 The replacement heat pump must be **SEER 14 or higher.**
- 1.3 If the customer has low usage due to non-working air conditioners and is Elderly or has small children, disabilities or health problems, contact the utility for permission to replace on a case-by-case basis.
- 1.4 There is a required minimum electric seasonal usage attributed to air conditioning , or heating, following the guidelines below:

For Central Air Conditioning	For Heat Pumps:
Total Summer electric seasonal consumption (June, July, August and September) due to AC usage required for AC replacement:	Total annual electric seasonal consumption due to Heat pump and Air Conditioning usage required for Heat Pump replacement:
3,000 kWh*	4,500 kWh*

* Values derived from Met-Ed sample usages – summer = 3,153 kWh, winter /summer combined = 4,734kWh

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Section 3 Room air conditioners

This section refers to room air conditioners, wall or window mounted.

1. Existing Room air conditioners will not be considered for *repairs or maintenance* other than filter replacement and coil cleaning.
2. If replacement occurs:
 - Replacement cost does not come out of the site spending guidelines.
 - Utility approval is not necessary.
 - Replacement units must be EER 10 or higher and must be Energy Star rated.
 - Removed unit must be scrapped and cannot be resold or returned to service.
 - Removed units must have all coolant removed in accordance with applicable local, state and federal laws
3. Seasonal usage must meet the following criteria to be considered for replacement**.

Minimum electric seasonal usage (June, July, Aug. & Sept.) due to AC usage	Number of window/wall air conditioners
2000 kWh	1
2500 kWh	2
3000 kWh	3

4. If the customer's summer usage meets the minimum usage criteria, then review the existing room air conditioner unit(s) EER. Also, remember that window/wall air conditioner replacements can occur all year; return visits may be necessary during the warmer months to qualify units for replacement.
 - Unit must be EER 6 or lower (EER can be found on the unit's rating label; if the EER rating is not available, the EER can be determined by dividing the unit BTU/hr rating by the unit watts (found on the nameplate). If the unit wattage isn't on the nameplate, the unit can be checked with a watt meter (outdoor temperature must be minimum 60 degrees). Alternatively, units manufactured before 1992 can be considered for replacement).
 - If the customer has not been in the home for the months of June through September (no usage history), they are not eligible for air conditioner replacements.
 - When a unit(s) qualifies for replacement, the recommendation must be thoroughly documented on the CP Audit, including the existing unit(s) EER and/or age, BTU/hr input, wattage and dimensions.
 - Educate the customer on how and when to perform maintenance on the new unit i.e. filter change and coil cleaning.
 - **If the customer has low usage due to non-working air conditioners and is elderly or has small children, disabilities or health problems, contact the utility for permission to replace on a case-by-case basis.
 - Use the following chart to determine sizing (for more precise sizing that takes into account solar gain, internal heat gains, room use, shading, and/or occupant numbers, refer to www.energystar.gov):

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Area to be cooled (square feet)	Capacity needed (BTUs per hour)
100 to 150	5,000
150 to 250	6,000
250 to 300	7,000
300 to 350	8,000
350 to 400	9,000
400 to 450	10,000
450 to 550	12,000
550 to 700	14,000
700 to 1,000	18,000
1,000 to 1,200	21,000
1,200 to 1,400	23,000
1,400 to 1,500	24,000
1,500 to 2,000	30,000
2,000 to 2,500	34,000