Chapter 12

Ignition Systems

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Chapter 12

Ignition Systems

Introduction

The main component of the ignition system is a solid state ignitor that utilizes electronics to produce an output voltage from 14,000 to 20,000 volts. Some older burners still in the field have an ignition transformer that supplies 10,000 to 12,000 volts. When these transformers fail, they are usually replaced by ignitors.

These components supply high voltage to electrodes which carry the voltage to the area just above the nozzle. When the burner starts, a spark "jumps" from the tip of one electrode to the tip of the other, igniting the atomized fuel. A typical ignition system is shown in Figure 12-1.

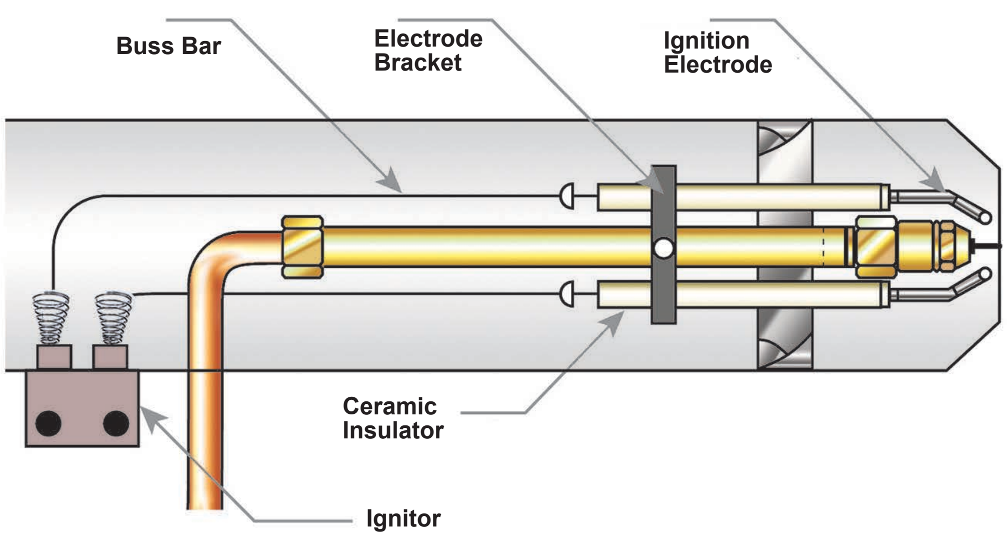
The voltage travels from the ignitor through the buss bars to the electrodes, which are held in place by ceramic insulators (porcelains). When the voltage reaches the tips of the electrodes it jumps the gap between them, creating a spark.

Types of ignition systems

Burners use one of two types of ignition control systems:

Interrupted ignition: The ignition spark remains on for only a short time at the beginning of each burner operating cycle and is turned off after flame has been established (based on the primary controls trial for ignition timing).

Figure 12-1: Ignition system components



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Terminology has changed over the years and you may hear intermittent ignition referred to as constant ignition. Constant ignition refers to systems in which the ignition source is always on regardless of whether the appliance is operating or not. An example of this would be a gas water heater with a standing pilot.

Intermittent ignition: The spark remains on for the entire time the burner runs.

**Intermittent ignition may hide combustion problems. The constant arc between the electrodes can cause the burners primary control to malfunction and fail to shut the burner off when there is a poor flame. This does not happen with interrupted ignition because the arc shuts off once flame is established. See chart below.

Benefits of interrupted ignition

	Interrupted	Intermittent
Electrical Consumption	less	more
Electrode Life	longer	reduced
Ignitor Life	longer	reduced
Flame Noise	less	more
**Safety	greater	less

A strong spark

The spark across the electrode gap at the tips of the electrodes must be strong enough to withstand the velocity of the air being blown through the air tube by the burner fan. The air being blown through the air tube forces the ignition spark to form an arc toward the oil spray. This arc extends into the spray, causing the fuel vapors to ignite and the flame to establish.

Buss bars & spring clips

To conduct high voltage from the ignitor, an effective and efficient path must be provided to the ignition electrodes. This path may be made with buss bars or spring type conductors.

Buss bars are non-insulated heavy gauge strips of metal that are made by the burner manufacturer to the length and shape to fit a certain model of burner. They are not usually interchangeable with other burner models.

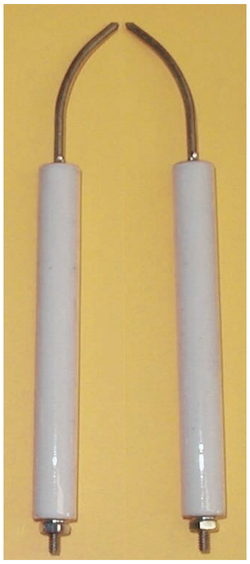
After some time, clips can lose their tension and prevent proper and desired contact. They should be checked whenever the burner is serviced.

Electrodes

Electrodes are metal rods made of specialized steels, and partially covered with a ceramic (porcelain) insulator, Figure 12-2.

The porcelains serve two purposes: They securely position the electrode rods and they serve as insulators, protecting the metal rod against shorting out to the nozzle assembly.

Figure 12-2: Electrodes



Electrode maintenance & setting

Technicians should inspect the electrodes each time the nozzle assembly is removed from the burner and replace them when they show excessive wear, such as cracked porcelains or eroded tips. Figure 12-3

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Figure 12-3:
Electrodes showing excessive wear

Electrodes should be adjusted to the recommendations of the burner manufacturer. Figure 12-4 is a setting for electrodes when one is not available from the manufacturer. Electrode tips should never be permitted to touch or extend into the fuel spray. A carbon bridge will build up between them, ultimately causing ignition failure.

Testing ignitors and transformers

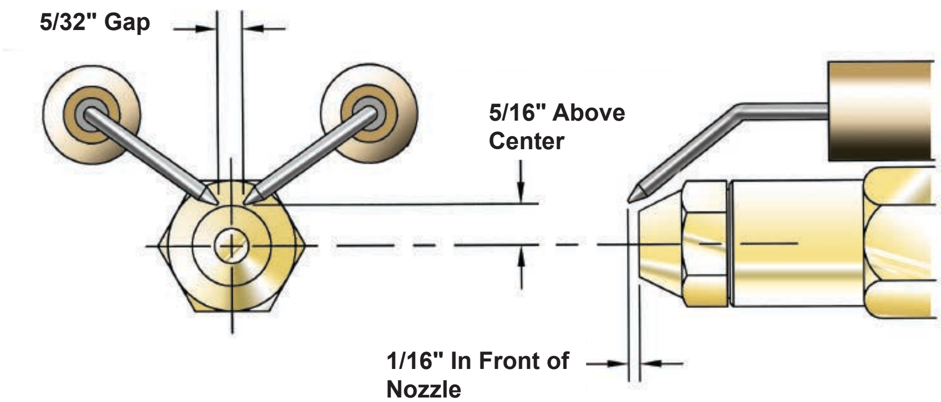
Unfortunately, some people believe that the way to test a transformer is to energize it, then place a screwdriver across the springs or buss bars and slowly move the blade away from one spring while it is still contacting the other. They believe that the ignitor is good if the arc that jumps the gap between the spring and the screwdriver blade tip can be maintained until the tip is at least ½" away from the spring. NORA believes that this "test" isn't checking the ignitor, it's checking the screwdriver. If the insulation on the screwdriver's handle is compromised or a technician touches the blade, they can get a serious shock. It's always better to be safe and use the proper tools and procedures.

DO NOT TEST IGNITORS OR TRANSFORMERS WITH SCREWDRIVERS!

Ignitors and transformers can be tested with instruments designed for this purpose. There are several different types of testers available, some test transformers, some test ignitors and some can test both, Figure 12-5. It is important to be familiar with the tester being used, as both the tester and the ignitor/transformer can be damaged if instructions are not followed.

Figure 12-5:
Instrument to test both transformers and ignitors

Figure 12-4: Typical generic setting



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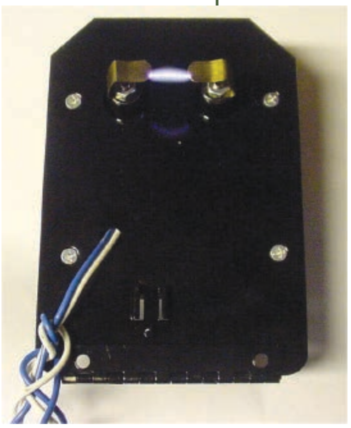

Figure 12-6:
Spark test

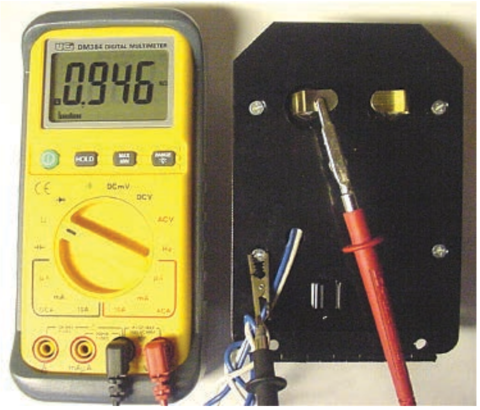

Figure 12-7: Ohmmeter test

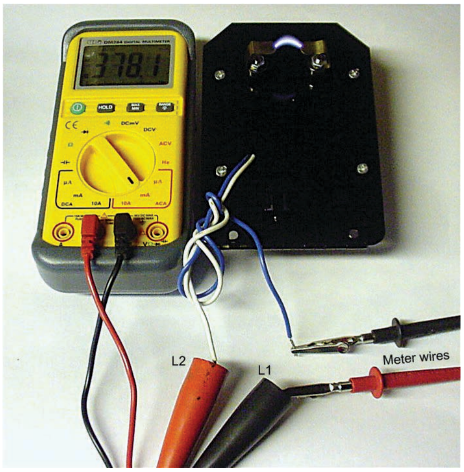

Figure 12-8: Milliammeter

There are also several tests that can be performed by technicians onsite:

1. The first basic test for ignitors (and transformers) is to bring the output terminals to within ½ to ¾ of an inch apart and then apply power to the ignitor, Figure 12-6. A strong spark should jump the gap between the terminals. If it does not, the component needs to be replaced.

2. Place an ohmmeter across the ignitor output terminals with the power off and measure the resistance from each ignitor post to ground, Figure 12-7. Generally, the ignitor is considered good if the resistance from each post to ground has no more than a 10% difference between posts.

3. Bring the ignitor or transformer output terminals to within ½ to ¾ of an inch apart. Place a milliammeter in series with the hot line going to the ignitor and apply power, Figure 12-8.

The reading should stay steady and not vary for at least five minutes. A strong spark should be maintained throughout the test while staying within 10% of the rated amperage draw for the device.

Ignition service problems

Ignition problems are often the easiest to recognize and solve. Sometimes merely cleaning the electrodes and ensuring that all connections are tight and that the spark gap is in proper adjustment is all that is required. The technician must make certain that the electrode porcelains and the ignitor terminal porcelain insulators are not cracked or fuel soaked.

A prolonged delayed ignition can lead to a situation where fuel vapors do not ignite until after the burner has sprayed fuel into the appliance for some time. The accumulated vapors might ignite at once creating more combustion products than the venting system can handle. Delayed ignition can cause soot to blow out of the draft regulator and in severe cases, it can knock down the flue pipe.

The best way to avoid ignition problems is to strictly adhere to the recommended electrode settings as shown in the burner manufacturer's recommendations.

Troubleshooting ignition problems

1. **Loose ignitor connections.** Make sure that wire nuts and spade connectors are tight.

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2. **Test the ignitor.** Replace if defective.
3. **Electrodes not making contact with high voltage ignitor terminals.** Adjust the terminals and/or buss bars.
4. **Remove the porcelain insulators from the electrode holder to determine whether they are cracked.** In many cases the porcelains will crack beneath the clamp of the electrode holder. Replace cracked porcelains, even if they are still functioning properly.
5. **Carbonized insulator.** Carbon accumulations on the ceramic insulators will conduct electricity causing the spark to short out against either the nozzle adapter, nozzle line, or the electrode holder. The carbon must be removed with a solvent or cleaner. Then the insulators must be dried and checked for cracks and/or spark leakage. Determine why the ignitors are carbonized. Typically, this is caused by delayed ignition or a draft problem.

Keep in mind, that a whole house fan can cause a backdraft by pulling air down a chimney. A significant number of windows must be open throughout the house to provide proper ventilation when these fans are in operation.

6. **Electrodes in fuel spray.** If the electrode tips are extending into the fuel spray, a carbon bridge may form between the electrode tips, shorting out the spark and ultimately causing ignition failure. Clean the electrode tips and set them to manufacturer specs.
7. **Electrodes too close to the nozzle.** If the electrodes are set too close to the nozzle, it will cause the spark to short from the electrode tip to the nozzle creating a delayed ignition or ignition failure. Set electrode tips according to manufacturers' specifications.
8. **Spark gap too wide.** If the spark gap is too wide, there will be no spark at all. Set the gap to manufacturer specifications.
9. **Insulators not held securely.** In the event the electrode support bracket is loose or the porcelains do not fit properly in the bracket, it is possible that the electrodes may move out of adjustment because of burner vibrations. Set electrodes and tighten the electrode support bracket securely, but do not overtighten because that may crack the ceramic insulators.
10. **Delayed ignition may be caused by lack of draft.** If it is discovered that the ceramic insulators are heavily sooted and/or carbonized and the electrode tips are properly gapped and properly set, it is possible that lack of overfire draft is causing the trouble. Check both the overfire draft and breech draft to determine if the appliance needs to be cleaned or if there's a problem with the venting system.

Chapter 12: 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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