Shop Manual

Model Numbers

AHE-100-02S - 12 VDC
AHE-200-02S - 24 VDC
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1.1 Aqua-Hot Component Overview

**Figure 1**
Section 1: Aqua-Hot Information

1.2 Aqua-Hot Identification Plate

The I.D. Plate is located on the right sidewall of the heating unit, directly below the VAC Access Panel, see Figure 1.

The lower portion of the I.D. Plate is located inside the heating unit to the right of the Electric Heating Element Access Panel, see Figure 1.

Figure 2
2.2 Control / High-Limit Thermostat Wiring

- **Orange Wire**
  - VDC Control Thermostat, 190˚F, Blue Dot

- **Blue Wire**
  - VAC High-Limit Thermostat, 230˚F White Dot
  - 12-2 ROMEX Cable w/ground

- **Green Wire**
  - Black Wire
  - White Wire
  - VAC Control Thermostat, 198˚F, Red Dot
  - Green Wire (Ground)
  - Orange Wire

- **Purple Wire**
  - Black Wire
  - White Wire
  - VDC High-Limit Thermostat, 230˚F, Black

- **Black Wire**
  - White Wire
  - Ground Post
  - Aqua-Hot Junction Box

- **White Wire**
  - Black Wire
  - “GROUND” Green Wire to ROMEX Copper Wire

- **120 VAC / 1650 Watt Electric Heating Element**
  - “120 VAC POWER SUPPLY” Black ROMEX Wire to “LOAD” Black Wire
  - “COMMON” White Wire to White ROMEX Wire

**Figure 4**
Section 3: Diesel-Burner Information

Overview

3.1 Diesel-Burner Component Overview

1. Control Unit
2. Motor
3. Ignition Coil
4. Clutch
5. Combustion Air Fan
6. Fuel Solenoid Valve
7. Electrode Holder
8. Ignition Electrodes
9. Fuel Nozzle
10. Combustion Chamber
11. Heat Exchanger
12. Exhaust Port
13. Flame Detection Photocell
14. Fuel Pump
15. Fuel Ports (Supply / Return)
16. Combustion Air Port (Intake) with Adjustable Shutter

Figure 5
### Diesel-Burner Operational Flow-Chart

#### Operation sequence once the Aqua-Hot's Diesel-Burner Control Switch is turned ON.

The Control Switch's indicator light will illuminate.

The "MOTOR" (#2) (which turns the "COMBUSTION AIR FAN" (#5) and drives the "FUEL PUMP" (#14)) will begin to run.

**NOTE:**
If the Aqua-Hot's Coolant reservoir temperature is approximately 175 degrees Fahrenheit, or higher, the "MOTOR" (#2) will not operate. Only when the temperature has dropped below 175 degrees Fahrenheit will the "VDC CONTROL THERMOSTAT" (see Figure 4) allow the "MOTOR" (#2) to operate.

After approximately 10 - 25 seconds the "FUEL SOLENOID VALVE" (#6) opens and fuel is sprayed into the "COMBUSTION CHAMBER" (#10) through the "FUEL NOZZLE" (#9).

Simultaneously the "IGNITION COIL" (#3) produces a High Voltage Spark across the "IGNITION ELECTRODES" (#8) which ignites the incoming Air / Fuel.

Once the ignited Air / Fuel mixture (FLAME) is observed by the "FLAME DETECTION PHOTOCELL" (#13), the "IGNITION COIL" (#3) will automatically switch OFF. The combustion process now continues to operate unassisted.

The combustion process will continue to operate in this manner until:

A.) The "VDC CONTROL THERMOSTAT", (see Figure 4) (which senses Coolant Temp.), reaches the preset temperature of approximately 190 degrees Fahrenheit.

B.) The Aqua-Hot's Diesel-Burner Control Switch is turned OFF.

Once the Heater switches OFF, thermostatically or manually, the "FUEL SOLENOID VALVE" (#6) closes, which interrupts the supply of diesel fuel to the "FUEL NOZZLE" (#9).

The "MOTOR" (#2) will continue to run for approximately three (3) additional minutes. This is called the "Purge-Cycle", which cools down the Heater's internal components and purges the "COMBUSTION CHAMBER" (#10) of any residual exhaust gases.

**NOTE:**
When the Aqua-Hot Diesel-Burner is switched OFF by the "VDC CONTROL THERMOSTAT" (see Figure 4):

A.) The "MOTOR" (#2) will shut-off once the three (3) minute "Purge-Cycle" has expired.

B.) The Aqua-Hot's Diesel-Burner will automatically turn back ON once the coolant temp. reaches the preset temperature of approximately 175 degrees Fahrenheit.

**SUMMARY:**
The Aqua-Hot's Diesel-Burner is operational anytime the operator activates the Diesel-Burner Control Switch to the ON position. The Diesel-Burner will then automatically maintain the temperature of the coolant without any additional involvement from the operator.

---

*Reference Figure 5 for all numbers indicated inside parenthesis. (i.e #8).*
### Diesel Burner Information

#### 3.3 Diesel-Burner Identification Plate

**Diesel Burner I.D. Plate**

The Diesel-Burner I.D. Plate is located on the left side of the Diesel-Burner Head.

---

**Figure 6**

**Fabrikschild-Duplikat**
gültig nur zusammen mit Original

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<thead>
<tr>
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<td>13.2 kW</td>
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<tr>
<td>Brennstoff</td>
<td>Diesel</td>
</tr>
<tr>
<td>zul. Betriebsüberdruck</td>
<td>2 bar</td>
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<tr>
<td>Prufzeichen</td>
<td>~</td>
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<td>Fabriknummer</td>
<td>18230410</td>
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<tr>
<td>Inbetriebnahmejahr</td>
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**Model Type**

**Voltage / Wattage**

**Fuel Type**

**Serial Number (230410)**
Section 4: Diesel-Burner Wiring Information

4.1 Control Unit Wiring

Figure 7

- (+) Indicator Light (Blue)
- (-) Battery (Brown)
- (+) On / Off Switch With Low Voltage Protection (White)

B-Plug

- (+) Battery (Red)
- (-) Indicator Light (Green)

C-Plug

- (+) VDC Control Thermostat (Orange)
- (+) Blower Motor (Black)
- (-) To Overheat Circuit And Solenoid Valve (Blue)
- (+) To Ignition Coil (Yellow)
- (+) From Normally Closed VDC Control Thermostat (White)
- (+) Flame Detector (Green)
- (-) For All Heater Components (Brown)
5.1 General Maintenance

Monthly

Check the Aqua-Hot's solution of water and antifreeze to ensure that it is at the proper level. Do this by visually checking the coolant level in the Aqua-Hot's Expansion Tank, see Figure 1. This should be checked only when the Aqua-Hot is at full operating temperature, “HOT.”

Annually

<table>
<thead>
<tr>
<th>CAUTION: Before cleaning or servicing, disconnect all power supplies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is ideal to have your Aqua-Hot tuned-up yearly. A tune-up should consist of a Fuel Nozzle and Fuel Filter replacement and a thorough cleaning of the Combustion Chamber, if necessary, see Figure 8. This simple tune-up will keep your Aqua-Hot running smoothly throughout the year. This annual tune-up will also allow service personnel to inspect for wear and tear of other components.</td>
</tr>
<tr>
<td>CAUTION: Operating the Aqua-Hot's Diesel-Burner or the 120 VAC Electric Heating Element without the water and antifreeze solution will cause serious damage to the Heater.</td>
</tr>
</tbody>
</table>

![Figure 8](image-url)
5.2 Detaching the Diesel-Burner Head

Instructions For Detaching the Diesel-Burner Head from the Aqua-Hot

**CAUTION:** Before detaching the Diesel-Burner Head, disconnect all power supplies.

1. Loosen the two Eye-Bolt Nuts and swing the Eye-Bolts out of the way.

2. With both hands, carefully pull the Diesel-Burner away from the Aqua-Hot, approximately 4-5 inches. Please note that you may have to lift the head slightly while pulling it away from the Aqua-Hot.

3. Rotate the head approximately 90 angular degrees to the right or until all the internal components are visible.

**NOTE:** It may be necessary to disconnect the two RED wires, which are connected to pin #6 of the B-Zone relay, when rotating the head beyond 90 degrees, see Figure 3.

**CAUTION:** When reattaching the Diesel-Burner Head to the Aqua-Hot, be sure to properly align the head and **DO NOT** over tighten the Eye-Bolt Nuts. An improper alignment and or an over tightening of the Eye-Bolt Nuts can cause damage to the Diesel-Burner Head’s aluminum-cast housing (Blower Casing), see Figure 9.
5.3 Flame Detection Photocell

Figure 10

Flame Detection Photocell

Cleaning Notes
For light dirt, dust and carbon deposits simply wipe off the Flame Detection Photocell with a soft cloth. Should heavy carbon deposits be present, completely remove the Flame Detection Photocell from the Photo Disc and clean with carburetor cleaner.

5.4 Ignition Electrodes

Figure 11

Adjustment gauge properly positioned

Note: Electrode Adjustment Gauge is located on the outside surface of the Diesel-Burner on the lefthand side.

Note: Once adjustment is complete, remove Electrode Adjustment Gauge and reattach to Diesel-Burner.
**Fuel Nozzle**

**5.5 Fuel Nozzle**

*Figure 12*

**Solenoid Valve**

**5.6 Fuel Solenoid Valve**

*Figure 13*

**Note:** When replacing the Fuel Nozzle, be sure to tighten the Nozzle, then loosen 1/4 turn and firmly retighten. This will establish a seated fit and avoid any leaks.
### Figure 14

**5.7 Fuel Pump**

![Diagram of Fuel Pump](image)

**Note:** Adjust fuel pressure to 145 PSI.

- (+) Clockwise rotation increases fuel pressure.
- (-) Counter Clockwise rotation decreases fuel pressure.

**Fuel Pressure Gauge**

![Diagram of Fuel Pressure Gauge](image)

**Note:** Fuel Pressure gauge replaces the Fuel Nozzle when adjusting fuel pressure.

---

Page 13
Troubleshooting Flow-Chart

6.1 Troubleshooting Flow-Chart

1. Turn the Control Switch **ON**.

   Is the indicator light illuminated?
   - Yes
     - 1. Replace the indicator light bulb. Replace if necessary.
   - No
     - 2. Remove the Aqua-Hot's ACCESS COVER.
     - 3. Check Aqua-Hot fuses (E & F) for continuity, see Figure 3. Replace if necessary.
     - 4. Check DC power supply at the "POWER POST" and "GROUND POST", see Figure 3.
     - 5. Attempt heater restart.

2. Is the Diesel-Burner's "MOTOR" (#2) operating?
   - Yes
     - 1. Remove the Aqua-Hot's ACCESS COVER.
     - 2. Remove the "THERMOSTAT ACCESS PANEL", see Figure 1.
     - 3. Check the Diesel-Burner's "VDC HIGH-LIMIT THERMOSTAT" for continuity, see Figure 4.
     - **NOTE:** This Thermostat protects against overheating temperatures.
     - Is there continuity across the Thermostat?
       - Yes
         - 1. Replace the Thermostat.
       - No
         - 1. Replace the Thermostat.
   - No
     - Is there continuity across the Thermostat?
       - Yes
         - 1. Replace the Thermostat.
       - No
         - 1. Replace the Thermostat.

3. Check the Diesel-Burner's "VDC CONTROL THERMOSTAT" (blue dot) for continuity, see Figure 4.

4. Is there continuity across the Thermostat?
   - Yes
     - Replace Thermostat.
   - No
     - Replace Thermostat.
     - Attempt heater restart.

**NOTE:** The indicator light will illuminate for only 30 seconds if fuse (F) is blown (open circuit).

**NOTE:** Aqua-Hot operating temperature must be below 170 degrees Fahrenheit when checking the "VDC CONTROL THERMOSTAT" for continuity, see Figure 4.

**NOTE:** The indicator light will illuminate for only 30 seconds if fuse (F) is blown (open circuit).

**NOTE:** The indicator light will illuminate for only 30 seconds if fuse (F) is blown (open circuit).
Section 6: Troubleshooting

1. Turn the Control Switch **OFF**.

2. Remove the fuel-line from the Aqua-Hot's "DIESEL FUEL RETURN" (see Figure 1) and place a short piece of fuel line in its place.

3. Put the opposite end of the fuel line in a container.

4. Place the probes of a DC-multi meter into plug locations, B-1 (+) and B-2 (-), of the Diesel-Burner's "CONTROL UNIT" (#1), see Figures 1 and 7. Also, measure the voltage across B-2 (-) and B-4 (+).

5. Turn the Control Switch **ON**.

6. Observe the fuel flow. Flow should be consistent without air bubbles.

---

1. Check for fuel leaks in the Diesel-Burner's "DIESEL FUEL SUPPLY" line, see Figure 9. Repair if necessary.

2. Check the Aqua-Hot's "FUEL FILTER" (see Figure 8) for clogging. Replace if necessary.

3. Reattach "DIESEL FUEL RETURN" line, see Figure 1.

4. Attempt heater restart.

---

1. Check the voltage level of the DC-multi meter.

**NOTE:** Voltage level should be within 0.5 volts of the system's DC battery voltage.

---

1. Inspect the "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10) for dust and or sooty carbon deposits. Clean if necessary.

2. Completely cover the "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10) with a shop rag.

3. Turn the Control Switch **ON**. After approx. 20 seconds of operation a bright blue arc (spark) should appear across the "IGNITION ELECTRODES" (#8), see Figure 11.

---

1. Check the Control Switch's:
   - A. wire connections.
   - B. fuse (E) for continuity, see Figure 3.

2. Check DC power supply wires and connections, see Figure 3.

3. Reattach "DIESEL FUEL RETURN" line, see Figure 1.

4. Attempt heater restart.

---

1. Turn the Control Switch **OFF**.

2. Reattach "DIESEL FUEL RETURN" line, see Figure 1.

3. Detach the "DIESEL-BURNER HEAD" from the Aqua-Hot, see Figures 1 and 9.

4. Disconnect one of the wires from the "FUEL SOLENOID VALVE" (#6), see Figure 13.

**NOTE:** Do not remove or cut any of the external wires attached to the "DIESEL-BURNER HEAD".

**WARNINGS:**

1. **DO NOT** attempt to restart the Aqua-Hot when the "DIESEL-BURNER HEAD" is detached. An open flame can result and cause serious personal injury.

2. To prevent a fire hazard, be sure to disconnect one of the "FUEL SOLENOID VALVE" (#6) (see Figure 13) wires.
Section 6: Troubleshooting

Does a spark appear across the Ignition Electrodes?

Remove shop rag from the "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10), exposing it to a light source. The spark should disappear.

Does a spark disappear after the Photocell is exposed to light?

1. Replace "FLAME DETECTION PHOTOCELL" (#13), see Figure 10.
2. Reconnect "FUEL SOLENOID VALVE" (#6) (see Figure 13) wire.
3. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

Cover "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10) again with a shop rag. The spark should reappear and continue for approx. 15 seconds and then switch off.

Does the Photocell operate properly?

1. Replace "CONTROL UNIT" (#1), see Figure 7.
2. Reconnect "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10) wires and "FUEL SOLENOID VALVE" (#6) (see Figure 13) wire.
3. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

Yes

No

1. Turn the control switch OFF.
2. Check "FLAME DETECTION PHOTOCELL" (#13) (See Figure 10) for proper operation by: Removing both wires from the Photocell and covering with a shop rag. When dark, Photocell wire leads should read 300,000 ohms, or greater, of electrical resistance. Remove shop rag and expose to light; electrical resistance should be 300 ohms or less.

Does a spark appear across the Ignition Electrodes?

Within 15 seconds, after turning ON the Control Switch, disconnect one of the two wires from the "FLAME DETECTION PHOTOCELL" (#13) (blue or green), see Figure 10. A spark should now appear across the "IGNITION ELECTRODES" (#8), see Figure 11.

Yes

No

1. Turn the Control Switch OFF.
2. Check "IGNITION COIL" (#3) for proper operation by: Removing C-plug from "CONTROL UNIT" (#1), see Figure 7. Apply DC power (+) to C-8 plug (yellow wire) and ground (-) to C-5 plug (brown wire). A spark should now appear across the "IGNITION ELECTRODES" (#8), see Figure 11.

Does the Ignition Coil operate properly?

1. Replace "IGNITION COIL" (#3).
2. Reconnect "FLAME DETECTION PHOTOCELL" (#13) (see Figure 10) wire, "FUEL SOLENOID VALVE" (#6) (see Figure 13) wire and C-plug.
3. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

No
Section 6: Troubleshooting

Does the spark reappear?

1. Turn the Control Switch **OFF**.
2. Replace "CONTROL UNIT" (#1), see Figure 7.
3. Reconnect "FUEL SOLENOID VALVE" (#6) (see Figure 13) wire.
4. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

Is a mist of fuel (cone-shaped) present?

1. Replace "FUEL SOLENOID VALVE" (#6), see Figure 13.
2. Retest fuel flow (without Fuel Nozzle).
3. Install "FUEL NOZZLE" (#9), see Figure 12.
4. Retest Fuel Nozzle spray pattern (fine mist of fuel present?).
5. Reconnect ignition wires to "IGNITION ELECTRODES" (#8) (see Figure 11) or remove jumper wire.
6. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

1. Turn the Control Switch **OFF**.
2. Reconnect "FUEL SOLENOID VALVE" (#6) (see Figure 13) wire.
3. Remove both ignition wires from the "IGNITION ELECTRODES" (#8) (see Figure 11) or connect a jumper wire across the Electrodes.

**CAUTION:** To prevent a **HIGH VOLTAGE** shock and or a fire hazard, be sure to remove both "IGNITION ELECTRODES" (#8) (see Figure 11) (tape the ends and separate the wires) or connect a jumper wire across the Electrodes.

4. Turn the Control Switch **ON**. After approx. 20 seconds the "FUEL SOLENOID VALVE" (#6) (see Figure 13) should receive power from the "CONTROL UNIT" (#1), see Figure 7. A fine mist of fuel should appear from the "FUEL NOZZLE" (#9), see Figure 12.

1. Turn the Control Switch **OFF**.
2. Remove "FUEL NOZZLE" (#9), see Figure 12.
3. Turn the Control Switch **ON**. After approx. 20 seconds fuel should flow freely from the fuel nozzle port.

1. Check "FUEL SOLENOID VALVE" (#6) (see Figure 13) for proper operation by: Removing both wires from the Solenoid Valve and applying VDC power (+) and ground(-) to the Solenoid Valve electrical terminals. "FUEL SOLENOID VALVE" (#6) (see Figure 13) should click when VDC power is applied.
Section 6: Troubleshooting

1. Check "FUEL SOLENOID VALVE" (#6) (see Figure 13) wires for continuity. Replace wires if necessary.
2. Replace "CONTROL UNIT" (#1) (see Figure 7) if wires indicate continuity.
4. Install "FUEL NOZZLE" (#9), see Figure 12.
5. Retest Fuel Nozzle spray pattern (fine mist of fuel present?).
7. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.

NOTE: If an improper fuel spray is still observed (a normal spray pattern should be observed as a coned-shaped mist) the Diesel-Burner's "FUEL PUMP" (#14) (see Figure 14) should be calibrated for the proper fuel pressure setting.

End of Troubleshooting Flow-Chart.
For additional troubleshooting information please contact: Vehicle System's Service Dept. at 303-857-2901

1. Turn the Control Switch OFF.
2. Replace "FUEL NOZZLE" (#9), see Figure 12.
3. Retest Fuel Nozzle spray pattern (fine mist of fuel present?).
4. Reconnect ignition wires to "IGNITION ELECTRODES" (#8) (see Figure 11) or remove jumper wire.
5. Reattach "DIESEL-BURNER HEAD" (see Figure 9) and attempt heater restart.
WARRANTY POLICY

- FOR AQUA-HOT MODELS -

Vehicle Systems Inc. warrants the AQUA-HOT Heater, to the original owner, to be free from defects in material and workmanship under design usage and service conditions for a period of two (2) years on parts and labor beginning on the date of purchase of the vehicle. Replacement parts are covered for the remainder of the heating system’s warranty or for six months (180 days) whichever is greater.

This warranty does not apply to damage or failure of the AQUA-HOT Heater or the vehicle into which it was installed due to improper installation, assembly, maintenance, abuse, neglect, accident, or the use of parts not supplied by Vehicle Systems Inc. Vehicle Systems is not responsible for incidental or consequential damages.

The intent of this warranty is to protect the end user of the heating system from such defects which would occur in the manufacture of the product. The warranty is not intended to protect the end user from problems which are outside the ability of Vehicle Systems’ control.

To obtain warranty repair authorization or for additional information, please contact our Technical Support Department at 1-800-685-4298 (8 AM to 5 PM) Mountain Standard Time.
### Section 8: Parts List

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<td>Control Unit, 24 VDC, DBW 2010-300, AH/HH/WH</td>
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<td>ELE-L08-190</td>
<td>Thermostat, VDC Control, 190° F, Blue Dot, AH</td>
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<tr>
<td>ELE-L08-230</td>
<td>Thermostat, VDC High-Limit, 230° F, Black, AH</td>
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<tr>
<td>ELE-254-010</td>
<td>Thermostat, VAC High-Limit, 230° F, White Dot, AH</td>
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<tr>
<td>ELE-010-198</td>
<td>Thermostat, VAC Control, 198° F, Red Dot, AH</td>
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<tr>
<td>FLX-120-BS1</td>
<td>Filter, Fuel, System, 10 Micron, AH/HH</td>
</tr>
<tr>
<td>FLX-R12-TRA</td>
<td>Filter, Fuel, Spin-On Element, 10 Micron, AH/HH</td>
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* Asterisk denotes 24 volt model
### Section 9: Special Tools

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<tr>
<td>102</td>
<td>WPX-310-646</td>
<td>Gauge, Adjustment, Electrode, DBW 2010-300, AH/HH/WH</td>
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<td>WPX-440-280</td>
<td>Control Box, Tester, DBW 2010-300, AH/HH/WH</td>
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<td>139</td>
<td>WPE-600-190</td>
<td>Gauge Kit, Fuel Pressure, DBW 2010-300, AH/HH/WH</td>
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<td>140</td>
<td>***************</td>
<td>Tester, CO-2, DBW 2010-300, AH/HH/WH</td>
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</tbody>
</table>

Order item #140 from a Grainger Industrial Supply Store near you or visit the Grainger website at www.grainger.com. (Grainger Part# 6T153)