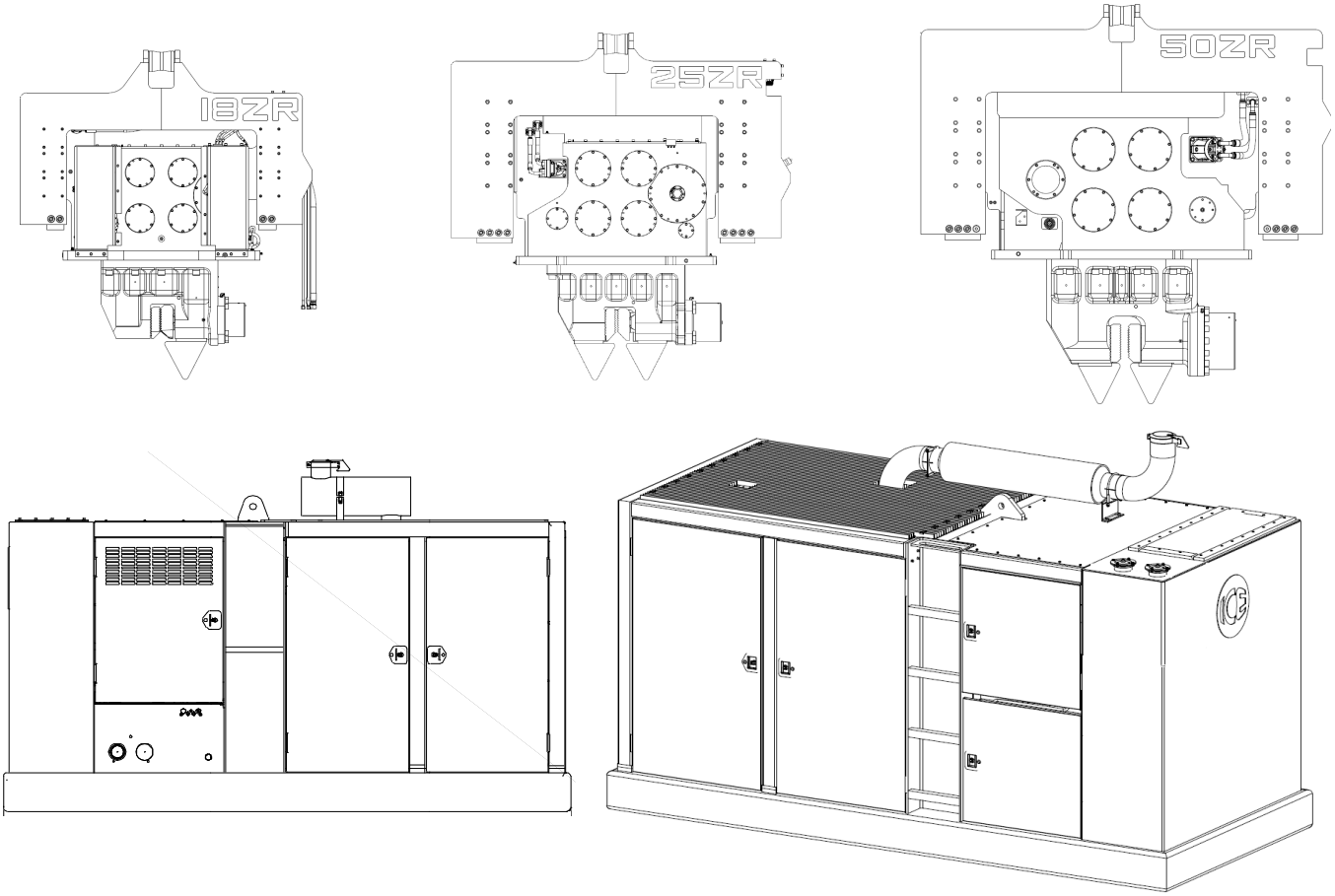
OPERATION AND MAINTENANCE MANUAL

This manual is for ICE Model 18ZR, 25ZR, 50ZR vibrators used with 350GZ, 450GZ, 595GZ power units



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WARRANTY

International Construction Equipment, Inc. Standard Warranty

International Construction Equipment, Inc., hereafter referred to as ICE, warrants new products sold by it to be free from defects in material and workmanship for a period of one year after date of delivery to the first user and subject to the following conditions:

ICE's obligation and liability under this warranty is expressly limited to replacing, at ICE's option, any parts that appear to ICE 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 ICE or at the ICE distributor of the product during regular working hours.

This warranty shall not apply to component parts or accessories not manufactured by ICE and which carry the warranty of the manufacturer thereof or to normal maintenance parts (such as filters).

Replacements 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.

ICE'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 ICE, products or parts for which a warranty claim is made are to be returned, transportation paid, to ICE.

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

For impact pile hammers, driving in excess of 10 blows per inch (25mm) [set of 0.1 (2.5mm) per blow] is considered practical refusal. Driving in excess of 10 blows per inch (25mm) for more than 6 inches (150mm) or driving in excess of 20 blows per inch (25mm) at all is considered improper use and will void the hammer warranty.

For vibratory drivers, driving/extracting when the movement is less than 1" (25mm) per minute is considered practical refusal. Driving/extracting when movement is less than 1" (25mm) per minute for more than 5 minutes of driving/extracting or driving at all when penetration is less than 1" (25mm) per minute and amplitude is greater than 1" (25mm) [vibrator and pile are bouncing] is considered improper use and will void the vibrator warranty. Driving/extracting when bearing covers (paint removed) are above 210°F (100°C) is considered improper use and will void the vibrator warranty. Use of a vibrator on a batter without discussing the operation with ICE and getting prior written approval is considered improper use and will void the vibrator warranty.

For limited-access drills and top-drive rotary heads, the use of a down-the-hole hammer without discussing the operation with ICE and getting prior written approval is considered improper use and will void the drill warranty.

For leads, use in lengths or at batters exceeding the initial set-up without ICE evaluating the new set-up and providing prior written approval is considered improper use and will void the leads warranty.

For power units, welding on power units or other equipment with electrical or electronic controls must be done with the battery leads disconnected. Welding with battery leads connected will void the warranty.

ICE MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

No employee or representative is authorized to change this warranty unless such change is made in writing and signed by an officer of ICE.

INTRODUCTION

Literature

This manual contains parts information for your ICE equipment. This manual should be stored in or near the power unit in a literature holder or literature storage area. Read, study and keep it with the equipment literature, ICE Parts Manuals, and CAT engine information. English is the primary language for the ICE publications. The English used facilities translation and consistency in electronic media deliver. Some photographs or illustrations in this manual show details or attachments that may be different from your equipment. Guards and covers may have been removed for illustrative purposes. Continuing improvement and advancement of product design may have caused changes to your equipment which are not included in this manual. Whenever a question arises regarding your equipment or this manual, please consult ICE or your ICE distributor for the latest available information**.**

Equipment Manual Set

The manuals for your ICE equipment consists of three or four manuals – 1) an Operation and Maintenance Manual for your power unit and vibrator or rotary head, 2) a Parts Manual for your power unit, 3) a Parts Manual for your vibrator or rotary head, and 4) a Vibrator Clamp and Accessories Parts Manual for your vibrator.

Section 1 - General Information

This section provides a description of the equipment and specifications.

Section 2 - Safety

The safety section lists the basic precautions and identifies hazardous and potentially dangerous situations. It is imperative that all operators and support staff read and understand the precautions listed before beginning operation, repair, or maintenance on the equipment.

Section 3 - Loading, Unloading and Shipping

This section provides information for loading, unloading and shipping the equipment.

Section 4 & 5 - Preparation for Operation and Operating Instructions

These sections are a reference for proper operation. Illustrations and proper procedures give guidance for operational preparation, handling, engine starting and equipment warm-up, operation, and stopping the equipment. Controls and gauges are explained. The operational description is basic. Operators gain knowledge and develop skills and techniques that enhance efficiency and economical production through experience and time dedicated to understanding equipment application and operation.

Sections 6 & 7 - Maintenance and Torque Charts

These sections serves as a guide for equipment care. Service intervals, required lubrication, adjustments, and torque specifications for fasteners are listed. Major repairs are not detailed here or in the troubleshooting section. Major repairs should be entrusted only to experienced personnel.

Section 8, 9 & 10 - Troubleshooting, Electrical and Hydraulic Information

These sections aid in resolving difficulties with equipment. The information provided gives indications of possible causes for difficulties and the repairs required to correct malfunctions. Please contact International Construction Equipment, Inc. for assistance in diagnosing unresolved issues and corresponding repairs.

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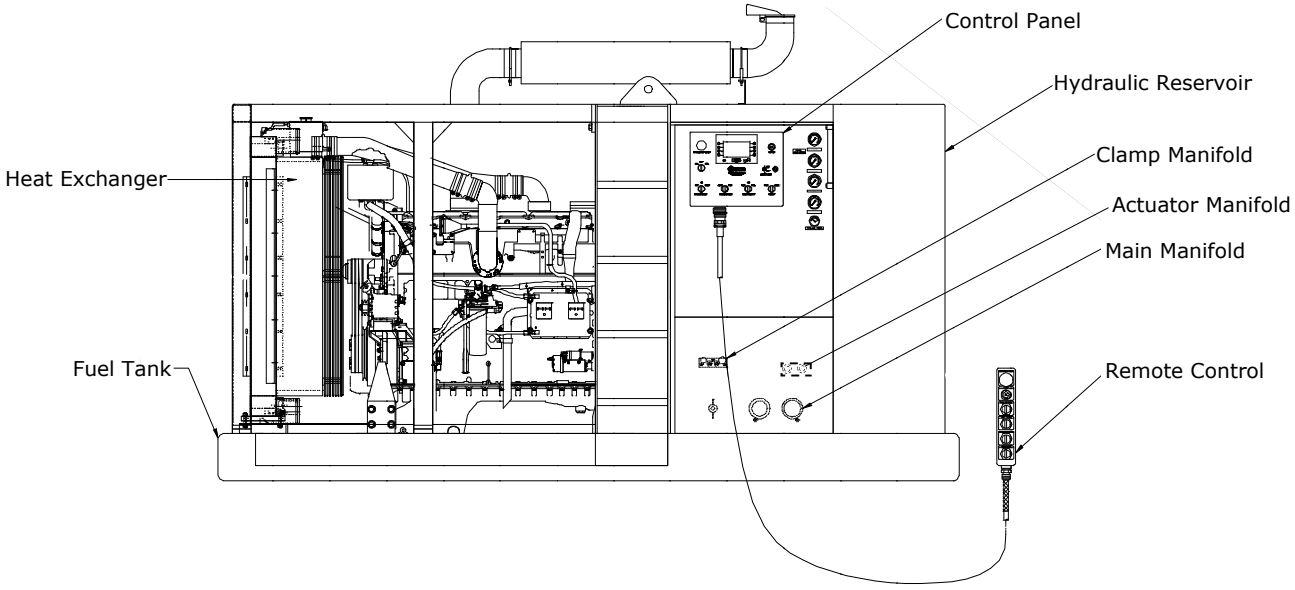
Section 1: GENERAL INFORMATION

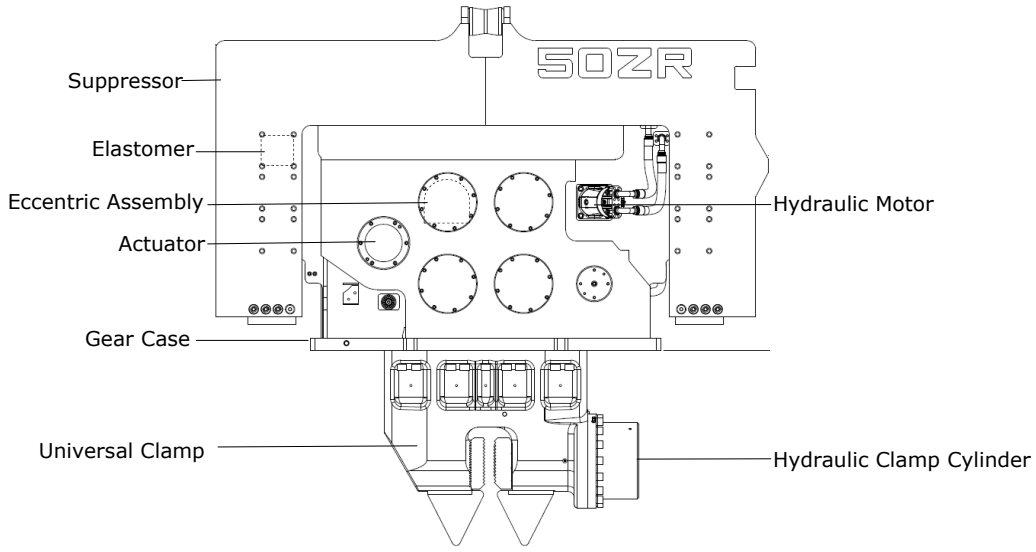
Power Unit

The ICE power unit is powered by a Caterpillar Tier 3 diesel engine and is mounted on a tubular sub-base that serves as a fuel tank. The power unit and vibrator are operated from the control panel or remote control pendant. Hydraulic oil is stored in the reservoir. A heat exchanger is mounted in front of the engine for engine cooling, hydraulic oil cooling, and turbocharger after-cooling. All components are contained in a sheet metal enclosure with lockable doors and a central lifting point.



Vibrator Driver/Extractor

The Vibratory Driver/Extractor consists of three major components - the gear case, the vibration suppressor, and the hydraulic clamp. The gear case contains eccentric weights that rotate in a vertical plane to create vibration. Hydraulic motors drive the eccentric weights. Additionally, the ICE ZR series of vibrators have an actuator that can vary the eccentric moment from zero to maximum. This controlled variable eccentric moment allows for gentle starts and stops. The vibration suppressor contains rubber elastomers to isolate the vibration from the crane line. The hydraulic clamp attaches the vibrator to the pile.



Hydraulic Hoses

There are seven hoses, that connect vibrator to the power unit. Two hydraulic hoses, 150 feet (45 m) in length, connect the main circuit to the motors on the vibrator. Two additional smaller hoses connect the eccentric - moment shift actuator, two more connect the clamp circuit. A hose is also provided for motor case drainage return to the hydraulic reservoir.

Clamps and Accessories

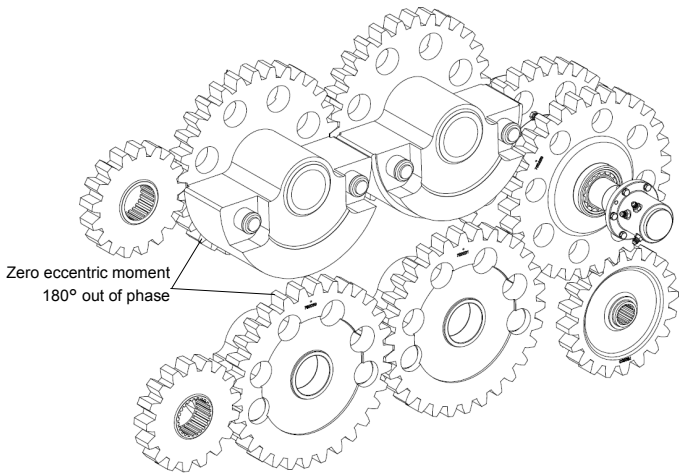
A variety of clamps and accessories are available for ICE vibrators. Please consult the individual Vibrator Parts Manual or the Vibrator Clamps & Accessories Parts Manual.

General Description of ZR Operation

Zero Resonance vibratory driver/extractors eliminate vibration in the damaging range by adjusting eccentric moment to zero during start-up and shut-down. The ZR vibratory driver/ extractors are designed to never operate at a frequency range that could cause resonance vibration to the soil, structures or crane line.

- Prior to start-up, the eccentric moment is set to zero.
- During start-up, vibrator frequency passes through 600-1200 vpm with zero eccentric moment'eliminating disturbance in the soil, structures or crane line.
- After full operating frequency is reached, eccentric moment is set to maximum for driving and extracting.
- Before shut-down, the eccentric moment is again set to zero.
- During shut-down, vibrator frequency again passes through 600-1200 vpm with zero eccentric moment and no disturbance in the soil, structures or crane line.

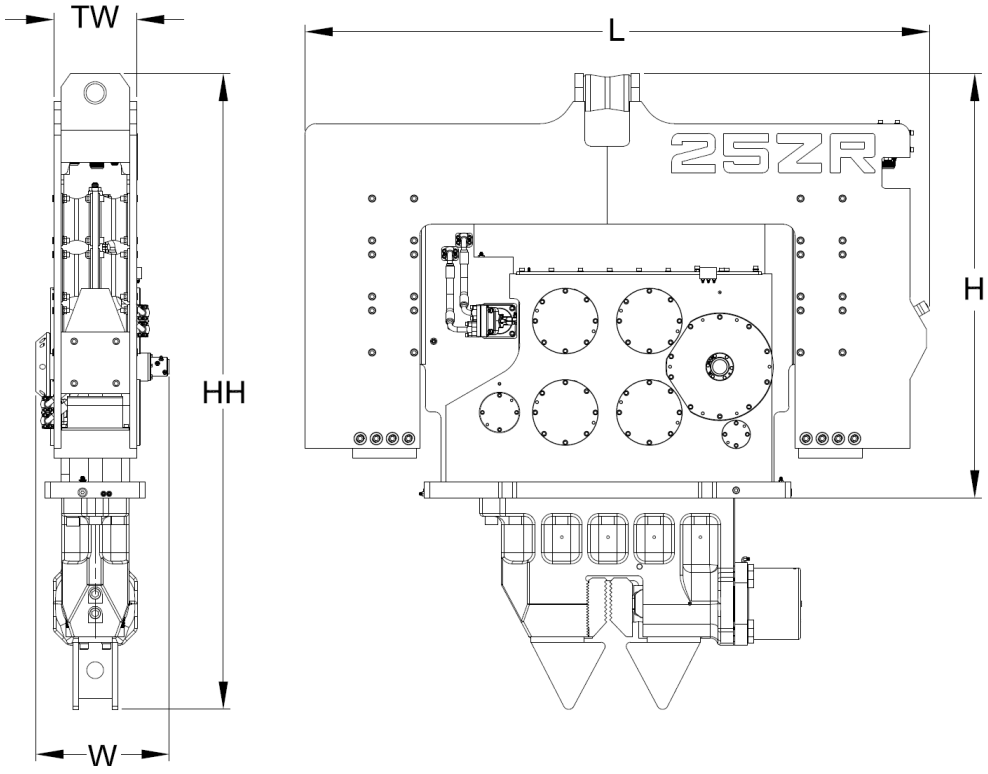
Eccentric moment is controlled from the vibrator remote-control pendant. Shifting between zero and maximum eccentric moment occurs simply and quickly.



Eccentrics 180° out of phase (top to bottom row)

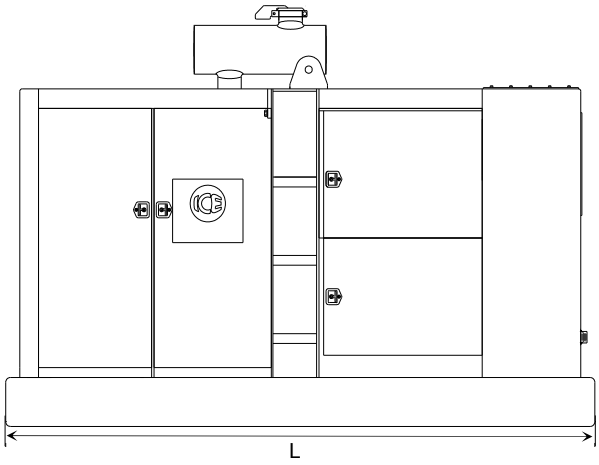
Vibrator Specifications

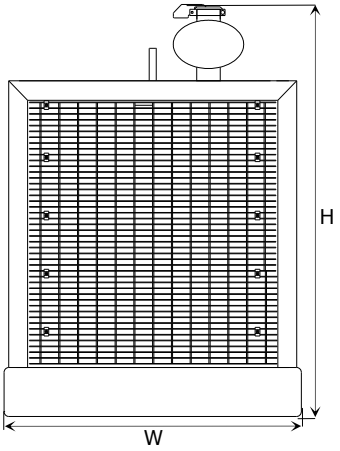
Description	Unit	18ZR	25ZR	50ZR
Eccentric moment	in-lbs, kg-m	1500, 18	2200, 25	4400, 51
Maximum frequency	vpm	1650	2050	1600
Driving Force	tons, kN	93, 825	136, 1 210	168, 1 495
Centrifugal force	tons, kN	85, 755	130, 1 170	160, 1 425
Amplitude (free w/o clamp)	In, mm	0.9, 24	0.8, 20	0.86, 22
Standard line pull for extracting	tons, kN	30, 270	100, 890	120, 1 070
Maximum line pull for extracting	tons, kN	40, 355	100, 890	120, 1 070
Weight (no clamp or hoses)	lbs, kg	7900, 3 585	9650, 4375	14650, 6 645
Non-vibrating Weight	lbs, kg	2960, 1 345	4180, 1 895	4410, 2000
Height without clamp (H)	in, mm	80, 2 035	78, 1 965	82, 2 060
Height with clamp (HH)	in, mm	118, 3 661	116, 2 924	120, 3 019
Length (L)	in, mm	77, 1 945	112, 2 835	131, 3 330
Width (W)	in, mm	21, 525	26, 660	44, 1 120
Throat width (TW)	in, mm	14.25, 362	14.75, 375	14.75, 375
Hydraulic hose length	ft, m	150, 46	150, 46	150, 46
Hydraulic hose weight	lbs, kg	1425, 646	1425, 646	1555, 705
Universal clamp	Model	140	140	196
Universal clamp weight	lbs, kg	2200, 1 000	2200, 1 000	2900, 1 315
Power Unit	Model	350GZ / 450GZ	450GZ / 595GZ	700GZ / 800GZ



Power Units Specifications

Constant improvement and engineering progress make it necessary that we reserve the right to make specification changes without notice. Please consult ICE for the latest available information.





Description	Unit	350GZ	450GZ	595GZ	700GZ	800GZ
Engine - Caterpillar		C9	C13	C15	C18	C18
Power	HP, kW	350, 261	440, 328	595, 444	630, 475	800, 597
EPA, EU	Tier, Stage	3, IIIA	3, IIIA	3, IIIA	3, IIIA	3, IIIA
Operating Speed	rpm	1950	2000	1850	1800	1800
Drive Pressure (max.)	psi, bar	5500, 380	5500, 380	5500, 380	5500, 380	228, 880
Drive Flow (no load)	gpm, lpm	97, 367	126, 477	160, 610	175, 670	228, 880
Clamp Pressure	psi, bar	4800, 331	4800, 331	4500, 310	4500, 310	4500, 310
Clamp Flow	gpm, lpm	6, 21	6, 21	6, 21	6, 21	6, 21
Weight (W)	lbs, kg	11000, 4990	14675, 6657	16350, 7420	26500, 12020	26500, 12020
Length (L)	in, mm	130, 3302	147, 3728	160, 4040	218, 5540	218, 5540
Width (W)	in, mm	62, 1556	64, 1613	73, 1855	80, 2035	80, 2035
Height	in, mm	83, 2108	91, 2312	100, 2540	104, 2630	104, 2630
Hydraulic Reservoir	gal, lit	275, 1040	275, 1040	430, 1630	550, 2080	550, 2080
Fuel Capacity	gal, lit	118, 447	118, 447	150, 570	200, 750	200, 750

Clamp & Accessory Specifications

Please consult the Clamps & Accessories Parts Manual for specification information on those items.

Constant improvement and engineering progress make it necessary that we reserve the right to make specification changes without notice. Please consult ICE for the latest available information.

Section 2: SAFETY

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this equipment can be dangerous and could result in serious injury or death to you or other persons.

Do not operate or perform any lubrication, maintenance or repair on this equipment, until you have read and understood the operation, lubrication, and maintenance and repair information in both the International Construction Equipment, Inc. and Caterpillar Operation & Maintenance Manuals.

Safety precautions and warnings are provided in the manuals. If these hazard warnings are not heeded, serious bodily injury or death could occur to you or other persons.

Important Safety Information is marked as shown below.

!WARNING – Safety!

The meaning of this safety warning is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

!WARNING – Equipment!

The meaning of this safety warning is as follows:

Attention! Become Alert! Equipment could be damaged.

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

International Construction Equipment, Inc. and Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in the manuals and on the equipment are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended in writing by authorized personnel from International Construction Equipment, Inc. or Caterpillar is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the equipment would not be damaged or made unsafe by the operation, lubrication, maintenance and/or repair procedures you choose.

The information, specifications, and illustrations in the manuals are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. International Construction Equipment, Inc and Caterpillar dealers have the most current information available.

Hazard Information

Use caution when removing filler caps, grease fittings, pressure taps, breathers or drain plugs. Hold a rag over the cap or plug to help prevent being sprayed or splashed by liquids under pressure.

Wear a hard hat, protective glasses, hearing protection and other protective equipment as required by job conditions.

Do not wear loose clothing or jewelry that can catch on controls or other parts of the equipment.

Make certain all protective guards and covers are secured in place.

Use all cleaning solutions with care.

Never put maintenance fluids into glass containers since glass containers can break.

Report all needed repairs.

Maintenance Procedures

Stop the equipment. Stop the engine.

Ensure the protective locks or controls are in the applied position.

Disconnect the batteries whenever performing any maintenance or before servicing the electrical system. If the engine has an electric starter, disconnect and tape the battery ground leads to prevent accidental starting.

Disconnect the batteries before performing any welding. Failure to do so will cause serious damage to the power unit's operating system.

Do not attempt any repairs or adjustments to the engine or equipment while it is running.

Do not attempt any repairs that you do not understand or for which you are not qualified. Use proper tools; replace or repair broken or damaged equipment.

Block or restrain the equipment, if applicable before operating or performing maintenance.

Do not adjust, or set, hydraulic pressures higher or lower than those specified in the parts manual.

Pressurized Air and Water Hazards

Pressurized air can cause personal injury. When using pressurized air for cleaning, wear a protective face shield, protective clothing and protective shoes.

The maximum air pressure must be below 30 psi (205 kPa) and maximum water pressure must be below 40 psi (275 kPa) for cleaning purposes.

Wear eye protection at all times when cleaning the cooling system. Pressurized water could cause debris and/or hot water to be blown and result in serious personal injury.

Do not spray pressurized water at the control box. Pressurized water could result in damage to the onboard computer module, which could cause the operating system to malfunction.

Fluid Penetration Risk

Always use a board or cardboard when checking for a leak. Escaping fluid under pressure, even a pinhole size leak, can penetrate body tissue, causing serious injury or possible death.

If fluid is injected into your skin, a doctor familiar with this type of injury must treat it immediately.

Hoses, Lines and Tubes Handling Procedures

Do not pull on, or attempt to move equipment, by force or pressure to the hydraulic hoses. The power unit will need to be moved closer to the work if hoses do not reach.

Do not operate this equipment with hydraulic hoses that are damaged or kinked. Replace damaged hoses immediately.

Do not lift or support hydraulic hoses with wire rope slings.

Do not pull kinks in the hoses. Kinks will reduce the hose safety factor by 50 percent.

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

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

Inspect all lines, tubes and hoses carefully. Do not use your bare hands to check for leaks. Tighten all connections to the recommended torque.

Make sure that all clamps, guards and heat shields are installed correctly to prevent rubbing against other parts and excessive heat during operation.

Hoses, Lines and Tubes Check List

- End fittings damaged, leaking or displaced.
- Outer covering chafed or cut and wire reinforcing exposed.
- Outer covering ballooning locally.
- Evidence of kinking or crushing of the flexible part of the hose.

Precautions for Oils

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

Keep all exhaust manifold and turbocharger shields in place to protect hot exhaust from oil spray in the event of a hose, tube or seal failure.

Fire Extinguisher Requirements

Have a fire extinguisher of the appropriate type and size available and know how to use it. Inspect and have it serviced as recommended on its instruction plate.

Fire or Explosion Prevention

All fuels, most lubricants, hydraulic oil, and some coolant mixtures are flammable.

Diesel fuel is flammable. Gasoline is flammable. The mixture of diesel and gasoline fumes is extremely explosive.

Do not weld or flame cut on pipes or tubes that contain flammable fluid(s). Clean them thoroughly with non-flammable solvent before welding or flame cutting on them.

Shields must be installed correctly. These shields are for the purposes of protecting against some hot exhaust components produced by oil or fuel and can assist in lessening the range of a spray in the event of a line, hose, and tube or seal failure.

Fire or Explosion Prevention (continued)

Clean and tighten all electrical connections. Check regularly for loose or frayed electrical wires. Refer to maintenance schedules for inspection interval. Have all loose or frayed electrical wires tightened, repaired or replaced before operating the equipment.

Wiring must be kept in good condition, properly routed and firmly attached. Routinely inspect wiring for wear or deterioration. Loose, unattached, or unnecessary wiring must be eliminated. All wires and cables must be of the recommended gauge and properly fused. Never bypass fuses. Maintaining tight connections, and replacing worn, frayed or damaged wire and cable will prevent arcing that could cause a fire.

Crushing or Cutting Prevention

Support equipment and attachments properly at all times and especially when working beneath them.

Never attempt adjustments while the engine is running unless otherwise specified in this manual.

Stay clear of all rotating and moving parts. Guards should be in place whenever maintenance is not being performed.

Keep objects away from moving fan blades. They will throw or cut any object or tool that falls into their path.

Wear protective glasses when striking objects to avoid injury to your eyes.

Make sure no one can be injured by flying debris before striking any object. Chips or other debris can fly off objects when struck.

Mounting and Dismounting

Do not climb on, or jump off the equipment or stand on components that cannot support your weight. Use an adequate ladder. Always use steps and handholds when mounting and dismounting.

Clean steps, handholds and areas of the equipment you will be working on or around.

Before Starting the Engine

Read "Before Starting the Engine" in the Caterpillar Operation & Maintenance Manual.

Make sure the remote-control pendant (or radio control) is in a safe place. Do not leave the pendant (or radio control) unattended.

On the control panel, make sure the main circuit (REV-OFF-FOR) and auxiliary circuit (REV-OFF-FOR) switches are set to OFF.

On the remote-control pendant, make sure the main circuit (REV-OFF-FOR) and auxiliary circuit (REV-OFF-FOR) switches are set to OFF.

On the control panel and pendant, make sure the clamp OPEN-CLOSE switch is in the center (neutral) position.

Make sure power unit is on level, stable ground.

Make sure equipment areas are clear for operation.

Do not smoke or use open flame in the vicinity when filling fuel tanks or when flammable vapors are present.

Section 3: LOADING, UNLOADING & SHIPPING

Power Unit

The power unit should be loaded with the heat exchangers facing to the rear of the truck to prevent damage to the heat exchangers from flying objects. The power unit is usually held to the truck by wrapping a chain around both ends of the fuel tank sub-base. Before shipping the power unit, tape the exhaust rain cap shut to prevent rainwater from entering. If quick-couplers do not have safety cables for the caps and plugs, store caps and plugs under the panel in the storage box rather than risk the possibility of them coming loose and falling off into traffic. Make sure all doors are fully closed and latched. Tighten fuel cap and close fuel petcock to prevent loss of diesel fuel.

Vibrator or Rotary Head

The equipment should be shipped laying or sitting flat on the trailer deck. Lift the equipment by rigging one line to the lifting pin and one line to the hose bundle as one load. Avoid crushing hydraulic lines.

Damage During Shipment

Before the truck leaves, carefully inspect the equipment and hoses for any missing components or signs of damage that may have occurred during shipment or unloading. In the event of damage during shipment, notify the trucking agent at once. Note all damage on the bill of lading. Fax or email the information to International Construction Equipment, Inc. as soon as possible. Any delay may make it difficult to identify the responsible party.

Section 4: PREPARATION FOR OPERATION

General

When unloading and unpacking the power unit and equipment, use extreme care.

For your protection, make a thorough inspection of the unit immediately upon 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.

Rigging of Vibrator

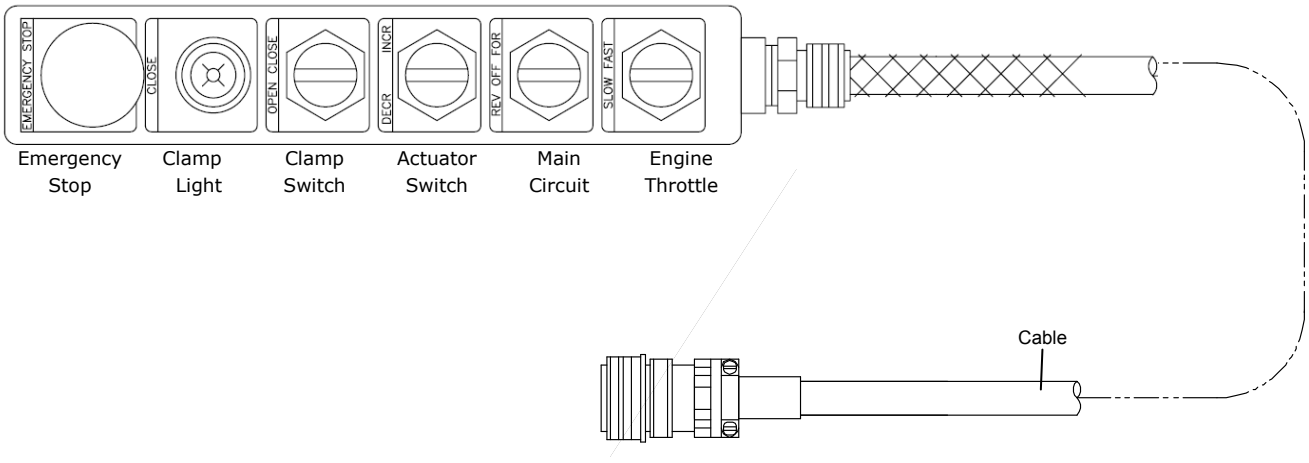
A steel wire rope sling must be connected to the lifting pin of the vibration suppressor. The required strength of this sling depends on the capacity of the crane and the work to be carried out. A safety factor of five is recommended. Several turns of a smaller diameter cable will usually last longer than one turn of a larger diameter cable. Consult a rigging expert or rigging handbook for guidance. Be aware of protocols, regulations, and guidelines for rigging.

!WARNING – Safety!

Wire rope failure or cable clamp slippage may result in injury or death.
Check cables and cable clamps daily.

Installing Proper Remote-control Pendant

To use power unit with vibrator, install ZR vibrator remote control pendant



Amphenol™ Connection to Power Unit Control Panel

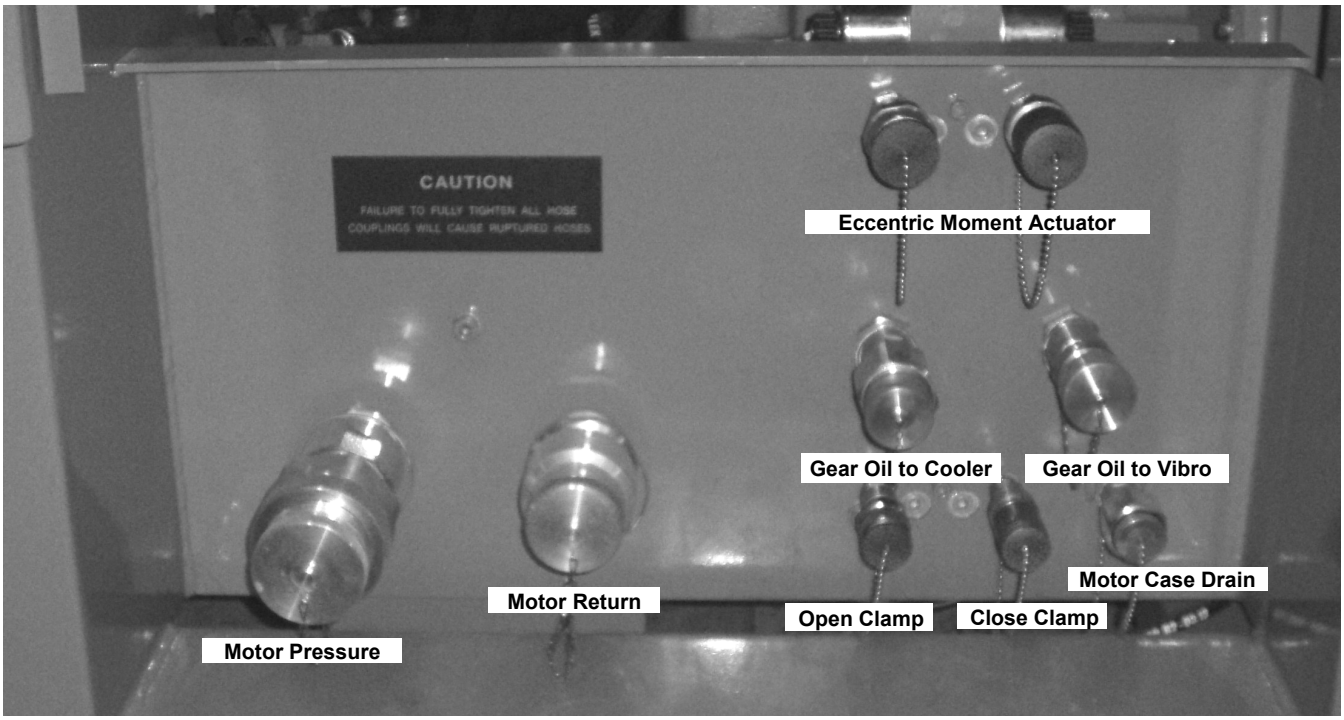
The remote-control pendant is connected to the power unit at the control panel with a multi-pin modular plug and hand nut connection. The pendant control has switches for the clamp, vibrator, engine throttle, emergency stop, clamp indicator light. The cable allows 50 feet of distance from the power unit. If pendant cable needs to be connected to power unit, align modular plug and push together before tightening metal nut on Amphenol™ connection.

!WARNING – Equipment!

Remote Pendant should not be left unattended while power unit engine is running. Be cautious of damaging pendant cable or allowing controls to be submerged in water or mud. Avoid stretching cable or shutting control panel door on cord.

Connecting Vibrator Hoses to Power Unit

350GZ Quick Disconnect Panel



The vibrator's interconnecting hoses (in the bundle) terminate with quick disconnect couplers specific to each function and mating quick disconnect at the power unit. Use care to connect couplers straight and screw together completely. Should quick disconnects or hoses require replacement, use care not to mix up the connectors and hose routing.

!WARNING – Safety! **!WARNING – Equipment!**

Power unit must be shut down during connection of hydraulic hoses.
Improper hose connections can cause ruptured hoses or damaged components and poor equipment performance.

The vibrator and hydraulic clamp are connected to the power unit by seven hydraulic hoses. The functions are listed above on the corresponding quick disconnect couplers.

The hoses connect to the power unit with quick-disconnect couplers. Hose couplers are arranged to insure correct connections at the power unit .

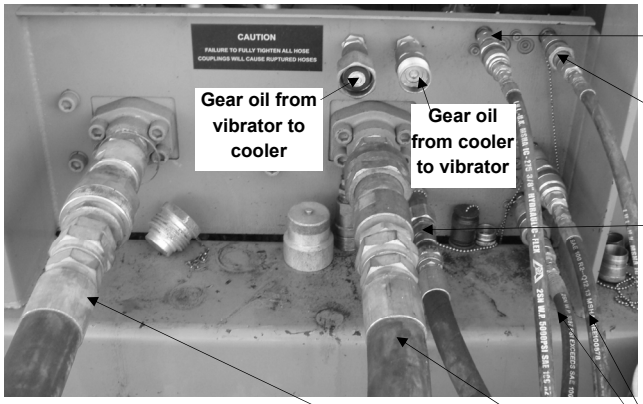
Clean couplers with a lint-free cloth before making connections.

Make sure that the couplers are fully run up and hand tightened prior to using an appropriate chain type wrench.

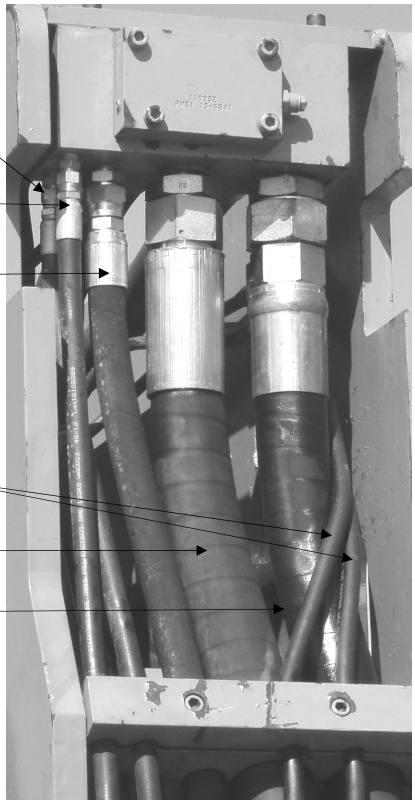
Connection of Hydraulic Hoses at Vibrator

The vibrator is usually shipped with the hoses attached. The quick disconnect ends are oriented on the inter-connecting hose bundle, so that lines can only be connected only to the proper corresponding quick disconnect at the power unit. Should it be necessary to remove hoses or quick disconnect fittings, verify correct routing in reference to the power unit connection(s). If there is any confusion, contact ICE to avoid damage to equipment and risk to personnel when in operation.

595 GZ Power Pack Quick Disconnect Panel



50ZR Hoses at Vibrator



Hoses at the vibrator are connected with JIC fittings. Make sure fittings are tight when replacing hoses. Check for oil leaks when operating, using all safety measures to avoid being sprayed by pressurized hydraulic oil.

Attaching Hydraulic Clamp or Caisson Beam to Vibrator

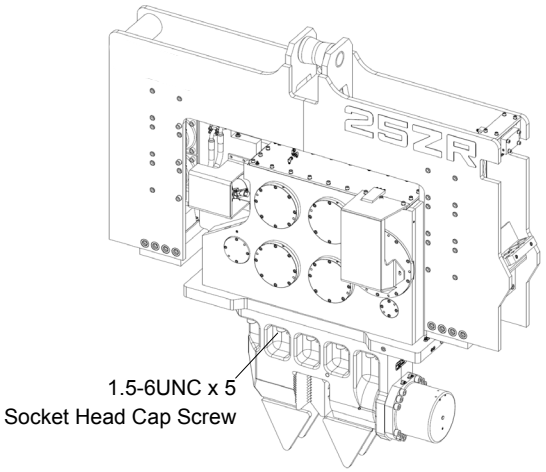
The vibrator is often shipped with the hydraulic clamp or caisson beam already attached. If the clamp or beam is not attached, it will be necessary to attach it to the bottom of the vibrator.

!WARNING – Safety! **!WARNING – Equipment!**

The bottom of the vibrator and the top of the clamp or caisson beam must be clean and free of rust or paint. Dirt, rust or paint could cause bolts to loosen and the clamp or beam to come loose.
Use only high strength (grade 8) socket-head cap screws to attach clamp or beam.

Attaching Sheeting Clamp to Vibrator

Attach the clamp to the vibrator with the clamp cylinder end (moveable jaw) at the same side of the vibrator as the hose chute. All 1.5-6UNC x 5 socket-head cap screws with lock washers must be in place and tightened to approximately 2,700 ft-lbs (3600 N-m). Read Section 7: TORQUE SPECIFICATIONS. See "Connection of Sheeting Clamp Hoses".

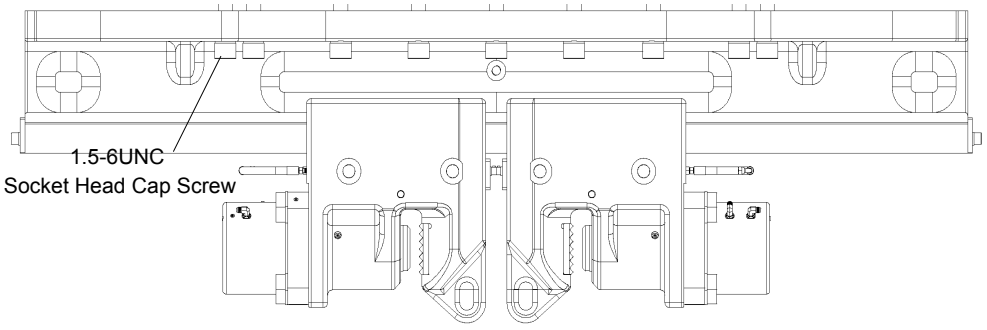


!WARNING – Safety! **!WARNING – Equipment!**

Under-tightening or over-tightening may cause bolts to break and clamp or caisson beam to come loose. If one bolt breaks, others may be damaged and all must be replaced.
Never use vibrator if one or more bolts are broken.
Check bolt torque daily. See Section 7: TORQUE SPECIFICATIONS.

Attaching Caisson Beam to Vibrator

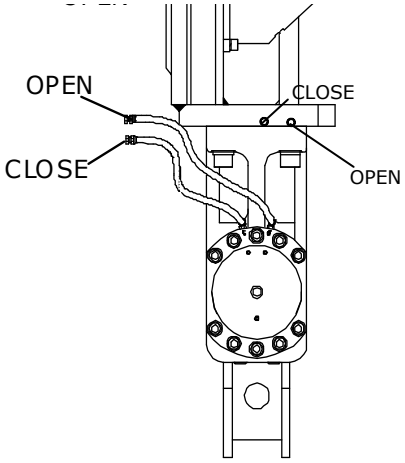
Attach the caisson beam to the bottom of the vibrator and tighten as above. Different caisson beam require different length bolts. Check Vibrator Clamp Parts Manual for correct length of bolts and whether lock washers are required. Bolts should allow for 1½ - 2" (35-50 mm) of penetration into vibrator base. After caisson beam is attached to vibrator, slide the caisson clamps into position on the caisson beam and lock in place.
The mating surfaces of the caisson beam and clamps must be clean and free of dirt, rust or paint. See "Connection of Caisson Clamp Hoses".



Connection of Sheeting Clamp Hoses

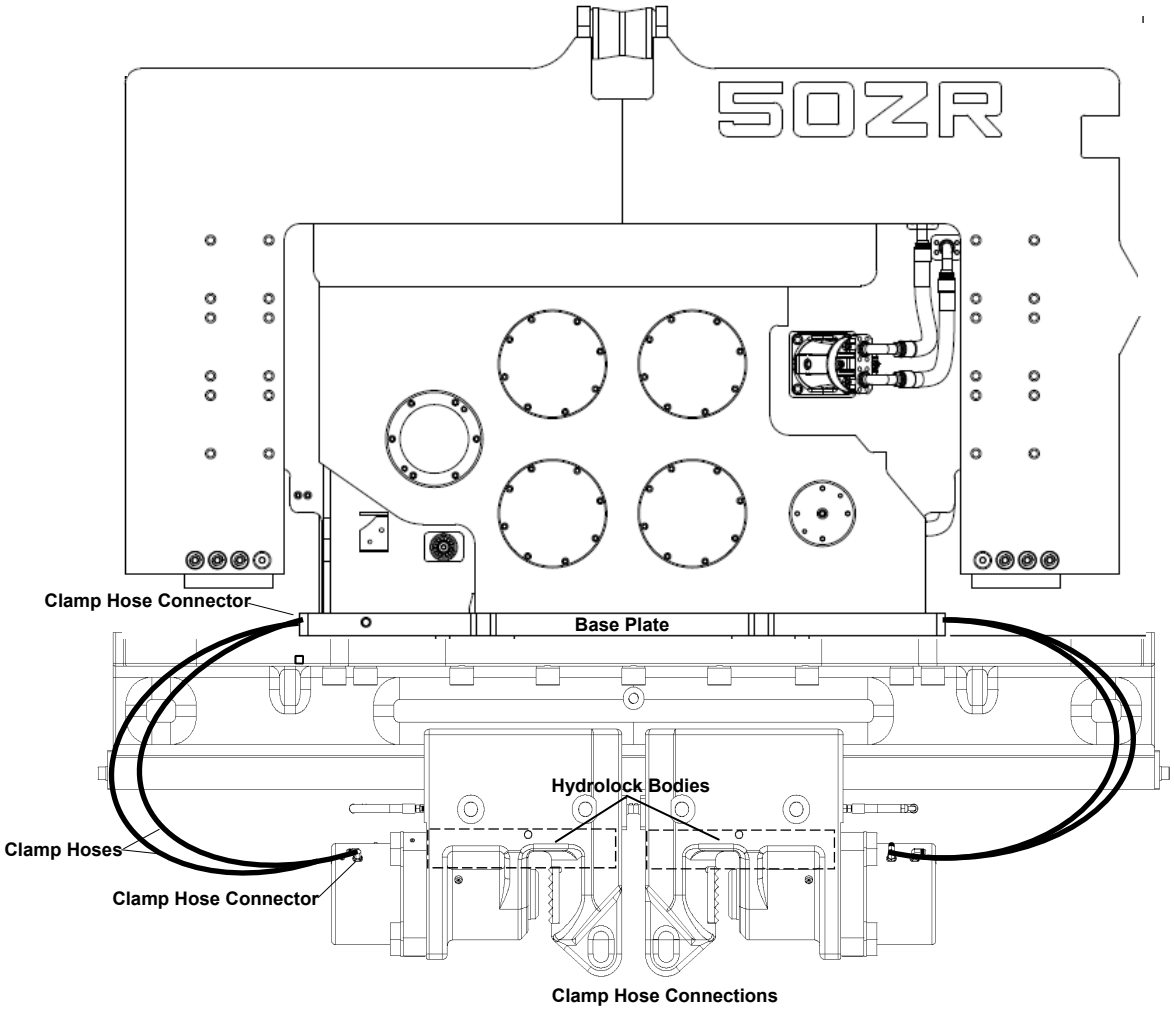
1. Connect two hoses at end of the vibrator to the sheeting clamp at that end as shown at right.

2. Connect hose from fitting marked "C" on vibrator to fitting marked "C" on clamp. Connect hose from fitting marked "O" on vibrator to fitting marked "O" on clamp.



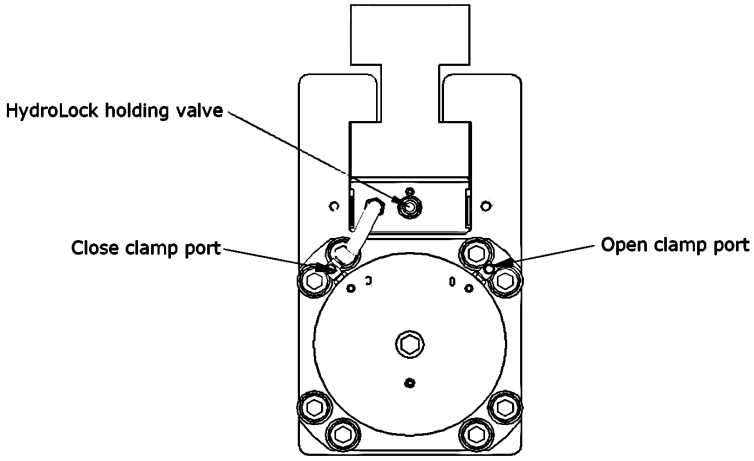
Connection of Caisson Clamp Hoses

The vibrator's clamp connectors are on both sides of base plate. Connect hoses from fitting stamped "C" on vibrator to fittings stamped "C" on clamps. Connect hose from fittings stamped "O" on the vibrator to fittings stamped "O" on clamp on either side.



Adjusting Position of Caisson Clamps with HydroLocks

1. Lift vibrator with clamps into the air.
2. With jaws open, loosen jam nut on HydroLock holding valve (see diagram below).
3. Back out Allen-screw to relieve pressure. It may be necessary to rest the weight of the vibrator on the clamps to release the HydroLock cylinders.
4. Adjust position of clamps on caisson beam.
5. Hand tighten Allen-screw. Tighten jam nut.
6. Close clamp jaws. Wait for CLOSED light to come on.
7. Open jaws. Clamps will be locked onto caisson beam.



Bleeding Hoses

When the equipment is shipped with all hoses attached, the hoses are usually full of oil and may be used immediately.

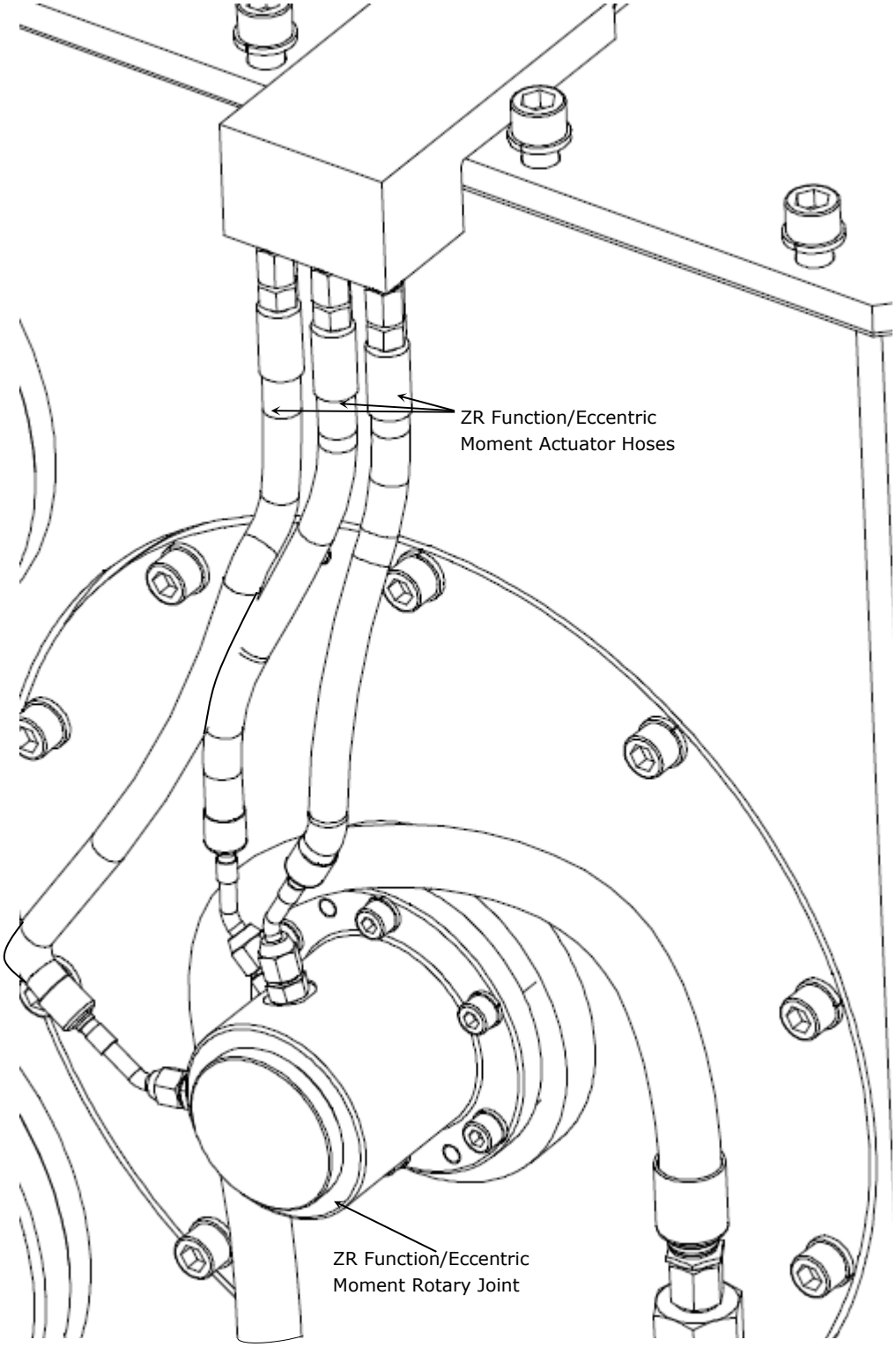
If the clamp hoses are connected at the job site or if air is present in these hoses, they must be bled prior to operation.

!WARNING – Safety!

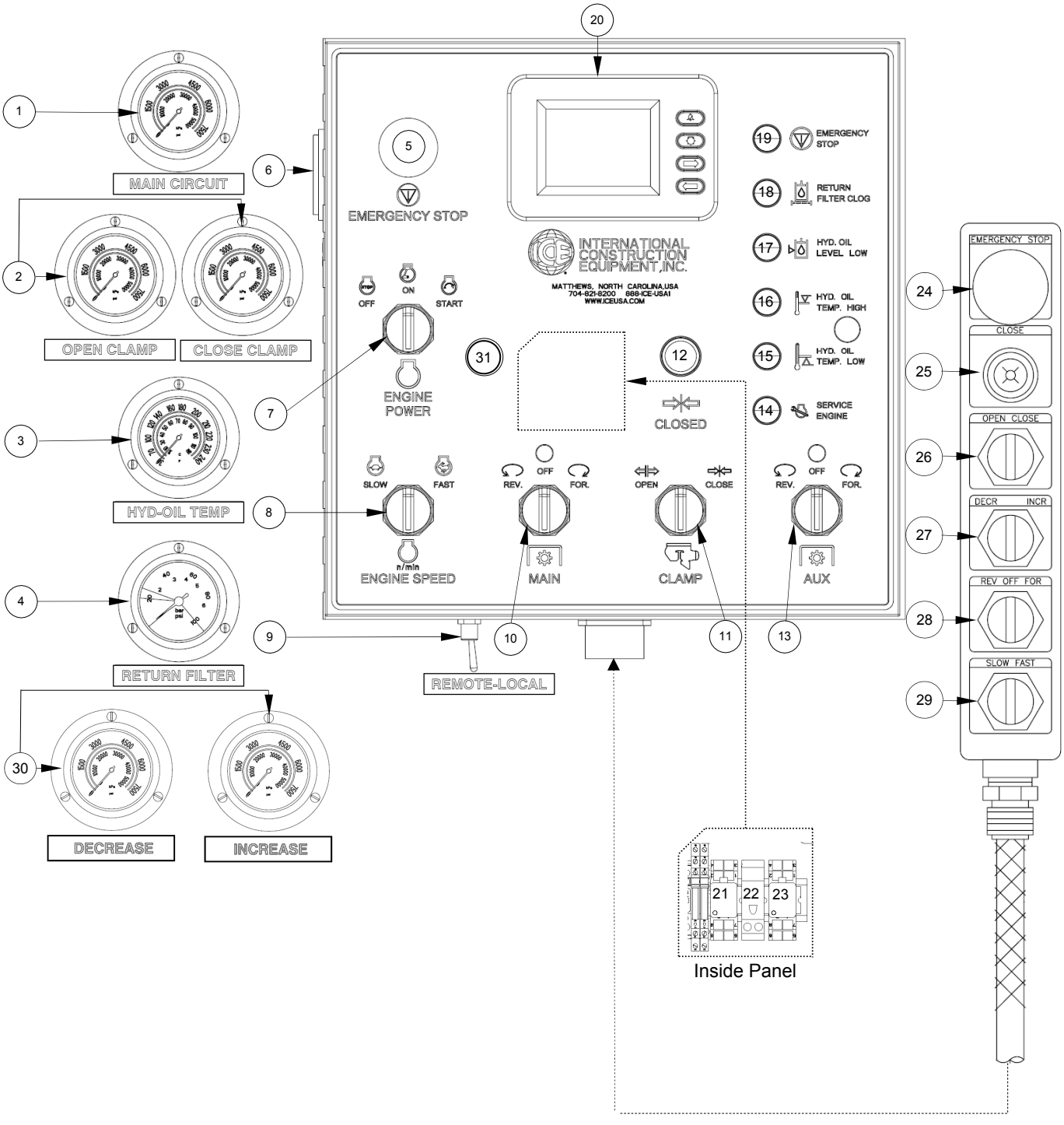
Always use a board or cardboard when bleeding hoses. Escaping oil under pressure, even a pinhole size leak, can penetrate body tissue causing serious injury or possible death.

1. Read Section 5: OPERATION. Also, see Caterpillar Operation & Maintenance Manual. Start and warm up the diesel engine in accordance with Section 5: OPERATION.
2. With the engine warmed up and running at 1000 RPM, loosen the close clamp line at the clamp or remove the setscrew in the end of the hydraulic cylinder. Turn the clamp switch on the remote-control pendant to CLOSE. Wait until oil flows from the connection at the clamp. When oil flows without air, tighten the connection. Use a catch basin for escaping oil and discard in an approved manner.
3. After the line has been bled, alternately turn the clamp switch to CLOSE and OPEN to insure that the clamp is working properly. It may be necessary to bleed the line more than once. The open-clamp line may also require bleeding.
4. Use the above method to bleed ZR function or eccentric moment actuator lines.

Bleeding Hoses for ZR Function Hoses



Control Box & Remote-Control Pendants - Exterior



Completion of Set-up and Maintenance

Complete all preparation as described in Section 4: PREPARATION FOR OPERATION.

Read Section 6: MAINTENANCE and perform any required maintenance. See Caterpillar Operation & Maintenance Manual.

Control Panel Components

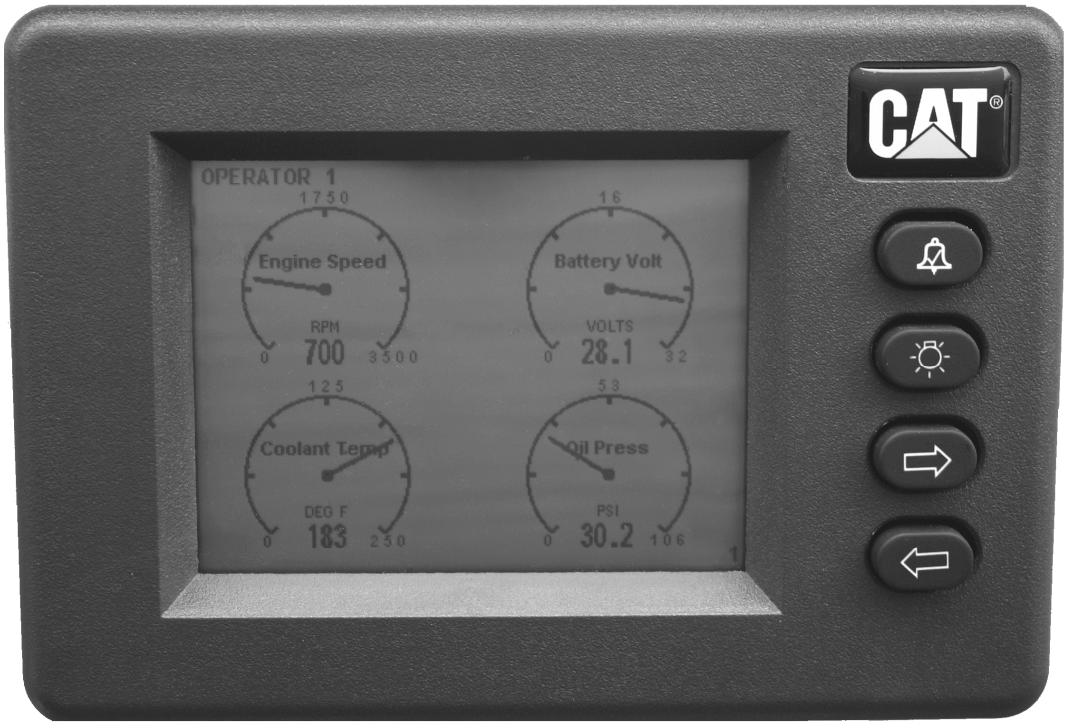
The power unit control panel contains the controls for the diesel engine and displays operating parameters and fault lights. Local controls are provided for the vibrator and clamp. A remote-control pendant is provided as the primary control for vibrator and clamp.

The control panel and pendant contain following controls and components:

Number	Description
1	Main circuit pressure gauge
2	Clamp circuit pressure gauge
3	Hydraulic oil temperature gauge/switch
4	Return filter pressure gauge
5	Emergency stop button
6	Hour meter
7	Engine power switch (OFF-ON-START)
8	Engine speed switch (SLOW-FAST)
9	Remote - Local switch (REMOTE-LOCAL)
10	Main circuit (vibro motors) switch (REV-OFF-FOR)
11	Clamp switch (OPEN-CLOSE)
12	Clamp light (CLOSED)
13	Moment actuator switch - ZR function (DEC-INC)
14	Service engine light
15	Hydraulic oil temperature low light
16	Hydraulic oil temperature high light
17	Hydraulic oil level low light
18	Return filter clog light
19	Emergency stop light
20	Engine display
21	Pendant override switch (PO) (inside control panel)
22	Maintenance reset switch (MR) (inside control panel)
23	Hydraulic override switch (HO) (inside control panel)
24	Pendant EMERGENCY STOP button
25	Pendant clamp light (CLOSED)
26	Pendant clamp switch (OPEN-CLOSE)
27	Pendant moment actuator switch - ZR function (DEC-INC)
28	Pendant main circuit switch (REV-OFF-FOR)
29	Pendant engine speed switch (SLOW-FAST)
30	Moment actuator pressure gauges - ZR function
31	Lube Pressure Light (Yellow)-ZR Vibrator

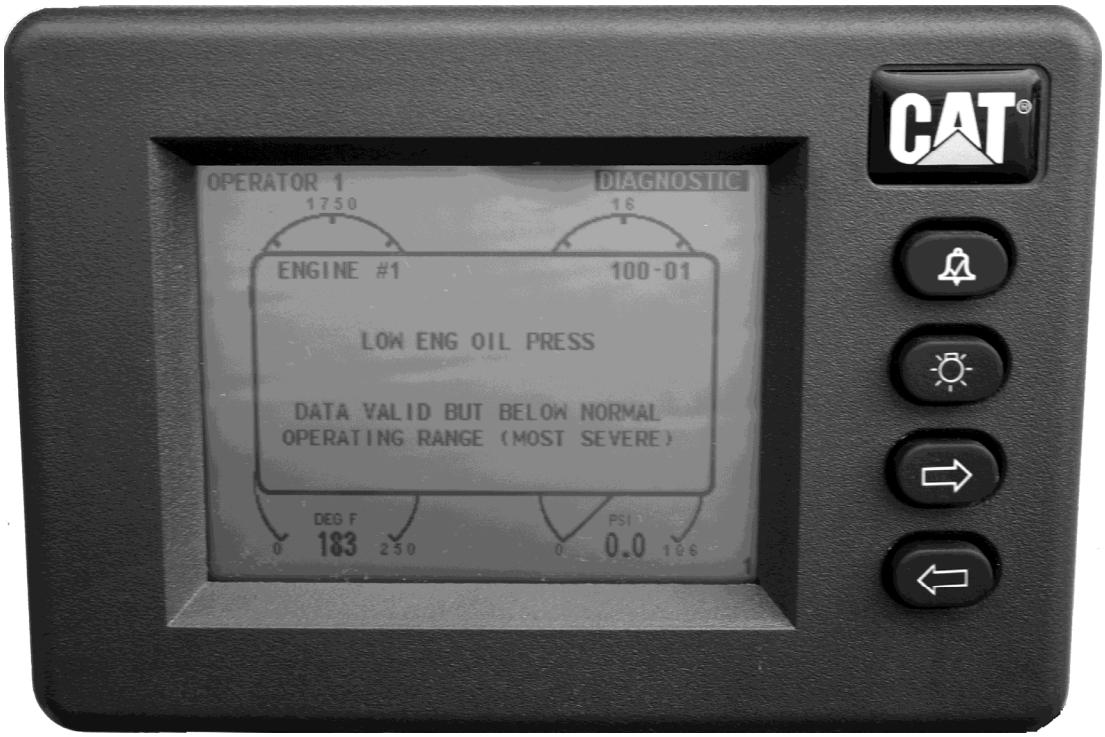
The OPERATION AND MAINTENANCE INSTRUCTIONS near the control panel are there as reminders only. They are not intended to substitute for a thorough understanding of this Operation Manual.

Engine Display



The picture above shows the Display as it appears during normal engine operations. To change the screen for night operation, press the light button (2nd from top).

The picture below shows the Display if an engine problem has occurred. One of three conditions may have occurred - 1) Warning, 2) Derate, or 3) Shutdown. If a screen similar to that below appears, go to Section 8: TROUBLESHOOTING.



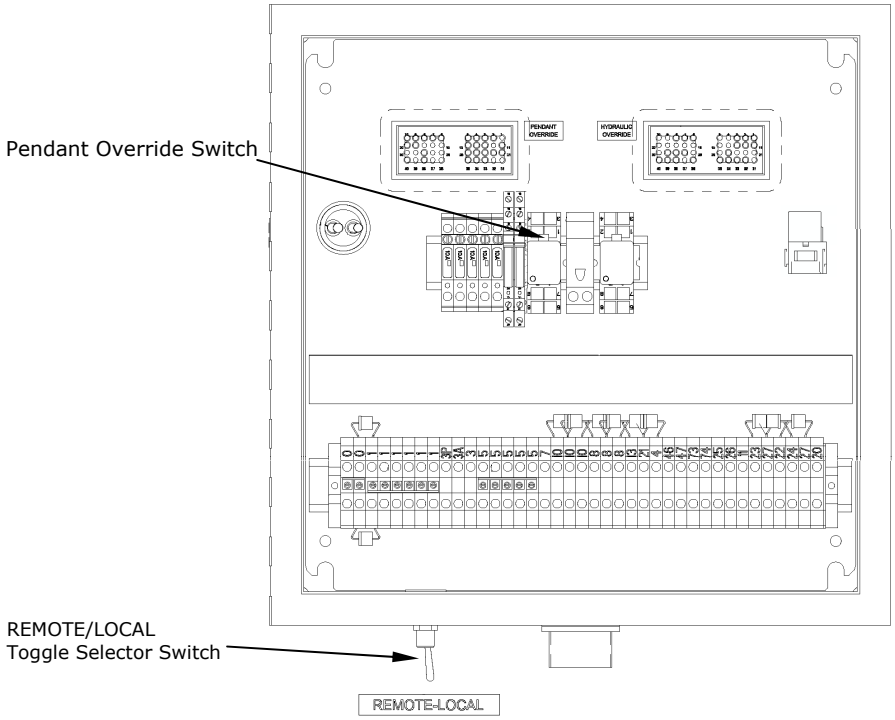
Local or Remote Operation

The power unit and vibrator or rotary head may be operated either from the control panel (LOCAL) or from the remote-control pendant (REMOTE). Additionally, an optional radio control is available for remote operation. Remote or Local operation is selected by using the REMOTE-LOCAL switch at the control panel.

Operation using Remote-control Pendant (REMOTE)

The remote-control pendant can control the operation of the vibrator or rotary head. The pendant is connected to the control cabinet with 50' (15 m) of electrical cable to permit operation from any position to best view the operation of the equipment. Optional pendant extensions are available upon request.

The REMOTE-LOCAL switch must be in the REMOTE position to operate the vibrator using the remote-control pendant. To use the controls on the control panel, the switch must be in the LOCAL position.



Operation From the Control Panel (LOCAL) if Pendant is Damaged or Missing

If the remote-control pendant is damaged, if the pendant line is cut, or if the radio-remote is malfunctioning, the equipment may be operated from the control panel.

If the remote-control pendant is damaged, disconnect the remote-control pendant from the control panel.

Open the control panel and depress the button for Pendant Override. A LED light on the switch will illuminate once the switch has been activated. When main power is turned off, the Pendant Override will be deactivated and will have to be depressed again. Make sure that the REMOTE-LOCAL switch is in the LOCAL position.

To operate using pendant, install an undamaged pendant and change the REMOTE-LOCAL switch to REMOTE.

Operation From the Control Panel (LOCAL) if Pendant is Damaged or Missing

To operate using a radio-remote control, unplug the remote control pendant and plug in the radio remote control module.

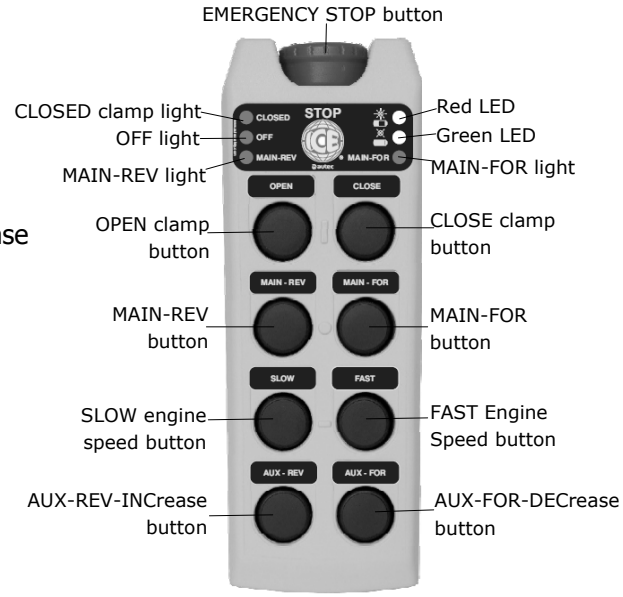
Operation using Optional Radio-remote Control

The optional radio-remote control may be used to control the operation of the vibrator. The radio-remote control has an operating range of 100' (30 m) to permit control from any position to best view the operation of the equipment. The REMOTE-LOCAL switch must be in the REMOTE position to operate the vibrator using the radio-remote control. To use the controls on the control panel, the REMOTE-LOCAL switch must be in the LOCAL position.

To initialize the radio-remote control for operation:

1. Turn ENGINE POWER switch on control panel to ON.
2. Press and hold the AUX-FOR button on the radio-re mote control until the green LED light blinks fast. Release the AUX-FOR button.
3. Press and release the AUX-REV button. Press and release the AUX-FOR button.
4. When green LED blinks slowly (once per second), the radio-remote control is ready for operation.

The radio-remote control may be initialized with the power unit engine running or not running.



!WARNING – Safety!

If the engine is started before the radio-remote control is initialized, the EMERGENCY STOP button on the radio-remote control will not function.
After the radio-remote control is initialized, the EMERGENCY STOP button on the radio-remote control will function.

Radio-remote control error and low battery conditions are indicated by the red LED

1. Steady on at power on - EMERGENCY STOP button is activated or damaged. Turn EMERGENCY STOP clockwise to deactivate. Repair or replace EMERGENCY STOP button.
2. Blinks twice at power on - at least one of operating buttons is activated or damaged. Correct situation.
3. Blinks three times at power on - battery is discharged. Charge battery.
4. On for 2 seconds - unit does not work correctly. Repair or replace radio-remote control.
5. Blinks slowly - About 4 hours battery time remaining.
6. Blinks fast - About 10 minutes battery time remaining.

Checking battery available run time

1. Turn ENGINE POWER switch on control panel to OFF. Turn EMERGENCY STOP off (clockwise).
2. Alternately press and release OPEN and AUX-FOR buttons until three left LED's illuminate.
3. Three LED's on indicate maximum battery time, two on indicate medium time, one on indicates low battery time.
4. LED's will go out after a few seconds.

Recharging radio-remote control battery. Charge between 40°F (5°C) and 105°F (45°C).

1. Power on the battery charging station.
2. Place radio-remote control into charging station. Red LED indicates charging.
3. Green LED indicates fully charged. Fully discharged to fully charged takes four hours.

Starting and Warming Engine

Before starting the engine, read the Caterpillar Operation & Maintenance Manual carefully. Follow the engine starting, operating, and maintenance procedures in the Caterpillar Manual

!WARNING – Equipment!

Operation with hydraulic oil below 0°F (-18°C) may result in damage to hydraulic components. In these conditions, it is recommended that provision be made to keep the power unit warm or to run it continuously.

1. Turn the ENGINE POWER (OFF-ON-START) switch to ON.
2. Turn the MAIN CIRCUIT (REV-OFF-FOR) and the AUXILIARY CIRCUIT (REV-OFF-FOR) on the control panel and pendant to the OFF position.
3. Turn the CLAMP (OPEN-CLOSE) switch on the control panel and pendant to the center (neutral) position.

!WARNING – Safety!

Vibrator or the rotary head could start or clamp could close due to component malfunction.

5. Turn the ENGINE POWER switch to START. There is one second delay before the engine will crank. If engine fails to start after thirty seconds of cranking, allow starter to cool for two minutes before attempting to start again.
6. As the engine starts, release the ENGINE POWER switch. It will return to the ON position, providing power to the controls.

Changing Engine Speed

To increase engine speed, turn the Engine Speed (SLOW-FAST) switch to FAST. Engine rpm will increase.

To decrease engine speed, turn the Engine Speed (SLOW-FAST) switch to SLOW. Engine rpm will decrease.

Full-speed operation

The equipment should not be operated at full speed if hydraulic oil temperature is below 75°F (24°C). (HYD. OIL TEMP. LOW light on control power is on)

!WARNING – Equipment!

Full-Speed operation with hydraulic oil below 75°F (24°C) may result in damage to hydraulic components.

Full Speed Operation

When the engine is warmed-up and the temperature of the hydraulic oil exceeds 75°F (24°C), full speed operation may begin. Adjust the throttle so that the engine is running at the high idle rpm indicated below. The engine should maintain the full load rpm indicated below under load.

Power Unit	Vibrator	High Idle	Full Load	Low Idle
350GZ	18ZR	1950	1850	700
450GZ	18ZR/25ZR	2100	2000	700
595GZ	25ZR	1850	1750	700
700Gz	50ZR	1800	1700	700
800GZ	50ZR	1800	1700	700

Hydraulic oil temperature is monitored by the Hydraulic Oil Temperature Switch (TS2). Hydraulic oil temperature should never exceed 175°F (80°C). If hydraulic oil temperature exceeds 175°F (80°C), the engine will be automatically shut down by the Hydraulic Oil Temperature Switch and the HYD. OIL TEMP. HIGH light will be turned on.

!WARNING – Equipment!

Operation of the equipment with hydraulic oil above 175°F (80°C) may result in damage to hydraulic components.

Engine Shutdown

1. Stop the vibrator by turning the MAIN (REV-OFF-FOR) switch to OFF.
2. If the engine has not been warmed up, the engine may be shut down without a cool-down period. Turn the ENGINE POWER switch to OFF.
3. If the engine has been warmed up (running at above 185°F [85°C] for 15 minutes or more), the engine should be cooled down before shut-down.
   a. If the engine has not been idled down, reduce engine rpm to 1200 for 2 minutes, then reduce to 700 for 2 more minutes.
   b. If the engine has been idled down, increase engine rpm to 1200 for 2 minutes, then reduce to 700 for 2 more minutes.
   c. After the 4-minute cooling period, turn the ENGINE POWER switch to OFF.

Emergency Stop

In an emergency, the engine and vibrator may be stopped by pushing the EMERGENCY STOP button on either the control pendant or the control panel.

!WARNING – Safety! **!WARNING – Equipment!**

Engine shutdown may cause hydraulic clamp to open.

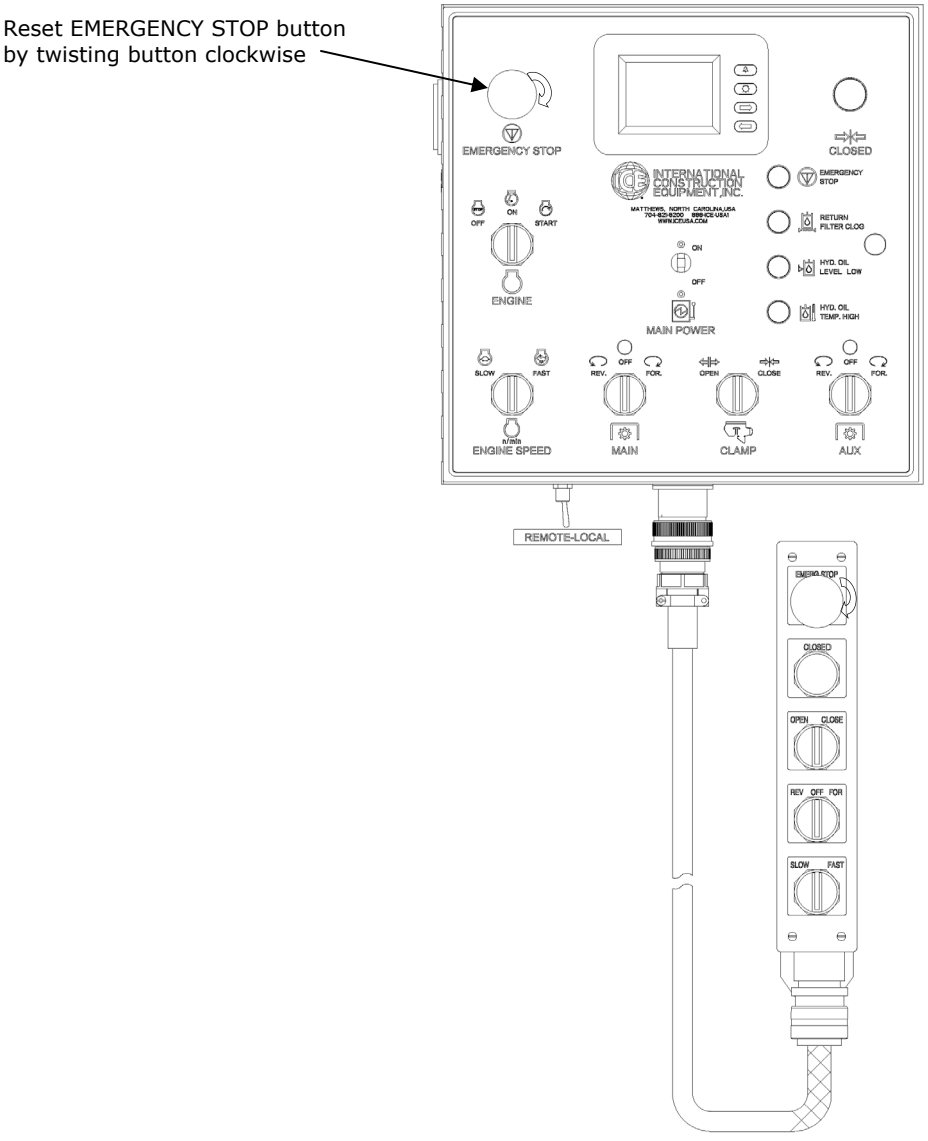
Use the emergency stop button only in actual emergencies as the required engine cool-down period is eliminated.

Resetting Emergency Stop Button After Use

Pushing the EMERGENCY STOP button will cause all operating functions to stop. Diesel engine and vibrator will stop immediately.

To reset the EMERGENCY STOP button, turn the EMERGENCY STOP button clockwise.

To restart the power unit, follow normal engine start procedure. Both EMERGENCY STOP buttons (pendant and control panel) must be reset for engine start.



Operation with Vibrator Driver/Extractor

Operating Limitations

As with all equipment, there are limitations for operation where the equipment can be expected to operate in a long-lasting, safe and efficient manner.

For ICE vibrators, limits exists for refusal, rebound, bearing temperatures, and batter. Exceeding these limits may result in unsafe or damaging operation. Operation beyond these limits will void the vibrator or power unit warranty.

Refusal

Driving/extracting when the movement is less than 1" (25mm) per minute is considered practical refusal. Driving/extracting when movement is less than 1" (25mm) per minute for more than 5 minutes of driving/ extracting is considered improper use and will void the vibrator warranty.

Rebound

Rebound can occur when the pile hits a nearly impenetrable layer or obstruction. Pile energy may be transferred back into the vibrator causing the vibration suppressor to move violently relative to the vibrator gear case. If rebound occurs, the vibrator should be stopped immediately.
Driving when amplitude is greater than 1" (25mm) [vibrator and pile are bouncing] is considered improper use and will void the vibrator warranty.

Maximum Bearing Temperatures

Maximum bearing cover temperatures (paint removed) should not exceed 210°F (100°C).
Driving/extracting when bearing covers (paint removed) are above 210°F (100°C) is considered improper use and will void the vibrator warranty.

Operation on Batters

Call ICE to review the planned operation before using an ICE vibrator on a batter.
Use of a vibrator on a batter without discussing the operation with ICE and getting prior written approval is considered improper use and will void the vibrator warranty.

Safety Features

The vibrator, when operated with an ICE power unit, has several features to insure safe, efficient, and environmentally-friendly operation.

1. The vibrator cannot be started until the clamp is closed.
2. A check valve maintains clamping pressure if a clamp hose fails
3. Pressure relief valves limit operating pressure in vibrator and clamp hydraulic circuits.
4. Stop blocks maintain a connection between vibrator gear case and suppressor if elastomers fail.
5. The engine is shut down if the hydraulic return filter is clogged.
6. The engine is shut down if the hydraulic oil level is low.
7. The engine is shut down if the hydraulic oil temperature is high.
8. The engine is shut down if the engine coolant temperature is high.

If an ICE vibrator is operated by a power unit from another manufacturer, review how the above systems work with that power unit.

Operation with Vibratory Driver/ Extractor (continued)

!WARNING – Safety!

Make sure that crew has a clear view of vibrator and working area.
Insure good communication between vibrator operator and crane operator.

!WARNING – Safety!

Industry practice suggests a safety line should connect pile to crane or piling rig.

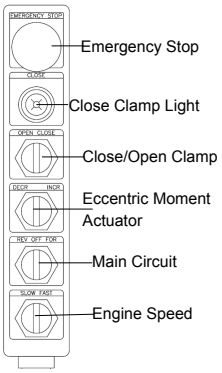
Clamp to Pile

Position vibrator on pile. Turn the CLAMP (OPEN-CLOSE) switch on the pendant to CLOSE. The CLAMP CLOSED light on the pendant and control panel will illuminate when the clamp has achieved adequate pressure to permit vibration to begin. The light should normally come on in a few seconds.

Start Vibrator

!WARNING – Safety!

Visually check that clamp is attached to pile. Make sure CLAMP CLOSED light is ON. Improper clamping may result in clamp losing grip on pile or caisson.



1. Make sure engine is running at the proper speed.
2. Turn the Moment (DEC-INC) switch to DEC, hold for 3 seconds and release. Eccentric moment will be zero.
3. Turn the MAIN (REV-OFF-FOR) switch to FOR position.

To Change Eccentric Moment

1. To increase eccentric moment, turn the Moment (DEC-INC) to INC. The eccentric moment will increase. Full eccentric Moment should be achieved in about 3 seconds.
2. To decrease eccentric moment, turn the MOMENT (DEC-INC) switch to DEC. The eccentric moment will decrease. Zero eccentric moment shall be achieved in about 3 seconds.

Stop Vibrator

1. Turn the MOMENT (DEC - INC) to DEC, hold for 3 seconds and release. Eccentric moment will go to zero.
2. Turn the MAIN (REV-OFF-FOR) switch to OFF position. Momentarily turning the switch to the REV position has no effect and will not cause damage or adverse operation.

Lube Pressure ZR Vibrator

The yellow light on the control panel illuminates when oil pressure from vibrator's lube pump is normal. An operating temperature of 100°F (38°C) is required for the pressure switch to turn on light. Check the pressure gauge mounted on switch center of reservoir to verify pressure when vibrator is first started.

!WARNING – Equipment!

Stop vibrator if yellow light on control is illuminated. Do not operate vibrator if lube oil pressure is low.

Unclamp from Pile

1. Make sure the MAIN (REV-OFF-FOR) switch is in the OFF position and vibration has stopped.
2. Take slack from crane line holding vibrator.
3. Hold the CLAMP switch in the OPEN position to open the hydraulic clamp. Opening of clamp usually takes about ten seconds.

!WARNING – Safety!

Visually check that vibration has stopped before opening clamp.
Visually check that crane or piling rig line is tight.

Changing Frequency (vibrations per minute)

In order to provide maximum flexibility in achieving optimum pile penetration and extraction rates, the frequency of the vibrator is adjustable.

The frequency can be varied by changing the engine rpm and in combination with eccentric moment control can be helpful in adjusting driving force in particular conditions.

Underwater Operation

ICE vibrators may be safely operated underwater provided proper preparation is made and certain precautions are taken.

!WARNING – Equipment!

Water in the gear case will probably result in damage to gears and bearings.
Check gear case sight gauge frequently.

For operation at depths up to 15′ (5m):

Although ICE vibrators have been used at shallower depths many times without problems, it is recommended that the procedure below be used whenever operating underwater.

For operation at depths below 15′ (5m):

1. Install a 15 psi (1 bar) relief valve into a gear case fill hole. On vibrators with only one fill hole, remove the centrifugal breather and attach relief valve there.
2. Air pressure is applied at the other gear case fill hole. The preferred method of pressure control is to use a diving regulator mounted on the suppressor housing to automatically regulate pressure.
3. Connect an air hose to other the gear case fill hole on the top of the gear case. Use a 2-wire, 3/4" hose rather than an air hose to prevent crimping. Connect the hose to the regulator and thread hose through suppressor housing and add to hydraulic hose bundle running to power unit.
4. If air pressure is to be controlled manually rather than using a regulator, pressure must be increased by 0.5 psi per foot of water depth (1 atm per 8 m) as vibrator goes deeper. Pressure must be decreased by 0.5 psi per foot of water depth (1 atm per 8 m) as vibrator gets shallower.
5. At end of job, drain gear oil, flush gear case with diesel fuel, and add new gear oil.
6. **Check gear oil level in sight glass every time the vibrator comes out of the water. If the oil level is increasing or appears milky, replace the gear oil immediately.**
7. It is helpful to install a 1/4" line along with the air hose for connection to a diving pressure gauge.

Section 6: MAINTENANCE

General

Preventive maintenance includes normal servicing that will keep the power unit, vibratory driver/extractor and rotary head 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 preventative maintenance, controlling to a great extent the useful life of the unit. Different lubricants are needed and some components in the unit require more frequent lubrication than others. 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 shutdown and major repair, several other services or inspections are recommended for the same intervals as the periodic lubrications. The purpose of these services or inspections is to assure uninterrupted operation.

Before servicing, be sure to clean all lubrication fittings, caps, filler and level plugs and their surrounding surfaces to prevent dirt from entering with lubricants and coolants.

The intervals given in the schedule are based on normal operating conditions. For operation under abnormal or severe conditions, such as heavy dust or severe cold, perform these services, lubrications and inspections more often and as needed.

!WARNING – Equipment!

Batteries must be disconnected before welding on power unit to avoid possible damage to electrical components. Welding on power unit without disconnecting batteries will void the equipment warranty.

Maintenance Safety

If the equipment must be operated or activated during maintenance:

1. Make sure two people are present both of whom are instructed on safety issues.
2. One person should supervise the safety of the other person.
3. The supervisor should have immediate access to the Emergency Stop.

The work area shall be properly illuminated. A permanent communication between serviceman and operator shall be maintained.

Caterpillar Maintenance

Perform all maintenance checks and lubrication indicated in the Caterpillar Operation & Maintenance Manual.

Engine hours are displayed on Engine Service Screen on the control panel. Use upper arrow to move to Service Screen. Use Lower arrow to return to operating screen.

Daily Maintenance - Power Unit

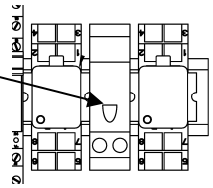
!WARNING – Equipment!

It is absolutely imperative that no dirt or other impurities be permitted to contaminate the hydraulic oil. Any contamination will drastically shorten the life of the high-pressure hydraulic system.

Before Engine Start-up Checklist:

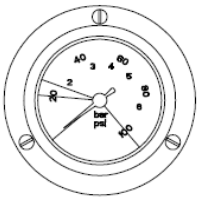
1. Check the entire set-up prior to starting the power unit.
2. Check the oil level in the hydraulic reservoir and refill if necessary.
3. With ENGINE POWER switch ON, check if SERVICE ENGINE light is ON. If ON, perform 250 hour CAT service. After service, push MAINTENANCE RESET switch inside control panel to turn off SERVICE ENGINE light.

Reset (turn off) ENGINE SERVICE light by depressing MAINTENANCE RESET button in.



After Engine Start-up Checklist:

1. Check all hydraulic hoses for leaks.
2. Check that all hydraulic hoses hang freely with no kinks.
3. Check all pumps and hydraulic manifolds for leaks.
4. Check that EMERGENCY STOP works.
5. Check the RETURN FILTER GAUGE located on the control panel with the diesel engine running at full speed and after hydraulic oil has reached 100◦ F (38◦ C)



RETURN FILTER

Green (0-20)- Filter OK
Yellow (20-25)- Change filter
Red (25-100)- Filter clogged, change filter
Operating in red above 100◦ F (38◦ C) will cause engine shutdown

Daily Maintenance - Vibrator

Before Start-up Checklist:

1. Check the entire set-up prior to starting the power unit.
2. Visibly inspect and check tightness of all bolts, nuts and screws including the bolts fastening the hydraulic clamp to the vibrator gear case.
3. Grease the plunger in the hydraulic clamp with any good multi-purpose grease.
4. Check wire ropes connecting vibrator to crane or piling rig.
5. Check the oil level in the vibrator gear case and add oil if required. The oil level should be in the middle of the sight glass with the vibrator level. Change oil if milky or contaminated. Do not over fill.

!WARNING – Safety!

Vibration loosens bolts, nuts and screws. Loose or broken bolts or screws may cause components to loosen and fall from the vibrator or clamp resulting in injury or death. Check carefully. Recheck clamp or caisson beam bolt torque.

!WARNING – Equipment!

Low or contaminated oil in the gear case can result in damage to gears and bearings. Too much oil in the gear case can result in over-heating and damage to gears and bearings.

!WARNING – Safety!

Vibration loosens bolts, nuts and screws. Loose or broken bolts or screws may cause components to loosen and fall from the vibrator or clamp resulting in injury or death. Check carefully. Recheck clamp or caisson beam bolt torque.

!WARNING – Equipment!

Low or contaminated oil in the gear case can result in damage to gears and bearings. Too much oil in the gear case can result in over-heating and damage to gears and bearings.

Service Intervals

Every 100 Hours

Vibratory/Driver Extractor

Drain and refill vibrator gear case with new lubricant.

Every 500 Hours

Vibratory/Driver Extractor, Engine

An oil testing program is encouraged for the vibrator. Follow Caterpillar's recommendations for engine testing.

Power Unit Annual Maintenance

At least once a year, have the hydraulic oil tested by a local hydraulic service center or oil company and replace if required.

Severe Conditions

The service intervals and daily maintenance specified prior to this section are based on normal operating conditions. Operation under severe or unusual conditions will require some adjustments in service intervals.

Example: 100 hours changes to 50 hours, 500 hours changes to 250 hours, annual changes to 6 months.

Extreme Temperature
Above 80° F (27° C) or below -10° F (-23° C), reduce service intervals to half of those specified.

Air Conditions
Operating in dust or sand, reduce service intervals to half of those specified.
Operating in salt or high moisture, have hydraulic oil tested quarterly and use normal service intervals.

Extended Work Hours
Operating in excess of twelve hours per day, reduce service intervals to half of those specified.

Extended Inactive Periods
Consult Caterpillar Operation and Maintenance Manual. Also see Storage Procedure for Caterpillar Products (CAT Publication Number - SEHS9031-04).

Consult ICE for Vibrator.

Lubrication

Crankcase - Diesel Engine

Follow the engine manufacturer's maintenance schedule and the lubricating oil specifications outlined in the Caterpillar Operation & Maintenance Manual.

The lubricant shall meet the performance requirements of API Service Classification CH-4.

New engines are shipped with Caterpillar CH-4 (10W-30). The table below gives oil viscosity requirements for varying ambient temperature. Use only engine oil that conforms to the requirements in the Caterpillar Operation and Maintenance Manual. Caterpillar makes no recommendation for after-market additives to engine oils.

CAT DEO Multigrade EMA LRG-1 API CH-4 and API CF-4 Viscosity Grade	Ambient temperature Minimum	Ambient temperature Maximum
SAE 0W20	-40°C (-40°F)	10°C (50°F)
SAE 0W30	-40°C (-40°F)	30°C (86°F)
SAE 0W40	-40°C (-40°F)	40°C (104°F)
SAE 5W30	-30°C (-22°F)	30°C (86°F)
SAE 5W40	-30°C (-22°F)	40°C (104°F)
SAE 10W30	-20°C (-40°F)	40°C (104°F)
SAE 15W40	-40°C (-40°F)	50°C (122°F)

Recommended Lubricating Oils for Vibrator Gear Case

The recommended lubricating oil for the ZR series vibrator gear case is SCHAEFFER 740, ISO 220 or 741, ISO 150. These oils are lighter than those preferred for standard vibrator gear cases and power unit pump drive adapters.

It is our experience that Schaeffer oil allows for reduced maintenance time and cost. In addition, extensive tests have indicated that the use of SCHAEFFER 740 & 741 (ISO 220 & ISO 150 results in better performance with less fluid resistance to drive gears, cooler operation and extended bearing life for the ZR Vibrators. Schaeffer 740 or 741 oil may be purchased from International Construction Equipment, Inc. in five gallon cans. Schaeffer 741, ISO 150 can be used as a replacement and is preferable in ambient temperatures below 50°F (10°C). Schaeffer 740 is preferable for temperatures for temperatures above 50°F (10°C).

If Schaeffer 740, ISO 220 or 741, ISO 150 is not available, the following oils may be used. Check and change these oils at shorter intervals.

Alternate Gear Oil for Shaeffer 740, ISO 220

MOBILUBE SYNTHETIC	80W -140 ISO 220
ESSO GX EXTRA	80W -140 ISO 220
CITGO CITGEAR HD	80W -140 ISO 220
GULF SYN GEAR LUBE	80W -140 ISO 220
PHILLIPS TRITON SYN	80W -140 ISO 220
CHEVRON DELO SYN	80W -140 ISO 220
SHELL SPIRAX AXME	80W -140 ISO 220

Alternate Gear Oil for Shaeffer 741, ISO 150

MOBILUBE SYNTHETIC	75W - 90 ISO 150
ESSO GX EXTRA	75W - 90 ISO 150
CITGO CITGEAR HD	75W - 90 ISO 150
GULF SYN GEAR LUBE	75W - 90 ISO 150
PHILLIPS TRITON SYN	75W - 90 ISO 150
CHEVRON DELO SYN	75W - 90 ISO 150
SHELL SPIRAX AXME	75W - 90 ISO 150

Vibrator Gear Case

Checking Oil Level:

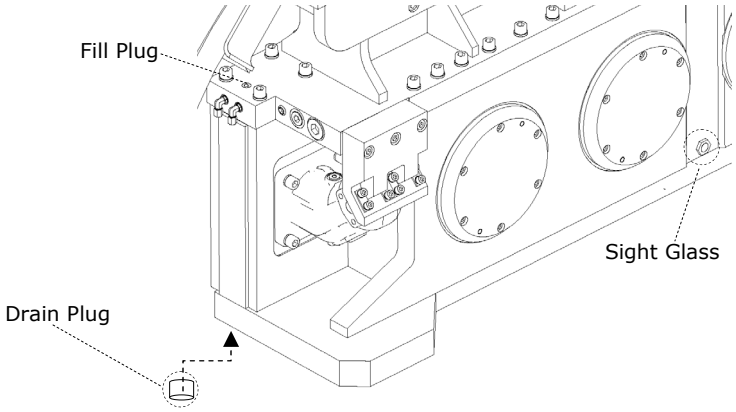
Check oil level in sight glass located on the lower center of the vibrator gear case. Oil level should be in the middle of the sight glass.

Adding Oil:

On the vibrator gear case top plate, remove the 1" pipe plug to add oil.

Draining Oil:

Remove ¾" pipe plug at either end of the gear case base plate. Tilt the case for complete drainage.



Power Unit Pump Drive Adapter (350G & 350GZ only)

Checking Oil Level:

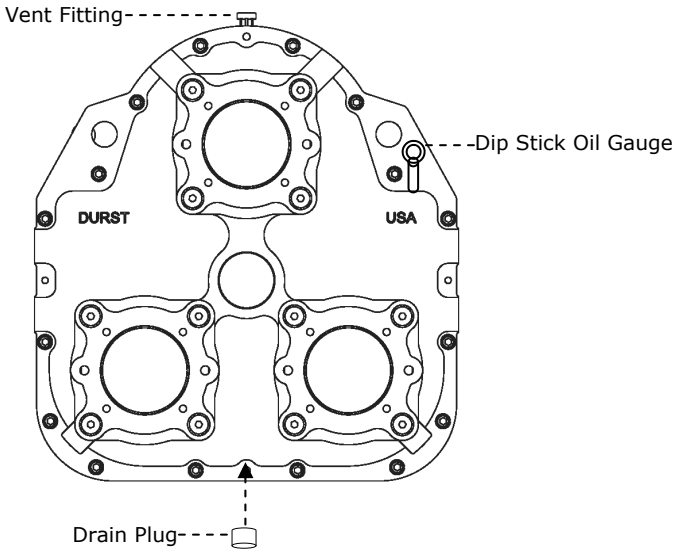
Check oil level using the dipstick mounted on the pump drive adapter.

Adding Oil:

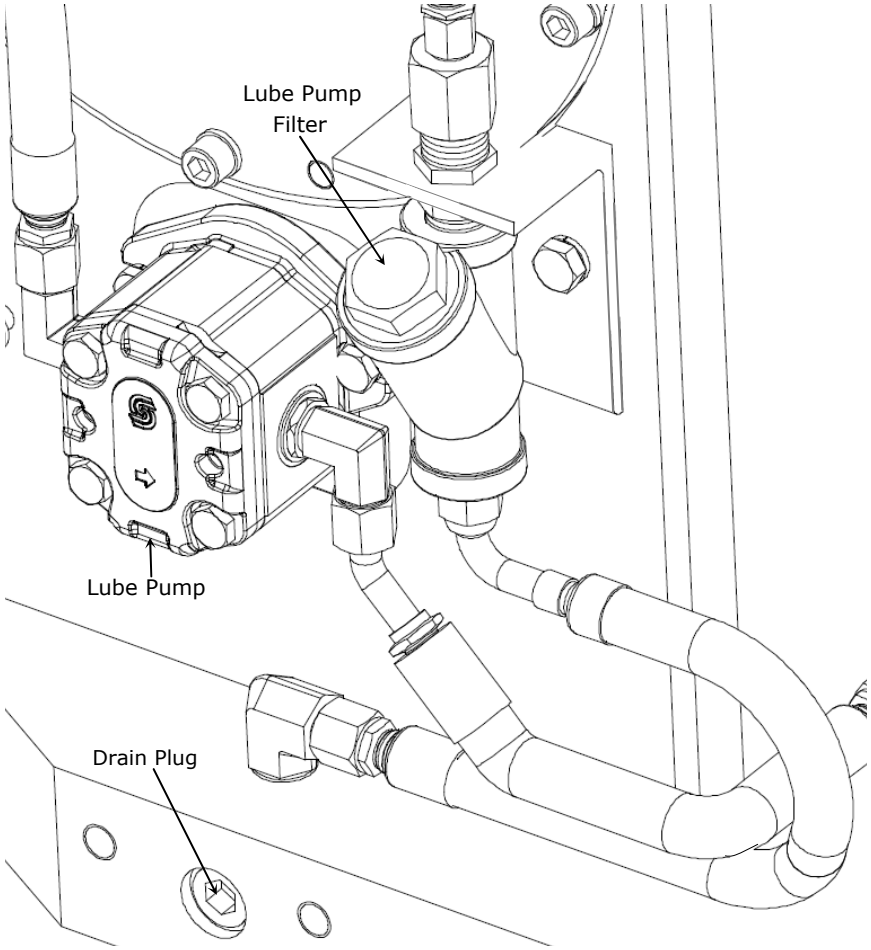
Add oil by removing the vent fitting from the top of the pump drive adapter.
of the pump drive adapter.

Draining Oil:

Remove the drain plug on the bottom of the pump drive adapter.



Gear Case Oil Lube Pump



The hoses on the gear case lube pump hoses should be bled when first placed in operation to ascertain proper function and to purge air from system. The filter should be checked and cleaned when servicing gear oil. Be aware of foreign material in filter and have oil tested if in doubt. A periodic oil testing program is encouraged. Make sure all hoses are in good condition, not routed tight the vibrator's edges and fittings are tight.

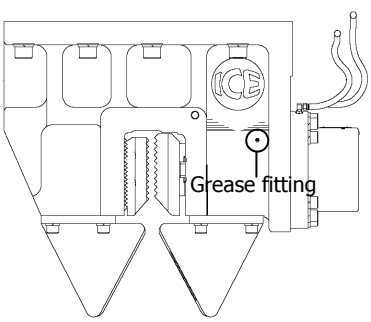
Power Unit Pump Drive Adapter

The pump drive adapter from factory is filled with Schaeffer 268 synthetic gear oil and is the preferable lubricant. Schaeffer 740 or 741 are acceptable replacements, as well as the alternates in the table. More frequent service is recommended if these alternate lubricants are used.

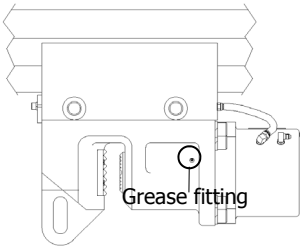
Engine oil	CAT CH-4 (10W-30)
Vibratory gear case	Schaeffer 740/741 ISO 220/150
Pump drive adapter	Schaeffer 268, ISO 320

Factory Installed Oils

Grease Clamp Plungers



Grease the plunger in the with any good multi-purpose grease (2-3 pumps) at least once a day. If submerging the clamp in water or mud, grease plunger frequently to push out foreign matter. Dusty conditions also require frequent greasing.



Hydraulic System

To maintain the maximum operating efficiency in the precision parts of the hydraulic system, it is extremely important to eliminate factors that can cause breakdowns or unsatisfactory performance in the system.

Among the most common of these factors are rust, corrosion, contamination and products of oil deterioration.

Most problems can be minimized or avoided simply by maintaining a disciplined preventive maintenance program.

Draining and Filling Hydraulic Oil Reservoir

Checking oil level: Make sure hydraulic oil is visible in the sight gauge on the reservoir.

!WARNING – Equipment!

Power Unit should not be operated if hydraulic oil is not visible in sight gauge.

Adding oil: Use the manual pump mounted on the engine-side behind the reservoir. Oil is added to the reservoir through the return filters (F1) to insure no dirt enters.

Draining oil: Drain by removing the plug on the bottom of the reservoir.

Changing Hydraulic Return Filter Elements (filter on back of reservoir)

Removing return filter elements

1. Loosen the bolts on the cover and rotate cover clockwise
2. Bypass check valve and spring will come off with cover
3. Remove the filter elements from the filter housing

Replacing return filter elements

1. Clean filter housing with a lint free rag
2. Slide new filter elements into housing making sure element engages tube in back of housing
3. Replace cover and tighten the cover bolts

Changing Hydraulic Return Filter Element (filter on top of reservoir)

Removing return filter element

1. Loosen the bolts on the cover and remove cover
2. Bypass check valve and spring will come off with cover
3. Remove the filter element from the filter housing

Replacing return filter element

1. Slide new filter element into housing making sure element engages tube in bottom of housing
2. Replace cover and tighten the cover bolts

!WARNING – Equipment!

Inspect for leaks when engine is running.
The use of ICE filter elements is strongly recommended. After-market brands could provide poor filtration and shorten life of components.

!WARNING – Equipment!

Foreign material in the hydraulic system can drastically affect the life and operation of hydraulic components.

Recommended Hydraulic Oil

ICE power units are shipped with CHEVRON Clarity™ AW46 hydraulic oil. CHEVRON Clarity hydraulic oil exceeds the requirements of both the E.P.A. and U.S. Fish and Wildlife Service for non-toxicity and is inherently biodegradable. CHEVRON Clarity AW46 hydraulic oil is available from International Construction Equipment, Inc. in five or fifty-five gallon drums. See "Bulk" in the Parts Manual.

Mixing of different manufacturers' hydraulic oil is not recommended. However, it can be done only when the oils are miscible (contain the same base and additive). It is necessary to contact an oil supplier to determine if oils can be mixed. **Do not add any other oil to CHEVRON Clarity AW46 hydraulic oil.**

If an alternate oil is used, the following list contains recommendations that may be used to replace CHEVRON oil in the hydraulic system.

CHEVRON	CLARITY™ AW46
EXXON MOBIL	DTE 15M

First Preference Group

TEXACO	RANDO ASHLESS
CHEVRON	HYDRAULIC OIL AW ISO 32
EXXON	TERRASTIC EP 32
SHELL	Tellus PLUS 32

Second Preference Group

Whenever oils from the second preference group are used, it is necessary to test the oil more often to insure that viscosity remains within recommended limits while in service.

The recommended oils in were chosen based on the hydraulic system operating temperature range being 0°F (-18°C) (cold ambient start-up) to 175°F (80°C) (maximum operating).

Operating in Sub-freezing Conditions

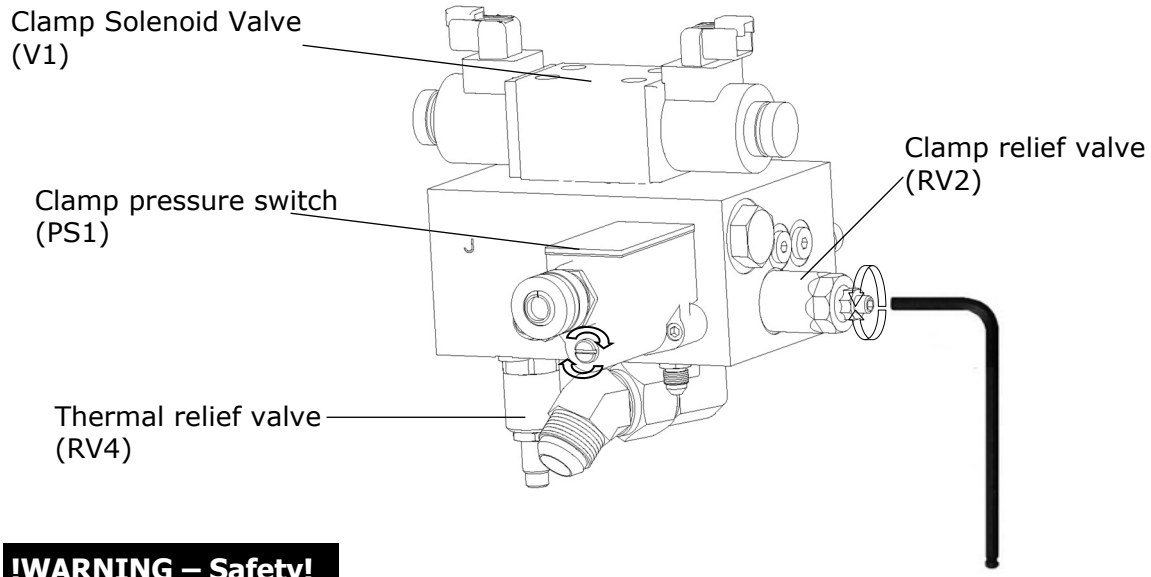
Contact ICE for arctic operating procedures.

It may also be necessary in extremely cold or hot climates to use different viscosity oil which is better adapted to adverse conditions. Contact the nearest oil supply representative for suggested procedures.

Setting Clamp Relief Valve for Vibrator

The Clamp Pressure Relief Valve (RV2 on hydraulic schematic) must be set at 4,800 psi (330 bar).

The clamp relief valve is located on the power unit clamp manifold that is located on the right behind the quick-disconnect couplers at the power unit.



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!WARNING – Safety!

Keep hands away from the clamp as it opens and closes.

To set clamp relief valve:

1. Clamp hoses must be attached to set relief valve.
2. Start and warm up the diesel engine.
3. With the engine warmed up, increase engine speed to 1800 rpm.
4. While observing the CLAMP pressure on the CLAMP pressure gauge (GA1), turn the clamp (OPEN-CLOSE) switch to OPEN.
5. The pressure should read 4800 psi (330 bar).
6. If the pressure does not read 4800 psi (330 bar):
   a. Release the clamp (OPEN-CLOSE) switch.
   b. While holding the clamp relief valve adjusting screw with a hex key, loosen the adjusting screw jam nut with an open-end wrench
   c. Adjust the clamp relief valve by turning the adjusting screw approximately 1/8th turn in the desired direction. Turning the screw clockwise will increase the pressure setting. Turning counter-clockwise will decrease the pressure setting.
7. While observing the CLAMP pressure gauge (GA1), turn the clamp (OPEN-CLOSE) switch to OPEN.
8. The pressure should read 4800 psi (330 bar).
9. If the pressure is not correct, repeat steps 6 through 8.

Setting ZR Function Relief Valve (Eccentric Moment Control Actuator Relief)

The Clamp Pressure Relief Valve (RV2 on hydraulic schematic) limits eccentric pressure for the ZR function (eccentric moment control actuator). This relief valve must be set at 1,500 psi (100 bar).

To set relief valve for eccentric moment actuator:

1. Eccentric moment actuator hoses must be attached to set relief valve.
2. Start and warm up the diesel engine.
3. With the engine warmed up, increase engine speed to 1800 rpm.
4. While observing the eccentric moment actuator pressure on the CLAMP pressure gauge (GA4), turn the control switch (INCR-DECR) to DECR.
5. The pressure should read 1500 psi (103 bar).
6. If the pressure does not read 1500 psi (103 bar):
   a. Turn the torque switch (DECR-INCR) to INCR.
   b. While holding the clamp relief valve adjusting screw with a hex key, loosen the adjusting screw jam nut with an open-end wrench
   c. Adjust the clamp relief valve by turning the adjusting screw approximately 1/8th turn in the desired direction. Turning the screw clockwise will increase the pressure setting. Turning counter-clockwise will decrease the pressure setting.
7. While observing the ZR function pressure gauge (GA4), turn the ZR actuator (DECR-INCR) switch to DECR.
8. The pressure should read 1500 psi (103 bar).
9. If the pressure is not correct, repeat steps 6 through 8.

Setting Clamp Restore Pressure

The Clamp Pressure Switch (PS1 on hydraulic schematic) monitors clamp pressure when the clamp is closed. If clamp pressure drops below 4500 (310 bar), the pressure switch activates the clamp control valve to restore clamp pressure.

To set clamp pressure switch:

1. The Clamp Relief Valve (RV2) must be set to 4800 psi (330 bar) prior to setting the Clamp Pressure Switch.
2. The Clamp Pressure Switch is located on the clamp manifold, which is located on the right behind the quick-disconnect couplers at the power unit (see drawing on page 44).
3. **Connect clamp hoses from clamp to the power unit. Make sure the quick disconnects are fully tightened.**
4. Start engine and adjust to 1000 rpm.
5. Bleed clamp hoses before attempting to set the Pressure Switch.
6. With the power unit running and warmed up, turn Clamp switch to CLOSE. It will take a few seconds for the clamp cylinder to move and begin building full pressure.
7. Observe the pressure reading on the Clamp gauge. Adjust the adjusting screw of the pressure switch with a flat blade screw driver to 4500 (310 bar). Clockwise increases the pressure setting and counterclockwise reduces the pressure setting.
8. It may be necessary to momentarily turn the Clamp switch to OPEN and release some of the pressure before bringing the pressure adjustment down. Make adjustments to the switch and then turn the Close Clamp switch to CLOSE again.
9. Once the pressure is adjusted, recheck your setting. Readjust if necessary.

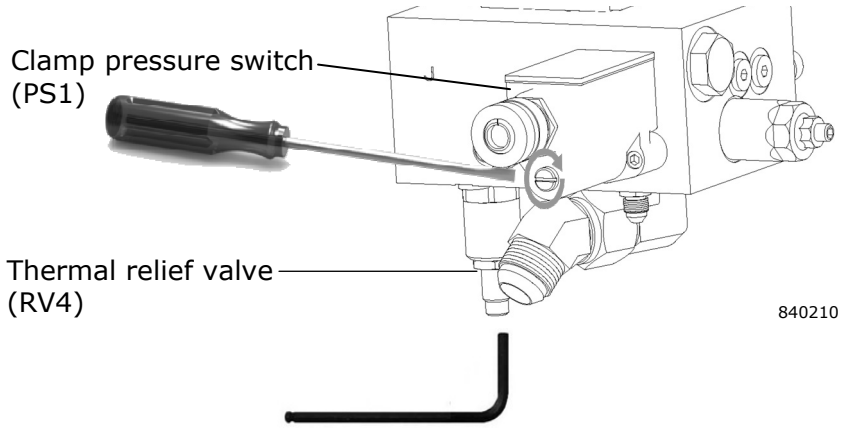
Setting Clamp Temperature Relief Valve

The Clamp Temperature Relief Valve (RV4 on hydraulic schematic) must be set at 5,800 psi (400 bar).

The clamp temperature relief valve is located on the power unit clamp manifold that is located on the right behind the quick-disconnect couplers at the power unit (see drawing on page 44).

To set clamp temperature relief valve:

1. While holding the clamp temperature relief valve adjusting screw with a hex key, loosen the adjusting screw jam nut with an open-end wrench.
2. Turning the adjusting screw clockwise as far as it will go.
3. Back off adjusting screw counter-clockwise 1/4 to 1/2 turn.
4. Tighten adjusting screw jam nut.



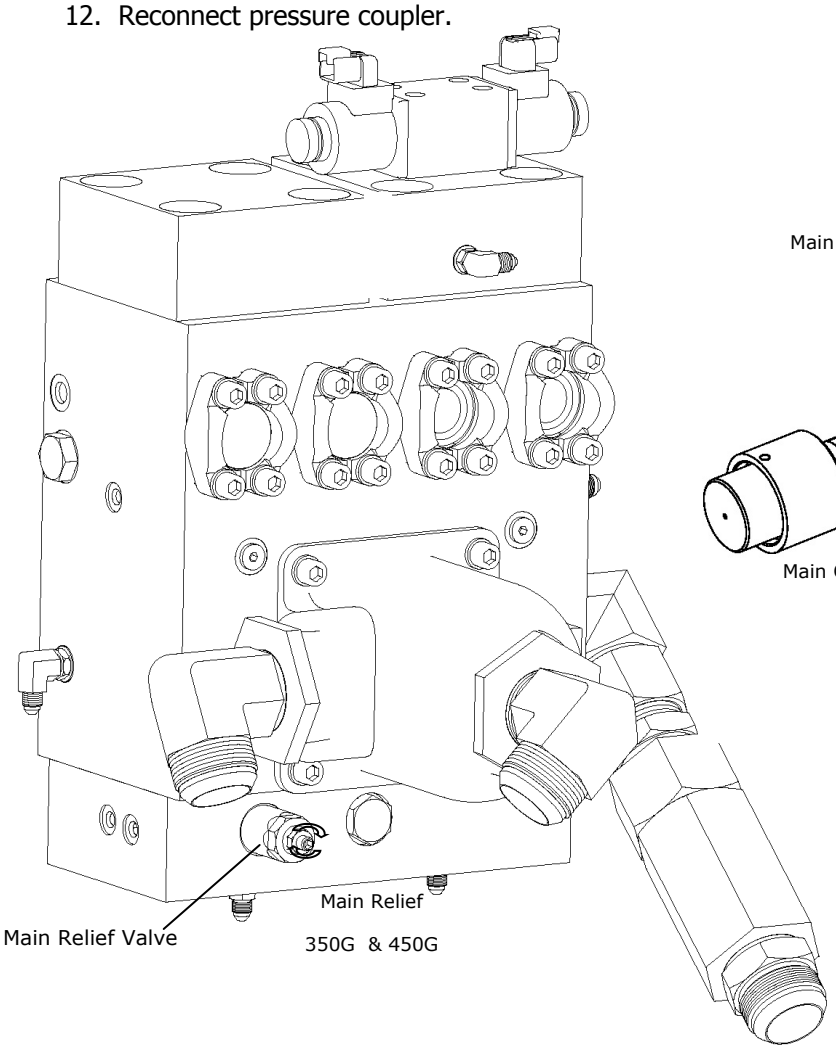
Setting Main Relief Valve

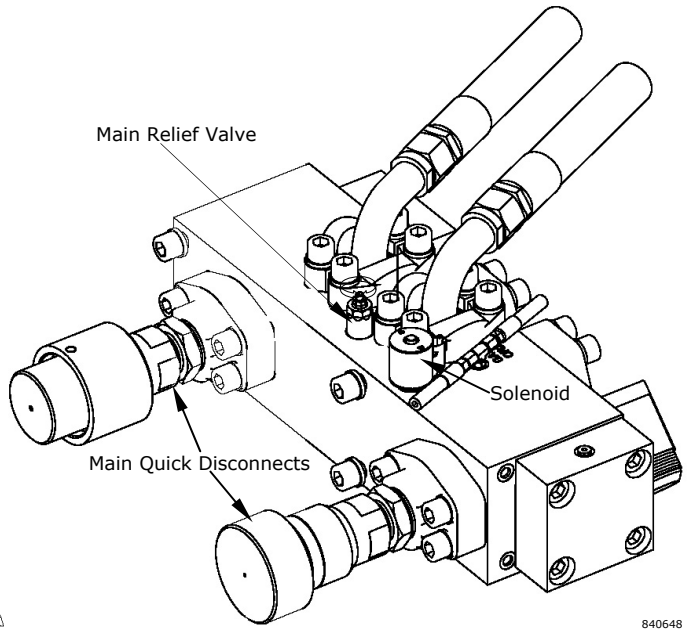
The Main Relief Valve (RV1) on hydraulic schematic) must be set at 5500 psi (380 bar).

The Main Relief Valve is near the bottom of the main manifold that is located behind the quick-disconnect couplers at the power unit (see drawing below).

To set main relief valve:

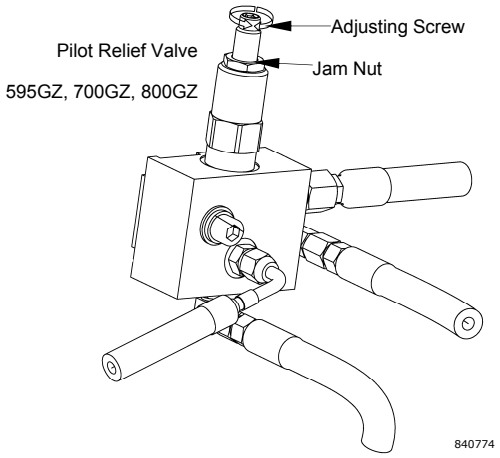
1. On the main relief valve, loosen the jam nut (turn counterclockwise). Back out the Allen-head adjusting screw (turn counterclockwise) until the adjustment screw is free of spring tension.
2. Disconnect main pressure hose coupler at power unit (left coupler).
3. Start and warm up the diesel engine.
4. With the engine warmed up, increase engine speed to 1800 rpm.
5. For vibrators, turn CLAMP switch on pendant to CLOSE and wait until clamp CLOSED light comes on.
6. Turn the MAIN (REV-OFF-FOR) switch to FORWARD. Pressure should read 150-200 psi (10-14 bar).
7. Turn the adjusting screw on the relief valve clockwise and observe main pressure.
8. Adjust pressure to 5500 psi (380 bar).
9. While holding adjusting screw, tighten jam nut (turn clockwise).
10. Turn clamp switch to OPEN.
11. Shut down diesel engine.
12. Reconnect pressure coupler.





Main Relief

595G, 700G &800G



Setting Pilot Relief Valve 595G, 700G & 800G

The Pilot Relief Valve (RV1 on hydraulic schematic) must be set at 6000 psi (415 bar).

The Pilot Relief Valve is located on the hydraulic reservoir (see drawing above left).

To set pilot relief valve:

1. While holding the pilot relief valve adjusting screw with a hex key, loosen the adjusting screw jam nut with an open-end wrench
2. Turn the adjusting screw clockwise as far as it will go.
3. Back off adjusting screw counter-clockwise 1/4 to 1/2 turn.
4. While holding adjusting screw, tighten the adjusting screw jam nut.

Setting Reservoir Pressure Regulator 595G, 700G & 800G

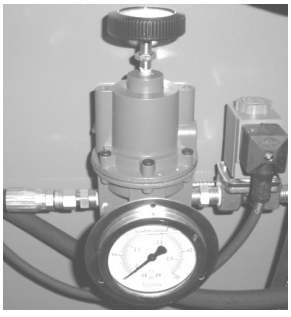
Setting Reservoir Pressure Regulator:

The Reservoir Pressure Regulator (RR on the hydraulic schematic) must be set at 1.5 psi (0.1 bar). Check the air pressure on Gauge (GA4), which is installed on the front of Regulator (RR).

The Reservoir Pressure Regulator is located inside the power unit enclosure on the back of the control panel. Mounted on the side of the Regulator (RR) is the Reservoir Pressure Solenoid Valve (V4 on the hydraulic schematic).

To set the reservoir pressure regulator:

1. Loosen jam nut and turn adjusting knob fully clockwise. This sets the regulator to 2 psi (0.14 bar). Tighten jam nut.
2. When hydraulic oil temperature is below 75°F (24° C) and with engine running under load (vibrator running or using flow meter), loosen jam nut. Turn adjusting knob counterclockwise until pressure reads 1.5 psi (0.1 bar). Tighten jam nut.



Reservoir Pressure Regulator

595GZ, 700GZ, 800GZ

Section 7: TORQUE SPECIFICATIONS

!WARNING – Equipment! **!WARNING – Safety!**

Vibration from operation of equipment loosens bolts, nuts, and screws.
Loose or broken fasteners may cause components to break away and fall resulting in injury, equipment damage or both. Check all fasteners daily.

!WARNING – Equipment! **!WARNING – Safety!**

Mismatched, dirty, damaged, or incorrect fasteners can result in damage, malfunction, or injury. Make sure fasteners are correct, clean, and undamaged.
Check fasteners daily.

!WARNING – Equipment! **!WARNING – Safety!**

A torque wrench is strongly recommended for assembly and maintenance of ICE equipment.

Torque is measured in terms of force and distance. Force is the amount of pushing or pulling applied at the end of the lever. Distance is the length of the lever that is being used. Torque values are given in the following units: NEWTON meters (N-m), inch pounds (in-lb) and foot-pounds (ft-lb).

Be sure to use a torque wrench that has the proper range. Torque wrenches must be used properly in order to ensure that the correct torque is applied. Always use a smooth pull for torque wrenches. Do not jerk a torque wrench. Do not use adapters that change the length of the torque wrench. For the correct use of the torque wrench, refer to the instructions that were packaged with the torque wrench.

Prior to installation of any hardware, ensure that components are in near new condition. Bolts and threads must not be worn or damaged. Threads must not have burrs or nicks. Hardware must be free of rust and corrosion. Clean reused fasteners with a noncorrosive cleaner. Lightly lubricate the threads of reused fasteners. Lightly lubricate the mating surface of the head of reused fasteners.

Note: Too much tension on the bolt will cause the bolt to be stretched beyond the point of yield. The bolt will be permanently stretched. The bolt will loosen the grip on the parts that are being fastened. If the bolt is tightened again, the bolt will break. Do not reuse bolts that have been permanently stretched.

Torque Sequence

1. Hand tighten all fasteners. Larger connections may require the use of a small hand wrench.
2. Torque all fasteners to 40% of full torque.
3. Torque all fasteners to 70% of full torque
4. Torque all fasteners to full torque by using a cross pattern. Large flanges may require additional passes.
5. Apply at least one final full torque to all fasteners in a clockwise direction until all torque is uniform. Large connections may require additional passes.

Torque Specifications (continued)

Torque values are for lubricated fasteners. Increase torque by 1/3 for dry fasteners.

UNC Screw Size	Allen Wrench Size	Standard Torque Ft-lbs	Standard Torque N-m		UNF Screw Size	Allen Wrench Size	Standard Torque Ft-lbs	Standard Torque N-m
1/4-20	3/16	10	14		1/4-28	3/16	12	16
5/16-18	1/4	22	30		5/16-24	1/4	24	32
3/8-16	5/16	38	52		3/8-24	5/16	43	58
7/16-14	3/8	61	83		7/16-20	3/8	68	92
1/2-13	3/8	93	126		1/2-20	3/8	105	142
5/8-11	1/2	179	243		5/8-18	1/2	202	274
3/4-10	5/8	317	430		3/4-16	5/8	354	480
7/8-9	3/4	511	693		7/8-14	3/4	564	765
1-8	3/4	767	1040		1-12	3/4	860	1166
1-1/4-7	7/8	1533	2078		1-1/4-12	7/8	1697	2301
1-1/2-6	1	2668	3617		1-1/2-12	1	3001	4069

Torque for Socket Head Cap Screws
Source: Fastenal/Century

Thread Size	Standard Torque N-m	Standard Torque Ft-lb
1/4	12 ± 3	9 ± 2
5/16	25 ± 6	18 ± 4
3/8	47 ± 9	35 ± 7
7/16	70 ± 15	50 ± 11
1/2	105 ± 20	75 ± 15
9/16	160 ± 30	120 ± 22
5/8	215 ± 40	160 ± 30
3/4	370 ± 50	275 ± 37
7/8	620 ± 80	460 ± 60
1	900 ± 100	660 ± 75
1 1/8	1300 ± 150	960 ± 110
1 1/4	1800 ± 200	1320 ± 150
1 3/8	2400 ± 300	1780 ± 220
1 1/2	3100 ± 350	2280 ± 260

Torque for Grade 8 UNC Bolts & Nuts
Source: CAT SENR3130

Thread Size	Standard Torque N-m	Standard Torque Ft-lb
M6	12 ± 3	9±2
M8	28 ± 7	21 ± 5
M10	55 ± 10	41 ± 7
M12	100 ± 20	75 ± 15
M14	160 ± 30	120 ± 22
M16	240 ± 40	1 75 ± 30
M20	460 ± 60	340 ± 44
M24	800 ± 100	590 ± 75
M30	1600 ± 200	1180 ± 150
M36	2800 ± 350	2100 ± 260

Torque for Metric (ISO) Bolts & Nuts
Source: CAT SENR3130

Section 8: TROUBLESHOOTING

It cannot be emphasized enough that over 90% of difficulties can be prevented by good periodic inspection, lubrication, and maintenance. The time and energy consumed in proper care is only a fraction of that incurred when trouble stops operation.

When difficulties arise, please first use this troubleshooting guide and the Caterpillar Operation & Maintenance Manual. If the difficulty cannot be corrected, contact your Caterpillar dealer, the local ICE service location or International Construction Equipment, Inc. at 888 ICEUSA1 or 704 821-8200. Components in CAPITAL LETTERS are shown on the Electrical and Hydraulic Schematics (see Sections 9 & 10).

Electrical and Hydraulic Components, Schematics & Operation

Information on the operation of the electrical and hydraulic systems are included in Sections 9 and 10. An understanding of the operation of these systems is useful in locating and resolving operating difficulties.

Power Unit Monitoring and Protection

Both ICE and Caterpillar monitor critical operating parameters and can display a warning, derate (slow down) the engine and, in some cases, shut down the diesel engine. Read Engine Problems Indicated on Display and Hydraulic Problems Indicated on Control Panel on the next few pages.

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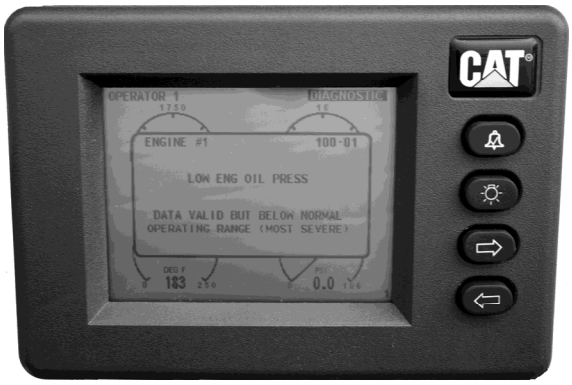
Engine Problems Indicated on Engine Display

If there is an engine problem, a screen similar to the one on the left below will appear on the engine display. There are three levels of engine conditions that may be indicated - 1) warning, 2) derate, and 3) shutdown.



Engine condition	Warning code	Derate code	Shutdown code
High coolant temperature	110-15	110-16	110-00
High fuel temperature	174-15	None	174-00
High fuel pressure	94-15	None	None
Low oil pressure	100-17	None	100-01

If an engine condition and code other than those shown above appears, call for Caterpillar service.

Engine warning

Shut down engine and correct the engine warning condition.

High coolant temperature - Check engine coolant level and check for coolant leaks.
High fuel temperature - Most likely caused by low fuel level. Refill fuel tank.
High fuel pressure - OK to continue operation. Call Caterpillar to resolve fuel pressure issue.
Low oil pressure - Check engine oil level and check for oil leaks.

Press Alarm button (top button) twice to remove the problem screen. The problem indicator (DIAGNOSTIC) will go out when the problem is corrected.

After correcting condition, follow the normal engine start procedure.

Engine derate (slowdown)

If the engine coolant temperature exceeds 232°F (111°C), the engine will derate (slow down). If the vibrator was running when the coolant temperature became high, the engine derate will usually cause the engine to stall. If the vibrator was not running, the engine will just run at reduced speed.

To reduce engine coolant temperature, turn vibrator MAIN switches (pendant and control panel) to OFF and follow normal engine start procedure. Allow engine coolant temperature to go below 230°F (110°C).

Press Alarm button twice to remove the problem screen. The problem indicator (DIAGNOSTIC) will go out when the problem is corrected.

After engine coolant temperature is reduced, normal vibrator operation may begin.

Engine shutdown

If the engine condition in the table above (with the exception of high fuel pressure) becomes severe, the engine will shut down.

Correct the engine shutdown condition as indicated above. Press Alarm button twice to remove the problem screen. The problem indicator (DIAGNOSTIC) will go out when the problem is corrected.

After correcting condition, follow the normal engine start procedure.

Other Engine Screen Displays

In addition to the normal operating engine screen display shown on the left below, two other screens are available as pictured below.

Operating screen

Service screen

History screen

The screen in the center shows certain engine information that may be useful to the job mechanic, ICE serviceman, or Caterpillar service person in diagnosing engine problems. This screen may be assessed by pressing the upper arrow key. To return to the normal operating engine screen, press the lower arrow key.

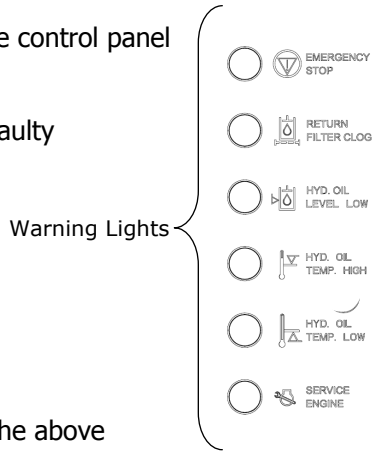
The screen on the right shows certain engine information for ICE engineering. This screen may be assessed by pressing the upper arrow key twice. To return to the normal operating engine screen, press the lower arrow key twice.

Hydraulic Problems Indicated on Control Panel

The engine may be shut down by a hydraulic problem.

If the engine is shut down by the following hydraulic problems, a red light on the control panel will illuminate.

Hydraulic return filter clogged - Filter is clogged and oil is bypassing or faulty filter pressure reading
Hydraulic oil level low - Low hydraulic oil level or faulty oil level reading
Hydraulic oil temperature high – High oil temperature or faulty hydraulic oil temperature reading



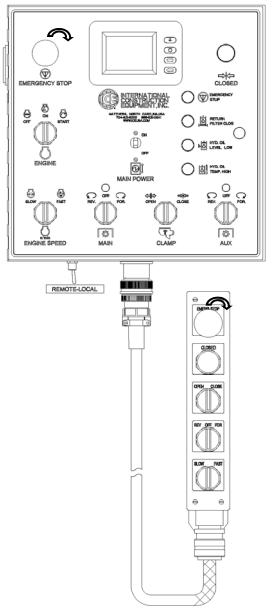
Correct the hydraulic problem and follow normal engine start procedure.

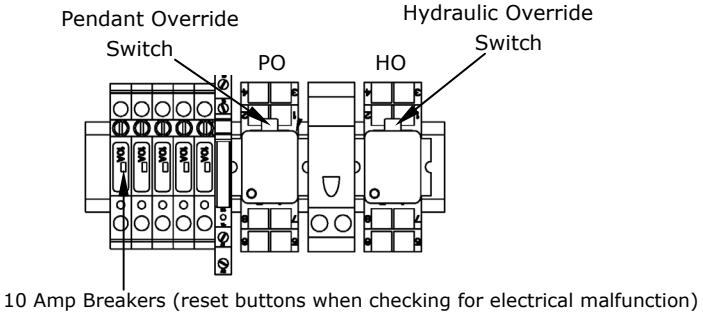
Without fixing the problem, the operator can override the shutdown caused by the above hydraulic problems and restart the power unit.

To override the engine shutdown:

1. Open the control panel.
2. Push and release the button labeled HO (HYDRAULIC OVERRIDE). The red light at the button will come on.
3. Close the control panel.
4. Follow the normal engine start procedure.
5. The engine will run until it is shut down manually (normally) or another fault occurs.

If the condition causing a shutdown has not been fixed and the engine has been manually (normally) shut down, the above override sequence must be repeated for engine restart.





Emergency Stop Indicated on Control Panel

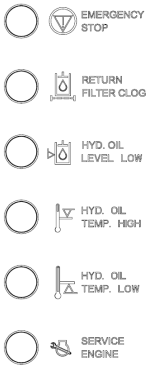
If the engine has been shut down by the Emergency Stop button, a red Emergency Stop light on the control panel will illuminate.

After dealing with the situation requiring the emergency stop, disengage (turn clockwise) the EMERGENCY STOP button on the control panel and pendant. Engine will not start unless both EMERGENCY STOP buttons are disengaged.

Follow the normal engine start procedure.

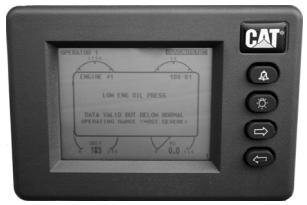
Diesel Engine Does Not Start

Shutdown Lights



Main power switch must be ON.
All other switches on control panel and pendant must be in central (neutral) position.
EMERGENCY STOP BUTTON must be disengaged (turned clock-wise).
Check if any of four shutdown lights on control panel are on.

Engine Display



Shutdown light is on
Correct problem or bypass hydraulic shutdown.
After correcting situation, resume operation

No Shutdown lights are on
Check if engine fault message appears on engine display.

Fault message
Correct engine problem.
After correcting situation, resume operation.

No fault message
Check the following:
- Battery
- Electrical connections and components
- Starter relay
- Fuel filter

If problem is not solved, consult Caterpillar Operation & Maintenance Manual or call local Caterpillar dealer.

Diesel Engine Will Not Run at Full Speed

See normal engine speeds in table below.
Use engine speed switch (SLOW - FAST) to set high-idle speed.

The Caterpillar engine control module (ECM) reduces speed (derates) if a condition occurs that could damage the engine. Derate speed is typically 50% of normal engine speed. If the condition is severe, the engine may be shutdown.

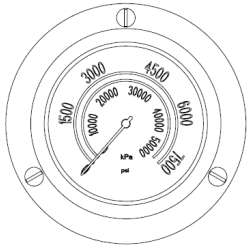
If the ECM derates or shuts down the engine, a fault indicator will appear on the engine display on the control panel (see page 51).

When the condition causes derate or shutdown is corrected, the engine may be started.

If the problem cannot be resolved, consult the Caterpillar Operation & Maintenance Manual or call your local Caterpillar dealer.

Power Unit	High Idle	Low Idle
350GZ	1950	700
450GZ	2000	700
595GZ	1850	700
700GZ	1800	700
800GZ	1800	700

Clamp Closes But CLOSED Light Does Not Come ON



CLAMP CIRCUIT

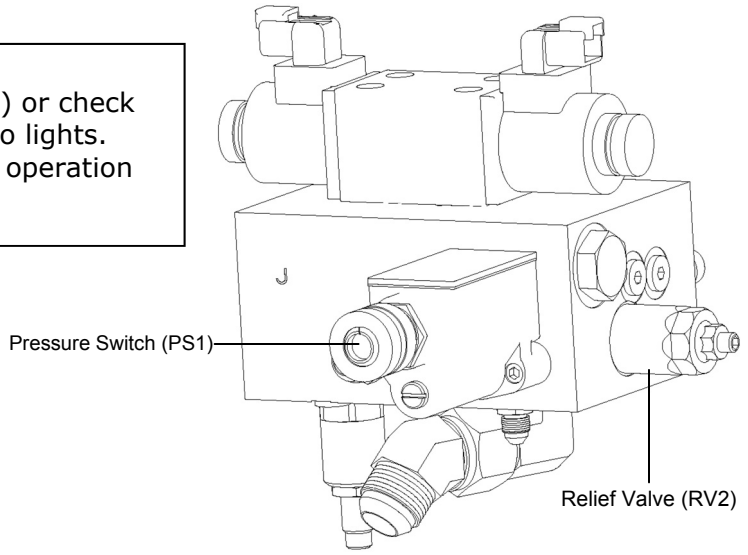
Engine is running.
Hoses are connected.
Clamp switch to CLOSE
Check CLOSED lights on both pendant and control panel.

Both CLOSED lights out
Hold clamp switch on OPEN for 20 seconds and observe open-clamp pressure.

One CLOSED light out
Replace bulb or fix wiring.
Resume normal operation.

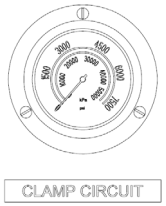
Pressure below 4500 psi
Set clamp relief valve (RV2) to 4800 psi (see Section 6: MAINTENANCE).
Set pressure switch to 4500 psi
After setting, resume normal operation.

Pressure at 4500 psi
Change pressure switch (PS1) or check wiring from pressure switch to lights.
After repairs, resume normal operation



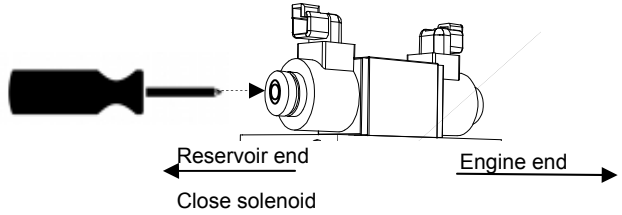
Clamp Control Stack

Clamp Will Not Close



Engine is running
Hoses are connected
Clamp switch on CLOSE

Pressure on clamp gauge is zero
Manually shift clamp solenoid valve



Clamp pressure is above zero
Go to next page

Clamp pressure builds
Check voltage to close-clamp solenoid

Clamp pressure is zero
Turn & hold clamp switch on OPEN

Voltage to solenoid
Replace clamp solenoid

No voltage to solenoid
Switch from Remote to Local or vice versa (see Section 5: OPERATION)

Works in Local
Replace pendant

Works in Remote
Replace clamp switch

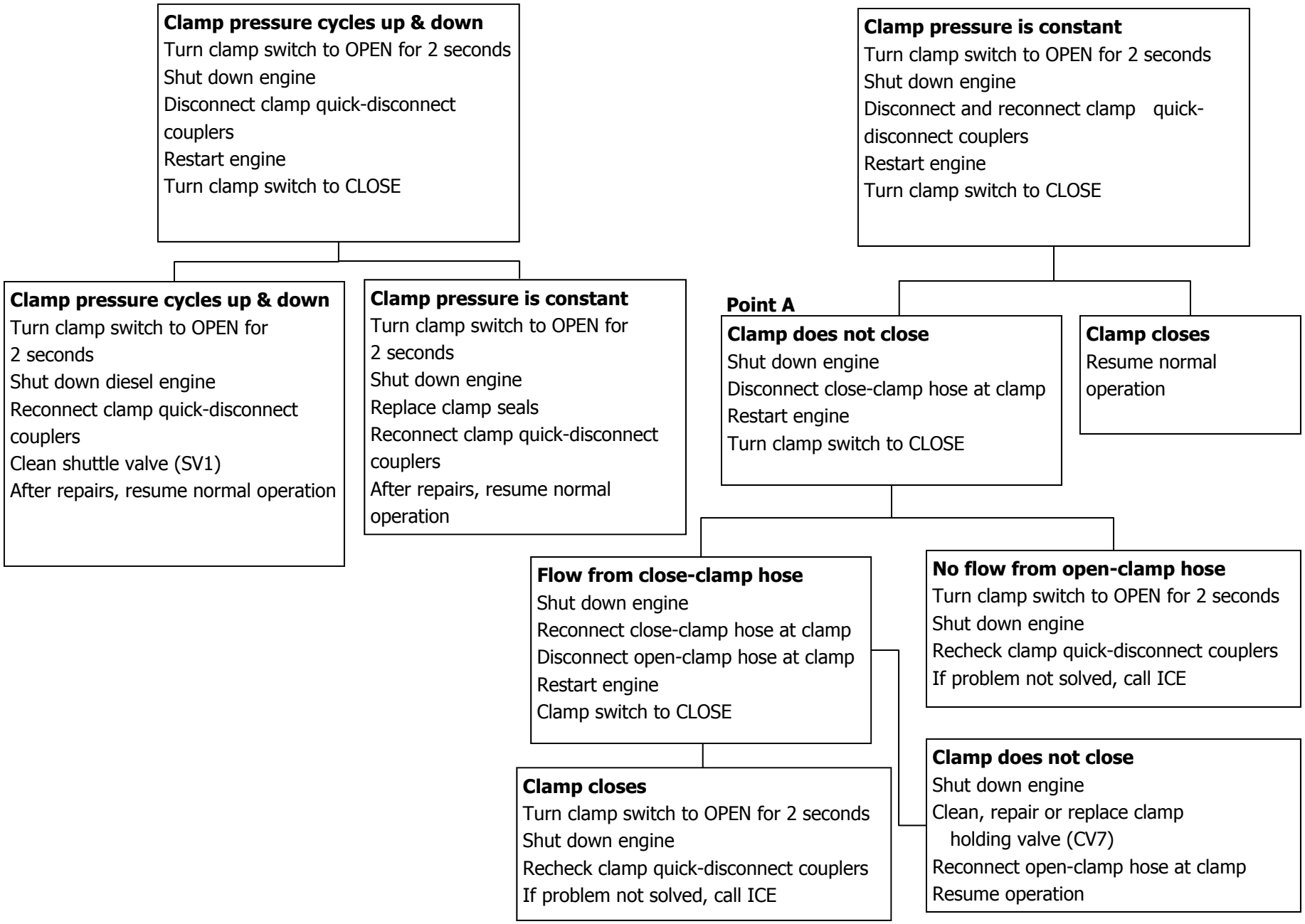
Clamp pressure is zero
Shut down diesel engine
Cycle clamp relief valve (RV2) by moving adjusting screw in and out
Reset relief valve to 4800 psi (see Section 6: MAINTENANCE)
Turn & hold Clamp switch on OPEN

Clamp pressure builds but clamp does not close
Go to Point A on next page

Clamp pressure builds
Resume normal operation

Clamp pressure is zero
Repair or replace clamp

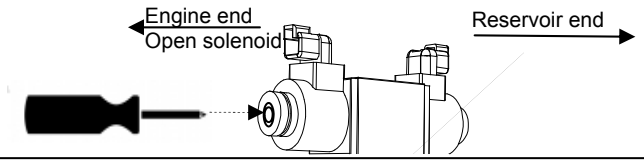
Clamp Will Not Close (Continued)



Clamp Will Not Open

Engine is running
Hoses are connected
Clamp is closed
Turn clamp switch to OPEN,
hold for 20 seconds and read

Pressure on clamp gauge is zero
Manually shift clamp solenoid valve



Clamp pressure is 4800 psi
Go to next page

Clamp pressure is zero
Shut down diesel engine
Cycle clamp relief valve (RV2) by moving adjusting screw in and out
Reset relief valve to 4800 psi (see Section 6: MAINTENANCE)
Restart engine
Turn & hold clamp switch on OPEN

Clamp pressure builds but clamp does not open
Check voltage to clamp close solenoid

Clamp pressure is zero
Repair or replace clamp pump (P2)
After repairs, resume operation

Clamp opens
Resume normal operation

No voltage to solenoid
Switch from Remote to Local or vice versa (see Section 5: OPERATION)

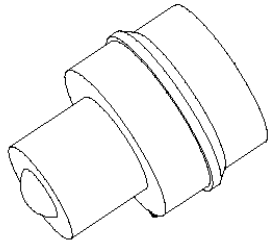
Voltage to solenoid
Replace solenoid
After repairs, resume operation

Works in Local
Replace or repair pendant
After repairs, resume operation

Works in Remote
Replace clamp switch
After repairs, resume operation

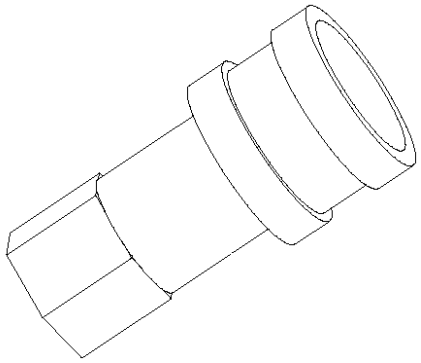
Clamp Will Not Open (Continued)

Clamp pressure is 4800 psi
Shut down engine
Disconnect clamp quick disconnect coupler
Restart engine
Turn & hold clamp switch on OPEN



Clamp opens
Shut down engine
Reconnect clamp quick-disconnect couplers
Restart engine
Restart normal operation

Clamp does not open
Shut down engine
Disconnect open clamp hose at clamp
Restart engine
Turn & hold clamp switch to OPEN



Flow from open-clamp hose
Shut down engine
Reconnect open-clamp hose at clamp
Disconnect close-clamp hose at clamp
Restart engine
Turn & hold clamp switch to OPEN

No flow from open-clamp hose
Shut down engine
Reconnect open-clamp hose at clamp
Recheck clamp quick-disconnect couplers
If problem not solved, call ICE

Clamp opens
Shut down engine
Reconnect close-clamp hose at clamp
Recheck clamp quick-disconnect couplers
If problem not solved, call ICE

Clamp does not open
Use bleed valve to release close-clamp pressure
CAUTION – release pressure slowly
Clean, repair or replace clamp holding valve (CV7)
Reconnect close-clamp hose at clamp
Resume operation

Vibrator Will Not Start

Engine running
Main (REV-OFF-FOR) switch to FOR
Clamp CLOSED light on
Check main pressure gauge reading

Pressure is zero
Switch from REMOTE to LOCAL
or vice versa (see Section 5: OPERATION)

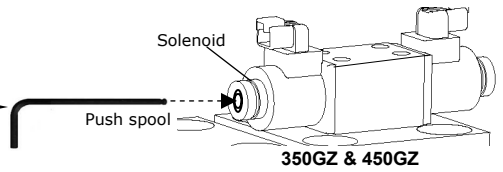
Vibrator starts
Resume normal operation
Repair or replace damage pendant or fix control panel problem

Vibrator does not start
Check main pressure gauge reading

Pressure is less than 1500 psi
Call ICE to discuss checking vibrator anti-cavitation check valve (CV6)

Pressure is above 1500 psi
Turn main switch to OFF
Shutdown engine
Disconnect and reconnect main quick-disconnect couplers
Restart engine
Turn main switch to FOR

Pressure is zero
Manually shift main control valve



350GZ & 450GZ

Pressure is above zero
Check wiring to main control valve solenoid or replace solenoid

Pressure is zero
Turn main switch to OFF
Shutdown engine
Remove, clean & reinstall orifice (OR1)
Restart engine
Turn main switch to FOR
Check main pressure gauge reading

Vibrator does not start
Call ICE to discuss checking vibrator motors or gear case

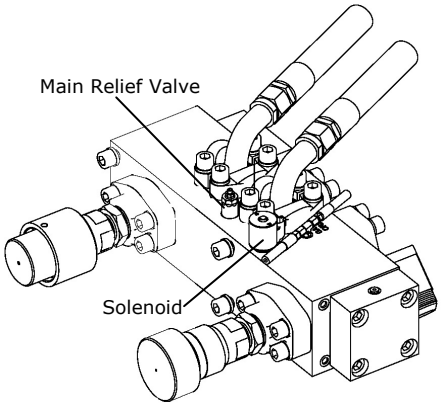
Vibrator starts
Resume normal operation

Pressure is 5500 psi
Go to Point A on next page

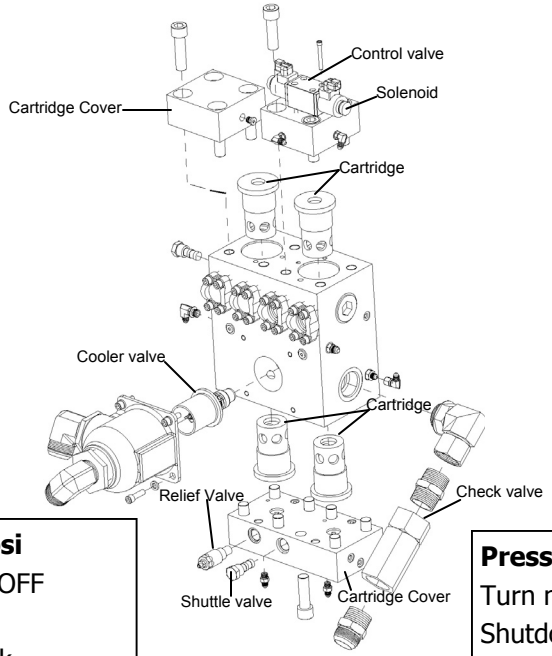
Pressure is zero
Go to Point B on next page

595GZ, 700GZ & 800GZ

Vibrator Will Not Start (continued)



Control Manifold (595GZ, 700GZ, 800GZ)



Control Manifold (350GZ & 450GZ)

Point A

Pressure is 5500 psi
Turn main switch to OFF
Shutdown engine
Reconnect main quick-disconnect couplers
Restart engine
Turn main switch to FOR

Vibrator does not start
Check main pressure gauge

Vibrator starts
Resume normal operation

Pressure is less than 1500 psi
Call ICE to discuss checking vibrator cavitation check valve

Pressure is above 1500 psi start
Call ICE to discuss checking vibrator motors or gear case

Point B

Pressure is zero
Check main relief valve (RV1) by loosening jam nut and moving adjusting screw in and out several times
Reset relief valve (See Section 6: MAINTENANCE)
Restart engine
Turn main switch to FOR
Check main pressure gauge reading

Pressure is zero
Turn main switch to OFF
Shutdown engine
Disconnect main quick-disconnect couplers
Restart engine
Turn main switch to FOR
Check main pressure gauge reading

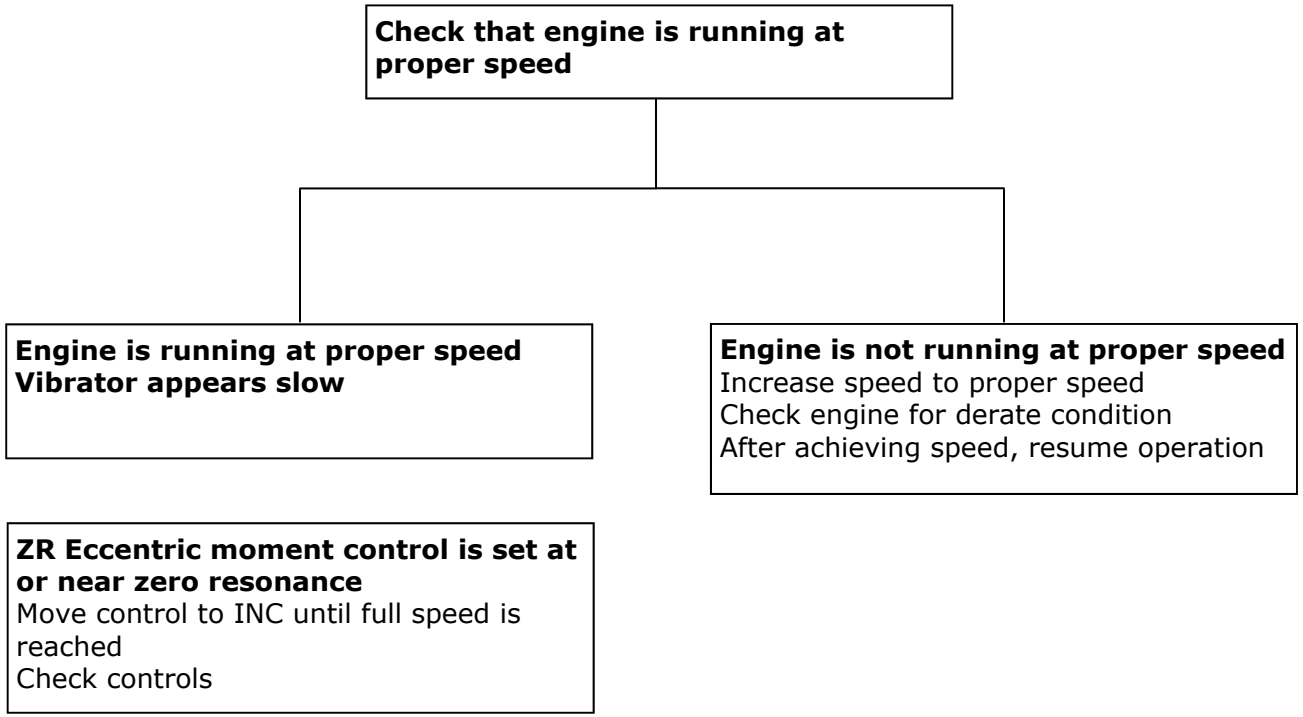
Pressure is 5500 psi
Turn main switch to OFF
Shutdown engine
Reconnect main quick-disconnect couplers
Resume normal operation

Pressure is zero
Turn main switch to OFF
Shutdown engine
Remove, clean & reinstall orifice (OR1)
Restart engine
Turn main switch to FOR
Check main pressure gauge reading

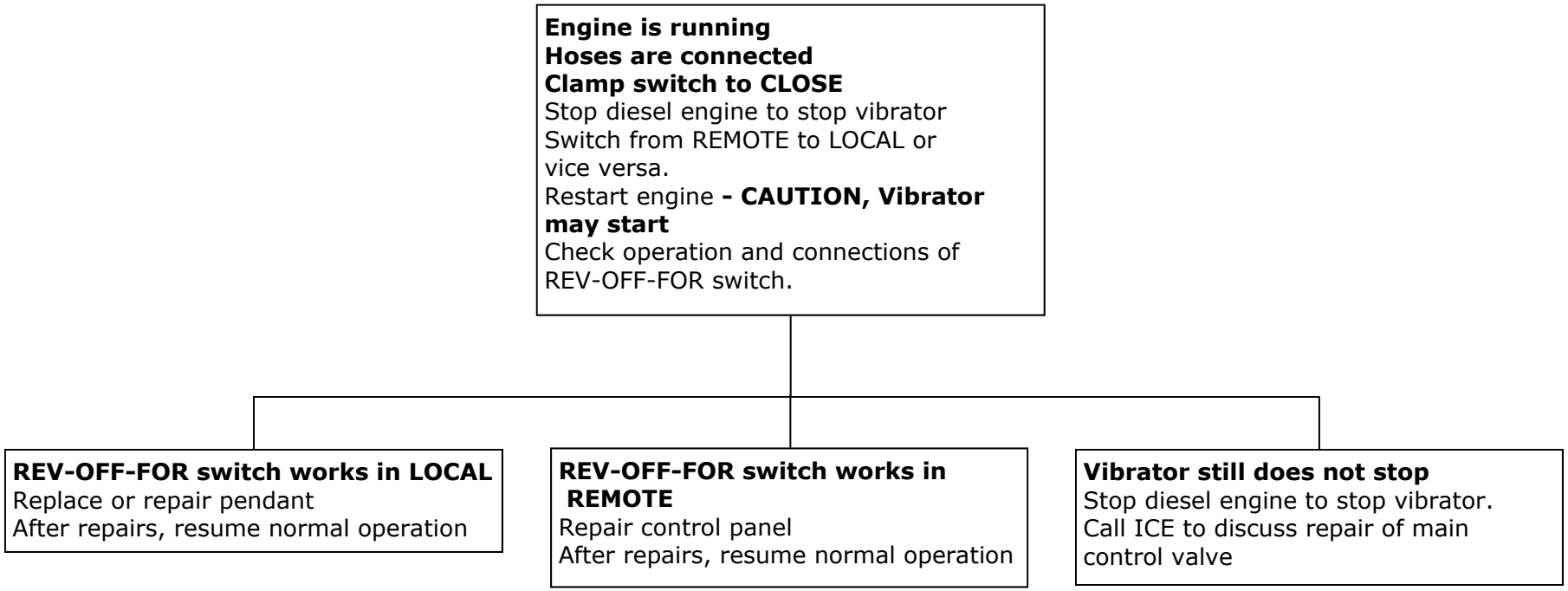
Pressure is 5500 psi
Turn main switch to OFF
Shutdown engine
Reconnect main quick-disconnect couplers
Restart engine
Turn main switch to FOR

Pressure is zero
Call ICE to discuss main pump

Vibrator Does Not Come Up to Speed



Vibrator Does Not Stop When Main REV-OFF-FOR Switch is Turned to OFF



Case Drain Valve in Vibrator Manifold at Suppressor Blows Off or Leaks

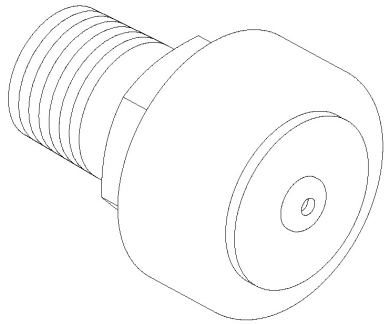
Shut down engine.
Disconnect & reconnect case drain quick disconnect coupler at power unit.
Check that case drain hose is not pinched.

QD Coupler and hose OK
Replace case drain relief valve (RV3)

Coupler loose or hose pinched
After correcting problem, resume operation

Leak stopped.
Resume normal operation.

Case drain relief valve still leaks.
Call ICE



Case Drain Relief (RV3)

Vibrator Gear Case Runs Hot

Temperature of Bearing Covers (paint removed should be below 210°F (100°C)

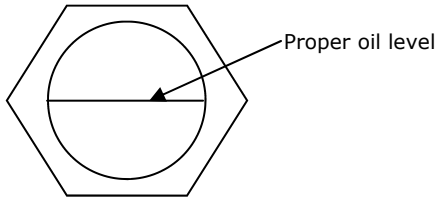
Check level of oil in gear case.
Oil should be in middle of sight glass.
Too much or too little oil will cause overheating.

Oil level OK
Check if oil is milky or dirty

Oil high or low
Correct oil level

Milky or dirty
Change oil.

Oil Clean
Call ICE to discuss operating or bearing problem.

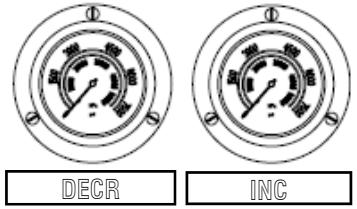


Oil Level Sight Gauge

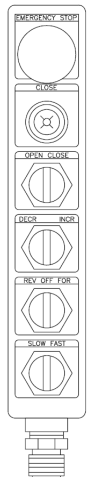
Vibrator Gear Case Fills With Hydraulic Oil

Call ICE

Eccentric Moment Actuator Control (INC - DEC) Is Not Operational



Engine running
Main (REV-OFF-FOR) switch to FOR
ZR remote control pedant (must be used)
Check main pressure gauge reading



Pressure is zero
Switch from REMOTE to LOCAL
(see Section 5: OPERATION)

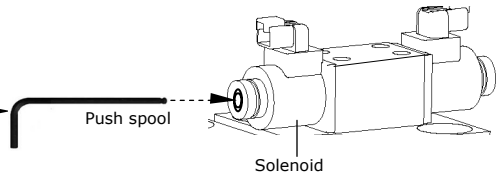
Moment Actuator Control functions
Repair or replace damage pendant or fix control panel problem
Resume normal operation

Control does not function
Check main pressure gauge reading

Pressure is low
Call ICE to discuss checking Moment actuator control system

Pressure is high
Turn main switch to OFF
Shutdown engine
Disconnect and reconnect Moment actuator quick disconnect couplers (check condition & replace if necessary) Restart engine
Turn main switch to DECR & INC and check gauges

Pressure is zero
Manually shift ZR moment control valve



Pressure is above zero
Check wiring to main control valve solenoid or replace solenoid

Pressure is zero
Turn main switch to OFF
Shutdown engine
Remove, clean valve & reinstall
Restart engine
Turn main switch to DECR & INC
Check pressure gauges reading

Moment actuator control does not work
Call ICE to discuss pump circuit

Moment actuator control works
Resume normal operation

Pressure is 1500psi (103 Bar) Go to Point A on next page

Pressure is zero
Go to Point B on next page

Section 10: Electrical CIRCUITRY

Electrical Schematic

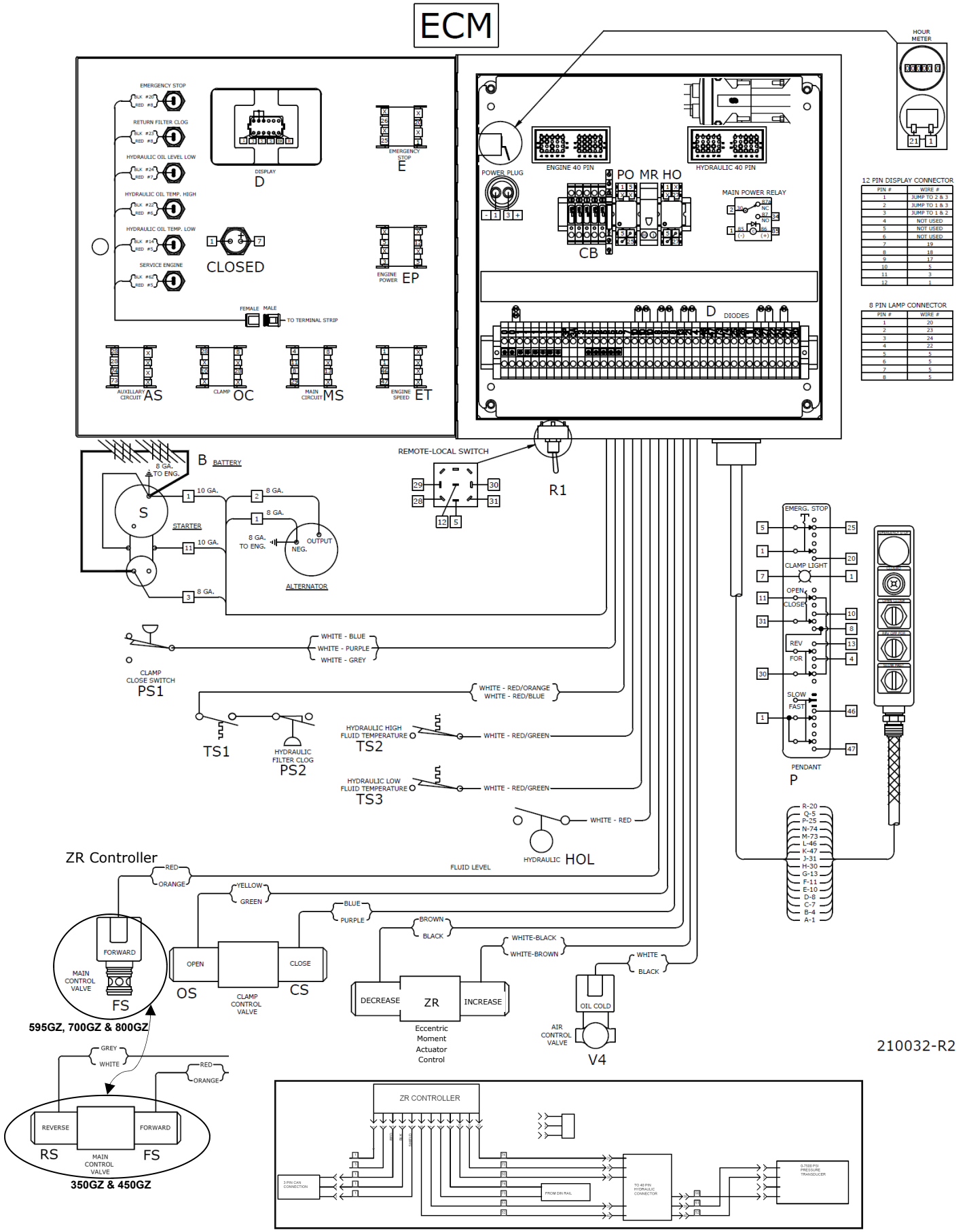
The electrical control circuitry presented in this section's diagrams is for trouble shooting reference.

The control system is packaged in a control cabinet with various switches and controls.

Major components of the system are listed in the table below.

Electrical Components

Item	Part Number	Qty.	Description
A	See CAT parts	1	Alternator
AS	400718	1	Auxiliary Switch (Optional)
B	100529	2	Battery
CB	731155	5	10 Amp Circuit Breaker
CLOSED	100359	1	Closed Light
CS	730807	1	Close Clamp Solenoid
D	750311	1	Display
Dd	100413	11	Diode
E	130507	1	Emergency Stop Switch
ECM	840814	1	Electric Control Panel Assembly
EP	110615	1	Engine Power
ET	100566	1	Engine Throttle Switch
FS	750513	1	Forward Solenoid
FI	840872	1	Fault Indicator Light
FLR	731201	1	Filter Lamp Relay
FT1	840097	1	Fuel Level Transducer Assembly
HO	731185	1	Hydraulic Override Switch
HOL	100314	1	Hydraulic Fluid Level Switch
MPR	731202	1	Main Power Relay
MR	731179	1	Maintenance Reset Switch
OC	130155	1	Clamp Switch
OS	730807	1	Open Clamp Solenoid
P	840090	1	Pendant Control Assembly
PO	731185	1	Pendant Override Switch
PS1	840477	1	Close Clamp Pressure Switch
PS2	100602	1	Pressure Switch - Return Filter
RL	140361	1	Remote Local Switch
TDR	731176	1	Time Delay Relay
TS1	770686	1	Temperature Switch - Return filter low
TS2	770687	1	Temperature Switch - Hydraulic oil high
TS3	770684	1	Temperature Switch - Hydraulic oil low
S	See CAT parts	1	Starter


ECM
HOUR METER
EMERGENCY STOP
RETURN FILTER CLOG
HYDRAULIC OIL LEVEL LOW
HYDRAULIC OIL TEMP. HIGH
HYDRAULIC OIL TEMP. LOW
SERVICE ENGINE
DISPLAY
D
CLOSED
EMERGENCY STOP
E
ENGINE POWER
EP
FEMALE
MALE
TO TERMINAL STRIP
AUXILLARY CIRCUIT
AS
CLAMP
OC
MAIN CIRCUIT
MS
ENGINE SPEED
ET
POWER PLUG
ENGINE 40 PIN
PO MR HO
HYDRAULIC 40 PIN
MAIN POWER RELAY
CB
D
DIODES
12 PIN DISPLAY CONNECTOR
PIN # WIRE #
1 JUMP TO 2 & 3
2 JUMP TO 1 & 3
3 JUMP TO 1 & 2
4 NOT USED
5 NOT USED
6 NOT USED
7 19
8 18
9 17
10 5
11 3
12 1
8 PIN LAMP CONNECTOR
PIN # WIRE #
1 20
2 23
3 24
4 22
5 5
6 5
7 5
8 5
B BATTERY
8 GA. TO ENG.
S
STARTER
10 GA.
8 GA.
8 GA. TO ENG.
NEG.
OUTPUT
ALTERNATOR
REMOTE-LOCAL SWITCH
R1
EMERG. STOP
CLAMP LIGHT
OPEN
CLOSE
REV
FOR
SLOW
FAST
PENDANT
P
CLAMP CLOSE SWITCH
PS1
WHITE - BLUE
WHITE - PURPLE
WHITE - GREY
WHITE - RED/ORANGE
WHITE - RED/BLUE
TS1
HYDRAULIC FILTER CLOG
PS2
HYDRAULIC HIGH FLUID TEMPERATURE
TS2
WHITE - RED/GREEN
HYDRAULIC LOW FLUID TEMPERATURE
TS3
WHITE - RED/GREEN
WHITE - RED
HYDRAULIC
HOL
FLUID LEVEL
ZR Controller
RED
ORANGE
YELLOW
GREEN
BLUE
PURPLE
BROWN
BLACK
WHITE-BLACK
WHITE-BROWN
WHITE
BLACK
FORWARD
MAIN CONTROL VALVE
FS
595GZ, 700GZ & 800GZ
OPEN
CLOSE
OS
CS
CLAMP CONTROL VALVE
DECREASE
ZR
INCREASE
Eccentric Moment Actuator Control
OIL COLD
AIR CONTROL VALVE
V4
GREY
WHITE
RED
ORANGE
REVERSE
FORWARD
RS
MAIN CONTROL VALVE
FS
350GZ & 450GZ
ZR CONTROLLER
210032-R2

Electrical Components and Operation

Components indicated in CAPITAL LETTERS below are shown on the Electrical Components Diagram and the Electrical Schematics.

Optional Control

Duplicate vibrator and clamp switches are located on the CONTROL PENDANT and on the CONTROL PANEL. Turning the REMOTE-LOCAL switch on the control panel to REMOTE permits operation of the clamp and vibrator from the PENDANT. Turning the REMOTE-LOCAL switch to LOCAL, disconnecting the pendant, and pressing the PENDANT OVERRIDE BUTTON (PO) inside the control panel permits operation of the clamp and vibrator from the CONTROL PANEL.

The rotary head should be operated using the remote-control pendant. The rotary head may be operated from the control panel, but the safety feature preventing torque-speed shifting while the rotary head is turning is not effective.

The information below assumes operation from the PENDANT.

Control Panel Display

The control panel DISPLAY (D) shows engine speed, coolant temperature, charging voltage, oil pressure and fuel pressure. Engine fault codes are shown on the DISPLAY. These codes go out if the condition is corrected.

Control System and Engine Power

Turning the ENGINE POWER (EP) switch to ON energizes the MAINPOWER RELAY (MPR) which sends power to the control system and the ENGINE CONTROL MODULE (ECM). The control and engine circuitry is protected by five 10-amp Circuit Breakers (CB). Diodes (Dd) protect the circuitry from reverse polarity.

Engine Monitoring

The ENGINE CONTROL MODULE (ECM) monitors the engine for any of the following conditions:

1. Low oil pressure
2. High fuel temperature
3. High coolant temperature
4. Engine over speed

If any of these conditions occurs, a fault code is shown on the DISPLAY(D) on the control panel and a signal is sent to the ENGINE CONTROL MODULE (ECM) to shut down the engine. The fault code goes away if the condition is corrected.

After the condition is corrected, turn the ENGINE POWER (ON-OFF–START) switch off and on to reset ECM. Follow normal engine start procedure.

Hydraulic System Monitoring

The control system monitors the hydraulic system for any of the following abnormal operating conditions:

1. Clogged hydraulic return filters
2. Low hydraulic oil in reservoir
3. High hydraulic oil temperature

If either of these conditions occurs, a signal is sent to the ENGINE CONTROL MODULE (ECM) to shut down the engine. A fault light on the control panel is illuminated.

If the hydraulic oil level in the reservoir is low, the HYDRAULIC FLUID LEVEL switch (HOL) turns on the HYD. OIL LEVEL LOW light on the control panel.

If the hydraulic oil pressure at the return filters is too high and the hydraulic oil temperature is warm, the RETURN FILTERS PRESSURE SWITCH (PS2) and RETURN FILTERS TEMPERATURE SWITCH (TS1) turn on the RETURN FILTER CLOG light on the control panel.

If the hydraulic oil temperature in the reservoir is too high, the HYDRAULIC OIL TEMPERATURE SWTTCH (TS2) turns on the HYD. OIL TEMP. HIGH light on the control panel.

The fault light goes out when the condition is corrected. After correcting the condition, follow normal engine start procedure. The engine may be restarted before correcting these conditions by pressing the HYDRAULIC OVERRIDE BUTTON (HO) inside the control panel.

If the hydraulic oil temperature in the reservoir is too low, the HYDRAULIC OIL TEMPERATURE SWTTCH (TS3) turns on the HYD. OIL TEMP. LOW light on the control panel. The engine is not shut down.

Starting Diesel Engine

The ENGINE BATTERIES (B) provide 24 volt current to start the diesel engine. Turning the ENGINE POWER (EP) switch to START energizes the ENGINE STARTER (S) which starts the diesel engine.

On both PENDANT and CONTROL PANEL, the MAIN switch and the AUXILIARY switch must be in the OFF position and the clamp (OPEN-CLOSE) switch must be in the center (neutral) position to allow engine start. If any of these switches are not in the correct position for engine start, the engine will not start.

Changing Engine Speed

Turning the SLOW-FAST SWITCH on the PENDANT to SLOW sends a signal to the engine ECM to decreases engine rpm. Turning the SLOW-FAST SWITCH on the PENDANT to FAST increases engine rpm. The switch must be held in position for 2 seconds before engine rpm will change.

Stopping Diesel Engine

Turning the ENGINE POWER (EP) switch to OFF sends a signal to the ECM to stop the engine.

Emergency Stop

When the diesel engine is running, pressing the EMERGENCY STOP (ES) button on the PENDANT or the CONTROL PANEL sends a signal to the ENGINE CONTROL MODULE (ECM) which immediately shuts down the engine and vibrator. To restart the engine, follow the normal engine start procedure.

Hydraulic Clamp

With the diesel engine running, turning the clamp switch (OPEN-CLOSE) on the PENDANT to CLOSE energizes the CLOSE-CLAMP SOLENOID (CS) on the hydraulic CLAMP CONTROL VALVE. The clamp closes.

When the pressure in the close-clamp hydraulic circuit reaches 4,500 psi (310 bar), the CLAMP PRESSURE SWITCH (PS1) de-energizes the CLOSE-CLAMP SOLENOID and turns on the on the clamp CLOSED lights on the PENDANT and CONTROL PANEL. If the close-clamp pressure falls below 4,500 psi, the CLAMP PRESSURE SWITCH reenergizes the CLOSE-CLAMP SOLENOID to rebuild clamp pressure. The CLOSED lights are turned out. When pressure returns to 4,500 psi (310 bar), the CLAMP PRESSURE SWITCH de-energizes the CLOSE-CLAMP SOLENOID and turns on the CLOSED lights.

With the diesel engine running, holding the CLAMP SWITCH (OPEN-CLOSE) in the OPEN position energizes the OPEN-CLAMP SOLENOID (OS). The clamp opens. The CLOSED lights are turned out.

Vibrator

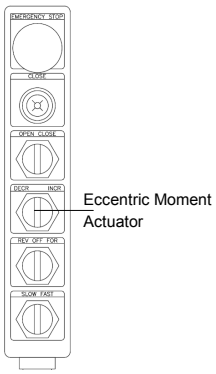
With the diesel engine running, turning the MAIN (REV-OFF-FOR) switch on the PENDANT to FOR energizes the FORWARD SOLENOID (FS) on the hydraulic MAIN CONTROL VALVE. The MAIN CONTROL VALVE directs hydraulic oil to the vibrator hydraulic motors and the vibrator starts.

With the diesel engine running, turning the MAIN (REV-OFF-FOR) switch on the PENDANT to OFF de-energizes the FORWARD SOLENOID on the MAIN CONTROL VALVE. The vibrator stops.

ZR Function (Moment or Phase Control)

1. To increase eccentric moment, turn the Moment (DEC-INC) to INC. The eccentric moment will increase. Full eccentric Moment should be achieved in about 3 seconds.
2. To decrease eccentric moment, turn the MOMENT (DEC-INC) switch to DEC. The eccentric moment will decrease. Zero eccentric moment shall be achieved in about 3 seconds.

1. Turn the MOMENT (DEC - INC) to DEC, hold for 3 seconds and release. Eccentric moment will go to zero.
2. Turn the MAIN (REV-OFF-FOR) switch to OFF position. Momentarily turning the switch to the REV position has no effect and will not cause damage or adverse operation.



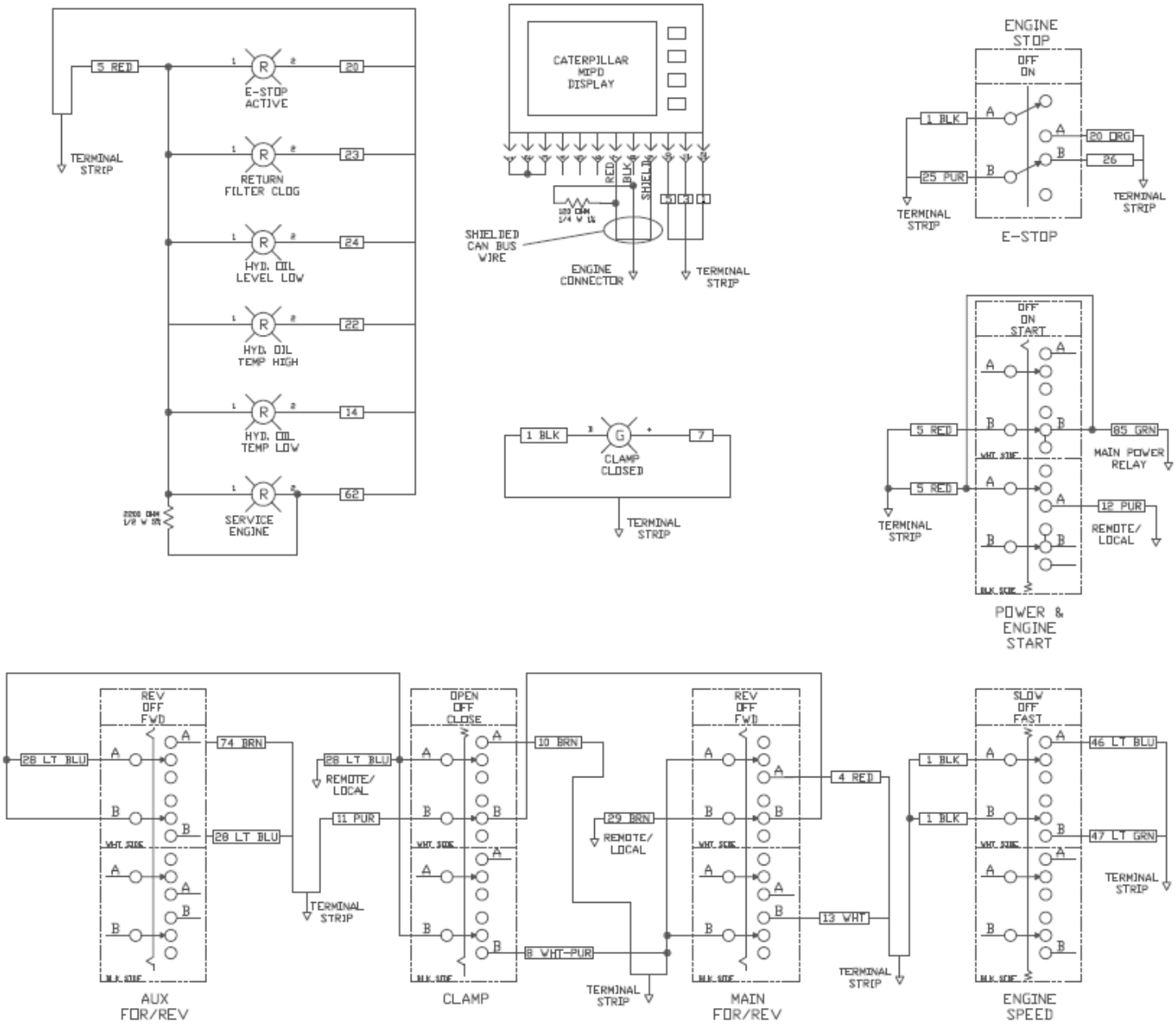
Other

An AUXILIARY CIRCUIT switch (AS) is mounted on the CONTROL PANEL and to control an optional AUXILIARY CONTROL VALVE.

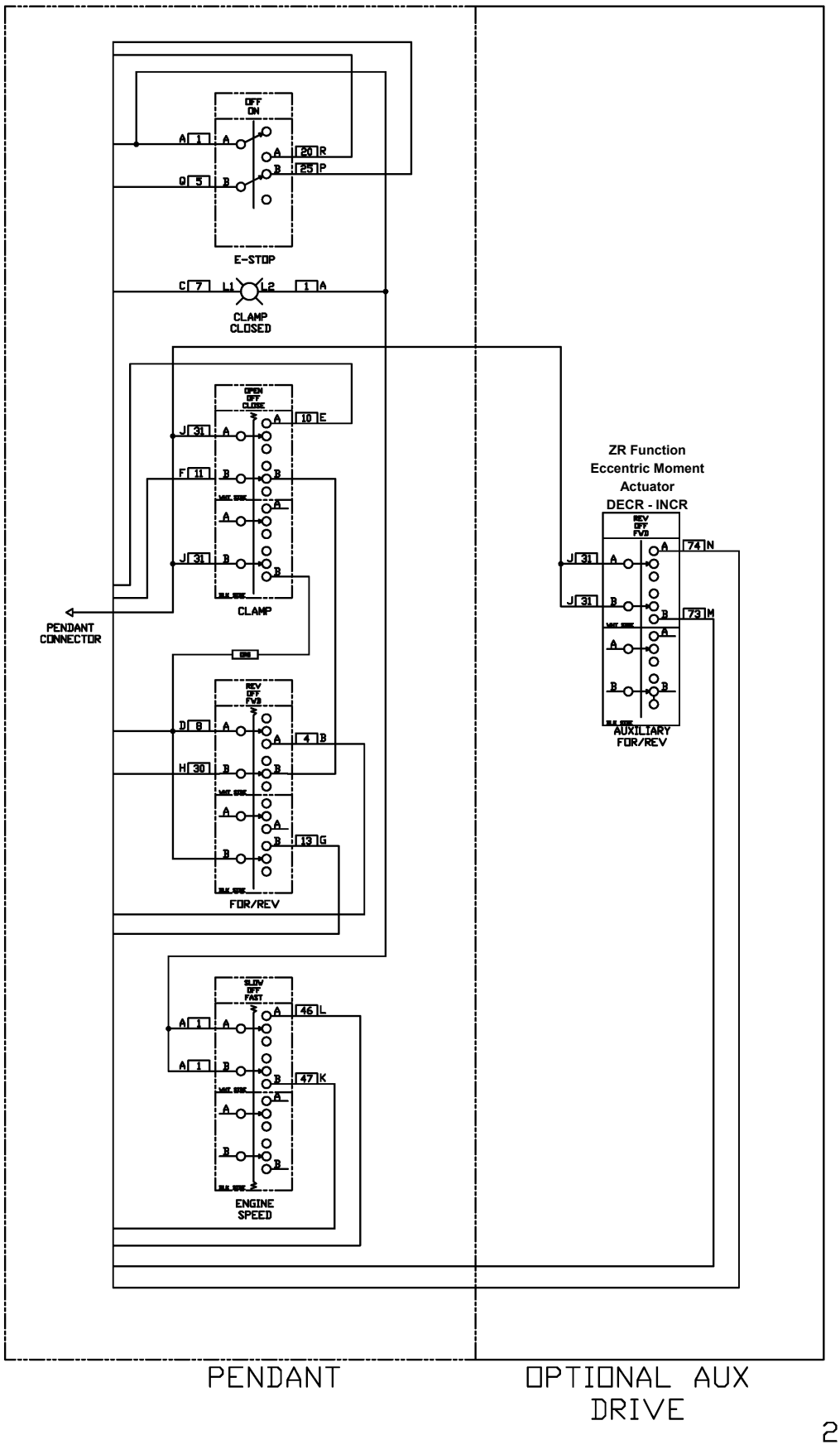
An HOUR METER records the time the MAIN (REV-OFF-FOR) switch is in the FOR or REV position.

The yellow light on the control panel illuminates when oil pressure from vibrator's lube pump is normal. An operating temperature of 100°F (38°C) is required for the pressure switch to turn on light. Check the pressure gauge mounted on switch center of reservoir to verify pressure when vibrator is first started.

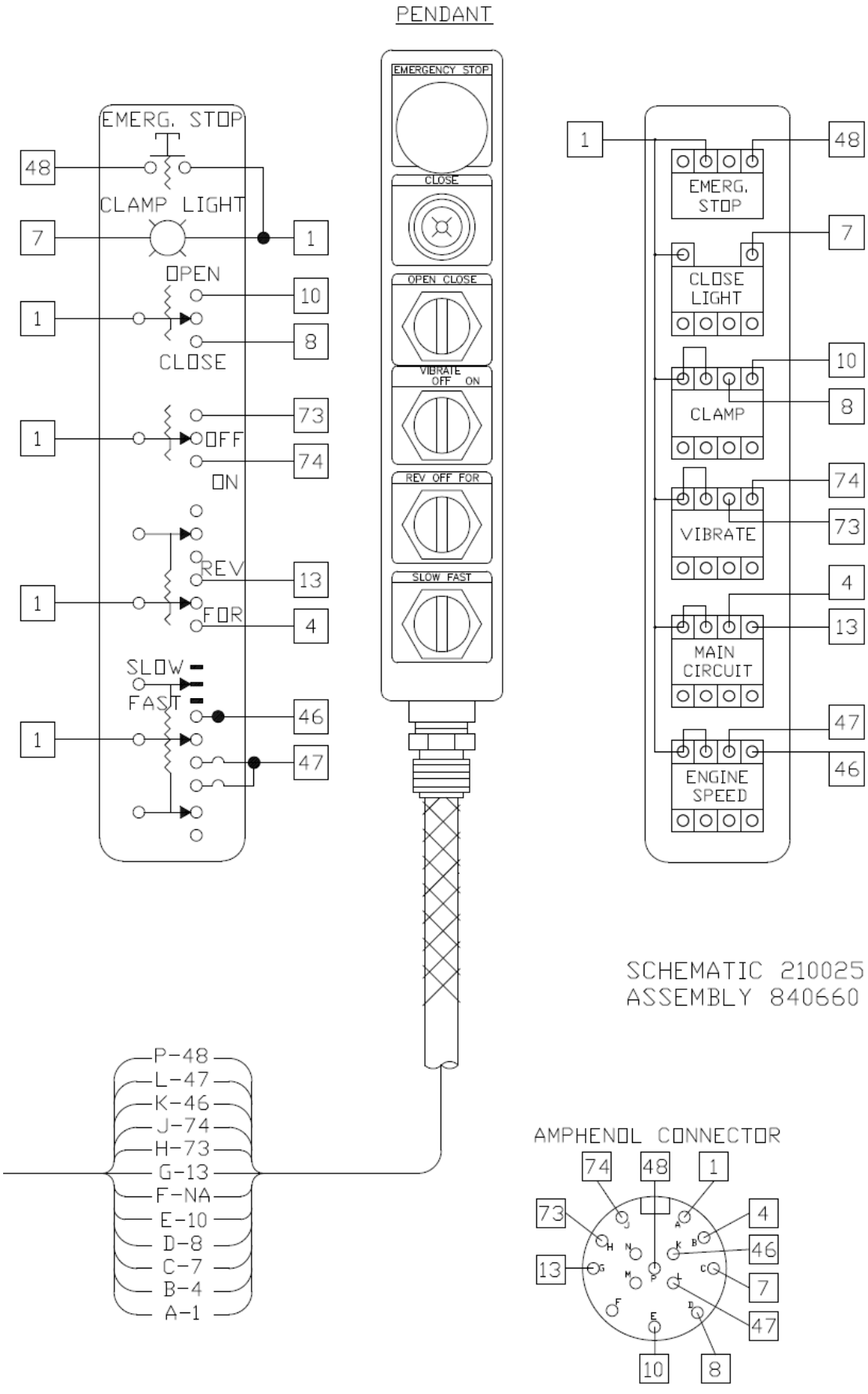
Electrical Schematic and Wiring A



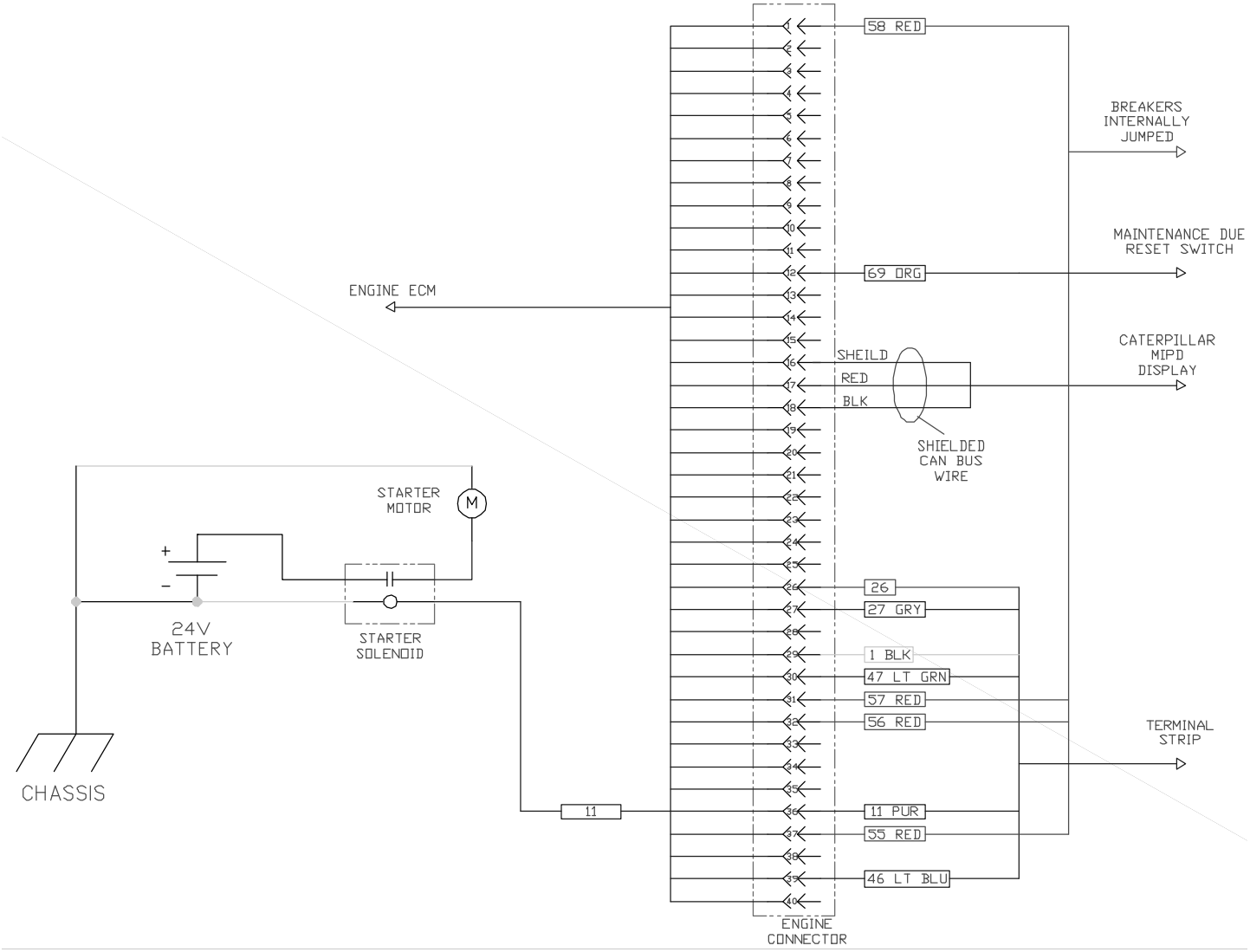
Electrical Schematic and Wiring B (Vibrator)



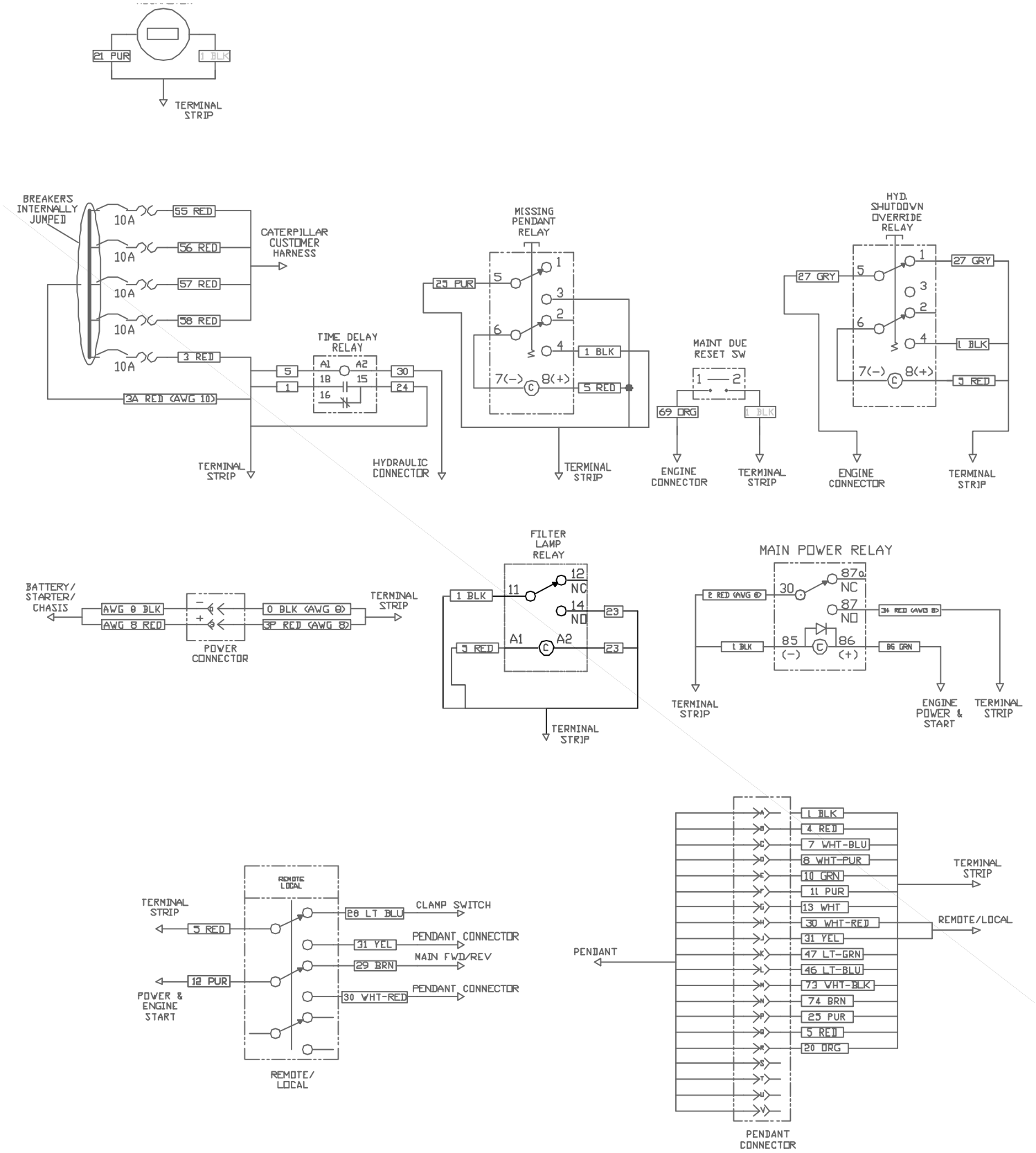
Electrical Schematic and Wiring B (Rotary Head)



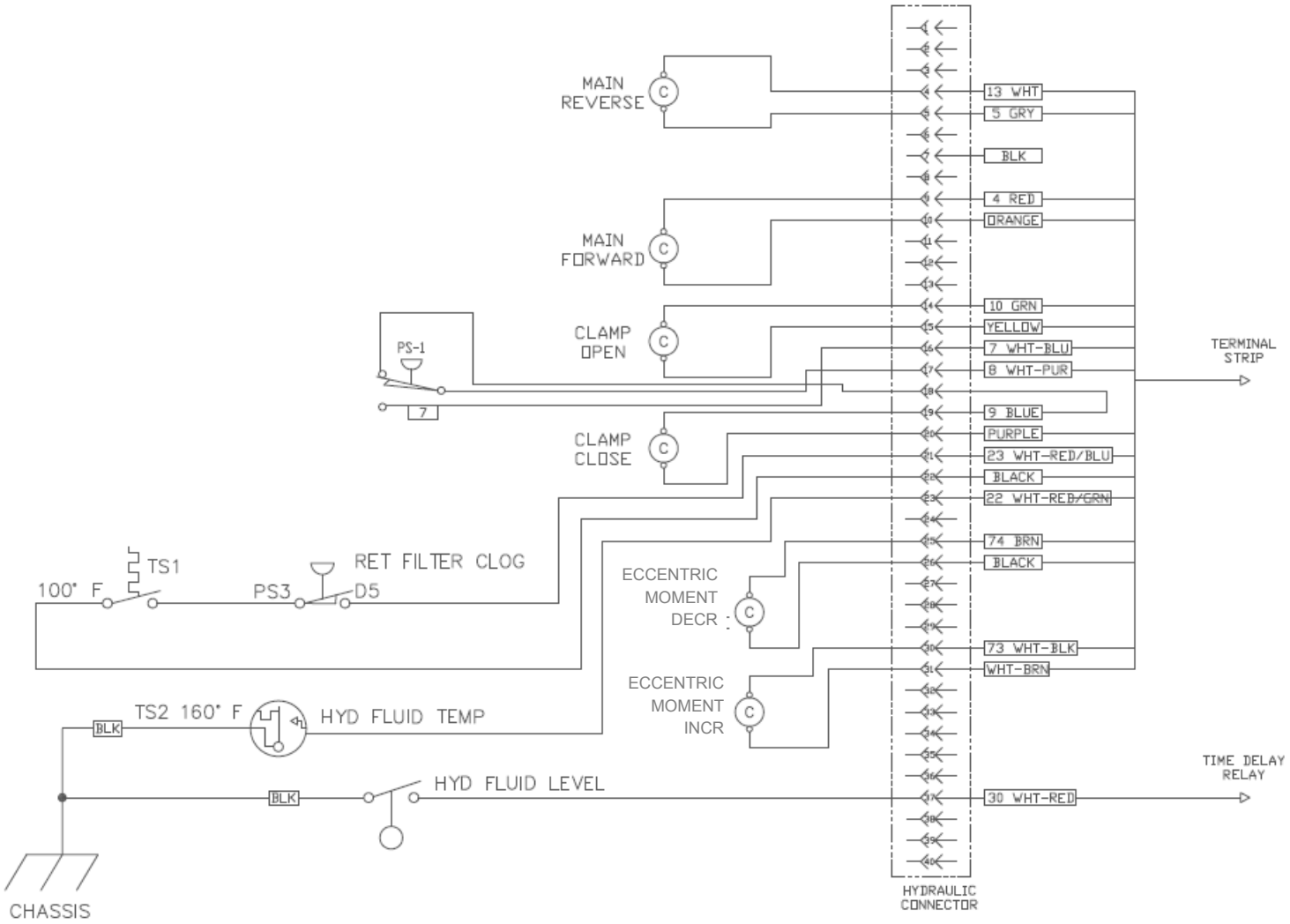
Electrical Schematic and Wiring C



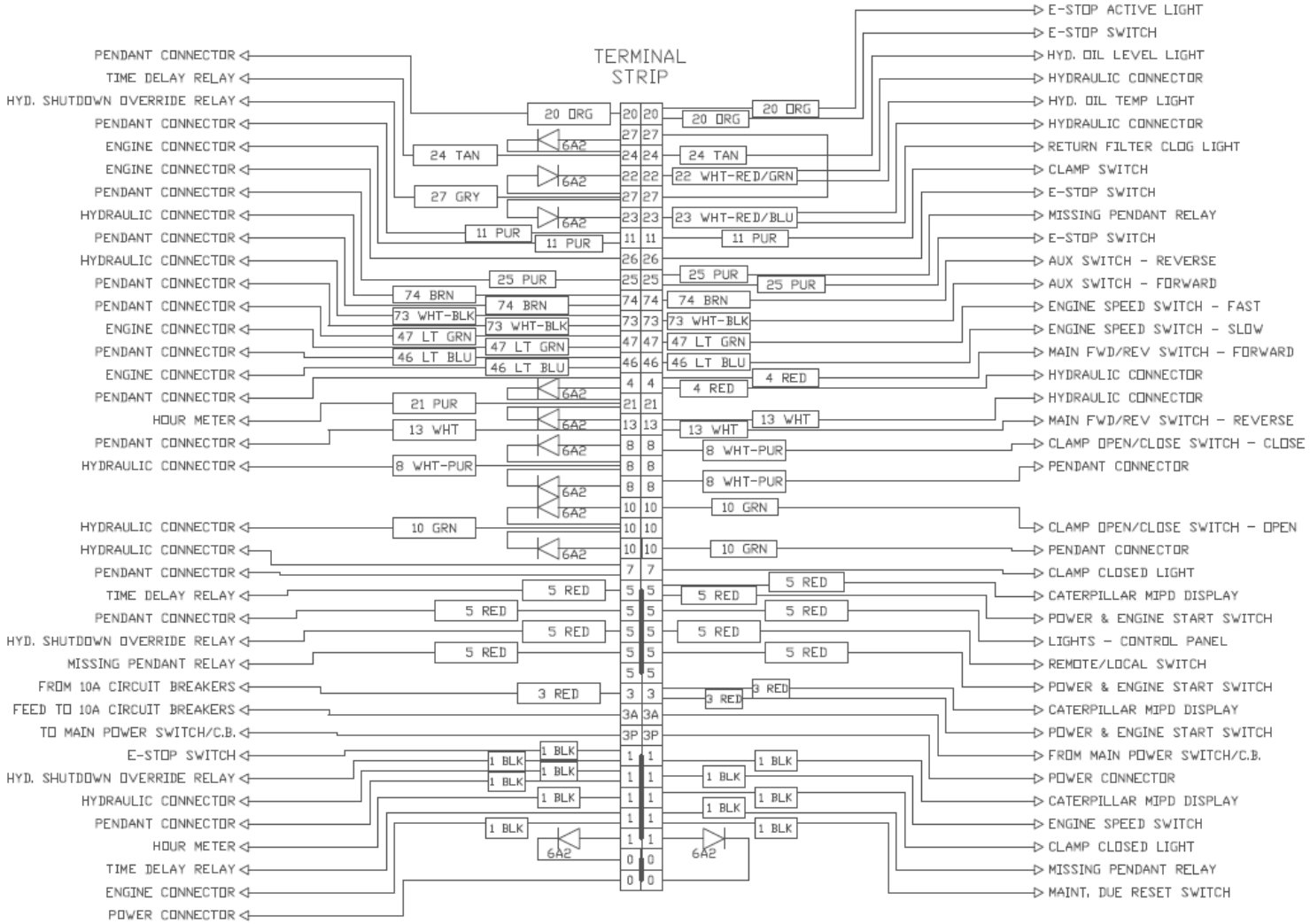
Electrical Schematic and Wiring D

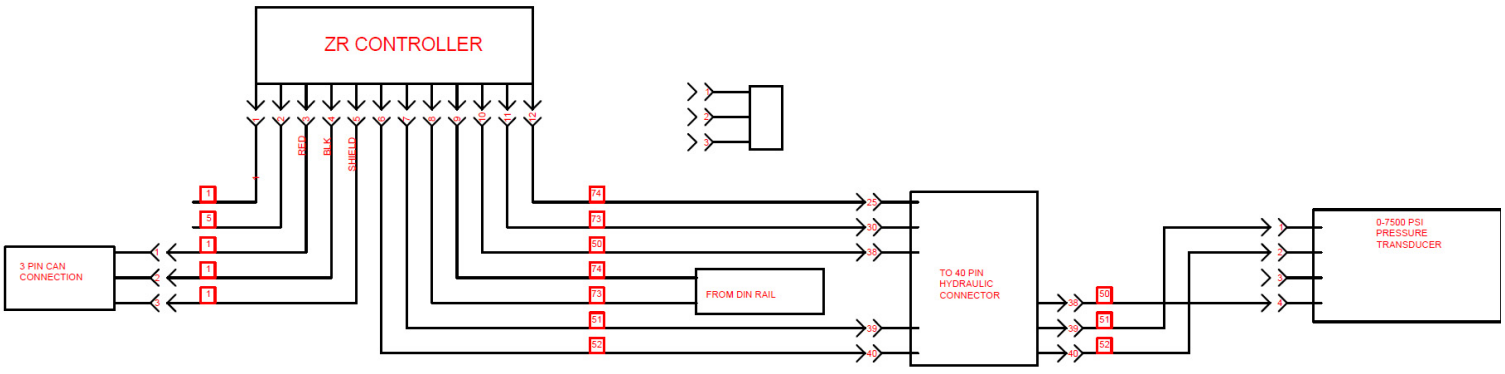


Electrical Schematic and Wiring E



Electrical Schematic and Wiring F



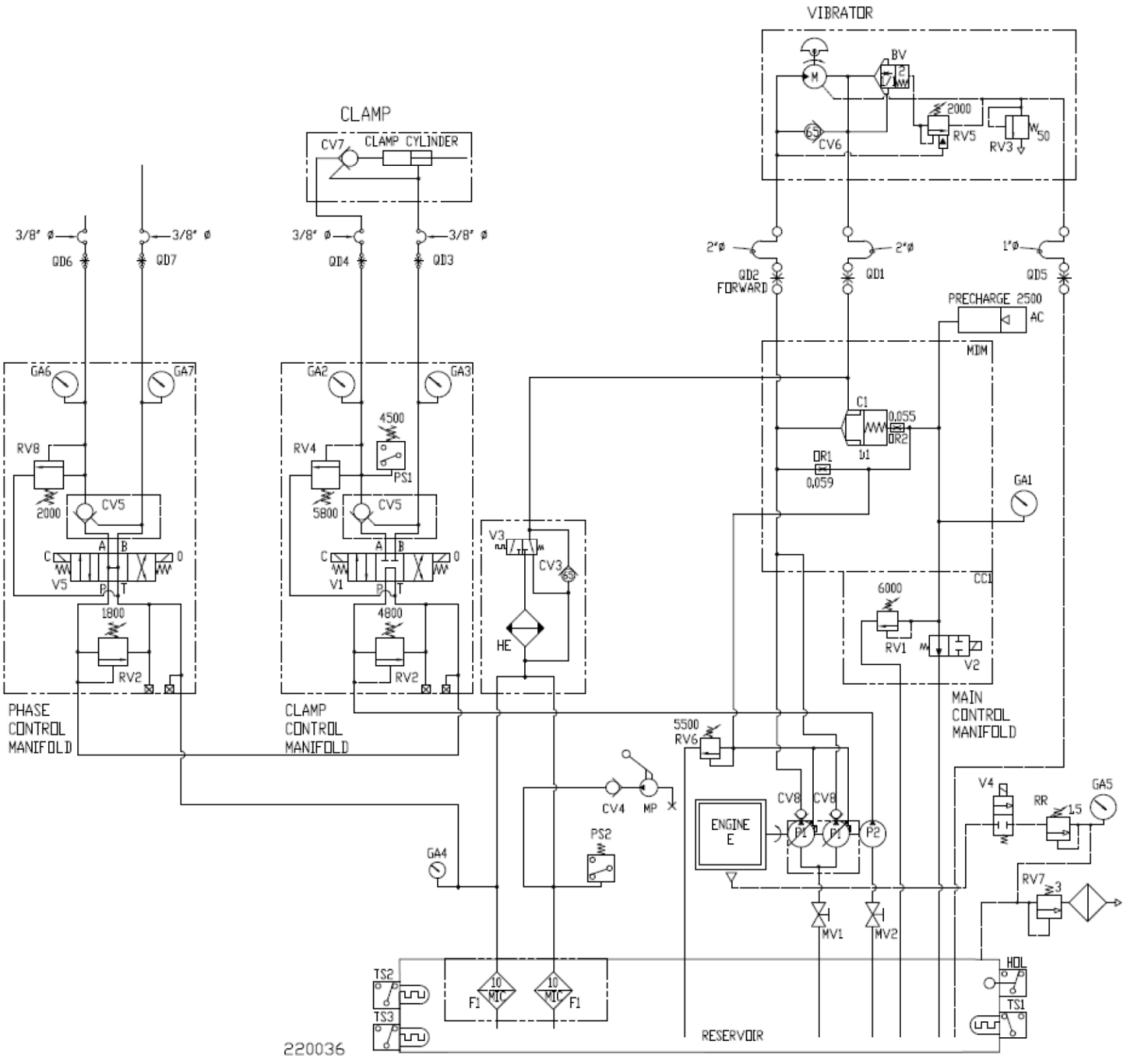


Section 10: HYDRAULIC CIRCUITRY

Hydraulic Components - Vibrator

ITEM	QTY.	PART NO.	DESCRIPTION
AC	1	750064	ACCUMULATOR
P1	1	510070	MAIN PUMP
P2	1	100684	CLAMP PUMP
E	1	730816-SE	ENGINE - CAT C15
CV1	NA	NA	NA
CV3	1	NA	CHECK VALVE
CV4	1	100451	CHECK VALVE
CV5	1	760036	CHECK VALVE
CV6	1	110296	CHECK VALVE
CV7	1	120629	CHECK VALVE
CV8	2	500120	CHECK VALVE
QD1	1	731129	QUICK DISCONNECT
QD2	1	731130	QUICK DISCONNECT
QD3	1	100777	QUICK DISCONNECT
QD4	1	100245	QUICK DISCONNECT
QD5	1	400095	QUICK DISCONNECT
GA1	2	110600	PRESS GAUGE 0-7500
GA2	1	110600	PRESS GAUGE 0-7500
GA3	1	100436	PRESS GAUGE 0-60
GA4	1	510319	PRESS GAUGE 0-15
OR1	1	760302	ORIFICE - 0.059"
OR2	1	500167	ORIFICE - 0.055"
RV1	1	750408	RELIEF VALVE
RV2	1	750408	RELIEF VALVE
RV3	1	110214	RELIEF VALVE
RV4	1	NA	RELIEF VALVE
RV5	1	731161	RELIEF VALVE
RV6	1	750408	RELIEF VALVE
RV7	1	510315	RELIEF VALVE/BREATHER
SV	2	750024	SHUTTLE VALVE
V1	1	750334	SOLENOID VALVE - 24V
V2	1	750513	SOLENOID VALVE - 24V
V3	1	510274	THERMOSTATIC VALVE
V4	1	510317	SOLENOID VALVE - 24V
MP	1	100447	MANUAL PUMP
HE	1	730230	COOLER PACKAGE
F1	1	790008	RETURN FILTER
FE	4	100584	FILTER ELEMENT
HOL	1	100314	FLOAT SWITCH - HYD
TS1	1	770686	TEMP SWITCH - HIGH
TS2	1	770687	TEMP SWITCH - FILTER
TS3	1	770684	TEMP SWITCH - LOW
PS1	1	100627	PRESS SWITCH - CLAMP
PS2	1	100602	PRESS SWITCH - FILTER
MDM	1	500156	MAIN DRIVE MANIFOLD
CC1	1	500159	COVER
C1	1	140669	POPPET - 1:1
BV	1	110622	BRAKE VALVE
MV1	1	510095	BALL VALVE
MV2	1	170433	BALL VALVE
M	2	730214	MOTOR
RV6	1	750408	RELIEF VALVE

Hydraulic Schematic - Vibrator



Hydraulic Components and Operation - Vibrator

Hydraulic Components and Operation

Components listed in CAPITAL LETTERS are shown on the components list and schematic.

Hydraulic Clamp

With the DIESEL ENGINE (E) running, hydraulic oil is taken from the RESERVOIR by the CLAMP PUMP (P2). The clamp pump flow returns to the RESERVOIR if the clamp switch on the pendant is in the center position.

Turning the clamp switch on the control pendant to CLOSE activates the CLAMP CONTROL VALVE (V1). Hydraulic oil is directed to the close-clamp side of the hydraulic CYLINDER on the clamp. The clamp closes.

Clamping pressure is displayed by the CLAMP GAUGE (GA1) on the control panel. A SHUTTLE VALVE (SV1) sends open-clamp or close-clamp pressure to the CLAMP GAUGE. When clamping pressure reaches approximately 4500 psi (290 bar), the CLAMP PRESSURE SWITCH (PS1) centers the CLAMP CONTROL VALVE (V1), which directs the flow from the CLAMP PUMP to the RESERVOIR. Pressure at the clamp is maintained by the CLAMP CHECK VALVE (CV5). If clamping pressure falls below 4500 psi (290 bar), the CLAMP PRESSURE SWITCH activates the CLAMP CONTROL VALVE to restore pressure. In the event of hose failure, the CLAMP HOLDING VALVE (CV7) located in the clamp cylinder will hold the clamp cylinder closed.

Turning the clamp switch on the control pendant to OPEN activates the CLAMP CONTROL VALVE (V1). Hydraulic oil is directed to the open-clamp side of the hydraulic CYLINDER. The pressure in the open-clamp line opens the CLAMP CHECK VALVEs (CV5 & CV7). The clamp opens.

Pressure in the clamping circuit is limited to 4800 psi (330 bar) by the CLAMP RELIEF VALVE (RV2). A TEMPERATURE RELIEF VALVE (RV4) limits pressure in the close-clamp circuit caused by high ambient temperatures to 5800 psi (400 bar).

The quick disconnect couplers (QD3 & QD4) permit de-coupling of the clamp hoses at the power unit.

The clamp circuit on all ICE power units can be configured to operate auxiliary equipment, such as spotters, pile gates, etc. Contact ICE for instructions.

Vibrator

With the DIESEL ENGINE (E) running, hydraulic oil is taken from the RESERVOIR by the VIBRATOR PUMPs (P1). If the vibrator switch (REV-OFF-FOR) on the control pendant is in the OFF position, pilot pressure flows back to the RESERVOIR. Without pilot pressure, cartridge C1 on the MAIN CONTROL MANIFOLD opens and allow hydraulic oil to flow back to the
RESERVOIR through the RETURN FILTER (F1).

Turning the vibrator switch on the control pendant to the FOR position activates the FORWARD SOLENOID on the MAIN CONTROL VALVE (V2) blocking pilot flow from returning to the RESERVOIR. Pilot pressure closes cartridge C1. Pump flow goes to the VIBRATOR MOTOR (M) instead of the RESERVOIR. Full motor speed is reached within a few seconds. The accumulator (AC) provides a controlled increase in vibrator speed.

Oil exiting the VIBRATOR MOTORS opens BRAKE VALVE (BV) and returns to the power unit. The BRAKE VALVE opens easily because its pilot flow is "vented" by the BRAKE COUNTER-BALANCE VALVE (RV5). The BRAKE COUNTER-BALANCE VALVE is held open by pressure coming from the motors FORWARD system.

Vibrator (continued)

Turning the vibrator switch on the control pendant to OFF, de-energizes the CONTROL VALVE (V2) and "vents" (opens) cartridge C1 allowing pump flow to go directly back to the RESERVOIR. When pressure is removed from the main FORWARD system, the BRAKE COUNTER-BALANCE VALVE (RV5) closes and blocks the pilot flow from BRAKE VALVE (BV) cartridge causing the BRAKE VALVE cartridge to close. Maximum brake pressure is limited to 2000 psi (138 bar) by the BRAKE COUNTER-BALANCE VALVE. This 2000 psi (138 bar) back pressure rapidly brakes the MOTORS (M) to a stop. Motor cavitation in the braking operation is prevented by the CHECK VALVE (CV6).

Vibrator pressure is displayed by the VIBRATOR PRESSURE GAUGE (GA2) on the control panel. Maximum vibrator pump pressure is limited to 5,500 psi (380 bar) by the PUMP PILOT RELIEF VALVE (RV1). Maximum vibrator pilot pressure is limited to 6,000 psi (415 bar) by the VIBRATOR PILOT RELIEF VALVE (RV1). The VIBRATOR PILOT RELIEF VALVE, if opened by excess pressure, removes pilot pressure from cartridge C1 allowing it to partially open and directing some or all of the main pump flow to return to the RESERVOIR.

Case drain oil from the MOTOR(s) returns to the RESERVOIR. Case drain pressure is limited to 50 psi (3.4 bar) by the CASE DRAIN RELIEF VALVE (RV3).

Hydraulic oil temperature is regulated by the COOLER VALVE (V3). When oil temperature is below 100°F (38° C), the COOLER VALVE directs the flow directly to the RESERVOIR through the RETURN FILTERS (F1). When oil temperature exceeds 100°F (38°C), the COOLER VALVE directs flow through the HEAT EXCHANGER (HE) and then through the RETURN FILTERS. Over pressurization of the HEAT EXCHANGER is prevented by CHECK VALVE (CV3) which limits pressure to 65 psi (4.5 bar).

Returning oil is filtered by the RETURN FILTER (F1). The return FILTER CHECK VALVE (CV1) prevent oil loss from the RESERVOIR when the filter elements are removed. RETURN FILTERS pressure is displayed by the RETURN FILTER GAUGE (GA3). If return filters pressure is too high and hydraulic oil temperate is over 125^{o} F (40^{o} C), as measured by the TEMPERATURE SWITCH (TS1), the RETURN FILTER Pressure Switch (PS2) turns on the RETURN FILTER CLOG light on the control panel and shuts down the diesel engine.

The quick-disconnects couplers (QD1, QD2, and QD5) permit de-coupling of the vibrator and case drain hoses at the power unit.

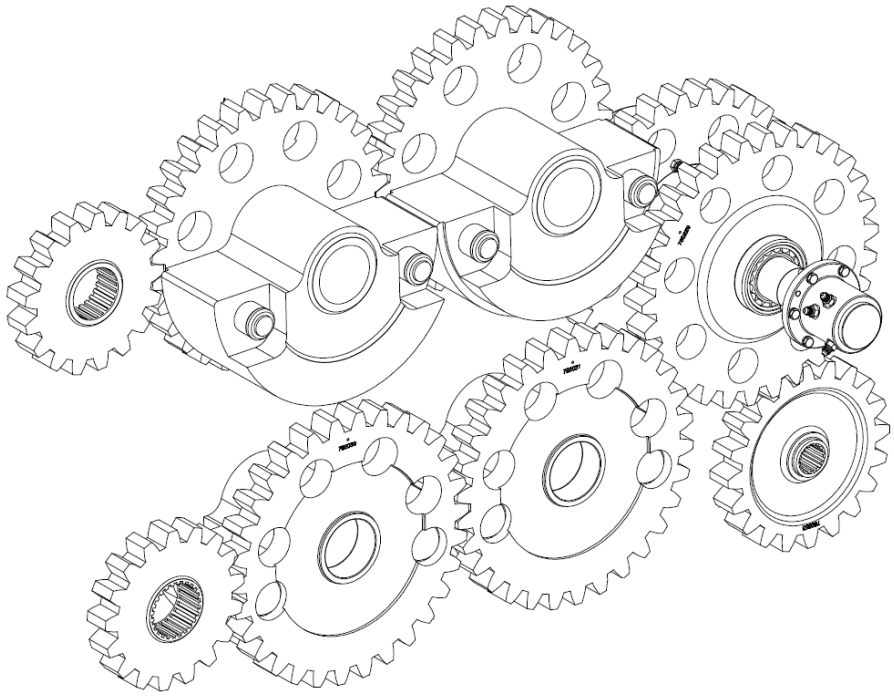
ORIFICES (OR1, OR2, OR3 & OR4) control vibrator pilot flow.

General Description of ZR Operation

Zero Resonance vibratory driver/extractors eliminate vibration in the damaging range by adjusting eccentric moment to zero during start-up and shut-down. The ZR vibratory driver/ extractors are designed to never operate at a frequency range that could cause resonance vibration to the soil, structures or crane line.

- Prior to start-up, the eccentric moment is set to zero.
- During start-up, vibrator frequency passes through 600-1200 vpm with zero eccentric moment'eliminating disturbance in the soil, structures or crane line.
- After full operating frequency is reached, eccentric moment is set to maximum for driving and extracting.
- Before shut-down, the eccentric moment is again set to zero.
- During shut-down, vibrator frequency again passes through 600-1200 vpm with zero eccentric moment and no disturbance in the soil, structures or crane line.

Eccentric moment is controlled from the vibrator remote-control pendant. Shifting between zero and maximum eccentric moment occurs simply and quickly.



Other

If the hydraulic oil level in the RESERVOIR gets low, the HYDRAULIC OIL LEVEL switch (HOL) shuts down the diesel engine and turns on the HYD. OIL LEVEL LOW light on the control panel

If the hydraulic oil temperature returning to the RESERVOIR exceeds 175°F (80°C), the HYDRAULIC OIL TEMPERATURE SWITCH (TS2) shuts down the diesel engine and turns on the HYD. OIL TEMP. HIGH light on the control panel.

If the hydraulic oil temperature returning to the RESERVOIR is below 75°F (24°C), the HYDRAULIC OIL TEMPERATURE SWITCH (TS3) turns on the HYD. OIL TEMP. LOW light on the control panel.

A manual PUMP (MP) is provided to fill the hydraulic RESERVOIR. A CHECK VALVE (CV4) prevents loss of hydraulic oil back through this pump.

MANUAL VALVES (MV1 & MV2) allow removal of the vibrator and clamp pumps without loss of RESERVOIR oil.