



United States Department of Agriculture

Forest Service Helitorch M-2015 Operations Manual



Forest
Service

National Technology &
Development Program

1951-2806P-NTDP
Fire & Aviation Management

February
2020



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Shawn Steber
Project Leader

USDA Forest Service
National Technology and Development Program
Missoula, MT

5150 TE42P11 Ignitions Systems Tech Services—
Residues

February 2020

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Introduction

The U.S. Department of Agriculture, Forest Service, National Technology and Development Program (NTDP) developed a new helitorch for intragency aerial ignition operations. The Forest Service Helitorch M-2015 is a gelled fuel aerial ignition device that connects to a helicopter’s external cargo attachment point (cargo hook). The device consists of:

- A lightweight frame
- A 55-gallon fuel drum
- An electronic control box
- A fuel pump
- An igniter arm
- A propane system
- A suspension system

The pilot controls the ignition system and fuel pump electronically. The pilot can jettison the helitorch by releasing the cargo hook.

NTDP designed the helitorch for reliable and simple operation. The basic operation involves a gasoline transfer pump that delivers gelled fuel from the fuel drum to the fuel discharge tip where ignition occurs. An electric spark ignites the propane and the gelled fuel ignites as it passes through the propane flame.

The components of the helitorch are easily accessible for inspection, cleaning, repair, and replacement. This manual provides information about the Forest Service Helitorch M-2015 components, safety and design features, and maintenance requirements. The publication “NWCG Standards for Aerial Ignition, PMS 501” <<https://www.nwcg.gov/sites/default/files/publications/pms501.pdf>> provides additional information about helitorch inspection, use, and safety.

Helitorch Specifications

Note: Weights and dimensions given are approximate.

Helitorch Specifications	
Component	Weight (pounds)
Torch—unfueled	172
Torch—fueled (55 gallons)	557
Suspension system	18
Torch, suspension, and fuel	575
Component	Dimensions
Torch height	39 inches
Torch length	60 inches
Torch width	27 inches
Suspension length	22 feet
Suspended distance from cargo hook	25 feet

Helitorch Test Reminders

- Bench test the helitorch before attaching it to the helicopter.
- Use a 24-volt power supply for the helitorch during bench testing.
- Always test the ignition system (spark and propane) before testing the pump to avoid igniting gelled fuel.
 - ✧ Clear away vegetation close to the igniter tip.
 - ✧ Ensure that no one stands directly in front of the igniter tip during testing. The propane flame will cause severe burns.
- Test the helitorch using the helicopter power supply to verify pilot control.





Helitorch Components

The helitorch in figure 1 shows the igniter arm in the operational position and the suspension system configured for attachment to the aircraft.

Inspect the helitorch before and after each use. Refer to the troubleshooting section of this manual if problems occur (appendix A).

Helitorch Operations and Maintenance

The following sections describe the instructions for operating and maintaining the helitorch components. Photos of the components and a parts list are included in appendix B.

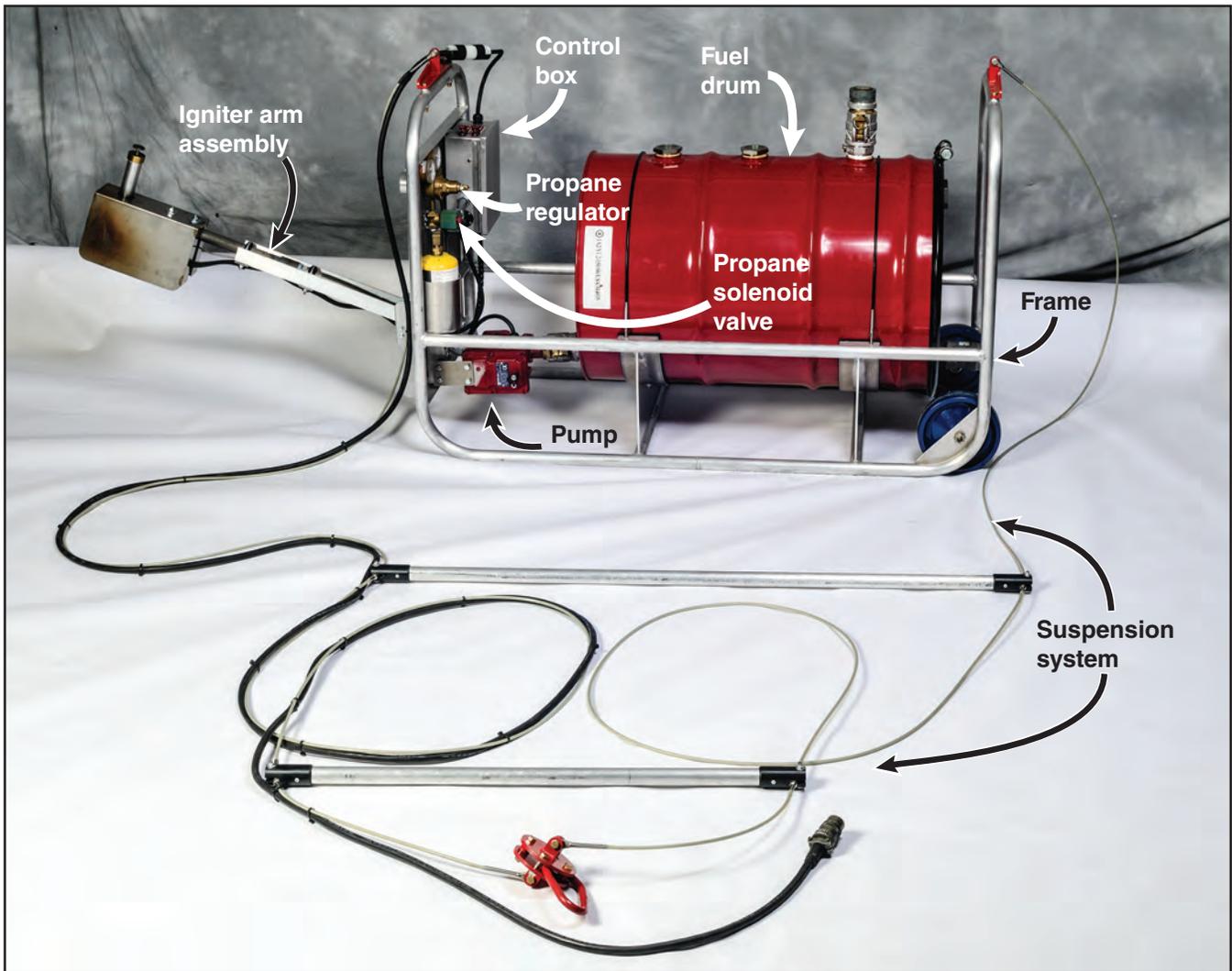


Figure 1—The fully assembled helitorch in a wheeled frame, configured to attach to a helicopter.



Control Box

The control box (figure 2) is located on the right side of the control panel. It houses the electrical connections and components (figures 3 and 4) that provide spark energy to the igniter tip and power the pump and propane solenoid valve.

Toggle switches on top of the control box power the spark and pump (figure 5). The helitorch ground crew activates both switches for the helitorch to be fully operational during flight. The ground crew closes the switch guards to deactivate the helitorch. The spark switch controls power for

the propane solenoid valve and the electrical spark. The pump switch controls power for the pump only.

The “SlickSTART” magneto booster delivers an electrical pulse to the 24-volt ignition coil, supplying spark energy to the igniter tip.

Control box inspection:

- Inspect all wiring for damage and for loose connections.
- Ensure that the control box is closed and secure the closure tabs before testing the helitorch.

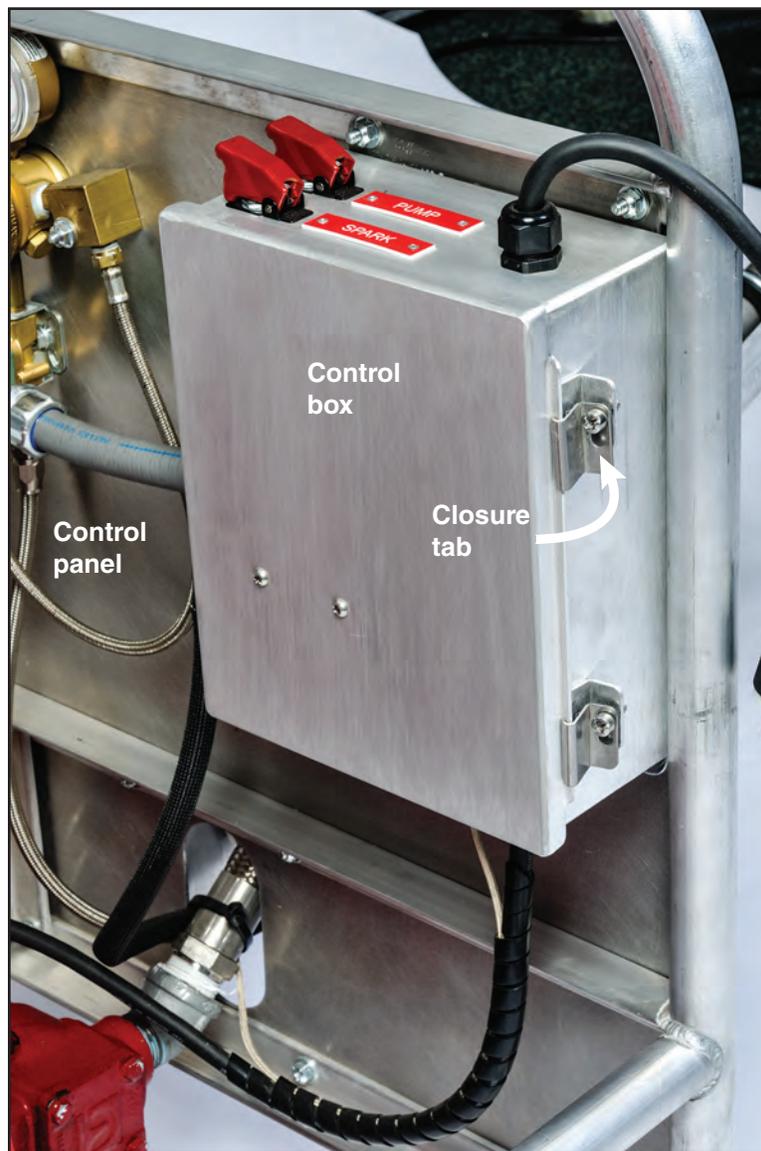


Figure 2—External view of the control box.

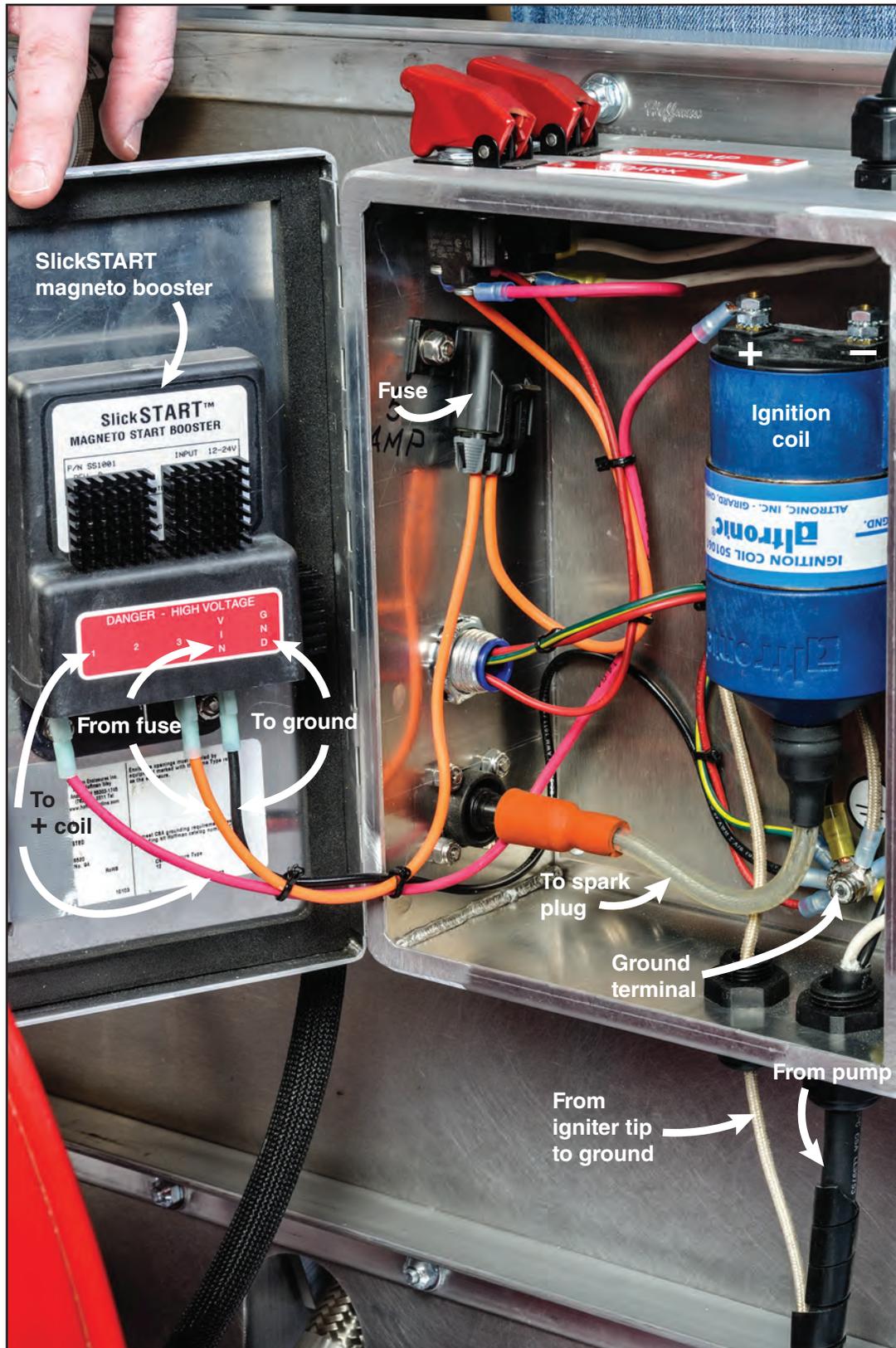


Figure 3—Wiring details inside the control box.

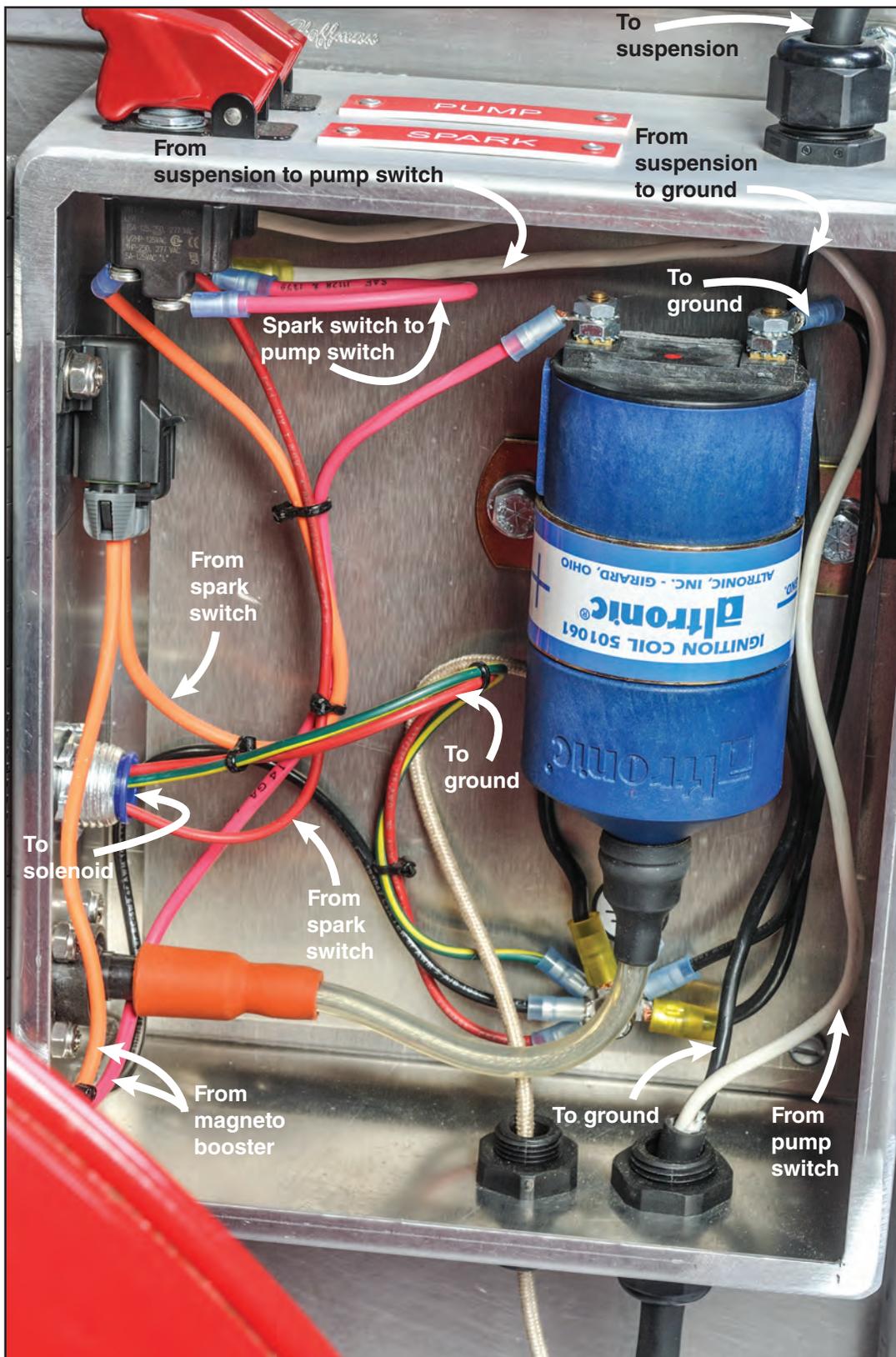


Figure 4—Additional wiring details inside the control box.

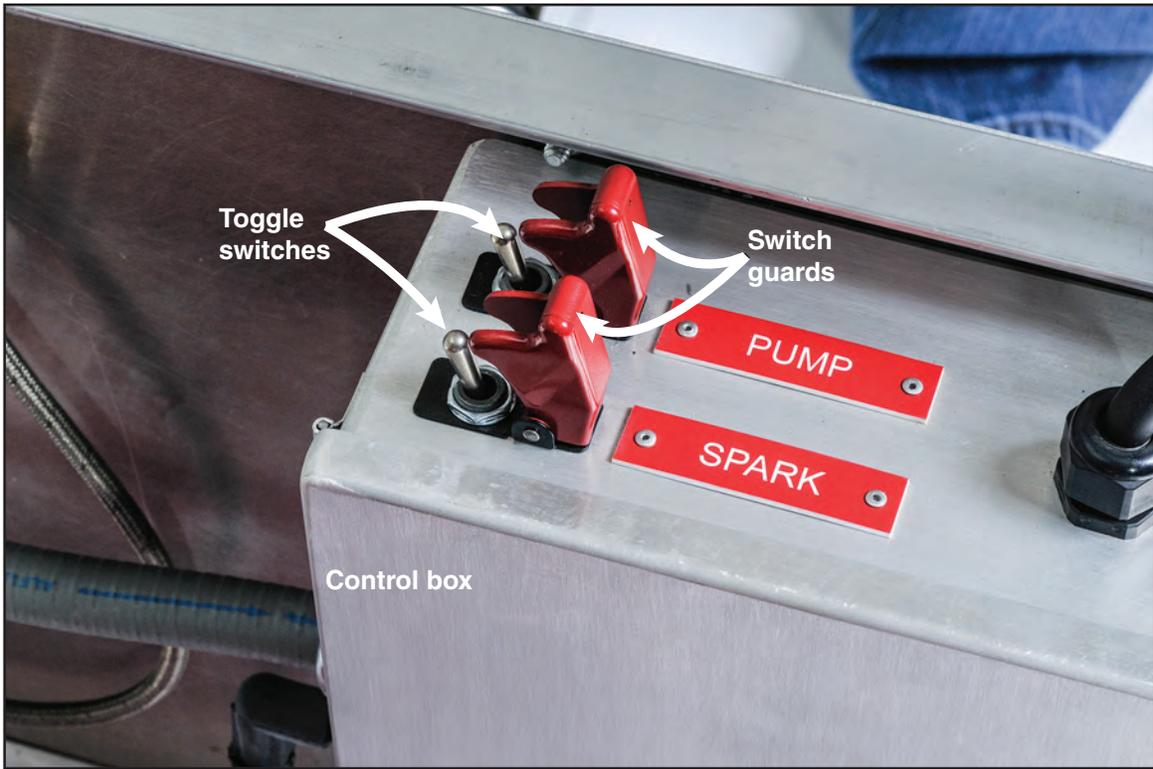


Figure 5—The pump and spark control switches are located on top of the control box.





Pump

A 24-volt gasoline transfer pump (figure 6) provides fuel flow and pressure to the fuel discharge tip. This pump is rated for 20 gallons per minute using ungelled gasoline.

NTDP removed and replaced the pump on/off lever with a tab (figure 7), so the pump is always locked in the “On” position. The pump switch on top of the control box supplies power to the pump.

Replace the carbon pump vanes in a pump with bronze vanes (figure 8) for increased durability. Consult the manufacturer’s pump manual for the parts location schematic.

Pumps come from the factory with a debris screen or strainer installed at the fuel inlet. Remove the screen or strainer to allow gelled fuel to flow adequately. Consult the manufacturer’s pump manual for the parts location schematic.

Pump inspection:

- Inspect the pump for obvious external damage.
- Inspect all piping connections for leaks.
- Ensure that the camlock fitting is closed and locked.

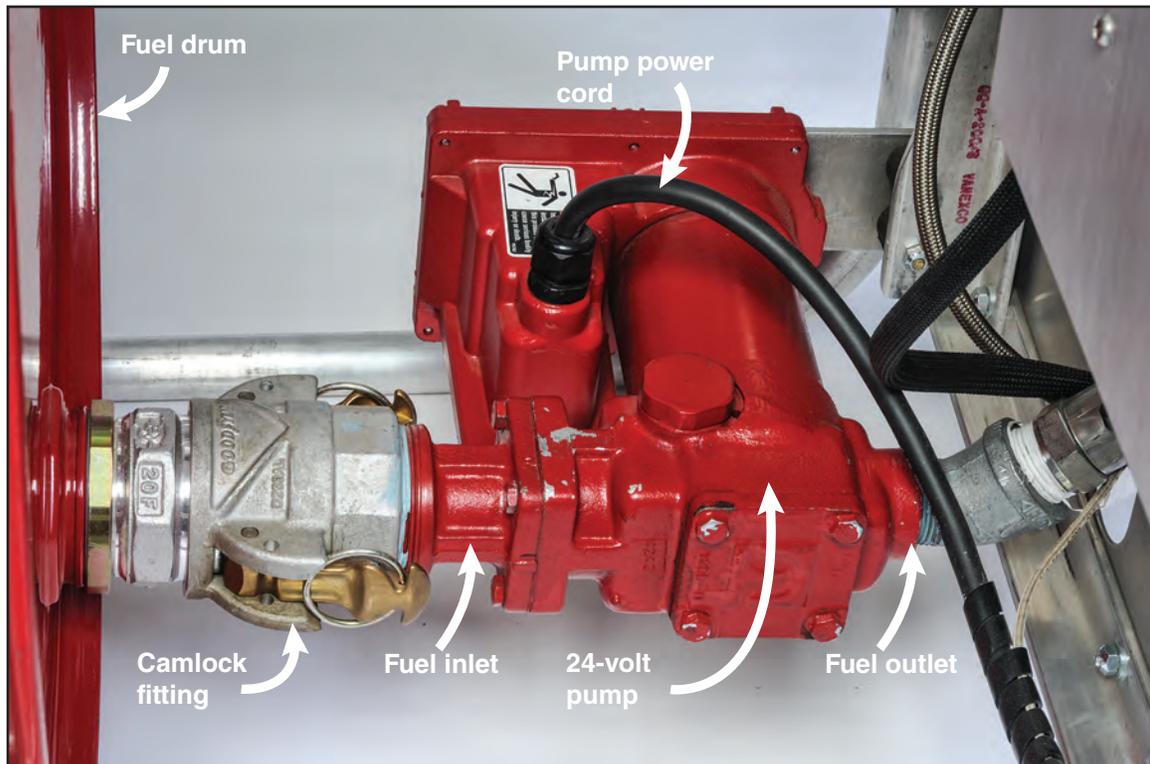


Figure 6—The pump draws gelled fuel from the drum and supplies it to the fuel discharge tip.

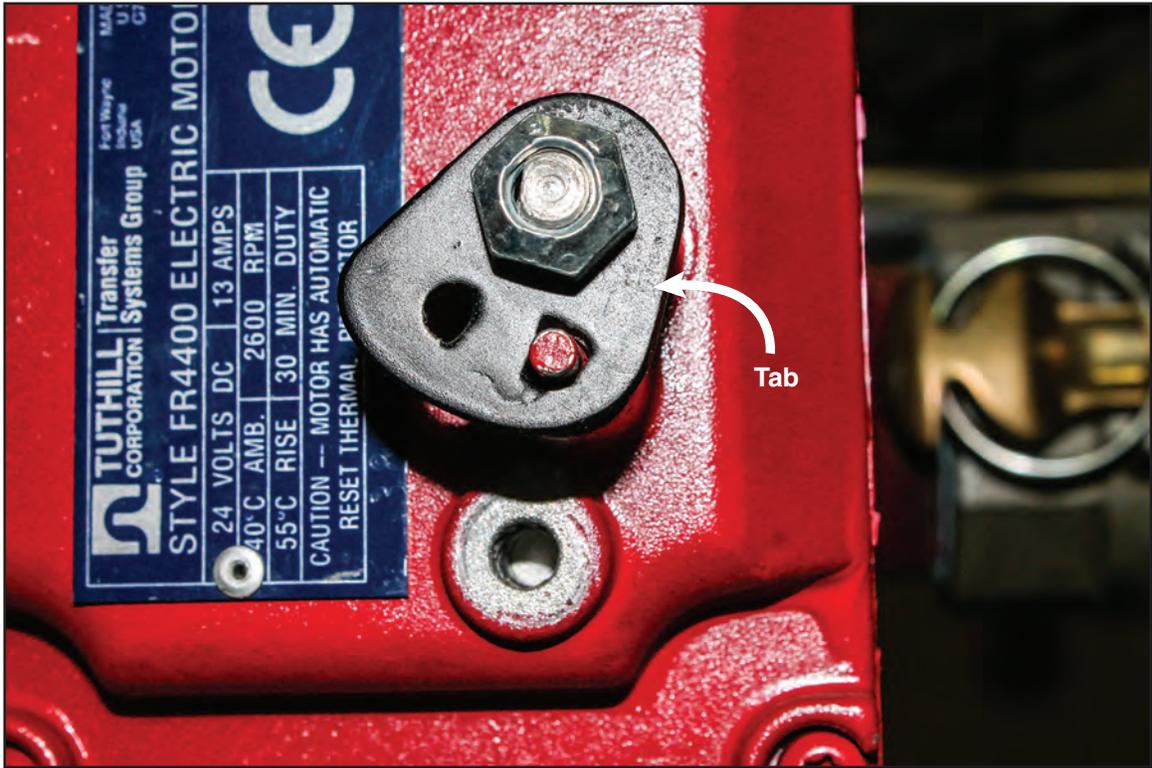


Figure 7—A tab locks the pump in the “On” position.

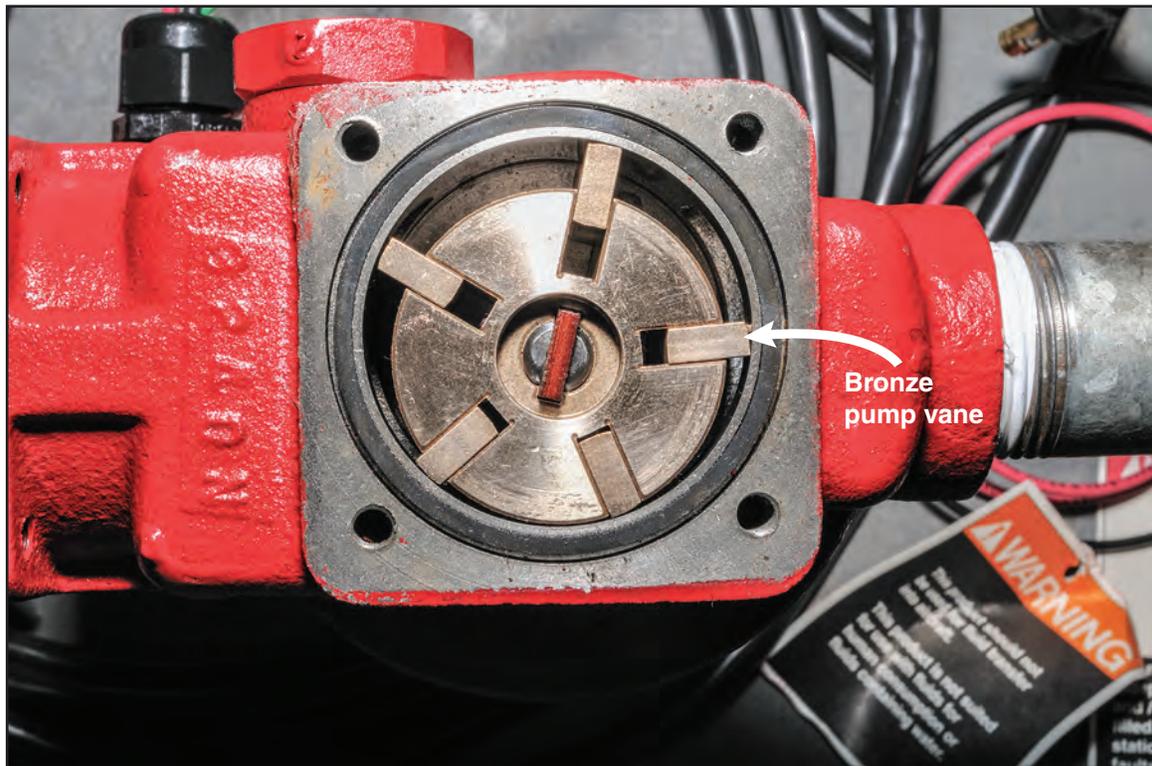


Figure 8—Bronze pump vanes should be installed for better durability.



Fuel Drum

The fuel drum (figures 9, 10, and 11) has a 55-gallon capacity and a removable head to facilitate cleaning the drum interior. Four sight windows (two on the top of the drum and one on each end) provide a view of the fuel level. The recommended fuel level for a full drum is near the bottom of the end sight windows (about 50 gallons).

To fill the drum, connect the dry-break fitting to the batch mixer or mix transfer system discharge hose. When filling the drum, remove the camlock with vapor valve and attach a vapor recovery hose. After filling the drum, reinstall and lock the camlock.

Before removing the empty drum for cleaning, maintenance, or inspections, place absorbent material or a pan

under the camlock to catch any residual fuel, then disconnect the drum attachment cables and unclasp the camlock fitting attached to the pump.

Drum inspection:

- Inspect the drum for external damage and ensure that the drum attachment cables connect to the helitorch frame.
- Ensure that the drum head locking ring is properly installed and secure.
- Inspect all drum fittings for leaks.
- Use a fuel-resistant polytetrafluoroethylene (PTFE) thread sealant—or something similar—on all drum fittings.

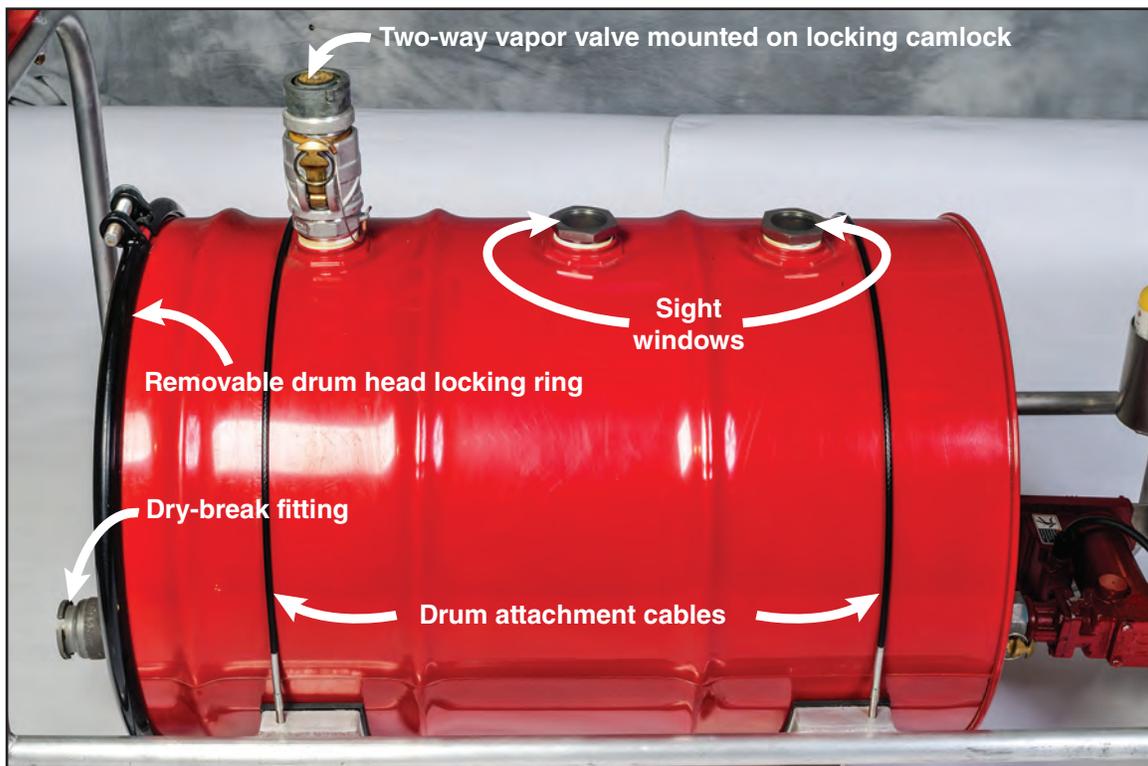


Figure 9—Side view of the helitorch fuel drum showing the drum components.

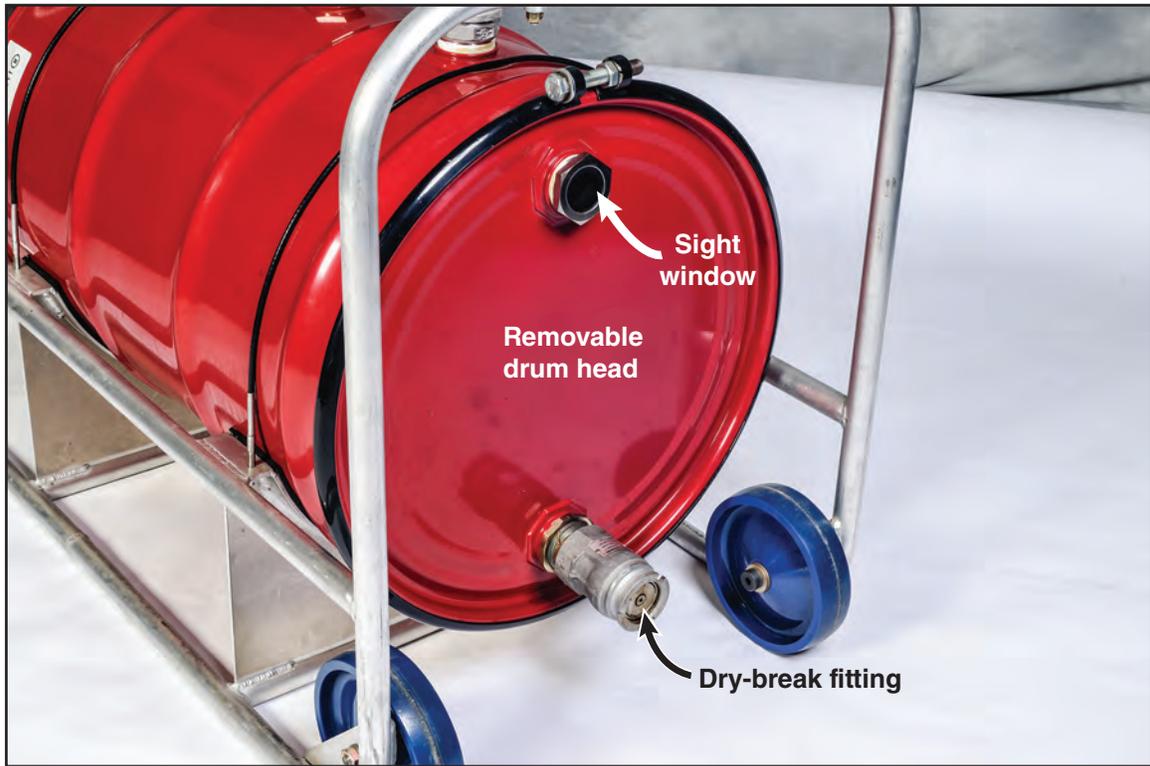


Figure 10—End view of the helitorch fuel drum showing the removable head.

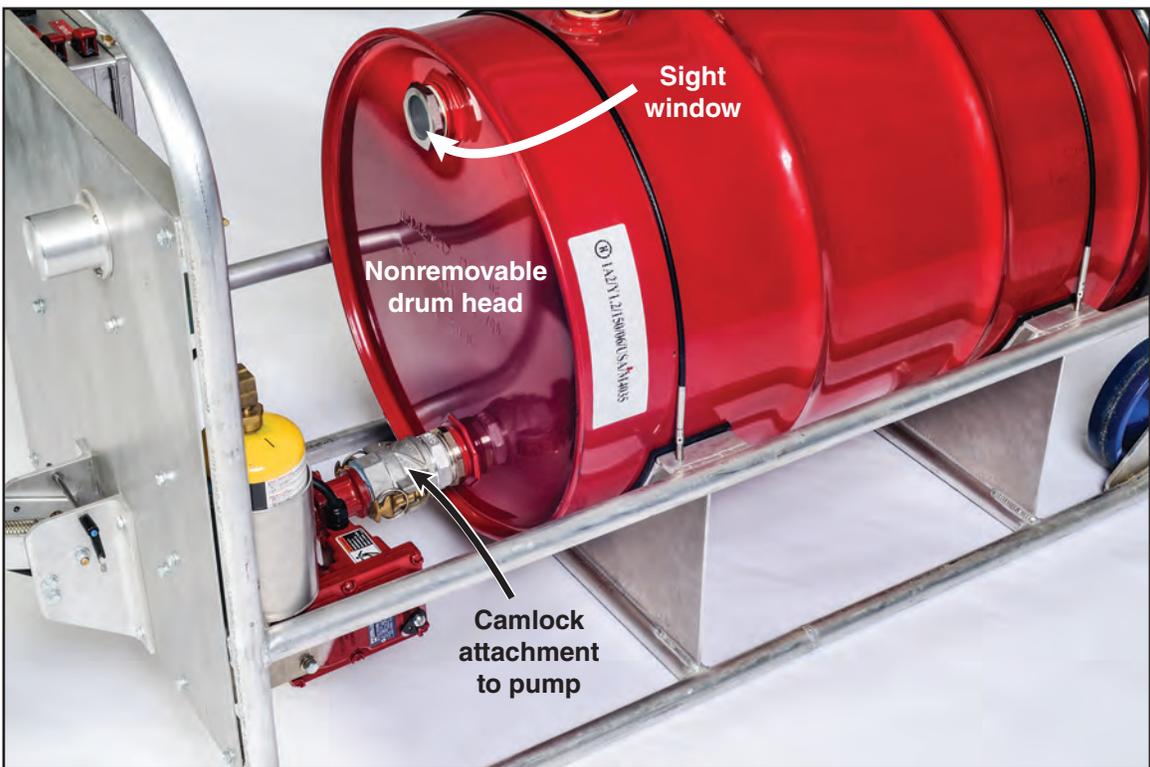


Figure 11—End view of the helitorch fuel drum showing the nonremovable head.



Propane System

The propane regulator (figure 12) allows the ground crew to adjust the pressure supplied to the propane orifice at the igniter tip (figure 13) to achieve the desired flame for ignition. There are two pressure gauges on the regulator. One indicates the pressure remaining in the propane bottle and the other indicates the pressure of the propane being delivered to the igniter tip. The regulator adjustment screw adjusts the pressure of the propane flowing through the propane orifice. For best results, adjust the pressure with propane flowing. When the regulator indicates the desired pressure, tighten the adjustment knob locknut to prevent pressure changes.

The solenoid valve (figure 12) provides the on/off control for the flow of propane. The spark switch electronically controls the valve. This normally closed valve only opens when the spark switch supplies power to the solenoid.

Propane system inspection:

- Ensure that all propane hose connections and fittings are secure.
- Inspect the regulator for external damage.
- Inspect the propane hoses for damage and wear.
- Check the propane orifice for debris and carbon buildup; clean as necessary.
- When replacing the propane bottle, ensure that the bottle gasket remains on the bottle and not on the stem of the propane cylinder connector (figures 14 and 15). If the gasket remains on the stem, remove and reinstall it on the propane cylinder. Clean any residue or debris from the stem.

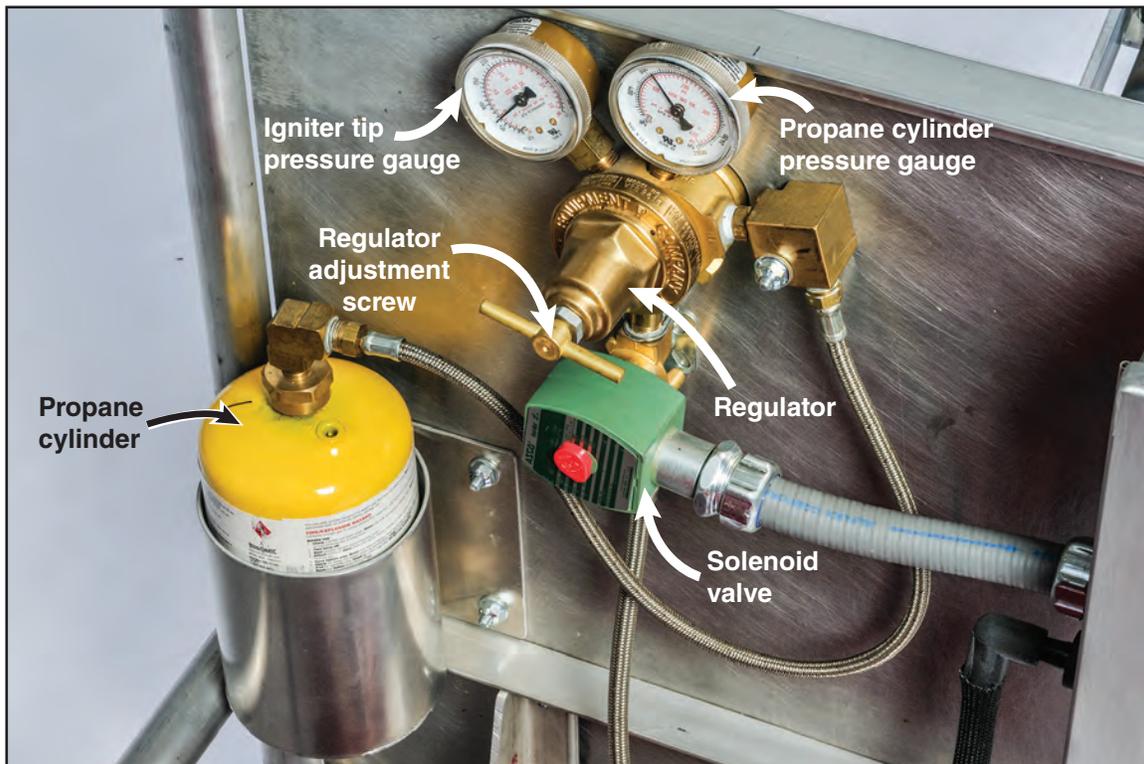


Figure 12—The propane system includes a regulator, solenoid valve, and a source of propane.

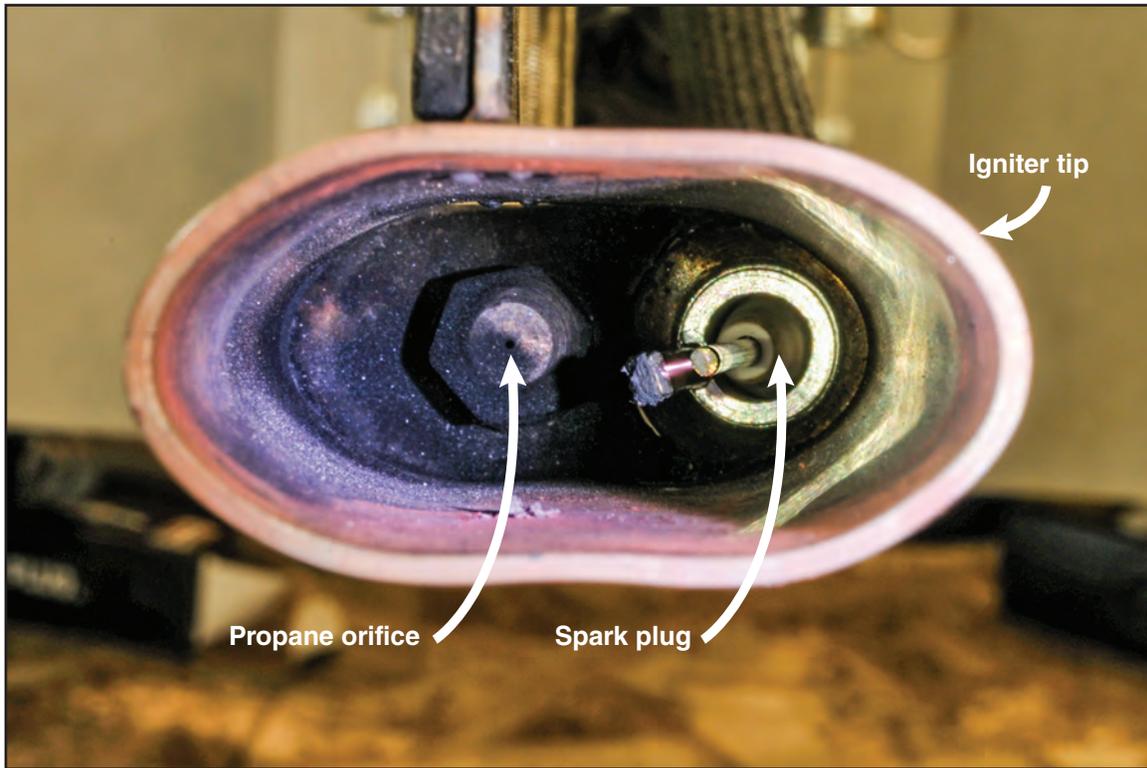


Figure 13—The propane orifice is located in the igniter tip.

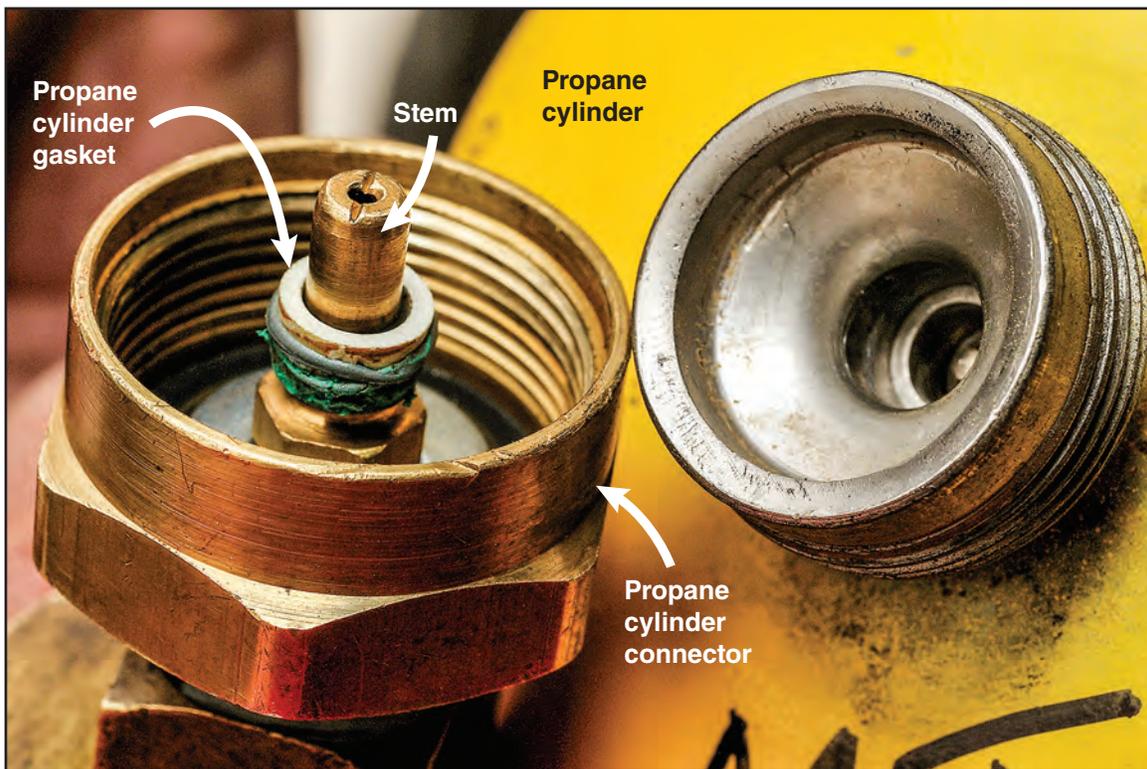


Figure 14—After unscrewing the propane bottle, the propane cylinder gasket remained on the propane cylinder connector stem. In this case, place the gasket back on the propane bottle.

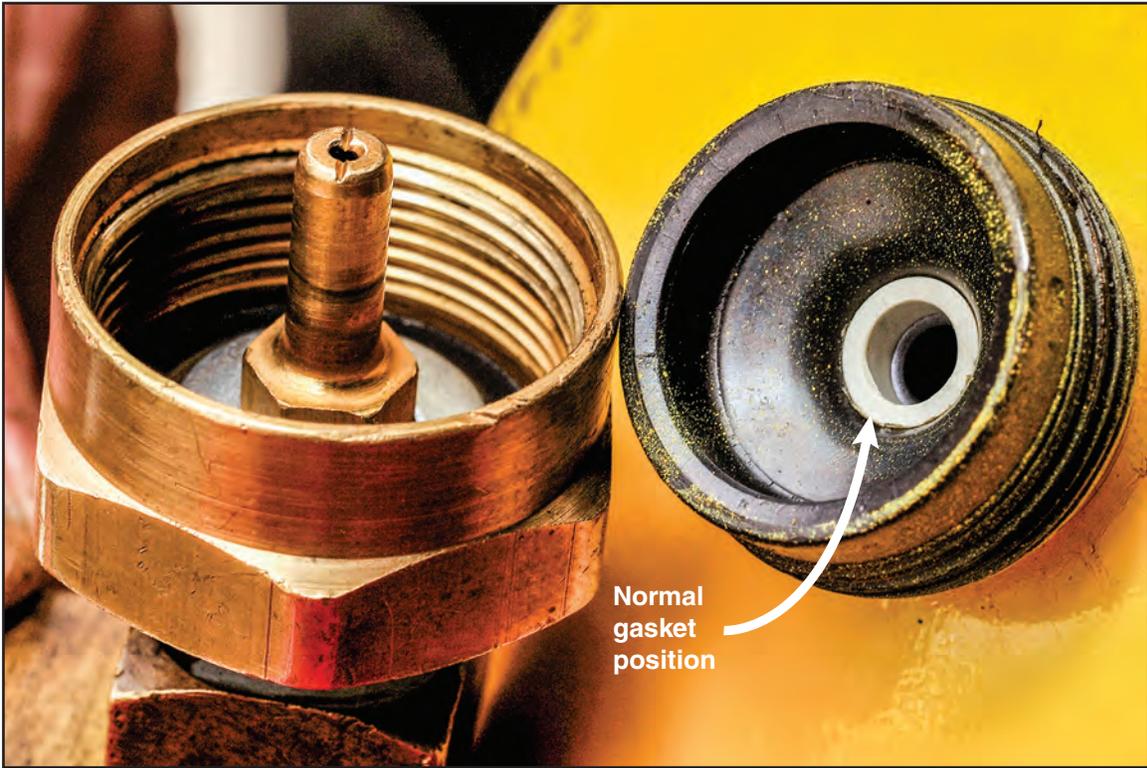


Figure 15—The propane cylinder gasket reinstalled on the propane bottle.





Igniter Arm Assembly

The igniter arm assembly (figures 16 and 17) includes:

- Fuel piping and support structure
- Ignition and fuel discharge components
- Windscreen

The igniter arm pivots up for storage and down for use. A push-lock pin secures the raised arm, but does not lock the lowered arm. This hinge allows the arm to pivot if the helitorch is set down on uneven ground, preventing damage to the igniter arm components. Replace the push-lock pin after lowering the arm.

The fuel discharge plunger regulates fuel flow through the fuel discharge tip. Pressure is applied when the pump is engaged, raising the plunger. This opens the fuel discharge tip and allows fuel to flow. Spring pressure lowers the fuel discharge plunger to close the tip and shut off the flow when the pump is secured. Remove the windscreen for better access to inspect and clean the ignition components (figure 17).

Remove the fuel discharge plunger (figure 18) and disconnect the camlock fitting to clean the components and inspect the seals. Lubricate the tip seals with a silicone grease or other similar lubricant. Align the fuel discharge tip vertically when reinstalling; the camlock can cause the tip to install at an angle, which may direct fuel away from the flame. Remove the fuel discharge tip to clean as needed. The owner can change the tip for a different spray pattern as desired. The tip spring may lose its compression strength over time. To ensure proper spring reaction, pull up on the fuel discharge plunger and release. The plunger should return easily to its seated position.

The igniter tip shroud houses the propane orifice and spark plug. The owner can remove the propane orifice and spark plug through the rear of the shroud. An upper orifice (figure 19) and a lower orifice at the rear of the igniter tip shroud allow oxygen to flow into the shroud for better propane combustion.

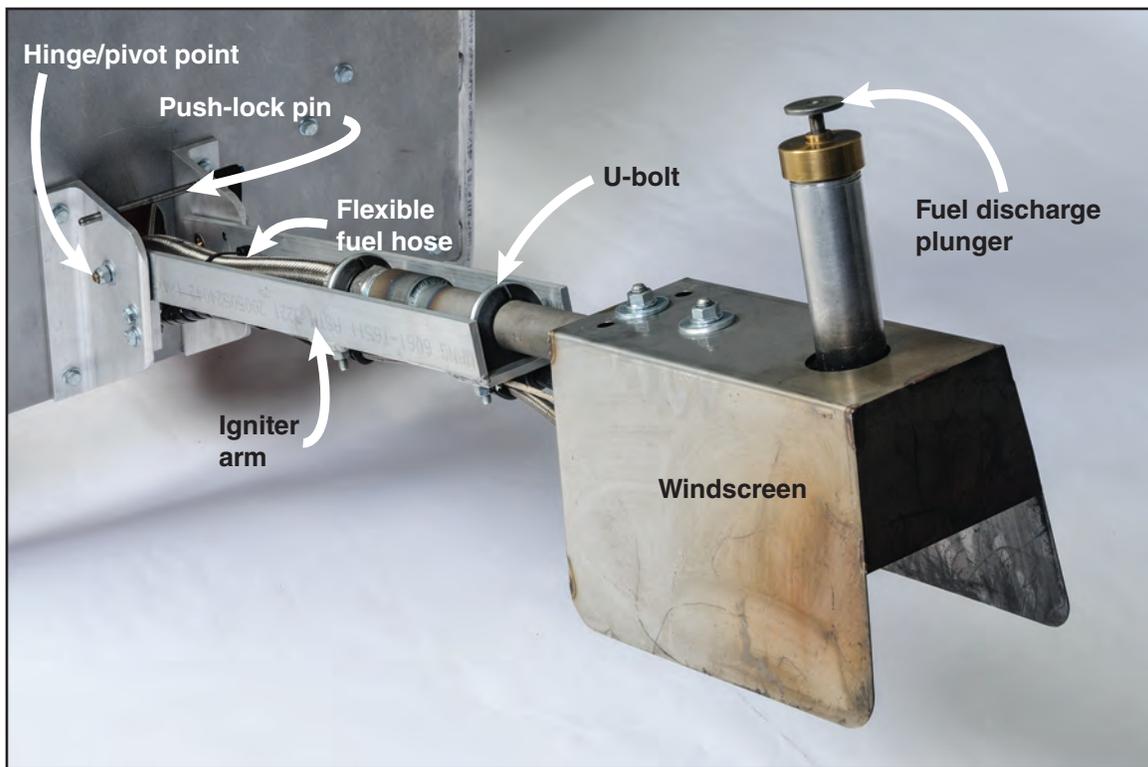


Figure 16—The igniter arm assembled for use and shown in the lowered position.

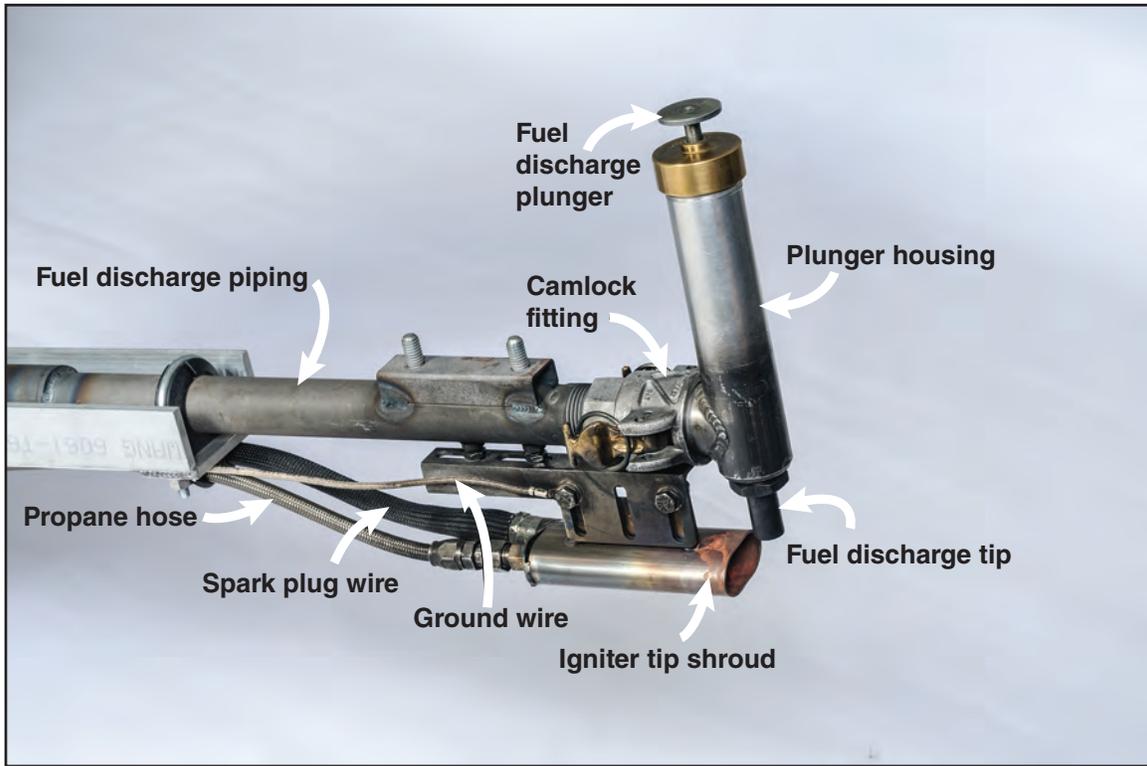


Figure 17—The igniter arm components with the windscreen removed.

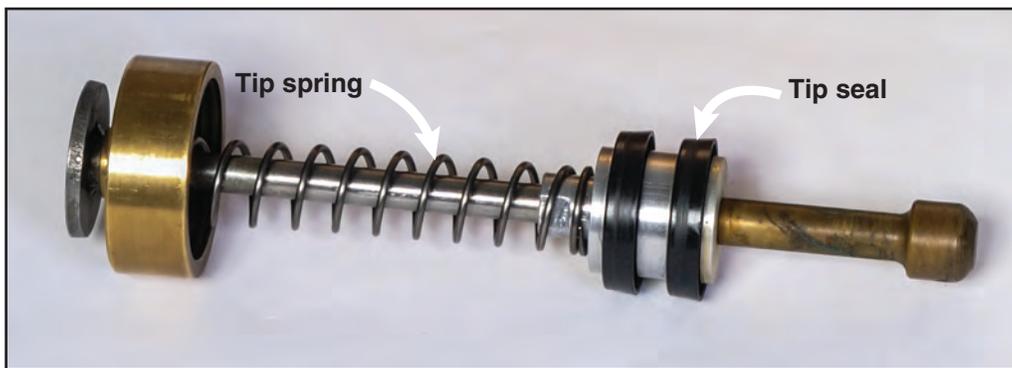


Figure 18—The fuel discharge plunger removed from the plunger housing.

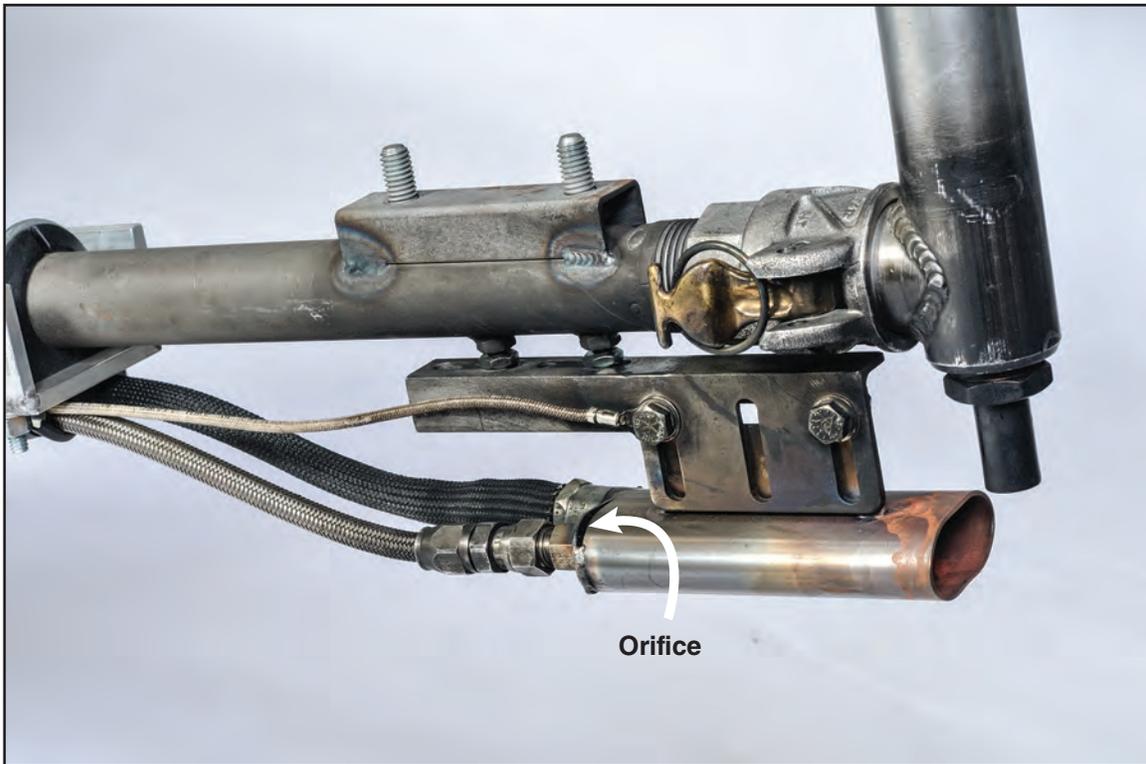


Figure 19—The upper orifice of the igniter tip shroud. A similar opening is positioned directly below on the lower portion of the shroud.

Caution: When testing or troubleshooting only the spark, remove the propane bottle and purge the hoses of all propane before looking into the igniter tip shroud. Propane will ignite and cause severe burns.

Igniter arm assembly inspection:

- Check for obvious external damage.
- Ensure that all connecting bolts are tight.
- Inspect the fuel hose for leaks or loose connections.
- Ensure that the U-bolts are secure with their cushions in place.
- Ensure that the propane and spark plug connections are tight.
- Ensure that the ground wire is connected.
- Remove the fuel discharge plunger to check the tip seals for damage. Reinstall the plunger and ensure that it is tightly screwed onto the housing.
- Inspect the fuel discharge tip spring visually and by raising the fuel discharge plunger.
- Ensure that the fuel discharge tip camlock fitting is closed and locked.
- Ensure that the fuel discharge tip is tight and contains no residual fuel and excess carbon buildup.
- Tighten the windscreen bolts after inspecting the ignition components.



Suspension System

Two rigging brackets at the top of the frame mechanically connect the helitorch suspension system to the helitorch (figures 20 and 21). Tighten the clevis tab bolts, but leave them loose enough to allow the clevis fitting to rotate.

Connecting the twist-lock connector from the suspension system to the plug on the control box electrically connects the helitorch suspension system to the helitorch (figures 20 and 22).

Rigging bolts must be aircraft grade, as designated in the parts list. Notify the NTDP ignition specialist if a rigging bolt or bracket breaks.

Suspension system inspection:

- Inspect the rigging brackets for cracking and ensure that the bracket hardware is secure.
- Inspect the clevis tabs for elongated holes or cracking.
- Inspect the electrical cord and connectors for damage.
- Inspect the separator bars for damage and ensure that the ball with shank fittings and end bolts are secure (figure 23).

- Inspect the clevis fitting for cracks and deformation (figure 24). Ensure that the connection between the clevis fitting and suspension cable is tight.
- Inspect the suspension adapter, pear ring, and eye fittings for cracking, deformation, elongated holes, and loose hardware (figure 25). Ensure that the connection between the eye fitting and suspension cable is tight.
- Inspect the suspension cable for missing coating, frayed or broken cable strands, and kinks.
- Remove the suspension cable from service if any kinks, frayed or broken strands, or excessive corrosion are present.

If the cargo hook orientation requires it, the pear ring can be oriented to be in plane with the suspension cables by moving the eye fittings to the outer bolt locations (figure 25).

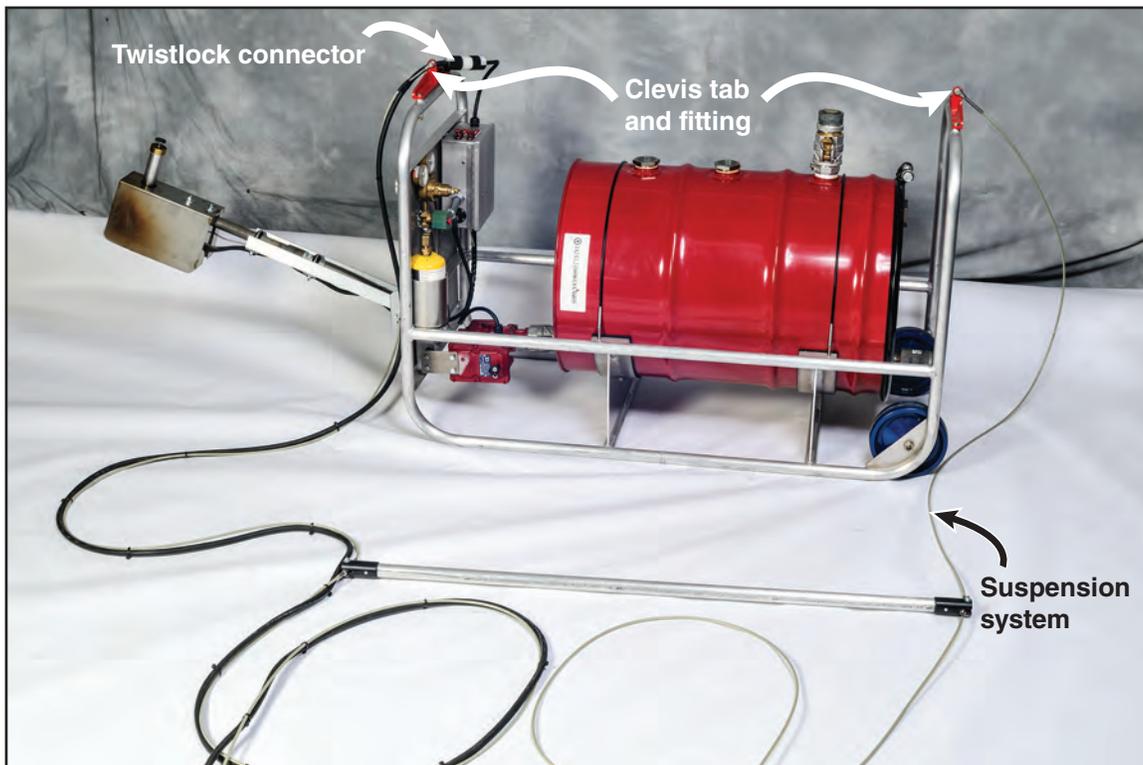


Figure 20—The helitorch suspension attachment.

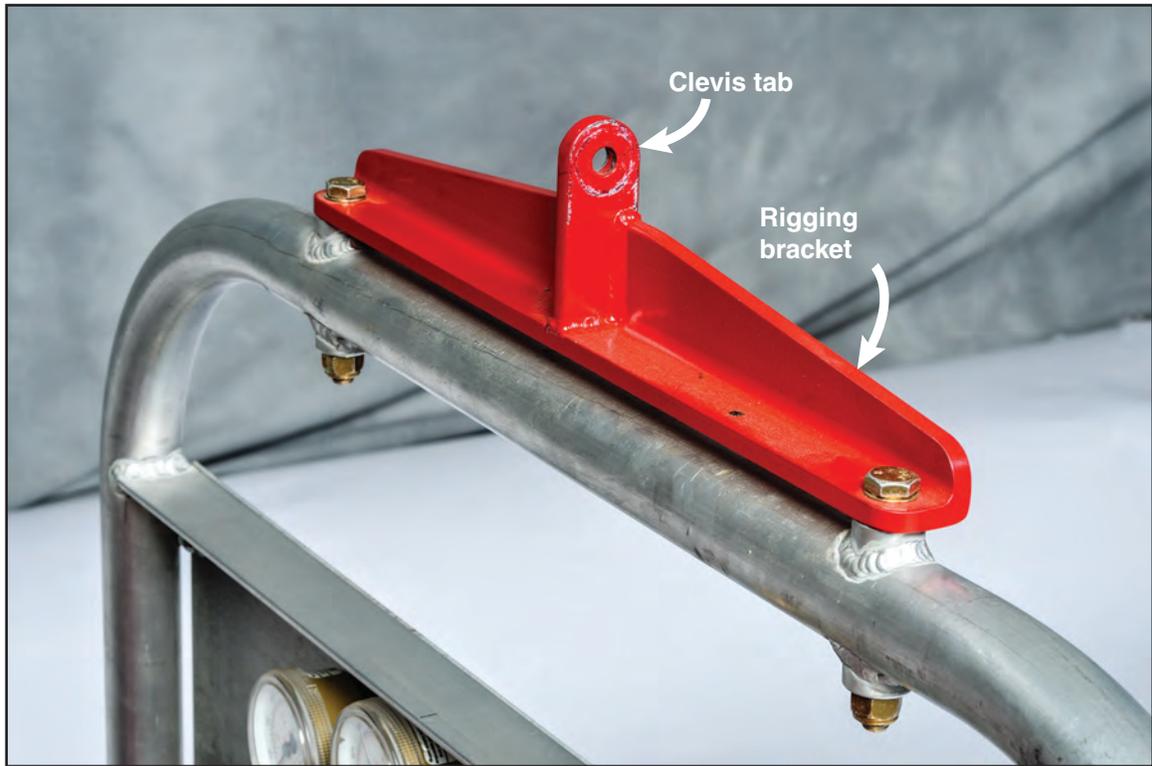


Figure 21—The helitorch rigging bracket and clevis tab attachment point.

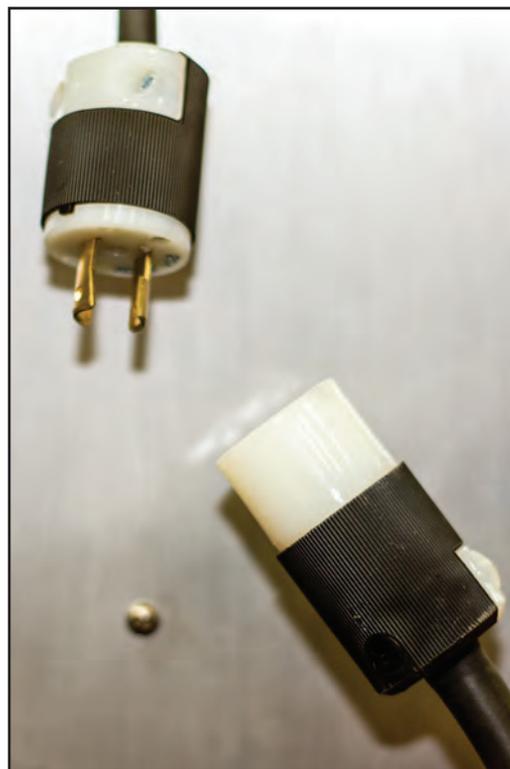


Figure 22—The electrical connection from the control box to the suspension.

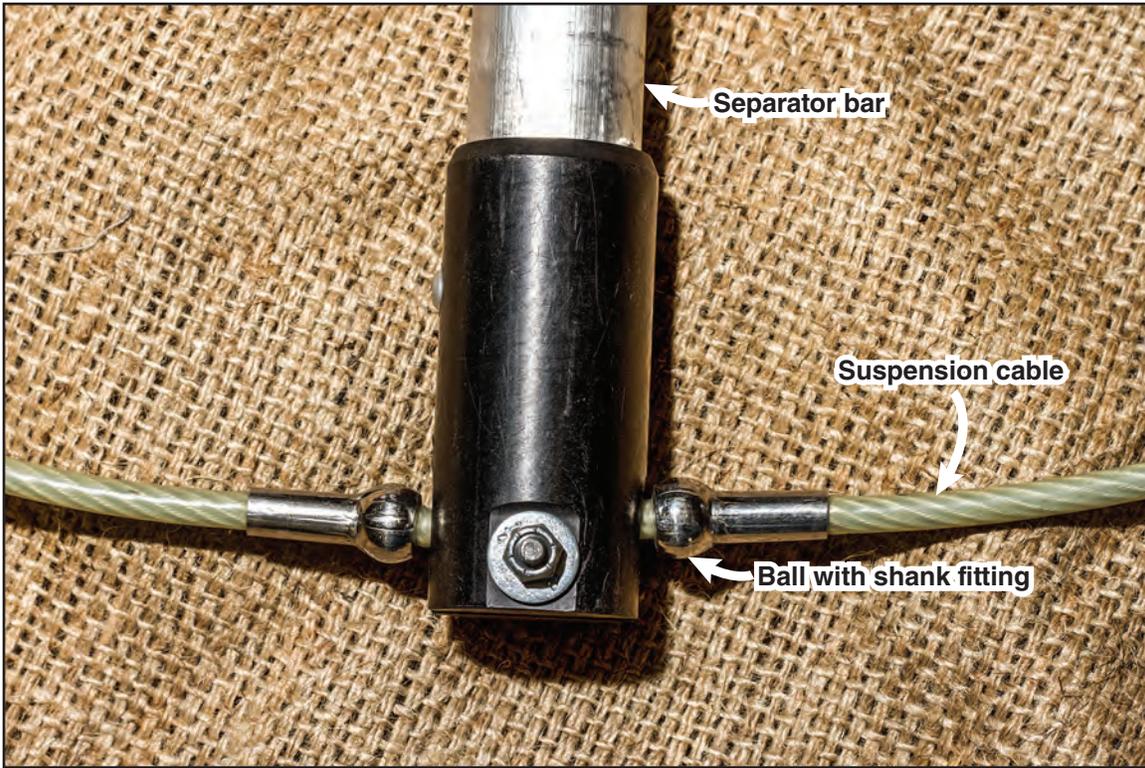


Figure 23—The separator bars are held in place by ball with shank fittings and a bolt at the end of the bar.

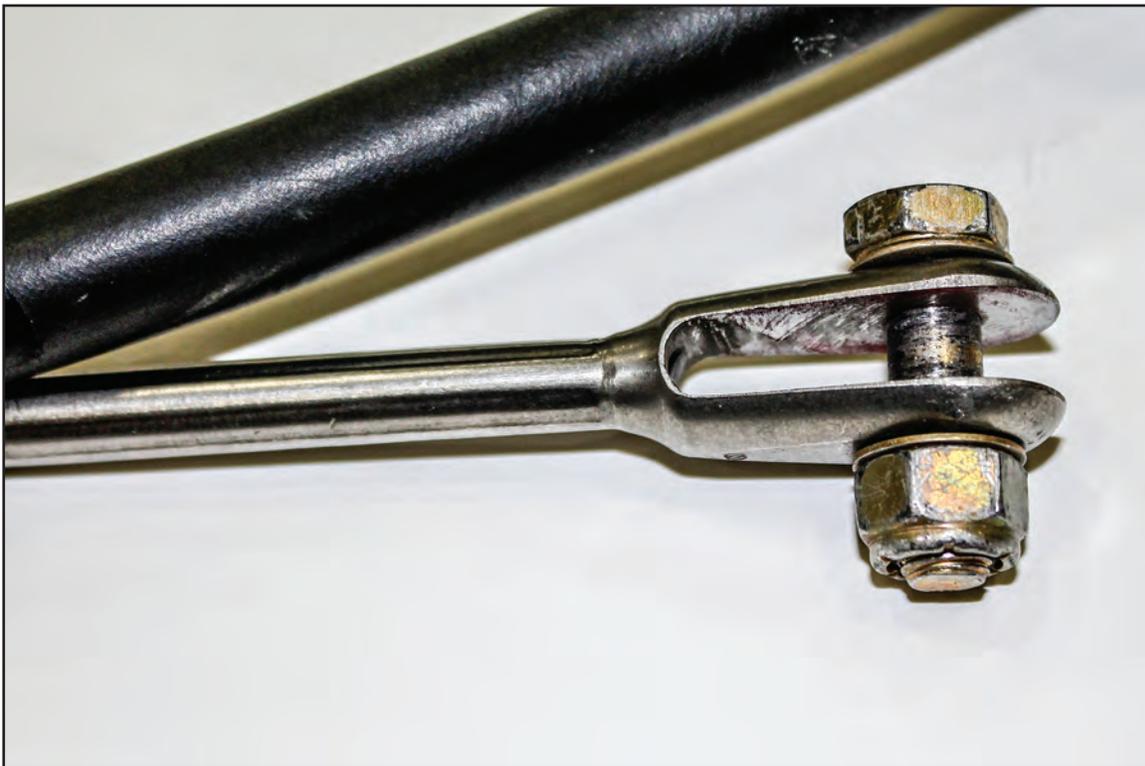


Figure 24—The clevis fitting and hardware required to attach the suspension to the rigging bracket.

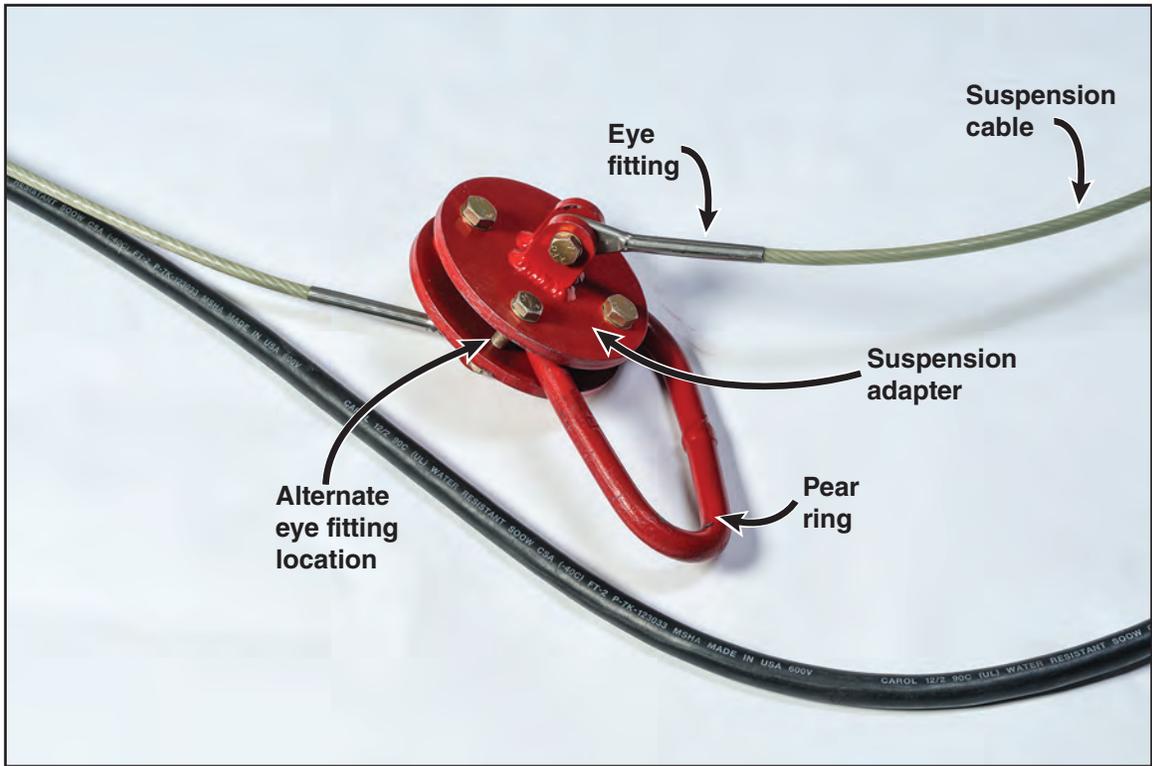


Figure 25—The suspension adapter connects to the helitorch through the suspension cable and eye fitting and to the helicopter through the pear ring. The eye fittings can be moved to the alternate location if required.





Appendix A: Troubleshooting

Refer to the table footnotes for explanations of the acronyms.

Forest Service Helitorch M-2015 Troubleshooting Procedures		
Malfunction	Test or inspection	Corrective action
Insufficient fuel flow	Ensure that the gel is not too thick. If the gel is too thick, the pump and tip may clog.	Thin the fuel gel mixture.
	Ensure that the tip is not clogged.	Disassemble and inspect for clogs. Clean the tip after each work shift.
	Lift up/release the plunger, which should spring back into a seated position.	Disassemble the plunger from the housing and clean the residue. Lubricate the tip seals. If the spring loses compression strength, replace the spring.
	Inspect the pump vanes.	Replace the pump vanes if they are worn or damaged. If carbon vanes disintegrate, fragments can block the fuel flow at restrictions in the fuel line.
	Inspect the two-way vapor valve for gel residue.	Clean or replace the vapor valve if it is not functional. Keep gelled fuel away from the vapor valve.
	Verify that the screen or strainer was removed from the fuel pump.	Consult the pump manual for the screen or strainer location to remove the screen (if present).
Igniter will not maintain a flame or flame is weak	Ensure that the propane cylinder contains fuel.	If the cylinder is empty or low, replace the cylinder.
	Ensure that the propane pressure is adequate.	The regulator gauge should read about 10 to 20 psi. Adjust the gauge as appropriate.
	Ensure that the solenoid is functioning properly.	To test, flip the igniter switch to the "On" position and listen for the solenoid (clicking sound). If propane flows, the solenoid is functional. If there is no clicking sound or propane flow, recheck the switch position, check the wiring connections, or replace the solenoid.
	Inspect the propane orifice.	Clean the propane orifice of all debris and carbon residue.
	Ensure that the igniter tip air orifices are not too small or obstructed.	Open the air orifices as needed for more airflow. A strong propane flame requires sufficient oxygen.
No spark from igniter	Ensure that the spark switch is in the "On" position.	Flip the toggle switch to the "On" position.
	Ensure that the electrical connections, fuse, and wiring are intact. Ensure that the electrical connection to the helicopter is secure.	Inspect the fuse, SlickSTART magneto booster, and coil boot connections. Secure the connections and check the fuse. Ensure that the 9-pin connector is secure and the suspension conductor cord is connected to the control box.
	Verify that the SlickSTART magneto booster and ignition coil are operational.	Inspect the electrical connections. Check for voltage at the SlickSTART magneto booster and ignition coil terminals. Try a spare SlickSTART magneto booster and/or ignition coil. If the SlickSTART magneto booster is hot, install another heat sink over the hot spot to help dissipate the heat.
	Verify that the coil and spark plug boots are not corroded and are seated securely.	Clean corrosion from the terminals; use dielectric grease if desired. Reseat the coil boots.
	Visually inspect the spark plug electrodes for spark. Purge propane from the system before visually inspecting the spark.	Clean or replace the spark plug. Adjust the electrode gap.



Malfunction	Test or inspection	Corrective action
No fuel flow (Refer to the "Insufficient fuel flow" troubleshooting section of this table for further information)	Verify that the pump switch is in the "On" position.	Flip the pump switch to the "On" position.
	Check the pump.	Check the electrical connections. Verify the 24 V supply. Ensure that the switch on the pump is engaged or that the locking tab is in place.
	Inspect the wiring connections to the helicopter.	Check all connections. Ensure that the 9-pin connector is secure and that the suspension conductor cord is connected to the control box.
Torch leaks at fuel tip	Check the plunger movement; it should spring back to a seated position.	Disassemble and clean the fuel tip. Lubricate the tip seals. Replace the tip spring if the compression strength has decreased. Remove any dried fuel remnants from the plunger housing.
Propane leak	Check for loose propane hose connections.	Tighten the propane hose connections.
	Check for a hole in the propane hose.	Find the leak and replace the propane hose.
	Ensure that the propane cylinder gasket is not missing or stuck on the propane cylinder connector stem.	Reseat the propane cylinder gasket. Clean the propane cylinder connector stem. Replace the propane cylinder if the gasket is missing.
	Check for a loose propane cylinder connector.	Tighten the connector.
	Ensure that the solenoid valve is not stuck open.	Attempt to free the valve by energizing and de-energizing the valve. If the valve continues to stick, disassemble it and inspect for obstructions. Repair or replace the valve.
Drum does not vent	Inspect the two-way vapor valve for gel residue.	Clean away the gel residue or replace the vapor valve.
Drum will not fill	Check the dry-break fitting; the spring-loaded plate should seat itself when depressed and released.	Clean or replace the dry-break fitting.
	Ensure that the fill delivery system is attached properly.	Correctly attach the fill system dry-break coupler and open the valve.
	Ensure that the fill delivery system hose is not plugged.	Drain or backflush the hose to loosen a clog.

psi = pounds per square inch
V = volt



Appendix B: Parts

Parts Photos

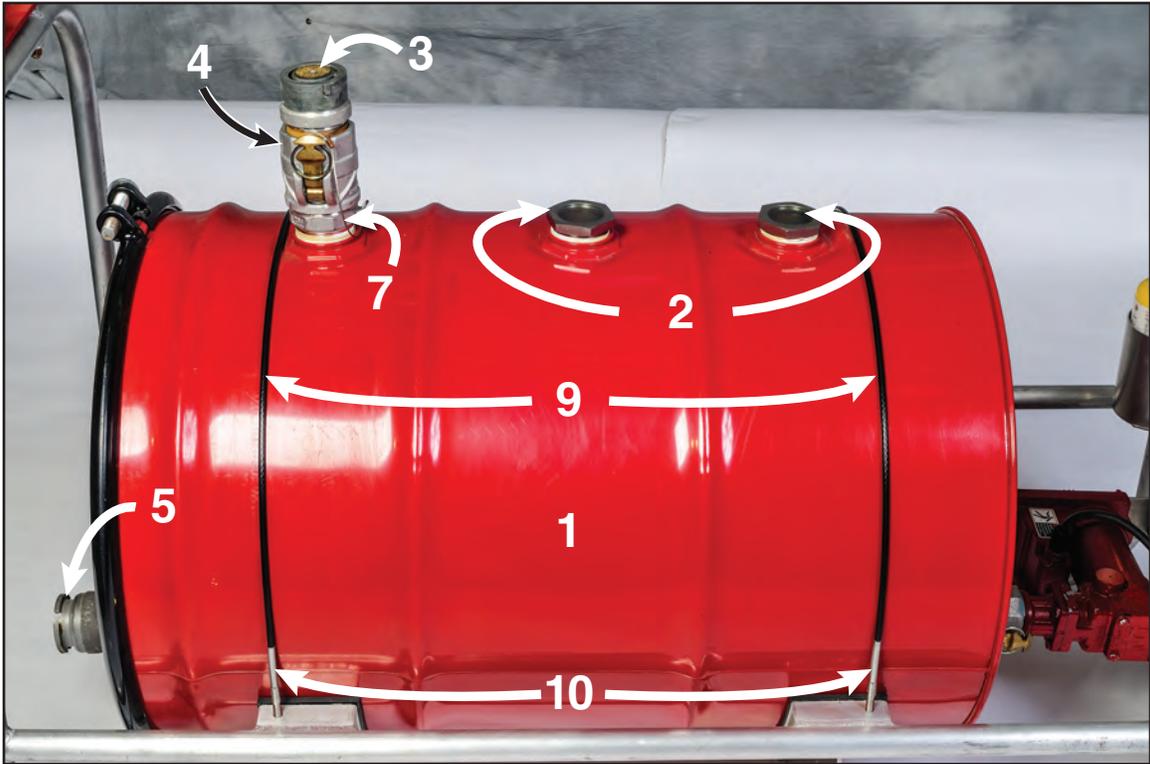


Figure B-1—The fuel drum components.

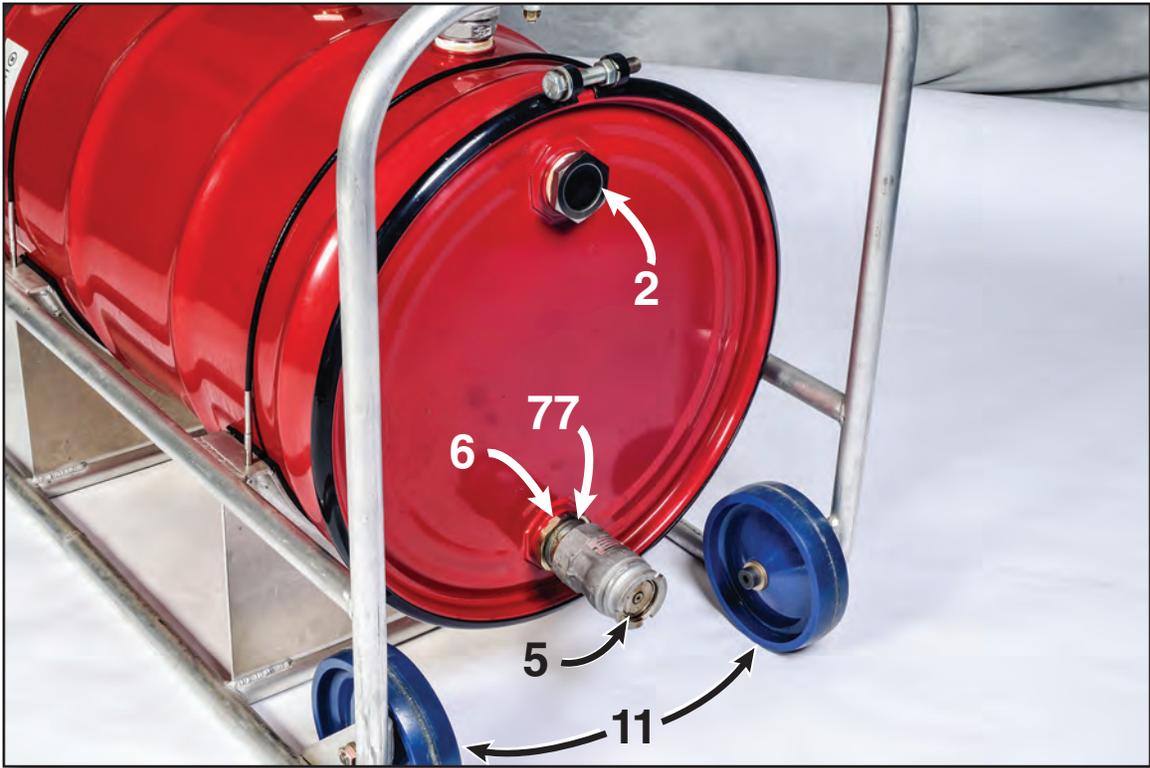


Figure B-4—The fuel drum end and wheels.

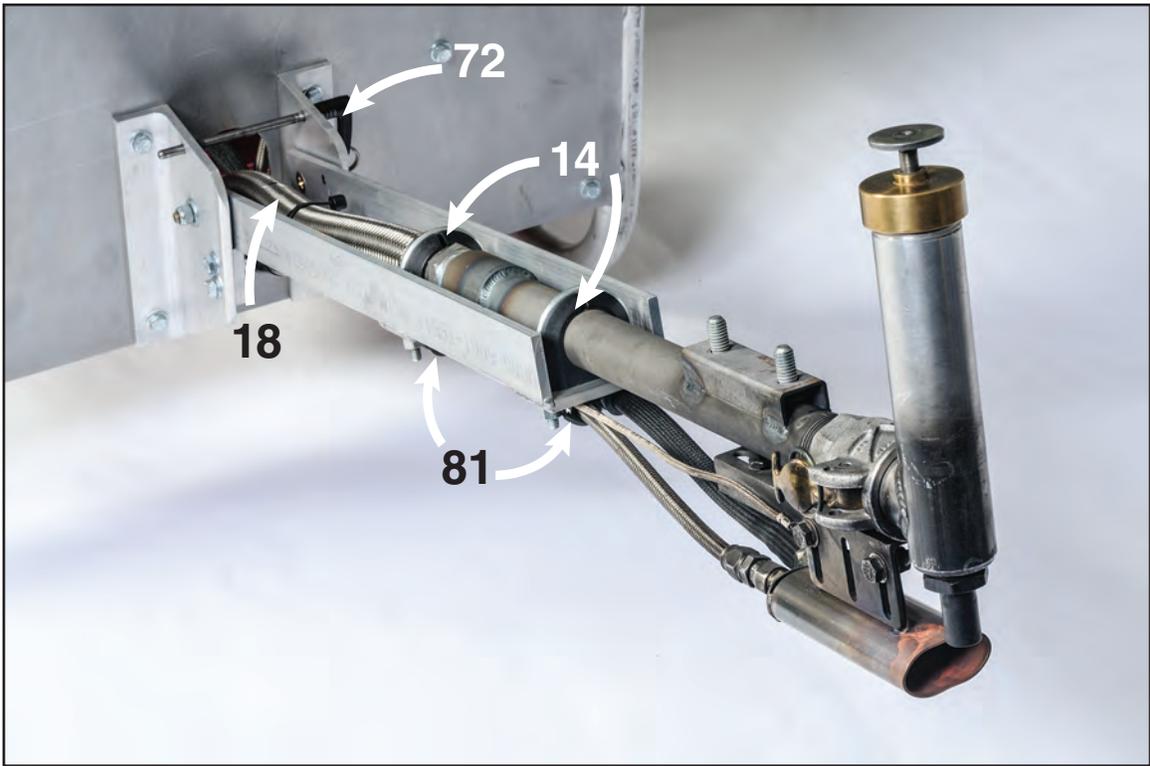


Figure B-5—The igniter arm assembly.

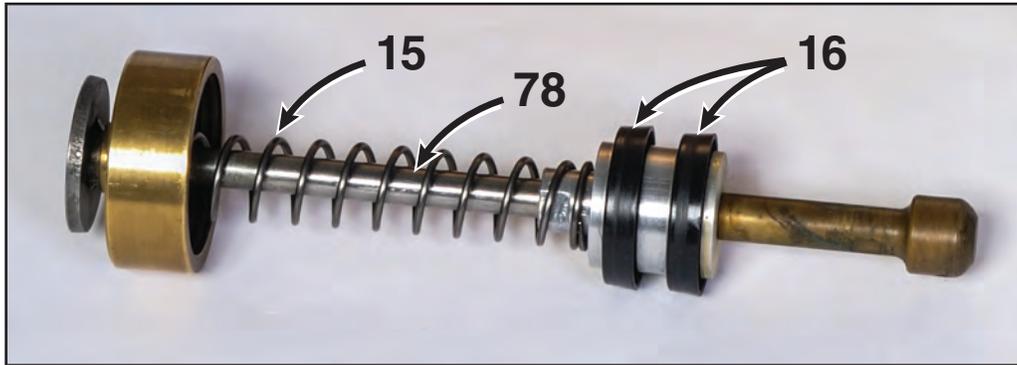


Figure B-6—The fuel discharge plunger.

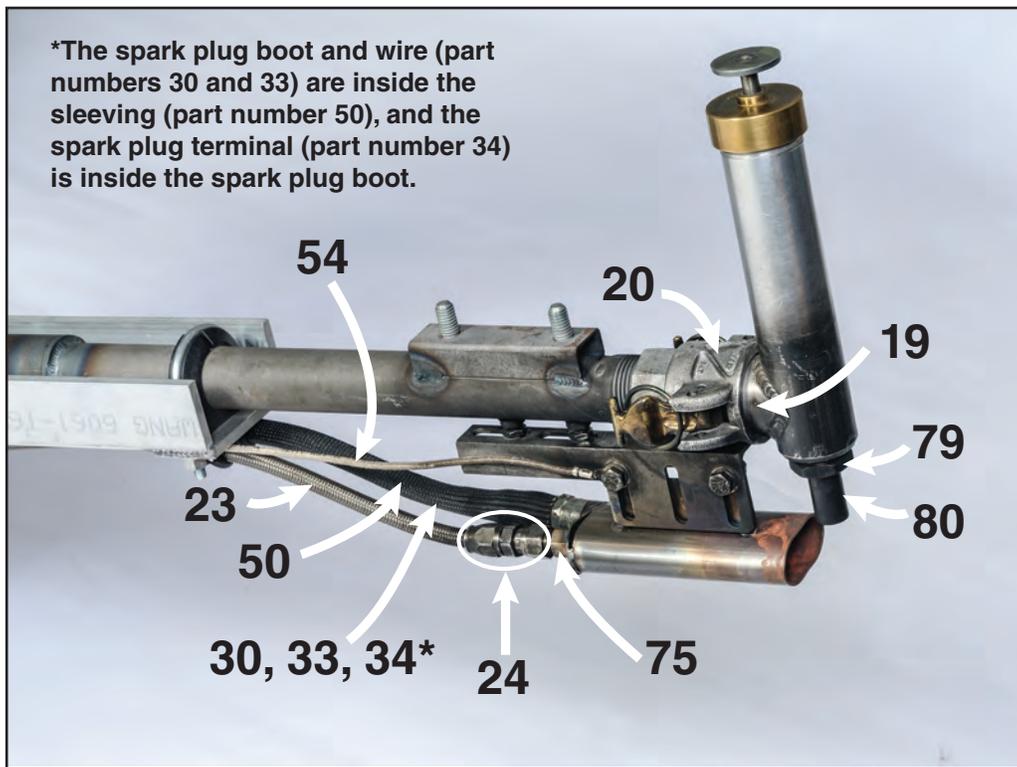


Figure B-7—The ignition components with the windscreen removed.



Figure B-8—The spark plug boots and terminals.

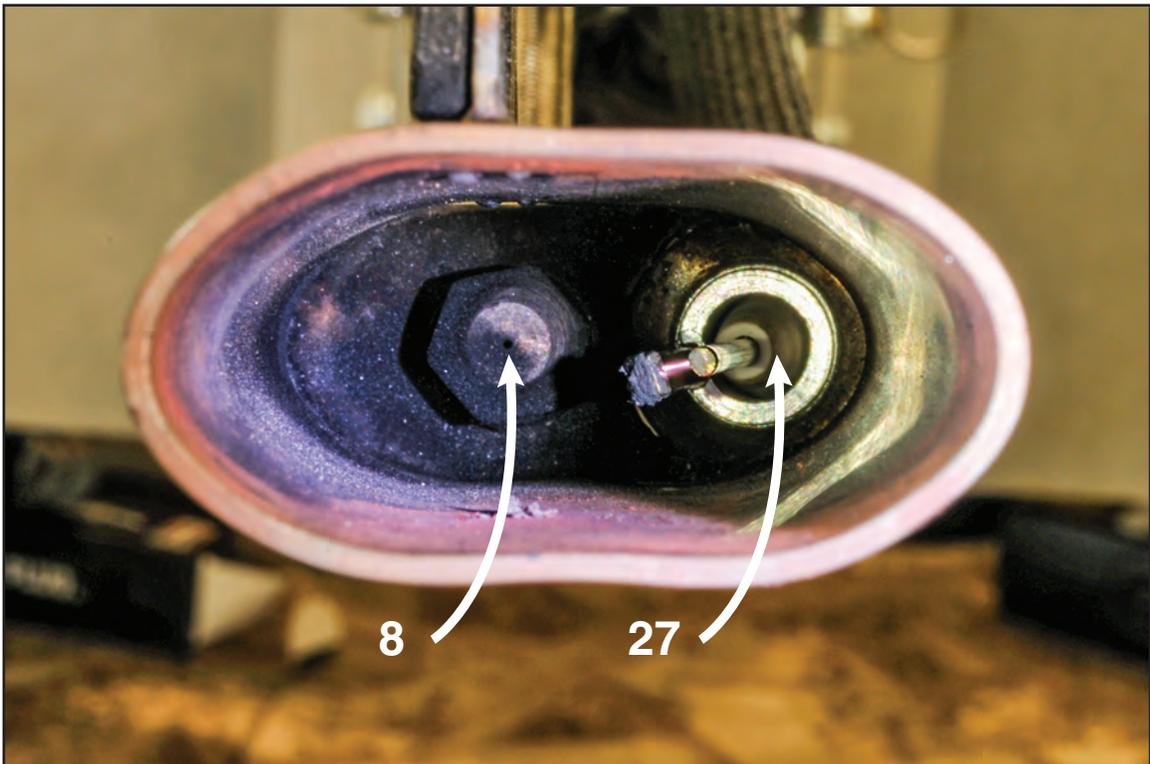


Figure B-9—The propane orifice and spark plug in the igniter tip shroud.

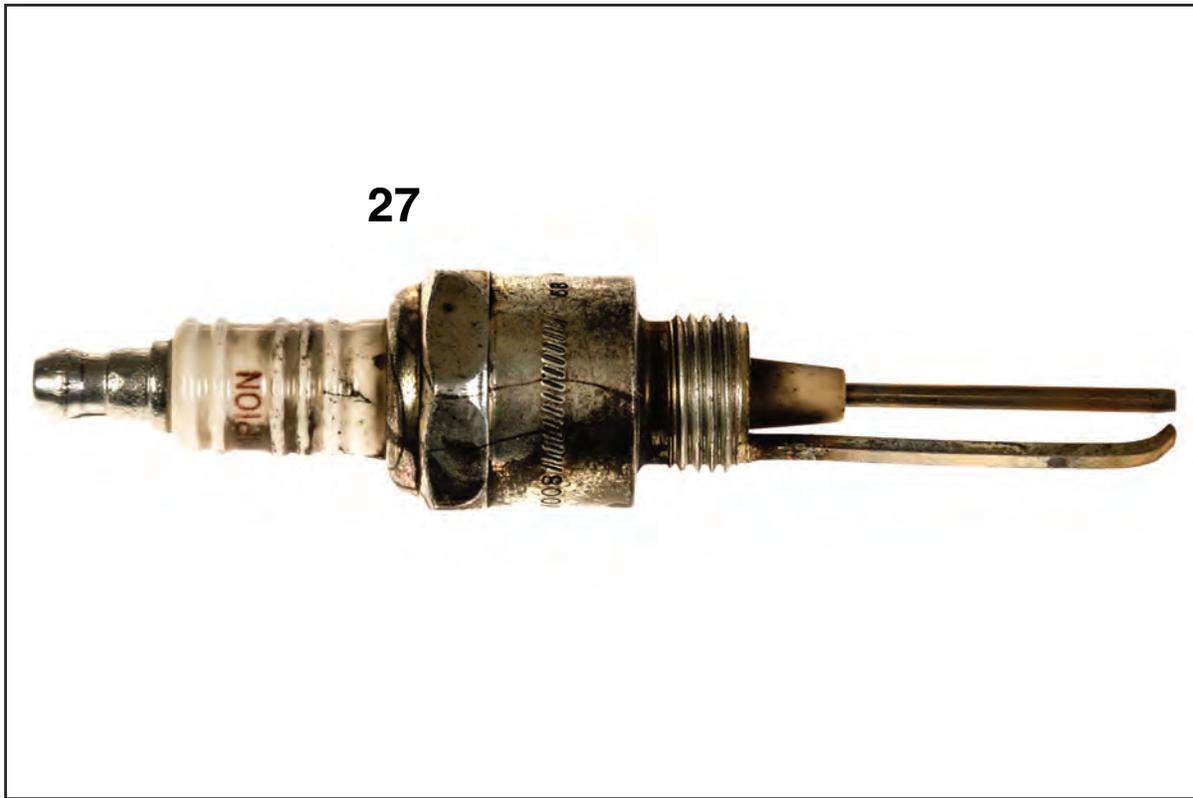


Figure B-10—The spark plug.

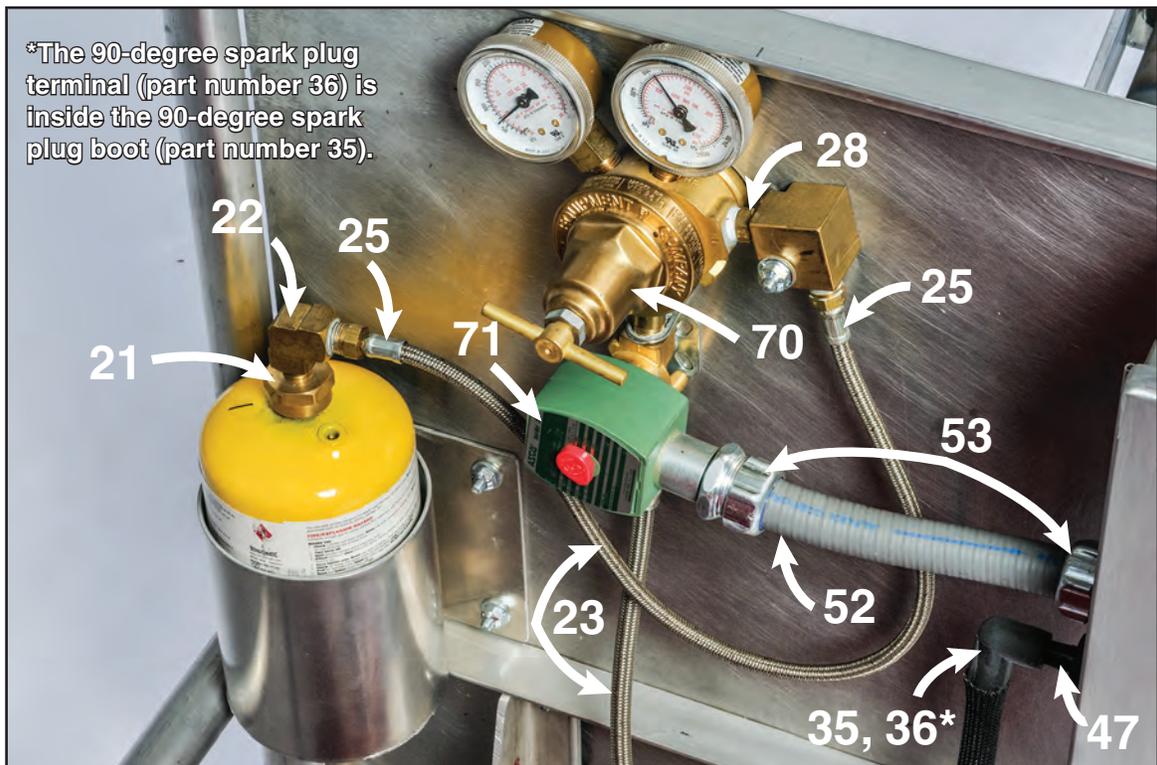


Figure B-11—The propane system.



Figure B-12—Closeup of the hex nipple.

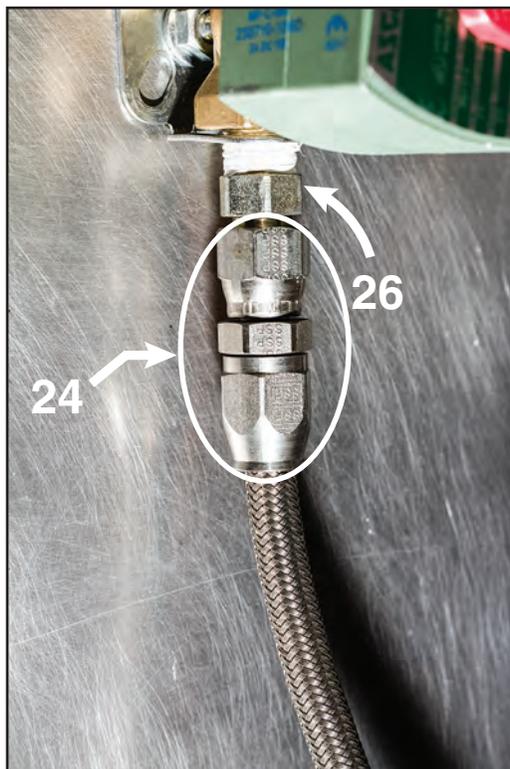
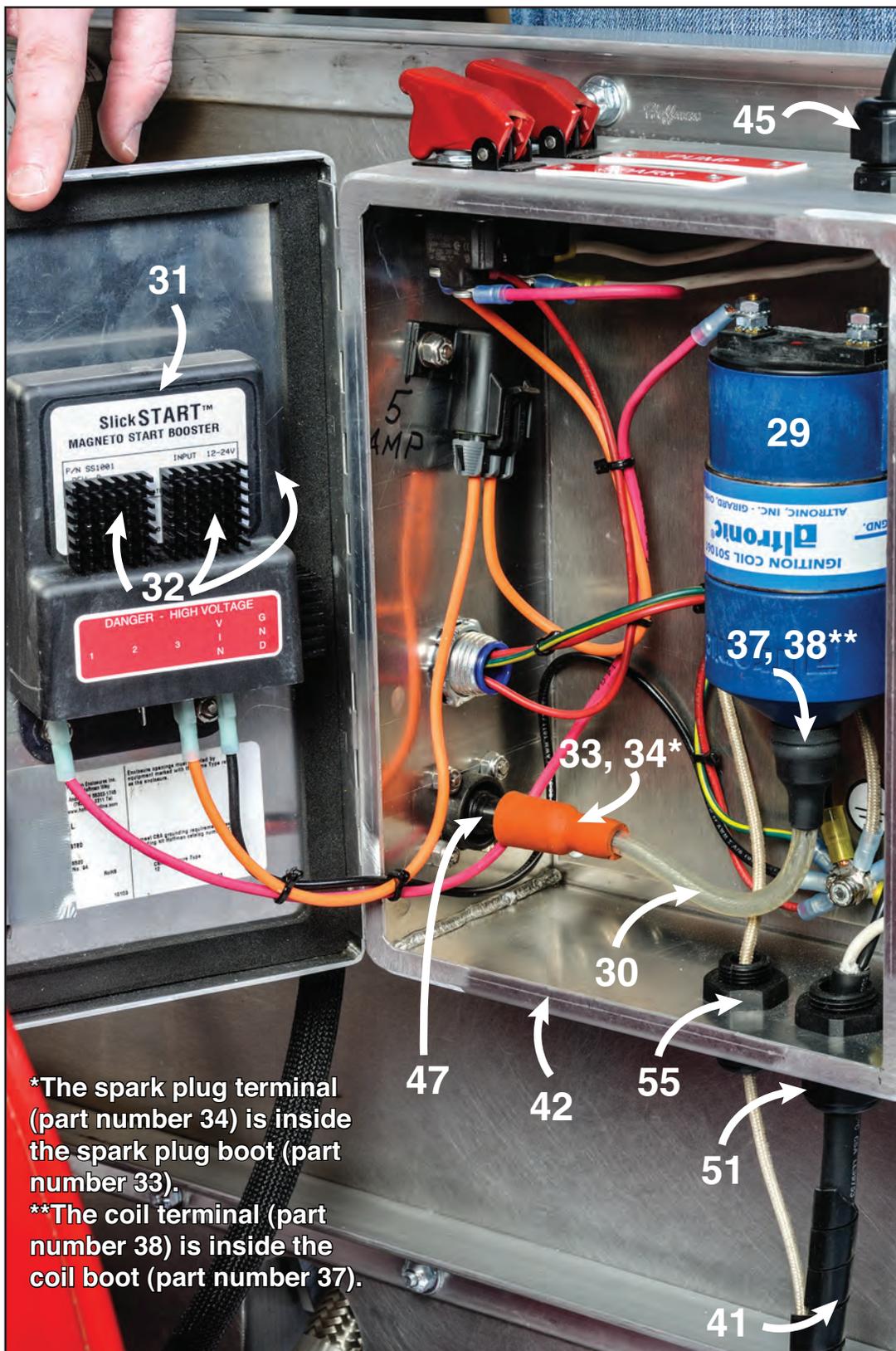
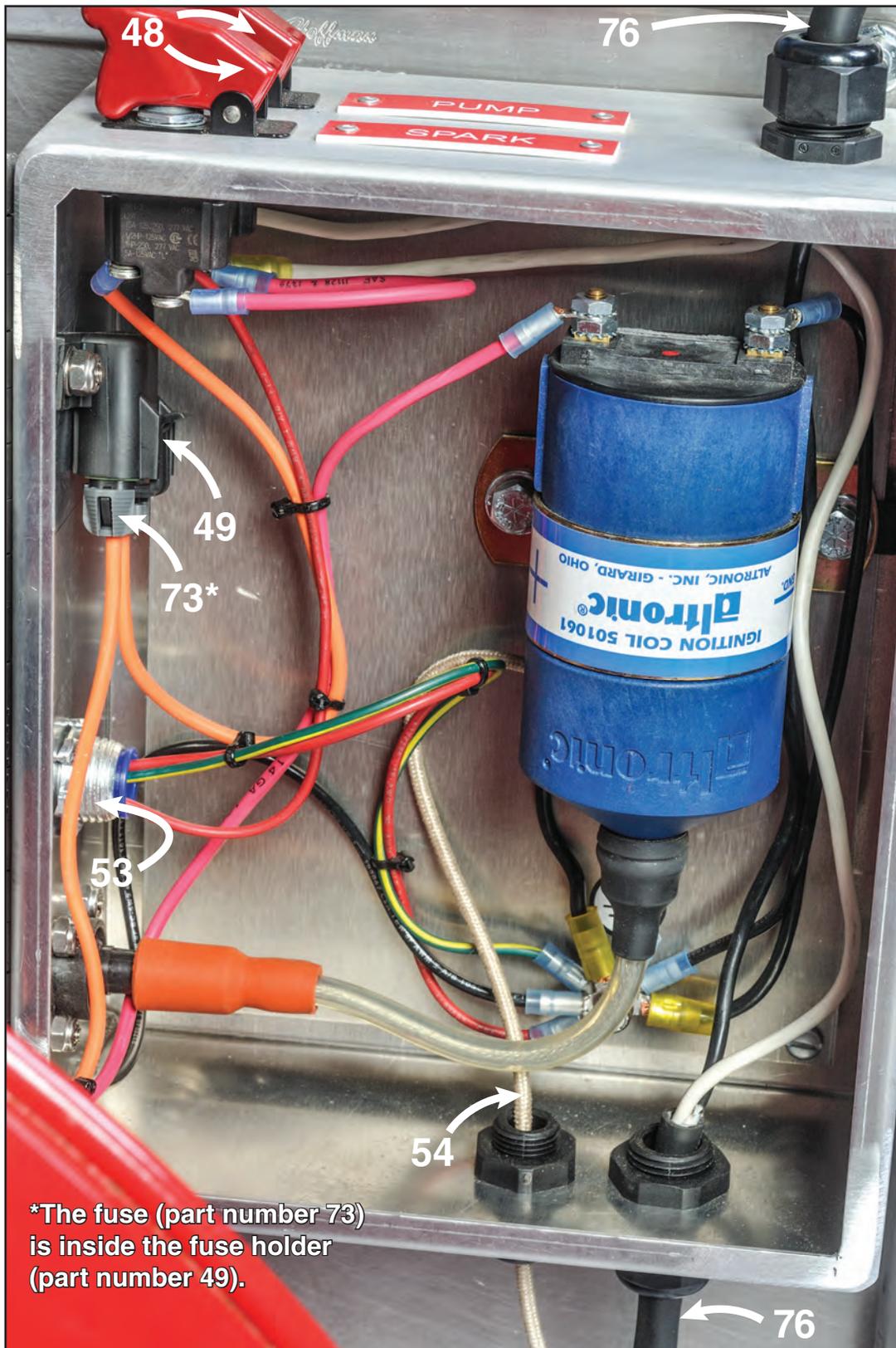


Figure B-13—Propane hose fittings.



*The spark plug terminal (part number 34) is inside the spark plug boot (part number 33).
**The coil terminal (part number 38) is inside the coil boot (part number 37).

Figure B-14—Control box wiring.



*The fuse (part number 73) is inside the fuse holder (part number 49).

Figure B-15—Control box wiring.

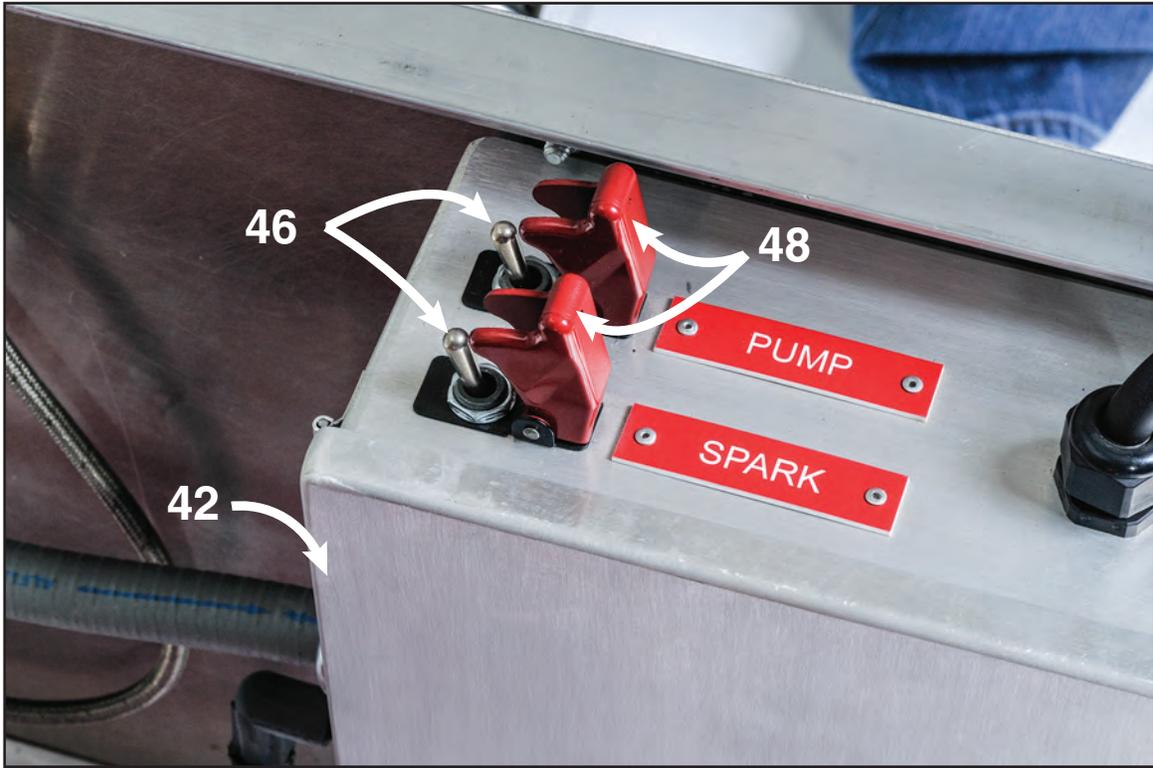


Figure B-16—The pump and spark switches.

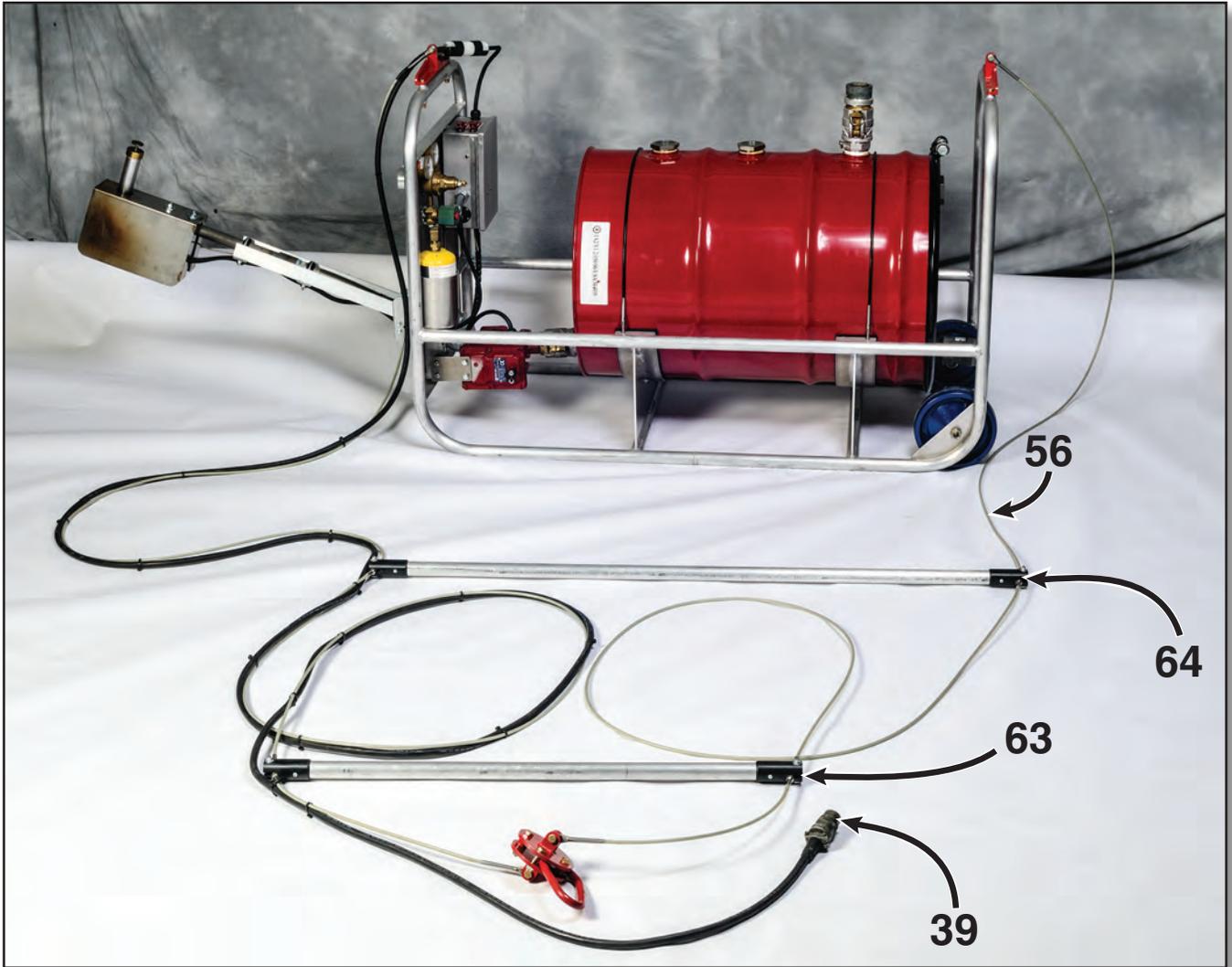


Figure B-17—The suspension components.

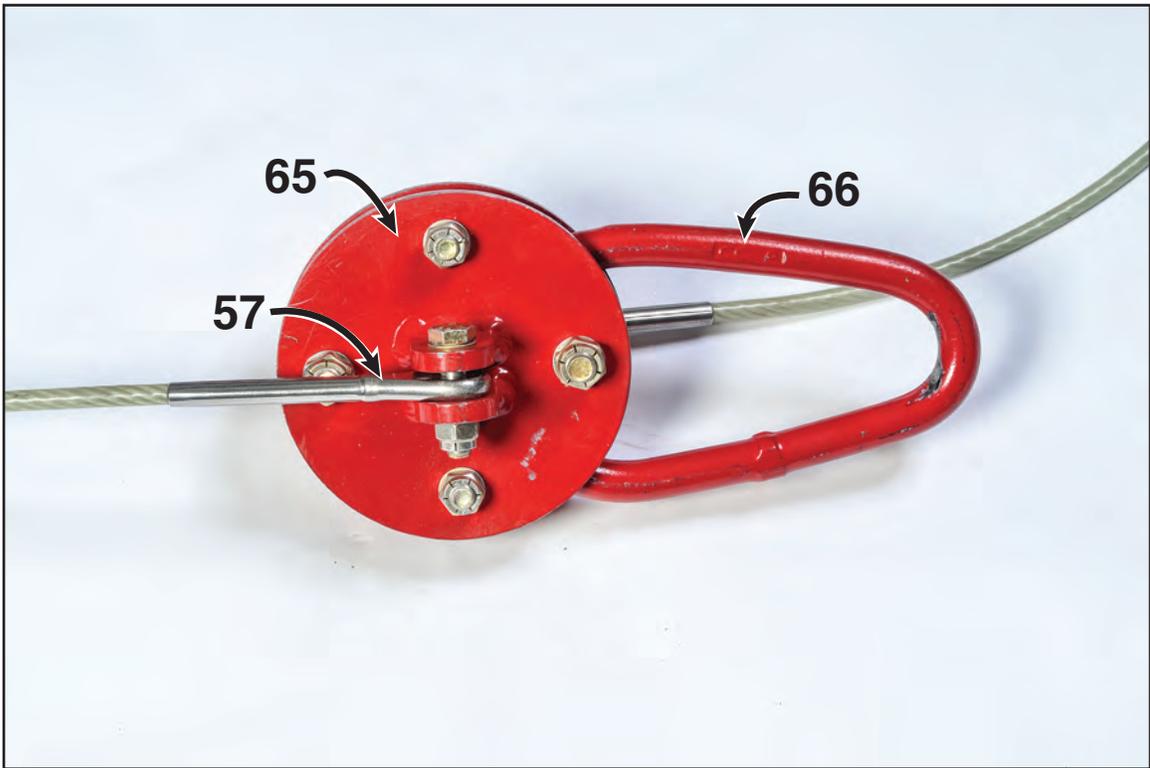


Figure B-18—The suspension adapter.

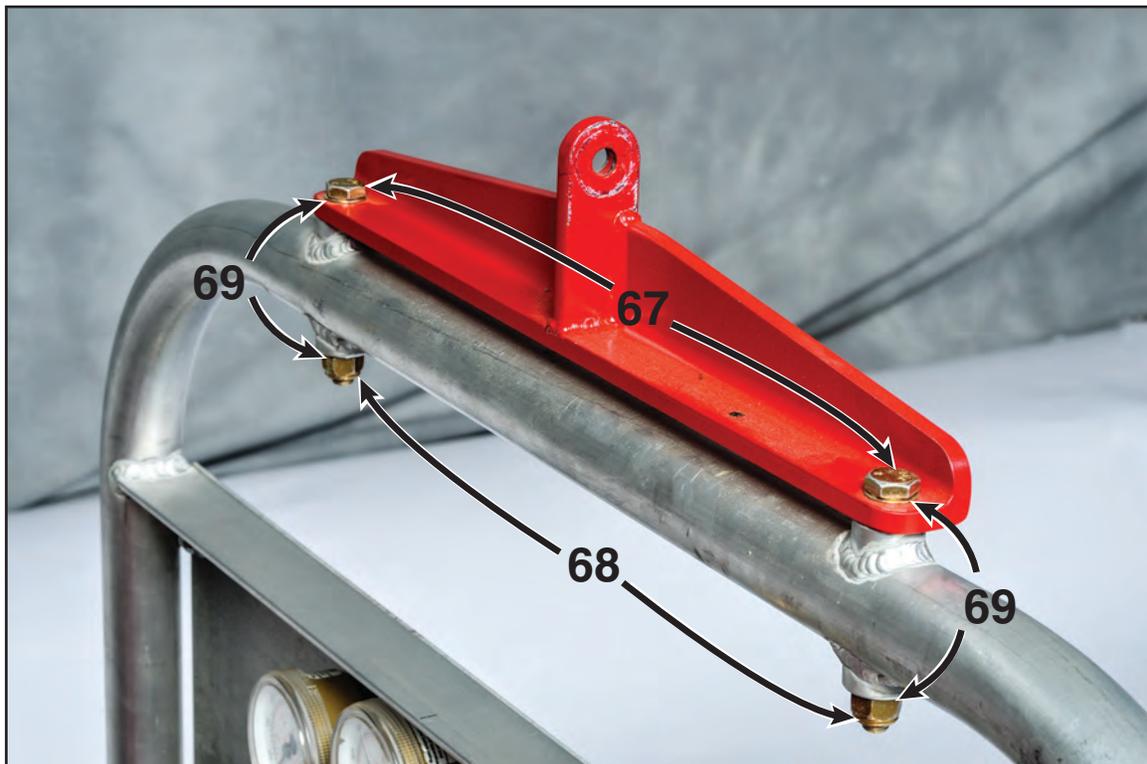


Figure B-19—The rigging bracket.



Figure B-20—The suspension ball with shank fittings.

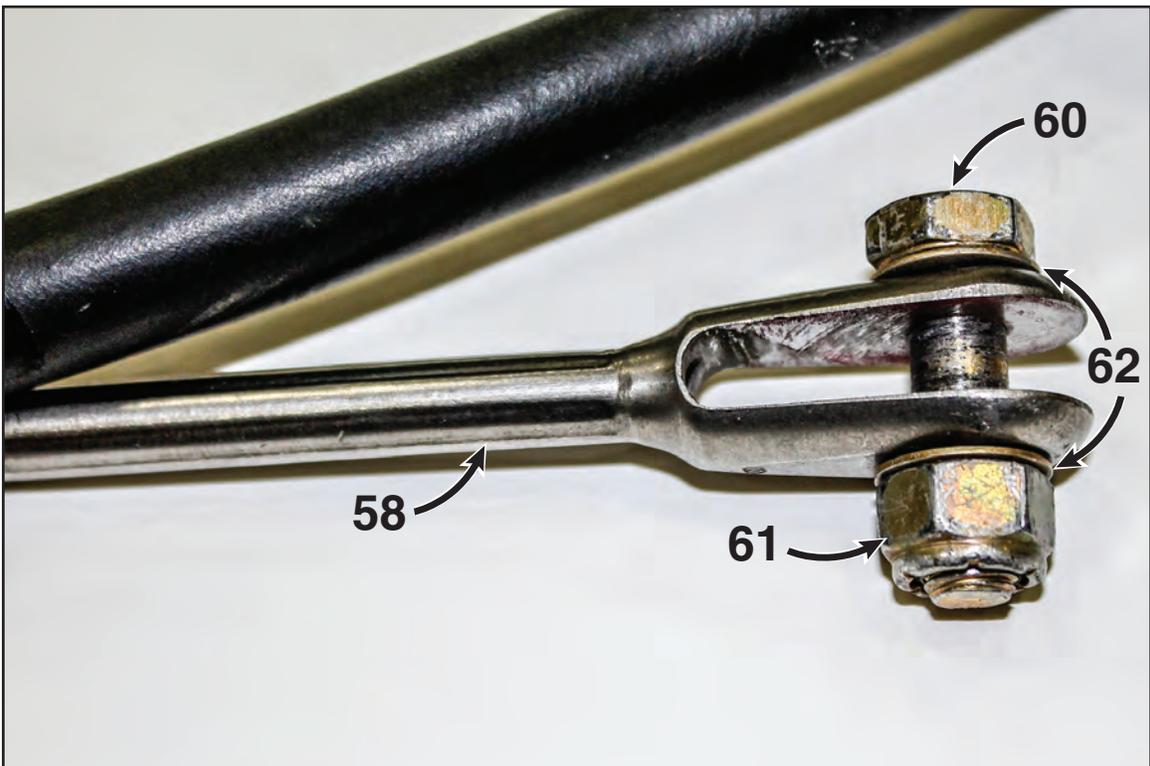


Figure B-21—The suspension clevis fitting and hardware.

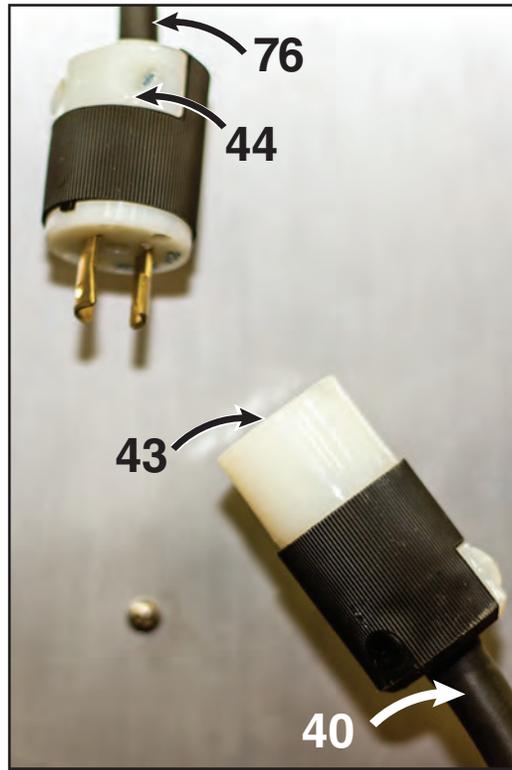


Figure B-22—Conductor cord connectors from the suspension and control box.

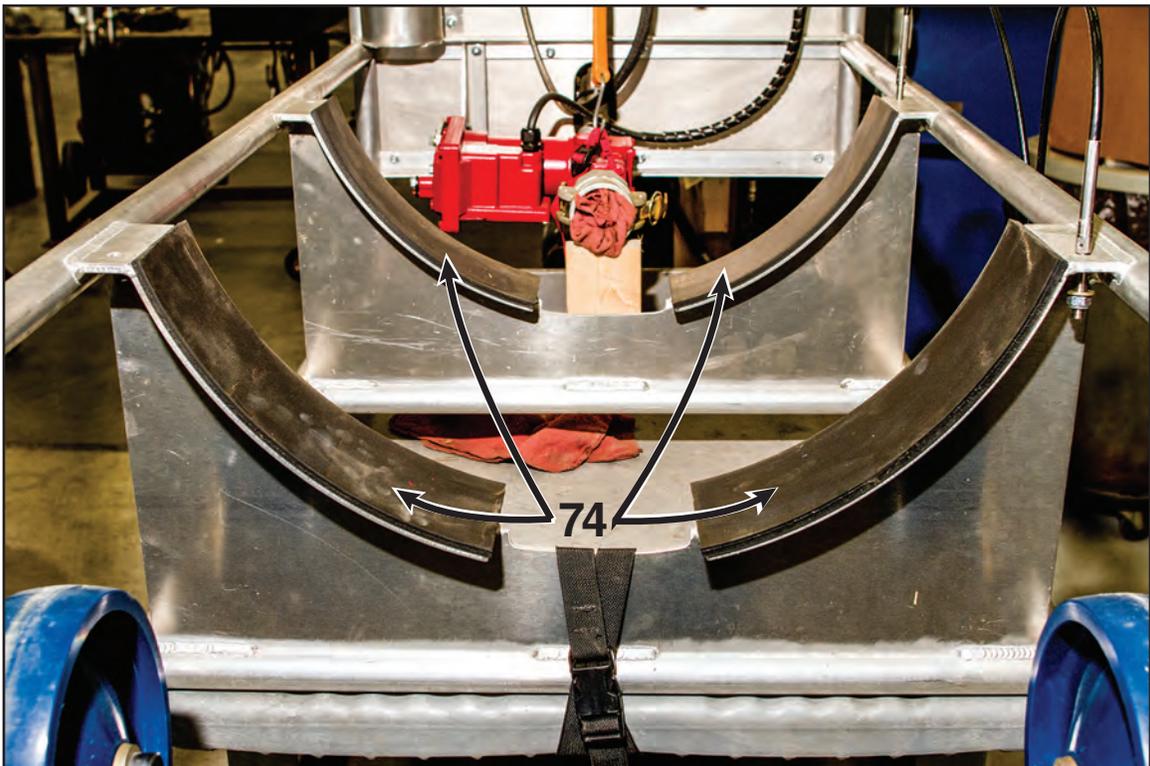


Figure B-23—Adhesive back rubber for fuel drum cushioning.



Parts List

Note: Refer to the part photos in the previous section for the Forest Service Helitorch M-2015 part numbers listed below. Refer to the table footnotes for explanations of the acronyms.

Forest Service Helitorch M-2015 Parts List				
NTDP part number	Part description	Quantity	Description and specifications	Distributor and part number
1	Fuel drum (figure B-1)	1	9 bung, UN 1A2 55 gallon	GelFire Systems http://www.gelfiresystems.com
2	Sight window (figures B-1, B-4)	4	2-inch sight window	John C. Ernst Co., Inc. model number 322 McMaster-Carr part number 3277K27
3	Two-way vapor valve (figure B-1)	1	2-inch relief valve 3.0-psi gauge pressure relief -0.5-psi gauge vacuum relief	Clay & Bailey Mfg. Co. model number 37 part number 0037-03-2030
4	Cam and groove coupler (camlock) (figures B-1, B-2)	2	2-inch aluminum female coupler by female NPT Insta-Lock type D coupler	Goodyear Tire & Rubber Co. part number D200AL Applied Industrial Technologies part number MA3106441
5	Dry-break fitting (figures B-1, B-4)	1	2-inch aluminum adapter with Viton seals	Emco Wheaton part number J72A-AVMO-A
6	Lock nut (figures B-2, B-4)	2	2-inch lock nut PTFE seal	McMaster-Carr part number 5530K29
7	Camlock adapter (figures B-1, B-2)	2	2-inch aluminum male adapter by male NPT Insta-Lock type F adapter	Goodyear Tire & Rubber Co. part number F200AL Applied Industrial Technologies part number MA3106427
8	Propane orifice (figure B-9)	1	Misting nozzle 1.9 gallons per hour at 40 psi stainless steel cone pattern	McMaster-Carr part number 3178K43
9	Drum attachment cable (figure B-1)	2	3/16-inch-diameter cable (40½ inches long) 7 by 19 galvanized steel nylon coating (¼-inch diameter with coating) 4,200 pound strength	McMaster-Carr part number 8923T535
10	Cable attachment fitting (figure B-1)	4	Stud swage fitting for 3/16-inch-diameter cable 5/16-inch 24 thread	McMaster-Carr part number 3870T25
11	Wheel (figure B-4)	2	8- by 2-inch polyurethane ¾-inch axle	McMaster-Carr part number 2472T87
12	Pump (figure B-2)	1	24-V fuel transfer pump	Fill-Rite part number FR4410
13	Bronze pump vane (figure B-3)	5	1¼-inch bronze vane	Fill-Rite part number 1200G9485
14	U-bolt, vibration dampening (figure B-5)	2	U-bolt for 1-inch pipe ¼ inch 20 thread	McMaster-Carr part number 3176T33
15	Tip spring (figure B-6)	1	3½-inch compression spring 12.4 coils 0.720-inch od 0.586-inch id 0.067-inch wire diameter	Century Spring Corp. part number 71989



NTDP part number	Part description	Quantity	Description and specifications	Distributor and part number
16	Tip seal (figure B-6)	2	U-cup seal ¼-inch height ¾-inch id 1¼-inch od	McMaster-Carr part number 9691K55
17	45-degree street elbow (figure B-2)	1	1-inch NPT galvanized iron 45-degree female by male street elbow	McMaster-Carr part number 4638K147
18	Pump outlet hose (figure B-5)	1	18-inch Teflon-lined stainless steel braided hose 1-inch male NPT	Kongsberg Automotive part number T-1568-16
19	Cam and groove adapter (figure B-7)	1	1-inch aluminum male adapter by male NPT Insta-Lock type F adapter	Goodyear Tire & Rubber Co. part number F100AL Applied Industrial Technologies part number MA3106430
20	Cam and groove coupler (figure B-7)	1	1-inch aluminum female coupler by female NPT Insta-Lock type D coupler	Goodyear Tire & Rubber Co. part number D100AL Applied Industrial Technologies part number MA3106444
21	Propane cylinder connector (figure B-11)	1	¼-inch MPT by 1-inch 20 female thread	Flame Engineering part number F-144
22	Elbow (figure B-11)	1	¼-inch NPT 90-degree female brass elbow	McMaster-Carr part number 50785K36
23	Propane hose (figures B-7, B-11)	2	Teflon-lined stainless steel hose ¼-inch id, 0.375-inch od 42-inch long (37 degree flared female fitting to solenoid) 21-inch long (propane cylinder to regulator) 3,000 psi	McMaster-Carr part number 52515K2
24	37-degree flared female fitting (figures B-7, B-13)	2	¼-inch id stainless steel fitting	McMaster-Carr part number 52515K62
25	Propane hose end (figure B-11)	2	¼-inch id hose end 1,500 psi brass with zinc plated steel nut	McMaster-Carr part number 52515K32
26	Solenoid adapter fitting (figure B-13)	1	37-degree flared tube fitting ¼-inch NPT stainless steel male adapter	McMaster-Carr part number 50715K162
27	Spark plug (figures B-9, B-10)	1	Champion 220 industrial plug	Local auto parts store
28	Hex nipple (figures B-11, B-12)	1	¼-inch NPT brass hex nipple	McMaster-Carr part number 5485K22
29	Ignition coil (figure B-14)	1	Altronic Blue Ignition Coil 24 V	Ignition Systems and Controls part number 501061 Phone: 1-800-777-5559
30	Spark plug wire (figures B-7, B-14)	2	Single conductor 14 AWG, 7-inch coil wire 43½-inch spark plug wire 42,000 V dc 40 A	McMaster-Carr part number 9620T19
31	SlickSTART magneto booster (figure B-14)	1	Solid state magneto	Aircraft Spruce & Specialty Co. part number 08-01000 Phone: 1-877-477-7823
32	Heat sink (figure B-14)	3	1- by 1- by ¾-inch heat sink	McMaster-Carr part number 8822T11



NTDP part number	Part description	Quantity	Description and specifications	Distributor and part number
33	Spark plug boot (figures B-7, B-8, B-14)	2	7-millimeter straight S/plug	NAPA Auto Parts number BEL 727401
34	Spark plug terminal (figures B-7, B-8, B-14)	2	7-millimeter straight S/terminal	NAPA Auto Parts number BEL 727005
35	Spark plug boot (90 degree) (figures B-8, B-11)	1	7-millimeter 90-degree spark plug boot	NAPA Auto Parts number BEL 727402
36	Spark plug terminal (90 degree) (figures B-8, B-11)	1	7-millimeter 90-degree spark plug terminal	NAPA Auto Parts number BEL 727006
37	Coil boot (figures B-8, B-14)	1	7-millimeter coil boot	NAPA Auto Parts number BEL 727303
38	Coil terminal (figures B-8, B-14)	1	7-millimeter coil terminal	NAPA Auto Parts number BEL 727003
39	9-pin connector (figure B-17)	1	9-pin male electrical connector	Newark Electronics Digikey Mouser Electronics Galco Industrial Electronics part number MS3106E24-11P
40	Suspension conductor cord (figure B-22)	1	Length as required 12 gauge 2-conductor cord SOOW, 600 V ac 25 A	McMaster-Carr part number 7081K16
41	Spiral cable wrap (figure B-14)	2	½-inch, 10-inch igniter arm 15-inch pump cable	McMaster-Carr part number 7432K164
42	Control box (figures B-14, B-16)	1	Hoffman Control Box with panel 8 by 10 by 4 inch	http://www.hoffmanonline.com part number A1008CHAL
43	Female plug connector body (figure B-22)	1	Twistlock connector 250 V ac 20 A 2 pole 2 wire, L2-20	Hubbell part number HBL7101C Grainger, Inc. part number 3D237
44	Male plug (figure B-22)	1	Twistlock plug 250 V ac 20 A 2 pole 2 wire, L2-20	Hubbell part number HBL7102C Grainger, Inc. part number 3D238
45	Cord grip (figure B-14)	1	½-inch NPT nylon cord grip cord diameter 0.39 to 0.56 inch	McMaster-Carr part number 69915K57
46	Switch (figure B-16)	2	Oil-spraytight washdown switches 12 A at 28 V dc	McMaster-Carr part number 8002K71
47	Feed-through (figures B-11, B-14)	1	Firewall feed-through	Summit Racing part number MSD-8211
48	Switch guard (figures B-15, B-16)	2	½-inch diameter cutout switch guards 0.69-inch max switch height	McMaster-Carr part number 1143T1
49	Fuse holder (figure B-15)	1	Delivered with SlickSTART magneto booster. Replace with mini fuse holder, 2-30 A 12 AWG	Class C Solutions Group part number C29063
50	Sleeving (figure B-7)	1	High temperature fiberglass sleeving ¾-inch id ¾-inch wall 43 inches long	McMaster-Carr part number 2592K61
51	Cord grip (figures B-2, B-14)	2	½-inch NPT nylon cord grip cord diameter 0.24 to 0.47 inch	McMaster-Carr part number 69915K53



NTDP part number	Part description	Quantity	Description and specifications	Distributor and part number
52	Conduit (figure B-11)	1	½-inch flexible galvanized steel conduit 6-inches long polyvinyl chloride jacket	McMaster-Carr part number 74525K81
53	Conduit end (figures B-11, B-15)	2	½-inch NPT zinc conduit end	McMaster-Carr part number 7119K72
54	Igniter tip ground wire (figures B-7, B-15)	1	Single-conductor ground wire 57½ inches long 14-gauge high temperature 600 V ac 39 A	McMaster-Carr part number 8240K33
55	Cord grip (figure B-14)	1	⅜-inch NPT nylon cord grip, cord diameter 0.08 to 0.24 inch	McMaster-Carr part number 69915K52
56	Suspension cable (figure B-17)	n/a	⅜-inch-diameter cable length per drawing MTDC-1110 7 by 19 galvanized steel, nylon coating (¼-inch diameter with coating) 4,200 pound strength	McMaster-Carr part number 8923T535
57	Eye fitting (figure B-18)	2	⅜-inch type 303 stainless steel fitting, MS20668-6	McMaster-Carr part number 3872T15
58	Clevis fitting (figure B-21)	2	¼-inch type 303 stainless steel fitting MS20667	McMaster-Carr part number 3865T18
59	Ball with shank fitting (figure B-20)	8	¼-inch type 303 stainless steel fitting MS20664-8	McMaster-Carr part number 3869T67
60	Bolt (figure B-21)	2	⅝-inch 24 thread by 1⅜ cadmium-plated steel	Genuine Aircraft Hardware Co. part number AN5-10A
61	Nut (figure B-21)	2	⅝-inch 24 thread cadmium-plated steel	Genuine Aircraft Hardware Co. part number MS21045-5
62	Washer (figure B-21)	4	⅝ inch light 0.328-inch id 0.562-inch od 0.032-inch thick carbon-plated steel	Genuine Aircraft Hardware Co. part number NAS1149F0532P
63	Upper separator bar assembly (figure B-17)	1	Suspension cable separator bar assembly	See drawing MTDC-1110
64	Lower separator bar assembly (figure B-17)	1	Suspension cable separator bar assembly	See drawing MTDC-1110
65	Suspension adapter (figure B-18)	1	Suspension adaptor assembly	See drawing MTDC-1110
66	Pear ring (figure B-18)	1	Pear shaped link	See drawing MTDC-1110
67	Rigging bracket bolt (figure B-19)	4	⅝-inch 24 thread by 2.594-inch with 2.063-inch grip length cadmium-plated steel	Genuine Aircraft Hardware Co. part number AN5-24A
68	Rigging bracket nut (figure B-19)	4	⅝-inch 24 thread locknut cadmium-plated steel	Genuine Aircraft Hardware Co. part number MS21045-5
69	Rigging bracket washer (figure B-19)	8	⅝ inch light 0.328-inch id 0.562-inch od 0.032-inch-thick cadmium-plated steel	Genuine Aircraft Hardware Co. part number NAS1149F0532P
70	Propane regulator with gauges (figure B-11)	1	Victor professional two-stage medium-capacity regulator	Victor Equipment Company part number VTS 261B



NTDP part number	Part description	Quantity	Description and specifications	Distributor and part number
71	Solenoid valve (figure B-11)	1	¼-inch NPT solenoid valve 24 V brass, normally closed	Asco Red Hat II model 8262H212
72	Push-lock pin (figure B-5)	1	¼- by 4-inch L-handle push button release pin	McMaster-Carr part number 90302A161
73	Fuse (figure B-15)	1	5 A fuse mini	McMaster-Carr part number 7460K513
74	Adhesive back rubber (figure B-23)	2	4- by 36- by ¼-inch thick Buna-N 40D adhesive back	McMaster-Carr part number 9023K66
75	Flared tube fitting (figure B-7)	1	¼-inch tube diameter 37-degree female pipe adapter 7/16-inch 20 UNF nut thread stainless steel	McMaster-Carr part number 50715K171
76	Conductor cord (figures B-2, B-15, B-22)	1	Pump to control box and suspension to control box length as required 12-gauge 2-conductor cord SJEOOW 300 V ac, 25 A	McMaster-Carr part number 7082K29
77	Pipe nipple (figure B-4)	1	2-inch pipe size 2½-inch long steel threaded pipe nipple	McMaster-Carr part number 44615K449
78	Shoulder screw (figure B-6)	1	5/16-inch shoulder diameter 3½-inch shoulder length ¼-inch 20 thread 18-8 stainless steel	McMaster-Carr part number 90298A597
79	Fuel nozzle bushing (figure B-7)	1	¾-inch male by ½-inch female brass hex reducing bushing	McMaster-Carr part number 50785K71
80	Fuel nozzle tube (figure B-7)	1	5/8-inch od 0.527-inch id 0.049-inch wall type 304 smooth-bore seamless stainless steel tubing	McMaster-Carr part number 89895K255
81	Loop clamp (figure B-5)	4	½-inch od EPDM cushion zinc-plated steel loop clamp	McMaster-Carr part number 3225T4

A = ampere
 ac = alternating current
 AWG = American wire gauge
 dc = direct current
 EPDM = ethylene propylene diene monomer
 id = inside diameter
 MPT = male pipe thread
 NPT = national pipe thread taper
 od = outside diameter
 psi = pounds per square inch
 PTFE = polytetrafluoroethylene
 SJEOOW
 SJ = junior service cord (300 V)
 E = thermoplastic elastomer
 OO = oil-resistant inside insulation and outside jacket
 W = weather and water resistant
 SOOW
 S = service cord (600 V) standard
 OO = oil-resistant inside insulation and outside jacket
 w = weather and water resistant
 UNF = unified national fine thread
 V = volt



Recommended Spare Parts

- Part number 3—Two-way vapor valve
- Part number 8—Propane orifice
- Part number 13—Bronze pump vane
- Part number 15—Tip spring
- Part number 16—Tip seal
- Part number 27—Spark plug
- Part number 29—Ignition coil
- Part number 31—SlickSTART magneto booster
- Part number 32—Heat sink
- Part number 39—9-pin connector
- Part number 43—Female plug connector body
- Part number 44—Male plug
- Part number 60—Bolt
- Part number 61—Nut
- Part number 62—Washer
- Part number 73—Fuse

Technical Support

For technical support, contact:

Ignition Specialist
USDA Forest Service—NTDP
5785 Hwy 10 West
Missoula, MT 59808-9361
Phone: 406-329-3900



Recommended Toolkit Contents

- Socket set (U.S. customary)
- Combination wrenches (U.S. customary) up to 1 inch
- Crescent wrench set: 8 inch, 12 inch
- Phillips-head screwdriver
- Flat-tip screwdriver
- Needlenose pliers
- Multimeter
- Wire strippers
- Bung wrench
- Fuel-resistant thread seal tape



About the Author

Shawn Steber is a project leader at the U.S. Department of Agriculture, Forest Service, National Technology and Development Program (NTDP). In 2006, he received his bachelor's degree in general engineering with a mechanical engineering option from Montana Tech of the University of Montana. Before coming to NTDP in 2010, he worked for the U.S. Department of the Navy as a civilian nuclear engineer. Steber also has worked for the State of Montana as an engine boss and wildland firefighter.

About NTDP

The U.S. Department of Agriculture, Forest Service, National Technology and Development Program provides Forest Service employees and partners with practical, science-based solutions to resource management challenges. We evaluate, design, and develop new technologies, products, and systems to solve problems and deliver solutions.

Library Card

Steber, S. 2019. Forest Service Helitorch M-2015 operations manual. 1951–2806P–NTDP. Tech. Rep. Missoula, MT: U.S. Department of Agriculture, Forest Service, National Technology and Development Program. 42 p.

The U.S. Department of Agriculture, Forest Service, National Technology and Development Program, developed a new helitorch for interagency aerial ignition operations. The helitorch consists of a lightweight frame, a 55-gallon fuel drum, an electronic control box, a fuel pump, an igniter arm, a propane system, and a suspension system. The components of the helitorch are easily accessible for inspection, cleaning, repair, and replacement. This operations manual provides information about the Forest Service Helitorch M-2015 components, safety and design features, and maintenance requirements.

Keywords: aerial ignition, fuel transportation, gelled fuel, prescribed burns, safety at work, U.S. Department of Transportation, DOT



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Produced by the
National Technology & Development
Program Missoula, MT

1951-2806P-NTDP