



## High Energy Spark Igniter

ATEX Version Service Manual

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BURNERS • IGNITERS • DAMPERS • CONTROLS

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## INTRODUCTION




This manual contains information for the ATEX 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 ATEX 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, <b>will</b> result in death or serious injury.
 <b>WARNING</b>	Indicates a hazardous situation which, if not avoided, <b>could</b> 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.

Revision	Date	Comments
A	01-14-2013	Initial Release
B	08-16-2013	Add 120 Wiring Diagram, update contact info
C	9-20-2013	Add Carbon Steel models
D	06-1-2018	Update spark tip temperatures, logos, safety icons, ATEX to 2014
E	04-10-2019	Update product labels to reflect new CE number
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## General Description and Specifications

The High Energy Spark Igniter (HESI) is a Class 3 Special Igniter used for direct spark ignition of oil or gas igniters or small burners. The 12 joules of power delivered to the spark tip easily ignites the fuel. Approximately three 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 components, constructed of high quality materials, undergo strict testing procedures prior to assembly and shipment. However, every piece of equipment may become damaged or stop operating for numerous reasons occurring in the course of its use. Getting thoroughly acquainted with the manual and strict observance of its guidelines will reduce the possibility of equipment breakdown and will help ensure safe handling of the igniter during normal operation.

The power pack is an ATEX Exd IIC T6 enclosure suitable for wall mounting at the burner front. The power pack sends 12 joules of energy to the spark tip through heavy-duty electrical components. The spark is generated in the secondary circuit of the power pack using a capacitor and is powered with 2000 VDC. It has a 15-minute on and 30-minute off maximum fire cycle at temperatures up to 135°F (57°C) ambient.

The spark rod is a rigid design and features a self-cleaning surface gap spark tip that is easily replaceable through a threaded connection. The spark rod is available with an optional retraction assembly to allow the spark tip to be inserted and retracted from the firing position.

### 1. Application

The HESI igniter is an integral component of oil and gas burners used mainly in utility, power, petrochemical and chemical industry. The explosion-proof HESI main application is in gas-fired igniters or pilot igniters installed in hazardous areas. Its versatile design and many advantages can be combined with multiple burner types and for retrofitting of existing burner systems.

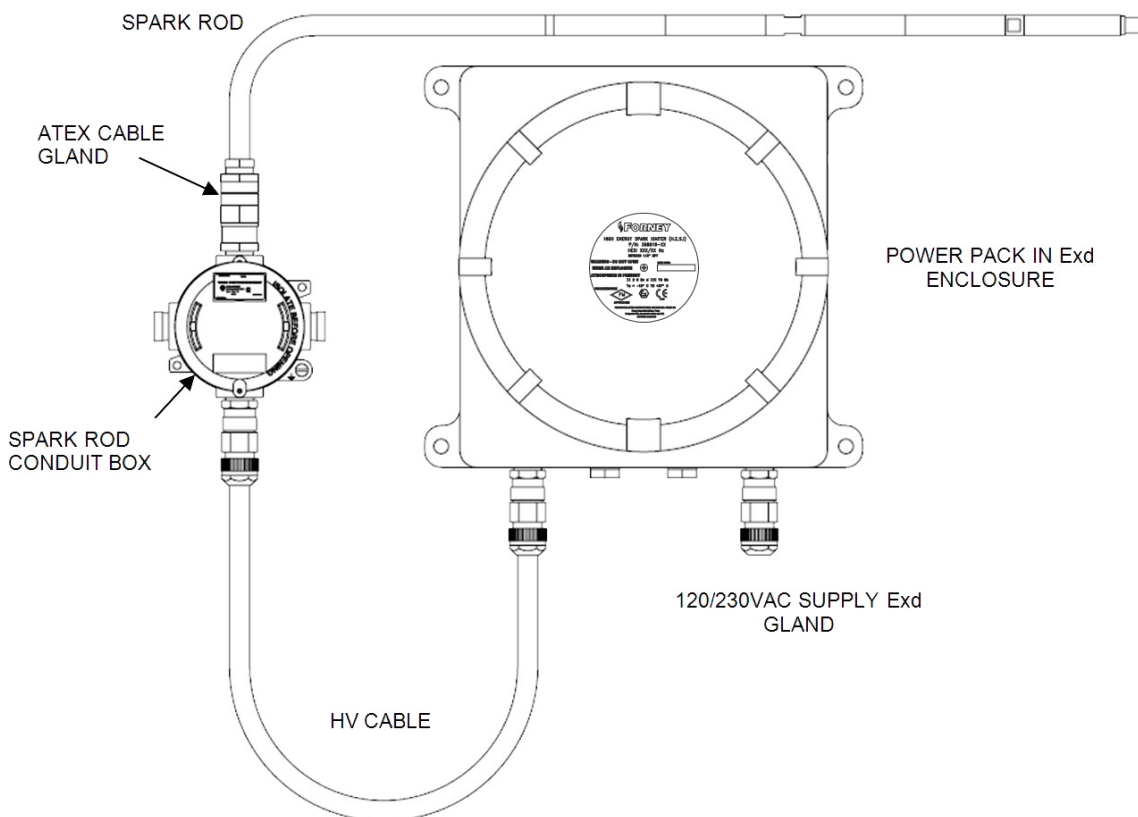
### 2. Features and Benefits

The HESI (High Energy Spark Igniter) is an electrical igniter based on the principle of cyclic discharge of a capacitance circuit through a spark tube which causes generation of high-energy sparks. It can be categorized as a pulsating igniter enabling ignition of gas or liquid fuel-fired burners, including those fired with heavy oils atomized with steam or air. The benefits of the HESI include:

- **Non-fouling Spark Tip** - The surface gap spark tip produces a self-cleaning, highly reliable, 12-joule spark 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, high voltage flexible cable connects the power unit to the spark rod assembly ensuring operator safety.
- **Application Flexibility** – Retractable HESI models are available to fit a variety of igniter or burner types.

The explosion-proof HESI (Refer to Figure 1-1) consists of:

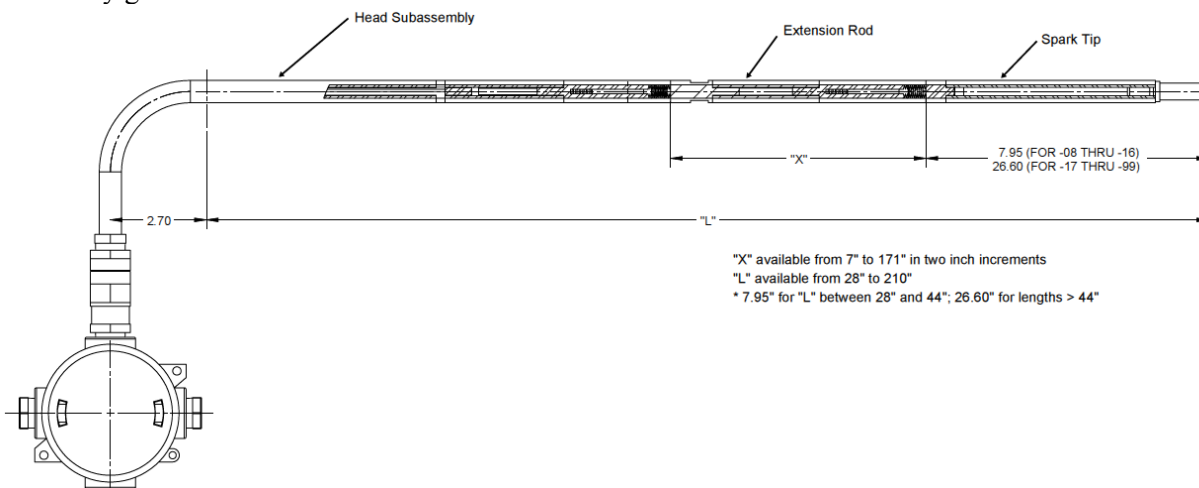
- Spark Rod (Refer to Figure 1-2)
- HESI Power Pack: 120 VAC/60 Hz or 230 VAC/50 Hz in explosion proof ATEX enclosure
- HV Connection Cable



**Figure 1-1 ATEX High Energy Spark Igniter (HESI)**

The spark rod has an external diameter of 5/8" and is available in lengths from 28" to 210". The spark rod is equipped with concentrically placed electrodes with a uniform gap between them. The rod design allows for application in environments featuring adverse conditions, such as the presence of dust, humidity, oil, or combustion products from the combustion chamber. The rod tube surface located in the hazardous area is designed to be potential-free and has an explosion-proof conduit box on its end joined with an ATEX approved cable gland.

The power supply unit (power pack board) is encapsulated in an explosion-proof enclosure. The power supply is connected to the HESI spark rod via a two-core, screened power cable with explosion-proof cable entry glands.



**Figure 1-2 ATEX HESI Spark Rod Assembly**

## Specifications

Igniter Class:	Class 3 Special
Approval:	ATEX Exd IIC T6
Output Energy:	12 joules per spark
Output Voltage:	2000 vdc
Input Voltage:	120/240 vac, 50/60 Hz
Input Power:	120 vac (2-A fuse); 240 vac (1-A fuse)
Spark Rate:	Approximately 3 sparks per second
Spark Rod Length:	210 in. (533.4cm) maximum
Spark Rod Diameter:	0.625 in. (1.6 cm)
Spark Rod Material:	304 SST or Carbon Steel
Spark Rod Conduit Box Material:	Light alloy, natural finish
Spark Tip Type:	Gas tight, surface gap
Spark Tip Length:	8 and 27 inches (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 Pack Temperature Ratings:	-18° C to 57° C (0° F to 135° F)
Maximum Furnace Pressure:	50 Inches H <sub>2</sub> O
Power Pack Enclosure:	12.0" x 11.0" x 9.0" (30.48 cm x 27.94 cm x 22.86 cm)
Power Pack Enclosure Body Material:	Feraloy iron alloy
Power Pack Enclosure Cover Material:	Copper-free aluminum
Field Conduit Hole Diameter	0.50in (1.27 cm) NPT
Power Cable:	12 gage, 3000 v in 0.5" (1.27 cm) cable with ATEX Certified glands
Power Cable Lengths:	6, 12, 15 ft (1.8, 3.65, 4.57 m)
Maximum Firing Cycle:	15 minutes on and 30 minutes off (maximum ambient temperature of 57°C (135°F)



The HESI meets the requirements set forth in the following documents:



- Directive 89/336/WE Electromagnetic Compatibility: Standards PN-EN 61000-6-2:2005, PN-EN 61000-6-4:2007, PN-EN 55016-2-3:2007, PN-EN 55014-1:2004; based on the BE/54/2008 Report; the CE marking awarded.
- ATEX Standards: EN60079-0:2012+A11:2013 and EN60079-1:2014
- ATEX Directive: 2014/34/EU



## 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.

	<div style="background-color: #f4a460; padding: 5px; text-align: center;">  <b>WARNING</b> </div> <p>Hazardous voltage is present and serious injury to personnel can occur. Before opening the power pack's 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.</p>
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	<div style="background-color: #f4a460; padding: 5px; text-align: center;">  <b>WARNING</b> </div> <p><b>Explosion Hazard.</b> Do not connect or disconnect while the circuit is live or unless the area is free of ignitable concentrations.</p>
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The HESI assembly uses a 2000-vdc energy source to produce a 12-joule spark 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 lift or carry the spark rod or power pack when the HESI is energized.
6. Do not hold or touch the rod during operation.
7. Do not perform modifications on this equipment.
8. Before opening the power pack's threaded 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.
9. Before disconnecting terminals, place a voltmeter across terminals 1 and 2 of capacitor C1 to ensure that no voltage is present.
10. Adhere to safety-related information on all drawings.
11. Before applying the energizing signal to the assembly, fully connect the spark rod to the power unit.
12. 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 located in a non-hazardous location. Ensure that personnel are not in contact with the spark rod during the test period. Replace the rod immediately following testing.
13. Handling of the HESI's rod after use may only be done while wearing gloves due to the possibility of hot water or oil flowing down the rod as well as the fact that after lighting a burner the rod itself is usually very hot.

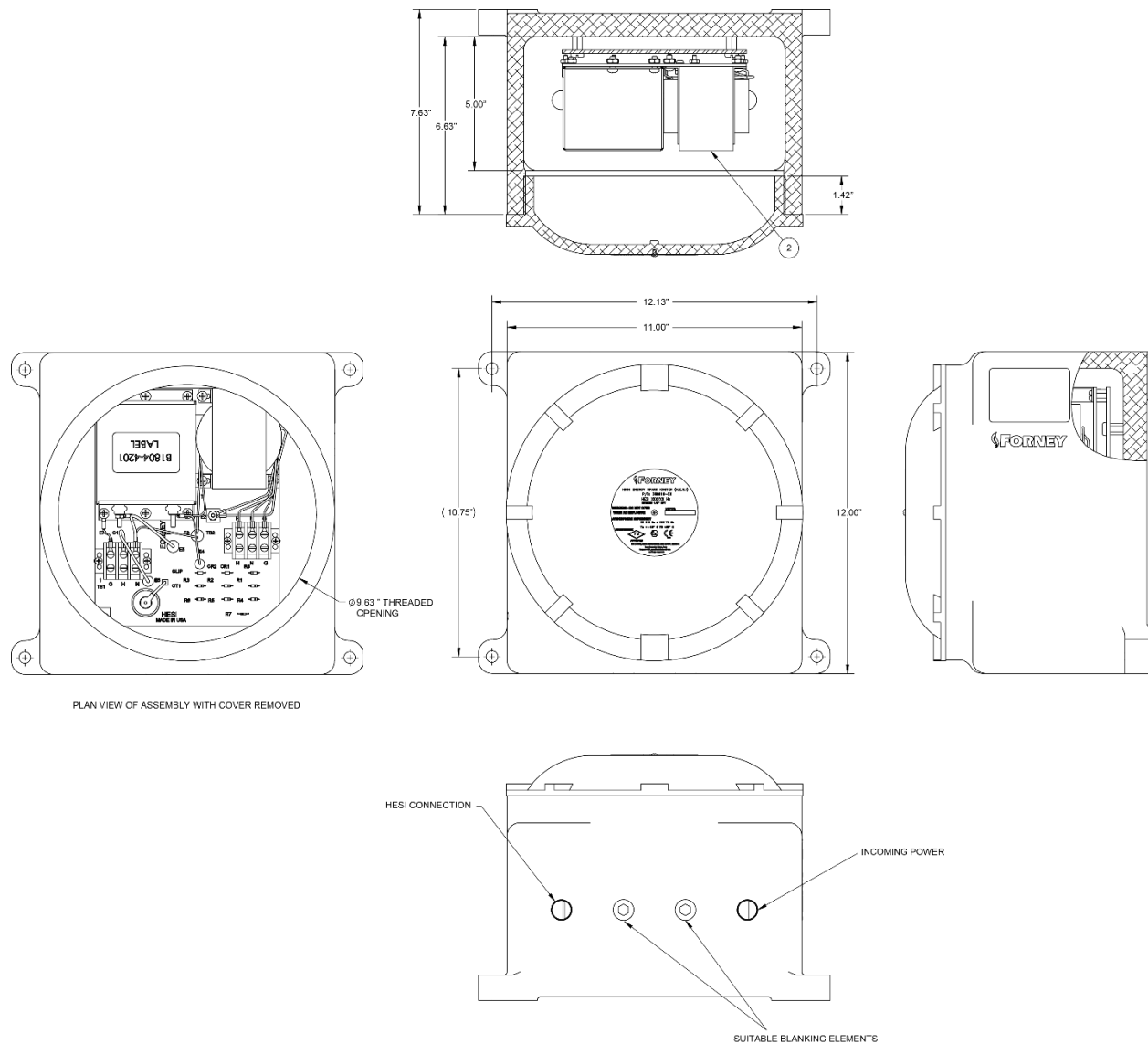
	<div style="background-color: #f4a460; padding: 5px; text-align: center;">  <b>WARNING</b> </div> <p>Only knowledgeable and qualified technicians should be allowed access to this system or to its components. The installation, maintenance, and operation of electronic equipment entails several elements of danger. Carelessness can result in serious injury or death from electrical shock, falls, or improper use of tools and test equipment.</p>
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## Installation

### 3. Power Pack

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 field wiring entries are facing down (power pack is upright) to facilitate cable installation.



**Figure 4-1 Power Pack**



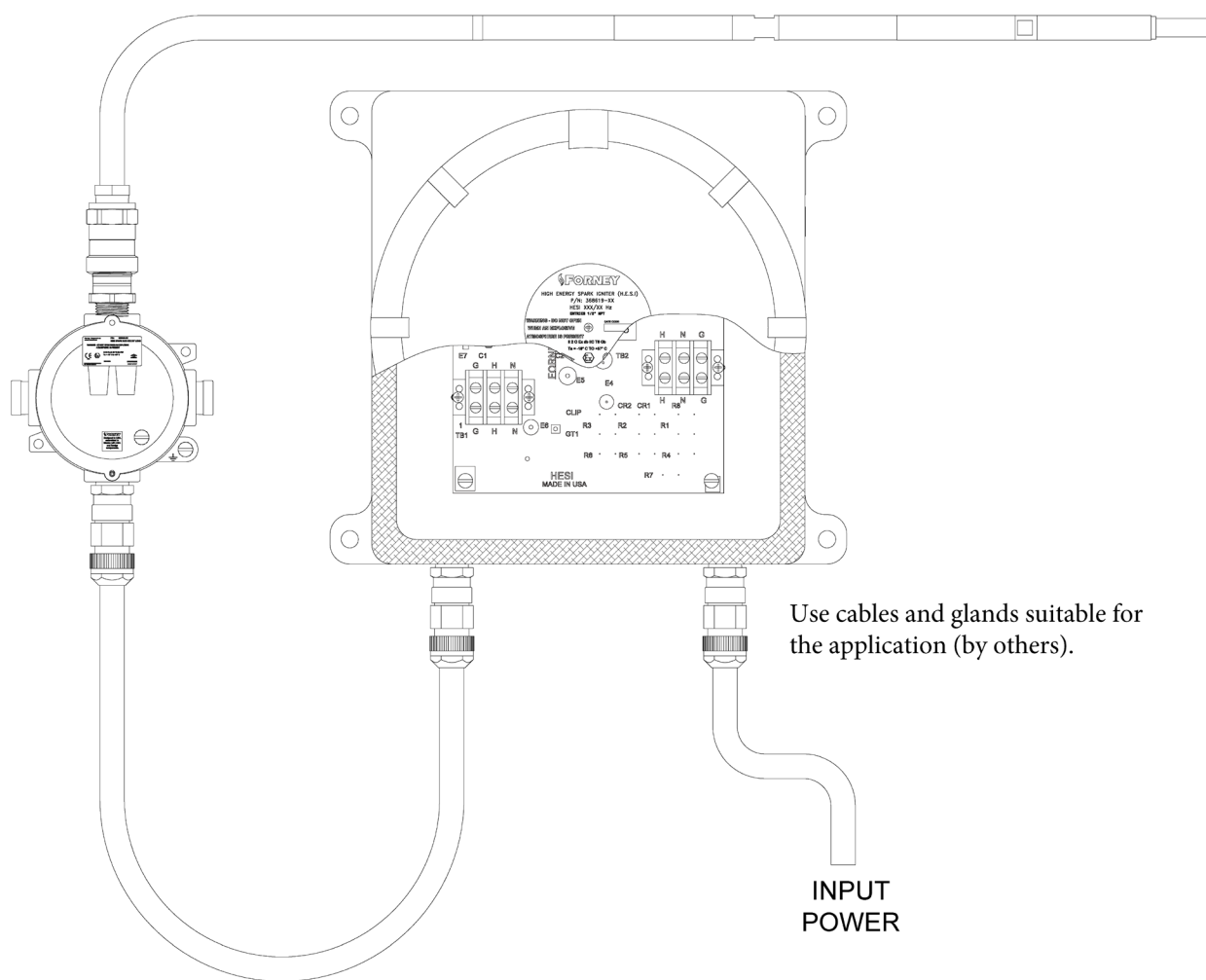
## 4. Spark Rod

In most applications, the HESI spark rod fits into a guide tube that houses the spark rod assembly. Observe the following steps for installing the spark rod assembly:

1. Carefully insert the spark tip into the guide tube until the spark rod extends into the primary ignition zone. Note: The insulator on the rod is inside the HESI mount tube. 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.

## 5. Cable Assembly

Connect power input leads to TB2, H (hot), N (neutral), and G (ground) to the power pack.



**Figure 4-2 Power Pack Connection**

## Commissioning

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

1. Verify input power voltage and frequency meet the specifications.
2. Energize the power pack.
3. The spark rod assembly is functioning properly when discharge of approximately three sparks per second is visible on the rod tip. No other sparking should be visible on rod and connectors.

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. Verify explosive atmosphere is not present.
- 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.

If no spark is present refer to Troubleshooting section of this manual.

4. 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.)
5. The HESI rod may need repositioning if the HESI system functions properly but the igniter does not light. 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.

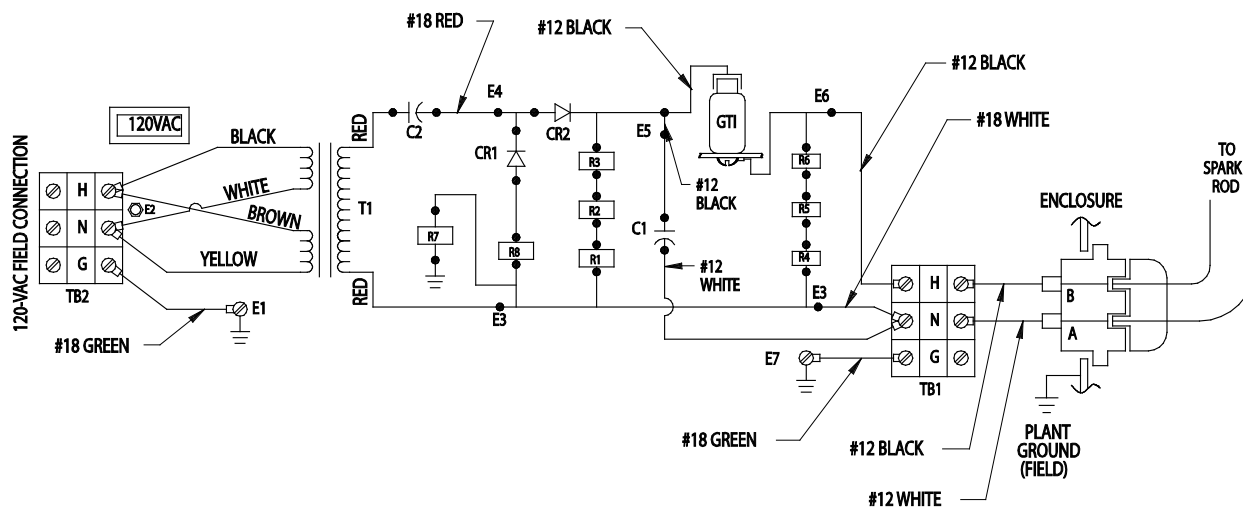
## Operation

The HESI igniter is a Class 3 Special Ignition Source and is only in service during 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).

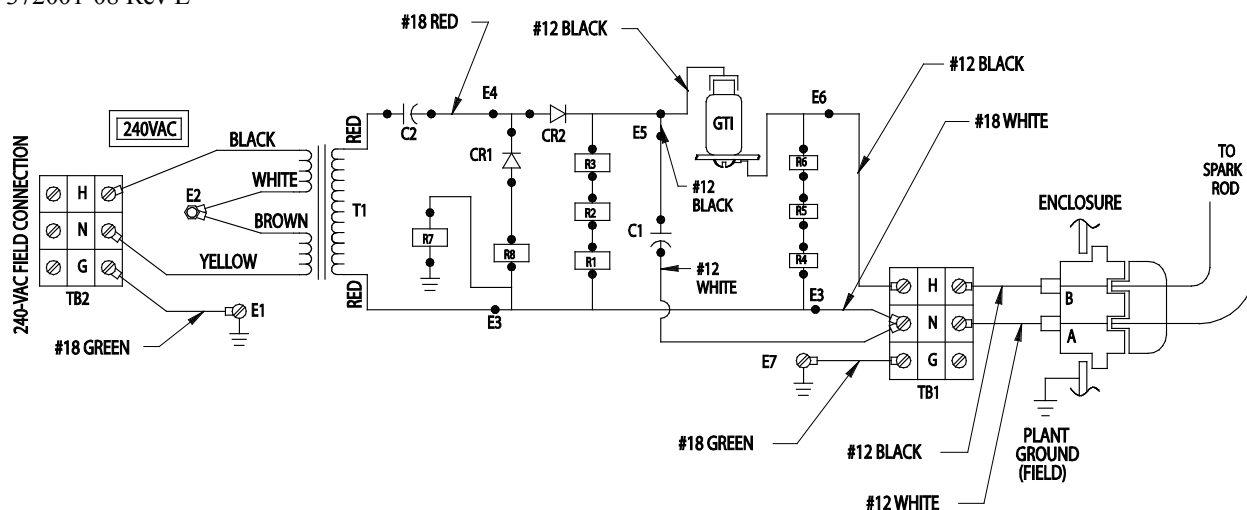
The burner management system provides the control signal that energizes the HESI during the ignition time trial period. The power unit transforms the signal into short 12-joule discharges at the rate of three sparks per second. The cable assembly transmits these discharges to the spark rod assembly.

The HESI's electric circuit is a capacitance-based system whose main components comprise a transformer, capacitor, spark tube, and a rectifier circuit. All of the above components are mounted inside a box. The discharge current is transmitted via a connection cable to the rod. The 120/230 VAC is converted by the transformer and rectifier into 2000 VDC. The capacitor is charged the moment when the charge energy accumulated in the spark tube exceeds the value required for the spark formation. The discharge that follows induces current flow to the rod tip and a spark flash between the electrodes occurs. The cycle is repeated throughout the whole period of the voltage supply. The system is switched on by voltage being supplied to the unit from the power pack. The primary circuit should be protected by a 1A fuse.

The spark discharge at the HESI's tip takes place between the central positive electrode and the grounded negative electrode which is the rod's casing. If a short-circuit between the electrodes occurs, the charge flows to the neutral terminal and then system ground. The whole system is perfectly safe provided the correct grounding is present. Additional protection is provided by the spark generator's interrupt.



**Figure 6-1 ATEX HESI 120 VAC Wiring Diagram**



**Figure 6-2 ATEX HESI 240 VAC Wiring Diagram**

## 6. Specific Conditions of Use

When the HESI is used for ignition of a gas flame, the rod tip should be placed within the zone of the gas mixture flow, possibly in the vicinity of the gas burner nozzle. During the ignition of a liquid fuel-fired burner the tip should enter the sprayed fuel cone 9 – 15 cm deep, up to the zone of the secondary vortex (recirculation), as close as possible to the burner's nozzle. In either case, once the burner has been lit, the spark rod tip must be withdrawn as soon as possible from the flame zone to a distance which will maintain its temperature below 1000°F. The recommended idle temperature range is below 500°F. In addition, the rod length and manner of installation should guarantee the surface temperature of the external part of the rod, located in the hazardous area, does not exceed 248°F (120°C) and the temperature of the sealing fitting does not exceed 185°F (85°C).

The HESI is approved to be used with #2 oil, natural gas, propane, coke oven gas, and land-fill gas. For the direct ignition of heavy fuel oils (#4, #5, and #6), the oil must be heated to a minimum of the closed cup flash point temperature or the temperature required for proper atomization (maximum viscosity of 125 SSU), whichever is higher. Also, the HESI must be reliably inserted into a flow recirculation zone where the fuel vapor/air ratio is within the flammability limits and the fuel oil must be properly atomized to produce a fuel vapor/air mixture so that sustained ignition can be accomplished. Consult with the factory for use with other fuels.

Consult the manufacturer if dimensional information on the flameproof joints is necessary.

Install in accordance with this Instruction Manual 372001-08.



## 7. Troubleshooting

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 6-1 for troubleshooting information.

**Table 6-1 Troubleshooting**

Symptom	Probable Cause	Remedy
Proof of spark visual indication not flashing	Input voltage low	Provide correct supply voltage.
	Power pack failure	Replace power pack
Proof of spark visual indication flash weak or erratic	Spark tip fouled and shorting	Replace tip assembly and adjust tip to gun setting as specified in drawing or igniter manual.
	Tip insulator cracked or damaged	Replace tip assembly and adjust tip to gun setting as specified in drawing or igniter manual.
	High-tension cable inside rod broken or insulation damaged	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.

	 <b>WARNING</b>
	<p>Hazardous voltage is present and serious injury to personnel can occur. Before opening the power pack's cover, disconnect the electrical supply from the box. Allow at least <b>2 minutes</b> for the capacitor to discharge. Exercise extreme care when the power pack cover is open.</p>

## Maintenance

Forney recommends performing the following preventive maintenance every six months.

	<div data-bbox="711 304 1015 367"> <b>WARNING</b></div> <p>Do not open when an explosive atmosphere is present. This inspection and maintenance cannot be conducted as described unless it can be confirmed that an explosive atmosphere is not present.</p>
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### 8. Spark Tip Inspection and Maintenance

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 3).
2. Remove and replace tip using ½-inch wrench flats.

### 9. Power Pack Inspection and Maintenance

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

Should the power pack malfunction, 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. Unscrew the Exd power pack enclosure cover and check the connections on the power pack board terminals and the condition of Exd glands.
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.

### 10. Spark Gap Tube Operation Verification

If no spark is generated at the rod's tip and the spark circuit does not discharge normally, perform the following:

- Disconnect the power source and wait 2 minutes.
- Check the power supply of the control box.
- Check the condition of the supply cable.
- After opening the control box, check the electrical connections and both the capacitor and transformer.
- If the capacitor and transformer work correctly, replace the spark generator.
- Connect the power supply and make the functional test.
- If no spark is generated after the above measures have been taken, consult Forney.

### 11. Cable Inspection and Maintenance

Inspect the cable for fraying or kinks. Make sure the cable entry Exd glands are not loose. Replace frayed cable.






## Storage and Handling




- Store the HESI in a clean, dry environment. When possible, store the igniter in its original shipping container until it is installed.
- The rod should be carried in a manner safe for other people while avoiding hitting against other objects or bending. Lifting the rod by its ends should be avoided as well.




## 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.




Forney Corporation ADDICK, TEXAS USA 76001		P/N: 368542-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
 2809		II 2 G Ex d IIC T4 IP67 Ta = - 28° C to +55° C	 APPROVED
FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT

Forney Corporation ADDICK, TEXAS USA 76001		P/N: 365045-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
 2809		II 2 G Ex d IIC T4 IP67 Ta = - 28° C to +55° C	 APPROVED
FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT

Forney Corporation ADDICK, TEXAS USA 76001		P/N: 368935-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
 2809		II 2 G Ex d IIC T4 IP67 Ta = - 28° C to +55° C	 APPROVED
FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT

Forney Corporation ADDICK, TEXAS USA 76001		P/N: 365667-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
 2809		II 2 G Ex d IIC T4 IP67 Ta = - 28° C to +55° C	 APPROVED
FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT

Forney Corporation ADDICK, TEXAS USA 76001		P/N: 368930-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
 2809		II 2 G Ex d IIC T4 IP67 Ta = - 28° C to +55° C	 APPROVED
FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT

Forney Corporation ADDICK, TEXAS USA 76001		P/N: 365668-XX HESI SPARK ROD XXX.XX" LONG	
<b>WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT</b>			
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FOR INSTALLATION INSTRUCTIONS SEE BULLETIN 372001-08		DATE CODE:	FM12ATEX0086X ENTRY 1/2" NPT



## Spare Parts

When ordering spare parts, contact Forney's Spares Department via any of the following methods, and furnish the following information:

E-Mail:	Phone:	Fax:
sales@forneycorp.com	(972) 458-6100 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

## 12. Recommended Spare Parts

The recommended spare parts list in Table 10-1 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 10-1 Recommended Spare Parts List**

Part Description	Part Number	Quantity
Spark Tip, Short (Spark Rods 36" and shorter)	383726-02	1 for every 4 igniters
Spark Tip, Long (Spark Rods greater than 36")	383726-03	1 for every 4 igniters
Capacitor	79942-01	1 for every 5 igniters
Capacitor for 50Hz units	79942-04	1 for every 5 igniters
CE HESI Transformer (50 Hz)	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 (3 flashes per second; no weak or erratic flashing, etc.)
- ☐ Spark rod/tip is operating correctly according to guidelines in this service manual (3 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