

OPERATION AND PARTS MANUAL



ActivPrime

AP6/AP8 Series TRASH PUMPS

(JOHN DEERE 4024TF281-49 Diesel Engine)
(JOHN DEERE 4045TF290-66 Diesel Engine)



Revision #0 (06/11/14)

To find the latest revision of this
publication, visit our website at:
www.multiquip.com



THIS MANUAL MUST ACCOMPANY THE EQUIPMENT AT ALL TIMES.

PN: 17804

 WARNING 
CALIFORNIA — Proposition 65 Warning
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.

REPORTING SAFETY DEFECTS

If you believe that your vehicle has a defect that could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Multiquip Inc. at 1-800-421-1244.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Multiquip Inc..

To contact NHTSA, you may either call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153), go to <http://www.safercar.gov>, or write to:

Administrator
NHTSA
400 Seventh Street, SW.,
Washington, DC 20590

You can also obtain information about motor vehicle safety from <http://www.safercar.gov>.

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PARTS ORDERING PROCEDURES

Ordering parts has never been easier! Choose from three easy options:

Effective:
January 1st, 2006

www.multiquip.com



Order via Internet (Dealers Only):

Order parts on-line using Multiquip's SmartEquip website!

- View Parts Diagrams
- Order Parts
- Print Specification Information



If you have an MQ Account, to obtain a Username and Password, E-mail us at: parts@multiquip.com.

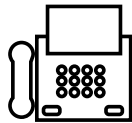
To obtain an MQ Account, contact your District Sales Manager for more information.

Goto www.multiquip.com and click on

Order Parts to log in and save!

Use the **internet** and qualify for a **5% Discount** on *Standard orders* for all orders which include complete part numbers.*

Note: Discounts Are Subject To Change



Order via Fax (Dealers Only):

All customers are welcome to order parts via Fax.

Domestic (US) Customers dial:
1-800-6-PARTS-7 (800-672-7877)

Fax your order in and qualify for a **2% Discount** on *Standard orders* for all orders which include complete part numbers.*

Note: Discounts Are Subject To Change



Order via Phone: Domestic (US) Dealers Call:
1-800-427-1244

Non-Dealer Customers:

Contact your local Multiquip Dealer for parts or call 800-427-1244 for help in locating a dealer near you.



International Customers should contact their local Multiquip Representatives for Parts Ordering information.

When ordering parts, please supply:

- Dealer Account Number
- Dealer Name and Address
- Shipping Address (if different than billing address)
- Return Fax Number
- Applicable Model Number
- Quantity, Part Number and Description of Each Part
- Specify Preferred Method of Shipment:
 - UPS/Fed Ex
 - Priority One
 - Ground
 - Next Day
 - Second/Third Day
 - DHL
 - Truck

NOTICE

All orders are treated as *Standard Orders* and will ship the same day if received prior to 3PM PST.

WE ACCEPT ALL MAJOR CREDIT CARDS!



TRAINING CHECKLIST

TRAINING CHECKLIST

This checklist will lists some of the minimum requirements for machine maintenance and operation. Please feel free to detach it and make copies. Use this checklist whenever a new operator is to be trained or it can be used as a review for more experienced operator's

Training Checklist			
No,	Description	OK?	Date
1	Read operation manual completely.		
2	Machine layout, location of components, checking of engine.		
3	Fuel system, refueling procedure.		
4	Operation of controls (machine not running).		
5	Safety controls, safety stop switch operation.		
6	Emergency stop procedures.		
7	Startup of machine, pre-heat, engine choke.		
8	Shutdown of machine.		
9	Lifting of machine (lift loops).		
10	Machine transport and storage.		

DAILY PRE-OPERATION CHECKLIST

DAILY PRE-OPERATION CHECKLIST

Daily Pre-Operation Checklist		✓	✓	✓	✓	✓	✓
1	Hardware and damage check						
2	Engine oil level						
3	Braking control operation						

SAFETY INFORMATION

Do not operate or service the equipment before reading the entire manual. Safety precautions should be followed at all times when operating this equipment. Failure to read and understand the safety messages and operating instructions could result in injury to yourself and others.



SAFETY MESSAGES

The four safety messages shown below will inform you about potential hazards that could injure you or others. The safety messages specifically address the level of exposure to the operator and are preceded by one of four words: **DANGER**, **WARNING**, **CAUTION** or **NOTICE**.

SAFETY SYMBOLS

! DANGER

Indicates a hazardous situation which, if not avoided, **WILL** result in **DEATH** or **SERIOUS INJURY**.

! WARNING

Indicates a hazardous situation which, if not avoided, **COULD** result in **DEATH** or **SERIOUS INJURY**.






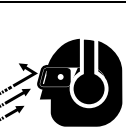
! CAUTION

Indicates a hazardous situation which, if not avoided, **COULD** result in **MINOR** or **MODERATE INJURY**.

NOTICE

Addresses practices not related to personal injury.

Potential hazards associated with the operation of this equipment will be referenced with hazard symbols which may appear throughout this manual in conjunction with safety messages.

Symbol	Safety Hazard
	Lethal exhaust gas hazards
	Explosive fuel hazards
	Burn hazards
	Respiratory hazards
	Accidental starting hazards
	Eye and hearing hazards

SAFETY INFORMATION

GENERAL SAFETY

CAUTION

- **NEVER** operate this equipment without proper protective clothing, shatterproof glasses, respiratory protection, hearing protection, steel-toed boots and other protective devices required by the job or city and state regulations.



- **NEVER** operate this equipment when not feeling well due to fatigue, illness or when under medication.



- **NEVER** operate this equipment under the influence of drugs or alcohol.



NOTICE

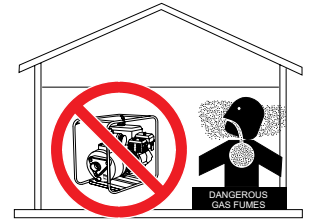
- This equipment should only be operated by trained and qualified personnel 18 years of age and older.
- Whenever necessary, replace nameplate, operation and safety decals when they become difficult read.
- Manufacturer does not assume responsibility for any accident due to equipment modifications. Unauthorized equipment modification will void all warranties.
- **NEVER** use accessories or attachments that are not recommended by Multiquip for this equipment. Damage to the equipment and/or injury to user may result.
- **ALWAYS** know the location of the nearest **fire extinguisher**.
- **ALWAYS** know the location of the nearest **first aid kit**.
- **ALWAYS** know the location of the nearest phone or **keep a phone on the job site**. Also, know the phone numbers of the nearest **ambulance, doctor** and **fire department**. This information will be invaluable in the case of an emergency.



PUMP SAFETY

DANGER

- **NEVER** pump volatile, explosive, flammable or low flash point fluids. These fluids could ignite or explode.
- The engine fuel exhaust gases contain poisonous carbon monoxide. This gas is colorless and odorless, and can cause death if inhaled.
- The engine of this equipment requires an adequate free flow of cooling air. **NEVER** operate this equipment in any enclosed or narrow area where free flow of the air is restricted. If the air flow is restricted it will cause injury to people and property and serious damage to the equipment or engine.



- **NEVER** operate the equipment in an explosive atmosphere or near combustible materials. An explosion or fire could result causing severe **bodily harm or even death**.



WARNING

- **NEVER** pump corrosive chemicals or water containing toxic substances. These fluids could create serious health and environmental hazards. Contact local authorities for assistance.
- **NEVER** open the priming plug when pump is hot. Hot water inside could be pressurized much like the radiator of an automobile. Allow pump to cool to the touch before loosening plug. The possibility exists of scalding, resulting in severe bodily harm.
- **NEVER** operate the pump with closed discharge hose. The liquid could reach boiling temperatures, build pressure, and cause the casing to rupture or explode.
- **NEVER** run the pump dry.
- **NEVER** disconnect any **emergency or safety devices**. These devices are intended for operator safety. Disconnection of these devices can cause severe injury, bodily harm or even death. Disconnection of any of these devices will void all warranties.



SAFETY INFORMATION

CAUTION

- **NEVER** lubricate components or attempt service on a running machine.
- **NEVER** block or restrict flow from discharge hose. Remove kinks from discharge line before starting pump. Operation with a blocked discharge line can cause water inside pump to overheat.
- **NEVER** allow the suction line to become clogged or mired in mud. This condition could cause water inside the pump to overheat creating a rupture or explosion.

NOTICE

- **ALWAYS** fill the pump casing with water before starting the engine. Failure to maintain water inside the pump casing will cause severe damage to the pump and mechanical seal.
- **FREEZING WEATHER**
 - In winter drain water from pump casing to prevent freezing.
 - If freezing of the pump is evident or suspected, stop engine immediately.
- **NEVER** start the pump with the clean-out cover removed. The rotating impeller inside the pump can cut or sever objects caught in it. Before starting the pump, check that the clean-out cover is securely fastened.
- **ALWAYS** keep the pump in proper running condition.
- **ALWAYS** ensure pump is on level ground before use and wheels are secured with chock blocks.
- Fix damage to pump and replace any broken parts immediately.
- **ALWAYS** store equipment properly when it is not being used. Equipment should be stored in a clean, dry location out of the reach of children and unauthorized personnel.
- **ALWAYS** make sure that all suction hose connections are tighten securely.
- **NEVER** operate the pump at an excessive angle of inclination.

- **NEVER** attempt suction lifts over 25 ft. (7.62 meters).
- Keep suction lift to a minimum and support all hoses and piping as needed.
- **NEVER** pump sand, abrasive liquids, or solids.
- **NEVER** lift the pump with suction or discharge hoses attached.

ENGINE SAFETY

WARNING

- **DO NOT** place hands or fingers inside engine compartment when engine is running.
- **NEVER** operate the engine with heat shields or guards removed.
- **DO NOT** remove the engine oil drain plug while the engine is hot. Hot oil will gush out of the oil tank and severely scald any persons in the general area of the pump.



CAUTION

- **NEVER** touch the hot exhaust manifold, muffler or cylinder. Allow these parts to cool before servicing equipment.



NOTICE


- **NEVER** run engine without an air filter or with a dirty air filter. Severe engine damage may occur. Service air filter frequently to prevent engine malfunction.
- **NEVER** tamper with the factory settings of the engine or engine governor. Damage to the engine or equipment can result if operating in speed ranges above the maximum allowable.



SAFETY INFORMATION


FUEL SAFETY

DANGER


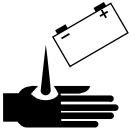
- **DO NOT** start the engine near spilled fuel or combustible fluids. Fuel is extremely flammable and its vapors can cause an explosion if ignited.
- **ALWAYS** refuel in a well-ventilated area, away from sparks and open flames.
- **ALWAYS** use extreme caution when working with **flammable** liquids.
- **DO NOT** fill the fuel tank while the engine is running or hot.
- **DO NOT** overfill tank, since spilled fuel could ignite if it comes into contact with hot engine parts or sparks from the ignition system.
- Store fuel in appropriate containers, in well-ventilated areas and away from sparks and flames.
- **NEVER** use fuel as a cleaning agent.
- **DO NOT** smoke around or near the equipment. Fire or explosion could result from fuel vapors or if fuel is spilled on a hot engine. 

BATTERY SAFETY (ELECTRIC START ONLY)

DANGER

- **DO NOT** drop the battery. There is a possibility that the battery will explode.
- **DO NOT** expose the battery to open flames, sparks, cigarettes, etc. The battery contains combustible gases and liquids. If these gases and liquids come into contact with a flame or spark, an explosion could occur. 

WARNING

- **ALWAYS** wear safety glasses when handling the battery to avoid eye irritation. The battery contains acids that can cause injury to the eyes and skin. 
- Use well-insulated gloves when picking up the battery.
- **ALWAYS** keep the battery charged. If the battery is not charged, combustible gas will build up.
- **DO NOT** charge battery if frozen. Battery can explode. When frozen, warm the battery to at least 61°F (16°C).
- **ALWAYS** recharge the battery in a well-ventilated environment to avoid the risk of a dangerous concentration of combustible gases.
- If the battery liquid (dilute sulfuric acid) comes into contact with **clothing or skin**, rinse skin or clothing immediately with plenty of water. 
- If the battery liquid (dilute sulfuric acid) comes into contact with **eyes**, rinse eyes immediately with plenty of water and contact the nearest doctor or hospital to seek medical attention.

CAUTION

- **ALWAYS** disconnect the **NEGATIVE** battery terminal before performing service on the equipment.
- **ALWAYS** keep battery cables in good working condition. Repair or replace all worn cables.

SAFETY INFORMATION

TRANSPORTING SAFETY

⚠ CAUTION

- **NEVER** allow any person or animal to stand underneath the equipment while lifting.

NOTICE

- Before lifting, make sure that the equipment parts are not damaged and screws are not loose or missing.
- **ALWAYS** make sure forklift forks are inserted into pockets (if applicable) as far as possible when lifting the pump.
- **ALWAYS** shutdown engine before transporting.
- **NEVER** lift the equipment while the engine is running.
- Tighten fuel tank cap securely and close fuel cock to prevent fuel from spilling.
- Use one point suspension hook and lift straight upwards.
- **DO NOT** lift machine to unnecessary heights.
- **ALWAYS** tie down equipment during transport by securing the equipment with rope.
- Never allow any person or animal to stand underneath the equipment while lifting.

TOWING SAFETY

⚠ CAUTION

- Check with your local county or state safety towing regulations, in addition to meeting **Department of Transportation (DOT) Safety Towing Regulations**, before towing your generator.
- Refer to MQ Power trailer manual for additional safety information.
- In order to reduce the possibility of an accident while transporting the generator on public roads, **ALWAYS** make sure the trailer that supports the generator and the towing vehicle are mechanically sound and in good operating condition.
- **ALWAYS** shutdown engine before transporting
- Make sure the hitch and coupling of the towing vehicle are rated equal to, or greater than the trailer “gross vehicle weight rating.”



- **ALWAYS** inspect the hitch and coupling for wear. **NEVER** tow a trailer with defective hitches, couplings, chains, etc.
- Check the tire air pressure on both towing vehicle and trailer. **Trailer tires should be inflated to 50 psi cold.** Also check the tire tread wear on both vehicles.
- **ALWAYS** make sure the trailer is equipped with a **safety chain**.
- **ALWAYS** properly attach trailer's safety chains to towing vehicle.
- **ALWAYS** make sure the vehicle and trailer directional, backup, brake and trailer lights are connected and working properly.
- DOT Requirements include the following:
 - Connect and test electric brake operation.
 - Secure portable power cables in cable tray with tie wraps.
- The maximum speed for highway towing is **55 MPH** unless posted otherwise. Recommended off-road towing is not to exceed **15 MPH** or less depending on type of terrain.
- Avoid sudden stops and starts. This can cause skidding, or jack-knifing. Smooth, gradual starts and stops will improve towing.
- Avoid sharp turns to prevent rolling.
- Trailer should be adjusted to a level position at all times when towing.
- Raise and lock trailer wheel stand in up position when towing.
- Place **chock blocks** underneath wheel to prevent **rolling** while parked.
- Place **support blocks** underneath the trailer's bumper to prevent **tipping** while parked.
- Use the trailer's swivel jack to adjust the trailer height to a level position while parked.

ENVIRONMENTAL SAFETY/DECOMMISSIONING

NOTICE

Decommissioning is a controlled process used to safely retire a piece of equipment that is no longer serviceable. If the equipment poses an unacceptable and unrepairable safety risk due to wear or damage or is no longer cost effective to maintain (beyond life-cycle reliability) and is to be decommissioned (demolition and dismantlement), be sure to follow rules below.

- **DO NOT** pour waste or oil directly onto the ground, down a drain or into any water source.
- Contact your country's Department of Public Works or recycling agency in your area and arrange for proper disposal of any electrical components, waste or oil associated with this equipment.
- When the life cycle of this equipment is over, remove battery and bring to appropriate facility for lead reclamation. Use safety precautions when handling batteries that contain sulfuric acid.
- When the life cycle of this equipment is over, it is recommended that the pump and all other metal parts be sent to a recycling center.



Metal recycling involves the collection of metal from discarded products and its transformation into raw materials to use in manufacturing a new product.

Recyclers and manufacturers alike promote the process of recycling metal. Using a metal recycling center promotes energy cost savings.

EMISSIONS INFORMATION

NOTICE

The diesel engine used in this equipment has been designed to reduce harmful levels of carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NOx) contained in diesel exhaust emissions.

This engine has been certified to meet US EPA Evaporative emissions requirements in the installed configuration.

Attempting to modify or make adjustments to the engine emission system by unauthorized personnel without proper training could damage the equipment or create an unsafe condition.

Additionally, modifying the fuel system may adversely affect evaporative emissions, resulting in fines or other penalties.

Emission Control Label

The emission control label is an integral part of the emission system and is strictly controlled by regulations.

The label must remain with the engine for its entire life.

If a replacement emission label is needed, please contact your authorized Engine Distributor.

SPECIFICATIONS (PUMP)

Table 1. AP6 Series Pump Specifications

Model	AP6	AP6TB	AP6TP	AP6S	AP6STB	AP6STP	AP6SAB	AP6SAP
Pump Mounting	Skid Mounted	Trailer, Ball Coupler	Trailer, Pintle Coupler	Skid Mounted	Trailer, Ball Coupler	Trailer, Pintle Coupler	Auto Start, Trailer, Ball Coupler	Auto Start, Trailer, Pintle Coupler
Weight - lbs. (kg)	2,915 (1,322)	3,665 (1,662)	3,665 (1,662)	4,300 (1,950)	4,300 (1,950)	4,950 (2,245)	4,950 (2,245)	4,980 (2,259)
Max. Flow - gpm (lpm)	2,300 (8,706)							
Max. Head - ft. (m)	110 (33.5)							
Max. Head - PSI (kPa)	47.6 (322)							
Suction Lift - ft. (meters)	28 (8.5)							
Max. Solids - in. (mm)	3 (76.2)							
Max. Water Temp. F° (C°)	212 (100)							
Max. Casing - PSI (kPa)	195 (1,344)							
Mechanical Seal	Grease Lubricated							
Fuel Consumption - gph (lph)	1.75 (6.62) @ 1,800 RPM							
Operating Time	28 hrs. @ 1,800 RPM or 39 hrs. @ 1,600 RPM							
Compressor Type	Single Cylinder, Gear Drive @ 8.5 CFM							
Sound Level dB(A)	N/A			63 @ 23 ft. (7 meters)				

Table 2. AP8 Series Pump Specifications

Model	AP8	AP8TB	AP8TP	AP8S	AP8STB	AP8STP	AP8SAB	AP8SAP
Pump Mounting	Skid Mounted	Trailer, Ball Coupler	Trailer, Pintle Coupler	Skid Mounted	Trailer, Ball Coupler	Trailer, Pintle Coupler	Auto Start, Trailer, Ball Coupler	Auto Start, Trailer, Pintle Coupler
Weight - lbs.(kg)	3,425 (1,553)	4,185 (1,898)	4,185 (1,898)	5,037 (2,284)	5,825 (2,642)	5,825 (2,642)	5,875 (2,664)	5,875 (2,664)
Max. Flow - gpm (lpm)	2,700 (9,464)							
Max. Head - ft./m	213 (50.2)							
Max. Head - PSI (kPa)	71.4 (492)							
Suction Lift - ft. (meters)	28 (8.5)							
Max. Solids - in. (mm)	4 (102)							
Max. Water Temp. F° (C°)	212 (100)							
Max. Casing - PSI (kPa)	195 (1,344)							
Mechanical Seal	Grease Lubricated							
Fuel Consumption - gph (lph)	1.94 (7.34) @ 2,000 RPM							
Operating Time	28 hrs. @ 2,000 RPM							
Compressor Type	Single Cylinder, Gear Drive @ 8.5 CFM							
Sound Level dB(A)	N/A			66 @ 23 ft. (7 meters)				

SPECIFICATIONS (ENGINE)

Table 3. Engine Specifications		
Engine Manufacturer	John Deere	
Engine Model	4024TF281-49	4045TF290-66
Engine Type	Turbo Diesel	
EPA Tier	Tier 4 Interim	
Number of Cylinders	4	
Bore/Stroke - in./mm	86 x 105 (3.39 x 4.13)	106 x 127 (4.17 x 5.00)
Displacement - cu-in (liters)	2.44 (149)	4.5 (275)
Power - hp/kW @ 2800 RPM	49 (36)	66 (49)
Oil Capacity - quarts (liters)	8.5 (8)	15.5 (14.7)
Oil Type	John Deere Plus-50™ 10W-30, ACEA E4, E5 or E6	
Cooling System	Water Cooled	
Fuel Type	No 2 Diesel Fuel Low Sulfur or Ultra Low Sulfur Diesel Fuel	
Starting Method	Electric Start	
Battery	175 Ah 900 CCA	
Battery Dimensions - in./mm (LxWxH)	13 X 6.5 X 8.75/330 X 165 X 222	
Weight - lbs. (kg)	251 (553)	396 (873)
Dimensions - in./mm (LxWxH)	26.1 X 22.3 X 30.4 662 X 566 X 772	33.9 X 24.1 X 39.1 860 X 612 X 994

Table 4. Trailer Specifications		
Model	AP6	AP8
Axle, Single - lbs. (kg)	5,000 (2,268)	
Stablizer Jacks (Front/Rear)	4	
Top Wind Swivel Jack (Tongue)	1	
Brakes	Electric/ With Breakaway Switch	
Coupler	2-5/16" Ball/3-inch Pintle	
Tires (2)	ST225/75D15	
Lights	DOT Approved	
Safety Chain, Hook Type		
Fuel Tank Capacity - gallons (liters)	50 (189)	55 (208)
Dimensions	Reference Table 6, Figure 2	

PUMP DIMENSIONS (CANOPY)

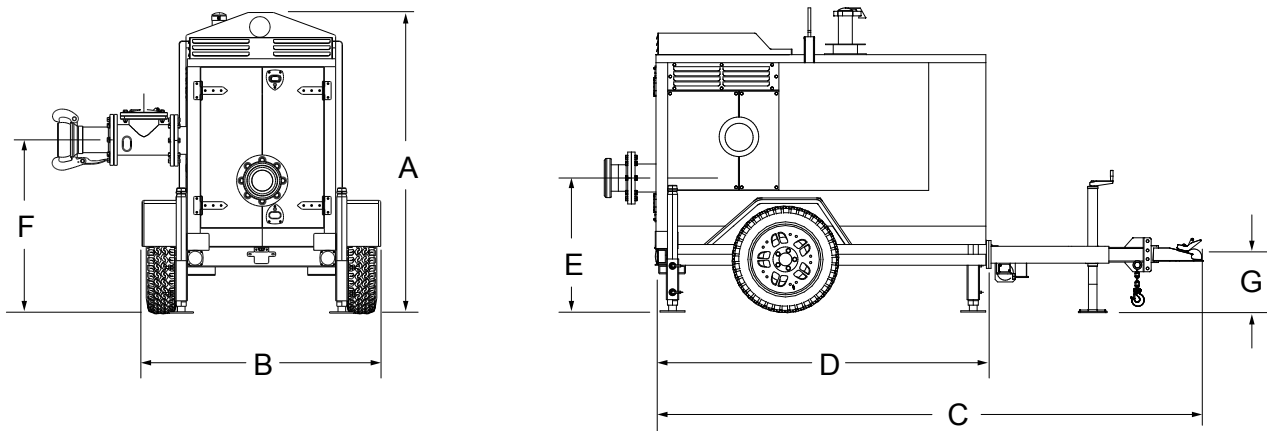


Figure 1. Pump Dimensions (Canopy)

Table 5. Pump Dimensions (Canopy)			
MODEL		AP6	AP8
REFERENCE LETTER	DESCRIPTION	DIMENSIONS: IN. (MM)	DIMENSIONS: IN. (MM)
A	HEIGHT	83 (2,108)	90 (2,286)
B	WIDTH	65 (1,651)	65 (1,651)
C	LENGTH (TONGUE EXTENDED)	118 (2,997)	118 (2,997)
D	SHIPPING LENGTH	71 (1,803)	71 (1,803)
E	SUCTION HEIGHT	38 (965)	39 (991)
F	DISCHARGE HEIGHT	48 (1,219)	48 (1,219)
G	COUPLER HEIGHT	18 (457)	18 (457)

PUMP DIMENSIONS

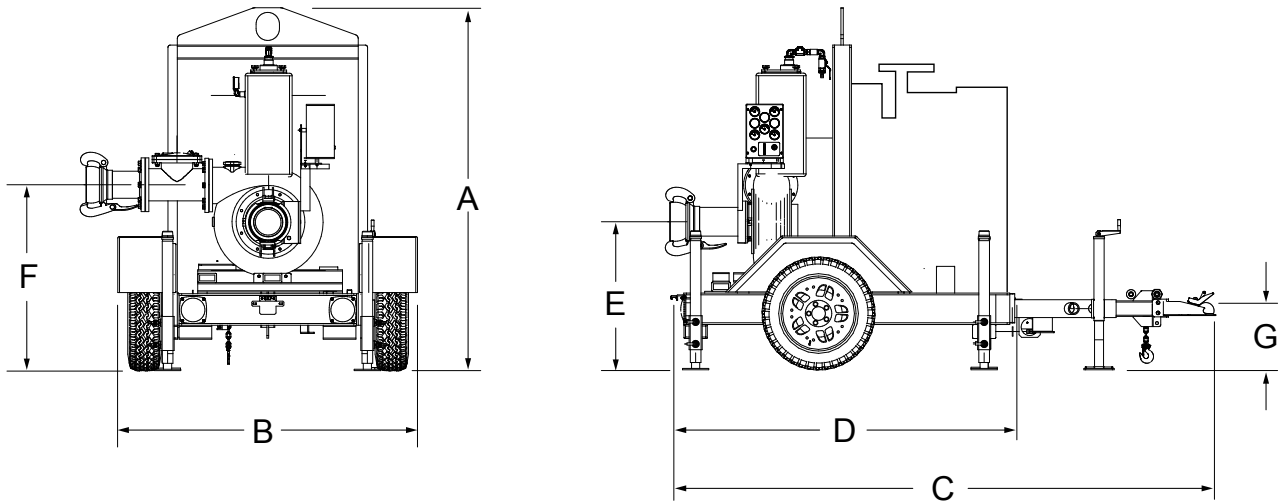


Figure 2. Pump Dimensions (Without Canopy)

Table 6. Pump Dimensions (Without Canopy)			
MODEL		AP6	AP8
REFERENCE LETTER	DESCRIPTION	DIMENSIONS: IN. (MM)	DIMENSIONS: IN. (MM)
A	HEIGHT	83 (2,108)	90 (2,286)
B	WIDTH	65 (1,651)	65 (1,651)
C	LENGTH (TONGUE EXTENDED)	118 (2,997)	118 (2,997)
D	SHIPPING LENGTH	71 (1,803)	71 (1,803)
E	SUCTION HEIGHT	38 (965)	39 (991)
F	DISCHARGE HEIGHT	48 (1,219)	48 (1,219)
G	COUPLER HEIGHT	18 (457)	18 (457)

PERFORMANCE CURVES

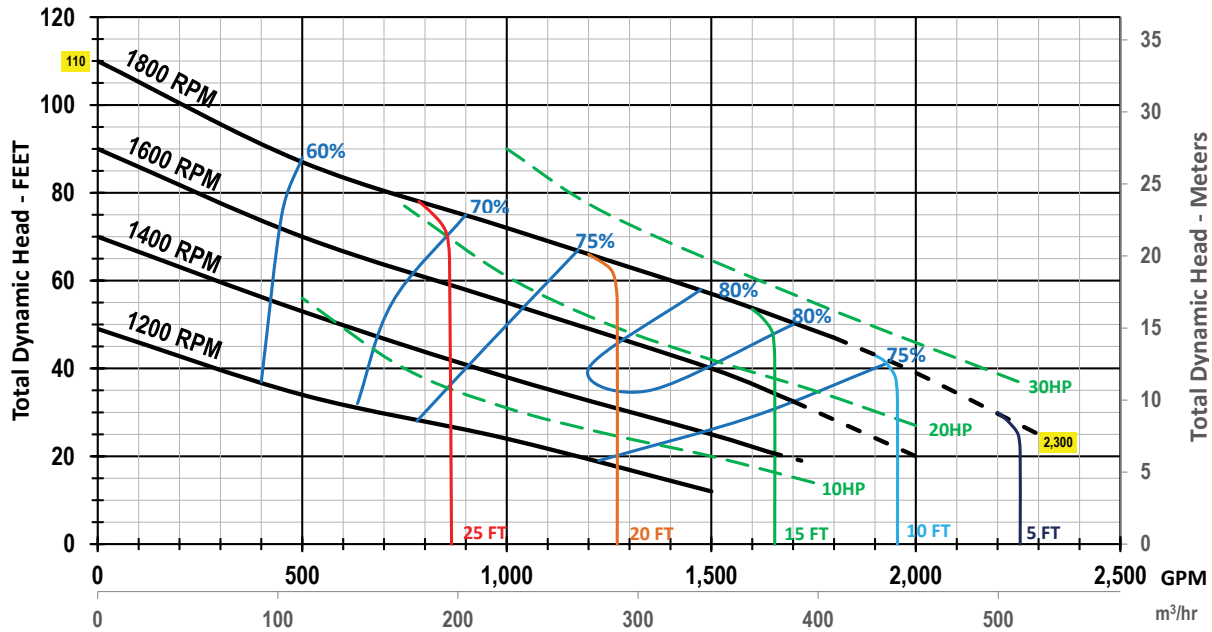


Figure 3. AP6 Series Pump Curve

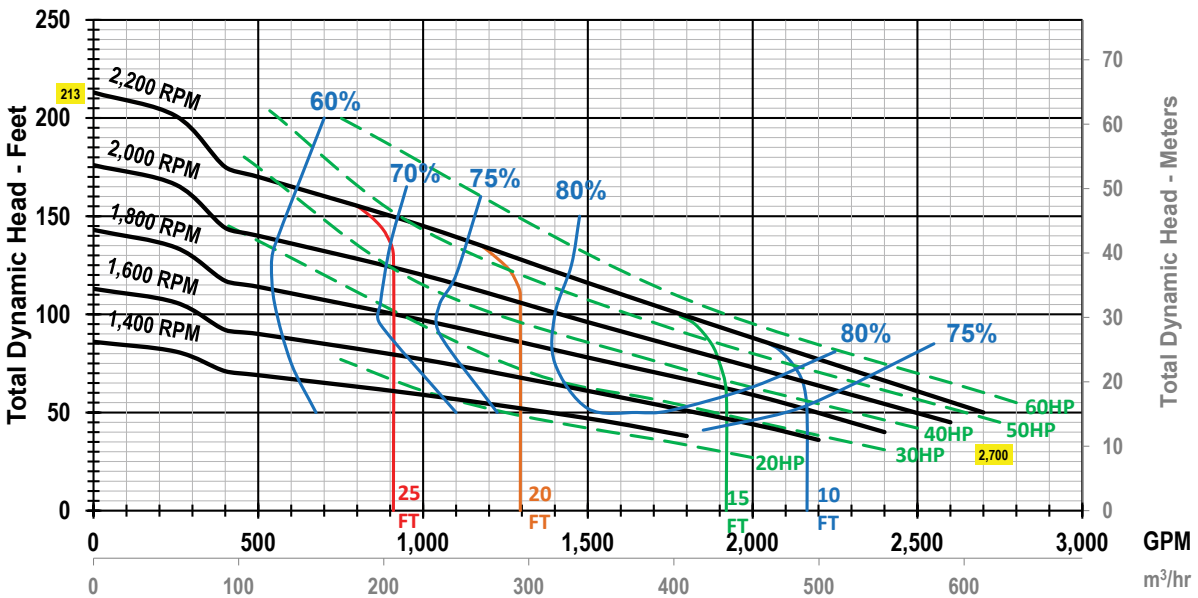


Figure 4. AP8 Series Pump Curve

GENERAL INFORMATION

The Multiquip AP6/AP8 series pumps are automatic prime-assist pumps that can handle dewatering, sewer bypass, and wellpoint applications.

The AP6/AP8 series pumps use a vacuum pump to remove the air. This becomes important in certain applications such as long suction hose runs or multiple suction points (such as wellpoints). In these cases, high volumes of air enters into the pump.

The AP6/AP8 series pumps use direct-drive vacuum pump to efficiently remove very large volumes of air quickly to obtain the priming necessary for these special applications. The AP6/AP8 series pumps are very useful when you have to move a lot of water fast.

IMPELLER

The impeller used on the AP6/AP8 series pumps has a patented design to eliminate cavitation. It is a closed 2-blade spiral, smooth flow, open, non-clog impeller, designed to handle up to 3 or 4 inch solids depending on pump model.

The impeller pulls water directly into the pump from the priming tank, reducing friction losses, and then pushes it out the volute discharge. This design does not cause turbulence normally found in centrifugal pumps.

WEAR PLATE

In conjunction with the impeller, the wear plate gives a perfect match for great pump performance and durability. The wear plate can be fully adjusted up to .6 inch (15 mm) for wear.

PRIMING SYSTEM

The vacuum system is innovative, simple, yet rugged and dependable. It uses direct drive which means no belt failure and with only one moving part, means no maintenance. It uses liquid-ring design with a closed water system. Separate oil bath lubrication, for the seal and bearings with oil reservoir, can run dry without damage. It operates quietly with no pollution or unwanted discharge noise.

FLOAT AND BACKFLUSH (PRIMING TANK)

The priming tank float is a one-piece welded construction, rubber valve seat, self-aligning rubber hinge. This design increases reliability. The backflush valve allows for cleaning of the suction strainer or wellpoint heads while the engine is running.

FUEL SYSTEM

The AP6 and AP8 series pumps have fuel tanks integrated into the trailer. These fuel tanks provide each pump with the capability for continuous running for long-term jobs. There are two corner fuel drains to check the condition of the fuel.

AP6 Series Fuel Tank

Fuel tank capacity for the AP6 series pumps is 50 gallons (189 liters) with a run time of 28 hours @1800 rpm or 39 hours @1600 rpm.

AP8 Series Fuel Tank

Fuel tank capacity for the AP8 series pumps is 55 gallons (208 liters) with a run time of 28 hours @2000 rpm.

FRAME AND TRACKBAR SYSTEM

The TrackBar system allows for the easy addition of jack stands, fenders, axle, lifting bail, and other options.

This allows for fast and easy positioning of the jack stands on the job site to fit the application, or to add subtract jack stands as required. The removable, retractable towing tongue minimizes storage requirements.

VOLUTE

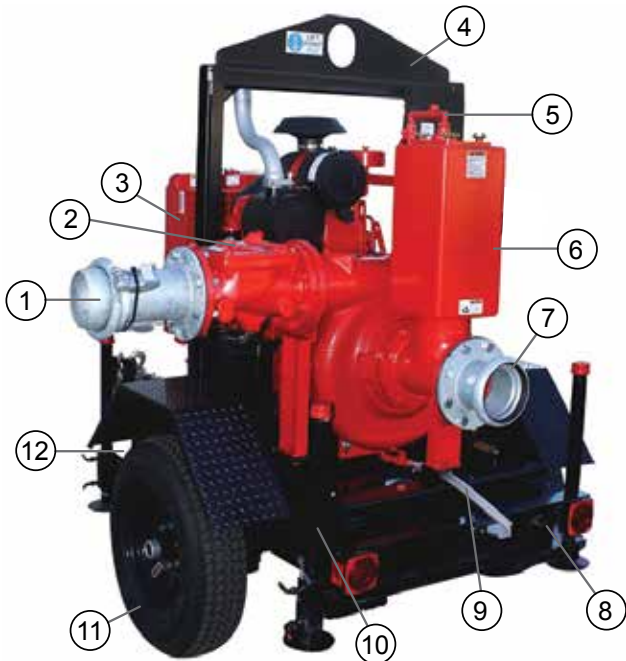
The pump volute has an external inspection/clean-out cover to inspect or clear the impeller. The pump shaft bearings and mechanical seal are run in independent oil baths for low maintenance.

LOFA ENGINE CONTROL PANEL

This control panel provides five engine status gauges (oil pressure, tachometer, high coolant temperature, hour meter and volt meter) along with engine shutdown capability in the event of low oil pressure, high coolant temperature, and alternator belt breakage.

An optional auto-start module is also available with float switch capability which is designed for the automatic start-stop of the pump. Additionally, audible and visual alerts signal engine restarting through a control panel alarm and beacon attachment.

PUMP COMPONENTS (AP6/AP8)



AP6/AP8 Silent Canopy Series

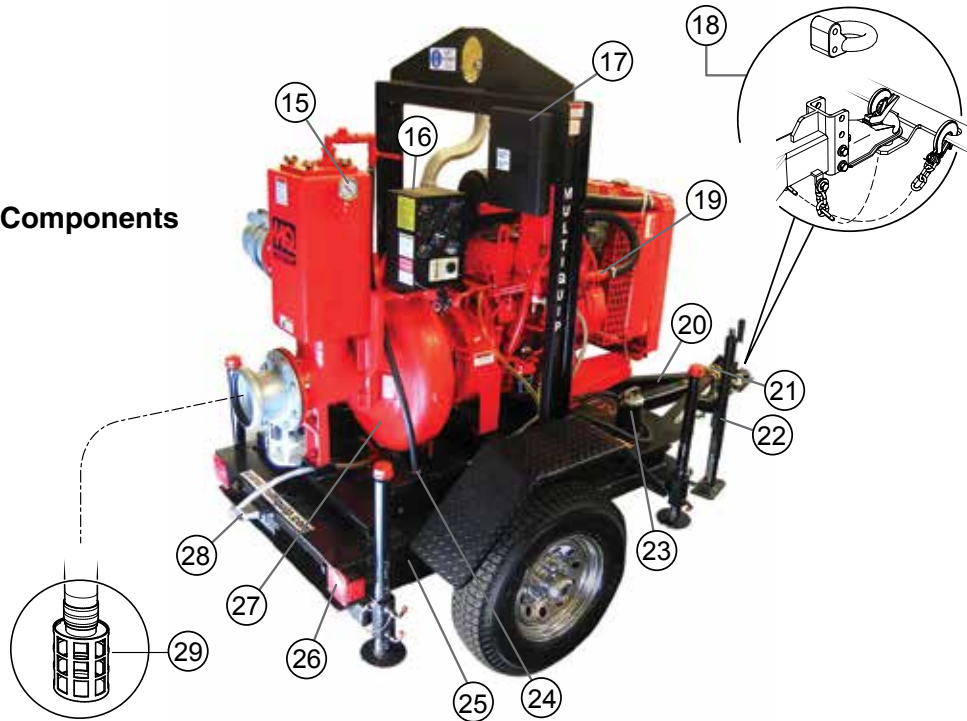
Figure 5. Pump Components

Figure 5 and Figure 6 show the location of the components for the AP6/AP8 series pumps. The function of each component or control is described below:

1. **Discharge Port** – When connecting discharge hose to this port, use galvanized Bauer flange ball coupler.
2. **ValveMatic Discharge Valve** – For low friction, high flow water discharge. 100% airtight, Ductile Iron w/ epoxy coating, no slam flapper valve design with easy access clean-out.
3. **Diesel Engine** – AP6 series pumps use a John Deere 49 HP turbo diesel engine and the AP8 series pumps use a 66 HP John Deere turbo diesel engine. Reference Table 3 for more detailed information.
4. **Lifting Bail** – Attach a suitable lifting device to this lifting point when lifting of the pump is required. Lifting device should be capable of lifting 6,000 lbs. (2,721 kg) maximum.
5. **Flooded Suction Valve** – Easy **ON/OFF** ball valve that quickly orients the pump to provide flooded suction operation.
6. **Air Separator Chamber** – Component essential in suction air evacuation that assists in the automatic pump priming process. Easy clean out port and quick action flooded suction valve.
7. **Suction Port** – When connecting suction hose to this port use galvanized Bauer flange socket coupler.
8. **Fuel Drain Plug** – Remove this plug to drain the fuel.
9. **Air Discharge Hose/Drain** – Air outlet for the venturi priming system. Can also be used to drain water from the pump.
10. **Leveling Jackstand (4)** – Use these four adjustable jack stands (front/rear) to level and stabilize the pump. Always make sure jack stands are deployed before operating pump and make sure pump is always placed on secure level ground where it will not slip or slide.
11. **Tires** – Both AP6/AP8 series pumps use ST225/75D15 type tires. Replace with only recommended type tires. Replace defective or worn tires immediately.
12. **Tie Down Rings (4)** – Solid tie down eyelets for safe flat bed and vehicle transportation.
13. **Silent Canopy** – To reduce noise, a sound attenuated canopy is available. The AP6 will maintain a sound level of 63 dB(A), while the AP8 canopy series will provide a sound level of 66 dB(A) @ 23 ft. (7 meters)
14. **Locking Handle** – The silent canopy provides for six locking-hinged doors with three removal panels that allow unrestricted access to all compartments for servicing.

PUMP COMPONENTS (AP6/AP8)

Figure 6. Pump Components



15. **Air Separator Vacuum Gauge** – 0 to 30 in. Hg (0~762 mm Hg) vacuum gauge that indicates vacuum pressure. Under normal operating conditions this gauge should read between 24~25 in. Hg (610~635 mm Hg).
16. **Control Box** – Displays vital engine parameters via gauges and LEDs. Included gauges are tachometer, temperature, battery voltage, hour meter, oil pressure. Engine fault LEDs include battery discharge, low oil pressure, high temperature, alternator failure and V-belt failure.
17. **Document Box** – Contains all documentation relating to the pump or engine.
18. **Couplers** – Trailer is available with either a 2-5/16 inch ball coupler or a 3-inch pintel coupler.
19. **Compressor** – Single cylinder, water cooled, gear driven 8.5 CFM compressor that is an integral component of the automatic priming system.
20. **DOT Approved Trailer** – Industrial DOT/NHTSA certified trailer. Includes break-away electric brakes, lashing rings, stabilizer stands and includes fuel cell.
21. **Safety Chains** – Heavy duty safety tow chains with locking coupler. Always cross chains when connecting to the tow vehicle.
22. **Top-Wind Jack** – Levels trailer tongue when connecting to a tow vehicle.
23. **Fuel Cap/Fuel Filler Port** – Lockable, EPA approved fuel cap with filtration screen and security chain. Use only No. 2 diesel fuel when replenishing fuel.
24. **Venturi Assembly** – Facilitates the creation of 24~25 inches (610~635 mm) of vacuum and works in conjunction with the air separator chamber for the automatic priming process.
25. **Fuel Tanks** – The AP6 pump is available with a 50 gallon (190 liters) fuel tank, while the AP8 is equipped with a 55 gallon fuel tank (208 liters). Both fuel tanks are constructed of heavy gauge steel.
26. **Tailights** – **ALWAYS** make sure lights are working correctly before towing.
27. **Pump End** – Pump casing is 3/4-inch thick class 30 cast iron with built in volute. Pressure rated up to 195 PSI. Casing includes ductile iron high efficiency closed impeller and 416 stainless steel shaft sleeve.
28. **License Plate Light** – **ALWAYS** make sure light is working correctly before towing at night.
29. **Strainer** – Always attach a strainer to bottom side of the suction hose to prevent large objects and debris from entering the pump. Strainer should be positioned so that it will remain completely under water. Running the pump with the strainer above water for long periods can damage pump.

ENGINE COMPONENTS (AP6)

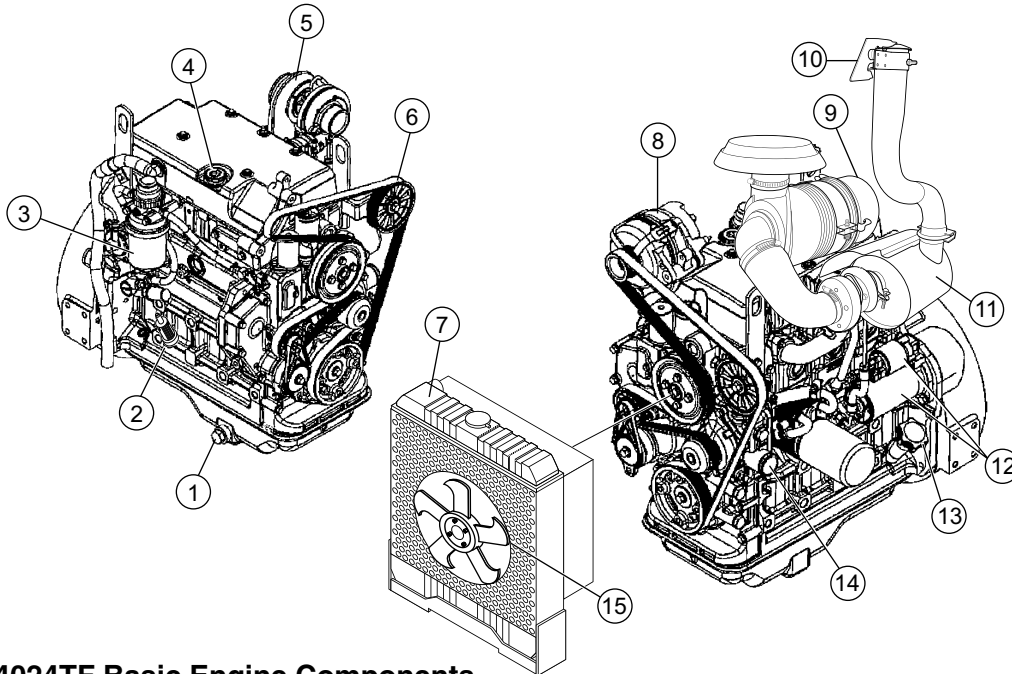


Figure 7. JD 4024TF Basic Engine Components

Figure 7 illustrates the location of the basic components for the John Deere Model 4024TF air cooled diesel engine. See Table 2 for engine specifications. The function of each component is described below:

1. **Crankcase Drain Plug** – Remove this plug to drain engine oil from the crankcase. Replace with recommended engine oil as specified in the maintenance section of this manual.
2. **In-Line Fuel Filter** – Replace or clean fuel filter as specified in the maintenance section of this manual.
3. **Primary Fuel Filter** – Replace or clean the fuel filter as specified in the maintenance section of this manual.
4. **Oil Filler Port Cap** – Remove this cap to add engine oil to the crankcase. Fill with recommended type oil as specified in the maintenance section of this manual.
5. **Turbocharger** – Pushes the fuel and air mixture into the engine at a high pressure to increase power.
6. **Drive Belt** – **ALWAYS** make sure that drive belt is properly tensioned. A loose or defective drive belt can adversely affect the performance of the pump.
7. **Radiator** – Only fill with recommended coolant. Reference maintenance section in this manual for correct type of coolant.
8. **Alternator** – Provides power to the electrical system. Replace with only manufactures recommended type alternator.
9. **Air Cleaner** – Prevents dirt and other debris from entering the fuel system. Replace with only manufactures recommended type air cleaner.
10. **Muffler Rain Cap** – Always make sure rain cap is in place (closed) when engine is not in use. This will prevent water and dirt from entering the engine.
11. **Muffler/Guard** – **DO NOT** touch the muffler when engine is running. The muffler can become extremely hot, causing severe burns. **NEVER** run the pump with the muffler guard removed.
12. **Starter Motor/Solenoid** – **NEVER** allow water or any foreign debris to come in contact with the starter motor/solenoid.
13. **Oil Filler Port/Dipstick** – Remove this dipstick to determine if engine oil is low. Maintain oil level at the "H" marking on the dipstick. **NEVER** run engine with low oil.
14. **Oil Filter** – Replace oil filter as recommended in the maintenance section of this manual.
15. **Cooling Fan Blades** – Make sure that the blades of the cooling fan are not bent or broken. A damaged fan blade can cause the engine to run hot and overheat.

ENGINE COMPONENTS (AP8)

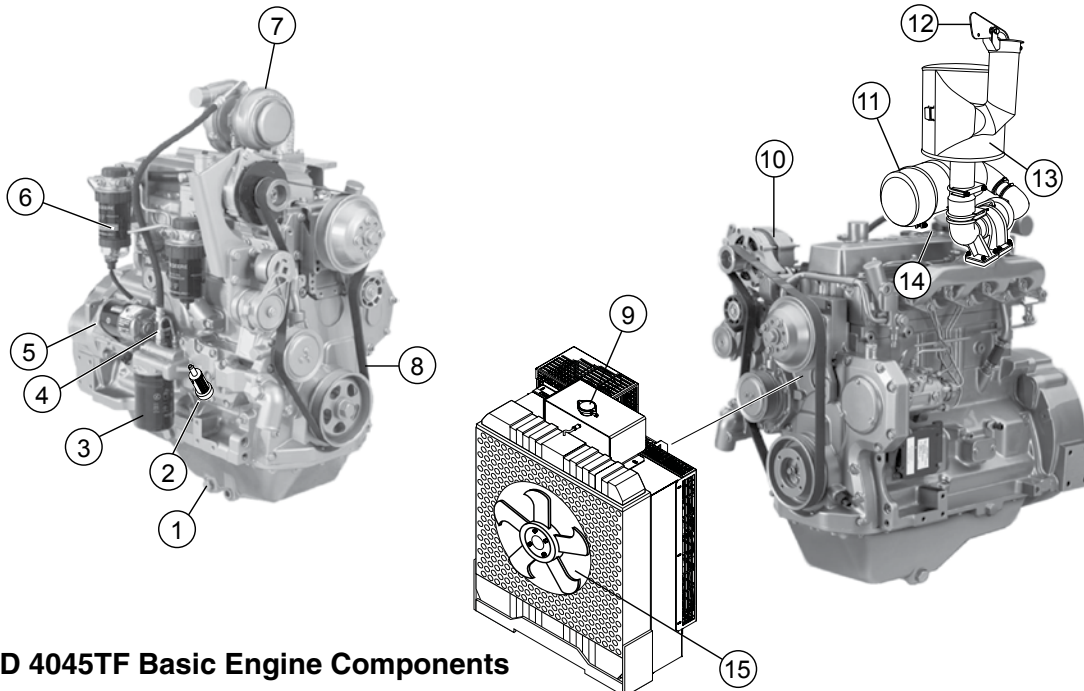


Figure 8. JD 4045TF Basic Engine Components

Figure 8 illustrates the location of the basic components for the John Deere Model 4045TF air cooled diesel engine. See Table 2 for engine specifications. The function of each component is described below:

1. **Crankcase Drain Plug** – Remove this plug to drain engine oil from the crankcase. Replace with recommended engine oil as specified in the maintenance section of this manual.
2. **In-Line Fuel Filter** – Replace or clean fuel filter as specified in the maintenance section of this manual.
3. **Oil Filter** – Replace oil filter as recommended in the maintenance section of this manual.
4. **Dipstick** – Remove this dipstick to determine if engine oil is low. Maintain oil level at the "H" marking on the dipstick. **NEVER** run engine with low oil.
5. **Starter Motor/Solenoid** – **NEVER** allow water or any foreign debris to come in contact with the starter motor/solenoid.
6. **Primary Fuel Filter** – Replace or clean the fuel filter as specified in the maintenance section of this manual.
7. **Turbocharger** – Pushes the fuel and air mixture into the engine at a high pressure to increase power.
8. **Drive Belt** – **ALWAYS** make sure that drive belt is properly tensioned. A loose or defective drive belt can adversely affect the performance of the pump.
9. **Radiator** – Only fill with recommended coolant. Reference maintenance section in this manual for correct type of coolant.
10. **Alternator** – Provides power to the electrical system. Replace with only manufactures recommended type alternator.
11. **Air Cleaner** – Prevents dirt and other debris from entering the fuel system. Replace with only manufactures recommended type air cleaner.
12. **Muffler Rain Cap** – Always make sure rain cap is in place when engine is not in use. This will prevent water and dirt from entering the engine.
13. **Muffler/Guard** – **DO NOT** touch the muffler when engine is running. The muffler can become extremely hot, causing severe burns. **NEVER** run the pump with the muffler guard removed.
14. **Oil Filler Port Cap** – Remove this cap to add engine oil to the crankcase. Fill with recommended type oil as specified in the maintenance section of this manual.
15. **Cooling Fan Blades** – Make sure that the blades of the cooling fan are not bent or broken. A damaged fan blade can cause the engine to run hot and overheat.

ENGINE CONTROL BOX COMPONENTS

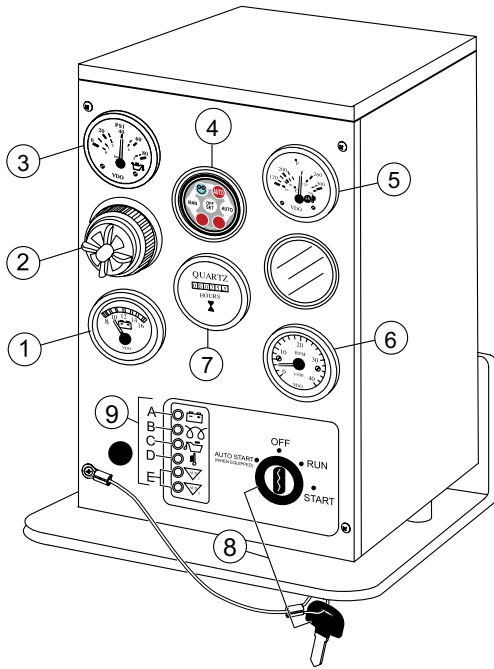


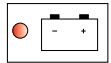
Figure 9. EP250 Control Box

Figure 9 shows the location of the components for the engine control box. The function of each component is described below:

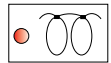
1. **Voltmeter Gauge** – Indicates battery voltage. If battery voltage reading is approximately 14 volts while the engine is running indicates the battery is charging properly.
2. **Audible Alarm** - When remote starting (auto mode) of the pump is required this alarm will sound indicating that the engine will begin cranking.
3. **Oil Pressure Gauge** - Indicates the oil pressure of the engine. Under normal operating conditions the oil pressure is approximately 50~52 psi. (345~358 kPa).
4. **MS-200 Programmable Auto Start Controller** - The MSS-200 controller is an *optional* add-on component for the MSS-200 automatic start stop module (float switches).
5. **Coolant Temperature Gauge** - Indicate the coolant temperature. Under normal operating conditions the coolant temperature should be between 170°~200°F (77°~93°C).

6. **Engine Tachometer** – Indicates the speed of the engine when the pump is operating. Under normal operating conditions this speed is approximately 2200 RPM's.
7. **Engine Hour Meter** – Indicates the number of hours the engine has been in use.
8. **Ignition Switch/Key** – To start engine, insert ignition key into ignition and turn clockwise to the **RUN** position, then continue turning clockwise to the **START** position and release. To stop the engine turn ignition key fully counterclockwise to the **OFF** position.
9. **Engine Warning Status LEDs** — These engine status indicators when active (ON) indicate battery discharge, low oil pressure, high coolant temperature, alternator failure and V-belt failure. LEDs will remain ON indicating fault until reset:

a. **Battery Charge LED** — When ON indicates that the charging system is not working properly. This condition will cause the engine to shutdown..



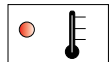
b. **Glow Plug Pre-Heat LED** — This LED goes ON when the preheat system is in process. When LED extinguishes, the preheat period is complete and the engine may be cranked..



c. **Low Oil Pressure LED** — When ON indicates that the oil pressure has dropped to 11.4 psi (78.6 kPa). This condition will cause the engine to shutdown. During normal operation of the pump this LED should remain OFF.



d. **Overheat LED** — This LED goes ON when the cooling water temperature rises above 225°F, ± 5°F (107°C, ± 5°C). If this LED comes ON during normal operation of the pump, the emergency shutdown device will stop the engine automatically.



e. **Auxiliary LEDs** — These status LEDs can be used for additional engine operating parameters. Currently these two status LEDs are not used.



PUMPING APPLICATION

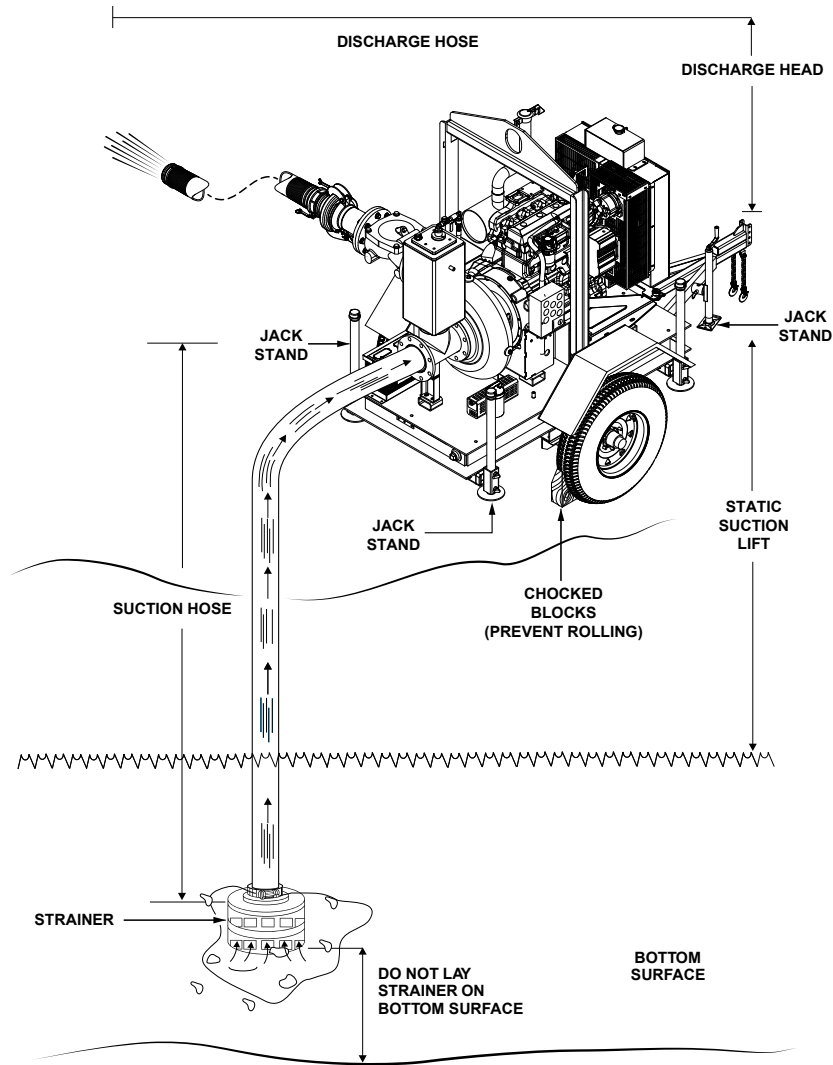


Figure 10. Pump Application

Figure 10 shows a typical application using the Dry Prime diesel-powered prime-assist pump. Please note that this pump is intended for the removal of clean water and water containing some debris and solids. Maximum size of solids should not exceed 3.2 inches (81.2 mm) in diameter. **DO NOT** set strainer on bottom of water bed.

Placing the strainer above the water bed will prevent the pump from drawing in excessive amounts of sand and foreign debris.

The following terms are usually used when referring to lift or head:

1. Static Suction Lift – The vertical distance from the water line to the center of the impeller.

2. Static Discharge Head – The vertical distance from the discharge outlet to the point of discharge or liquid level when discharging into the bottom of a water tank.

3. Dynamic Suction Head – The static suction lift plus the friction in the suction line. Also referred to as total suction head.

4. Dynamic Discharge Head – The static discharge head plus the friction in the discharge line. Also referred to as total discharge head.

5. Total Dynamic Head – The Dynamic Head Suction Head plus the Dynamic Discharge Head. Also referred to as total head.

FLOAT SWITCHES (AUTO MODE)

Mechanical Float Switch

For unattended operation of the pump two mechanically activated float switches will be required. These float switches can be connected directly to EP250 control box via a 4-pin connector located at the rear of the control box.

When the pump is placed in **AUTO** mode, the float switches will allow the pump to start and stop depending on the length of the tether.

How It Works

The mechanical float switch control will turn **ON** (closes) when the float tips 45° above horizontal, indicating a high level. It turns **OFF** (opens) when the float switch drops 45° below horizontal. Reference Figure 12 and Figure 13. Maximum pumping range is 120 degrees. See Figure 11 below.

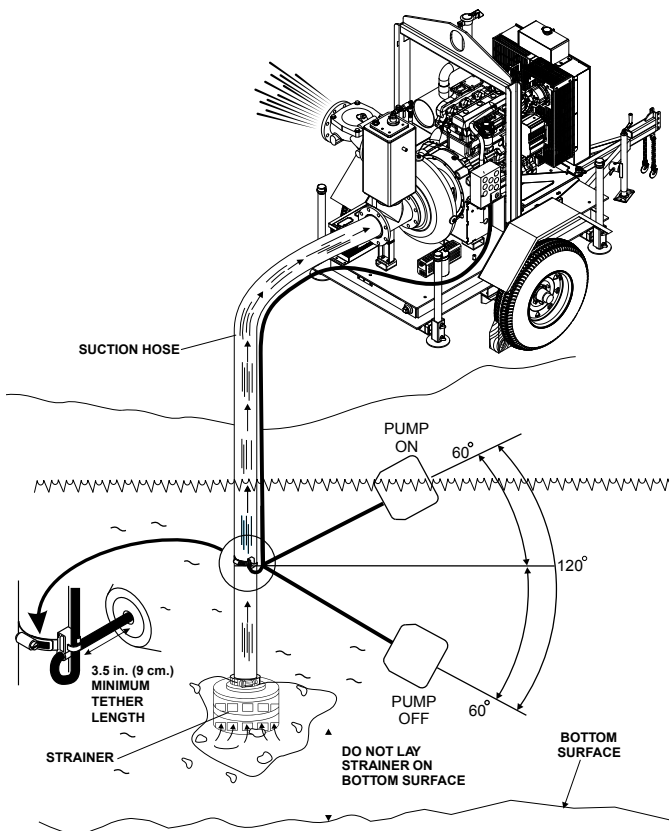


Figure 11. Pumping Range (Float Switch)

Pumping Range

The pumping range of the pump is determined by the float switch tether cord. Use Table 7 as guide line to determine your required pumping range. Pumping ranges are based on non-turbulent conditions. Range may vary due to water temperature and cord shape. Please note as the tether length increases, so does the variance of the pumping range.

Design Features

Float switch housings are constructed of high-impact, corrosion resistant polypropylene with mechanically activated, snap action contacts.

- Suitable for most liquid environments.
- Hermetically sealed.
- Thick-walled non-corrosive PVC plastic enclosure.
- Pressure tested to 30 ft. (9 meters).
- Standard SJO, 16-gauge, 2 conductor cord (20 ft./6.09 m).

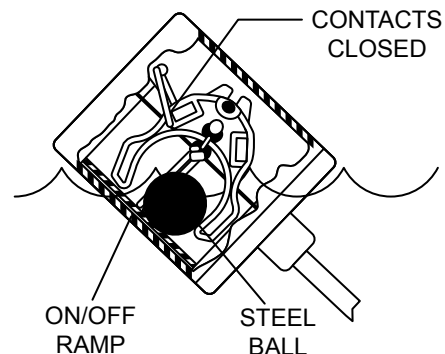


Figure 12. Float Switch (Closed)

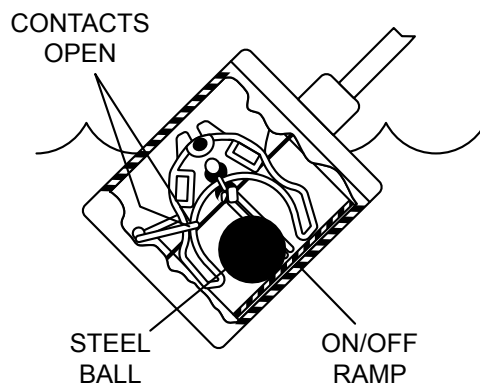


Figure 13. Float Switch (Open)

FLOAT SWITCHES/ALARM BEACON (AUTO MODE)

Table 7. Pumping Range

Tether Length in. (cm.)	2 (5.08)	4 (10.1)	6 (15.24)	8 (20.32)	10 (25.4)	12 (30.48)	14 (35.56)	16 (40.46)
Pumping Range in. (cm.)	6 in. (15.24)	10 (25.4)	14 (35.56)	(18) (45.72)	22 (55.88)	27 (68.58)	31 (78.74)	35 (88.9)

Mounting The Float Switches

1. Determine the required **cord tether length** as shown in Figure 11 and Table 7.
2. Place the cord into the clamp as shown in Figure 11.
3. Secure the clamp to the suction hose as shown in. **DO NOT** install cord under hose clamp.

4. Using a screwdriver, tighten the hose clamp. **DO NOT** over-tighten. Make sure the float cord is not allowed to touch the excess hose clamp band during operation.

Float Switch/Alarm Beacon Connections

Connect the float switches and alarm beacon to the control box as shown in Figure 14.

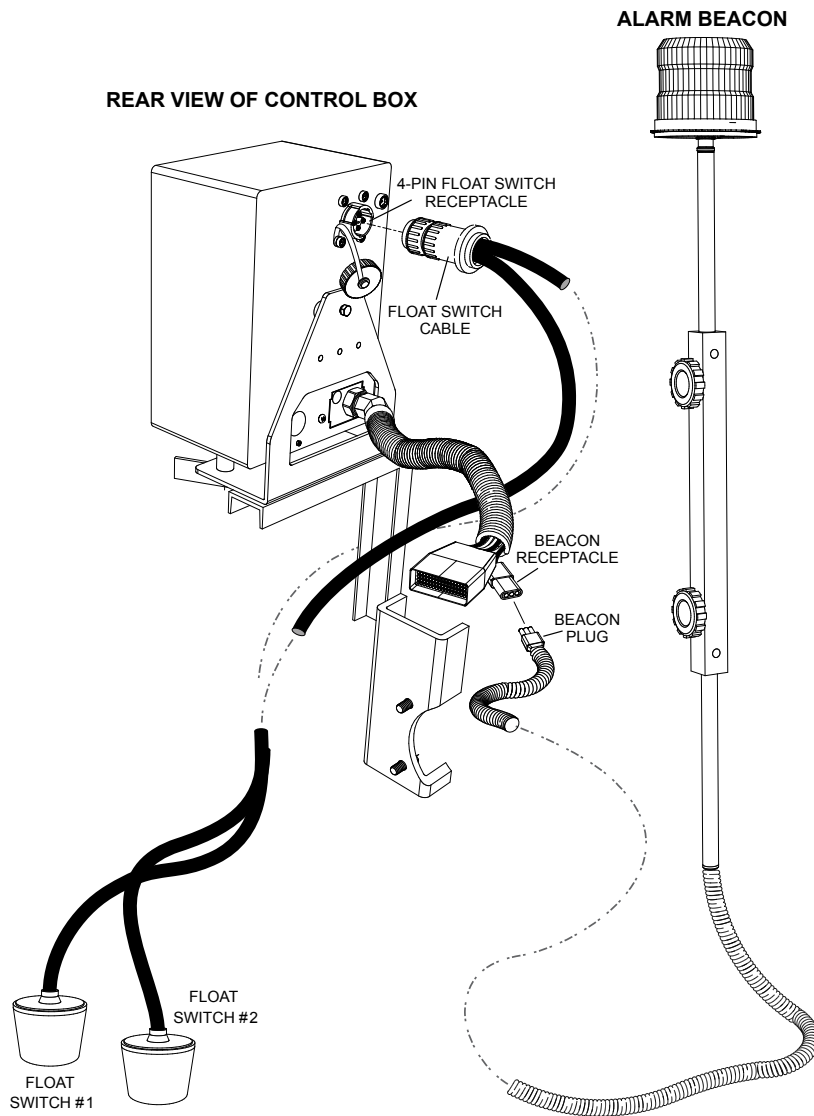


Figure 14. Float Switches/Alarm Beacon Connections

TOWING APPLICATION

NOTICE

Reference **Trailer Safety Guidelines** section in this manual for a more detailed complete understanding on towing requirements.

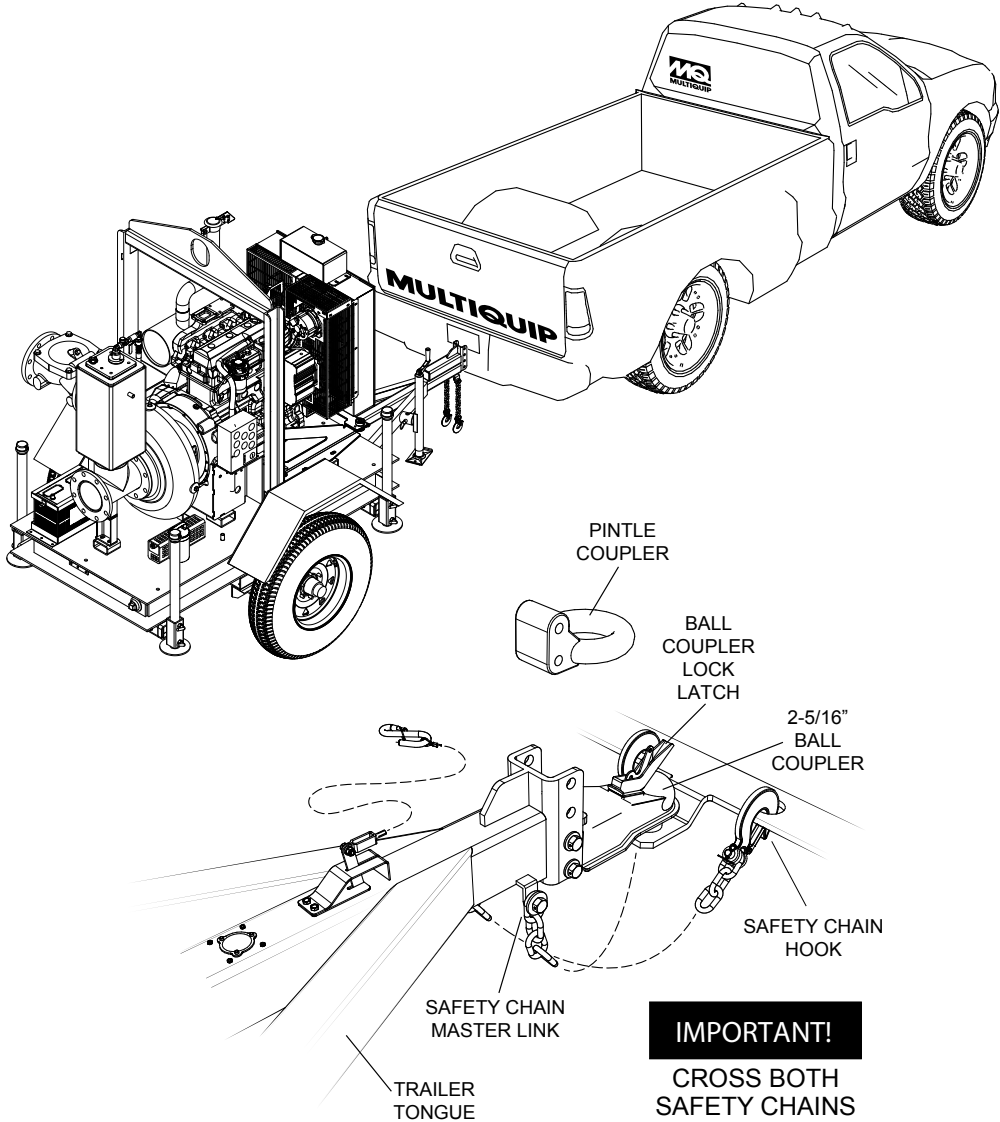


Figure 15. Towing Application

ENGINE OIL

When checking the engine oil, be sure to check if the oil is clean. If the oil is not clean, drain the oil by removing the oil drain plug, and refill with the specified amount of oil as outlined in Table 3 or the **John Deere Engine Owner's Manual**. Oil should be warm before draining.

Other types of motor oils (Table 8) may be substituted if they meet the following requirements:

- API Service Classification CJ-4
- API Service Classification CI-4
- API Service Classification CI4 Plus
- API Service Classification CH-4
- ACEA Oil Sequence E3

Table 8. Recommended Motor Oil		OIL: SAE	
°F	°C		
122	50		
104	40	10W/40	30
86	30		
68	20		
50	10		
32	0		
-14	-10	ARCTIC OIL	5W/30
-4	-20		
-22	-30		
-40	-40		
		10W/40	15W/30
			10W/30
			10W
			20W/40

Checking Engine Oil

1. Make sure pump is placed on secure level ground.
2. Remove the engine oil dipstick from its holder.
3. Verify that the oil level (Figure 16) is maintained between the two notches on the dipstick.

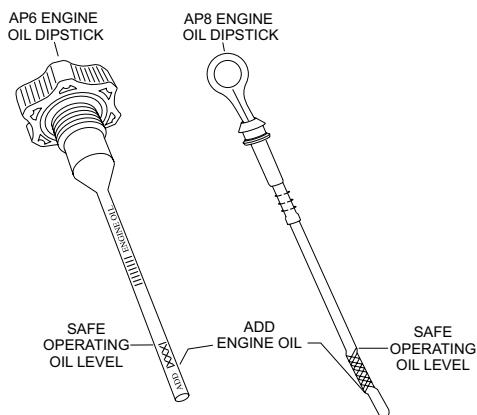


Figure 16. AP6/AP8 Engine Oil Dipstick

4. If engine oil is low, fill engine crankcase with lubricating oil through filler hole (Figure 17 and Figure 18, but **DO NOT** overfill).

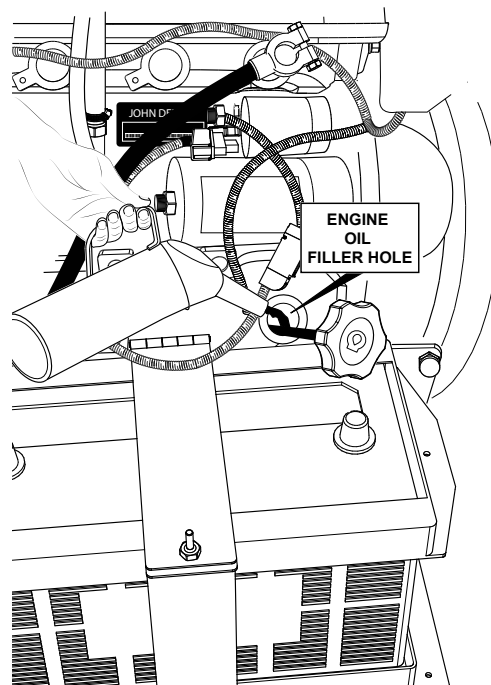


Figure 17. AP6 Engine Oil Filler Hole

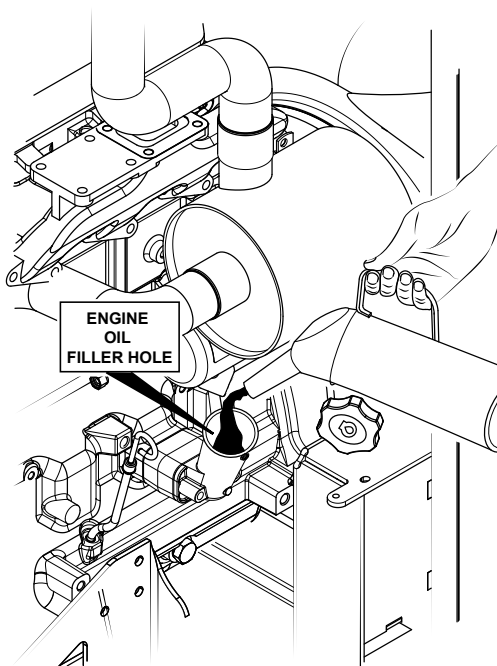


Figure 18. AP8 Engine Oil Filler Hole

FUEL CHECK

! DANGER - Fire/Explosion

NEVER fill the fuel tank while the engine is running or in the dark. Fuel spillage on a hot engine can cause a fire or explosion. If fuel spillage occurs, wipe up the spilled fuel completely to prevent fire hazards.



1. The fuel tank used with this pump has a built in fuel gauge (Figure 19) within the tank. Read the fuel gauge to determine if the fuel level is low.

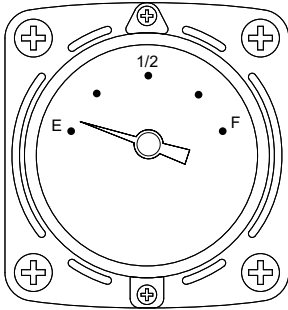


Figure 19. Fuel Gauge

2. Handle fuel in a safety container. If the container does not have a spout use a funnel.
3. If the fuel level is low, fill (Figure 20) with recommended type diesel fuel as referenced in Table 3. **DO NOT** fill fuel tank beyond capacity.

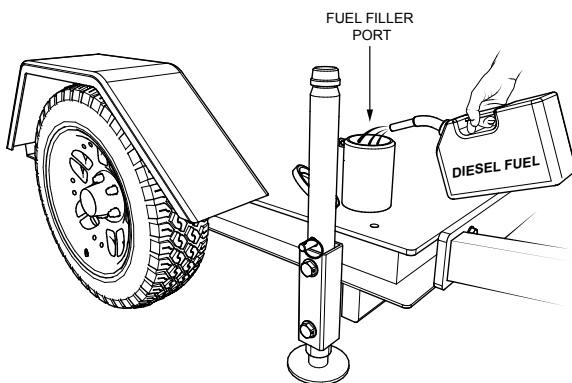


Figure 20. Refueling

4. Pay attention to the fuel tank capacity when replenishing fuel. Refer to the fuel tank capacity listed in Table 4, Trailer Specifications.
5. Tighten fuel tank cap securely after filling.

BATTERY CABLE CONNECTION

ALWAYS make sure the battery cables are properly connected to the battery terminals. The **RED** cable is connected to the positive terminal of the battery, and the **BLACK** cable is connected to the negative terminal.

PUMP PLACEMENT

1. Read safety instructions at the beginning of manual.
2. Place pump on secure level ground as near to the water as possible.
3. Deploy all four trailer jack stands to level the pump. If possible place chock blocks underneath each wheel to prevent the pump from rolling.

SUCTION/DISCHARGE HOSES CONNECTIONS

! DANGER -High Pressure

PVC discharge hoses and thin-walled rubber hoses can easily fail at the end of the hose fittings. Leaks from the hoses can cause high-pressure liquid to be discharged, causing dangerous conditions. Make sure pressure rating of hoses exceeds the pump maximum pressure to prevent hose failure.



1. Check that the suction and discharge hoses (Figure 21) are securely attached to the pump via Bauer™ couplers and are not restricted.
2. Place each hose so that it lays as straight as it is possible on the ground. Remove any twists or sharp bends from hose which may block the flow of water.
3. If using a light weight discharge hose, it should be anchored to avoid movement with high flow or high pressure water. Always use a suction hose or pipe that matches the size of the pump inlet to insure optimum performance and reduce the risk of damage to the pump.

NOTICE

It is recommended that the discharge hose or pipe match the size of the pump outlet to reduce friction as much as possible. Using a discharge line that is larger than the pump outlet will reduce friction and improve water flow. Similarly, a smaller line will reduce water flow by increasing friction.

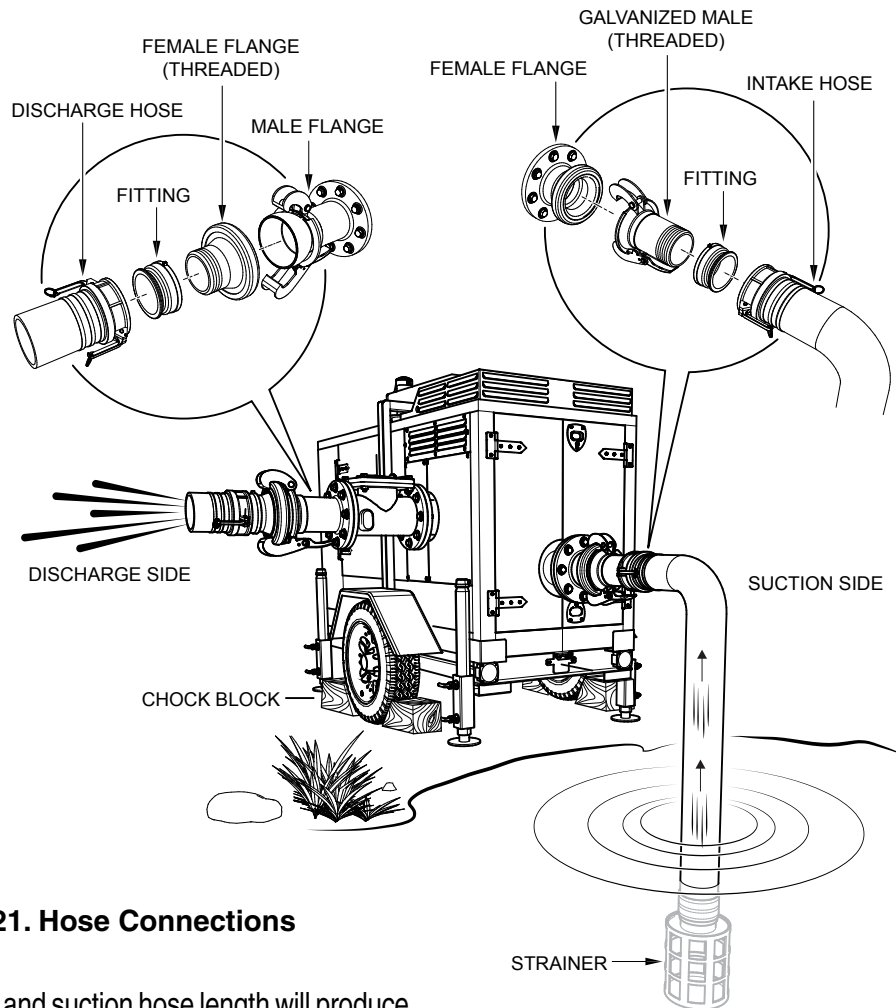


Figure 21. Hose Connections

4. Shorter suction lift and suction hose length will produce better performance.
5. Remember suction hoses must be **rigid** enough not to collapse when the pump is in operation.
6. Make sure the suction strainer is clean and securely attached to the water end of the suction hose. The strainer is designed to protect the pump by preventing large objects from being pulled into the pump. Failure to use a strainer could cause damage to the pump, impeller, pump shaft, pump bearings, or wear plate.
7. If a strainer becomes clogged with debris, clean the strainer.

⚠ CAUTION - Strainer Placement

The strainer should be positioned so it will remain completely **under water**. Running the pump with the strainer above water for long periods can damage the pump.

NOTICE

Suction and discharge hoses are available from Multiquip. Contact your nearest dealer for more information.

⚠ DANGER - Flammable Fluids

DO NOT pump flammable fluids, corrosive chemicals or fluids containing toxic substances. These fluids can create potentially dangerous health and environmental hazards. Contact local authorities for assistance.

OPERATION (MANUAL MODE)

ENGINE STARTUP (MANUAL MODE)

1. Insert ignition key into ignition switch.

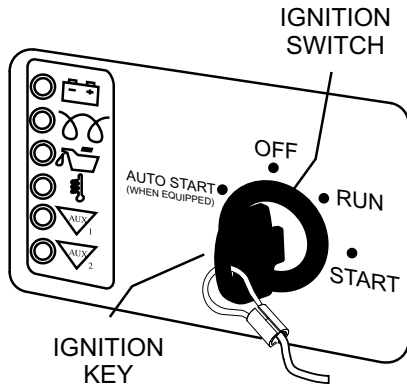


Figure 22. Ignition Switch/Key

2. Turn ignition key to the **RUN** position, and verify that voltmeter gauge on the control box indicates 12 VDC.
3. Verify that the battery, glow plug, oil pressure and coolant temperature status LEDs are all **ON**.
4. Next, continue turning the ignition key clockwise and place in the **START** position.
5. Release ignition key as soon as engine starts, and verify that ignition switch automatically returns back to the **RUN** position.
6. Verify that the all status LEDs are **OFF**.
7. If battery charge indicator LED remains **ON**, increase engine speed until LED goes **OFF**. When the charge LED turns **OFF**, it can then be assumed that the charging system is working correctly.
8. If the charge LED remains **ON** while the engine is running, refer to Engine Troubleshooting Table or the John Deere Engine Service Manual.
9. Unlock the throttle control lock knob (Figure 23) by turning the knob counterclockwise.
10. Next, adjust the engine speed by turning the throttle control clockwise to increase engine speed and counterclockwise to reduce engine speed.
11. Once the desired engine speed has been achieved, turn the throttle control lock knob clockwise to lock the selected engine speed setting.

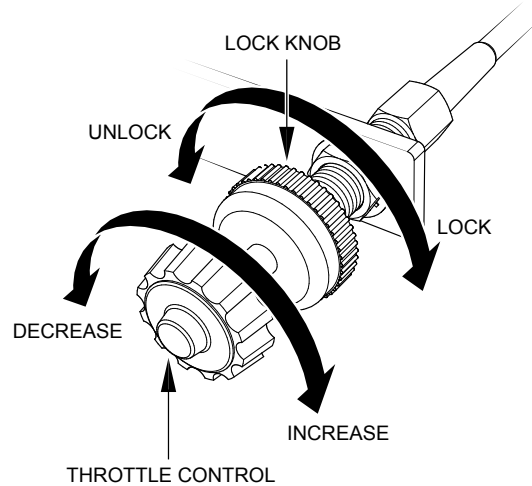


Figure 23. Throttle Control

NOTICE

If engine does not start, turn ignition key to the **OFF** position to reset. Wait 10 seconds before restarting. Use hand fuel pump to remove air from fuel return line.

Operation

1. The pump should begin pumping water within a minute depending on the length of suction hose and height the pump is above water.

NOTICE

Longer suction hoses will require more time for the pump to begin pumping water.

2. If pump does not begin to pump water after a few minutes, check for loose connections or air leaks in the suction hose. Make sure there is water in the vacuum system and strainer is not clogged with debris. Reference Pump Troubleshooting Flowchart.
3. Make certain suction hose does not have any air leakage. Tighten hose clamps and couplings as required.
4. Check for leaks between pump and engine. If water is leaking between the pump and bearing housing, the seal inside the pump may be worn or damaged. Continued operation of the pump is not recommended. Further usage of the pump under these conditions may cause severe water damage to bearing housing assembly.

OPERATION (MANUAL MODE)

Engine Shut-Down

1. Place engine throttle control in the idle position and place the ignition key in the **OFF** position.

 **CAUTION -Disconnecting Discharge Hose**

If pumping in a positive head (pumping up hill), be sure to open discharge check valve drain and release pressure before uncoupling hose.

Pump Inspection After Use

2. It is recommended that the pump be inspected after each use for damage or wear.
3. Drain and flush pump volute and priming system from suction end.
4. Inspect impeller for wear or damage and measure impeller clearance if it appears worn. Inspect interval should be about every 1000 hours. This inspection should be done when the pump is scheduled for maintenance inspection.
5. Inspect discharge check valve for wear or damage. Replace if necessary.
6. Inspect fuel tank and check for water by removing 0.5-inch drain plugs. Do not overtighten when replacing.
7. Check oil reservoirs for contamination or water.
8. Do dry vacuum test to check seal and check valve seal. This check should be done when the pump is scheduled for maintenance inspection.

Pump Storage

For storage of the pump for over 30 days, the following is required:

- Drain the fuel tank completely.
- Run the engine until the fuel in the injection system is completely consumed.
- Completely drain used oil from the engine crankcase and fill with fresh clean oil, then follow the procedures described in the engine manual for engine storage.
- Remove the drain plug from the pump and drain out any water from left in the housing.
- Remove the pump cover and clean inside of pump housing. Coat inside of pump housing with a light film of oil to reduce corrosion. A spray can of oil works well for this application.
- Cover suction and discharge ports with duct tape to prevent any foreign matter from falling into pump.
- Cover pump and engine with plastic covering or equivalent and store in a clean, dry place.

OPERATION (AUTO MODE)

AUTO MODE

Both the AP6 and AP8 series pumps have an **optional** auto-start controller (MS-200). This controller allows for a float switch capability which is designed for the automatic start-stop of the pump. Additionally, audible and visual alerts signal engine restarting through a control box alarm and beacon attachment.

MSS 200 AUTO START CONTROLLER

NOTICE

The MSS-200 is a dual function controller, meaning it can be used for generator or pump applications. When programming the various operating parameters use **pump related parameters** only (pump mode).

The MSS-200 is an automatic engine start stop controller. The MSS-200 is fully programmable. Its **15 parameters** are pre-programmed at the factory to the most commonly used parameters. Changing the factory preset, however, is easily accomplished by pushing three buttons (Figure 24) on the front of the face of the controller.

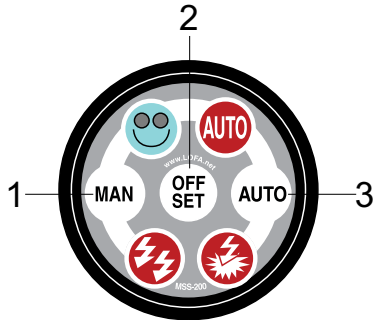


Figure 24. MS-200 Controller Buttons

Automatic Shutdowns

When used in combination with ground contact switches, the MSS-200 can also shutdown the engine. The control box allows for the wiring and automatic shutdown of the engine for the following parameters:

- High Oil Pressure 150 psi (1,034 kPa)
- High Coolant Temperature 220~230°F (102~112°C)
- Alternator Charge
- Broken V-Belt
- Engine Overspeed
- Other Customer Defined Parameters

FLOAT SWITCHES

Two pairs of normally open float switch contacts (high/low) are provided with the **auto-start** controller. The controller is pre-wired for the floats, utilizing a 4-pin connector located at the rear of the control box.

PARAMETERS

NOTICE

Refer to the programming section of this manual when changing any of the factory preset parameters is required.

Preheat Parameter

The duration period of preheat can be programmed by time (in 4 second increments) or by ambient temperature if used in combination with a PT-1000 thermistor or equivalent.

The preheat time setting, has priority over ambient temperature. In case of a defective thermistor or loose wire connection, it is important that a time value is always programmed when used in combination with a thermistor. When using the temperature thermistor provision, use Table 9 for temperature verses time comparison.

Table 9. Preheat Parameter #0			
°F	°C	Preheat Time (sec.)	After-Glow Time (sec.)
+122	+50	0	0
+104	+40	4	4
+68	+20	6	4
+32	0	12	6
-4	-20	22	6
-40	-40	30	6

The preheat function on the MSS-200 can also be used in combination with a pre-start audible alarm. Simply program a preheat duration and add an alarm to the preheat output to provide additional safety to your equipment. Alarms are available as an option.

OPERATION (AUTO MODE)

Repeated Engine Starts Parameter

If the engine does not start on the first auto start attempt, the engine will go into repeat start mode. The MSS-200 can be programmed to make a maximum of 15 new engine start attempts. During repeated starts the bottom left LED (Figure 25) will blink, indicating that the system is in repeated start mode.

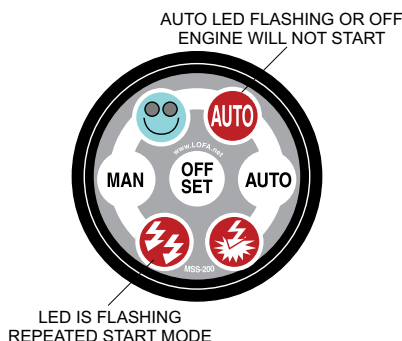


Figure 25. Repeated Start Mode LED (Flashing)

NOTICE

Engine will not go into repeated start mode if the engine is started manually by pressing the **MAN** button.

Pause Between Repeated Engine Starts Parameter

Pause between repeated engine start is the period between each repeated start-up attempt. The range for this pause is between 5~75 seconds in 5 second increments.

Overcrank Parameter

Overcrank is defined as the maximum time, in seconds, that the starter motor can be engaged if the engine fails to receive a frequency via the alternator's frequency terminal or proximity switch pick-up.

The over crank feature eliminates the need for any manual settings of starter motor duration usually required for low temperature conditions.

Engine Cool-Down Cycle Parameter

This parameter controls the length of time in which the engine is in its cooling-down cycle. Once the ground contact is removed from the **AUTO** terminal wire, the MSS-200 will shut off throttle control or compressor.

The engine will run without load for an amount of time established by the customer. Cool-down cycle time can be programmed from 0~900 seconds in 60 second increments.

NOTICE

The cool-down cycle can only be used when the controller's standby mode (parameter 30) is programmed to consume electricity.

Oil Pressure Switch Parameter

This parameter is used to select the type of oil pressure switch being used on the engine, i.e., normally closed (NC), normally open (NO) or no oil pressure switch.

The **no oil pressure switch** setting must be selected when the MSS-200 is used in combination with any other auxiliary engine monitored and shutdown system, i.e., EP-100, MC-536 or MC-6K.

In the solo mode the MSS-200 can also be programmed to monitor oil pressure. This feature adds starter motor protection by preventing the starter motor from engaging when the engine has oil pressure, or if the pressure switch wire has been disconnected.

Applications requiring shutdown for other critical functions like high temperature or pump pressure can connect the switch wires to the oil pressure input.

NOTICE

Connecting a small jumper wire from the overspeed (O/S) terminal to the OEL (oil) terminal eliminates the need for adding an extra relay for overspeed shutdown.

Oil Pressure Switch Time Delay Parameter

With this parameter a delay of 1 to 15 seconds can be programmed for oil pressure switch override. This feature gives the engine a certain amount of time to build up oil pressure during engine start prior to monitoring for shutdown.

This parameter is required only when the MSS-200 is used in solo mode and when the oil pressure parameter #12 is programmed to either a normally open or normally closed switch contact.

Auxiliary Engine Monitor Parameter

This parameter programs the MSS-200 controller to either a stand-alone application (solo) or to an application utilizing an optional engine shutdown device, i.e., EP-100, MC-536 or MC-6K.

OPERATION (AUTO MODE)

Duration of Start By Frequency Parameter

The MSS-200 will disengage the starter motor when the engine has reached a certain programmed frequency via the frequency terminal of the alternator or proximity switch (PNP).

This feature not only disengages the starter motor, but it is also used as a safety feature by preventing the engine from starting when the controller senses RPM.

Considering that a starter motor typically disengages at 500 RPM, use the following calculation below using an engine with a 6 pole pair alternator and a belt ratio of 2:X where:

$$X = \frac{6 \times 500 \times 2}{60 \text{ Seconds}} = \frac{6000}{60} = 100 \text{ Hz}$$

Pump Overspeed Shutdown (Course) Parameter

- Parameters 20, 22, and 24 provide overspeed shutdown for variable speed pump applications.

EXAMPLE: 1800 RPM Engine Engagement

$$X = \frac{6 \times 1800 \times 2}{60 \text{ Seconds}} = \frac{21600}{60} = 360 \text{ Hz}$$

- For parameter 20 select the next smaller number calculated. In our example we calculated 360 Hz. The next smaller number on the programming table is 240 Hz. Press the AUTO button until the LED pattern matches the **240 Hz** value.

Pressing the **OFF/SET** button (Figure 26) saves the programmed value and moves you to parameter 22.

PRESS TO SAVE VALUE

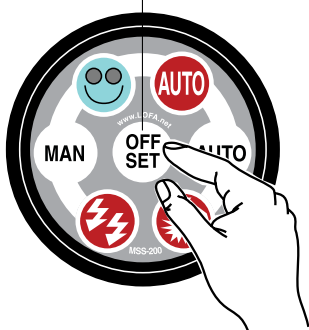


Figure 26. SET Button (Saving Data)

Pump Overspeed Shutdown (Medium) Parameter

Subtract the frequency value entered in step 2 from the total frequency calculated from step 1.

EXAMPLE: 360-240 = 120 (Balance)

- Divide the balance by the multiplier 16. Since you can not use a fraction use the next smaller number (7) and multiply by the multiplier (16) which in this example is 112 Hz. With this example, select the LED pattern that matches **112 Hz**.

$$\frac{120}{16} = 7.5 \rightarrow 7 \times 16 = 112 \text{ Hz}$$

Pump Overspeed Shutdown (Fine) Parameter

- Subtract 360 Hz from the total sums entered in steps 1 and 2. The multiplier for step 3 equals 1 Hz. Parameter 24 would be programmed to 8 Hz.

$$240 \text{ Hz} + 112 \text{ Hz} = 352 \text{ Hz}$$

$$360 \text{ Hz} - 352 \text{ Hz} = 8 \text{ Hz}$$

Variable Speed Pump Mode Selection Parameter

- Entering a value greater than zero programs the MSS-200 controller to a constant engine speed mode. The frequency programmed in parameter 26 then becomes the overspeed shutdown frequency.

Should the engine speed mode not require overspeed protection, then parameter 26 should be programmed to the highest overspeed frequency setting available (150 Hz). Use the following 2000 RPM calculation to program overspeed for a constant engine speed application:

EXAMPLE: Calculating Overspeed (Hz)

$$\frac{6 \times 2000 \times 2}{60 \text{ Seconds}} = \frac{24000}{60} = 400 \text{ Hz}$$

Subtract 360 (total Hz of G/S in step #20, 22 and 24) from 400 Hz (Over-Speed Hz) 400 – 360 = 40 Hz. The multiplier for parameter 26 equals 10. Press the AUTO or MAN buttons until the LED pattern matches the 40 Hz value.

OPERATION (AUTO MODE)

- Programming parameter 26 to zero programs the MSS-200 for variable speed pump application with overspeed. The frequency programmed in parameters 20, 22 and 26 then become the RPM at which the engine will shutdown.

NOTICE

When the MSS-200 is programmed in **pump mode** overspeed shutdown delay becomes a fixed zero second delay.

Engine Warm Up Duration Parameter

When the application is a variable speed pump with overspeed, this parameter can be used as a warm-up period from 8 to 38 seconds in 2 second increments.

Standby Mode Parameter

Standby mode on the MSS-200 can be programmed to either to consume electricity or to consume no electricity. In the standby mode that **consumes electricity**, the controller is activated by a ground contact to the **AUTO** terminal and deactivated when ground from the **AUTO** terminal is removed.

During standby mode, the top right **AUTO LED** (Figure 27) is lit indicating that the unit is in standby mode.

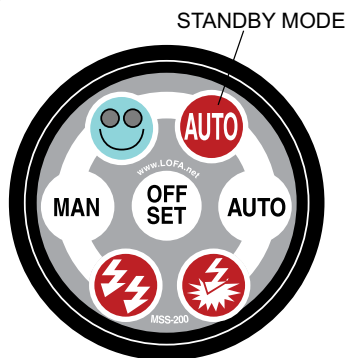


Figure 27. Standby Mode (Auto)

In the standby mode that **does not consume electricity**, the MSS-200 is activated when the unit receives a battery plus signal. When battery positive signal is removed, the engine will shut down immediately.

Basic Operation

The MSS-200 can be controlled directly from the face of the MSS-200 controller by simply pushing either **MAN OFF/SET**, and **AUTO** buttons (Figure 28).

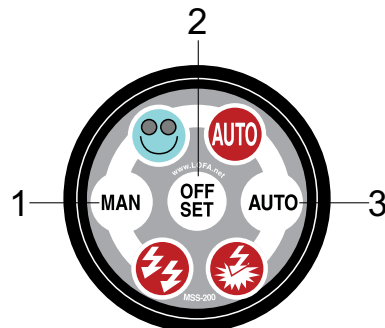


Figure 28. MSS-200 Control Buttons

Only when the MSS-200 is powered up and parameter 30 (standby mode) has been programmed to consume electricity will the **AUTO** and **MAN** buttons control the engine. Pressing the **MAN** button manually starts the engine. Engine will continue to run until the **OFF/SET** button is pressed again or until the power is turned off.

If parameter 10 (cool down cycle) is programmed with a cool down cycle time, pressing the **OFF/SET** button once will start the cool down cycle. Pressing the **OFF/SET** button again will override the cool down cycle and the engine will shut down immediately.

Pressing the **AUTO** button (Figure 29) will cause the **AUTO LED** to light up, indicating that the engine is in standby mode.

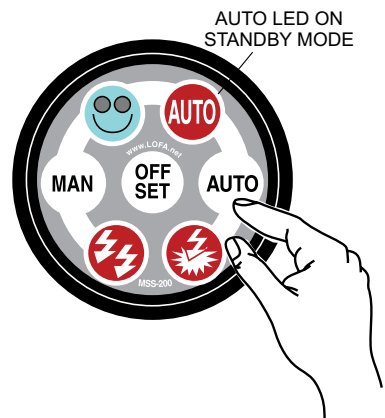


Figure 29. Auto LED ON (Standby Mode)

NOTICE

If the **AUTO LED** is not lit or flashing the engine will not start automatically.

OPERATION (AUTO MODE)

NOTICE

A blinking **AUTO LED** (Figure 30) during power up indicates that the **auto start** input was activated and prevents the engine from starting.

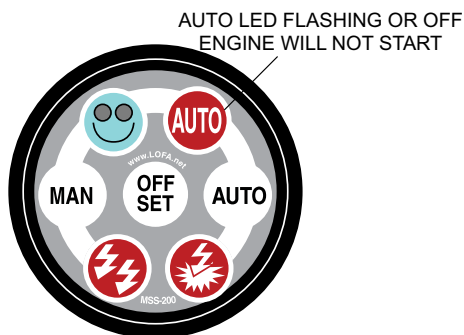


Figure 30. Auto LED Blinking/OFF

LED Status

Table 10 shows the status of the LED's when programming.

Table 10. LED Definitions	
LED Status	Description
	Indicates a flashing LED and identifies the parameter being programmed.
	Indicates LED is ON , and identifies the value of the parameter.
	Indicates LED is OFF .

NOTICE

There are 15 programmable parameters (Table 11). These parameters can be displayed on the controller in a binary pattern. Reference Table 12 (Programming Guide) on how to program the parameters.

Controller Display

The controller display face has 4 LEDs. Each LED has a dual function. Function number 1 is to display the indicated parameter Function number 2 is to display the set value of the indicated parameter.

Example Function 1

As shown in Figure 31, parameter 6 (**cool-down cycle**) has been selected LEDs 2 and 4 are blinking.

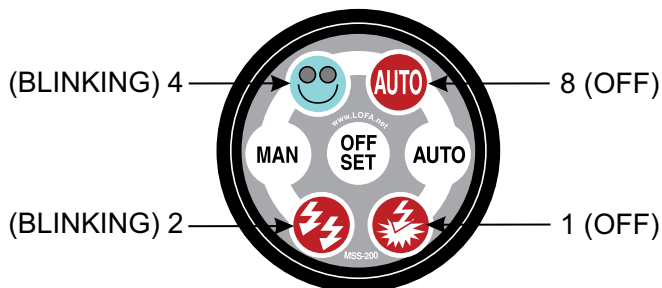


Figure 31. Parameter 6 Selection

Example Function 2

The cool-down cycle now needs to have a time duration (0~900 seconds) programmed into the controller. To accomplish this press the **AUTO** button on the controller until 2 bottom LEDs are on (Figure 32).

This produces a value of 3. This value multiplied by 60 (reference Table 12, engine cool-down) produces a total cool-down duration period of 300 seconds (5 minutes). Press the OFF/SET button to enter the value into the controller.

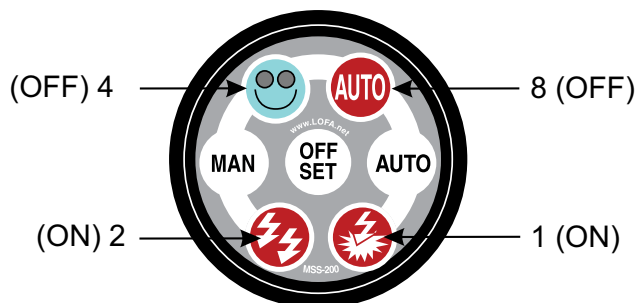


Figure 32. Parameter 6 Value

Table 11. Programmable Parameters								
LED's	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①
Parameter	Preheat 0-60 Sec. or Ambient Temp.	Number Repeated Starts 0-15	Pause Between Repeated Starts 5-75 Seconds	Overcrank 2-30 Seconds or Frequency	N/A	Engine Cool-Down Cycle 0-900 Seconds	Oil Pressure Switch NC, NO, No Switch	Oil Pressure Delay Override 1-15 Sec.
LED's	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①	④ ⑧ ② ①
Parameter	Auxiliary Engine Monitor EP100, MC536, Solo	Starter Motor Disengage Hz.	Turn On Throttle Control, Compressor etc.	Overspeed Shutdown Hz	Overspeed Shutdown Delay Seconds	Engine Warm-Up Duration 8-38 Seconds	Standby Mode Consume Electricity Yes/No	Pass Code #3 Digit 0-15

PROGRAMMING

1. Programming is accomplished by holding down the **OFF/SET** button (Figure 33) on the MSS-200 for 2 seconds while energizing the controller. Energizing the MSS-200 controller is accomplished by turning the ignition key to the left position marked "**Auto Start**".

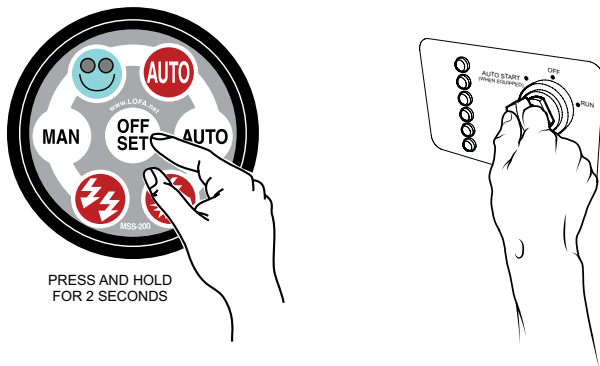


Figure 33. MSS-200 Controller Initialization

2. Releasing the **OFF/SET** button will bring you to **parameter 0, preheat duration** indicated by the flashing of LED 1 (Figure 34).

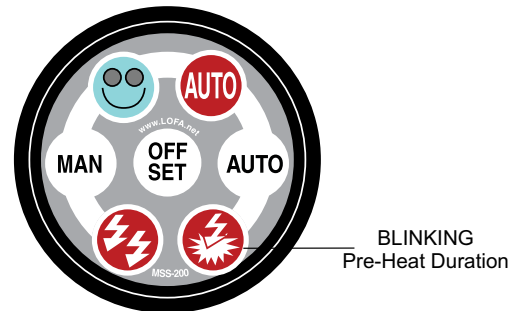


Figure 34. Pre-Heat Duration (Blinking)

3. Pushing the **OFF/SET** button moves to each parameter in ascending order and saves the programmed value. The **MAN** button decreases the programmed value while the **AUTO** button increases the programmed value.

NOTICE

The cool-down cycle and manual start functions can not be used in the consumes-no-electricity mode.

PROGRAMMING

Pass Code

The MSS-200 controller allows the user to input a **3-digit pass code** to prevent unauthorized personnel from changing any of the controller's parameters.

However, the factory set pass code does not prevent unauthorized personnel from changing any of the controller's parameters. Entering a user-defined pass code for the first time requires entering the factory-set pass code of **0, 0, 0**.

Entering Factory Pass Code (First Time)

1. Push the **AUTO** and **OFF/SET** buttons at the same time while turning the ignition key to the auto position.
2. As soon as the two buttons are released, LED 1 blinks indicating **pass-code digit 1**.

NOTICE

Please note that the **LED 1** indication is the same as the preheat duration parameter; however since the **AUTO** and **MAN** buttons were pushed at the same time, this parameter is now **pass-code**.

3. Press the **OFF/SET** button (Figure 35) this will enter the value zero for pass code digit 1 into the controller.

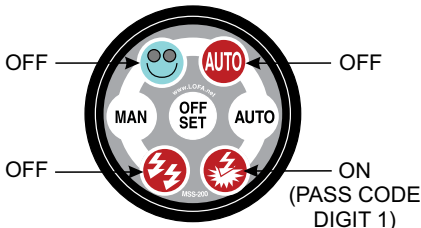


Figure 35. Pass Code Digit 1

4. Press the **OFF/SET** button (Figure 36) again this will enter the value zero for pass code digit 2 into the controller.

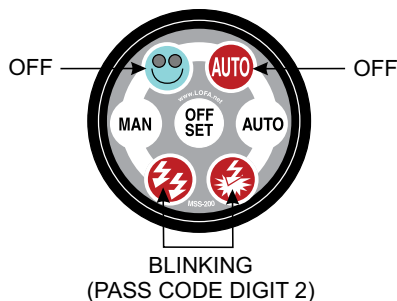


Figure 36. Pass Code Digit 2

5. Press the **OFF/SET** button (Figure 37) one last time this will enter the value zero for pass code digit 3 into the controller.

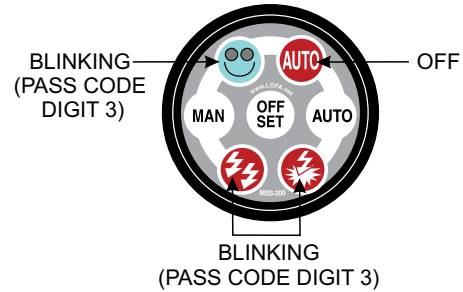


Figure 37. Pass Code Digit 3

6. Observe that **LED 1** starts blinking (Figure 34), indicating **preheat duration parameter**. From this point if you wish to enter a user defined pass code, press the **OFF/SET** button **32 times** and perform the procedure shown in Changing Factory Pass Code section in this manual.

Changing Factory Pass Code

NOTICE

See Table 12 (Programming Guide), reference steps 32, 34 and 36.

To change the factory pass code to a **user defined** pass code perform the procedure below:

1. Press the **OFF/RESET** button **32 times**. Reference steps 32, 34 and 36 (number of pushes of **OFF/SET** button) in Table 12, Program Guide.
2. Press the **OFF/SET** button and select the first pass code value (0 – 15) using the **AUTO** and **MAN** buttons.
3. Repeat this procedure until all 3 pass code numbers are entered.

End Programming

The programming mode can be terminated at any time simply by removing power from the MSS-200 or by going to the last parameter (Standby Mode, 30). As long as the **OFF/SET** button is pressed the last programmed value will be saved in memory.

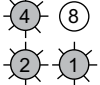
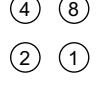
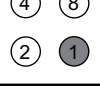
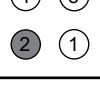
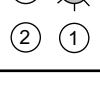
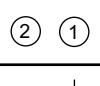
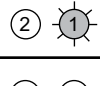
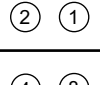
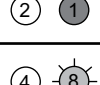
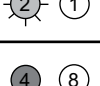
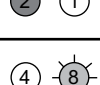
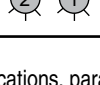
PROGRAMMING GUIDE

Reference Table 12 when programming of the MSS-200 is required.

Table 12. Programming Guide								
Number Of Pushes Of OFF/SET Button	Button To Push	Parameters	LED	Multiplier	Factory Setting	Range	Decrease Value	Increase Value
	OFF/SET Ignition Key	Turn On System						
0	OFF/SET	Preheat Duration						
	OFF/SET	Input: Time Seconds		4	0 Seconds	0~60 Seconds	(-) MAN	(+) AUTO
2	OFF/SET	Repeated Starts						
	OFF/SET	Input: Number Starts		1	3	0~15	(-) MAN	(+) AUTO
4	OFF/SET	Pause Between Starts						
	OFF/SET	Input: Time Seconds		5	5 Seconds	5~75 Seconds	(-) MAN	(+) AUTO
6	OFF/SET	Overcrank						
	OFF/SET	Input: Time Seconds		2	10 Seconds	2~30 Seconds	(-) MAN	(+) AUTO
10	OFF/SET	Engine Cool-Down Cycle						
	OFF/SET	Input: Time Seconds		60	0 Seconds	0~900 Seconds	(-) MAN	(+) AUTO

PROGRAMMING GUIDE

Table 12. Programming Guide (Continued)












Number Of Pushes Of OFF/SET Button	Button To Push	Parameters	LED	Multiplier	Factory Setting	Range	Decrease Value	Increase Value
12	OFF/SET	Oil Pressure Switch						
	OFF/SET	Input: Type		None	None	0-1-2		
	OFF/SET			Normally Closed (NC)		0-1-2	(-) MAN	(+) AUTO
	OFF/SET			Normally Open (NO)		0-1-2	(-) MAN	(+) AUTO
14	OFF/SET	Oil Pressure Delay						
	OFF/SET	Input: Time Seconds		1	8		(-) MAN	(+) AUTO
16	OFF/SET	Aux. Engine Monitoring						
	OFF/SET	Solo				0-1		
	OFF/SET	Option Engine Monitoring Device			Optional Device	0-1	(-) MAN	(+) AUTO
18	OFF/SET	Duration Of Start By Freq. (Alt./Pickup)						
	OFF/SET	Input: Frequency (Hz)		16	96 Hz	1~240 Hz	(-) MAN	(+) AUTO
20 Coarse RPM Setting, Step 1	OFF/SET	Pump Mode Overspeed						

Note:

For over speed shutdown for variable speed pump applications, parameter 26 must be programmed to zero "PUMP MODE". In pump mode overspeed shutdown delay is a fixed zero second delay.

PROGRAMMING GUIDE







Table 12. Programming Guide (Continued)

Number Of Pushes Of OFF/SET Button	Button To Push	Parameters	LED	Multiplier	Factory Setting	Range	Decrease Value	Increase Value
22 Medium RPM Setting, Step 2	OFF/SET	Pump Mode Overspeed						
	OFF/SET	Input: Frequency (Hz)		16	0 Hz	1~240 Hz	(-) MAN	(+) AUTO
24 Fine RPM Setting, Step 3	OFF/SET	Pump Mode Overspeed		1	0 Hz			
	OFF/SET	Input: Frequency (Hz)		1	0 Hz	1~15Hz	(-) MAN	(+) AUTO
26	OFF/SET	Pump Mode						
	OFF/SET	Pump Mode			Pump Mode		(-) MAN	(+) AUTO
28	OFF/SET	Pump Mode Warm-up Period (Sec.)		Refer To Parameter 26				
	OFF/SET	Input: Time Seconds				0-1		
30	OFF/SET	Standby Mode		2	8 sec	8~38 Seconds	(-) MAN	(+) AUTO
	OFF/SET	Consumes no electricity. Immediate Start With Current					(-) MAN	(+) AUTO
	OFF/SET	Consumes Electricity.		Manual or automatic start when system is grounded			(-) MAN	(+) AUTO

PROGRAMMING GUIDE









Table 12. Programming Guide (Continued)

Note:
When the MS-200 is programmed in STANDBY MODE which does not consume electricity, the AUTO input terminal on the MSS-200 must be connected to a ground at all times.

Number Of Pushes Of OFF/SET Button	Button To Push	Parameters	LED	Multiplier	Factory Setting	Range	Decrease Value	Increase Value
32	OFF/SET	Pass Code						
	OFF/SET	Input: First Digit Value		1	0	0~15	(-) MAN	(+) AUTO
34	OFF/SET	Pass Code						
	OFF/SET	Input: Second Digit Value		1	0	0~15	(-) MAN	(+) AUTO
36	OFF/SET	Pass Code						
	OFF/SET	Input: Third Digit Value		1	0	0~15	(-) MAN	(+) AUTO







MSS-200 DIAGNOSTICS (AUTO MODE)

Reference Table 13 for a brief explanation of the LED status indicators when MSS-200 is in AUTO mode.

Table 13. MSS-200 LED Status Auto Mode	
LED's	Description
	Automatic self test. The MSS-200 is turned on. System is energized.
	MSS-200 is awaiting start signal via ground (switch contact is open). Changing to manual start mode is possible by pressing the OFF/SET and then the MAN button.
	Switch contact was closed while energizing the system. Pushing the AUTO or OFF/SET then MAN button will start engine.
	Engine is preheating.
	Engine is starting.
	Engine is in repeated start mode.
	Engine is running. The AUTO LED is lit indicating that the engine was started automatically by grounding the AUTO terminal.
	While the engine was running, the switch contact was closed or the OFF/SET button was pushed one time. Engine is in the cooling down cycle.







MSS-200 DIAGNOSTICS (MANUAL MODE)

Reference Table 14 for a brief explanation of the LED status indicators when MSS-200 is in MANUAL mode.

Table 14. MSS-200 LED Status Manual Mode	
LED's	Description
	Automatic self test. The MSS-200 is turned on. System is energized.
	The MSS-200 is in off position and is awaiting a manual start signal Pushing MAN button will start engine. Changing to AUTO mode is possible by pressing the AUTO button.
	Engine is preheating.
	Engine is starting.
	Engine is running via the manual mode. If programmed engine will go into cool down cycle when the OFF/SET button is pushed 1 time. Engine will stop immediately when the OFF/SET button is pushed 2 times.
	Engine is the cooling down cycle. Engine will shut down after it runs without a load for the programmed amount of time.

MSS-200 TROUBLESHOOTING

Reference Table 15 for basic troubleshooting solutions.

Table 15. MSS-200 Troubleshooting			
LED's	Symptom	Possible Problem	Solution
	No oil pressure or over-speed	O/S to Oel jumper wire not connected?	Check jumper wire from O/S to Oel terminal.
	Defective alternator or pick-up, wire breakage or V-Belt breakage.	MS-200 is not receiving a frequency signal?	Check wiring (input signal)
	Engine did not reach the set engine speed within 30 seconds	Is programmed value correct?	Re-program value
	Cannot read sensor inputs.	Electrical short, wire breakage, or defective transistor?	Check wiring, sensor components.
	Incorrect alternator or oil pressure switch reading	Is programmed value correct?	Re-program value
	All engine start attempts failed.	Defective fuel filter? Empty fuel tank?	Clean or replace fuel filter. Check fuel level.

MAINTENANCE (PUMP)

PUMP MAINTENANCE

To ensure longer pump life and service, please follow the pump maintenance guidelines as listed in Table 16 and on preceding pages.

Table 16. Pump Maintenance	
Interval	Check
Daily	Check bearing housing.
	Check mechanical seal oil reservoir.
	Check vacuum pump seal oil reservoir.
	Check water level in vacuum system and anti-freeze concentration for weather conditions.
	Check for leaks and kinks in discharge hose.
	Check pump volute. Flush with clean water.
	Check strainer.
Every 250 Hours	Check if water is clean and anti-freeze is right for conditions in vacuum system.
	Check oil reservoirs for bearings, pump seal and vacuum pump seal for contamination, drain, and replace if necessary.
	Check impeller bolt for tightness.
Every 500 Hours	Flush vacuum system water tank and fill with clean water. Add antifreeze if necessary.
	Check impeller condition and clearance. Adjust clearance as needed.
Every 1000 Hours	Change oil in pump seal, pump bearing housing, and vacuum pump seal reservoirs.
	Inspect discharge check valve for wear. Replace if necessary.
Every 2000 Hours	Grease vacuum pump bearings.

DRY PUMP VACUUM TEST

- To perform the pump vacuum test do the following:
- Perform all start-up steps without installing the hoses.
- Block the suction with a plug or heavy rubber flap as shown in Figure 38. An accurate vacuum gauge should be installed in the plug or flap to check vacuum system performance and pump vacuum gauge.
- Place the ball valve on side of suction chamber in the **CLOSED** position, this will isolate the venturi.
- Start the engine and run at 1,800 RPM. Note the maximum vacuum reading.

- Shut off the engine and check the vacuum reading. The vacuum reading should be .75 to .9 bar or 25 to 27 in. hg. Vacuum reading should hold for about 3 to 10 minutes before dropping to zero.
- If vacuum reading drops fast, check for leaks and repair if necessary. Listen for leaks. If area is quiet, small air leaks should be easy to hear.

NOTICE

The vacuum test will indicate the condition on the impeller and wear ring. If this test fails, the pump must be disassembled, and the impeller and wear ring must be inspected for wear and clearance tolerances. Reference replacing the impeller procedure in the maintenance section of this manual.

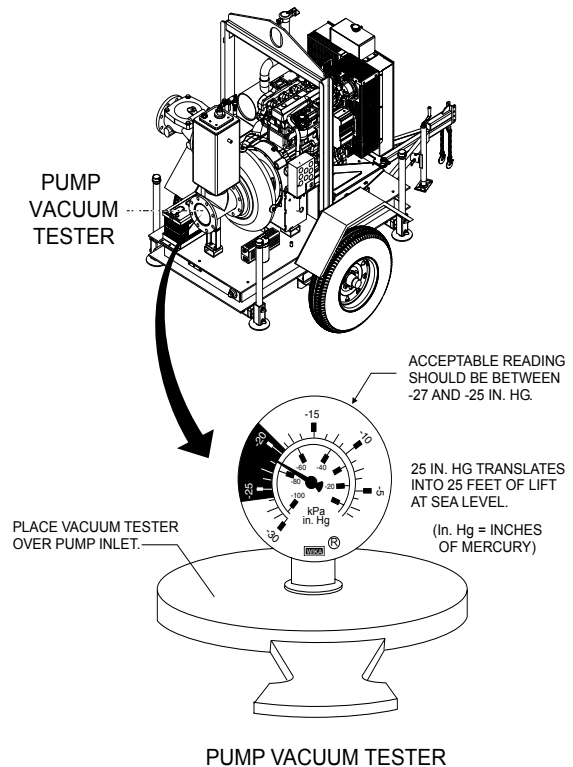


Figure 38. Dry Pump Vacuum Test

MAINTENANCE (PUMP)

NOTICE

Before attempting any maintenance procedures on the pump, **ALWAYS** disconnect the negative battery cable from the battery.

Refer to the **Pump End Assembly** drawing in the parts section of this manual for item numbers referenced in the maintenance procedures shown below and on the preceding pages.

PUMP FLUSHING

NOTICE

Proper pump care requires that the pump volute chamber be flushed with clean fresh water, to ensure that no corrosive liquids or potentially damaging particles are left inside the pump during idle periods.

1. Remove the 3 square head vent plugs (Figure 39) from the volute.

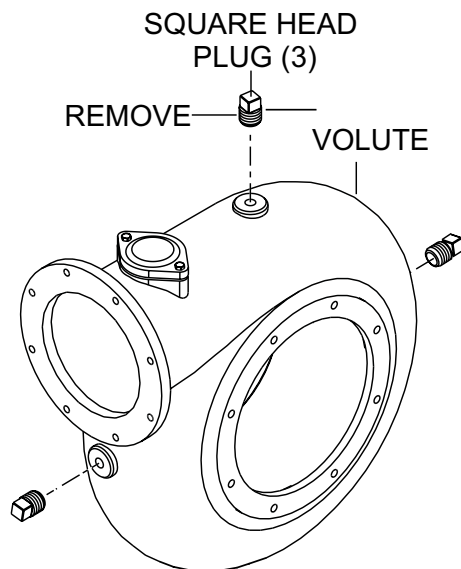


Figure 39. Plug Removal (2)

2. Remove the bolts (2) that secure the clean-out cover (Figure 40) volute casing.
3. Remove clean-out cover and o-ring.

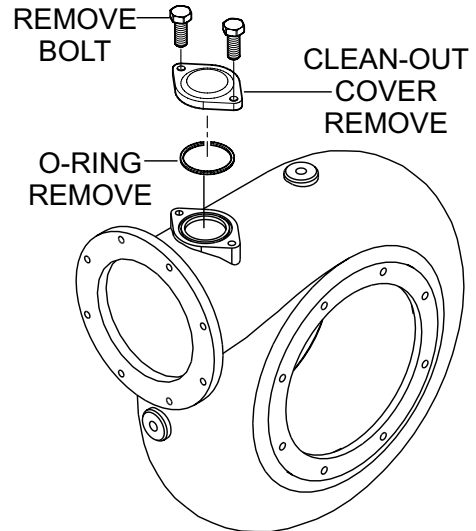


Figure 40. Clean-Out Cover Removal

4. Place the volute drain valve (Figure 41) in the **OPEN** position.

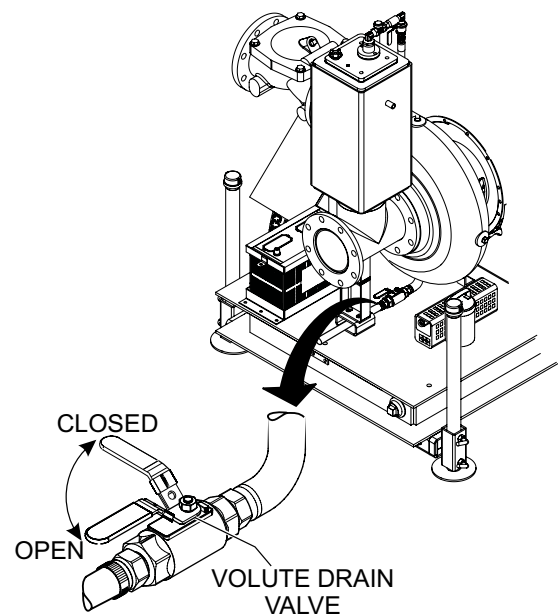


Figure 41. Volute Drain Valve (Open)

5. Flush the pump from the discharge side, using a high velocity stream of fresh water.
6. Continue flushing until clear water comes out of each drain plug, especially the bottom drain valve.
7. Reinstall the 3 square head vent plugs.
8. Reinstall the cleanout cover on the volute.
9. Place volute drain valve in the **CLOSED** position.

MAINTENANCE (PUMP)

Testing the Venturi Nozzle

1. Using a flat blade screw driver, disconnect the hose (Figure 42) connected to the suction chamber ball valve.

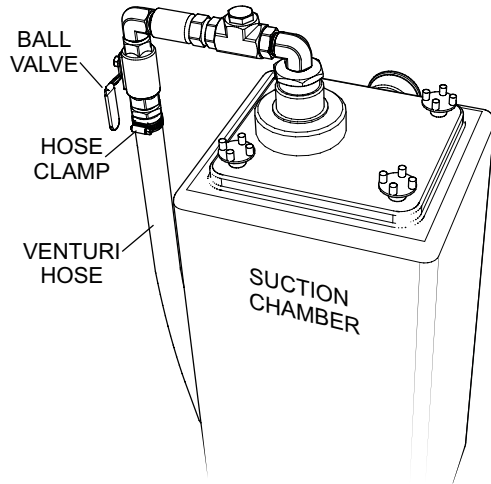


Figure 42. Venturi Hose Disconnection

2. Attach a 0 to 30 inch vacuum gauge to the free end of the venturi hose as shown in Figure 43.

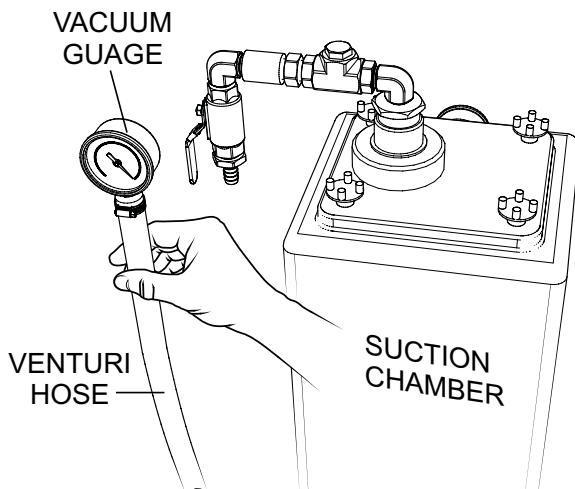


Figure 43. Vacuum Gauge

3. Start the engine. The test gauge should read 25 in. Hg.
4. If the vacuum reads 25 in. Hg or higher, then it can be assumed the pump is working correctly.
5. Stop the engine. Remove the gauge, and reconnect the venturi hose to the suction chamber ball valve.

Checking Operation of Float Assembly

1. Remove the 4 wrench nuts (Figure 44) from the top of the suction chamber.

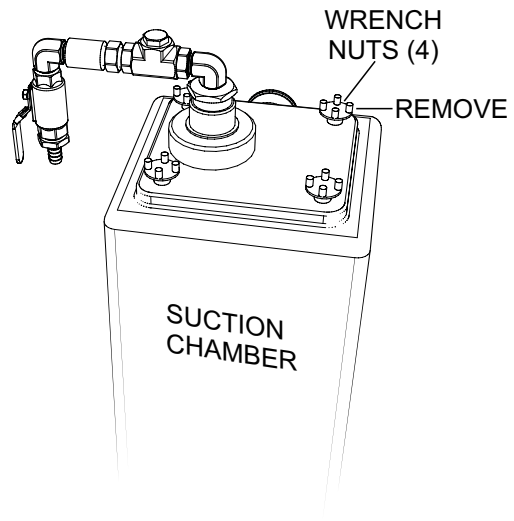


Figure 44. Wrench Nut Removal

2. Carefully remove the float assembly, and place it on top of the suction chamber, as shown in Figure 45.

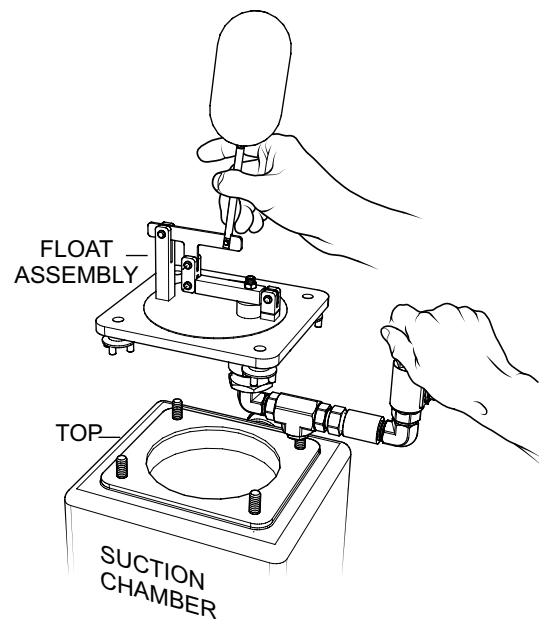


Figure 45. Float Assembly Removal

3. Measure the gap between points “A” and “B” as shown in Figure 46. This is done with the float causing the rubber bumper to rest lightly against the seat.

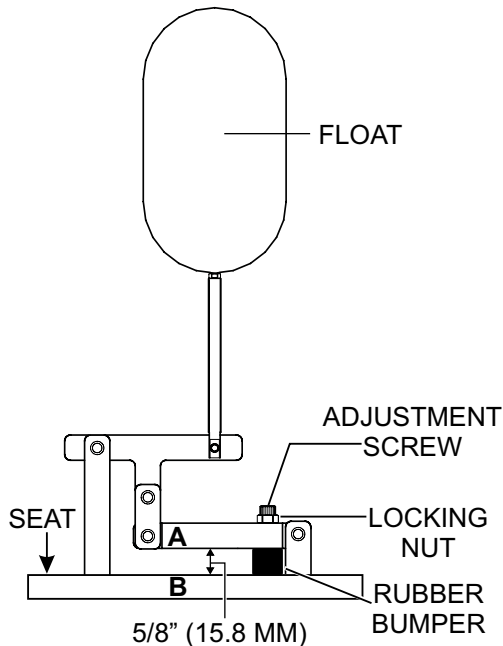


Figure 46. Float Adjustment

4. To set gap, loosen locking nut and turn adjustment screw until 5/8-inch (15.8 mm) length clearance is achieved. Replace rubber bumper if necessary to obtain this clearance.
5. Tighten locking nut.
6. Carefully reinstall the float assembly back inside the suction chamber.
7. Reinstall the 4 wrench nuts on top of the suction chamber, hand tighten wrench nuts snugly.

MAINTENANCE (ENGINE)

ENGINE MAINTENANCE

The following engine maintenance guidelines are intended to assist the operator in preventative maintenance. For a more detailed maintenance schedule refer to the *John Deere Engine Operator's Manual* supplied with the pump.

Table 17. Inspection/Maintenance		10 Hrs DAILY	250 Hrs	500 Hrs or Every 12 Months	3000 Hrs or Every 36 Months	OTHER
Engine	Check Engine Oil and Coolant Levels	X				
	Check Fuel Filter/Water Separator Bowl	X				
	Check Air Cleaner	X				
	Check Air Cleaner Element	X				
	Check for Leaks/Hoses/Clamps	X				
	Check for Loosening of Parts	X				
	Change Engine Oil and Oil Filter * 1		X			
	Clean Unit, Inside and Outside		X			
	Replace Fuel Filter Elements			X		
	Check Engine Mounts			X		
	Service Battery			X		
	Check Air Intake Hoses			X		
	Check Fan Belt Condition			X		
	Check Automatic Belt Tensioner			X		
	Check Electrical Ground Connection			X		
	Clean Radiator, Check Cooling System			X		
	Coolant Solution Analysis, Add SCA's As Required			X		
	Pressure Test Cooling System			X		
	Check Engine Speed			X		
	Test Thermostats				X	
	Check and Adjust Engine Valve Clearance				X	
	Test Glow Plugs				X	
	Flush and Refill Cooling System*2					2 yrs. or 2000 hrs.
Clean Inside of Fuel Tank					1000 hrs.	
Replace Air Cleaner Elements * 3					As Required	

*1 During initial operation of a new engine, change oil and filter between a minimum of 100 hrs. and a maximum of 250 hrs. Service interval depends on type of oil.

*2 If John Deere COOL-GARD™ John Deere COOL-GARD™ II is used, the flushing intervals may be extended. See "Testing Diesel Coolant" in engine manual.

*3 Replace primary air filter element when restriction indicator shows a vacuum of 625 mm (25 in. H₂O).

MAINTENANCE (ENGINE)

GENERAL INSPECTION

Prior to each use, the pump/engine should be cleaned and inspected for deficiencies. Check for loose, missing or damaged nuts, bolts or other fasteners. Also check for fuel, oil, and coolant leaks.

CAUTION

Certain maintenance operations or machine adjustments require specialized knowledge and skill. Attempting to perform maintenance operations or adjustments without the proper knowledge, skills or training could result in equipment damage or injury to personnel. If in doubt, consult your dealer.

WARNING



Accidental starts can cause severe injury or death.



ALWAYS place the ON/OFF switch in the OFF position.



Disconnect and ground spark plug leads and disconnect negative battery cable from battery before servicing.

WARNING



Some maintenance operations may require the engine to be run. Ensure that the maintenance area is well ventilated. Exhaust contains poisonous carbon monoxide gas that can cause unconsciousness and may result in **DEATH**

CAUTION



ALWAYS allow the engine to cool before servicing. **NEVER** attempt any maintenance work on a hot engine.

Changing Engine Oil

Change engine oil after first 20 hours of operation. Drain and refill engine crankcase with the correct type and amount oil (referenced in Table 3) after 250 hours of operation hours or once a week thereafter.

When draining engine crankcase oil, place oil into a suitable container while engine is still warm. Replace the drain plug tightly. Add oil through the filler hole.

Changing Engine Oil And Filter

Change the engine oil and filter after the first 50 hours of use, then every 6 months or 250 hours. Refer to Table 3 for recommended oil viscosity.

1. Prepare a waste oil collector to drain the oil into.
2. Remove the oil filler cap while draining the oil to allow the engine to drain easily.
3. Remove the drain plug to drain the oil.
4. After oil is sufficiently drained, securely tighten the drain plug.
5. Using a filter wrench, turn the oil filter counterclockwise to remove.
6. Clean sealing surface on engine where filter mounts.
7. Coat the seal of the new oil filter (Figure 47) with clean engine oil. Install new filter first by hand until it contacts the engine sealing surface. Tighten it another 3/4 turn using the filter wrench.

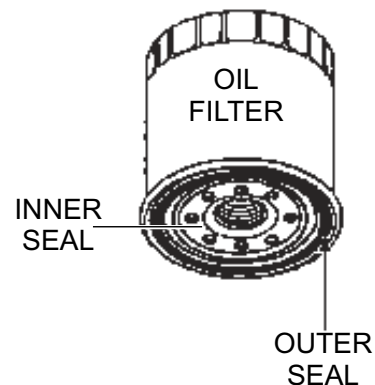


Figure 47. Oil Filter

MAINTENANCE (ENGINE)

8. Fill engine crankcase with high quality detergent oil classified. Fill to the upper limit of dipstick. **DO NOT** overfill. Reference Table 3 for crankcase oil capacity.
9. Run the engine briefly for several minutes. Watch for oil leakage. Shut the engine down and allow it to sit for several minutes. Top off the oil to the upper limit on the dipstick.

Fuel Water Separator Bowl

1. Inspect fuel water separator bowl (Figure 48) daily. If the bowl has collected a significant amount of water and sediment at the bottom of the bowl, it should be drained off.

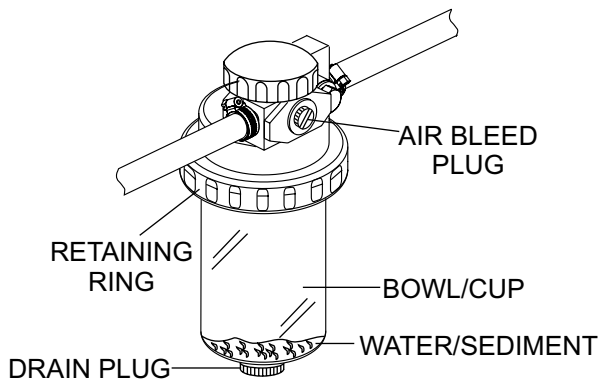


Figure 48. Fuel Water Separator

2. Loosen drain plug at bottom of bowl.
3. Loosen air bleed plug two full turns and drain water from bottom until fuel starts to drain out.
4. When fuel starts to drain out, tighten drain plugs securely.
5. After draining water from the fuel water separator, the fuel system must be primed by bleeding air from the fuel system. Referer to your John Deere Operator's Manual, "Bleeding Fuel System".

In-Line Fuel Filter

NOTICE

When reinstalling fuel filters, please note the arrows indicating the direction of fuel flow.

Replace the engine in-line fuel filter (Figure 49) every year or 300 hours.

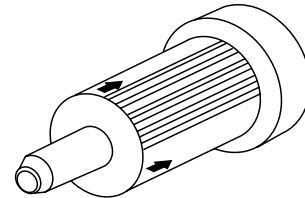


Figure 49. In-Line Fuel Filter

Air Filter (250 Hours)

CAUTION



Wear protective equipment such as approved safety glasses or face shields and dust masks or respirators when cleaning air filters with compressed air.

Air Cleaner

1. Release the latches (AP6 only) located on either side of the air cleaner dust pan. Remove the dust pan and both the primary and secondary air filters
2. Turn the air filter cover release knob (AP8 only) counterclockwise and remove air cleaner cover. Remove the wing nut and primary air filter element
3. Check the air cleaner daily or before starting the engine
4. Check for and correct heavy buildup of dirt and debris along with loose or damaged components.

NOTICE

Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

MAINTENANCE (ENGINE)

- To clean the main element (paper air filter) as referenced in (Figure 50), tap the filter element several times on a hard surface to remove dirt, or blow compressed air from the inside out (not to exceed 30 psi (207 kPa, 2.1 kgf/cm²).

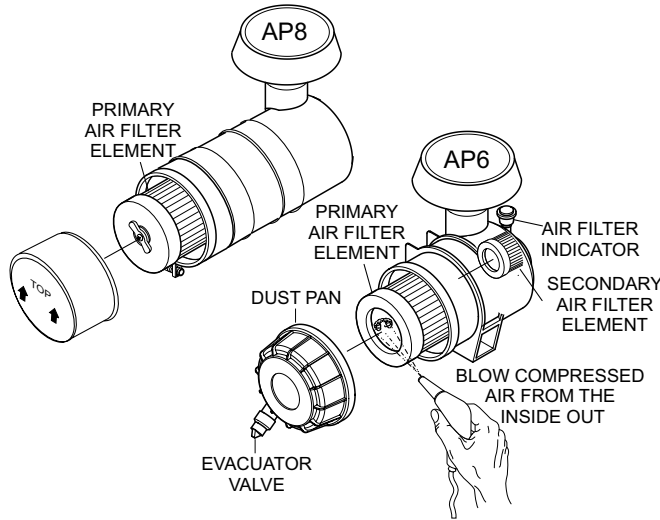


Figure 50. Air Filter

NOTICE

DO NOT use excessive air pressure or the paper air filter element will be damaged and will need to be replaced. The filter can be cleaned and reused for up to six times if properly cleaned. Replace air filter if rips or tears are detected while cleaning.

- Replace the element if it is damaged or excessively dirty.
- Clean the inside of the dust pan.
- Reinstall the element or if equipped, the precleaner over the paper air cleaner element.
- Reinstall the air cleaner dust pan and secure the latches.

NOTICE

DO NOT run the engine with the air cleaner removed or without an element.

Air Filter Dust Indicator

NOTICE

The air filter should not be changed until the indicator reads "RED". Dispose of old air filter. It may not be cleaned or reused.

The air filter indicator (Figure 51) is attached to the air filter. When the air filter element is clogged, air intake restriction becomes greater and the air filter indicator signal shows **RED**. When indicator is red, replace filter immediately. After changing the air filter, press the air filter indicator button to reset.

PUSH BUTTON TO RESET

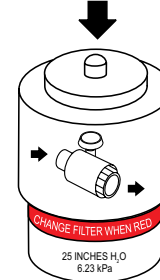


Figure 51. Air Filter Dust Indicator

Drive Belt Tension

A slack drive belt may contribute to overheating, or to insufficient charging of the battery, adjust drive belt in accordance with the John Deere Operator's manual

Drive Belt inspection

Inspect the drive belt (Figure 52) for damage and wear. Horizontal (across the belt) cracks are acceptable. Vertical (direction of belt ribs) cracks that intersect with horizontal cracks are not acceptable.

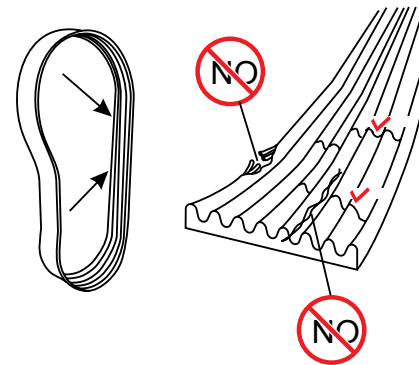


Figure 52. Drive Belt Inspection

If the drive belt is frayed, punctured, or material is missing **DO NOT** use drive belt.

MAINTENANCE (ENGINE)

Radiator/Cooling System

Coolant (Antifreeze/Summer Coolant/Water)

John Deere recommends antifreeze/summer coolant for use in their engines, which can be purchased in concentrate (and mixed with 50% demineralized water) or pre-diluted. See the **John Deere Operator's Manual** for further details.

WARNING



If adding coolant/antifreeze mix to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. The possibility of **hot!** coolant exists which can cause severe burns.

Day-to-day addition of coolant is done via the radiator. When adding coolant to the radiator, **DO NOT** remove the radiator cap until the unit has completely cooled. Reference Table 3 for coolant capacity.

Operation in Freezing Weather

When operating in freezing weather, be certain the proper amount of antifreeze has been added.

Table 18. Anti-Freeze Operating Temperatures

Vol % Anti- Freeze	Freezing Point		Boiling Point	
	°C	°F	°C	°F
50	-37	-34	108	226

Flushing Radiator and Replacing Coolant

1. Remove radiator cap.
2. Open radiator drain cock located at the bottom of the radiator and drain coolant into a suitable container.
3. Check hoses for softening and kinks. Check clamps for signs of leakage.
4. Flush the radiator by running clean tap water through radiator until signs of rust and dirt are removed. **DO NOT** clean radiator core with any objects, such as a screwdriver.
5. Replace with coolant as recommended by the engine manufacturer.
6. Tighten drain cock and close radiator cap tightly.

Radiator Maintenance

1. Check radiator for leaks that would indicate corrosion or damage.
2. Check coolant level daily. Top off as necessary. Always use recommended coolant/antifreeze. Use the mixing ratios specified by the coolant/antifreeze manufacturer or reference Table 18. Replace coolant/antifreeze at least once a year.
3. Check radiator hoses for fatigue or cracking. Replace any defective hoses immediately.
4. Check radiator cap seal and replace as necessary.
5. Blow off dirt and dust from fins and radiator with 28 psi (193 kPa) or less of compressed air (Figure 53) Be careful not to damage the fins with the compressed air.

NOTICE

When using a high pressure washer, stand at least 5 feet (1.5 meters) away from the radiator to prevent damage to the fins.

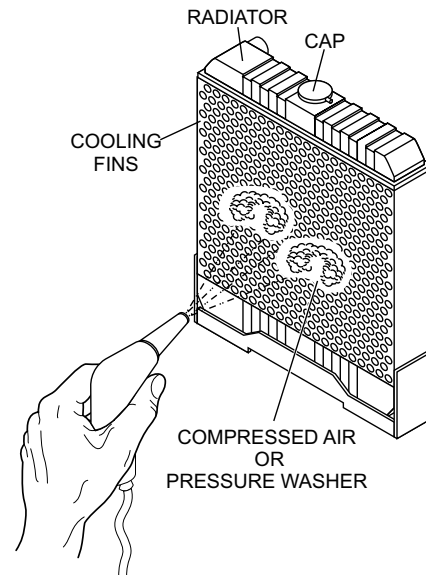


Figure 53. Radiator Cleaning

NOTICE

NEVER use high-pressure water or compressed air at greater than 28 psi (193 kPa) or a wire brush to clean the radiator fins. Radiator fins damage easily.

6. If there is a large amount of contamination on the fins, use detergent to clean and rinse thoroughly with tap water.

MAINTENANCE (ENGINE)

Removing Water from the Fuel Tank

After prolonged use, water and other impurities accumulate in the bottom of the tank. Occasionally inspect the fuel tank for water contamination and drain the contents if required.

During cold weather, the more empty volume inside the tank, the easier it is for water to condense. This can be reduced by keeping the tank full with diesel fuel.

Cleaning Inside the Fuel Tank

Drain the fuel inside the fuel tank completely. Using a spray washer (Figure 54) wash out any deposits or debris that have accumulated inside the fuel tank.

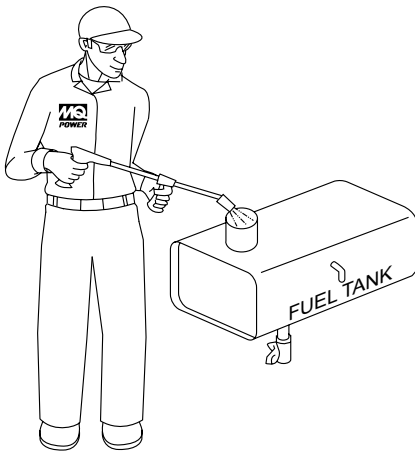


Figure 54. Fuel Tank Cleaning

Battery Maintenance

! DANGER

Use all safety precautions specified by the battery manufacturer when working with the battery.



Flammable, explosive gas. (produces hydrogen gas while charging or during operation). Keep area around battery well ventilated and keep from any fire source.



Battery electrolyte contains corrosive, toxic chemical. (dilute sulfuric acid). Avoid contact with eyes and skin.



Shock or Fire due to electric short-circuit. Disconnect battery cables before inspecting electrical system and never "spark" battery terminals to test for charge.

Mishandling of the battery shortens the service life of the battery and adds to maintenance cost. When handling the battery do the following:

- Be careful not to let the battery electrolyte come in contact with your body or clothing.
- **ALWAYS** wear eye protection and rubber gloves, since the battery contains sulfuric acid which burns skin and eats through clothing.

! CAUTION

Battery Safety

Wear safety glasses or face mask, protective clothes, and rubber gloves when working with battery.



- **ALWAYS** check the battery terminals periodically to ensure that they are in good condition.
- Use wire brush or sand paper to clean the battery terminals.
- **ALWAYS** check battery for cracks or any other damage. If white pattern appears inside the battery or paste has accumulated at the bottom, replace the battery.
- **NEVER** attempt to charge a battery that is frozen. The battery can explode unless first allowed to thaw.
- If the pump will not be in operation for a long period of time, store in cool dry place and check the battery charge level every month to maintain the performance of the battery.

MAINTENANCE (TRAILER)

The following trailer maintenance guidelines are intended to assist the operator in preventive maintenance.

TRAILER BRAKES

Properly functioning brake shoes and drums are essential to ensure safety. The brakes should be inspected the first 200 miles of operation. This will allow the brake shoes and drums to seat properly. After the first 200 mile interval, inspect the brakes every 3,000 miles. If driving over rough terrain, inspect the brakes more frequently.

ELECTRIC BRAKES

Electrically actuated brake (Figure 55) are similar to hydraulic brakes. The basic difference is that hydraulic brakes are actuated by an electromagnet. Listed below are some of the advantages that electric brakes have over hydraulic brakes:

- Brake system can be manually adjusted to provide the corrected braking capability for varying road and load conditions.
- Brake system can be modulated to provide more or less braking force, thus easing the brake load on the towing vehicle.
- Brake system has very little lag time between the time the vehicle's brakes are actuated and the trailer's brakes are actuated.
- Brake system can provide an independent emergency brake system.

Remember in order to properly synchronize the tow vehicle's braking to the trailer's braking, can only be accomplished by road testing. Brake lockup, grabbiness or harshness is due to lack of synchronization between the tow vehicle and the trailer being towed or under-adjusted brakes.

Before any brake synchronizations adjustments can be made, the trailer brakes should be burnished-in by applying the brakes 20-30 times with approximately a 20 mph decrease in speed, e.g. 40 mph to 20 mph.

Allow ample time for brakes to cool between application. This allows the brake shoes to slightly be seated into the brake drum surface.

Figure 55 displays the major electric brake components that will require inspection and maintenance. Please inspect

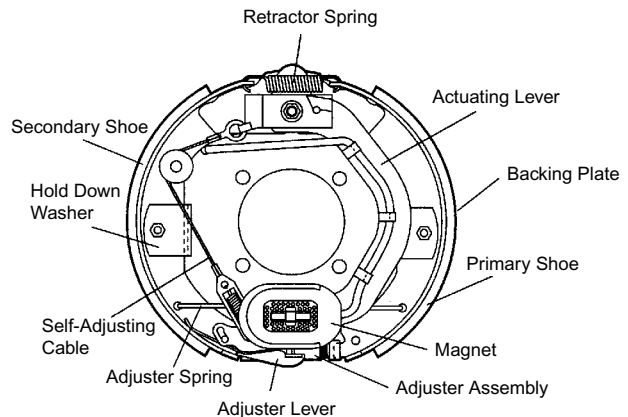


Figure 55. Electric Brake Component

BREAKAWAY BRAKE

Breakaway Battery

This battery supplies the power to operate the trailer brakes if the trailer uncouples from the tow vehicle. Be sure to check, maintain and replace the battery according to the battery manufacturer instructions.

Breakaway Switch

This switch causes the breakaway battery to operate the electric brakes if the trailer uncouples from the tow vehicle. The pull cable for the pull pin is connected to the tow vehicle, and the switch is connected to the trailer.

To check for proper functioning of the switch, battery and brakes, you must pull the pin from the switch and confirm that the brakes apply to each wheel. You can do this by trying to pull the trailer with the tow vehicle, after pulling the pin. The trailer brakes may not lock, but you will notice that a greater force is needed to pull the trailer.

WARNING

If electric breakaway brakes do not operate when trailer is uncoupled from the tow vehicle, death or serious injury can occur.

Check emergency breakaway brake system **BEFORE** each tow.

MAINTENANCE (TRAILER)

TOW VEHICLE OPERATED ELECTRIC BRAKES

The electric brakes that operate in conjunction with the tow vehicle brakes must be “synchronized” so that braking is properly distributed to the tow vehicle brakes and the trailer brakes.

For proper operation and synchronization, read and follow the axle/brake and the brake controller manufacturers’ instructions. To make certain an electrically-operated braking system will function properly, you must have your dealer inspect the magnets at least once a year, or each 12,000 miles. See the brake manual for wear and current inspection instructions.

If brakes are not working correctly reference Table 19.

Table 19. Electric Brake Troubleshooting		
Symptom	Possible Cause	Solution
No Brakes or Intermittent Brakes	Open circuits or broken wires?	Find and correct.
	Short circuits?	Find and correct.
	Faulty controller?	Find and correct.
	Loose connections?	Find and correct.
	Ground wire secure?	Find and correct.
Weak Brakes or Brakes Pull to One Side	Grease or oil on magnets or linings?	Clean or replace.
	Connections corroded?	Clean and correct cause of corrosion.
	Brake drums scored or grooved?	Machine or replace.
	Brakes synchronized?	Correct.
Locking Brakes	Brake components loose, bent or broken?	Replace Components.
	Brake drums out-of-round?	Replace.
Noisy Brakes	System lubricated?	Lubricate.
	Brake components correct?	Replace and correct.
Dragging Brakes	Brake lining thickness incorrect or not adjusted correctly?	Install new shoes and lining.
	Wheel bearings adjusted correctly?	Adjust.

ADJUSTABLE CHANNEL

Your trailer may be equipped with an adjustable channel (Figure 56) that allows the coupler to be raised or lowered to a desired height. Periodically check the channel bolts for damage or loosening.

NOTICE

When replacing channel mounting hardware (nuts, bolts and washers), **NEVER** substitute substandard hardware. Pay close attention to **bolt length** and **grade**. **ALWAYS** use manufacturer's recommended parts when replacing channel mounting hardware.

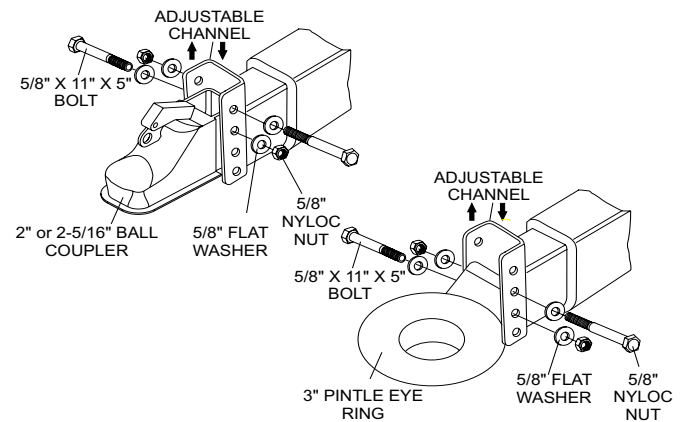


Figure 56. Adjustable Channel

Wheel Bearings

Wheel bearings (Figure 57) must be inspected and lubricated once a year or 12,000 miles to insure safe operation of your trailer.

If trailer wheel bearings are immersed in water, they must be replaced.

! DANGER

If trailer wheels are under water for a long period of time, wheel bearings may fail. If this is the case, service wheel bearings immediately.

The possibility exists of the wheels falling off causing equipment damage and severe bodily harm even death!

MAINTENANCE (TRAILER)

If the trailer has not been used for an extended amount of time, have the bearings inspected and packed more frequently, at least every six months and prior to use.

Follow the steps below to disassemble the wheel hub and service the wheel bearings. See Figure 57

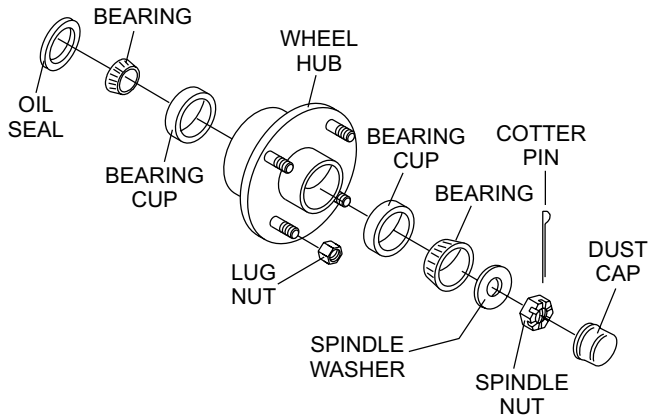


Figure 57. Wheel Hub Components

- After removing the dust cap, cotter pin, spindle nut and spindle washer, remove the hub to inspect the bearings for wear and damage.
- Replace bearings that have flat spots on rollers, broken roller cages, rust or pitting. Always replace bearings and cups in sets. The inner and outer bearings are to be replaced at the same time.
- Replace seals that have nicks, tears or wear.
- Lubricate the bearings with a high quality EP-2 automotive wheel bearing grease.

WHEEL HUB ADJUSTMENT

Every time the wheel hub is removed and the bearings are reassembled, follow the steps below to check the wheel bearings for free running and adjust.

- Turn the hub slowly, by hand, while tightening the spindle nut until you can no longer turn the hub by hand.
- Loosen the spindle nut just until you are able to turn it (the spindle nut) by hand. Do not turn the hub while the spindle nut is loose.
- Install a new cotter pin through the spindle nut and axle.
- Check the adjustments. Both the hub and the spindle nut should be able to move freely (the spindle nut motion will be limited by the cotter pin).

! DANGER

NEVER crawl under the trailer unless it is on firm and level ground and resting on properly placed and secured jack stands.

The possibility exists of the trailer falling thus causing equipment damage and severe bodily harm even death!

! DANGER

When performing trailer inspection and maintenance activities, you must jack up the trailer using jacks and jack stands.

When jacking and using jack stands, place them so as to clear wiring, brake lines, and suspension parts (i.e., springs, torsion bars). Place jacks and jack stands inside of the perimeter strip on the supporting structure to which the axles are attached.

! DANGER

Improper weld repair will lead to early failure of the trailer structure and can cause serious injury or death.

DO NOT repair cracked or broken welds unless you have a certified welder perform the repair. If not, have the welds repaired by your dealer.

! WARNING

If the trailer is involved in an accident, have it inspected immediately by qualified personnel. In addition, the trailer should be inspected annually for signs of wear or deformations.

The leaf suspension springs and associated components (Figure 58) should be visually inspected every 6,000 miles for signs of excessive wear, elongation of bolt holes, and loosening of fasteners. Replace all damaged parts (suspension) immediately.

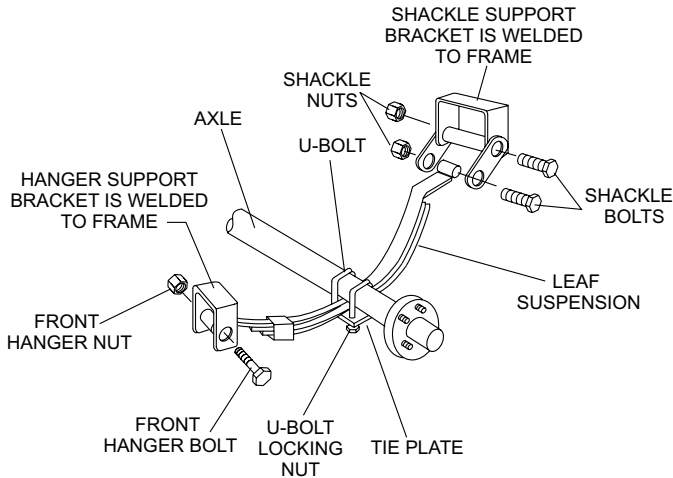


Figure 58. Leaf Suspension Components

⚠ DANGER

Worn or broken suspension parts can cause loss of control, damage to equipment and severe bodily injury, even death!

Check suspension regularly.

TRAILER SAFETY GUIDELINES

The following guidelines are intended to assist the operator in the operation and handling of a trailer.

Safety precautions should be followed at all times when operating a trailer. Failure to read, understand and follow the safety guidelines could result in injury to yourself and others. Loss of control of the trailer or tow vehicle can result in death or serious injury.

COMMON CAUSES FOR LOSS OF TRAILER

- Driving too fast for the conditions (maximum speed when towing a trailer is 55 mph).
- Overloading the trailer or loading the trailer unevenly.
- Trailer improperly coupled to the hitch.
- No braking on trailer.
- Not maintaining proper tire pressure.
- Not keeping lug nuts tight.
- Not properly maintaining the trailer structure.
- Ensure machine is towed level to tow vehicle.

TRAILER TOWING GUIDELINES

- Recheck the load tiedowns to make sure the load will not shift during towing.
- Before towing, check coupling, safety chain, safety brake, tires, wheels and lights.
- Check the lug nuts or bolts for tightness.
- Check coupler tightness after towing 50 miles.
- Use your mirrors to verify that you have room to change lanes or pull into traffic.
- Use your turn signals well in advance. Allow plenty of stopping space for your trailer and tow vehicle.
- Allow plenty of stopping space for your trailer and tow vehicle.
- **DO NOT** drive so fast that the trailer begins to sway due to speed.
- Allow plenty of room for passing. A rule of thumb is that the passing distance with a trailer is 4 times the passing distance without the trailer.

- Shift your automatic transmission into a lower gear for city driving.
- **ALWAYS** use lower gears for climbing and descending grades.
- **DO NOT** ride the brakes while descending grades, they may get so hot that they stop working. Then you will potentially have a runaway tow vehicle and trailer.
- To conserve fuel, don't use full throttle to climb a hill. Instead, build speed on the approach.
- Slow down for bumps in the road. Take your foot off the brake when crossing the bump.
- **DO NOT** brake while in a curve unless absolutely necessary. Instead, slow down before you enter the curve and power through the curve. This way, the towing vehicle remains in charge.
- **DO NOT** apply the brakes to correct extreme trailer swaying. Continued pulling of the trailer, and even slight acceleration, will provide a stabilizing force.
- Anticipate the trailer "swaying." Swaying is the trailer reaction to the air pressure wave caused by passing trucks and buses. Continued pulling of the trailer provides a stabilizing force to correct swaying. **DO NOT** apply the brakes to correct trailer swaying.
- Use lower gear when driving down steep or long grades. Use the engine and transmission as a brake. Do not ride the brakes, as they can overheat and become ineffective.
- Be aware of your trailer height, especially when approaching roofed areas and around trees.
- Make regular stops, about once each hour. Confirm that:
 - Coupler is secure to the hitch and is locked.
 - Electrical connectors are secure.
 - There is appropriate slack in the safety chains.
 - There is appropriate slack in the breakaway switch pullpin cable.
 - Tires are not visibly low on pressure.

TRAILER SAFETY GUIDELINES

INOPERABLE BRAKES, LIGHTS OR MIRRORS

Be sure that the brakes and all of the lights on your trailer are functioning properly before towing your trailer. Check the trailer taillights by turning on your tow vehicle headlights. Check the trailer brake lights by having someone step on the tow vehicle brake pedal while you look at trailer lights. Do the same thing to check the turn signal lights. See Trailer Wiring Diagram section in this manual.

Standard mirrors usually do not provide adequate visibility for viewing traffic to the sides and rear of a towed trailer. You must provide mirrors that allow you to safely observe approaching traffic.

WARNING

Improper electrical connection between the tow vehicle and the trailer will result in inoperable lights and can lead to collision.

Before each tow, check that the tail lights, brake lights and turn signals work.

TRAILER TOWING TIPS

Driving a vehicle with a trailer in tow is vastly different from driving the same vehicle without a trailer in tow. Acceleration, maneuverability and braking are all diminished with a trailer in tow.

It takes longer to get up to speed, you need more room to turn and pass, and more distance to stop when towing a trailer. You will need to spend time adjusting to the different feel and maneuverability of the tow vehicle with a loaded trailer.

Because of the significant differences in all aspects of maneuverability when towing a trailer, the hazards and risks of injury are also much greater than when driving without a trailer. You are responsible for keeping your vehicle and trailer in control, and for all the damage that is caused if you lose control of your vehicle and trailer.

As you did when learning to drive an automobile, find an open area with little or no traffic for your first practice trailering. Of course, before you start towing the trailer, you must follow all of the instructions for inspection, testing, loading and coupling. Also, before you start towing, adjust the mirrors so you can see the trailer as well as the area to the rear of it.

Drive slowly at first, 5 mph or so, and turn the wheel to get the feel of how the tow vehicle and trailer combination responds. Next, make some right and left hand turns. Watch in your side mirrors to see how the trailer follows the tow vehicle. Turning with a trailer attached requires more room.

Stop the rig a few times from speeds no greater than 10 mph. If your trailer is equipped with brakes, try using different combinations of trailer brake and tow vehicle brake. Note the effect that the trailer brakes have when they are the only brakes used. When properly adjusted, the trailer brakes will come on just before the tow vehicle brakes.

It will take practice to learn how to back up a tow vehicle with a trailer attached. Take it slow. Before backing up, get out of the tow vehicle and look behind the trailer to make sure that there are no obstacles.

Some drivers place their hands at the bottom of the steering wheel, and while the tow vehicle is in reverse, “think” of the hands as being on the top of the wheel. When the hands move to the right (counterclockwise, as you would do to turn the tow vehicle to the left when moving forward), the rear of the trailer moves to the right. Conversely, rotating the steering wheel clockwise with your hands at the bottom of the wheel will move the rear of the trailer to the left while backing up.

If you are towing a bumper hitch rig, be careful not to allow the trailer to turn too much because it will hit the rear of the tow vehicle. To straighten the rig, either pull forward or turn the steering wheel in the opposite direction.

TRAILER VIN TAG

Figure A below is a sample of the Vehicle Identification Number (VIN) Tag which is typically located on the left front of the trailer. See Figure B for location.

MANUFACTURED BY / FABRIQUE PAR:		DATE:	
GAWR / PNEV	KG (LB)	
GAWR (EACH AXLE) / PNEV (CHAQUE ESSIEU)	KG (LB)	TIRES / PNEUS
RIMS / JANTES			
COLD INFL. PRESS. / PRESS. DE GONFL. A FROID	RPA (PSI / LPSI <input checked="" type="checkbox"/> SINGLE <input type="checkbox"/> DUAL
THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S. FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.			
THIS VEHICLE CONFORMS TO ALL APPLICABLE STANDARDS PRESCRIBED UNDER THE CANADIAN MOTOR VEHICLE SAFETY REGULATIONS IN EFFECT ON THE DATE OF MANUFACTURE. - CE VEHICULE EST CONFORME A TOUTES LES NORMES QUI SONT APPLICABLES EN VERTU DU REGLEMENT SUR LA SECURITE DES VEHICULES AUTOMOBILES DU CANADA EN VIGUEUR A LA DATE DE SA FABRICATION.			
V.I.N. / N.I.V.:		TYPE / TYPE: TRAILER TRA / REM	FD-306 REV A

Figure A. Vehicle VIN Tag

TRAILER SAFETY GUIDELINES

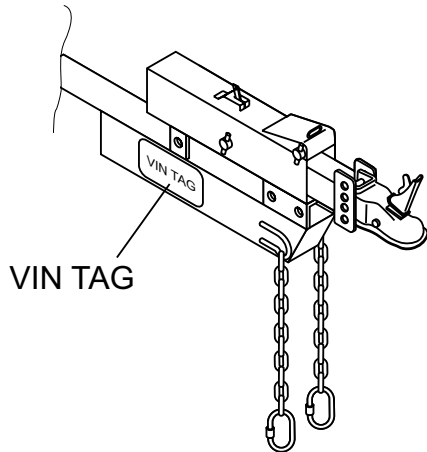


Figure B. VIN Tag Location

The trailer VIN Tag contains the following critical safety information for the use of your trailer.

GAWR: The maximum gross weight that an axle can support. It is the lowest of axle, wheel, or tire rating.

Usually, the tire or wheel rating is lower than the axle rating, and determines GAWR.

GVWR: The maximum allowable gross weight of the trailer and its contents. The gross weight of the trailer includes the weight of the trailer and all of the items within it. GVWR is sometimes referred to as GTWR (Gross Trailer Weight Rating), or MGTW (Maximum Gross Trailer Weight). GVWR, GTWR and MGTW are all the same rating.

The sum total of the GAWR for all trailer axles may be less than the GVWR for the trailer, because some of the trailer load is to be carried by the tow vehicle, rather than by the trailer axle(s). The total weight of the cargo and trailer must not exceed the GVWR, and the load on an axle must not exceed its GAWR.

PSIC: The tire pressure (psi) measured when cold.

VIN: The Vehicle Identification Number.

EMPTY WEIGHT: Some information that comes with the trailer (such as the Manufacturer's Statement of Origin) is not a reliable source for "empty" or "net" weight. The shipping documents list average or standard weights and your trailer may be equipped with options.

To determine the "empty" or "net" weight of your trailer, weigh it on an axle scale. To find the weight of the trailer using an axle scale, you must know the axle weights of your tow vehicle without the trailer coupled. Some of the trailer weight will be transferred from the trailer to the tow vehicle axles, and an axle scale weighs all axles, including the tow vehicle axles.

TOW VEHICLE

The towing hitch attached to your tow vehicle must have a capacity equal to or greater than the load rating of the trailer you intend to tow. The hitch capacity must also be matched to the tow vehicle capacity. Your vehicle dealer can provide and install the proper hitch on your tow vehicle.

SUSPENSION SYSTEM

Sway bars, shock absorbers, heavy duty springs, heavy duty tires and other suspension components may be required to sufficiently tow the trailer and pump.

BRAKE CONTROLLER

For trailers equipped with electric brakes, the electric brake controller is part of the tow vehicle and is essential in the operation of the electric brakes on the trailer. The brake controller is not the same as the safety breakaway brake system that may be equipped on the trailer.

SIDE VIEW MIRRORS

The size of the trailer that is being towed and your state law regulations determine the size of the mirrors. However, some states prohibit extended mirrors on a tow vehicle, except while a trailer is actually being towed. In this situation, detachable extended mirrors are necessary. Check with your dealer or the appropriate state agency for mirror requirements.

HEAVY DUTY FLASHER

A Heavy Duty Flasher is an electrical component that may be required when your trailer turn signal lights are attached to the tow vehicle flasher circuit.

ELECTRICAL CONNECTOR

An Electrical Connector connects the light and brake systems on the trailer to the light and brake controls on the towing vehicle.

TRAILER SAFETY GUIDELINES

EMERGENCY FLARES AND TRIANGLE REFLECTORS

It is wise to carry these warning devices even if you are not towing a trailer. It is particularly important to have these when towing a trailer because the hazard flashers of your towing vehicle will not operate for as long a period of time when the battery is running both the trailer lights and tow vehicle lights.

SAFETY CHAINS

If the coupler connection comes loose, the safety chains can keep the trailer attached to the tow vehicle. With properly rigged safety chains, it is possible to keep the tongue of the trailer from digging into the road pavement, even if the coupler-to-hitch connection comes apart.

TRAILER LIGHTING AND BRAKING CONNECTOR

A device that connects electrical power from the tow vehicle to the trailer. Electricity is used to turn on brake lights, running lights, and turn signals as required. In addition, if your trailer has a separate braking system, the electrical connector will also supply power to the brakes from the tow vehicle.

BREAKAWAY SYSTEM

If the trailer coupler connection comes loose, the breakaway system can actuate emergency hydraulic brakes depending on the type of actuator on the trailer. The breakaway cable must be rigged to the tow vehicle with appropriate slack that will activate the system if the coupler connection comes loose.

JACKSTAND

A device on the trailer that is used to raise and lower the coupler. The jack is sometimes called the “landing gear” or the “tongue jack”.

COUPLER TYPES

Two types of coupler used with the trailer are discussed below.

- Ball Hitch Coupler
- Pintel Eye Coupler

BALL HITCH COUPLER

A ball hitch coupler (Figure C) connects to a ball that is located on or under the rear bumper of tow vehicle. This system of coupling a trailer to a tow vehicle is sometimes referred to as “bumper pull.”

A ball hitch trailer may be fitted with a tongue jack that can raise and lower the coupler. The tongue jack is mounted to the A-frame (front or tongue) part of the trailer. By rotating the jack handle clockwise, the jack will extend and raise the tongue of the trailer.

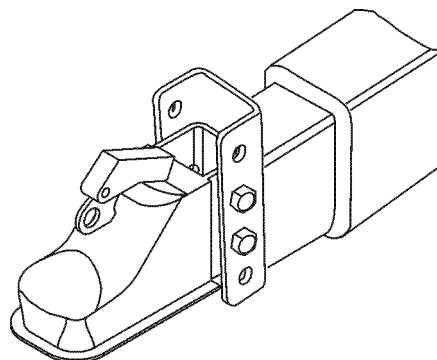


Figure C. Ball Hitch Coupler

Before each tow, coat the ball with a thin layer of automotive bearing grease to reduce wear and ensure proper operation. Check the locking device that secures the coupler to the ball for proper operation.

If you see or feel evidence of wear, such as flat spots, deformations, pitting or corrosion, on the ball or coupler, immediately have your dealer inspect them to determine the proper action to prevent possible failure of the ball and coupler system. All bent or broken coupler parts must be replaced before towing the trailer.

The coupler handle lever must be able to rotate freely and automatically snap into the latched position. Oil the pivot points, sliding surfaces, and spring ends with SAE 30W motor oil. Keep the ball socket and latch mechanism clean. Dirt or contamination can prevent proper operation of the latching mechanism.

The load rating of the coupler and the necessary ball size are listed on the trailer tongue. You must provide a hitch and ball for your tow vehicle where the load rating of the hitch and ball is equal to or greater than that of your trailer.

Also, the ball size must be the same as the coupler size. If the hitch ball is too small, too large, is underrated, is loose

TRAILER SAFETY GUIDELINES

or is worn, the trailer can come loose from the tow vehicle and may cause death or serious injury.

THE TOW VEHICLE, HITCH AND BALL MUST HAVE A RATED TOWING CAPACITY EQUAL TO OR GREATER THAN THE TRAILER **Gross Vehicle Weight Rating (GVWR)**. IT IS ESSENTIAL THAT THE HITCH BALL BE OF THE SAME SIZE AS THE COUPLER.

The ball size and load rating (capacity) are marked on the ball. Hitch capacity is marked on the hitch.

⚠ WARNING

Coupler-to-hitch mismatch can result in uncoupling, leading to death or serious injury.

Be sure the **LOAD RATING** of the hitch ball is equal or greater than the load rating of the coupler.

Be sure the **SIZE** of the hitch ball matches the size of the ball coupler.

⚠ WARNING

A worn, cracked or corroded hitch ball can fail while towing and may result in death or serious injury.

Before coupling trailer, inspect the hitch ball for wear, corrosion and cracks.

Replace worn or damaged hitch ball.

⚠ WARNING

A loose hitchball nut can result in uncoupling, leading to death or serious injury.

Be sure the hitch ball is tight to the hitch before coupling the trailer.

- Rock the ball to make sure it is tightened to the hitch, and visually check that the hitch ball nut is solid against the lock washer and hitch frame.
- Wipe the inside and outside of the coupler. Clean and visually inspect it for cracks and deformations. Feel the inside of the coupler for worn spots and pits.
- Be sure the coupler is secured tightly to the tongue of the trailer. All coupler fasteners must be visibly solid against the trailer frame.
- The bottom surface of the coupler must be above the top of the hitch ball. Use the tongue jackstand to support

the trailer tongue. Wood or concrete blocks may also be used.

Coupling the Trailer to the Tow Vehicle (Ball Coupler)

- Lubricate the hitch ball and the inside of the coupler with a thin layer of automotive bearing grease.
- Slowly back up the tow vehicle so that the hitch ball is near or aligned under the coupler.
- Using the jackstand at the front of trailer (tongue), turn the jackstand crank handle to raise the trailer. If the ball coupler does not line up with the hitch ball, adjust the position of the tow vehicle.
- Open the coupler locking mechanism. Ball couplers have a locking mechanism with an internal moving piece and an outside handle. In the open position, the coupler is able to drop fully onto the hitch ball.
- Lower the trailer (Figure D) until the coupler fully engages the hitch ball.

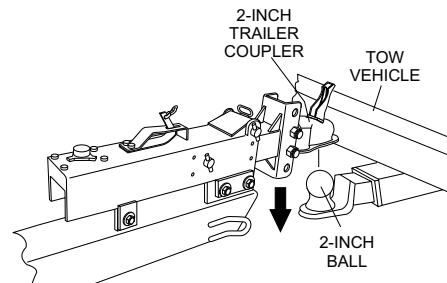


Figure D. Ball Hitch Coupling Mechanism

- Engage the coupler locking mechanism. In the engaged position, the locking mechanism securely holds the coupler to the hitch ball.
- Insert a pin or lock through the hole in the locking mechanism.
- Be sure the coupler is all the way on the hitch ball and the locking mechanism is engaged. A properly engaged locking mechanism will allow the coupler to raise the rear of the tow vehicle. Using the trailer jackstand, verify that you can raise the rear of the tow vehicle by 1 inch after the coupler is locked to the hitch.
- Lower the trailer so that its entire tongue weight is held by the hitch.
- Raise the jackstand to a height where it will not interfere with the road.

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NOTICE

Overloading can damage the tongue jack. **DO NOT** use the tongue jack to raise the tow vehicle more than one inch.

If the coupler cannot be secured to the hitch ball, do not tow the trailer. Call your dealer for assistance. Lower the trailer so that its entire tongue weight is held by the hitch and continue retracting the jack to its fully retracted position.

Attaching Safety Chain

Visually inspect the safety chains and hooks for wear or damage. Replace worn or damaged safety chains and hooks before towing.

Attach the safety chains so that they:

- Cross underneath the coupler. See Figure E.

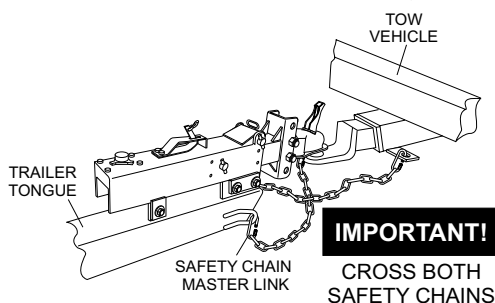


Figure E. Attaching Safety Chain (Ball Hitch)

- Loop around a frame member of the tow vehicle or holes provided in the hitch system (DO NOT attach them to an interchangeable part of the hitch assembly).
- Have enough slack to permit tight turns, but not be close to the road surface, so if the trailer uncouples, the safety chains can hold the tongue up above the road

WARNING

Improper rigging of the safety chains can result in loss of control of the trailer and tow vehicle, leading to death or serious injury, if the trailer uncouples from the tow vehicle.

- Fasten chains to frame of tow vehicle. DO NOT fasten chains to any part of the hitch unless the hitch has holes or loops specifically for that purpose.
- Cross chains underneath hitch and coupler with enough slack to permit turning and to hold tongue up, if the trailer comes loose.

Breakaway Brake System

If the coupler or hitch fails, a properly connected and working breakaway brake system (Figure F) will apply the hydraulic brakes on the trailer. The safety chains will keep the tow vehicle attached and as the brakes are applied at the trailer's axles, the trailer/tow vehicle combination will come to a controlled stop.

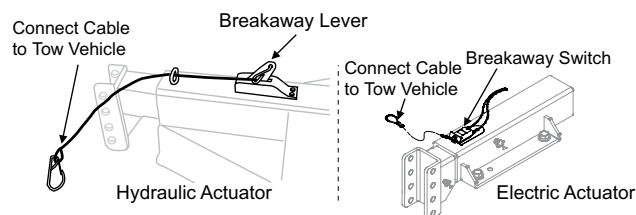


Figure F. Breakaway Brake System

Breakaway Cable Surge Brake System

The breakaway brake system includes a brake cable connected to the tow vehicle on one end and to the emergency brake lever located on the hydraulic actuator on the other end.

WARNING

- An ineffective breakaway brake system can result in a runaway trailer, leading to death or serious injury, if the coupler or ball hitch fails.
- Connect the breakaway cable to the tow vehicle and NOT to the hitch, ball or support.
- Before towing the trailer, test the function of the breakaway brake system. If the breakaway brake system is not working, DO NOT tow the trailer. Have it serviced or repaired.

NOTICE

DO NOT tow the trailer with the breakaway brake system ON because the brakes will overheat which can result in permanent brake failure.

NOTICE

Replace the breakaway brake battery (if equipped) at intervals specified by manufacturer.

TRAILER SAFETY GUIDELINES

Connecting Trailer Lights

Connect the trailer lights to the tow vehicle's electrical system using the electric connectors at the front of the trailer (tongue). Refer to the wiring diagram shown in the trailer wiring diagram section of this manual. Before towing the trailer check for the following:

- Running lights (turn on tow vehicle headlights).
- Brake Lights (step on tow vehicle brake pedal).
- Backup Lights (place tow vehicle gear shift in reverse).
- Turn Signals (activate tow vehicle directional signal lever).

WARNING

Improper electrical connection between the tow vehicle and the trailer will result in inoperable lights and electric brakes, and can lead to collision.

Before each tow:

- Check that the taillights, brake lights and turn signals work.
- Check that the electric brakes work by operating the brake controller inside the tow vehicle.

Uncoupling the Ball Hitch

Follow these steps to uncouple ball hitch from tow vehicle:

- Block trailer tires to prevent the trailer from rolling, before jacking the trailer up.
- Disconnect the electrical connector.
- Disconnect the breakaway brake switch cable. Promptly replace the pullpin in the switchbox.
- Before extending jackstand, make certain the ground surface below the jackstand foot will support the tongue load.
- Rotate the jackstand handle (or crank) clockwise. This will slowly extend the jack and transfer the weight of the trailer tongue to the jack.

PINTLE HITCH COUPLER

A pintle eye coupler (Figure G) connects to a pintle-hook hitch that is located on or under the rear bumper of the tow vehicle. This system of coupling a trailer to a tow vehicle is sometimes referred to as a "lunette eye, tow ring or G.I. hitch."

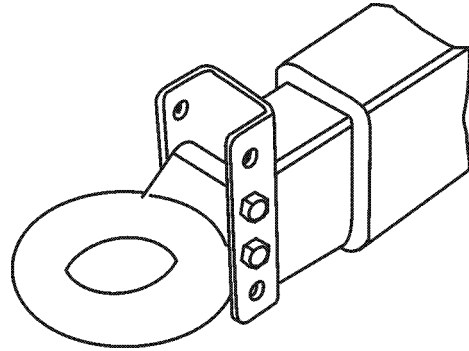


Figure G. Pintle Hitch Coupler

A pintle hitch trailer may be fitted with a tongue jackstand that can raise and lower the coupler. The tongue jack is mounted to the A-frame (front or tongue) part of the trailer. By rotating the jack handle clockwise, the jack will extend and raise the tongue of the trailer.

The load rating of the coupler and the necessary pintle hitch size are listed on the trailer tongue. You must provide a pintle hitch and pintle coupler for your tow vehicle, where the load rating of the pintle hitch and pintle coupler is equal to or greater than that of your trailer.

Also, the pintle hitch size must be the same as the pintle coupler size. If the hitch is too small, too large, underrated, loose or worn, the trailer can come loose from the tow vehicle, and may cause death or serious injury.

Pintle Coupler and Pintle Hook

Before each tow, check the locking device that secures the coupler to the pintle hook assembly.

The pintle hook lever must be able to operate freely and automatically snap into place into the latched position. Lightly oil the pivot points and sliding surfaces with SAE30W motor oil to prevent rust and help ensure proper operation of the latching mechanism.

If you see or feel evidence of wear, such as flat spots, deformations, pitting or corrosion, on the pintle hook or coupler, immediately have your dealer inspect them to determine the proper action to prevent possible failure of

TRAILER SAFETY GUIDELINES

the ball and coupler system. All bent or broken coupler parts must be replaced before towing the trailer.

THE TOW VEHICLE, PINTLE HITCH AND PINTLE COUPLER MUST HAVE A RATED TOWING CAPACITY EQUAL TO OR GREATER THAN THE TRAILER **Gross Vehicle Weight Rating (GVWR)**.

IT IS ESSENTIAL THAT THE PINTLE HITCH BE OF THE SAME SIZE AS THE PINTLE COUPLER.

The coupler size and load rating (capacity) are marked on the coupler. Hitch capacity is marked on the hitch.

WARNING

Coupler-to-hitch mismatch can result in uncoupling, leading to death or serious injury.

Be sure the **LOAD RATING** of the pintle hitch hook is equal or greater than the load rating of the pintle eye coupler.

Be sure the **SIZE** of the pintle hitch hook matches the size of the pintle eye coupler.

WARNING

A worn, cracked or corroded pintle hitch hook can fail while towing, and may result in death or serious injury.

Before coupling trailer, inspect the pintle hitch hook for wear, corrosion and cracks.

Replace worn or damaged pintle hitch hook.

- Rock the pintle eye coupler to make sure it is secured tightly to the hitch.
- Wipe the inside and outside of the pintle coupler. Clean and inspect it visually for cracks and deformations. Feel the inside of the coupler for worn spots and pits.
- Be sure the coupler is secured tightly to the tongue of the trailer. All coupler fasteners must be visibly solid against the trailer frame.
- Raise the bottom surface of the coupler to be above the top of the pintle hitch hook. Use the tongue jackstand to support the trailer tongue. Wood or concrete blocks may also be used.

WARNING

A defective pintle hitch not properly fastened can result in uncoupling, leading to death or serious injury.

Be sure the pintle hook is securely tightened to the tow vehicle before coupling the trailer.

Coupling Trailer to Tow Vehicle (Pintle Coupler)

- Slowly back up the tow vehicle so that the pintle hitch hook is near or aligned under the pintle eye ring coupler.
- Using the jackstand at the front of trailer (tongue), turn the jackstand crank handle to raise the trailer. If the pintle eye coupler does not line up with the pintle hitch hook, adjust the position of the tow vehicle.
- **OPEN** the pintle hook locking mechanism (Figure H). Place the hook inside the eye coupler. **CLOSE** the pintle hook mechanism.

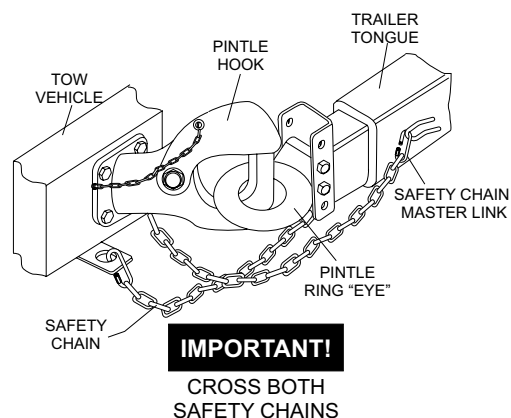


Figure H. Attaching Safety Chain (Pintle Hitch)

- Insert a pin or lock through the hole in the locking mechanism.
- Be sure the pintle hook is inserted completely through the eye ring and the locking mechanism is engaged. A properly engaged locking mechanism will allow the coupler to raise the rear of the tow vehicle. Using the trailer jack, test to see that you can raise the rear of the tow vehicle by 1-inch after the coupler is locked to the hitch.
- Lower the trailer so that its entire tongue weight is held by the hitch.
- Raise the jackstand to a height where it will not interfere with the road.

TRAILER SAFETY GUIDELINES

TIRE SAFETY

Unsafe Tires, Lug Nuts or Wheels

Trailer tires and wheels are more likely to fail than car tires and wheels because they carry a heavier load. Therefore, it is essential to inspect the trailer tires before each tow.

If a tire has a bald spot, bulge, cuts, is showing any cords, or is cracked, replace the tire before towing. If a tire has uneven tread wear, take the trailer to a dealer service center for diagnosis.

Uneven tread wear can be caused by tire imbalance, axle misalignment or incorrect inflation.

Tires with too little tread will not provide adequate tracking on wet roadways and can result in loss of control, leading to death or serious injury.

Improper tire pressure causes an unstable trailer and can result in a tire blowout and loss of control. Therefore, before each tow you must also check the tire pressure. Tire pressure must be checked when tires are cold.

Allow 3 hours cool-down after driving as much as 1 mile at 40 mph before checking tire pressure. Trailer tires will be inflated to higher pressures than passenger vehicle tires.

Since trailer wheels and lug nuts (or bolts) are subjected to greater side loads than automobile wheels, they are more prone to loosen. Before each tow, check to make sure they are tight.

The proper tightness (torque) for lug nuts is listed in the lug nut tightening section of this manual. Use a torque wrench to tighten the lug nuts. If you do not have a torque wrench, use a lug wrench (from your tow vehicle) and tighten the nuts as much as you can. Then have a service garage or trailer dealer tighten the lug nuts to the proper torque.

WARNING

Metal creep between the wheel rim and lug nuts will cause rim to loosen and could result in a wheel coming off, leading to death or serious injury.

Tighten lug nuts before each tow.

Lug nuts are also prone to loosen after first being assembled. When driving a new trailer (or after wheels have been remounted), check to make sure they are tight after the first 10, 25 and 50 miles of driving and before each tow thereafter.

Failure to perform this check can result in a wheel parting from the trailer and a crash, leading to death or serious injury.

WARNING

Lug nuts are prone to loosen after initial installation, which can lead to death or serious injury.

Check lug nuts for tightness on a new trailer or when wheel(s) have been remounted after the first 10, 25 and 50 miles of driving.

WARNING

Improper lug nut torque can cause a wheel parting from the trailer, leading to death or serious injury.

Be sure lug nuts are tight before each tow.

WARNING

Improper tire pressure can result in a blowout and loss of control, which can lead to death or serious injury.

Be sure tires are inflated to pressure indicated on side wall before towing trailer.

Determining Load Limit of Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification/VIN label that is located on the forward half of the left (road) side of the unit. This certification/VIN label will indicate the trailer's Gross Vehicle Weight Rating (GVWR). This is the most weight the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a the axle can weigh.

TRAILER SAFETY GUIDELINES

There is a vehicle placard (Figure I) located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum cargo capacity.

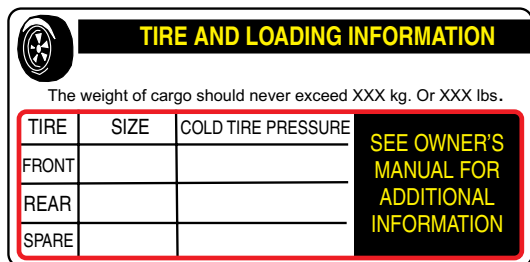


Figure I. Trailer Tire Placard

If additional work items (hoses, tools, clamps etc.) are going to be added to the trailer, be sure they are distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification/VIN label and/or on the Tire and Loading Information placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

Perform the following steps to determine the load limit of your trailer.

Step 1.

Locate the statement, “The weight of cargo should never exceed XXX kg or XXX lbs.,” on your vehicle’s Tire and Loading Information placard (Figure I). This value equals the available amount of equipment load capacity.

Step 2.

Determine the weight of the equipment being loaded on the tow vehicle. That weight may not safely exceed the available equipment load capacity. The trailer’s Tire Information Placard is attached adjacent to or near the trailer’s VIN (Certification) label at the left front of the trailer (See Figure I).

Determining Load Limit of Tow Vehicle

Step 1.

Locate the statement, “The combined weight of occupants and cargo should never exceed XXX lbs.,” on your vehicle’s placard.

Step 2.

Determine the combined weight of the driver and passengers who will be riding in your vehicle.

Step 3.

Subtract the combined weight of the driver and passengers from XXX kilograms or XXX pounds.

Step 4.

The resulting figure equals the available amount of cargo and luggage capacity. For example, if the “XXX” amount equals 1400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage capacity is 650 lbs. (1400-750 (5 x 150) = 650 lbs.).

Step 5.

Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage capacity calculated in Step 4.

If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle’s manual to determine how this weight transfer reduces the available cargo and luggage capacity of your vehicle.

Studies of tire safety show that maintaining proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards and inspecting tires for cuts, slashes and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling.
- Help protect you and others from avoidable breakdowns and accidents.
- Improve fuel economy.
- Increase the tire life.

TRAILER SAFETY GUIDELINES

Use the information contained in this section to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

TIRE FUNDAMENTALS

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires (Figure J). This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

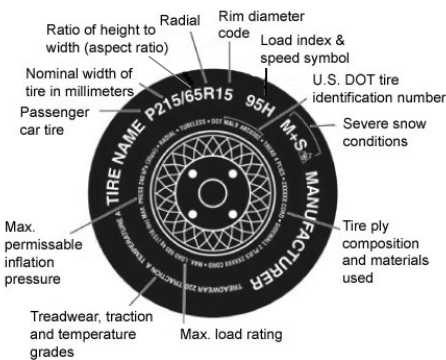


Figure J. Standard Tire Sidewall Information

P: The “P” indicates the tire is for passenger vehicles.

Next number: This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

Next number: This two-digit number, known as the aspect ratio, gives the tire’s ratio of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.

P: The “R” stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years.

Next number: This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Next number: This two- or three-digit number is the tire’s load index. It is a measurement of how much weight each tire can support. You may find this information in your owner’s manual. If not, contact a local tire dealer. *Note:* You may not find this information on all tires because it is not required by law.

M+S: The “M+S” or “M/S” indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.

Speed Rating: The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) to 186 mph. These ratings are listed in Table A. *Note:* You may not find this information on all tires because it is not required by law.

Letter Rating	Speed Rating
Q	99 mph
R	106 mph
S	112 mph
T	118 mph
U	124 mph
H	130 mph
V	149 mph
W	168* mph
Y	186* mph

U.S. DOT Tire Identification Number: This begins with the letters “DOT” and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacturer’s discretion. This information is used to contact consumers if a tire defect requires a recall.

Tire Ply Composition and Materials Used: The number of plies indicates the number of layers of rubber-coated fabric in the tire. In general, the greater the number of plies, the more weight a tire can support. Tire manufacturers also must indicate the materials in the tire, which include steel, nylon, polyester, and others.

Maximum Load Rating: This number indicates the maximum load in kilograms and pounds that can be carried by the tire.

Maximum Permissible Inflation Pressure: This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

TRAILER SAFETY GUIDELINES

Uniform Tire Quality Grading Standards (UTQGS)

Treadwear Number: This number indicates the tire's wear rate. The higher the treadwear number is, the longer it should take for the tread to wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter: This letter indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA", "A", "B", and "C".

Temperature Letter: This letter indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, underinflation or excessive loading, either separately or in combination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C".

Refer to Figure K for additional tire information for light trucks.

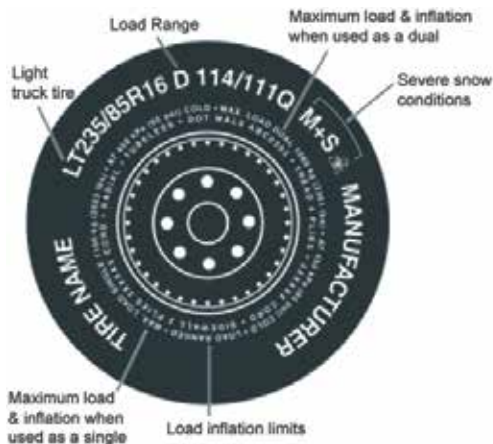


Figure K. UTQGS Tire Information

Tires for light trucks have other markings besides those found on the sidewalls of passenger tires.

LT: The "LT" indicates the tire is for light trucks or trailers.

ST: An "ST" is an indication the tire is for trailer use only.

Max. Load Dual kg (lbs) at kPa (psi) Cold: This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle).

Max. Load Single kg (lbs) at kPa (psi) Cold: This information indicates the maximum load and tire pressure when the tire is used as a single.

Load Range: This information identifies the tire's load-carrying capabilities and its inflation limits.

Tire Safety Tips

- Slow down if you have to go over a pothole or other object in the road.
- **DO NOT** run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.
- Check tire inflation pressure weekly during use to insure the maximum tire life and tread wear.
- **DO NOT** bleed air from tires when they are hot.
- Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma.
- Remove bits of glass and foreign objects wedged in the tread.
- Make sure your tire valves have valve caps.
- **ALWAYS** check tire pressure on tow vehicle and trailer before towing. Check tire pressure at least once a month.
- **DO NOT** overload tow vehicle. Check the tire information and loading placard for safe allowable tire loading conditions.

Tire Repair







The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

Replacing Worn or Damaged Tires


Replace the tire before towing the trailer if the tire treads have less than 1/16 inch depth or the telltale bands are visible. Check inflation pressure weekly during use to insure the maximum tire life and tread wear. A bubble, cut or bulge in a side wall can result in a tire blowout. Inspect both side walls of each tire for any bubble, cut or bulge; and replace a damaged tire before towing the trailer.

TRAILER SAFETY GUIDELINES

Table B below will help pinpoint the causes and solutions of tire wear problems.

Table B. Tire Wear Troubleshooting			
Wear Pattern		Cause	Solution
	Center Wear	Over inflation.	Adjust pressure to particular load per tire manufacturer.
	Edge Wear	Under inflation.	Adjust pressure to particular load per tire manufacturer.
	Side Wear	Loss of camber or overloading.	Make sure load does not exceed axle rating. Align wheels.
	Toe Wear	Incorrect toe-in.	Align wheels.
	Cupping	Out-of-balance.	Check bearing adjustment and balance tires.
	Flat Spots	Wheel lockup and tire skidding.	Avoid sudden stops when possible and adjust brakes.

WARNING



ALWAYS wear safety glasses when removing or installing force fitted parts. **DO NOT** attempt to repair or modify a wheel. **DO NOT** install an inner-tube to correct a leak through through the rim. If the rim is cracked, the air pressure in the inner tube may cause pieces of the rim to explode (break off) with great force and cause serious eye or bodily injury.

Wheel Rims

If the trailer has been struck, or impacted, on or near the wheels, or if the trailer has struck a curb, inspect the rims for damage (i.e. being out of round); and replace any damaged wheel. Inspect the wheels for damage every year, even if no obvious impact has occurred.

Wheels, Bearings and Lug Nuts

A loose, worn or damaged wheel bearing is the most common cause of brakes that grab.

To check wheel bearings, jack trailer and check wheels for side-to-side looseness. If the wheels are loose, or spin with a wobble, the bearings must be serviced or replaced. Check inflation pressure weekly during use to insure the maximum tire life and tread wear. Most trailer axles are built with sealed bearings that are not serviceable. Sealed bearings must be replaced as complete units.

NOTICE

NEVER use an pneumatic air gun to tighten wheel lug nuts.

Over-tightening lug nuts will result in breaking the studs or permanently deforming the mounting stud holes in the wheels.

WARNING

Lug nuts are prone to loosen after initial installation, which can lead to death or serious injury. Check all wheel lug nuts periodically.

Lug Nut Torque Requirements

It is extremely important to apply and maintain proper wheel mounting torque on the trailer. Be sure to use only the fasteners matched to the cone angle of the wheel. Proper procedure for attachment of the wheels is as follows:

1. Start all wheel lug nuts by hand.
2. Torque all lug nuts in sequence. See Figure L. **DO NOT** torque the wheel lug nuts all the way down. Tighten each lug nut in 3 separate passes as defined by Table C.
3. Check to see if the lug nuts are tight after the first 10, 25 and 50 miles of driving and before each tow thereafter

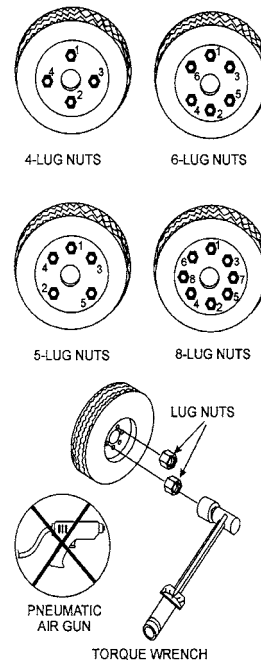


Figure L. Wheel Lug Nuts Tightening Sequence

TRAILER SAFETY GUIDELINES

Table C. Tire Torque Requirements

Wheel Size	First Pass FT-LBS	Second Pass FT-LBS	Third Pass FT-LBS
12"	20-25	35-40	50-65
13"	20-25	35-40	50-65
14"	20-25	50-60	90-120
15"	20-25	50-60	90-120
16"	20-25	50-60	90-120

Replace any broken or burned-out lamps as necessary. Check the wire harness for cuts, fraying or other damage. If it needs replacing, contact your dealer.

WARNING

Improper operating taillights, stoplights and turn signals can cause collisions.

Check all lights before each tow.

Lights and Signals

Before each tow, check the trailer taillights, stoplights, turn signals and any clearance lights for proper operation.

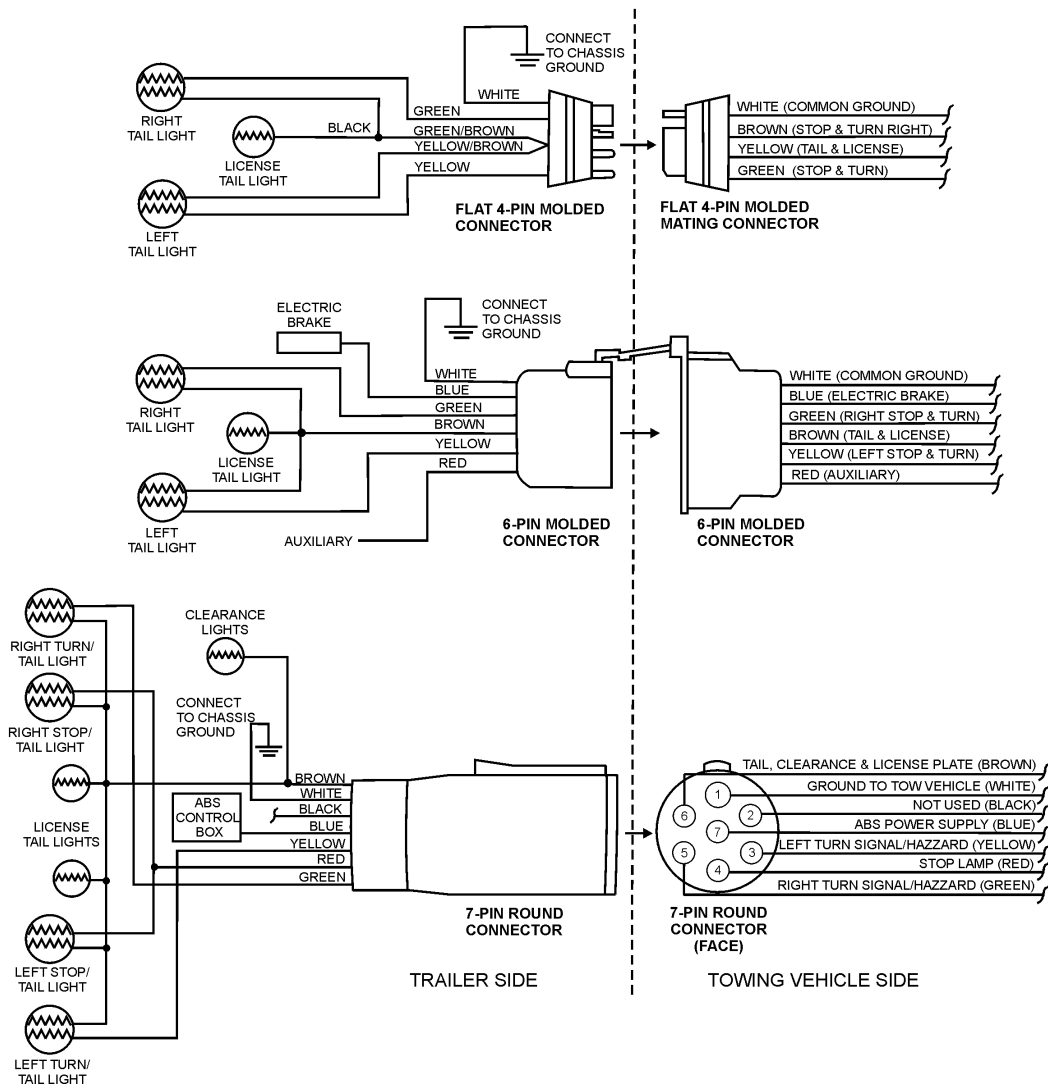


Figure M. Trailer to Tow Vehicle Wiring Diagram

TROUBLESHOOTING (PUMP)

Troubleshooting (Pump)		
Symptom	Possible Problem	Solution
Pump fails to prime – low vacuum.	Insufficient product at inlet (submergence)?	Lower strainer deeper in sump
	Pump drain valve left open?	Close drain valve
	Priming chamber valve closed?	Open priming chamber valve
	Speed too low?	Increase within recommended limits
	Air leak on suction side?	Fix leaks
	Air lock?	Vent air/install air release valve
	Discharge non return valve not seating?	Clear obstruction/check for wear
	Venturi or priming chamber bumper plugged?	Clear any obstructions
	Mechanical seal leaking?	Check and repair/replace as required
Pump fails to prime – high vacuum	Strainer clogged?	Clean strainer
	Excessive suction lift?	Lower if possible or select larger piping
Pump takes a long time to prime	Speed too low?	Increase within recommended limits
	High suction lift and/or long hose length?	Reduce if possible
	Air leak on suction side?	Fix leaks
	Discharge check valve obstructed or worn?	Clear obstruction/check for wear
	Worn air compressor or venturi?	Repair/replace
Pump fails to hold prime when turned off	End of hose/strainer out of fluid?	Check pipe/strainer submergence
	Discharge check valve obstructed or worn?	Clear obstruction/check for wear
	Air leak on suction side of pump?	Fix leaks
	Priming chamber non return valve obstructed?	Clear obstruction/check for wear
Reduced performance	Vortexing/improper submergence?	Lower strainer deeper in sump
	Air leaks on suction side?	Clear any obstructions
	Strainer or impeller partially clogged?	Lower if possible or select larger piping
	Excessive suction lift?	Increase within recommended limits
	Speed too low?	Lower if possible or select larger piping
	Discharge head too high?	Check and adjust/repair as required
	Pump internals worn?	Adjust/replace as necessary
Pump overheating	Strainer clogged?	Clear any obstructions
	Cavitation (improper suction design)?	Correct suction problems
	Discharge head too high?	Lower if possible or select large piping
	Pump internals worn?	Check and adjust/repair
	Air lock?	Vent air/install air release valve
Excessive pump vibration or noise	Material lodged in impeller (out of balance)?	Clear any obstructions
	Discharge head too high?	Lower if possible or select large piping
	Cavitation (improper suction design)?	Correct suction conditions
	Misalignment?	Align all rotating parts

TROUBLESHOOTING (PUMP CONTINUED)/CONTROL BOX

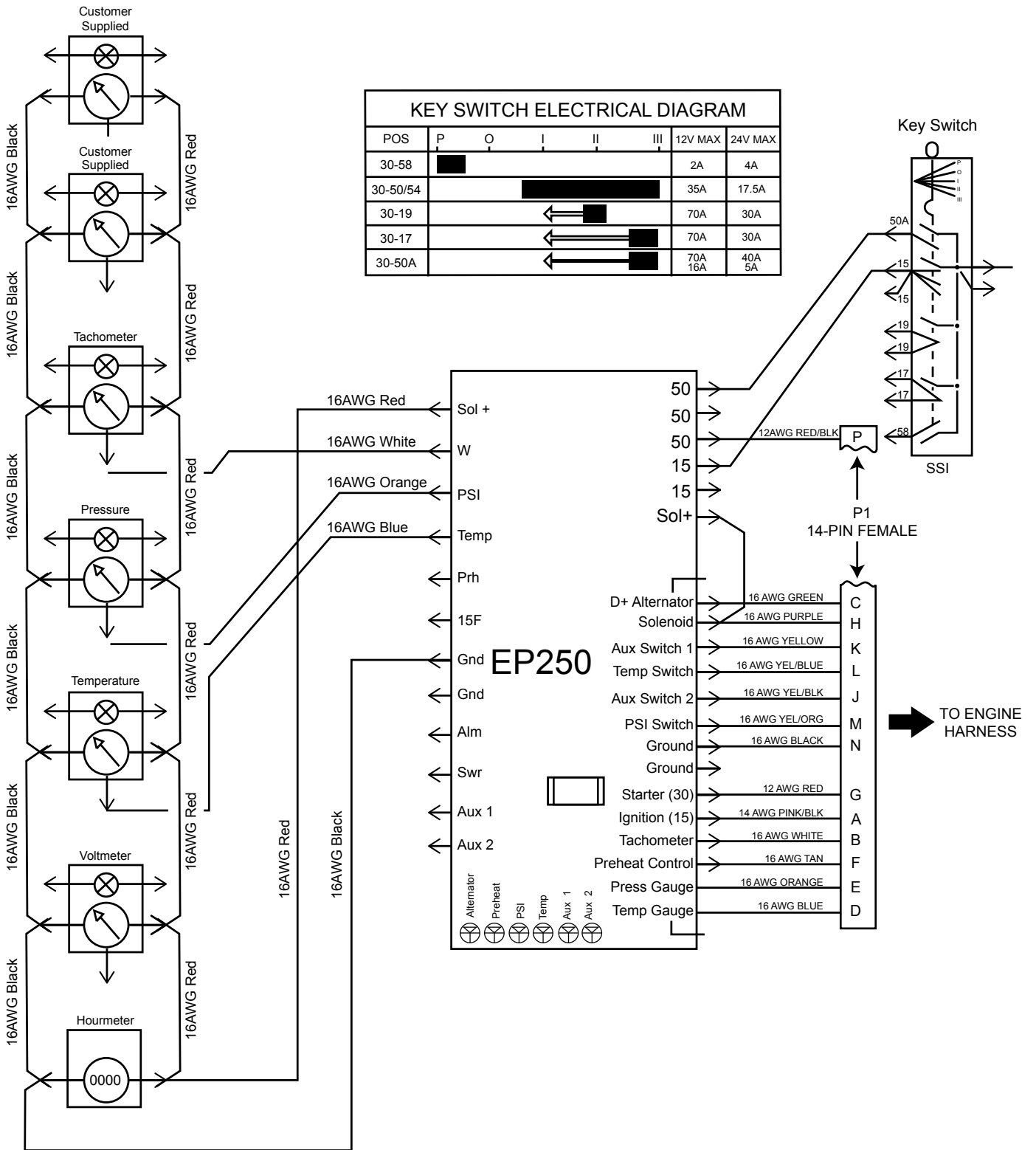
Troubleshooting (Pump Continued)		
Symptom	Possible Problem	Solution
Premature mechanical seal failure	Inadequate lubrication?	Regrease or refill with oil
	Loss of lubrication?	Check/replace lip seal
	Piping not properly supported?	Provide suitable bracing and supports
	Cavitation (improper suction design)?	Correct suction problems
	Misalignment?	Align all rotating parts
	Discharge head too high?	Lower if possible or select large piping
	Incompatibility with fluid being pumped?	Check pumping fluid properties
Fluid Discharging	Float obstructed or damaged?	Clean or replace.
	Priming chamber bumper obstructed or worn?	Clean or replace.

Troubleshooting Control Box		
Symptom	Possible Problem	Solution
Control system does not perform self test	Tripped overcurrent protection?	Correct fault, replace or reset overcurrent protection
	Faulty connection to battery?	Check battery connections
Control system performs normal self test, engine cranks, runs and shuts down	Only Battery LED illuminated	Check battery connections
	Only Oil Pressure LED illuminated	Correct low oil pressure condition or faulty switch, correct wiring fault
	Only Temperature LED illuminated	Correct overheating condition or faulty switch, correct wiring fault
	Only Aux LED illuminated? If applicable	Correct fault condition (i.e. v-belt, coolant level) or faulty switch, correct wiring fault
	All normally closed shutdowns illuminate for one second (control system reset)?	Add suppressor diodes, protect from nearby lightning strikes, shield induced spikes from other equipment, add electric motor control relay

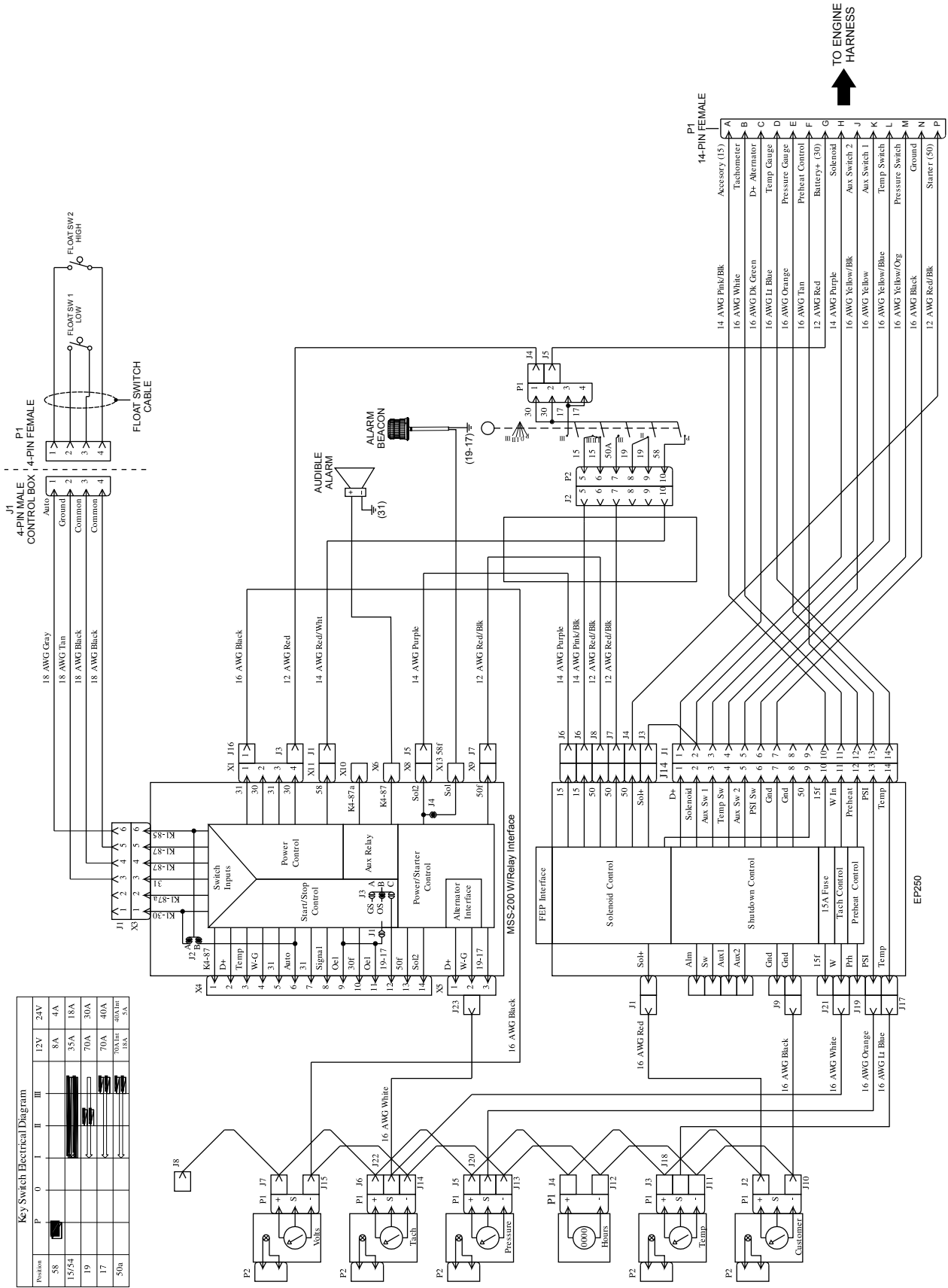
TROUBLESHOOTING (ENGINE)

Troubleshooting (Engine)		
Symptom	Possible Problem	Solution
Engine will not start or start is delayed, although engine can be turned over.	No Fuel reaching injection pump?	Add fuel. Check entire fuel system.
	Defective fuel pump?	Replace fuel pump.
	Fuel filter clogged?	Replace fuel filter and clean tank.
	Faulty fuel supply line?	Replace or repair fuel line.
	Compression too low?	Check piston, cylinder and valves. Adjust or repair per engine repair manual.
	Fuel pump not working correctly?	Repair or replace fuel pump.
	Oil pressure too low?	Check engine oil pressure.
	Low starting temperature limit exceeded?	Comply with cold starting instructions and proper oil viscosity.
	Defective battery?	Charge or replace battery.
	Air or water mixed in fuel system?	Check carefully for loosened fuel line coupling, loose cap nut, etc.
At low temperatures engine will not start.	Engine oil too thick?	Refill engine crankcase with correct type of oil for winter environment.
	Defective battery?	Replace battery.
Engine fires but stops soon as starter is switched off.	Fuel filter blocked?	Replace fuel filter.
	Fuel supply blocked?	Check the entire fuel system.
	Defective fuel pump?	Replace fuel pump.
Engine stops by itself during normal operation.	Fuel tank empty?	Add fuel.
	Fuel filter blocked?	Replace fuel filter.
	Defective fuel pump?	Replace fuel pump.
	Mechanical oil pressure shutdown sensor stops the engine due to low oil?	Add oil. Replace low oil shutdown sensor if necessary.
Low engine power, output and speed.	Fuel tank empty?	Replace fuel filter.
	Fuel filter clogged?	Replace fuel filter.
	Fuel tank venting is inadequate?	Ensure that tank is adequately vented.
	Leaks at pipe unions?	Check threaded pipe unions tape and tighten unions as required.
	Speed control lever does not remain in selected position?	See engine manual for corrective action.
	Engine oil level too full?	Correct engine oil level.
	Injection pump wear?	Use No. 2-D diesel fuel only. Check the fuel injection pump element and delivery valve assembly and replace as necessary.

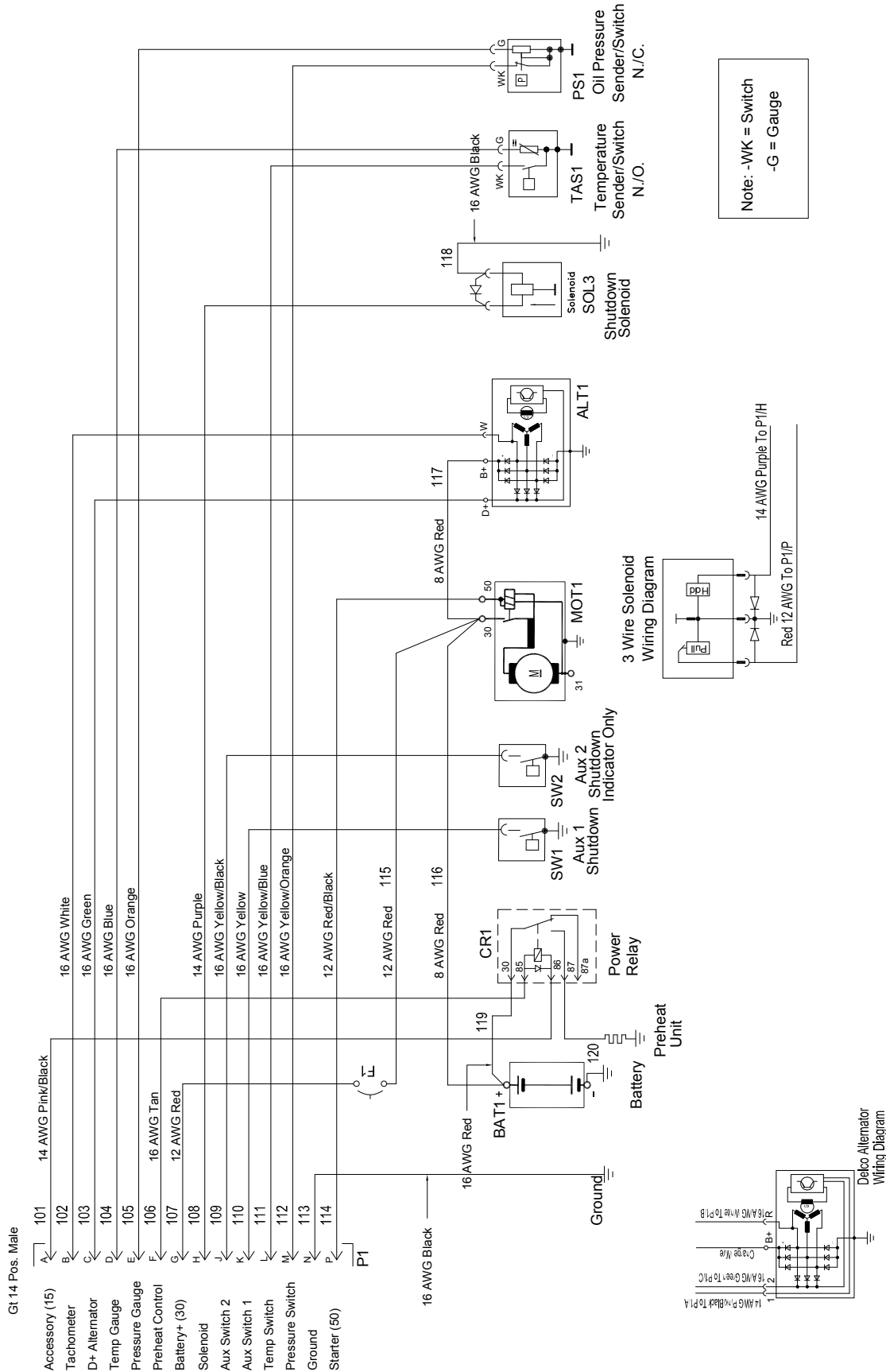
CONTROL BOX WIRING DIAGRAM (MANUAL MODE)



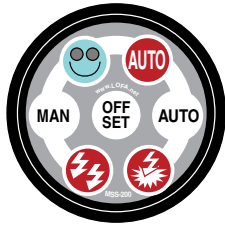
CONTROL BOX WIRING DIAGRAM (AUTO MODE)



ENGINE WIRING DIAGRAM



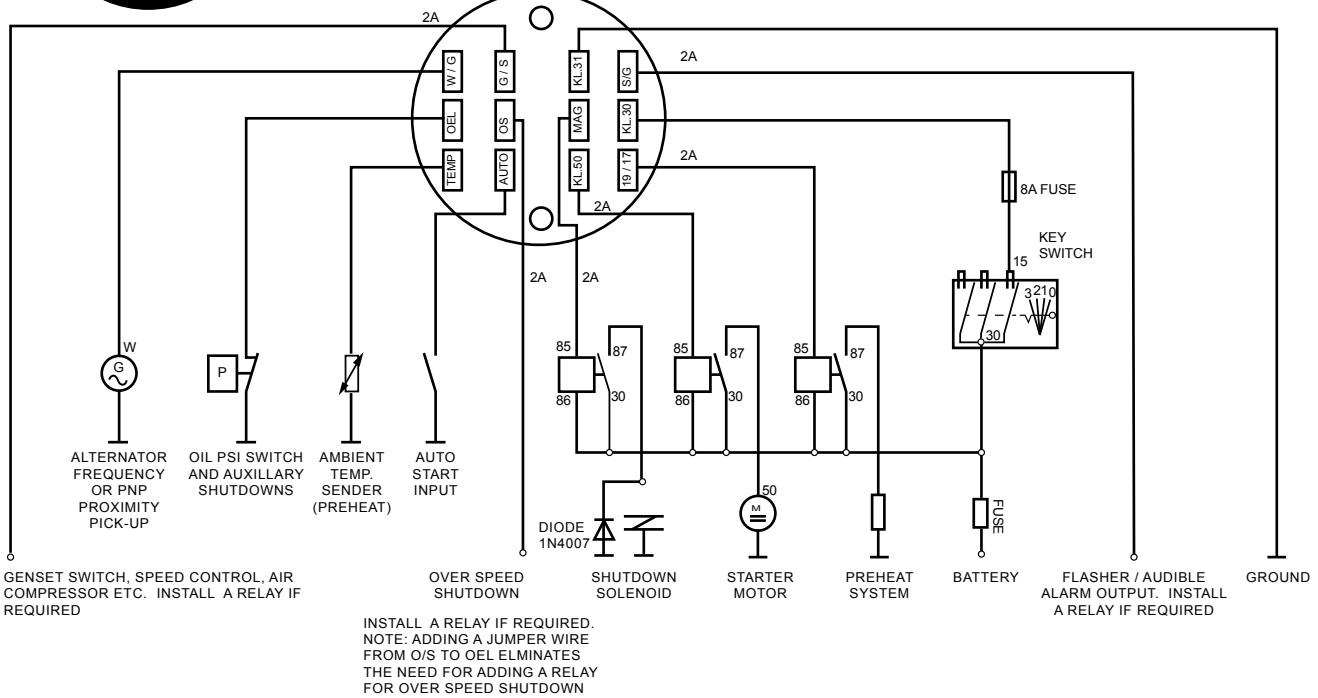
CONTROLLER APPLICATION/TACH. DIP SWITCH SETTING



FRONT VIEW

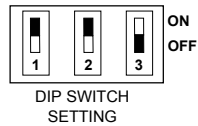
REAR VIEW

MSS-200 CONTROLLER APPLICATION



TACHOMETER WIRING AND DIP SWITCH SETTINGS

IF YOU REPLACE THE TACHOMETER, MAKE SURE YOU SET THE DIP SWITCHES ON THE NEW TACHOMETER TO MATCH THE OLD ONE.



DIP SWITCHES

TACHOMETER

FUSE BOX

LIGHT SWITCH

GROUND

GROUND

IGNITION SWITCH +12V

BATTERY

TERMINAL MARKED "W" OR "A/C"

ALTERNATOR

ALTERNATOR A/C TAP HOOKUP

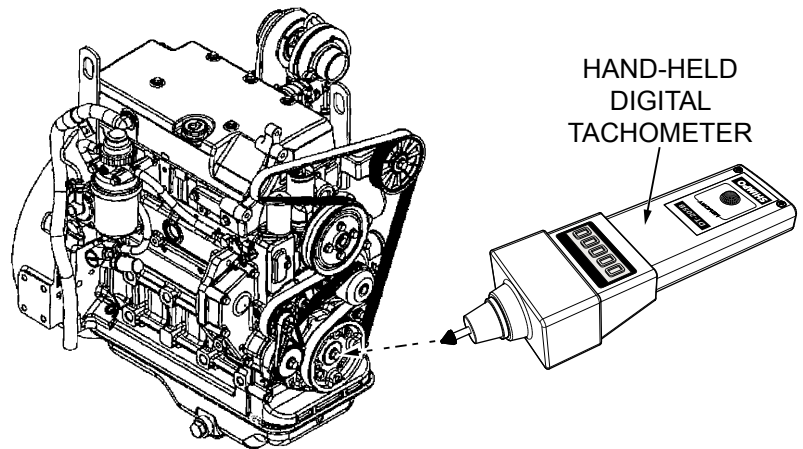
DIP SWITCH SETTINGS			4000 RPM TACH	6000 RPM TACH	8000 RPM TACH	PULSES PER REVOLUTION
#1	#2	#3				
OFF	OFF	OFF	6-9	8-12	6-9	
OFF	OFF	ON	9-13	12-17	9-13	
OFF	ON	OFF	13-20	17-24	12-18	
OFF	OFF	OFF	720-1200 HERTZ			}
OFF	OFF	ON	1200-1500 HERTZ			
OFF	ON	ON	1500-2400 HERTZ			

TACHOMETER VDO ADJUSTMENT SETTING

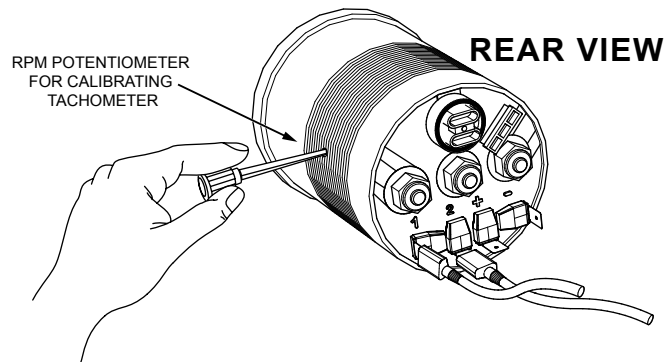
ADJUSTING THE TACHOMETER POINTER

USE OF THE TACHOMETER WITH AN ALTERNATOR, ALMOST ALWAYS REQUIRES ADJUSTMENT OF THE POINTER. THIS IS PERFORMED PER THE DIAGRAM SHOWN BELOW. THIS ADJUSTMENT IS DESIGNED TO ADJUST THE POINTER READING BETWEEN 30% AND 100% OF THE RPM RANGE.

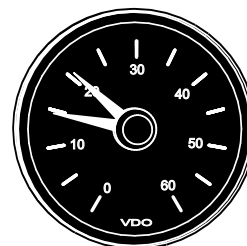
- 1 COMPARE THE VDO TACHOMETER READING WITH THAT OF A REFERENCE TACHOMETER.



- 2 ADJUST RPM POTENTIOMETER ON THE SIDE OF THE GAUGE.



- 3 THE POINTER WILL MOVE CLOCKWISE OR COUNTERCLOCKWISE AS YOU ADJUST. WHEN THE VDO TACHOMETER READING MATCHES THAT OF THE REFERENCE TACHOMETER, THE ADJUSTMENT IS COMPLETE.



FRONT VIEW

EXPLANATION OF CODE IN REMARKS COLUMN

The following section explains the different symbols and remarks used in the Parts section of this manual. Use the help numbers found on the back page of the manual if there are any questions.

NOTICE

The contents and part numbers listed in the parts section are subject to change **without notice**. Multiquip does not guarantee the availability of the parts listed.

SAMPLE PARTS LIST

NO.	PART NO.	PART NAME	QTY.	REMARKS
1	12345	BOLT.....	1	INCLUDES ITEMS W/%
2%		WASHER, 1/4 IN.....		NOT SOLD SEPARATELY
2%	12347	WASHER, 3/8 IN....	1	MQ-45T ONLY
3	12348	HOSE		A/R ...MAKE LOCALLY
4	12349	BEARING	1	S/N 2345B AND ABOVE

NO. Column

Unique Symbols — All items with same unique symbol

(@, #, +, %, or >) in the number column belong to the same assembly or kit, which is indicated by a note in the “Remarks” column.

Duplicate Item Numbers — Duplicate numbers indicate multiple part numbers, which are in effect for the same general item, such as different size saw blade guards in use or a part that has been updated on newer versions of the same machine.

NOTICE

When ordering a part that has more than one item number listed, check the remarks column for help in determining the proper part to order.

PART NO. Column

Numbers Used — Part numbers can be indicated by a number, a blank entry, or TBD.

TBD (To Be Determined) is generally used to show a part that has not been assigned a formal part number at the time of publication.

A blank entry generally indicates that the item is not sold separately or is not sold by Multiquip. Other entries will be clarified in the “Remarks” Column.

QTY. Column

Numbers Used — Item quantity can be indicated by a number, a blank entry, or A/R.

A/R (As Required) is generally used for hoses or other parts that are sold in bulk and cut to length.

A blank entry generally indicates that the item is not sold separately. Other entries will be clarified in the “Remarks” Column.

REMARKS Column

Some of the most common notes found in the “Remarks” Column are listed below. Other additional notes needed to describe the item can also be shown.

Assembly/Kit — All items on the parts list with the same unique symbol will be included when this item is purchased.

Indicated by:

“INCLUDES ITEMS W/(unique symbol)”

Serial Number Break — Used to list an effective serial number range where a particular part is used.

Indicated by:

“S/N XXXXX AND BELOW”

“S/N XXXX AND ABOVE”

“S/N XXXX TO S/N XXX”

Specific Model Number Use — Indicates that the part is used only with the specific model number or model number variant listed. It can also be used to show a part is NOT used on a specific model or model number variant.

Indicated by:

“XXXXX ONLY”

“NOT USED ON XXXX”

“Make/Obtain Locally” — Indicates that the part can be purchased at any hardware shop or made out of available items. Examples include battery cables, shims, and certain washers and nuts.

“Not Sold Separately” — Indicates that an item cannot be purchased as a separate item and is either part of an assembly/kit that can be purchased, or is not available for sale through Multiquip.

SUGGESTED SPARE PARTS

AP6/AP8 TRASH PUMP WITH JOHN DEERE 4024TF AND 4045TF DIESEL ENGINES

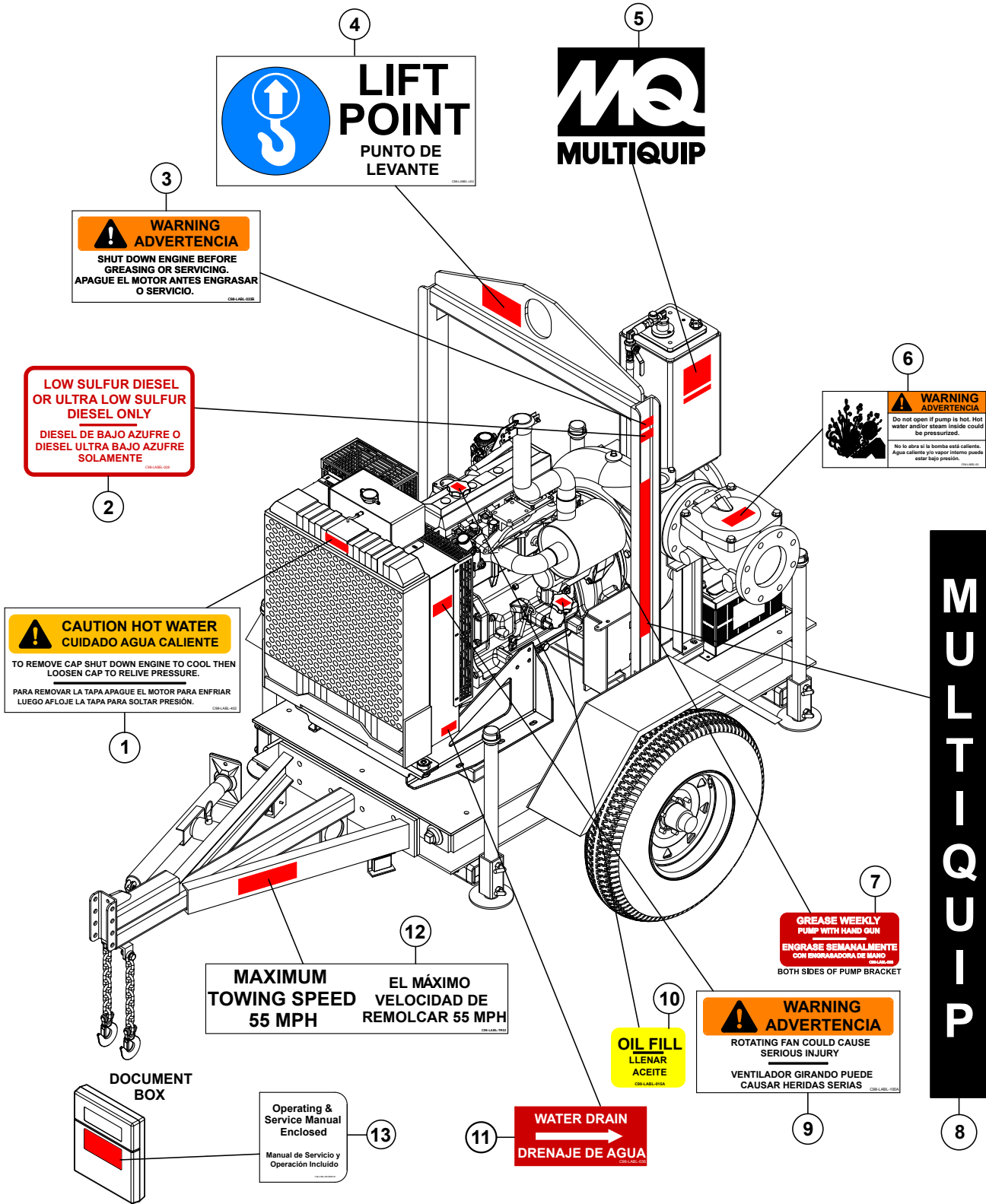
1 to 3 units

<u>Qty.</u>	<u>P/N</u>	<u>Description</u>
3.....	RE519626.....	OIL FILTER, 4024TF
3.....	RE504836.....	OIL FILTER, 4045TF
3.....	RE508202.....	FUEL FILTER, 4024TF
3.....	RE522868.....	FUEL FILTER, 4045TF
3.....	AT171853	ELEMENT, A/C, PRIMARY,4024TF
1.....	AT171854	ELEMENT, A/C, SECONDARY, 4024TF
3.....	P182063	AIR FILTER, 4045TF
1.....	RE515217.....	FAN BELT, 4024TF
1.....	R123432	FAN BELT, 4045TF
1.....	RE503242.....	TEMPERATURE SWITCH, 4045TF
1.....	APRD241500.....	MECHANICAL SEAL KIT
1.....	APRD253321.....	VENTURI, OUT AP6
1.....	APRD253322.....	VENTURI, OUT AP8
1.....	APRD253331.....	VENTURI, IN AP6
1.....	APRD253332.....	VENTURI, IN AP8
2.....	APW64WGPE0602	GASKET, DISCHARGE, INNER/OUTER, AP6
2.....	APW64WGPE0602	GASKET, DISCHARGE, INNER, AP8
2.....	APW64WGPE0802	GASKET, DISCHARGE, OUTER, AP8
2.....	APRD25342.....	GASKET, SUCTION, INNER
2.....	APRD253461.....	GASKET, SUCTION, OUTER, AP6
2.....	APRD253472.....	GASKET, SUCTION, OUTER, AP8
2.....	APRD31432.....	FILTER, FUEL

NOTICE

Part number on this Suggested Spare Parts list may supersede/replace the P/N shown in the text pages of this book.

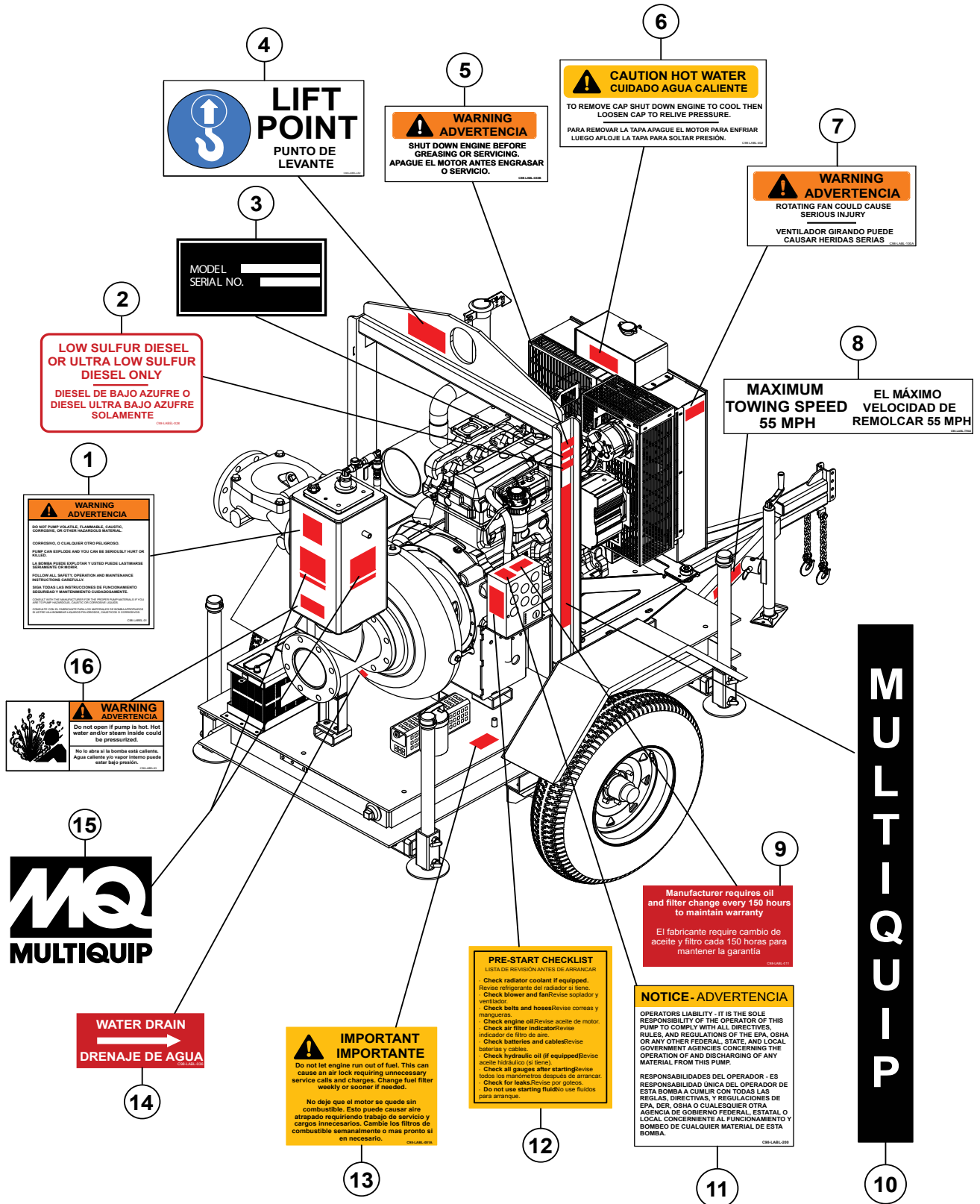
NAMEPLATE AND DECALS



NAMEPLATE AND DECALS

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APDIAG005610	DECAL; HOT WATER	1	
2	APDIAG005614	DECAL; LOW SULFUR DIESEL	1	
3	APDIAG005603	DECAL; SHUT DOWN ENGINE	1	
4	APDIAG005612	DECAL; LIFTING POINT	1	
5	APDIAG005617	DECAL; MULTIQUIP LOGO	1	
6	APDIAG005611	DECAL; STEAM WARNING	1	
7	APDIAG005608	DECAL; GREASE WEEKLY	1	
8	APDIAG005618	DECAL; MULTIQUIP (LIFTING BALE)	1	
9	APDIAG005609	DECAL; ROTATING FAN	1	
10	APDIAG005606	DECAL; OIL FILL	1	
11	APDIAG005605	DECAL; WATER DRAIN	1	
12	APDIAG005616	DECAL; MAX TOWING SPEED	1	
11	APDIAG005613	DECAL; DOCUMENT BOX	1	

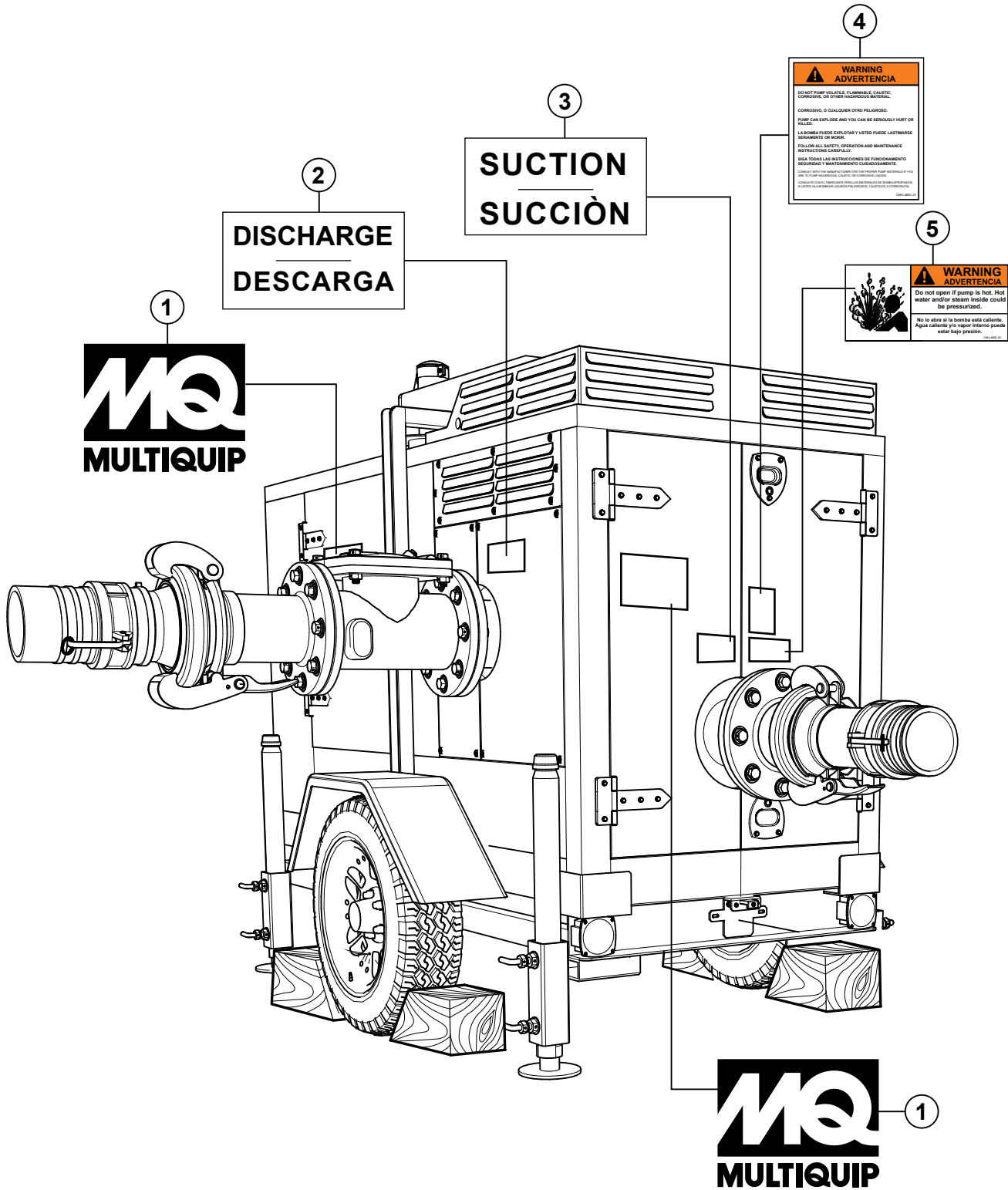
NAMEPLATE AND DECALS



NAMEPLATE AND DECALS

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APDIAG005604	DECAL; VOLATILE MATERIAL	1	
2	APDIAG005614	DECAL; LOW SULFUR DIESEL	1	
3		SERIAL PLATE	1CONTACT MQ PARTS DEPT.
4	APDIAG005612	DECAL; LIFTING POINT	1	
5	APDIAG005603	DECAL; SHUT DOWN ENGINE	1	
6	APDIAG005610	DECAL; HOT WATER	1	
7	APDIAG005609	DECAL; ROTATING FAN	1	
8	APDIAG005616	DECAL; MAX TOWING SPEED	1	
9	APDIAG005602	DECAL; MFG. REQUIREMENTS	1	
10	APDIAG005618	DECAL; MULTIQUIP	1	
11	APDIAG005601	DECAL; OPERATOR'S LIABILITY	1	
12	APDIAG005615	DECAL; PRE-START CHECKLIST	1	
13	APDIAG005607	DECAL; AIR LOCK WARNING	1	
14	APDIAG005605	DECAL; WATER DRAIN	1	
15	APDIAG005617	DECAL; MULTIQUIP LOGO	1	
15	APDIAG005611	DECAL; STEAM WARNING	1	
16	APDIAG005611	DECAL; STEAM WARNING	1	

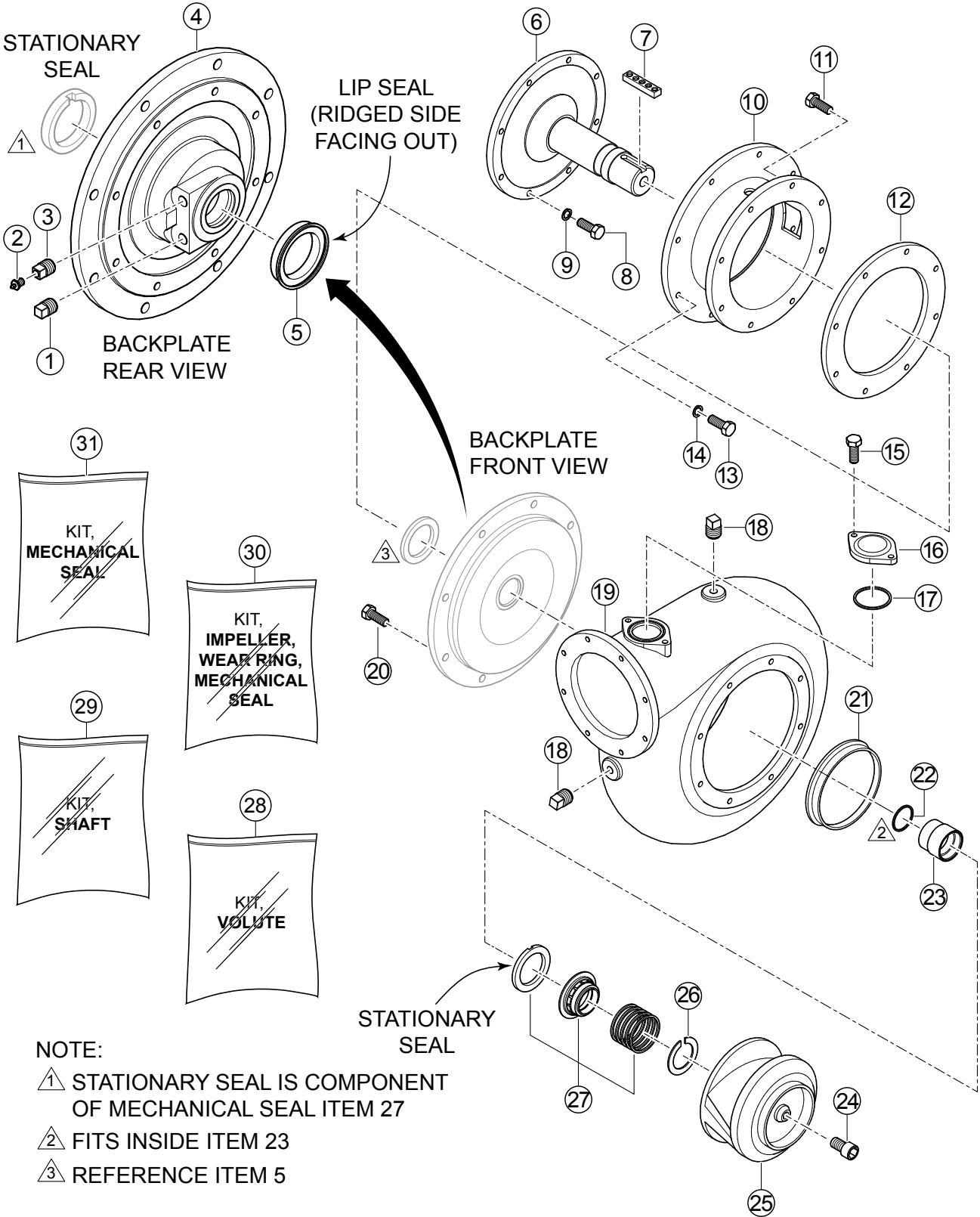
NAMEPLATE AND DECALS



NAMEPLATE AND DECALS

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APDIAG005617	DECAL; MULTIQIP LOGO		
2	APDIAG005620	DECAL; DISCHARGE	1	
3	APDIAG005619	DECAL; SUCTION	1	
4	APDIAG005604	DECAL; VOLATILE MATERIAL	1	
5	APDIAG005611	DECAL; STEAM WARNING	1	

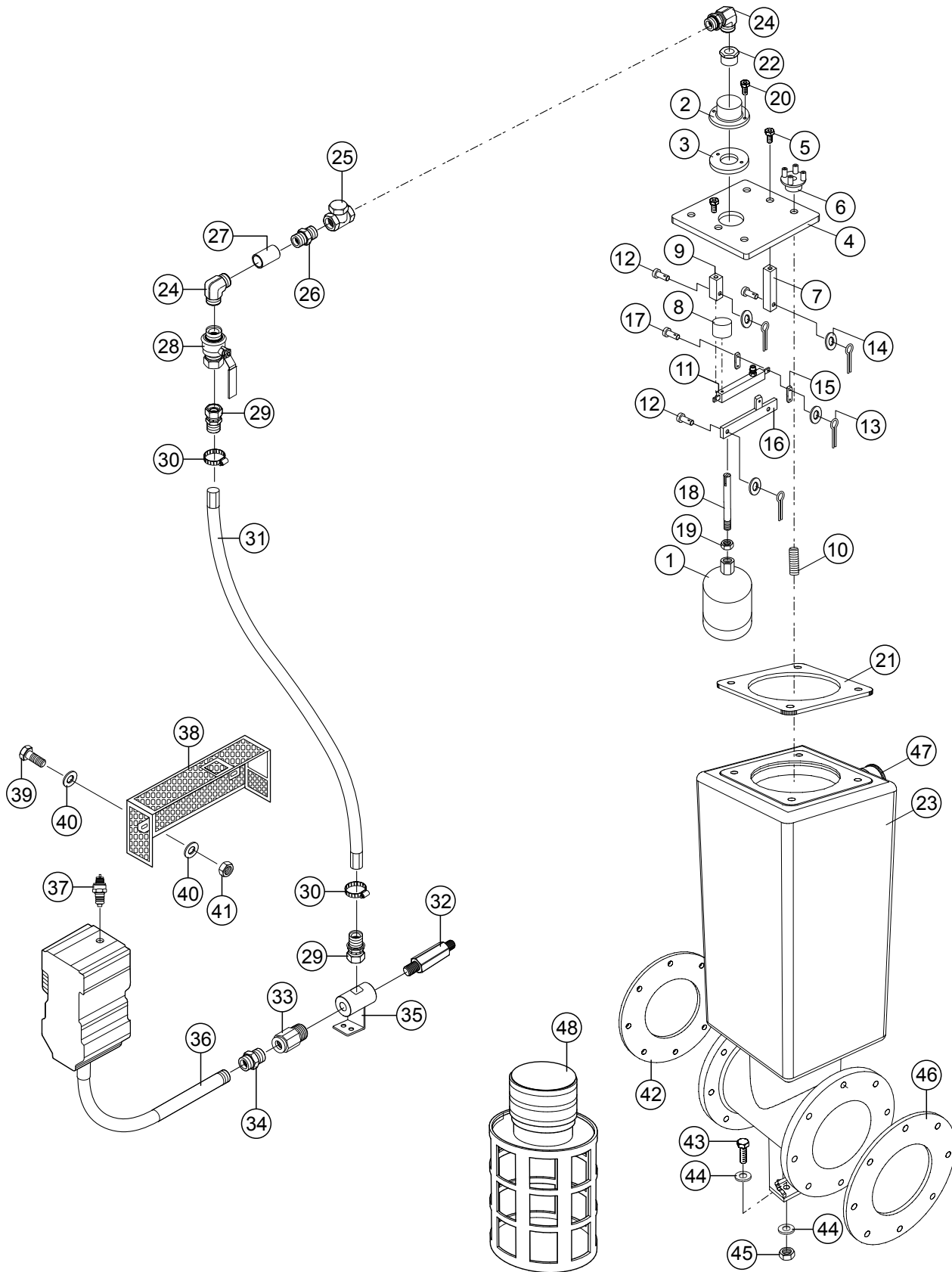
PUMP END ASSY.



PUMP END ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD24120	PLUG, 3/8" NPT BLACK STEEL	1	
2	APRD24119	NIPPLE, GREASE 1/4"	1	
3	APRD24117	BUSHING, REDUCING 3/8" X 1/4"	1	
4	APRD24116	BACKPLATE, CAST IRON	1	
5\$#%	APRD24142	SEAL, LIP	1	
6%	APRD24133	ENGINE STUB SHAFT SAE 10	1	
7\$#%	APRD24132	KEY, IMPELLER 0.50"x3"	1	
8	APRD24139	HHCS, 3/8X1-1/2 GRADE 5 PLTNC	8	
9	APRD24140	WASHER, LOCK 3/8 " ZINC	8	
10	APRD241291	ADAPTER, AP6TP, ENGINE MOUNT SAE4	1	
10	APRD241292	ADAPTER, AP8TP, ENGINE MOUNT SAE3	1	
11	APRD24147	HHCS, 1/2X1-1/4 GR 5 PLT NC	8	
12\$#%@	APRD24107	GASKET, VOLUTE	1	
13	APRD24137	AHCS, 10M-1.5-35M	12	
14	APRD24138	WASHER, LOCK 10M	12	
15@	APRD24143	HHCS, 1/2" X1"	2	
16@	APRD24102	CLEANOUT COVER, CAST IRON	1	
17@	APRD24144	O-RING, 3/16CS X 3.88 ID BUNA	1	
18@	APRD24104	PLUG, 1/2 " BLACK NPT	3	
19@	APRD24103	VOLUTE	1	
20	APRD24101	HHCS 5/8-11 X 1-1/2", GR 5, PLTNC	8	
21#@	APRD24108	RING, WEAR	1	
22\$#%	APRD24146	O-RING, 2.12 X 2.31 X .09 THICK	1	
23\$#%	APRD24115	SLEEVE, SHAFT	1	
24\$#%	APRD24105	SHCS, .75NC X 2.50 SS	1	
25#	APRD241091	IMPELLER, AP6TP, 10" TRIM	1	
25#	APRD241092	IMPELLER, AP8TP, 11" TRIM	1	
26\$%	APRD24145	SHIM, MECHANICAL SEAL (IF NEEDED)	1	
27\$#%	APRD24110	SEAL, MECHANICAL 2-1/2", TYPE 2	1	
28	APRD241700	KIT, VOLUTE.....	1	INCLUDES ITEMS W/@
29	APRD241800	KIT, SHAFT	1	INCLUDES ITEMS W/%
30	APRD241600	KIT SEAL, IMPELLER, WEAR RING/MECH.	1	INCLUDES ITEMS W/#
31	APRD241500	KIT, MECHANICAL SEAL.....	1	INCLUDES ITEMS W/\$

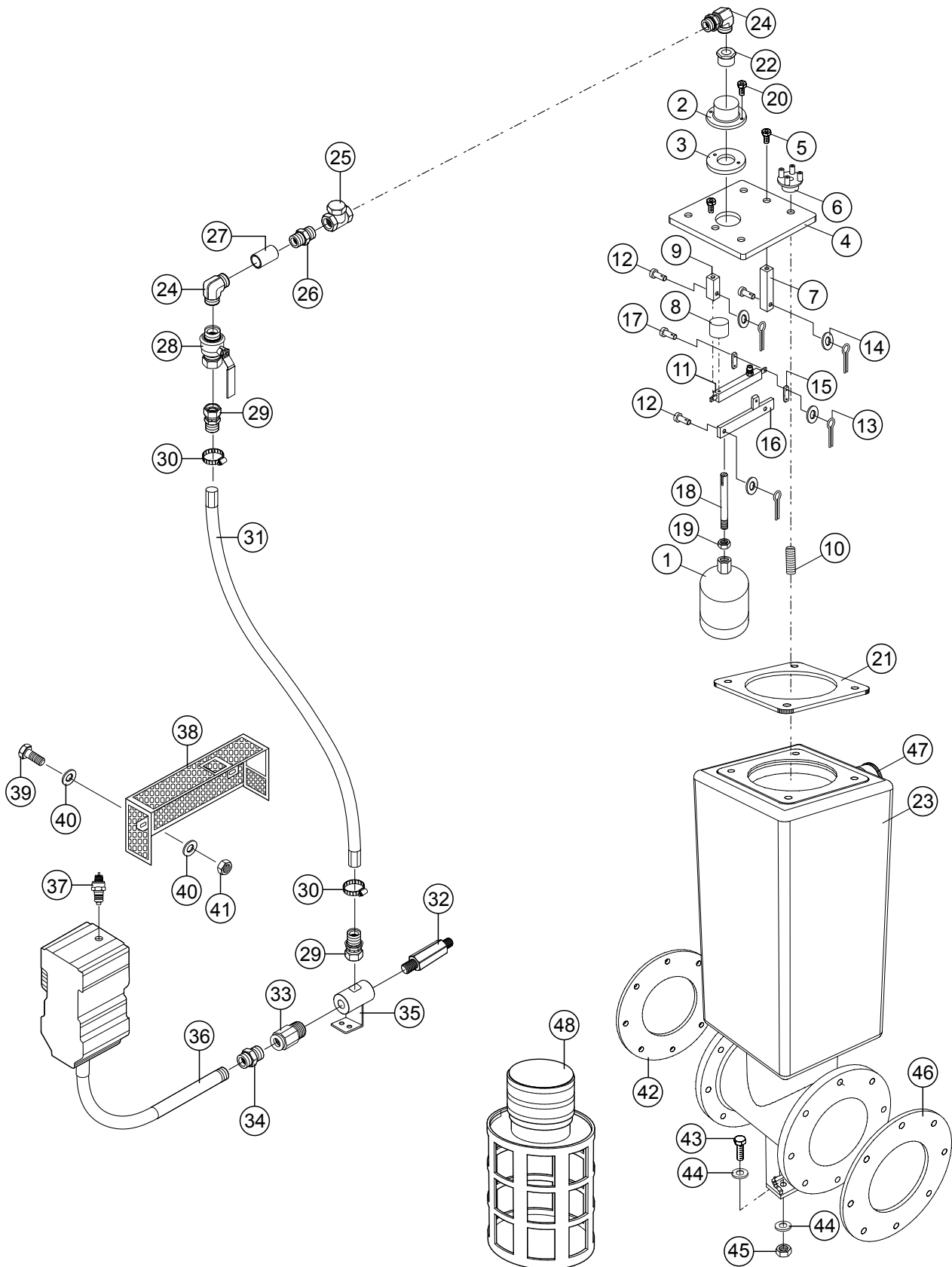
AIR SEPARATOR CHAMBER ASSY.



AIR SEPARATOR CHAMBER ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD25301	STAINLESS STEEL FLOAT	1	
2	APRD25302	AIR SEPARATOR VALVE	1	
3	APRD25303	AIR SEPARATOR VALVE GASKET	1	
4	APRD25304	INTAKE COVER	1	
5	APRD25305	SOCKET HEAD SCREW	2	
6	APRD25306	WRENCH	4	
7	APRD25307	LONG POST	1	
8	APRD25308	BUMPER	1	
9	APRD25309	PIVOT POST	1	
10	APRD25310	STUD	4	
11	APRD25311	PIVOT LONG ARM	1	
12	APRD25312	PIN	3	
13	APRD25313	COTTER PIN	5	
14	APRD25314	WASHER	5	
15	APRD25315	LINK	2	
16	APRD25316	LONG ARM	1	
17	APRD25317	PIN	2	
18	APRD25318	FLOAT ROD	1	
19	APRD25319	AM NUT	1	
20	APRD25320	ALLEN HEAD SCREW	2	
21	APRD25321	COVER GASKET	1	
22	APRD25322	REDUCER BUSHING	1	
23	APRD253231	INTAKE PLENUM, AP6TP	1	
23	APRD253232	INTAKE PLENUM, AP8TP	1	
24	APRD25324	ELBOW	2	
25	APRD25325	CHECK VALVE	1	
26	APRD25326	HEX NIPPLE	1	
27	APRD25327	COUPLING	1	
28	APRD25328	BALL VALVE	1	
29	APRD25329	FUEL FITTING	2	
30	APRD25330	HOSE CLAMP	2	
31	APRD25331	HOSE	2	

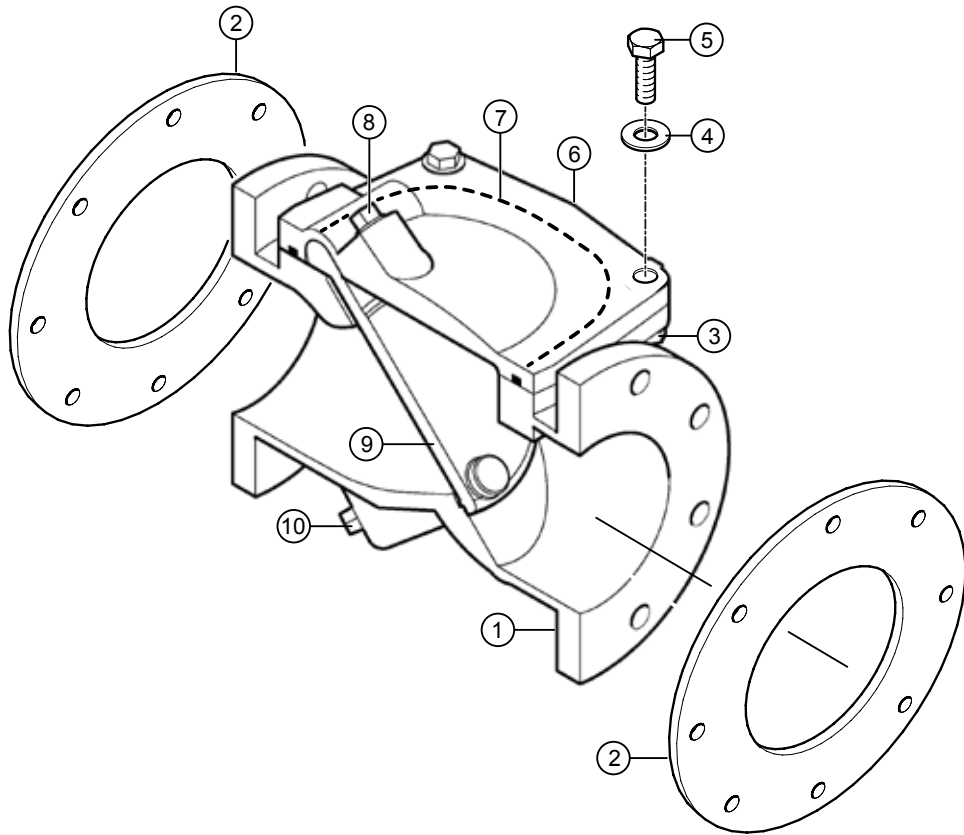
AIR SEPARATOR CHAMBER ASSY. (CONTINUED)



AIR SEPARATOR CHAMBER ASSY. (CONTINUED)

NO.	PART NO.	PART NAME	QTY.	REMARKS
32	APRD253321	VENTURI (OUT), AP6	1	
32	APRD253322	VENTURI (OUT), AP8	1	
33	APRD253331	VENTURI (IN), AP6	1	
33	APRD253332	VENTURI (IN), AP8	1	
34	APRD25334	SWIVEL PIPE	1	
35	APRD25335	VENTURI HOUSING	1	
36	APRD25336	HOSE, COMP, STEEL BRAIDED 42"	1	
37	APRD25337	RELIEF VALVE	1	
38	APRD253381	VENTURI GUARD, AP6	1	
38	APRD253382	VENTURI GUARD, AP8	1	
39	APRD25339	HEX BOLT	2	
40	APRD25340	FLAT WASHER	4	
41	APRD25341	LOCK NUT	2	
42	APRD25342	GASKET, VOLUTE SIDE	1	
43	APRD25343	HEX BOLT	2	
44	APRD25344	WASHER, FLAT	4	
45	APRD25345	LOCK NUT	2	
46	APRD253461	GASKET, SUCTION SIDE, AP6	1	
46	APRD253472	GASKET, SUCTION SIDE, AP8	1	
47	APRD25347	VACUUM GAUGE	1	
48`	APRD314231	STRAINER, AP6	1	
48`	APRD314232	STRAINER, AP8	1	

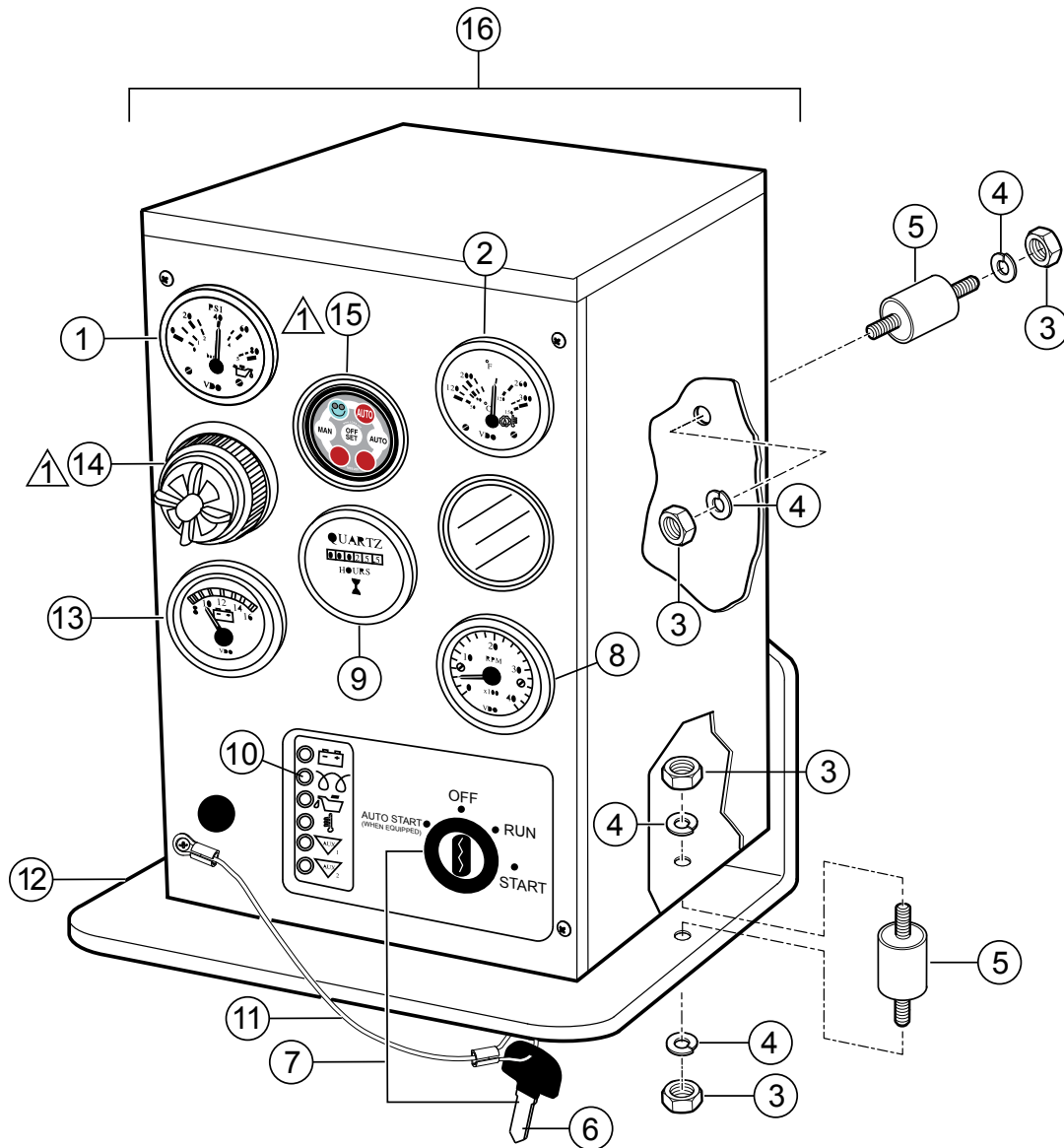
CHECK VALVE ASSY.



CHECK VALVE ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD265011	BODY, AP6	1	
1	APRD265012	BODY, AP8	1	
2	APRD25342	GASKET, AP6	1	
2	APRD25346	GASKET, AP8	1	
3	APRD26505B	COVER BOLT NUT, AP6	4	
3	APRD26505B	COVER BOLT NUT, AP8	6	
4	APRD26505C	COVER BOLT WASHER, AP6	8	
4	APRD26505C	COVER BOLT WASHER, AP8	12	
5	APRD26505A	COVER BOLT, AP6	4	
5	APRD26505A	COVER BOLT, AP8	6	
6	APRD265021	COVER, AP6	1	
6	APRD265022	COVER, AP8	1	
7	APRD265041	COVER SEAL, AP6	1	
7	APRD265041	COVER SEAL, AP8	1	
8	APRD26507	PLUG	1	
9	APRD265031	FLAPPER, AP6	1	
9	APRD265032	FLAPPER, AP8	1	
10	APRD26506	CLEAN OUT PLUG	1	

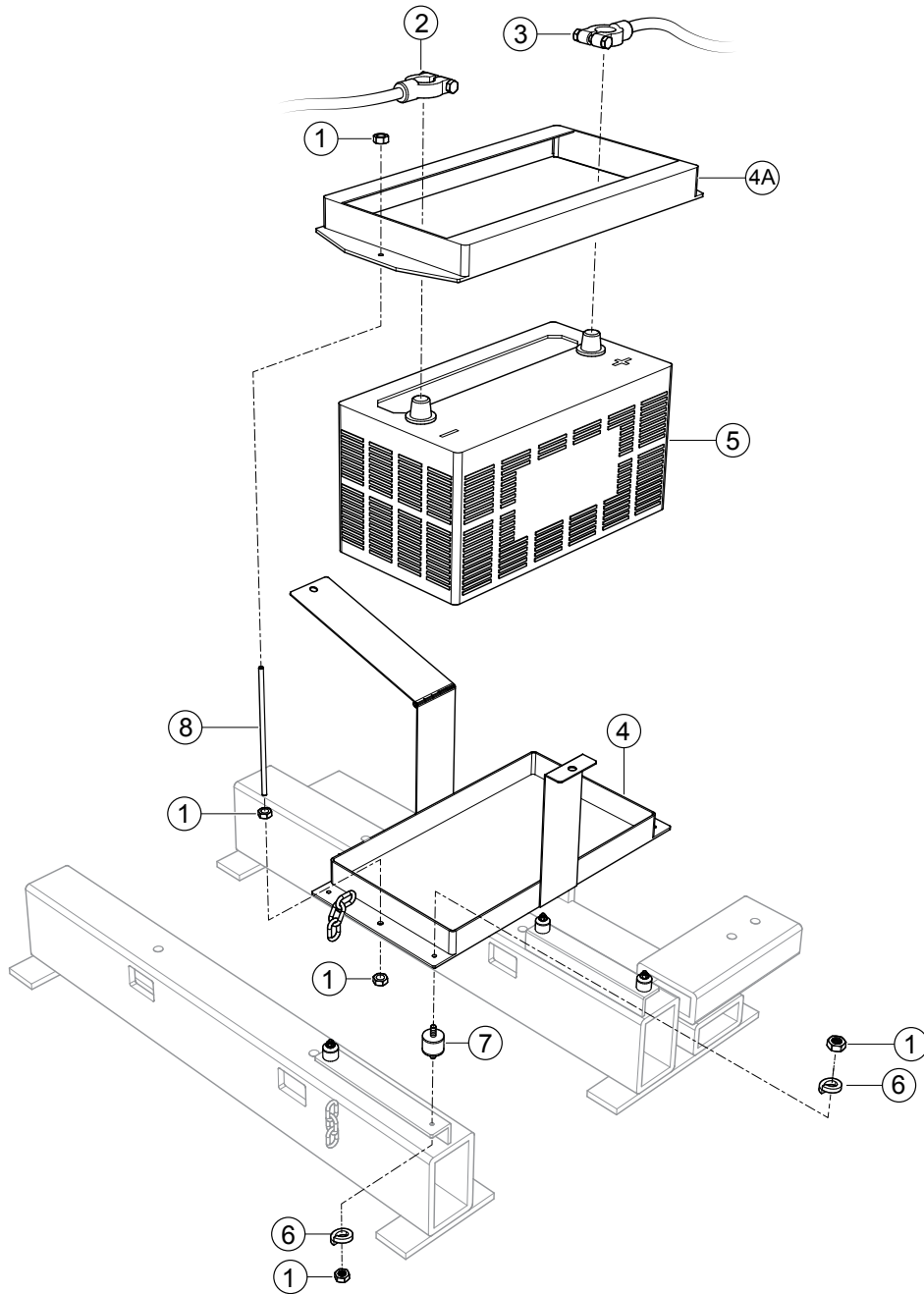
CONTROL BOX ASSY.



CONTROL BOX ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1#	APRD3132	GUAGE, PRESSURE 150 PSI	1	
2#	APRD3133	GUAGE, TEMP 250° F	1	
3#	APRD3133	NUT, KEP 5/16"-18 SS	6	
4#	APRD3137	WASHER, LOCK 5/16" SS	3	
5#	APRD3136	ISOLATOR, EP250 PANEL 5/16"	3	
6#	APRD3139	KEY	1	
7#	APRD31310	SWITCH, IGNITION W/2 KEYS	1	
8#	APRD3134	TACHOMETER, VDO 4000 RPM	1	
9#	APRD31311	HOURMETER, ANALOG VDC VDO	1	
10#	APRD31313	FACE PLATE.....	1	INCLUDES 6 LEDS
11#	APRD31314	LANYARD	1	
12#	APRD3138	MOUNTING BRACKET	1	
13#	APRD3131	VOLTMETER, 12 VOLT	1	
14	R48PW12D	ALARM, AUDIBLE	1	
15	R48201020000	MSS-200 AUTO-START COMTROLLER	1	
16	APRD313A	CONTROL BOX, COMPLETE, MANUAL	1	INCLUDES ITEMS W/#
16	R52EP25017000	CONTROL BOX, COMPLETE, AUTOSTART	1	INCLUDES ITEMS W/\$

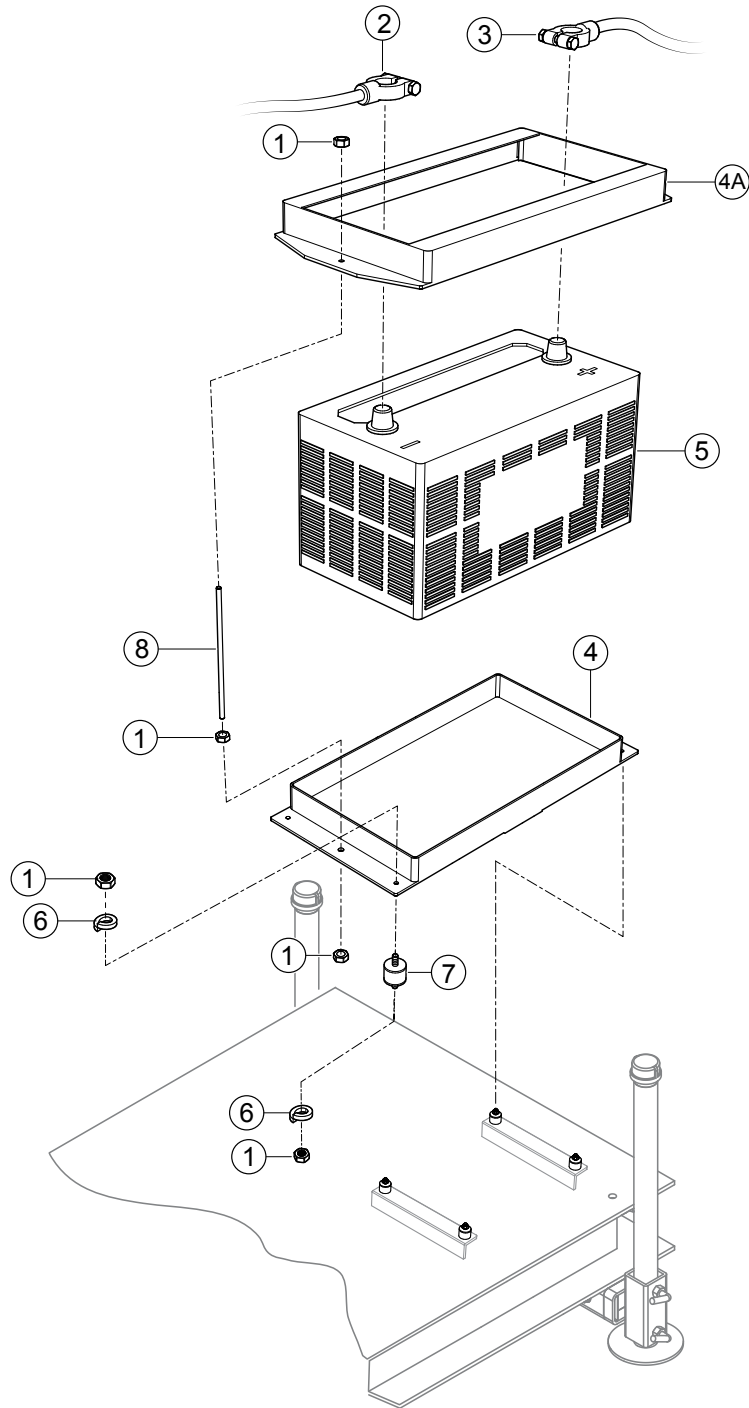
BATTERY ASSY. (AP6)



BATTERY ASSY. (AP6)

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD31418	NUT, NYLOCK	12	
2	APRD314121A	CABLE, BATTERY NEGATIVE	1	
3	APRD314122A	CABLE, BATTERY POSITIVE	1	
4	APRD3141511	BATTERY BOX, BOTTOM	1	
4A	APRD314151	BATTERY BOX, TOP	1	
5	APRD31414	BATTERY	1	
6	APRD31417	WASHER, LOCK	8	
7	APRD31416	ISOLATOR	4	
8	APRD31411	ROD	2	

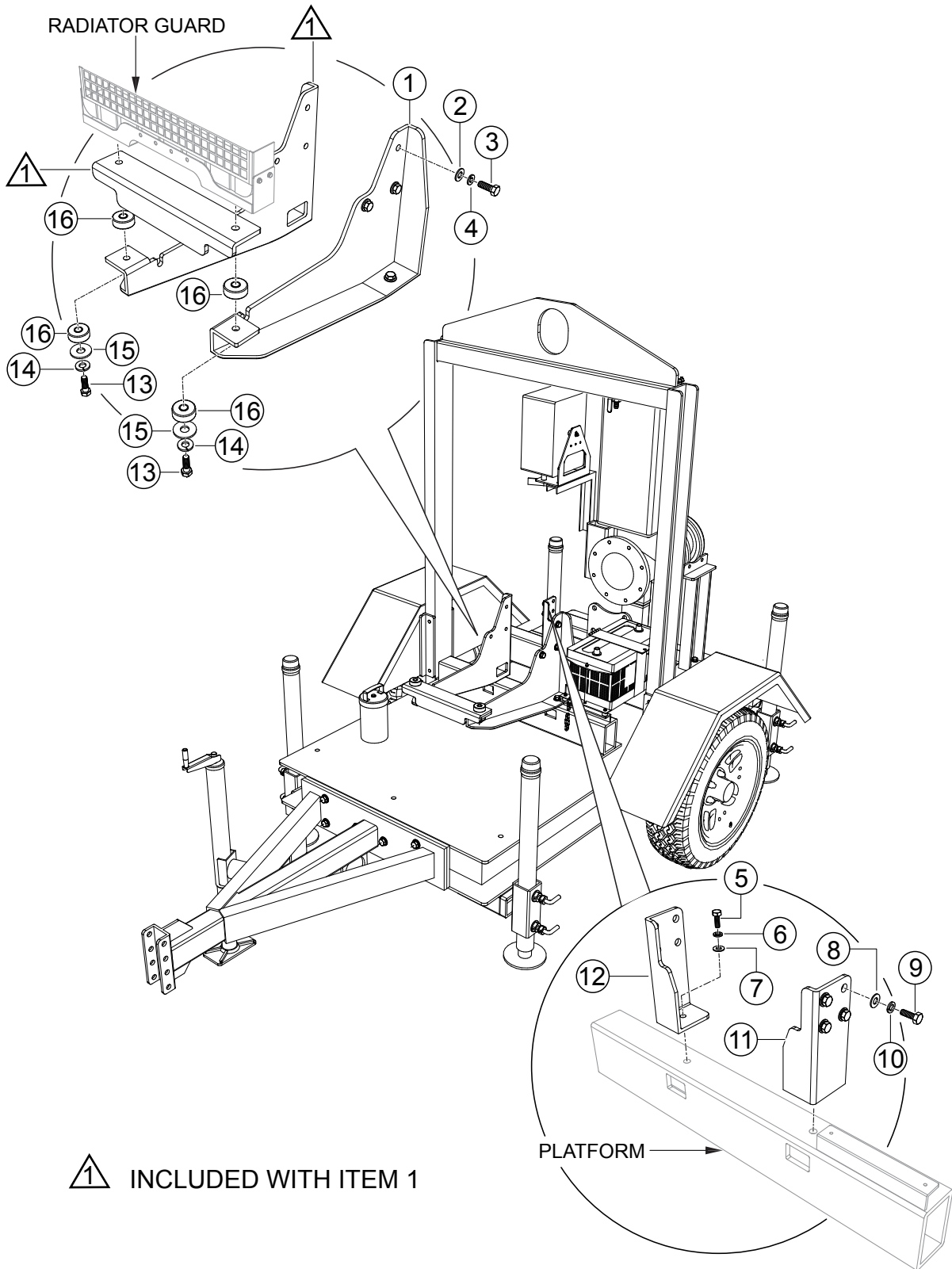
BATTERY ASSY. (AP8)



BATTERY ASSY. (AP8)

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD31418	NUT, NYLOCK	12	
2	APRD314121B	CABLE, BATTERY NEGATIVE	1	
3	APRD314122B	CABLE, BATTERY POSITIVE	1	
4	APRD3141512	BATTERY BOX, BOTTOM	1	
4A	APRD314152	BATTERY BOX, TOP	1	
5	APRD31414	BATTERY	1	
6	APRD31417	WASHER, LOCK	8	
7	APRD31416	ISOLATOR	4	
8	APRD31411	ROD	2	

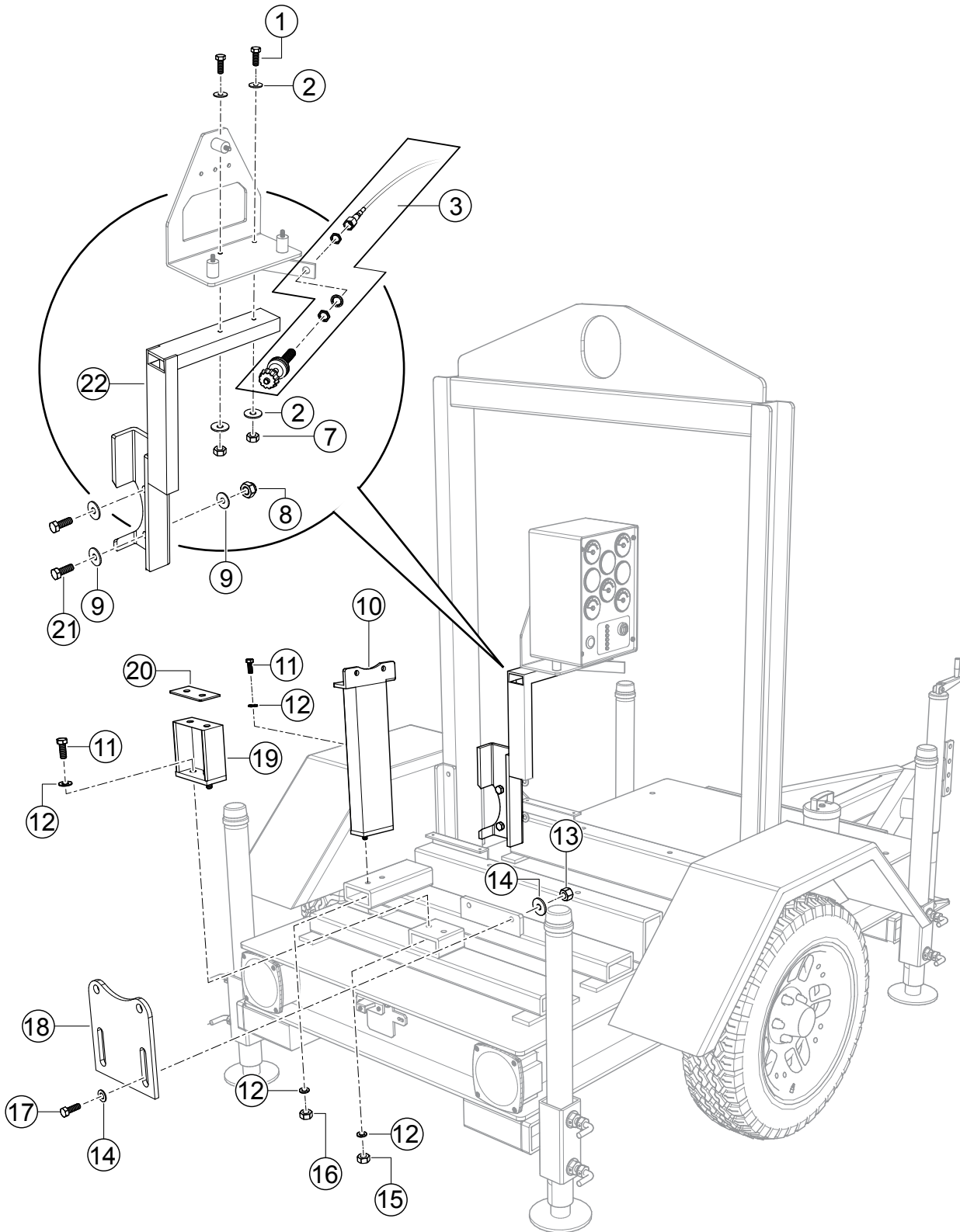
PUMP/ENGINE MOUNTING ASSY.



PUMP/ENGINE MOUNTING ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD314191	ENGINE SUPPORT, AP6	1.....	3 PIECE SET
1	APRD314192	ENGINE SUPPORT, AP8	1.....	3 PIECE SET
2	TBD	WASHER, LOCK	6	
3	TBD	BOLT	6	
4	TBD	WASHER, FLAT	6	
5	TBD	BOLT	2	
6	TBD	WASHER, LOCK	2	
7	TBD	WASHER, FLAT	2	
8	TBD	WASHER, FLAT	8	
9	TBD	BOLT	8	
10	TBD	WASHER, LOCK	8	
11	APRD31422	REAR ENGINE MOUNT, RIGHT	1	
11	APRD314211	REAR ENGINE MOUNT, LEFT, AP6	1	
12	APRD314212	REAR ENGINE MOUNT, LEFT, AP8	1	
13	TBD	BOLT	2	
14	TBD	WASHER, LOCK	2	
15	TBD	WASHER, FLAT	2	
16	APRD314201	ISOLATOR, AP6	4	
16	APRD314202	ISOLATOR, AP8	4	

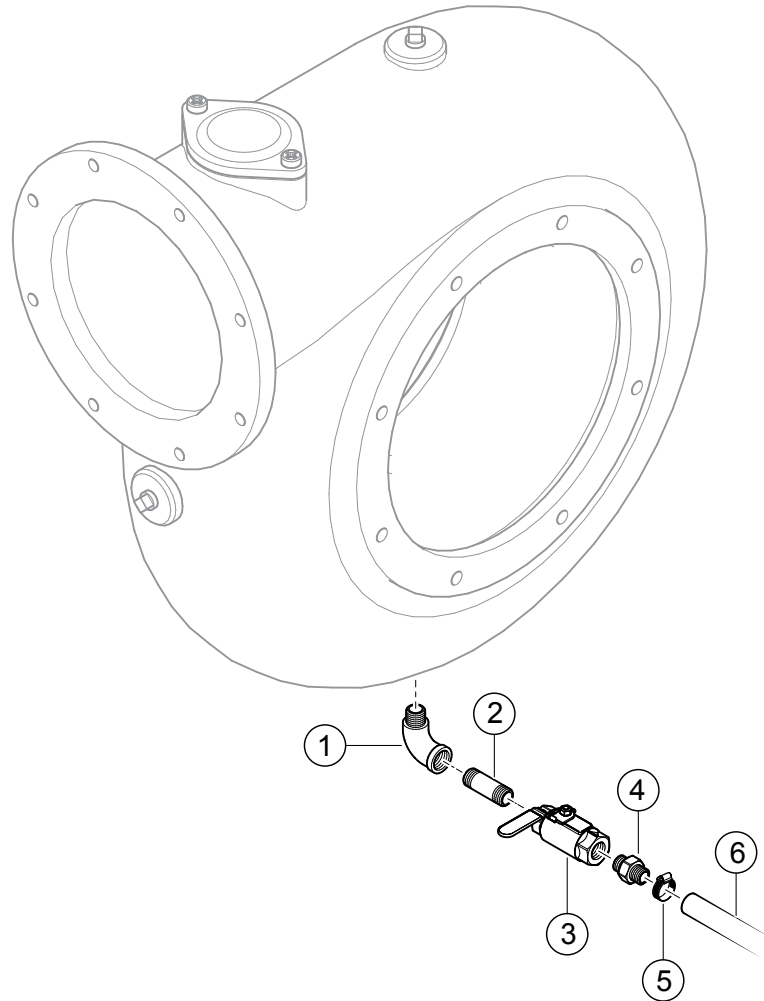
CONTROL BOX MOUNTING ASSY.



CONTROL BOX MOUNTING ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	TBD	BOLT	2	
2	TBD	WASHER, FLAT	4	
3	APF320000029	THROTTLE CABLE ASSY.	1	
7	TBD	NUT	2	
8	TBD	LOCK NUT	2	
9	TBD	WASHER	4	
10	APRD314101	DISCHARGE SUPPORT, AP6	1	
10	APRD314102	DISCHARGE SUPPORT, AP8	1	
11	APRD31407	HEX BOLT, 1/2" X 1-3/4	4	
12	APRD31408	WASHER, FLAT, 1/2"	8	
13	APRD31405	NUT, NYLOCK, 1/2"	2	
14	APRD31404	WASHER, FLAT	4	
15	APRD31409	NUT	4	
17	APRD31403	HEX BOLT, 5/16" X 2	2	
18	APRD31402	SUPPORT, PUMP END	1	
19	APRD314061	INTAKE SUPPORT, AP6	1	
19	APRD314062	INTAKE SUPPORT, AP8	1	
20	TBD	SEAL	1	
21	TBD	HEX BOLT, 3/4" X 2	2	
22	APRD31401	BRACKET, PANEL	1	

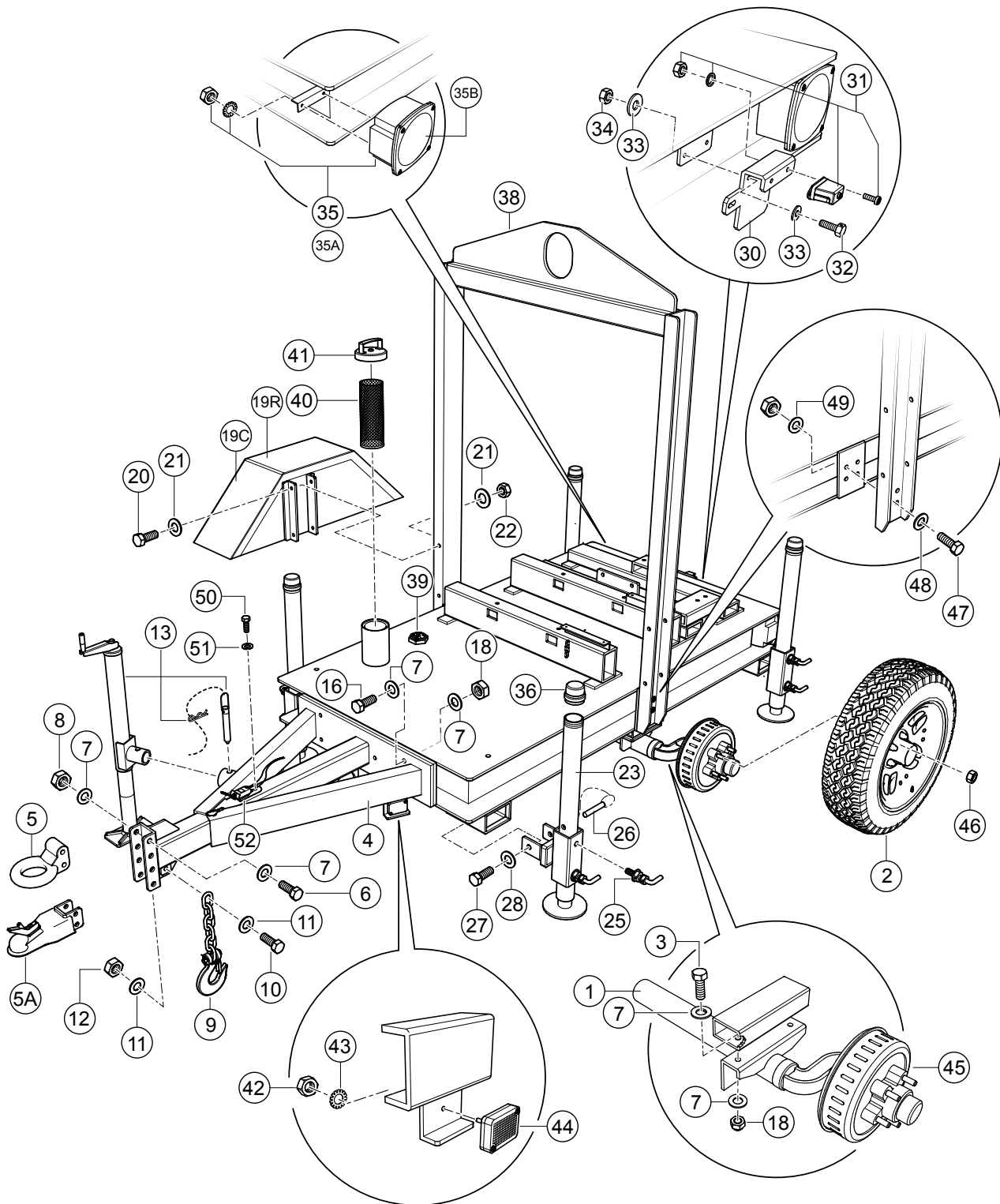
VOLUTE WATER VALVE ASSY.



VOLUTE WATER VALVE ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD31424	90° STREET ELBOW	1	
2	APRD31425	NIPPLE	1	
3	APRD31426	BALL VALVE	1	
4	APRD31427	HOSE FITTING, MALE	1	
5	APRD31428	CLAMP, HOSE	1	
6	APRD31429	HOSE, DRAIN	1	

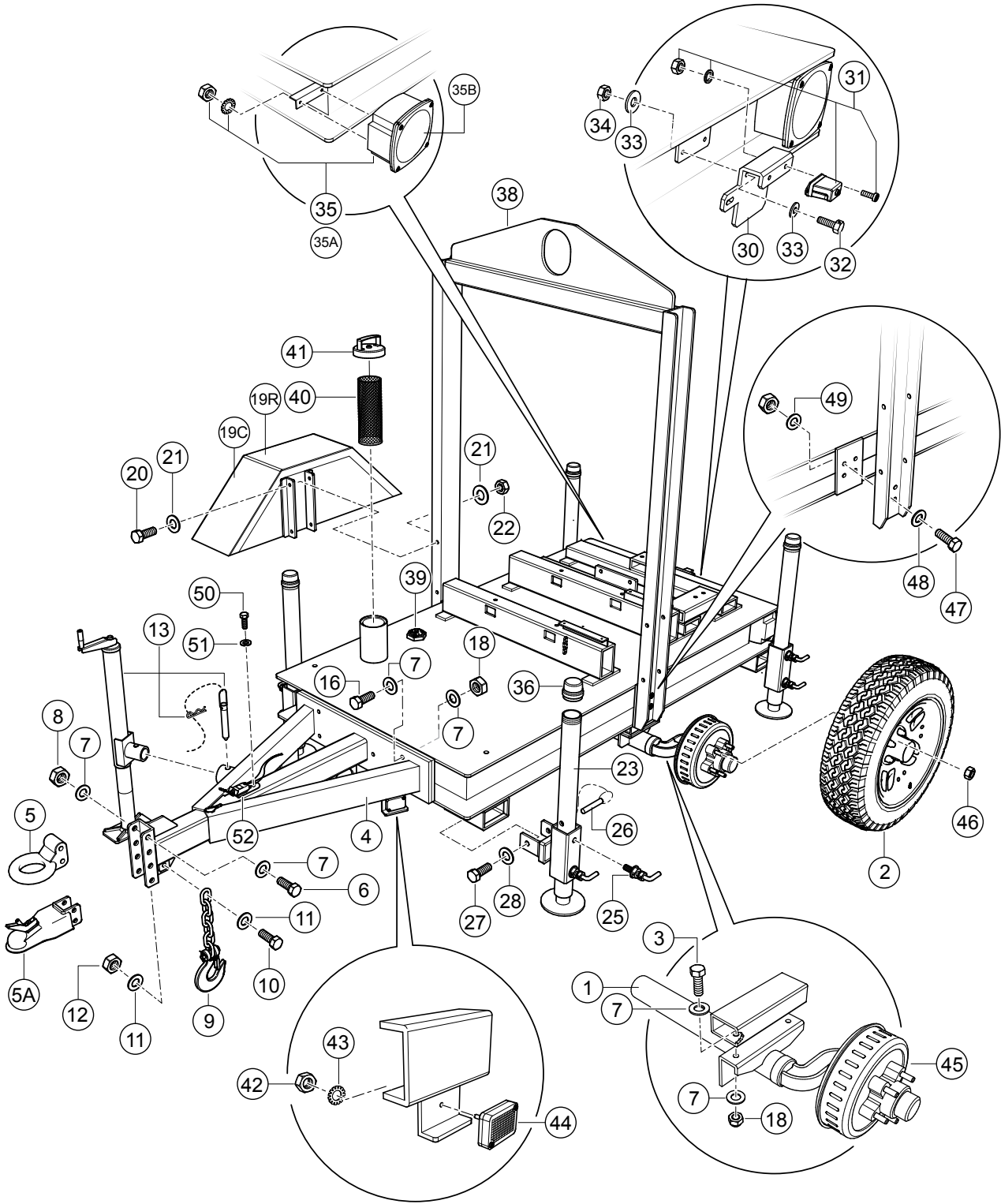
TRAILER ASSY.



TRAILER ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD27801	AXLE, TORSION 5200 6-LUG EB	1	
2	APRD27802	TIRE AND WHEEL, 225 15" - 6 LUG	2	
3	APRD27803	HHCS 5/8" X 2"	4	
4	APRD27804	TONGUE, RMV TRAILER, SHORT	1	
4	APRD27804L	TONGUE, RMV TRAILER W/ CANOPY	1	
5	APRD27805	COUPLER, PINTLE 3"	1	
5A	APRD27837	COUPLER, BALL HITCH 2-5/16"	1	
6	APRD27806	HHCS, 5/8"-11X4-1/2 USS GR5	2	
7	APRD27807	WASHER, FLAT 5/8" SAE	24	
8	APRD27808	NUT, LOCK 2 WAY 5/8"-11	2	
9	APRD27809	CHAIN, SAFETY 3/8"X36" W/ HOOK	2	
10	APRD27810	HHCS, 9/16"-12X1-3/4 GR8	2	
11	APRD27811	WASHER, FLAT 9/16" USS	4	
12	APRD27812	LOCK NUT, 9/16" -20 SAE	2	
13	APRD27813	JACKSTAND, TOPWIND	1	
16	APRD27816	HHCS, 5/8"-11X2-1/4" GR8	6	
18	APRD27818	NUT, NYLOCK 5/8"-11 USS GR8	10	
19R	APRD27819R	FENDER SINGLE, ROADSIDE	1	
19C	APRD27819C	FENDER SINGLE, CURBSIDE	1	
20	APRD27820	HHCS, 3/8"-16X5-1/2" USS GR5	4	
21	APRD27821	WASHER, FLAT 3/8" SAE	8	
22	APRD27822	NUT, NYLOCK 3/8"-16 USS	4	
23	APRD27823	TUBE, JACKSTAND 27"	4	
24	APRD27824	MOUNT, JACKSTAND 3X5 SLIDING	4	
25	APRD27825	BOLT, LOCKING - REAR JACKSTAND	8	
26	APRD27826	PIN, HITCH JACKSTAND	1	
27	APRD27827	HHCS, 1/2"-13X1-1/4" USS GR5	8	
28	APRD27828	WASHER, FLAT 1/2" SAE	8	
30	APRD27830	BRACKET, REMOVAL LICENSE PLATE	1	

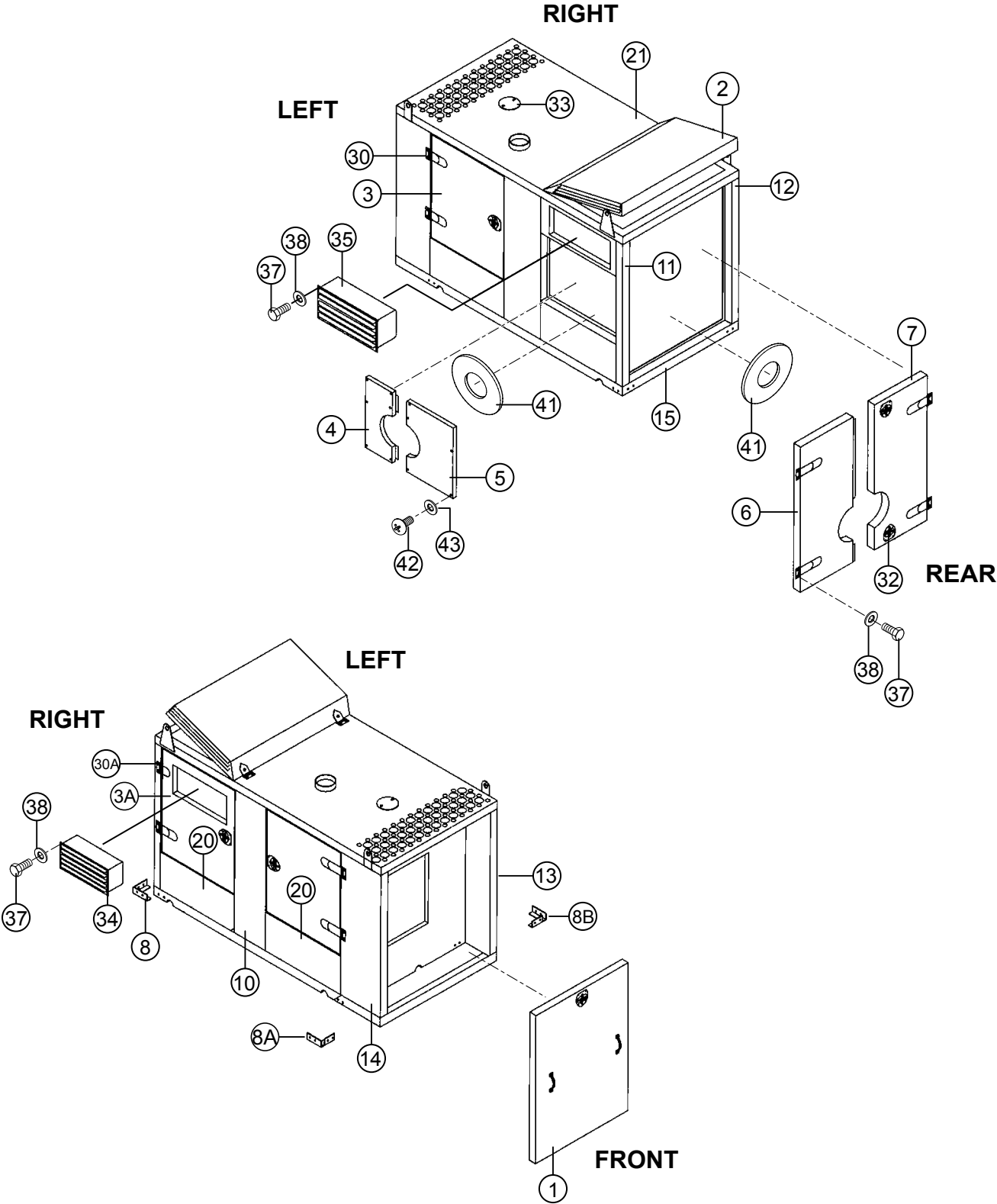
TRAILER ASSY (CONTINUED).



TRAILER ASSY (CONTINUED).

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
31	APRD24831	LIGHT, LICENSE PLATE	1	
32	APRD27832	SCREW, MACH 10-32X1/2" PAN SS	2	
33	APRD27833	WASHER, FLAT 1/4" SAE	2	
34	APRD27834	NUT, KEP #10-32	2	
35	APM25440L	TAIL LIGHT ASSY., ROADSIDE	1	
35A	APM25440	TAIL LIGHT ASSY., CURBSIDE	1	
35B	APM2544015	LENS, TAIL LIGHT ASSY.	1	
36	APRD27836	CAP, 1-1/2" NPT BLACK STEEL	4	
37	APRD310011	FRAME, AP6	1	
37	APRD310012	FRAME, AP8	1	
38	APRD310021A	LIFTING BALE, AP6	1	
38	APRD310021B	LIFTING BALE, AP6, CANOPY UNIT	1	
38	APRD310022A	LIFTING BALE, AP8	1	
38	APRD310022B	LIFTING BALE, AP8, CANOPY UNIT	1	
39	APRD365031	FUEL GAUGE, AP6	1	
39	APRD365032	FUEL GAUGE, AP8	1	
40	APRD31005	FUEL STRAINER	1	
41	APRD31006	FUEL CAP	1	
42	APM25114A	SIDE REFLECTOR ASSY, AMBER	2	
45	APM2592655	BRAKE DRUM	2	
46	APM25000030	LUG NUT	12	
47	APH600001094G8	BOLT, GRD8	8	
48	APH610001023	WASHER	16	
49	APHANYN625CG8	WASHER	8	
50	TBD	BOLT	1	
51	TBD	WASHER	1	
52	APM2589102	SWITCH, BREAKAWAY	1	

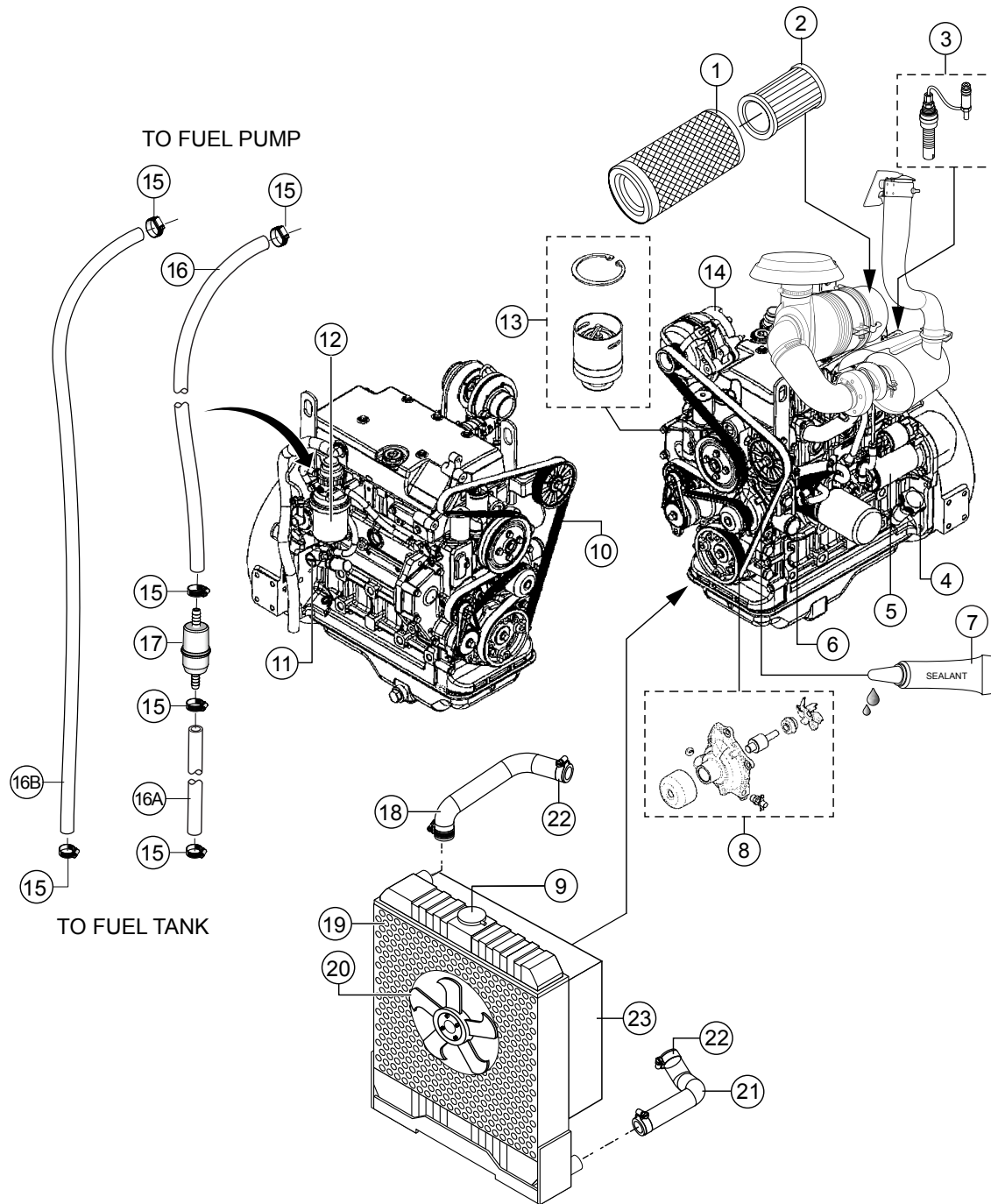
CANOPY ASSY.



CANOPY ASSY.

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	APRD301011	FRONT DROP IN PANEL, AP6	1	
1	APRD301012	FRONT DROP IN PANEL, AP8	1	
2	APRD301021	TOP DOOR	1	
3	APRD301031	SIDE DOOR	1	
4	APRD301041	DISCHARGE PANEL LEFT SIDE, AP6	1	
4	APRD301042	DISCHARGE PANEL LEFT SIDE, AP8	1	
5	APRD301051	DISCHARGE PANEL RIGHT SIDE, AP6	1	
5	APRD301052	DISCHARGE PANEL RIGHT SIDE, AP8	1	
6	APRD301061	SUCTION DOOR LEFT SIDE, AP6	1	
6	APRD301062	SUCTION DOOR LEFT SIDE, AP8	1	
7	APRD301071	SUCTION DOOR RIGHT SIDE, AP6	1	
7	APRD301072	SUCTION DOOR RIGHT SIDE, AP6	1	
8	APRD30108	CANOPY HOLD DOWN LEFT-RIGHT REAR	1	
8A	APRD301081	CANOPY HOLD DOWN FRONT LT. SIDE	1	
8B	APRD301082	CANOPY HOLD BOWN FRONT RT. SIDE	1	
10	APRD301101	CENTER PANEL, AP6	1	
10	APRD301102	CENTER PANEL, AP8	1	
11	APRD301111	REAR ROADSIDE CORNER PANEL, AP6.....	1.....	LEFT
11	APRD301112	REAR ROADSIDE CORNER PANEL, AP8.....	1.....	LEFT
12	APRD301121	REAR CURBSIDE CORNER PANEL, AP6.....	1.....	RIGHT
12	APRD301122	REAR CURBSIDE CORNER PANEL, AP6.....	1.....	RIGHT
13	APRD301131	FRONT ROADSIDE PANEL, AP6.....	1.....	LEFT
13	APRD301132	FRONT ROADSIDE PANEL, AP8.....	1.....	LEFT
14	APRD301141	FRONT CURBSIDE PANEL, AP6.....	1.....	RIGHT
14	APRD301142	FRONT CURBSIDE PANEL, AP8.....	1.....	RIGHT
15	APRD301151	CANOPY BOTTOM FRAME, AP6	1	
15	APRD301152	CANOPY BOTTOM FRAME, AP8	1	
20	APRD301201	FOOTER PANEL, AP6	2	
20	APRD301202	FOOTER PANEL, AP8	2	
20A	APRD3012011	HEADER PANEL, AP6	1	
20A	APRD3012012	HEADER PANEL, AP8	1	
21	APRD301211	TOP PANEL, AP6	1	
21	APRD301212	TOP PANEL, AP8	1	
30	APRD30130	HINGE	10	
30A	APRD301301	SMALL HINGE	2	
32	APRD30132	DOOR LATCH HANDLE	6	
33	APRD30133	RADIATOR CAP	1	
34	APRD301341	GRILL PANEL, AP6	1.....	RIGHT
34	APRD301352	GRILL PANEL, AP8	1.....	RIGHT
35	APRD301351	GRILL PANEL, AP6	1.....	LEFT
35	APRD301352	GRILL PANEL, AP8	1.....	LEFT
36	APRD301361	FRONT INNER WALL, AP6	1	
36	APRD301362	FRONT INNER WALL, AP8	1	
37	APRD301371	BOLT, 1/4-20 X 1" SS, AP6	66	
37	APRD301372	BOLT, AP8	66	
38	APRD301381	WASHER, FLAT AP6	66	
38	APRD301382	WASHER, FLAT AP8	66	
41	TBD	INSULATION	2	
42	TBD	SCREW, PHILLIPS HEAD	8	
43	TBD	WASHER, FLAT	8	

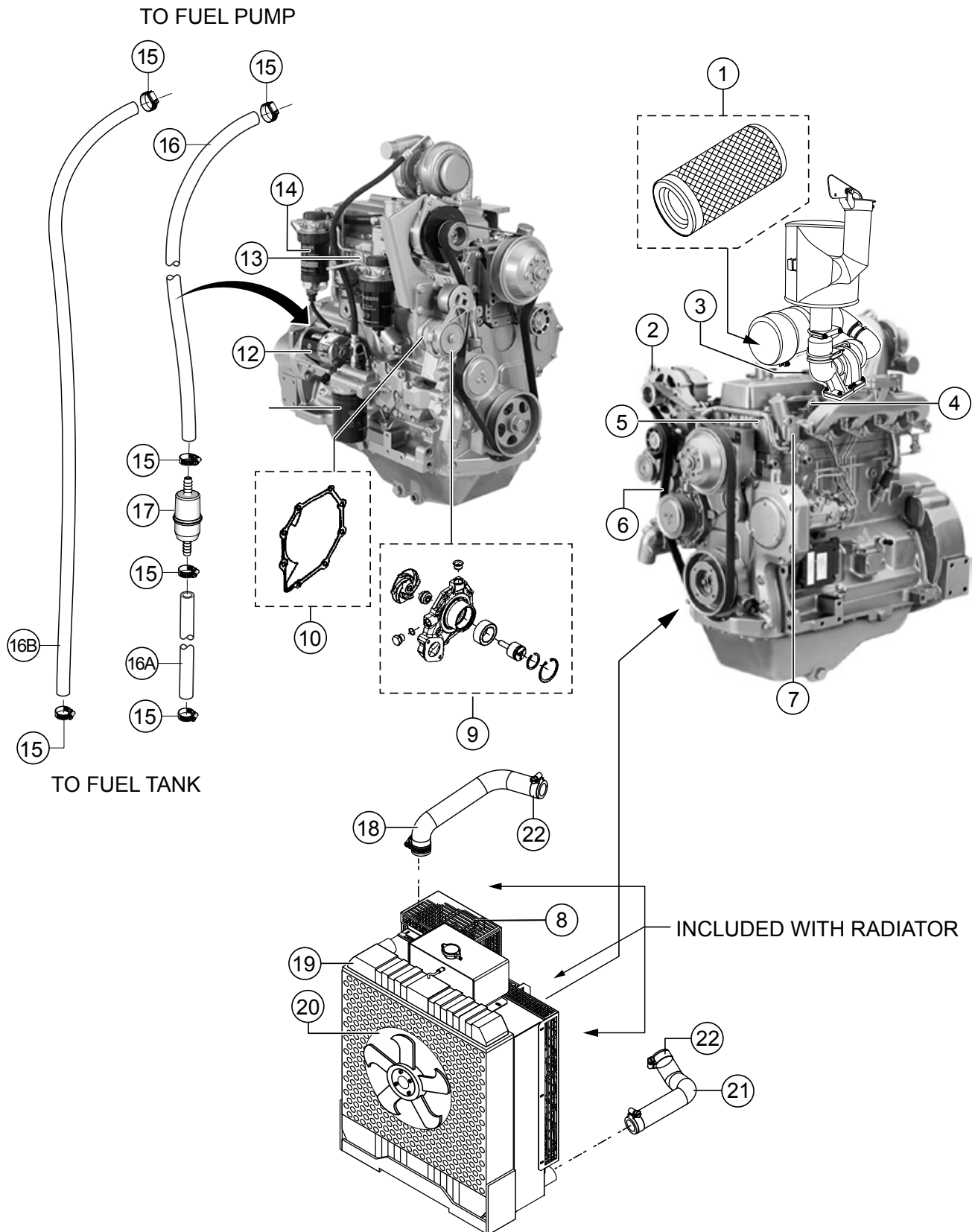
JOHN DEERE 4024TF ENGINE SERVICE PARTS



JOHN DEERE 4024TF ENGINE SERVICE PARTS

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	AT171853	ELEMENT, AIR CLEANER, PRIMARY	1	
2	AT171854	ELEMENT, AIR CLEANER, SECONDARY	1	
3	RE527597	FUEL PUMP, INJECTORS	1	
4	RE506791	DIPSTICK, ENGINE OIL	1	
5	RE508922	STARTER MOTOR	1	
6	RE519626	OIL FILTER	1	
7	RE524832	SEALANT, WATER PUMP	1	
8	RE518520	WATER PUMP	1	MUST ORDER ITEM 7 W/ ITEM 8
9	KV25481	FILLER CAP, RADIATOR	1	
10	RE515217	FAN BELT	1	
11	RE532211	FUEL PUMP	1	
12	RE508202	FUEL FILTER	1	
13	RE526915	THERMOSTAT KIT	1	
14	RE529377	ALTERNATOR	1	
15	APRD31430	CLAMP, HOSE	6	
16	APRD31431	HOSE, FUEL, 18 " LENGTH.....	2	1PC= 1 FT.
16A	APRD31431	HOSE, FUEL, 10 " LENGTH.....	1	1PC= 1 FT.
16B	APRD31431	HOSE, FUEL, 32 " LENGTH.....	3	1PC= 1 FT.
17	APRD31432	FILTER, FUEL, INLINE	1	
18	APR526511	HOSE, RADIATOR, UPPER	1	
19	APRE534047	RADIATOR	1	
20	AP47354129620	FAN	1	
21	APR525669	HOSE, RADIATOR LOWER	1	
22	APRE6098	CLAMP, HOSE	4	
23	APRE534049	FAN SHROUD	1	

JOHN DEERE 4045TF ENGINE SERVICE PARTS



JOHN DEERE 4045TF ENGINE SERVICE PARTS

<u>NO.</u>	<u>PART NO.</u>	<u>PART NAME</u>	<u>QTY.</u>	<u>REMARKS</u>
1	P182063	AIR FILTER	1	
2	RE533516	ALTERNATOR	1	
3	RE535560	CAP, OIL FILLER NECK	1	
4	RE531802	INJECTOR NOZZLE	1	
5	RE503242	TEMPERATURE SWITCH	1	
6	R123432	FAN BELT	1	
7	RE522076	THERMOSTAT	1	
8	R524988	FILLER CAP, RADIATOR	1	
9	RE505981	WATER PUMP	1ITEM 10 NOT INCLUDED
10	R123417	GASKET, WATER PUMP	1	
11	RE504836	OIL FILTER	1	
12	RE540302	STARTER MOTOR	1	
13	RE68345	FUEL PUMP	1	
14	RE522868	FILTER, FUEL	1	
15	APRD31430	CLAMP, HOSE	6	
16	APRD31431	HOSE, FUEL, 18 " LENGTH.....	21PC= 1 FT.
16A	APRD31431	HOSE, FUEL, 10 " LENGTH.....	11PC= 1 FT.
16B	APRD31431	HOSE, FUEL, 32 " LENGTH.....	31PC= 1 FT.
17	APRD31432	FILTER, FUEL, INLINE	1	
18	AP68900169P	HOSE, RADIATOR, UPPER	1	
19	APRE534047	RADIATOR	1	
20	APAT170040	FAN	1	
21	AP68900170P	HOSE, RADIATOR LOWER	1	
22	APRE6098	CLAMP, HOSE	4	

TERMS AND CONDITIONS OF SALE — PARTS

PAYMENT TERMS

Terms of payment for parts are net 30 days.

FREIGHT POLICY

All parts orders will be shipped collect or prepaid with the charges added to the invoice. All shipments are F.O.B. point of origin. Multiquip's responsibility ceases when a signed manifest has been obtained from the carrier, and any claim for shortage or damage must be settled between the consignee and the carrier.

MINIMUM ORDER

The minimum charge for orders from Multiquip is \$15.00 net. Customers will be asked for instructions regarding handling of orders not meeting this requirement.

RETURNED GOODS POLICY

Return shipments will be accepted and credit will be allowed, subject to the following provisions:

1. A Returned Material Authorization must be approved by Multiquip prior to shipment.
2. To obtain a Return Material Authorization, a list must be provided to Multiquip Parts Sales that defines item numbers, quantities, and descriptions of the items to be returned.
 - a. The parts numbers and descriptions must match the current parts price list.
 - b. The list must be typed or computer generated.
 - c. The list must state the reason(s) for the return.
 - d. The list must reference the sales order(s) or invoice(s) under which the items were originally purchased.
 - e. The list must include the name and phone number of the person requesting the RMA.
3. A copy of the Return Material Authorization must accompany the return shipment.
4. Freight is at the sender's expense. All parts must be returned freight prepaid to Multiquip's designated receiving point.

5. Parts must be in new and resalable condition, in the original Multiquip package (if any), and with Multiquip part numbers clearly marked.
6. The following items are not returnable:
 - a. Obsolete parts. (If an item is in the price book and shows as being replaced by another item, it is obsolete.)
 - b. Any parts with a limited shelf life (such as gaskets, seals, "O" rings, and other rubber parts) that were purchased more than six months prior to the return date.
 - c. Any line item with an extended dealer net price of less than \$5.00.
 - d. Special order items.
 - e. Electrical components.
 - f. Paint, chemicals, and lubricants.
 - g. Decals and paper products.
 - h. Items purchased in kits.
7. The sender will be notified of any material received that is not acceptable.
8. Such material will be held for five working days from notification, pending instructions. If a reply is not received within five days, the material will be returned to the sender at his expense.
9. Credit on returned parts will be issued at dealer net price at time of the original purchase, less a 15% restocking charge.
10. In cases where an item is accepted, for which the original purchase document can not be determined, the price will be based on the list price that was effective twelve months prior to the RMA date.
11. Credit issued will be applied to future purchases only.

PRICING AND REBATES

Prices are subject to change without prior notice. Price changes are effective on a specific date and all orders received on or after that date will be billed at the revised price. Rebates for price declines and added charges for price increases will not be made for stock on hand at the time of any price change.

Multiquip reserves the right to quote and sell direct to Government agencies, and to Original Equipment Manufacturer accounts who use our products as integral parts of their own products.

SPECIAL EXPEDITING SERVICE

A \$35.00 surcharge will be added to the invoice for special handling including bus shipments, insured parcel post or in cases where Multiquip must personally deliver the parts to the carrier.

LIMITATIONS OF SELLER'S LIABILITY

Multiquip shall not be liable hereunder for damages in excess of the purchase price of the item with respect to which damages are claimed, and in no event shall Multiquip be liable for loss of profit or good will or for any other special, consequential or incidental damages.

LIMITATION OF WARRANTIES

No warranties, express or implied, are made in connection with the sale of parts or trade accessories nor as to any engine not manufactured by Multiquip. Such warranties made in connection with the sale of new, complete units are made exclusively by a statement of warranty packaged with such units, and Multiquip neither assumes nor authorizes any person to assume for it any other obligation or liability whatever in connection with the sale of its products. Apart from such written statement of warranty, there are no warranties, express, implied or statutory, which extend beyond the description of the products on the face hereof.

Effective: February 22, 2006

OPERATION MANUAL

HERE'S HOW TO GET HELP

PLEASE HAVE THE MODEL AND SERIAL
NUMBER ON-HAND WHEN CALLING

UNITED STATES

Multiquip Corporate Office

18910 Wilmington Ave.
Carson, CA 90746
Contact: mq@multiquip.com

Tel. (800) 421-1244
Fax (310) 537-3927

Service Department

800-421-1244
310-537-3700

Fax: 310-537-4259

Technical Assistance

800-478-1244

Fax: 310-943-2238

MQ Parts Department

800-427-1244
310-537-3700

Fax: 800-672-7877
Fax: 310-637-3284

Warranty Department

800-421-1244
310-537-3700

Fax: 310-943-2249

CANADA

Multiquip

4110 Industriel Boul.
Laval, Quebec, Canada H7L 6V3
Contact: jmartin@multiquip.com

Tel: (450) 625-2244
Tel: (877) 963-4411
Fax: (450) 625-8664

UNITED KINGDOM

Multiquip (UK) Limited Head Office

Unit 2, Northpoint Industrial Estate,
Globe Lane,
Dukinfield, Cheshire SK16 4UJ
Contact: sales@multiquip.co.uk

Tel: 0161 339 2223
Fax: 0161 339 3226

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This manual MUST accompany the equipment at all times. This manual is considered a permanent part of the equipment and should remain with the unit if resold.

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