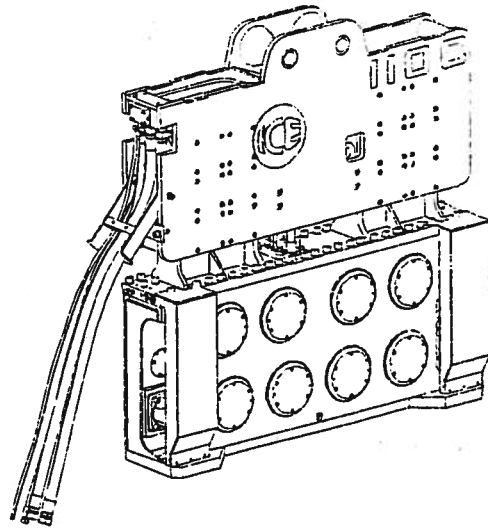
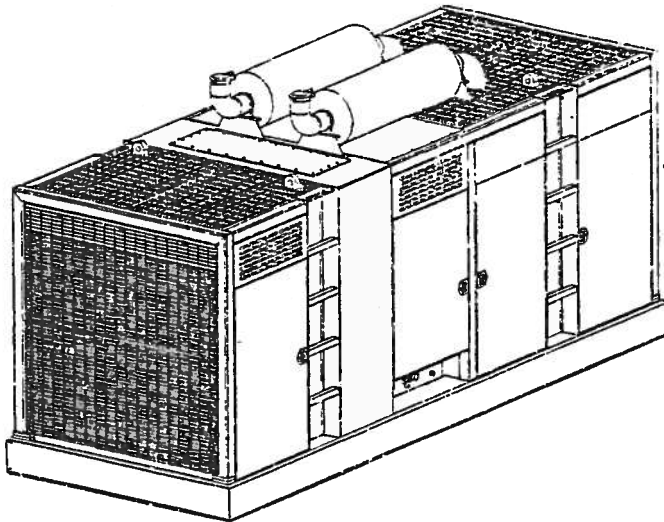


# Operation Maintenance Manual

Model 1200E Power Unit

Model 110C Vibrator



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International Construction Equipment, Inc. has the right to change parts of the equipment at any time without prior or direct notice. The contents of this publication are subject to change without prior notice.

This publication is to be used for the standard version of the equipment only.

For additional information as to adjustments or maintenance and repair, please contact the technical department with in the supplier from whom you purchased the equipment.

This publication has been written with great care. However, International Construction Equipment cannot be held responsible, either for errors occurring in this publication or for their consequences.



## 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) 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 200°F (93°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.

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.**

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## **Introduction**

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### **Literature**

This manual contains information and instructions concerning operation, safety, lubrication, maintenance, and basic troubleshooting for the specified ICE equipment. Ensure that all personnel responsible with the operation and maintenance of the equipment are familiar with the information within. This literature should be readily accessible for regular reference. Some illustrations show details or attachments that may differ from your equipment. Photographs or drawings show some guards and covers removed for illustrative purposes. In addition, continual improvement and advancement of product design may have caused changes to your equipment that are not included in this publication. Whenever a question arises regarding your equipment or this manual, please consult International Construction Equipment, Inc. for current revisions and up dated information. Also, Use the Parts Manual as a reference to elaborate on maintenance and trouble shooting details.

### **General Information**

This section provides a snapshot description of the equipment and specifications set up for normal operation.

### **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 duties on the ICE equipment.

### **Loading, Unloading, and Shipping**

Details are provided on how to load, unload, and ship the ICE equipment.

### **Preparation for Operation and Operation 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 referenced. 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.

### **Maintenance**

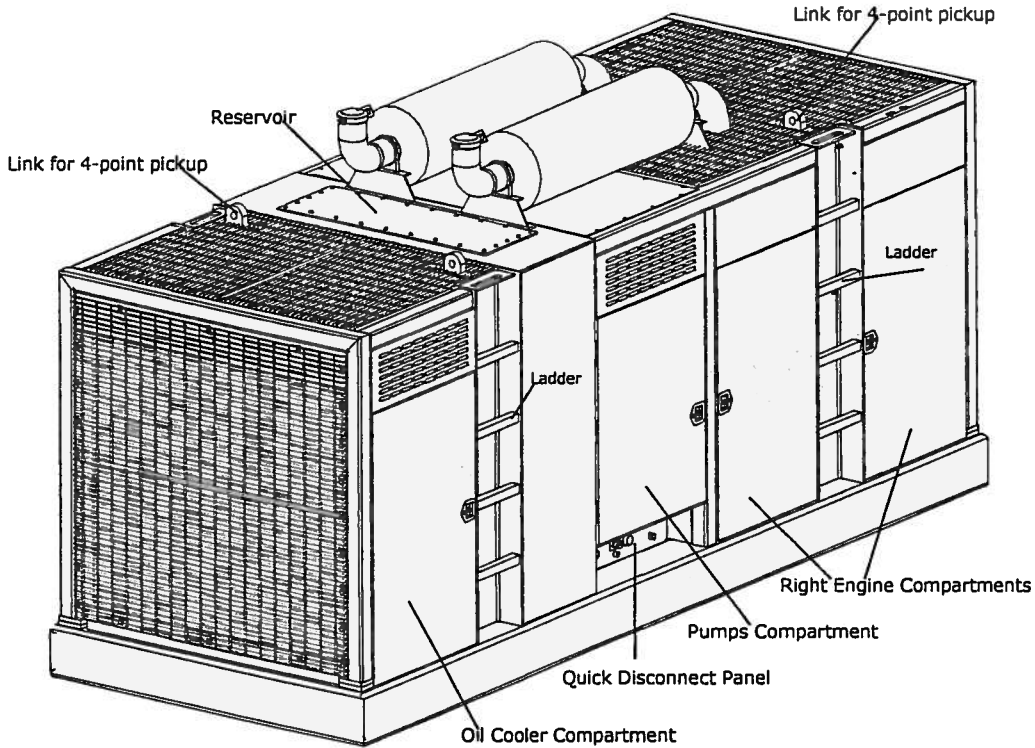
This section serves as a guide for equipment care. Service Intervals, required lubrication, wear tolerances, adjustments, and torque specifications for fasteners are listed. Major repairs are not detailed here or in the troubleshooting section. Major repairs should be entrusted to only experienced personnel.

### **Troubleshooting**

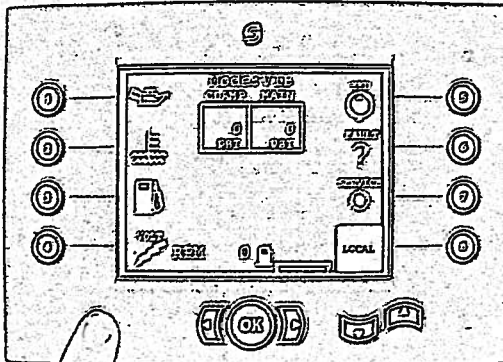
This section aids in resolving difficulties with equipment. The information provided give indications of possible causes for difficulties and the repairs required to correct malfunctions. Please contact International Construction Equipment, Inc. for assistance in diagnosing unresolved issues and corresponding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



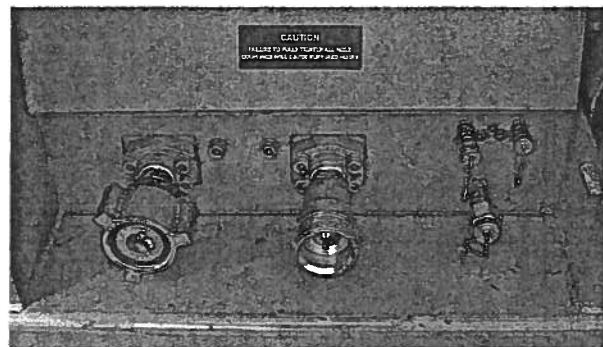
## Power Unit Layout



The ICE model 1200E is a twin diesel engine hydraulic power unit. All components are mounted on a tubular sub base that also serves the fuel tank for the unit. Hydraulic oil is supplied from the reservoir. The hydraulic oil temperature is maintained by a hydraulically driven fan drawing air through a heat exchanger assembly. Four lifting eyes are located on each corner of the roof to lift the unit level and securely. All components are enclosed in a sheet metal cabinet with locking doors. The power unit is controlled by a remote control pendant; with backup local controls at the panel. An electronic control panel display provides the control and status of the engines and hydraulic systems. Self sealing quick disconnect couplers provide connection for the 110 vibratory driver-extractor.



Electronic Display at Control Panel



Quick Disconnect Panel



## Power Unit Specifications

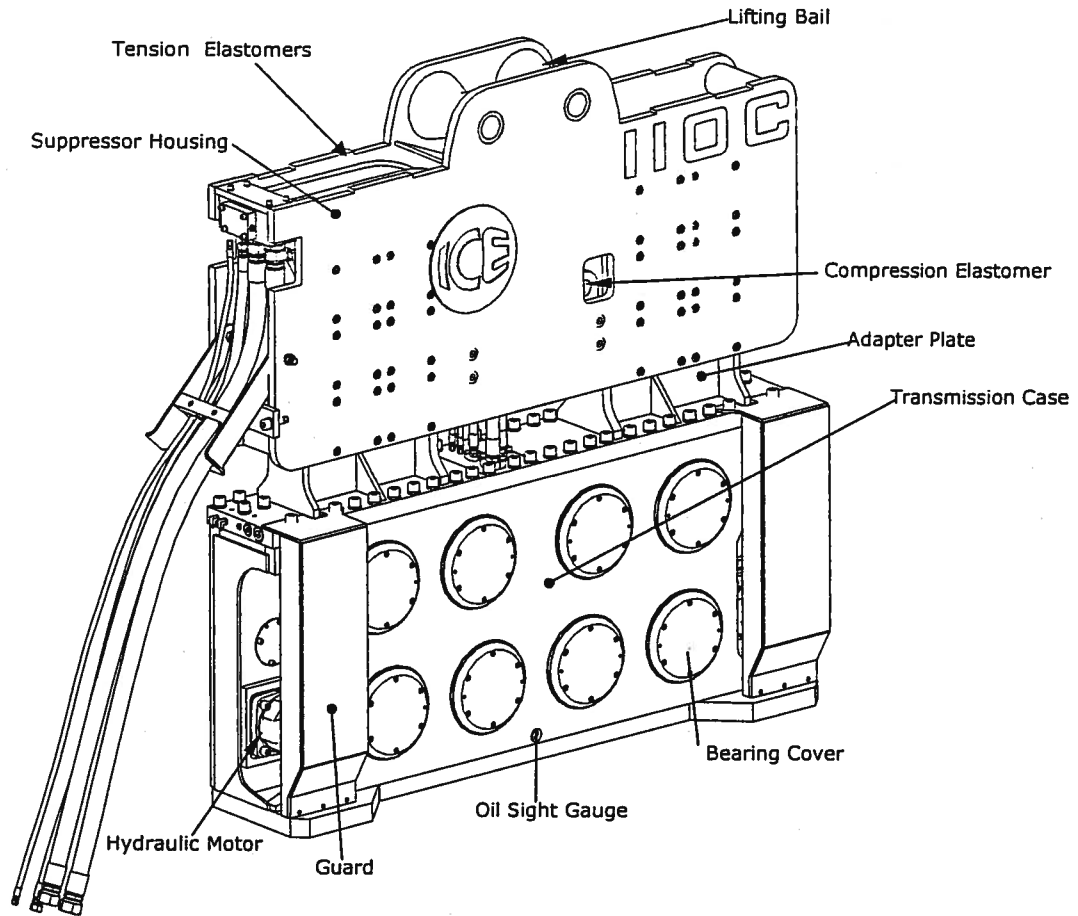
<b>Model 1200E</b>				
<b>Engine</b>	<b>Twin Caterpillar</b>		<b>C15</b>	
<b>Power</b>	1190	HP	887	kW
<b>Operating Speed</b>	1975	rpm	1975	rpm
<b>Max Drive Pressure</b>	5500	psi	380	bar
<b>Drive Flow</b>	250	gpm	946	lpm
<b>Clamp Pressure</b>	5000	psi	345	bar
<b>Clamp Flow</b>	3.3	gpm	12	lpm
<b>Weight (w/ full fluid &amp; fuel)</b>	32000	lbs	14515	kg
<b>Length</b>	224	in	5690	mm
<b>Width</b>	84	in	2134	mm
<b>Height</b>	114	in	2896	mm
<b>Hydraulic Reservoir</b>	550	gal	2082	liters
<b>Fuel Capacity</b>	340	gal	1287	liters



## Vibrator Specifications

<b>Model 110C</b>				
<b>Eccentric Moment</b>	11200	in-lbs	129	kg-m
<b>Frequency Range</b>	800-1550	vpm	13-26	Hz
<b>Driving Force</b>	380	tons	3381	kN
<b>Amplitude (free hanging)</b>	1.96	in	50	mm
<b>Max Line Pull for Extracting</b>	150	tons	1334	kN
<b>Weight (no clamp or hoses)</b>	18,500	lbs	7190	kg
<b>Non-vibrating Weight</b>	4750	lbs	2063	kg
<b>Height (without clamp)</b>	103.5	in	2565	mm
<b>Length</b>	97.25	in	2470	mm
<b>Width</b>	22.25	in	565	mm
<b>Throat Width</b>	15.5	in	394	mm
<b>Hydraulic Hose Length</b>	150	ft	46	m
<b>Hydraulic Hose Weight</b>	2400	lbs	1088	kg

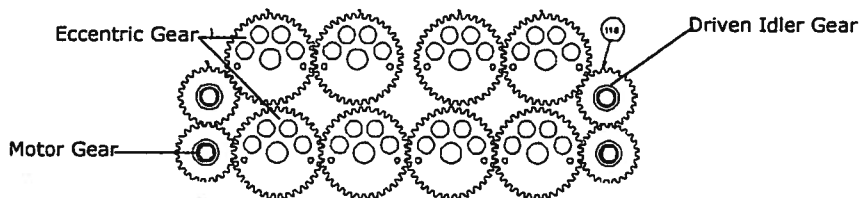
## Vibrator Layout



The ICE model 110C is a hydraulically powered vibrating driver/extractor. The basic components are the transmission case and the suppressor housing.

The suppressor is a steel housing that utilizes ICE's patented Dual-Pull® system with vibration dampening elastomers (compressible and tensioning). The tension elastomers are mounted on one surface to the suppressor housing and the other surface to the adapter plate that mounts to the top of the transmission case. The compression elastomers are mounted on the stop block plates bolted inside the suppressor toward the center; the elastomers are compressed by the underneath of the adapter plate near the top of the suppressor's stretch. A double thimble is fabricated into the top of the suppressor housing to form the lifting bail. The adapter plate is cross drilled to provide passages for oil flow to and from motors and clamps.

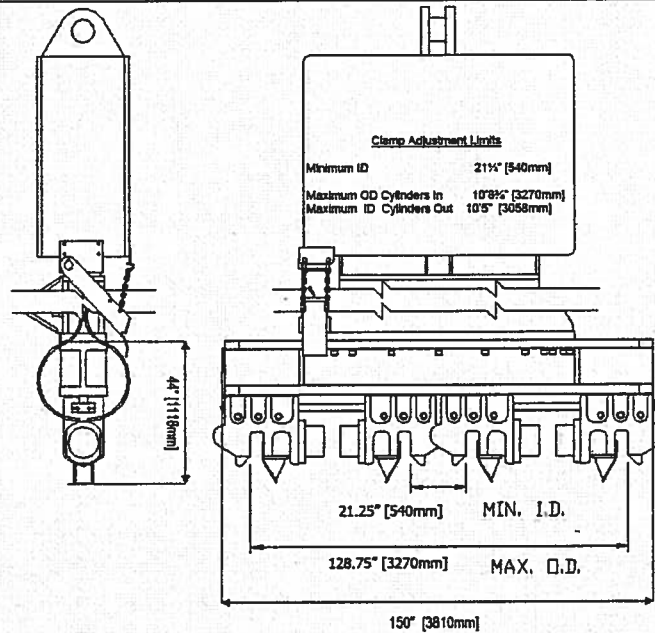
The transmission is comprised of eight gear driven eccentrics driven by two hydraulic motors with two drive gears and two driven gears. All is splash lubricated by the gear oil inside case. A variety of hydraulic clamps to grip piling are bolted to the bottom of the transmission case.



## Clamp Layout and Specifications

There are several specialized hydraulic clamps available for different piling types. Generally, larger vibrators are utilized to drive large pipe or caissons. The caisson clamps are used in tandem (2 clamps) or quad (4 clamps) configuration. The clamps mount on a beam, which bolts to the bottom of the transmission case and facilitates sliding the clamps closer together or apart for varying pipe diameters. The clamps lock onto the beam by a hydraulic device (Hydralock Assembly) or an optional manually adjustable wedge assembly. The clamps can be slid onto the beam with the cylinders in or out, depending on diameter of the pipe piling being driven.

Hydraulic Clamp	Model 142BH Caisson Clamp			
Clamp Force	142	tons	1263	kN
Weight	1776	lbs	806	kg
Width	14	in	356	mm
Height	32	in	813	mm



## Caisson Beams and Beam Accessories

Used for all casing clamp models				
Beam Model	Casing Clamp Models	lbs	kgs	Notes
10'	84C, 110C	6220	2821.4	Includes bolts
Quad for Single Vibro	V360, 110C	17200	7801.9	Quad Beam x 11'
Quad for Tandem Vibro	V360T, 110CT	41100	18642.8	Quad Beam x 12'



## 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 INSTRUCTIONS ARE 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 and project regulations.

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 electric starters, 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 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 electronics, which could cause the operating system to malfunction.

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## Fluid Penetration Risk

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Always use a board or cardboard as a barrier guard 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.

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## Hoses, Lines and Tubes Handling Procedures

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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 sling that could pinch and restrict oil flow; lift hose bundle together with a wide web sling making sure that large hoses support the smaller.

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.

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## Hoses, Lines, and Tubes Check List

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End fittings damaged, leaking or displaced. Replace hose and related fittings.

Outer covering chafed or cut and wire reinforcing exposed. Replace hose.

Outer covering ballooning locally. Replace hose.

Evidence of kinking or crushing of the flexible part of the hose. Replace hose.

Abrasion guard missing or torn. Replace cover.

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## Precautions for Oils

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**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.



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## **Fire or Explosion Prevention**

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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 nonflammable solvent before welding or flame cutting on them.

Power Unit fire shields must be installed correctly. These shields are for the purposes of isolating exhaust components from 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.

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.

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## **Fire Extinguisher Requirements**

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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.

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## **Injury Prevention**

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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.

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## **Mounting and Dismounting**

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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 Engines

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

- ⇒ Make sure the control pendant (or radio control) is in a safe place. Do not leave the control pendant (or radio control) unattended.
- ⇒ On the Control Panel: Make sure the main circuit REVOFF-FOR and auxiliary circuit REV-OFF-FOR switches are set to OFF
- ⇒ On the Remote-Control Pendant: Make sure the main circuit REVOFF-FOR and auxiliary circuit REV-OFF-FOR switches are set to OFF
- ⇒ Make sure the clamp OPEN-CLOSE switch is in the center (neutral) position.
- ⇒ Make sure power unit is on level, stable ground.
- ⇒ Do not smoke or use open flame in the vicinity when filling fuel tanks or when flammable vapors are present.
- ⇒ Make sure that all lifting equipment, including cranes, wire rope, slings, hooks, shackles, etc., are properly sized for the worst case loads anticipated during operations. Check wire rope clips for tightness, and check wire ropes for wear or damage daily.
- ⇒ Make sure equipment areas are clear for operation.
- ⇒ If there are any questions about the weights, specifications, or performance of the equipment, contact International Construction Equipment, Inc. before handling or operating the equipment.
- ⇒ Do not attempt to connect the quick-disconnect couplers when the power unit is running.
- ⇒ If the equipment is to be used for anything other than specified use, contact International Construction Equipment, Inc. before using the unit.
- ⇒ Make sure that operations will not damage adjacent structures or excavations

## During Engine Starting

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

#### Before Starting Equipment

- ⇒ Equipment area should be clear before starting operation.
- ⇒ Make sure no one is working on or close to equipment before starting.
- ⇒ Always make an inspection of the equipment before and after starting at the beginning of operations.
- ⇒ Read and become familiar with the electronic display and starting instructions.
- ⇒ Engines are started one at a time.
- ⇒ Both engines must be running to operate the equipment.



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## **Loading, Unloading, and Shipping**

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### **Power Unit**

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The power unit should be loaded with the heat exchangers (oil cooler and radiator) protected to prevent damage to the heat exchangers from flying objects while in transport. 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.

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### **Vibrator**

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The equipment should be shipped laying flat on the trailer deck or on suitably placed blocking. If possible coil the hose on top of vibrator and lift with a two point pickup. As an alternate, lift the equipment by rigging one line to the lifting pin and one line to the hose bundle as one load. A binding strap is used to secure the hose bundle to the top of vibrator. Avoid crushing hydraulic lines.

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### **Damage During Shipment**

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Before the truck leaves, carefully inspect the machine and hoses for any missing equipment or sign 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. Send via email or fax the information to International Construction Equipment, Inc. as soon as possible; photos are often the best evidential method of explaining a claim. Any delay may make it difficult to identify the responsible party.



## 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 (s) 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. Synthetic web slings should be selected with attention to job environment— presence of caustic chemicals, welding and cutting, abrasive or sharp edged adjacent structures or piles, as well as strength rating and profile.

#### **!WARNING – Safety!**

**Wire rope failure or cable clamp slippage may result in injury or death.**

### Connection Of Hydraulic Hoses

#### **!WARNING – Safety!**

**Disconnecting hoses under pressure can result in serious bodily injury or death.**

#### **!WARNING – Safety!**

**The power unit must be shut down during connection of the hydraulic hoses.**

#### **!WARNING – Equipment!**

#### **!WARNING – Safety!**

**Starting the equipment with the hoses reversed could result in reversed operation from labels on the control and pendant or in rare cases blown hoses on the vibrator.**

### Connection of Hoses at Power Unit for Vibrator

The vibrator and hydraulic clamp are connected to the power unit by five hydraulic hoses.

The hoses connect to the power unit with quick-disconnect couplers. Hose couplers are arranged to ensure correct connections at the power unit. Use care when servicing not to swap coupler locations.

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.



## Preparation for Operation, Continued

For caisson clamps, four hoses must be connected. The two 90° fittings on the underside of the vibrator hose chute must be removed and replaced by two tees. This allows the four hoses to run to both sides of the vibrator and operate the caisson clamps. The 90° fittings on the topside of the hose chute are stamped O and C (O for open clamp on the left side, C for close clamp on the right side).

## Connection of Hoses for Caisson Clamp Hydro-lock

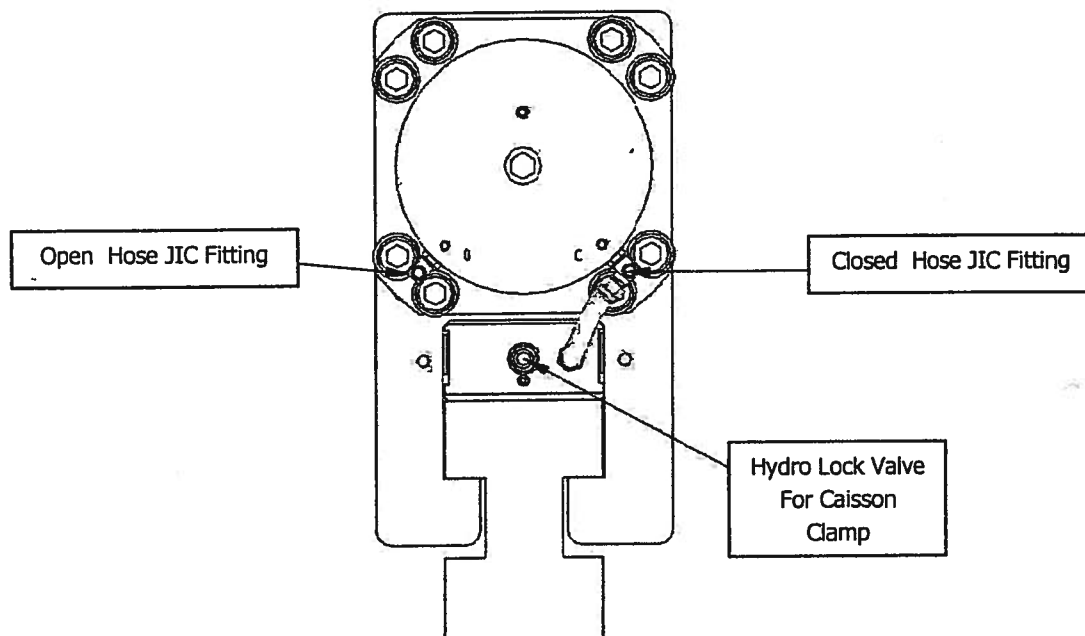
If not in place, connect hose from lock body to cylinder.  
Position clamps on beam to suit piling. Close holding valve by turning clockwise.  
Close clamp to energize Hydro-lock.  
To reposition clamps on beam, open the holding valve by turning counterclockwise (one clamp at a time) to release Hydro-lock.

## Adjust Position of Clamps

TO ADJUST POSITION OF CLAMPS: with jaws open, loosen jam nut at Hydrolock valve, then back out allen-head check valve to relieve pressure (you may need to use the weight of the hammer to compress the holding rams) ADJUST CLAMP POSITION. A pry bar or come along tool will facilitate moving

## Lock Clamps On Beam

TO LOCK CLAMPS ON BEAM: with jaws open, screw in allen-screw at Hydrolock valve; hand tight only Do Not Over Tighten. Tighten jam nut then close jaws and wait for light to come on, open jaws, clamps should be locked on beam



## Bleeding Clamp 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.

Also, see Caterpillar Operation & Maintenance Manual.

Start and warm up the diesel engine in accordance with "Operation".

### **!WARNING – Safety**

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

With the engines 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.

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.

## Filling Vibrator Pressure Hose

### **!WARNING – Safety**

**Vibrator may start if hoses are connected improperly.**

With the engine warmed up and running at 1000 RPM, turn and hold the vibrator switch (FOR-OFF-REV) in REVERSE. The hoses will fill with oil in about five minutes. If vibration begins in the vibrator, stop immediately and recheck hose connections.

## Equipment Operation

Only well-trained and experienced personnel should attempt to operate or maintain this equipment.

Do not leave the equipment control pendant (radio control) unattended.

Do not stand any closer to equipment than necessary when in operation. Parts may loosen and fall.

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 on, or attempt to move equipment, with hydraulic hoses.

Do not operate the equipment within 15' (5m) of electrical power lines, transformers, and other electrical equipment, or within such distance as required by applicable safety codes.

Do not side-load crane boom. Dangerous crane boom damage may result. Always be sure that the crane line is aligned with the centerline of the equipment used.

## Stopping Equipment

Make sure vibrator, rotary head, and power unit have completely stopped and engine is off before relocating equipment. Normal stop of equipment is accomplished by moving FORWARD-OFF-REVERSE switch to OFF

## Stopping Engines

**Read "Engine Stopping" in the Caterpillar Operation & Maintenance Manual.**

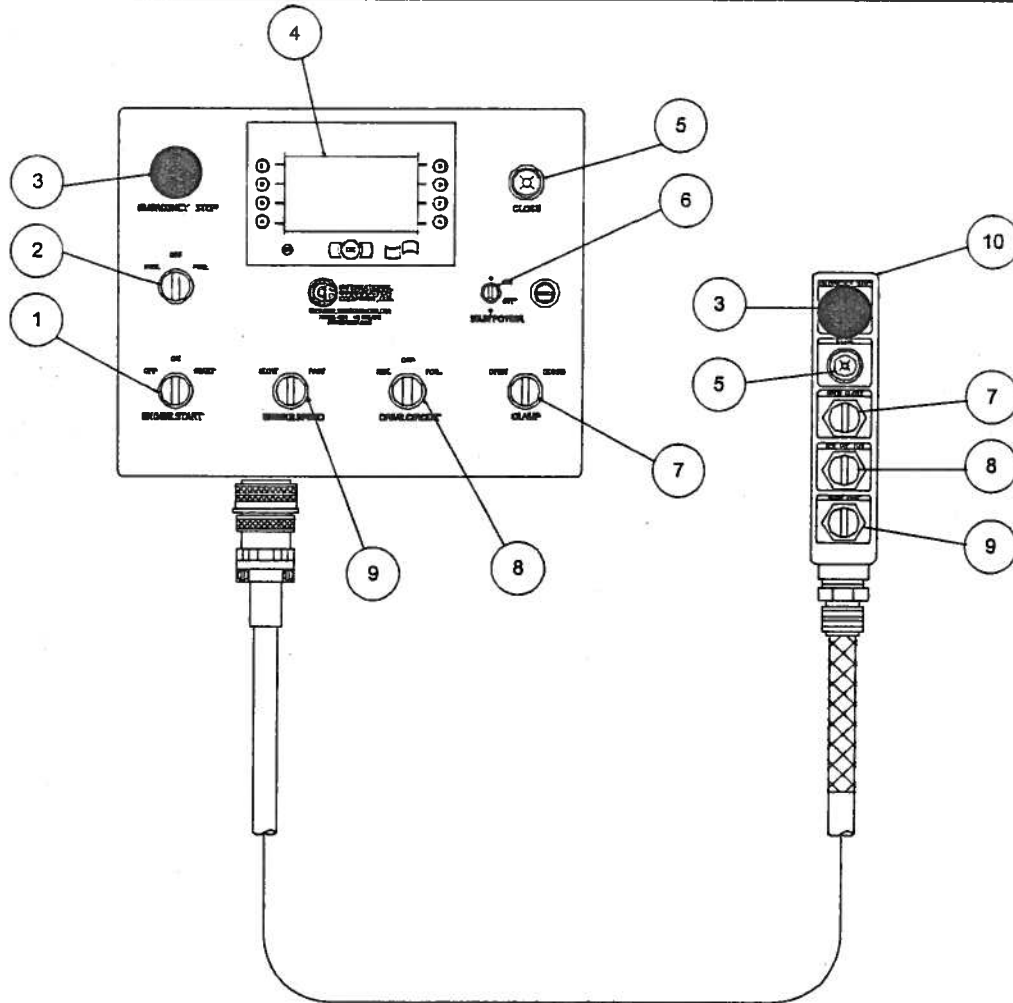
A cool down period is required

## Engines Emergency Stop

The engine emergency stop should be used only to prevent injury to personnel or damage to the equipment such as in the case of a ruptured hydraulic line. Often hazards can be avoided by simply stopping the vibration of the unit by switching the FORWARD-OFF-REVERSE switch to OFF. Emergency stop buttons are located on the control panel and the remote pendant control and are red in color. (See following page).

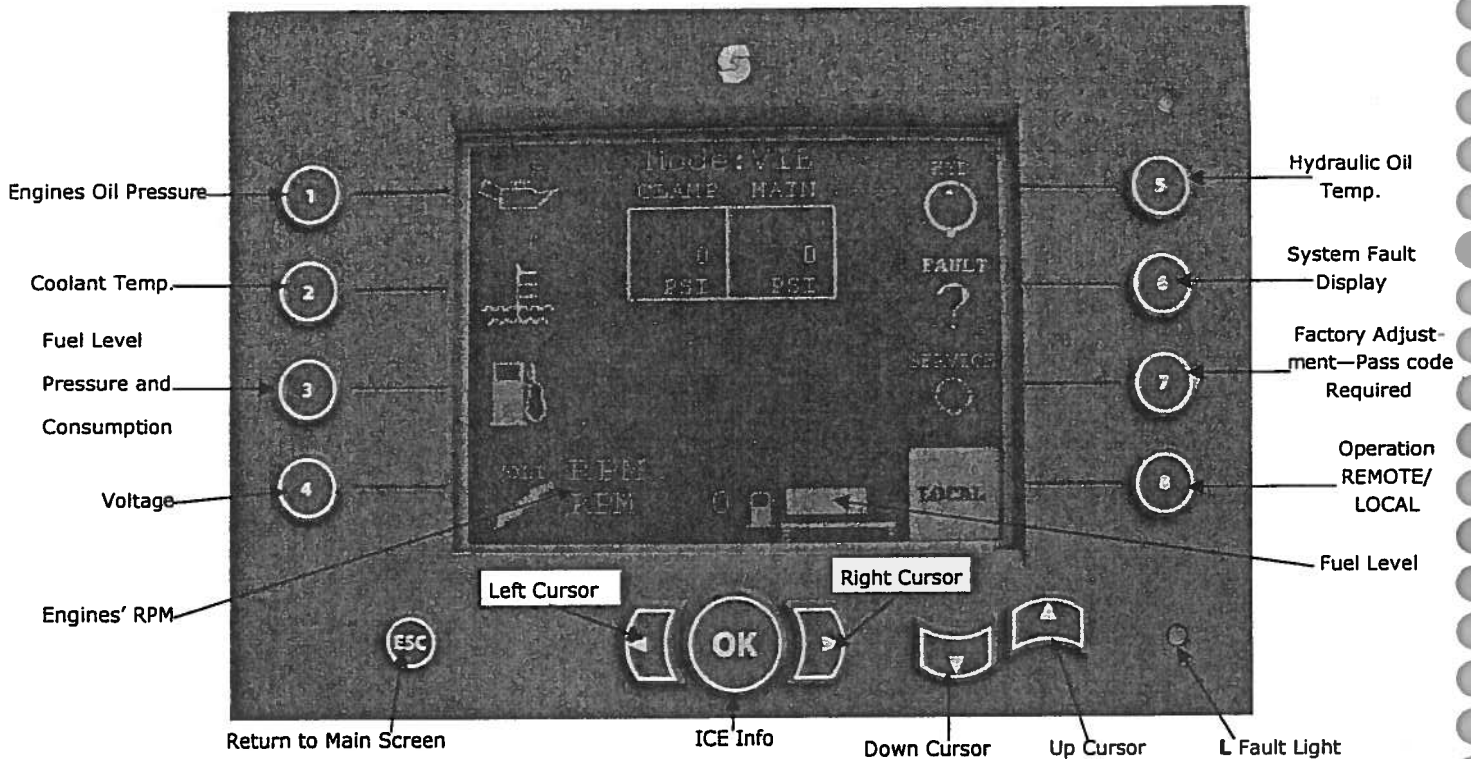


## Control Panel and Remote Pendant



Number	Description
1	Engine OFF-ON-START Switch
2	Auxiliary REV-OFF-FOR Switch
3	Engine EMERGENCY STOP Button
4	Control Panel Display for Onboard Computer Modules (OCM)
5	Light (CLAMP CLOSED)
6	Main Power Switch
7	Clamp OPEN-CLOSE Switch
8	Main Circuit REV-OFF-FOR Switch
9	Engine Speed SLOW-FAST switch
10	Pendant Engine EMERGENCY STOP Button
11	Pendant (CLAMP CLOSED) Light
12	Pendant Auxiliary DEC-OFF-INC Switch (Optional)
13	Pendant Clamp OPEN-CLOSE Switch
14	Pendant Main Circuit REV-OFF-FOR Switch
15	Pendant Engine Speed SLOW-FAST Switch

## Onboard Computer Module Display Screen



Button/Display	Function
1	Displays Engines Oil Pressure
2	Displays Engines Coolant Temperature
3	Displays Engines' fuel pressure, level, consumption.
4	Displays Engines Voltage
5	Displays Hydraulic Oil Temperature and Main Return Filter Pressure
6	Displays Fault Codes
7	Provides Access to Service Menu
8	Toggles Between REMOTE/LOCAL Control
▲▼	Scrolls Up / Down
<>	Scrolls Left / Right
ESC	Returns To Main Menu
L	Fault Indicator
Clamp	Displays Clamp Pressure
Main	Displays Main (Drive) Pressure
Mode	Displays Vibrator or Rotary Head Mode
Engine Rpm	Displays Engines Rpm
Fuel Level	Displays Fuel Level





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## Power Unit Controls

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The control panel contains an electronic display screen and local controls for the engine speed and vibratory functions. The operating parameters (engine speed, temperature, oil pressure, hydraulic system functions, and fault alarms can be viewed from the display). The three operational modes are Vibro, Auger1, and Auger2. The ICE 110C vibrator can only be operated in the VIB mode. To protect the equipment to be operated, the mode of operation is password protected.

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## Local or Remote Control

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The power unit control functions may be operated either from the control panel (Local) or from the remote control pendant (Remote). Additionally an operational radio control may be provided for remote operation. Remote/ Local operation is selected on the display screen by pressing button #8.

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## Remote Control

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The remote-control pendant can control the operation of the vibratory driver/extractor. The pendant is connected to the control cabinet with 50 feet (15 meters) of electrical cable to permit operation from advantageous positions to view the operation of the equipment. Pendant extensions and options are available upon request.

The electronic display control must be in the remote mode to operate the vibrator using the remote control pendant. Button #8 displays controls remote/local operation. If the display reads LOCAL, then pressing button #8 once will switch the control to REMOTE. Pushing the button again will return to LOCAL.

Should the remote control become damaged, select LOCAL and operate from control cabinet. The Safety Shutdown Override will have to be activated by pressing button #7 (service screen appears) and hold #1 until the default or home screen returns.

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## Starting and Warming Engines

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The display at the control panel will require the operator to start one engine at a time. Both engines must be running to operate the vibrator. The electronic screen will display ENGINE 1 flashing; this is the first engine to start. After engine one has started, press the right arrow; ENGINE 2 will now flash (as ENGINE 1 did previously). After ENGINE 2 starts the display returns to the main screen.

It is possible to bypass and start either engine individually for service or trouble shooting, but both engines must be running to operate the vibro. The left and right arrow buttons select ENGINE 1 or ENGINE 2. The up and down arrows select BYPASS or ENGINE START.

There is a one second delay before the engine will crank when turning START switch. If the engine fails to start after 30 seconds of cranking, allow the starter to cool for two minutes before reattempting engine start. After the engine starts, there is a two second delay before the control system will allow the engine throttle to increase or decrease.

After these two seconds have elapsed, adjust the throttle using the engines' speed switch until the engines register 1200 RPM and allow it to warm up for five minutes.

The equipment cannot be operated when the hydraulic oil is at or below 40°F (4°). The oil may be circulated in the REV position by holding the MAIN CIRCUIT REV-OFF-FOR switch in the REV position.

## Starting and Warming Engines-Continued

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

If the temperature of the hydraulic oil is at or below 0°F (-18°), the diesel engine will not start. The temperature may be read on the display by pressing #5 on the display screen.

The engines' temperature may be read on the display screen by pressing #2. If a temperature below 0°F (-18°) is anticipated, the application of external and immersion heaters and/ or an insulated shelter will be required. The engine will not start when the hydraulic oil is at or below 0°F (18°C)

### **!WARNING – Equipment!**

**Operation with hydraulic oil temperature below 0°F (18°C) may result in damage to hydraulic components.**

Turn the MAIN POWER switch on the control panel to ON.

Turn the ENGINE START OFF-ON-START switch to ON.

Turn the MAIN CIRCUIT (REV-OFF-FOR) and the AUXILIARY CIRCUIT (REV-OFF-FOR) on the control panel and pendant to the OFF position.

Turn the CLAMP OPEN –CLOSE switch on the control panel and pendant and pendant to the center (neutral) position. A red light on the lower right corner of the display will flash if any of these switches are not in the correct position, and the engine will not start. A text message will appear on the display once starting of the engines is attempted.

### **!WARNING – Safety!**

**Equipment could start due to component malfunction. Keep clear.**

Turn the ENGINE START 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.

As the engine starts, there is a two second delay before the control system will allow the throttle to increase or decrease.

After these two seconds have elapsed, adjust the throttle using the engines' speed switch until the engine is at 1200 RPM and allow it to warm up for five minutes.

### **!WARNING – Equipment!**

**The vibrator cannot be operated when the oil temperature is below 40° (4°C). The power unit should be only operated to warm oil.**



## Warming Hydraulic Oil

The equipment should not be operated at full speed if the hydraulic temperature is below 60°F (16°C).

After initial warm up, the engines should be throttled up to 1500 RPM. Operation of the equipment can begin at this speed. After the temperature exceeds 60°F (16°C), full speed (2050 RPM) operation can begin.

### **!WARNING – Equipment!**

**The equipment cannot be operated at full speed when the oil temperature is below 60° (16°C). Damage to components could result.**

The hydraulic oil temperature is monitored by the temperature transducer located in the return filter housing. The oil temperature should never exceed 160°F (71°C). If oil exceeds this temperature, the engine will automatically shut down.

### **!WARNING – Equipment!**

**Operation of the equipment when hydraulic oil temperature exceeds 160°F (16°C) could damage hydraulic components, as well as thermally stressing the hydraulic oil.**

## Engine Shutdown

Stop the vibratory driver/ extractor by placing the MAIN CIRCUIT REV-OFF-FOR switch in the OFF position.

Decrease engines' speed to 1500 RPM with the ENGINE SPEED SLOW-FAST switch and allow the Diesel Engine to run for five minutes.

Reduce the engine speed to low idle for thirty seconds.

Stop the engine by turning the ENGINE START switch to OFF.

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

### **!WARNING – Equipment!**

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

Pushing the EMERGENCY STOP BUTTON will cause all operating functions to stop.

Diesel Engine and Vibrator will stop immediately.

To restart the power unit the MAIN POWER switch must be turned to the OFF position, wait five seconds; then returned to the ON position to reset the system.



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## Power Unit Operation with Vibratory Driver/ Extractor

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### **!WARNING – Equipment!**

**The Display must be in the VIB mode prior to use with the vibratory Driver/ Extractor**

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### Clamp to Pile

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Position vibrator to pile. Turn the CLAMP OPEN-CLOSE switch on the pendant to CLOSE. The CLAMP 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.

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### Start Vibration

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Turn the MAIN CIRCUIT REV-OFF-FOR switch to FOR position. Make sure the engines are at adequate speed to maintain the vibrator's load.

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### Stop Vibration

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Turn the MAIN CIRCUIT REV-OFF-FOR switch to OFF position. Hold the CLAMP switch to the REV position has no effect in this VIB mode and will not have adverse results (holding the switch in REV can aid in warming the oil prior to operation).

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### Unclamp to Pile

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Make sure the MAIN CIRCUIT REV-OFF-FOR switch is in the OFF position. Allow all vibration to cease before opening the clamp. Hold the CLAMP switch in the OPEN position to open the hydraulic clamp so the vibrator can be moved from the pile. Complete opening requires about ten seconds. To prevent damage to the clamp, make sure the clamp is completely open before stabbing unto next piling.

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### Change Engine Speed

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Turn the ENGINE SPEED switch to SLOW and the engines will decrease RPMs. Turn the switch to FAST and the engines will increase RPMs . The switch must be held in desired direction for approximately two seconds before the system will change speed.

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### Change Engine Speed

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In order to provide maximum flexibility in achieving optimum pile penetration and extraction rates, the frequency of the vibrator must be adjusted. The frequency is varied by changing the engine speed. Generally the gradual increase of vibration frequency provides stability in the installation of piling. Decrease frequency if a hard ground creates rebound through the pile.

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## Maintenance

Preventative maintenance includes normal servicing that will keep the power unit and the vibratory driver/ extractor in peak operating condition and prevent unnecessary trouble from developing. Service consists of periodic lubrication and inspection of the moving parts and accessories of the unit.

Proper 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 breakdown and major repair, several other services or inspections are recommended for the same intervals as 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 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, severe temperature, duty cycle, etcetera, perform these services, lubrication replacements, and inspections more often.

<b>WARNING</b>
<b>POWER UNIT BATTERIES MUST BE DISCONNECTED BEFORE WELDING</b>

### **!WARNING – Equipment!**

**Serious equipment damage may result if the batteries are not disconnected prior to welding operations.**

## Engine Maintenance

As indicated in the Caterpillar operation and Maintenance Manual, perform all maintenance and lubrication checks. Please refer to their manual for additional daily and time-based maintenance requirements.



## Maintenance

### Daily Maintenance

#### Before Start-Up Checklist

- Check the entire set-up prior to starting the power unit.
- Check the oil level in the hydraulic reservoir and refill if necessary.
- Check oil level, with dipstick, in the pump drive. Replace oil if any water is present.
- Check all hoses for signs of damage or cuts that might cause hose failure during operation.
- Check all hose connections are tight, especially the quick-disconnect couplers.
- Inspect all connections to the equipment.
- As indicated in the Caterpillar Operation & Maintenance Manual, perform all daily maintenance checks and lubrications
- Check the clog air filter gauge.

#### After Start-Up Checklist

- Check all hydraulic hoses for leaks.
- Check all hydraulic hoses are hung freely with zero kinks.
- Check all pumps and hydraulic manifolds for leaks.
- With the diesel engine running at full speed, check the RETURN FILTER on the power pack by pressing Button 5. This indicates main return filters only.
- The secondary return filter has a mechanical gauge and has to be checked at the filter.

#### **!WARNING – Equipment!**

**It is absolutely imperative that the engines are not operated with low engine oil level, low coolant level, low gear lube in the multi-pump drive housings, or low hydraulic oil in the reservoirs. Do not use improper or contaminated fluid.**

#### **!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.**

#### **!WARNING – Safety!**

**Use safety glasses while performing the "After Start-Up Checklist". Keep hands and face clear of rotating and hot surfaces. Use caution while inspecting for fluid leakage—beware of the risk of pressurized or hot leaks.**



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## Service Intervals

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### 100 Hour Maintenance

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**Vibratory / Driver Extractor**— Drain and add new lubrication to vibrator's transmission case. Inspect used oil for contamination, debris, or metal particles. An oil testing program is an asset in setting main-

### 500 Hour Maintenance

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After the first 500 hours, drain and replace lubricant in the power unit multi-pump drive housing. Thereafter, change every six months. Inspect used oil for wear particles.

### Annual Maintenance

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**Hydraulic Oil:** At least yearly, have the hydraulic oil tested by a lab equipped to do so. Replace if required. Again, an oil testing program for all components is an asset to the maintenance program. Testing of the hydraulic oil is essential to prevent costly repairs. Never allow the unit to be operated with the hydraulic oil temperature above 160°F (71°C), be observant with the color of the oil or presence of water.

### Severe Conditions

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The service intervals and daily maintenance specified prior to this 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 change to 250 hours, annual changes to 6-months.

**Average Temperature:** Above 80°F (27°C) or below -10°F(-23°C) reduce service intervals by one half of those specified.

**Air Condition:** Operating in dust or sand, reduce service time by one 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 time intervals by one half of those specified.

**Extended Inactive Periods:** Not operational for five days, engines should be started once every three days and run until operating temperature is reached. During lengthy storage periods, daily maintenance intervals can be extended appropriately. Refer to Caterpillar for advice on lengthy storage periods.



## Lubrication

### Engine

Follow the Caterpillar maintenance schedule and oil specifications as printed in the Caterpillar Operation manual. Comparable brand engine oils:

AMOCO	15W-40 300
ARCO	15W-40 Fleet S3 Plus
ASHLAND	15W-40 400M
BORON (BP)	15W-40 Vanellus C Extra
CATERPILLAR	10W-30 CH-4
CHEVRON	15W-40 Delo 400
CITGO	15W-40 C500 Plus
CONOCO	15W-40 Fleet Supreme
EXXON	15W-40 XD3
GULF	15W-40 Super Duty Plus
MOBIL	15W-40 Delvac Super
PHILLIPS	15W-40 Super HD II
SHELL	15W-40 Rotella T
SUN	15W-40 Sunfleet Super C
TEXACO	15W-40 Ursa Super Plus
UNION	15W-40 Guardol
VALVOLINE	15W-40 All Fleet

### Vibrator Gear Case

**Checking Lubricating Oil Level:** Read oil level using sight glass located on the motors' side, lower center of the gear case. Fluid level should be in the middle of the sight glass.

**Adding Lubricating Oil:** On the vibrator gear case top plate, remove the 1" pipe plugs. When necessary, lubricating oil may be added through these holes.

**Draining the vibrator gear case:** Remove one 3/4" pipe plug at either end of the base plate; tilt the case for complete drainage

### Multi-Pump Drive Adapter Housings

**Checking Oil Level:** The oil level is easily checked using the dipstick on the side of each housing.

**Adding Oil:** Lubricating oil may be added by removing the filler breather plug from the fitting located on the top center of each multi pump drive adapter housing.

**Draining the Oil:** Draining the lubricant may be done by removing the magnetic drain plug on the bottom of the multi-pump drive housing.





## Recommendation per Lubricating Oil Vibrator Gear Case/ Multi Pump

All ICE gear drives come with Schaeffer 268. This product has been proven to have an excellent service life under intense duty cycles.

### Lubricating Oil in order of Preference:

Schaeffer	268
Exxon Mobil	SHC-634
Chevron	Gear Compound 460
Citgo	Premium MP 85W-140
Gulf	MP GL5 SAE 85W-140
Phillips	SMP 85W-140
Shell	Omala 460

If Schaeffer 268 is not available, service intervals should decrease. An oil testing program would be an asset in setting a proper maintenance program.

## 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 by maintaining a disciplined preventive maintenance program.

## Checking Oil Level

The hydraulic oil sight gauge is located on the reservoir and is accessible through the door above the hose quick disconnect couplers.

Make certain hydraulic oil is visible at the ambient or above temperature.

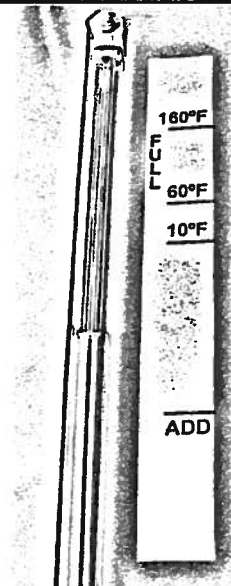
The oil level does climb as the oil warms.

### **!WARNING – Equipment!**

**The power unit should not be operated if hydraulic oil is not visible in sight glass, above the ADD line.**

Oil is added by the manual pump mounted on the reservoir to the right and below the sight gauge. Oil is pumped through a return filter to guarantee cleanliness of the oil.

The oil is drained through a plugged port on the bottom of the reservoir.



Oil Sight Gauge

## Changing Hydraulic Return Filters

### Remove Hydraulic Return Filters:

**Main Return Filters are mounted in reservoir in the oil cooler compartment side. The secondary return (for fan circuits) are mounted in the reservoir on the pump compartment side.**

Loosen and remove four bolts from each cover, gently tap and evenly pry off cover, remove old filter elements.

Inspect and remove bypass valves and make sure the valves open by hand.

Insert bypass valves into new filter elements.

Install new elements.

Inspect covers and sealing o-rings– replace if nicked or compressed.

Install covers and tighten evenly

Start engine and check for leaks

### **!WARNING – Equipment!**

**Guarantee, if installing elements other than those obtained through ICE, that the elements are a matched replacement. Inferior filter elements can break apart causing contamination.**

## Cautionary Practices for Hydraulic Oil and Return Filters

Keep stored oil dry and clean at all times and always store in clean sealed containers.

Keep tools, spouts, lids, funnels, etc when used in conjunction with the transfer of oil.

Do not return contaminated oil after component failure to reservoir.

Do not use dirty, water contaminated, or discolored oil in system without filtering and testing.

Replace filters at first indication that they are becoming clogged.

Mixing of different manufacturer's oil is not recommended; store replacement oil to prevent this issue.

### **!WARNING – Equipment!**

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

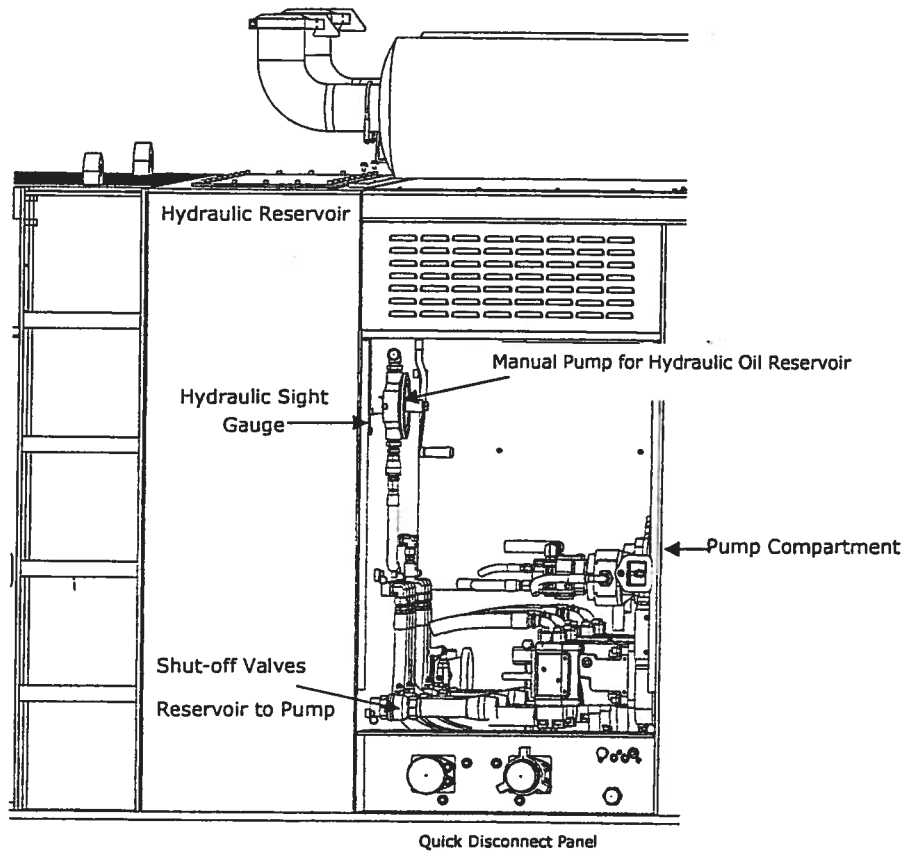
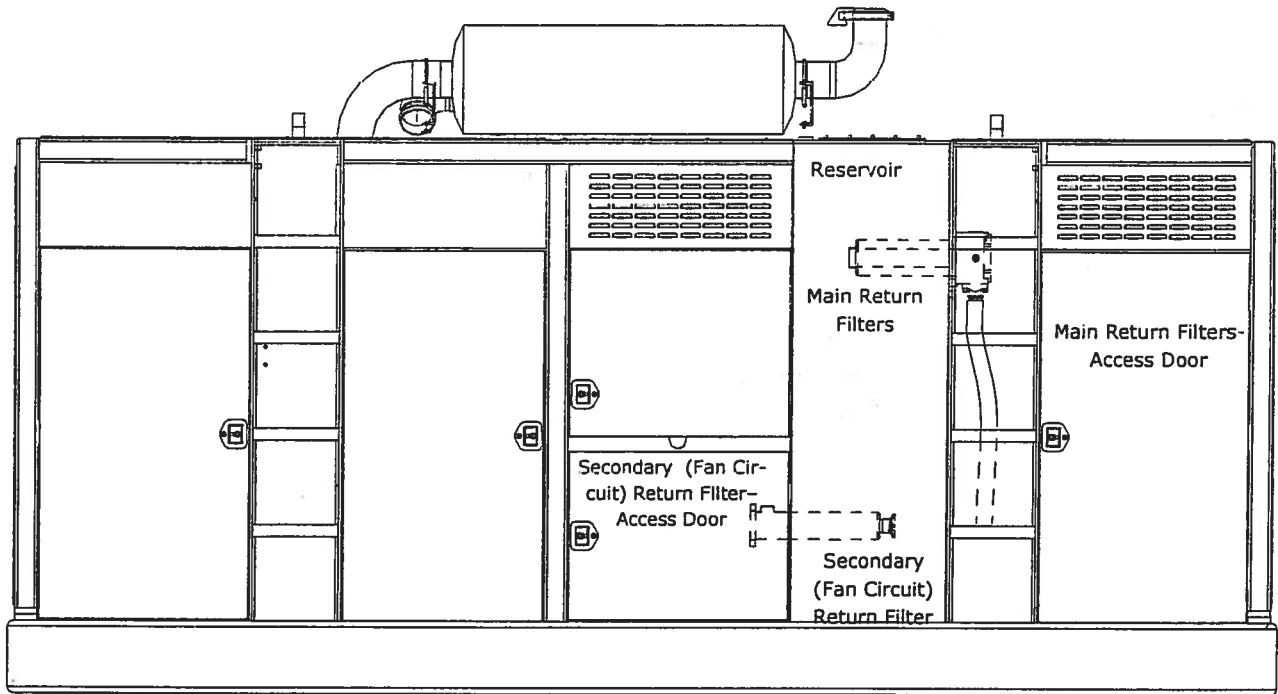
## Recommendations on Hydraulic Oil

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.

Power units are shipped with Chevron Clarity® AW46 hydraulic oil. Chevron Clarity exceeds the requirements of both the E.P.A. and the U.S. Fish and Wildlife Service for non-toxicity and is inherently biodegradable. Adding other oil will contaminate the Chevron Clarity AW46 and render it no longer environmentally friendly.

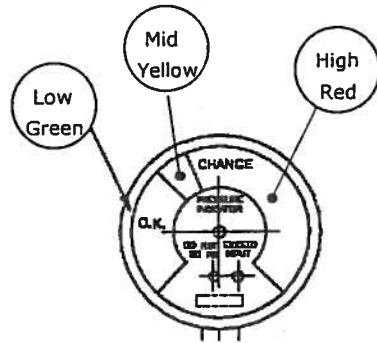


# Hydraulic Return Filters and Manual Pump for Filling Reservoir



## Secondary Hydraulic Return Filter Indicator Gauge

The secondary return filter is not linked to the onboard computer display. A pressure gauge mounted on the side of the filter's canister displays condition of filter elements and should be read with the hydraulic oil at operating temperature. If in the red, elements must be changed.



Secondary Return Filter Gauge

Low Scale=Filter Clean (0-17 psi); Mid Scale=Change Filter (18-23 psi); High Scale=Filter Clogged (24+psi)

## Recommended Hydraulic Oils

Oil is listed in order of preference. When not using the first two selections, the hydraulic oil should be tested more frequently.

Chevron	Clarity AW46
Exxon Mobile	DTE15M
Lyondell (Citgo)	Duro AW 32
Chevron	Hydraulic Oil AW ISO 32
Phillips	Magnus A ISO VG32
Shell	Tellus Plus 32

The hydraulic oils selected were chosen based on the hydraulic system being 5°F (-15°C), which is the cold ambient start-up to 160°F (71°C), the maximum operating.

**Operating in Sub- Freezing or Extreme Heat Conditions:** It may become necessary to change the viscosity of the hydraulic oil due to extremes of ambient temperature. Further steps such as additional oil cooling or oil heaters may be required. Contact ICE for specific concerns.



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## Setting Clamp Relief Valve

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**The Clamp Relief Valve limits clamp pressure to 4800 psi (330 bar).**

The Clamp Relief Valve is located on the power unit clamp manifold, which is located on the left behind the panel above the quick-disconnect couplers at the power unit.

Check the clamp hoses are connected properly in order to receive an accurate pressure reading.

Start and warm up the diesel engine.

With the engine warmed up, increase engine speed to 1950 rpm.

While observing the display screen, turn the clamp (OPEN-CLOSE) switch to OPEN. The pressure should read 4800 psi (330 bar).

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## Checking the Clamp Pressure

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If the pressure is not at least 4500 psi, Release the (OPEN-CLOSE) switch.

While holding the Clamp Relief Valve adjusting screw with a hex key, loosen the adjusting screw jam nut with an open-end wrench.

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 pressure

While observing the OPEN pressure gage, turn the clamp (OPEN-CLOSE) switch to OPEN, the pressure should read 4800 psi (330 bar)

**The Clamp Pressure Switch sets clamp pressure to 4500 psi (310 bar):**

- The Clamp Relief Valve must be set to 4800 psi (330 bar) prior to setting the Clamp Pressure Switch.
- The Clamp Pressure Switch is located on the power unit clamp manifold, which is located on the left behind the panel above the quick-disconnect couplers at the power unit.
- Turn MAIN POWER switch ON.
- On the Control Panel Display Screen, push Button 7 and then Button 6.
- Enter Password. Password can be obtained from your ICE service department.
- Use left arrow to scroll to clamp pressure display.
- Use up and down arrows to scroll to 4500 psi (310 bar).
- Press ESC Button to return to main screen.

### **!WARNING – Equipment!**

**The clamp must be connected to the power unit to properly adjust valves.**

### **!WARNING – Equipment!**

**Be cautious to keep hands away from jaws when opening and closing clamp.**



## Torque Specifications

**!WARNING – Equipment!**

**!WARNING – Safety**

Mismatched or incorrect fasteners can result in damage, malfunction, or possible injury.

Screw Size	Allen Wrench Size	Standard Torque		Screw Size	Allen Wrench Size	Standard Torque	
		Ft-lbs	Kg-m			Ft-lbs	Kg-m
10-24	5/32	6	0.83	10-32	5/32	6	0.83
1/4-20	3/16	13	1.8	1/4-28	3/16	15	2.1
5/16-18	1/4	27	3.7	5/16-24	1/4	30	4.2
3/8-16	5/16	48	6.6	3/8-24	5/16	55	7.6
7/16-14	3/8	77	10.6	7/16-20	3/8	86	11.9
1/2-13	3/8	119	16.4	1/2-20	3/8	133	18.4
5/8-11	1/2	234	32.3	5/8-18	1/2	267	36.9
3/4-10	5/8	417	57.6	3/4-16	5/8	467	64.5
7/8-9	3/4	676	93.4	7/8-14	3/4	742	102.5
1-8	3/4	1009	139.4	1-12	3/4	1126	155.6
1-1/4-7	7/8	1600	221.1	1-1/4-12	7/8	1800	248.8
1-1/2-6	1	2800	387	1-1/2-12	1	3000	414.6

Torque Table for Allen Head Bolts

Thread Size	Standard Torque	
	N-m	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 Table for UNC Bolts and Nuts

Metric ISO Thread Size	Standard Torque	
	N-m	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	175 ± 30
M20	460 ± 60	340 ± 44
M24	800 ± 100	590 ± 75
M30	1600 ± 200	1180 ± 150
M36	2700 ± 300	2000 ± 220

Torque Table for Metric Bolts and Nuts



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## Trouble Shooting

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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 general troubleshooting guide and the Caterpillar Operation and Maintenance Manual. If the difficulty cannot be corrected, contact your Caterpillar dealer for engine problems, the local ICE dealership, or ICE Corporate at 888-ICE-USA1 or 704-821-8200.

Components in CAPITAL LETTERS are shown on the Electrical and Hydraulic Schematics in the Power Unit Parts Manual.

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## Power Unit Monitoring and Protection

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The power unit utilizes an Onboard Computer Module (OCM). The Display Screen monitors OCM critical hydraulic and engine parameters for conditions that can damage the unit.

**The following hydraulic system parameters are monitored for conditions that can damage the hydraulic components:**

- ⌚Hydraulic oil level
- ⌚Hydraulic oil temperature
- ⌚Return filter pressure

**The following engine parameters are monitored for conditions that can damage the engines:**

- ⌚Oil pressure
- ⌚Fuel pressure
- ⌚Fuel temperature
- ⌚Fuel level
- ⌚Coolant temperature
- ⌚Intake air temperature
- ⌚Engine over speed

If any of these conditions deviate from the programmed parameters, the OCM will shut down or derate the engine.

After the problem is corrected, the OCM may be reset at the Display Screen by turning the MAIN POWER switch to OFF for at least five seconds.

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## Electrical Control Problems

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In the case of control malfunctions, try resetting circuit breakers. Check all plugs, connectors, terminals for good and complete connectivity.



## Safety Shutdown Overrides

If the Onboard Computer shuts down the power unit for any non-catastrophic fault, the operator can override shutdown faults until the power unit is either turned off or ten hour have elapsed. The following shutdowns are considered non catastrophic:

Low Hydraulic Level (but visible in the sight gauge and above add level)

High Return Filter Pressure (confirm that the mechanical pressure gauge is reading in the safe range)

Faulty Hydraulic Oil Temperature Reading

Faulty Fuel Level Reading

**The following steps are required to override the fault codes:**

1. Momentary push the Emergency Stop Button on the Control Panel
2. Push and release Button # 6 on the Display Screen
3. Push and release button #7 on the Display Screen
4. Press and hold Button #1 on the Display Screen until the fault is overridden.

### **!WARNING – Equipment!**

**Continued operation of the equipment while overriding fault codes could result in catastrophic damage. OCM problems must be corrected to prevent voiding the warranty.**

## Check System Faults

**How to check for OCM system faults using the Display Screen:**

1. Press #6 button on Display Module and try to start engines
2. Observe any fault code that appears.
3. Refer to fault code table for explanation and Reset if possible.

## Resetting Fault Codes

**Correct the condition that caused the fault according to the table and clear the fault code from the computer:**

1. Correct the condition that caused the fault according to the table.
2. Push Emergency Stop Button
3. Turn Main Power Switch to OFF and wait at least 5 seconds.
4. Turn Main Power Switch to ON





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## **Trouble Shooting**

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### **Diesel Engine Does Not Start**

---

Check Main Power Switch on the control panel is ON; wait 15 seconds for the Onboard Computer Module (OCM) to initialize.

Check all switches in the Off or neutral position on both pendant and local control panel.

Turn ENGINE START switch to ON

If Fault light on the Display Module is blinking, press Button 6 and read the Fault Codes.

Check engine coolant temperature; if over 220°F(105°C) allow the engine to cool before attempting operation of vibrator.

Check engine oil level

Check batteries' condition and connections, electrical components and connections, including the starter relay

Check fuel supply and fuel filter; verify that fuel is uncontaminated

Consult the Caterpillar Operation and Maintenance Manual

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### **Diesel Engine Does Not Stop**

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Call local Caterpillar dealer and service center.

Push Emergency Stop Button on remote control pendant or control panel.

Check all electrical connections

Consult Caterpillar Operation and Maintenance Manual

Call local Caterpillar engine dealership and service center

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### **Diesel Engine Speed Control Switch Not Functioning**

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Switch between Local or Remote mode to check for damaged pendant

Check fault codes.

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### **Diesel Engine Does Not Run at Full Speed**

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The Power Unit's OCM reduces engine speed or derates if conditions exist that could damage engine.

If the engine should slow down, stop vibrator's operation

Shut down engine.

Check oil level and pressure.

Turn Engine Start switch to Start and push Button 3 to check fuel pressure. If below 15 PSI (1 BAR), check fuel filter. Use primer pump to purge air from system.

Check engine coolant temperature.



## Trouble Shooting

### Vibrator Does Not Start or Vibrates Slowly

1. Both Diesel Engines must be running with the Display module in VIB mode at 2050 RPM.
2. Clamp must be closed with pressure above 4500 PSI (310 BAR).
3. With the Display Module in Remote Mode, turn the main circuit (REV-OFF-FOR) switch on remote control pendant to FOR. (check in local mode to verify continuity in pendant cable and switches). If Fault Light is blinking on the Display for Onboard Computer, press Button 6 and read the fault codes (refer to page 41).
4. With the Display in the LOCAL mode, turn the main circuit on the control panel to the FOR position.
5. Check that the pressure & return hydraulic hoses between power unit & vibrator are routed properly.
6. If main drive pressure is at 4500-5500 psi (310-380 BAR):
7. Check that the quick disconnect couplers are clean, straight, threaded completely and tightened fully- Do not remove or attach quick disconnect couplers with the engines running.
8. Check that vibrator's transmission is not overfilled with gear oil, or filled with hydraulic oil from failed motor shaft seals.
9. Make certain that the vibrator's momentum has not been negated by pile weight and/ or soil composition. Vibratory Driver / Extractor should vibrate at 1550 cycles per minute (speed can be tested with a photo tachometer) free hanging without pile. USE EXTREME CAUTION WHEN TESTING TO AVOID INJURY TO PERSONNEL, DAMAGE TO CRANE, SURROUNDING STRUCTURES, AND VIBRATOR.
10. If the pressure reads 500-800 PSI (55 BAR) and the vibrator does not start or shakes slowly, inspect the check valve (CV6) at the vibrator to make sure it is not stuck open.
11. If FOR does not appear above pressure reading check for loose wires or bad switch in control pendant box or at control panel.
12. If FOR appears above pressure reading, manually shift forward reverse control valve. If vibrator starts, check electric signal to solenoid and wire connections. Replace valve or solenoid if signal is present and electrical connections are good.
13. Shut off engine, disconnect the drive and return quick disconnect couplers and check system pressure. Running against the quick disconnect check valves, the main relief pressure should be between 4500-5500 PSI (310-380 BAR). If significantly less: Make shut-off valves at the reservoir to pumps are completely open, that breather filter at the top of reservoir is clean.
14. Check relief valve setting, check control manifold, proportional relief and cartridges-make sure movement is not inhibited by debris trash or scoring- clean and reassemble.

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### **Vibrator Does Not Start or Vibrates Slowly**

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15. If pressure at power unit is adequate; reconnect hoses at the quick disconnect couplers. Remove both motors from the vibrator's transmission case. Remove drain hoses from motors. Restart power unit run at full speed and main circuit switch in FOR position. Monitor motor shaft speed (use photo tachometer) and check drain flows. After comparing the two motors, replace motor if drain flow is significant, or if one shaft speed significantly slower. Consult with ICE for detail specifications if needed.
16. Test Pump flow from at each Drive pump outlet. Check condition and output speed of multi pump drive transmission. Remove Power Unit Drive pumps if flow is low and have inspected by an authorized hydraulic shop. (contact ICE for flow rates and speeds)
17. Inspect Vibrator transmission for mechanical failure – metal particles in gear oil – exterior paint burnt. Remove bearing covers and check for failed eccentric, drive, and motor bearings.

---

### **Vibratory Driver/ Extractor Case Drain Relief (RV2) Expels Oil**

---

Inspect, test, and/or replace the case drain relief valve to verify its condition.

Make sure that 1" Drain hose in bundle quick disconnect (QD5) is made up straight and completely

Make certain that 1" drain line is not kinked or smashed

Test Motors' drain flow; repair or replace as needed.



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## **Clamp Does not Close or Open.**

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Make sure that quick disconnect couplers are made up properly (trapped pressure under "ball checks" of connections can make threading couplers difficult by hand).

Make sure hoses are routed properly.

Check OPEN control pressure.

Swap from Remote to Local operation mode and attempt to close; pendant may be damaged.

Operate control valve manually. If successful, check for electrical connections or malfunctioning solenoid.

Check all clamps for internal (piston seal leaks). Often a malfunctioning clamp bypasses oil to opposite port end of a tandem clamp (one or more in quad clamp configuration) rendering it sluggish or unmoving.

Remove the open side clamp hose place clamp switch in CLOSE position; check hose and port for bypass oil after piston has closed (use caution in regard to hydraulic oil spray and spillage).

Check clamp pump output.

Make sure clamp rod is not seized in clamp body.

---

## **Clamp Light Does Not Illuminate**

---

### **If clamp closed pressure is reaching 4500 PSI:**

If clamp pressure on the display is above 4,500 PSI (310 BAR), replace the Clamp Light bulb, inspect socket contacts for corrosion or damage, check electrical connection where wires terminate, broken wires in the pendant.

### **If clamp pressure is below 4,500 PSI:**

Hold clamp switch to OPEN for 10 seconds and release. Disconnect close clamp coupler (QD4) at power unit. Turn clamp switch to CLOSE.

If above 4,500 PSI check close hose joints in bundle for leaks. Check for leaks at clamp(s) external and internal.

If below 4,500 PSI check relief valve setting (RV-2); it should be set to 4800 PSI. If turning screw in does not increase pressure check or replace relief valve. Test clamp pump.

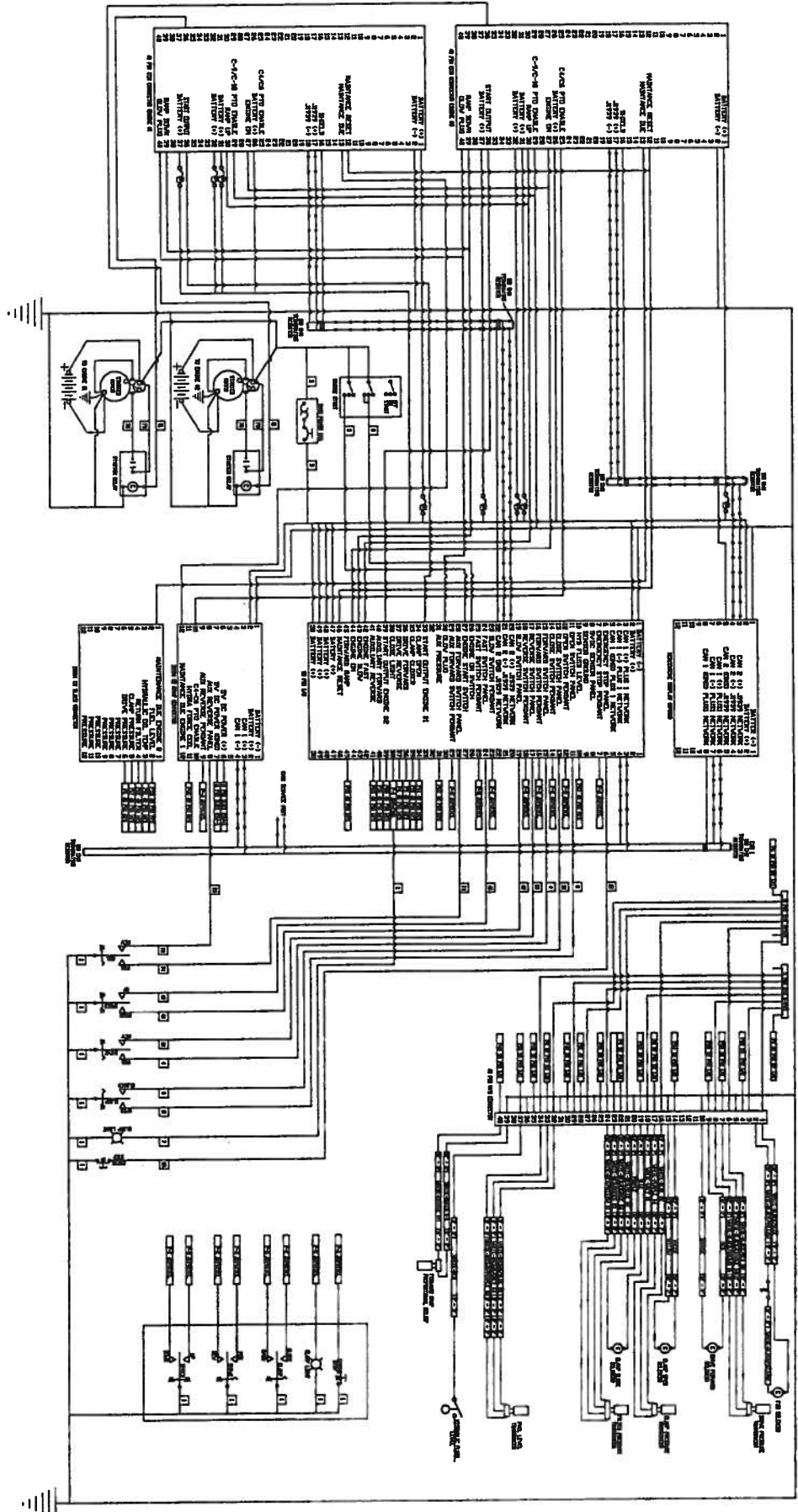


## Fault Codes

SW= Service Warning    ES=Engine Shutdown    W=Warning    HCS =Hydraulic Circuit Shutdown

Fault Message	Description	Corrective Action	Fault Level
Aux Trans	Auxiliary press. transducer malfunction	Inspect/Replace Part 770181	SW
C1P33 Start	Short/open circuit to engine start circuit	Inspect/repair wiring engine start circuit	SW
C1P34 Clamp Open	Clamp open solenoid malfunction	Inspect/replace Part 750360	SW
C1P35 Clamp Close	Clamp close solenoid malfunction	Inspect/replace Part 750360	SW
C1P36 Drive For	Forward drive solenoid malfunction	Inspect/replace Part 750026	SW
C1P37 Drive Rev	Reverse drive solenoid malfunction	Inspect/replace 750026	SW
C1P39 Hydraforce Valve	Hydraforce valve malfunction	Inspect/replace 730807	SW
C1P40 Aux Fwd	Forward drive solenoid malfunction	Inspect/replace Part 750026	SW
C1P41 Aux Rev	Reverse drive solenoid malfunction	Inspect/replace Part 750026	SW
C1P42 Fast	Short/open circuit engine fast circuit	Inspect/repair wiring eng. fast circuit	SW
C1P43 Slow	Short/open circuit engine slow circuit	Inspect/wiring to engine slow circuit	SW
C1P45 Prop Relief	Drive pressure relief valve malfunction	Inspect/replace drive pressure relief valve	SW
C1P46 Mnt Reset	CAT engine maintenance needed	Consult CAT Operation Maintenance Manual	SW
Case 1-6 Trans	Reserved	Not Used	NA
Clamp Trans	Clamp Pressure transducer malfunction	Inspect/replace 770181	SW
Change Filter	Return Filter Clogged	Replace return filter cartridge	ES
Drive Transducer	Drive pressure transducer malfunction	Inspect/replace Part 770181	SW
ES Shutdown	Emergency Stop Pressed	Reset System	ES
Filter Trans	Filter pressure transducer Malfunction	Inspect/replace 770182	SW
Fuel Low	Fuel Level is low	Add Fuel	W
Fuel Trans	Fuel level transducer malfunction	Inspect/replace 770182	SW
Fuel Out	Fuel tank is empty	Refill Tank	ES
Hyd . Oil Level	Hydraulic fluid level low	Refill Hydraulic Tank	ES
Oil temp 32°F	Hydraulic oil temp <32°F	Preheat Oil w/ optional heater	ES
Oil temp 45°F	Hydraulic oil temp <45°F	Heat oil by circulation	HCS
Oil Temp 145°F	Hydraulic oil temp >145°F	Cease vibration circulate oil to cool	W
Oil Temp 180°F	Hydraulic oil temp >180°F	Check oil cooler and oil level	ES
Oil Temp Trans	Oil temp. transducer malfunction	Inspect/replace Part 770179	SW





DATE: REV: INT: DESCRIPTION: INTERNATIONAL CONSTRUCTION EQUIPMENT INC. 2PL DECIMAL 434A DRAWN BY: RLM DATE: 03/23/59 SCALE: NONE MODEL: 1200E WIRING DIAGRAM



# Electrical Component Legend

## ENGINE (#2) 40 PIN - RIGHT

1	BATTERY (+)	UN-SWITCHED POS.
2	BATTERY (-)	NEGATIVE
3	NOT USED	NA
4	NOT USED	NA
5	NOT USED	NA
6	NOT USED	NA
7	NOT USED	NA
8	NOT USED	NA
9	NOT USED	NA
10	NOT USED	NA
11	NOT USED	NA
12	PIN 46 ON 50 PIN I/O	MAINTENANCE RESET
13	PIN 12 ON 12 PIN GREY I/O	MAINTENANCE DUE
14	NOT USED	NA
15	NOT USED	NA
16	PIN 5 ON 12 PIN FOR DISPLAY	CAN 3 (GND) J1939
17	PIN 3 ON 12 PIN FOR DISPLAY	CAN 3 (+) J1939
18	PIN 4 ON 12 PIN FOR DISPLAY	CAN 3 (-) J1939
19	NOT USED	NA
20	NOT USED	NA
21	NOT USED	NA
22	NOT USED	NA
23	NOT USED	NA
24	NOT USED	NA
25	NOT USED	NA
26	BATTERY (+)	SWITCHED POSITIVE
27	PIN 44 ON 50 PIN I/O	ENGINE ON
28	NOT USED	NA
29	BATTERY (-)	NEGATIVE
30	PIN 42 ON 50 PIN I/O	ENGINE FAST
31	BATTERY (+)	UN-SWITCHED POS.
32	BATTERY (+)	UN-SWITCHED POS.
33	NOT USED	NA
34	NOT USED	NA
35	NOT USED	NA
36	39 ON 50 PIN I/O	START OUTPUT
37	NOT USED	UN-SWITCHED POS.
38	NOT USED	NA
39	PIN 43 ON 50 PIN I/O	ENGINE SLOW
40	PIN 30 ON 50 PIN I/O	GLOW PLUG

## HYDRAULIC 40 PIN

1	GROUND	NA
2	5 ON TERMINAL STRIP	HYD FAN SOLENOID
3	8 PIN BUS (-5V)	NA
4	PIN 37 ON 50 PIN I/O	DRIVE REVERSE
5	GROUND	NA
6	8 PIN BUS (+5V)	NA
7	PIN 6 ON 12 PIN BLACK	DRIVE PRESSURE
8	8 PIN BUS (-5V)	NA
9	PIN 36 ON 50 PIN I/O	DRIVE FORWARD
10	GROUND	NA
11	NOT USED	NA
12	NOT USED	NA
13	NOT USED	NA
14	PIN 34 ON 50 PIN I/O	CLAMP OPEN
15	GROUND	NA
16	8 PIN BUS (+5V)	NA
17	PIN 5 ON 12 PIN BLACK I/O	CLAMP PRESSURE
18	8 PIN BUS (-5V)	NA
19	PIN 35 ON 50 PIN I/O	CLAMP CLOSED
20	GROUND	NA
21	8 PIN BUS (+5V)	NA
22	PIN 4 ON 12 PIN BLACK I/O	PRESSURE - FILTER
23	PIN 3 ON 12 PIN BLACK I/O	TEMPERATURE - FILTER
24	8 PIN BUS (-5V)	NA
25	P41 ON 50 PIN I/O	AUXILIARY REVERSE
26	GROUND	NA
27	8 PIN BUS (+5V)	NA
28	PIN 31 ON 50 PIN I/O	AUXILIARY PRESSURE
29	8 PIN BUS (-5V)	NA
30	PIN 40 ON 50 PIN I/O	AUXILIARY FORWARD
31	GROUND	NA
32	8 PIN BUS (+5V)	NA
33	PIN 2 ON 12 PIN BLACK I/O	FUEL LEVEL
34	8 PIN BUS (-5V)	NA
35	NOT USED	NA
36	GROUND	NA
37	PIN 10 ON 50 PIN I/O	HYD. FLUID LEVEL
38	NOT USED	NA
39	GROUND	NA
40	PIN 45 ON 50 PIN I/O	FORWARD RAMP

## 50 PIN I/O CONNECTOR

1	BATTERY (-)	NA
2	BATTERY (+)	NA
3	CAN 1 (+)	PLUS 1 NETWORK
4	CAN 1 (-)	PLUS 1 NETWORK
5	CAN 1 - GROUND	PLUS 1 NETWORK
6	WIRE 48 TO E-STOP	EMERGENCY STOP
7	PIN P ON AMPHENOL CONN.	CLAMP LIGHT
8	5VDC SENSOR PANEL	NA
9	SENSOR GROUND	NA
10	PIN 37 ON 40 PIN HYD. CONN.	HYDRAULIC FLUID LEVEL
11	WIRE 10 TO OPEN ON PANEL	OPEN SWITCH PANEL
12	PIN E ON AMPHENOL CONN.	OPEN SWITCH PENDANT
13	WIRE 8 TO CLOSE ON PANEL	CLOSE SWITCH PANEL
14	PIN D ON AMPHENOL CONN.	CLOSE SWITCH PENDANT
15	WIRE 4 TO FORWARD PANEL	FORWARD SWITCH PANEL
16	PIN B ON AMPHENOL CONN.	FORWARD SWITCH PENDANT
17	WIRE 13 TO REVERSE PANEL	REVERSE SWITCH PANEL
18	PIN G ON AMPHENOL CONN.	REVERSE SWITCH PENDANT
19	WIRE 46 TO SLOW ON PANEL	SLOW SWITCH PANEL
20	CAN 2 (+)	J 1939 NETWORK
21	CAN 2 (-)	J 1939 NETWORK
22	CAN 2 - GROUND	J 1939 NETWORK
23	PIN L ON AMPHENOL CONN.	SLOW SWITCH PENDANT
24	WIRE 47 TO FAST ON PANEL	FAST SWITCH PANEL
25	PIN K ON AMPHENOL CONN.	FAST SWITCH PENDANT
26	WIRE 5 TO ENGINE ON	ENGINE ON
27	WIRE 11 TO ENGINE START	ENGINE START
28	WIRE 74 TO AUX. FOR. PANEL	AUXILIARY FORWARD PANEL
29	PIN J ON AMPHENOL CONN.	AUXILIARY FORWARD PENDANT
30	PIN 40 ON 40 PIN ENG. CONN.	GLOW PLUG
31	PIN 28 ON 40 PIN HYD. CONN.	AUXILIARY PRESSURE
32	NOT USED	NA
33	PIN 36 ON 40 PIN ENG. #1	START OUTPUT (ENGINE #1)
34	PIN 14 ON 40 PIN HYD. CONN.	CLAMP OPEN SOLENOID
35	PIN 15 ON 40 PIN HYD. CONN.	CLAMP CLOSE SOLENOID
36	PIN 9 ON 40 PIN HYD. CONN.	DRIVE FORWARD SOLENOID
37	PIN 4 ON 40 PIN HYD. CONN.	DRIVE REVERSE SOLENOID
38	PIN C ON AMPHENOL CONN.	CLAMP LIGHT
39	PIN 36 ON 40 PIN ENG. #2	START OUTPUT (ENGINE #2)
40	PIN 30 ON 40 PIN HYD. CONN.	AUXILIARY FORWARD SOLENOID
41	PIN 25 ON 40 PIN HYD. CONN.	AUXILIARY REVERSE SOLENOID
42	PIN 30 ON 40 PIN ENG. CONN.	RAMP UP - IDLE (ENG. 1 & 2)
43	PIN 39 ON 40 PIN ENG. CONN.	RAMP DOWN - IDLE (ENG. 1 & 2)
44	PIN 27 ON 40 PIN ENG. CONN.	ENGINE ON (ENG. 1 & 2)
45	PIN 40 ON 40 PIN HYD. CONN.	FORWARD RAMP
46	PIN 12 ON 40 PIN ENG. CONN.	MAINTENANCE RESET(ENG 1 & 2)
47	BATTERY (+)	NA
48	BATTERY (+)	NA
49	BATTERY (+)	NA
50	BATTERY (+)	NA

## ENGINE (#1) 40 PIN - LEFT

1	BATTERY (+)	UN-SWITCHED POS.
2	BATTERY (-)	NEGATIVE
3	NOT USED	NA
4	NOT USED	NA
5	NOT USED	NA
6	NOT USED	NA
7	NOT USED	NA
8	NOT USED	NA
9	NOT USED	NA
10	NOT USED	NA
11	NOT USED	NA
12	PIN 46 ON 50 PIN I/O	MAINTENANCE RESET
13	PIN 12 ON 12 PIN GREY I/O	MAINTENANCE DUE
14	NOT USED	NA
15	NOT USED	NA
16	PIN 5 ON 12 PIN FOR DISPLAY	CAN 2 (GND) J1939
17	PIN 3 ON 12 PIN FOR DISPLAY	CAN 2 (+) J1939
18	PIN 4 ON 12 PIN FOR DISPLAY	CAN 2 (-) J1939
19	NOT USED	NA
20	NOT USED	NA
21	NOT USED	NA
22	NOT USED	NA
23	NOT USED	NA
24	NOT USED	NA
25	PIN 10 ON 12 PIN GREY I/O	C4-C6 PTO ENABLE
26	BATTERY (+)	SWITCHED POSITIVE
27	PIN 44 ON 50 PIN I/O	ENGINE ON
28	NOT USED	NA
29	BATTERY (-)	NEGATIVE
30	PIN 42 ON 50 PIN I/O	ENGINE FAST
31	BATTERY (+)	UN-SWITCHED POS.
32	BATTERY (+)	UN-SWITCHED POS.
33	NOT USED	NA
34	NOT USED	NA
35	NOT USED	NA
36	33 ON 50 PIN I/O	START OUTPUT
37	BATTERY (+)	UN-SWITCHED POS.
38	NOT USED	NA
39	PIN 43 ON 50 PIN I/O	ENGINE SLOW
40	PIN 30 ON 50 PIN I/O	GLOW PLUG

## BREAKERS

1	PIN 1 ON ENG #1 40 PIN	NA
2	TERM 5 ON TERM STRIP	NA
3	PIN 31 ON ENG #1 40 PIN	NA
4	TERM 5 ON TERM STRIP	NA
5	PIN 32 ON ENG #1 40 PIN	NA
6	TERM 5 ON TERM STRIP	NA
7	PIN 37 ON ENG #1 40 PIN	NA
8	TERM 5 ON TERM STRIP	NA
9	PIN 1 ON ENG #2 40 PIN	NA
10	TERM 5 ON TERM STRIP	NA
11	TERM 31 ON ENG #2 40 PIN	NA
12	TERM 5 ON TERM STRIP	NA
13	PIN 32 ON ENG #2 40 PIN	NA
14	TERM 5 ON TERM STRIP	NA
15	PIN 37 ON ENG #2 40 PIN	NA
16	TERM 5 ON TERM STRIP	NA

## 12 PIN BLACK I/O CONN.

1	PIN 13 ON 40 PIN ENG. #2	MAINTENANCE DUE ENGINE #2
2	PIN 33 ON 40 PIN HYD. CONN.	FUEL LEVEL TRANSDUCER
3	PIN 23 ON 40 PIN HYD. CONN.	TEMPERATURE TRANSDUCER
4	PIN 22 ON 40 PIN HYD. CONN.	FILTER PRESSURE TRANSDUCER
5	PIN 17 ON 40 PIN HYD. CONN.	CLAMP PRESSURE TRANSDUCER
6	PIN 6 ON 40 PIN HYD. CONN.	DRIVE PRESSURE TRANSDUCER
7	NOT USED	NA
8	NOT USED	NA
9	NOT USED	NA
10	NOT USED	NA
11	NOT USED	NA
12	NOT USED	NA

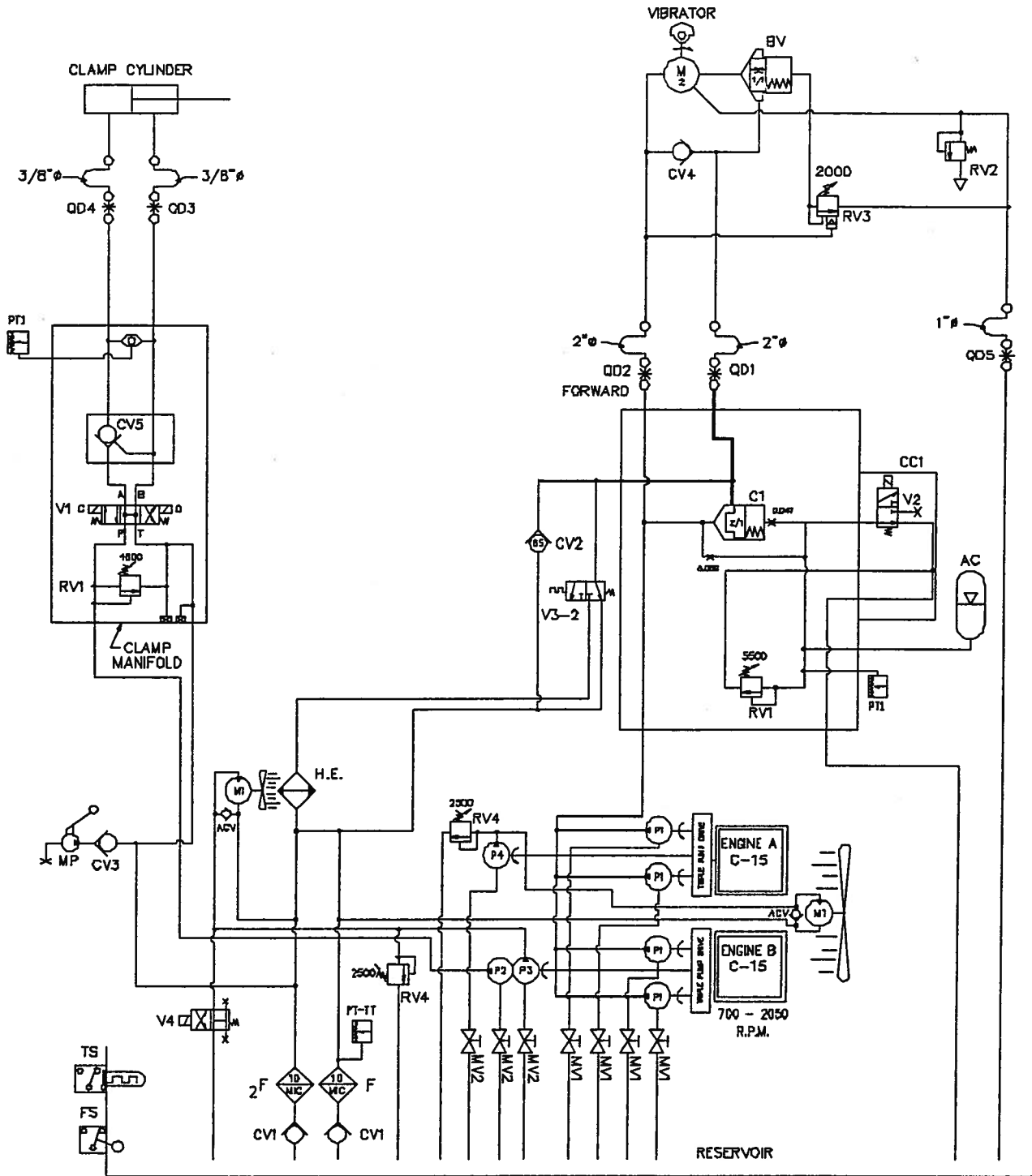
## 12 PIN GREY I/O CONN.

1	BATTERY (-)	NA
2	BATTERY (+)	NA
3	CAN 1 (+)	PLUS 1 NETWORK
4	CAN 1 (-)	PLUS 1 NETWORK
5	NOT USED	NA
6	8 PIN BUS (+5V)	NA
7	8 PIN BUS (-5V)	NA
8	WIRE 73 TO REVERSE PANEL	REVERSE SWITCH PANEL
9	PIN H ON AMPHENOL CONN.	REVERSE SWITCH PENDANT
10	NOT USED	NA
11	NOT USED	NA
12	PIN 13 ON 40 PIN ENG. #1	MAINTENANCE DUE ENGINE #2





# Hydraulic Schematic



HYDRAULIC SCHEMATIC



