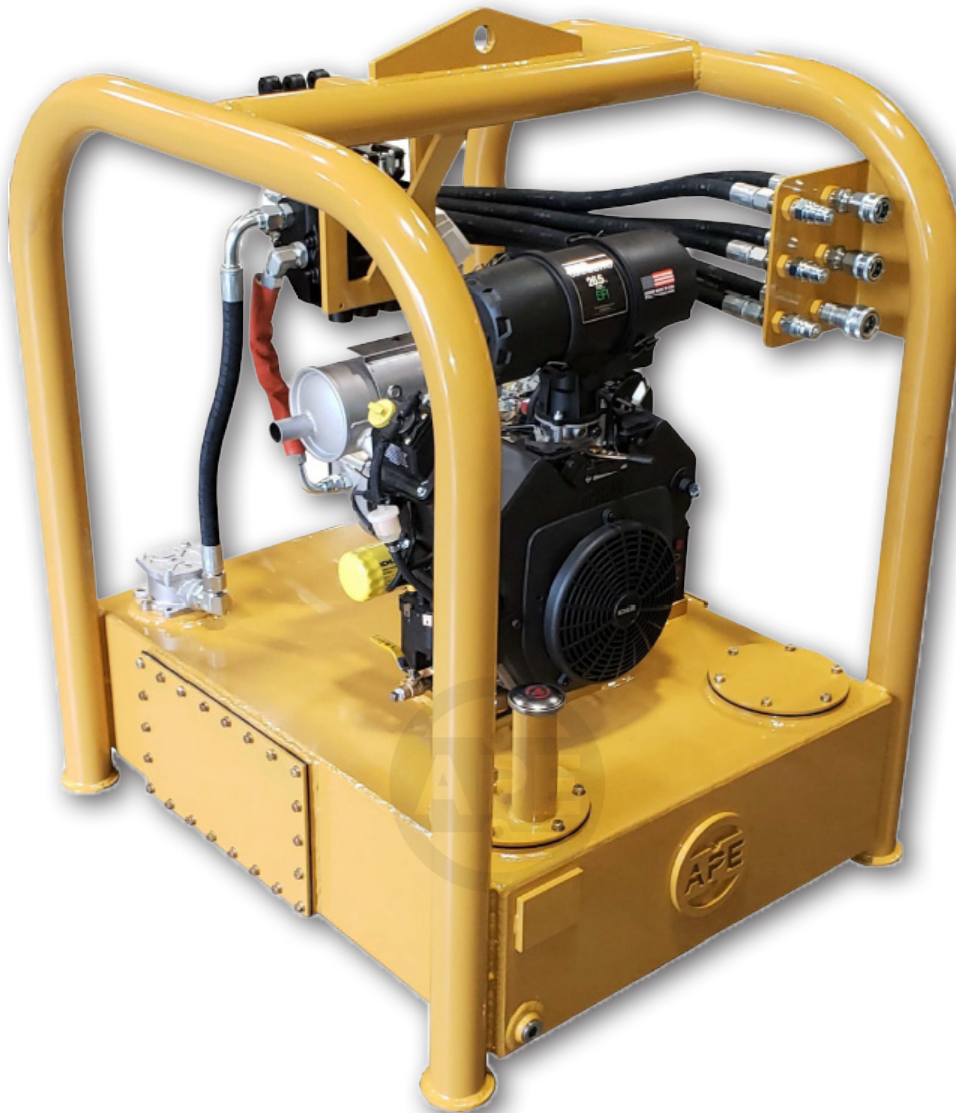




# APE POWER UNIT OWNER'S MANUAL

## DEEP FOUNDATION SOLUTIONS



**800-248-8498**

**WWW.AMERICANPILEDRIVING.COM**

**MODEL 27 POWER UNIT**

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**MODEL 27 POWER UNIT**

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# Quick Reference Guide

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This Quick Reference Guide will assist you in finding the information you're looking for.

**GENERAL INFORMATION**

**MAINTENANCE**

**TROUBLE SHOOTING**

**REPLACEMENT PARTS**

**REFERENCE / NOTES**

A Table of Contents is included after the Foreword.

**Description:**

**MODEL 27 POWER UNIT**



# WARRANTY INFORMATION

American Piledriving Equipment, Inc. (APE) warrants new products sold by it to be free from defects in material or workmanship for a period of one (1) years after the date of delivery to the first user and subject to the following conditions:

- APE's obligation and liability under this WARRANTY is expressly limited to repairing or replacing, at APE's option, any parts which appear to APE upon inspection to have been defective in material or workmanship. Such parts shall be provided at no cost to the user, at the business establishment of APE or the authorized APE distributor of the product during regular working hours.
- This WARRANTY shall not apply to component parts or accessories of products not manufactured by APE, and which carry the warranty of the manufacturer thereof, or to normal maintenance (such as engine tune-up) or normal maintenance parts (such as filters).
- Replacement or repair parts installed in the product covered by this WARRANTY are warranted only for the remainder of the warranty as if such parts were original components of said product.
- APE makes no other warranty, expressed or implied, and makes no warranty of merchantability of fitness for any particular purpose.
- APE's obligations under this WARRANTY shall not include any transportation charges, costs of installation, duty, taxes or any other charges whatsoever, or any liability for direct, indirect, incidental or consequential damage or delay.
- If requested by APE, products or parts for which a warranty claim is made are to be returned, transportation prepaid, to APE.

OIL MUST MEET ISO CLEANLINESS CODE 17/15/11. OIL THAT DOES NOT MEET CLEANLINESS CODE WILL **VOID** THE WARRANTY

ANY IMPROPER USE, INCLUDING OPERATION AFTER DISCOVERY OF DEFECTIVE OR WORN PARTS, OPERATION BEYOND RATED CAPACITY, SUBSTITUTION OF ANY PARTS WHATSOEVER, USE OF PARTS NOT APPROVED BY APE OR ANY ALTERATION OR REPAIR BY OTHERS IN SUCH A MANNER AS, IN APE'S JUDGMENT, AFFECTS THE PRODUCT MATERIALLY AND ADVERSELY, SHALL **VOID** THIS WARRANTY.

ANY TYPE OF WELDING ON APE'S EQUIPMENT WILL **VOID** THE WARRANTY UNLESS AUTHORIZED IN WRITING BY APE

NO EMPLOYEE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY UNLESS SUCH CHANGE IS MADE IN WRITING AND SIGNED BY AN OFFICER OF APE, INC.

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## Foreword

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This manual covers **APE Hydraulic Power Unit** safety, operation instructions, lubrication and maintenance information. This manual should be stored in or near the engine area in a literature holder or literature storage area.

The data provided in this manual gives the necessary information to operate and maintain APE equipment. The listed procedures are to be performed by qualified personnel who have an understanding of the equipment and who follow all safety precautions.

Some photographs or illustrations in this manual show details or attachments that may be different from your equipment. Continuing improvement and advancement of product design may have caused changes to your equipment which are not included in this manual. Whenever a question arises regarding your equipment, or this manual, please consult with your APE dealer for the latest available information.

### Using this manual:

- Refer to the Table of Contents for the page location of applicable sections.
- All weights and measurements are in English and Metric units.
- Please visit [www.americanpiledriving.com](http://www.americanpiledriving.com) for product data sheets and manuals and latest available information.

### **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.

### **CALIFORNIA Proposition 65 Warning**

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer, birth defects and reproductive harm. **Wash hands after handling.**

### **DISCLAIMER:**

This unit was tested and flushed before leaving our facility. In order to help provide years of trouble-free usage, please review the following documentation and make sure to clean and flush the quick disconnect fitting on any equipment before connecting it to the power unit.

Refer to schematic diagrams and the BOM (Bill of Materials) for component part specifications and recommended spare parts.

When calling APE, always have the equipment serial number on hand in order to obtain quicker service.

### **IDENTIFICATION TAG**



Serial No. can be found here.

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## Specification

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### DIMENSIONS

Overall Length	40 in	(101.6 cm)
Overall Width	36 in	(91.44 cm)
Overall Height	48 in	(121.92 cm)
Weight	990 lbs	(449.05 kg)
Fuel Capacity	10 gal	(37.8 L)

### ENGINE

Type	Kohler Command Pro ECV/ECH749	
Horse Power	26.5 hp	(19.8 kW)
Displacement	45 in <sup>3</sup>	(747 cc)
Compression Ratio	9.1:1	
Engine Speed	3,600 rpm	
Engine Oil	Engine Oil *****	
	2 qt (US)	(1.9 L)

### HYDRAULICS

Aux #1, #2, & #3		
Hydraulic Pressure	0 - 2500 psi	(172 bar)
Hydraulic Flow	0 - 15 GPM	(56 LPM)
Hydraulic Oil	Envirologic 146 Hydraulic Oil	
Hydraulic Capacity	30 gal	(113 L)



### SAFETY MESSAGES

There may be several specific safety messages on your equipment. The exact location and description of the safety messages are reviewed in this section. Become familiar with all safety messages.

Ensure that all the safety messages are legible. Clean the safety messages or replace the safety messages if the words cannot be read or if the illustrations are not visible. Use a cloth, water and soap to clean the safety messages. Do not use solvents, gasoline, or other harsh chemicals. Solvents, gasoline, or harsh chemicals could loosen the adhesive that secures the safety messages. The safety messages that are loosened could drop off the equipment.

Replace any safety message that is damaged or missing. If a safety message is attached to a part of the equipment that is replaced, install a new safety message on the replacement part. Your APE dealer can provide new safety messages.



**Do not operate or work on this equipment unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or read the warnings could result in injury or death. Contact any APE dealer for replacement manuals. Proper care is your responsibility.**

### QUICK DISCONNECT NOTICE

**NOTICE:** QUICK DIS-CONNECTS MUST BE FULLY SEATED TO ALLOW FREE HYDRAULIC FLOW. BLOCKED HYDRAULIC FLOW WILL STOP OR SLOW OPERATIONS AND CAUSE EXCESSIVE HEAT. TO SOLVE PROBLEM, REMOVE CLEAN AND RE INSTALL FITTINGS

Make sure all QD's are installed and connected completely. Failing to do so may cause damage or prevent proper operation.

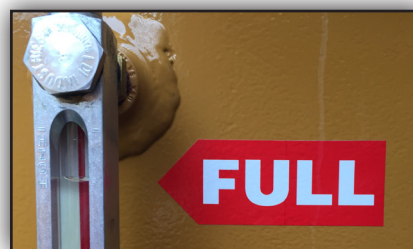
### IDENTIFICATION TAG



This information is important when contacting APE for replacement parts or other information.

- \* Model
- \* Serial No.

### HYDRAULIC OIL FULL



Hydraulic oil needs to be kept at correct FULL level at all times. Do **NOT** overfill the tank. This may cause leakage when hot, due to insufficient space for oil to expand. Depending on the power unit it will have either one or two electronic hydraulic sensors to monitor low oil level and oil level shutdown, to prevent damage to the power unit.

### DO NOT WELD



Do **NOT** weld on or around the power unit unless authorized in writing by APE. Doing so will void all warranties and may cause damage to the power unit or vibro.



## General Safety Precautions



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 where injury could occur but is unlikely to be serious or lead to death.



NOTICE indicates information that may help or guide you in the operation or service of the equipment.

### DISCLAIMER:

This unit was tested and flushed before leaving our facility. In order to help provide years of trouble free usage, please review the following documentation and make sure to clean and flush the field piping before connecting it to the power unit.

Refer to schematic diagrams and the BOM (Bill of Materials) for component part specifications and recommended spare parts.

When calling APE (American Piledriving Equipment), always inform them of the supplied serial # in order to obtain quicker service

## NOTICE

### READ THIS MANUAL THOROUGHLY BEFORE OPERATING AND / OR WORKING ON THE EQUIPMENT

1. Only well-trained and experienced personnel should attempt to operate or maintain this equipment.
2. NEVER adjust, lubricate and/or repair the unit when it is in operation or lifted above ground level.
3. NEVER remove, paint over and/or cover warning or safety labels. If labels become damaged or unreadable, replace immediately.
4. All personnel should wear approved safety clothing including HARD HATS, SAFETY SHOES, SAFETY GLASSES and HEARING PROTECTION when near this equipment.
5. Do **NOT** stand any closer to this equipment than necessary when it is in operation. Parts may loosen and fall. **NEVER** stand under operating or elevated equipment.
6. When maintaining and/or repairing the equipment, **NEVER** substitute parts not supplied or approved in writing by APE.

## NOTICE

### Do **NOT** weld or flame cut on this equipment.

7. NEVER use or store flammable liquids on or near the engine.
8. Insure that all lifting equipment, including cranes, wire rope, slings, hooks, shackles, etc., are properly sized for the worst caseloads anticipated during operations.
9. If there are any questions about the weights, specifications and/or performance of the unit, contact APE before handling and/or operating the equipment.
10. Check wire rope clips for tightness and wire ropes for wear daily.
11. Insure that ground vibrations will not damage or collapse adjacent structures or excavations.



***When operating in an enclosed area, exhaust fumes should be piped outside. Continued breathing of exhaust fumes may prove FATAL.***

12. Remove all tools, parts and/or electrical cords before starting the unit.
13. When servicing batteries, do **NOT** smoke and/or use an open flame in the vicinity. Batteries generate explosive gas during charging. There must be proper ventilation when charging batteries.
14. When filling the fuel tank, do **NOT** smoke and/or use an open flame in the vicinity.
15. If abnormal equipment operation is observed, discontinue use immediately and correct the problem.
16. Do **NOT** leave the equipment control pendant (radio control) unattended.
17. Store oily rags in approved containers and away from the engine exhaust system.
18. If running an auger/drill, make sure that the Auger rotation switch is in NEUTRAL before starting the Power Unit engine
19. Do **NOT** adjust and/or set the hydraulic pressures higher and/or lower than those specified in this Manual.
20. NEVER operate this equipment with hydraulic hoses that are damaged or 'kinked'. Replace damaged hoses immediately.
21. Do **NOT** lift and/or support hydraulic hoses with wire rope slings.
22. NEVER attempt to connect Quick Disconnects (QDs) when the Power Unit is running.
23. Do **NOT** pull on and/or attempt to move equipment with the hydraulic hoses.
24. Do **NOT** attempt to locate hydraulic leaks with your hands. High-pressure leaks can penetrate skin and cause severe damage, blood poisoning and/or infection.
25. Do **NOT** attempt to repair leaks while the equipment is in operation.
26. Do **NOT** attempt to tighten and/or loosen fittings and/or hoses when the machine is in operation.
27. Power Unit must always be placed on level, stable ground.
28. Do **NOT** remove Power Unit heat shields. Do NOT attempt to use the Power Unit without heat shields. Severe fires may result.

## NOTICE

***A properly maintained fire extinguisher, suitable for oil fires, MUST be kept in the immediate vicinity of equipment operations.***

29. When moving and/or transporting this equipment, insure that the vehicle and/or vessel is of sufficient capacity to handle the load. Make sure that the equipment is properly tied down.
30. When moving and/or transporting this equipment, be sure that the QD Dust Caps are tight and that the cap safety cables are in place. Be sure that all equipment parts are tight and/or properly secured before shipment. Unsecured parts may vibrate loose and fall during transport causing injury and/or property damage.
31. Rounded and/or damaged bolt heads and/or nuts should be replaced so that proper torque values may be obtained. Proper torque values are necessary to prevent parts on this equipment, leads and/or crane booms from loosening and/or falling. (Refer to the torque chart in this manual for the proper values.)
32. When operating in a closed area, pipe exhaust fumes outside. (**Warning:** Breathing exhaust fumes can cause serious injury or even death.)
33. When loading or unloading the power unit using a forklift, the forks must be placed under the entire depth of the unit.
34. Keep hands away from rotating fighting auger shaft and/or rotary joint.
35. Do **NOT** allow clothing, hoses, ropes, etc., to be entangled in, or wrap around, rotating fighting, Auger Shaft and /or rotary joint.
36. Never stand under an equipment at any time and keep your eyes on the equipment when it is in operation.

### GENERAL HAZARD INFORMATION



Attach a “Do Not Operate” warning tag to the start switch or controls before the equipment is serviced or repaired. Attach the warning tags to the engine and to each operator control panel. When appropriate disconnect the negative terminal on the battery.

Do not allow unauthorized personnel on the equipment or around the equipment while being serviced.

Cautiously remove the following parts. To help prevent spraying or splashing of pressurized fluids hold a rag over the part that is being removed.

- Filler caps
- Grease fittings
- Pressure taps
- Breathers
- Drain plugs

### PRESSURIZED AIR AND WATER

Pressurized air and/or water can cause debris and/or hot water to be blown out which could result in personal injury.

The maximum air pressure for cleaning purposes must be reduced to 30psi (205 kPa) when the air nozzle is deadheaded and used with effective chip guarding (if applicable) and personal protective equipment. The maximum water pressure for cleaning purposes must be below 40psi (275 kPa). When pressurized air and/or pressurized water is used for cleaning, wear protective clothing, protective shoes, and eye protection. Eye

protection includes goggles or a protective face shield. Always wear eye protection for cleaning the cooling system.

Avoid direct spraying of water on electrical connectors, connections, and components. When using air for cleaning, allow the equipment to cool to reduce the possibility of fine debris igniting when redeposited on hot surfaces.

### FLUID PENETRATION

Always use a board or cardboard when you check for a leak. Leaking fluid that is under pressure can penetrate body tissue. Fluid penetration can cause serious injury and possible death. A pin hole leak can cause severe injury. If fluid is injected into your skin, you must get medical treatment immediately. Seek treatment from a doctor that is familiar with this type of injury.

### CONTAINING FLUID SPILLAGE

## NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting, and repair of the equipment. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Dispose of all fluids according to local regulations and mandates.

### LINES, TUBES, AND HOSES

Do not bend or strike high-pressure lines. Do not install lines, tubes, or hoses that are damaged.

Repair any fuel lines, oil lines, tubes, or hoses that are loose or damaged. Leaks can cause fires or injury.

## Safety Section

Inspect all lines, tubes, and hoses carefully. Do not use bare hands to check for leaks. Always use a board or cardboard for checking equipment components for leaks. Tighten all connections to the recommended torque.

Check for the following conditions:

- End fittings that are damaged or leaking
- Outer covering that is chafed or cut
- Wire that is exposed in reinforced hose
- Outer covering that is ballooning locally
- Flexible part of the hose that is kinked or crushed
- Armoring that is embedded in the outer covering

Ensure that all of the clamps, guards, and heat shields are installed correctly. Correct installation of these components will help to prevent these effects: vibration, rubbing against other parts and excessive heat during operation.

### INHALATION

Exhaust fumes can be hazardous to your health. If you operate the equipment in an enclosed area, adequate ventilation is necessary,

### BURN PREVENTION

Do not touch any part of the equipment during operation. Allow the equipment to cool before any maintenance is performed on the engine. Relieve all pressures in the hydraulic system, fuel system, lubrication system, or cooling system before any lines, fittings, or related items are disconnected.

### COOLANT

When the engine is at operating temperature, the engine coolant is hot. The coolant is also under pressure. The radiator and all lines to the heaters or to the engine contain hot coolant. When pressure is relieved rapidly, the hot coolant can turn into steam.

Any contact with hot coolant or with steam

*Page 12*

can cause severe burns. Allow cooling system components to cool before the cooling system is drained.

Check the coolant level only after the engine has been stopped.

Do not step on the engine in order to remove the filler cap. Ensure that the filler cap is cool before removing the filler cap. Remove the filler cap slowly in order to relieve pressure.

Cooling system conditioner contains alkali. Alkali can cause personal injury. Do not allow alkali to contact the skin, the eyes, or the mouth.

### OIL

Hot oil and hot components can cause personal injury. Do not allow hot oil or hot components to contact the skin.

Keep all of the exhaust manifold and turbocharger heat shields in place in order to protect components from oil spray if there is a failure of a line, tube, or seal.

### BATTERIES

The battery electrolyte is acidic. Battery acid can cause personal injury. Do not allow battery acid to come in contact with the skin or the eyes. Always wear protective glasses for servicing batteries. Wash hands after touching the batteries and connectors. The use of gloves is recommended.

Batteries give off combustible gases which can explode. Ensure proper ventilation for batteries that are in an enclosure. Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operating. A spark can cause the combustible gases to ignite. Do not smoke when batteries are serviced.

Always thaw a frozen battery before jump starting the battery. Frozen batteries can explode.

## Safety Section

### CRUSHING PREVENTION AND CUTTING PREVENTION

Support the equipment properly when work beneath the equipment is performed.

Unless other maintenance instructions are provided never attempt adjustments while the engine is running.

Stay clear of all rotating parts and moving parts. Leave the guards in place until maintenance is performed. After the maintenance is performed reinstall the guards.

Keep objects away from moving fan blades. The fan blades will throw objects or cut objects.

Wear protective glasses in order to avoid injury to the eyes.

Chips or other debris may fly off objects when objects are struck. Before objects are struck, ensure that no one will be injured by flying debris.

### MOUNTING AND DISMOUNTING

Do not climb on the equipment, and do not jump off the equipment. Do not stand on the components which can not support your weight. Mount the equipment and dismount the equipment only at locations that have a ladder or handholds.

### BEFORE STARTING ENGINE

Inspect the engine for potential hazards.

All protective guards and all protective covers must be installed if the engine must be started in order to perform service procedures. To help prevent an accident that is caused by parts in rotation, work around the parts carefully.

Do not bypass the automatic shutoff circuits. Do not disable the automatic shutoff circuits. The circuits are provided in order to help prevent

personal injury and equipment damage.

On the initial start-up of a new engine or an engine that has been overhauled, be prepared to stop the engine if a problem occurs.

### ENGINE STARTING

If a warning tag or do not operate tag is attached to the engine start switch or to the controls, DO NOT start the engine or move the controls. Consult with the person that attached the warning tag before the engine is started.

All protective guards and all protective covers must be installed if the engine must be started in order to perform service procedures. To help prevent an accident that is caused by parts in rotation, work around the parts carefully.

Start the engine from the operator's panel or remote pendant start switch.

Always start the engine according to the procedure that is described in this Operation and Maintenance Manual, "Engine Starting" topic (Operation Section). Knowing the correct procedure will help to prevent major damage to the engine components. Knowing the procedure will also help to prevent personal injury.

Engine exhaust contains products of combustion that can be harmful to your health. Always start and operate the engine in a well ventilated area. If the engine is run in an enclosed area, vent the engine exhaust outside.

### ENGINE STOPPING

Stop the engine according to the procedure in the Operation and Maintenance Manual, "Engine Stopping (Operation Section)" in order to avoid overheating of the engine and accelerated wear of the engine components.

Use the Emergency Stop Button ONLY in an



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## Safety Section

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emergency situation. **Do not use the Emergency Stop Button for normal engine stopping.** After an emergency stop, DO NOT start the engine until the problem that caused the emergency stop has been corrected.

Stop the engine if an over speed condition occurs during the initial start-up of a new engine or an engine that has been overhauled. This may be accomplished by shutting off the fuel supply to the engine and/or shutting off the air supply to the engine.

To stop an electronically controlled engine, cut the power to the engine.

### ELECTRICAL SYSTEM

Never disconnect any charging unit circuit or battery circuit cable from a battery when the charging unit is operating. A spark can cause the combustible gases that are produced by some batteries to ignite.

If the engine must be started by an external electrical source, then always connect the positive jump start cable "+" to the positive terminal "+" of the battery.

To help prevent sparks from igniting combustible gases that are produced by some batteries, the negative "-" jump start cable should be connected last from the external power source to the negative "-" terminal of the starting motor. If the starting motor is not equipped with a negative "-" terminal, connect the jump start cable to the engine block.

### GROUNDING PRACTICES

Proper grounding for the equipment electrical system is necessary for proper engine performance and reliability. Improper grounding will result in uncontrolled electrical circuit paths and unreliable electrical circuit paths.

Uncontrolled equipment electrical circuit paths

can result in damage to the engine and pumps. All grounds should be tight and free of corrosion. The alternator and the starting motor must be grounded to the negative "-" battery terminal.

A grounding strap must be used for all equipment that has an alternator grounded to an engine component. The ground strap must be connected to the component and to the negative "-" battery terminal. The component must be electrically isolated from the engine.

A ground plate with direct path to the negative battery terminal "-" can be used as a common ground point for the components of one engine system.

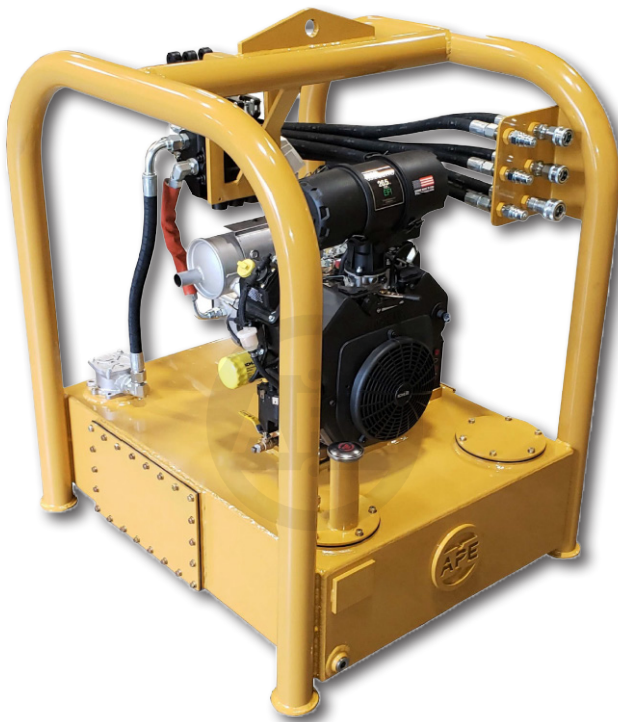
When servicing a power unit, make sure to disconnect both battery cables starting with the ground wire from the negative terminal on the battery. Not disconnecting the battery can cause damages to the ECM, fees will apply, warranties will be voided.

## Operation Section

### Lifting and Storage

Always load the power unit with the hydraulic tank facing the front of the truck, to prevent damage to the cooler and radiator from flying debris. When lifting the power unit, make sure to use proper rigging. See Photo.

**PICK HERE**



To connect the tool to the power unit:

1. Turn the power unit OFF.
2. Position power unit close enough to work that hoses will be able to reach.
  - Most hose failures are caused by pulling hoses off couplers. Avoid pulling on hoses.
3. Clean all quick disconnects with brake wash. They must be completely free of dirt or contaminants.
4. Attach quick disconnects. Note that quick disconnects of each hose type are mated to prevent backwards hookups.
5. Tighten all fittings to hand tightness. Verify with chain wrench.
  - DO NOT OVER TIGHTEN

***New hydraulic fluid is NOT clean oil!***

***Oil must meet ISO cleanliness code 17/15/11***

Please do the following:

- Set the engine at idle
- Run at idle for about 5-10 minutes to fill the lines
- Do not engage drive until the power unit is up to operating temperature.

## Attention!

**Pressurizing the system while there is air entrained in the fluid may cause damage to the components.**

**Let the system run at idle for an additional 5 minutes to allow the air to rise into the airspace of the hydraulic reservoir.**

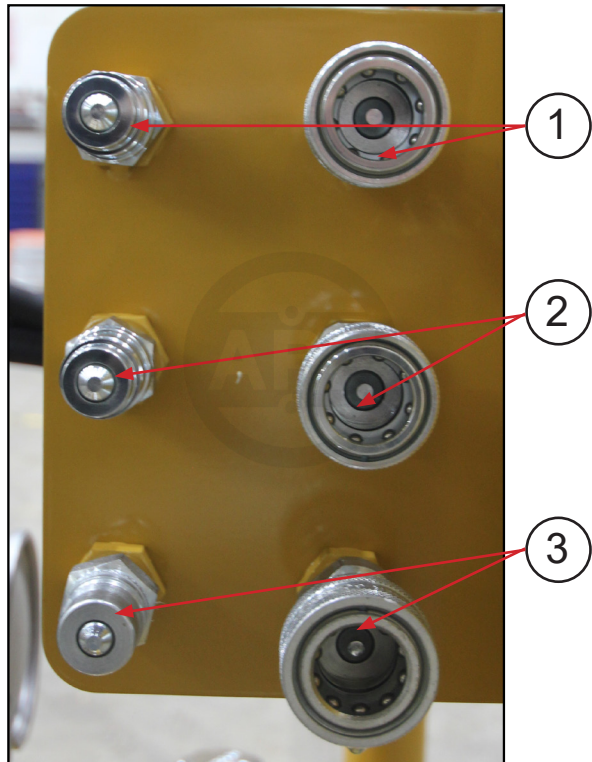
### Connecting the Hydraulics

Connecting the hoses is one of the most critical aspects of commissioning an APE tool.

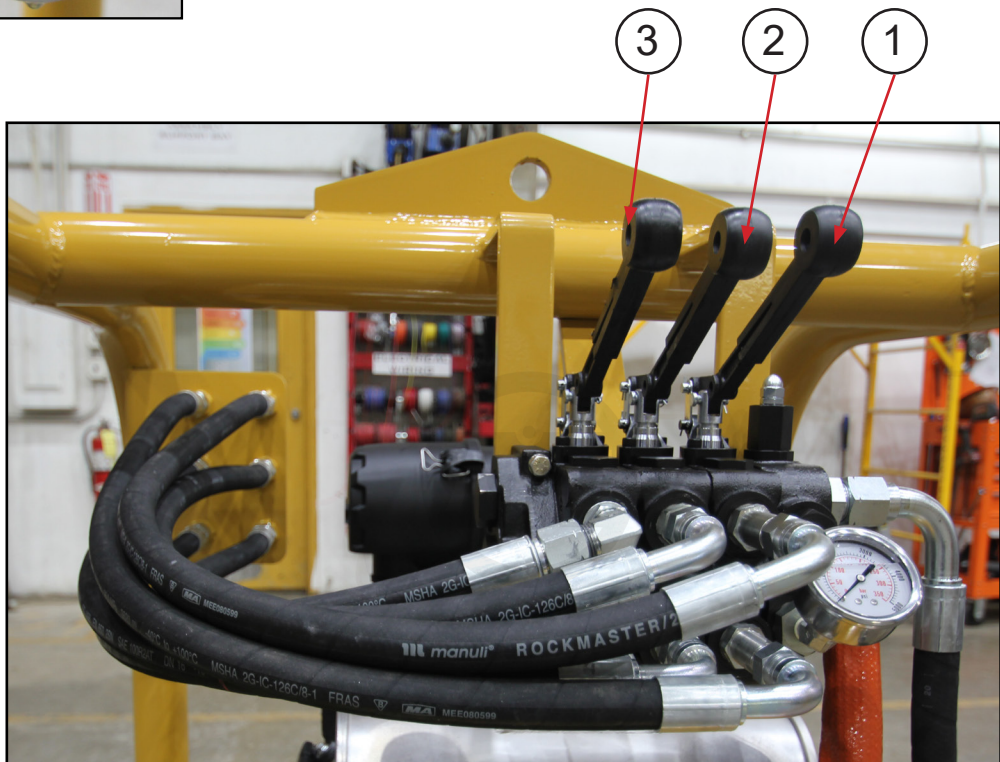
Take extreme care to keep these connections absolutely clean. This procedure is one of the most common ways for foreign particles to be introduced into a hydraulic system.

Connecting the Hydraulics

GENERAL INFORMATION



CALLOUT	DESCRIPTION
1	AUX CONNECTION #1
2	AUX CONNECTION #2
3	AUX CONNECTION #3





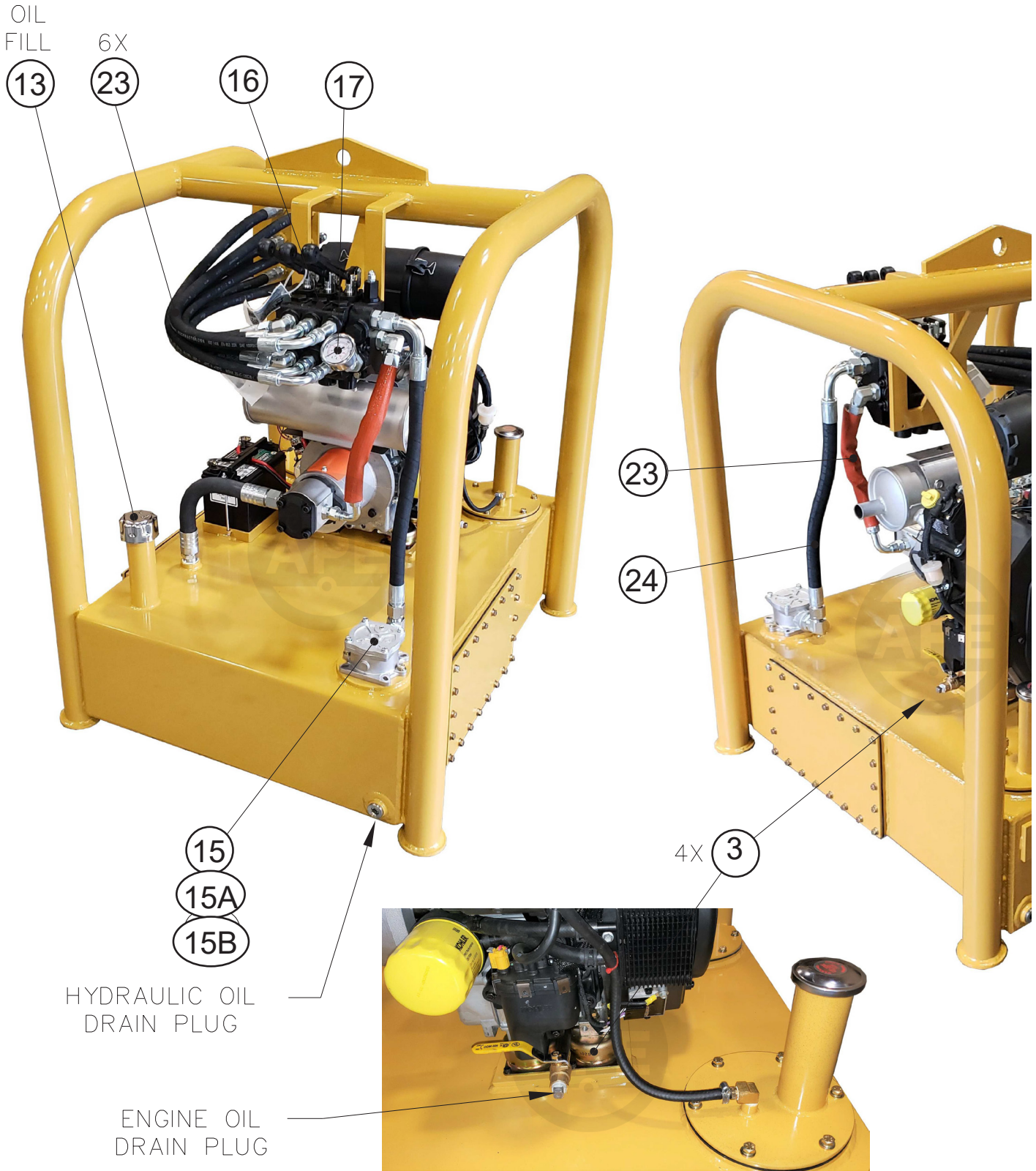
## Product Information B.O.M

CALLOUT	MANUFACTURE PART NUMBER	DESCRIPTION
1		MODEL 27 SKID ASSEMBLY
2	ECH749-3056	26.5HP KOHLER COMMAND PRO EFI ENGINE
3	CM2-50-B-N-T	ELASTOMER SHOCK & VIBRATION MOUNTS
4	BAT 8223	NAPA 8000 SERIES BATTERY BC1 NO. U1 230 A WET
4A	BK 7308181	ADJUSTABLE BATTERY HOLD-DOWN
4B	NOE 7302385	8-7/8 X 1IN. BATTERY HOLD DOWN BOLT
5	MPB 781145	BATTERY CABLE, POSITIVE
6	MPB 781116	BATTERY CABLE, NEGATIVE
7	E700602A	MAGNALOY PUMP/ENGINE MOUNT
8	CONTACT APE	COUPLINGS & INSERT
9	CONTACT APE	COUPLINGS & INSERT
10	CONTACT APE	COUPLINGS & INSERT
11	GP-F20-16-P1-C	DYNAMIC HYDRAULIC GEAR PUMP MODEL GP-F20
12	SLLG-05T-C	MAGNALOY LIQUID LEVEL GAUGES
13	TA080B10A101P01	METAL OIL FILLER AND AIR BREATHER FILLER CAP
14	31623	31623 FUEL CAP
15	K040798	RETURN FILTER
16	SA-5232-01	SECTIONAL DIRECTIONAL VALVE MANIFOLD
17	CF1P-350D	350 PSI PRESSURE GAUGE
18	H4-62	1/2" QUICK DISCONNECT 60 SERIES
19	H4-63	1/2" QUICK DISCONNECT 60 SERIES
20	6601-8-10	1/2" QUICK DISCONNECT 6600 SERIES
21	6602-8-10	1/2" QUICK DISCONNECT 6600 SERIES
22	SPIRTEX/K -16	HYDRAULIC HOSE
23	2SN-10 & 12	HYDRAULIC HOSE

*To order replacement parts, please call 800-248-8498.*

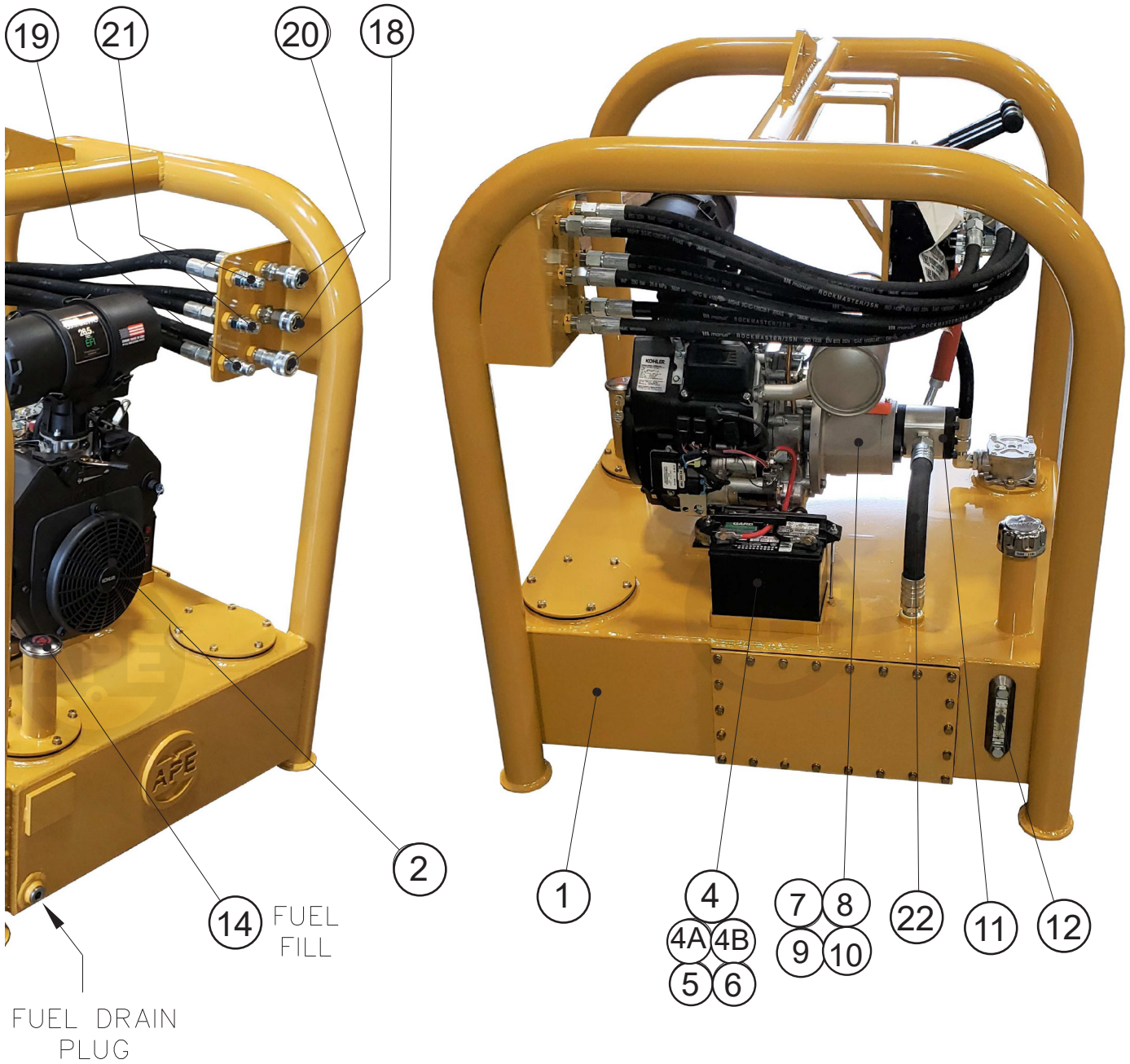
**GENERAL INFORMATION**






# Product Information

GENERAL INFORMATION



## Maintenance

### Maintenance Chart

	<b>⚠ WARNING</b>	Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.
	Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing.	

Normal maintenance, replacement or repair of emission control devices and systems may be performed by any repair establishment or individual; however, warranty repairs must be performed by a Kohler authorized dealer.

#### MAINTENANCE SCHEDULE

After first 5 Hours

<ul style="list-style-type: none"> <li>Change engine oil.</li> </ul>	Lubrication System
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Every 8 Hours

<ul style="list-style-type: none"> <li>Check oil bath air cleaner oil level in oil reservoir cup (if equipped).</li> </ul>	Air Cleaner/Intake
--	--------------------

Every 50 Hours

<ul style="list-style-type: none"> <li>Change oil in 2:1 with Clutch Reduction System (CH245, CH255, CH270, CH395, CH440).</li> </ul>	Gear Reduction System
---	-----------------------

Every 50 Hours<sup>1</sup>

<ul style="list-style-type: none"> <li>Service/replace oil bath air cleaner foam filter or foam elements (if equipped).</li> </ul>	Air Cleaner/Intake
--	--------------------

Every 50 Hours or Annually (whichever comes first)

<ul style="list-style-type: none"> <li>Service/replace Quad-Clean™ precleaner.</li> </ul>	Air Cleaner/Intake
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Every 100 Hours or Annually<sup>1</sup> (whichever comes first)

<ul style="list-style-type: none"> <li>Clean low-profile air cleaner element.</li> </ul>	Air Cleaner/Intake
<ul style="list-style-type: none"> <li>Change engine oil.</li> </ul>	Lubrication System
<ul style="list-style-type: none"> <li>Clean cooling areas.</li> </ul>	Air Cleaner/Intake

Every 200 Hours

<ul style="list-style-type: none"> <li>Replace Quad-Clean™ air cleaner element.</li> </ul>	Air Cleaner/Intake
--	--------------------

Every 300 Hours

<ul style="list-style-type: none"> <li>Replace low-profile air cleaner element.</li> </ul>	Air Cleaner/Intake
<ul style="list-style-type: none"> <li>Check fuel filters (tank outlet filter and in-line filter) clean or replace if needed (if equipped).</li> </ul>	Fuel System
<ul style="list-style-type: none"> <li>Change oil in 6:1 Reduction System (CH245, CH255, CH270).</li> </ul>	Gear Reduction System

Every 300 Hours<sup>2</sup>

<ul style="list-style-type: none"> <li>Check and adjust valve clearance when engine is cold.</li> </ul>	Reassembly
---	------------

Every 500 Hours or Annually<sup>1</sup> (whichever comes first)

<ul style="list-style-type: none"> <li>Replace spark plug and set gap.</li> </ul>	Electrical System
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<sup>1</sup> Perform these procedures more frequently under severe, dusty, dirty conditions.

### Hydraulic Oil

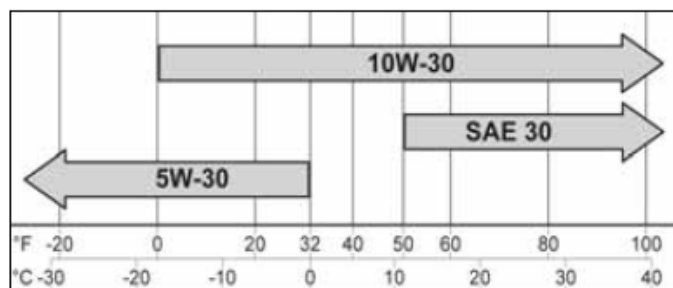
When adding or changing hydraulic fluid, APE uses only Biodegradable Envirologic 146 hydraulic fluid, which is not-toxic and will not harm soil or water, and is biodegradable. Unless requested a special type of hydraulic oil by Consumer. Consult your local oil supplier for recommendations on mixing hydraulic oils. Change hydraulic oil if it looks milky; this is an indication that water or other contamination may have occurred.

NOTE: Current Hydraulic Oil Type:

### ENVIROLOGIC 146 HYDRAULIC OIL

### Oil Recommendations

We recommend use of Kohler oils for best performance. Other high-quality detergent oils (including synthetic) of API (American Petroleum Institute) Service Class SJ or higher are acceptable. Select Viscosity based on air temperature at time of operation shown in the table below.



### Return Filter Elements

Change all filters when indicated dirty, Clog indication is located on top of the return filter.

1. Shut down power unit.
2. Place warning tag on control panel so that the power unit is not started while filters are being replaced.
3. Disconnect negative battery cable.
4. Clean area around filters so that when they are removed there is no chance of introducing dirt into the hydraulic system.
5. Removing holding bolts from return filter.
6. Remove housing.
7. Remove filter, make sure no debris falls into hydraulic tank. Always cover if left unattended.
8. Install new clean filter making sure the spring and o-ring are in the proper place.
9. Reinstall filter housing. Do not over tighten.



Preventative maintenance includes normal servicing that will keep the power unit in peak operative condition and prevent unnecessary trouble from developing. This servicing consists of periodic lubrication and inspection of moving parts and accessories of the unit.

Lubrication is an essential part of preventative maintenance controlling, to a great extent, the useful life of the unit. Different lubricants are needed and some components in the unit require more frequent lubrication than others. Therefore, it is important that the instructions regarding types of lubricants and frequency of their application be closely followed.

To prevent minor irregularities from developing into serious conditions that might involve shutdown and major repair, several other services or inspections are recommended for the same intervals as the periodic lubrications. The purpose of these services or inspections is to assure the uninterrupted operation of the unit.

- Thoroughly clean all lubrication fittings, caps, filler and level plugs along with their surrounding surfaces before servicing
- Prevent dirt from entering in with lubricants and coolants

The intervals given in the schedule are based upon normal operation.

Perform these services, inspections, etc., more often as needed for operation under abnormal or severe conditions.

## Storage

During short-term storage of a power unit, the following should be taken into consideration:

- Cover any pressure openings and open threaded holes with suitable caps
- Protect the unpainted surfaces from dirt and moisture
- The power unit should not be stored in an area with substances that have an aggressive corrosive nature; i.e., solvents, acids, alkalies and/or salts

For long-term storage (over 2 months), the following additional actions are recommended:

- Damages to surface paint must be repaired before item is stored
- Add Kohler Pro Series Fuel treatment or equivalent to the fuel tank. Run engine 2-3 minutes to get stabilized fuel into fuel system (Failure to do untreated fuel are not warrantable)
- Change Oil while engine is still warm from operation. Remove spark plug(S) and pour about 1 oz of engine oil into cylinder(S). Replace spark plugs(s) and crank engine slower to distribute oil.
- Disconnect negative battery cable.
- Fill the power unit completely with hydraulic fluid



If these instructions are followed to the letter, the power unit may be stored for approximately 1-Years. However, as storage conditions do have a significant effect, all suggested time frames should be considered as guide values only.

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## Troubleshooting

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When troubles occur, be sure to check simple causes which, at first, may seem too obvious to be considered. For example, a starting problem could be caused by an empty fuel tank.

Some general common causes of engine troubles are listed below and vary by engine specification. Use these to locate causing factors.

---

### Engine Cranks But Will Not Start

- Battery connected backwards.
- Blown fuse.
- Carburetor solenoid malfunction.
- Choke not closing.
- Clogged fuel line or fuel filter.
- Diode in wiring harness failed in open circuit mode.
- Empty fuel tank.
- Faulty spark plug.
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Fuel shut-off valve closed.
- Ignition module faulty or improperly gapped.
- Interlock switch is engaged or faulty.
- Key switch or kill switch in OFF position.
- Low oil level.
- Quality of fuel (dirt, water, stale, mixture).
- Spark plug lead disconnected.

---

### Engine Starts But Does Not Keep Running

- Faulty carburetor.
- Faulty cylinder head gasket.
- Faulty or misadjusted choke or throttle controls.
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Intake system leak.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Quality of fuel (dirt, water, stale, mixture).
- Restricted fuel tank cap vent.

---

### Engine Starts Hard

- Clogged fuel line or fuel filter.
- Engine overheated.
- Faulty ACR mechanism.
- Faulty or misadjusted choke or throttle controls.
- Faulty spark plug.
- Flywheel key sheared.
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Low compression.
- Quality of fuel (dirt, water, stale, mixture).
- Weak spark.

---

### Engine Will Not Crank

- Battery is discharged.
- Faulty electric starter or solenoid.
- Faulty key switch or ignition switch.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Pawls not engaging in drive cup.
- Seized internal engine components.

---

### Engine Runs But Misses

- Carburetor malfunction.
- Engine overheated.
- Faulty spark plug.
- Ignition module faulty or improperly gapped.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Quality of fuel (dirt, water, stale, mixture).
- Spark plug lead boot loose on plug.
- Spark plug lead loose.

---

### Engine Will Not Idle

- Engine overheated.
- Faulty spark plug.
- Idle fuel circuit in carburetor plugged/restricted.
- Idle speed adjusting screw improperly set.
- Inadequate fuel supply.
- Low compression.
- Quality of fuel (dirt, water, stale, mixture).
- Restricted fuel tank cap vent.

---

### Engine Overheats

- Cooling fan broken.
- Excessive engine load.
- High crankcase oil level.
- Lean fuel mixture.
- Low crankcase oil level.
- Cooling system components clogged or restricted.

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### Engine Knocks

- Excessive engine load.
- Incorrect oil viscosity/type.
- Internal wear or damage.
- Low crankcase oil level.
- Quality of fuel (dirt, water, stale, mixture).

## Troubleshooting

### Engine Loses Power

- Dirty air cleaner element.
- Engine overheated.
- Excessive engine load.
- Restricted exhaust.
- Faulty spark plug.
- High crankcase oil level.
- Incorrect governor setting.
- Low battery.
- Low compression.
- Low crankcase oil level.
- Quality of fuel (dirt, water, stale, mixture).

### Engine Uses Excessive Amount of Oil

- Loose or improperly torqued fasteners.
- Blown head gasket/overheated.
- Breather reed broken.
- Clogged, broken, or inoperative crankcase breather.
- Crankcase overfilled.
- Incorrect oil viscosity/type.
- Worn cylinder bore.
- Worn or broken piston rings.
- Worn valve stems/valve guides.

### Oil Leaks from Oil Seals, Gaskets

- Breather reed broken.
- Clogged, broken, or inoperative crankcase breather.
- Loose or improperly torqued fasteners.
- Piston blow by, or leaky valves.
- Restricted exhaust.

### EXTERNAL ENGINE INSPECTION


**NOTE:** It is good practice to drain oil at a location away from workbench. Be sure to allow ample time for complete drainage.

Before cleaning or disassembling engine, make a thorough inspection of its external appearance and condition. This inspection can give clues to what might be found inside engines (and cause) when it is disassembled.

- Check for buildup of dirt and debris on crankcase, cooling fins, grass screen, and other external surfaces. Dirt or debris on these areas can cause overheating.
- Check for obvious fuel and oil leaks, and damaged components. Excessive oil leakage can indicate a clogged or inoperative breather, worn or damaged seals or gaskets, or loose fasteners.
- Check air cleaner components for damage or indications of improper fit and seal.
- Check air cleaner element. Look for holes, tears, cracked or damaged sealing surfaces, or other damage that could allow unfiltered air into engine. A dirty or clogged element could indicate insufficient or improper maintenance.
- Check carburetor throat for dirt. Dirt in throat is further indication that air cleaner was not functioning properly.
- Check if oil level is within operating range on dipstick. If it is above, sniff for gasoline odor.
- Check condition of oil. Drain oil into a container; it should flow freely. Check for metal chips and other foreign particles.

Sludge is a natural by-product of combustion; a small accumulation is normal. Excessive sludge formation could indicate over rich fuel settings, weak ignition, overextended oil change interval or wrong weight or type of oil was used.

### CLEANING ENGINE

	<b>⚠ WARNING</b> Cleaning Solvents can cause severe injury or death. Use only in well ventilated areas away from ignition sources.
Carburetor cleaners and solvents are extremely flammable. Follow cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent.	

After inspecting external condition of engine, clean engine thoroughly before disassembly. Clean individual components as engine is disassembled. Only clean parts can be accurately inspected and gauged for wear or damage. There are many commercially available cleaners that will quickly remove grease, oil, and grime from engine parts. When such a cleaner is used, follow manufacturer's instructions and safety precautions carefully.

Make sure all traces of cleaner are removed before engine is reassembled and placed into operation. Even small amounts of these cleaners can quickly break down lubricating properties of engine oil.



## Troubleshooting

Typical carbureted fuel system and related components include:

- Fuel tank.
- Fuel lines.
- In-line fuel filter.
- Fuel tank filter.
- Carburetor.
- Fuel strainer screen in carburetor.

### FUEL RECOMMENDATIONS

Refer to Maintenance.

### FUEL LINE

Low permeation fuel line must be installed on carbureted Kohler Co. engines to maintain EPA and CARB regulatory compliance.

### FUEL FILTER

#### Fuel Tank Filter (if equipped)

A serviceable fuel tank filter is located under fuel tank cap, in filler neck.

Daily or as required clean filter of any accumulation as follows:


1. Remove fuel tank cap and filter.
2. Clean filter with solvent, replace if damaged.
3. Wipe filter and insert it.
4. Tighten fuel tank cap securely.

### FUEL SYSTEM TESTS

When engine starts hard, or turns over but will not start, fuel system might be causing problems. Test fuel system by performing following test.

1. Check for fuel in combustion chamber.
  - a. Disconnect and ground spark plug lead.
  - b. Close choke on carburetor.
  - c. Crank engine several times.
  - d. Remove spark plug and check for fuel at tip.
2. Check for fuel flow from tank to carburetor.
  - a. Remove fuel line from inlet fitting of carburetor.
  - b. Use an approved fuel container to catch fuel, and hold line below bottom of tank to observe fuel flow.
3. Check operation of fuel shut-off valve.
  - a. Remove fuel sediment bowl under inlet fitting of carburetor.
  - b. Turn fuel shut-off valve ON and OFF and observe operation.

### Fuel Valve

	<b>⚠ WARNING</b>
	Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running.
Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent.	

NOTE: Models with a low-profile air cleaner do not have fuel valve.

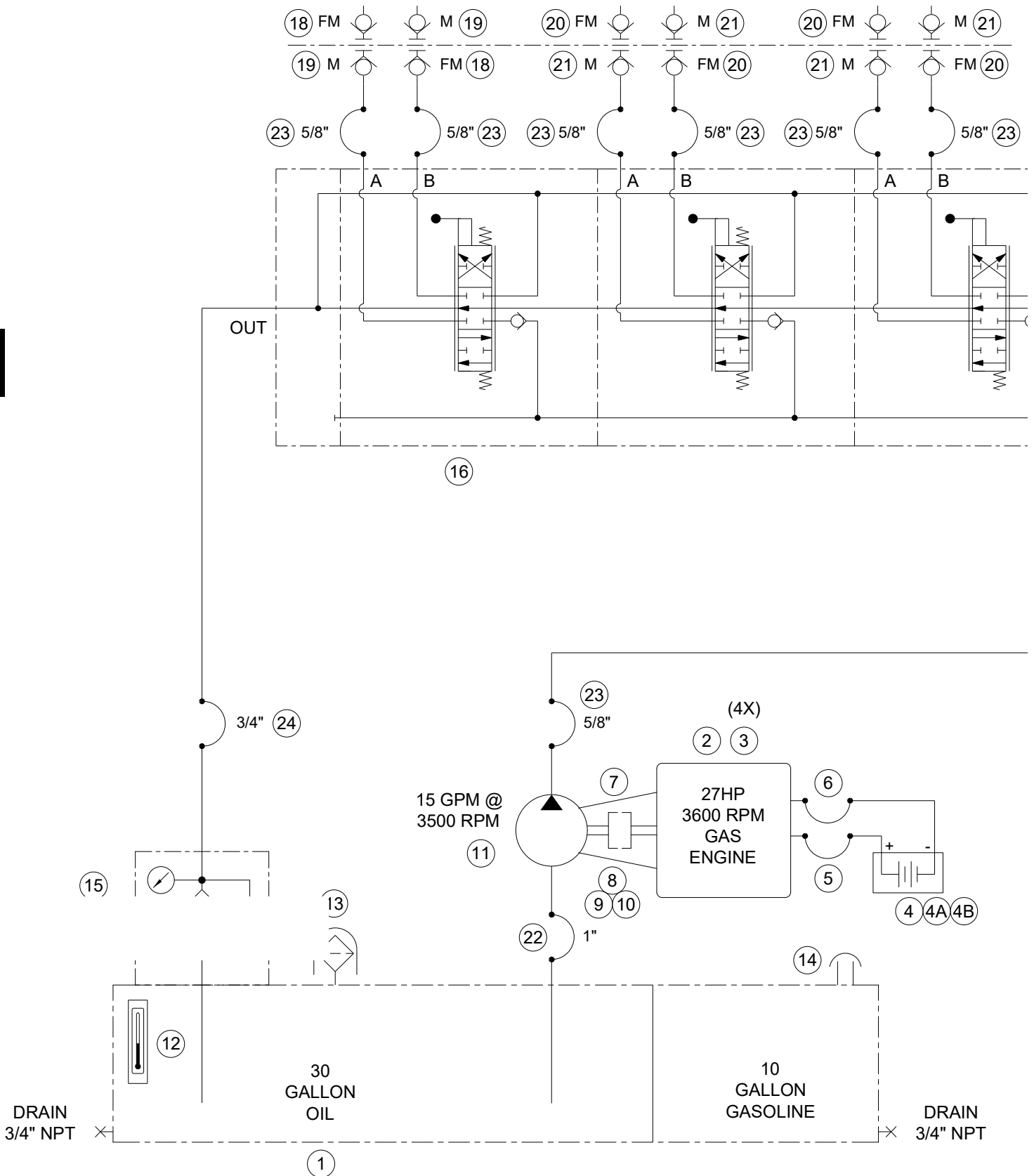
1. Stop engine.
2. Remove securing hardware and carburetor cover panel.
3. Turn fuel valve lever to OFF position.
4. Remove fuel valve cup.
5. Clean fuel valve cup with solvent and wipe it off.
6. Check O-ring, replace if damaged. Check screen for blockage or damage, replace if necessary. New screen must be located on pick-up tube.
7. Place O-ring on screen followed by fuel valve cup. Rotate fuel valve cup until it is finger tight. Turn with a wrench 1/2 to 3/4 turn.
8. Turn fuel valve to ON position and check for leaks. If fuel valve cup leaks repeat step 7.
9. Reinstall carburetor cover panel, using hardware removed in step 2 to secure.

Condition	Conclusion
Fuel at tip of spark plug.	Fuel is reaching combustion chamber.
No fuel at tip of spark plug.	Check fuel flow from fuel tank (step 2).
Fuel flows from fuel line.	Check operation of fuel shut-off valve (step 3).
No fuel flow from fuel line.	Check fuel tank vent, in-line filter threaded into tank, and fuel line. Correct any observed problem and reconnect line.
Fuel flows from valve.	Check for dirt and water in sediment bowl and screen. Clean bowl and screen as needed. Check for faulty carburetor, refer to Carburetor.
No fuel flows from valve.	Check for a restriction in fuel shut-off valve or inlet elbow.

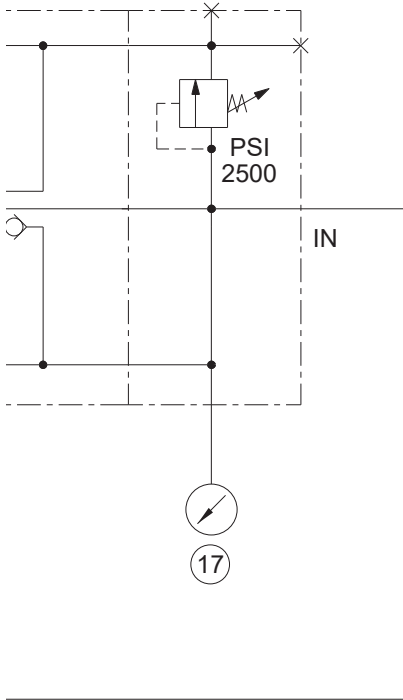


# Hydraulic Schematic

TROUBLE SHOOTING



# BOM



QTY.	PART NUMBER	DESCRIPTION	MANUFACTURER	ITEM
1	WR-5230-01	HPU TANK / FRAME ASSEMBLY, MODEL 27	NWFPC	1
1	ECH749-3059	GAS ENGINE, 27HP @ 3600RPM	KOHLER	2
4	CM2-50-B-N-T	VIBRATION ISOLATOR	KORFUND DYNAMICS	3
1	8223	12 VOLT BATTERY	NAPA	4
1	7308181	ADJUSTABLE BATTERY HOLD DOWN	NAPA	4A
1	7302385	BATTERY HOLD DOWN BOLTS	NAPA	4B
1	781145	RED BATTERY CABLE	NAPA	5
1	781116	BLACK BATTERY CABLE	NAPA	6
1	E700602A	PUMP / MOTOR ADAPTER	MAGNALOY	7
1	M20002406	COUPLING HALF, 3/4" x 3/16" (PUMP)	MAGNALOY	8
1	M20010408	COUPLING HALF, 1.25" x 1/4" (ENGINE)	MAGNALOY	9
1	M270H5	COUPLING INSERT, HYTREL	MAGNALOY	10
1	GP-F20-16-P1-C	GEAR PUMP, .97 cu"/Rev	DYNAMIC FLUID	11
1	SLLG-05T-C	LEVEL GAUGE	MAGNALOY	12
1	TA080B10A101P01	FILLER BREATHER	MP FILTRI	13
1	31623	VENTED ANTI SURGE FUEL CAP	GATES	14
1	K040798	RETURN FILTER	DONALDSON	15
REF	P171846 (1ea Req'd)	REPLACEMENT ELEMENT, K040798	DONALDSON	15A
1	P171956	CLOG INDICATOR	DONALDSON	15B
1	SA-5232-01	SECTIONAL DIRECTIONAL VALVE, MANUAL	NWFPC	16
1	CF1P-350-D	PRESSURE GAUGE, 0-5000 PSI	DYNAMIC FLUID	17
2	H4-62	QUICK DISCONNECT BODY, 1/2" FNPT	PARKER	18
2	H4-63	QUICK DISCONNECT NIPPLE 1/2" FNPT	PARKER	19
2	6601-8-10	QUICK DISCONNECT BODY, 1/2" FNPT	PARKER	20
2	6602-8-10	QUICK DISCONNECT NIPPLE 1/2" FNPT	PARKER	21
REF	SPIRTEX-K-16	SPIRTEX-K SUCTION HOSE	MANULI	22
REF	ROCKMASTER 2SN-10	PRESSURE HOSE, 5/8"	MANULI	23
REF	ROCKMASTER 2SN-12	PRESSURE HOSE, 3/4"	MANULI	24

TROUBLE SHOOTING



# UNDERSTANDING ISO CODES

The ISO cleanliness code is used to quantify particulate contamination levels per milliliter of fluid at 3 sizes 4μ[c], 6μ[c], and 14μ[c]. The ISO code is expressed in 3 numbers (ie 19/17/14). Each number represents a contaminant level code for the correlating particle size. The code includes all particles of the specified size and larger. It is important to note that each time a code increases the quantity range of particles is doubling.

ISO 4406 Chart		
Range Code	Particles per milliliter	
	More than	Up to/including
24	80000	160000
23	40000	80000
22	20000	40000
21	10000	20000
20	5000	10000
19	2500	5000
18	1300	2500
17	640	1300
16	320	640
15	160	320
14	80	160
13	40	80
12	20	40
11	10	20
10	5	10
9	2.5	5
8	1.3	2.5
7	0.64	1.3
6	0.32	0.64

Sample 1 (see photo 1)

Particle Size	Particles per ml*	ISO 4406 Code range	ISO Code
4μ[c]	151773	80000~160000	24
6μ[c]	38363	20000~40000	22
10μ[c]	8229		
14μ[c]	3339	2500~5000	19
21μ[c]	1048		
38μ[c]	112		

Sample 2 (see photo 2)

Particle Size	Particles per ml*	ISO 4406 Code range	ISO Code
4μ[c]	492	320 ~ 640	16
6μ[c]	149	80 ~ 160	14
10μ[c]	41		
14μ[c]	15	10 ~ 20	11
21μ[c]	5		
38μ[c]	1		

Photo 1

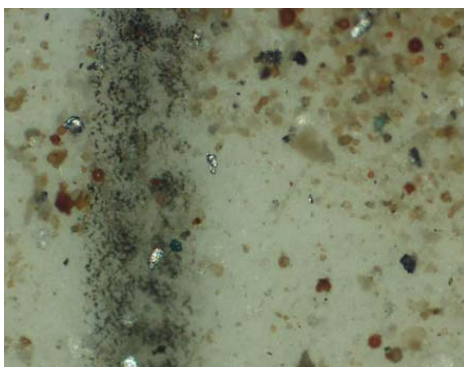


Photo 2



## Hydraulic Cleanliness Codes

# TARGET ISO CLEANLINESS CODES

When setting target ISO fluid cleanliness codes for hydraulic and lubrication systems it is important keep in mind the objectives to be achieved. Maximizing equipment reliability and safety, minimizing repair and replacement costs, extending useful fluid life, satisfying warranty requirements, and minimizing production down-time are attainable goals. Once a target ISO cleanliness code is set following a progression of steps to achieve that target, monitor it, and maintain it justifiable rewards will be yours.

### Set the Target.

The first step in identifying a target ISO code for a system is to identify the most sensitive on an individual system, or the most sensitive component supplied by a central reservoir. If a central reservoir supplies several systems the overall cleanliness must be maintained, or the most sensitive component must be protected by filtration that cleans the fluid to the target before reaching that component.

### Other Considerations

Table 1 recommends conservative target ISO cleanliness codes based on a several component manufacturers guidelines and extensive field studies for standard industrial operating conditions in systems using petroleum based fluids. If a non-petroleum based fluid is used (i.e. water glycol) the target ISO code should be set one value lower for each size (4 μ[c]/6μ[c]/14μ[c]). If a combination of the following conditions exists in the system the target ISO code should also be set one value lower:

- Component is critical to safety or overall system reliability.
- Frequent cold start.
- Excessive shock or vibration.
- Other Severe operation conditions.

### Recommended\* Target ISO Cleanliness Codes and media selection for systems using petroleum based fluids per ISO4406:1999 for particle sizes 4μ[c] / 6μ[c] / 14μ[c]

	Pressure < 140 bar < 2000 psi	Media βx[c] = 1000 (βx = 200)	Pressure 212 bar 3000 psi	Media βx[c] = 1000 (βx = 200)	Pressure > 212 bar > 3000 psi	Media βx[c] = 1000 (βx = 200)
<b>Pumps</b>						
Fixed Gear	20/18/15	22μ[c] (25 μ)	19/17/15	12μ[c] (12 μ)	-	-
Fixed Piston	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)	17/15/12	7μ[c] (6 μ)
Fixed Vane	20/18/15	22μ[c] (25 μ)	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
Variable Piston	18/16/13	7μ[c] (6 μ)	17/15/13	5μ[c] (3 μ)	16/14/12	7μ[c] (6 μ)
Variable Vane	18/16/13	7μ[c] (6 μ)	17/15/12	5μ[c] (3 μ)	-	-
<b>Valves</b>						
Cartridge	18/16/13	12μ[c] (12 μ)	17/15/12	7μ[c] (6 μ)	17/15/12	7μ[c] (6 μ)
Check Valve	20/18/15	22μ[c] (25 μ)	20/18/15	22μ[c] (25 μ)	19/17/14	12μ[c] (12 μ)
Directional (solenoid)	20/18/15	22μ[c] (25 μ)	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
Flow Control	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
Pressure Control (modulating)	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)	17/15/12	7μ[c] (6 μ)
Proportional Cartridge Valve	17/15/12	7μ[c] (6 μ)	17/15/12	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)
Proportional Directional	17/15/12	7μ[c] (6 μ)	17/15/12	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)
Proportional Flow Control	17/15/12	7μ[c] (6 μ)	17/15/12	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)
Proportional Pressure Control	17/15/12	7μ[c] (6 μ)	17/15/12	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)
Servo Valve	16/14/11	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)	15/13/10	5μ[c] (3 μ)
<b>Bearings</b>						
Ball Bearing	15/13/10	5μ[c] (3 μ)	-	-	-	-
Gearbox (industrial)	17/16/13	12μ[c] (12 μ)	-	-	-	-
Journal Bearing (high speed)	17/15/12	7μ[c] (6 μ)	-	-	-	-
Journal Bearing (low speed)	17/15/12	7μ[c] (6 μ)	-	-	-	-
Roller Bearing	16/14/11	7μ[c] (6 μ)	-	-	-	-
<b>Actuators</b>						
Cylinders	17/15/12	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)	15/13/10	5μ[c] (3 μ)
Vane Motors	20/18/15	22μ[c] (25 μ)	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
Axial Piston Motors	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)	17/15/12	7μ[c] (6 μ)
Gear Motors	20/18/14	22μ[c] (25 μ)	19/17/13	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
Radial Piston Motors	20/18/15	22μ[c] (25 μ)	19/17/14	12μ[c] (12 μ)	18/16/13	12μ[c] (12 μ)
<b>Test Stands, Hydrostatic</b>						
Test Stands	15/13/10	5μ[c] (3 μ)	15/13/10	5μ[c] (3 μ)	15/13/10	5μ[c] (3 μ)
Hydrostatic Transmissions	17/15/13	7μ[c] (6 μ)	16/14/11	5μ[c] (3 μ)	16/14/11	5μ[c] (3 μ)

\*Depending upon system volume and severity of operating conditions a combination of filters with varying degrees of filtration efficiency might be required (i.e. pressure, return, and off-line filters) to achieve and maintain the desired fluid cleanliness.

Example	ISO Code	Comments
Operating Pressure	156 bar, 2200 psi	
Most Sensitive Component	Directional Solenoid	19/17/14 recommended baseline ISO Code
Fluid Type	Water Glycol	18/16/13 Adjust down one class
Operating Conditions	Remote location, repair difficult High ingress rate	17/15/12 Adjust down one class, combination of critical nature, severe conditions

## Bolt information

# RECOMMENDED BOLT TIGHTENING TORQUE “LUBRICATED SHCS”

Socket Head Cap Screws

When installing any APE equipment or parts apply lubricant and use APE standard **Anti-Seize** torque specs. See Tightening Torque Spec below. Failure to follow tightening torque spec can result in under / over tightening fasteners, leading to equipment failure or personal injury.



### COARSE THREADS

Nominal Screw Size	Nominal Socket Size	Tightening Torque (ft-lbs)
#10-24	5/32	6
.25-20	3/16	10
.31-18	1/4	22
.38-16	5/16	38
.44-14	3/8	61
.50-13	3/8	93
.63-11	1/2	179
.75-10	5/8	317
.88-9	3/4	511
1.00-8	3/4	767
1.25-7	7/8	1,533
1.50-6	1	2,668

### FINE THREADS

Nominal Screw Size	Nominal Socket Size	Tightening Torque (ft-lbs)
#10-32	5/32	6
.25-28	3/16	12
.31-24	1/4	24
.38-24	5/16	43
.44-20	3/8	68
.50-20	3/8	105
.63-18	1/2	202
.75-16	5/8	354
.88-14	3/4	564
1.00-12	3/4	860
1.25-12	7/8	1,697
1.50-12	1	3,001

## RECOMMENDED ANTI-SEIZE LUBRICANT



### BENEFITS & FEATURES

- **Excellent Anti-Seize** Prevents seizing causing by galling, galvanic action, fretting, fusion, pitting, thread distortion, breakage, rust, and corrosion.
- **Water Resistant** Provides long term protection with just one application, outdoors or indoors, even in the damp areas or against salt spray. Will not wash off.
- **Wide Temperature Range** Coating withstands temperatures of -65 Degree F to 2100 Degree F. (-54 C to 1100 C)
- **Stable Coating** Will not harden or fuse to metal, cake, evaporate or separate
- **Compatible with many materials** Can be used as an anti-seize on the threads of steel, stainless steel, steel alloy, cast iron, aluminum, copper brass, and titanium parts and reduces friction and wear on plastic.
- **Environmentally Desirable** Past contains no lead compounds traditionally found in this type of product.

**WARNING: USING OTHER TYPES OF ANTI-SEIZE NOT RECOMMENDED BY APE CAN LEAD TO EQUIPMENT FAILURE OR PERSONAL INJURY. WARRANTY WILL BE VOIDED AND FEES MAY APPLY.**

All information given in this Manual is current and valid per the information available at the time of publication. (Please check the updated revision date at the bottom of each page.)

American Piledriving Equipment (APE) reserves the right to implement changes without prior notice.

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