



# 48 Joule High Energy Spark Igniter (HESI) User Manual

Publication 372001-16 Rev. C

● BURNERS ● IGNITERS ● DAMPERS ● CONTROLS

[www.forneycorp.com](http://www.forneycorp.com)

# INTRODUCTION

This manual contains information for the 48 Joule High Energy Spark Igniter (HESI) from Forney Corporation, 16479 Dallas Parkway, Suite 600, Addison, Texas. [www.forneycorp.com](http://www.forneycorp.com)

All personnel should become thoroughly familiar with the contents of this manual before attempting to use the Forney 48 Joule High Energy Spark Igniter (HESI). 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

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

## REVISIONS

| REVISIONS | DATE       | COMMENTS                                       |
|-----------|------------|--|
| A         | 01/24/2017 | Initial Release                                |
| B         | 02/19/2018 | Update spark tip temperatures and safety icons |
| C         | 01/14/2020 | General Rewrite                                |

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# TABLE OF CONTENTS

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# TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>Section 1 Description</b>  | <b>1</b>  |
| <a href="#">1.1 Features and Benefits</a>   | 1         |
| <b>Section 2 Specifications</b>   | <b>3</b>  |
| <b>Section 3 Safety</b>   | <b>4</b>  |
| <b>Section 4 Installation</b>   | <b>5</b>  |
| <a href="#">4.1 Overview of Installation</a>  | 5         |
| <a href="#">4.2 Power pack</a>  | 5         |
| <a href="#">4.3 Spark Rod</a>   | 6         |
| <a href="#">4.4 Cable Assembly</a>  | 9         |
| <b>Section 5 Commissioning</b>  | <b>10</b> |
| <b>Section 6 Operation</b>  | <b>11</b> |
| <a href="#">6.1 Troubleshooting</a>   | 11        |
| <b>Section 7 Maintenance</b>  | <b>13</b> |
| <a href="#">7.1 Spark Tip Inspection and Maintenance</a>                            | 13        |
| <a href="#">7.2 Power Pack Inspection and Maintenance</a>                           | 13        |
| <a href="#">7.3 Spark Gap Tube Operation Verification</a>                           | 14        |
| <a href="#">7.4 Cable Inspection and Maintenance</a>                                | 14        |
| <b>Section 8 Storage</b>  | <b>15</b> |
| <b>Section 9 RMA / Warranty</b>   | <b>16</b> |
| <b>Section 10 Spare Parts</b>   | <b>17</b> |
| <a href="#">10.1 Recommended Spare Parts</a>  | 17        |
| <b>TABLE OF FIGURES</b>   |           |
| <b>Figure 1</b> <a href="#">HESI Components</a>                                     | 2         |
| <b>Figure 2</b> <a href="#">HESI Power Pack</a>                                     | 6         |
| <b>Figure 3</b> <a href="#">HESI Spark Rod</a>                                      | 7         |
| <b>Figure 4</b> <a href="#">HESI Mount Tube with Quick Disconnect Packing Gland</a> | 8         |
| <b>Figure 5</b> <a href="#">HESI with Retraction Assembly</a>                       | 8         |
| <b>Figure 6</b> <a href="#">Electrical Connections for Cable Assembly</a>           | 9         |

# SECTION 1

## DESCRIPTION

The High Energy Spark Igniter (HESI) is a Class 3 igniter used for direct spark ignition of oil or gas igniters or small burners. The 48 Joule of power delivered to the spark tip easily ignites the fuel. Approximately five (5) sparks per second are delivered. The High Energy Spark Igniter consists of three major components: a power pack, a spark rod, and a cable. Optional retraction units are available.

The 48 Joule HESI power pack is packaged in a NEMA-4 enclosure suitable for wall mounting at the burner front. The power pack sends 48 joules of energy to the spark tip through heavy-duty electrical components. It has a 15-minute on and 30-minute off maximum fire cycle at temperatures up to 140°F (60°C). The proof of spark feature provides local indication that the power unit is functioning properly.

The spark rod is available in the standard rigid design or in a flexible configuration for use in tilting tangential burner applications. The spark rod features a self-cleaning surface gap spark tip that is easily replaceable through a threaded connection. Both the rigid and flexible spark rods are available with an optional retraction assembly to allow the spark tip to be inserted and retracted from the firing position.

## 1.1 FEATURES AND BENEFITS

- **Non-fouling Spark Tip**

The surface gap spark tip produces a self-cleaning, highly reliable, 48 Joule per second even in the presence of moisture, oil, and carbon deposits.

- **Removable Spark Tip**

The spark tip completely detaches from the spark rod through a threaded connection making replacement of the spark tip quick and easy.

- **Safe Operation**

Heavy-duty, UL-approved flexible cable connects the power unit to the spark rod assembly ensuring operator safety.

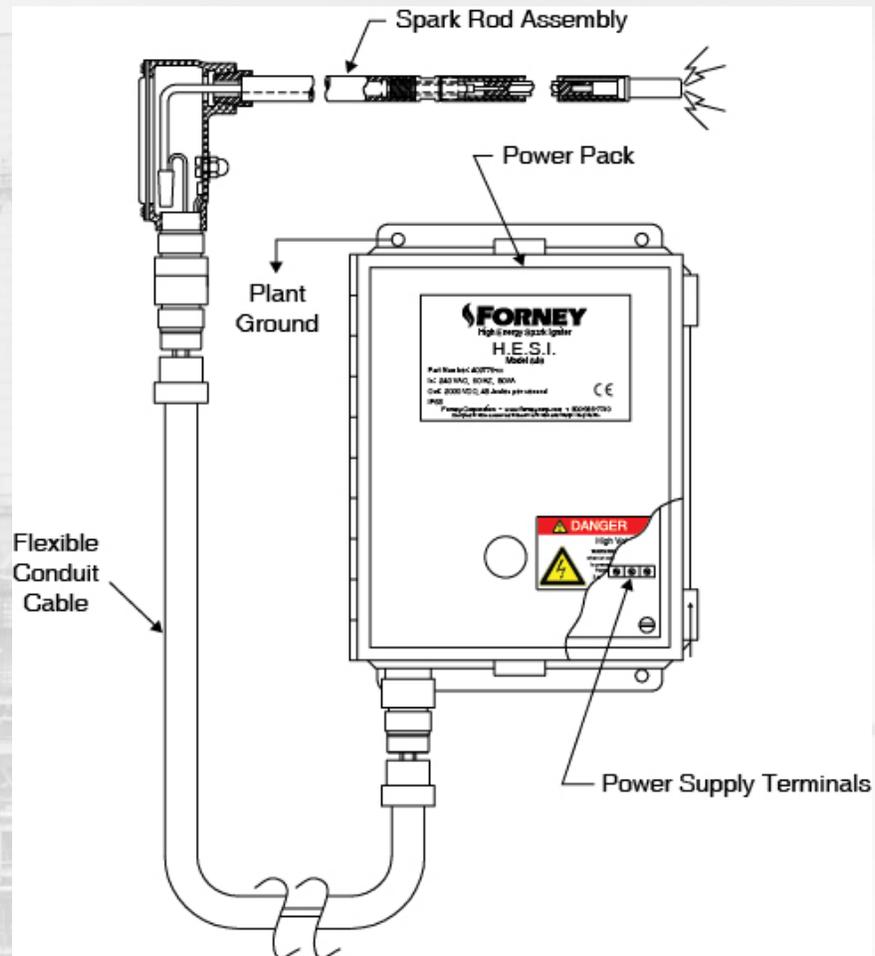
- **Application Flexibility**

Standard, flexible and retractable HESI models are available to fit a variety of igniter or burner types.

- **Proof of Spark Indication**

Both a visual and a contact output is available for proof of spark indication.

**Figure 1 HESI Components**



# SECTION 2

## SPECIFICATIONS

|                                    |  |
|------------------------------------|--|
| Igniter Class:                     | Class 3 Special  |
| Approval:                          | Factory Mutual   |
| Output Energy:                     | 48 Joule per second  |
| Output Voltage:                    | 2000 vdc   |
| Input Voltage:                     | 240 VAC, 50 Hz   |
| Input Power:                       | 240 VAC @ 0.75A (1-A fuse)   |
| Spark Rate:                        | 5 sparks per second  |
| Spark Rod Length:                  | 195 in. (495.3 cm) maximum   |
| Spark Rod Diameter:                | 0.625 in. (1.6 cm)   |
| Spark Tip Type:                    | Gas tight, surface gap   |
| Spark Tip Length:                  | 6, 8 and 27 inches (15.24 cm, 20.32 cm and 68.58 cm)                             |
| Spark Tip Material:                | High temperature alloy with a silicon carbide insulator                          |
| Operating Tip Temperature:         | 1112°F (600° C); Higher temperature during duration of light-off                 |
| Power Unit Temperature Ratings:    | -40°C to 60°C ( -40°F to 140°F )   |
| Power Pack Enclosure (NEMA-4, 4X): | Dimensions: 10" x 8" x 4.25" (25.4 cm x 20.32 cm x 10.8 cm)<br>Weight: 17 lbs    |
| Field Conduit Hole Diameter        | 0.88 in. (2.2 cm)  |
| Power Cable:                       | 12 gage, 3000 v in 0.5" (1.27 cm) flexible conduit                               |
| Power Cable Lengths:               | 6, 12, 15 ft (1.8, 3.65, 4.57 m)   |
| Maximum Firing Cycle:              | 15 minutes on and 30 minutes off<br>(maximum ambient temperature of 60°C (140°F) |

# SECTION 3

## SAFETY

Safety is the responsibility of each individual who installs, operates, or maintains Forney equipment. The Forney design of the HESI includes personnel safety as a basic design element.



**WARNING:** Hazardous voltage is present and serious injury to personnel can occur.



**WARNING: Explosion Hazard.** Do not connect or disconnect while the circuit is live or unless the area is free of ignitable concentrations.

The HESI assembly uses a 2000-vdc energy source to produce 48 joules per second for fuel ignition purposes. Observe the following safety instructions as a minimum to ensure basic electrical safety.

1. Use equipment only for its intended use.
2. Follow the proper installation, operation, and maintenance procedures discussed in this publication.
3. Ensure that all electrical apparatus used to perform work on this equipment is in good working order and calibrated correctly.
4. Do not lift or disconnect grounding cables/wires while equipment is energized.
5. Do not perform modifications on this equipment.
6. Before opening the power pack'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 pack cover is open.
7. Before disconnecting terminals, place a voltmeter across terminals 1 and 2 of capacitor C1 to ensure that no voltage is present.
8. Adhere to safety-related information on all drawings.
9. Before applying the energizing signal to the assembly, fully connect the spark rod to the power unit.
10. When the HESI spark rod is removed from its operating position for testing, do not attempt to energize it without taking precautions. Lay the spark rod in a secure position. Ensure that personnel are not in contact with the spark rod during the test period. Replace the rod immediately following testing.



**WARNING:** Only knowledgeable and qualified technicians should be allowed access to this system or to its components. The installation, maintenance, and operation of electronic equipment entails several elements of danger. Carelessness can result in serious injury or death from electrical shock, falls, or improper use of tools and test equipment.

# SECTION 4

## INSTALLATION

### 4.1 OVERVIEW OF INSTALLATION

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(For Quick Start Up)

1. Mount the power pack in a suitable location, as far as possible from the burner front plate and extreme temperatures. Ensure that cable connectors are facing downward.
2. Carefully insert the HESI spark rod tip into the guide tube until the spark rod extends into the primary ignition zone. If using the HESI in combination with gas or oil igniters, refer to your igniter manual for spark tip location.
3. If retraction assembly is supplied, manually or automatically exercise the retract assembly to verify correct operation.
4. Once tip penetration is set, attach and tighten the locking device to the spark rod.
5. Connect cable assembly from the power unit to the spark rod. Tighten threaded connection.
6. Connect power input leads to H (hot), N (neutral), and G (ground) to terminal block 2 inside the power pack.
7. Energize the power pack to test the spark tip. Observe proper operation.

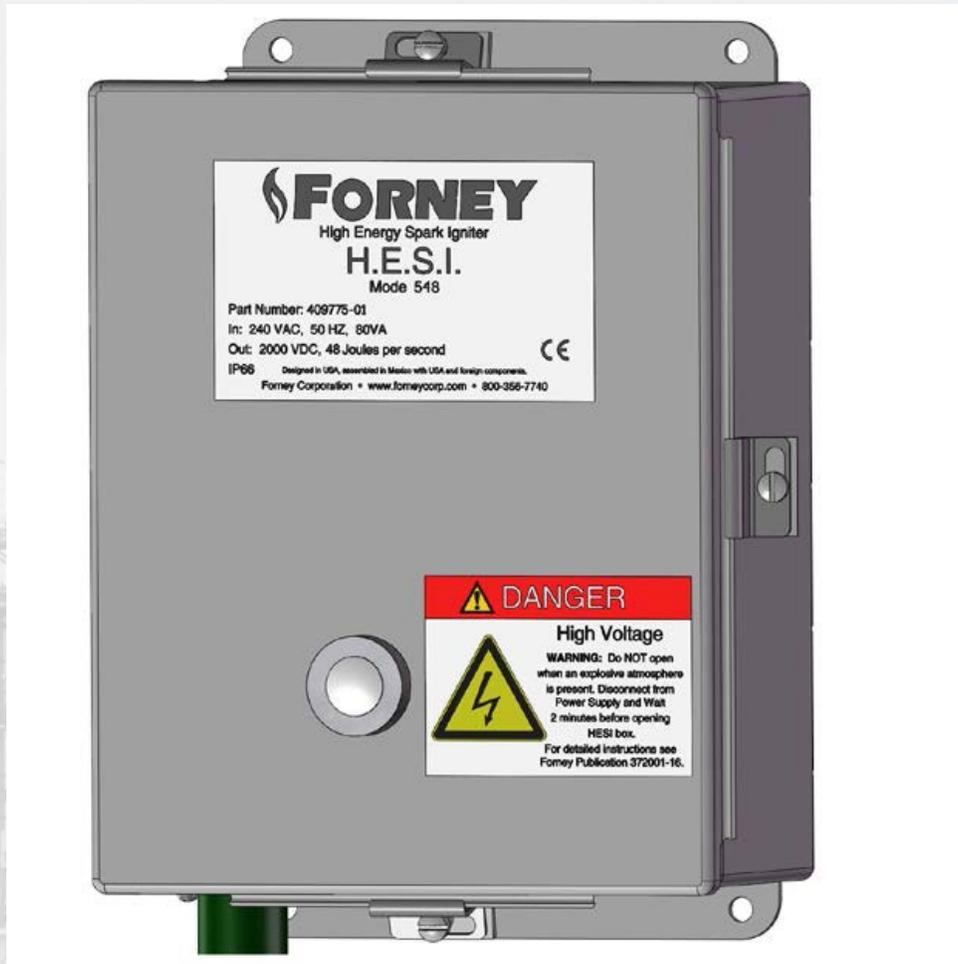
### 4.2 POWER PACK

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Observe the following steps for installing the power pack assembly:

1. Locate power pack away from extreme temperatures and as far away from burner front plate as possible. Allow for cable length, retraction, and boiler expansion.
2. Mount the power pack with fasteners through the four mounting holes. Ensure that the cable connectors are facing down (power pack is upright) to facilitate cable installation.

Figure 2 HESI Power Pack

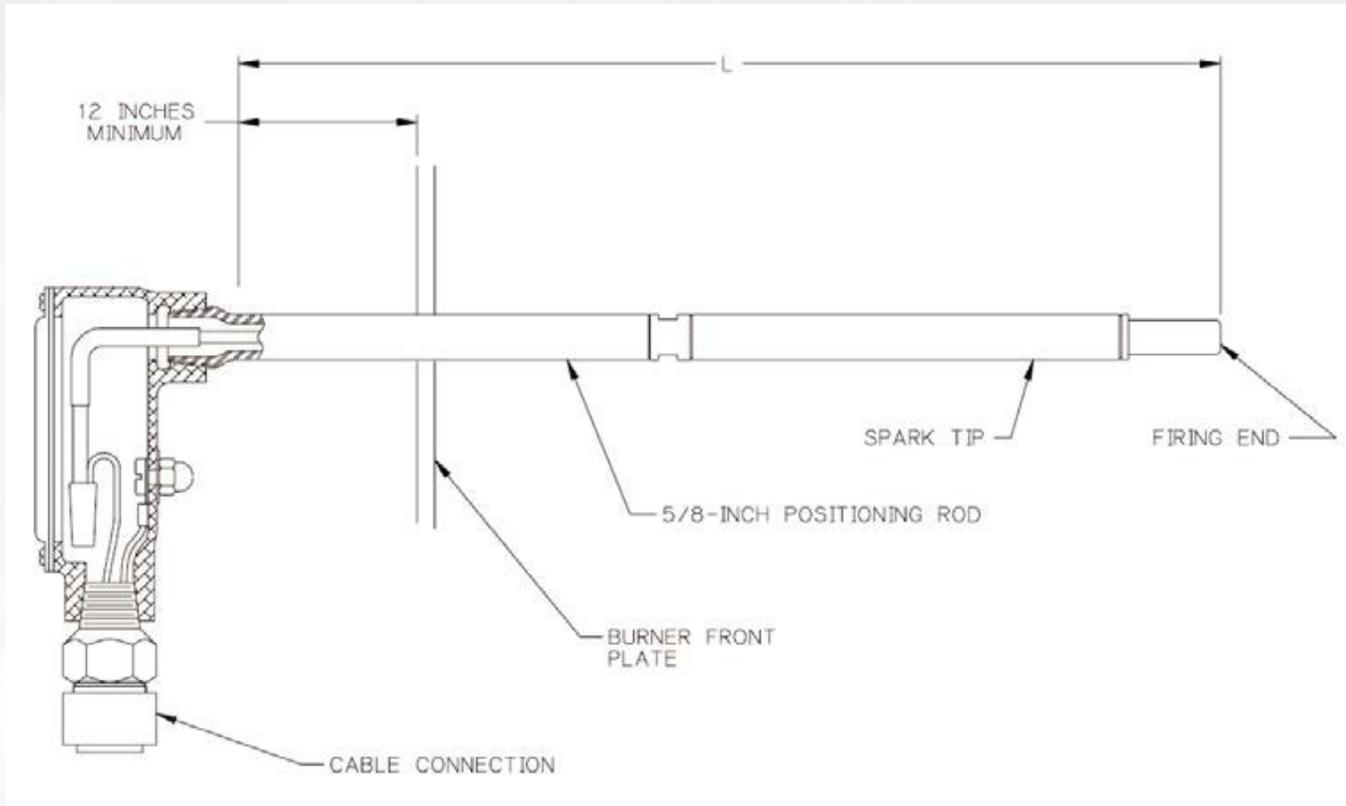


## 4.3 SPARK ROD

In most applications, the HESI spark rod fits into a guide tube of a gas or oil igniter. If using the HESI in combination with gas or oil igniters (i.e. Forney's MaxFire® or DuraFire®), refer to your igniter manual for additional information. Observe the following steps for installing the spark rod assembly into a gas or oil igniter:

1. Carefully insert the spark tip into the guide tube until the spark rod extends into the primary ignition zone. If using the HESI in combination with gas or oil igniters, refer to your igniter manual for spark tip location.
2. When a retraction assembly is supplied, exercise the retract cylinder, either manually or automatically, in the extend and retract positions to check for correct operation.
3. Once the tip penetration is set, attach and tighten the locking device to the spark rod.

**Figure 3 HESI Spark Rod**

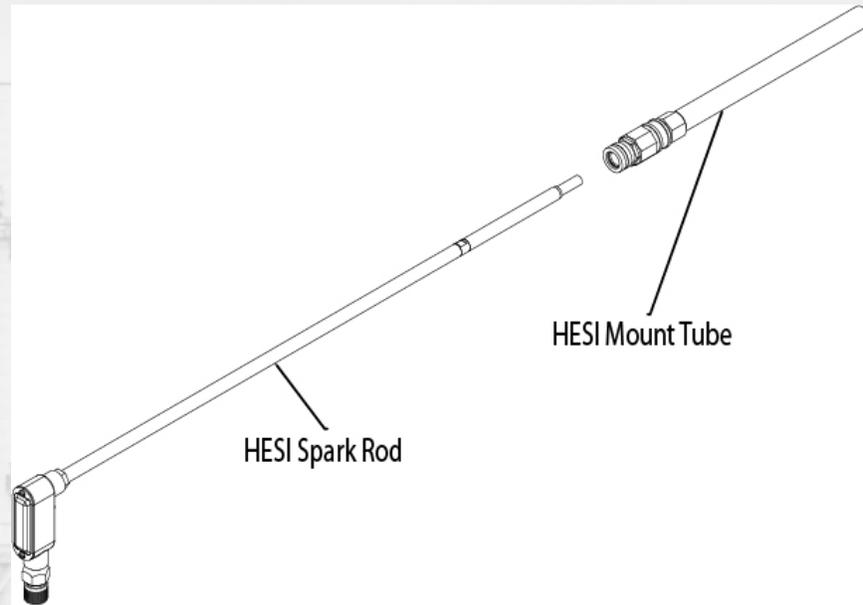


In applications where the HESI spark rod is installed individually, the HESI mount tube is fixed permanently to the burner front plate and supports the HESI assembly. The design of the HESI allows the user to weld the HESI mount tube directly to the burner front plate, if desired.

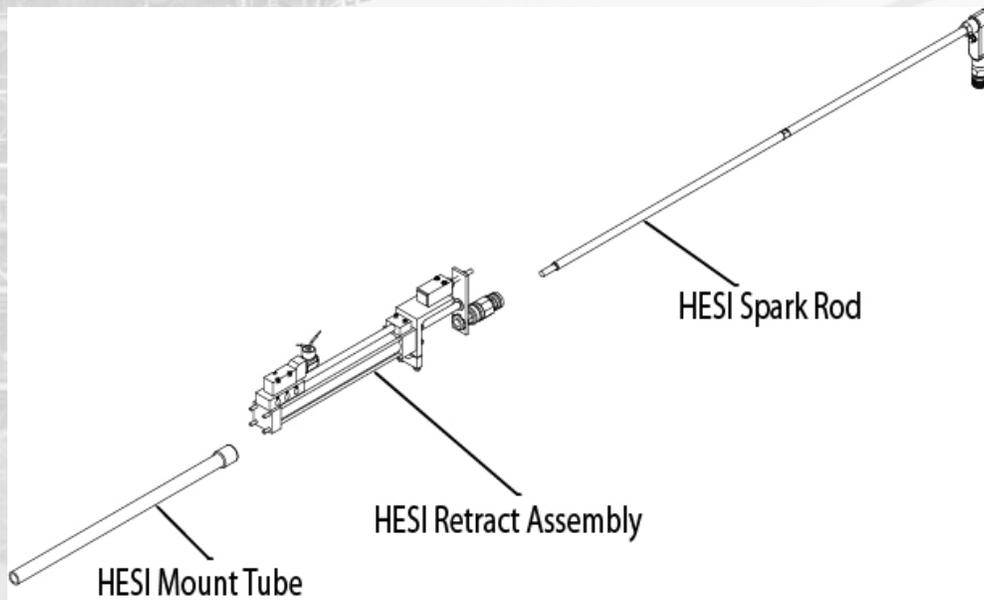
1. Cut a hole through the burner front plate in the location desired or as indicated on the installation drawing. The diameter of the hole should be slightly larger than the outside diameter of the HESI mount tube which is 1.05”.
2. Insert the mount tube through the front plate and into the burner area. Support the mount tube at the position and penetration angle required by the burner manufacturer.
3. Seal-weld the HESI mount tube to the burner front plate. On some older installations where cast iron plates must be penetrated, a steel flange or cover plate can be bolted to the cast iron, so that the HESI mount tube can be welded to that flange or plate. When installing the HESI mount tube, avoid contact with internal burner parts, such as air vanes or burner sleeves. Occasionally, air vanes may have to be trimmed in order to provide clearance for the HESI mount tube.
4. Before inserting the HESI into the HESI mount tube, inspect the primary combustion region for cleanliness.
5. Insert the HESI into the HESI mount tube and tighten the packing gland once the HESI is inserted to the correct depth.

6. If applicable, install the HESI retraction assembly onto the HESI mount tube using the HESI retraction assembly mounting clamp and then connect HESI to HESI retraction assembly using the provided couplings.
7. Once the HESI retraction assembly is installed, adjust the retraction settings, and wire the limit switch.

**Figure 4 HESI Mount Tube with Quick Disconnect Packing Gland**



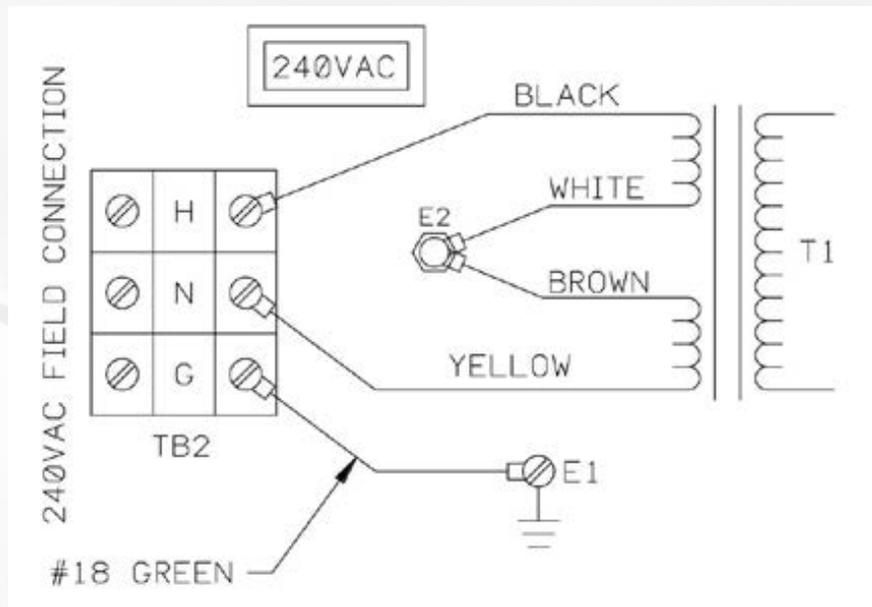
**Figure 5 HESI with Retraction Assembly**



# 4.4 CABLE ASSEMBLY

Connect power input leads to TB2, H (hot), N (neutral), and G (ground) to the power pack as shown in installation drawings and in Figure 2.

**Figure 6 Electrical Connections for Cable Assembly**



# SECTION 5

## COMMISSIONING

When you have completed the installation, perform a spark test and observe spark rod operation in the following manner.

1. Energize the power pack and observe the operation of the spark gap tube.
2. The spark rod assembly is functioning properly when discharge of approximately three sparks per second is visible.

If the spark rod cannot be observed in place,

- a. De-energize the power pack and mark the rod so it can be repositioned to its previous location.
  - b. Remove the rod and place it in a safe location away from any personal contact.
  - c. Energize the power pack and observe the rod for visible emission of three sparks per second.
  - d. If the spark rod assembly functions properly, de-energize the power pack and reinsert the rod into the guide tube at the rod's original position.
3. If the rod functions properly, energize the system to observe the rod's performance with its associated fuel gun.

Check the following items:

- a. Igniter fuel pressure,
- b. Atomizing media pressure, and
- c. Combustion air pressure.

(Refer to the appropriate igniter service manual for pressure specifications.)

The HESI rod may need repositioning if the HESI system functions properly but the igniter does not light.

4. To test other HESI locations, start from the current location and move the HESI rod inward 0.5 inch (13 mm) and retest. Continue to move the HESI rod inward and outward 0.5 inch (13 mm) at a time, testing after each move. Do not move the rod more than 3 inches (76mm) in any direction.

# SECTION 6

## OPERATION

The HESI igniter is a Class 3 ignition source and is only in service during an ignition time trial duration. The HESI can operate during ignition and during oil gun shutdown and purge. Depending on the application, the spark rod can be set in a fixed position or attached to a retraction assembly to move it out of firing position. The spark rod should be fitted with the retraction assembly whenever the HESI spark rod tip will be exposed to continuous temperatures above 149° C (300° F).

The burner management system provides the control signal that energizes the HESI during the ignition time trial period. The power unit transforms the signal into short 12-joule discharges at the rate of three sparks per second. The cable assembly transmits these discharges to the spark rod assembly.

## 6.1 TROUBLESHOOTING

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If the HESI assembly malfunctions, ensure that the procedures described in the Commissioning section have been performed successfully.

If problems continue to occur, refer to Table 1 for troubleshooting information.

**Table 1 Troubleshooting**

| Symptom  | Probable Cause  | Remedy   |
|--|---|--|
| Proof of spark visual indication not flashing          | 1. Input voltage low  | 1. Provide correct supply voltage.   |
|  | 2. Power pack failure   | 2. Replace power pack  |
| Proof of spark visual indication flash weak or erratic | 1. Spark tip fouled and shorting                              | 1. Replace tip assembly and adjust tip to gun setting as specified in drawing or igniter manual.   |
|  | 2. Tip insulator cracked or damaged                           | 2. Replace tip assembly and adjust tip to gun setting as specified in drawing or igniter manual.   |
|  | 3. High-tension cable inside rod broken or insulation damaged | 3. Replace cable assembly on older models which have cable and tip as a single subassembly. The tip must be replaced along with the cable. Adjust tip to gun settings specified on drawing or in igniter manual. |



**WARNING:** Hazardous voltage is present and serious injury to personnel can occur. Before opening the power pack'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 pack cover is open.

# SECTION 7

## MAINTENANCE

Forney recommends performing the following preventive maintenance every six months.

## 7.1 SPARK TIP INSPECTION AND MAINTENANCE

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Remove the spark rod and inspect the spark tip for damage due to overheating, excessive use, and mishandling of equipment. A concave shape of the spark tip end represents normal wear. If the semiconductor material is chipped, cracked, or eroded, replace the spark tip. If the inner electrode, tip center, or tube shows deterioration, wear, or erosion, also replace the spark tip. When replacing the spark tip, observe the following steps:

1. Disconnect all electric power from the power unit, and ensure that all residual voltage is dissipated. (See Safety section.)
2. Remove and replace tip using ½-inch wrench flats.

Note: On older models, which have cable and tip as a single subassembly, follow these steps:

- a. Open the cover plate at the end of the spark rod
- b. Remove the wire nut in the electrical connection and separate the wire.
- c. Straighten the wire.
- d. Unscrew the spark tip using the wrench flats.
- e. Remove spark tip and wire.
- f. Replace above items in the reverse order. Take care to minimize twisting of the wire inside the tip during tip reconnection.

## 7.2 POWER PACK INSPECTION AND MAINTENANCE

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The power pack generally does not need periodic maintenance other than cleaning the exterior and checking the hinged cover for proper closure and sealing.

If the power pack malfunctions, the following steps describe power pack inspection and maintenance.

1. Disconnect all electric power from the power pack, and ensure that all residual voltage is dissipated.  
(See Safety section.)
2. Open the power pack door.
3. Test capacitor C1 for resistance across terminals 1 and 2.
4. Test transformer T1 for resistance at the two red secondary leads.

An open circuit reading on capacitor C1 and/or a low resistance value reading at transformer T1 indicates a normal condition. If a normal condition is present, circuitry problems could exist elsewhere. Replace the power pack.

## 7.3 SPARK GAP TUBE OPERATION VERIFICATION

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A lens in the power pack cover allows for a visual check of the discharging operation of the spark gap tube. A visible flashing of the spark gap tube indicates the presence of electric-discharge voltage and delivery to the spark tip.

## 7.4 CABLE INSPECTION AND MAINTENANCE

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Inspect the cable for fraying or loose connections. Replace frayed cable.

# SECTION 8

## STORAGE

Store the HESI in a clean, dry environment. When possible, store the igniter in its original shipping container until it is installed.

# SECTION 9

## 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 10

## RECOMMENDED 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          |
|----------------------|---|--------------|
| sales@forneycorp.com | 972-458-6100 or<br>972-458-6142 or<br>1-800-356-7740<br>(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

## 10.1 RECOMMENDED SPARE PARTS

The recommended spare parts list in Table 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 2 Recommended Spare Parts List**

| <b>Part Description</b>                            | <b>Part Number</b> | <b>Quantity</b>        |
|--|--------------------|------------------------|
| Spark Tip, Short<br>(for flexible assemblies only) | 383726-01          | 1 for every 4 igniters |
| Spark Tip, Short<br>(Spark Rods 36" and shorter)   | 383726-02          | 1 for every 4 igniters |
| Spark Tip, Long<br>(Spark Rods greater than 36")   | 383726-03          | 1 for every 4 igniters |
| Solenoid & Coil for Retract<br>Assembly, 230 VAC   | 78892-10           | 1 for every 5 igniters |
| Coil Only for Retract Assembly,<br>230 VAC         | 78059-05           | 1 for every 5 igniters |
| Spark Gap Tube                                     | 77741-01           | 1 for every 5 igniters |
| Capacitor for 60Hz units                           | 79942-01           | 1 for every 5 igniters |
| Capacitor for 50Hz units                           | 79942-04           | 1 for every 5 igniters |
| Transformer  | 79941-00           | 1 for every 5 igniters |
| HESI Transformer, CE                               | 79941-10           | 1 for every 5 igniters |

## HESI Commissioning Checklist

After reading this service manual and following its instructions, complete this Commissioning Checklist while following the guidelines discussed in the Installation and Commissioning sections. Return the completed form to Forney Corporation.

Customer name: \_\_\_\_\_

Contact: \_\_\_\_\_

Plant location and unit number: \_\_\_\_\_

Type of igniter with which HESI is used: \_\_\_\_\_

Check the following boxes if the listed conditions have been completed satisfactorily. Use this service manual's installation and commissioning guidelines while completing this checklist.

HESI spark tip location is set according to service manual and applicable drawings.

Tip location: \_\_\_\_\_

Spark gap tube is operating correctly according to guidelines given in this manual (5 flashes per second; no weak or erratic flashing, etc.)

Spark rod/tip is operating correctly according to guidelines in this service manual (5 sparks per second)

HESI advance and retraction (if provided) functions are operating properly.

Send this form to:

Attn: Service Department

Forney Corporation

16479 North Dallas Parkway, Suite 600

Addison TX 75001