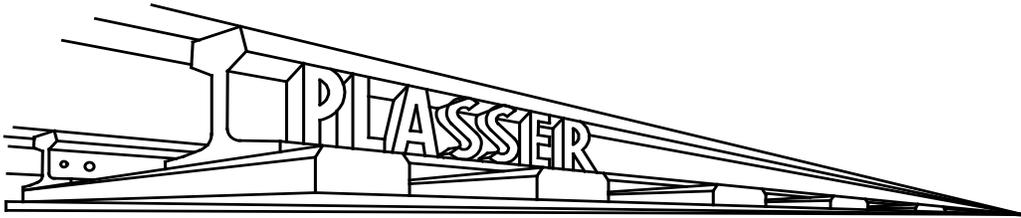
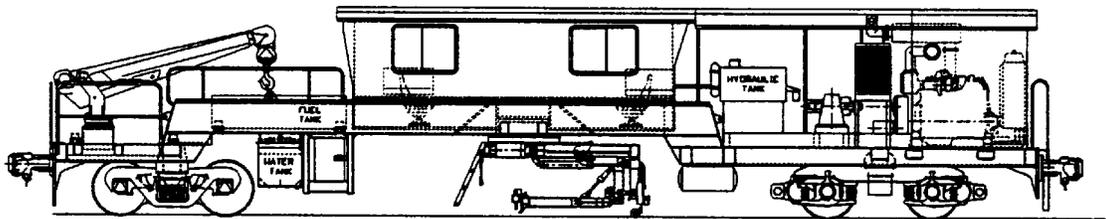


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PLASSER AMERICAN CORPORATION



OPERATION and TECHNICAL

for the

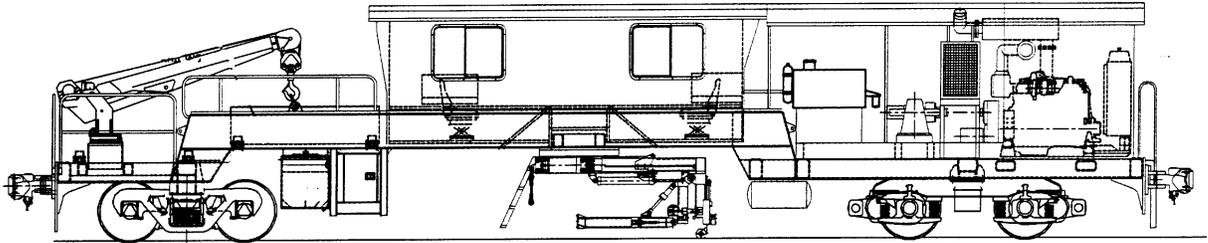
SM-4

AUTOMATIC TORQUE MACHINE

Direct any question / comments to:

Plasser American Corporation
Service, Customer Education
P. O. Box 5464
Chesapeake, Virginia 23324-0464

PROFILE



SM-4 TORQUE MACHINE

A self propelled vehicle used to tighten and loosen track bolts. The vehicle is power by a diesel engine which operates the hydraulic pumps. The drive system is a hydrostatic drive system powering 2 - 2 speed axles on one truck assembly. The vehicle has a 15kw generator, a crane and can carry ten personnel in the cabin. When the machine is operating, it will work as a continuous action machine thereby giving the maximum work out put. It is capable of operating in the fully automatic with very little operator input or semi-automatic mode with some operator input.

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LUBRICATION DIAGRAM_____	
LOCK DIAGRAM_____	

SAFETY FIRST

1. The safety of everyone involved in the operation and maintenance of the vehicle is the most important consideration. Safety requirements must be observed in accordance with railroad requirements.
2. Test the brakes BEFORE YOU HAVE TO USE THEM.
3. Always watch for other personnel working close to the vehicle.
4. Do not forget to watch for signals, switches and track obstructions.
5. Always lock the vehicle before you leave. Make sure that the vehicle is protected in accordance with railroad rules.
6. Never bypass a safety feature on the vehicle unless it is an emergency. Bypasses which have to be made because of an emergency must be corrected immediately thereafter.
7. Keep the vehicle clean. Remove accumulations of grease and oil which could be a safety hazard.
8. Ensure that all safety requirements are met before performing maintenance around or under the frame.
9. Exercise caution when setting reducing or relief valves in the hydraulic system as there is high pressure involved.
10. Bleed off any residual pressure if any maintenance is required on or near pneumatic and hydraulic components.
11. Set the brakes, stop the engine and turn off the battery disconnect switch when doing any work within or under the machine. Observe all requirements of a lock-out/tag-out program.
12. **Unqualified persons should not attempt to start, travel or operate the vehicle.**
13. **These safety concerns are not intended to supersede normal railroad operating rules.**

GENERAL NOTES

1. Keep the machine well lubricated at all times and remove excess grease. Wipe off grease fitting before and after greasing. Grease the machine when warm, at the end of the work day is ideal.
2. Keep the machine tight. Periodically tighten all nuts and bolts. Inspect hoses and fittings for security and leakage.
3. Drain any water from applicable filters, separators and air or fuel tanks daily.
4. The fuel tank should be kept full to prevent condensation. Fill at the end of the work day.
5. Whenever you have the opportunity, while waiting to go out on the job, do some of the smaller maintenance jobs - such as tightening loose nuts or bolts and cleaning the machine.
6. Check all belt tension frequently.
7. Do not crank the engine for more than 10 seconds continuously and wait a full minute between starting attempts.
8. Never turn off the battery switch while the engine is running; an interlock is provided which must not be bypassed.

REMEMBER - Quality track work can only be achieved with a well maintained machine.

SPECIFICATIONS

Dimensions:

Height	13 feet (3.96m)
Length	55 feet (16.7m)
Weight	approx. 70,00lbs.
Truck Centers	39.5 feet (12.03m)
Axle Centers	5 feet (1.52m)
Wheel Diameter	28 inches (711.2mm)

Machine Speeds:

Travel	45 mph (72.4 kph)
Work	max. 3000ft/hr

Engine:

Make	Caterpillar
Model	3406
No Load Max. Speed	2248 rpm
Idle Speed (no load)	1000 rpm
Top Speed	2100 rpm
HP rating	430hp @ 2100 rpm
Fuel Consumption	approx. 22.0 gph

Capacities:

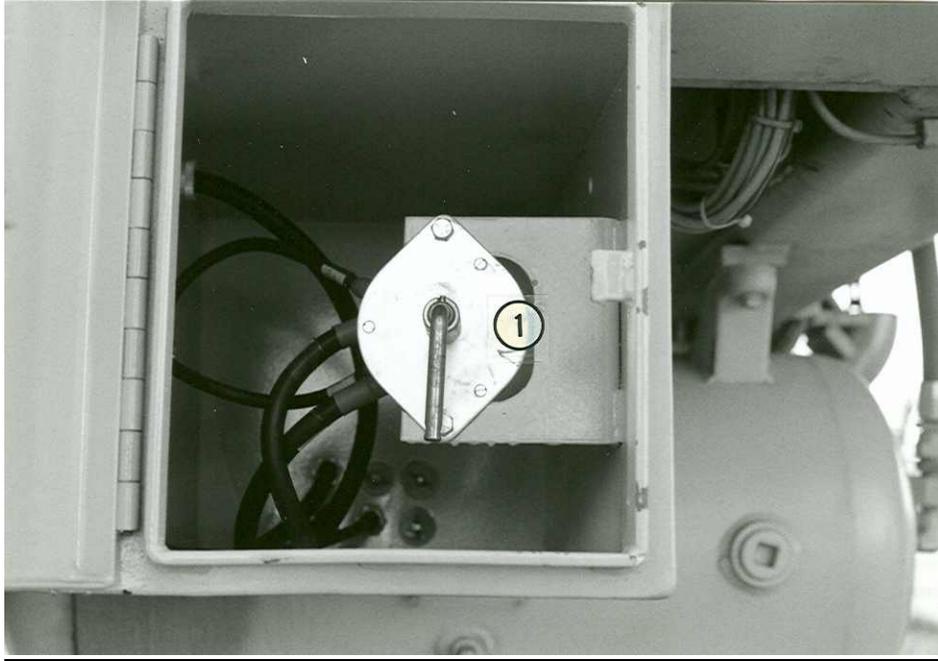
Fuel	430 gal. (1627Liters)
Hydraulic Oil	237 gal. (900 liters)
Water	470 gal. (1779 liters)

Filter Elements:

Engine Oil	1R0716
Engine Fuel	1R0749
Hydraulic Suction	HY-S501.90.10ES
Charge Pump Suction	PC230-MIC 25
Hydraulic Return	HY-R501.330.10AES

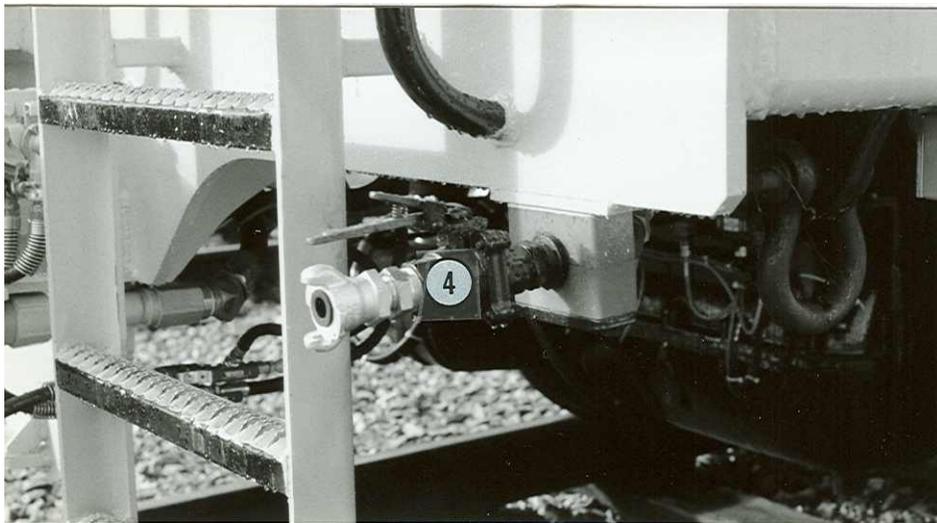
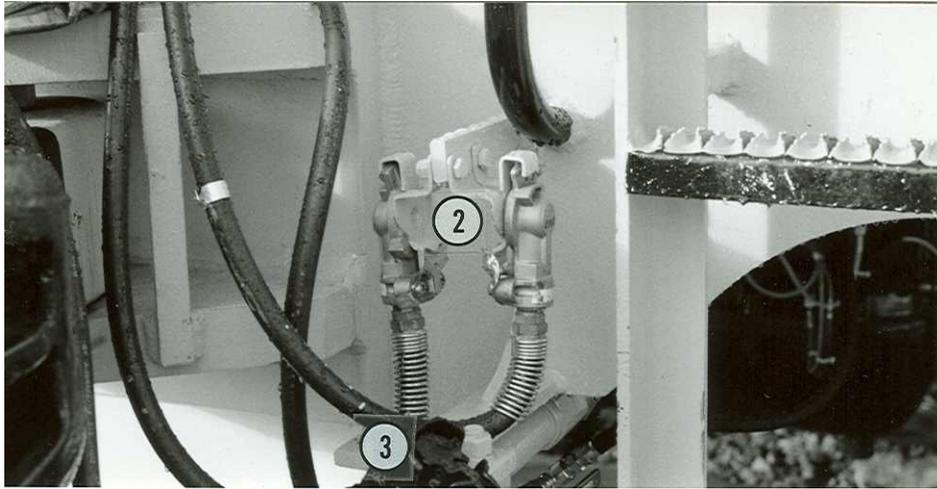
PICTURES
and
DESCRIPTIONS

BATTERY ISOLATION SWITCH



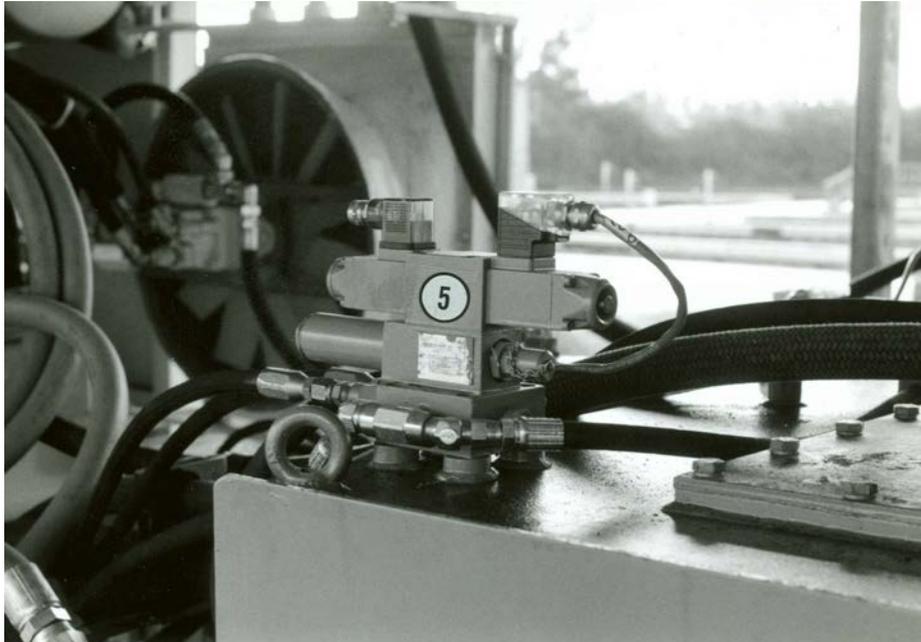
1. Battery Isolation Switch - this switch is used to disconnect the batteries from the electrical system. It should be turned off at the end of each work shift to prevent battery drain down. **NEVER** turn the Battery isolation switch off while the engine is running, this can cause damage to the electrical and electronic systems.

AIR LINE CONNECTIONS



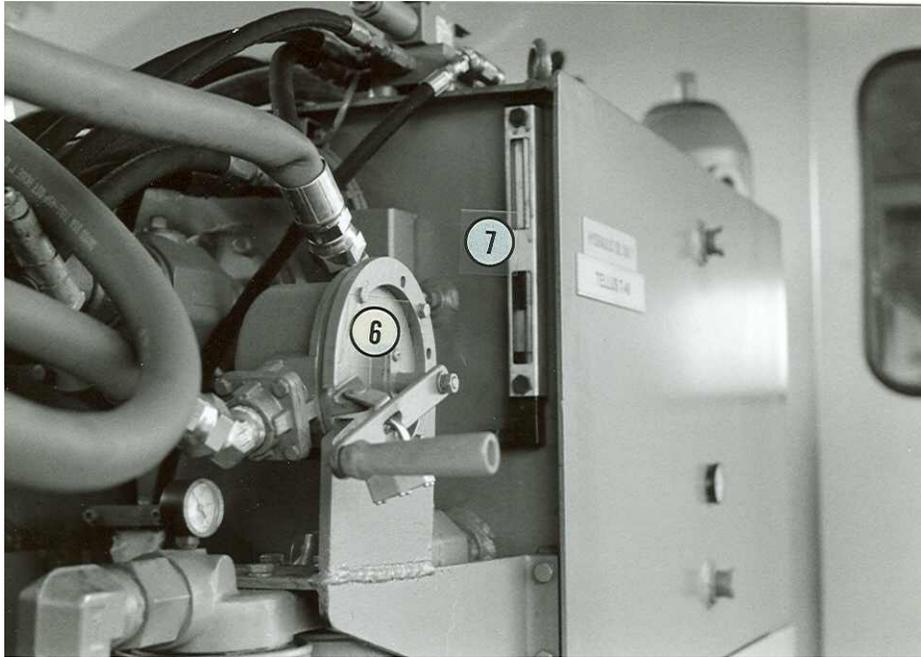
2. Emergency and Service Brake connections for use with an M&W flat car. One of these hoses is used to release the fail safe side of the brake cylinders, while the other hose is used to apply the service side of the brake cylinder.
3. Train Line Angle-Cock - used with a standard railroad brake system on railroad cars.
4. Auxiliary Air Connection-used to supply air from the Auxiliary air reservoir at approximately 125psi. This is used for air tools and is not connected to the machines internal air supply.

CONTROL VALVE



5. Pump control valve- Used to select the pump into soft torque mode. There is one valve for two pumps and motors. The valves are located on the front corners of the hydraulic tank.

HYDRAULIC TANK



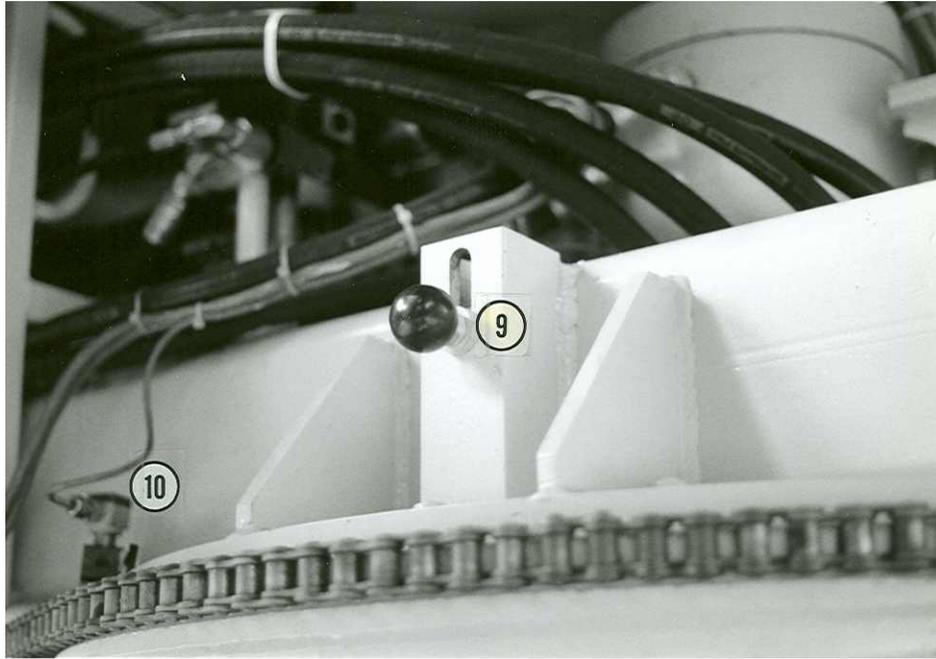
6. Hydraulic Hand Pump- This pump is used to pump hydraulic oil into the reservoir should it become necessary. This pump is connected to a fitting on the top of the tank after it goes through a filter.
7. Hydraulic Tank Level Sight Glass- used to check the level of the hydraulic oil in the reservoir. This level should be maintained at $\frac{3}{4}$ of the glass and not more due to expansion of the fluid.

ENGINE AIR CLEANER



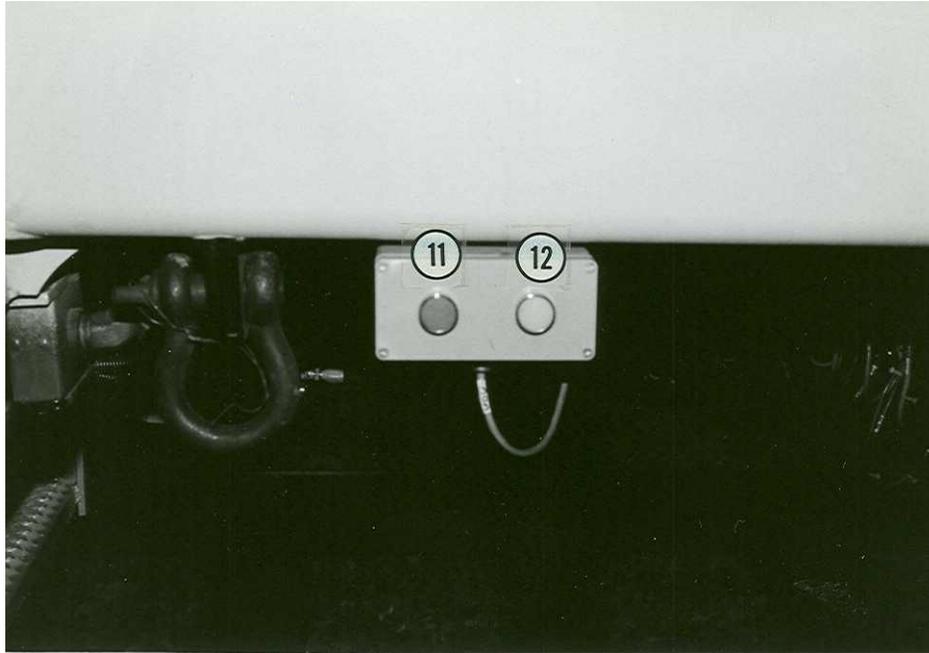
8. Air Cleaner Indicator- Mounted on the top of the engine is a vacuum indicator to show the condition of the engine intake air filter. As the air filter gets dirty the indicator will show more and more vacuum. With the engine shut down the indicator will remain at the highest reading until it has been reset by depressing the end of the indicator.

TURN TABLE LOCK



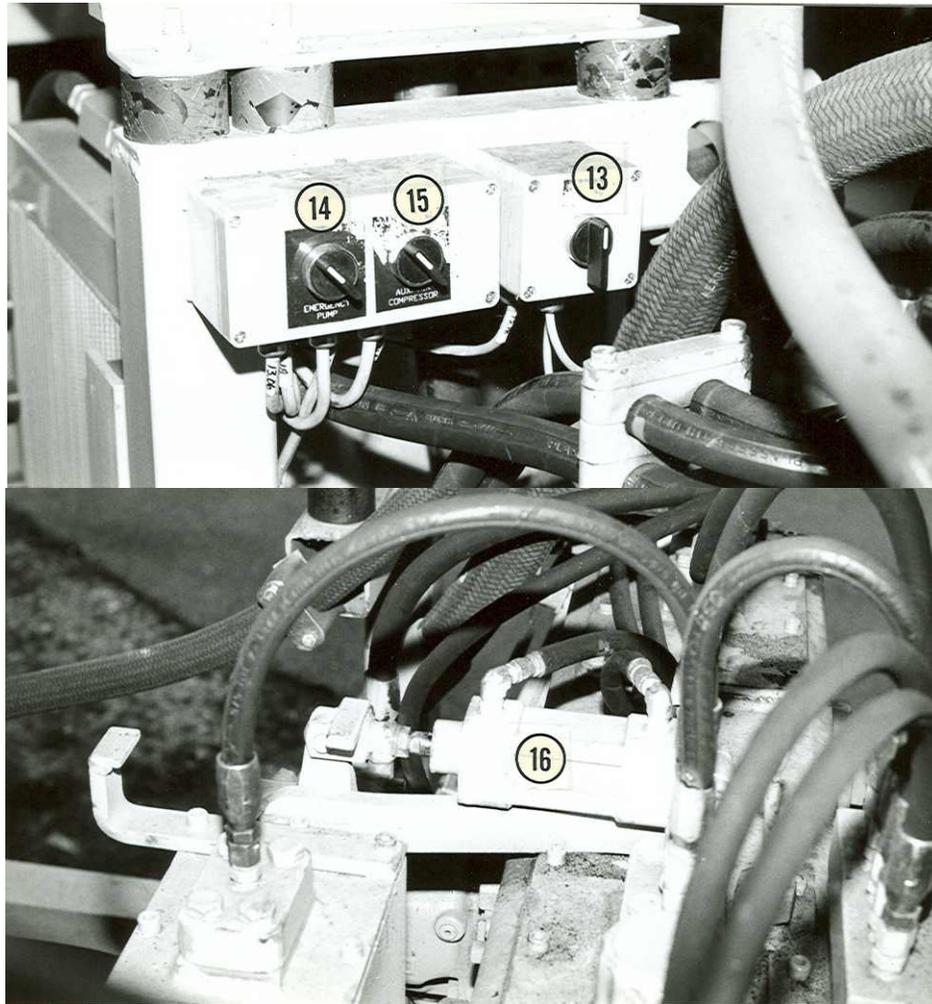
9. Turntable Lock- visible from the front work operators seat. This lock should always be in place while traveling the machine. When setting up the machine for work this lock should be unlocked to facilitate setting up the screw head arms and rail brakes. It should remain unlocked through out the use of the work units to allow for any curves in the track or line swings. To unlock the lock, grasp the ball and pull straight out and then lift up, the unit may need to be bumped slightly left or right to allow the lock to disengaged the hole.
10. Proximity Sensor- Used to indicate in what direction the machine will be working.

BUTTON BOXES



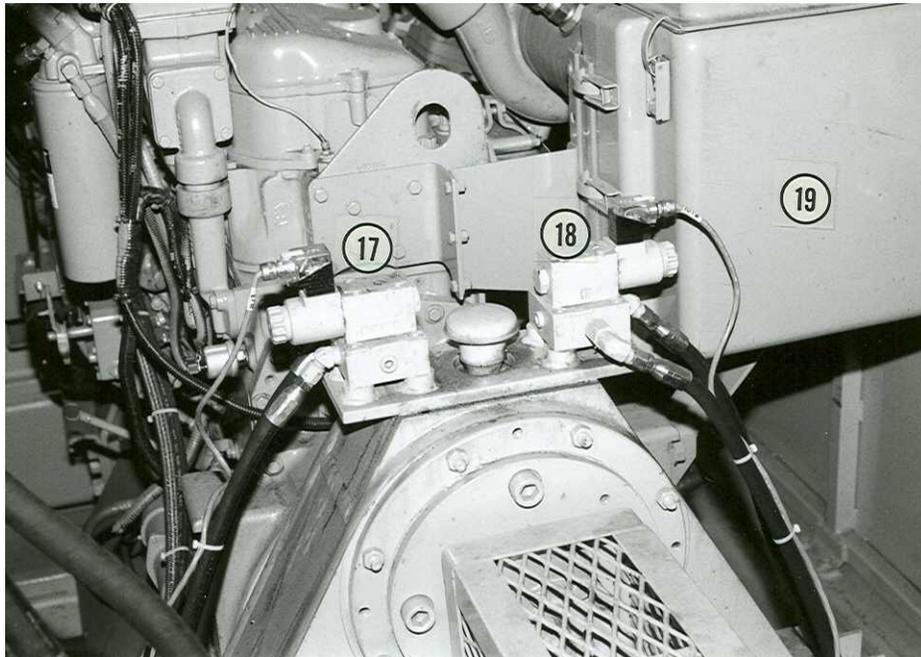
On each corner of the machine is a control box with two momentary push buttons.

11. Red Button - used in an emergency to shut down the engine. To do this, the push button must be depressed and held until the engine stops.
12. Yellow Button - a momentary push button used to sound the electric horns.



13. Pump Drive Engage/Disengage Switch- A three-position momentary switch used to engage or disengage the input shaft to the main pump gear box. Only to be activated with the engine shut down.
 14. Emergency Pump Switch- a two position momentary switch used to energize the emergency hydraulic pump to temporarily pressurize the hydraulic work system to facilitate storing work units after a main pump failure.
 15. Auxiliary Air Compressor- A two position momentary switch used to signal the processor to activate the auxiliary air compressor for use with air tools and auxiliary equipment.
 16. Pump Drive Engage Cylinder- used to engage or disengage the main pump drive.
- The junction box with item #14 & 15 has been moved inside the cab.

TRAVEL DRIVE



17 & 18. Drive Pump Bypass Valves- A single solenoid valve used to bypass the servo flow around the swash plate cylinder. These solenoid valves will energize every time the travel controls are not on zero.

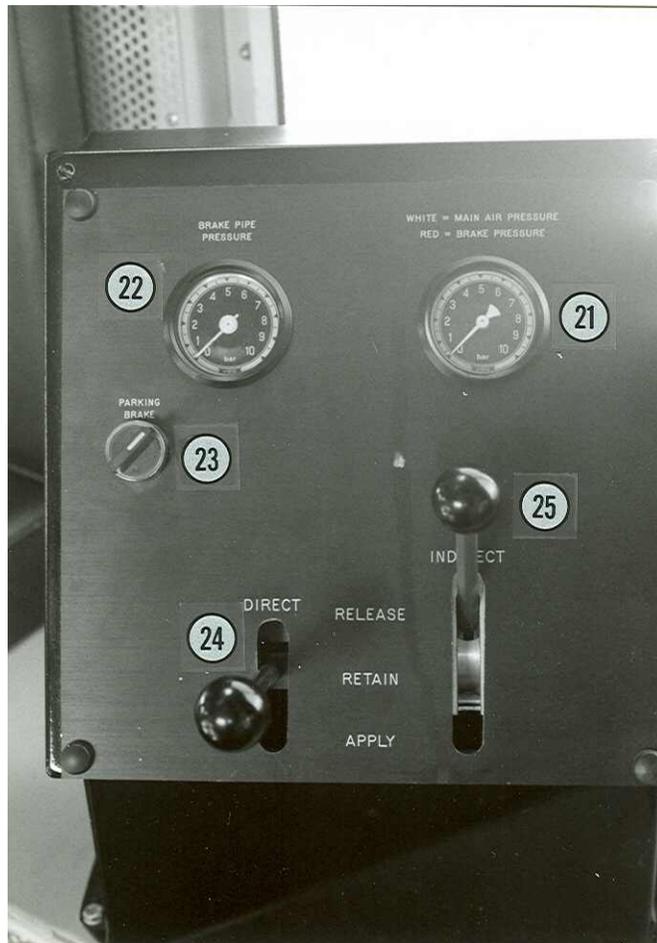
19. Engine Air Filter

CRANE CONTROLS



20. Crane Hand Controls- A remote hand control unit used to control all crane functions. When plugged into the left rear side of the crane, the operator has the ability to control the Boom up/down, Hoist up/down, Rotation cw / ccw, or Boom Extend in/out. There is also a Power on/off switch which when left unattended should remain in the “off” position.

AIR PANEL



- 21. Dual Air Pressure Gauge
 - a. White Needle = Main air Reservoir Pressure
 - b. Red Needle = Brake Cylinder Pressure
- 22. Brake Pipe Pressure Gauge
- 23. Park Brake Switch
- 24. Direct Brake Handle
- 25. Indirect Brake Handle

AIR PANEL

Dual Air Pressure Gauge ref.
17-21

A two needle gauge used to display separate functions. The WHITE needle is used to display the air pressure that is in the main reservoir. The governor on the compressor regulates the pressure to approximately 7 bar.

The RED needle indicates the air pressure that is being applied to the brake cylinders by the brake system. The maximum on the cylinders is regulated to 5 bar in travel, or 3bar in work.

Brake Pipe Pressure ref.
17-22

An air pressure gauge used to display the air pressure in the brake pipe, or train brake system. If not using the brake system the pressure in the brake pipe should be kept at approximately 5 bar.

Parking Brake Switch ref.
17-23

A two position illuminated switch used to apply or release the parking brake. When the parking brake is active the light in the switch will illuminate. By turning the switch on, air pressure is applied to the emergency side of the brake cylinder thereby releasing the parking brake, and the light will extinguish.

Direct Brake Handle ref.
17-24

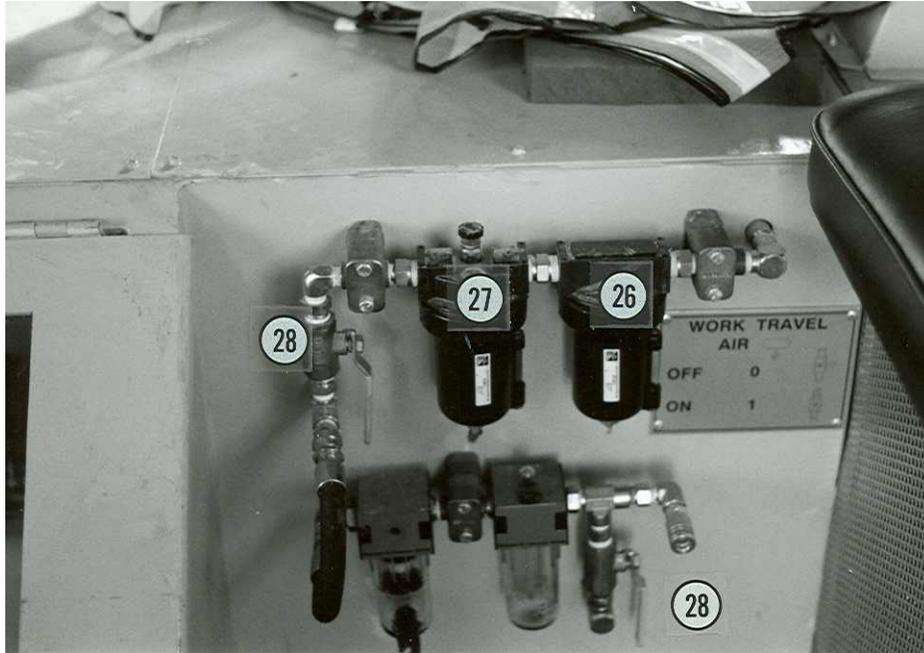
A closed center valve used for the application of the service brake. By pulling back on the handle air is applied to service port of the brake cylinders. Pulling fully back on the handle will lock the handle in place. To release the brakes, push fully forward.

Indirect Brake Handle ref.
17-25

A closed center valve used to charge the train brake system when using the machine for moving standard railroad cars. The handle must

be pushed fully forward to charge the train brake system and then the system is slowly drained down to make brake applications.

AIR VALVES



26. Water Separator- takes condensed water out of the compressed air, there is a sight glass on the side and the bowl should be emptied when there is an accumulation of liquid in the bowl.
27. Air Line Lubricator- uses light weight machine oil to lubricate the air as it is being used. The lubricator should need to be refilled once every two weeks.
28. Work Air Valve- A manually operated valve used to apply air pressure to the work circuits. By opening this valve it also puts 3 bar of pressure on the brakes which is released with an electric solenoid valve.

LEFT-WORK HAND CONTROLS



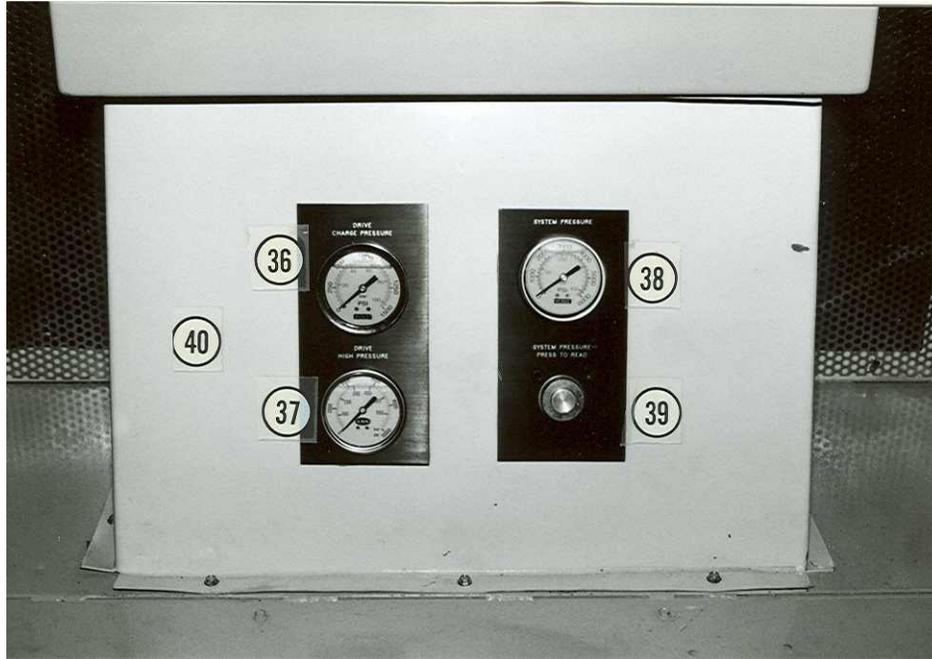
- 29. Cycle Start/Stop Joystick- A three position spring centered joystick used in the semi-automatic mode to start the cycle and can be used in semi-automatic or automatic mode to break the cycle for the right side.
- 30. Cycle Indicator LED- explained later in the manual
- 31. Drive Stop Push Button- A latching push button used to stop the drive and apply the work brakes. To release the stop push button twist the button clockwise. The button is also active in the drive mode and must be released to allow travel from any position.
- 32. Horn Push-Button- A momentary push button used to activate the electric horn.

RIGHT WORK HAND CONTROL



- 33. Cycle Indicator LED
- 34. Right Hand Cycle Start/Stop Joystick
- 35. Work Drive Speed Control- A variable potentiometer used to control the drive speed of the machine in the work mode. Turning the control Clockwise, from the 12 o'clock position, will first release the brakes and then start the machine moving forward. Counter-clockwise will release the brakes and start the machine moving in the reverse direction.

HYDRAULIC PRESSURE GAUGES



- 36. Drive Charge Pressure - A pressure gauge used to monitor the charge pressure of the drive system. Charge pressure is used to maintain a positive pressure on the low pressure side of the travel pumps.
- 37. Drive Pressure Gauge - A pressure gauge used to monitor the drive pressure used to move the machine.
- 38. System Pressure Gauge- A pressure gauge used to monitor the work system hydraulic pressure.
- 39. System Pressure Switch- A push button used to activate the system pressure gauge.
- 40. Not Shown – Torque Pressure Gauge - Used to monitor the torque pressure used during the operation of the torque units.
 - Loosening = 250 bar
 - Tightening = 100 bar

MECHANICAL HAND BRAKE



- 41. Mechanical Hand Brake- A ratchet lever used to apply the mechanical hand brake
- 42. Release Lever- A quick release lever used to release the mechanical hand brake. To release the brake grasp the lever and lift up.

B5 ENGINE PANEL



- 43. Diesel Fuel Tank gauge
- 44. Engine oil Pressure Gauge
- 45. Engine Temperature Gauge
- 46. Tachometer
- 47. Speedometer
- 48. Voltmeter
- 49. Amp-Meter
- 50. Warning Indicator LED's
- 51. Desk Select Switch
- 52. Drive Stop Push Button
- 53. Axle Engaged Indicators
- 54. Travel Speed Control
- 55. Engine Section
- 56. Accessory Section
- 57. Ignition Switch and Battery Indicator

B5 ENGINE PANEL

Diesel Fuel Gauge 24-43	ref.
An electric gauge used to indicate the level of diesel fuel in the fuel tank.	
Engine Oil Pressure 24-44	ref.
An electric gauge used to show the amount of engine oil pressure that is present while the engine is running. As a back-up there is a mechanical gauge mounted on the top of the engine in the engine compartment.	
Engine Temperature Gauge 24-45	ref.
An electric temperature gauge for the engine temperature.	
Tachometer 24-46	ref.
A dial indicator to show the engine speed. The no load Minimum engine speed is set for Approx.1000 rpm's. The Maximum no load is 2100 rpm's.	
Speedometer 24-47	ref.
Voltmeter 24-48	ref.
Shows the voltage in the batteries.	
Amp-meter 24-49	ref.
Shows the electrical usage, whether the alternator is charging or not.	
Warning Indicators LED's 24-50	ref.

A series of LED's used to warn of improper conditions. The LED's will illuminate for loss of engine oil pressure, high coolant temperature, high oil filter pressure, and lack of alternator charge. There are three for the hydraulic system: High temperature, low reservoir level and high return filter pressure. The last one is for low main air system pressure.

Desk Selector Switch

ref.

24-51

A two position switch used to select the driving desk and also to select travel gear range. Only one Desk Select switch may be active at a time. More than one desk select switch on will give a drive fault indication on the LED's explained later.

B5 ENGINE PANEL

(con't)

Drive Stop Push Button ref.

24-52

A latching push button used to stop the drive of the machine. In the travel mode, if depressed it will cancel the enable routine required for travel on the machine. It will also cause the travel enable LED to flash indicating a Drive Stop is latched. To release the drive stop push button simply twist the button clock wise until it pops out.

Axle Indicator LED's ref.

24-53

The axle indicators are fully explained in a section starting on page 37.

Travel Speed Control ref.

24-54

A variable position handle that controls the output of the travel pumps and controls the speed of the machine while in the travel mode.

Engine Section ref.

24-55

The engine section has the controls for the engine starting and throttle. To start the engine first the "Push to Start" button must be depressed and held until engine oil pressure is up. Then the start push button must be depressed to activate the starter, release the start push button as soon as the engine starts.

- There is also a stop button used to shut the engine down.
- A spring centered joystick used to adjust the throttle.
- The buzzer off Switch is used to cancel the warning buzzer.
- The yellow push button is used to activate the electric horn.

Accessory Section ref.

24-56

The accessory section contains the switches for lights and windshield wipers.

Ignition Switch and Battery Indicator

ref.

24-57

- The ignition switch turns on the power to the engine circuits and enables all the gauges.
- The Battery On indicator illuminates as soon as the battery switch is turn on and there is power available.

B11 AUXILIARY DRIVE PANEL



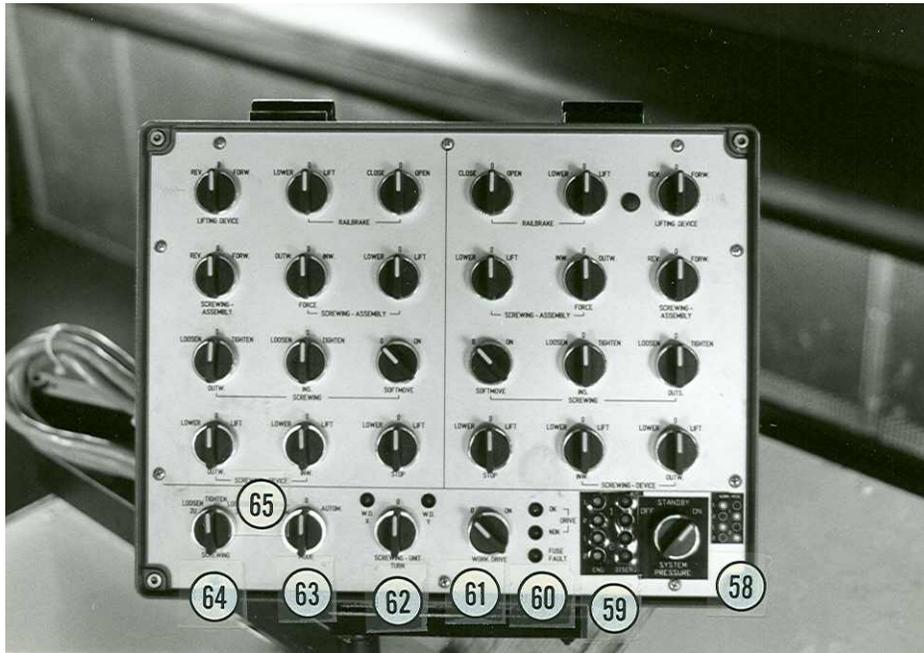
The B11 auxiliary drive control panel has the same controls on it as the B5 panel. This driving desk is at the rear of the cab and is used to travel the machine in a rearward direction.

MAIN ELECTRICAL CIRCUIT BREAKER PANEL



- The circuit breaker panel is used for the AC power circuits from the generator.
- Before starting or stopping the generator the main circuit breaker should be tripped off so as not to stop or start the generator under load.

OPERATORS MAIN CONTROL PANEL



The operators control panel is divided into three sections. The top two sections relate to the torque arm assemblies left and right. The third section, on the bottom, sets up the machine to work. and relates to both sides.

- 58. Work System Switch
- 59. Axle Indicator LED's
- 60. Drive Indicator LED's
- 61. Work Drive Switch
- 62. Screwing Unit Turn Switch and Indicators
- 63. Semi-Automatic or Automatic Mode Switch
- 64. Screwing Direction Switch
- 65. Not Shown = Screwing Revolution Digital

OPERATORS MAIN CONTROL PANEL

Work System Switch ref.
29-58

A two position switch used to enable the work system pump. This switch must be on in the work mode while torqueing bolts to supply hydraulic power. It should also be on while traveling the machine to provide oil flow to oil cooler fans. The third function that the system pump must be on for is for crane operations.

Axle Indicator LED's ref.
29-59

The axle indicators display which gear the axles are in. They are explained more fully later in the manual starting at page 37.

Drive Indicator LED's ref.
29-60

Indicate the status of the drive system and are more fully explained later in this manual starting at page 41.

Work Drive Switch ref.
29-61

A two position switch used to select work drive. The selection of work drive also places the axles into 1st gear and uses only one drive pump.

Screwing Unit Turn and LED Indicators ref.
29-62

A three position switch used to rotate the screw assembly for working in the reverse direction. The LED's that are adjacent to the switch indicate which direction the machine will be working.

Semi-Automatic / Automatic Mode Switch
29-63

ref.

A three position switch used to select between fully automatic or semi-automatic or the manual mode. In either one of the automatic modes of operation the switches on this panel or the hand control panel before inoperative.

Screwing Routine Loosen, Tighten, or Loosen / Tighten
29-64

ref.

This three position switch signals the processor what function is required.

- The first is Loosen - in loosen the system will use 250 bar of hydraulic pressure to loosen the fixing bolts the number of turns that are required.
- The second is Tighten - in tighten the system will use 100 bar of hydraulic pressure to tighten the bolts, this equates to approximately 300ft/lbs of torque. The tighten mode will last for approximately 5 seconds once the full speed full pressure has initiated.
- The third is Loosen / Tighten - in this mode the system will use 250 bar of hydraulic pressure to loosen the bolts, pause, then tighten the bolts with 100 bar of hydraulic pressure.

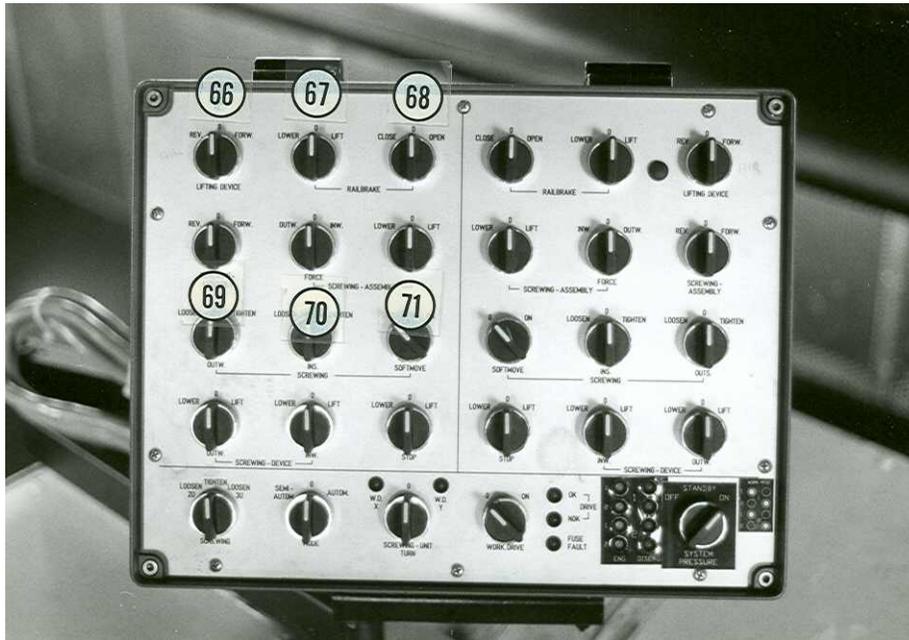
Loosening Revolution Counter
29-65

not shown

ref.

A one section digital used to select the number of revolutions to loosen a bolt.

OPERATORS MAIN CONTROL PANEL



- 66. Lifting Device Forw. / Rev.
- 67. Rail Brake Lift / Lower
- 68. Rail Brake Open / Close
- 69. Screwing Assembly Forw. / Rev.
- 70. Screwing Assembly Force Inw. / Outw.
- 71. Screwing Assembly Lift / Lower

OPERATORS MAIN CONTROL PANEL

Lifting Device Forw. / Rev. ref.
32-66

A three position spring center switch used to activate an air cylinder to move the screw head assembly on one side either forward or reverse in the manual mode.

Rail Brake Lift / Lower ref.
32 -67

A three position spring centered switch used to raise or lower the rail brake assembly for set up of the machine.

Rail Brake Open / Close ref.
32-68

A three position spring centered switch used to open or close the rail brake in Manual mode.

Screwing Assembly For. / Rev. ref.
32-69

A three position switch used to move the lower section of the screw arm assembly forward or reverse in the manual mode.

Screwing Assembly Force Inw. / Outw. ref.
32-70

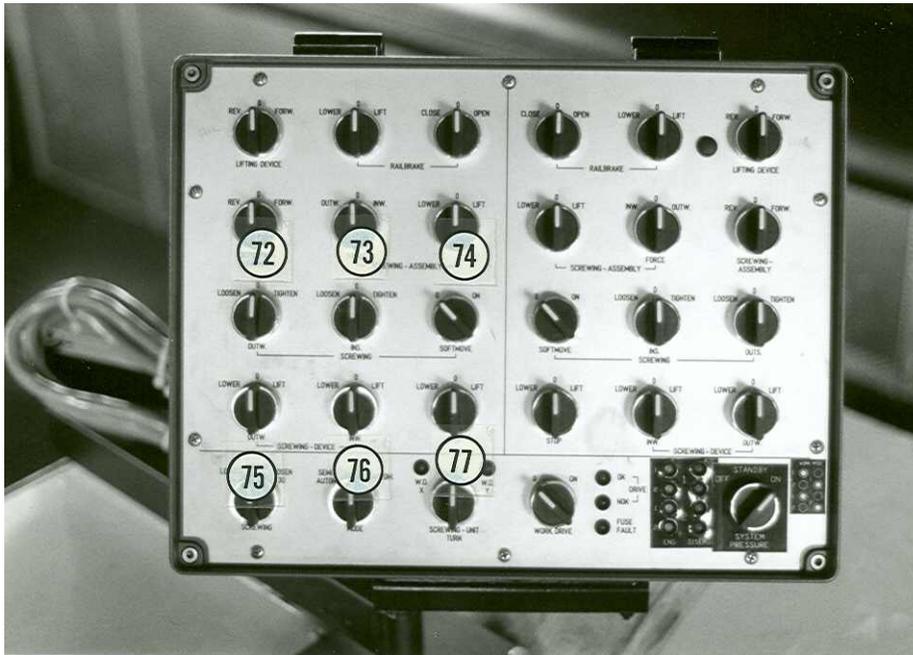
A three position spring centered switch used while setting up the machine to slew the work unit in or out to line up with the rail.

Screwing Assembly Lift / Lower ref.
32-71

A three position spring centered switch used to manually lift or lower the screw assembly.

NOTE: The switches in this section of the panel are only active when the system is in the manual mode of operation. Operating any of these switches while either in semi-automatic or automatic will create no action from any of the functions.

OPERATORS MAIN CONTROL PANEL



- 72. Screwing Rotation Loosen / Tighten (outside)
- 73. Screwing Rotation Loosen / Tighten (inside)
- 74. Soft Move
- 75. Screwing Device Lift / Lower (outside)
- 76. Screwing Device Lift / Lower (inside)
- 77. Stop Lift / Lower

OPERATORS MAIN CONTROL PANEL

Screwing Rotation Loosen / Tighten (outside) ref.
34-72

A three position spring centered switch that manually turns on the rotation of the torqueing motors either to tighten or to loosen.

Screwing Rotation Loosen / Tighten (inside) ref.
34-73

Works the same as the outside but for the inside motor.

Soft Move ref.
34-74

A two position switch used to put the system into the soft mode of operation. The soft mode changes the torque motor drive to slow speed and low torque, this used while trying to get onto the bolt head.

Screwing Device Lift / Lower (outside) ref.
34-75

A three position latching switch used to manually lift or lower the torque motors.

Screwing Device Lift / Lower (inside) ref.
34-76

Same as the switch for the outside.

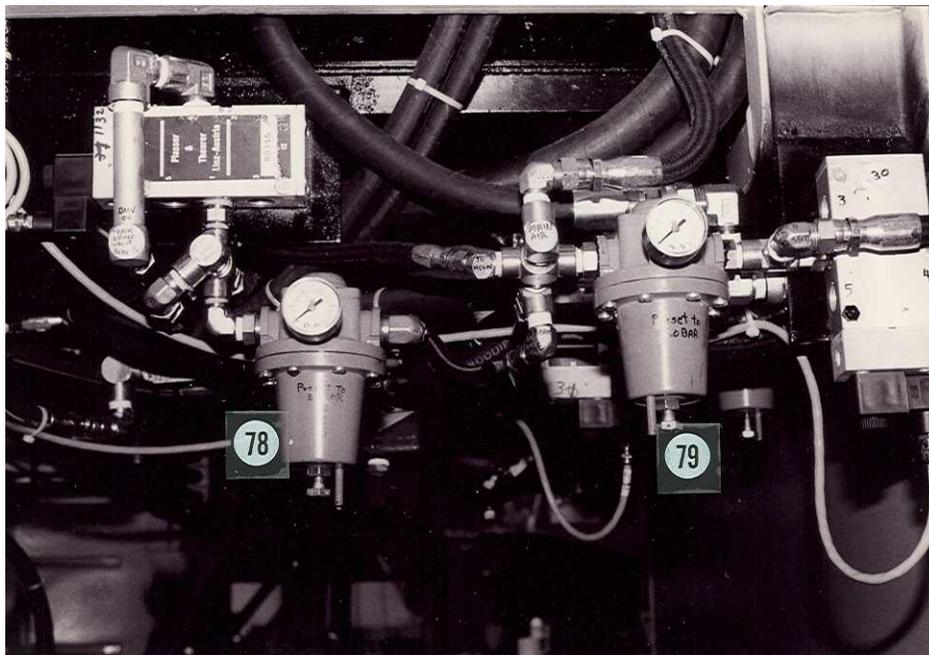
Stop Lift / Lower ref.
34-77

A three position switch used to lift or lower the bolt finder assembly, which includes two torque motors.

NOTE: The switches in this section of the panel are only active when the system is in the manual mode of operation. Operating any of these switches while either in semi-automatic or automatic will create no action from any of the functions.

NOTE: The switches on the right side of the panel are identical in respect to the operation, they work the functions on the opposite side.

AIR VALVES



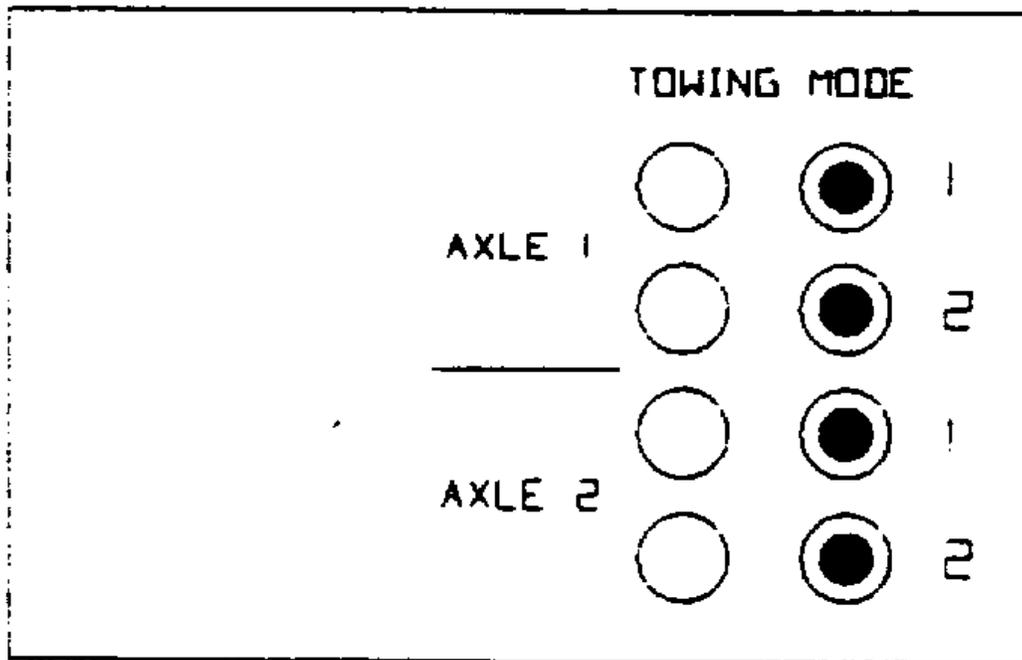
- 78. 5.0 BAR Pressure reducing valve for the brake system
- 79. 3.0 Bar pressure reducing valve for the work brake system.

DRIVE AXLE INDICATIONS

TOWING

When all drive switches are in the “OFF” position, the gears on both axles will be disengaged.

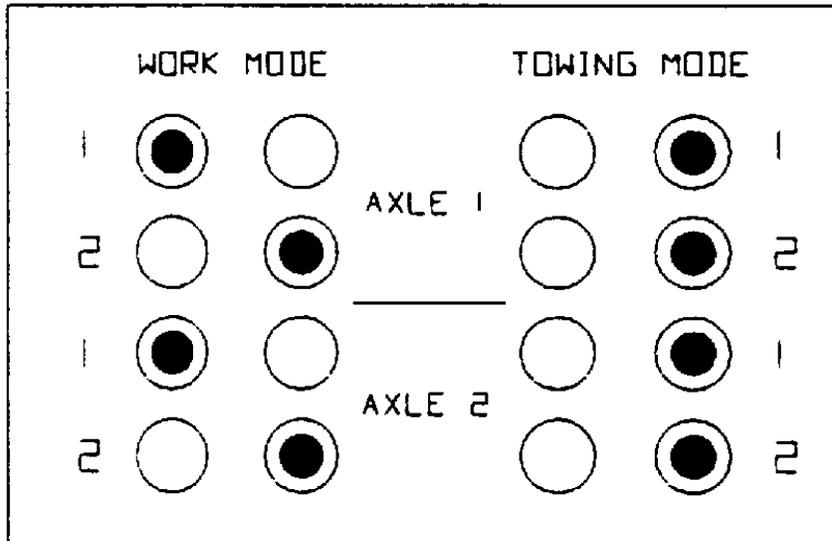
The following LED’s will be illuminated:



	<u>Engaged</u>	<u>Disengaged</u>
Axle #1 Gear #1 ON	YELLOW LED OFF	GREEN LED
Axle #1 Gear #2 ON	YELLOW LED OFF	GREEN LED
Axle #2 Gear #1 ON	YELLOW LED OFF	GREEN LED
Axle #2 Gear #2 ON	YELLOW LED OFF	GREEN LED

WORK DRIVE

This is a low speed drive used while working with the screw units. The work drive on/off switch is located on the operator's control panel. Work drive speed control is located on the operators right hand control box. A latching Drive Stop push button is located on the operators left hand control box. In order to switch work drive on, both Travel Desk Select switches have to be switched OFF. Work drive ON automatically engages the first gear on both axles. The LED's will illuminate as follows.



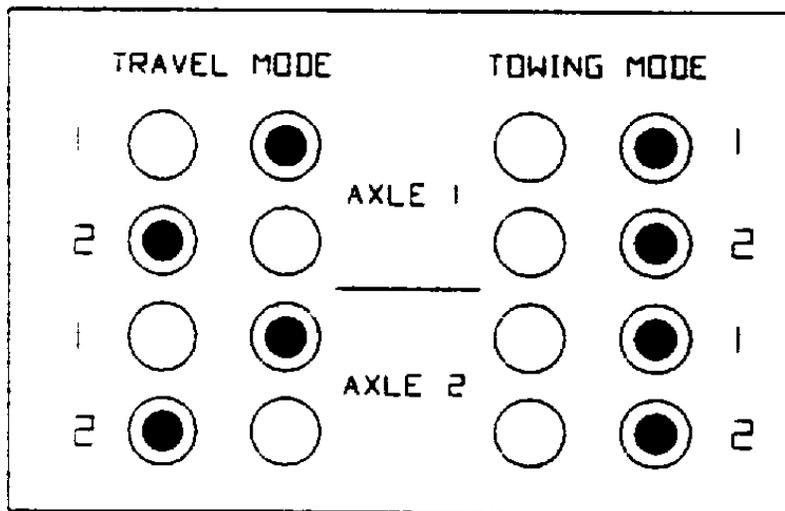
	<u>ENGAGED</u>	<u>DISENGAGED</u>
Axle #1 Gear #1 OFF	YELLOW LED ON	GREEN LED
Axle #1 Gear #2 ON	YELLOW LED OFF	GREEN LED
Axle #2 Gear #1 OFF	YELLOW LED ON	GREEN LED
Axle #2 Gear #2 ON	YELLOW LED OFF	GREEN LED

NOTE: Before switching the Work Drive "ON", activate the Drive Stop push button. The Work Drive Speed Control might not be in the Zero ("0") position.

TRAVEL DRIVE

The second ear is used for traveling. On each engine panel there is a Desk Select (Travel on/off) switch, a Travel Speed control and a latching Drive Stop push button. Work Drive must be switch off. Only the front or rear (both on = drive fault) Travel Desk Select switch may be switched on. Travel drive “ON” automatically selects second gear on both axles.

The following LED’s will illuminate:



ENGAGED

DISENGAGED

Axle #1 Gear #1
ON

YELLOW LED OFF

GREEN LED

Axle #1 Gear #2
OFF

YELLOW LED ON

GREEN LED

Axle #2 Gear #1
ON

YELLOW LED OFF

GREEN LED

Axle #2 Gear #2
OFF

YELLOW LED ON

GREEN LED

NOTE: Each control panel has a label below the row of LED’s which indicates the proper gear lever position for each drive mode.

The operator is responsible for insuring the proper gear selection.

CHANGING GEARS

Before changing gears, the previous gear must be fully disengaged. If a gear doesn't fully disengage, switch back to the previous gear selection and briefly move the machine before disengaging the gears again.

If the LED's indicate that all gear levers are in the disengaged position, you may change gears.

If one gear doesn't fully engage, briefly activate the Drive Control a small amount. This will allow the gears to mesh properly.

Never attempt to move the machine with an undefined gear position indication.

Never attempt to drive the machine while showing gear #1 and gear#2 engaged.

DRIVE INDICATIONS

Every panel has a green LED indicating DRIVE “OK” and a red LED indicating DRIVE “NOT OK”

All possible LED indications are shown below.

Green LED on solid:

- Desk selection = OK and No Drive Stop push buttons activated.

Green LED flashing slowly:

- Desk selection = OK and one of the Drive Stop push buttons activated

Green LED off:

- No Desk selected OR
- Two desks selected at the same time => malfunction

Red LED on solid:

- One of the drive controllers either open or short circuit

Red LED flashing slowly:

- a. In work drive - when the satellite beam reaches the rear position
 - Cuts out the drive in the operators forward or reverse direction.
 - Moving the satellite beam forward of the rear position reactivates the drive.
- b. In Working drive and Manual mode when you index in the operator’s reverse direction and the satellite beam is in the front position and the bolt finder is in the down position.
 - Cuts out the drive in the operator’s reverse direction
 - Raising the bolt finder or moving the satellite back reactivates the drive.

STARTING

1. Before starting the pre-start checks inspect the machine for damage from vandalism.
2. Check the engine oil, the engine coolant, hydraulic oil supply (10-7), fuel supply and battery electrolyte level.
3. At the battery box, insert and turn on the main battery disconnect switch key (7-1).
4. Inside the machine, ensure that all electrical switches are turned off.
5. Ensure the Desk Select switches (24-51) are in the off position.
6. Ensure the work air valves (19-28) is in the off position.
7. Check that the charge LED and the oil pressure LED (24-50) are on.
8. Sound the warning horn (24-55) and depress the push to start push button (24-55) and the start push button. Do not crank the engine for more than 10 seconds continuously, and wait a full minute between starting attempts.
9. When the engine starts, observe the engine gauges (24-44,45,46,48,49) for proper operation, the charge and oil pressure LED's (24-50) will extinguish as the oil pressure comes up to normal and the alternator starts to charge.
10. After the engine has started, turn the system pressure switch (29-58) on the operators control panel to the on position. This **MUST** be on for the hydraulic oil cooler fan to run.
11. Allow the machine to warm up, 5 - 15 minutes, depending on the ambient temperature.

TRAVELING

1. Start and warm-up the machine as previously outlined in the start-up procedure.
2. Ensure that the service brakes are applied by pulling back and latching the direct brake handle on the air brake panel (17-24) by the drive panel that will be used.
3. On one of the drive panels (B5 or B11), turn on the desk select switch 24-51). Zero (0) being “off” and one (1) being “on”.
4. Ensure that both axles are engaged in second gear as indicated by the LED’s on the drive panels. Also the travel enable LED must be on steady.
5. If the travel enable LED is blinking - one of the Drive Stop latching push buttons (24-52, 20-31) is engaged and must be released. To release them they must be twisted slightly clock wise and it will pop out.
6. Release the mechanical hand brake by pulling up on the quick release lever (23-42_.
7. When ready to move raise the engine throttle up to full RPM’s (2100). This ensures a constant pressure and flow from the charge pump to the travel pump to prevent cavitation.
8. Release the parking brake by turning the park brake switch (17-23) on the active air panel. When the park brake releases the light in the switch will extinguish.
9. Release the service brake by pushing fully forward on the direct brake handle until the “Red” needle for brake cylinder pressure (17-21) drops to zero.
10. On the drive control “T” handle, depress the green push button (on the end of the handle) and move the handle off zero in the desired travel direction. The handle up away from the driver moves the machine in the direction the operator is considering forward.
11. After the machine begins to move return the drive control “T” handle to zero and apply the brakes to perform a brake test.
12. After a satisfactory brake test has been completed:
13. Depress the green push button on the drive control “T” handle.
14. Move the drive control “T” handle far enough off zero to achieve the desired travel speed. *Note:* Do not lower the engine speed while traveling the machine.

15. Release the green push button on the drive control “T” handle and the handle will remain at the desired setting until again pushed to release it or a dive stop push button is depressed.
16. To slow down and stop, Depress the green push button on the drive control “T” handle and return the handle to the zero position.
17. There will be a display of pressure on the drive pressure hydraulic gauge indicating dynamic back pressure (or braking) which will help in slowing the machine.
18. Apply the service brakes with sufficient pressure to stop the machine but not slide the wheels.
19. After the machine has stopped and there is no more movement anticipated - engage the parking brake by turning the parking brake switch (the switch will illuminate when the parking brake has applied).
20. Return the engine to an idle (approximately 1000 rpm’s).
21. If leaving the machine unattended, the mechanical hand brake (23-41) should be applied and the air parking brake shall always be set (switch illuminated) when leaving the operators seat.

WORK SET-UP

NOTE: Prior to departure from the yard or side track, it must be determined what the work direction will be. Due to the third rail clearance and the ability to only rotate the work unit out to one side, it may be impossible to rotate the unit once at the job site.

1. Start and warm-up the machine as previously outlined in this manual.
2. After arriving at the job site:
3. Set and latch the service brake by pulling fully back on the direct brake handle.
4. Latch the drive stop push button (20-31) on the left hand control on the seat to be used.
5. Turn off the desk select switch on the driving panel.
6. On the main work panel turn on the system pressure switch if not previously on.
7. Turn on the work air manual valve (19-28) in the cab of the machine to apply air to the work air system. This will also apply the work brakes, which are electrically released through the work brake release valve.
8. Using the portable hand control:
 - a. Plug the hand control into one side of the work unit.
 - b. Raise the rail brake assembly, remove the lock pin and lower the wheel to the track.
 - c. Raise the screw head arm, undue the lock cable and lower it to the track using the inward/outward force switch to center the wheel on the rail.
 - d. Use the lift/lower stop switch to raise, unlock and lower the bolt finder assembly.
 - e. After lowering the bolt finder assembly with the lift/lower stop switch extend the lock again and bring the assembly back up against it.
 - f. After these preparations are complete unplug the hand control and repeat steps 'a thru e' for the opposite side.
9. Back inside the machine:
 - a. On the main work panel select the mode of operation: (2U) Loosen, Tighten, or (3U) Loosen - Tighten.
 - b. If loosening, select the number of revolutions 1-9 with the digital switch.

- c. Select either semi-automatic or automatic mode. At this time the screw heads and the bolt finder assemblies will come up to the full up position and the screw head arms will move to the front position, this is the start position.

WORKING

1. Set-up as previously described.
2. On the work panel select either semi-automatic or automatic mode.
 - a. In semi-automatic the front sensor is inactive and the machine depends on the operator to start the cycle for each side. After initiation of the cycle start the bolt finder lowers to the ready position. Then the sensors are active to complete the cycle.
 - b. In automatic mode the front sensor starts the cycle and the machine will complete the cycle with the other sensors.
3. Raise the throttle up to maximum (2100 rpm's).
4. With the drive control potentiometer at zero
5. Release the drive stop push button by rotating it clock-wise until it pops out.
6. Start the machine moving by rotating the drive control potentiometer clock-wise until it has reached the desired speed.
7. Bring the speed on the machine up, slowly as work progresses. The speed should only be such that the cycle has a chance to complete before the main frame catches up with the satellite unit.
8. There is 10 steps to the complete cycle:
 1. **Go to start position** = When switched to one of the automatics, or the cycle is complete, each unit goes to the start position, which is: 0 bar down pressure on the turn table guide rollers. Rail brakes open. Inner and outer screw motors are raised to the up position. Bolt finder assembly is raised to the up position. 10 bar of side pressure is applied to the screw head arm. Screw head arm up/down cylinder is switched to floating. When the screw head motor and the bolt finder are in the up position: The screw head arm fwd/rev is moved to the front position. The satellite beam is moved to the front position.

2. **Standby in “0” position** = When the satellite beam reaches the front position, the standby mode is activated. The unit will now move with the main frame of the machine.
3. **Bolt finder down** = The front tie plate finder locates the plate and starts the cycle in full automatic mode. The operator starts the cycle in the semi-automatic mode. This causes the bolt finder assembly to go down.
4. **Standby in the bolt finder down position** = When the bolt finder is in the “DOWN” position , the unit is set to locate the bolt.
5. **Screw head arm floating** = When the bolt finder is 50mm before the bolt (detected by the second Ultra-sonic sensor on each side) the screw head arm pressure is switch “OFF” and the arm is switched to float. This allows side adjustment f the bolt finder wedge to align with the bolt.
6. **Satellite beam forward “OFF”** = When the Bolt Finder is press against the bolt it holds the unit back while the main frame continues to move. When the unit has moved back far enough to clear the forward position proximity switch, Satellite beam forward is turned “OFF”. This causes the rail brake to close which prevents longitudinal movement of the screw head arm. At the same time, the screw head arm bypass solenoid is energized, blocking any side movement of the arm. The unit is in a fixed solid position.
7. **Screw head arm fwd/rev cylinder Reverse** = With the unit firmly in place, the screw head arm fwd/rev cylinder will move back so that the sockets will be centered over the bolts.
8. **Screw head motors down, Soft Mode** = When the screw head arm fwd/rev reaches the rear position, proximity switch, the screw head motors will lower and rotate in the Soft mode (low torque, low speed). In this step the sockets will be set on the bolts.
9. **Screw** = When both screw head motors reach their down position, the motors will change from Soft mode to full speed (high speed, high torque).
10. **Screw head motors up, Bolt finder up, Rail brake release** = When the bolts have either been tightened or loosened, both screw heads and the Bolt finder will raise and the Rail Brake will release.

Return to step #1:

Automatic Cycle Interrupt

- The operator can interrupt the automatic cycle for each side independently with the stop joystick.
- This will cause that side to return to step #1.
- If you switch to manual mode (full/semi-automatic—OFF), the cycle is interrupted and all units remain in their present position.

Automatic Cycle Indicator

Each hand control box has a LED above the cycle start/stop joystick indicating the status of the automatic mode.

LED Slow Flashing

- Indicates the unit is in step #2 (standby in “0” position) and ready to continue the cycle with step #3.

LED on Steady

- Indicates the unit is in between automatic step #3 and #10.

LED Fast Flashing

- Indicates the unit has completed the cycle and is now in step #1 (return to start position).

USING THE CRANE

1. Start and warm-up the machine as previously outlined in this manual.
2. When at the sight where the crane is to be used:
3. Plug the hand control into the receptacle on the crane.
4. Lower the lifting cable enough to unhook the hook from the storage point.
5. Using the hand controls the operator can: Rotate the crane, Elevate the boom, Extend or Retract the boom, and Lift or Lower loads with the winch. *Note:* These functions are all hydraulic which means the engine will have to remain running while the crane is in use.
6. The crane is equipped with an electric over load pressure switch that will inhibit the lifting of any loads greater than the capacity of the crane at any angle or extension.
7. If the over load switch detects an over load, the only functions of the crane that will be available are the one that allow the operator to lower the load back down.
8. In the boom up circuit there is a micro switch used to prevent the boom from going above a predetermined angle. This will prevent the boom from going over backwards.

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PRESSURE SETTINGS

HYDRAULIC

Work System	120 bar (1765psi.)
Work System Relief	200 bar (2940 psi)
Oil Cooler Protection	8 bar (120 psi)
Torque Pump Displacement Pressure	18 bar (265 psi)
Loosening Pressure	250 bar (3675 psi)
Tightening Pressure	100 bar (1470 psi)
Logic Block Relief	250 bar (3675 psi)
Drive Pressure Relief	370 bar (5439 psi)
Drive Pump Charge Pressure	24 bar (352 psi)

PNEUMATIC

Main Air System	7-8 bar (103 - 117
psi)	
Low Air Alarm Switch	4.7 bar (70 psi)
Tank safety Relief	10.2 bar (150 psi)
Maximum Brake Pressure	5.0 bar (73.5 psi)
Work Brake	3.0 bar (45 psi)
Parking Brake Pressure Switch	3.0 bar (45 psi)
Drive Cut-out Pressure Switch	1 bar (14.7 psi)
Auxiliary Air System	8.5 bar (125 psi)
Auxiliary Air Compressor Cut off Switch	9.5 bar (140 psi)