



DURAFire® Oil Igniter User Manual

Publication 372000-47 Rev I

● BURNERS ● IGNITERS ● DAMPERS ● CONTROLS



www.forneycorp.com

INTRODUCTION

This manual contains information for the DuraFire® Oil Igniter from Forney Corporation, 16479 North Dallas Parkway, Suite 600 Addison, TX 75001.

All personnel should become thoroughly familiar with the contents of this manual before attempting to install, operate or maintain the DuraFire® Oil Igniter. Because it is virtually impossible to cover every situation that might occur during operation and maintenance of the equipment described in this publication, personnel are expected to use good engineering judgment when confronted with situations that are not specifically mentioned herein.

PROPRIETARY NOTICE

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SAFETY ICON DEFINITIONS

	DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE	Indicates unsafe practices that can result in property damage only.

REVISIONS

REVISIONS	DATE	COMMENTS
A	4/2003	Initial Release
B	5/2003	
C	2/2004	
D	3/2005	
E	5/2005	
F	3/2006	
G	11/2010	Update capacity rating specs
H	02/2018	Update logo & addresses, safety icons
I	08/2020	

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SECTION 1

DESCRIPTION

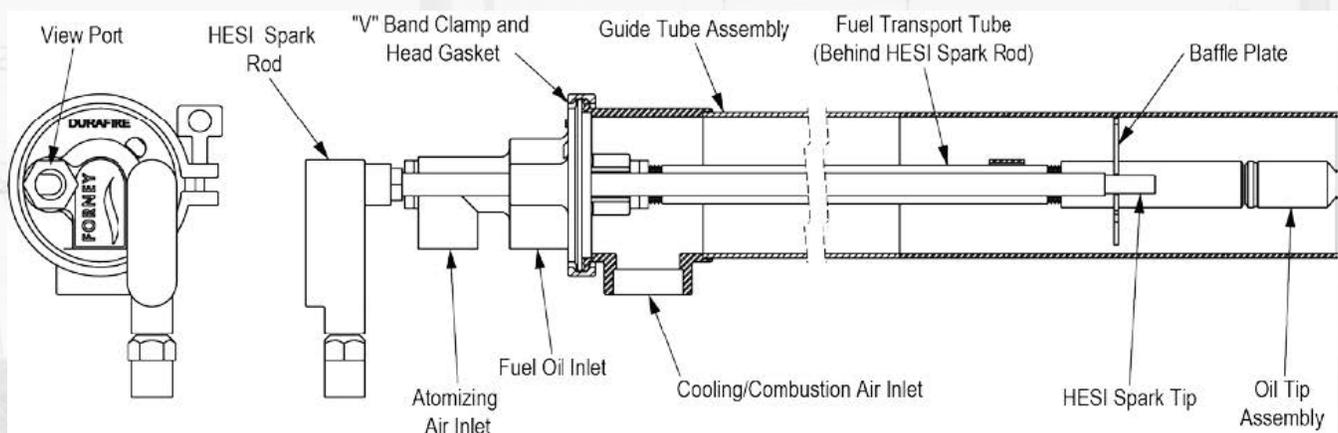
The DuraFire oil igniter is a versatile and reliable source of ignition energy for oil and coal burners. It is a self-contained unit that features a stable and clean burning flame, repeatable fuel ignition, low maintenance (no moving parts), and low cooling air requirements.

The DuraFire oil igniter is NFPA-rated as a Class 1, Class 2, or Class 3 igniter, depending on the application. Class 1 igniters are used for burner light off and support under any condition. Class 2 igniters are used for light off and support under prescribed light off conditions. Class 3 igniters are used for light off only and are not intended for warm-up or support.

These igniters are provided with a durable High Energy Spark Igniter (HESI) for repeatable light off. Refer to the HESI Service Manual (publication 38407702) for detailed HESI information.

The major components of the DuraFire oil igniter are a mount tube, a guide tube assembly, HESI, atomizer, fuel transport tube, and oil tip assembly. Figure 1-1 shows the DuraFire oil igniter assembly.

Figure 1-1 DuraFire Igniter Assembly



1.1 MOUNT TUBE

The mount tube (Figure 1-2) is welded to the burner front plate and supports the igniter assembly. The igniter guide tube slides into the mount tube and is secured in place by a split clamping ring (squeeze collar), which is welded to the mount tube. The squeeze collar also acts as a packing gland.

Figure 1-2 Typical DuraFire Mounting Tube



1.2 GUIDE TUBE ASSEMBLY

The guide tube assembly contains the working parts of the igniter and houses the atomized fuel transport tube (Figure 1-3), baffle, and HESI spark rod. The No. 2 oil is atomized in the head of the igniter and is then directed down the fuel transport tube for combustion within the primary combustion zone. A pilot flame is generated that provides a reliable ignition source for the main flame. Cooling / combustion airflow is directed down the guide tube to support and maintain the primary combustion zone during operation. Ignition first occurs at the spark tip generating a primary flame and then spreads to the fuel transport tube opening at the tip of the igniter.

1.3 HIGH ENERGY SPARK IGNITER

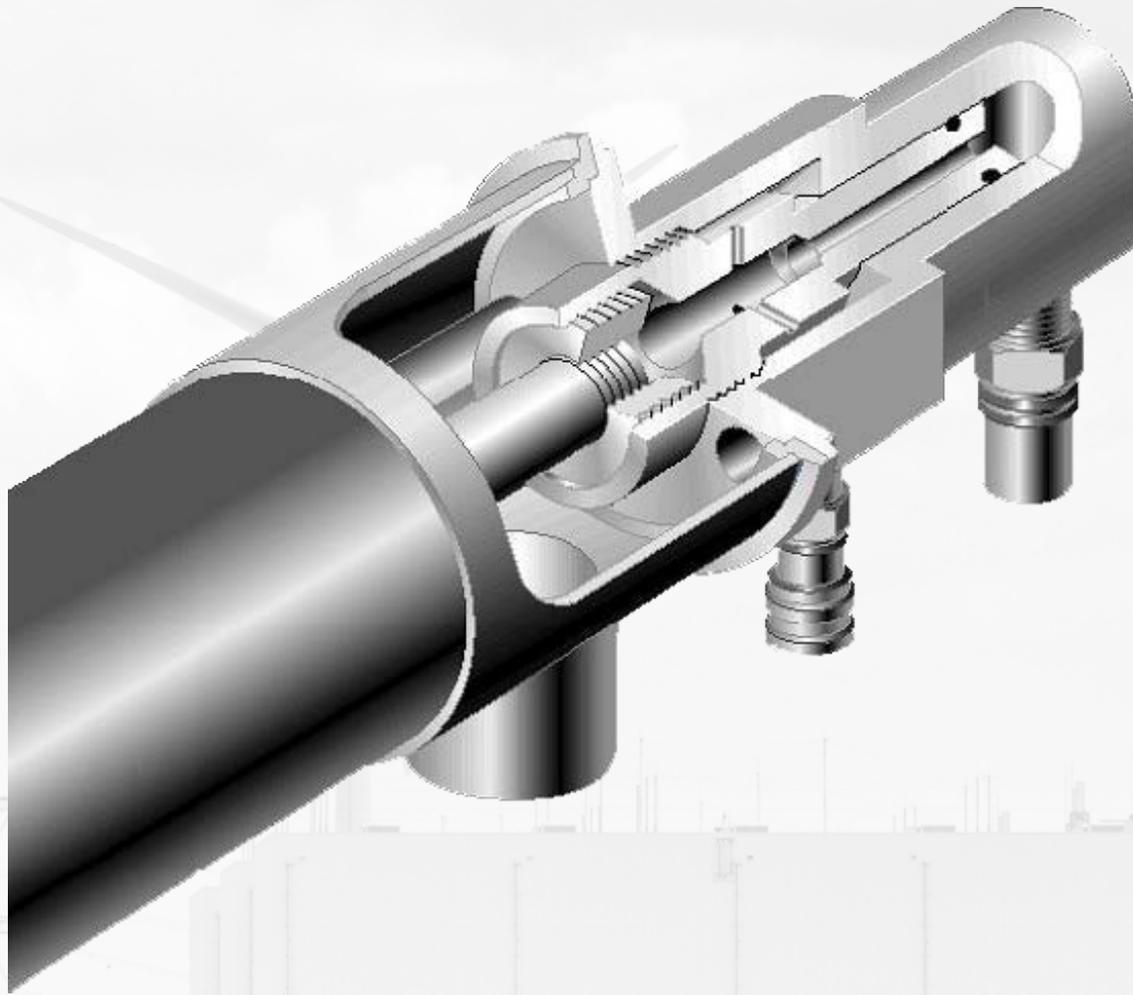
The HESI spark rod provides a 12-joule spark (approximately 3 times per second) that ignites the atomized oil/air mixture. The HESI consists of a non-fouling, surface-gap, spark tip connected to a positioning rod, power unit, and cable. (Refer to HESI Service Manual for details.)

1.4 FLAME DETECTION

Forney recommends the use of Forney's IDD-IIU infrared flame detector.

To sight the igniter flame from a separate 3-inch (76 mm) OD sight tube, the sight tube should be positioned such that it views the igniter flame 3 to 4 feet (91.4 to 121.9 cm) off the tip of the igniter.

Figure 1-3 Atomizer & Fuel Transport Tube



SECTION 2

SPECIFICATIONS

The following specifications are general:

Fuel:	No. 2 oil
Capacity Rating*:	6-33 MBtu/hr (1.76 - 9.67 MW)
Atomization Media:	Air
Fuel Pressure:	60 psig (4.22 kg/cm ²) at igniter
Atomizing Air:	Pressure: 80 psig (5.62 kg/cm ²) at igniter Flow: 0.40 lb air/1 lb fuel
Cooling / Combustion Air:	Flow: 60 SCFM (1.7 Nm ³ /min) at igniter Pressure Drop: Approximately 3 in. (76.2mm) WC across device Connection: 1½ inch NPT female
Length:	Available in 2" (50.8mm) increments from 24 to 180 inches (609 to 4572 mm)
Guide Tube Outside Diameter:	4" (101.6 mm) - igniter can be installed in an existing mount tube for a 4" (101.6 mm) diameter device
Mount Tube Outside Diameter:	4.5" (114.3 mm)
Construction Material:	Guide Tube and Mount Tube - Carbon Steel Furnace End of Guide Tube - 304 Stainless Steel Oil Tip Assembly - 304 Stainless Steel
Retraction Assembly	Per Customer Requirements
Oil Tip Assembly	Narrow or Wide angle, as required
Ignition Method	HESI (see Forney HESI documentation for specifications)
NFPA	Class 1, 2 or 3

* Individual igniters are sized to the specified capacity requirement when ordered. No turndown is available. To change igniter capacity, please contact the factory.

SECTION 3

SAFETY

Safety is the responsibility of each individual who installs, operates, or maintains Forney equipment. Observe the following safety instructions prior to performing installation, operation, or maintenance on the igniter:



WARNING: Hazardous voltage is present, and serious injury can occur. See HESI Service Manual for operation/maintenance instructions for HESI equipment.

1. Use this equipment only for its intended purpose.
2. Follow only the installation, operation, and maintenance procedure discussed in this publication and on appropriate drawings.
3. Ensure that all electrical apparatus used to perform work on this equipment is in good working order and has been calibrated correctly.
4. Do not lift or disconnect grounding cables/wires while equipment is energized.
5. Do not perform modification on this equipment.
6. Before opening the HESI power unit's hinged cover, disconnect the electrical supply from the box. Allow at least 2 minutes for the capacitor to discharge. Exercise extreme care when the power unit cover is open. Refer to the HESI Service Manual for complete safety instructions for HESI equipment.
7. Ensure that no voltage is present prior to disconnecting terminations.
8. Adhere to safety-related information on all drawings.
9. Close the manual fuel shutoff valves before performing maintenance or troubleshooting procedures.
10. Test all fuel pipe connections for leaks.
11. The HESI power unit enclosure and the igniter guide tube should be grounded. (See HESI Service Manual for details.)
12. When removing the igniter assembly from an operating furnace, wear protective clothing and insulated gloves. While observing the igniter flame through an open observation port, wear a face shield and protective clothing.

Only qualified technicians should be allowed access to this system and its components. The installation, maintenance, and operation of the electrical and mechanical equipment entail several elements of danger. Carelessness can result in serious injury or death.

SECTION 4

INSTALLATION

For job-specific installation instructions, refer to the appropriate arrangement and installation drawings (if purchased).

During installation, protect terminal boxes, spark rods, surfaces, round tubes, or any other protruding devices from accidental bumps or bending forces.

4.1 MOUNT TUBE

The mount tube (Figure 1 - 2) is affixed permanently to the burner front plate and supports the igniter assembly. Many retrofit installations may have a suitable mount tube. The inside diameter of an existing mount tube must provide adequate sliding clearance from the 4-inch (101.6 mm) outside diameter of the guide tube, in order to prevent binding of the igniter during installation. If a suitable mount tube is not available, one may be installed. Perform the following steps for installing a mount tube.

1. Cut a hole in the burner front plate in the location desired or as indicated on the installation drawing. The diameter of the hole should be slightly larger than the 4.5-inch (137.2 mm) outer diameter of the mount tube.
2. Insert the mount tube through the front plate and into the burner area. Position the mount tube to the correct distance and angle.
3. Seal-weld the mount tube to the burner front plate (6011- carbon steel to carbon steel welding rod is recommended). Care should be exercised to prevent burn through of the mount tube; any burn through would interfere with the sliding fit of the guide tube. On some older installations where cast iron plates must be penetrated, a steel flange or overlay can be bolted to the cast iron, so the mount tube can be welded to that flange or plate. When installing the guide tube, avoid contact with internal burner parts, such as air vanes or burner sleeves. Occasionally, air vanes may need trimmed in order to provide clearance for the mount tube.
4. On the mount tube, loosen packing and clamping nuts, so the guide tube can slide into the mount tube.

4.2 IGNITER INSTALLATION

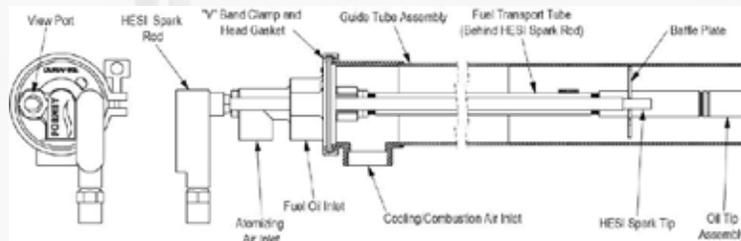
The following procedure describes the installation steps necessary for the correct positioning of the igniter.

1. Before installing the igniter assembly into the mount tube, inspect the primary combustion area of the igniter for cleanliness and proper HESI spark rod position. The HESI spark rod is factory set and should not need adjustment. If necessary, refer to Figure 4-1 for HESI spark rod tip settings.
2. When inspection is complete, slide the DuraFire igniter assembly into the mount tube. If necessary, apply a thin coat of high-temperature-resistant lubricant to the outside surface of the guide tube to assist with sliding it through the squeeze collar.
3. Position the DuraFire igniter assembly to the required depth. In the absence of installation drawings, insert the furnace end of the DuraFire guide tube assembly to the same location as the previous igniter.



NOTICE: Position the DuraFire tip as far back as possible without causing flame impingement on the burner throat or any burner components (up to a maximum of 12" behind the vertical plane of the burner fuel nozzle).

Figure 4-1 Typical HESI Spark Tip Location



NOTICE: HESI Position must be at the 3 o'clock position. HESI and site port cutouts in the baffle plate are to be positioned on the horizontal plane.

4.3 FUEL AND ATOMIZING AIR PIPING

Figure 4-2 shows a typical recommended piping arrangement for the DuraFire igniter. Forney recommends using the following general guidelines when installing the piping:

- Constant fuel and atomizing media pressure at each igniter is important for reliable and efficient operation of the igniter. Exercise care in the design, especially on multiple igniter/burner furnaces, to achieve even distribution under all flow conditions.
- To prevent contamination of the igniter during commissioning, ensure that all piping and hoses have been blown free of debris and moisture.
- Forney recommends installation of fuel pressure regulators for each elevation burner.
- If accumulators are supplied, ensure that they are in place and pressurized with nitrogen to 60% of design igniter operating oil pressure.
- Install strainer elements at each igniter oriented in the correct direction.
- Install the flexible hoses with all of the bends in one plane. The hoses cannot withstand twisting or kinking. It may be necessary to install an additional union.
- It is recommended that fuel and atomizing air-piping approach the igniter from below the igniter elevation.



NOTICE: If fuel and atomizing air piping are part of Forney's supply, refer to job specific drawing to assist with piping installation.

Figure 4-2 Typical Recommended Piping Arrangement for DuraFire Igniter



4.4 COOLING COMBUSTION AIR

1. Ensure that all cooling/combustion air piping is blown free of debris and moisture.
2. Connect the flexible air hoses to the cooling/combustion-air inlet on the guide tube. Install the flexible air hoses to allow for maximum boiler expansion. A balancing valve is required at each igniter cooling combustion-air inlet.

4.5 WIRING

The DuraFire igniter requires AC service to the HESI power unit.

Before commissioning the equipment, test all electrical components for proper operation by energizing the component while it is isolated from the burner management system. Improper operation or failure of a component to operate requires troubleshooting techniques, such as performing a continuity check, locally energizing the component, or temporarily bypassing the interlock.

Keep accurate records of all electrical tests. Before proceeding with commissioning, all interlocks must be restored to operating condition.

SECTION 5

COMMISSIONING



NOTICE: Descriptions in this section depict a typical DuraFire commissioning; any of the directions may vary by specific installation.

Use the following checklist to ensure that the DuraFire igniter is ready for initial operation.

- Installation has been completed per the instructions in this manual.
- The fuel and air-piping configuration is correct, and dampers, valves, strainers, and instrumentation are installed properly.
- The air and fuel connections to the igniter are installed according to the preceding instructions.
- The igniter is inserted to the proper depth relative to the burner fuel nozzle.
- All electrical components are wired properly and tested.

To commission the DuraFire igniter, complete the above checklist and then perform the following steps:

1. Place the cooling/combustion air system into service.
2. Each igniter should have a manual airflow adjusting valve in the 1½ inch (38.1 mm) cooling /combustion airline. To set the correct cooling/combustion airflow, insert an airflow measuring device in the 1½ inch (38.1 mm) line. Adjust the manual valve to obtain the correct airflow. For multiple burner boilers all igniters must be set and re-checked to ensure the entire system is balanced.



NOTICE: Before proceeding, all light off permissive conditions must be met.

3. Prepare to place the DuraFire Igniter into service by completing the following steps: Start oil pumps
 - a. Open the manual oil valve at each igniter.
 - b. Set the igniter oil header pressure regulator to required pressure at the oil gun block valve.
 - c. Open the manual atomizing air valve at each igniter.
 - d. Set the atomizing air regulator to maintain 80 psig (5.62 kg/cm²) air pressure at the igniter.
4. Initiate a START command to the DuraFire igniter while observing the fuel pressure. If the DuraFire igniter fails to ignite, refer to the Troubleshooting section.
5. The DuraFire should ignite as soon as the oil and atomizing air pressure reach 60 and 80 psi, respectively.

6. When the igniter is in service, ensure that the flame is burning as follows:
 - The ignition of the primary combustion zone will commence inside the guide tube and extend approximately 12 inches (304.8mm) beyond the guide tube. The secondary combustion will commence within 12 inches (304.8mm) of the guide tube. A properly burning oil flame is bright yellow at its base and more orange as the flame travels into the furnace. The DuraFire burns very cleanly with the flame tips being a bright orange.
 - If these conditions exist, no adjustments are necessary. If the flame is not burning according to the preceding description, refer to Section 7 - Troubleshooting.
7. Initiate a shutdown command to the igniter. Ensure that the fuel valve fully closes. The gun should go through a purge cycle as directed by the burner management system.



NOTICE: The DuraFire does not require a separate purge valve. By closing the oil valve and leaving the atomizing air valve open the igniter will purge.

8. Repeat the start and shutdown procedure in steps 4-7 to demonstrate light off repeatability.
9. Ensure that the igniter purge sequence duration is long enough to remove all of the oil from the gun. Duration of ≤ 1 minute is recommended.
10. After the DuraFire igniter has been commissioned and adjustments have been optimized, practice normal maintenance procedures, as outlined in the Maintenance section.

SECTION 6

OPERATION



NOTICE: Descriptions in this section depict a typical DuraFire operation, any of the directions may vary by specific installation.

The DuraFire igniter is ready for normal operation after the installation and commissioning procedures have been completed.

Place the DuraFire igniter into service from a cold state as follows:

1. Prepare the boiler for light off by satisfying all light off permissive conditions.
2. Pressurize the igniter oil distribution header by performing the following instructions:
3. Start the oil pumps.
4. Open the header trip valve.
5. Pressurize the atomizing air header.
6. Start the cooling/combustion air fan(s) or open an air path from other air sources. The fans must remain in service while the boiler is in operation, unless an alternate means of cooling the igniter tip is provided.
7. Initiate an igniter START command. The following sequence of events occurs as the DuraFire igniter goes into service (the following information is typical; individual systems may vary):
 - a. An ignition time trial begins.
 - b. The HESI power pack is energized, and the HESI spark rod begins Sparking.
 - c. Oil and atomizing valves open and emit fuel and atomizing air to the tip.
 - d. Ignition occurs within a few seconds of the fuel admission.
 - e. The flame detector detects the flame when ignition occurs.

If an igniter flame is not detected within the ignition time trial limit, an igniter trip is initiated, the fuel and atomizing valves are closed, and the HESI is de-energized. The gun is not purged after a flameout, igniter trip, or other emergency shutdown condition, because there is a master fuel trip condition. The oil gun(s) should be purged as soon as possible to prevent blockage.



NOTICE: On a manually controlled igniter system, refer to NFPA for time limits and events sequence.

If an igniter flame is detected, the igniter remains in service until the operator either shuts down the igniter, or the burner management system removes the igniter from service.

To remove the DuraFire igniter from service, either manually or automatically, under normal boiler operating conditions, follow these steps (the following is typical; individual systems may vary):

1. Initiate an igniter STOP command. The following oil gun purge sequence occurs:
 - a. The HESI power unit is energized and starts to spark.
 - b. The oil block valve closes.
 - c. The DuraFire will purge with only the atomizing air valve open.
 - d. After the purge period expires, the HESI is de-energized and the atomizing air valves close.
If retraction is provided the igniter will retract.

SECTION 7

TROUBLESHOOTING

If the igniter fails to ignite, any of the following conditions may be the cause.

1. If the igniter does not ignite, ensure that the following conditions exist.



NOTICE: Frequently, initial light off requires several attempts to ensure that the fuel piping system is purged of air and full of fuel. Also, ensure that the atomizing piping is free of water.

- All manual valves in the fuel and atomizing air supply to the igniter are open.
- All control, trip and block valves in the oil and air atomizing lines are functioning properly. Ensure that the block valves open smoothly and are fully open within 2 to 5 seconds of the START command.
- Fuel and atomizing air pressure is regulated to within plus or minus 5 psi of its set point during light off. Any pressure deviation should be recovered to the set point within 2 to 3 seconds.
- Ensure that the HESI spark tip is firing. If the spark rod cannot be observed in place, mark the rod so that it can be repositioned to its previous location. Remove the spark rod from the guide tube, and place the rod in a safe location away from personal contact. Observe the rod for visible emission of three sparks per second. If the spark rod assembly functions properly, reinsert the rod into the guide tube at the rods original position. If the HESI spark rod does not function properly, refer to the HESI Service Manual.
- The HESI spark rod tip is positioned correctly, as shown in Figure 4-1, and is sparking during the ignition process.
- When fuel and air are available to the oil gun, and a spark is present but no oil spray is observed, or an erratic spray exists, remove the oil gun, and inspect the nozzle tip for fouling or obstructions. It will also be necessary to examine the pilot orifices for blockage. Disassemble and clean or repair the gun, as required. Refer to the Maintenance section, Oil Gun Removal and Oil Gun Assembly subsections.



NOTICE: Tip fouling and tip carbonization may occur, due to inadequate purge or a leaking shutoff valve. This condition can result in oil migrating to the hot tip. It may be necessary to increase the purge time or check for shutoff valve leakage. Check for this leakage by removing the igniter end of the flexible oil hose and allowing the oil to collect in a container. While oil pressure is available to the shutoff valve, observe the flexible oil hose for oil leaks. If leakage is evident, repair the shutoff valve. Fouling, failure to light and erratic combustion also can be caused by contaminated or degraded oil. Oil stored for long periods of time can form paraffin and other solids that can plug orifices.

- On installations where remote or local automatic light off sequencing and flame detection is involved, consult system operating logic and ensure that the igniter time trial for ignition is adequate to allow the oil and atomizing media to reach the burner tip and stabilize.

2. If the igniter lights but fails to stay on, ensure that the following Conditions exist:

- Oil and atomizing media pressure is maintained as the igniter starts.
- Cooling/combustion airflow is set properly and maintained as the igniter starts.
- Burner airflow is not blowing out the flame.
- The flame detector is functioning properly.

3. If the igniter lights but an inadequate flame exists, i.e., orange flame with dark tails, ensure that the following conditions exist:

- The amount of cooling / combustion air to the igniter and the amount of secondary air around the igniter is adequate. Dark tails usually indicate insufficient combustion air and fuel mixing.
- Atomizing air is maintained at 80 psi at the igniter and is dry.
- The oil gun tip is clean and free of any obstruction.

SECTION 8

MAINTENANCE

The DuraFire components discussed below require maintenance. Proper care of these components ensures long and reliable service. On a periodic basis, complete the preventive maintenance activities as follows.



NOTICE: Maintenance on all internal parts such as fuel transport tube or HESI tip will require removal of the complete internal assembly. The DuraFire is not designed to remove the HESI rod only from the igniter.



CAUTION: Use protective clothing and gloves if furnace is in operation.

8.1 GUIDE TUBE

Inspect the guide tube from the furnace side or remove internals from the mount tube every 12 months or during a planned boiler outage.



NOTICE: If heat distortion is observed, the cooling airflow to the DuraFire igniter may be impaired in some way, or the igniter may be too far forward. Refer to the Commissioning section and make necessary adjustments to the cooling/ combustion airflow and igniter position.

8.2 FUEL TRANSPORT TUBE AND TIP

The following procedure details recommended maintenance steps for the fuel transport tube and orifices.

1. Close the manual valve to shut off the oil to the igniter, and then disconnect fuel line from igniter.
2. Remove HESI spark rod electrical connections.
3. Remove the guide tube V-band clamp from the rear flange.
4. Carefully remove the internals of the igniter from guide tube.

5. Inspect the tip assembly for plugged orifice.
6. The primary orifice should not require cleaning under normal operation. If it becomes necessary to clean the primary orifice a review of the operating conditions should be undertaken to determine the cause of the plug. Suggested cleaning method:
 - a. At the firing deck, remove hoses and HESI cable from igniter.
 - b. Disconnect V-band that holds igniter internals in the guide tube.
 - c. Remove igniter internals.
 - d. Take internals to adequate support bench.
 - e. Using a penetration rod no larger than 0.005 to 0.010 inches (0.127 to 0.254mm) smaller than the primary orifice, remove any debris that may restrict the orifice opening. It is permissible to use a cutting torch tip-cleaning rod that has serrated edges. Use caution not to damage the contour of the orifice.
 - f. Use a vacuum to pull any debris out of the tip through the large orifices at the igniter tip.
 - g. Reinstall the igniter internals in the reverse order.

In the unlikely event that the plug cannot be removed in the manner described above it may become necessary to soak the tip in cleaning solvent. Soaking the tip can be accomplished either by removing the tip or not removing the tip.

7. If removing the tip from the transport tube is necessary, follow the procedure below:
 - a. Loosen spark rod retainer nut and slide spark rod out of diffuser on tip.
 - b. Unscrew tip. Note that the tip is threaded to the fuel tube using a National Pipe Thread and could be very tight. The fuel tube must be secured in a vice or pipe clamp when removing the tip.
 - c. Submerge tip in cleaning solvent.
 - d. Use penetration rod 0.005 to 0.010 inches (0.127 to 0.254mm) smaller than orifice to clean.
 - e. When orifice is clean, reinstall the tip by threading it onto the fuel tube and tightening until the HESI opening in the diffuser aligns with the HESI rod opening in the igniter head.
8. Reinstall the HESI rod and tighten the compression fitting.

SECTION 9

STORAGE

Store the DuraFire igniter in a clean, dry atmosphere. When possible, store the assembly in its original shipping container until used. If the DuraFire igniter is removed from its shipping container, store it in a horizontal position supported at both ends of the guide tube. Protect both guide tube ends from damage due to inadvertent bumps or blows. Cover the DuraFire igniter with plastic to keep it free of dust and dirt. Storage longer than 30 days requires humidity less than 85% and temperature less than 120°F (49°C).

SECTION 10

RMA / WARRANTY

Forney Corporation warrants this product to be free of defective material and workmanship. Forney will replace this equipment as long as it is being used for its intended use and is found to be defective upon receipt up to the expiration of the warranty period.

Prior to returning any material to Forney, please contact your Forney customer service representative and provide the contract number or the customer purchase order number.

SECTION 11

SPARE PARTS

When ordering spare parts, contact Forney's Aftermarket Department via any one of the following methods and furnish the following information.

Email	Phone	Fax
spares@forneycorp.com	972-458-6100 or 972-458-6142 or 1-800-356-7740 (24-hour direct line)	972-458-6600

1. Contract number
2. Customer purchase order number
3. For each part ordered, provide the following information:
 - a. Part number
 - b. Part description
 - c. Quantity required

The recommended spare parts list in Table 11-1 advises of the minimum stock level of replacement parts that should be in the customer's stock for system startup and the first year of operation. Replacement parts should be ordered as necessary to maintain the suggested stock of spare parts at the recommended level.

Table 11-1 Recommended Spare Parts List

Part Description	Part Number	Quantity
HESI Spark Rod Tip, Short	383726-02	1 for every 5 igniters
HESI Spark Rod Tip, Long	383726-03	1 for every 5 igniters
Atomizer Assembly O-Ring	73031-01	1 for every igniter
HESI Power Pack	358447-05	1 for every 5 igniters
V-band Clamp	91102-06	1 for every 10 igniters
Head Gasket	369110-01	1 for every 10 igniters

The recommended spare parts list advises of the minimum stock level of replacement parts that should be in the customer's stock for system startup and the first year of operation.



NOTICE: Drawing number, stock number, and part number are interchangeable for Forney-supplied items.