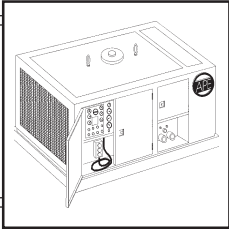




OPERATION / MAINTENANCE MANUAL

MODEL 990 POWER UNIT
7032 So. 196th - Kent, WA. 98032 - (253) 872-0141 / Fax (253) 872-8710



OPERATION AND MAINTENANCE MANUAL



SERIAL NUMBER:

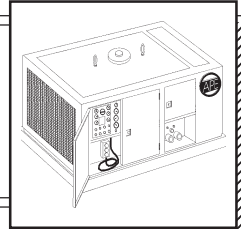
MODEL 990 POWER UNIT



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MODEL 990 POWER UNIT

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Preface

General

This manual covers the **Model 990 Power Unit**. 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.

Guide to Using the Manual

1. Refer to the Table of Contents for the page location of applicable sections.
2. All weights and measurements in this manual are in both English and Metric units.
3. The manual will be revised as necessary to reflect current information.

Abbreviations

The following are abbreviations used within this manual.

- lbs.** = Pounds
- psi.** = Pounds per Square Inch
- hp.** = Horse Power
- gpm.** = Gallons Per Minute
- rpm.** = Revolutions Per Minute
- eng.** = Engine
- cyl.** = Cylinder
- mm.** = Millimeter
- mtg.** = Mounting
- S/N** = Serial Number
- sol.** = Solinoid

Serial Number Locations

POWER UNIT: On back of the hydraulic tank above the APE logo.



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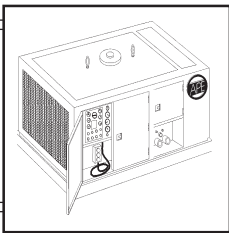


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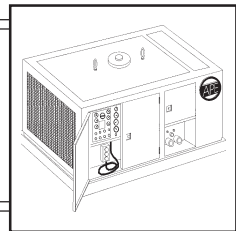


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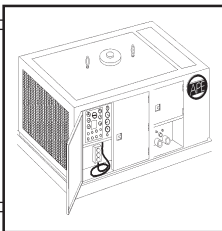
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Safety Precautions

(This list of precautions must be followed at all times to ensure personal & equipment safety.)

1. Read this manual from beginning to end before operating or working on this machine.
2. When operating in a closed area, pipe exhaust fumes outside. (**WARNING:** Breathing exhaust fumes can cause serious injury and even death.)
3. When servicing batteries, avoid any type of spark or open flame. Batteries generate explosive gases during charging. There must be proper ventilation when charging batteries.
4. Never Adjust or repair the unit while it is in operation.
5. Make sure the Control Pendant is in the "LOCAL" position before starting the unit.
6. Remove all tools and electrical cords before starting the unit.
7. Keep oily rags away from the exhaust system.
8. Never store flammable liquids near the engine.
9. Never stand under hammer at any time and keep your eyes on the hammer when it is in operation. Keep a look out for loose bolts or leaking hydraulic lines.
10. Avoid pulling on hose quick dis-connect fittings. Move power unit closer to work if hoses cannot reach. Do not use hoses as a tow line to tug the power unit! If a hose fails at the hydraulic couplers then it is a result of "hose tugging by the pile crew".
11. Avoid kinks in the hoses. Kinks will cut the hose safety factor by 50 percent.
12. Always wear eye and ear protection.
13. Avoid standing downwind of vibrating piles. Dirt and other matter may become airborne and fall into the unprotected eye.
14. Always wear a hardhat, gloves, and safety shoes.
15. Always attach safety line to pile when extracting or hoisting into position.
16. (**WARNING**) Never clamp hammer to pile and dis-connect from crane line. Lay vibro down on ground when not in use.
17. Do not truck power unit with quick disconnect caps and plugs screwed on to fittings unless the caps and plugs have wire rope safety lines attached. Store in storage box under control panel.
18. When loading or unloading the hammer or power unit using a forklift, the forks must be placed under the entire depth of the unit. Do not allow anyone to stand in between the hammer or power unit while it is being moved on the forks of the fork lift. **DO NOT STAND BETWEEN THE LOAD BEING LIFTED OR TRANSPORTED AND THE FORKLIFT BECAUSE THE LOAD COULD SHIFT WHILE ON THE FORKS AND CRUSH YOU TO DEATH. NEVER STAND BETWEEN THE LOAD BEING LIFTED AND THE DEVICE DOING THE LIFTING. NEVER STAND BETWEEN THE CRANE AND THE LOAD.** This equipment must be transported and loaded or unloaded by experienced, trained personnel only. Be aware that anything being lifted by a forklift is subject to sudden movement if the forklift operator tilts to far forward or back.
19. Consult the factory for exact weights and measures of each unit by APE serial number.



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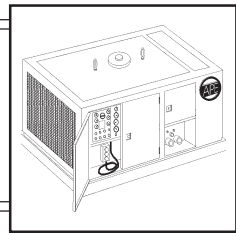


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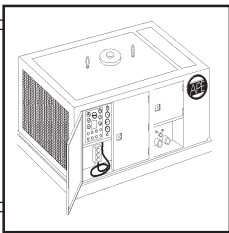
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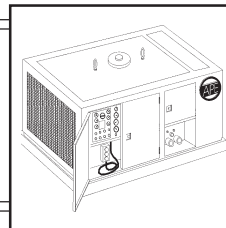




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Warranty

American Piledriving Equipment, Inc. STANDARD WARRANTY

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 year after the date of delivery to the first user and subject to the following conditions:

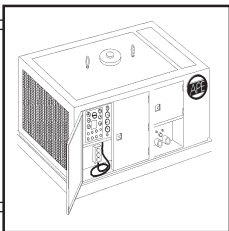
APE's obligation and liability under this WARRANTY is expressly limited to repairing or replacing at APE's option, any parts which appear to APE upon inspection to have been defective in material or workmanship. Such parts shall be provided at no cost to the user, at the business establishment of APE 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. AMERICAN PILEDIVING EQUIPMENT, INC. makes no other warranty, expressed or implied and makes no warranty of merchantability of fitness for any particular purpose.

APE's obligation 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. Any improper use, including operation after discovery of defective or worn parts, operation beyond rated capacity, substitution of any parts whatsoever, or parts not approved by APE or any alteration or repair by others in such manner as in APE's judgment affects the product materially and adversely, shall void this warranty.

NO EMPLOYEE OR REPRESENTATIVE 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.

**ANY TYPE OF WELDING ON EQUIPMENT
WILL VOID THE WARRANTY**



I. GENERAL INFORMATION

I-1. General Description of Model 990 Power unit.

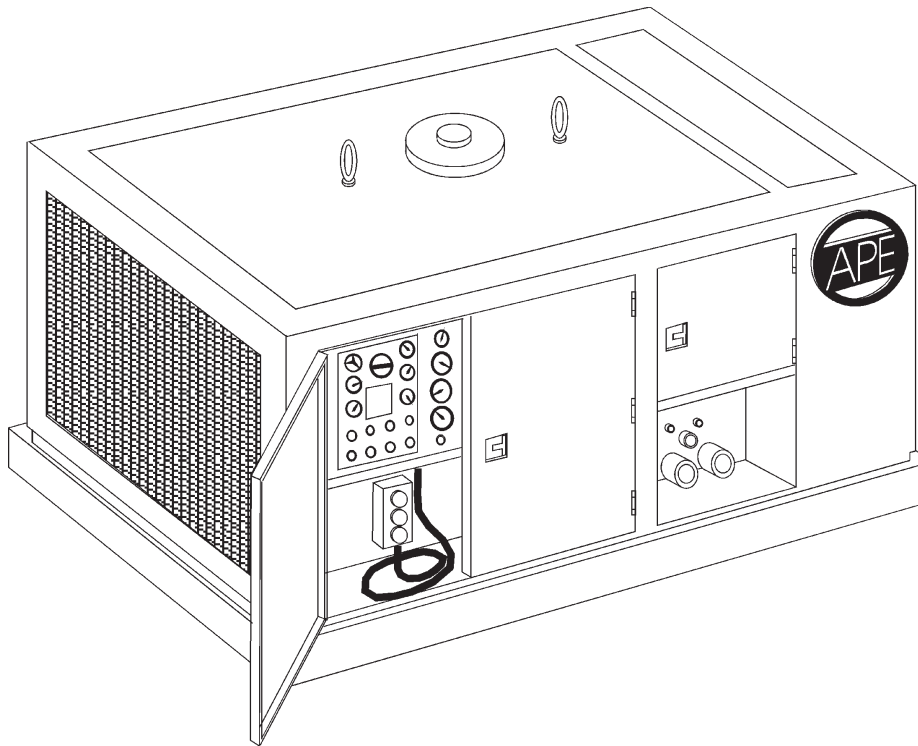


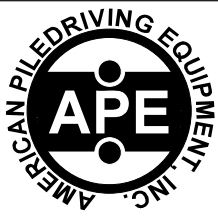
Figure 1-A. General Description of Power Unit

Table 1-A. General Description of Power Unit Specifications

Hydraulic source for super large Impact Hammers, Vibros and High torque Drills

Engine	CAT 3412E
Maximum Power	990 HP (738kw)
Operating Speed	2100 rpm
Maximum Drive Pressure	4500 psi (310 bar)
Maximum hyd. flow: Forward:	273 gpm (1033 lpm)
Clamp Pressure	5000 psi (345 bar)
Clamp Pump Flow @ 2200 rpm.	10 gpm. (38 lpm)
Weight	24,000 lbs (10,886 kg)
Length	186 inches (4,724 mm)
Width	72 inches (1,829 mm)
Height	96.5 inches (2451 mm)

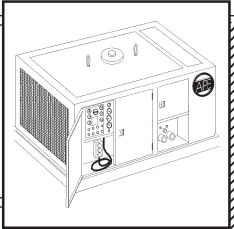
* Operates APE Model 75 Drill with 75,000 ft. lbs. of torque @ 50 rpm.



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I. GENERAL INFORMATION (Continued...)

I-2. General Description of Power Unit

The APE 990 has a CAT 3412E Twin Turbo 990 horsepower engine. The engine is mounted to a tubular frame that also serves as a diesel fuel tank. A sheet metal and tube frame covers the engine and is equipped with locking doors for protection from the environment. A control panel is located behind one of the doors and comes complete with a 50 foot control pendant. There are two hydraulic tanks on the power unit. One is the main tank and the other is a storage tank for extra oil in case the main tank becomes depleted. The Impact Hammer is connected to the power unit via four hydraulic hoses. The two large 2" hoses are the pressure and return lines for the actuator. The two smaller 3/8" hoses are used to adjust stroke length. The hoses are attached to the power unit by connecting the "quick disconnect fittings" on the end of the hoses leading from the impact hammer. The fittings go on only one way so there is no chance of hooking up the hoses improperly.

WARNING: Clean with ether or a clean rag before installing quick disconnects. Make sure you seat the quick disconnect fittings all the way tight. Failure to tighten the quick disconnects will stop the flow of oil and will prevent the impact hammer from operating. Failure to tighten the stroke fittings completely tight will cause the stroke cylinder to either not extend or not retract.

Drawing of power unit is used for all model. This drawing does not represent the actual shape of each power unit.

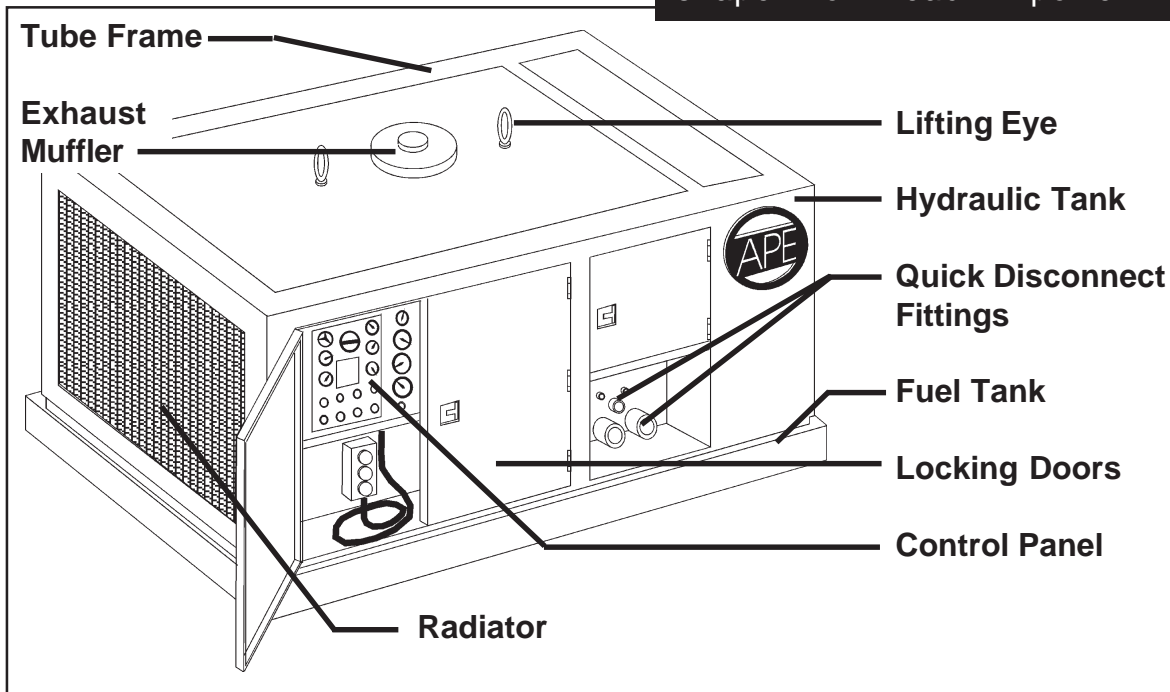
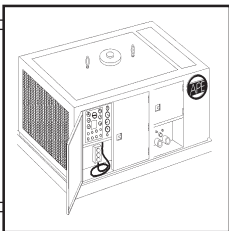


Figure 1-B. General Description of Power Unit



II. MAJOR COMPONENT DEFINITION

II-1. Skid Identification.

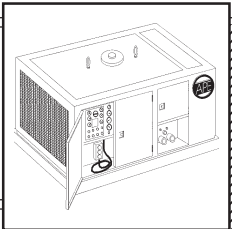


Figure 2-A. Skid Identification.



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II. MAJOR COMPONENT DEFINITION (Continued...)

II-1. Skid Identification.

Table 2-A. Skid Identification

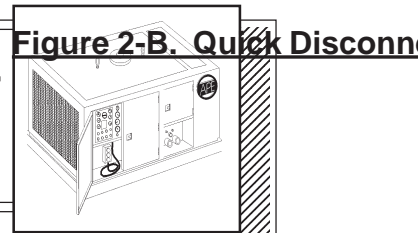
Item	Qty	Description	
1	1	Model 990 Power Unit Skid	
2	1	Radiator Grill	
3	3	Door	
4	3	Door	
5	1	Door	
6	1	Door	
7	1	Door	
8	1	Door	
9	1	Door	
10	1	Cover Plate 12" x 15"	
11	1	Cover Plate 15" x 18"	
12	10	Door Handle / Lock	
		Lock Two Point Handle Locking	
13	23	Hinges Weld On	



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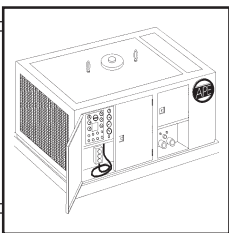
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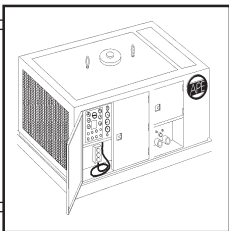
III. LOADING AND UNLOADING

III-1. Model 990 Power Unit.

The Power Unit is always loaded with the oil cooler facing to the rear of the truck to prevent damage to the cooler and the radiator from flying objects. The Power Unit is usually held to the truck by wrapping a chain around both ends of the fuel tank base and the truck bed. After loading the Power Unit, tape the exhaust rain cap shut to prevent rain water from getting inside. If quick disconnects do not have safety cables then store them under the panel in the storage box rather than risk the possibility of the caps and plugs coming loose and falling off into traffic. Make sure all doors are fully closed. Tighten fuel cap to prevent diesel fuel from washing out the fill spout.

III-2. What to do if damaged during shipment.

In the event of damage, notify the trucking agent at once. Note all damage on the bill of lading. Fax the information as soon as possible, any delay may make it impossible to find the responsible party.



IV. SUB COMPONENT DEFINITION

IV-1. Coupler Panel Identification.

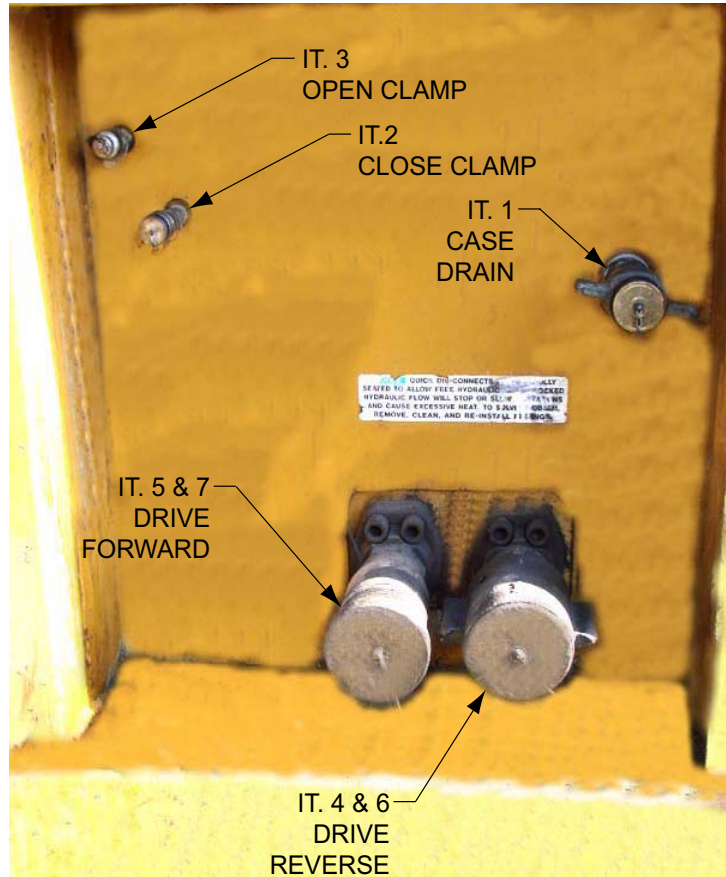
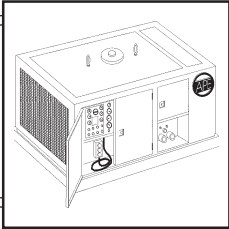


Figure 4-A Coupler Panel Identification.

Table 4-A. Coupler Panel Identification

Item	Qty	Description	
1	1	1 1/4" Male Quick Disconnect	
2	1	3/8" Female Quick Disconnect	#421024
3	1	3/8" Male Quick Disconnect	#421025
4	1	2" Female Quick Dissconnect	#441301
5	1	2" Male Quick Dissconnect	#441303
6	1	2" Dust Plug	#441022
7	1	2" Dust Cap	#441021



IV. SUB COMPONENT DEFINITION (Continued...)

IV-2. Quick Disconnect Couplings.

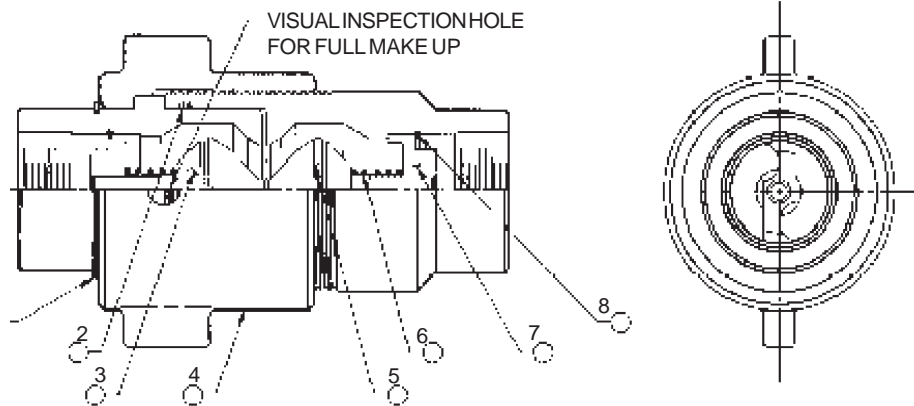
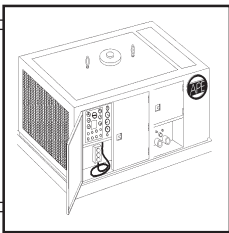


Figure 4-B. Quick Disconnect Coupling Identification.

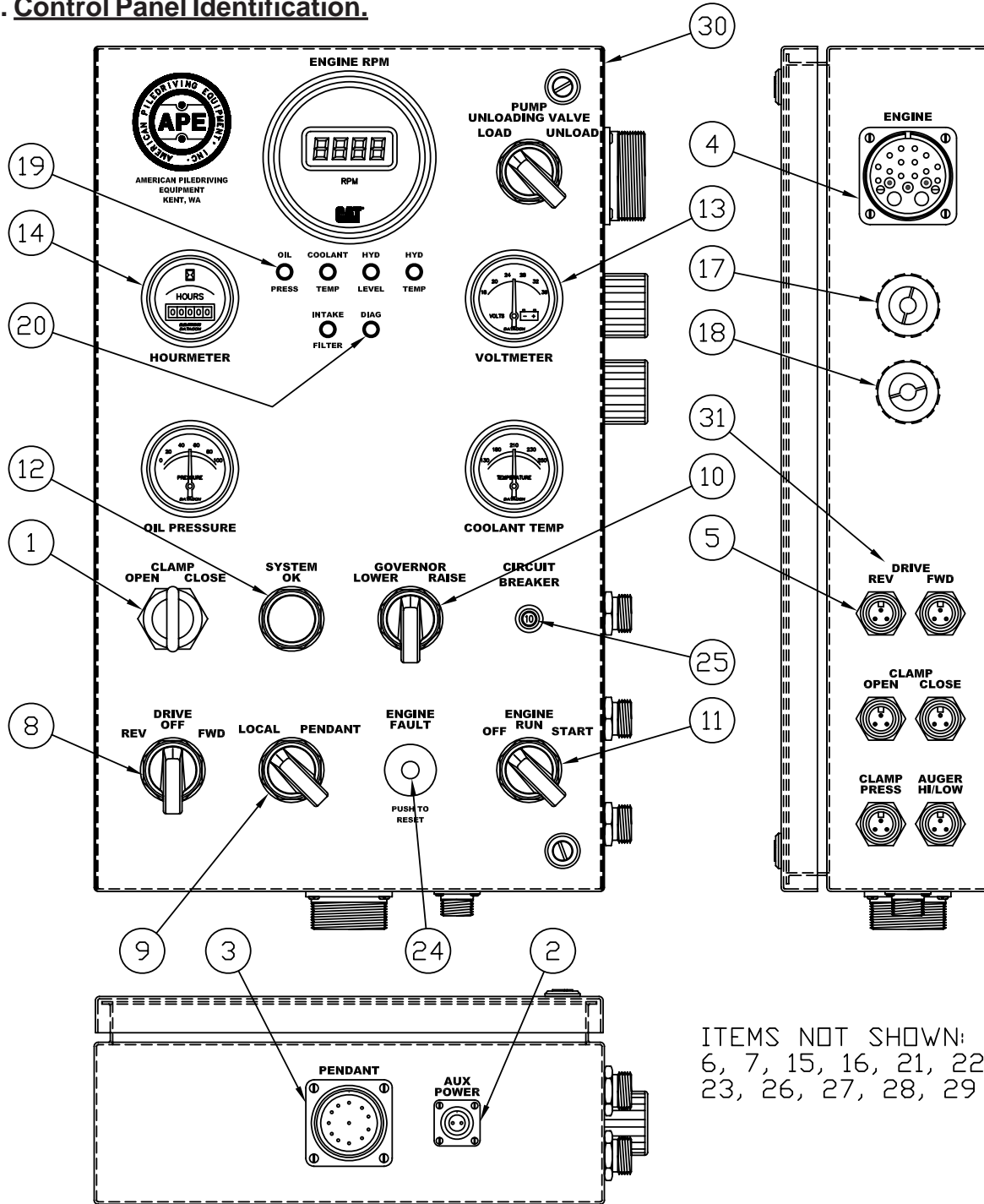
Table 4-B. Quick Disconnect Coupling Identification

Item	Description
1	NUT RETAINER RING
2	NIPPLE SEAL (O-RING/BACK UP RING)
3	POPPET VALVE
4	HIGH STRENGTH CAST STEEL NUT
5	VALVE SEAL SWAGED IN AGAINST WASHOUT
6	VALVE SPRING
7	EXCLUSIVE FOUR POINT CONTACT POPPET GUIDE
8	2-TURN LOCK RING



IV. SUB COMPONENT DEFINITION (Continued...)

IV-3. Control Panel Identification.



ITEMS NOT SHOWN:
6, 7, 15, 16, 21, 22
23, 26, 27, 28, 29

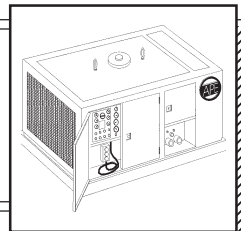
Figure 4-C Control Panel Identification.



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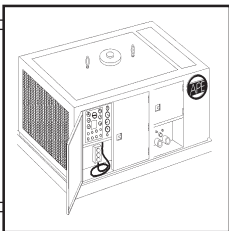
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IV. SUB COMPONENT DEFINITION (Continued...)

IV-3. Table 4-C. Control Panel Identification.

Item	Qty	Description
1	1	Lighted Clamp Open/ Close Switch
2	1	Aux Socket
3	1	Pendant Receptacle
4	1	Engine Receptacle
5	6	S.O. Cord Receptacle
6	1	Toggle Switch
7		Toggle Switch
8	1	Drive Forward / Reverse Switch
9	1	Local / Pendant Switch
10	1	Governor Raise / Lower Switch
11	1	Engine Control Switch
12	1	System O.K. Lampholder
13	1	Volt Meter
14	1	Hour Meter
15	1	Speed Switch
16	1	Drive Hour Meter
17	1	3/8" - 1/2" Cord Connector
18		3/4" Cord Connector
19	5	Red L.E.D.
20	1	Amber L.E.D.
21	42	Terminal Block
22	2	Lighted Relay
23	15	Diode
24	1	Murphy Mag Switch
25	1	Circuit Breaker 10 Amp
26	2	Circuit Breaker 16 Amp
27	1	Tach Transducer
28	4	Mount Leg
29	1	Back Pan S.S.
30	1	Cover Door
31	1	Side Panel Label



IV. SUB COMPONENT DEFINITION (Continued...)

IV-4. Control Panel Gages

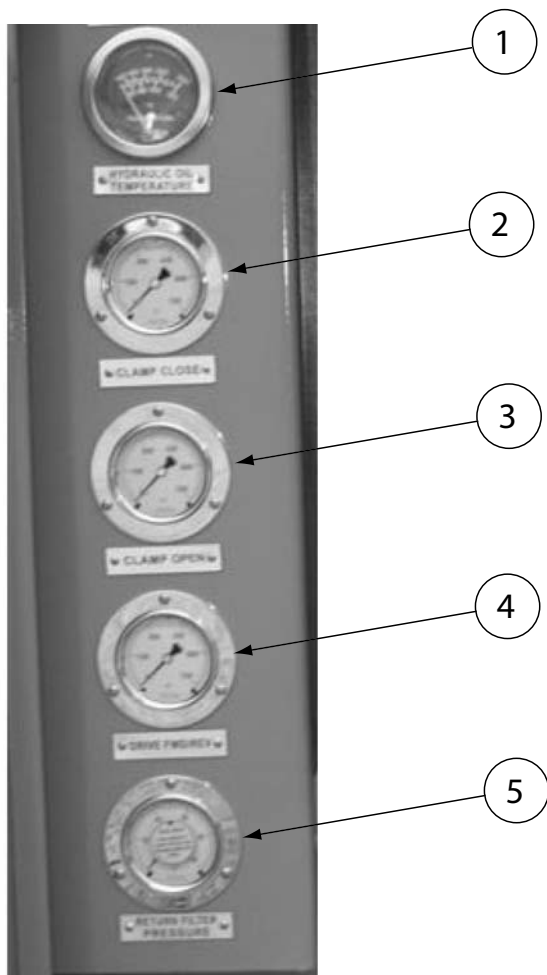
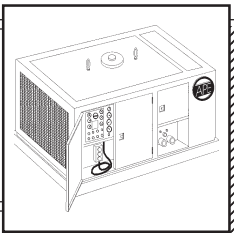


Table 4-D. Control Panel Gages

Item	Description	P/N
1	Oil Temp Gage	555051
2	Clamp Close Gage	523016
3	Clamp Open Gage	513007
4	Drive Gage	513007
5	Return Filter Gage	513007A

Figure 4-D Control Panel Gages



IV. SUB COMPONENT DEFINITION (Continued...)

IV-5. Remote Pendant.

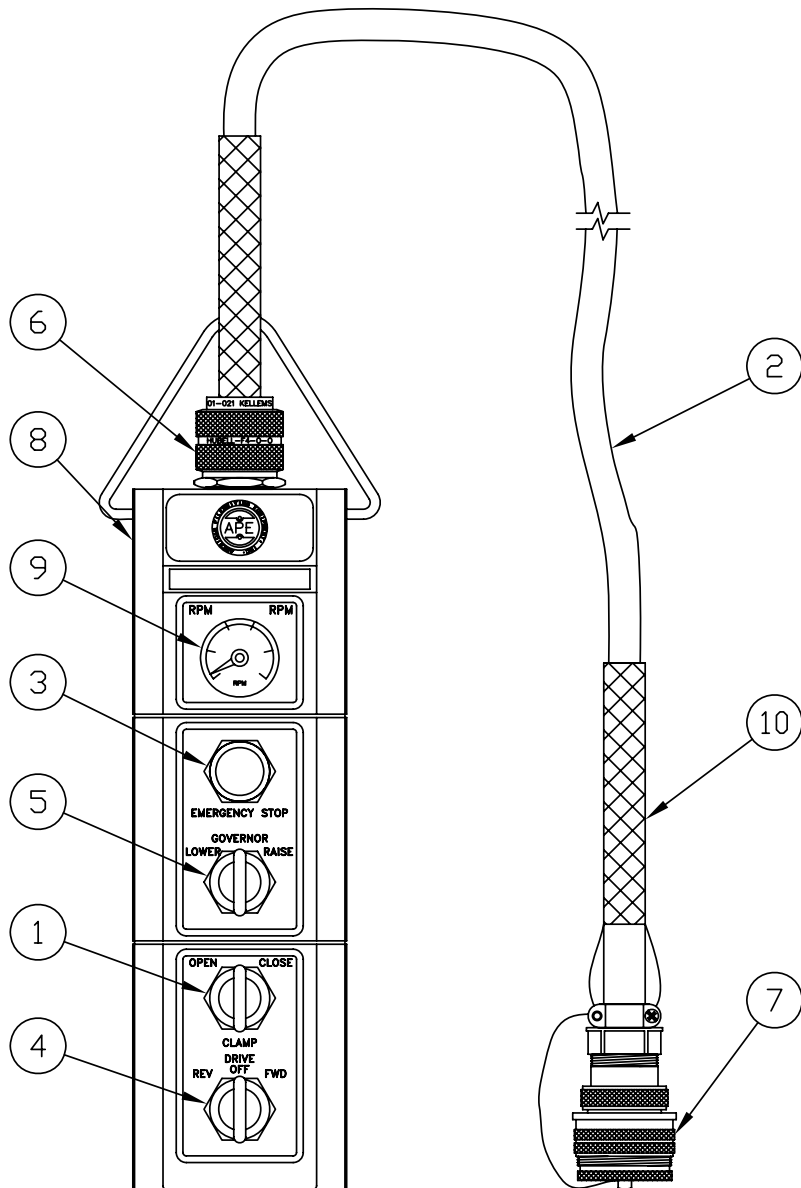


Table 4-E. Remote Pendant

It	Description
1	Clamp Open/Close Switch
2	Pendant Cable
3	Emergency Stop Button
4	Drive Rev/Fwd Switch
5	Gov. Raise/Lower Switch
6	Cord Grip
7	Pendant Plug
8	Pendant Box
9	Tachometer
10	Cable Mount Grip

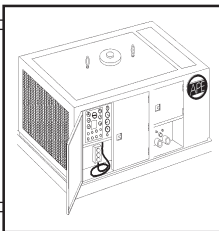
Figure 4-E Remote Pendant



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V. PREPARATION AND OPERATION

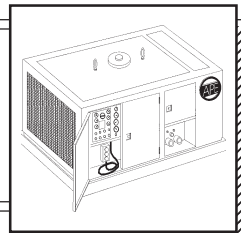
V-1. Relief Valve Settings Prior to Operation.

1. Do not hook up quick disconnects. Start engine and bring to full rpm.
2. The Clamp circuit is used for the stroke length setting. The pressure is set lower to operate the trip cylinder than when being used for a Hydraulic Pile Clamp.
3. Check Clamp relief valve setting by turning clamp switch to "open" and holding it there while you read the clamp "open" gauge on the panel. The gauge should read between 1500 to 1800 psi. Avoid reading the clamp "close" gauge. You must read only the "open" gauge to know the proper setting. If it is not coming up to pressure then set the relief valve (FACTORY AUTHORIZED PERSONNEL ONLY) by loosening the lock nut and turning the knob in slowly until the proper pressure is reached. Turn in to increase pressure and out to decrease pressure. Lock the locknut and re-check the pressure to make sure that you did not move the setting while you were tightening the lock nut.
4. Check the clamp pressure switch setting. Turn the clamp to "close" and see if the green light comes on indicating proper clamp pressure. If it does then everything is too high for the trip cylinder. Call the factory if you have any questions. (800) 248-8498 or see Manual for Vibrotory Plie driver.

V-2. Shut-down Procedures.

The following procedures explain what to do with the power unit to correctly shut down the APE Hydraulic Impact Hammer. (Please refer to page 4-3 for control locations)

- 1.) Stop the hammer. (Turn Drive Rev/Fwd switch to Off.)
- 2.) Allow the diesel engine to run for five minutes at 1000 engine rpms.
- 3.) Reduce engine speed to low idle for about 60 seconds.
- 4.) Shut engine off by turning off the main power switch.



V. PREPARATION AND OPERATION (Continued...)

V-3. Operation of the Remote Pendant.

1. All functions of the hammer can be controlled by the hand held pendant. It is the choice of the crew as to where best to locate the pendant. The "Local / Remote" switch must be turned to Remote for the pendant to operate. Some prefer to give it to the crane operator so he can control all functions. Others prefer to give it to one of the ground crew so that he can position himself close to the work at hand. A 50 foot cord is provided as standard equipment. If this is not long enough, additional 50 foot sections can be added. Should the pendant become damaged, all functions can be manually operated.

V-4. Normal steps to operate hammer:

1. Position hammer on pile.
2. Set the stroke length to the minimum height.
3. Turn to Forward to begin impacting the pile.
4. To drive, lower crane line with hammer and pile.
5. To increase driving force increase the stroke length.
6. To stop the hammer turn the Forward switch to off, the ram will free fall and stop.

WARNING!

Do not stand under the hammer while it is driving a pile. Watch for falling tools or other items left on hammer prior to hoisting. Keep hands away from pile and locating devices. Never put your hands on the pile while hammer is being lowered on to the pile.

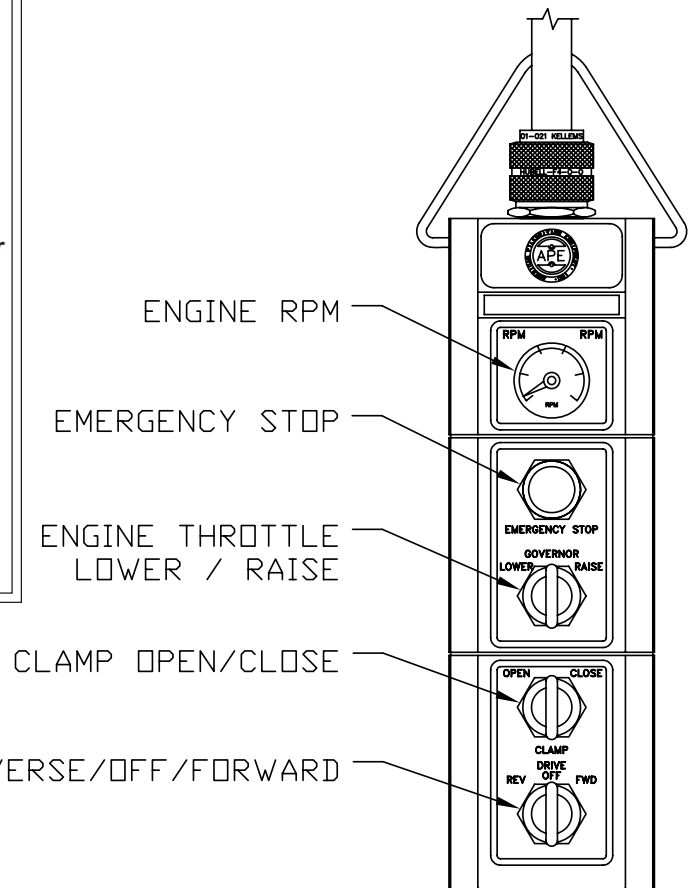


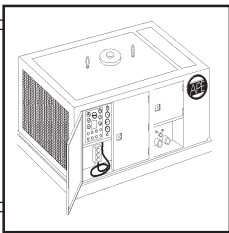
Figure 5-A Remote Pendant



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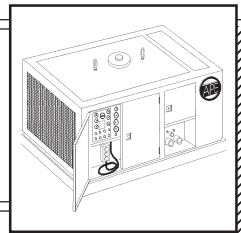




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V. PREPARATION AND OPERATION (Continued...)

V-5. Checklist After Power Unit Engine Has Started

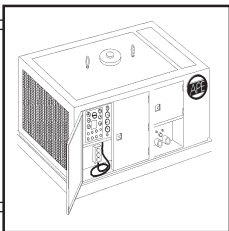
- 1.) Check all hydraulic hoses for leaks. Make sure they hang free with no kinks.
- 2.) Check inside the Power Unit. Look at all hoses and valves, check for leaks.
- 3.) Check filter indicator with engine running at full rpm. Replace if necessary.
- 4.) Check wire rope sling and make sure it is in excellent condition.
- 5.) Check cushion material.
- 6.) Check striker plate.
- 7.) Check drive cap.



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VI. MAINTENANCE

VI-1. Power Unit - Filters, Fluid Types, and Capacities.

FILTERS

LOCATION	ENGINE	FILTER TYPE	QUANTITY
Engine Oil:	3412E	CAT 1R1808	2 each
Engine Fuel :	3412E	CAT 1R0749	2 each
(Warning! be careful. Fuel filters under pressure. Always wear eye protection)			
Water Sep Filter	3412E	CAT 129-0372	1 each
Air Filter Inner	3412E	CAT 6I-2510	2 each
Air Filter Outer	3412E	CAT 6I-2509	2 each
Hand Pump Filter:	-----	Zinga AE-25	1 each

ENGINE OIL TYPES AND CAPACITIES

LOCATION	ENGINE	OIL TYPE	CAPACITY
Hydraulic Oil-Main:	-----	Terresolve 146	750 gallons
Hyd Oil-Reserve:	-----	Terresolve 146	125 gallons
Engine Oil:	CAT Engines	CAT 15W40	48 quarts
Engine Water:	-----	50/50 Water/Gyicol	27 gallons
Fan Drive:	-----	Multi-Purpose Grease	
Governor Control:	-----	Multi-Purpose Grease	
Pump Drive:	-----	Mobil SHC 629	

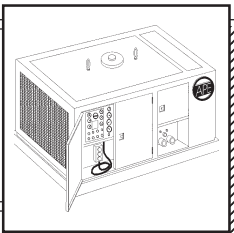
Table 6-A. Power Unit - Filters, Fluid Types, and Capacities.



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VI. MAINTENANCE (Continued...)

VI-2. Hydraulic Fluid.

When adding or changing hydraulic fluid APE uses only Terresolve Hydraulic Vegetable oil which is non-toxic and will not harm oil or water and is biodegradable. Consult your local oil supplier for recommendations on mixing hydraulic oils. Change hydraulic oil if it looks milky. This includes all hydraulic lines leading to and from the vibro. Milky oil indicates that water is in the oil.

VI-3. Draining and Filling Hydraulic Fluid Tank

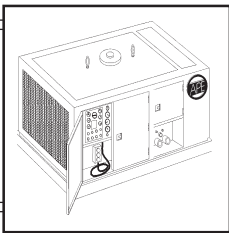
1. Remove plug located on bottom of tank
2. Refill by manually pumping with hand crank.
3. Prime both the clamp and the main pump before restarting.
4. Take extreme caution that no dirt or other unwanted particles enters the system.



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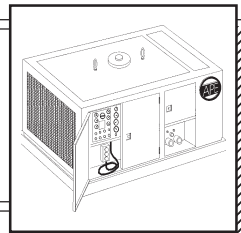




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VI. MAINTENANCE (Continued...)

VI-4. Changing Hydraulic Return Filter Element.

The hydraulic return filter is mounted on the hydraulic tank inside the power unit. It is mounted high on the tank so that when the filter element is removed the oil will not drain from the hydraulic tank. The filter has a manual pop-up type indicator to tell when the filter is dirty. The pop-up indicator turns red when it is dirty.

VI-5. Steps to Remove the Return Filter Element.

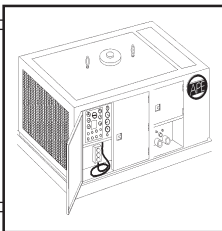
1. Shut down power unit by turning off the diesel engine.
2. Place warning tag on control panel so that no one mistakenly starts the unit while filters are being changed.
3. Clean area around filter so that when it is removed there is no chance of introducing dirt into the hydraulic system.
4. Using a filter wrench, turn the filter counter clockwise and spin the filter off the filter housing.
5. Install new clean filter making sure the o-ring is in place and lubricated.
6. Depress filter indicator to re-set to "clean position".



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VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-1. Clamp - Stroke Circuit. (Used for extending and retracting the stroke cylinder.)

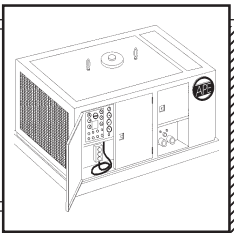
Oil for the stroke circuit is provided by one half of a dual pump "G1". All oil to the inlet of this pump flows from the reservoir through a shut-off valve, which must be open at all times. Oil is then directed from the pump to the Stroke manifold "F" which contains the directional control valve. When the stroke switch is in the neutral position, the oil flows through the directional control valve and back to the oil tank. When stroke switch is moved to OPEN, solenoid "B" (on the directional control valve) is energized the oil will flow out to the stroke cylinder and extend the trip valve lever. Turn the switch to OPEN or CLOSE to achieve the stroke length you need at that time. The stroke open pressure can be seen on the clamp pressure gage. When the stroke switch is moved to CLOSE, solenoid "A" (on the directional control valve) will be energized and oil flow will be directed to the stroke cylinder. The stroke cylinder will then retract the trip valve lever. Stroke pressure is maintained in clamp cylinder by a pilot operated check valve. Maximum stroke pressure is limited by the pressure relief valve set at 1500 psi. The quick disconnect couplers permit de-coupling of clamp hoses.

VII-2. Drive Circuit. (Used for operating APE hydraulic Impact Hammer)

There are three pumps (two dual pump and one half of another) that direct oil to the actuator. The maximum drive pressure is controlled by the drive pressure relief valve, to 5000 psi. max. When the drive switch is moved to the FWD position, solenoid "A" of the drive directional control valve is energized. Oil flow is directed to the actuator to lift the ram. When the drive switch is moved to the OFF position, oil flow is directed back to the tank through the drive directional control valve and solenoid "A" is de-energized.

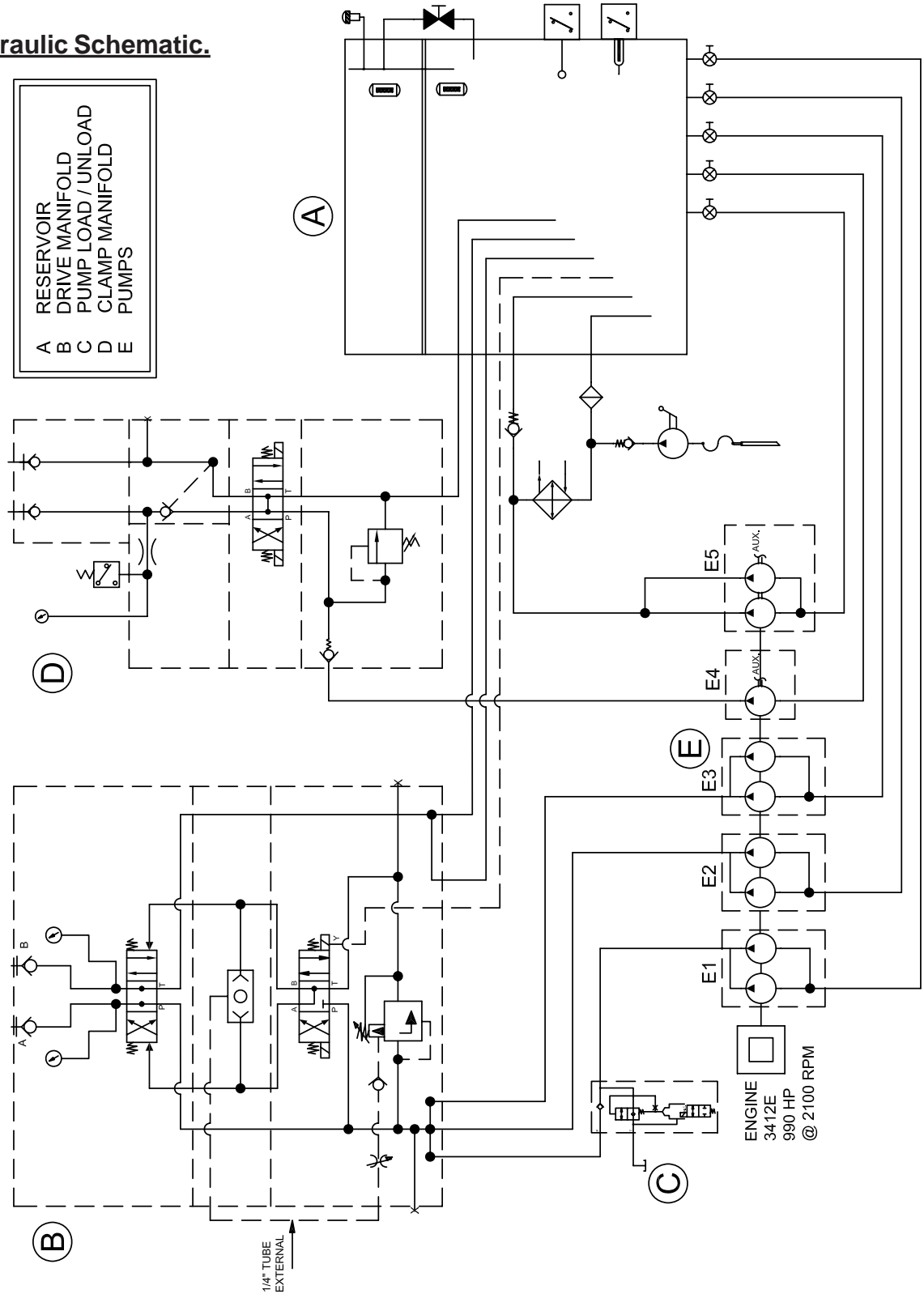
(Because of the high oil flow in the drive circuit, APE, Inc. has developed a circuit that eliminates high shock loads. Small internal components located in the drive manifold provide a soft shift feature for the drive directional control valve.)

The quick-disconnect couplings permit de-coupling of the drive and case drain hoses at the power unit.



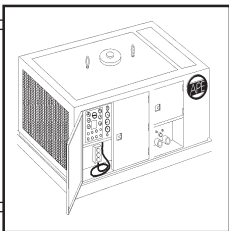
VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-3. Hydraulic Schematic.



- RESERVOIR
 - DRIVE MANIFOLD
 - PUMP LOAD / UNLOAD
 - CLAMP MANIFOLD
 - PUMPS
- A B C D E

Figure 7-A Hydraulic Schematic



VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-4. Clamp - Stroke Manifold Assembly.

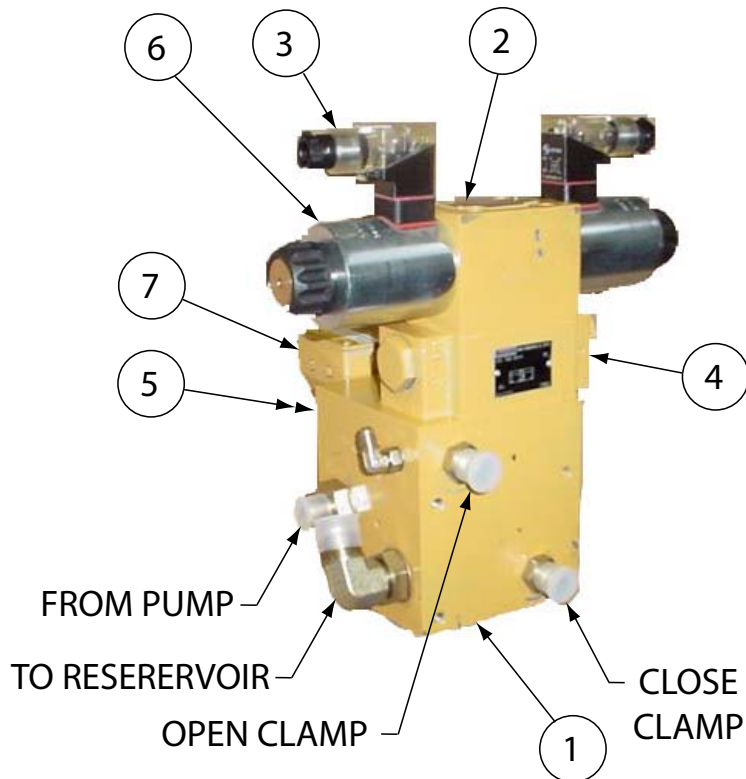


Figure 7-B Clamp - Stroke Manifold Assembly

Table 7-A Clamp - Stroke Manifold Assembly

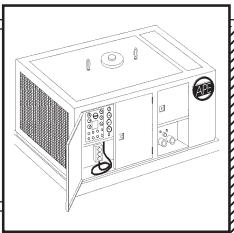
It	Description	P/N
1	Machined Manifold	
2	Control Valve	555075
3	Lighted Connector	555077
4	PO Check Valve	555079
5	Relief Valve	
6	Control Valve Coil	555101
7	Pressure Switch	555085



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VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-5. Hydraulic Schematic Clamp - Stroke Manifold.

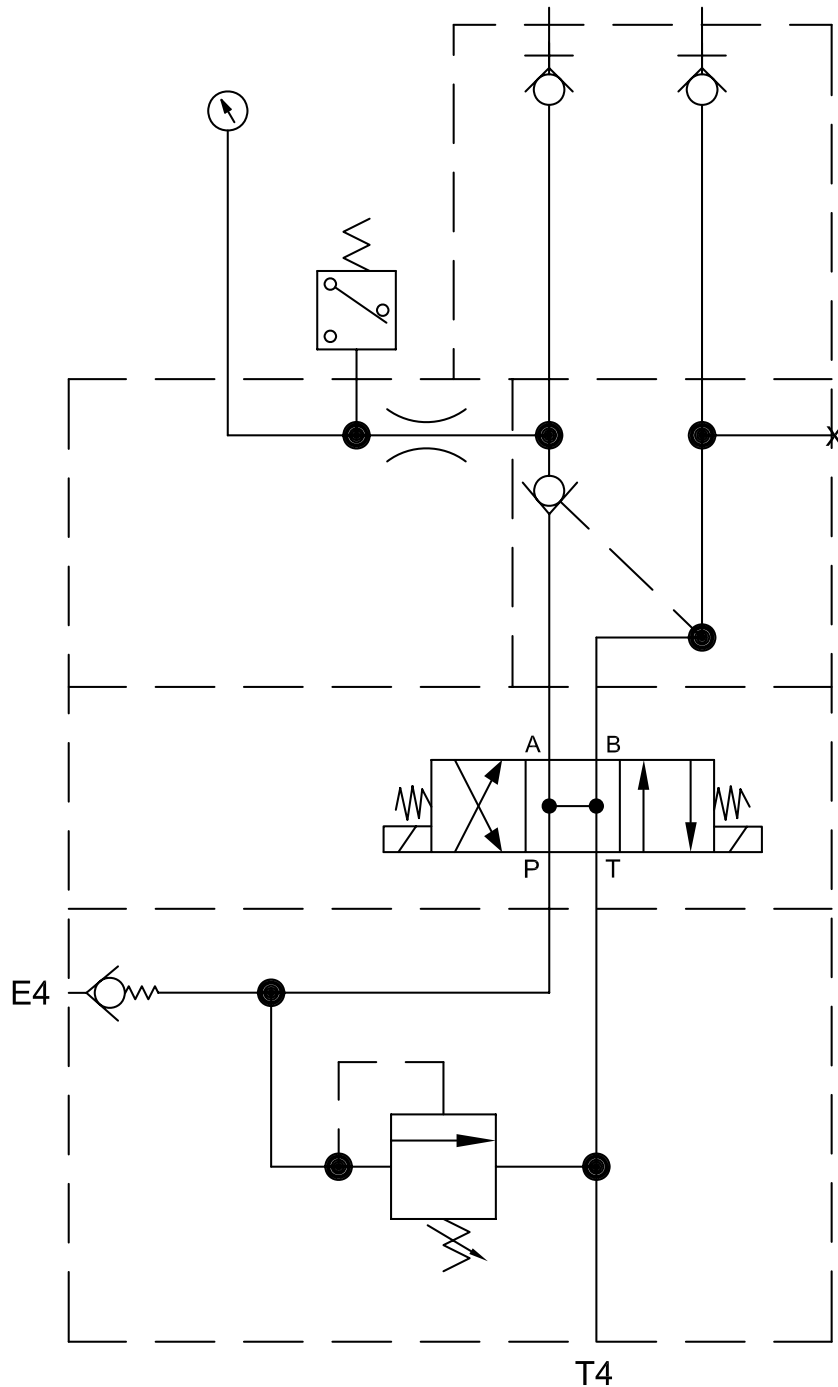
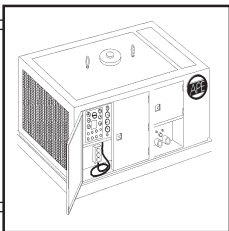


Figure 7-C Hydraulic Schematic Clamp -Stroke Manifold



VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-6. Drive Manifold Assembly.

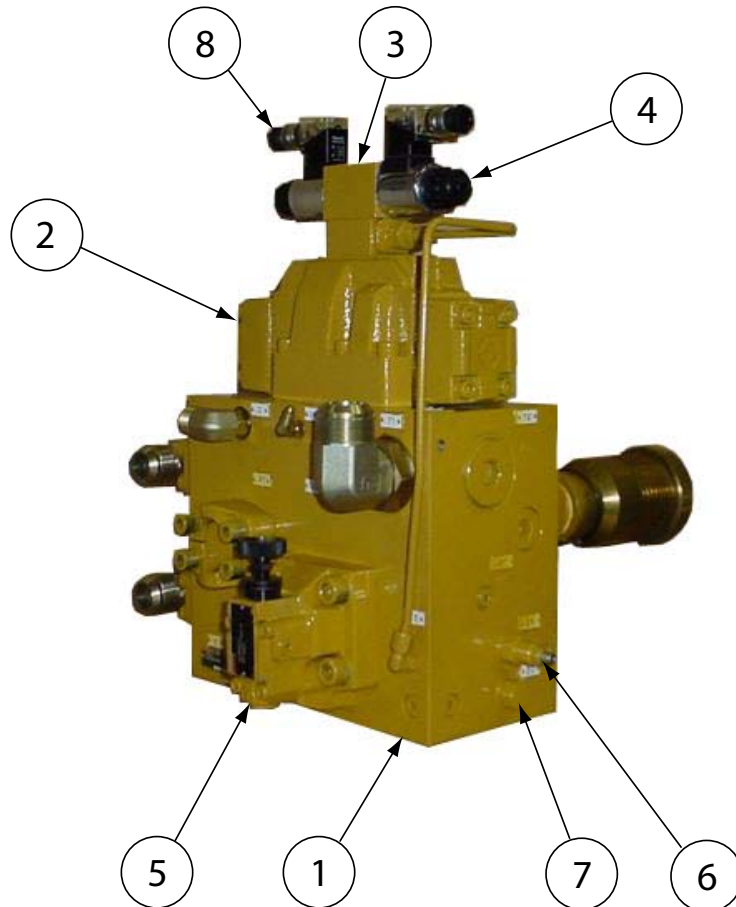


Figure 7-D Drive Manifold Assembly

Table 7-B Drive Manifold Assembly

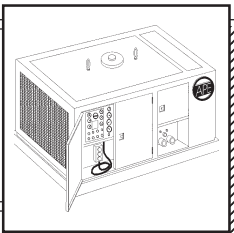
It	Description	P/N
1	Machined Manifold	
2	Control Valve	
3	Sol Control Valve	
4	Coil	543043
5	Relief Valve	513018B
6	Needle Valve	555069
7	Check Valve	555071
8	Lighted Connector	513048



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VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-7. Hydraulic Schematic Drive Manifold.

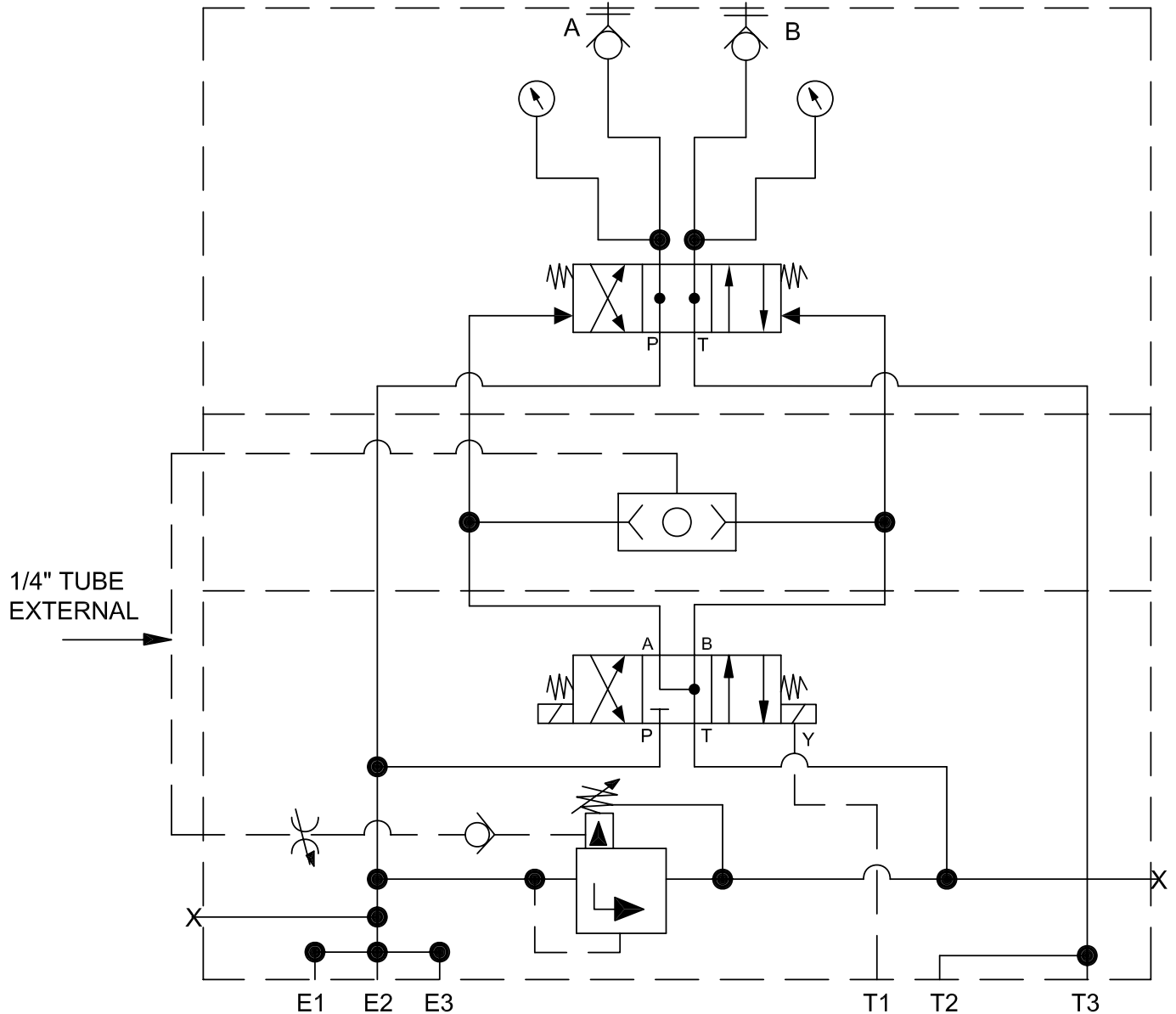


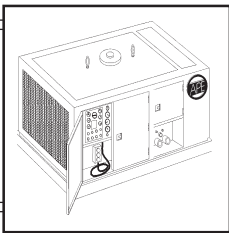
Figure 7-E Hydraulic Schematic Drive Manifold



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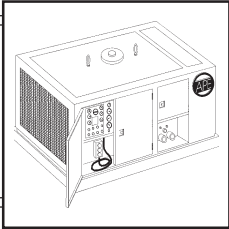




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VII. HYDRAULIC CIRCUITRY AND ASSEMBLIES

VII-8. Return Filter.

Returning hydraulic oil is filtered by the return filter.

VII-9. Oil Cooler.

The hydraulic oil is cooled by the oil cooler, which is continuously pumped through the cooler while the engine is running. This cooler is protected from high pressure by a check valve that will bypass hydraulic oil to the reservoir.

VII-10. Manual Pump.

A manual pump is provided to fill the reservoir with hydraulic oil. A check valve prevents loss of hydraulic oil from the reservoir back thru the manual pump.

VII-11. Hydraulic Oil Temperature.

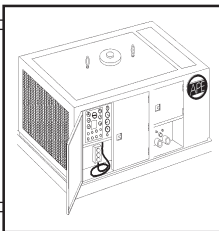
A temperature gage indicates hydraulic oil temperature. The sending unit is mounted on the front of the main reservoir.



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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-1. Electrical Controls.

The Main Control Panel contains all of the equipment necessary to Start, Control and Monitor the engine, as well as control the hammer functions. Remote control of the hammer functions can be achieved by plugging either a Remote Pendant cord, or a Radio Remote into the large receptacle, located on the bottom of the panel. The Remote Pendant allows the operator to move about in approximately a 50 ft. radius of the Power Unit. The Radio Remote will allow the operator to move about in approximately a 400 ft. radius of the Power Unit.

VIII-2. Main Circuit Breaker.

A circuit breaker is provided to protect the control wiring in the event of an electrical overload or a shorted circuit. If the circuit breaker should trip, find and repair the fault, then reset the breaker by pressing the circuit breaker reset button on the face of the Control Panel.

VIII-3. Tachometer.

A digital tachometer, located on the front of the control panel, is provided to monitor the engine RPM. A magnetic sensor picks up a signal from the flywheel, and sends it to the tachometer.

VIII-4. Hourmeters.

Two hourmeters are on the Control Panel, one on the face of the panel, and one on the inside of the panel. The hourmeter on the face of the panel monitors the time that the engine is running. The hourmeter inside the panel monitors the time the "Forward Drive" is operating.

VIII-5 Engine Safety Shutdown Switch.

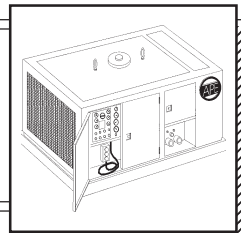
Mounted to the control Panel door, is a Murphy Magnetic switch with a manual reset button. When the contact on the switch is closed, 24V electrical power is supplied the engine ECM, the hourmeter and the "System OK" light. Then the contact is open, the above items will be de-energized, and the engine will not run. The contact can be manually closed by pressing the "Reset" button on the face of the control panel. The contact will remain latched closed, unless the coil on the switch is energized. Each time the coil is energized, the contact will be unlatched, and the contact will open, to stop the engine. There are five switches that can energize the coil on the Murphy Magnetic switch, to stop the engine, (Engine Oil Pressure Gage, Engine Coolant Temperature Gage, Hydraulic Oil Gage, Hydraulic Oil Level Switch, and Emergency Stop Button on the Pendant).



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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-6 Murphy "Engine Oil Press" gage.

The Engine Oil Pressure Gage is located on the door of the Main Control Panel. A low cutoff switch is located inside the Murphy "Engine Oil Pressure" gage. When the engine oil pressure is too low, the switch will close to energize the coil in the Murphy Mag Switch. The cutoff pressure has been set at the factory. If the setting should need to be changed, use the adjustment screw provided in the front of the gage. A 1/16" allen wrench is required. Each time the engine is to be started, the Murphy Mag Switch coil will be energized by the switch in this gage. (To start the engine, one must press and hold the manual reset button on the Murphy Mag Switch until sufficient engine oil pressure is achieved. Sufficient oil pressure has been achieved when the "Oil Press" light on the face of the Control Panel goes out.)

VIII-7 Murphy "Engine Coolant Temp" gage.

The Engine Coolant Temperature Gage is located on the door of the Main Control Panel. A high cutoff switch is located in the Murphy "Engine Coolant Temp" gage. When the engine temperature is too high, the switch will close to energize the coil in the Murphy Mag Switch. The cutoff pressure has been set at the factory. If the setting should need to be changed, use the adjustment screw provided in the front of the gage. A 1/16" allen wrench is required. (Do not set the cutoff temperature above 220 degrees F. without factory permission.)

VIII-8 Murphy "Hydraulic Oil Temp" gage.

The Hydraulic Oil Temperature Gage is located in the Gage Assembly on the left of the Control Panel. A high cutoff switch is located in the Murphy "Hyd Oil Temp" gage. When the hydraulic oil temperature is too high, the switch will close to energize the Murphy Mag Switch. The cutoff temperature has been set at the factory. If the setting should need to be changed, use the adjustment screw provided in the front of the gage. A 1/16" allen wrench is required. (Do not set the cutoff temperature above 180 degrees F. without factory permission.)

VIII-9 Hydraulic Oil Level Float Switch.

The "Hydraulic Oil Level" float switch is located in the reservoir, next to the sight gage. A glass window is provided in the switch so that the float and the oil level can be observed. If the oil level gets too low, the switch will close to energize the coil in the Murphy Mag switch.

VIII-10 Pendant "Emergency Stop" button.

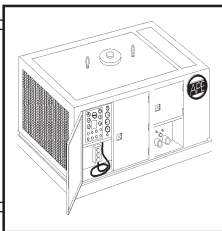
To stop the engine in an emergency, press the "Emergency Stop" button on the Remote Pendant. This "Emergency Stop" button will work, regardless of the position of the "Local-Pendant" selector switch.



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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-11. Pilot lights.

There are six pilot lights on the face of the control panel that are associated with the Safety Shutdown Switch discussed above.

1. "System OK" light. A lit "System OK" light is an indication that the Engine Oil Pressure, Engine Coolant Temperature, Hydraulic Oil Temperature, and the Hydraulic Oil Level are all okay. When the "System OK" light is not lit, the engine will have been automatically stopped. The problem can be detected by observing the following lights.
2. "Engine Oil Press" light. Anytime the engine oil pressure is too low, this light will be on, (with the following exception). If the "Engine Coolant Temperature Gage", the "Hydraulic Oil Temperature Gage", or the "Hydraulic Oil Level Switch" has stopped the engine, the "Engine Oil Press" light will not be on; but, one of the following lights will be on.
3. "Engine Coolant Temp" light. If the Engine Coolant Temp is too high, this light will be on.
4. "Hydraulic Oil Temp" light. If the Hydraulic Oil Temperature is too high, this light will be on.
5. "Hydraulic Oil Level" light. Any time the Hydraulic Oil Level is too low, this light will be on.
6. Intake Filter" light. Anytime the fresh air intake filters become dirty the back-pressure raises too high, this light will be on.

In addition to the above, there is a pilot light in each of the terminal connectors on the solenoid valves. By observing these lights, one can tell which solenoids are energized.

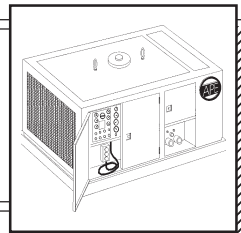
VIII-12. Engine Control Switch "OFF-RUN-START".

The Engine Control Switch is located on the control panel, and is used to start and stop the diesel engine, as well as control power to all the other electrical equipment on the power unit. This switch must be in the "RUN" position before the engine or any of the other electrical components will operate. The "OFF" and the "RUN" positions are detented, but the "START" position is spring loaded to return to the "RUN" position. Turning the switch to the "START" will energize the starter motor on the engine. The Open - Close switch and the Rev - Fwd switch must be in the neutral "OFF" position to start the engine. The Local - Remote switch must be in the Local position for the Engine Control switch to be energized.



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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-13. "LOCAL - PENDANT" Switch.

The Local Pendant switch is located on the control panel, and determines the location from which the hammer can be operated. The hammer can not be operated from more than one location at a time. When this switch is turned to the "Local" position, the hammer can be operated only by the switches on the power unit control panel. When the switch is turned to the "Pendant" position, operation of the hammer is controlled only by the switches on the remote pendant. (The radio remote can be a substitute for the remote pendant.)

CAUTION should be used when changing the position of this switch. Check to make sure that all of the Open - Close switches and the Rev - Fwd switches are in the neutral "OFF" position before turning this switch. If any of the above switches are "ON" the hammer could accidentally be activated, causing mechanical damage or personal injury.

VIII-14 Governor Control "RAISE - LOWER" Switch.

The Governor Control switch is located on the control panel and the remote pendant. To increase the engine rpm, turn the governor control switch to the "Raise" position. To decrease the engine rpm, turn the switch to "Lower" position. This adjustment can be made at any time the engine is running.

VIII-15 Stroke Control "OPEN - CLOSE" Switch.

Stroke control switch is located on the control panel and the remote pendant. To increase the ram stroke, turn the stroke control switch to the "Open" position. To decrease the ram stroke, turn the stroke control switch to the "Close" position. When the ram stroke is at the desired length turn the stroke control switch to the neutral position. This adjustment can be made at any time, before starting the hammer or while the hammer is operating.

VIII-16 Drive Control "FORWARD - OFF - REVERSE" Switch.

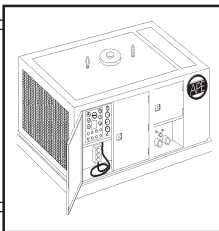
The Drive control switch is located on the control panel and the remote pendant. To start the hammer turn the switch to "FWD", the switch is detented to hold this position. To stop the hammer turn the switch to "OFF" the ram will fall to the bottom and stop the lifting process. The "REV" position of this switch is used only when the power unit is used to operate an Auger.



OPERATION / MAINTENANCE MANUAL

MODEL 990 POWER UNIT

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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-17 Preparing the Electrical System for Engine Startup.

The following procedure should be followed at Engine Startup:

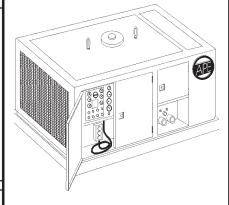
1. The Circuit Breaker must be closed (pushed in and locked).
2. Turn the Stroke Control switches on both the control panel and the remote pendant to the neutral "OFF" position.
3. Turn the Drive switches on both the control panel and the remote pendant to the "OFF" position.
4. The Local - Pendant switch must be in the "Local" position.
5. Turn the Engine Control switch to the "RUN" position.
6. Check the Pilot lights on the control panel. If any lights, other than the "Engine Oil Press" light is on, correct the problem before proceeding. If the "Engine Oil Press" light is on, proceed to step #7.
7. Depress and hold the button on the Engine Safety Shutdown switch (Murphy). This button must be depressed until engine oil pressure is present.
8. Turn the Engine Control switch to the "START" position to engage the starter motor. Once the engine is running, release the Engine Control switch. It will return to the "RUN" position.
9. Once engine oil pressure is present, release the Engine Safety Shutdown switch.



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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-18 Electrical Schematic.

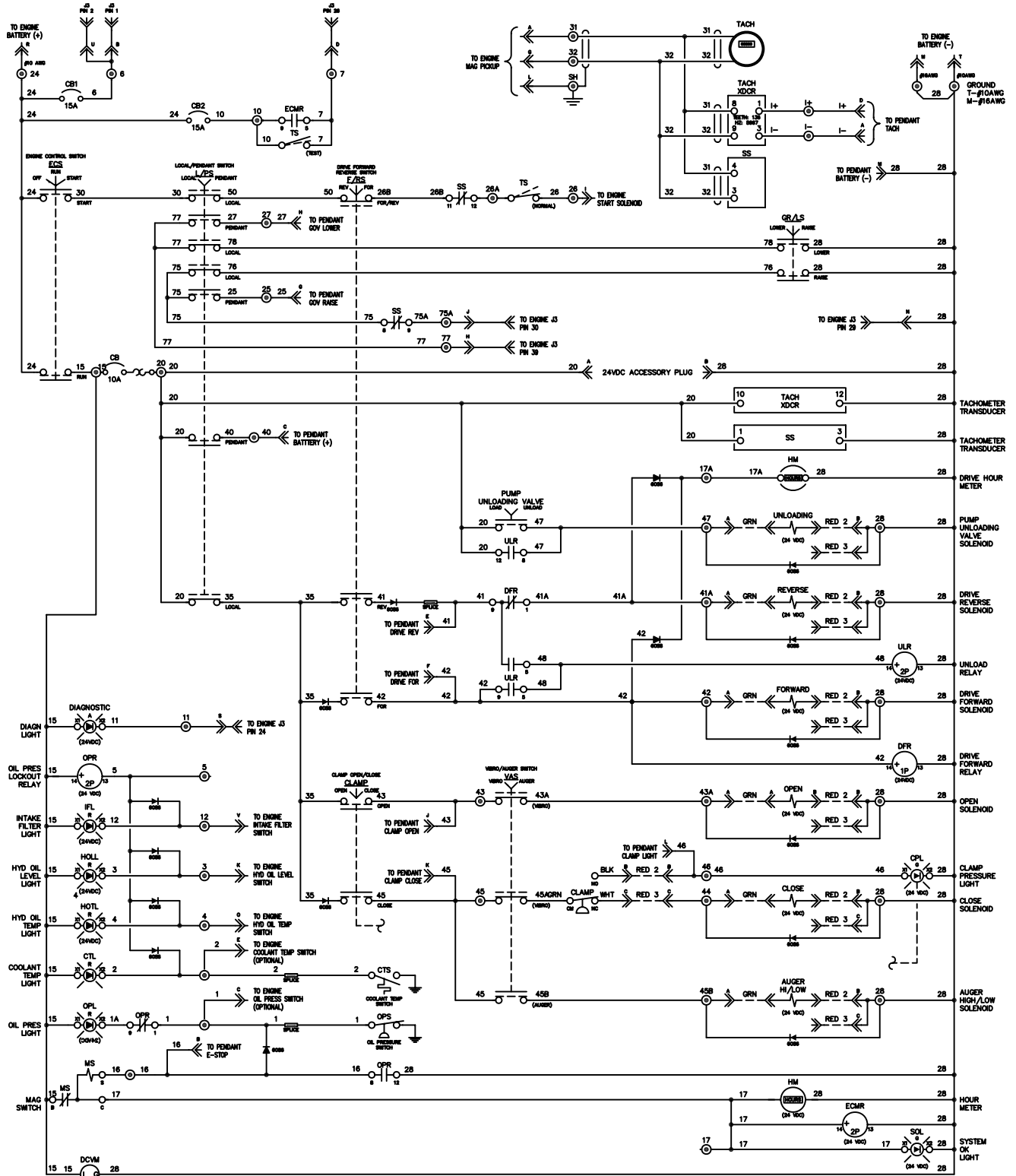


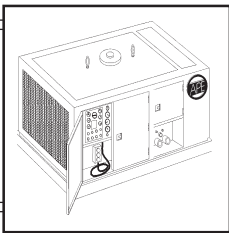
Figure 8-A Electric Schematic



OPERATION / MAINTENANCE MANUAL

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VIII. ELECTRICAL CIRCUITRY AND COMPONENTS

VIII-19 Remote Pendant Electric Schematic

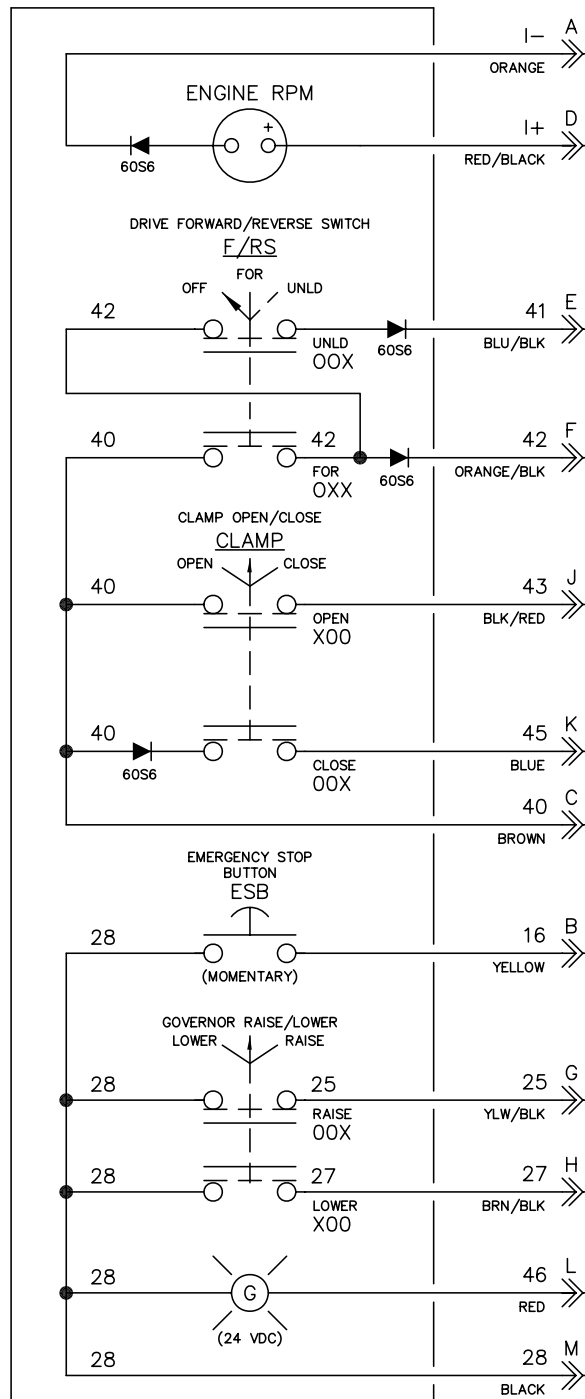


Figure 8-B Remote Pendant Electric Schematic