Vibro Definition

A vibro is a tool that, when attached to a pile, shakes it up and down in a vertical motion for the purpose of installing or removing it from the soil.

Vibratory Pile Driver/Extractors In Action!

Example:

Vibrating
H-Beams

Example: Vibrating Casings

Example: Vibrating Plastic Sheets

Example: Pulling Concrete Piles

Example: Pulling Pile Piles

Example: Power Pole Foundations

Example:
Excavator
Mounted

Example: Vibrating Large Caissons

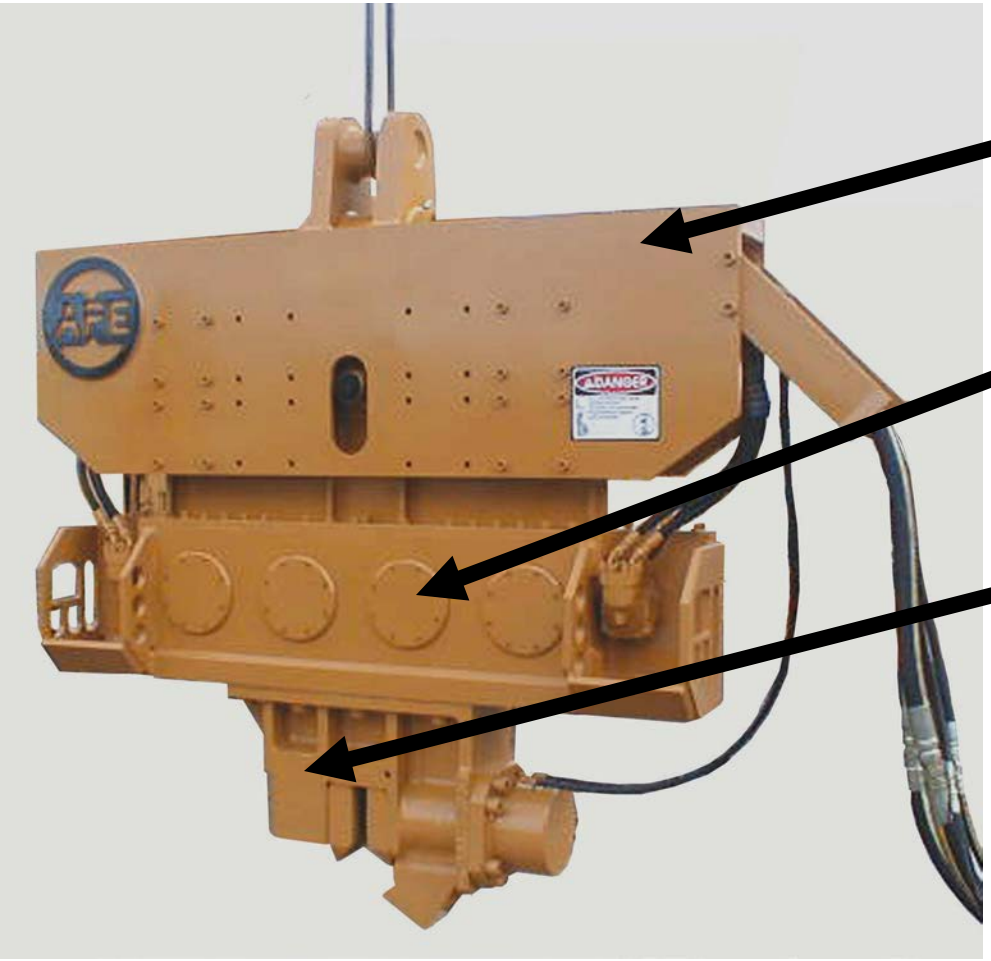
Example: Vibrating Wick Drains

Example: Vibrating Sheet Piles

Example: Big Concrete Caissons

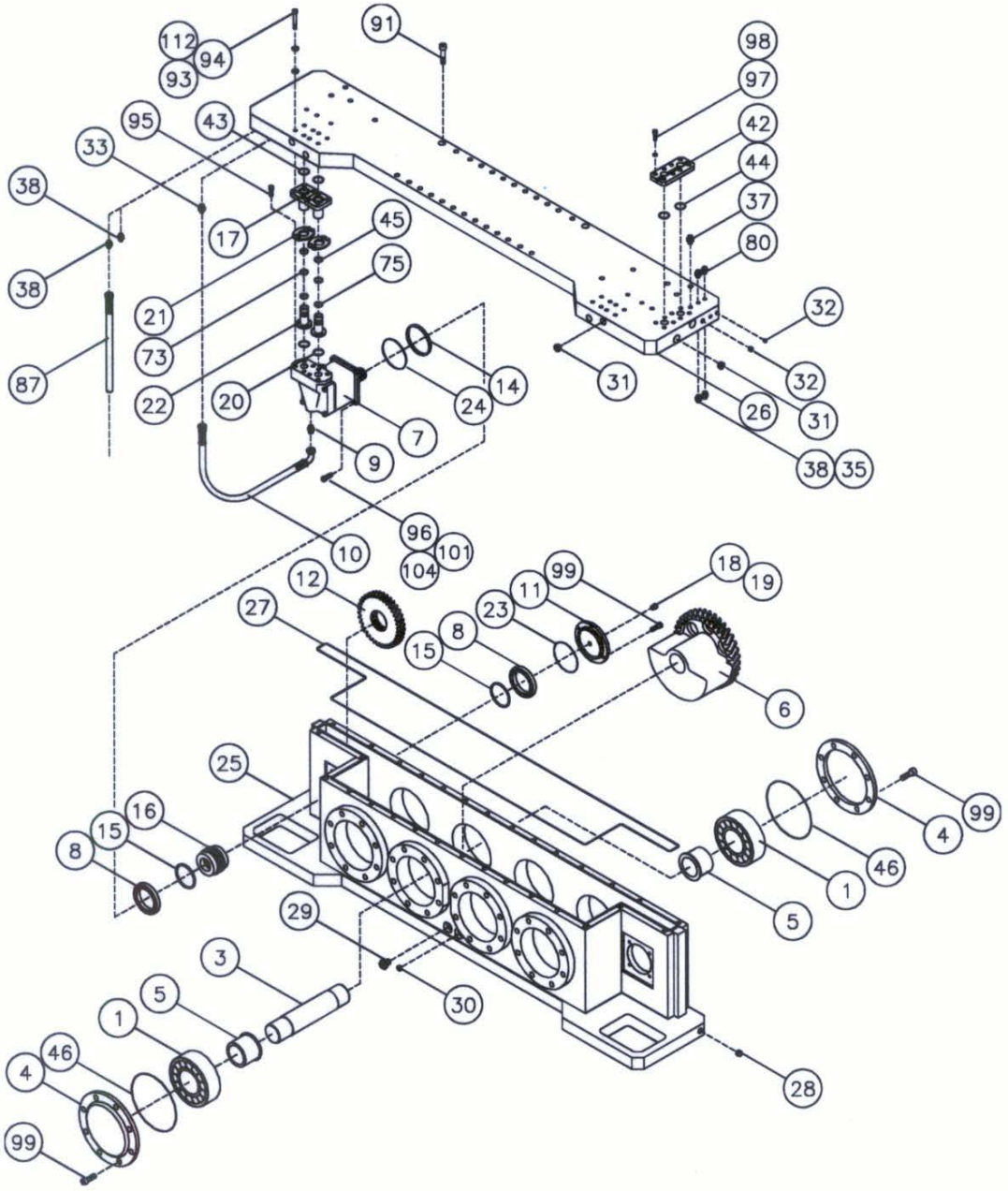
Understanding The Components Of a Vibratory Pile Driver/Extractor

Vibratory Pile Drivers/Extractors



How Does A Vibratory Pile Driver/Extractor Work?

What's Inside The Gearbox



Eccentrics: The Heart of the Vibro

All Vibratory Pile Driver/Extractors Have Rotating Eccentrics.

This Photo Shows One Example Of An Eccentric And Gear.

A look inside a vibro

Eccentric

Two Eccentrics

All Vibratory Pile Driver Extractors Have At Least Two Paired Eccentrics

Two Eccentrics

Four Eccentrics

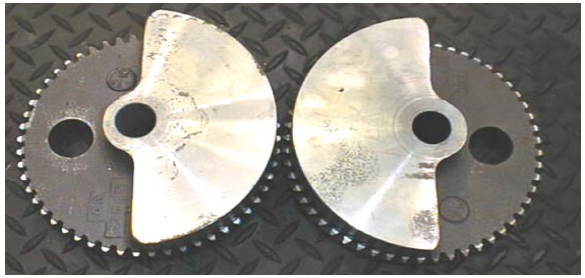
Six
Eccentrics

Four strokes of the paired eccentrics

1 work

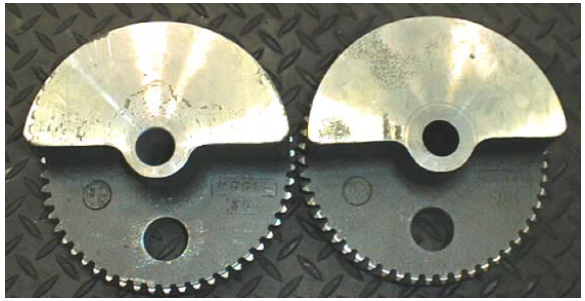
Forces the vibro and the casing downward

2 Cancel



Nothing happens. Each eccentric cancels other out.

3 work



Both eccentrics for vibro and casing upward

4 Cancel

Nothing happens. Each eccentric cancels other out.

History

Russia’s Barken

French/Japan

MKT: Hyd

H&M

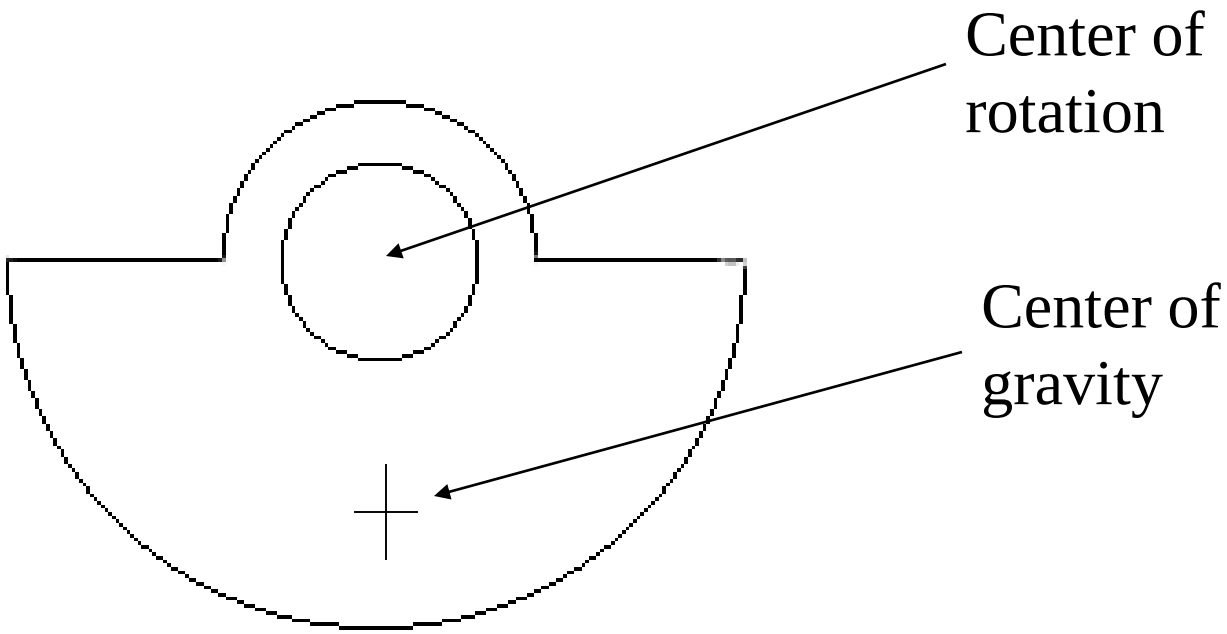
ICE: Rubber springs

APE- Two stage, rifle bore, etc.

Variable Moment

Vibro-Driver/Extractors

Eccentric moment



Eccentric moment **=** distance between the center of rotation and the center of gravity **x** the total mass of the eccentric.

Example of calculating eccentric moment of one eccentric:

Equation:

Distance between

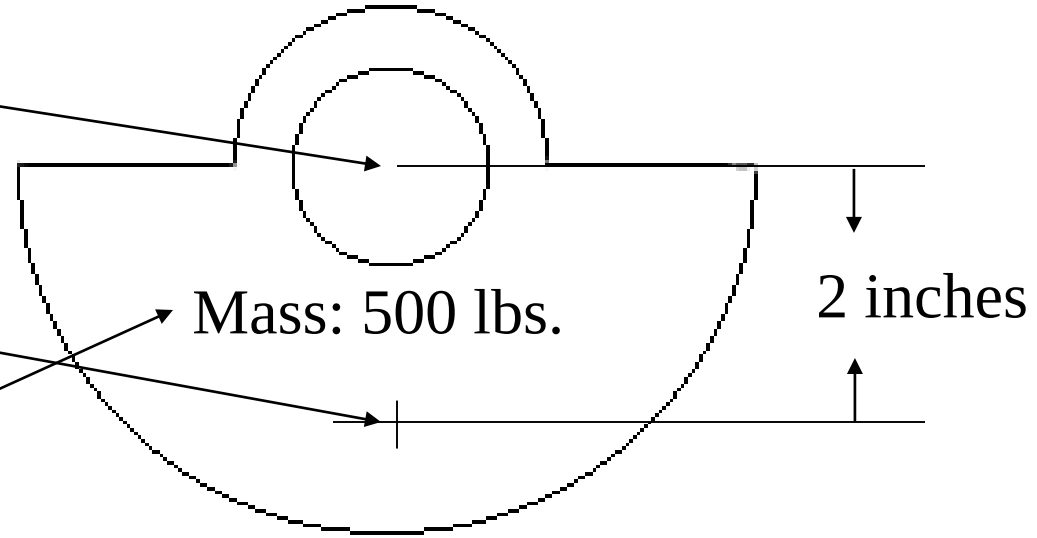
Center of Rotation

and

Center of Gravity

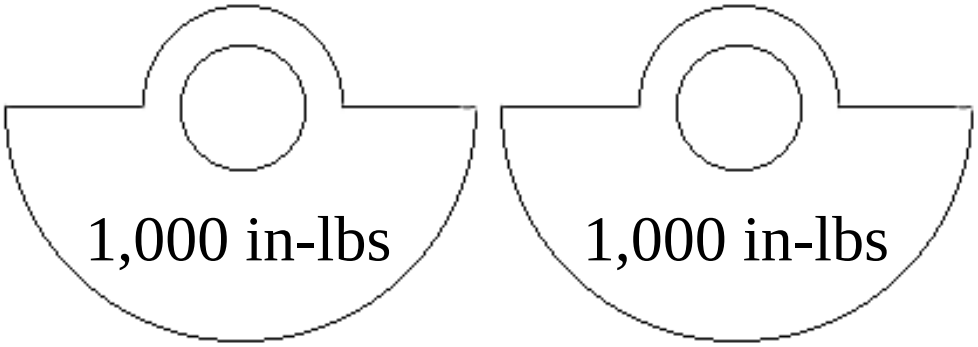
Multiplied by

The Mass



2 times 500 equals: 1,000 inch pounds

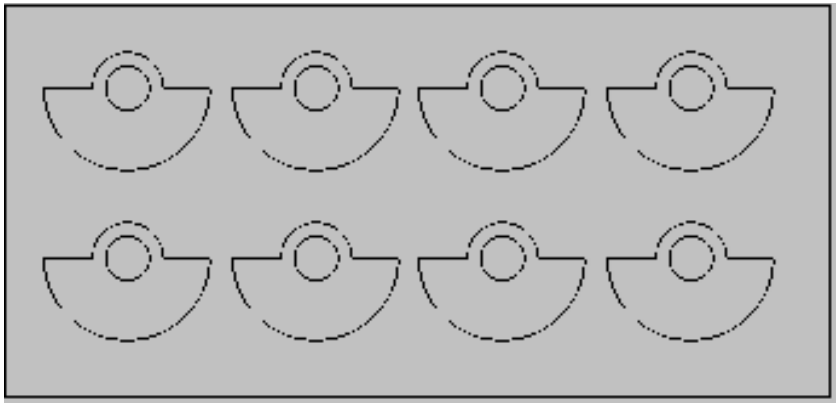
Eccentric moment of a vibro is measurement of all eccentrics combined.

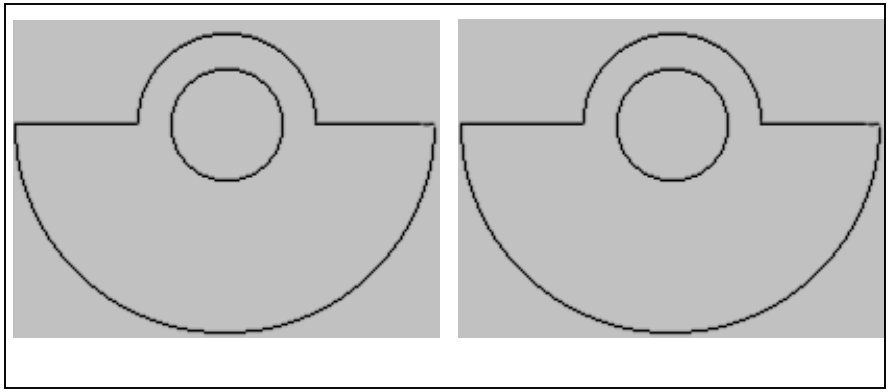


equals: 2,000 in-lbs.

If each eccentric has 1,000 in-lbs then the vibro has a total of 2,000 in-lbs.

Some Vibros have many small eccentrics to get a large total inch pounds while others have less eccentrics that are bigger.





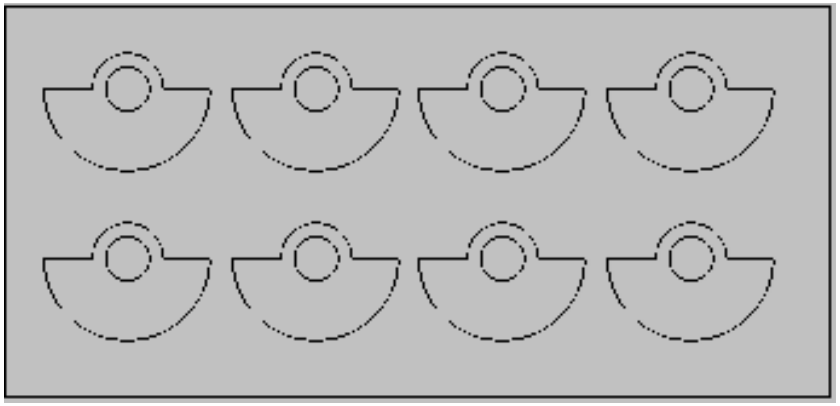
More vibrating weight

Less amplitude

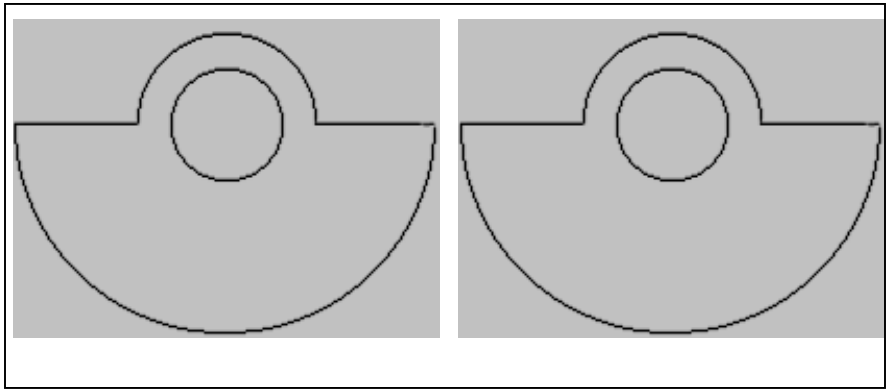
Less vibrating weight

More amplitude

Smaller weights means more bearings, shafts, gears



More parts



Less parts

Amplitude

$$A = \frac{2 \times Mt}{Mv}$$

Mt = Eccentric Moment in inch pounds

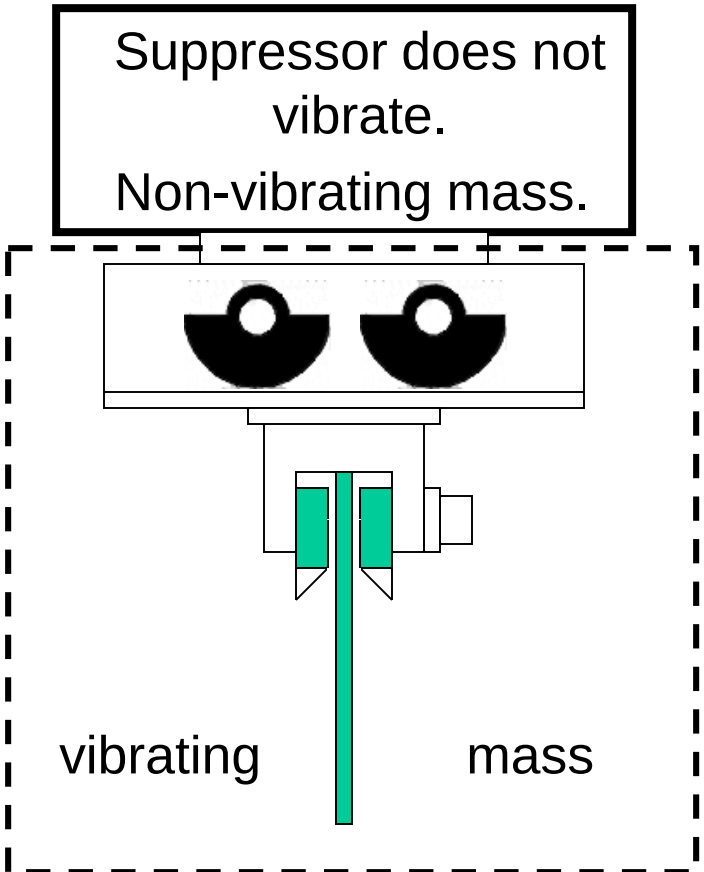
Mv = Total Vibrating Weight

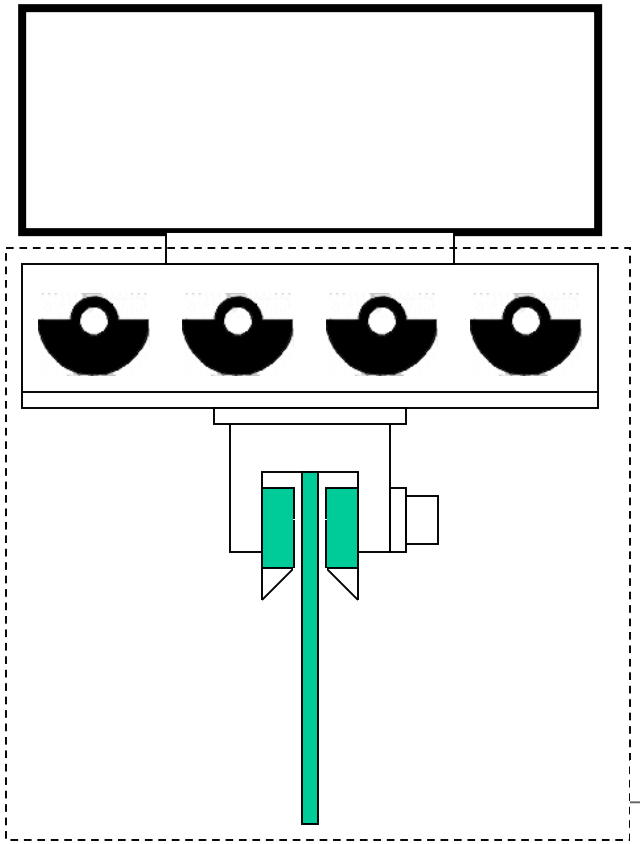
A = Amplitude in inches

Vibrating weight: Mv

The vibrating weight is the sum of all the weights of the vibrating mass.

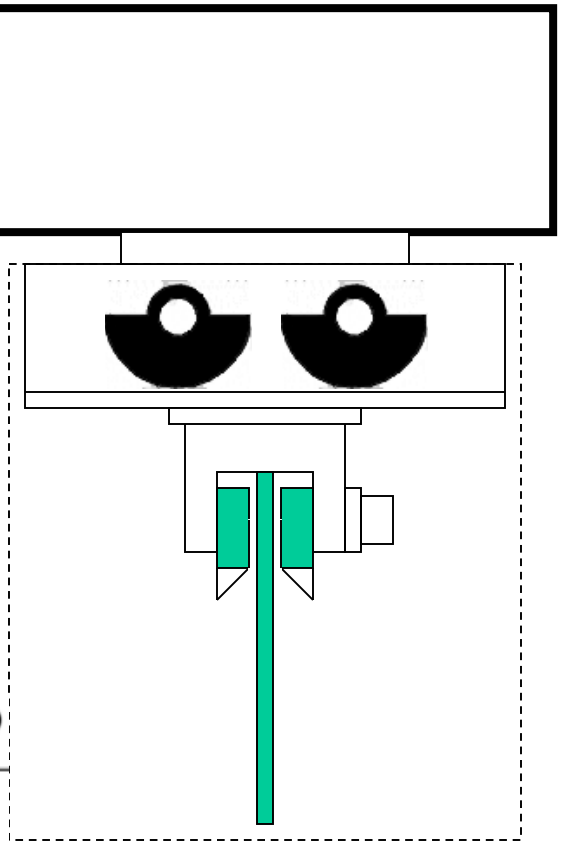
- B: Gear Box (vibrating mass)
- C: Clamping device including all plates or clamps
- D: Pile weight





Amplitude

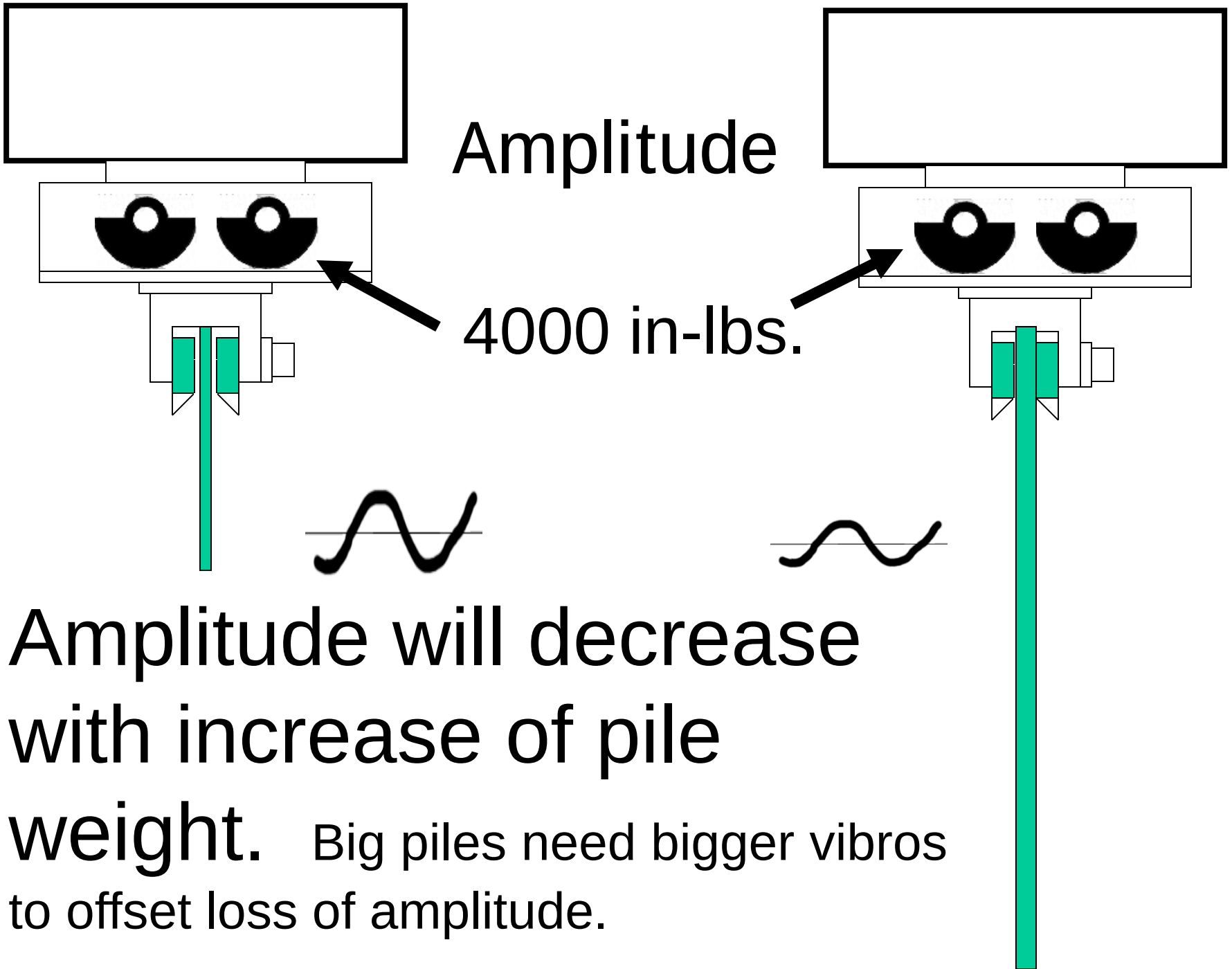
4000 in-lb.



Vibrating mass: 6500 lb

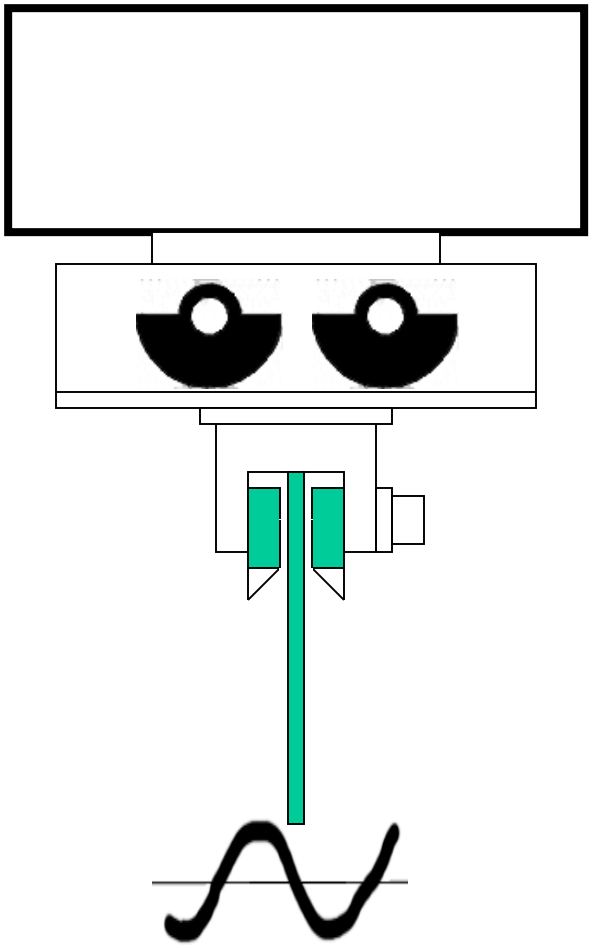
Vibrating mass: 5000 lb

The hammer on the left has the same eccentric moment but less amplitude because the vibrating mass is heavier.



Amplitude will decrease with increase of pile weight. Big piles need bigger vibros to offset loss of amplitude.

Amplitude



Amplitude will decrease with increase of:

- Pile weight
- Soil resistance
- Weights, gears, shafts, hoses, motors
- Extra clamp attachments
- Anything that increases vibrating mass.

$$\text{Amplitude} = \frac{2 \times EM}{VM}$$

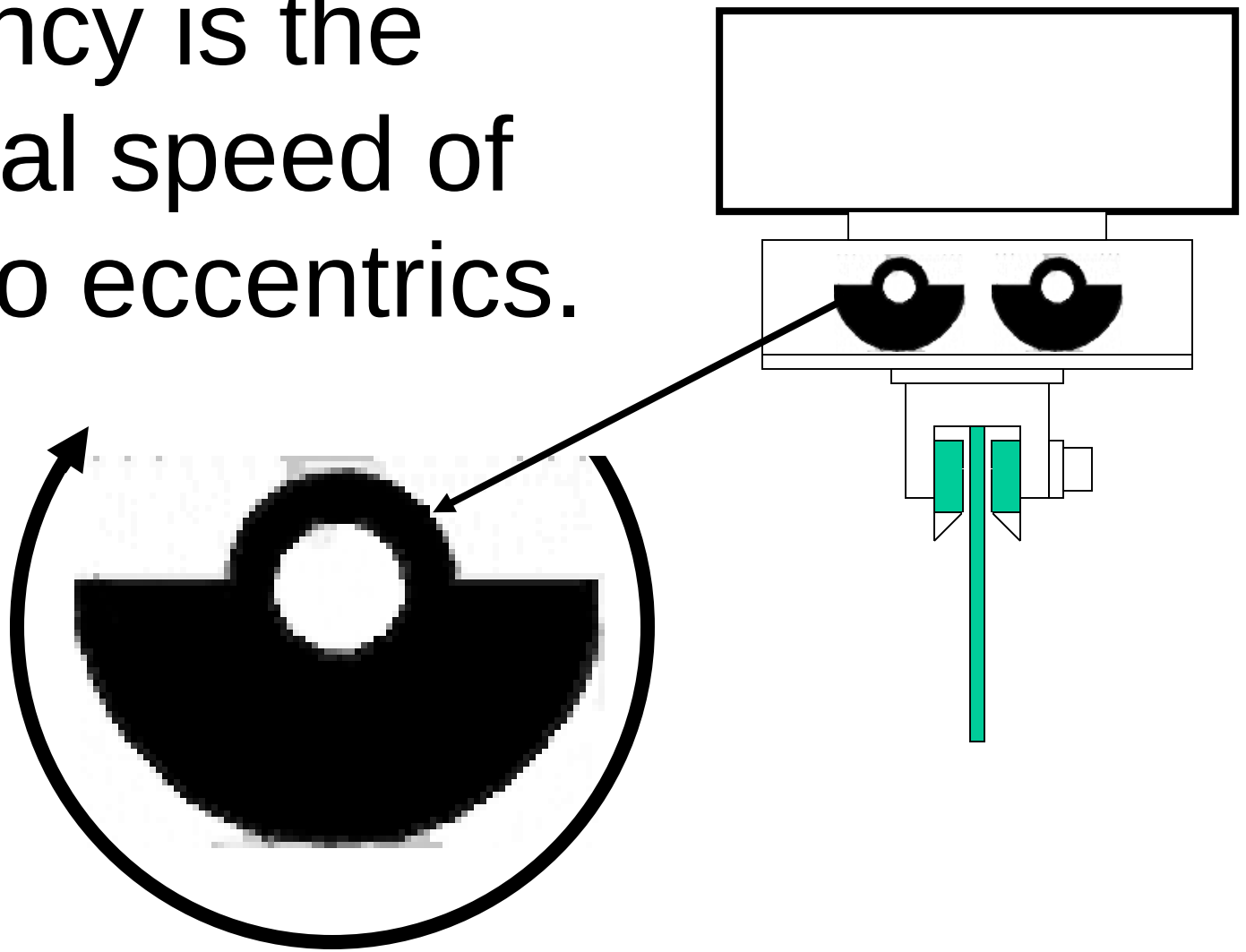
EM: Eccentric Moment

VM: Vibrating Mass

Frequency (Vibrations Per Minute) or (Cycles Per Minute)

VPM CPM

Frequency is the rotational speed of the vibro eccentrics.



Drive Force (Dynamic Force)

$$\text{Drive Force} = \frac{\text{Eccentric Moment} \times 0.0142 \times \text{Frequency (Cycles per minute) squared}}{1{,}000{,}000}$$

Example:

Moment: 4400 in-lb.

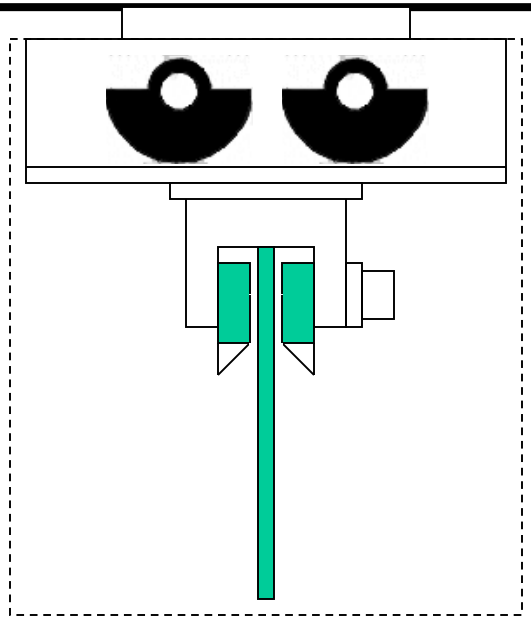
Frequency: 1600 Cycles per minute

$$\frac{4400 \times 0.0142 \times 1600 \times 1600}{1{,}000{,}000} = 159.94 \text{ Tons}$$

Drive Force

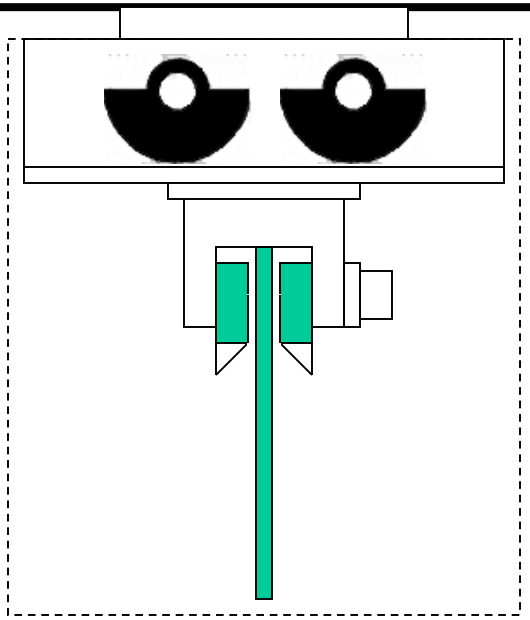
How Frequency Matters

1100 cpm



4000 in-lb.

1600 cpm



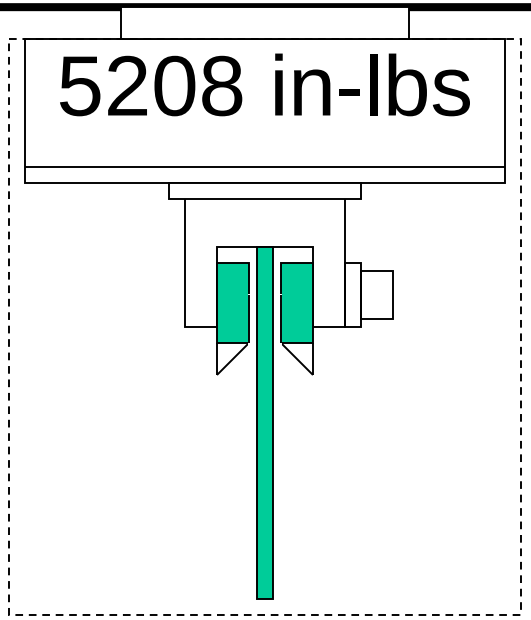
$$\frac{4400 \times 0.0142 \times 1100 \times 1100}{1{,}000{,}000} = 75 \text{ tons}$$

$$159.94 = \frac{4400 \times 0.0142 \times 1600 \times 1600}{1{,}000{,}000}$$

Higher frequency dramatically increases drive force because frequency is squared.

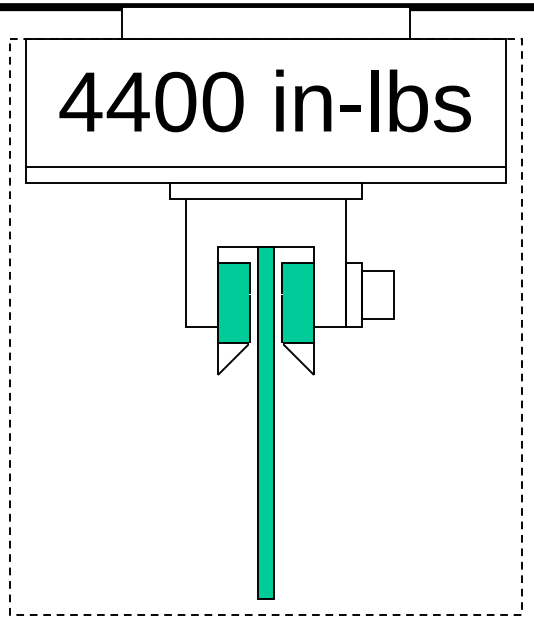
1100 cpm

5208 in-lbs



1600 cpm

4400 in-lbs

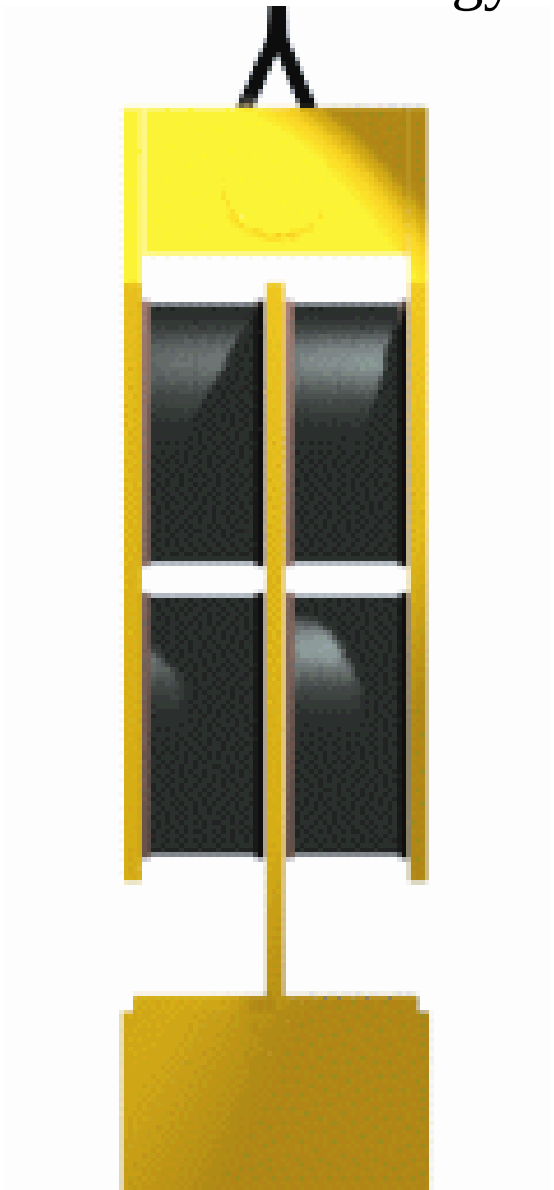


$$\frac{5208 \times 0.0142 \times 1100 \times 1100}{1{,}000{,}000} = 89 \text{ tons}$$

$$159.94 = \frac{4400 \times 0.0142 \times 1600 \times 1600}{1{,}000{,}000}$$

Understanding Vibro Suppressors

Old Technology



Much more capacity with no vibration to the crane line.

New Technology

Centerline Clamp

A Centerline Clamp has two jaws that are controlled by giant gears to keep the pile always in the center. Used to drive or extract pipe, wood, or concrete piles. It is also used to extract concrete filled shell piles.

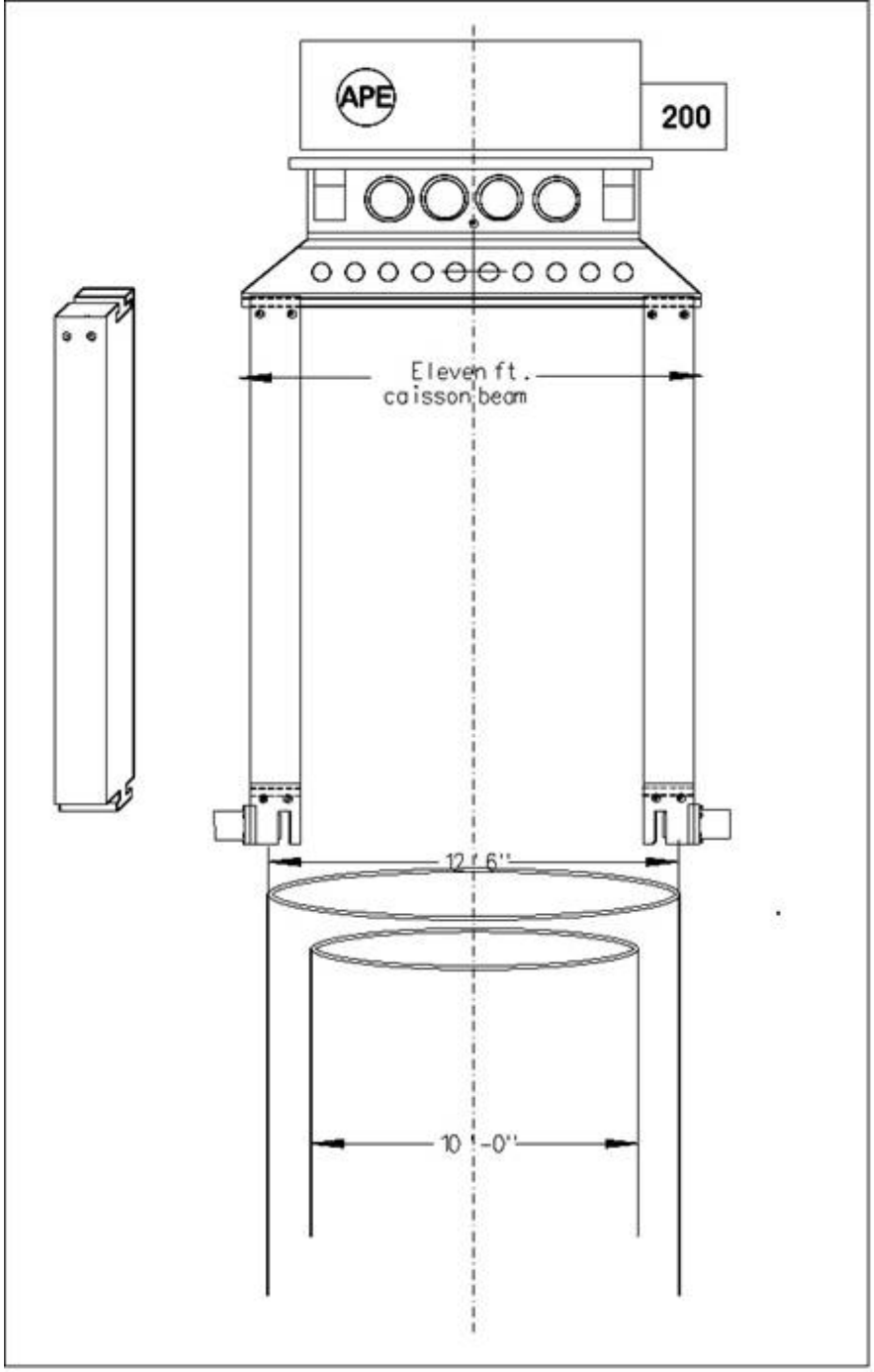
Centerline Clamp Pulling Concrete

Extracting Concrete Piles

90 degree plate

Clamp Extension

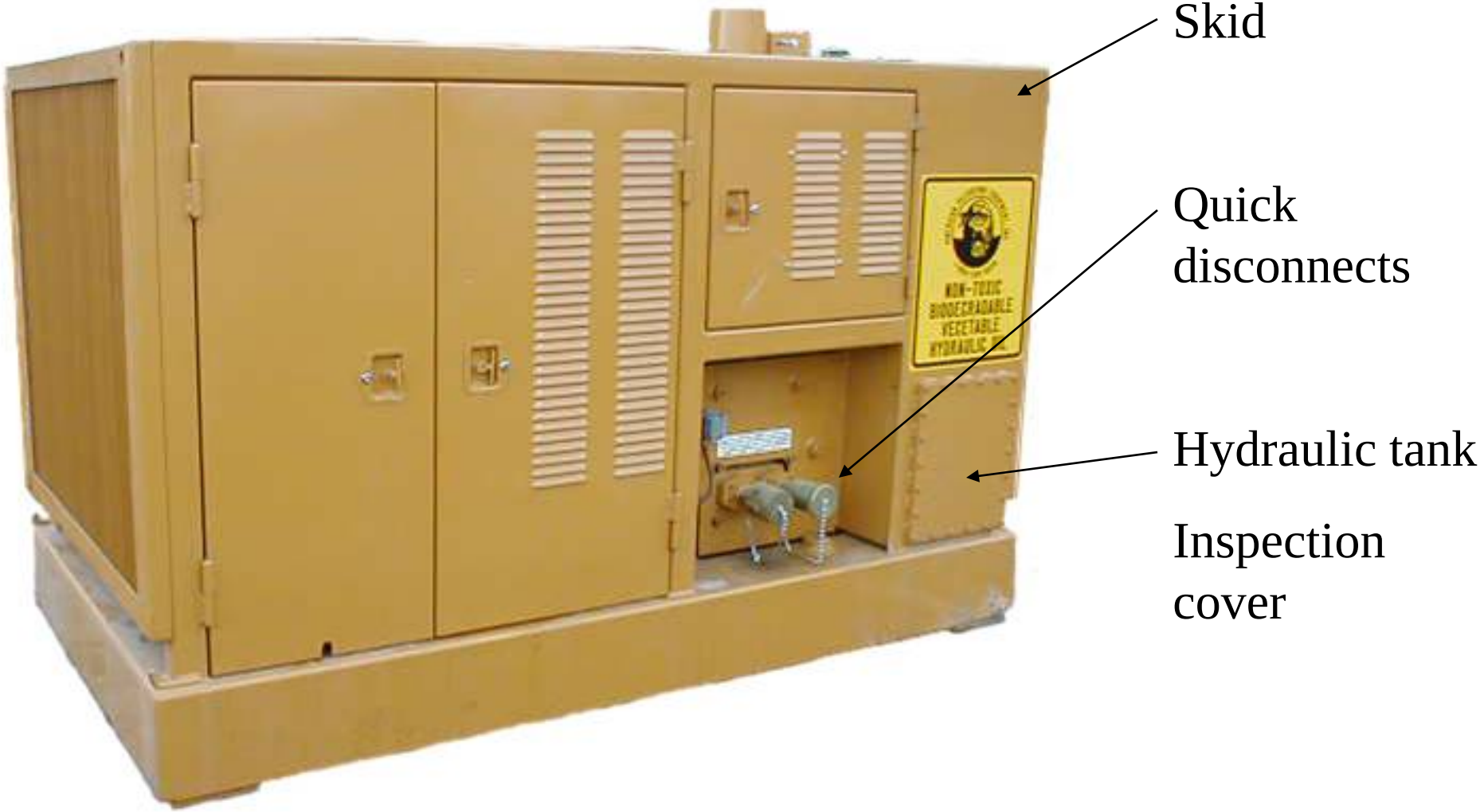
Extending caisson clamps down to clear rebar cage.



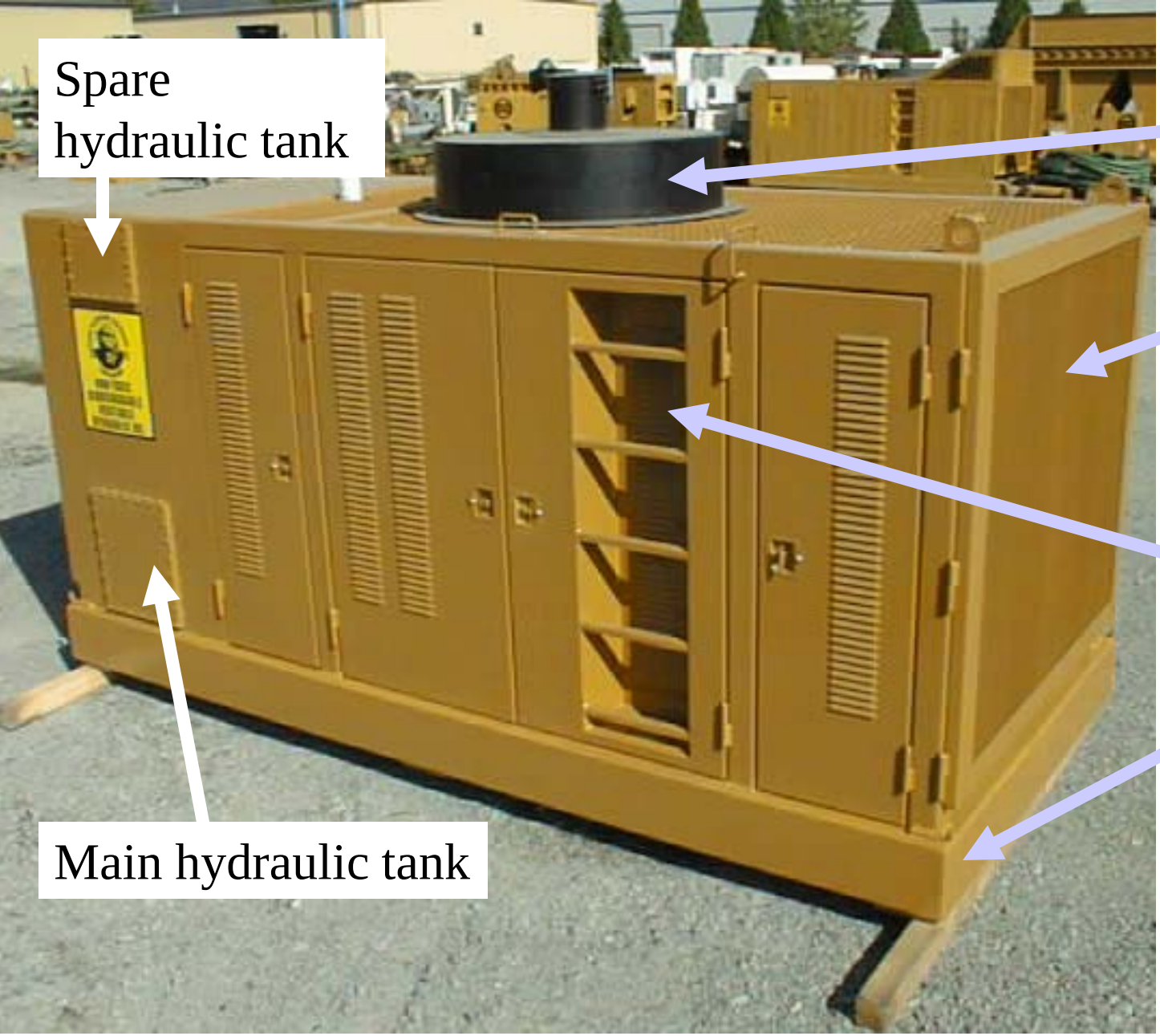

DANGER
HARD HAT
AREA

Duel guiding, full six inch slide, check valve clamp, easy to read

Understanding the Power Unit.



Power Unit view on quick disconnect side.



View of power unit from ladder side.

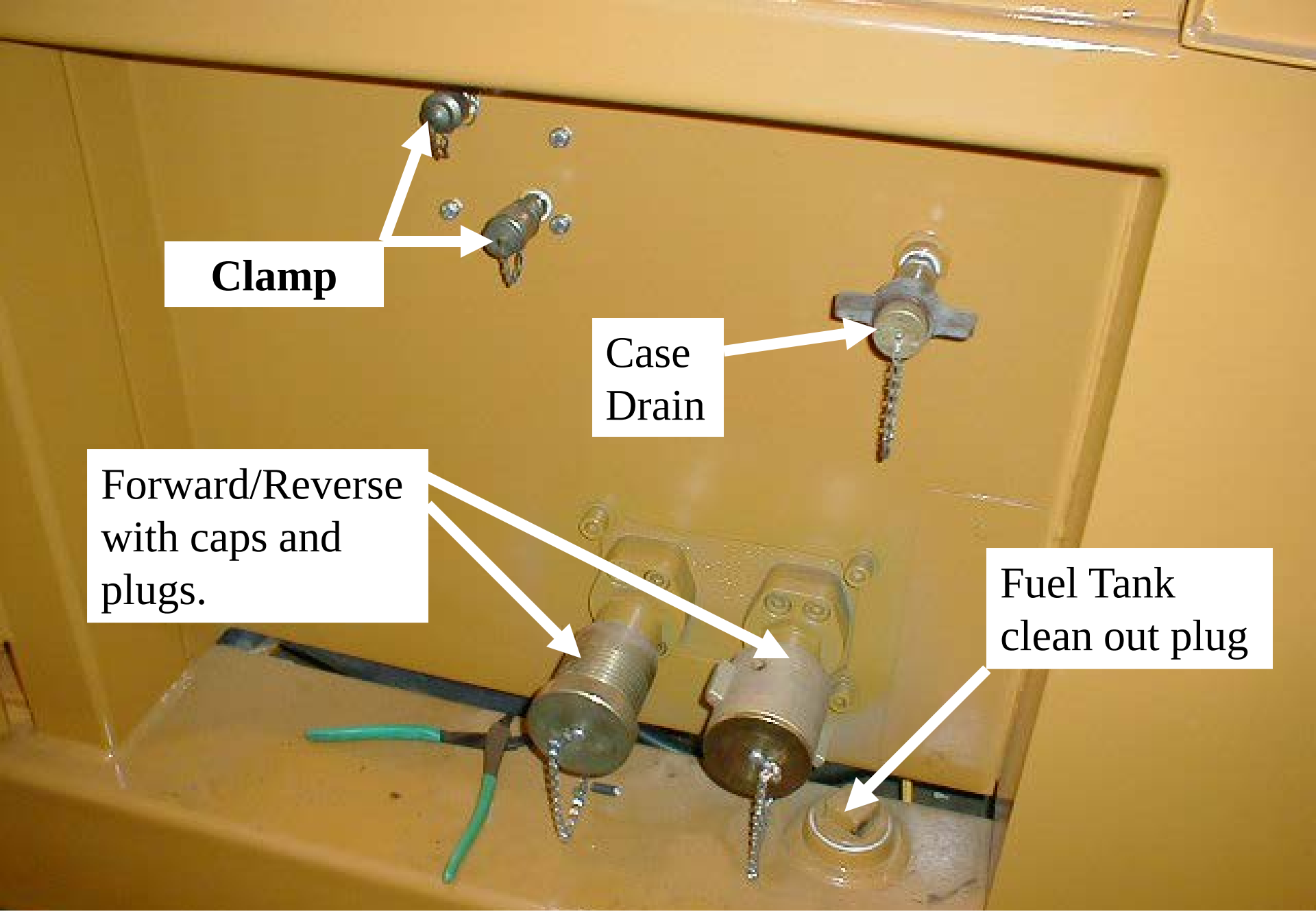
View of hydraulic tank level gauges and return filter.

Spare tank ¼ turn valve.

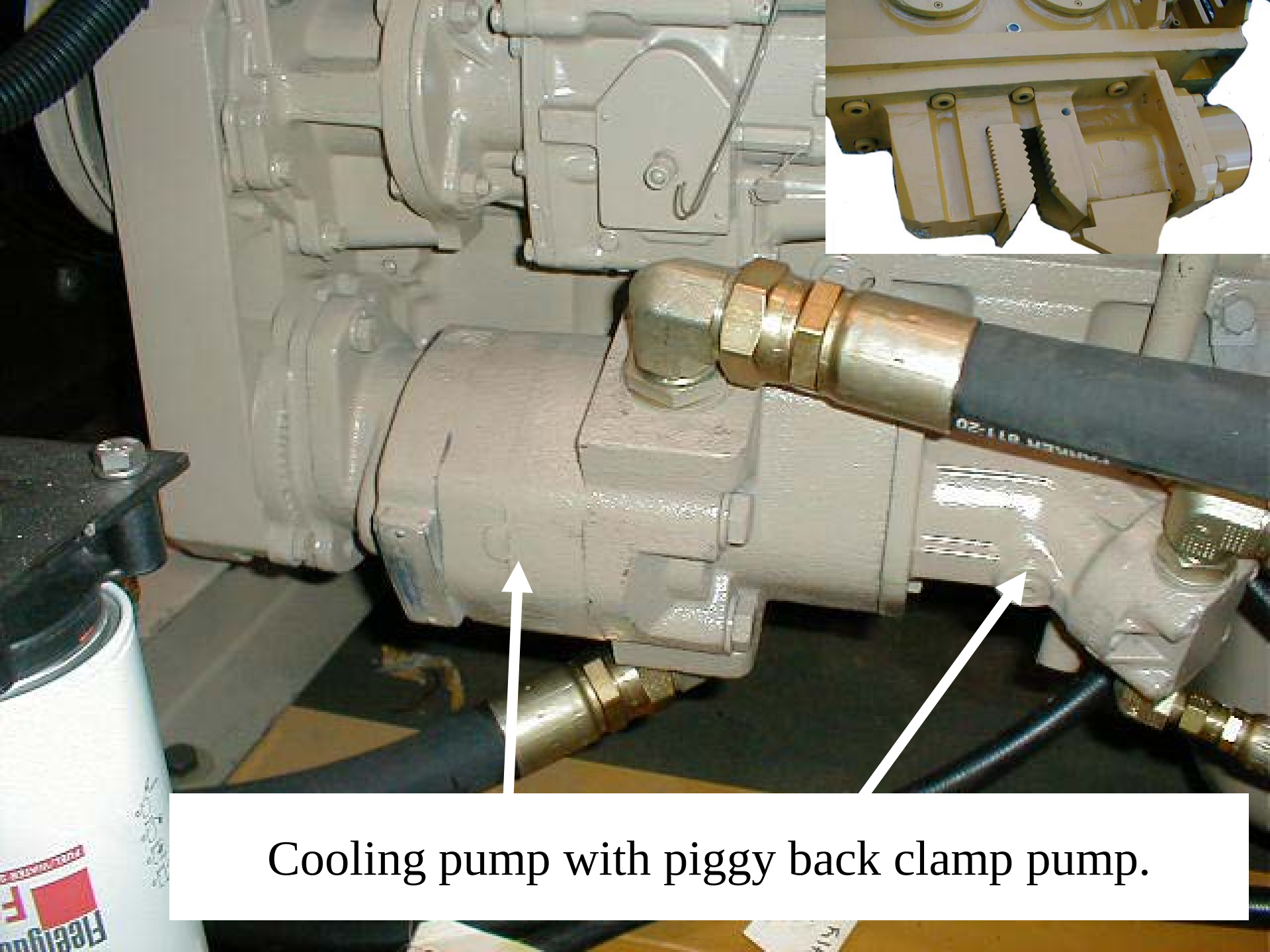
CAT Engine

Float switch

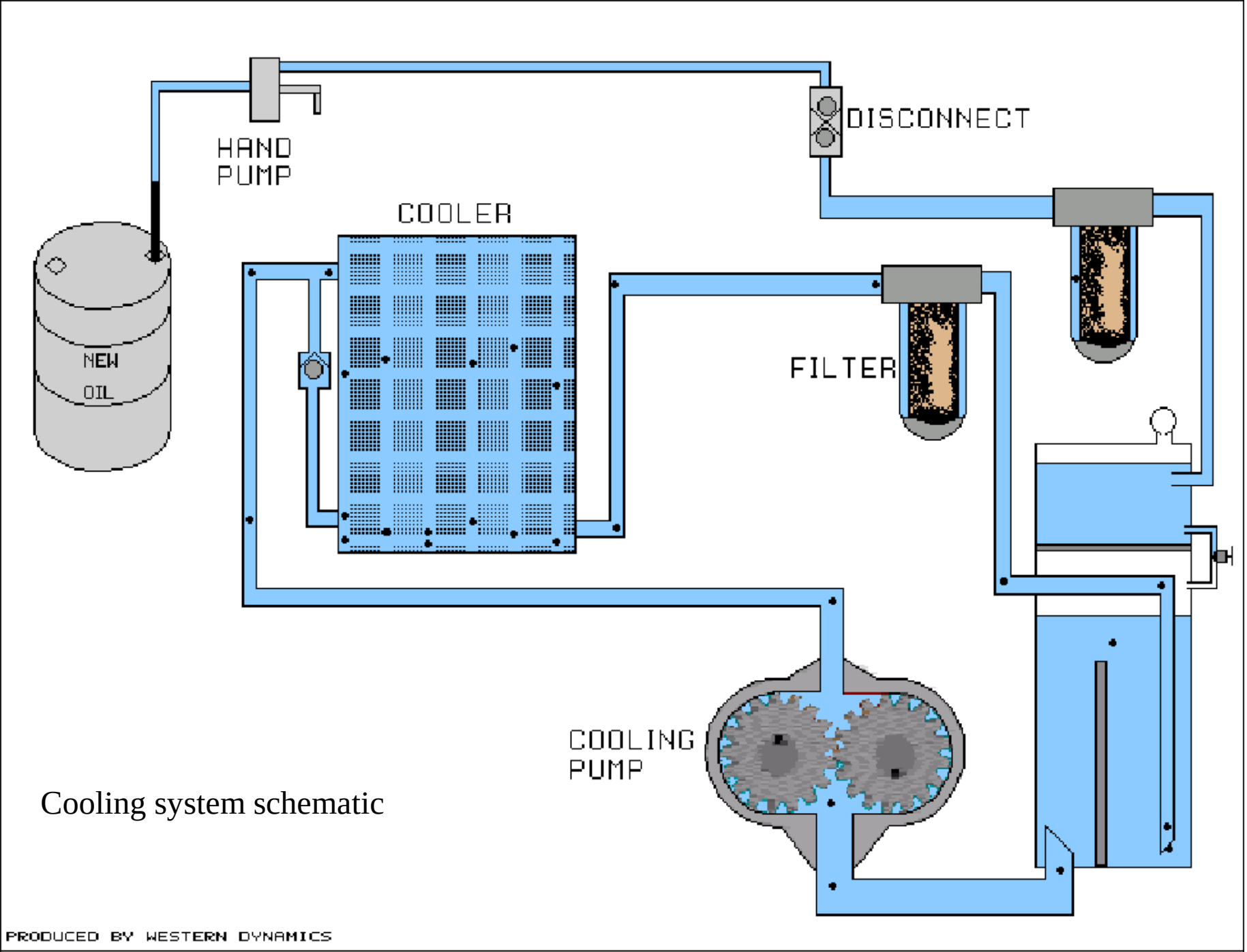
Quick disconnects



Quick disconnects



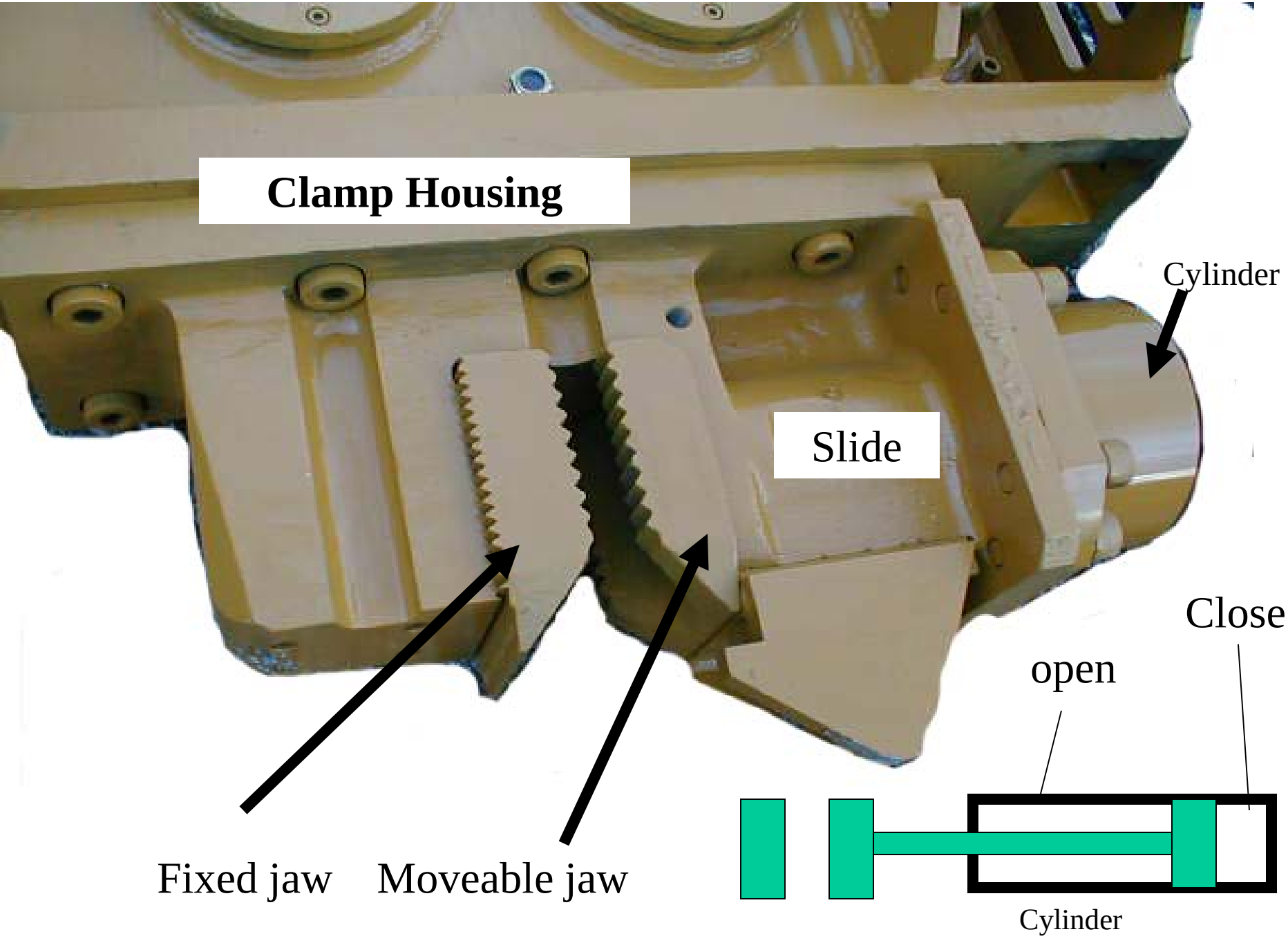
Cooling pump with piggy back clamp pump.

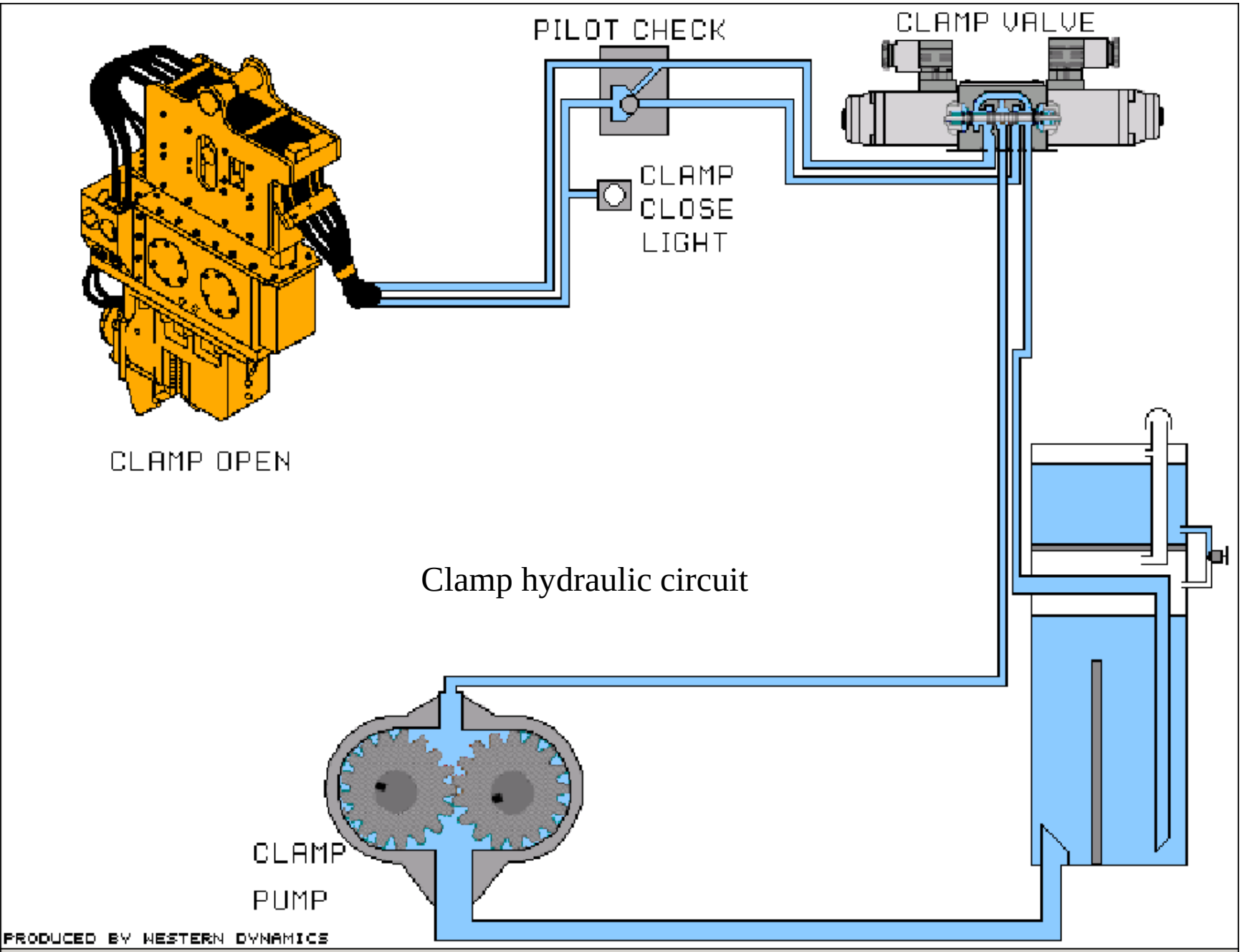


Cooling system schematic

PRODUCED BY WESTERN DYNAMICS

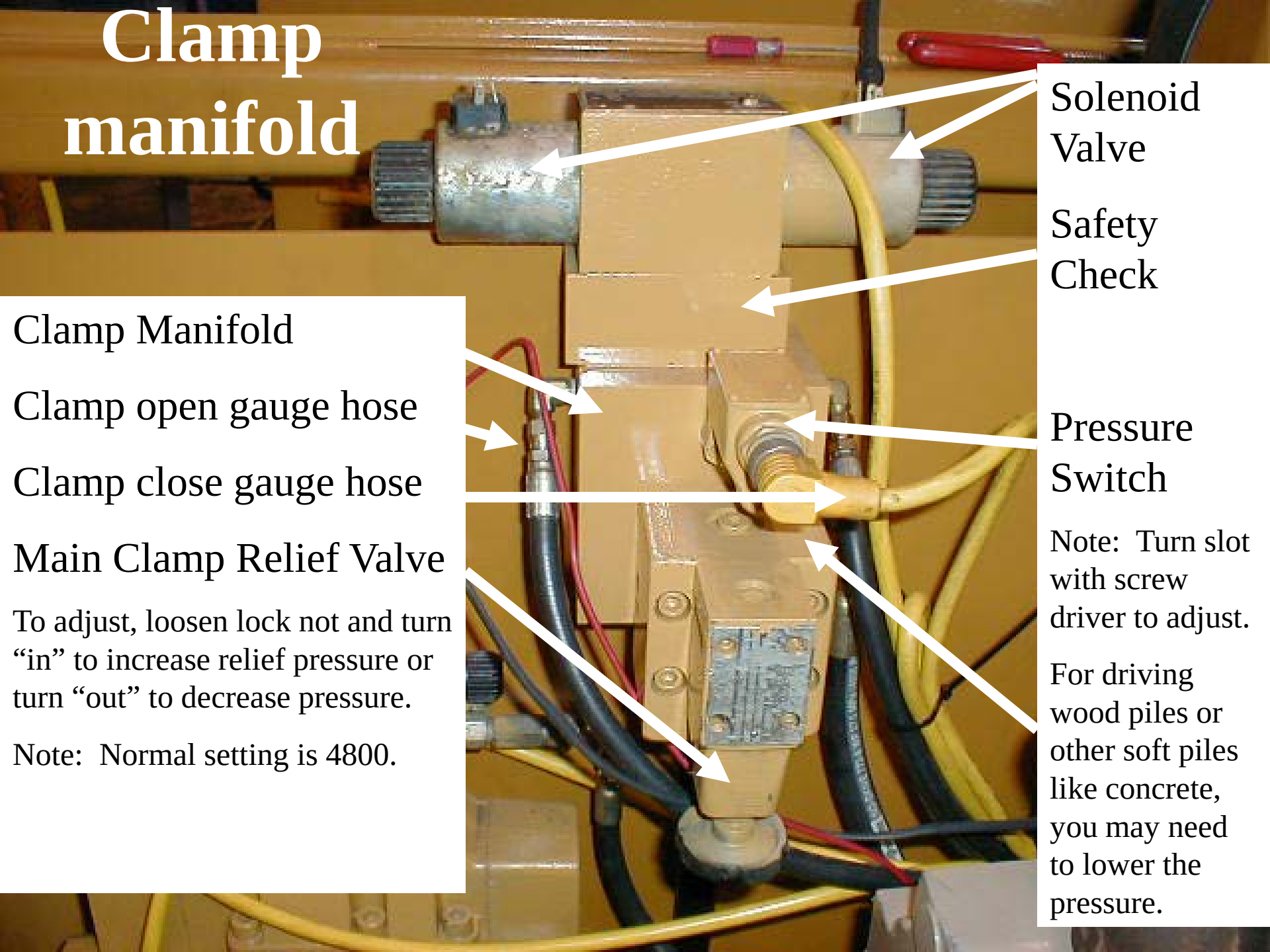
View of clamp and its components




PILOT CHECK
CLAMP VALVE
CLAMP
CLOSE
LIGHT
CLAMP OPEN
Clamp hydraulic circuit
CLAMP
PUMP
PRODUCED BY WESTERN DYNAMICS

Clamp disconnects with caps and plugs attached.

Clamp manifold



Clamp Manifold

Clamp open gauge hose

Clamp close gauge hose

Main Clamp Relief Valve

To adjust, loosen lock not and turn “in” to increase relief pressure or turn “out” to decrease pressure.

Note: Normal setting is 4800.

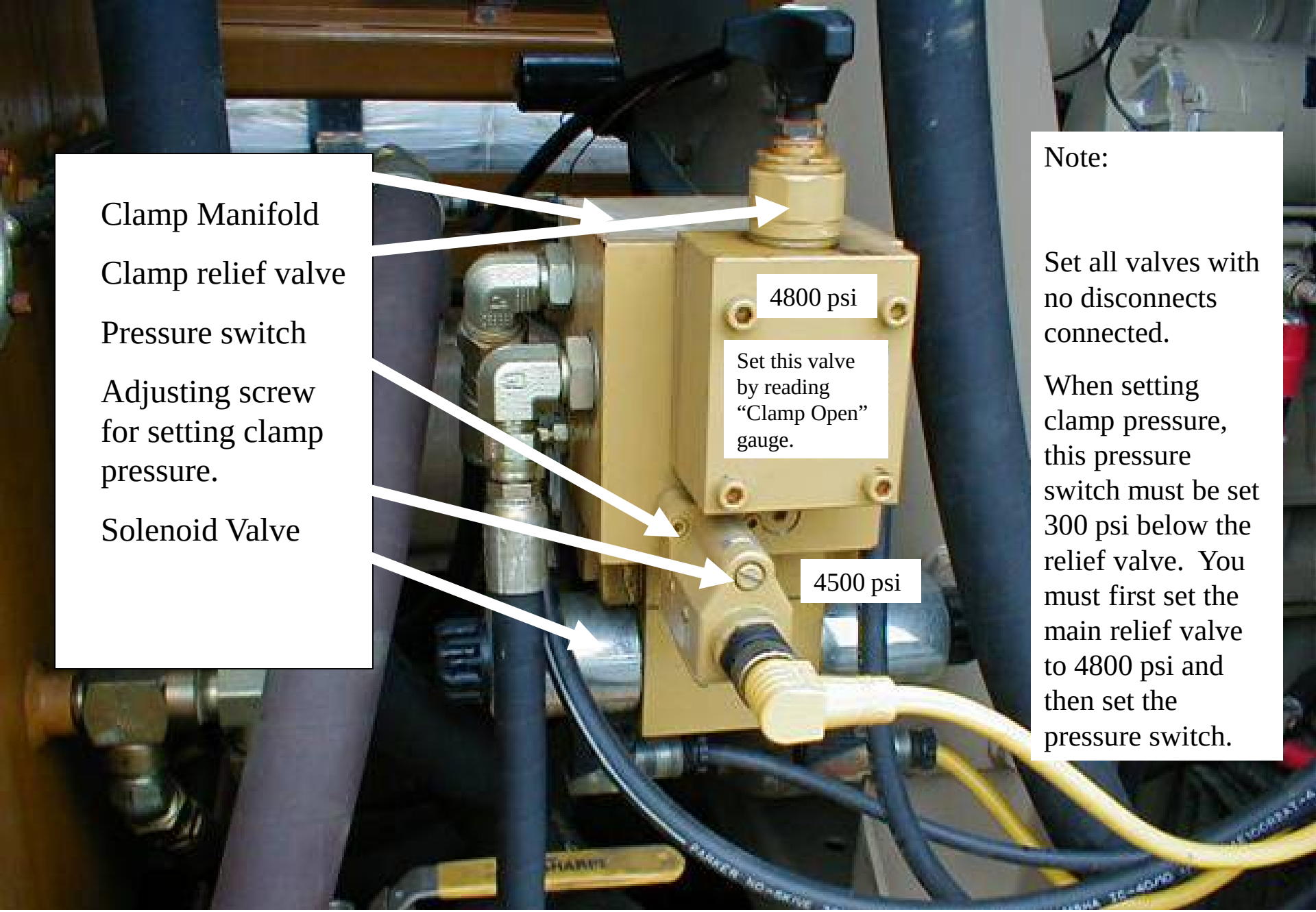
Solenoid Valve

Safety Check

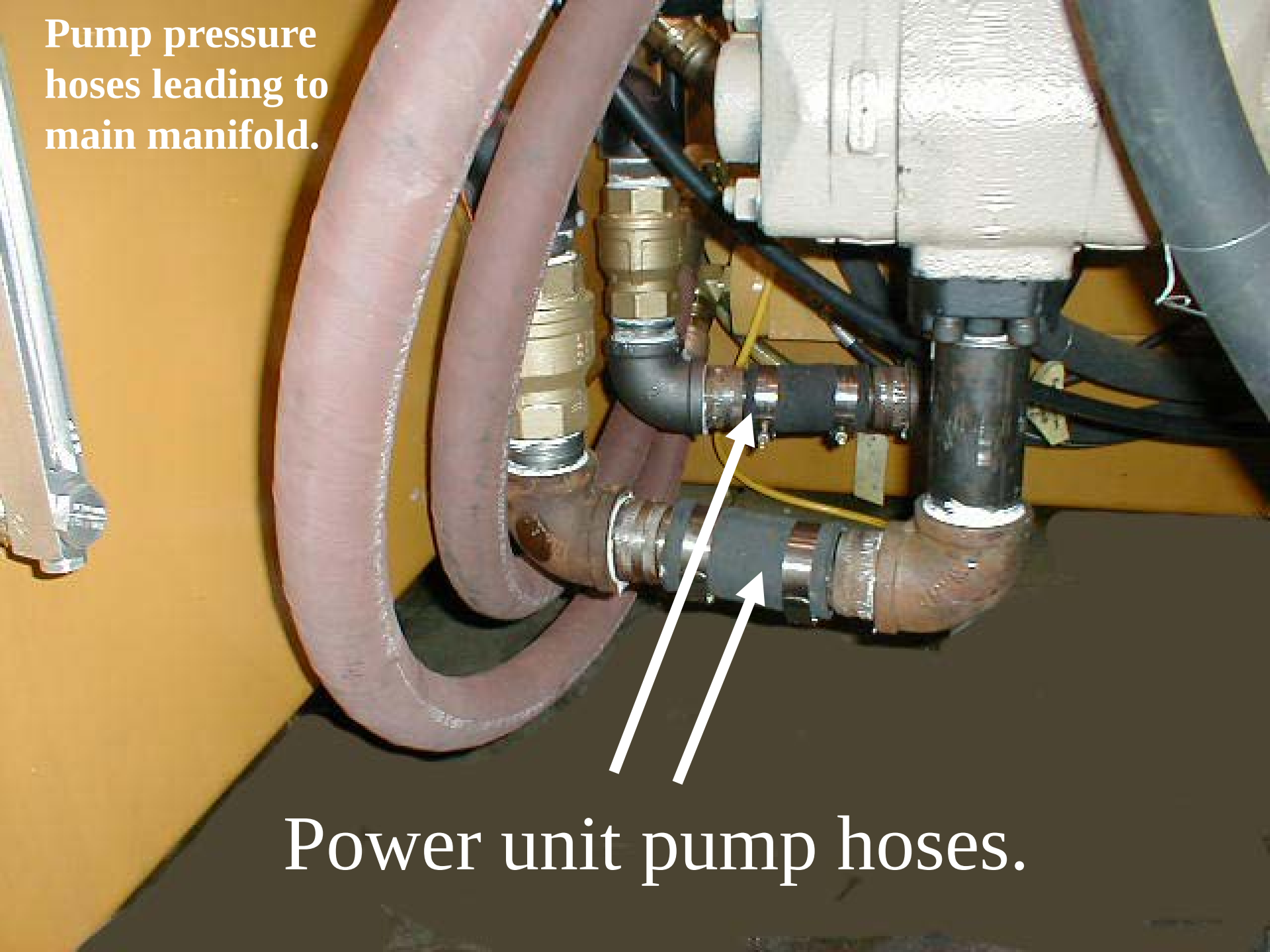
Pressure Switch

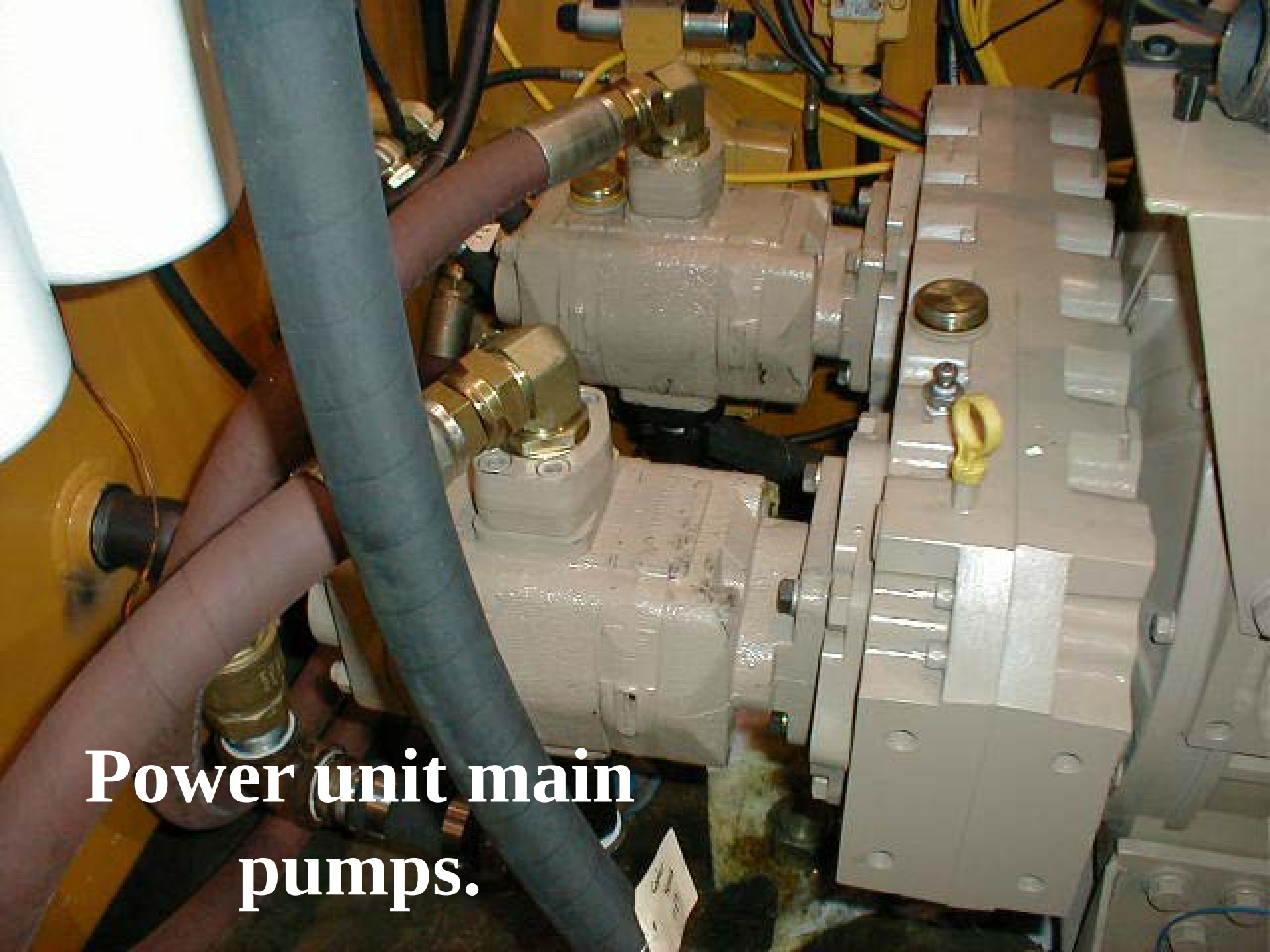
Note: Turn slot with screw driver to adjust.

For driving wood piles or other soft piles like concrete, you may need to lower the pressure.

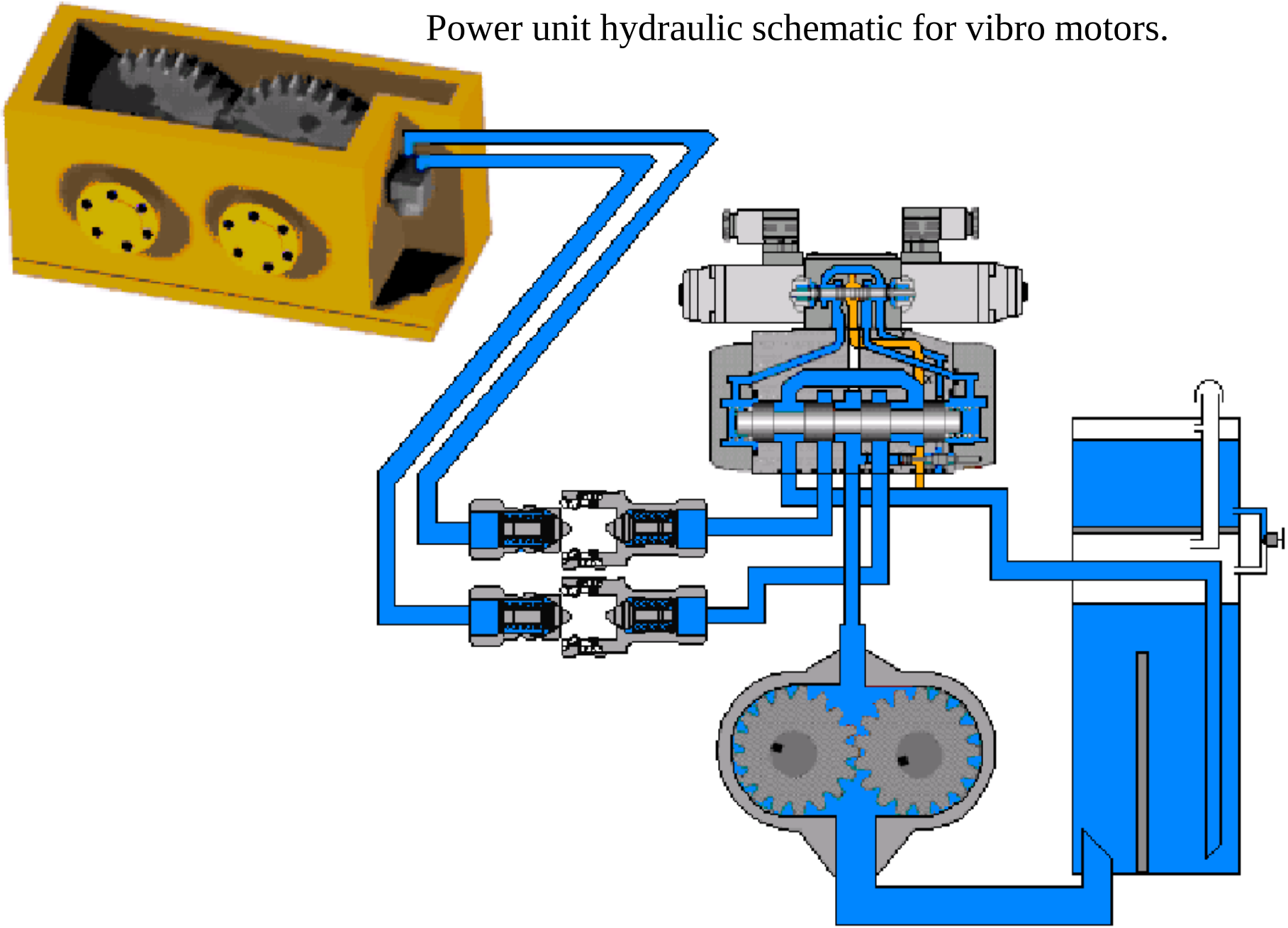


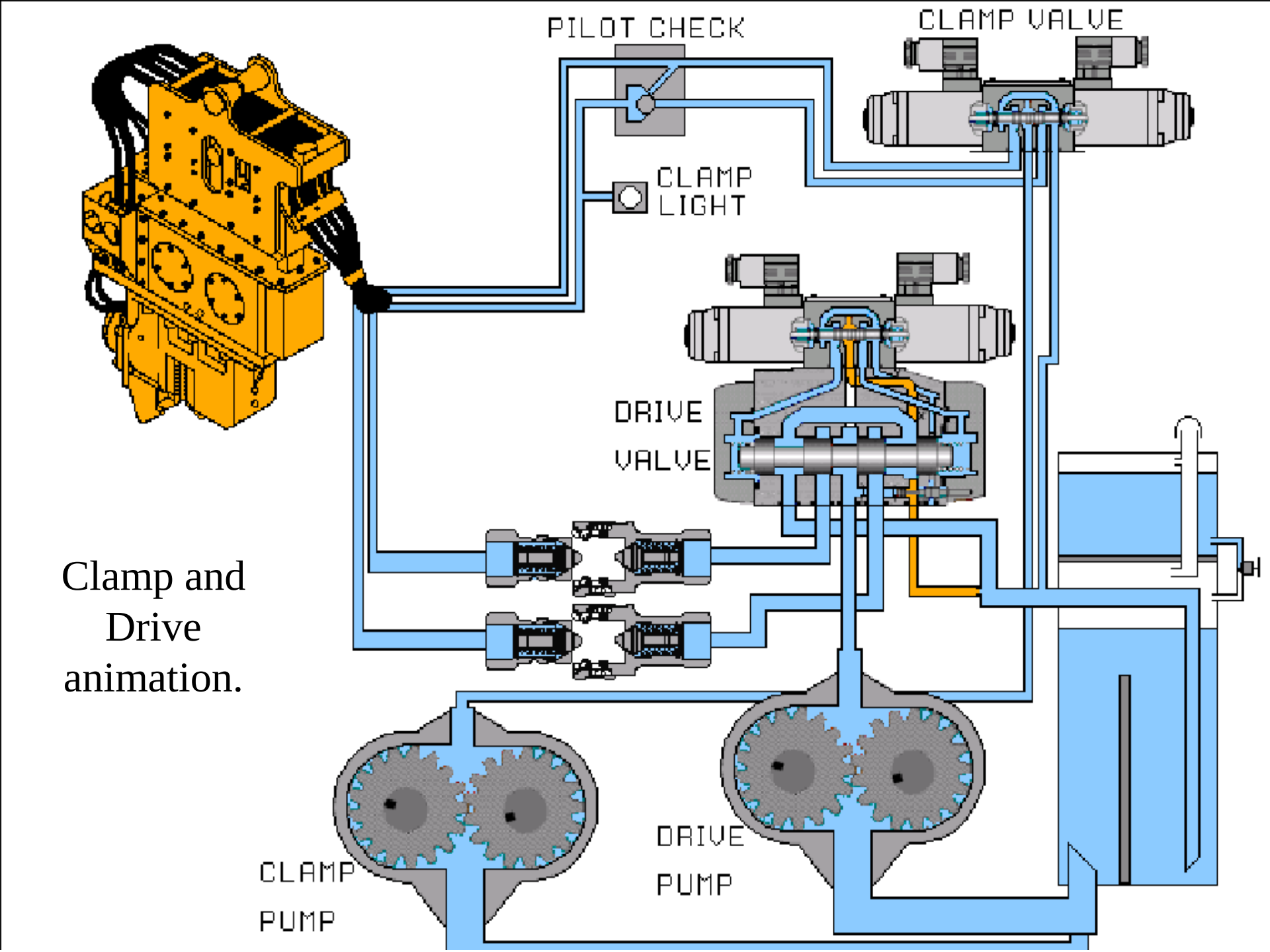
Clamp manifold (other than bulkhead mounted)


Pump pressure hoses leading to main manifold.
Power unit pump hoses.


Power unit main
pumps.

Power unit hydraulic schematic for vibro motors.





Clamp and Drive animation.

Main drive forward and reverse QD’s

Case Drain QD

Drive manifold

Control panel showing how power cables for solenoids can be removed quickly.

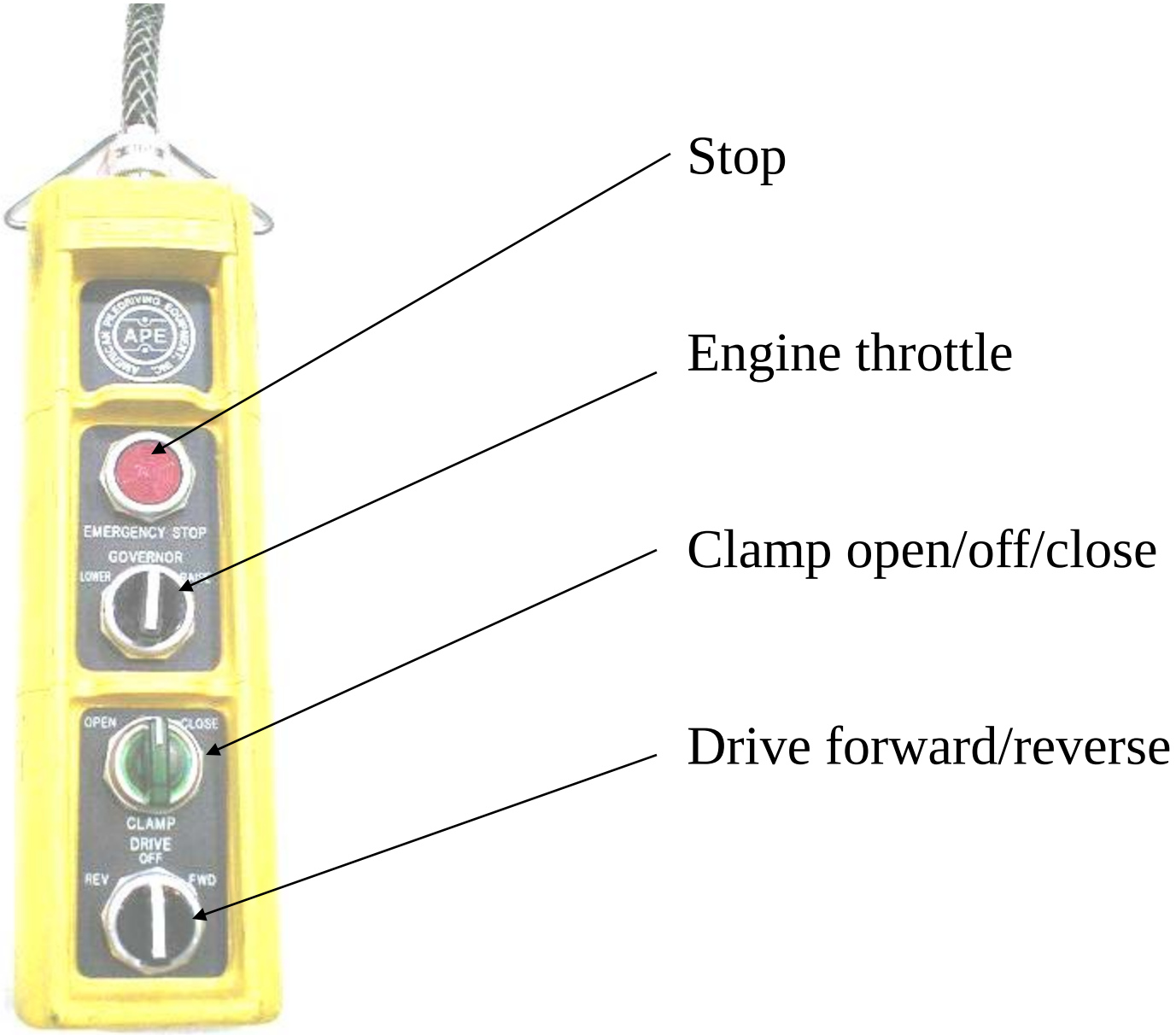
Controls for power unit

Emergency stop

Vibro start/stop/reverse

Clamp open/close/off

Engine throttle



Remote pendant control box

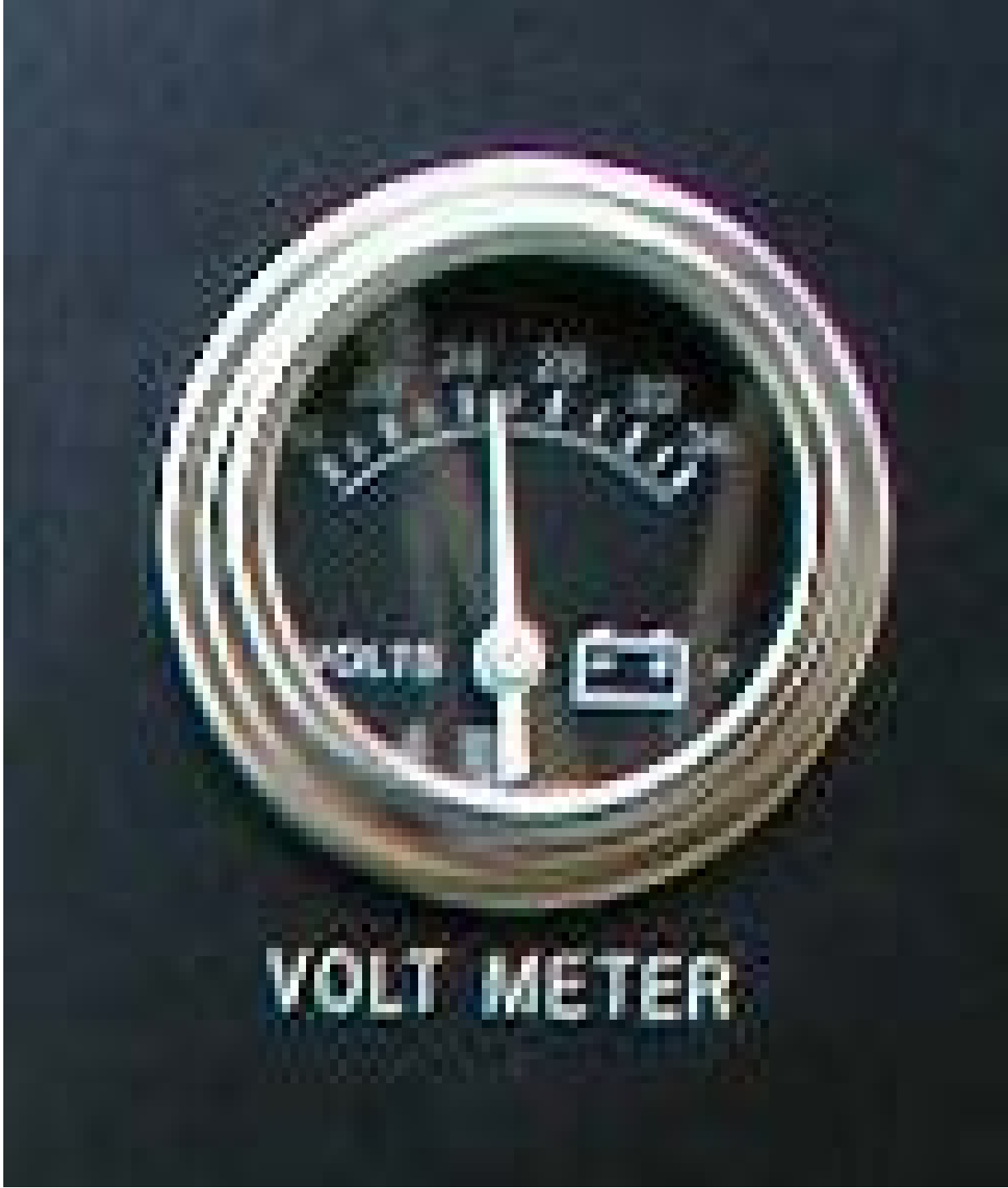
Control panel

Shut down warning indicators

Engine Hour Meter

Hour Meter

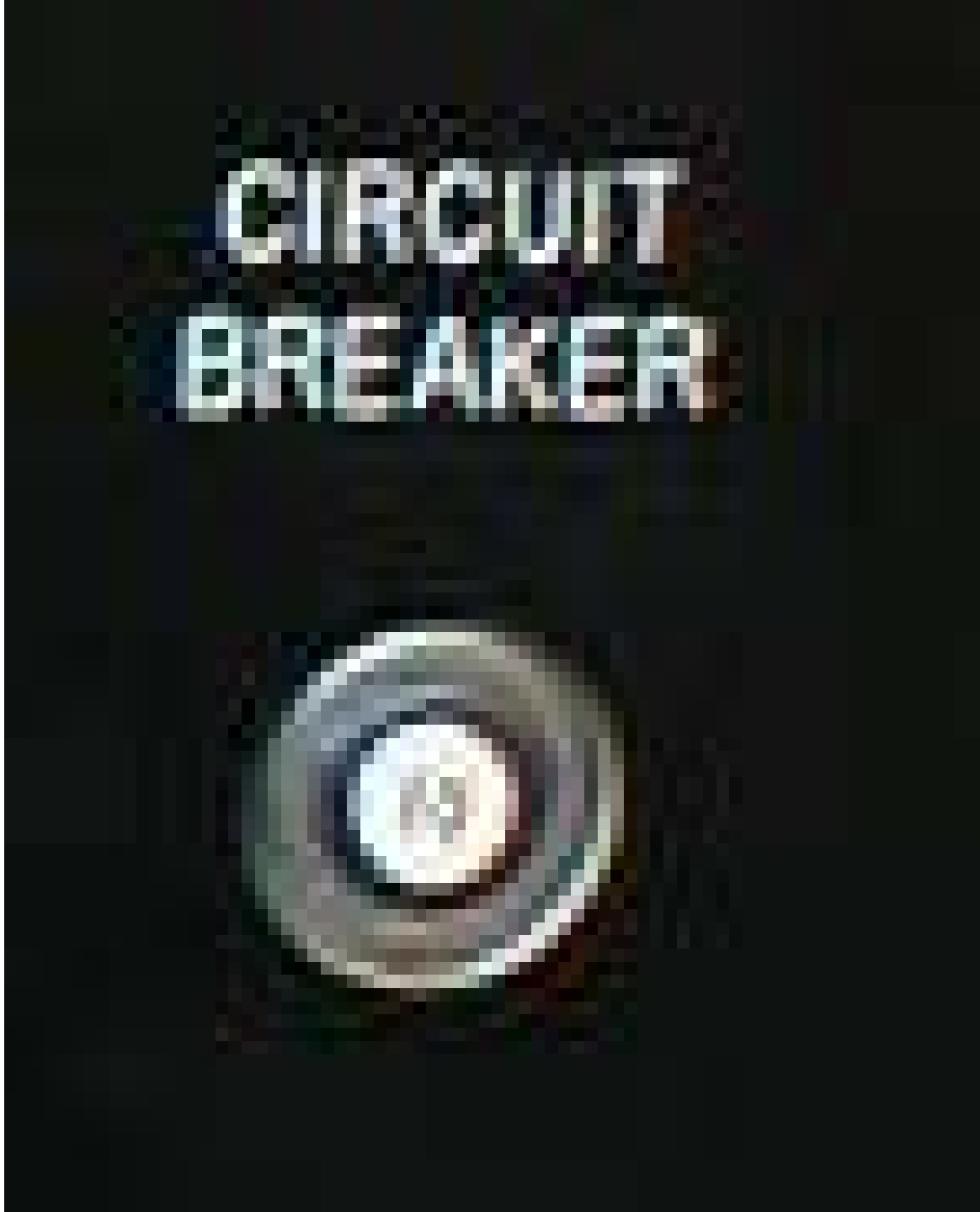
Volt
Meter



Reads water temp and is also shut down switch.

Adjust here.

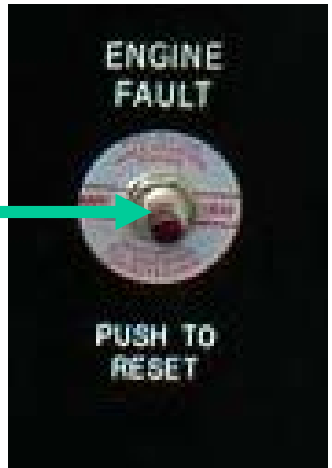
Pops out when something is wrong.



Starts diesel engine.

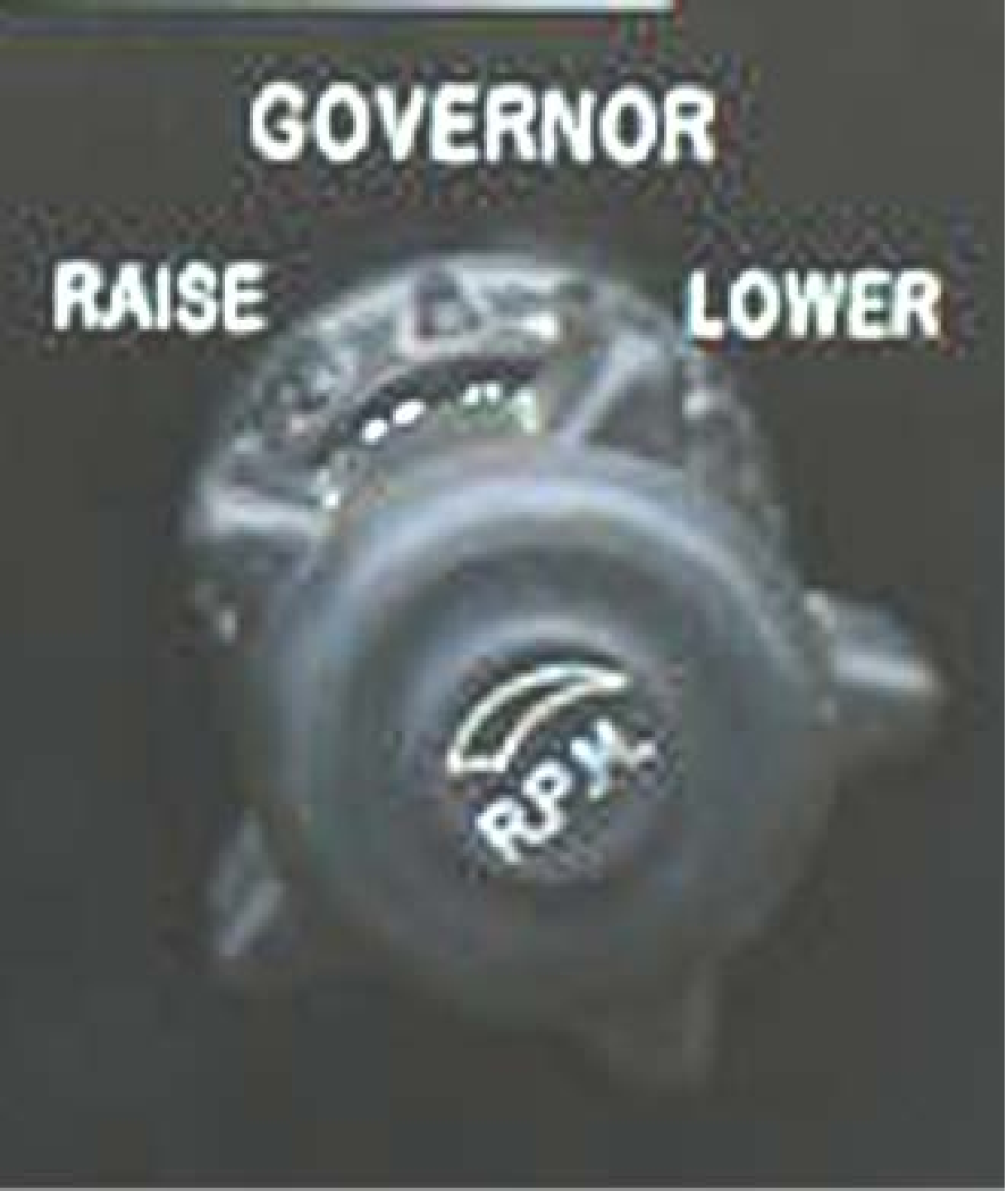
You must hold in the fault switch to override the engine oil pressure switch until oil pressure is reached.

Push and hold until oil pressure is normal, then let go.



You must push this button in and then watch oil pressure gauge until it goes up past switch setting

Engine Oil Pressure Gauge is also a switch that is adjustable with a small Allen wrench.



Controls engine RPM

Local / Pendant Switch

Turn to *“pendant”* when you are using the 50 foot hand held pendant.
Switch to *“local”* if you are going to run the power unit off the control panel.

Turn to forward to vibrate.

Turn to reverse if you are using a drill.

Note: Do not use reverse at any time to run the vibro. Vibro drives and extracts in forward position only!

Turn to “open” to open jaws.

Turn to “close” to close jaws. Keep on “close” and make sure light comes on.

Switch is also a light. Light comes on when jaw pressure raises high enough to engage the pressure switch.

Understanding power unit gauges

Hydraulic oil temp gauge and switch. Switch shuts engine down when oil temp passes setting. Set the maximum temp using a small allen wrench. Usually set at about 190 degrees.

Clamp Close gauge reads hydraulic pressure on the clamp jaws.

Clamp open reads the actual relief valve setting on the clamp manifold. You are reading the safety relief valve setting.

Note: This is not the valve you change if you are wishing to lower pressure on the clamp. Use the pressure switch for that. This gauge reads your pressure setting and it should be at 4800 pounds per square inch.

Note: Always check this first. With clamp lines disconnected, turn the clamp switch and hold it to open and read the gauge. It should be at 4800 psi.

Drive Forward/Reverse

Drive forward is used to turn the vibro eccentrics. Turn to forward for driving and extracting. Note: Only use the reverse when the power unit is operating a drill and you need to reverse the rotation of that drill. Vibro will not work in reverse.

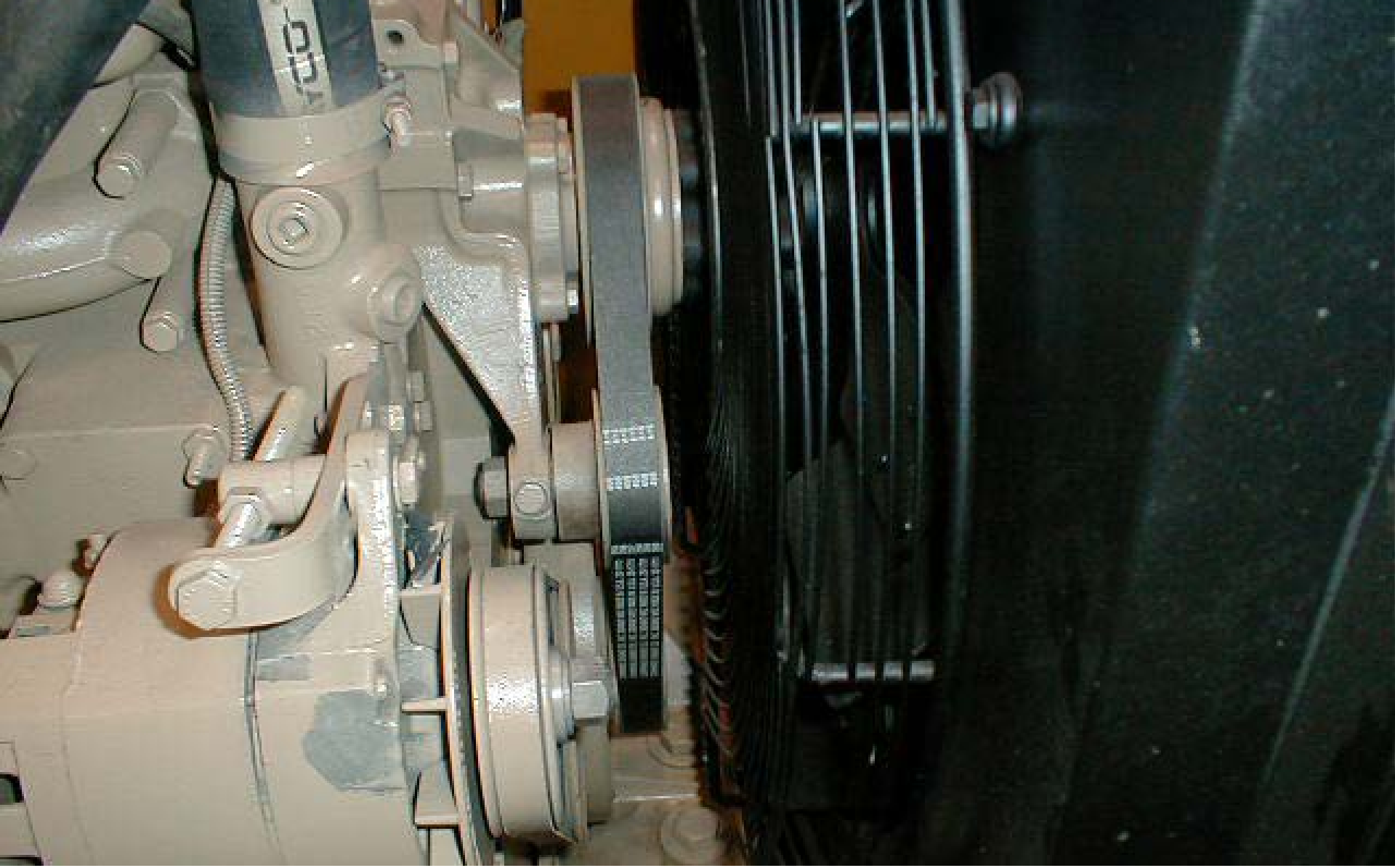
Hydraulic oil filter gauge tells you if the oil filter needs changing.

Change filter if you pass 50 pounds per square inch. Note: May read high if oil is cold. Wait until oil is 100 degrees.

Things to do before starting the engine

Radiator Cap - Check level.

Check engine oil level



Check V-belts

Check hydraulic oil level

Check pump drive gear box oil level

Check diesel fuel level

To Start:

Push and hold while turning the start switch. Holding the fault button over rides the engine oil pressure shut down switch. Once oil pressure is reached, you can let go of the button.

Local / Pendant Switch

Turn to “pendant” when you are using the 50 foot hand held pendant.
Switch to “local” if you are going to run the power unit off the control panel.

Unit will not start if drive forward switch is turned on.

Controls for power unit

Emergency stop

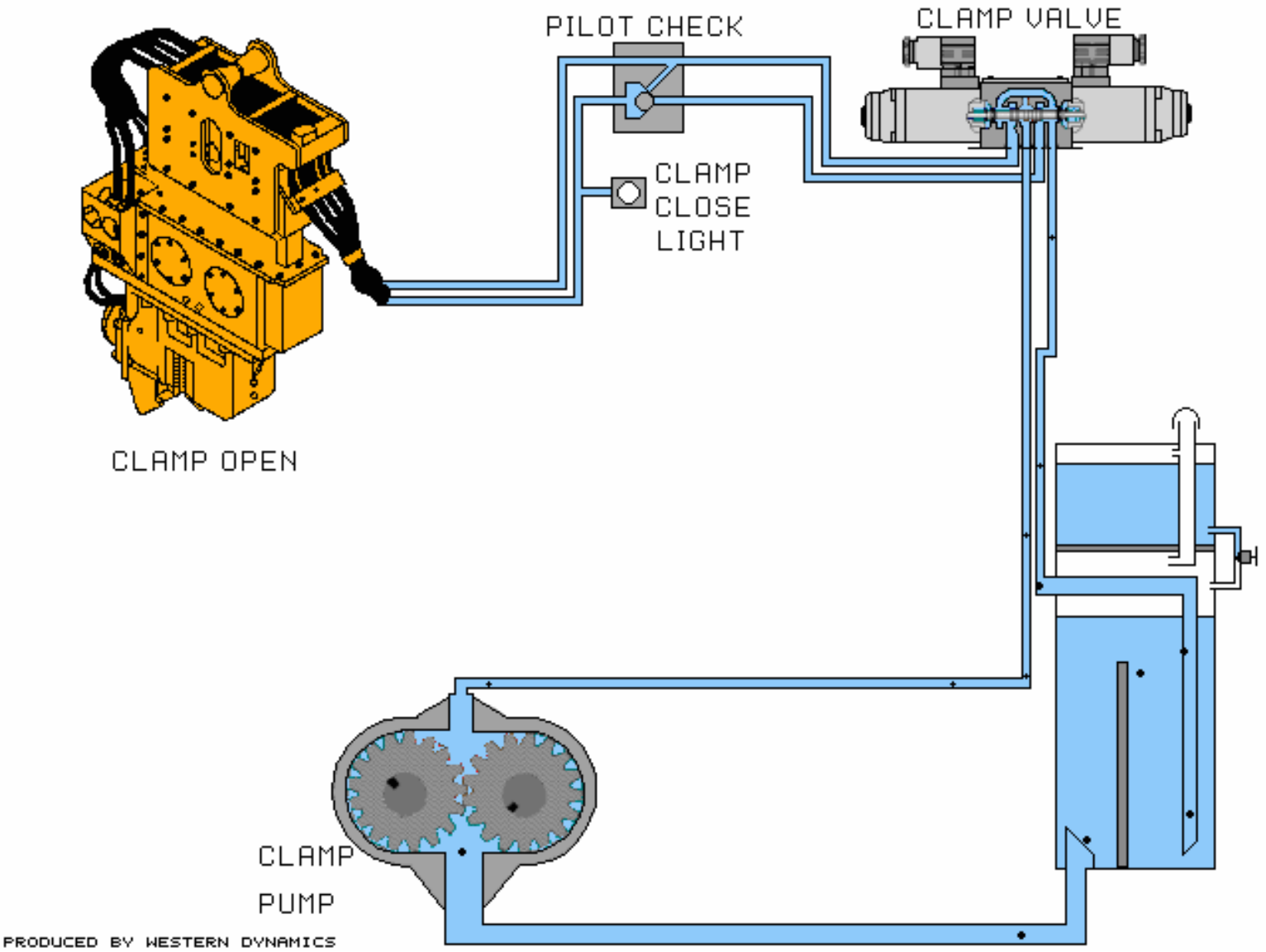
Vibro start/stop/reverse

Clamp open/close/off

Engine throttle

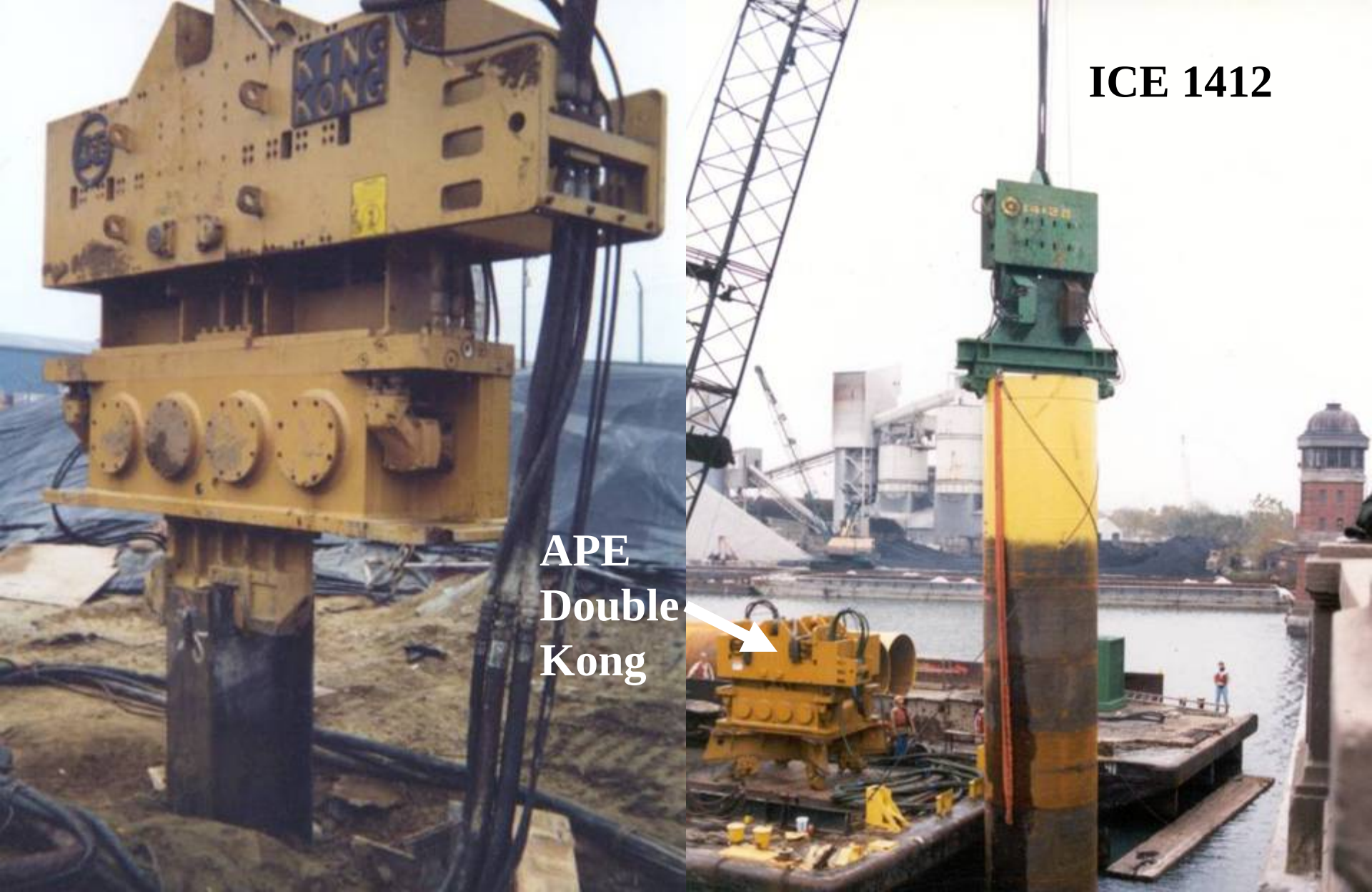
Control panel on power unit

Same controls as on hand held pendant serve as back up controls if hand held pendant is damaged. Gauges show all pressures.


PILOT CHECK
CLAMP VALVE
CLAMP
CLOSE
LIGHT
CLAMP OPEN
CLAMP
PUMP
PRODUCED BY WESTERN DYNAMICS

Vibro in action

Vibros in action



Vibros in action

Vibros in action

Vibros in action

Vibros in action

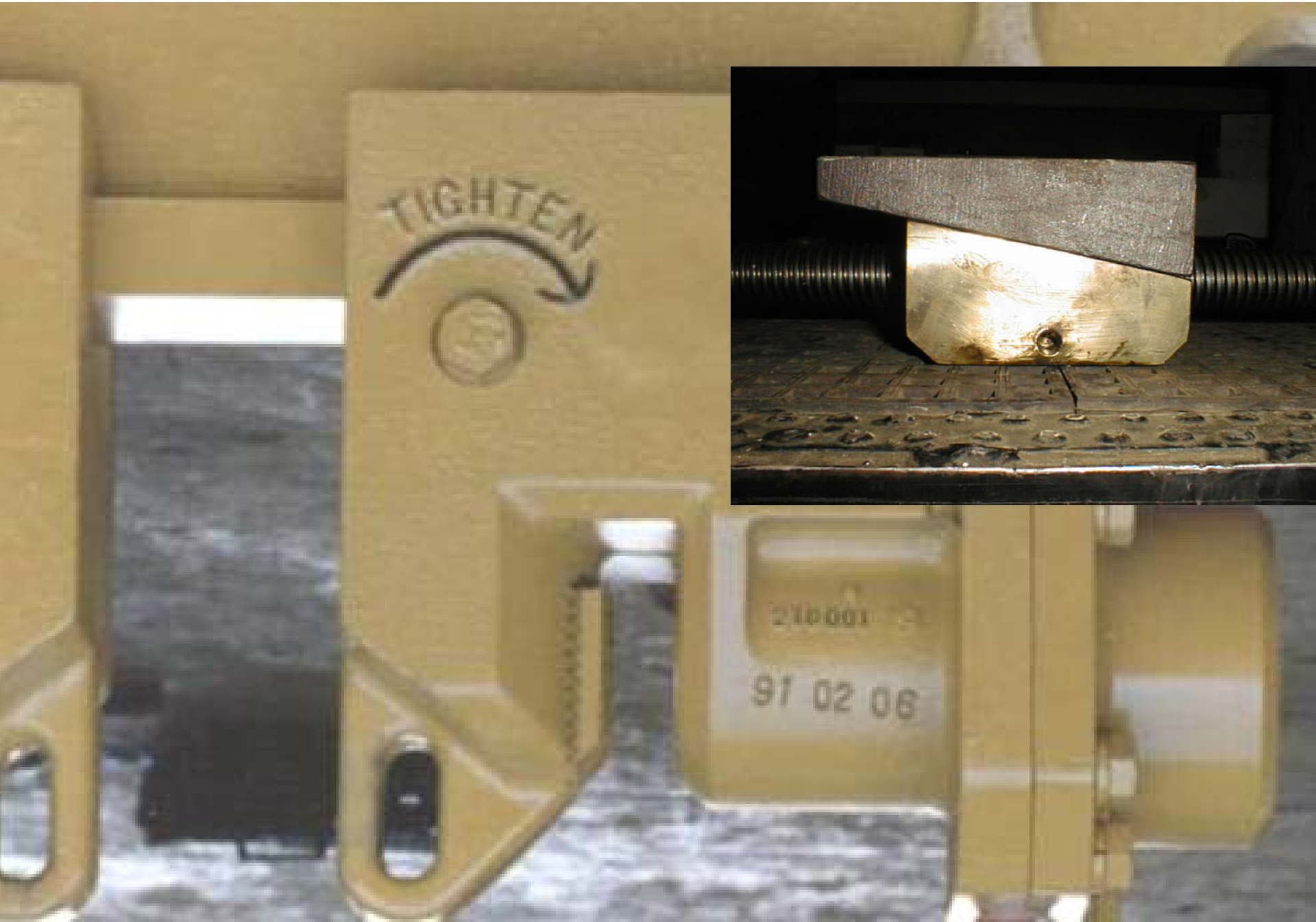
Tandem vibro with tandem power units

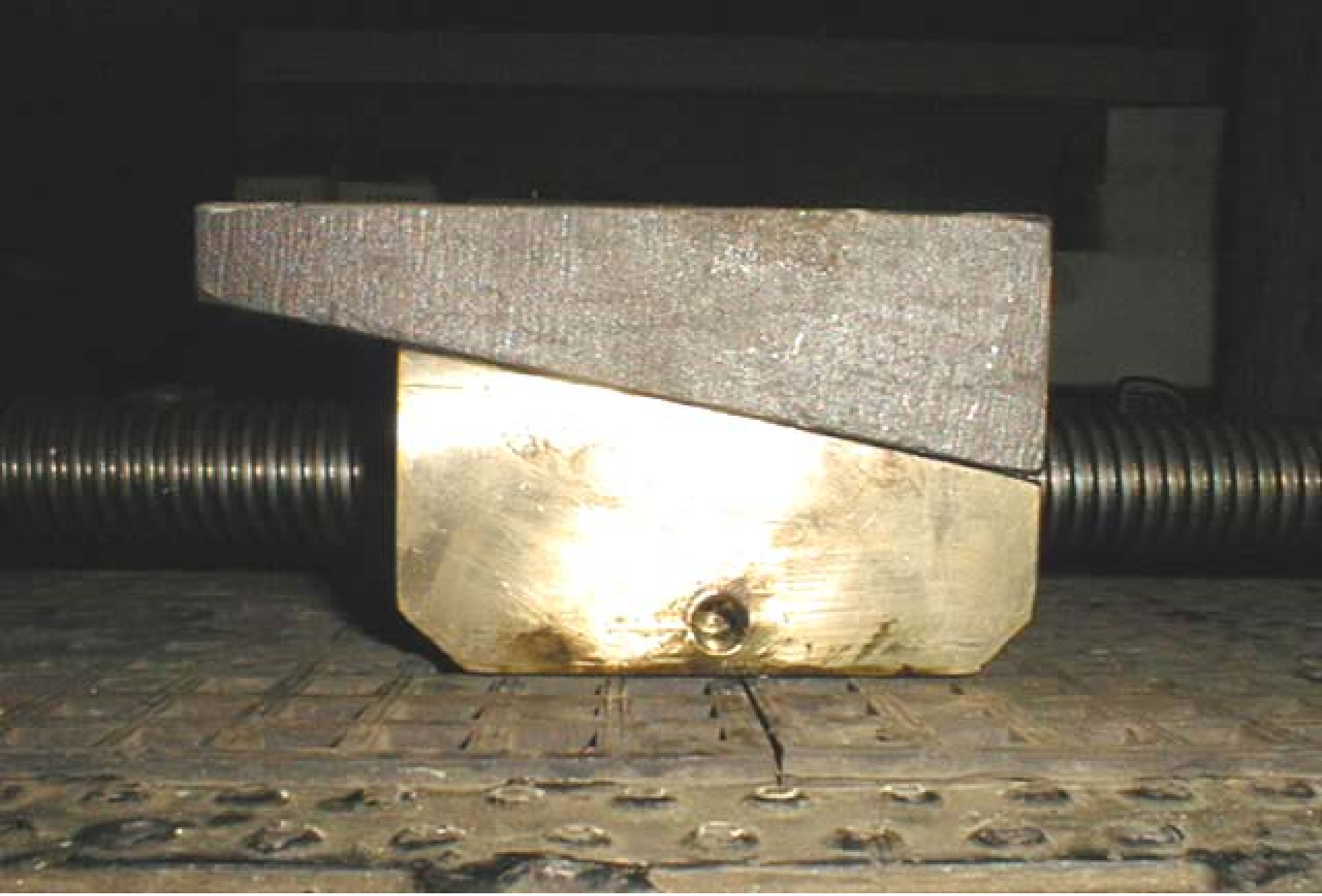
Clamp attachments- two clamps

Casing clamps- two clamps Japanese style

Two clamp system-French style

Adjusting clamps

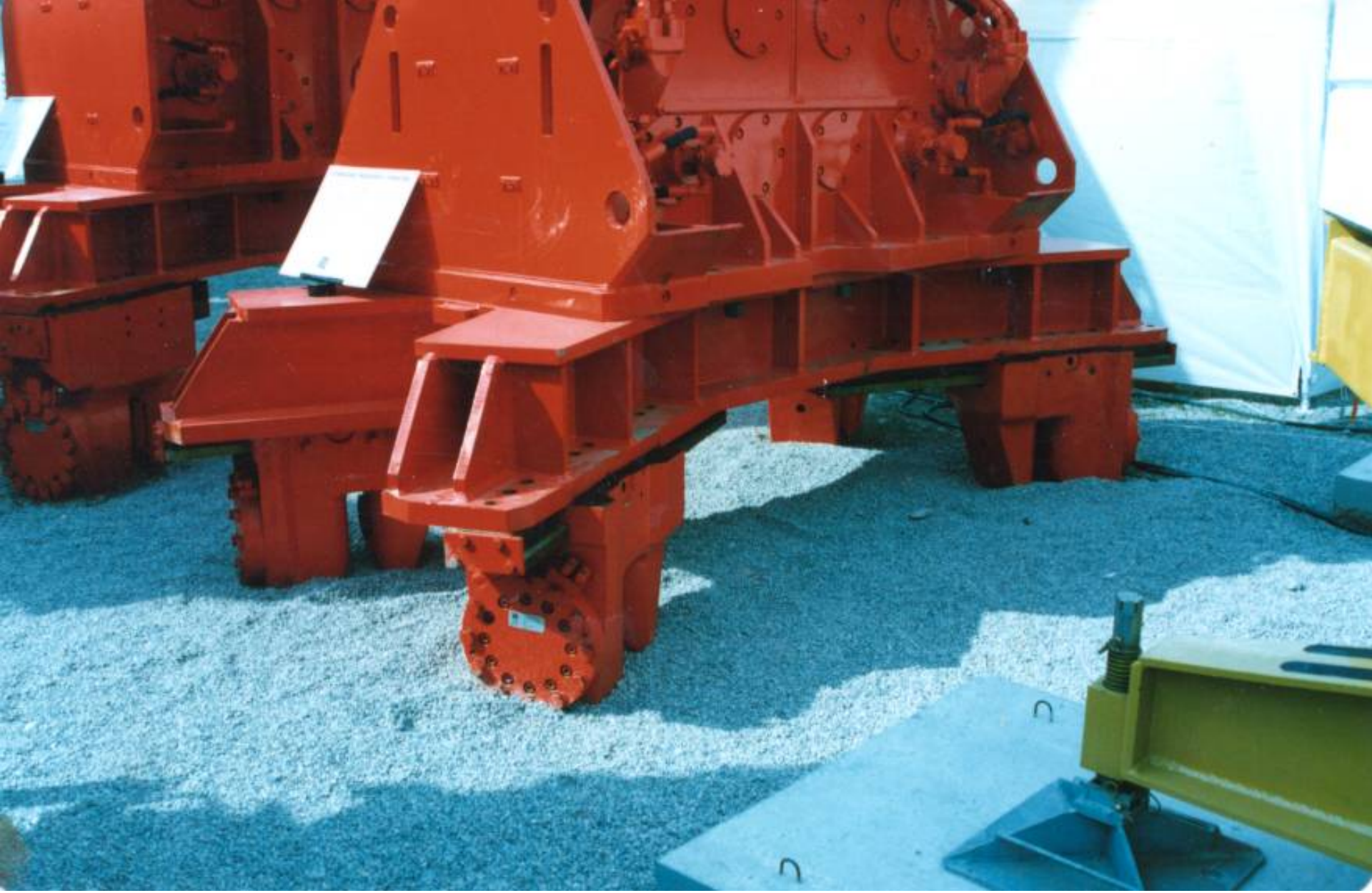




Rotating all thread raises or lowers wedge distance

Nut is welded. Always look at wedges while turning to make sure you are turning the right direction.

Wedges must be greased. If wedges are not tight the vibro will not put energy into the casing.



Attachments: Four Clamp

Attachments:
Concrete

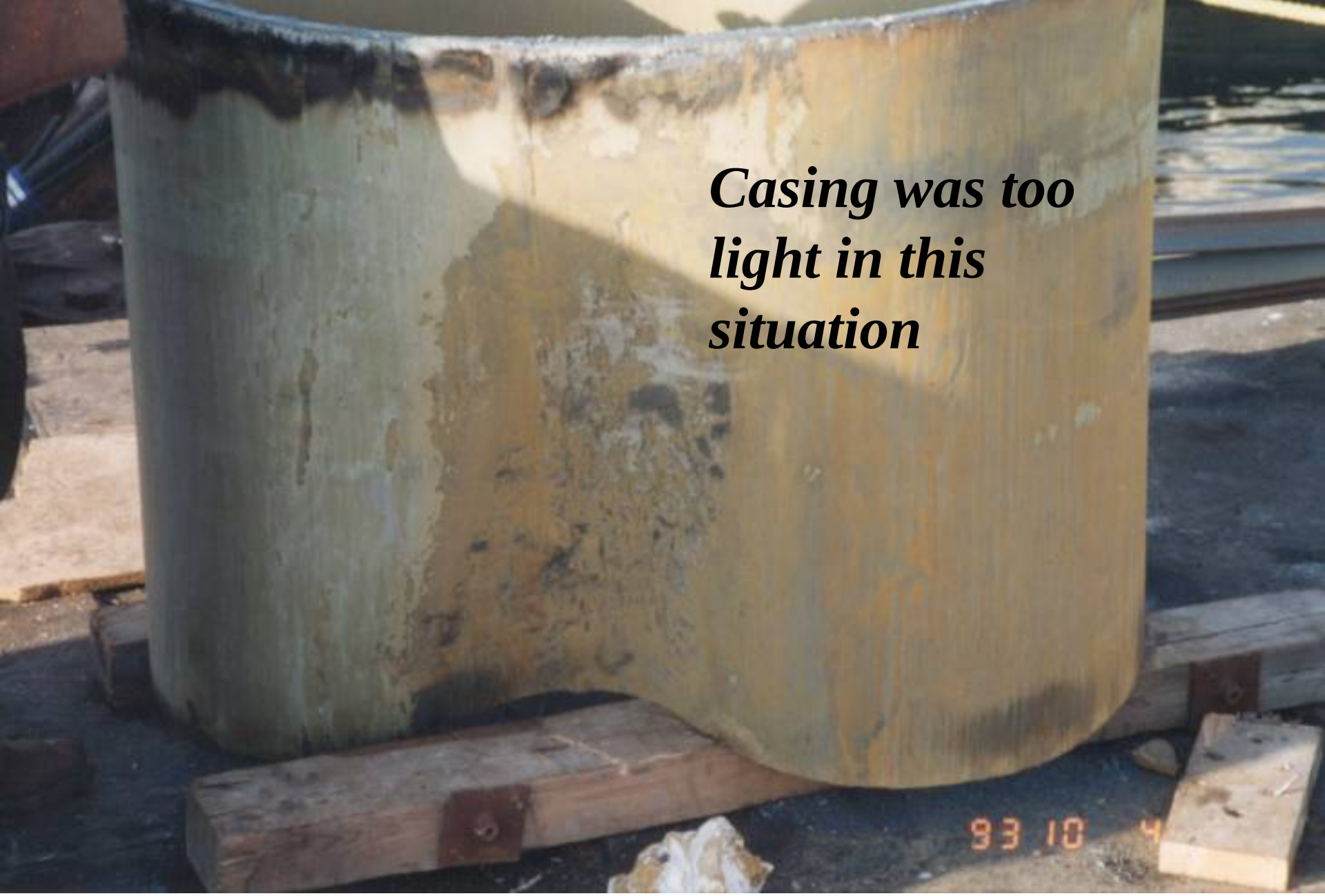
Attachments
concrete piles

Center pull clamp has two jaws that are gear timed to make sure pile is centered. Designed for pipe up to 24”, concrete piles, & wood piles.

H-Beams

Sheet Piles

Pile failures



Pile or casing failures

Belly bands are added to the top and sometimes to the bottom of the casing to solve the following problems:

Keep jaws from tearing off top of casing

Prevent flexing of the casing which causes unwanted vibrations to adjacent soil and buildings.

Flexing also takes away energy from the vibro that needs to be at the tip.

Adding belly bands

Vibros underwater

Underwater operations

Underwater operations