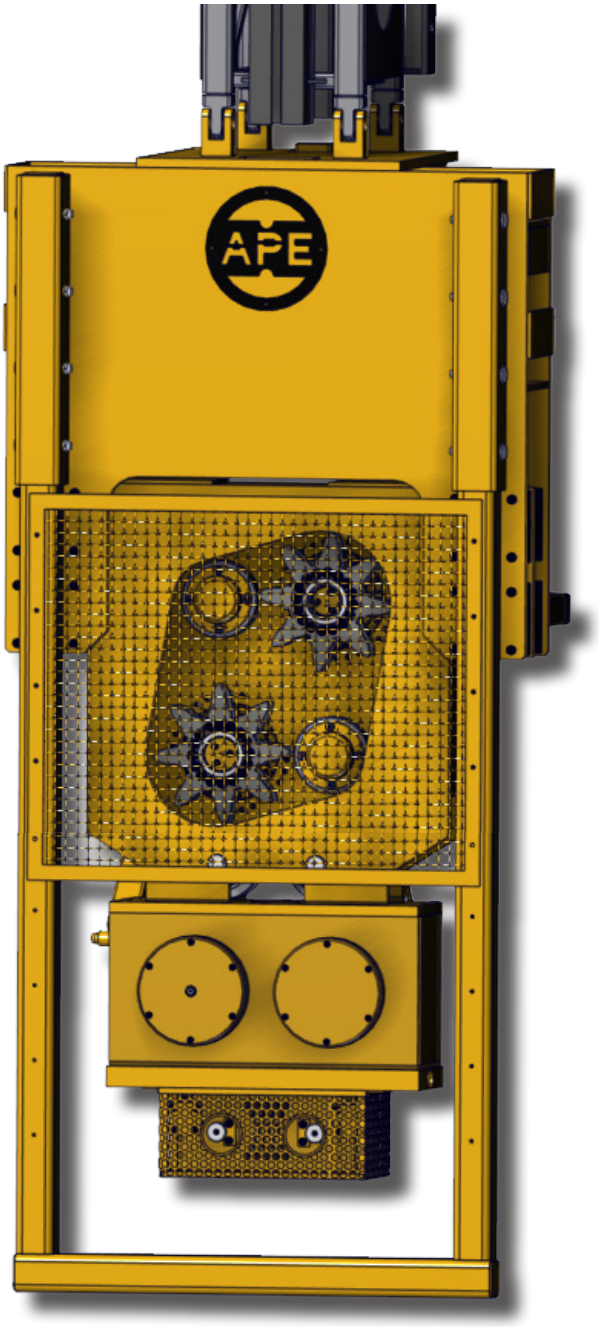
APE WICK DRAIN
OWNER'S MANUAL

DEEP FOUNDATION SOLUTIONS



AMERICAN PILEDRIVING EQUIPMENT
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MODEL 100 WICK DRAIN(S)

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

A Table of Contents is included after the Foreword.

Description:

100 WICK DRAIN (S)

WARRANTY INFORMATION

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

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

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

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

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

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

(These precautions must be followed at all times to ensure personal and equipment safety.)

DANGER DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION CAUTION indicates a hazardous situation where injury could occur but is unlikely to be serious or lead to death.

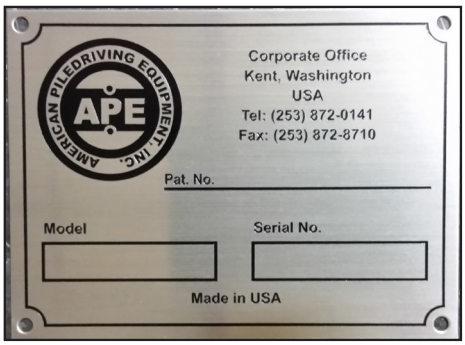
NOTICE NOTICE indicates information that may help or guide you in the operation or service of the equipment.

DISCLAIMER

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

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

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



This plate contains numbers key to identifying the unit. This information is important when contacting APE for replacement parts or repair instructions.

NOTICE

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

NOTICE

A PROPERLY MAINTAINED FIRE EXTINGUISHER, SUITABLE FOR OIL FIRES, MUST BE KEPT IN THE IMMEDIATE VICINITY OF OPERATIONS.

WARNING

KEEP HANDS, FEET, AND/OR TOOLS WELL CLEAR OF SUPPRESSOR ELASTOMERS.

WARNING

DO NOT ATTEMPT TO LIFT OR WALK WITH PILES EXCEEDING 10 TONS WEIGHT.

(These precautions must be followed at all times to ensure personal and equipment safety.)

NOTICE

CHECK THE ENTIRE UNIT PRIOR TO AND DURING SET-UP
EACH DAY OR AT THE BEGINNING OF EACH SHIFT

Prior to starting the unit or at the beginning of each shift, check the following:

- Visually inspect all bolts, nuts and screws.
- Visually inspect all suppressor elastomers.
- Tighten bolts holding gripping jaws to the hydraulic clamp.
- Check the oil level in the vibration case and add oil if required. The oil level should be in the middle of the sight glass. Change oil if it is milky or contaminated.
  * ***DO NOT OVERFILL.***
- Visually inspect all hydraulic fittings for leaks. If a leak is found or suspected, shutdown the power unit. If a fitting appears to be damaged replace it with a new fitting.
- Check the hydraulic motor and hydraulic manifold for leaks.

NOTICE

IT IS ABSOLUTELY IMPERATIVE THAT NO DIRT OR OTHER IMPURITIES BE PERMITTED TO CONTAMINATE THE HYDRAULIC FLUID. ANY CONTAMINATION WILL DRASTICALLY SHORTEN THE LIFE OF THE HIGH-PRESSURE HYDRAULIC SYSTEM.

VIBRATION LOOSENS BOLTS. CHECK THEM THOROUGHLY.

Do not use the Wick Drain as a lifting device. Can cause property damage, serious injury, or death.

FOREWORD

This manual covers the **100 WICK DRAIN(S)** installation, maintenance and use.

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.

All information given in this manual is current and valid according to the information available at the time of publication. American Piledriving Equipment, Inc. reserves the rights to implement changes without prior notice.

Using this manual:

- Refer to the Table of Contents for the page location of applicable sections.
- All weights and measurements are in English and Metric units.
- Any revisions to this manual will appear on the Revision Record page at the back of this manual.
- Please visit www.americanpiledriving.com for product data sheets and manual.

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

CALIFORNIA
Proposition 65 Warning
Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer, birth defects and reproductive harm. **Wash hands after handling.**

COMMON ABBREVIATIONS AND TERMS

APE	: American Piledriving Equipment	**cm**	: Centimeters
Vibro	: Vibrator	**m**	: Meters
QD	: Quick Disconnect	**kg**	: Kilogram
HCLW	: High Collar Lock Washer	**kN**	: Kilo-newton
SHCS	: Socket Head Cap Screw	**Rpm**	: Revolutions per Minute
BOM	: Bill of Materials	**Vpm**	: Vibrations per Minute
P.O.	: Pilot Operated	**cyl**	: Cylinder
Lbs	: Pounds	**eng**	: Engine
in	: Inches	**Mtg**	: Mounting
psi	: pound per Square Inch	**Sol**	: Solenoid
mm	: Millimeters	**S/N**	: Serial Number

SERIAL NUMBER LOCATIONS

Vibrator	: Above and in between the eccentric covers on both sides of the machine.
Power Unit	: On both sides in front of reservoir near the top

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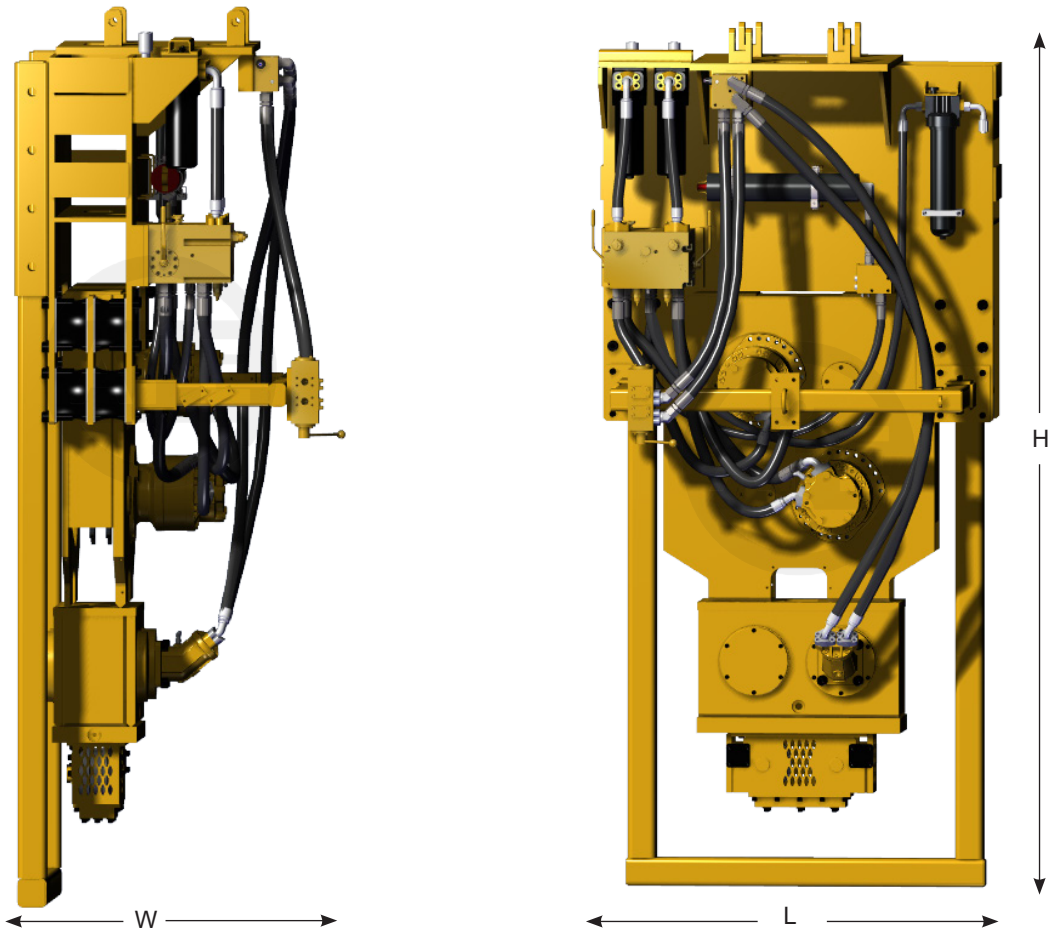
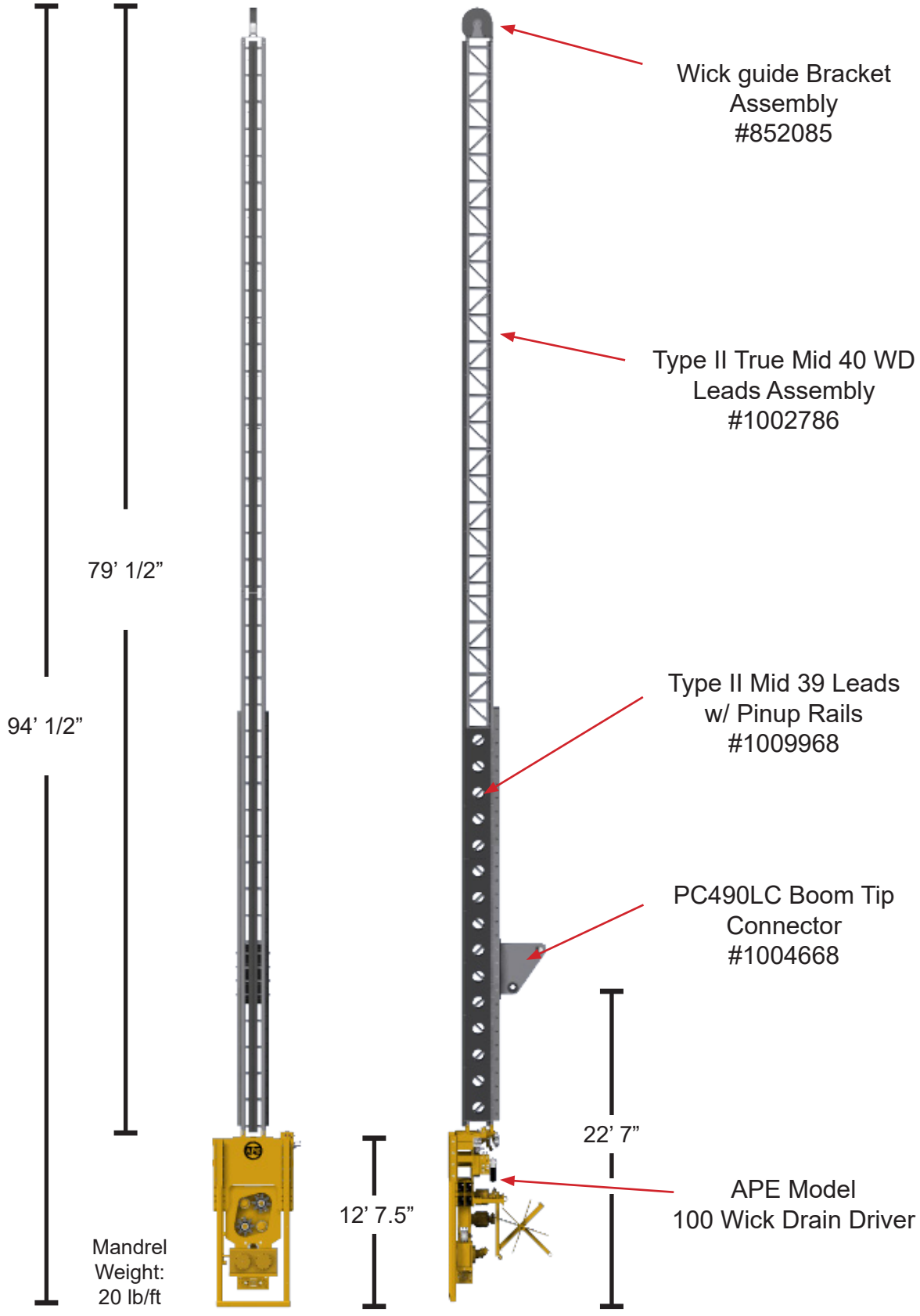
SPECIFICATIONS



SPECIFICATIONS	DATA
Static (Crowd) Force	279 kN / 28 Us tons
Dynamic Force @ 1,650 vpm	(608 in-lbs) 211 kN / 23.7 US tons
Combined Static / Dynamic Force	458 kN / 51.5 US tons
Operating Frequency	0 - 1,650 vpm
Suspended Weight	3,855kg / 8,500 lbs
Maximum Pressure	380 bars / 5500 psi
Length	217.86 cm / 85.77 in
Width	175.26 cm / 68.99 in
Height	374.01 cm / 147.25 in

Note: Model may not represent current model

EQUIPMENT OVERVIEW

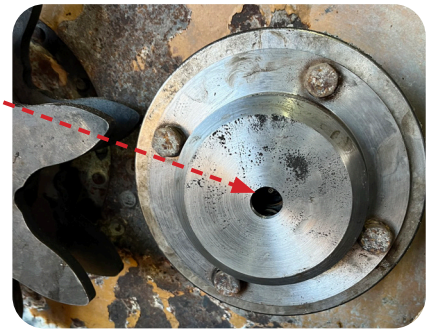


Total weight w/o mandrel = 24,258 lbs

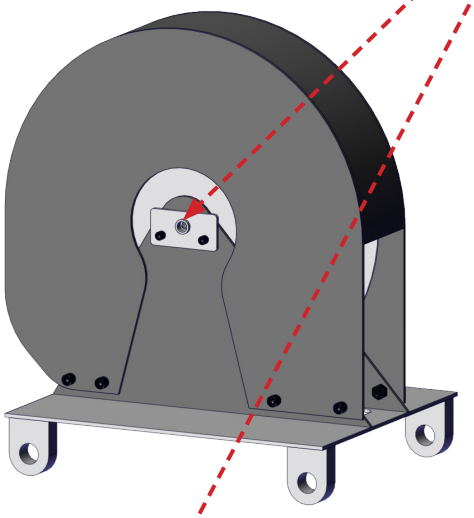
Note: Does not include hoses, fluids, fasteners, welds, wick material, or rigging

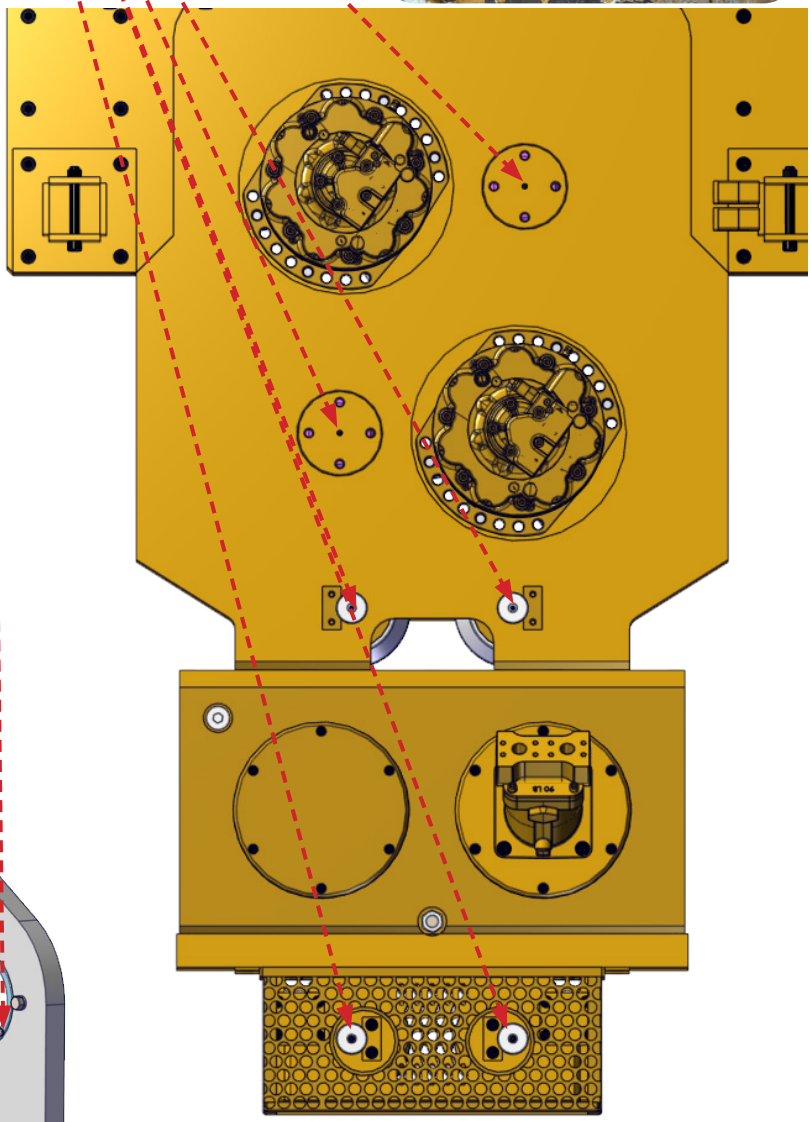
GREASE HERE DAILY!

Some models may have grease zerk locations on the mandrel roller assembly that can be access through grate side (see image below)

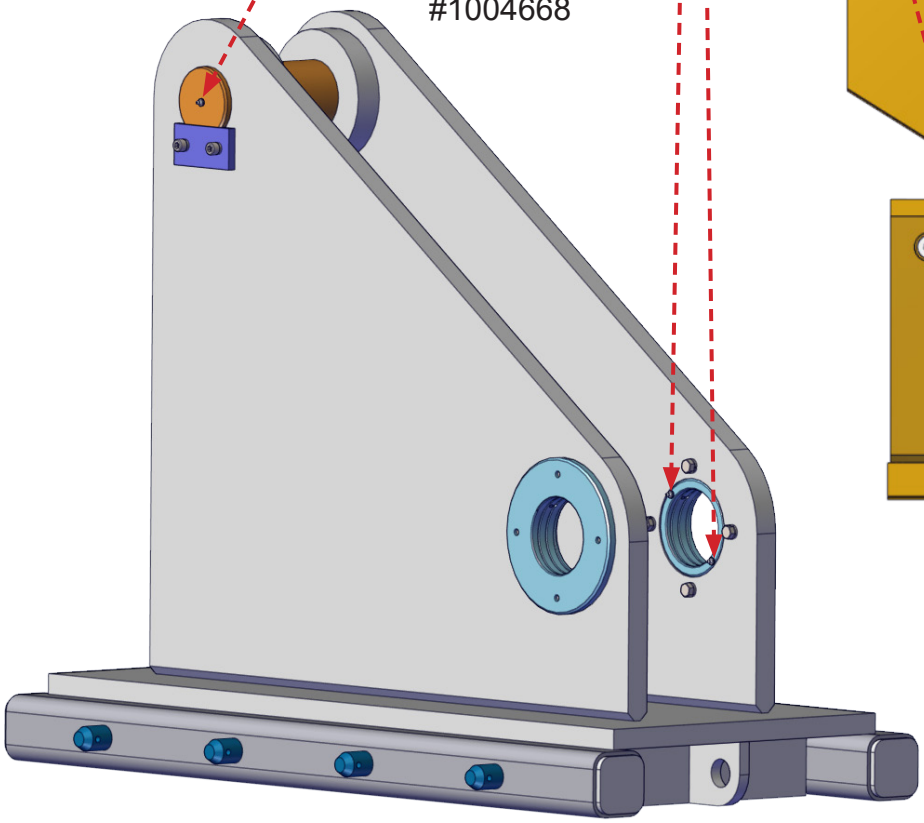


Wick guide Bracket Assembly #852085





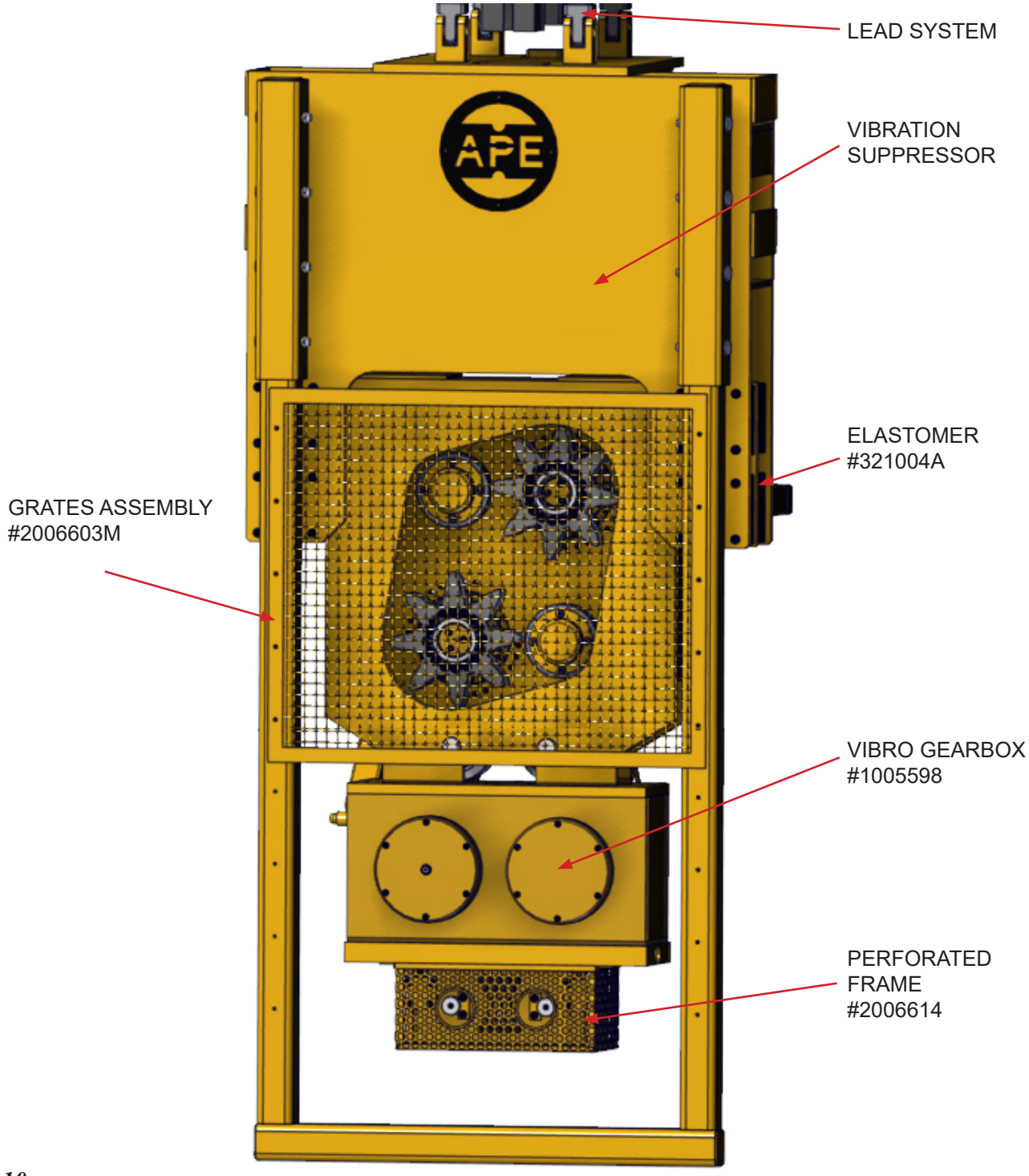
PC490LC Boom Tip Connector #1004668



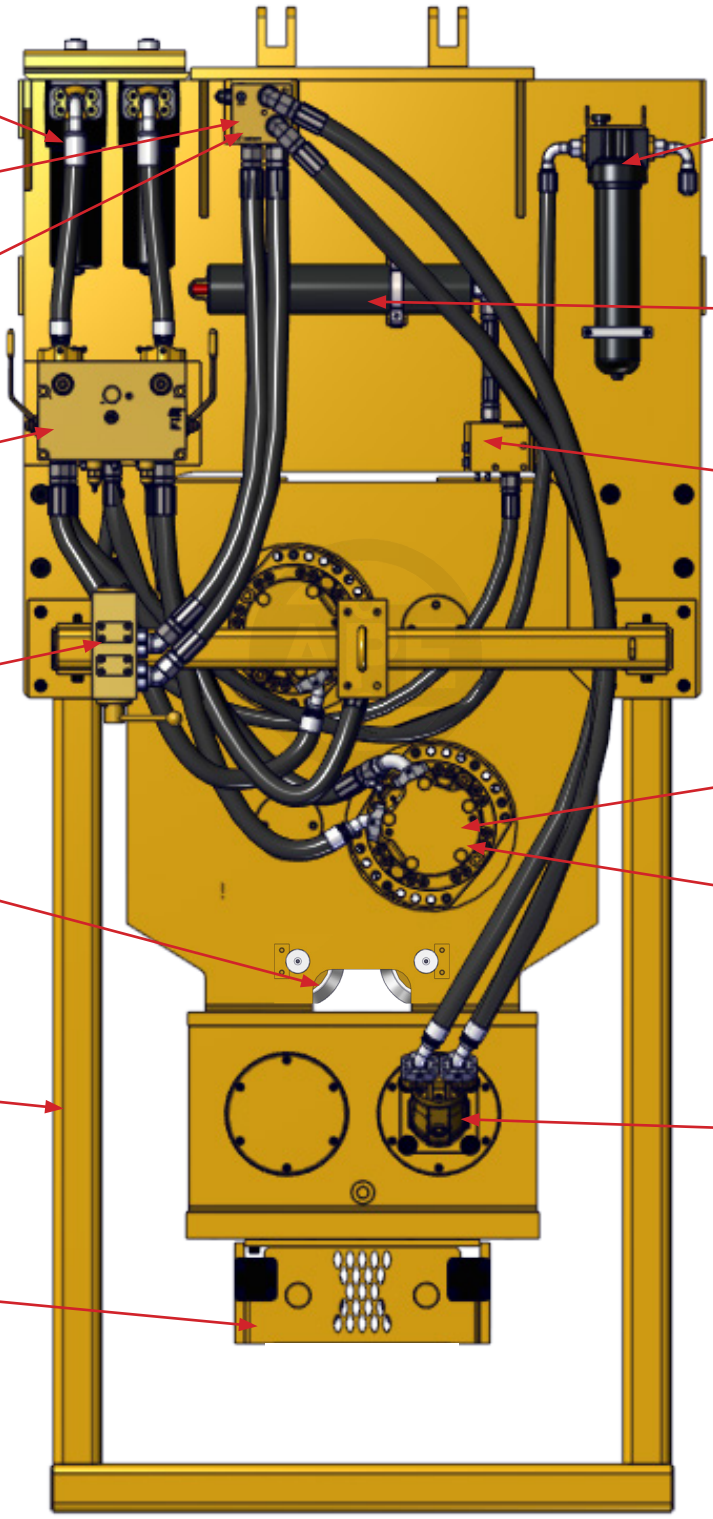
Model 100 Wick Drain Overview

The APE Model 100 BOTTOM DRIVE WICK INSERTER is a vibratory wick drain inserter. Designed to insert wick drain by forcing a wick threaded mandrel into wet soil while vibrating through tough soil.

The Model 100 Wick operates in a frequency range of 800 to 1,650 vibrations per minute to provide maximum mandrel penetration rates in a wide variety of soils. Produces 23.7 US tons (211 kN) of dynamic force and 28 US tons (279 kN) of static driving force, a combined force of 51.5 US tons (458 kN).



EQUIPMENT IDENTIFICATION



EQUIPMENT CHECKOUT SHEET

Wick Drain Checklist Prior to Shipment

*** Items checked with an asterisk should be checked regularly, but not every time the unit is serviced**

Checking the suppressor

- □ Removed all wire rope for insurance reasons
- □ Checked Shackle pin cotter key and nut
- □ Checked large elastomers for signs of cracks
- □ Checked small elastomers for signs of cracks
- □ Checked all bolts on elastomers
- □ Removed and checked anti-cavitation valve*
- □ Inspected pop off safety check valve
- □ Checked line pull pin and multi-stage pin
- □ Inspected all suppressor mounting bolts
- □ Inspected entire suppressor for weld cracks
- □ Installed safety line pull sticker
- □ Inspected all hoses and fittings on suppressor
- □ Inspected all fittings on rifle board top plate
- □ Checked suppressor loop hoses for wear

Vibro gearbox

- □ Checked gearbox oil level
- □ Flushed gearbox with flushing system
- □ Changed gearbox oil
- □ Removed and cleaned gearbox oil site gage
- □ Removed and cleaned magnetic drain plug
- □ Checked/replaced damaged bearing cover bolts
- □ Removed, cleaned, and replaced breather valve
- □ Checked motor bearing cover bolts
- □ Checked bottom of gearbox- all mounting holes
- □ Checked entire bottom clamp mounting surface
- □ Checked hydraulic motor mounting bolts
- □ Checked motor couplers for leaks
- □ Checked motor coupler bolts
- □ Inspected entire gearbox for signs of cracks
- □ Removed any welding attached by pile crew
- □ Inspected main bearings visually for wear*
- □ Inspected motor bearings visually for wear*
- □

Vibro test

- □ Checked and cleaned quick disconnects
- □ Checked to make sure caps and plugs are there
- □ Checked all o-rings on QD's
- □ Put spare o-ring kit in tool box of power unit
- □ Closed jaws and checked hoses for leaks
- □ Checked clamp pressure with hoses attached
- □ Checked pendant light to make sure it works

Test Data:

Free hanging drive pressure:_____

Cycles per minute:_____

Temperature of hydraulic oil at time of test:_____

Tips for the APE service technicians and pile crew:

Please clean the control panel and spray some armor all on it. Prior to the vibro going out on rent it must look like new condition If the paint appears bad then paint it. If the paint surface is bad then have it sand blasted. Do not allow the hammer to go out looking bad. Any bad hoses should be replaced. The most important thing is the condition of the jaws and the hoses. Both should be new or in new condition. If this unit is going to operate in cold weather then please make sure the proper oils have been used. In cold weather operations we must use a softer o-ring to handle the colder temperatures. Spare parts that should be with the vibro power unit:

- □ One sight glass with teflon tape already installed and boxed
- □ One socket wrench for removing and replacing sight glass
- □ One manual with copy of this check out sheet

Vibration Gear Box

The vibration gear box contains four eccentric weights which rotate in a vertical plane to create vibration (Dynamic Force). The eccentric weights are driven by a hydraulic motor.

Vibration Suppressor

The vibration suppressor contains 12 rubber elastomers to isolate the vibration case from the leads. The mandrel insert / extract motors are mounted here. A pair of hydraulic motors with a sprocket assembly mounted to the motors force the mandrel into the ground as well as removing the mandrel from the ground. There is a roller assembly that works together with the sprockets keeping the mandrel engaged with the sprockets.

Wick Carrier

The wick carrier assembly is designed to carry six spools of wick drain. This assembly has capability to hold one spool on the center of the wick tube and five to the side of center of the wick tube. While you line-up the first spool of wick to the wick tube the rest of the carrier can hold the spare spools of wick. When the center spool is close to being empty mechanically join the end of the wick to the beginning of a new spool of wick. When the center spool is empty, remove spool bracket and wick roll tube. Re-install spool bracket, slide the wick spools so that the first spool is in-line with the wick tube and slide the other spool bracket over to keep the remaining wick spools in place. Continue to mechanically joining the end of a spool to the beginning of the next spool and adjusting the spool bracket.

Mandrel Guide

The mandrel guide is a set of rollers at the bottom of the vibration case used to maintain position of the mandrel fore and aft as well as right and left. The mandrel is a rectangular steel tube that is used to thread the wick drain into the soil.

Legs

The legs are to rest upon the ground to stabilize the wick inserter while inserting wick or removing the mandrel. They are adjustable to suit the job site and operators preference of height for best visibility.

Leader System

The leader system is a lattice system used to support and guide the mandrel and wick drain. This system has a trough for the mandrel to run in maintaining it's location in relationship to the wick inserter assembly. A set of lugs and pins connect the leader system together as well as the leader system to the inserter assembly. On top of the leader system is a wick guide bracket that aligns the wick drain that goes to the top of the leader system and over to top of the mandrel.

UNLOADING

When unloading and unpacking the bottom drive wick inserter, use extreme care. For your protection, make a thorough inspection of the unit immediately on delivery. In case of any damage or shortage, notify the transit agent at once and have the delivering carrier make a notation on the freight bill.

SAFETY PRECAUTIONS

Safety is very important and is everyone's responsibility that operates this equipment or services this equipment.

Use the following safety precautions as a general guide to safe operations, when in doubt consult APE before proceeding with any operation that may produce an unsafe result. These safety guidelines do not constitute all possible safety issues that may occur during operation or maintenance.

1. Read this manual thoroughly before operating or working on the equipment.
2. Read and follow any safety instructions in the excavator's operators manual.
3. Only well trained and experienced personnel should attempt to operate or maintain this equipment.
4. Never adjust, lubricate or repair the unit when it is in operation, or lifted above ground level.
5. Never remove, paint over or cover warning or safety labels. If labels become damaged or unreadable, replace immediately.
6. All personnel should wear approved safety clothing, including HARD HATS, SAFETY SHOES, SAFETY GLASSES and HEARING PROTECTION when in the vicinity of this machinery.
7. Do not stand any closer to this equipment than necessary when it is in operation. Parts may loosen and fall. Never stand under operating, or elevated, equipment.
8. When maintaining or repairing the equipment, never substitute parts not supplied, or approved in writing, by APE.
9. Do not weld, or flame cut, on this equipment.
10. Never use or store flammable liquids on or near the engine.
11. Insure that all lifting equipment, including cranes, wire rope, slings, hooks, shackles, etc., are properly sized for the worst case loads anticipated during operations.
12. If there are any questions about the weights, specifications, or performance of the unit, contact APE before handling or operating the equipment.
13. If the equipment is to be used for anything other than inserting plumb wick drains, contact APE before using the unit.

Safety Precautions (Continued)

14. Insure that ground vibrations will not damage or collapse adjacent structures or excavations.
15. Remove all tools, parts and electrical cords before starting the unit.
16. When operating in an enclosed area, pipe exhaust fumes outside. Continued breathing of exhaust fumes may be fatal.
17. When servicing batteries, do not smoke or use open flames in the vicinity. Batteries generate explosive gas during charging. There must be proper ventilation when charging batteries.
18. When filling fuel tank, do not smoke or use open flame in the vicinity.
19. If abnormal equipment operation is observed, discontinue use immediately and correct the problem.
20. Do not adjust, or set, hydraulic pressures higher or lower than those specified in this manual.
21. Never operate this equipment with hydraulic hoses that are damaged or “kinked”. Replace damaged hoses immediately.
22. Do not lift, or support, hydraulic hoses with wire rope slings.
23. Do not pull on, or attempt to move equipment, with hydraulic hoses.
24. Do not attempt to locate hydraulic leaks with your hands. High pressure hydraulic leaks can penetrate the skin, causing severe damage, blood poisoning and infection. Do not attempt to repair leaks while the equipment is in operation.
25. Do not attempt to tighten, or loosen, fittings or hoses when the machine is in operation.
26. A properly maintained fire extinguisher, suitable for oil fires, must be kept in the immediate vicinity of equipment operations.
27. When moving or transporting this equipment, insure that the vehicle or vessel is of sufficient capacity to handle the load, and that the equipment is properly tied down.
28. Be sure that all equipment parts are tight, or properly secured, before shipment. Unsecured parts may vibrate loose and fall, during transport, causing injury or property damage.
29. Keep crane boom, mandrel, lead system, wire rope and other equipment at least 15’ (5M) from electrical power lines, transformers and other electrical equipment, or at such distance as required by applicable safety codes.
30. Rounded or damaged bolt heads or nuts should be replaced so that proper torque values may be obtained. Proper torque values are necessary to prevent parts on this equipment, leads and crane boom from loosening and falling. Refer to Torque Chart, in this manual, for proper values.
31. Never induce mandrel crowd or extraction force before starting the unit in vibration. Always start both driving and extraction of mandrel insertion / extraction circuit in neutral.
32. Keep hands away from mandrel sprocket assemblies.
33. Keep hands away from vibrator suppressor during operation. Clearances may change causing pinch points.
34. When driving “batter” wick drain insure that the lead system, and crane boom, have sufficient bending strength to handle the worst case load. Consult APE.

NOTICE

Rigging of Inserter

A mast system is designed to mount to the base rig that the Bottom Drive Wick Inserter is mounted to that also guides the Mandrel with the wick. The following instructions provide guidelines for the assembling.

An adapter has been designed for the entire assembly for the original project to a certain excavator.

1. With Mast in horizontal position bolt the lower two wick lead sections to mast.
2. Stand mast vertical.
3. Pin bottom drive wick inserter to wick lead.
4. Lower mast to horizontal.
5. Pin upper sections of wick lead to the lower sections that are bolted to the mast.
6. Supporting and hanging mandrel load into the bottom of bottom drive wick inserter using Roller Guide Asm.
7. With the BV1 motor valve in the “FREE WHEEL” position and the needle valve (NV1) closed all but one turn open.
8. Slowly pull the lever in the extract wick position to allow the bottom motor sprocket to pull the mandrel into the mast.
9. The mandrel will engage into the upper motor sprocket. You can continue to feed the mandrel as is.
10. With BV1 turned to the “RUN” position and the NV1 open all the way fee d the remainder of the mandrel.

The pins supplied for the mast are the only pins to be used and installed with supplied fastening hardware.

The mandrel can be loaded in the lengths of delivery and welded together as the end of the mandrel nears the Roller Guide Asm. Another way to load the mandrel is to completely weld the entire length in advance. Either way it is a must to use the Mandrel Template P/N: 352017 to align and properly space the sections.

NOTICE

All rigging of either the inserter must be done in accordance with standard rigging guide lines set forth in ASTM standards; APE does not assume responsibility for incorrect rigging or procedures.

Filling Vibrator Pressure Hose

The vibrator is usually shipped with the vibrator hydraulic hoses full of fluid and the unit may be used immediately. However, if the pressure hose has been removed from the vibrator, the hose should be allowed to fill with hydraulic fluid prior to full speed operation.

- Start and warm up the diesel engine, Hold the vibrator in a vertical position.
- With the engine warmed up and running at 1000 RPM, turn and hold the vibrator switch REVERSE. The hoses will fill in approximately 5 minutes.

NOTICE

WARNING

If vibration begins in the vibrator, stop immediately and recheck hose connections.

Hydraulic Hoses Connection

1.Connection of hoses inserter.

- The inserter gear box motor and crowd / extraction motors are connected to the base rig by five hydraulic hoses.

The base rig must be shut down during connection of the hydraulic hoses.

- Clean connection fittings with a lint-free cloth before making connections.
- Make sure that the connectors are fully tightened with wrenches.

Connection of hoses at base rig.

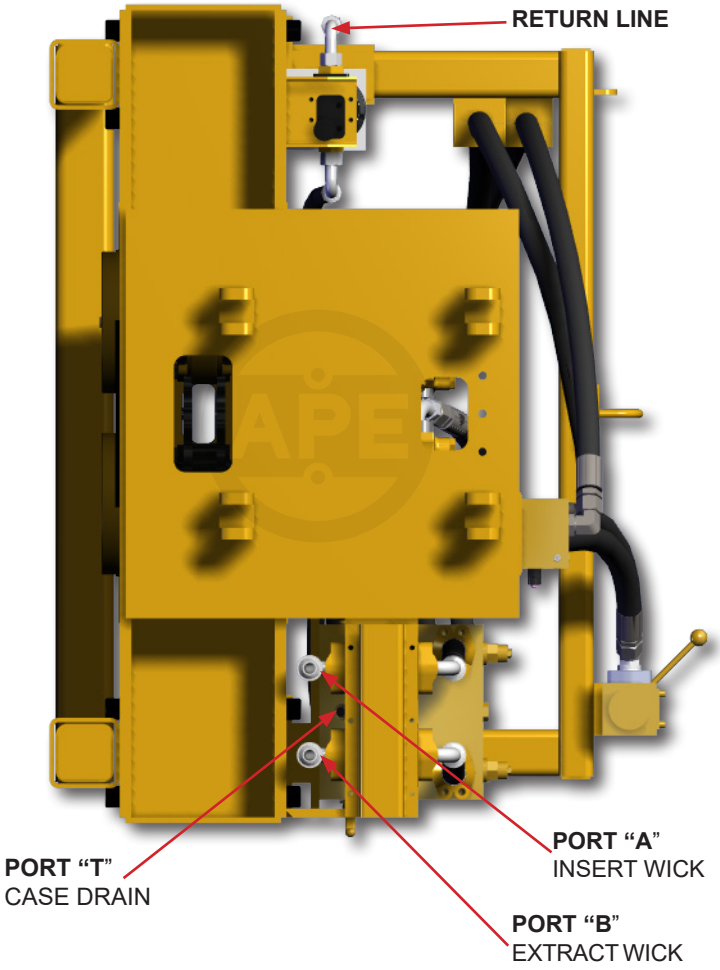
- The vibrator circuit is controlled by the tool circuit.

NOTICE

Use caution when bleeding any hydraulic lines, even low hydraulic pressure can cause injury to personnel.

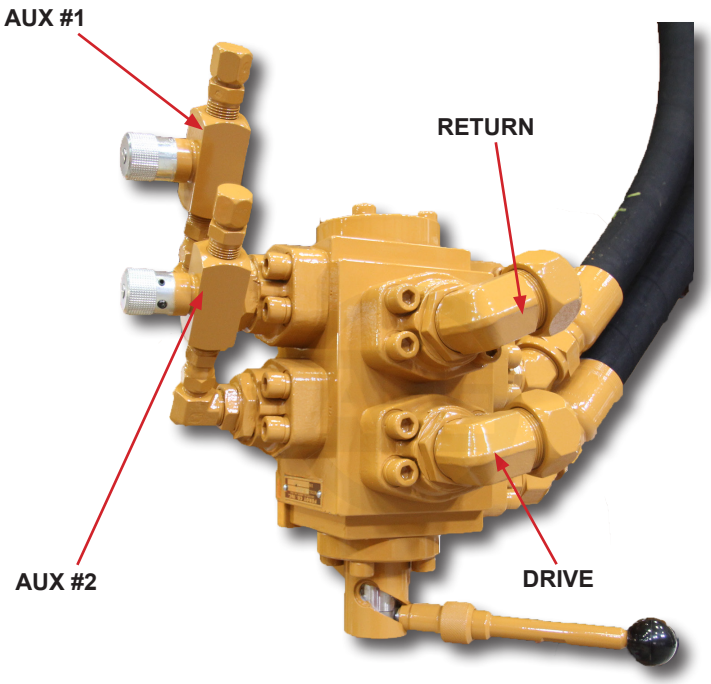
CAUTION

WARNING



EXCAVATOR CONNECTION

Contact APE Certified Service Technician for more information



NOTE: AUX #1 & AUX #2 CONTROLS THE MAST ROTATE CYLINDER.

Note: Model might not represent current model

Preparing For Lift - Lead Systems

1. Fully assemble Wick Driver / Leader system on the ground, horizontal, using cribbing where needed.
2. The wick spool is normally not attached, due to potential interference with the excavator boom.
3. Insert the mandrel into the Wick Driver. Blow or vacuum the wick material through the mandrel.
4. It is recommended that the Wick Driver Standoff Leg assembly be installed prior to lifting.
5. Grease all points shown on page 35.
6. Inspect connection pins. Make sure they are retained with cotter pins.
7. Inspect the Wick Driver for leaks or loose bolts.
8. Inspect leads for loose items that could fall. Fasteners, tools, and other assembly items.

⚠ CAUTION

Adjustment of the mast - lead system should only be done when NO mandrel is below the surface of soil.

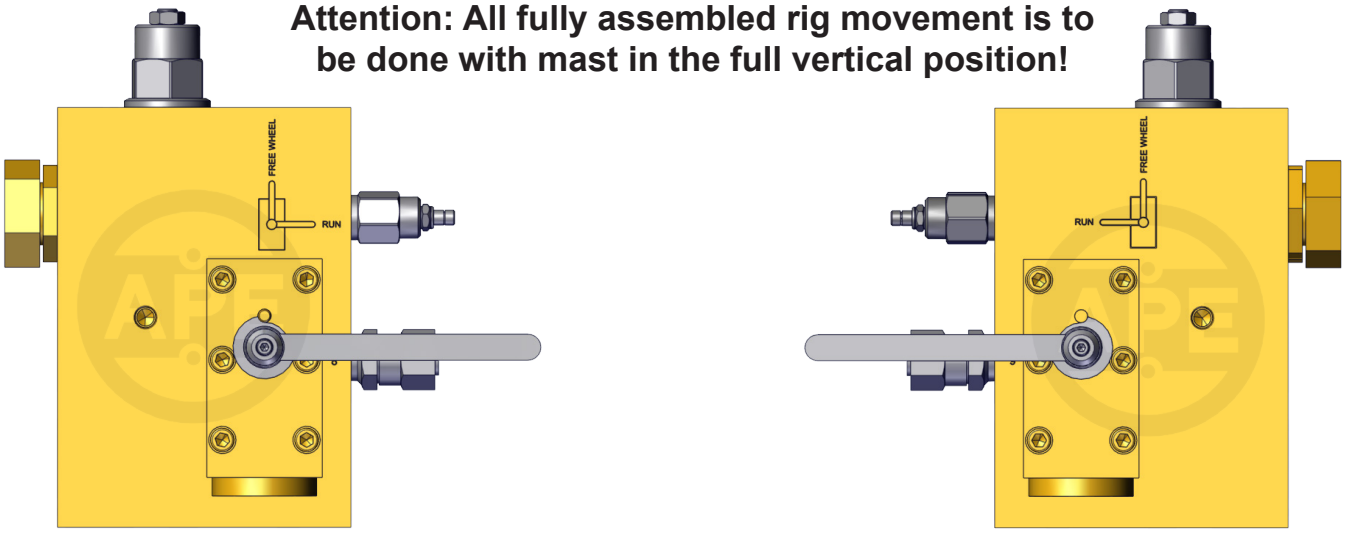
Raising The Mast

The mast is raised by the excavator. A combination of Boom Up and Stick Cylinder Retract is all that is required. Technique might vary from operator to operator.

1. The excavator operator must appropriately signal the ground crew before lifting.
2. Ground crew should position themselves in a safe place.
3. The excavator should not be traveling on tracks during the lift.
4. Raise boom several degrees until leads begin to clear the ground.
5. Carefully retract the stick cylinder to rotate the leader system.
6. The operator should take care to not lift the Wick Driver too high. The Standoff Leg should be just a few inches above the ground.
7. The operator should take care to not over-apply the rotation (stick cylinder) with the Wick Driver too close to the ground. Damage could result.
8. Repeat steps 2 & 3 until the system is vertical. An experienced operator can perform boom and stick cylinder operations simultaneously.
9. Install the wick spool.

NOTICE

Attention: All fully assembled rig movement is to be done with mast in the full vertical position!



Driving / Extracting Mandrel

- Pushing the “WINCH-AUX” lever, this lever is the third from the right and is the knob is Blue.
- Pushing and holding the lever a small amount will allow the mandrel to move down slowly. The further the lever is pushed the faster the mandrel will move.
- Returning the lever to the neutral position stops the mandrel.
- Pulling the “WINCH-AUX” lever, this lever is the third from the right and is the knob is Blue.
- Pulling and holding the lever a small amount will allow the mandrel to move up slowly. The further the lever is pushed the faster the mandrel will move.
- There is an indicator at the top of the mandrel. This indicator allows the operator and crew to know how far the mandrel is in the ground by how much is above the bottom drive wick inserter. This indicator is especially useful to determine how much mandrel is left in the ground when extracting the mandrel. The crew and operator must keep in mind that the mandrel will not stop based on the position the mandrel. The mandrel will smash out the top roller if the mandrel is not stopped before this happens.

Running The Vibro (Bottom Wick)

- When the mandrel slows or stops running into the ground using the mandrel inserting motors the use of the vibros is needed.
- A good indicator that the driving of the mandrel is getting tough the gear case will be pushed up into the suppressor.
- It is recommended that when you see this happen push and hold the “VIBRO” button.
- Within a few seconds the Vibro will begin to vibrate at full speed.
- With Vibro running at full speed continue to run the mandrel.
- If you wait until the mandrel stops release the WINCH AUX lever and push and hold the “VIBRO” button.
- With Vibro running at full speed continue to run the mandrel.
- When the tough soil layer is broken through release the “VIBRO” button while continuing to run the mandrel.

Shut Down

1. Stop the vibration gear box and mandrel drive motors.
2. Allow the diesel engine to run for five minutes at 1500 RPM.
3. Reduce speed to low idle for about thirty seconds.
4. Stop the engine by turning the ENGINE START switch to OFF.

Maintenance Chart

NOTICE

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

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

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

Thoroughly clean all lubrication fittings, caps, filler and level plugs and their surrounding surfaces before servicing. Prevent dirt from entering with lubricants and coolants. The intervals given in the schedule are based on normal operation. Perform these services, inspections, etc., more often as needed for operation under abnormal or severe conditions.

DAILY	WEEKLY	70 HOURS
• Check operators report. • Check oil level in the gearbox and bring to correct level. • Inspect bolts, nuts, and screws for tightness. • Inspect elastomers for cracks. • Inspect fittings, hoses, and manifolds for leaks.	• Inspect hydraulic hoses and fittings for fraying and leaks. Replace any hoses with broken threads. • Bleed air from the hydraulic lines as described in the previous chapter. • Inspect gearbox magnetic drain plug for metal flakes. If flakes are found see Troubleshooting chart.	• Change gearbox oil. • Clean gearbox breather and pop-off valves. • Cycle oil into the hydraulic clamps as described later in this chapter.
250 HOURS OR 6 MONTHS	**1500 HOURS OR 1 YEAR**	**6000 HOURS OR 3 YEARS**
• Inspect eccentric bearings.	• Check torque on gearbox, suppressor, and clamp attachment mounting bolts. • Inspect hydraulic motors for leaks, wear, and proper operation. • Replace eccentric bearings.	• Inspect, replace eccentrics, elastomers, and hydraulic motors if necessary.

Severe Conditions

The servicing intervals are specified on normal operation conditions. Operation under severe conditions require shorter service intervals.

- When the average outside temperature is above 80 F (26 C) or below -10 F (-23 C), reduce service time intervals by one-half.
- When operating in the presence of dust or sand, reduce service time intervals by one-half.
- When operating in air with high salt or moisture the service intervals do not need to be changed. However the unit should be inspected weekly to determine if additional servicing is required.
- When operating in excess of twelve hours per day, reduce service time intervals by one-half of those specified.

Vibratory Gearbox

The oil level is easily read through the sight glass located at the lower center of the vibratory gearbox on the motor side. Lubricating oil may be added when necessary, through the hole in the vibration case top plate after removing the 1" SAE O-ring plug. To drain the case, remove the 1" pipe plug at the end of the base plate. Tilt the case for complete drainage.

The preferred lubricating oil for APE vibro gearbox is high molly oil. The recommended oil by APE is Schaeffer 268.

Vibro Oil Recommendations

The gearbox lubricant installed by APE during manufacturing is Schaefer 268. If it is unavailable an alternative oil may be used when changing lubricants. Test and change the gearbox oil at smaller intervals if Schaefer 268 is not being used. The gearbox capacity is 1.5 gal, fill until you reach the half line mark on the sight glass.

Second Preference Group

Mobil	SHC-634
Boron	Gearep 140
Chevron	Gear Comp. NL460
Citgo	Premium MP 85W-140
Citgo	Standard MP 85W-140
Gulf	Lub 85W-140
Phillips	MP 85W-140
Shell	Omala 460
Sun	Sunep 1110

Third Preference Group

Amoco	Perma Gear EP140
Arco	Pennant NL 460
Conoco	EP 460
Exxon	Spartan EP 460
Phillips	AP 140
Texaco	Meropa 460
Union	MP 85W-140
Valvoline	Gear Lub 85W-140

Hydraulic Oil Cleanliness

When adding or changing hydraulic fluid, APE uses only Biodegradable Envirologic 146 hydraulic fluid. Consult your local oil supplier for recommendations on mixing hydraulic oils. See the warranty document at the beginning of this manual concerning fluid cleanliness, and Understanding ISO Codes at the rear of this manual.

NOTICE

NEW HYDRAULIC FLUID IS NOT CLEAN OIL!
OIL MUST MEET ISO CLEANLINESS CODE 17/15/11

Storage

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

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

For long-term storage (over 9 months), the following additional actions are recommended:

- Damages to surface paint must be repaired before item is stored.
- Protect the unpainted surfaces with suitable anti-corrosion treatment such as CRC SP-350, CorrosionX corrosion inhibitor, or WD-40 Long Term Corrosion Inhibitor.
- Fill the power unit completely with hydraulic fluid.

If these instructions are followed to the letter, the vibro may be stored for approximately 2-years. However, as storage conditions do have a significant effect, all suggested time frames should be considered as guide values only.

Reading the Vibro Gearbox Oil Level

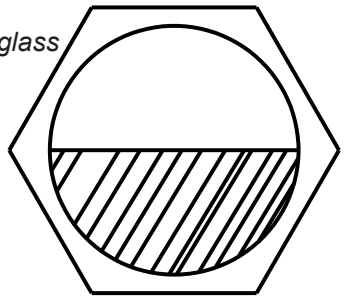
The gearbox oil is a useful indicator of the health of the unit. Check the Troubleshooting chart if gearbox is overfilled, has discolored oil, or the oil contains metal flakes.

The oil level may be read from a sight-glass halfway up the vibro gearbox. Ideally the oil will fill midway up the sight-glass when the vibro is upright. If the level cannot be read remove the sight-glass and clean the window with ether.

NOTICE

IF YOU CANNOT READ THE GEARBOX SIGHT-GLASS DO *NOT* ASSUME IT IS FILLED. YOU MUST READ THE LEVEL TO RUN THE VIBRO.

Graphic of the sight-glass at ideal fill level.



Changing Vibro Gearbox Oil

Gearbox oil can be added through a hole in the gearbox top plate. Remove the SAE plug to add oil.

To drain the gearbox, remove the pipe plug beside the gearbox sight-glass and tilt the vibro until the oil drains out.

Do not overfill the gearbox. Gearbox oil is viscous when cold. Add one gallon, allow the oil to spread out, then fill the remainder slowly while watching the sight glass.

When replacing either of the pipe plugs, add sealing tape to make sure oil and containments cannot enter or leave the gearbox.

Checking Bearings and Eccentrics

Periodic maintenance and some vibro symptoms require the gearbox bearings to be inspected. The results of this inspection may indicate that the eccentrics require replacement.

During this check make sure no dust, dirt, or other contaminants can enter the gearbox.

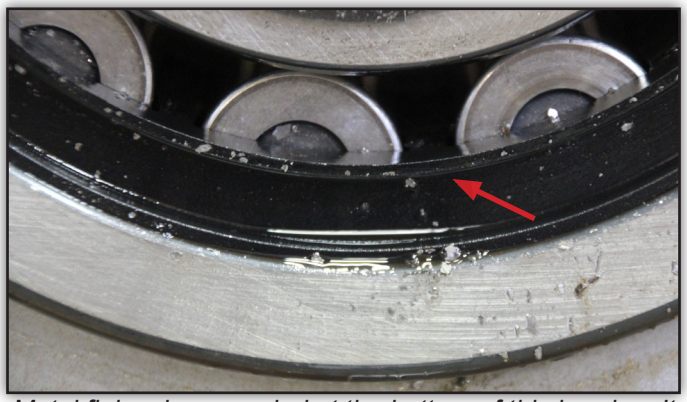
If this procedure is being followed as part of regular maintenance only one cover needs to be removed and examined. If a problem is suspected all covers should be removed and inspected.

1. Remove one gearbox bearing cover.
2. Clean the bearing face. Examine both the bearing face and the interior of the bearing cover for wear or scorch marks.
3. Check the stamping on the outer ring of the bearing. There should be letters etched top.
   - If the lettering is not on top, tap the bearing with a rubber mallet to check if it is loose. If it is loose, replace it and check the eccentrics.
4. Inspect all visible components for chipping, pitting, corrosion, or deformation.
5. If no damage is found, apply lube to the bearing cover o-ring. Re-seat it, then attach the bearing cover to the gearbox with loctited bolts.

It is often difficult to determine if the eccentrics are damaged. In general, damage to a bearing requires the replacement of an eccentric. To check the eccentrics:

1. Unbolt and remove the suppressor and gearbox top plate.
2. Inspect eccentrics for chipping, pitting, corrosion, or deformation.
3. Replace damaged eccentrics and bearings, if necessary.
4. Apply fresh lube to o-ring cord before sealing gearbox.

Etched words of manufacture location example: "USA" should be top center of bearings. If lettering is not on top, tap on the bearing with a rubber mallet to check if it is loose.
Note: not all bearings are made in USA.



Metal flakes have pooled at the bottom of this bearing. It needs to be replaced.

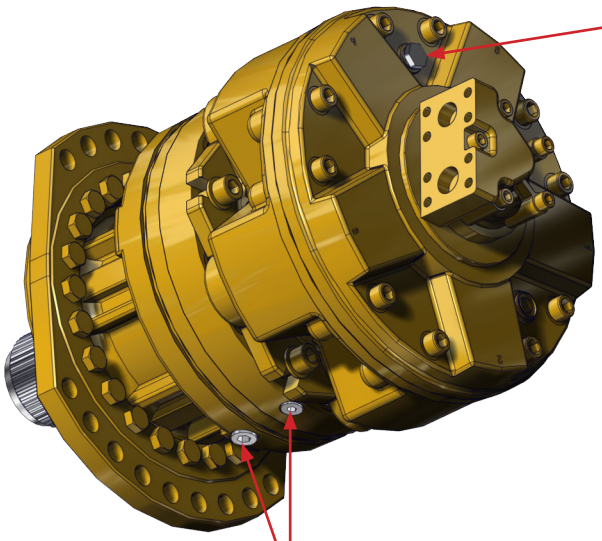
Damaged eccentric bearing in need of immediate replacement.

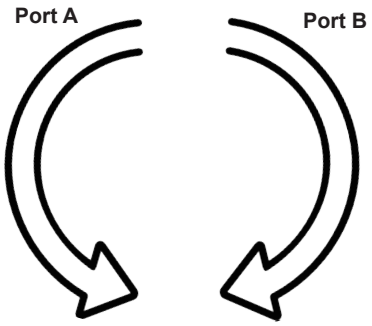
DANGER

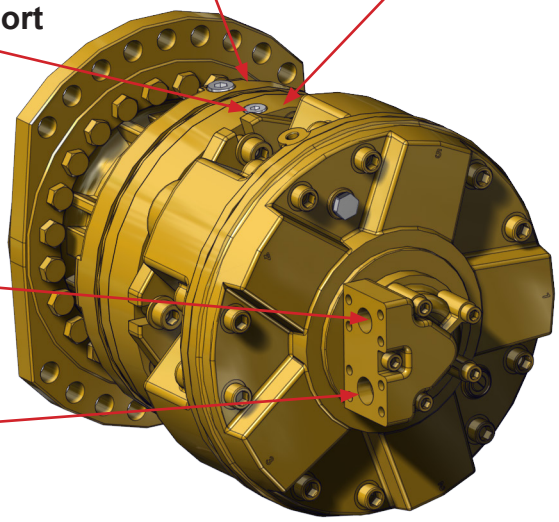
ECCENTRICS MAY SWING UNEXPECTEDLY AND ARE HEAVY. THE INTERIOR OF THE GEARBOX IS A MAJOR PINCH AND CRUSH HAZARD WHEN OPEN.

Hydraulic motor on gearbox.

Identifying Sai Motor







Port B
Rotates the motor clockwise

Port A
Rotates the motor counter-clockwise

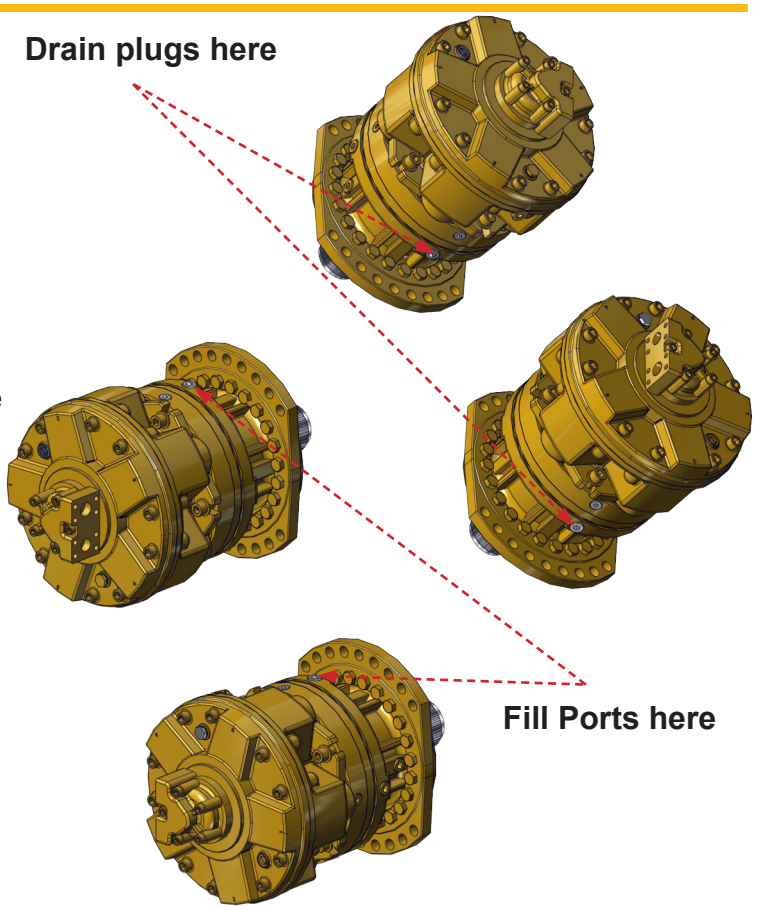
APE has equipped these motors with: Castrol SAE 80W-90
APE recommends: Schaeffer gear oil 268 SUPREME GEAR LUBE SAE 80W-90

Sai Motor Maintenance

The only actions to be taken are to the check the oil level and to replace the lubricant. As a rule of thumb, level checking should be done every 3 to 6 months. Oil replacement should take place every 6-36 months, based on the type of lubricant used, the duty cycle and the ambient and oil temperature. For High Performance Synthetic Lubricants the longer the Service Intervals are valid while Standard Mineral Oils require the shorter intervals.

Oil replacement should be carried out while the oil is still hot enough to flow freely. Wear protection apparel (Gloves and googles etc.) as the hot surfaces and hot oil might lead to severe injury!

Draining The SAI Motor



Step 1: Ensure the wick drain driver is fully disengaged and positioned upright before initiating the motor draining process.

Step 2: Identify and remove all drain plugs located at the bottom of the SAI motor assembly.

Step 3: Perform the draining procedure while the oil is sufficiently warm to facilitate free flow.

Step 4: Position a suitable container or bucket beneath the motor to collect the drained fluids, ensuring no spillage or contamination occurs.

Follow all relevant safety precautions and environmental disposal regulations when handling and disposing of used oil.

Filling The SAI Motor

Step 1: Remove the fill port plug located at the top of the SAI motor. Ensure the area around the plug is clean to prevent contamination.

Step 2: Before reinstalling the drain plug on the bottom of the SAI motor, begin the oil filling process.

Step 3: Slowly add oil to the motor through the top fill port until oil begins to exit through the bottom drain plug. This process helps purge any residual oil from the motor system.

Step 4: Once oil flows steadily from the drain plug, securely reinstall it. Tighten the drain plug adequately but avoid over tightening, which could damage threads or sealing surfaces.

Oil Capacity: The SAI motor requires 2 to 2.5 quarts of oil. Under no circumstances should the motor be filled with more than 2.5 quarts to avoid overfilling and potential damage.

Ensure proper disposal of old oil and follow all relevant environmental and safety guidelines.

Initial Operation

Make sure the gearbox is filled to the correct level with suitable gear lubricant
On initial start-up, the gearbox should be run at low speed with no load. It should be observed for 5 minutes, and if no problems are present (such as excessive noise or vibrations), the unit may be run at normal speeds and loads of given application. The first time that the motor is operation under normal conditions, it should be inspected again for excessive noise or vibration. In case any adverse behavior is noted, check for the correct alignment, as well as proper oil level. After first run, check the oil level and for any oil leaks. Make sure that mounting bolts are tightened properly.

Troubleshooting Chart

Symptom	Possible Cause	Solution
Oil blowing out between gearbox and hydraulic motor	1. Blocked case drain. 2. Breather plugged or damaged. 3. O-rings not sealing properly.	1. Ensure case drain hose is attached and not kinked. 2. Remove and clean breather, replacing if damaged. 3. Verify o-ring seal and cleanliness between gearbox and motor.
Vibro gearbox overheating at the bearing covers	1. Vibro is being run too hard. 2. There is too much or too little oil in gearbox. 3. Gearbox oil is damaged.	1. Check that the unit is penetrating at least 1 inch of soil for every 30 seconds of operation. Allow the vibro to cool down between sessions of hard operation. 2. Set the gearbox upright and level and check the sight glass. If the oil level is too high remove the sight glass and allow some to drain. If it is too low replace missing oil. 3. Check oil quality in sight gauge and drainage plug. For oil that is black, milky, or contains large metal flakes see the next symptom on this chart.
The gearbox oil is discolored or contains contaminants	1. Gearbox oil has a dark or milky appearance from water, hydraulic oil, or dirt. 2. Damaged bearings or eccentrics are leaving metal flakes or brass chunks.	1. Check all seals, especially those near the hydraulic motor, hoses, and the gearbox exterior for damage, breaches, or faulty o-rings. 2. Perform the check bearings and eccentrics procedure. If damage is found replace the components and gearbox oil.
Gearbox is filling with oil	Hydraulic oil is entering the gearbox through a bad motor seal.	Remove the hydraulic motor and check for damage to the o-ring or gearbox.
Vibro won't come up to normal operating speed	1. Power unit at low RPM. 2. Hoses are damaged or kinked. 3. Defective or damaged hydraulic motor. 4. Power unit pumps need repaired.	1. Raise the Power unit engine RPM. 2. Check all hose connections and fix any loose or kinked lines. 3. Perform the Checking Hydraulic Motors procedure. Replace a motor that shows damage. 4. Contact a Qualified Service Technician to service or replace the power unit pump.
An attachment bolt broke	1. Bolts didn't fully seat or are overstressed.	1. Replace all clamp bolts with special attention paid to cleaning all surfaces. Check working loads to ensure they're within acceptable levels.
Vibro won't start when DRIVE button is engaged	1. The Vibro won't drive while the clamp is open. 2. Hoses not connected properly. 3. The hydraulic motor is damaged. 4. Gearbox seized up.	1. Make sure the clamps are fully closed and the clamp light is on at the joystick. 2. Check hose connections at the Vibro Pigtails, Qd, and Power unit. 3. Follow Checking Hydraulic Motors procedure. 4. Inspect the gearbox, bearings, and eccentrics. If there is damage found consult APE for repair and/or replacement.

Ordering Replacement Parts

Unit Information

Provide the serial and model number of the unit when contacting APE for replacement parts. This information can be found on a tag like the one on this page. Confirm all orders in writing to avoid duplicating shipments.

Original and Modified Equipment

The previous equipment breakdowns apply only to equipment originally furnished with the unit. Any equipment that has been changed or upgraded won't be accurate to these schematics.

Shipment

If the shipment recipient and method of shipment isn't stated then APE will use its own judgment.

Shortages

APE does not assume responsibility for any delay, damage, or loss of material while in transit. Damaged or lost material should be refused or a full description made of its condition to the carrier agent on the freight or express bill. Make any such claims immediately upon receipt of parts.

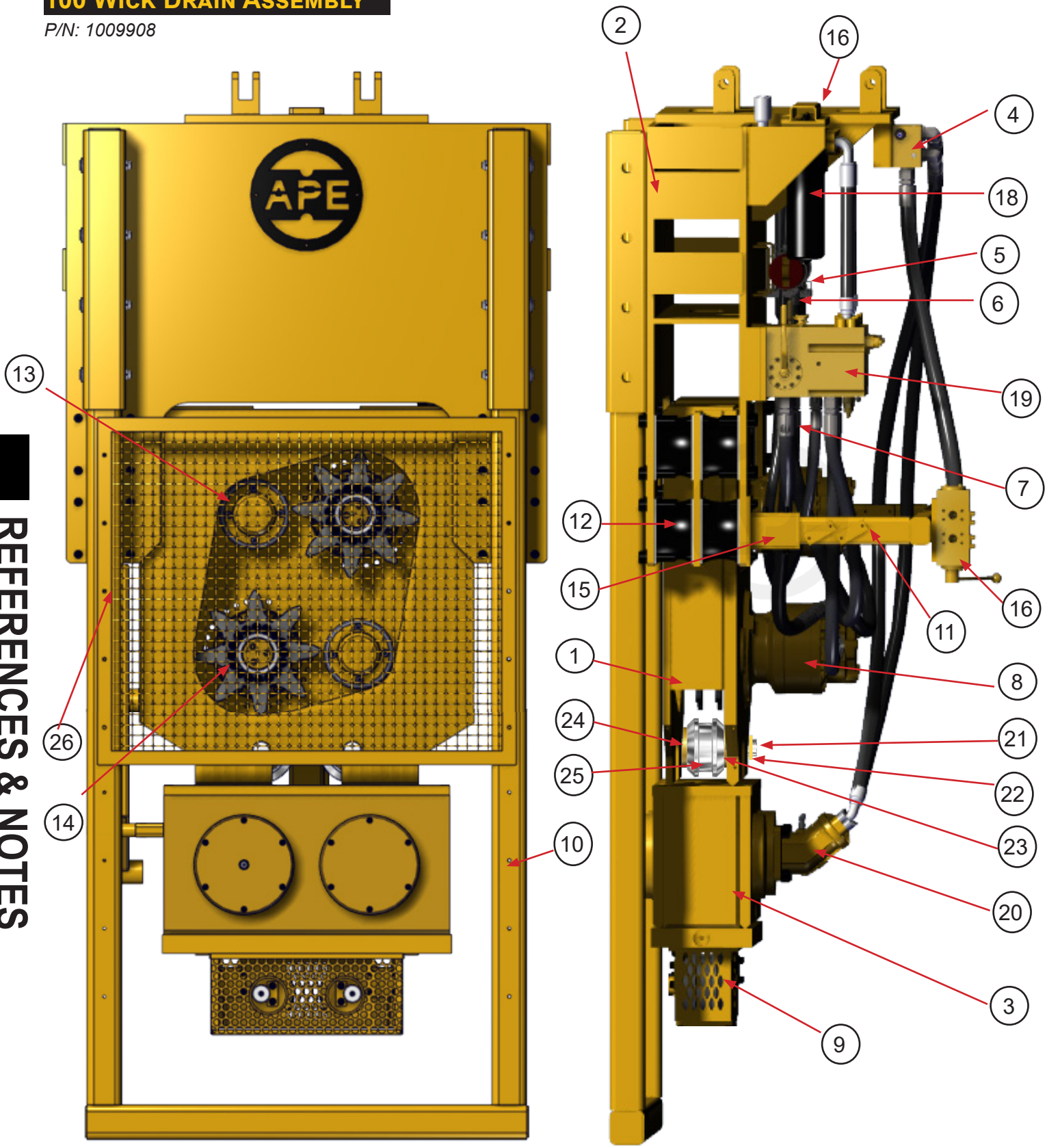
Return of Parts

If for any reason you desire to return parts to the factory or to any distributor from whom these parts were obtained, you must first secure permission to return the parts. Shipping instructions will be given along with this permission. A ten percent handling charge must be assessed against the returned shipment unless an error is made by the factory or by the distributor when filling your order.

A tag with identifying numbers for the unit.

100 Wick Drain Assembly

P/N: 1009908



100 Wick Drain Assembly Bom

P/N: 1009908

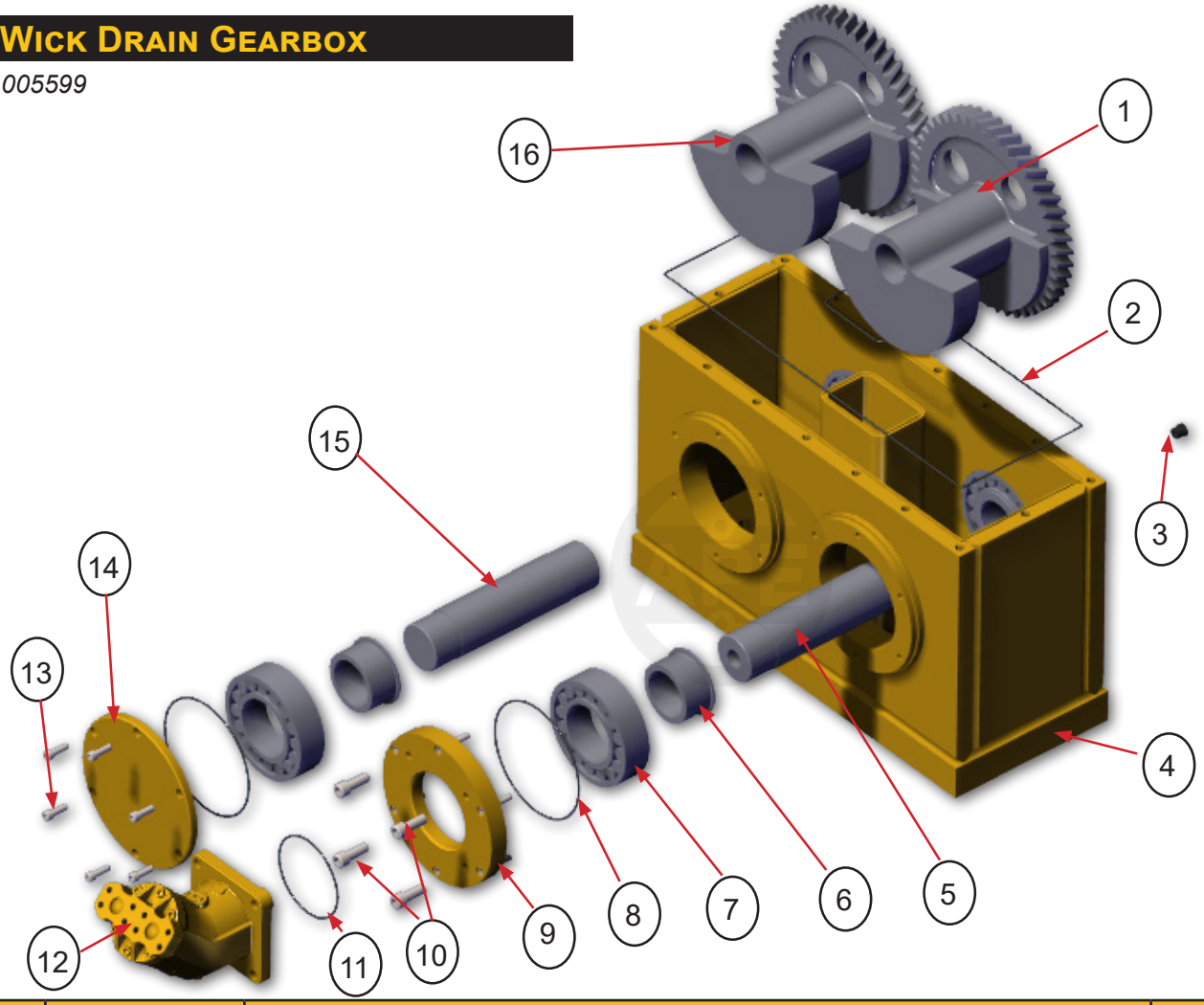
Item no.	Part no.	Description	Qty
1	1005601	100 WICK INNER SUPP. MACHINING	1
2	1009903	100 WICK OUTER SUPP. MACHINING EXTEND	1
3	1005599	100 GEARBOX ASM	1
4	1009541	(OLD) BRAKE VALVE	1
4	2001077	**(NEW) BRAKE VALVE**	1
5	1000952	ACCUMULATOR ASM	1
6	1001044	ACCUMULATOR. MOUNT ASM	2
7	1009543	CHARGE MANIFOLD	1
8	352027	(OLD) MS35 MOTOR	2
8	1009378	**(NEW) SAI MOTOR - GM4 800 9HGP D47RA DBM PSR200**	2
9	1002323A	GUIDE ROLLER ASSEMBLY	1
10	1009904	STANDOFF LEG-EXTENDED	1
11	1001502	200 WICK SUPPORTING FRAME	1
12	100796	ELASTOMER	8
13	1002099	DIRT GUARDS ASSEMBLY	2
14	1002143	SPROCKET & HUB ASSEMBLY	2
15	352061	SUPPORT FRAME BRACKET	2
16	352021	FEROY SELECTOR VALVE	1
17	1001411	RETURN FILTER KKZ25	1
18	1001412	PRESSURE FILTER HSN60 / 13HZ10	2
19	1003812	MANIFOLD #016133	1
20	1004931	MOTOR-HYDRO LEDUC MA125	1
21	2009063	GUIDE ROLLER PIN	2
22	352028	KEEPER PLATE	2
23	2009064	ROLLER SPACER 1.25	2
24	2009065	ROLLER SPACER 0.50	2
25	1004454	ROLLER AND BUSHING ASSEMBLY	2
26	2006603M	GRATES	

Common Replacement Filters

Item no.	Part no.	Description	Qty
1	2003562	HSN60 / 13HZ10 PRESSURE FILTER ELEMENT	2
2	100586	KKZ25 FILTER ELEMENT	1

100 Wick Drain Gearbox

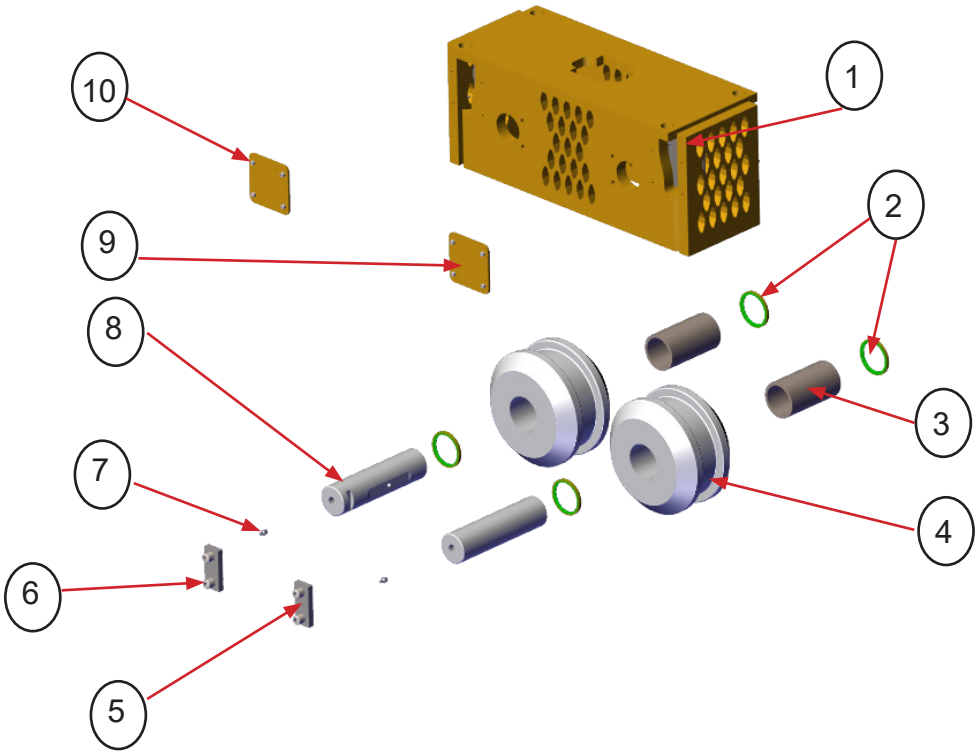
P/N: 1005599



Item No.	Part No.	Description	Qty
1	181007F	ECCENTRIC RIGHT	1
2	352079	O-RING CORD 0.13 C.S	1
3	123005	SIGHT GLASS	1
4	1005598	GEARBOX MACHINING	1
5	352045	DRIVE SHAFT	2
6	181005	BEARING SLEEVE	4
7	181001A	22224 ECCENTRIC BEARING	4
8	352081	2-272 O-RING	4
9	352011	BEARING COVER MOTOR MOUNT	1
10	CONTACT APE	BEARING COVER MOTOR MOUNT BOLTS SHCS	4
11	352113	2-163 O RING	1
12	1004931	MA125 PISTON MOTOR	1
13	CONTACT APE	BEARING COVER BOLTS - SHCS	24
14	181004	BEARING COVER	2
15	181003	ECCENTRIC SHAFT	1
16	181007F	ECCENTRIC LEFT	1
17	352077	ECCENTRIC BEARING COVER/SAE BREATHER PORT	1

100 Wick A-Guide Roller Asm BOM

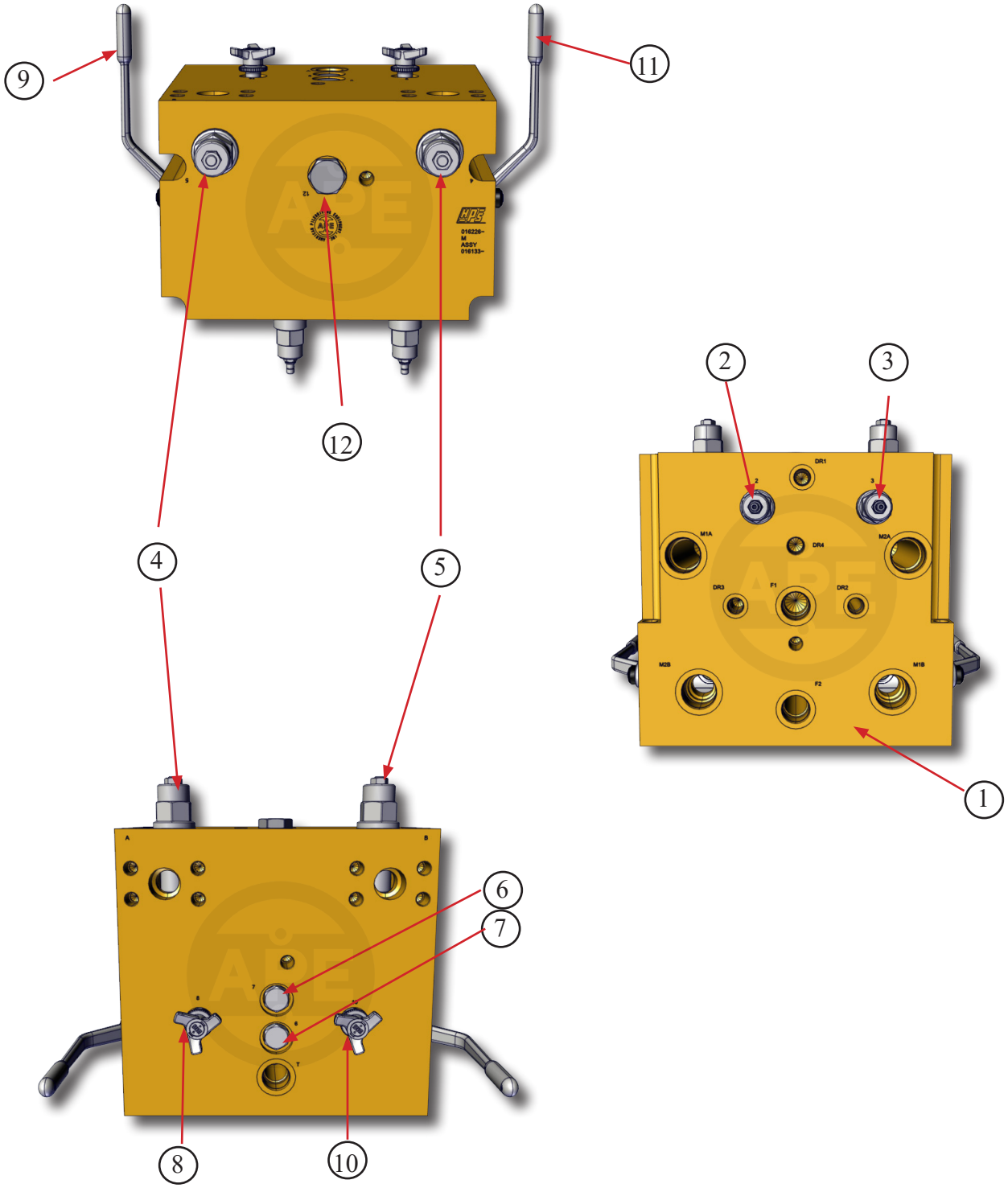
P/N: 1002323A



Item No.	Part No.	Description	Qty
1	1002292	ROLLER FRAME ASM MACHINING	1
2	1002163	WIPER SEAL ASM	4
3	1002301	BUSHING	2
4	1002300	GUIDE ROLLER	2
5	352028	ROLLER PIN KEEPER PLATE	2
6	CONTACT APE	HX-SHCS 0.625-11X0.625X0.625-N	4
7	CONTACT APE	GREASE ZERK	2
8	2009063	GUIDE ROLLER PIN	2
9	1003153	COVER PLATE	4
10	CONTACT APE	HX-SHCS 0.625-11X0.625X0.625-N	16

WICK MANIFOLD

P/N: 1003812

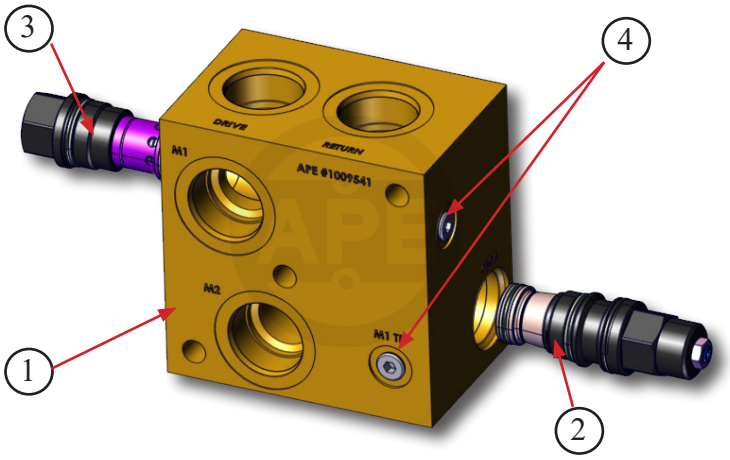


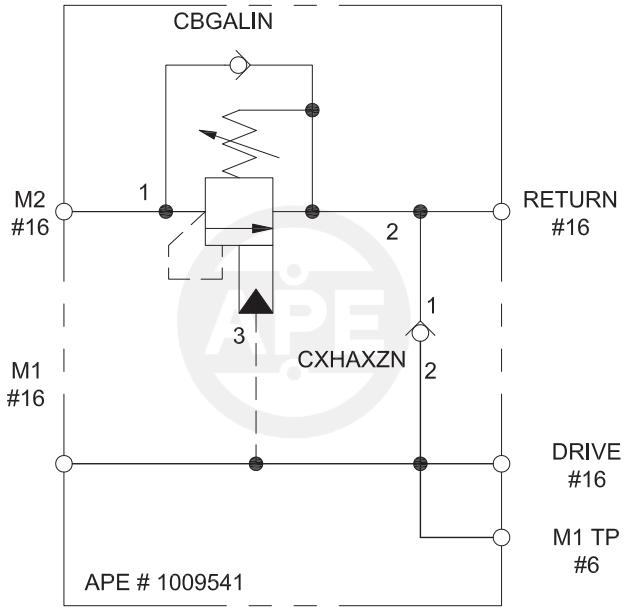
Wick Manifold

Item No.	Part No.	Description	Description 2	Qty
1		DUCTILE IRON MANIFOLD BLOCK	016226	1
2	110239	RELIEF VALVE, DIRECT ACTING, T-16A	RDHALCN	1
3	110239	RELIEF VALVE, DIRECT ACTING, T-16A	RDHALCN	1
4	352117	COUNTER BALANCE VALVE 3:1, T-19A	CBIALBN	1
5	352117	COUNTER BALANCE VALVE 3:1, T-19A	CBIALBN	1
6	110233	CHECK VALVE, T-5A	CXFAXZN	1
7	110233	CHECK VALVE, T-5A	CXFAXZN	1
8	543103	FULLY ADJUSTABLE NEEDLE VALVE, T-13A	NFCCLCN	1
9	CONTACT APE	1-1/4" BALL VALVE INTRAMANIFOLD	SV2C-1250-1111	1
10	543103	FULLY ADJUSTABLE NEEDLE VALVE, T-13A	NFCCLCN	1
11	CONTACT APE	1-1/4" BALL VALVE INTRAMANIFOLD	SV2C-1250-1111	1
12	CONTACT APE	CAVITY PLUG, 2W, ALL PORTS BLOCKED BUNA N	CP16-20-N	1
13	CONTACT APE	TRIP-GRIP HANDKNOB CONTROL KIT	991034	2

Brake Valve Manifold

DWG #1009541

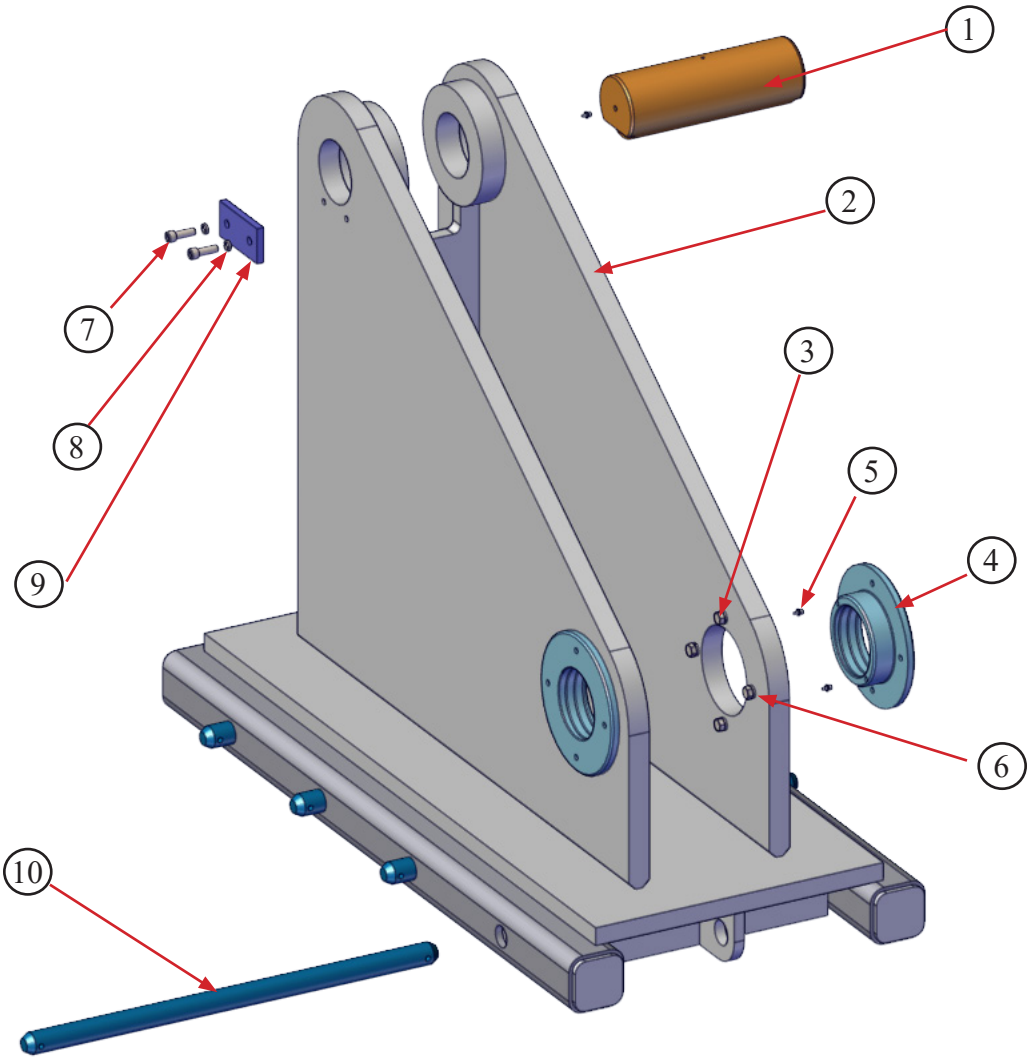




Item No.	Part No.	Description	Description 2	Qty
1	1009540	WICK DRAIN BRAKE VALVE MACHINED		1
2	352116	COUNTER BALANCE VALVE	CBGA-LIN	1
3	352106	CHECK VALVE	CXHA-XZN	1
4	2004448	-6 SAE PLUG	EPCO06	3

PC490LC Boom Tip Connector

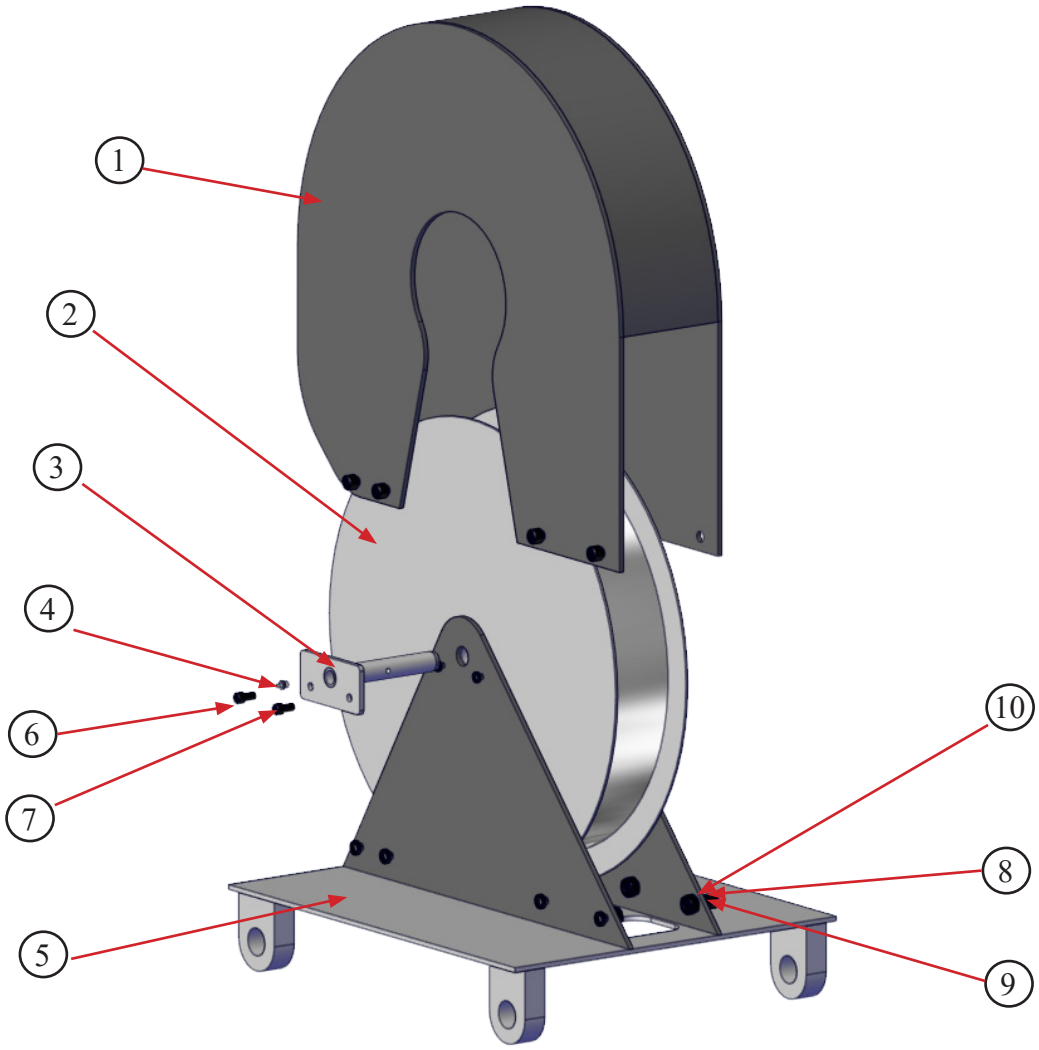
P/N: 1004668



Item No.	Part No.	Description	Qty
1	1003468	Stick Cylinder Pin	1
2	1004668	PC490LC Machined	1
3	Contact APE	Hex Bolt	8
4	1003467	Boom Pin Bushing w/ Grease Zerk	2
5	Contact APE	Grease Zerk	4
6	Contact APE	Lock washer	8
7	Contact APE	Shcs	4
8	Contact APE	Hi collar	4
9	2000133	Stick Pin Retainer Plate	2
10	1005376	Cross Pin	4

Wick Guide Bracket Assembly

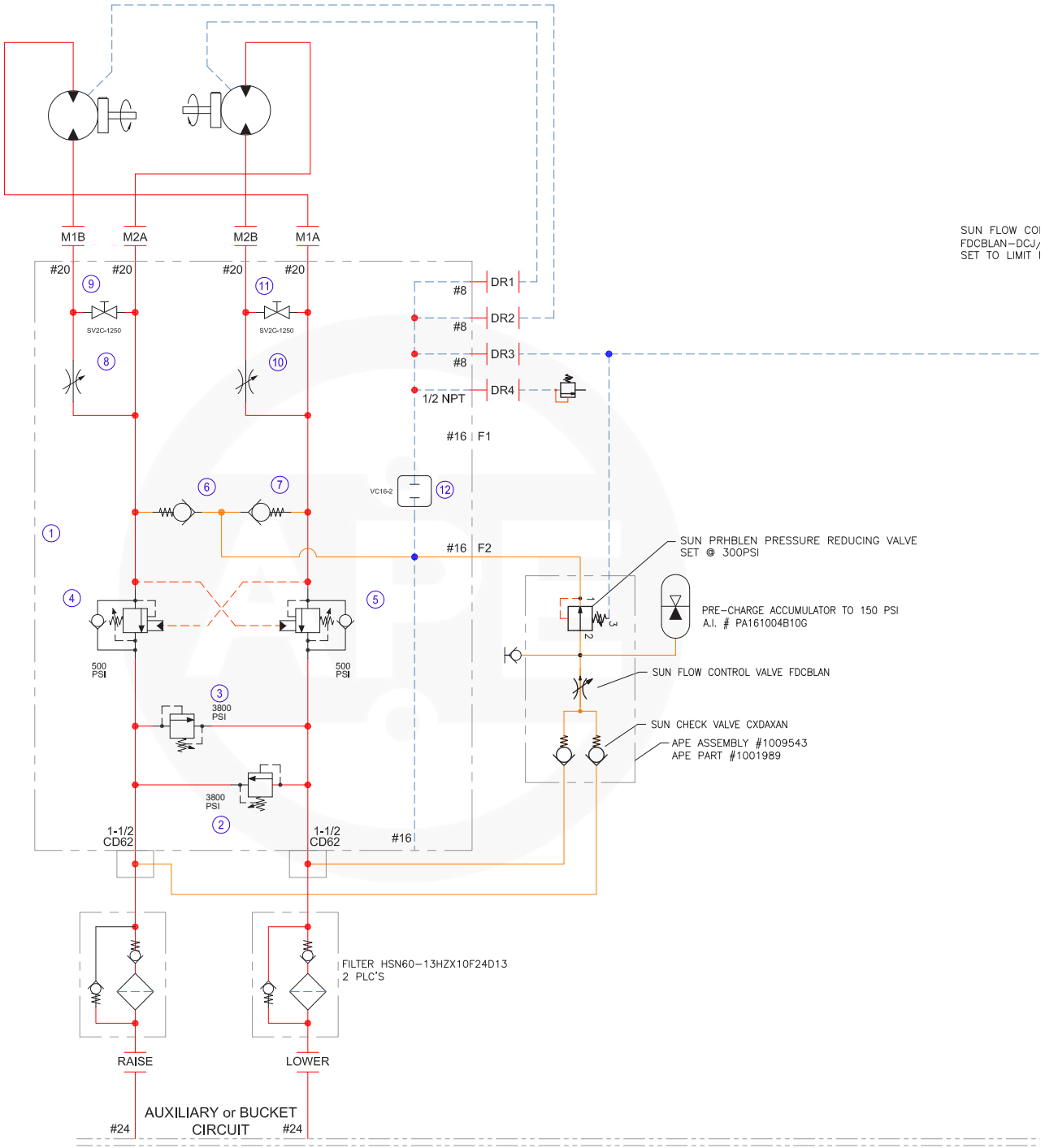
P/N: 852085



Item No.	Part No.	Description	Qty
1	1001101	Roller Bracket Cover	1
2	352089	Wick Guide Roller	1
3	352111	Wick Guide Pin	1
4	Contact APE	Grease Zerk	1
5	352087	Wick Guide Roller Bracket	1
6	Contact APE	0.375 Shcs x .75	2
7	Contact APE	0.375 Hi collar Lock washer	2
8	Contact APE	0.5 Shcs x 1.25	8
9	Contact APE	0.5 Hex Nut	8
10	Contact APE	0.5 Hi collar Lock washer	

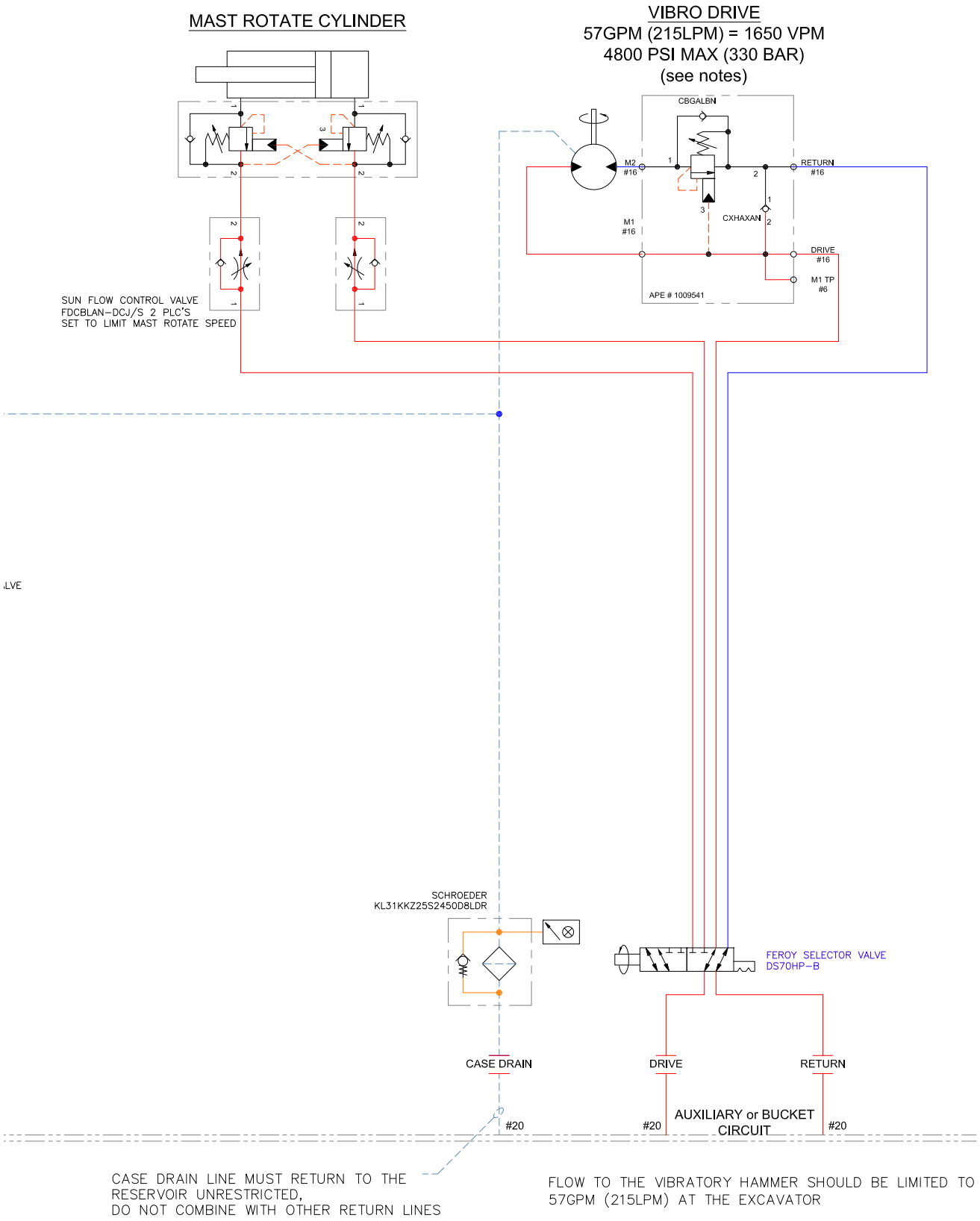
HYDRAULIC SCHEMATIC

MANDREL DRIVE:
100 GPM = 2.8 FT/SEC
120 GPM MAX = 3.3 FT/SEC
3,600 PSI MAX



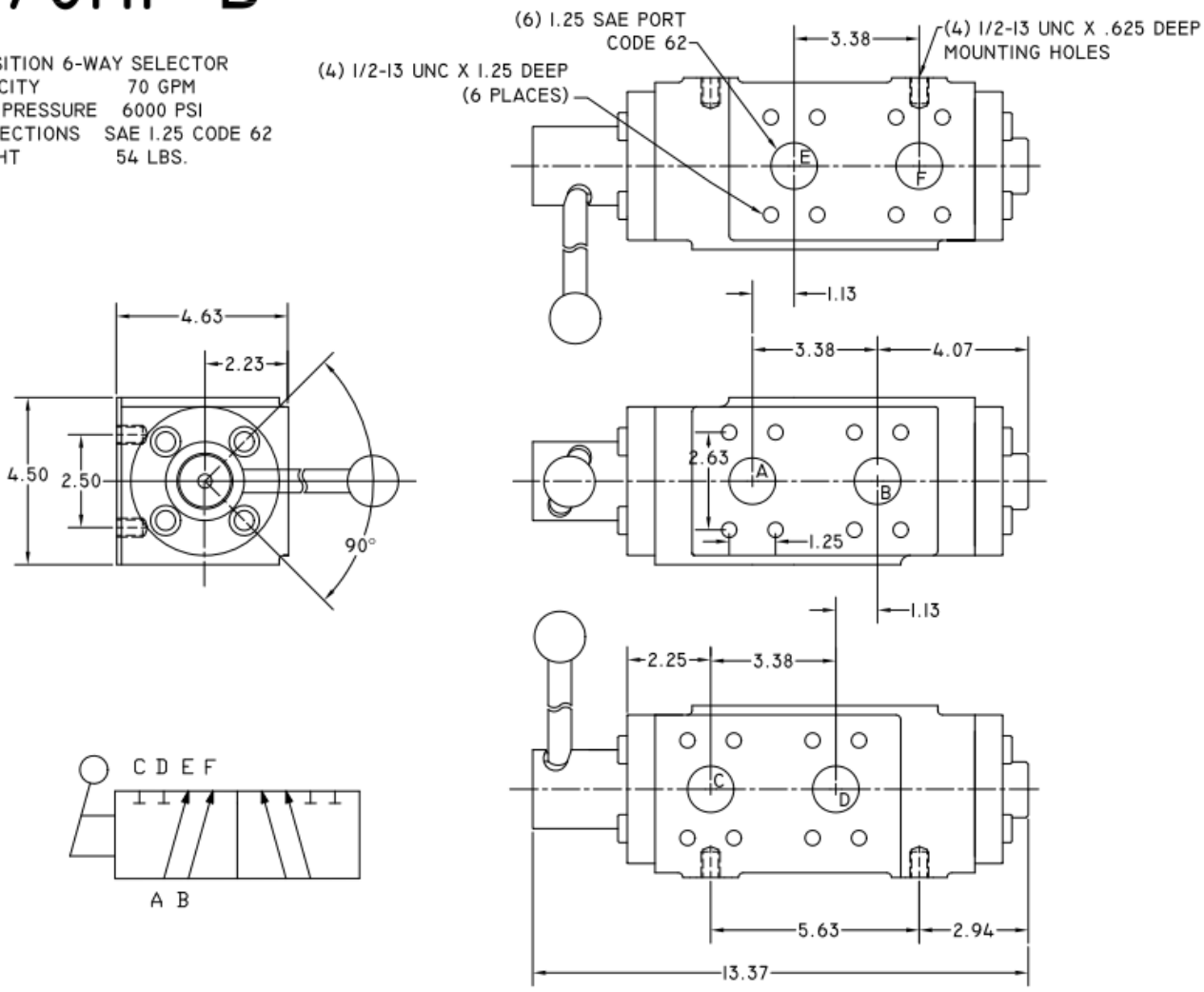
NOTE:
MAX PRESSURES MUST BE SET AT THE EXCAVATOR.
FAILURE TO DO SO WILL CAUSE THE SYSTEM TO OVERHEAT.

THE RELIEF VALVES IN MANDREL DRIVE MANIFOLD ARE FOR OVER PRESSURE PROTECTION ONLY, AND ARE NOT INTENDED TO BE USED TO REGULATE PRESSURE.



DS70HP-B

2-POSITION 6-WAY SELECTOR
CAPACITY 70 GPM
MAX. PRESSURE 6000 PSI
CONNECTIONS SAE 1.25 CODE 62
WEIGHT 54 LBS.



RECOMMENDED BOLT TIGHTENING TORQUE "LUBRICATED SHCS"

Socket Head Cap Screws

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

COARSE THREADS

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

FINE THREADS

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

Recommended Anti-Seize Lubricant

BENEFITS & FEATURES

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

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

SAI Motor Installation, Use, and Maintenance

The following is a list of things to consider when choosing and installing a planetary gearbox. This is a general guideline, for further assistance, either refer to the User Manual or contact Plan Star Engineering.

Installation

The structure or frame on which the gearbox is installed must be sufficiently rigid in order to safely transmit torque and shaft loads.

The wall thickness of the bearing surface is very important and - as a rule of thumb - should not be less than 1.5 to 2 times the fixing bolt diameter. The mating surfaces must be machined with the bearing surface to be perpendicular to the gear axis, the recommended tolerance for the bore is H8.

The mating surfaces must be free from oil and grease. Carefully de-grease them with a suitable solvent, making sure all safety regulations are strictly followed. The use of locking adhesives (e.g. Loctite) on the flange mating surfaces prevents corrosion and may increase the coefficient of friction, but please keep in mind this will make the removal of the unit more difficult. Grease-like corrosion inhibitors are not admissible on the flange mounting surfaces, as they reduce the transmissible torque to a minimum.

Gear units that have a female splined output shaft, which cannot bear any shaft loads, must be carefully aligned. Furthermore, very precise machining of the whole structure is necessary. Perfect perpendicularity between bearing surface and the machine shaft is a must. The machine shaft MUST have its own bearings. Misalignment of the shaft end due to bending is NOT admissable!

Always use all of the bolt holes on the mounting flange. Bolts should be of proven quality and should always have a marking showing the manufacturer and grade. At least 8.8 grade bolts must be installed. In the case of shock loads, inversions, and shaft/torque loads close to the maximum admissable, 12.9 grade bolts are necessary. Tighten the bolts by means of a torque wrench to 80% of the yield strength of the bolts. See the users manual for recommended torque settings.

Larger gear units (starting with size 300) have pre-installed dowels, which must be driven into the machine frame. See dimensional sheets for depth of dowel holes to be drilled (dimension "1f"). These large units provide double pilots (spigots) which both must be used when gearboxes with solid shafts have shaft loads exceeding 50% of the admissable values.

When mounting and removing couplings to (from) input and output shafts use suitale devices (e.g. pullers, jack screws). DO NOT USE A HAMMER!

The general mounting arrangement must allow free access to fill, level, and drain plugs. In case of vertical mounting, extension pipes and external oil tanks might be needed. Table 7 supplies some basic information regarding plug positions. The table covers all gear sizes and versions, however there might be some minor deviations from the chart.

Please ask Plan-Star Engineering for a certified outline drawing of your specific unit before designing your machine.

Breather plugs (vents) and shaft seals must not be painted. Adequate protection during the painting process must be provided in order to avoid solvents or paint to cause damage to the seals or to clog the vent.

Rotating and/or moving parts of the gear units, such as input shafts (HSS), Output shafts (LSS), pinions, sprockets, belt and chain drives, couplings, ect., must be adequately protected against accidental contact. The customer must provide suitable guards/shields in compliance with all applicable safety regulations. Plan-Star Inc. shall not be liable for any injuries or damage to persons or things caused by lack of observance of all applicable rules, regulations, and laws.

Vertical mounting positions with the output shaft pointing upwards must be specified when ordering. Several gear sizes and versions require the installation of grease lubricated top bearings when mounted vertically.

Initial Operation

Make sure the gear box is filled to the correct level with a suitable gear lubricant (See “Lubrication” for further details).

On initial start-up, the gearbox should be run at low speed with no load. It should be observed for 5 minutes, and if no problems are present (such as excessive noise or vibrations), the unit may be run at normal speeds and loads of the given application. The first time that the motor is operation under normal conditions, it should be inspected again for excessive noise or vibration. In case any adverse behavior is noted, check for correct alignment, as well as proper oil level. After first run, check the oil level and for any oil leaks. Make sure that mounting bolts are tightened properly.

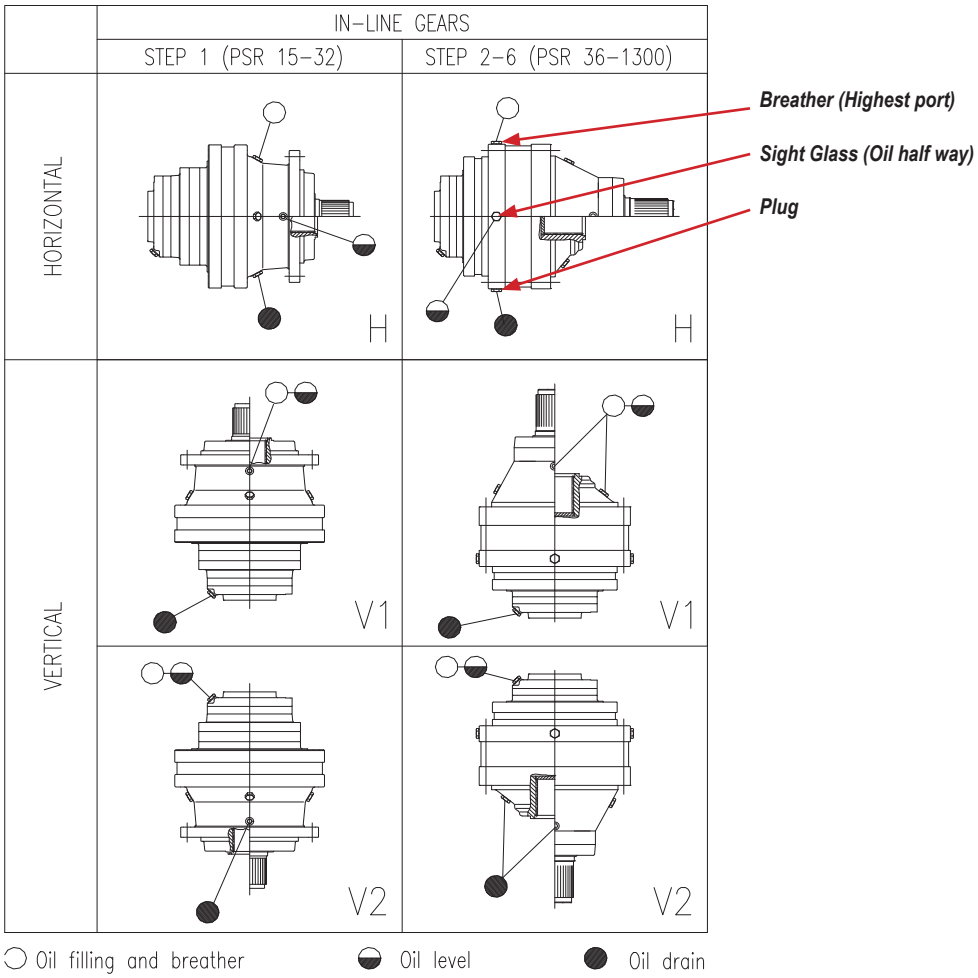
APE has equipped these motors with: Castrol SAE 80W - 90
APE recommends: Schaeffer gear oil 267 SUPREME GEAR LUBE SAE 80W-90

Lubrication

As a standard, the gear unit is delivered without oil. Please make sure the gearbox is filled to the correct level with a suitable gear lubricant before start-up, see table 6 for a list of recommended oils. Lubrication with gycol-based lubricants is admissable in certain instances. The compatibility of the lubricant with the gear box must be verified. Please contact the Plan-Star Engineering Department for further details. See the user manual for maintenance intervals. As a rule of thumb, level checking should be done every three months and oil replacement should take place every 6 to 36 months, based on duty cycle, temperature, and type of lubricant used.

Ambient Temp.		-20°C - +5°C	+5°C - +40°C	+40°C - +65°C	+65°C - +70°C
VISCOSITY	°E/50°C	7.3	10.8 - 12.5	15 - 18	22 - 26
	ISO VG	100	150	220	320
AGIP		BLASA 100	BLASA 150	BLASA 220	BLASA 320
BP		ENEROL GR-HP 100	ENEROL GR-HP 150	ENEROL GR-HP 220	ENEROL GR-HP 320
CASTROL		ALPHA SP 100	ALPHA SP 150	ALPHA SP 220	ALPHA SP 320
CHEVRON		NL GEAR COMPUND 100	NL GEAR COMPUND 150	NL GEAR COMPUND 220	NL GEAR COMPUND 320
ELF		SPARTAN EP 100	SPARTAN EP 150	SPARTAN EP 220	SPARTAN EP 320
ESSO		REDUCTELF SP 100	REDUCTELF SP 150	REDUCTELF SP 220	REDUCTELF SP 320
FINA		GIRAN 100	GIRAN 150	GIRAN 220	GIRAN 320
IP		MELLANA 100	MELLANA 150	MELLANA 220	MELLANA 320
MOBIL		-	MOBILGEAR 629	MOBILGEAR 630	MOBILGEAR 632
SHELL		OMALA EP 100	OMALA EP 150	OMALA EP 220	OMALA EP 320
TOTAL		CARTER EP 100	CARTER EP 150	CARTER EP 220	CARTER EP 320

Table 6: Recommended Gear Oils



Approximate Oil Quantity (Quarts)

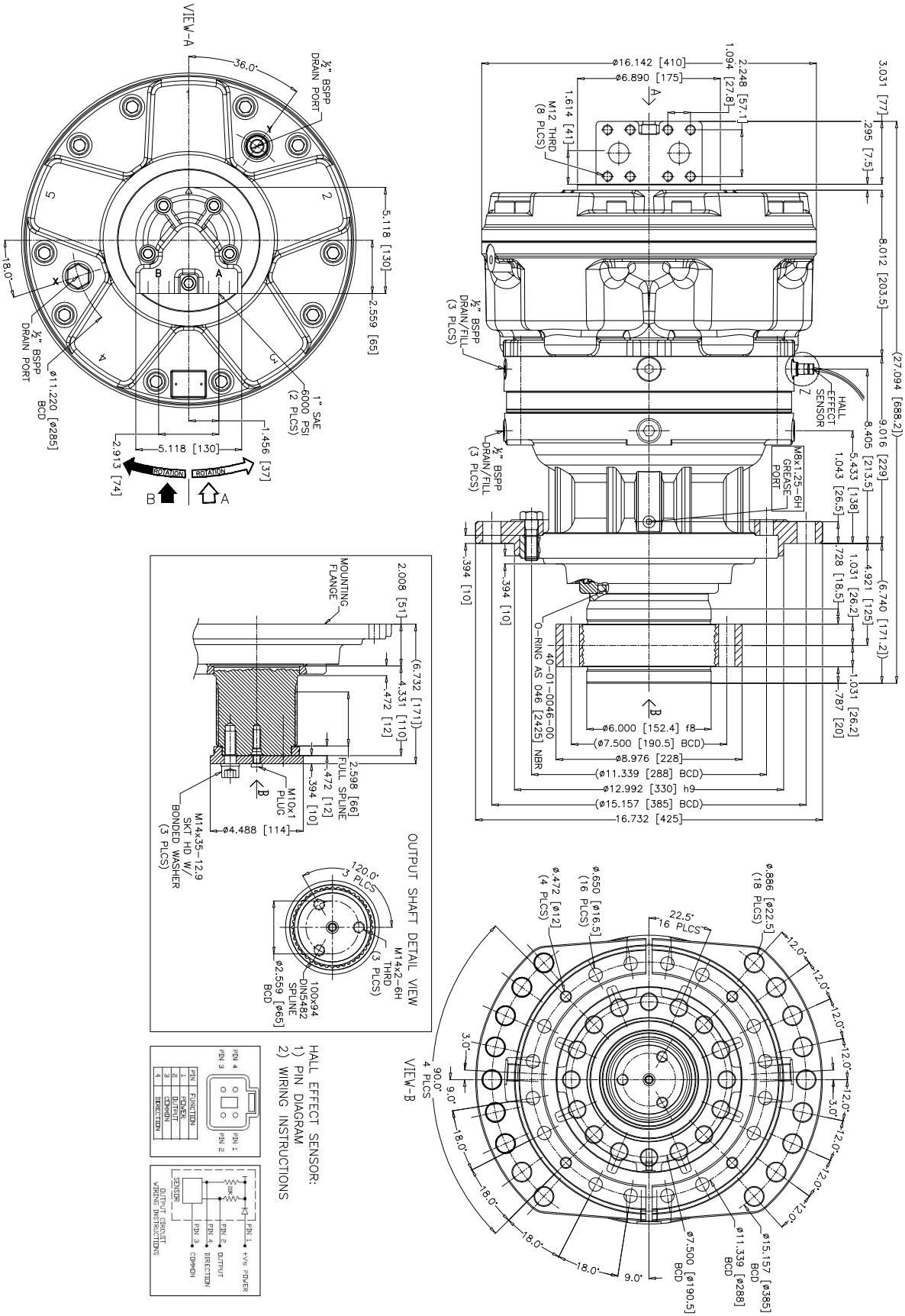
		IN-LINE MALE			IN-LINE FEMALE		
		Horizontal H	Shaft Up V1	Shaft Down V2	Horizontal H	Shaft Up V1	Shaft Down V2
STEP 1 PSR 18-32	1 Stage (L1)	0.5	1	1	0.5	1	1
	2 Stage (L2)	1	2	1.5	1	2	1.5
	3 Stage (L3)	1.5	2.5	2	1.5	2.5	2
	4 Stage (L4)	2	3	2.5	2	3	2.5
STEP 2 PSR 36-67	1 Stage (L1)	1	2	1.5	1	2	1.5
	2 Stage (L2)	1.5	3	2.5	1.5	3	2.5
	3 Stage (L3)	2	3.5	3	2	3.5	3
	4 Stage (L4)	2.5	4	3.5	2.5	4	3.5
STEP 3 PSR 75-130	1 Stage (L1)	2	3	3.5	2	3	3.5
	2 Stage (L2)	3	4	4	3	4	4
	3 Stage (L3)	3.5	4.5	4.5	3.5	4.5	4.5
	4 Stage (L4)	4	5	5	4	5	5
STEP 4 PSR 140-260	1 Stage (L1)	3	5	4	2.5	4.5	4
	2 Stage (L2)	4	6.5	5	3.5	6.5	5
	3 Stage (L3)	5	9	7	4.5	8.5	7
	4 Stage (L4)	5.5	9.5	7.5	5.5	9	7.5
STEP 5 PSR 300-560	1 Stage (L1)	4.5	8	7	4	7.5	6.5
	2 Stage (L2)	6	11	9	5.5	10	8.5
	3 Stage (L3)	9	16	14	7	13	11
	4 Stage (L4)	9.5	16.5	14.5	7.5	13.5	11.5
STEP 6 PSR 710-1300	1 Stage (L1)	8	15	12	6.5	13	10
	2 Stage (L2)	9	17	14	7.5	15	12
	3 Stage (L3)	11	20	17	9.5	18	15
	4 Stage (L4)	12	21	18	10.5	19	16

Bolt Torques

Property Class	8.8		10.9		12.9	
Nominal Size	Bolt Torque Specs in Foot Pounds or (Inch Pounds)					
	Dry	Lubed	Dry	Lubed	Dry	Lubed
M5	(54)	(41)	(78)	(59)	(91)	(68)
M6	(92)	(69)	(133)	(99)	(156)	(116)
M7	(156)	(116)	(222)	(167)	(260)	(195)
M8	(225)	(169)	(333)	(242)	(377)	(284)
M10	37	28	53	40	62	47
M12	65	49	93	69	108	81
M14	104	78	148	111	173	130
M16	161	121	230	172	269	202
M18	222	167	318	238	372	279
M20	314	235	449	337	525	394
M22	428	321	613	460	716	537
M24	543	407	776	582	908	681

Lubed means cleaned dry bolts lubricated with a standard medium viscosity machine oil.

SAI MOTOR REFERENCE / NOTES



REFERENCES & NOTES

UNDERSTANDING ISO CODES

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

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

Sample 1 (see photo 1)

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

Sample 2 (see photo 2)

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

Photo 1

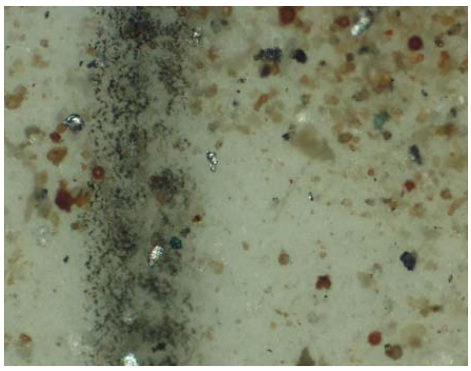
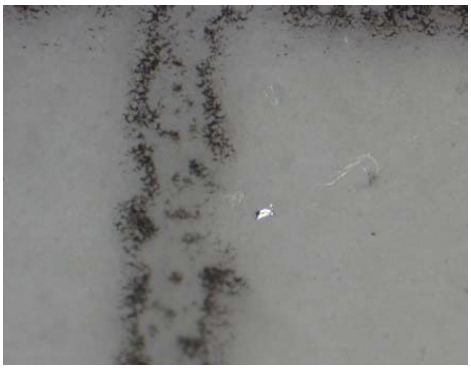


Photo 2



TARGET ISO CLEANLINESS CODES

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

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

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

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

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

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

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

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

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

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

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