

# Chapter 14

## Annual Maintenance





**AMTROL**  
**EXTROL**  
BUILDING SYSTEM EXPANSION TANK

Wayne

**PETRO** HOME SERVICES



## Chapter 14

# Annual Maintenance

The annual preventive maintenance is one of the most important services this industry offers. A properly performed tune-up assures the customer that their heating system is operating at peak safety, reliability and efficiency.

### Four key factors for a proper tune-up

1. Safety
2. Efficiency
3. Reliability
4. Cleanliness

#### 1. Safety

During the tune-up, the heating system is serviced and adjusted to minimize the possibility of a problem, which might cause a dangerous situation, such as fire or a carbon monoxide issue. In addition, the

#### Checking the limit control



system's controls are checked to be sure they work properly and shut the burner off if a problem develops.

#### 2. Efficiency

When a combustion analyzer is used to adjust the system for maximum efficiency, the customer can conserve fuel and save money. The tune-up also presents an opportunity for the technician to recommend new equipment to those customers whose systems are not as reliable or as efficient as today's equipment.

#### 3. Reliability

Typically, certain parts (such as nozzles and filters) are replaced, even though they haven't failed. This pro-active replacement helps ensure that the system will operate



Accompanying audio files are available at [Learning.NORAweb.org/manual](http://Learning.NORAweb.org/manual)



Use the time stamp on each page to navigate.

Audio  
01:28

efficiently throughout the year. The technician also checks components, looks for and corrects potential problems and lubricates those components that require it per the manufacturer's recommendations.

#### 4. Cleanliness

There are two critical aspects to the cleanliness of a tune-up:

1. The technician should be focused on assuring that the system is operating at peak performance, with as little impact on the environment as possible.

2. Most of the work performed during a tune-up is not visible to the customer. Every effort must be made to make sure that what the customer does see—the outside of the unit and the area around it—are neat and clean when the job has been completed.

Focusing on these four factors during the tune-up reduces the possibility of breakdowns during the heating season and helps the customer save money by minimizing their fuel consumption.

Dirty strainer



Keep your tools neat in your truck



### Tools of the trade

To successfully perform a tune-up, technicians must have certain tools, instruments, parts and supplies. In general, the service vehicle should include at least the following:



**A complete set of hand tools including:**

- Standard wrenches: a set of 1/4" through 3/4" standard open and box wrenches
- Adjustable wrenches: an eight-inch and a ten-inch handle adjustable wrench
- Socket wrench kit: 1/4" to 3/4"
- Pliers: groove joint pliers (commonly called water-pumps or channel locks<sup>®</sup>), linesman pliers, locking pliers (such as Vise Grips<sup>®</sup>) and needle nose pliers
- Allen wrenches (hex keys): a standard set
- Screwdrivers: an assortment of slotted and Phillips heads
- Nut drivers: 3/16", 1/4", 3/8" and 1/2"
- Wire cutter & stripper
- Filter wrench
- Scraping tool (single edge razor)
- Tubing cutters: 3/4" regular and mini
- Flaring tool
- Flashlight with spare batteries
- Drop light
- Jumper leads with insulated alligator clips
- Tape measure: 12' minimum
- Drill and drill bits

**Test equipment:** pressure gauge, vac-

uum gauge, electric meter and complete combustion analyzer.

**Vacuum cleaner:** with assorted adaptors and boiler/furnace brushes.

**Supplies:** furnace cement, rags, cleaner, drip tray, builder's paper or other floor covering.

***For Riello Burners and other brands with metric components the following are also required:***

- 8mm, 10mm, 12mm, 14mm and 15mm wrenches #20 and #25 Torx wrenches
- 4mm and 5mm Allen wrenches (long and short handle)

## Tune-up procedure

*Following are the procedures for a typical tune-up. Individual companies often develop tune-up procedures that vary from these. It is important to follow company policies and procedures.*

This is an effective way to perform a tune-up in a thorough, systematic manner. Although there may be circumstances that make it impossible to perform all the operations or do them in the suggested sequence, NORA recommends this outline whenever possible.

### Step 1. Customer Interview:

Give the customer a friendly and professional greeting. Ask if they have experienced any problems or if they have any

#### **Helpful hint:**

**Try to avoid unplugging any electrical appliances when performing service. If anything must be unplugged, the technician should ask the customer for permission first and leave their truck keys tied to the cord to ensure it will be plugged back in before leaving.**

questions. Listen carefully and address their concerns. Operate the remote switch to be sure it works properly and leave it in the "off" position.

### Step 2. Visually inspect the unit:

Visually inspect the unit while spreading sheets of builder's paper or other material to protect the work area.

1. Verify that limit controls are properly set with the correct differential. Note what nozzle, filter and fuel unit are installed so the correct parts can be selected on the next trip to the service vehicle.
2. If the unit has not been in operation for some time, turn the burner on for about 5 minutes to dry the heat exchanger surfaces.
3. Check the draft drop by testing at the breech and over-the-fire. If the drop is greater than -.04 inches, there is probably a buildup of soot and scale or there may be air leaks in the unit. Note any problems so that they can be repaired during the tune-up and turn the unit off before proceeding.

### Step 3. Inspect the fuel tank:

NORA recommends that technicians check the fuel tank for visible damage and water during tune-ups. If water is found, the technician's supervisor should be notified so arrangements can be made for it to be removed and an investigation made as to the source. Be sure to tighten any tank plugs or components that were removed while checking the tank for water.

### Step 4. Fuel lines, valves, and filters:

Inspect the fuel line for leaks, kinks or dents. If the line is run underground, check to be sure it is made of coated copper or run



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07:11

**Fuel line  
Vacuum gauge**



through protective tubing. If bare copper is run underground, notify the customer and follow company procedures. Make sure there are no compression fittings anywhere in the fuel line, if any are found, NORA recommends that they be replaced with flare fittings.

Shut off the oil valve, place a pan under the filter to protect the area & collect any fuel drippings and replace the fuel filter.

**Cartridge filters**—Follow the manufacturer’s instructions, if they are not available the following procedures are recommended:

1. Loosen the center bolt, remove the bowl, remove & discard the old cartridge and gaskets.
2. Carefully clean the filter bowl and head.

**Inspect for:**

- Scratches, flaking, pitting or bubbling
- Missing coating or exposed metal
- Visible rust or corrosion
- Leaks or potential leaks
- Surface flaws or corrosion on center bolt, vent screw
- Evidence of lower bolt or nut damage

If any of these defects are found, the unit should be replaced.

3. Install the new cartridge first, and then the gaskets for the bowl, center bolt and vent screw.
4. Re-assemble the bowl to the filter head and tighten the center bolt in accordance with the manufacturers specifications.

**Spin on filters**—Follow the manufacturer’s instructions, if they are not available the following procedures are recommended:

1. Using a filter wrench, loosen and spin off the old cartridge.
2. Cut and remove the old O-ring.
3. Inspect the threads for signs of wear or damage and replace head if required.
4. Apply a thin coat of petroleum jelly or motor oil to the gasket.
5. Spin on the new cartridge.

**Step 5. Fuel unit:**

1. Clean or replace the strainer, carefully scrape off the old gasket before installing a new one.
2. Open the valve, turn the switch on and bleed the unit. Run fuel through a clear tube into a container until there are no visible air bubbles. Check for leaks in the line and at the valve, filter and the fuel unit.
3. Disconnect the nozzle line from the drawer assembly and install a pressure gauge on it.
4. Operate the unit until the pressure

**Checking pressure gauge on nozzle line**



holds steady, then increase it 40-50 PSI above the recommended setting. Check that the pressure reading changes smoothly as the adjustment screw is turned. A pulsating or bouncing needle could indicate a leaking fuel line or a defective fuel unit.

5. After adjusting the fuel unit back to its proper setting, wait until the unit shuts off on safety and verify the primary control's safety timing.
6. When the unit shuts off, the pressure should drop no more than 15 to 20% and then hold steady. If the pressure continues to drop, the fuel unit has a bad cut-off and requires replacement.

#### Step 6. Nozzle line electrode assembly (aka drawer assembly or firing assembly):

Mark the position of the nozzle assembly on the burner housing before removing it.

1. Remove the nozzle and carefully drain the fuel into a container. Inspect the nozzle adapter and replace it if it is stripped, cracked or if the seat is worn. Flush out the assembly, fill it with clean fuel and install a new nozzle.
2. Clean, inspect and adjust the electrodes using the appropriate gauge. Replace them if the porcelains are damaged or the electrode tips are worn beyond the ability to set them properly.
3. Clean and inspect the air tube, including the end cone slots and holes.
4. Reinsert the nozzle assembly into the air tube and secure it in place, making sure it is in the same position that was marked earlier. Verify the position using the manufacturer's gauge if appropriate.

#### Step 7. Burner motor, housing and fan:

1. Remove the burner motor and check the burner housing for fuel which could indicate a loose fitting, cracked flare or leaking fuel pump seal.
2. If there are oiling points on the motor, lubricate each with 3-4 drops of SAE 20 non-detergent oil. If there are cooling slots, clear off any dust or blockages.
3. Check the motor shaft for end play, if it is excessive, replace the motor.
4. Inspect the burner coupling to be sure it is not worn or stripped.
5. Clean the air inlets and fan using a small brush.



Using a fan brush

6. After reinstalling the motor, spin the fan a few times to make sure that the motor, fan and fuel unit are moving freely and that everything is properly connected.
7. Check all wires and connections at the burner.

Audio  
12:39

Adjusting draft  
regulator on flue



### Step 8. Ignitor and cad cell:

1. Clean and check the ignitor's bushings and springs. Verify that the electrode rods (or other connectors) make solid contact with the ignitor connections (springs).
2. Clean the cad cell eye and wires. Make sure the bracket is positioned correctly for good flame sighting.
3. As the ignitor is being closed, be sure the electrodes are making solid contact with the ignitor springs and that no wires are being pinched.

### Step 9. Flue pipe:

1. Verify that the flue pipe is properly screwed together and supported, correct any deficiencies.
2. Remove the pipe and brush it out, inspect its condition, replace it if necessary.
3. Check the draft regulator to be sure it swings freely.
4. Clean the chimney base and check the chimney for blockages. If there is an accumulation of broken brick or liner, advise the customer to contact a chimney professional and note this information on the service ticket.

If the unit is equipped for power venting, follow the manufacturer's maintenance instructions. If the instructions are not available, the recommended procedures include:

1. Cleaning and checking the fan blower wheel.
2. Oiling the motor; checking the draft-proving switch.
3. Checking/cleaning the outside hood and exterior mechanism.

### Step 10. Clean the heat exchanger and combustion area:

1. Remove any baffles and brush the flue

### Using a vacuum



passages, keeping the vacuum hose close to the brush to avoid spreading soot. Look for signs of air or water leaks and reinsert the baffles.

2. Clean the combustion area, being careful not to damage the chamber or target wall.
3. Inspect the condition of the refractory material and repair or replace it as necessary.

*NOTE: Be extremely careful when vacuuming the unit. Be sure it is cool enough to prevent hot embers from entering the vacuum.*

### Step 11. Replace, seal and fasten:

Reassemble the unit using furnace cement if necessary to seal any air leaks.

### Step 12. Fire the unit and check operation:

1. Start the burner, if possible check the appearance of the flame and make sure that there is no impingement.
2. Cycle the burner to check for prompt ignition, smooth operation and clean cut-off.
3. If appropriate, disconnect the thermostat leads and install a jumper across the T-T terminals to keep the burner running. Check the operation of the high limit control.



**Step 13. Combustion analysis and adjustments:**

1. Perform a complete combustion analysis, make appropriate adjustments and record the final readings. The readings should be in line with the manufacturer recommendations, typically:
  - Smoke: zero
  - Draft: Unless the unit is designed for positive pressure, draft over-the-fire should be approximately  $-.02wc$  (negative point zero two inches)
  - $CO_2$ :  $10\frac{1}{2}$  to 12%
  - Net stack temperature: Over  $350^\circ F$
2. After final burner adjustments are completed, remember to remove any jumpers installed to facilitate testing.

*Customers may be concerned when they see the combustion test hole. Some companies routinely seal the hole after tests are completed to prevent these concerns.*

**Step 14. The heating system:**

The following steps will vary depending on the type of heating system being worked on. Regardless of the type of system, it is important that the technician follows manufacturer instructions to verify that ALL LIMIT CONTROLS are functioning properly. If there is more than one thermostat, ask the customer to set each one 10 degrees above room temperature.

**Hot water system**

1. Check the zone valves and/or circulators to be sure each operates properly. If applicable, lubricate the circulator motor and bearing assembly.
2. Check the circulator couplings and motor mounts, replace if worn.
3. Check the control settings to be sure

they will provide for proper heating, hot water, and circulator operation.

4. Check the system pressure and the expansion tank.
5. If there is an indirect water heater, check its circulator and control.

**Warm air system**

1. Check heat exchanger for cracks, missing or loose cleanouts and anything else that would allow flue gas to enter the home.
2. Check the blower limit settings.
3. Inspect and clean the blower compartment.
4. Check the air filters and clean or replace them. Note the filter size on the service ticket and remind the customer to check and clean/replace the filter regularly.

*If applicable:*

5. Check and lubricate the blower.
6. Check the condition and tension of the fan belt. Replace or adjust as required.
7. Check the blower mountings and bearings for excessive wear.
8. Check the humidifier for proper operation, water leaks and mineral build up.

**Steam boiler**

1. Check the low water cutoff by draining water from the system until the burner shuts off.
2. Check the automatic water feeder.
3. Clean the sight glass and replace it and the washers if necessary. If the glass fills with dirty, oily water, skim the boiler until it clears up.
4. Check the main vents and look for evidence of leaks.

Audio  
18:33

**For all systems**

1. After completing these steps, be sure to return all controls to their proper settings and double check to be sure that all jumpers have been removed.
2. Ask the customer to reset all thermostats to their normal settings.

**Step 15. Cleanup the work area:**

Once everything is working properly, spend a few minutes cleaning up.

**Make it shine before leaving**



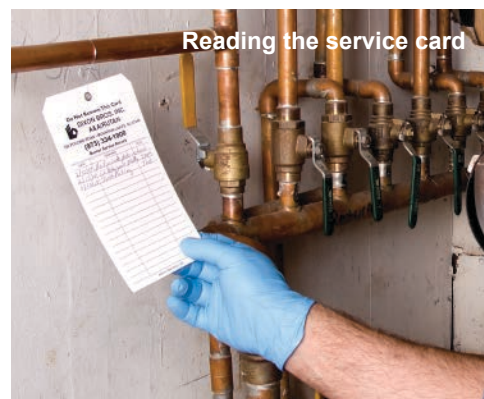
1. Wipe and clean all external surfaces of the boiler or furnace and work area. Use only clean rags to avoid leaving an odor behind.
2. Collect all used parts and debris (builders' paper, oil absorbent, etc.) and place them in the service vehicle, avoid using the customers garbage cans.
3. Use a vacuum cleaner to clean the area around the system.

Before leaving, check the work area one last time. Pay particular attention to potential sources of fuel leaks, such as the filter canister, fuel unit, burner housing and oil valve.

**Step 16. Reset and record:**

1. Verify that thermostats and controls have been returned to their proper settings.

2. Fill out the service card with the work that has been performed, the parts that have been replaced, the efficiency readings, the nozzle size, and the safety timing.
3. Fill out all company required paperwork completely and note anything that needs to be followed-up on.



**Step 17. Report to the customer:**

1. Before leaving, explain what was done, including actions taken to address concerns discussed during the initial interview. Explain the combustion analysis results and advise the customer about potential energy saving improvements.
2. If follow up work is required, explain what and why.
3. Have the customer sign the work order, give them the appropriate copy and thank them for their business.

## Chapter 14: Additional Resources

NORA has compiled a library of additional technical resources for your continued education. Scan the QR code or go to the web address. Check back often, as NORA will continually add content as it becomes available.



You will find:

- Videos
- Technical Bulletins
- Instructions
- and More

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