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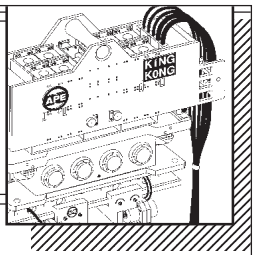
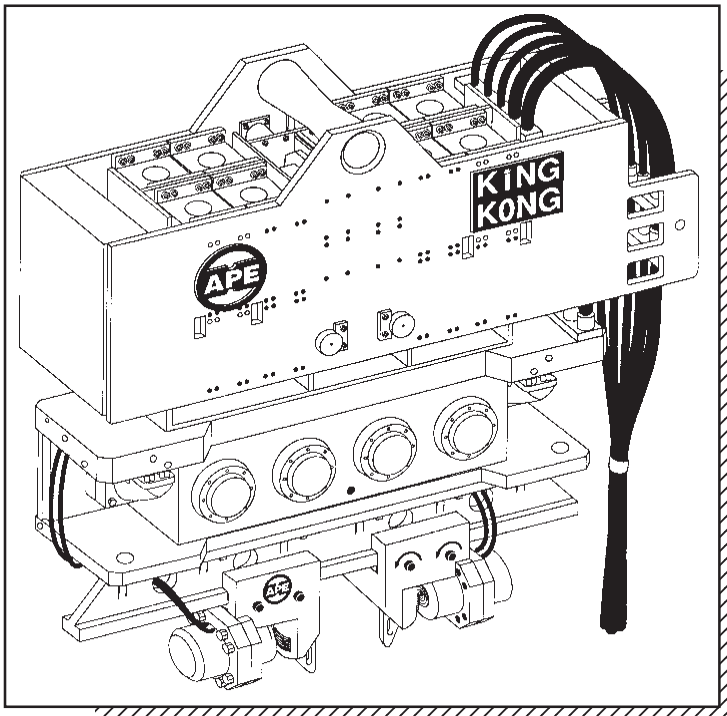


OPERATION AND MAINTENANCE MANUAL



SERIAL NUMBER:

MODEL 400 VIBRO WITH MODEL 800 POWER UNIT

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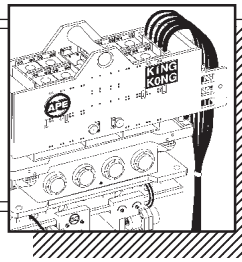

Revision Record

Change Number	Page Number	Date	Revision Description
01	--	1/8/94	Revised Troubleshooting, O-Rings, Bolts & Hoses.
			added Power Unit & Engine Information. Added 2-8
02	--	5/25/94	Added new pendant & misc. updates.

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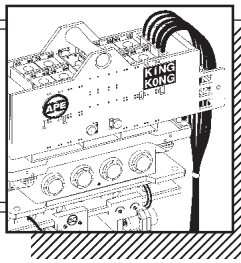

Preface

General

This manual covers the **Model 400 Vibratory Hammer and Model 800 Power Unit**. The data provided in this manual gives the necessary information to operate and maintain APE equippment. 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

1. VIBRATOR: Above and in between the eccentric covers on both sides of the machine.

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

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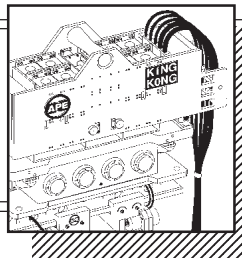

Table of Contents

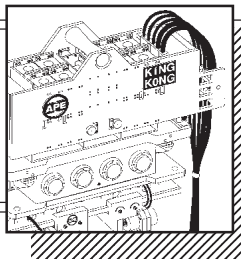

Table of Contents (Continued...)

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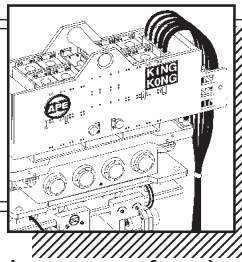

Safety Precautions

(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 "**OFF**" 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 vibro at any time and keep your eyes on the vibro 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 vibro 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.

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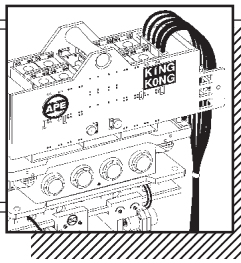

Illustration List

Table List

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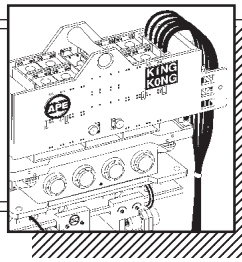

Warranty

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 PILEDRIVING 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

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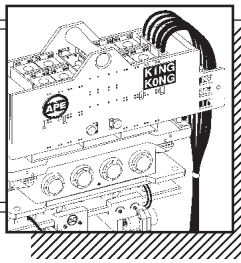

I. GENERAL INFORMATION

I-1. Machine Features. - Model 400 Vibratory Hammer.

Patented breakthrough multi-stage suppressor housing allows variable suppression levels which change to match variable line pull.

Shorter overall height and a lower center of gravity.

One piece eccentric/ gear design eliminates bolts, keyways, splines and pins.

Four eccentrics filled with "heavy metals" produce more amplitude with less parts.

Giant spherical bearings are five times larger than those found on other machines.

Heavy clamp cylinders need no guards and all hoses are tucked out of harms way. The one piece design eliminates rear seals, tie rods & nuts.

The Model 400 out performs other vibros in its class. It is lighter and allows more pull and reach.

Gear box drilled to accept attachments manufactured by APE and by other manufacturers.

The heavy duty lifting pin allows easy rigging of the vibro and two safety lift pins ensure maximum safety.

High speed gear train allows the vibratory Hammer to operate off many different power units.

Up to 200 Tons of line pull! More pulling ability than other comparable vibros.

Gearbox incorporates a machined O-ring groove to seal the top plate with no leaky gaskets.

Rifle bored top plate eliminates more unwanted hoses that can cause serious downtime.

Hydraulic motors are recessed which eliminates the need for bolted on guards. Less parts - less problems. Vertical motor mounting is approved by Volvo.

Computer designed gearbox is perfectly balanced with a very low center of gravity. Release crane line without bending piles.

The 400 vibro can be shipped fully assembled on one truck.

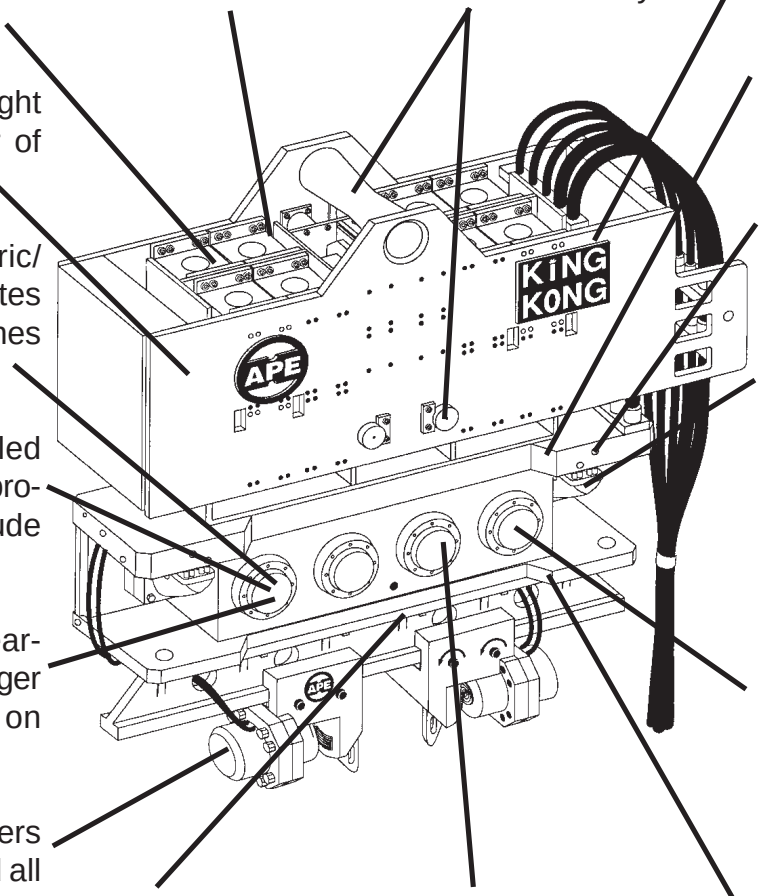

Figure 1-A. Machine Features

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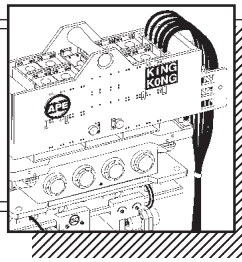
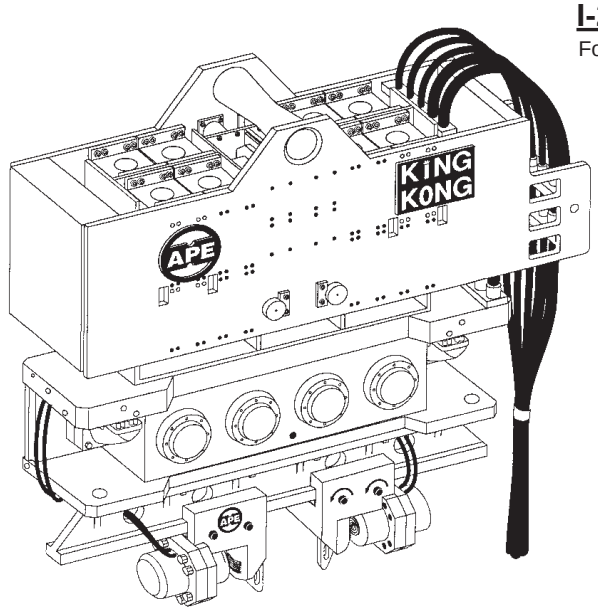


I. GENERAL INFORMATION (Continued...)

APE "KING KONG" MODEL 400 VIBRATORY PILE DRIVER/EXTRACTOR

I-2. Machine Specifications.

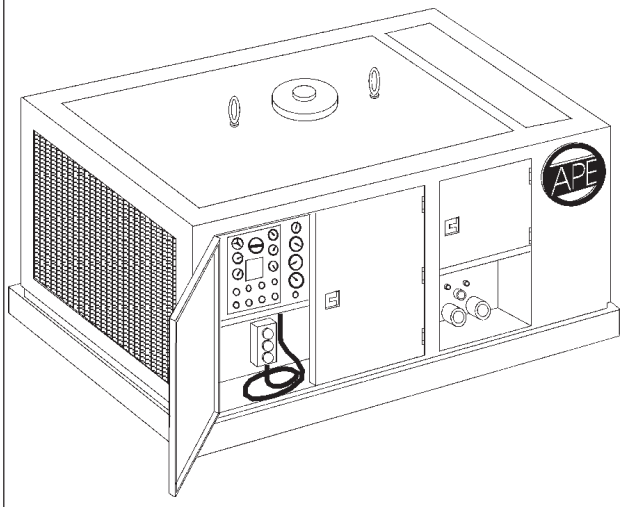


I-2A. Model 400 Vibratory Hammer - (Table 1-A.)

For driving and extracting heavy caissons, sheets or plates in clay soil conditions.

Eccentric Moment	Consult Factory
Drive Force	400 Tons (3,559 kN)
Frequency (cpm)	0 to 1500
Amplitude	1 1/8" (28.5 mm)
Pile Clamp Force	250 Tons (2,224 kN)
Line Pull for Extraction	200 Tons (1,780 kN)
Hydraulic Hose Length	200 feet (61 meters)
Suspended Weight*	34,000 lbs (15,445 Kg)
Length	120 inches (660 mm)
Width	26 inches (660 mm)
Height	70 inches (1,778 mm)
Height with Clamp	96 inches (2,438 mm)

APE engineers can adjust flows and pressures to job site requirements.
* Suspended weight includes all hoses.

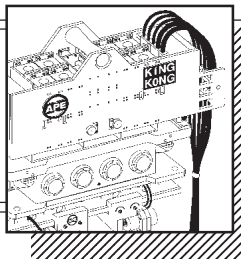


I-2B. Model 800 Hydraulic Power Unit - (Table 1-B.)

Hydraulic source for super large vibros and high torque drills

Engine	CAT 3412 Twin Turbo 800 HP
Maximum Power	800 HP (597 kW)
Operating Speed	2000 rpm.
Maximum Drive Pressure	6000 psi. (414 bar)
Maximum hyd. flow: Forward:	250 gpm. (946 lpm)
Maximum hyd. flow: Reverse:*	250 gpm. (946 lpm)
Clamp Pressure	6000 psi. (414 bar)
Clamp Pump Flow @ 2200 rpm.	10 gpm. (38 lpm)
Weight	24,000 lbs. (10,909 kg)
Length	174 inches (4,420 mm)
Width	82 inches (2,083 mm)
Height	96 inches (2,438 mm)

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



I. GENERAL INFORMATION (Continued...)

I-3. General Description of Model 400 Vibro.

The **APE Model 400** is a variable frequency vibratory pile driver/extractor designed for driving and extracting extremely large caissons, heavy plates, sheet piles, closed-ended pipe piles and concrete piles in difficult soil conditions including clay. The 400 can also be used for soil compaction and pre-boring by displacement method where contaminated soils cannot be removed.

The Model 400 operates in a frequency range of 0 to 1500 cycles per minute depending on the hydraulic flow and on the hydraulic motors fitted to the gear train.

The three major parts to the Model 400 are as follows:

A.) The Suppressor housing.
B.) The Gearbox.
C.) The Clamping Attachment.

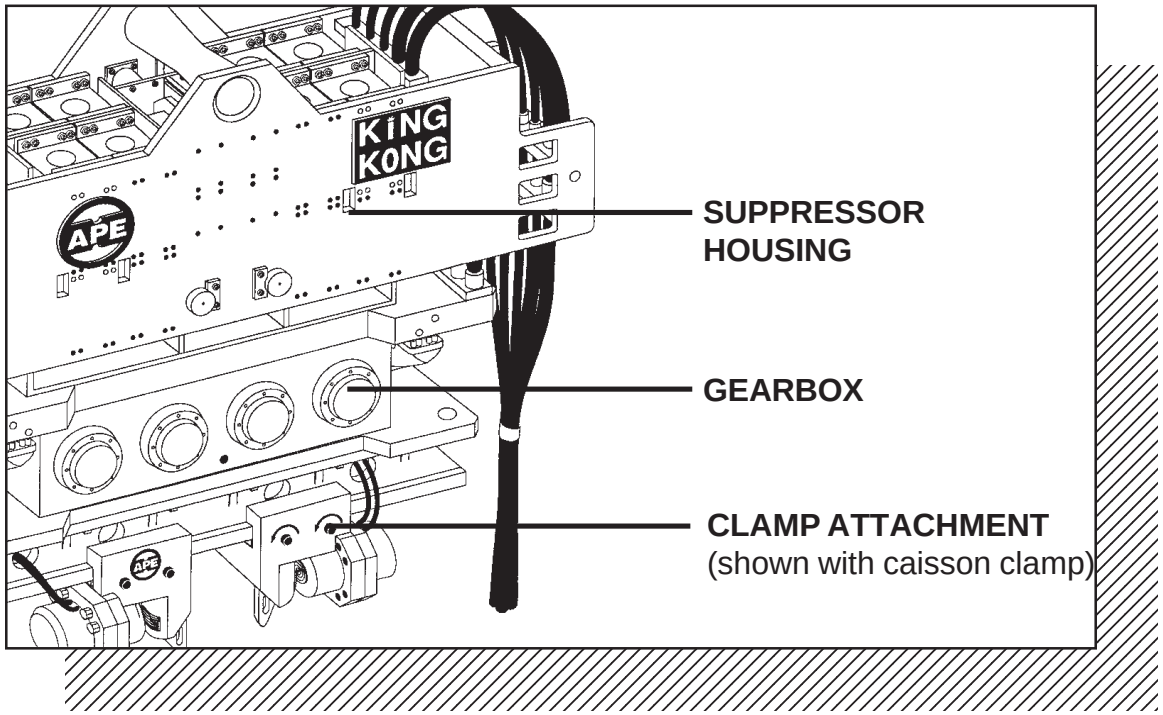
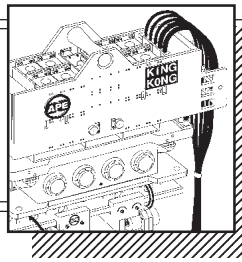


Figure 1-B. General Description of Model 400 Vibro.



I. GENERAL INFORMATION (Continued...)

I-3A. The Suppressor Housing.

The suppressor housing of the **Model 400 APE Vibrator** is a patented multi-stage system consisting of up to sixteen large rubber elastomers and eight small elastomers. The large rubber elastomers (technically called the first stage) are used during all driving operations and light to medium extraction. The second stage is made up of eight small high capacity elastomers. During the first stage, two large safety pins travel up with the outer housing as the line pull is increased. The safety pins are then engaged by the lifting bracket which activates the second stage. **(WARNING! Hard pulling for long periods of time will heat and damage the large elastomers. The heat generated from constant heavy line pull will destroy the chemical bond between the rubber and mounting plate which will cause the large elastomer to fail.)** When engaged in hard extracting, break every 15 minutes to allow elastomers to cool.

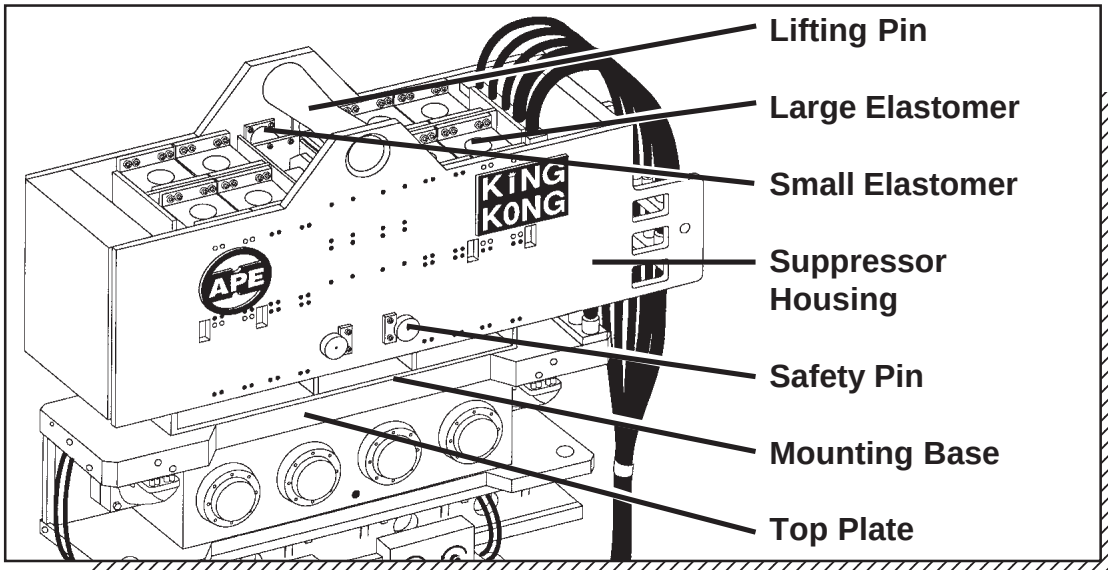


Figure 1-C. General Description of Suppressor Housing.

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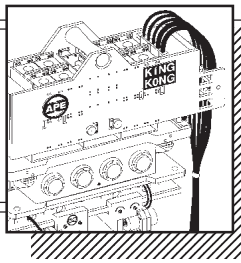


I. GENERAL INFORMATION (Continued...)

I-3B. The Vibrator Gearbox.

The vibrator gearbox contains four high amplitude eccentric weights cast in one piece with the gear. This design is unique to the industry and was developed by the engineers of APE to solve a number of problems associated with other types of vibrator machines. Both the eccentric and the drive gears have been helically cut to provide high speed operation with reduced noise and wear. Vibration is caused by the vertical movement created when the eccentrics are rotated. The eccentric and drive gears are all driven in line by two Volvo motors tucked in on the outboard side of the gearbox. The motors are recessed for maximum protection. The eccentrics rotate on four shafts housed by eight giant spherical bearings. The gears and bearings receive lubrication as a result of the fluid splashing inside the gearbox when the gears are rotated. The oil level is quickly determined by looking at the site gauge. The Model 400 can be operated under water to a depth of 30 feet without modifications. (Consult factory for depths below 30 feet.)

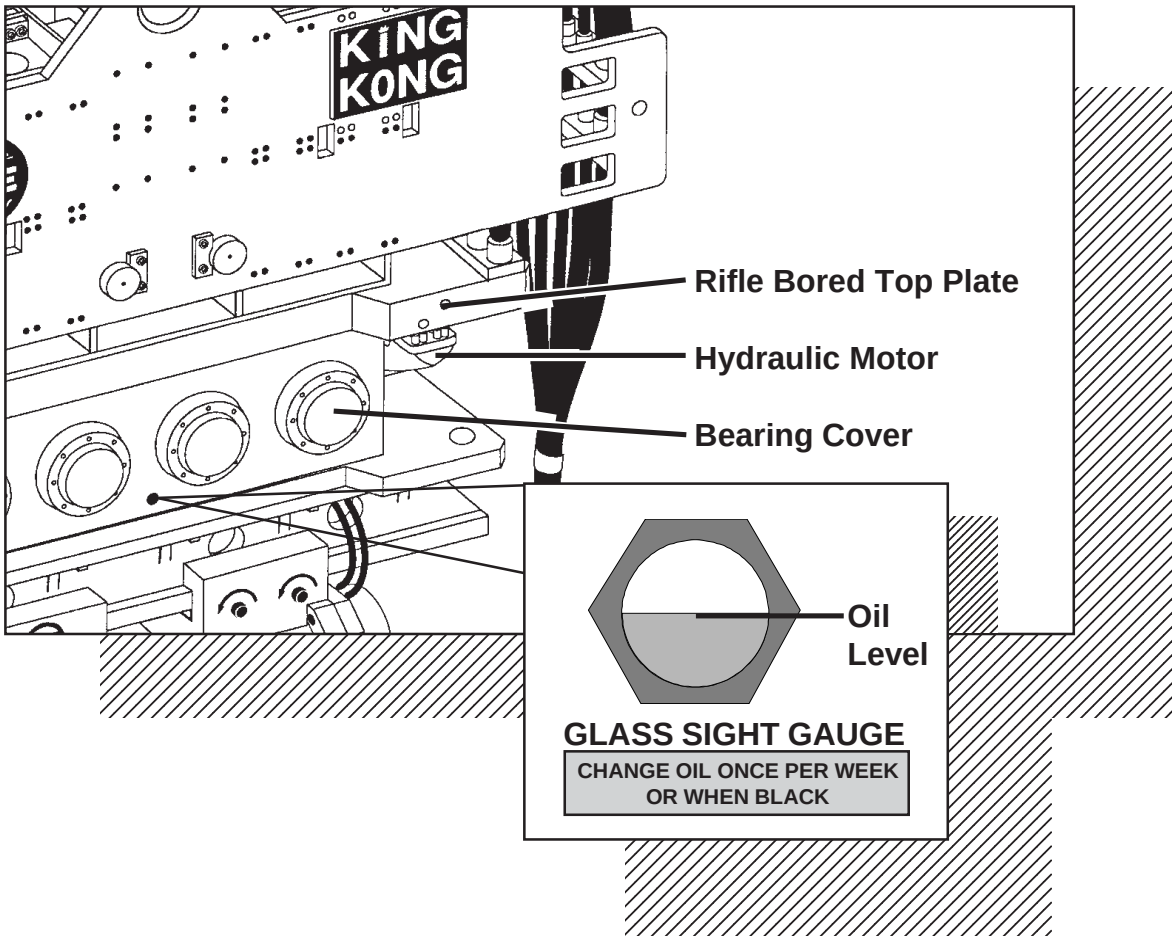
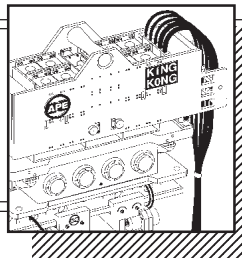


Figure 1-D. General Description of Vibrator Gearbox.



I. GENERAL INFORMATION (Continued...)

I-3C. The Clamp Attachment.

The APE Model 400 comes with a **Caisson Beam and Caisson Clamps**. The clamps contain two gripping jaws. One is "fixed" and one is "moveable." A large hydraulic cylinder operates the moveable jaw with up to 250 tons of clamping force depending on clamp pump relief pressure. The jaws open and close by turning a switch on the remote control pendant or may be operated by turning the switch at the main control panel mounted behind one of the doors on the power unit. The valve can be manually operated with a screwdriver if all electrical fails. **The APE Caisson Clamp** can be used for driving and extracting caissons from 16 inches to 11feet. The one piece cast beam will not bend or break and was designed to be compatible with all types of vibros. The heavy duty design of the clamp cylinders eliminates the need for cylinder guards. The clamps are held in place on the beam with a simple wedge-lock design. (Clamps can be fitted with hydraulically activated wedges for faster adjustments when driving more than one size caisson. Please call the factory for more information on clamp attachments for special pile types.)

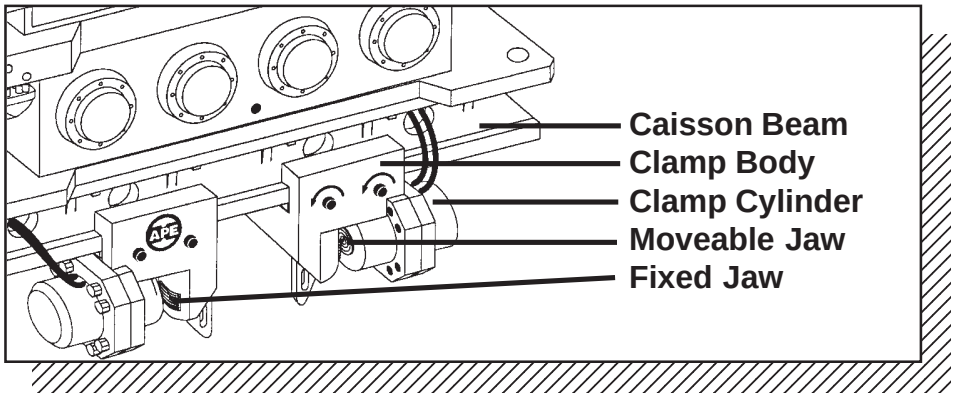


Figure 1-E. General Description of Clamp Attachment.

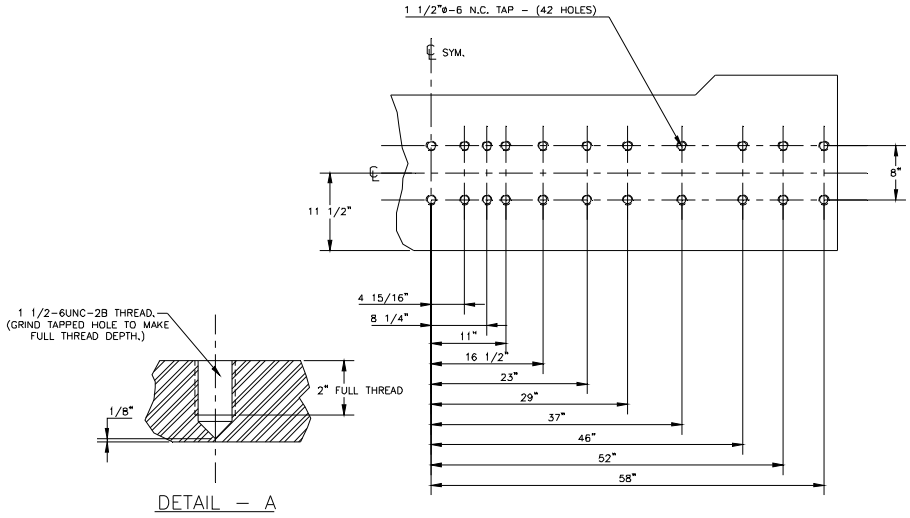


Figure 1-F. Clamp Attachment Hole Configuration

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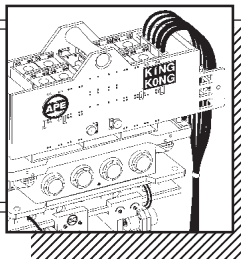
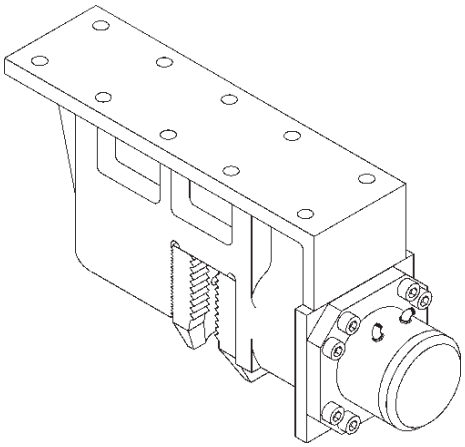


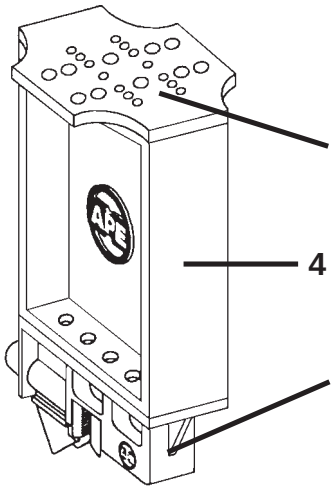
I. GENERAL INFORMATION (Continued...)

I-3D. <u>Optional Attachments.</u>

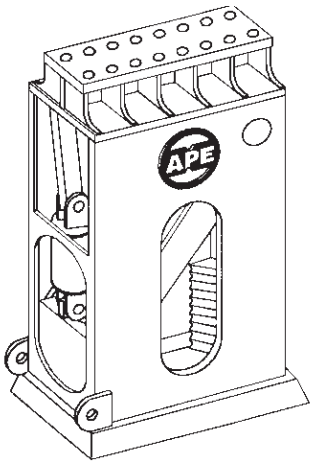
The following are some of the optional attachments for the Model 400 Vibratory hammer. (Contact APE or your local APE distributor for more information about these and other available equipment.)



SHEET PILE CLAMP ATTACHMENT
(#240000)

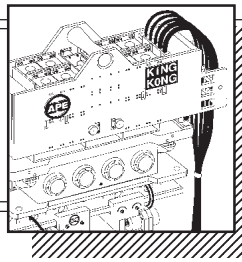


APE 90 DEGREE
ADAPTER WITH EXTENSION



APE DELUXE WOOD CLAMP
(#907000)

<u>Figure 1-G. Optional Attachments</u>



I. GENERAL INFORMATION (Continued...)

I-4. General Description of Model 800 Power Unit

The Model 400 vibrator runs off the APE 800 power unit. The APE 800 has a CAT 3412 Twin Turbo 800 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. A hydraulic tank supplies oil to four pumps. Three pumps feed the two vibrator motors. A small pump feeds the clamp attachment. The Vibrator is connected to the power unit via five hydraulic hoses. The two large 2" hoses are the pressure and return lines for the vibrator motors. The two smaller 3/8" hoses are for the clamp system and the one middle sized 1 1/4" hose is for the vibrator motor case drain line. The hoses are attached to the power unit by connecting the "quick dis-connect fittings" on the end of the hoses leading from the vibrator. 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 vibro from operating. Failure to tighten the clamp fittings completely tight will cause the jaws to either not open or not close. If this happens you may have to crack the fitting and bleed off the pressure to release the quick dis-connects.

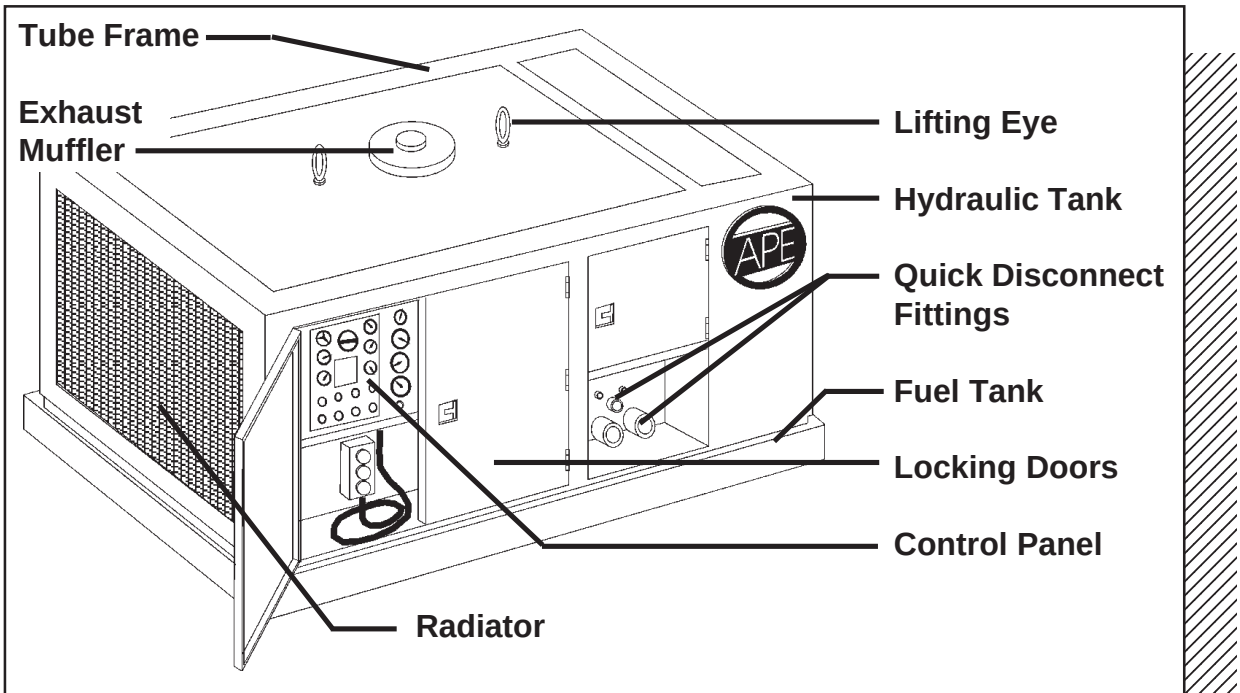


Figure 1-H. General Description of Model 800 Power Unit

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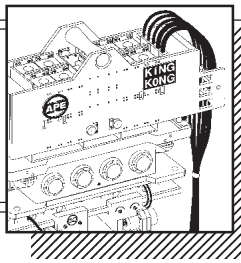


II. MAJOR COMPONENT DEFINITION

II-1. Component Identification - Model 400 Vibratory Hammer.

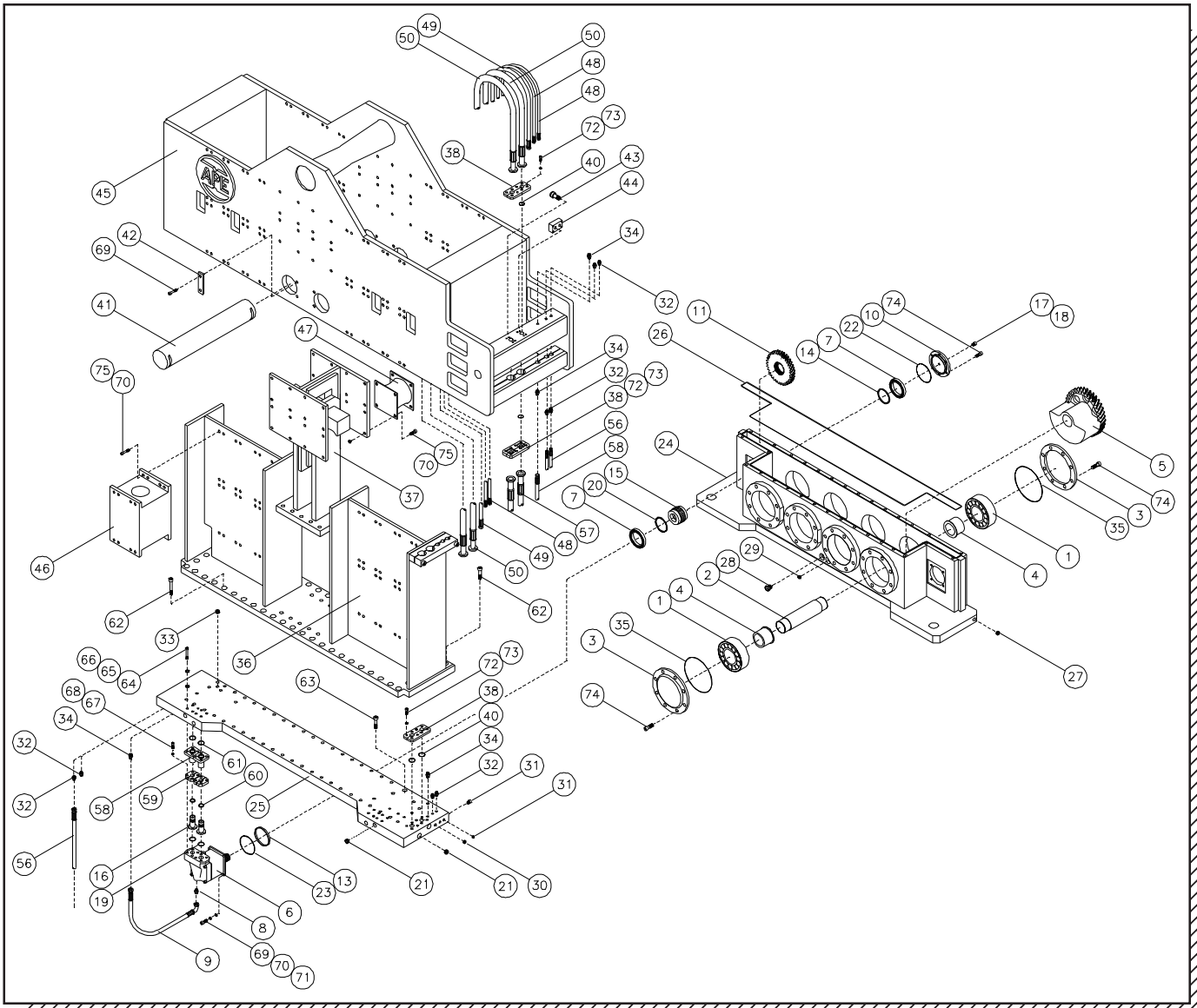
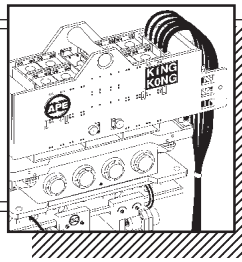


Figure 2-A. Component Identification - Model 400 Vibratory Hammer.



II. MAJOR COMPONENT DEFINITION (Continued...)

II-1. Component Identification.

The following is a general listing of the APE Model 400 Major components and part numbers. (Please see Figure 2-A. for component location.)

Table 2-A. Component Identification.

Item	Qty	Description	Part #
1	8	Model 400 Eccentric Bearing	#141001
2	4	Eccentric Shaft	#141003
3	8	Eccentric Bearing Cover	#141004
4	8	Eccentric Bearing Sleeve	#141005
5	4	Eccentric Weight - Model 400	#141007
6	2	Vibratory Motors	#142001
7	2	Motor Bearing	#142002
8	2	Fitting #F40X-S-812MJICxMBSPP	#142003
9	2	Motor Hose Assembly	#142004
10	2	Motor Bearing Cover	#142005
11	1	Drive Gear - Left	#142006
12	1	Drive Gear - Right	#142007
13	2	Bearing Spacer	#142008
14	4	Gear Spacer	#142009
15	2	Gear Carrier	#142010
16	4	Hydraulic Motor Adapter	#142018
17	1	#10 SAE Breather Plug	#122014
18	1	Breather Valve	#122015
19	4	Parker O-Ring #2-225	#122027
20	2	Gear Spacer (Narrow)	#142011
21	8	#32 SAE Socket Drive Plug	#143007
22	2	Motor Cover O-Ring #2-258	#142019
23	2	Motor O-Ring #2-163	#142020
24	1	Vibratory Gearbox	#143001
25	1	Top Plate	#143002
26	1	.070 C/S BUNA 70 CORD O-Ring	#143003
27	2	Magnetic Drain Plug	#123004
28	1	Sight Gauge	#123005
29	1	Gearbox Oil Level Plug	#123006
30	2	#20 SAE Socket Drive Plug	#123007
31	8	#8 SAE Socket Drive Plug	#123008
32	2	#8 SAE / #6 JIC Fitting	#123009
33	1	Oil Fill Plug	#123012
34	2	#12 SAE / #12 JIC Fitting	#123013
35	8	Bearing Cover O-Ring #2-276	#141008
36	1	Suppressor Mounting Base	#340102
37	1	Lifting Bracket	#340103
38	3	Double Split Flange	#123018
39	1	Bolt Kit	#144000
40	6	Flange O-Ring #2-225	#143020
41	2	Center Pin	#341006
42	2	Keeper Plate	#341007
43	1	Pop-Off Valve	#321009
44	1	Check Valve	#321015
45	1	Suppressor Housing	#340101
46	16	Large Elastomers	#321003
47	8	Small Elastomers	#321004
48	2	Hose, Suppressor, Clamp 3/8"	#440103
		3 Wire x 12' w/6-6FJX ea. end.	
49	1	Hose, Suppressor, Case Drain	#440102
		1 1/4" 100R2AT x 12' Coupled	
		HL20-20NJ ea. end.	
50	2	Hose, Suppressor, Motor Feed	#440101
		2" 100R13 x 12' Coupled	
		ER32-32PH ea. end.	
56	6	Hose, Clamp Line 3/8"	#421004
		3 Wire x 6' w/6-6FJX ea. end.	
57	2	Hose, Pigtail, 2" 100R13 x 6'	#441007
		ER32-32PH & ER32-32NJ ea. end	
58	4	Hydraulic Flange Coupling	#142012
59	4	Hydraulic Motor Split Flange	#142017
60	4	Parker "Polypak" #18701750-375	#142019
61	4	Parker O-Ring #2-332	#142020
62	---	Bolt-SHCS 3/4"NC x 6"	#144104
63	---	Bolt-SHCS 3/4"NC x 2 1/4"	#144303
64	---	Bolt-SHCS 7/16" x 4 1/2"	#144108
65	---	Flat Washer - 7/16"	#144110
66	---	Lock Washer - 7/16" High Collar	#144111
67	---	Bolt M14 x 30	#144112
68	---	Lock Washer M14	#144117
69	---	Bolt-SHCS 3/4"NC x 1 1/2"	#144101
70	---	Flat Washer - SAE 3/4"	#144305
71	---	Lock Washer 3/4" High Collar	#144105
72	---	Bolt-SHCS 5/8"NC x 2"	#144114
73	---	Lock Washer 5/8" High Collar	#144115
74	---	Bolt-SHCS 1/2"NC x 1"	#144107
75	---	Bolt-SHCS 3/4"NC x 2 1/4"w/Nut	#144303
76	-	-	#
77	-	-	#
78	-	-	#
79	-	-	#
80	-	-	#
81	-	-	#
82	-	-	#
83	-	-	#
84	-	-	#
85	-	-	#
86	-	-	#
87	-	-	#
88	-	-	#
89	-	-	#
90	-	-	#

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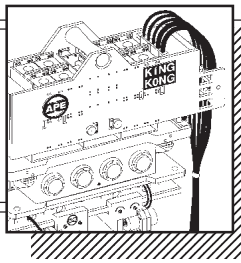


II. MAJOR COMPONENT DEFINITION (Continued...)

II-2. Hose Bundle Identification.

The following is a general listing of the standard hoses that are shipped with the APE Model 400 Vibratory Hammer. (Please see Figure 2-B. for component location.)

Table 2-B. Hose Bundle Identification.

Item	Qty	Description	Part #
1	2	2" Red Hose x 50'	#441008
		2"XT5 CAT Hose #ER2424NJ Ea	End
2	2	2" Red Hose x 50'	#441008
		2"XT5 CAT Hose #ER2424NJ Ea	End
3	2	1 1/4" Two Wire Hose x 50'	#421009
4	4	3/8" Gates Hose x 50'	#421010
		w/#HU66NJ Ea. End	
5	1	Fitting #6 JIC Male/#6 Female	#421011
6	4	Fitting #32 Male JIC Union	#441012
7	2	Fitting #20 Male JIC Union	#441013
8	6	Fitting #6 Male JIC Union	#421014
9	2	Fitting #32 JIC/#24 Pipe	#441015

Item	Qty	Description	Part #
10	1	Fitting#12 JIC/#20 Pipe	#441016
11	1	Fitting #6 JIC/#6 Pipe Male	#421017
12	1	Aeroquip Male Q.D. #5100S112B	#421020
13	1	Aeroquip Dust Cap #5100S712B	#421021
14	2	Safeway Female Q.D. #S35-3	#421024
15	2	Safeway Male Q.D. #S31-3	#421025
16	2	Safeway Cap #S39-3	#421026
17	2	Safeway Plug #S34-3	#421027
18	2	Q.D. Hydraulic Female Coupling	#441301
19	2	Q.D. Hydraulic Male Coupling	#441303
20	1	APE Dust Plug	#441022
21	1	APE Dust Cap	#441021

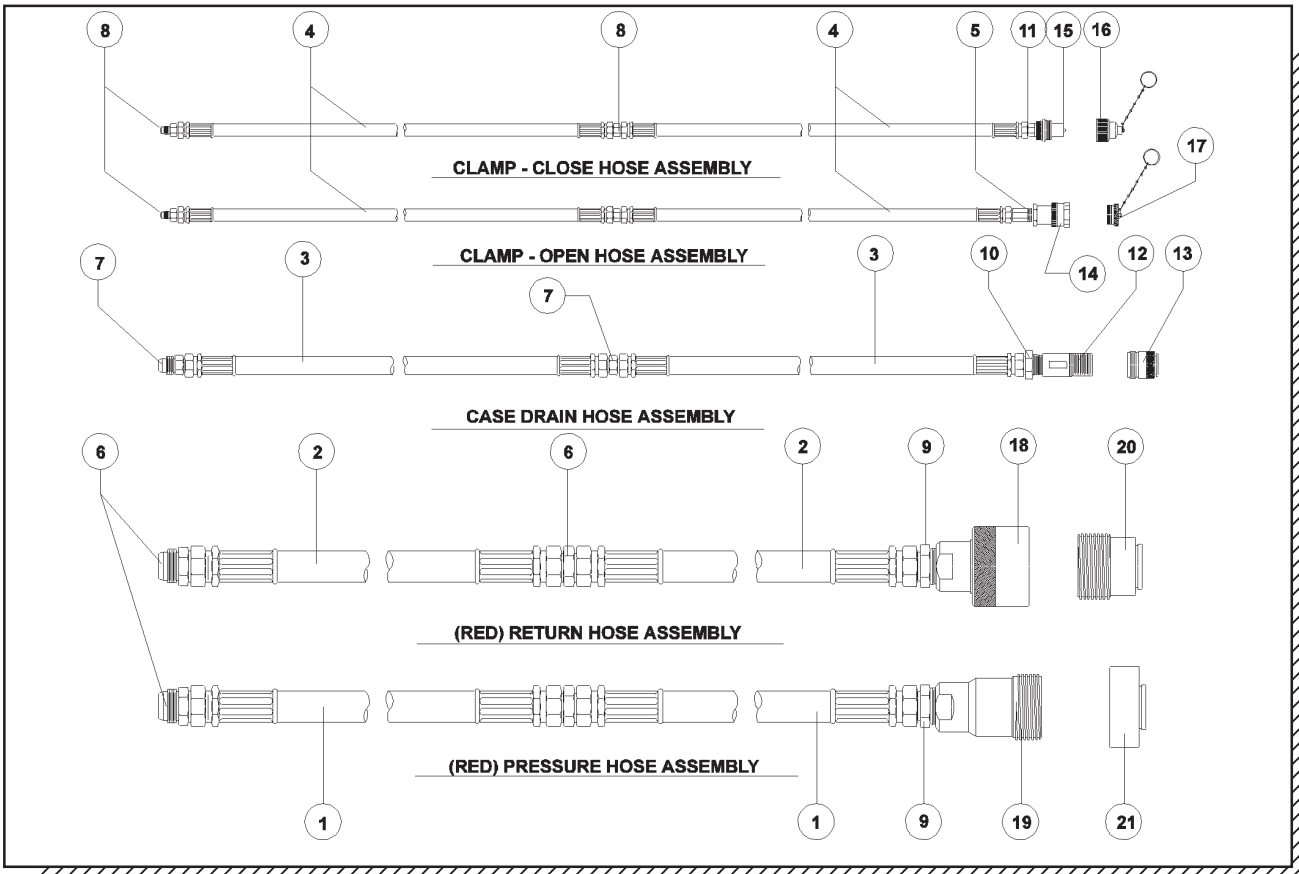
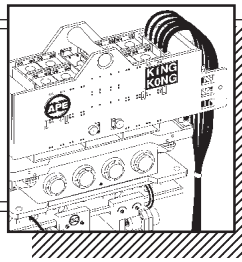


Figure 2-B. Hose Bundle Identification



II. MAJOR COMPONENT DEFINITION (Continued...)

II-3. Caisson Clamp Identification.

The following is a general listing of the parts for the APE Caisson Clamp and Beams. (Please see Figure 2-C. for component location.)

Table 2-C. Caisson Clamp Identification

Item	Qty	Description	Part #
1	1	Caisson Clamp Body	#250101
2	6	Grease Zert	#221001
3	1	Caisson Clamp Plunger/Jaw	#250301
4	1	Caisson Clamp Fixed Jaw	#250202
5	2	Bolt - SHCS 5/8" x 4"	#124214
6	2	Lock Washer 5/8" High Collar	#124115
7	2	Male Wedge Half	#243102
8	2	Female Wedge Half	#243105
9	2	Wedge Bolt w/Washer	#124211
10	2	Wedge Nut w/Washer	#124212
11	17	Bolt - SHCS 1 1/2" x 3 1/2"	#124201
12	17	Lock Wa. - 1 1/2" High Collar	#124202
13	1	Clamp Cylinder	#250001
14	2	#6 SAE/#6 JIC 45 Deg. Fitting	#222002
15	8	Bolt - SHCS 1 1/4"NFx3 1/2"GR.8	#124204
16	8	Lock Wa. - 1 1/4"High Collar	#124205
17	1	Cylinder End Cap	#250302

Item	Qty	Description	Part #
18	1	Cylinder Piston	#250303
19	1	Plunger	#250301
20	1	Bolt -SHCS 1 1/2-8 x 3"	#250304
21	1	Wiper - #959-41	#
22	1	Caisson Beam 11ft.	#903000
23	1	Poly Seal - #2500-4500-375B	#
24	12	Bolt - SHCS 5/8-18 x 1"	#
25	8	Spring Pin	#250103
26	4	Wedge Spring	#250104
27	1	Wear Ring - #W2-4750-750	#
28	1	Hydraulic Wedge Activator Kit	#243100
29	1	Parker O-Ring #8-367	#
30	1	Parker O-Ring #2-367	#
31	1	Piston O-Ring #2-338	#
32	1	Piston Wear Ring #W2-8000-750	#
33	1	TFER8000 Bronze w/Loader Ring	#
34	1	Square Ring - #4426	#

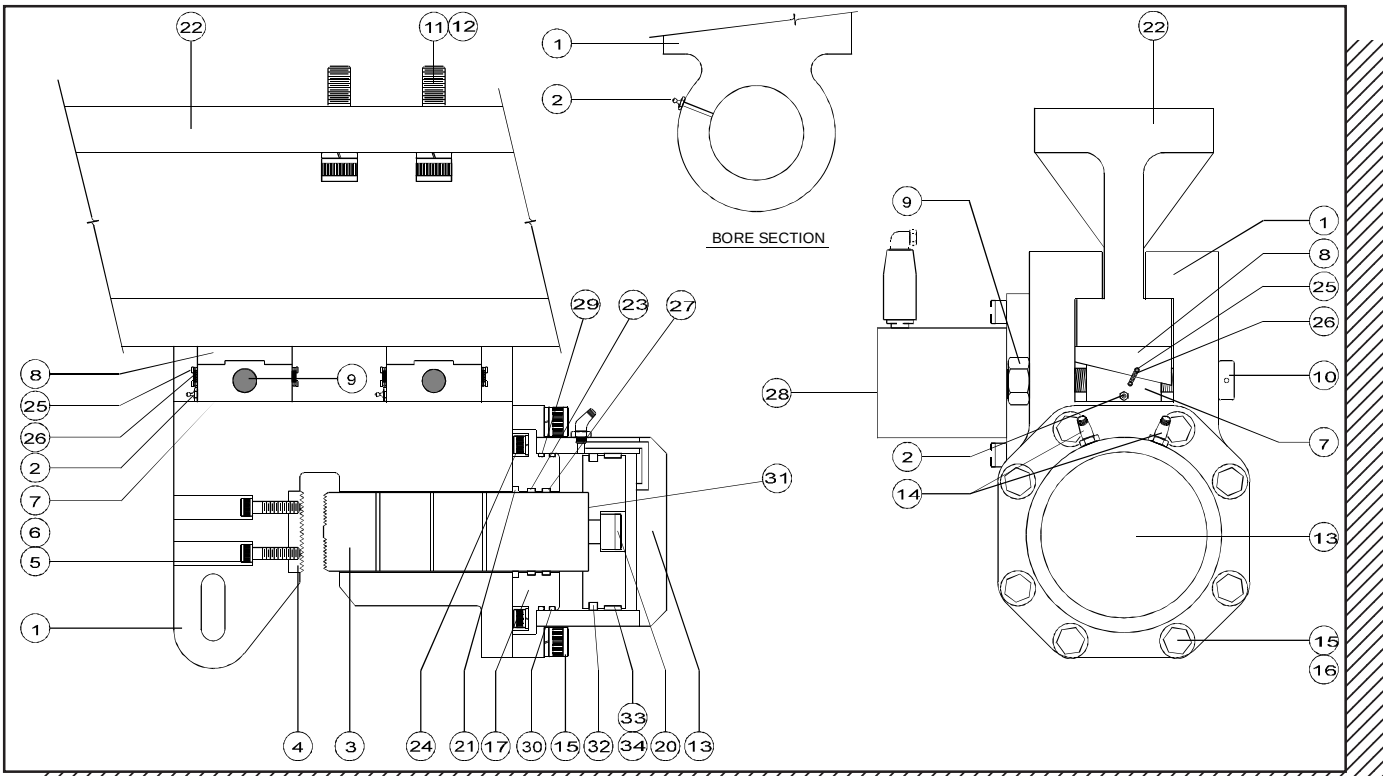


Figure 2-C. Caisson Clamp Identification.

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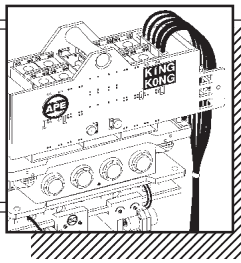


II. MAJOR COMPONENT DEFINITION (Continued...)

II-4. Model 800 Power Unit Skid Identification.

Table 2-D. Model 800 Power Unit Skid Identification

Item	Qty	Description
1	1	Model 800 Power Unit Skid
2	1	Radiator Grill
3	1	Door 28 1/4" x 85 1/2"
4	1	Door 21 1/2" x 85 1/2"
5	1	Door 21 1/2" x 85 1/2"
6	1	Door 24 7/8" x 85 1/2"
7	1	Door 29 1/2" x 85 1/2"
8	1	Door 25 1/2" x 50 1/2"
9	2	2" Hydraulic Coupling
10	1	1 1/4" Hydraulic Coupling
11	2	3/4" Hydraulic Coupling
12	10	Door Handle / Lock
		Lock-#EMC 56462W Two Point Lock
		Handle-#EMC 48742W Locking Handle
13	29	Hinges #R140-150 Weld On Hinge
14	2	Lifting Eye Nuts - Crosby Laughlin #6-400 #10
15	1	Cover Plate 12" x 15"
16	1	Cover Plate 15" x 18"
17		
18		
19		
20	1	APE Dust Plug #441022
21	1	APE Dust Cap #441021

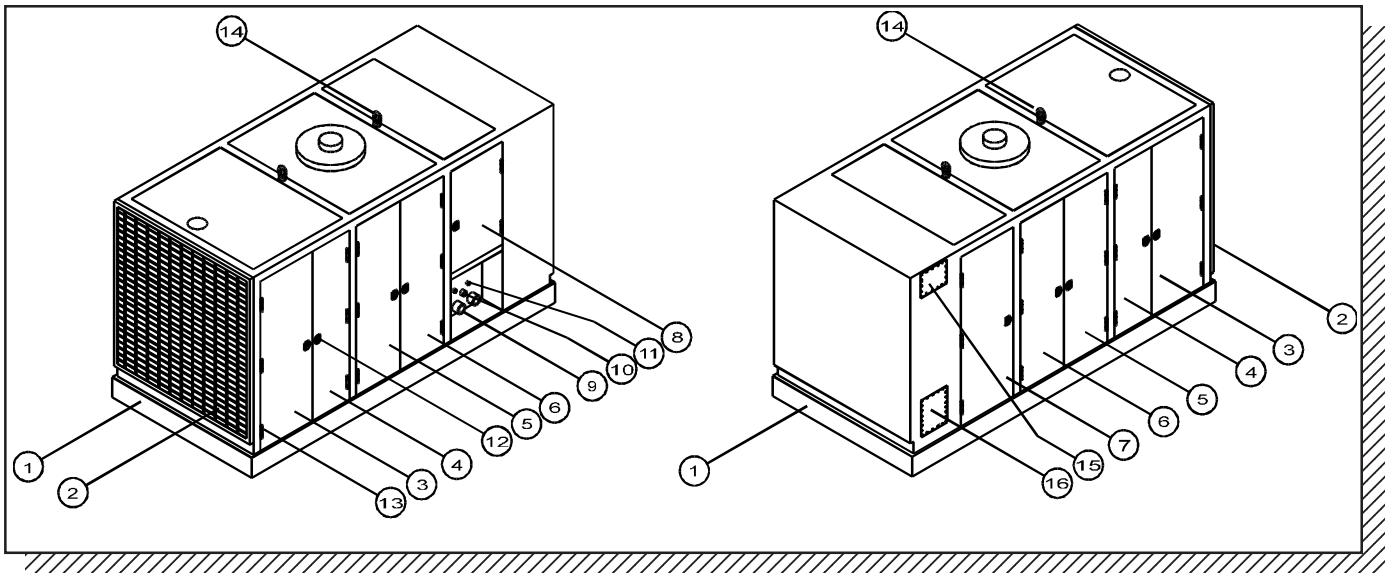
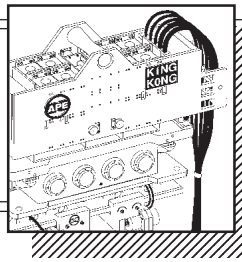


Figure 2-D. Model 800 Power Unit Skid Identification.



II-5. Quick Disconnect Couplings. - Figure 2-E.

The 5TV series high pressure hydraulic coupling is designed for rugged hydrostatic drive applications in the mining and oil industries. Service in many such applications has proven the design compatible to extreme pressures, structural and system induced shockloads. The construction makes the coupling attractive in applications having low operating pressures. NOTE - Not for use with gaseous fluids.

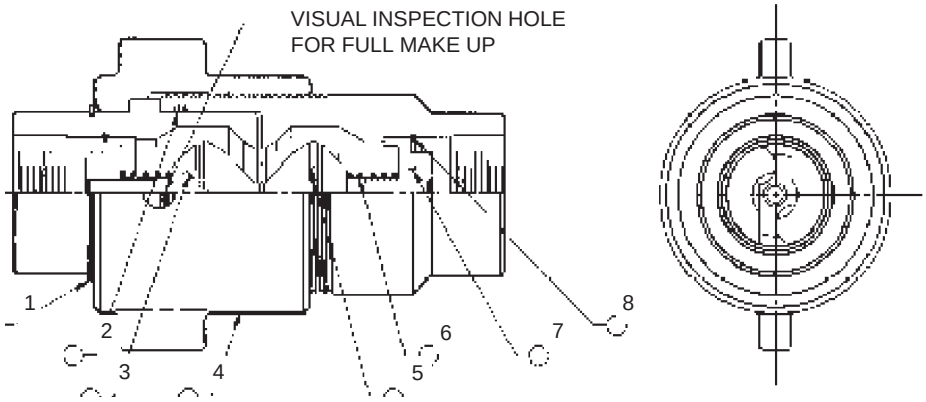


Figure 2-E. Quick Disconnect Coupling Identification.

1 NUT RETAINER RING
2 NIPPLE SEAL (0-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

OPERATING LIMITS

- 5,000 P.S.I. operating pressure - all sizes
  20,000 P.S.I. minimum burst - coupled
- Vacuum to 28" Hg
- Standard seal - temperature range -65OF to +250OF
- Buna-N seals - standard

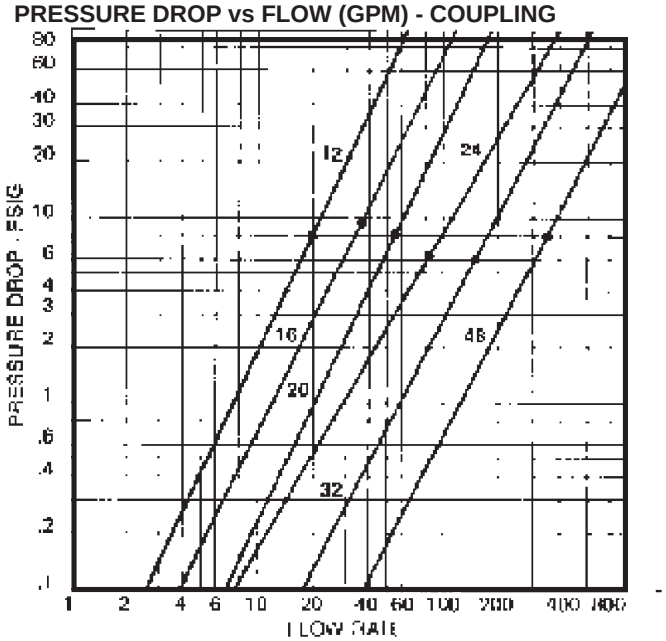
DESIGN FEATURES

- Excellent flow characteristics for continuous duty applications. See flow chart.
- High strength steel poppet guides prevent break up and washout of coupling valving during high surge and shock conditions.
- Exclusive four point support design of poppet guide provides positive alignment of valving during surging flow conditions.
- Flat crested stub-acme threads and all steel construction withstand storage and rig-up damage.
- Protective treatment equal to industry standards for SAE steel hose fittings.
- Structurally compatible with weight of 5,000 P.S.I. flex-hose and system induced shockloads.

SIZES AND CONNECTION TYPE

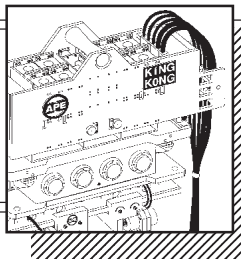
- 3/4" thru 3' - female NPTF pipe thread

PRESSURE DROP vs FLOW (GPM) - COUPLING



- Pressure drop thru coupling based on flowgiving15 FPS fluid velocity thru nominal bore size.

COUPLING PART NO.	DUST PLUG PART NO.	DUST CAP PART NO.	VALVE ASS'Y PART NO.	NIPPLE SEAL PART NO.
5TV-CN-32	5TV-DP-32	5TV-DC-32	5TV-VA-32	5TV-NS-32



II. MAJOR COMPONENT DEFINITION (Continued...)

II-6. Tool Set Identification.

Mounted inside the **Model 800 Power Unit** is a set of tools frequently used for the maintenance of the **APE Model 400 Vibratory Hammer**. The following figure and table shows the location and the use for each tool.

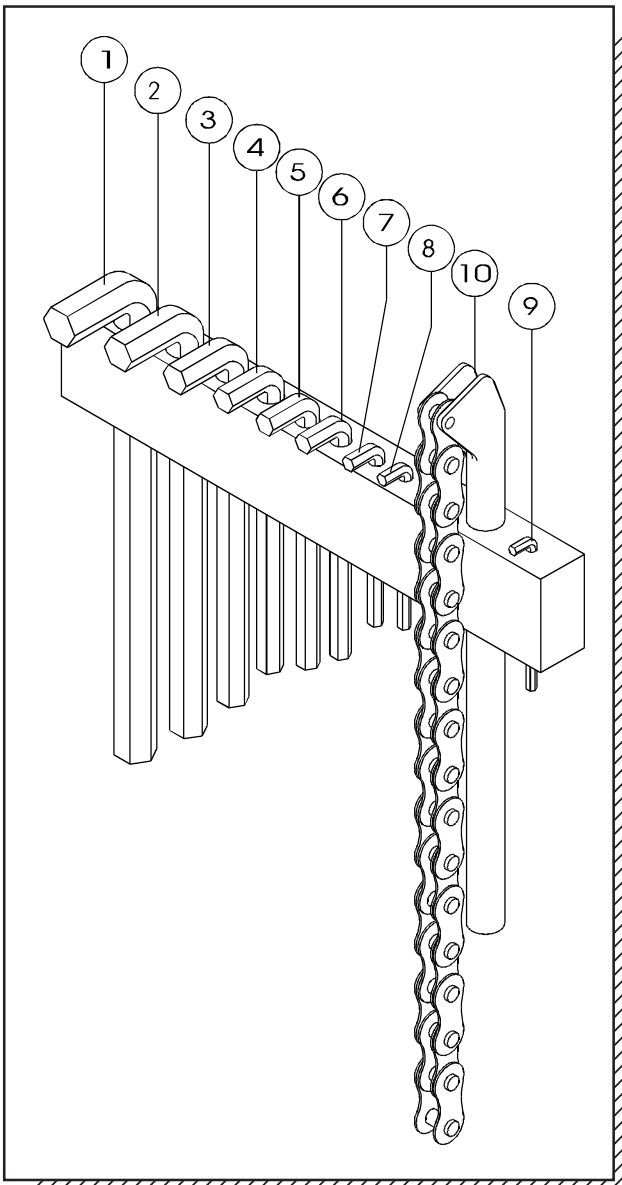
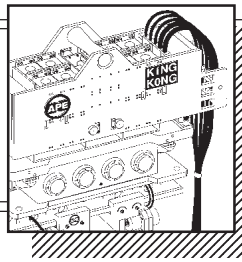


Figure 2-F. Tool Set Identification.

Table 2-E. Tool Set Identification.

ITEM	QTY	DESCRIPTION	PART#
1	1	1" Allen Wrench	#950002
For use with the clamp attachment bolts			
2	1	7/8"Allen Wrench	#950003
For use with the drain plug & sheet guide			
3	1	3/4"Allen Wrench	#950004
For use with the clamp fixed jaw bolts			
4	1	5/8"Allen Wrench	#950005
For use with the hydraulic motor mnt. bolts			
5	1	9/16"Allen Wrench	#950011
For use with the hose bracket bolts			
6	1	1/2"Allen Wrench	#950006
For use with the suppressor top plate bolts			
7	1	3/8"Allen Wrench	#950007
For use with the bearing cover bolts			
8	1	5/16"Allen Wrench	#950012
For use with the hose bracket bolts			
9	1	Chain Wrench	#950009
Used to tighten the quick disconnects			
10	1	1/4"Allen Wrench	#950013
For use with the vibro oil level check			



II. MAJOR COMPONENT DEFINITION (Continued...)

II-7. Caisson Clamp Wedge Actuator.

The following is a listing of the Caisson Clamp Wedge Actuator components and locations.

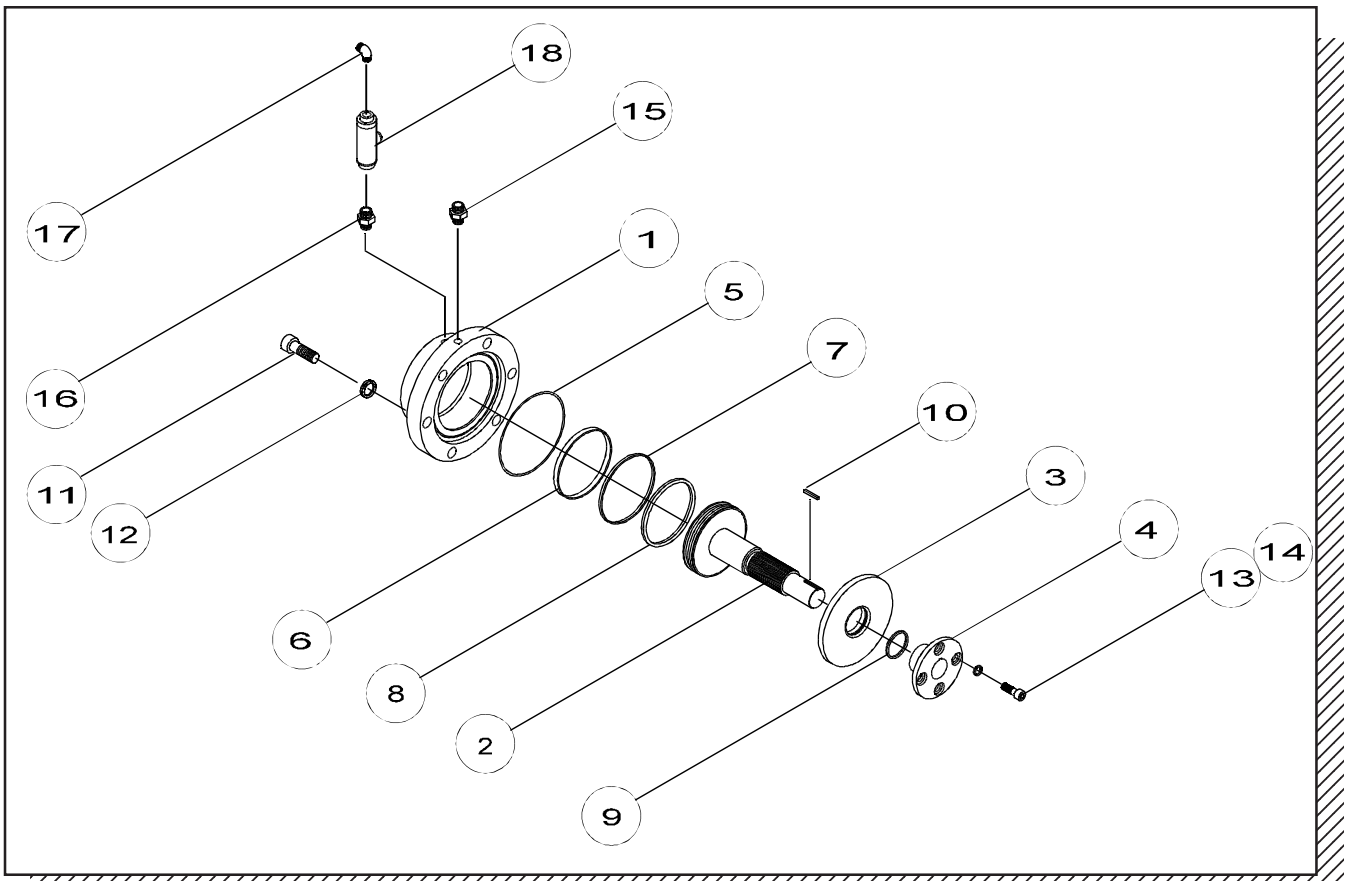


Figure 2-G. Caisson Clamp Wedge Actuator.

Table 2-F. Caisson Clamp Wedge Actuator.

Item	Qty	Description	Part #
1	1	Wedge Cylinder	#243001
2	1	Wedge Piston	#243006
3	1	Cylinder Flange	#243003
4	1	Support Bushing	#243004
5	1	O-Ring Parker #2-242	#243011
6	1	Wear Ring #W2-12503500-375	#243012
7	1	#TFES-3500 Piston Ring	#243013
8	1	Loader Ring	#243014
9	1	Poly-Seal Parker #1250-1375	#243015

Item	Qty	Description	Part #
10	1	Key Stock 1/4" x 1/4" x 1"	#243007
11	6	Bolt - SHCS 1/2"-13 x 2 1/2"	#244001
12	6	Lock Washer 1/2"	#244002
13	4	Bolt - SHCS 3/8"N.C. x 1"	#244003
14	4	Lock Washer 3/8"	#244004
15	1	Fitting #6SAE/#6JIC	#123014
16	1	Fitting 3/8"Pipe/#6JIC	#243016
17	1	90deg. Fitting 3/8"Pipe/#6JIC	#243017
18	1	Check Valve	#243106

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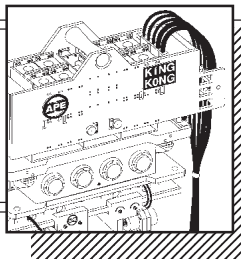

III. LOADING AND UNLOADING

III-1. Model 400 Vibratory Hammer.

The APE Model 400 vibrator is normally shipped standing up on the trailer deck with the beam and clamps removed and the hose bundle coiled next to it. Lift the vibrator by rigging one line to the lifting pin lifting the vibro and hose bundle as one load. Avoid smashing hydraulic lines. Vibro should be loaded standing as mentioned earlier. Before the truck has left, carefully inspect the machine and hoses for any missing equipment or sign of damage that may have occured during shipment or unloading.

III-2. Model 800 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-3. 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.

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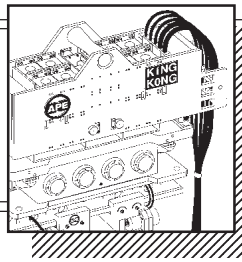

IV. PREPARATION AND OPERATION

IV-1. Rigging of Vibratory Hammer

A steel wire rope sling must be connected to the lifting bail located on top of the vibro. The required strength of this sling depends on the capacity of the crane and the work to be carried out. A safety factor of six is recommended. Several turns of a smaller diameter cable will result in a longer lasting sling than one larger diameter cable. When making a sling, avoid using cheap cable clamps. Check the clamps daily.

IV-2. Installing the Clamp Attachment

Several types of clamps are used on APE vibros to fit many different types of piles. A step by step installation procedure is provided as follows:

1.) Clean all drilled and tapped threads on the bottom surface of the gearbox. Use a 1 1/2"UNC tap to clean any rusted threads and blow out any remaining fragments with compressed air. If there is a cutting torch on the jobsite then use the oxygen setting to blast the threads clean. Hold a rag over the tapped hole to prevent flying dirt from blasting into your eyes.

2.) Clean the machined bottom surface of the gearbox and prepare to mount the clamp. If the clamp bolts should ever break, check the machined surface with a straight edge to make sure it is true and flat.

3.) Clean the machined surface of clamp. Eye-ball the entire surface for damage. Make sure the surface is flat and void of all dirt.

4.) Start by getting the center bolt in first and work outwards. Do not tighten bolts until you have all of the bolts started.

5.) Tighten bolts using a six-foot cheater pipe. If you do not have a cheater pipe then use a sledge hammer.

6.) Go around all bolts at least three times making sure they are tight.

7.) After vibrating the first pile, check the bolts again.

8.) If one bolt breaks, replace them all since they may be weak or cracked.

9.) Never operate the vibro with missing clamp bolts.

WARNING: Do not use grade five bolts. All bolts should be allen head cap screw bolts. If one bolt breaks then the others are damaged and must be replaced. Never drive piles if one bolt is broken. Bolts break only because they were not tight and the crew neglected to check them. A good operator insists that every bolt is checked twice daily.

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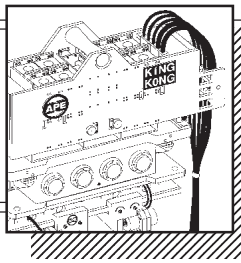


IV-3. Plumbing the Vibro Hoses to the Power Unit.

There are five hoses leading from the vibro that must be connected to the power unit to begin operation (Please see section III-2. Hose Identification on [page 2-3] and Figure 2-B on [page 2-4]). There are two big hoses, two little hoses and one middle sized hose. The hoses attach to the power unit by screwing the quick dis-connect couplers onto the proper couplers of the power unit. The couplers on the power unit are mated with the couplers on the vibro so there is no chance of putting them on backwards. Please take the following steps when installing the couplers:

WARNING: TURN THE POWER UNIT OFF BEFORE INSTALLING COUPLERS

1.) Turn the power unit OFF.

2.) Clean all couplers with a can of ether if available. A clean dry cloth will also work but will require extreme care. Fittings must be spotless clean.

3.) Install couplers by screwing them onto their respective counterparts. Try to avoid cross-threading and maintain a straight line. Jerk the hose back and forth while turning coupler to aid installation effort. **Push hard to get the big coupler threads started.**

4.) Make sure fittings are tight. If they are properly cleaned they should run up tight with just a firm hand grip. However, they should be double checked with a chain wrench.

5.) Avoid over-tightening.

6.) If near salt water, spray with a light oil to prevent oxidation.

7.) Position the Power Unit so that vibrator has enough hose to reach the work. Avoid pulling too hard on hoses. Most hose failures are caused by pulling hoses off couplers.

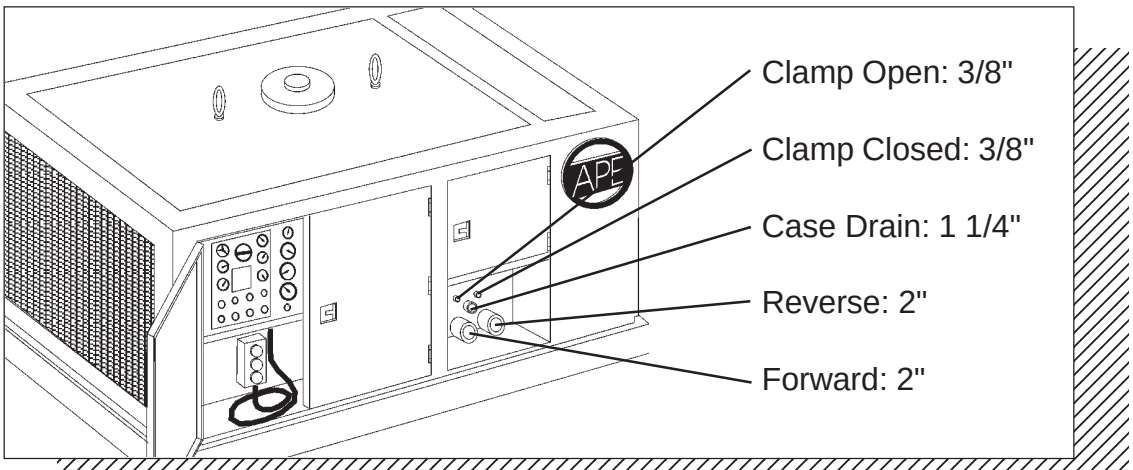
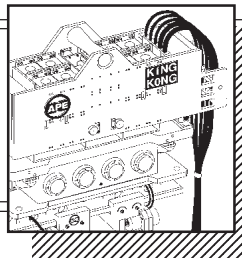


Figure 4-A. Power Unit Coupler Layout



IV. PREPARATION AND OPERATION (Continued...)

IV-4. Filling Vibrator Pressure Hose.

The vibrator is shipped with the hoses filled with oil. However, if the unit has been sitting for a long period of time or if a damaged hose has been replaced with a new one, then the hoses must be filled. Hook up all the hoses to the power unit (see Section IV-3 on [page 4-2] and Figure 4-A.). Start the power unit and let it run for ten minutes before running the vibro. The hoses will fill up by themselves in ten minutes even if the vibro is not in the vibrate mode.

IV-5. Bleeding the Clamp Attachment Hydraulic Hoses.

If the opening and closing of the jaws seems spongy or slow, it may be a result of air in the clamp hoses. Normally there is no need to worry about bleeding the clamp lines because the unit is shipped fully tested. However, should the vibro sit for a long period of time, if a new attachment is being installed or if a damaged clamp hose has been replaced, then the system may require bleeding to remove unwanted air in the system. To bleed the clamp system, follow the steps listed below:

1.) Shut Power Unit OFF.
2.) Make sure the clamp line quick dis-connects are coupled to the power unit.
3.) Start the power unit engine and run at 1500 rpm. Give the engine time to warm up.
4.) Loosen the clamp lines at the hydraulic cylinder by backing the fittings off just a little.
5.) Turn the clamp switch on the power unit control pendant to "CLOSE" and wait for oil to flow from the fittings. WATCH FOR AIR BUBBLES. When air bubbles have stopped then quickly re-tighten the fittings.
6.) Repeat the same procedure for "OPEN" side.
7.) Operate the jaws. If they are still a bit spongy then repeat bleeding steps once more.

WARNING: DO NOT BLEED SYSTEM AT FULL ENGINE THROTTLE BECAUSE TOO MUCH OIL WILL FLOW FROM THE HOSES AND COULD CAUSE INJURY.

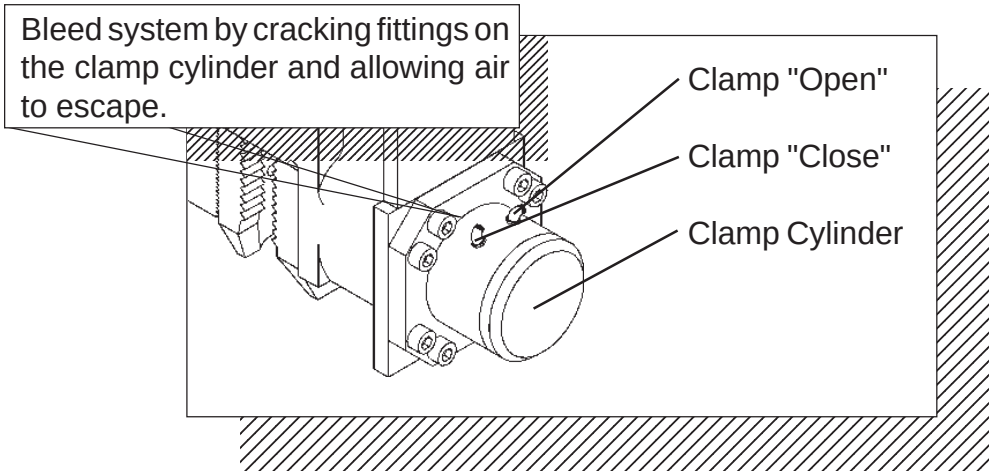
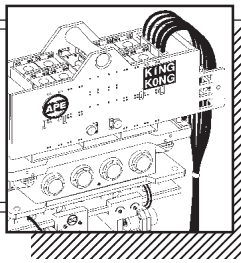


Figure 4-B. Bleeding Clamp Attachment



IV. PREPARATION AND OPERATION (Continued...)

IV-6. Precautions and Rules for Operation.

The following is a list of precautions, suggestions and rules that are intended to help promote the safe and productive use of the APE Model 400 Vibratory Hammer.

1.) Follow the Daily Maintenance Required Prior to Operation, [Section V-1.] [page 5-1].
2.) Read and follow the Safety Precautions, [page iii].
3.) Follow the start-up procedures listed in the manual for the power unit being used.
4.) Start with piles in good condition.
5.) Put all teeth in pile.
6.) Drive in steps eight feet or less.
7.) Keep sheets plumb.
8.) Come up to speed before doing work.
9.) No dancing. Avoid de-intensification.
10.) Drive past obstacles and then go back.
11.) Backhoe on site to remove obstacles.
12.) Lead with the ball.
13.) Probe the pile if it appears stuck.
14.) Keep piles plumb or down the road you go.
15.) Never rush the sheet pile foreman.
16.) Slow and plumb and the job will get done.
17.) Melted inner locks - piles out of plumb.
18.) Never stand under pile hammers.
19.) Low clamp pressure means jaw failures.
20.) Wait for vibro to get to full speed then pull.
21.) Don't over excavate - lower the ring.
22.) Look at the jaws during driving.
23.) Beware of cracked or broken sheets.
24.) In sandy soils drive faster.
25.) In clay amplitude is everything.
26.) Low drive pressure means easy work.
27.) High pressure means friction on piles.
28.) Over 5000 psi means get a bigger hammer.
29.) No amplitude means get a bigger hammer.
30.) Caissons need heavy wall to avoid flex.
31.) Check clamp bolts each morning.
32.) Read the manual - know your machine.
33.) Attach whip line to pile when pulling.
34.) Know your line pull.
35.) Extract straight - look at boom and cable.
36.) Give boom stops some room.
37.) Stalled engine means dirty fuel filters.

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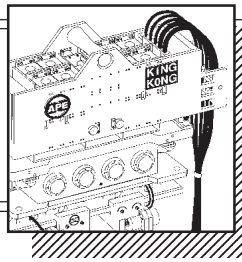


IV. PREPARATION AND OPERATION (Continued...)

IV-7. Relief Valve Settings Prior to Operation - Model 800 Power Unit.

1. Do not hook up quick disconnects. Start engine and bring to full rpm.

2. Check CIamp 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 4300 psi. 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. When you turn the clamp switch to "open" and hold it, a small light on the solenoid comes on to show that there is power to the solenoid. The solenoid light should go off when you turn it to the "Off" position.

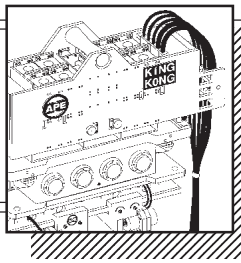
3. Check the clamp pressure switch setting. Turn the clamp to "close" and see if the green light comes on indicating proper clamp pressure. If it does then everything is fine. Clamp pressure should read 4000 psi and light on pendant or panel should be lit. To set the pressure switch, turn the set screw out using a screwdriver. Turn it out a few turns counter clockwise. Turn clamp switch to "open" for a second. Make sure the clamp open gauge reads 4300 psi. If it does not then go back to step 2 and set the clamp relief valve first. Knowing that your clamp relief valve is set to 4300 psi, turn the clamp switch to "closed." Green light should be on and clamp pressure should be very low or not reading at all. If green light is on then slowly turn the pressure switch screw clockwise with a screw driver until the pressure is 4000 psi or 300 psi below the clamp relief valve setting. Always set the clamp pressure switch 300 psi below the clamp relief valve setting or the light will never come on. We do not want the clamp pump to pump oil over the relief valve because this will cause heat and take away 25 horsepower from the engine. Call the factory if you have any questions. (800) 248-8498

IV-8. Shut-down Procedures.

The following procedures explain what to do with the power unit to correctly shut down the APE Model 400 Vibratory Hammer. (Please refer to the operating manual of the power unit for control locations and operation procedures.)

1.) Stop the vibrator. (Refer to the power unit operating manual .)
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.

WARNING: Do not shut the power unit engine down while the vibrator is clamped onto a pile. The clamp check valve will slowly bleed off if there is any leakage in the hose lines or worn clamp seals in the cylinder that moves the jaw open or closed.



IV. PREPARATION AND OPERATION (Continued...)

IIV-9. Operation of the Remote Control Pendant.

1. All functions of the vibro can be controlled by the hand held pendant. It is the choice of the crew as to where best to locate the pendant. 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. See Section VII-3, Page 7-8 in this manual for more details on operation. See Section VII-3A, Page 7-9 of this manual for wiring diagram and pendant components.

IV-10. Normal steps to operate vibrator:

1. Position vibro on pile.

2. Turn clamp switch to Close and wait for light to come on pendant.

3. Turn to Forward to begin vibrating pile.

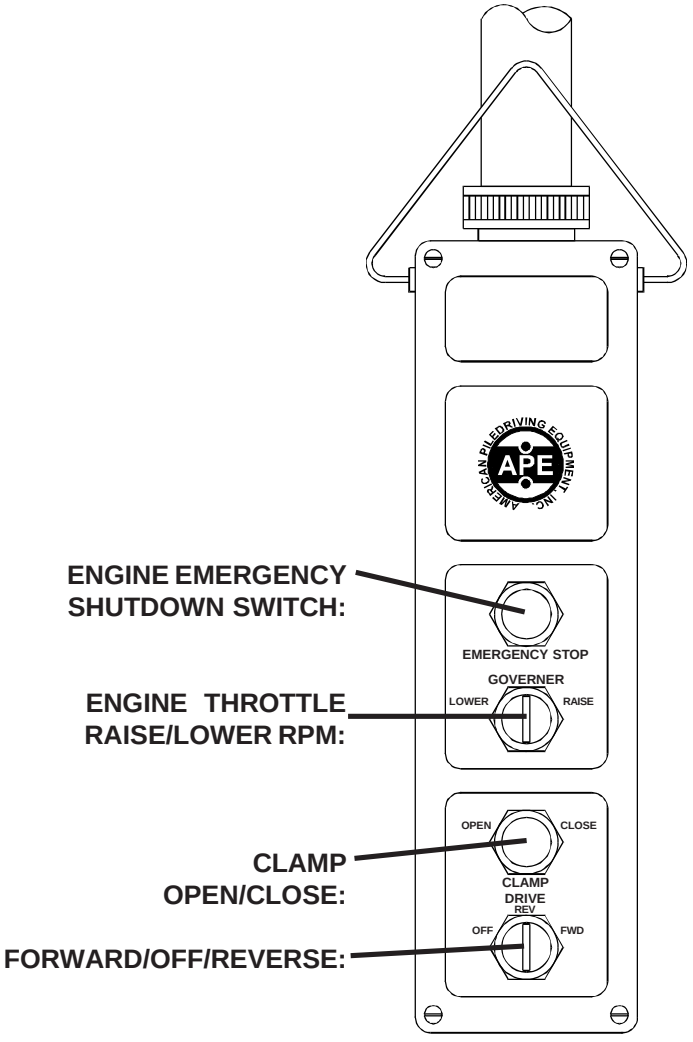
4. To drive, lower crane line as vibro vibrates pile.

5. To extract, pull up on vibro while vibrating.

6. See "Precautions and Rules for Operation" in this manual for more detailed operations on driving and extracting piles.

7. To stop the vibro turn the Forward switch to off.

8. To release clamp, press clamp switch clamp light will turn off.



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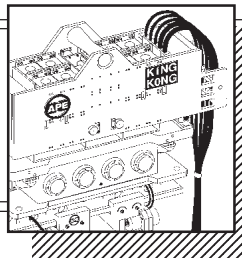


V. MAINTENANCE

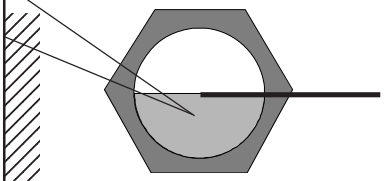
V-1. Daily Maintenance Required Prior to Operation.

1.) Visually inspect the entire vibro for loose nuts or bolts. Put a wrench on the clamp bolts and check them for tightness.

2.) Grease the Jaw Plunger on the clamp housing.

3.) Check the oil level in the vibrator. Hang vibro from crane and look at sight gauge. Make sure the oil is half way up gauge. If you cannot read it then you can't run the vibro. Remove the gauge and clean it by spraying a shot of starting fluid at it. **YOU MUST KNOW THE LEVEL!**

IF THE OIL LOOKS BLACK OR MILKY THEN DRAIN THE GEARCASE AND ADD NEW HYDRAULIC OIL.



Oil Level
Chevron AW46 or equal.

Sight Gauge

4.) If the oil is milky or black then change it. **Change the oil every 75 hours regardless.**

5.) Check the fluid level in the power unit hydraulic tank.

6.) Look at all the hoses. Check for cuts or other damage that might cause an oil leak.

7.) Check the rubbers in the suppressor housing. Look for cracks.

8.) Perform all start up checks as per the "start-up procedures" in the Power Unit manual.

V-2. 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 jaws for wear. Replace if necessary.

6.) Close jaws, make sure clamp light comes on.

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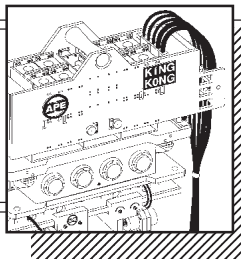

V. MAINTENANCE (Continued...)

V-3. Maintenance and Adjustments. (75 Hours)

Change the oil in vibrator gearbox. Remove the drain plug from bottom of gearbox and drain the oil into a bucket. Check oil for any metal shavings. Replace oil in gearbox by adding 25 gallons of standard weight oil. Mobil Gear 626.

Clean the gearbox breathers each time the oil is changed. Replace the breathers if necessary.

V-4. Maintenance and Adjustments. (Eccentric Bearings)

The Eccentric Bearings should be checked and/or replaced after every 5000 hours of operation.

V-5. Maintenance and Adjustments in Severe Conditions.

When average temperature is above (80 deg. F) or below (-1 deg. F) reduce servicing intervals to one half of those specified above.

When operating in the presence of dust or sand, reduce servicing intervals to one-third of those specified.

During stand-by or inactive periods, the servicing intervals may be reduced to one-half. The unit should be run every 30 days or less to keep internal parts lubricated.

V-6A. Lubrication - Vibratory Gearbox.

The Gearbox oil should be changed weekly or when black or milky. Mobil Gear 626 or equal is the preferred oil. Just ask your oil supplier for an equivalent type of oil. The gearbox requires 25 gallons of oil.

V-6B. Lubrication - Clamp Attachment.

The Clamp Attachment hydraulic oil must be checked and changed on a regular basis. The Clamp Cylinder Plunger should be checked for rust and debris. Lubricate the plunger on a regular basis using the grease zert on the side of the clamp housing .

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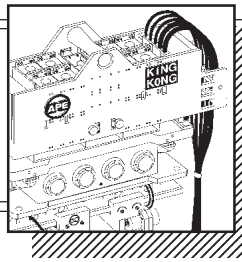

V. MAINTENANCE (Continued...)

V-7A. Power Unit - Filters, Fluid Types, and Capacities. (Table 5-A.)

FILTERS

LOCATION	ENGINE	FILTER TYPE	QUANTITY
Engine Oil:	CAT Engines	CAT 1 R0716	2 each
Engine Fuel:	CAT Engines	CAT 1 R0712	1 each
Air Filter:	CAT Engines	CAT 4N0015	1 each
Hydraulic Oil Filters:	----------	Pall 750OSDS8H	2 each
Hand Pump Filter:	----------	Fairey Arlon FA35-10	1 each

ENGINE OIL TYPES AND CAPACITIES

LOCATION	ENGINE	OIL TYPE	CAPACITY
Hydraulic Oil-Main:	----------	Mobil EAL 224 Veg.	300 gallons
Hyd Oil-Reserve:	----------	Mobil EAL 224 Veg.	55 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	
GearBox:	----------	9OW or Synthetic Model 803	

See small sight glass in center of gearbox between hydraulic motors. Oil should be filled to this level. Change every six months.

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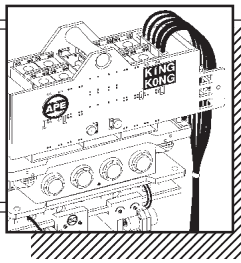


V. MAINTENANCE (Continued...)

V7-B. Power Unit - Hydraulic Fluid.

When adding or changing hydraulic fluid APE uses only Mobil 224 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.

V7-C. Power Unit - 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.

V7-D. Power Unit - Cleaning Hydraulic Tank Suction Filter. (No suctions on 1993 and newer)

1. Located inside the hydraulic tank or reservoir, is a suction filter.

2. Drain tank.

3. Remove side cover.

4. Reach into tank and unscrew filter from pipe fitting.

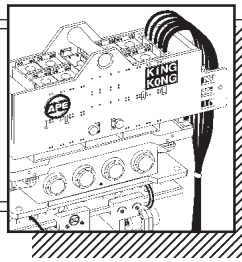
5. Clean with solvent and re-install. If damaged then replace.

6. Re-install filter.

7. Re-install tank cover.

8. Add new oil to tank.

9. Prime pumps.



V. MAINTENANCE (Continued...)

V-7E. Power Unit - 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.

V-7F. Power Unit - Steps to Remove the Element.

1. Shut down power unit by turning off the diesel engine.

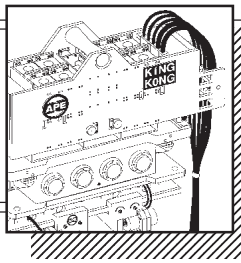
2. Place warning tag on control panel so that no one mistakenly starts the unit while filters are being changed.

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.

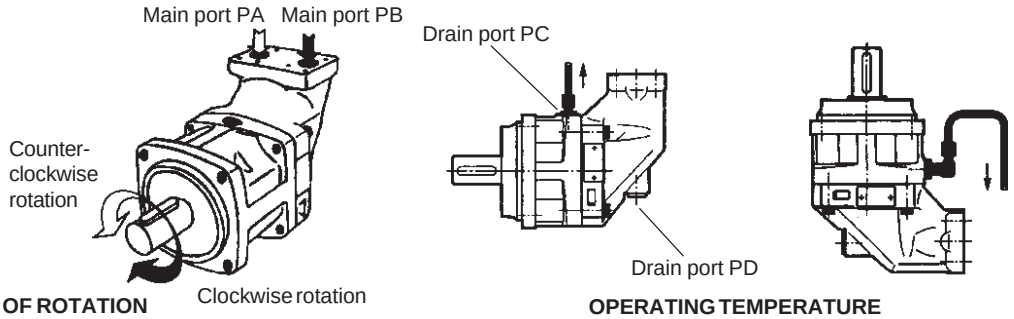
5. Install new clean filter making sure the o-ring is in place.

6. Depress filter indicator to re-set to "clean position".



V. MAINTENANCE (Continued...)

V-8. Hydraulic Motor - Installation and Start-Up. - Figure 5A.



DIRECTION OF ROTATION

The F12 motor is bi-directional. The picture shows direction of flow vs. shaft rotation. When fluid enters port **PB** (black arrow) the motor turns counter clockwise, and when port **PA** is pressurized (open arrow) the shaft turns counter clockwise.

The F12 pump rotates clockwise or counter clockwise. The ordering code shows the direction of rotation.

FILTRATION

To obtain maximum motor service life, the fluid cleanliness should be checked to meet ISO code 18/13 or better (ISO 4406). A10 um (absolute) filter is recommended.

REQUIRED INLET PRESSURE

The motor sometimes operates as a pump (e.g. when it is used in a propel transmission and the vehicle is going downhill). The motor inlet port must then be supplied with sufficient fluid pressure, or increased noise and deteriorating performance may otherwise be experienced.

CASE PRESSURE

The table shows the highest recommended case pressure (F12 shaft seal type **H**) as a function of shaft speed.To obtain the longest seal life, the case pressure should be limited to 50% or less of the figures shown.

NOTE: Contact VOAC Hydraulics for information on other shaft seals.

Motor case pressure [bar] vs. shaft speed [rpm]

designation	1500	3000	4000	5000	6000
F12-30	14.0	7.0	5.5	4.5	3.5
F12-40	12.0	6.0	4.5	3.5	
F12-60	12.0	6.0	4.5	3.5	
F12-80	10.0	5.0	4.0		
F12-110					

CASE DRAIN CONNECTIONS

There are two drain ports (**PC** and **PD**). The uppermost drain port should be utilized. In mounting positions such as 'shaft up', a drain line loop can be formed to provide bearing lubrication and cooling. Preferably, the drain line should be connected directly to the tank to avoid excessively high case pressure.

NOTE: When the motor is operating, the case must be filled with fluid to at least 50%.

OPERATING TEMPERATURE

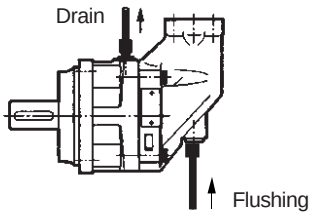
The following temperatures should not exceed (type **H** seal):

System fluid: 80deg. C
Drain fluid: 100deg. C

Type **V** ('Viton') shaft seals can be used to 115deg. C.

Continuous operation may require case flushing in order to meet the above viscosity and temperature limitations. The table shows operating speeds, above which flushing is usually required, as well as suggested flow through the case.

Motor designation	Speed [rpm]	Flow [l/min]
F12-30	3500	4-8
F12-40	3000	5-10
F12-60	3000	7-14
F12-80	2500	8-16
F12-110	2300	9-18



BEFORE START-UP

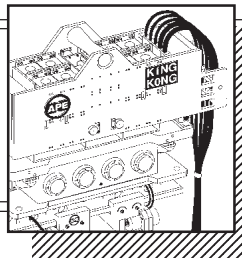
Make sure the motor case as well as the entire hydraulic system is filled with a recommended fluid. The internal leakage, especially at low operating pressures, is not sufficient to provide lubrication at start-up.

HYDRAULIC FLUIDS

Ratings and performance data for series F12 are based on operating with good quality, contamination-free petroleum-based fluids, Hydraulic fluids type HLP (DIN 51524), automatic transmission fluids type A, or API CD engine oils can be used.

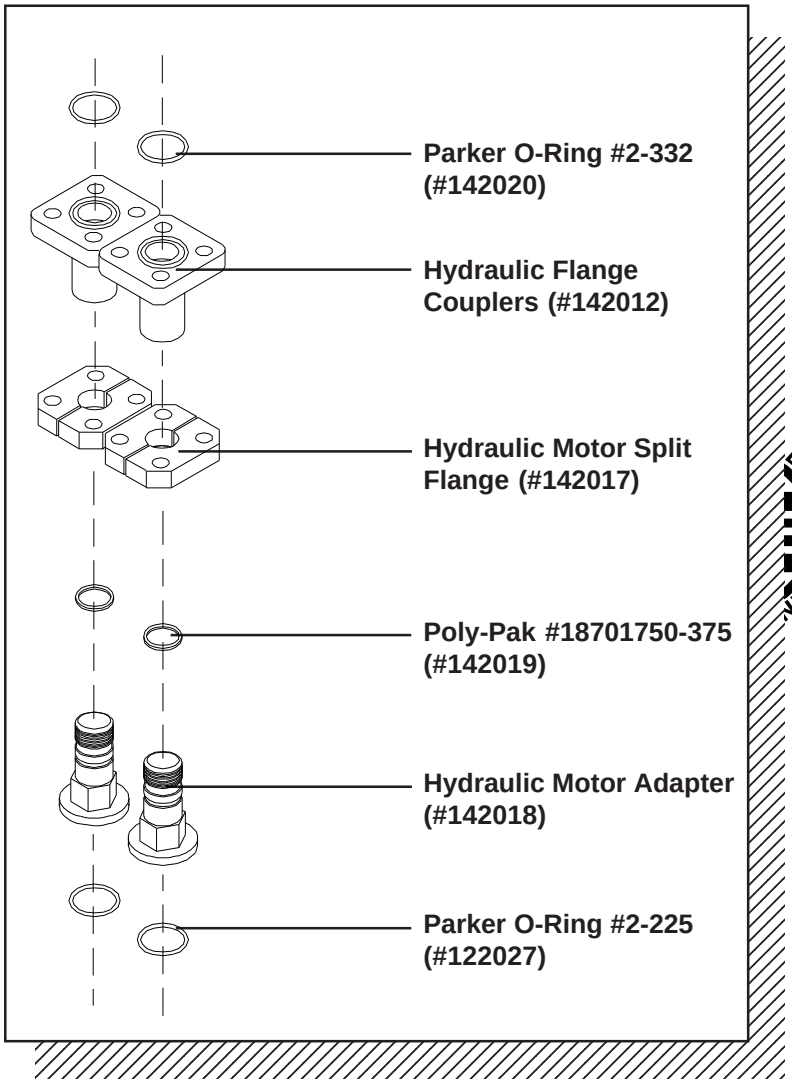
At operating temperature, the viscosity (of the drain fluid) should normally be kept above 8 mm2/s (cSt). At start-up, the viscosity should not exceed 1000 mm2/s.

Fire resistant fluids, when used under modified operating conditions, and synthetic fluids are also suitable. Contact VOAC Hydraulics for further information.



V-9. Hydraulic Motor Coupling Assembly.

The APE Hydraulic Motor Coupling Assembly allows the hydraulic fluid to flow between the rifle bored top plate of the vibro gearbox and the hydraulic motors. The following steps should be followed when removing and installing the hydraulic motors or if disassembly is required for maintenance of the coupling assembly:



Coupling Removal and Re-assembly:

1. Remove the bolts holding the "Split Flange" to top of the motor.

2. Loosen the 4 bolts which connect the "Hydraulic Flange Couplers" to the bottom of the gearbox top plate.

3. Screw the "Hydraulic Flange Couplers" and the "Hydraulic Motor Adapters" together (This will decrease the overall size of the assembly and allow easier removal of the components).

4. Watch for oil flowing out from the openings on the under side of the top plate. Insert a clean rag into the openings to block the oil flow and to prevent debris from entering the opening and contaminating the hydraulic oil.

5. Reverse the procedure for re-assembly. At assembly, make sure the hydraulic motor is parallel to the top plate by verifying both sides with a tape measure. If necessary, loosen the 4 bolts holding the motor to the gearbox face and shift the motor until the top plate and motor machined face are parallel.

Figure 5-B. Hydraulic Motor Coupling Assembly.