REXWORKS

3-90C Trashmaster

Service Training Information

2 Speed Propulsion System

(Effective GJ 185-.....)

Revised 7/1/97

GENERAL PROPULSION COMPONENTS 4-1
HYDROSTATIC DRIVE SYSTEM COMPONENTS 4-2
HYDROSTATIC DRIVE SYSTEMS 4-4
BASIC CLOSED LOOP 4-6
CASE DRAIN & OIL COOLER FLOW 4-8
CHARGE SYSTEM, FILTRATION, & DISPLACEMENT CONTROL 4-10
MULTIFUNCTION VALVES 4-12
LOOP FLUSHING AND CHARGE RELIEF 4-14
OPERATION OF 3-90C PROPULSION SYSTEM 4-16
WORK RANGE 1 OPERATION 4-18
WORK RANGE 2 OPERATION 4-20
OPERATION OF FORWARD AND REVERSE 4-22
PRESSURE CONTROL SERVO CIRCUIT OPERATION 4-24
PCS - WORK RANGE 1 4-26
PCS - WORK RANGE 2 4-28
HYDROSTATIC PUMP/MOTOR - WHEEL SPEED PERFORMANCE 4-30
W1 LOCK-IN VALVE 4-31
LOAD SHEDDING AND TIME DELAY RELAY 4-32
3-90C SYSTEM DIAGRAM 4-34
LOAD CONTROLLER 4-36
AUTOMATIC SHUTDOWN PROTECTION 4-38
AUTOMATIC SHUTDOWN PROTECTION - ANNUNCIATOR 4-40
AUTOMATIC SHUTDOWN PROTECTION - GUAGE PANELS 4-44
WHEEL SPEED PERFORMANCE EVALUATION 4-46
ENGINE RPM DROOP TESTING & ADJUSTMENT 4-47
LOAD CONTROLLER ADJUSTMENTS 4-48
PUMP NULL (NEUTRAL) ADJUSTMENT 4-49
TESTING / ADJUSTING DIFFERENTIAL PRESSURE 4-52
HYDROSTATIC GAUGE INFORMATION 4-54
Pump NULL (Hydraulic Gauge Method) 4-56
Multifunction Valve Testing / Adjustments 4-58
Charge Pressure Relief Valve Adjustment 4-60
HYDROSTATIC PUMP NAME PLATE 4-62
HYDROSTATIC MOTOR NAME PLATES 4-66
PRESSURE CONTROL SERVO VALVE TROUBLESHOOTING 4-70
LOAD CONTROLLER TROUBLESHOOTING 4-72

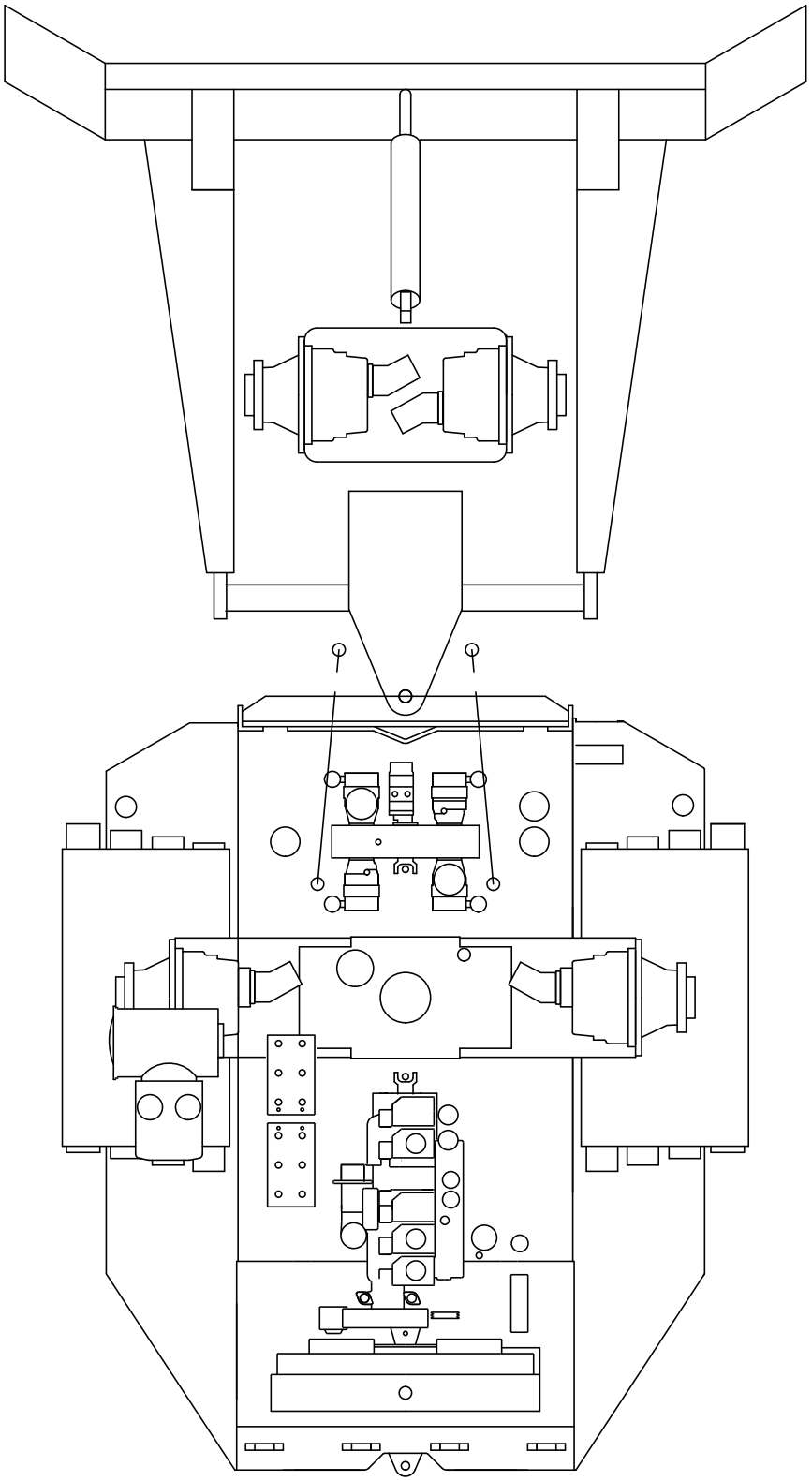
Trashmaster 3-90C

GENERAL - The propulsion system of the Trashmaster 3-90C consists of:

1. Pump Drive Gear Box
2. Four Variable Displacement Hydrostatic Pumps
3. Four Variable Displacement Hydrostatic Motors
4. Pressure Control Servo Valve
5. Hydraulic Disengage Valve
6. W1 Lock-in Valve
7. Four Planetary Final Drives

The integration of hydrostatic drive with electro-hydraulic controls provides the operator with two operating ranges. If the Trashmaster encounters conditions which demand more horsepower than the engine is capable of delivering each of the operating ranges can be throttled back by a load controller. The load controller responds to overload conditions by decreasing the speed of the Trashmaster, to maintain smooth operation in all situations.

Hydrostatic Drive System Components

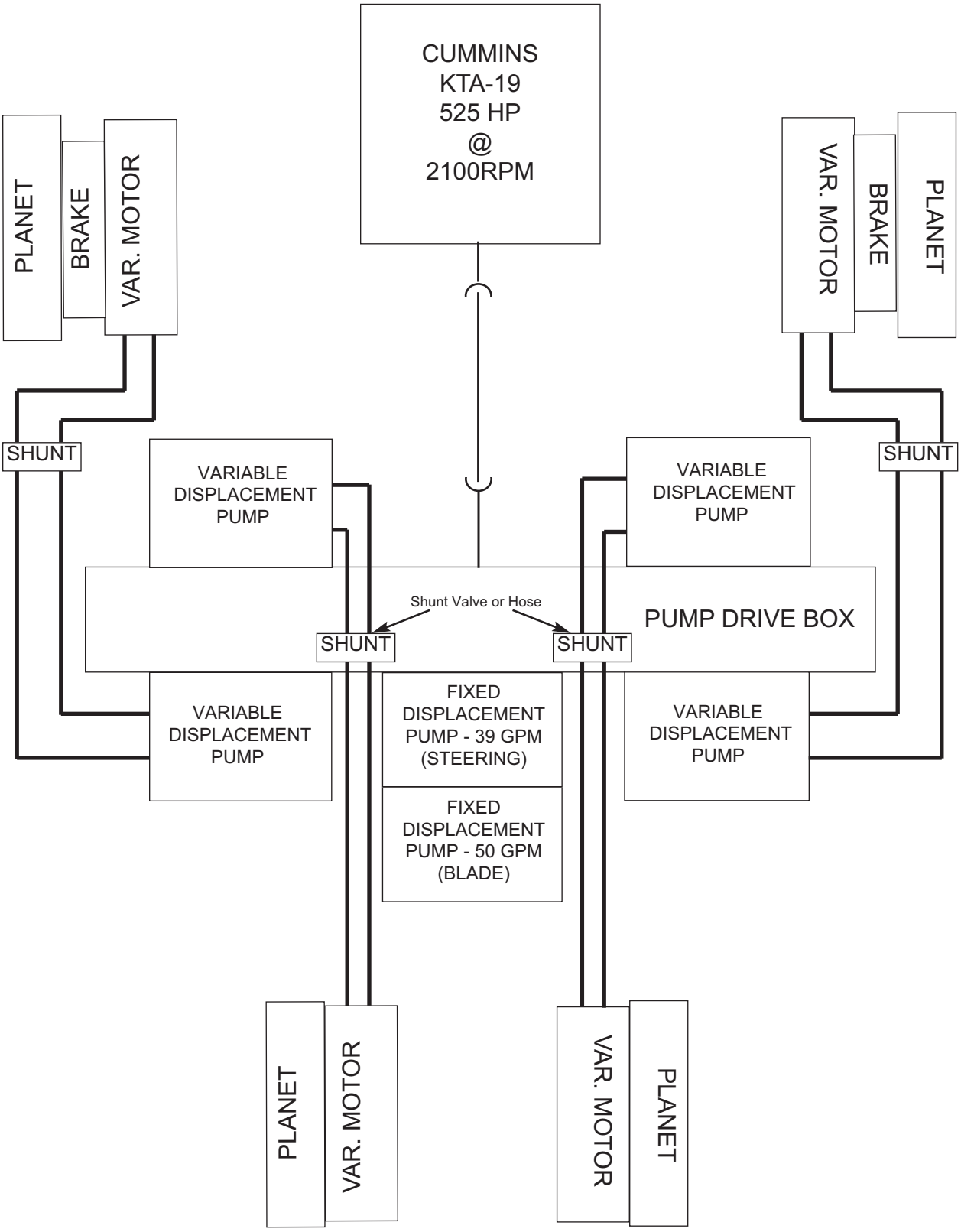


TM-5B

Hydrostatic Drive System Components

Hydraulic Reservoir	Common hydraulic and hydrostatic reservoir fill port. Except on fill these two tanks are essentially independent (connected only by a screen protected inter-tank line which allows fill from the common port).
Filtration	Fill port is protected by a 30 mesh screen. Oil entering the hydrostatic drive tank is filtered by a 141 micron non-bypass strainer. Each of the four charge pump inlets is protected by a single 10 micron non-bypass suction filter with a magnet to capture steel particles. Output of each charge pump is filtered by a 10 micron non-bypass filter before it enters its respective drive circuit.
Charge Pump/Relief	The charge pump is a fixed displacement gear type pump is mounted on end of hydrostatic pump and driven off the main shaft. Charge pressure relief is controlled by a charge relief valves. This valve is set at 350 △PSI (24.1 △Bar).
Hydrostatic Pumps	Four variable displacement axial piston type pumps mounted to a common pump drive gear box.
Pump Drive	Pump drive box is rubber isolated and torsionally protected. Pump spline lubrication is supplied by a gear pump mounted to engine auxiliary drive. The pump drive box oil temperature is monitored by the automatic shut down system and will shut down the engine if the temperature exceeds desired levels.
Hydrostatic Motors	Four variable displacement axial piston type motors mounted to the planetary final drive of each wheel.
High Pressure Control	Each hydrostatic pump includes two 4640 △PSI (320 △Bar) pressure limiting valves and two 5640 △PSI (389 △Bar) high pressure crossover relief valves. These pressure control devices are part of a multi-function cartridge valve located in each Forward and Reverse) hydrostatic pump high pressure circuit.
Oil Cooler	Steel (.010” fins) hydrostatic oil cooler assembled next to radiator. The oil cooler is protected by a 180° F (82° C) thermostatically controlled oil cooler bypass valve.
PCS Valve	Provides signal pressures to control what displacement the hydrostatic pumps and motors operate at. This valve also controls the direction the system drives the 3-90C and has a manual operator for troubleshooting purposes.
Hydraulic Disengage	This valve is located below the PCS valve and prevents hydrostatic pump engagement when the brakes are applied. This solenoid should be energized in all speeds.
W1 Lock-in Valve	This valve is located below the PCS valve and blocks signal pressures to each hydrostatic motor “locking” the motor at maximum displacement in Work Range 1. This solenoid should be energized in Work Range 2 only.

Hydrostatic Drive Systems



4

Hydrostatic Drive Systems

Hydrostatic drive systems contain a number of components. On the 3-90C, those components would include:

Pumps — The Trashmaster 3-90C system utilizes four variable displacement pumps, one for each drive wheel. The pumps are activated by the load controller as engine speed is increased to the proper (approximately 1650) RPM.

Motors — Located at the input shaft of each planetary final drive housing. Each hydrostatic motor drives the shaft by means of a splined coupler. These motors are variable displacement, which contributes to the ability to provide two operating speeds.

Lines — High pressure hoses are used to provide a means transmit hydraulic flow from the pumps to the motors and back.

Hydrostatic drive has the following advantages over conventional gear drive systems.

Ease Of Control — As the engine pulls down the load controller automatically decreases the flow from each pump, thereby reducing the horsepower requirement from the engine. As the engine speed recovers the load controller increases pump flow to increase the working speed of the 3-90C.

Speed Variability — Since the hydrostatic pumps flow can be varied an infinite amount the load controller can be used to "fine tune" the pumps out put. This means that as the engine pulls down the load controller automatically decreases the flow from the pump, thereby reducing the horsepower requirement from the engine just enough to allow the 3-90C to proceed at optimum speed. As the engine speed recovers the load controller increases pump flow to increase the working speed of the machine. There is no need to stop to change drive gear ratios.

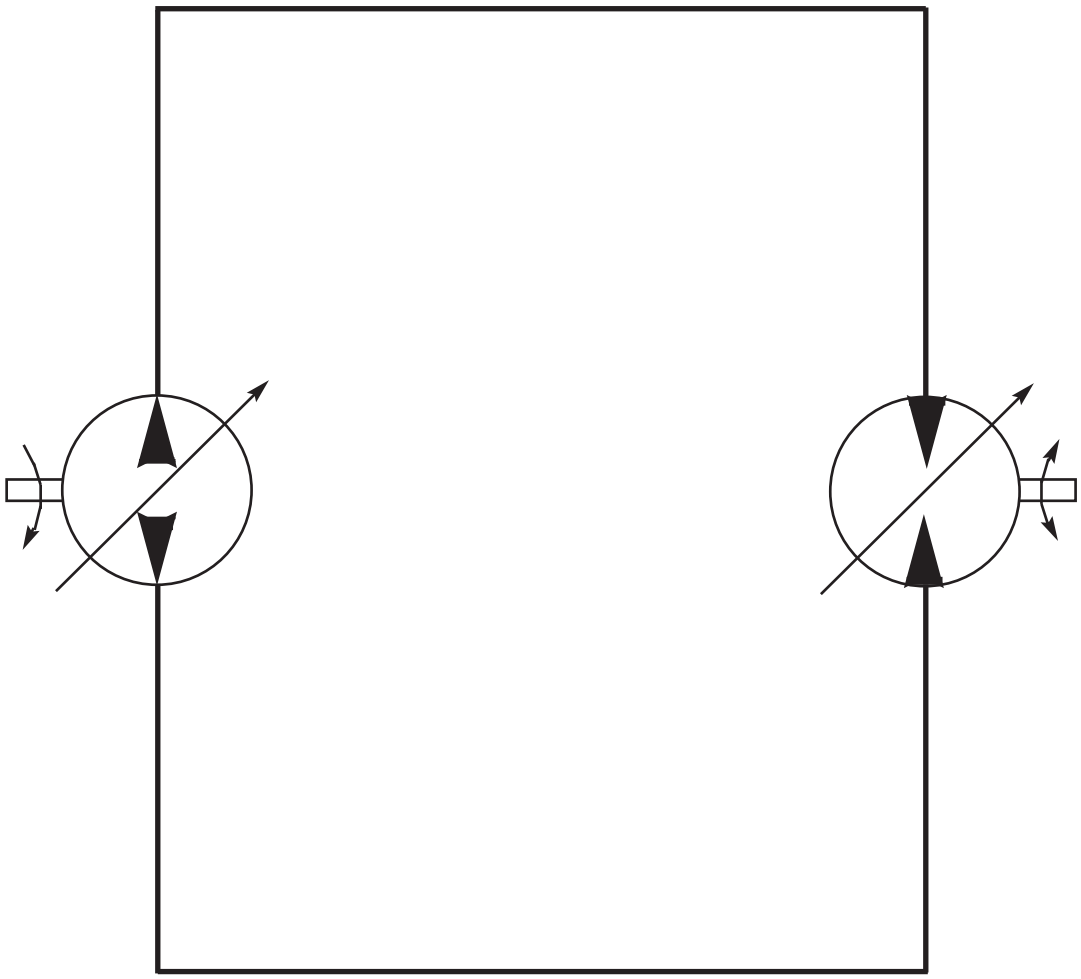
Force Multiplication — In a hydrostatic drive system, smaller forces can be used to move large loads by increasing the displacement of the motor. This allows Work Range 1 to be used to move large blade loads. Work Range 2 should be used with no blade load or backing down slopes.

Power Distribution — Because each wheel is driven by a separate hydrostatic system, the drive pressures and flows operate independently at each wheel. This means that even though one wheel may lose traction momentarily the other three will continue to pull until that wheel regains its tractive footing.

NOTE

All 3-90C Trashmasters are equipped with shunt valves or hoses.

Basic Closed Loop Circuit



3-90C Hydrostatic Components And Basic Closed Loop Circuit

The hydrostatic pump is a variable displacement pump and is controlled by a compact and responsive electro-hydraulic, control system. In the case of the 3-90C these hydrostatic pumps are controlled by a hydraulic input signal provided by the pressure control servo (PCS) valve.

Charge Pump - Each hydrostatic pump will include the charge pump and associated valving to provide the necessary flow for the following functions:

1. Make-up for leakage within the system.
2. To operate the control circuit (right rear charge pump only).
3. To provide the necessary volume to cool the hydrostatic system.

Multifunction Valves - Each hydrostatic pump contains two multifunction cartridge valves. These valves are designed into the pump housing to provide the following functions:

1. Check valve.
2. Pressure limiter.
3. High pressure relief valve
4. Bypass functions.

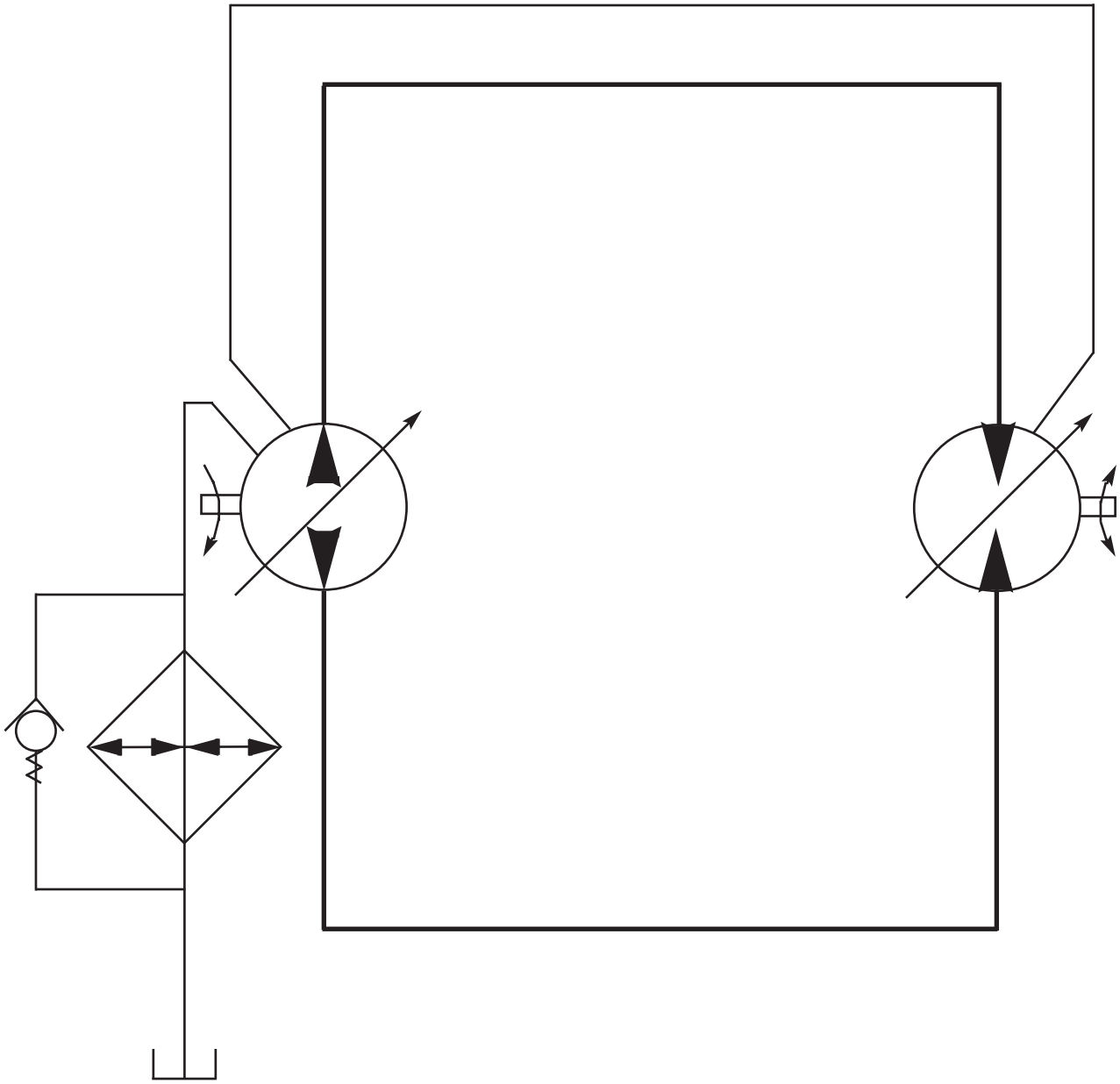
NOTE

Maximum drive circuit operational pressure is controlled by the multifunction valves and referenced to charge pressure.

Circuit Flushing and Cooling - The variable displacement motors also use the axial piston design, in conjunction with a variable displacement swash plate and a mechanical limiter. Valving within the motors (flushing / charge relief valve) are located in the hydrostatic motor end cap to provide cooling and flushing functions for the hydrostatic system.

Basic Closed Loop Circuit - The main ports of the pump (labeled A and B) are connected in a closed loop by high pressure hydraulic lines to the main ports of the motor. Hydraulic fluid flows from the pump to the motor, then back to the pump (in either direction).

Case Drain And Oil Cooler Flow



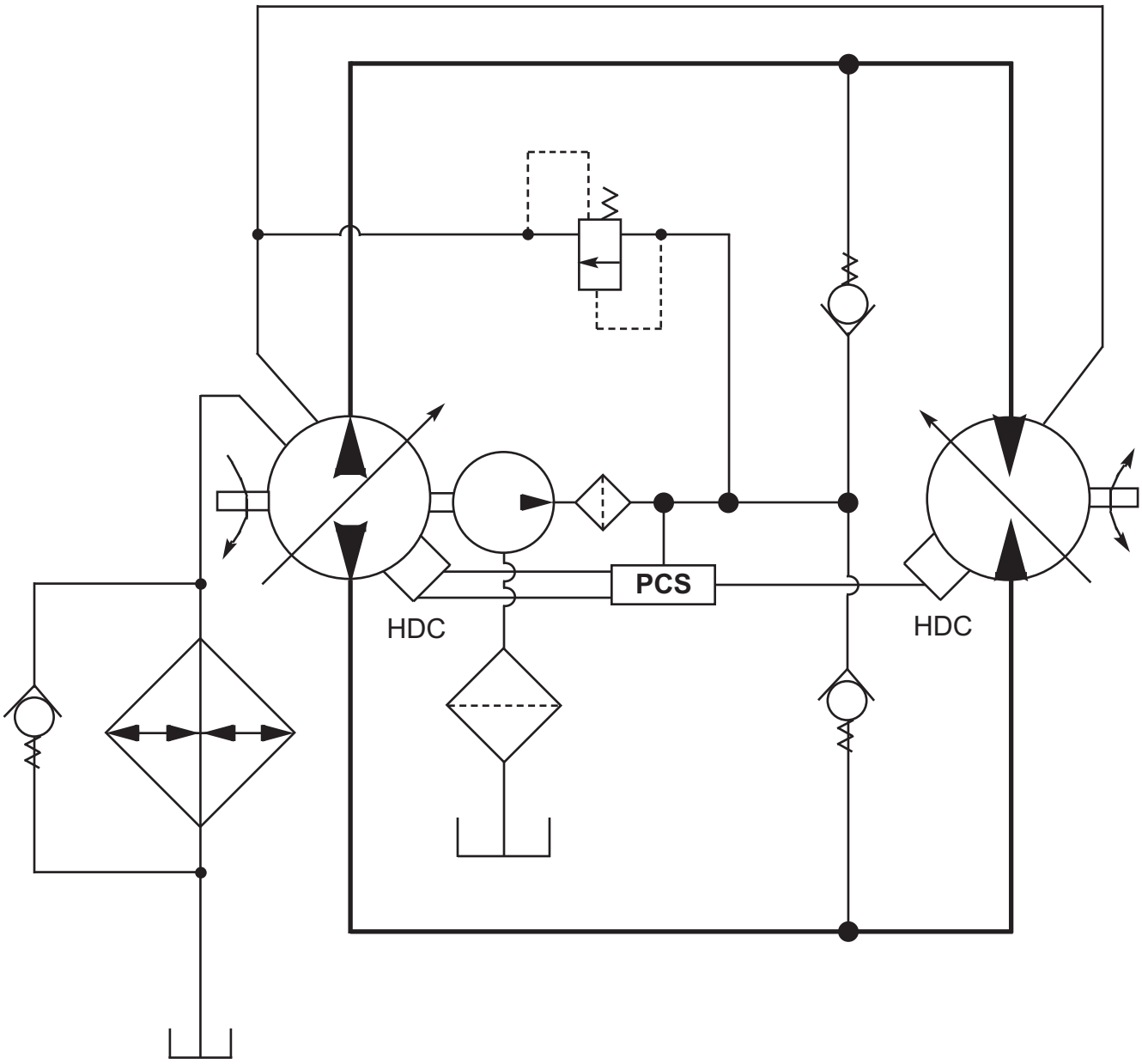
4

Case Drain And Oil Cooler Flow

Case Drain - Both the pump and the motor will experience internal leakage. For this reason the pump and motor will require a method to remove this oil from the system. This method is called case drain. To insure that no air will be allowed into the system the housing should be drained from the highest point. The 3-90C the case drain circuit is collected in a manifold near the left side of the machine. This oil is directed to the oil cooler and then back to the hydrostatic reservoir.

Hydrostatic Oil Cooler - All case drain oil is channeled through an oil cooler located next to the radiator before it is returned to the reservoir. The oil cooler will be protected from extreme pressures by a bypass valve. In the event the of low temperature operation, the bypass valve will react thermostatically (180° F/82° C and below) to provide a warm-up feature.

Charge System, Filtration, And Displacement Control



4

Charge System, Filtration, And Displacement Control

Charge System - A fixed displacement gerotor gear type pump is installed in the variable displacement pump housing and driven off the main shaft. The charge pump supplies cool fluid to the system to make up for the oil that was returned to the reservoir through case drain (this is called charge). The charge circuit also supplies oil to operate the control system. Charge pressure with the 3-90C in neutral (zero flow) is limited by a relief valve (located in the hydrostatic pump housing) set at 350 PSI (24.1 Bar) above case pressure at 1800 pump RPM. Charge pressure with the 3-90C in operation is limited by a relief valve located in the hydrostatic motor housing.

NOTE

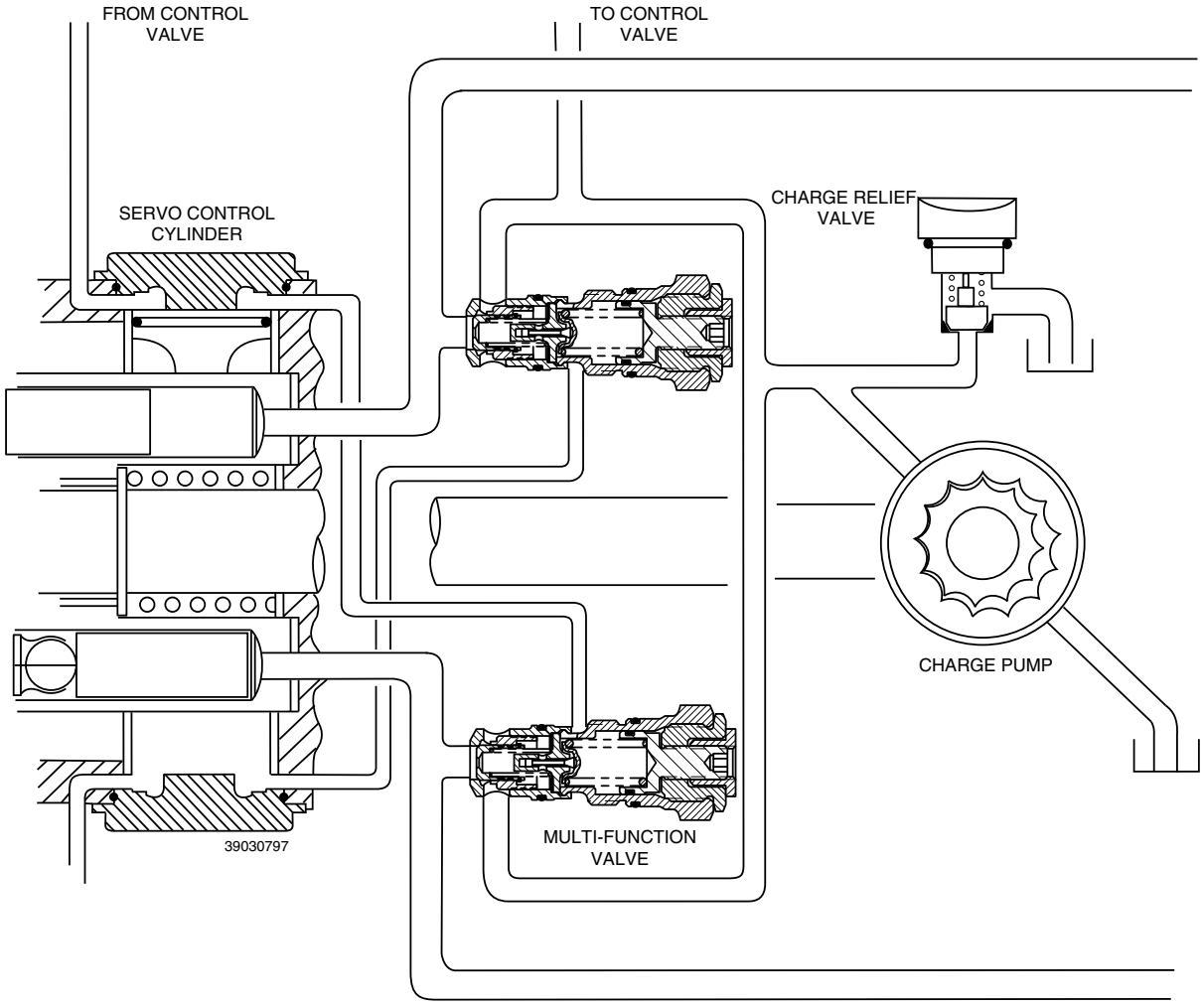
Charge pressure will be less with the 3-90C in operation than when in neutral.

Since either of the main hydraulic lines could be under high pressure, there will be a charge check valve in each side of the hydrostatic circuit. These check valves will be contained in multi-function valves located in the pump end cap.

Inlet and Outlet Filtration - The charge pump draws fluid from the reservoir through an inlet filter to insure that only clean oil enters the charge pump. This inlet filter is a 10 micron non-bypass suction filter that includes a magnet to trap any iron particles in the oil. At the outlet of each charge pump is a 10 micron non-bypass filter to insure that only clean oil enters the closed loop circuit.

Hydraulic Displacement Control - The hydraulic displacement control system used on the 3-90C Trashmaster uses a hydraulic signal to operate a spring centered four way servo valve. The servo valve will port hydraulic pressure to either side of a double acting servo piston. The servo piston controls the swash plate through an angular rotation of + 17^{o} in forward to - 17^{o} when the 3-90C operates in the reverse direction. This can vary the pumps displacement from full displacement in one direction to full displacement in the opposite direction.

Multifunction Valves



4

Multifunction Valves

General - The hydrostatic pumps used on the 3-90C Trashmaster are designed with a sequenced pressure limiting system and high pressure relief valves. Both the pressure limiting and pressure relief valves are located in the multi-functional valves assembled into the pump end cap.

NOTE

Pressure limiter and relief valve pressures are always referenced to operational charge pressure.

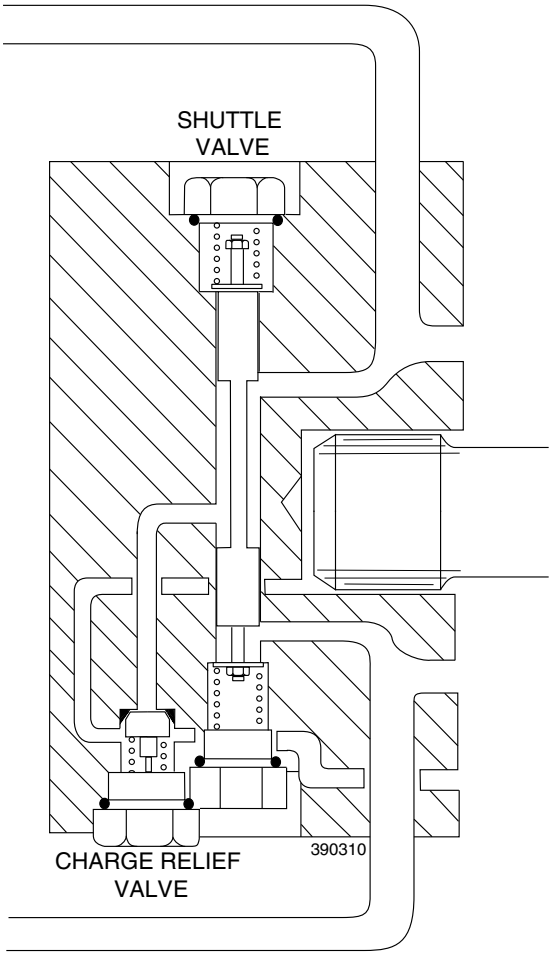
Pressure Limiter - When a preset pressure of 4640 △PSI (320 △Bar) is reached, the pressure limiter reacts to control the displacement of the pump so the pump outlet pressure will not increase any further.

When the set pressure 4640 △PSI (320 △Bar) is exceeded the pressure sensing valve ("A") allows oil to flow through passage "B" into the servo piston. The servo-piston then decreases the flow from hydrostatic pump. As the flow decreases, the pressure is controlled to a value below the pressure limiter valve setting. As conditions stabilize, normal function will return.

The pressure limiter avoids system over heating associated with simple relief valves.

High Pressure Relief - The pressure relief valve section is available to limit any pressure spikes which might exist while operating in extreme conditions. If extreme load application were to occur, a high pressure relief valve is also available to limit pressure to 5640 △PSI (389 △Bar). The pressure limiting sensing poppets also act as pilot valves for the relief valve spools such that the relief valves are sequenced to operate at pressures above the de-stroke pressure level. This means that the pressure relief valve will act at a pressure of 1000 PSI (69 Bar) above the pressure level that the pressure limiter valve operates at.

Loop Flushing And Charge Relief



4

Loop Flushing And Charge Relief

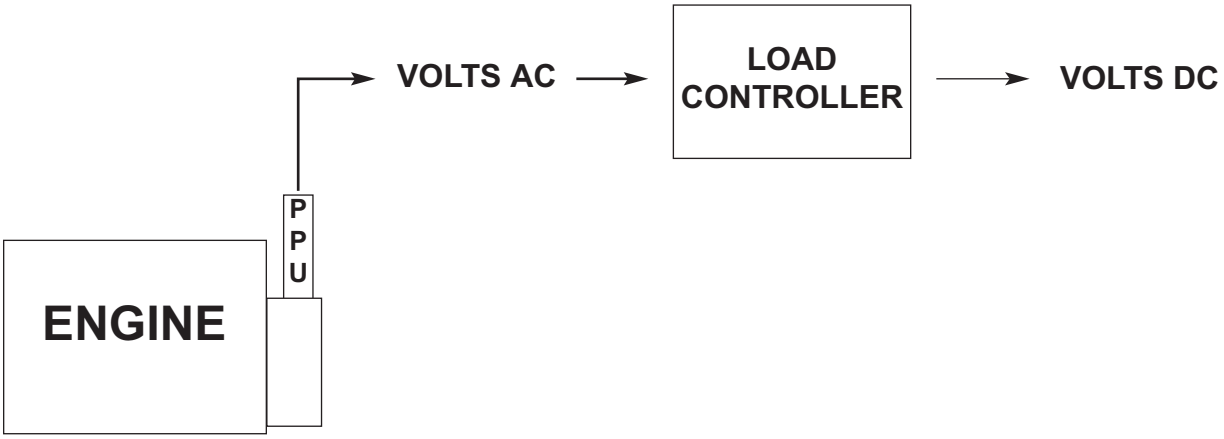
Loop Flushing Valve - A shuttle valve and charge relief valve are built into the hydrostatic motor end cap to provide the 3-90C hydrostatic system with a flushing (cleaning) function. The shuttle valve provides a passage between the low pressure side of the closed loop and the charge relief valve in the motor end cap. Due to the movement of the shuttle valve only one charge relief valve is necessary in each motor end cap.

Hydrostatic Motor Charge Relief Valve - The hydrostatic motor charge relief (located in the hydrostatic motor housing) is normally set at a slightly lower value than the hydrostatic pump charge relief. This relief valve regulates the charge pressure level when there is a difference in pressures in the main loop (during machine operation). The shuttle is spring centered to the closed position so no high pressure fluid is lost during transitions from forward to reverse.

NOTE

Because the hydrostatic motor charge relief regulates the charge pressure when there is a difference in pressures in the main loop the hydrostatic motor charge relief valve is monitored with the machine in operation.

General Operation of 3-90C Trashmaster Propulsion System



1650 -2100 RPM

Load Controller DC Output Voltage Is A Function Of Engine RPM	
Engine RPM	**Volts DC**
800 RPM	Volts DC
1650 RPM	Volts DC
2100 RPM*	**21 Volts DC***
2250 RPM	23 Volts DC

4

*** 2100 RPM is the engine speed used for adjustment of load controller RPM droop set point. Set point voltage shown is effective with S/N GJ 197 (except GJ 200). For more information refer to Engine RPM Droop Testing And Adjustment in this manual.**

General Operation of 3-90C Trashmaster Propulsion System

General - During operation,the engine speed is monitored by a magnetic pulse speed pick up (PPU) sensor. The PPU develops an AC voltage signal which is proportional to the engine speed. The load controller will monitor that AC signal and supply a DC Voltage to the PCS valve coils. The load controller should be adjusted so that at an engine speed of 2100 RPM, the load controller output voltage will be 21 Volts DC. The voltage signal will be used in conjunction with the load controller to operate the Pressure Control Servo Valve. By using the load controller to operate the PCS valve consistent load requirements on the engine will be maintained.

NOTE

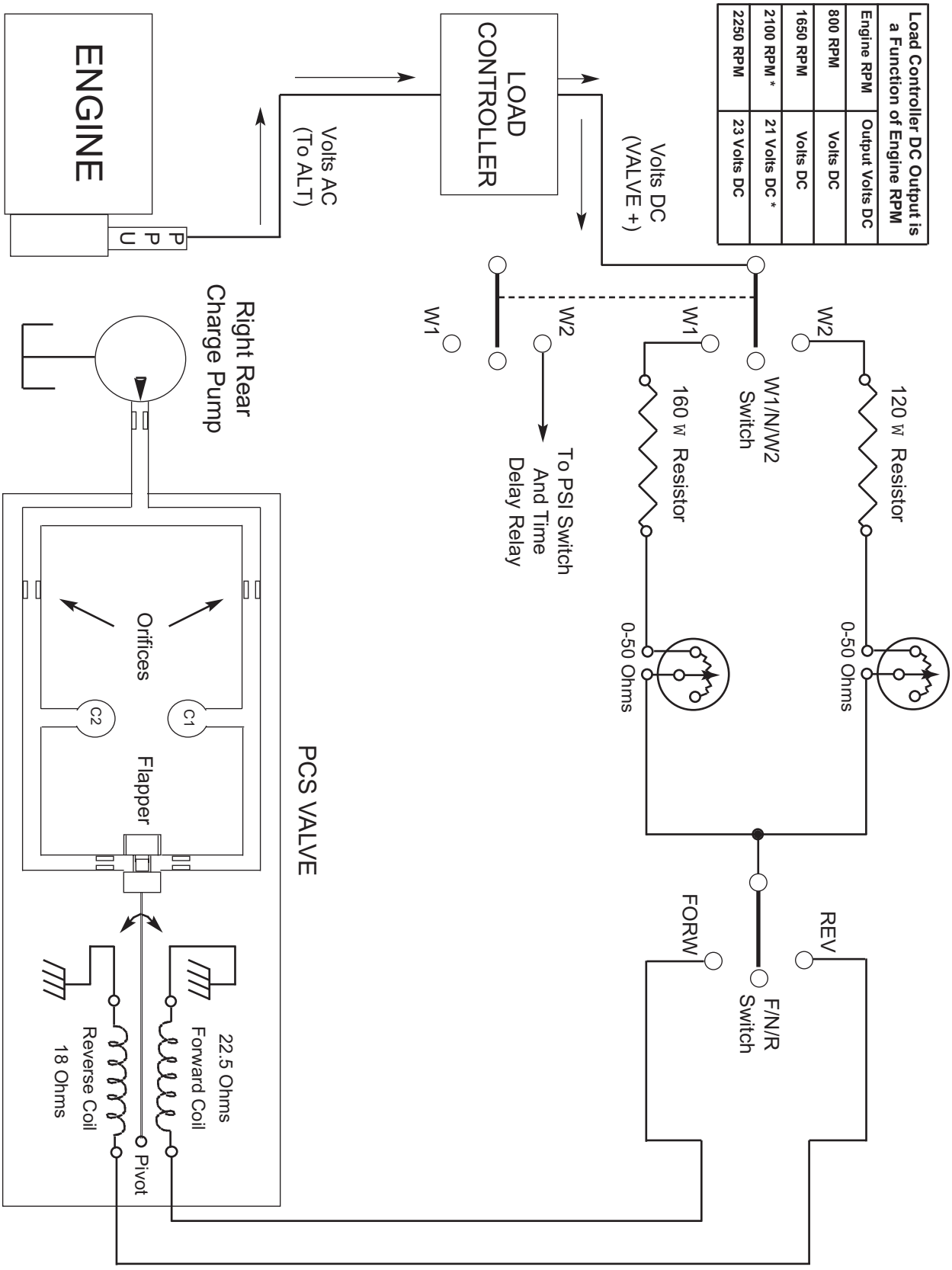
Engine speed of the 3-90C is monitored by two magnetic pulse pick-up sensors. One pick-up sensor is used to provide a signal for the tachometer. One pick-up sensor is used to provide a signal for the load controller and automatic shutdown annunciator.

4

*** 2100 RPM is the engine speed used for adjustment of load controller RPM droop set point. Set point voltage shown is effective with S/N GJ 197 (except GJ 200). For more information refer to Engine RPM Droop Testing And Adjustment in this manual.**

Work Range 1 Operation

Load Controller DC Output is a Function of Engine RPM	
Engine RPM	Output Volts DC
800 RPM	Volts DC
1650 RPM	Volts DC
2100 RPM *	21 Volts DC *
2250 RPM	23 Volts DC



4

Work Range 1 Operation

General Operation - In all both operating ranges, an electrical supply will be fed to the work range selector switch (located in the LH control lever). If the operator selects either work operating range, the voltage will then be fed to a fixed resistor. The size of the fixed resistor is as follows:

Operating Range	Resistor Size Effective With S/N GJ 197
Work Range 1	160 Ohms
Work Range 2	120 Ohms

From the fixed resistor voltage is available to a variable resistance rheostat to the F/N/R switch and the appropriate PCS valve coil.

Work Range 1 - If the operator selects the W1 switch position, the voltage signal will be fed from the work range selector switch to the 160 Ohm resistor, through a variable rheostat set nominally at 25 Ohms (midpoint), and the into the F/N/R rocker switch (located in the RH control lever). The total resistance of this part of the circuit will be approximately 175 Ohms plus any Pressure Control Servo (PCS) solenoid coil resistance.

Work Range 2 - If the operator selects the W2 switch position, the voltage signal will be fed from the work range selector switch to the 120 Ohm resistor, through a variable rheostat set nominally at 25 Ohms (midpoint), and the into the F/N/R rocker switch (located in the RH control lever). The total resistance of this part of the circuit will be approximately 145 Ohms plus any Pressure Control Servo (PCS) solenoid coil resistance.

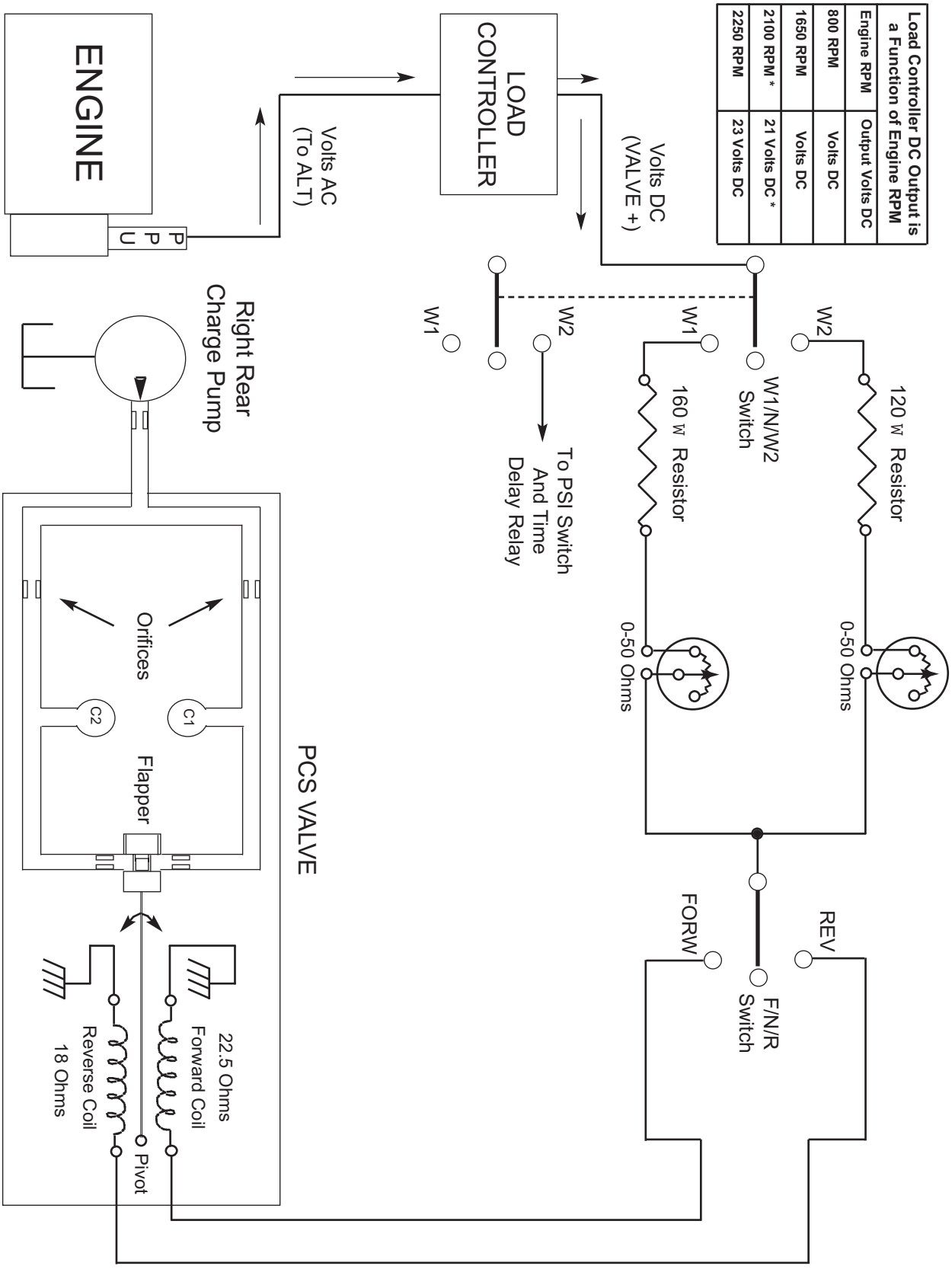
Operating Range	Circuit Resistance Forward	Circuit Resistance Reverse
Work Range 1	207 Ohms Nominal	203 Ohms Nominal
Work Range 2	167 Ohms Nominal	163 Ohms Nominal

IMPORTANT

2100 RPM is the engine speed used for adjustment of load controller RPM droop set point. Set point voltage shown is effective with S/N GJ 197 (except GJ 200). For more information refer to Engine RPM Droop Testing And Adjustment in this manual.

Work Range 2 Operation

Load Controller DC Output is a Function of Engine RPM	
Engine RPM	Output Volts DC
800 RPM	Volts DC
1650 RPM	Volts DC
2100 RPM *	21 Volts DC *
2250 RPM	23 Volts DC



4

Work Range 2 Operation

General Operation - In all both operating ranges, an electrical supply will be fed to the work range selector switch (located in the LH control lever). If the operator selects either work operating range, the voltage will then be fed to a fixed resistor. The size of the fixed resistor is as follows:

Operating Range	Resistor Size Effective With S/N GJ 197
Work Range 1	160 Ohms
Work Range 2	120 Ohms

From the fixed resistor voltage is available to a variable resistance rheostat to the F/N/R switch and the appropriate PCS valve coil.

Work Range 1 - If the operator selects the W1 switch position, the voltage signal will be fed from the work range selector switch to the 160 Ohm resistor, through a variable rheostat set nominally at 25 Ohms (midpoint), and the into the F/N/R rocker switch (located in the RH control lever). The total resistance of this part of the circuit will be approximately 175 Ohms plus any Pressure Control Servo (PCS) solenoid coil resistance.

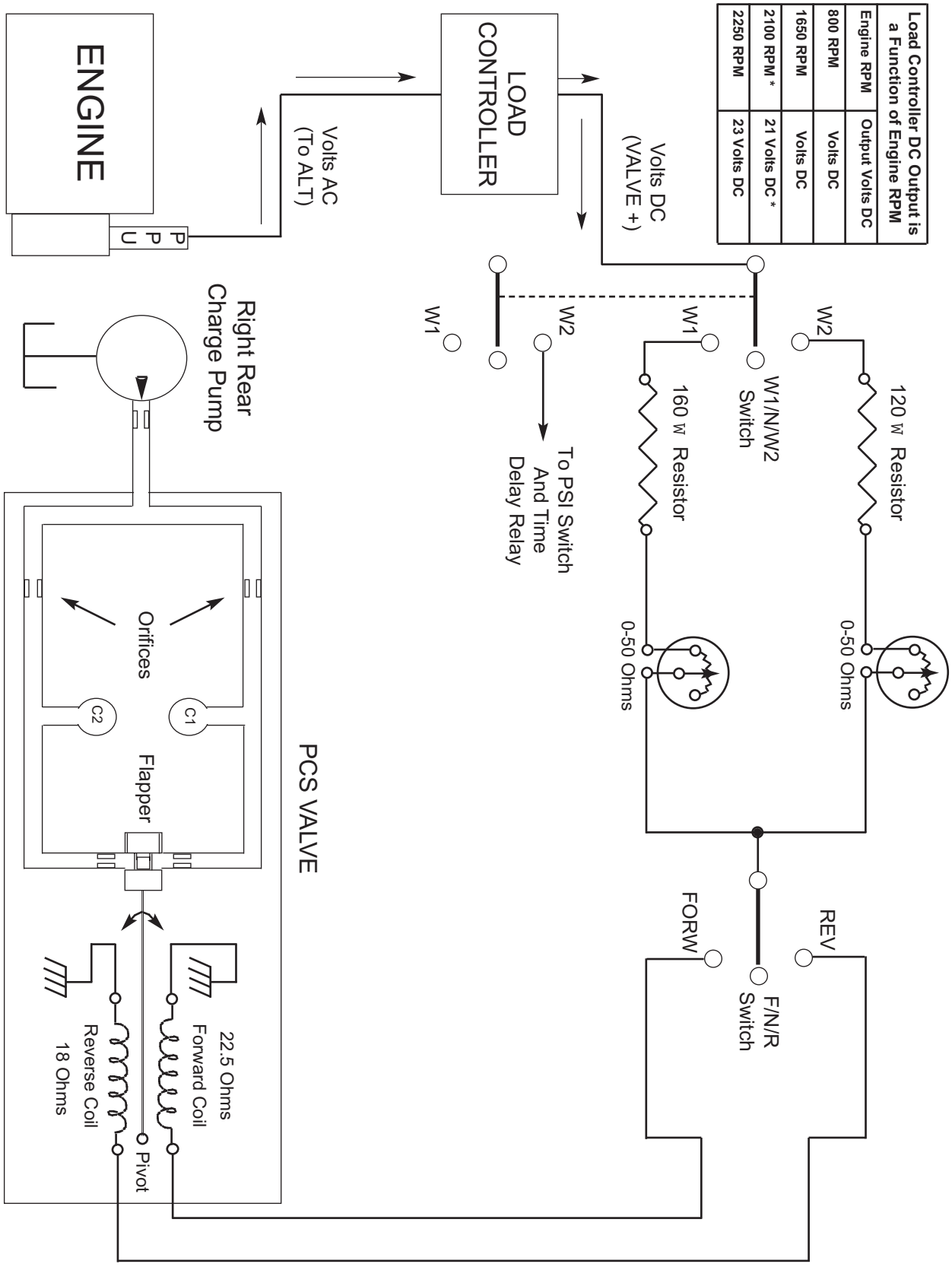
Work Range 2 - If the operator selects the W2 switch position, the voltage signal will be fed from the work range selector switch to the 120 Ohm resistor, through a variable rheostat set nominally at 25 Ohms (midpoint), and the into the F/N/R rocker switch (located in the RH control lever). The total resistance of this part of the circuit will be approximately 145 Ohms plus any Pressure Control Servo (PCS) solenoid coil resistance.

Operating Range	Circuit Resistance Forward	Circuit Resistance Reverse
Work Range 1	207 Ohms Nominal	203 Ohms Nominal
Work Range 2	167 Ohms Nominal	163 Ohms Nominal

IMPORTANT

2100 RPM is the engine speed used for adjustment of load controller RPM droop set point. Set point voltage shown is effective with S/N GJ 197 (except GJ 200). For more information refer to Engine RPM Droop Testing And Adjustment in this manual.

Operation In Forward Or Reverse



Operation In Forward Or Reverse

After passing through the Forward/Neutral/Reverse rocker switch, DC power will be fed to a fixed resistor, variable resistance rheostat, and then the Pressure Control Servo (PCS) Valve forward or reverse coil.

Forward

1. If the operator selects the forward switch position, the voltage signal will be fed through the forward coil with a resistance value of approximately 22 Ohms. The total resistance of the circuits will be as follows:

Operating Range	Circuit Resistance Forward	Circuit Resistance Reverse
Work Range 1	207 Ohms Nominal	203 Ohms Nominal
Work Range 2	167 Ohms Nominal	163 Ohms Nominal

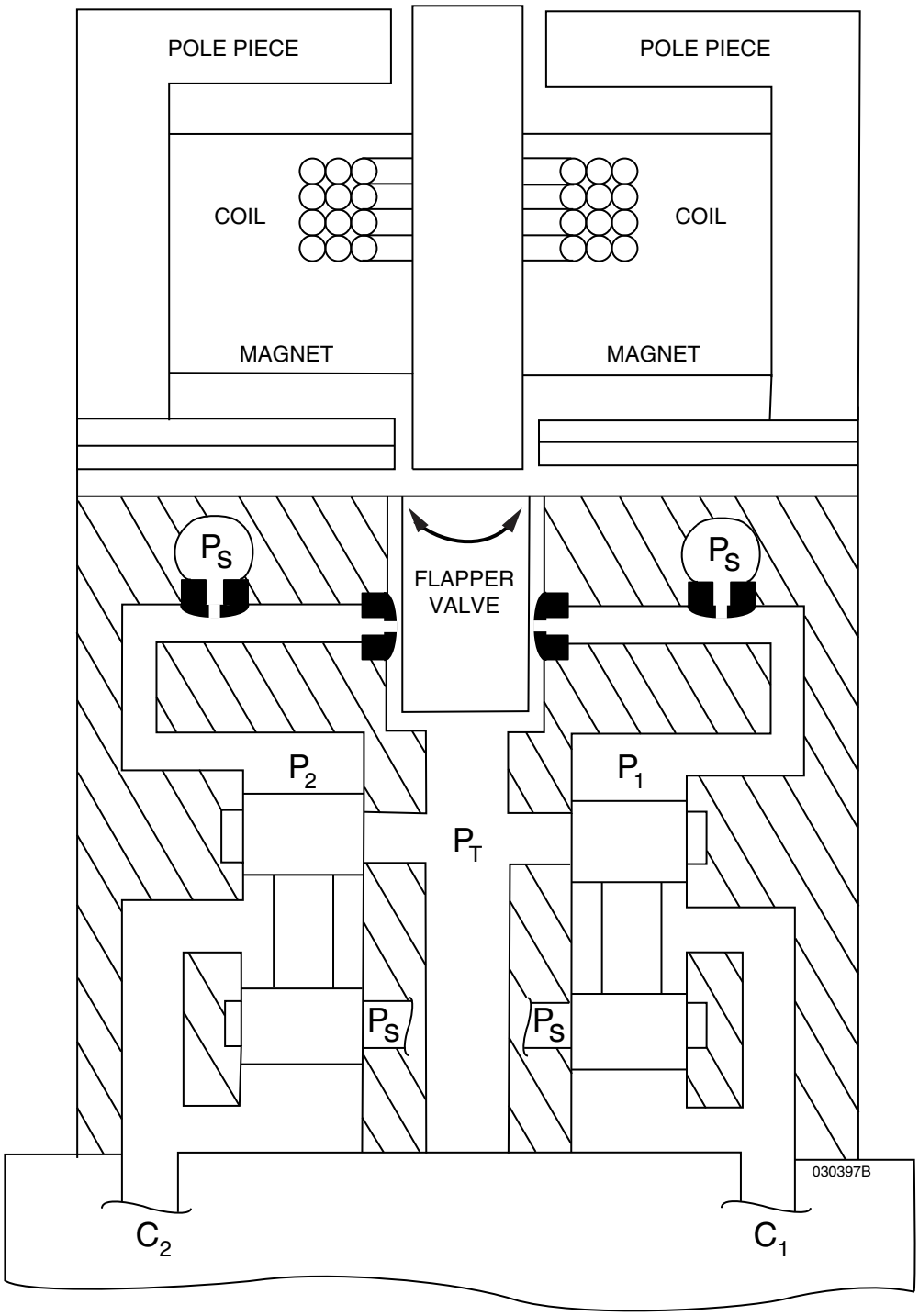
Reverse

1. If the operator selects the reverse switch position, the voltage signal will be fed through the reverse coil with a resistance value of approximately 18 Ohms. The total resistance of the circuits will be as follows:

Operating Range	Circuit Resistance Forward	Circuit Resistance Reverse
Work Range 1	207 Ohms Nominal	203 Ohms Nominal
Work Range 2	167 Ohms Nominal	163 Ohms Nominal

PCS Valve Response - The PCS valve is responsive to changes (varying amounts) in electrical current. It will utilize the current to develop two separate PCS control pressure circuits. These control pressures are referred to as C1 and C2 (high and low sides) and will be used to control the displacement of the hydrostatic pumps and motors during operation. The load controller will vary the output voltage if the engine speed (RPM) changes. As the output voltage changes, the amount of available current will change as well. This change in current will affect the control pressures. As the current decreases, the control pressure will be closer to each other. As the current increases the control pressures will be farther apart. Anytime the control pressure are closer together the 3-90C speed will decreases. Controlling output voltage (and current) allows the load controller to control the horse power requirement by controlling the speed the machine moves.

Pressure Control Servo Circuit Operation



4

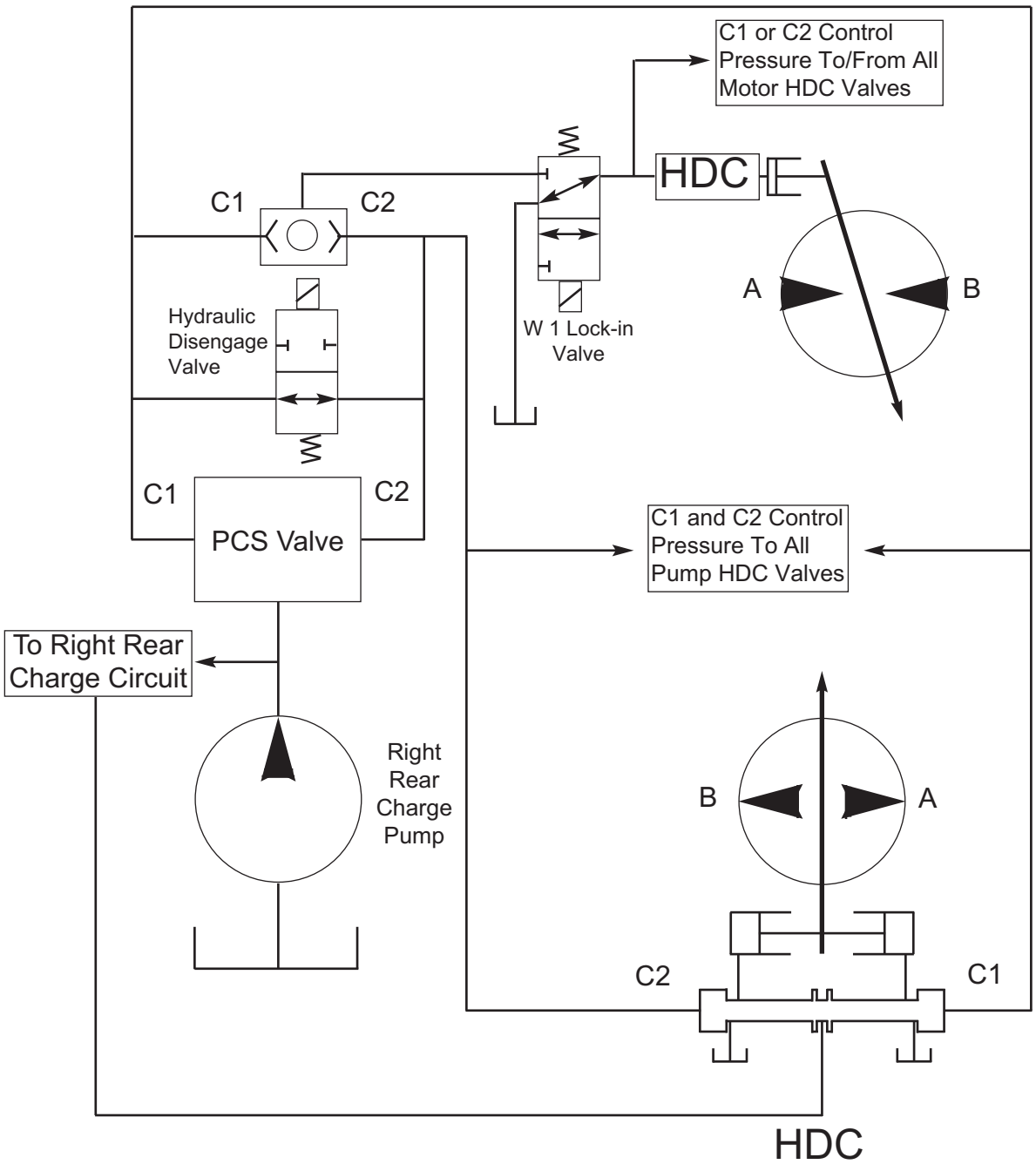
Pressure Control Servo Circuit Operation

General - The PCS control pressures are produced by means of a flapper valve and a torque motor. The PCS high and low side control pressures (C1 and C2) are supplied to a shuttle valve. The PCS high side control pressure will go through the shuttle valve and to the W1 Lock-in Valve. The W1 Lock-in Valve will be energized in Work Range 2. If energized, the high side control pressure will be supplied into each hydrostatic motor hydraulic displacement control valve. Control pressures C1 and C2 will be supplied to the hydrostatic pump hydraulic displacement control valve (HDC). The hydraulic displacement control valve controls the swash plate angle of each hydrostatic pump and motor.

Pressure Control Servo Valve - The pressure control servo valve utilizes a torque motor actuated, double nozzle flapper valve. As current flows through the valve coil in the pilot section, a proportional control output differential pressure will be produced and delivered to the second stage.

As the electrical input from the load controller is changed, the pressures that are delivered to the second stage will change as well. One of the pressures will raise, and the other will decrease. This will cause the spools in the second stage to seek a new position, with the higher pressure spool moving down and the lower pressure spool moving up. The new spool positions will be determined as a change in the spool land will vary the orifice size between supply pressure and the work pressure ports. As the orifice size changes, new control pressures will result at the work ports. The work pressures are fed to the under side of the spool until they equalize the force at the other end. Movement of the spools will continue until an equilibrium is established and the control pressures (C1 and C2) stabilize.

Pressure Control Servo - Work Range 1



4

NOTE
All schematics shown with vehicle parked and power off.

Pressure Control Servo - Work Range 1

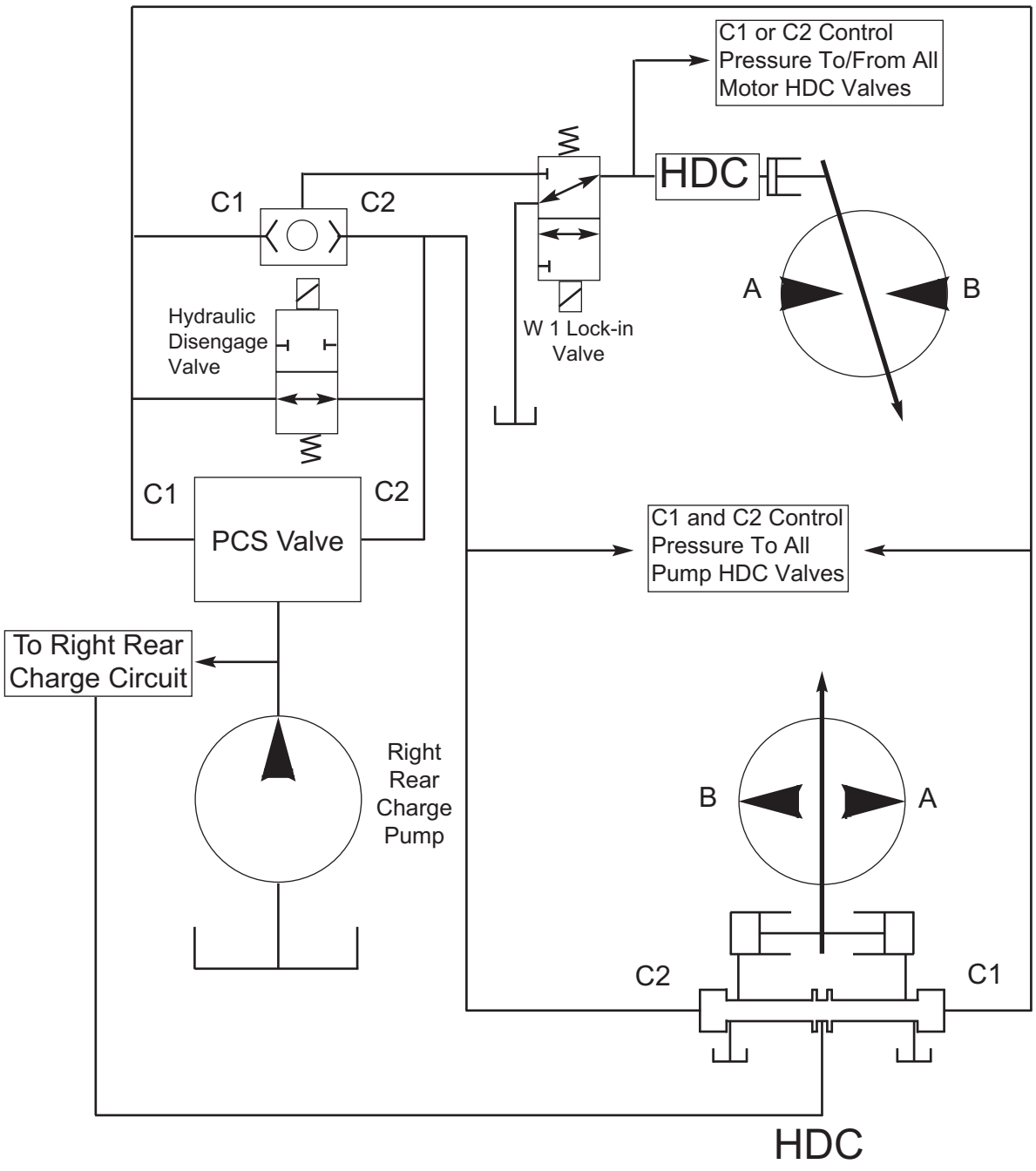
General - The PCS control pressures are produced by means of a flapper valve and a torque motor. The PCS high and low side control pressures (C1 and C2) are supplied to a shuttle valve. The PCS high side control pressure will go through the shuttle valve and to the W1 Lock-in Valve. The W1 Lock-in Valve will be energized in Work Range 2. If energized, the high side control pressure will be supplied into each hydrostatic motor hydraulic displacement control valve. Control pressures C1 and C2 will be supplied to the hydrostatic pump hydraulic displacement control valve (HDC). The hydraulic displacement control valve controls the swash plate angle of each hydrostatic pump and motor.

Work Range 1
In Work Range 1, the Pressure Control Servo high side signal pressure is blocked by the W1 Lock-in Solenoid Valve and the motor control servo pressure is drained to tank. Since the hydrostatic motor servo control pressure is drained to tank the servo control springs will push the hydrostatic motor swash plates against their maximum displacement stop. By having the hydrostatic motor swash plates at their maximum displacement position, each of motors will turn at a slower speed (RPM) giving the operator more torque to push and level trash with the blade.

PCS Manifold Coils Energized

Operating Range	Coils Energized
Work Range 1	Hydraulic Disengage Valve
Work Range 2	Hydraulic Disengage Valve W1 Lock-in Valve

Pressure Control Servo - Work Range 2



4

NOTE
All schematics shown with vehicle parked and power off.

Pressure Control Servo - Work Range 2

General - The PCS control pressures are produced by means of a flapper valve and a torque motor. The PCS high and low side control pressures (C1 and C2) are supplied to a shuttle valve. The PCS high side control pressure will go through the shuttle valve and to the W1 Lock-in Valve. The W1 Lock-in Valve will be energized in Work Range 2. If energized, the high side control pressure will be supplied into each hydrostatic motor Hydraulic displacement Control Valve. Control pressures C1 and C2 will be supplied to the hydrostatic pump Hydraulic Displacement Control Valve (HDC). The hydraulic displacement control valve controls the swash plate angle of each hydrostatic pump and motor.

Work Range 2
In Work Range 2, the W1 Lock-in Solenoid Valve is energized allowing, the Pressure Control Servo high side signal pressure to the hydrostatic motor control servo piston. Since the hydrostatic motor servo control pressure is supplied to the servo control piston the hydrostatic motor swash plate is moved against the minimum displacement stop. By having the hydrostatic motor swash plates at their minimum displacement position, each of motors will turn at a faster speed (RPM) giving the operator more speed.

Time Delay Relay - While operating in Work Range 2, if any of the hydrostatic drive circuit pressures reaches 4000 PSI (276 Bar), a pressure switch is closed signaling a time delay relay. Anytime the time delay relay receives the signal from the pressure switch for a continuous period in excess of 3 (three) seconds the W1 Lock-in Valve will be de-energized. After the time delay relay de-energizes the W1 Lock-in Valve, displacement the hydrostatic motors will be controlled in a manner similar to Work Range 1.

NOTE

The time delay relay will only affect the displacement of the hydrostatic motors while operating in Work Range 2. To reset the the time delay relay (and return to Work Range 2) place the W1/N/W2 switch in the neutral position.

PCS Manifold Coils Energized

Operating Range	Coils Energized
Work Range 1	Hydraulic Disengage Valve
Work Range 2	Hydraulic Disengage Valve W1 Lock-in Valve

Hydrostatic Pump/Motor - Wheel Speed Performance

To achieve maximum performance from the 3-90C, all wheels must turn at the same speed. Because each of the hydrostatic drive circuits are separate, individual wheel speed and performance may fluctuate.To insure the 3-90C will pull equally with each wheel the actual wheel speeds may need to be checked in each speed (W1, W2, forward, and reverse) to evaluate performance.

To insure that any wheel speed check is as accurate as possible it will be made with the engine at high idle (approximately 2250 RPM). All speed checks should be made after the hydrostatic oil temperature has reached its stable operating temperature. Once the speed check is completed in one speed, the wheel speeds should be rechecked in all other speeds and directions.

$$\text{Wheel Speed (RPM)} = \frac{1200}{\text{Time in seconds for 20 wheel revolutions}}$$

APPROXIMATE WHEEL SPEED REFERENCE CHART AT HIGH IDLE		
RANGE SELECTED	APPROXIMATE NO LOAD FORWARD WHEEL RPM	APPROXIMATE NO LOAD REVERSE WHEEL RPM
WORK RANGE 1	14.4 RPM	14.4 RPM
WORK RANGE 2	20.0 RPM	20.0 RPM

NOTE

Each individual wheel speed should be within 1 (one) RPM of all others in all speeds and all directions to achieve maximum performance.

4

W1 Lock-in Valve

General - The W1 Lock-in Valve is located on the manifold valve below the Pressure Control Servo Valve in the engine compartment. The W1 Lock-in Valve is used to control the position of the hydrostatic motor swash plate (maximum or minimum depending on speed selected by the operator).

Work Range 1 - The W1 Lock-in Valve holds the hydrostatic motor displacement at maximum for all engine speeds. In this situation the solenoid coil is de-energized. Anytime the solenoid coil is de-energized the valve spool will return to the spring centered position. In this position all control pressure in the motor part of the circuit is blocked by the valve spool and drained to sump from the hydrostatic motor servo piston. When this happens the swash plate bias spring moves the swash plate, and the displacement of the motor increases. If the displacement of the motor increases the the wheels will turn at a slower speed.

Work Range 2 - The hydrostatic pump and motor displacements are controlled by signal pressure (high side) developed by the Pressure Control Servo Valve. If the operator has selected Work Range 2, the W1 Lock-in valve spool is in a position (coil energized) so the hydrostatic motor displacement will be controlled by the Pressure Control Servo Valve high side control pressure.

NOTE

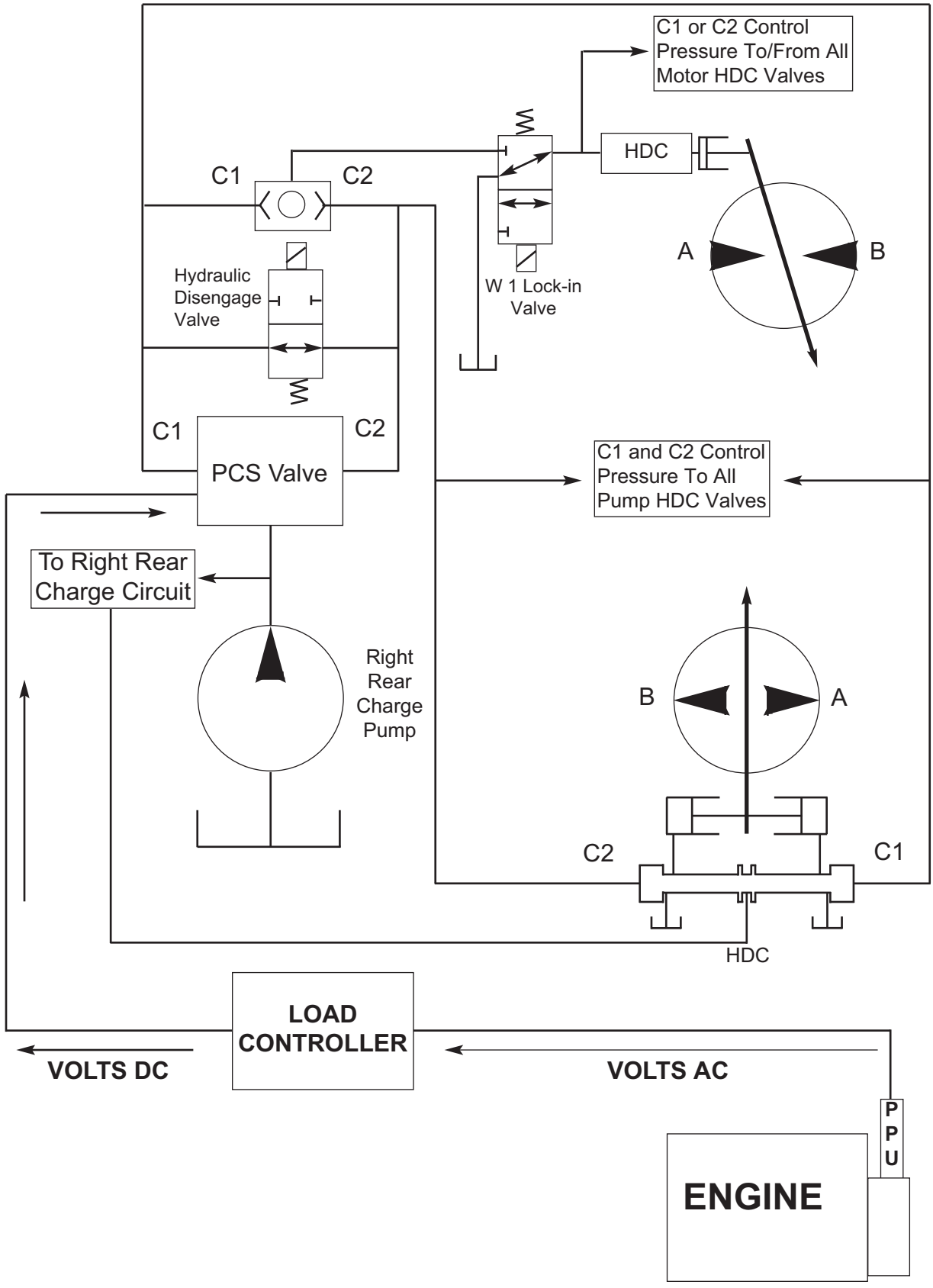
The time delay relay can affect the displacement of the hydrostatic motors while operating in Work Range 2. Refer to Pressure Control Servo - Work Range 2 in this manual or more information

SWASH PLATE ANGLE CONTROL		
Operating Range	Hydrostatic Pump Swash Plate Angle Controlled By	Hydrostatic Motor Swash Plate Angle Controlled By
Work Range 1	HDC Valve - Variable	Swash Plate Limiter - MAXIMUM
Work Range 2	HDC Valve - Variable	Swash Plate Limiter - MINIMUM

The operator selects which operating range he would like the 3-90C to operate in. If the engine speed remains above 2100 RPM and the machine is on a good tractive surface it will move at the following approximate speeds:

Work Range 1	3.05 MPH Forward	3.05 MPH Reverse
Work Range 2	4.2 MPH Forward	4.2 MPH Reverse

Load Shedding And Time Delay Relay



4

Load Shedding And Time Delay Relay

General - If the load on the engine increases and the engine speed (RPM) drops below 2100 RPM the 3-90C engine could stall. To prevent this from occurring, "load shedding" will take place. As the engine RPM decreases the pulses produced by the Pulse Speed Pick-up sensor (located on the engine flywheel housing) will also decrease. This will cause the AC Voltage signal that is fed into the load controller to decrease as well. As the load controller detects this drop in engine RPM, it will decrease the output DC voltage it supplies to the PCS Valve. If voltage supplied to the PCS Valve decreases the current will decrease as well. The reduced current will cause the control pressures (C1 and C2) to change at the hydrostatic pump and motor HDC Valves. Depending on the magnitude of the control pressure signal being fed into the hydrostatic pump and motor hydraulic displacement control valves, the pump and motor displacements adjust to accommodate the power available from the engine.

NOTE

Whenever load shedding occurs, hydrostatic pump displacements will decrease (hydrostatic motor displacements will increase), and the corresponding ground speed of the 3-90C in that particular operating range will also decrease.

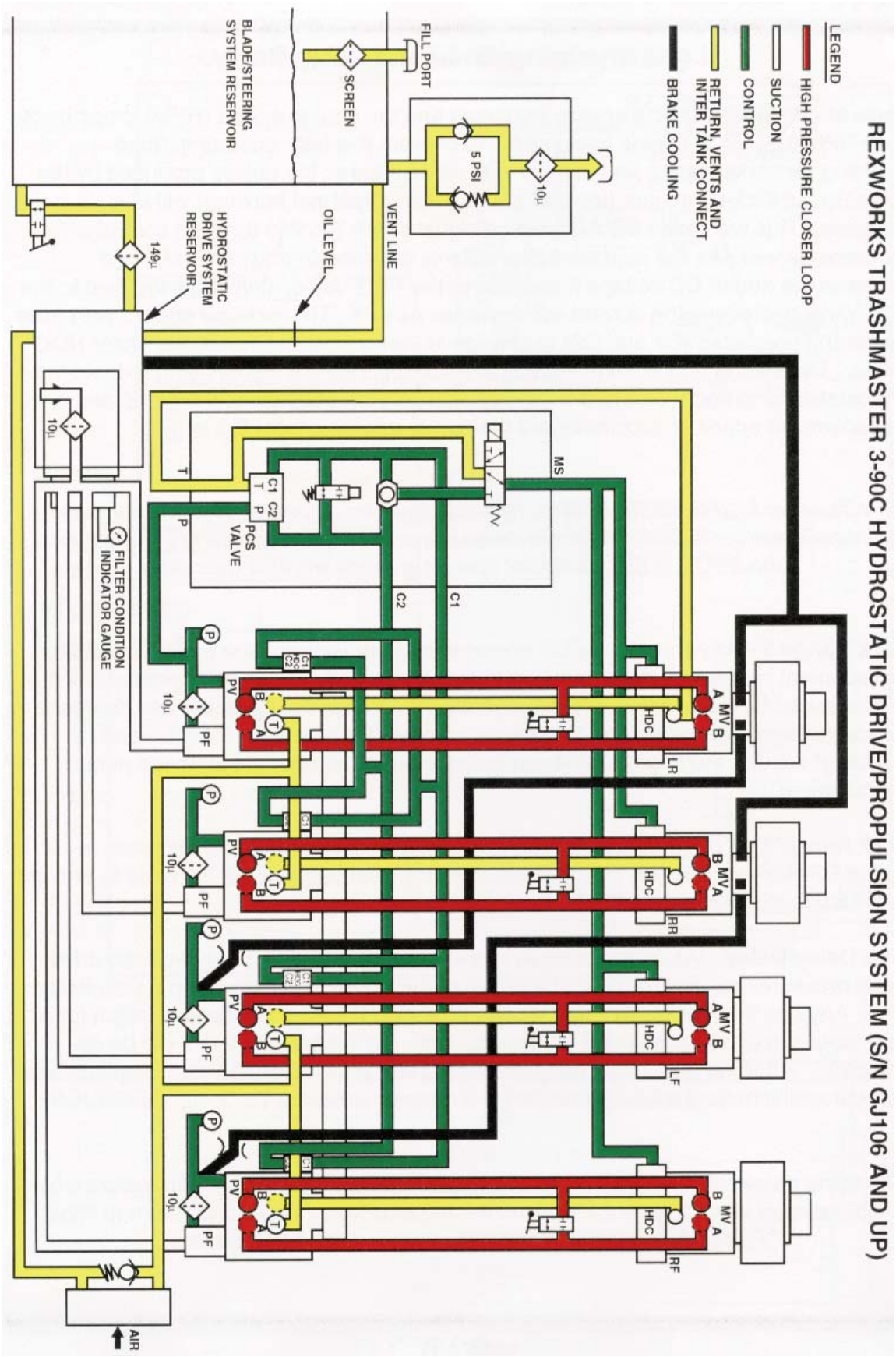
Work Range 1 - Any time the 3-90C operates in Work Range 1 the hydrostatic motor displacement remains at maximum due to the W1 Lock-in Valve (de-energized). If the engine speed decreases due to excessive load the pump displacement can decrease to reduce the power required from the engine to move the machine. If such "load shedding" occurs, the engine RPM can then increase resulting in increased pump displacement.

Work Range 2 - If the 3-90C is operating in the Work Range 2 and a decrease in engine RPM is experienced the hydrostatic motor displacement will increase to provide more torque to the wheels.

Time Delay Relay - While operating in Work Range 2, if any of the hydrostatic drive circuit pressures reaches 4000 PSI a pressure switch is closed signaling a time delay relay. Anytime the time delay relay receives the signal from the pressure switch for a continuous period in excess of 3 (three) seconds, the W1 Lock-in Valve will be de-energized. After the time delay relay de-energizes the W1 Lock-in Valve, displacement the hydrostatic motors will be controlled in a manner similar to Work Range 1.

NOTE

The time delay relay will only affect the displacement of the hydrostatic motors while operating in Work Range 2. To reset the the time delay relay (and return to Work Range 2) place the W1/N/W2 switch in the neutral position.


REXWORKS TRASHMASTER 3-90C HYDROSTATIC DRIVE/PROPULSION SYSTEM (S/N GJ106 AND UP)
LEGEND
HIGH PRESSURE CLOSER LOOP
SUCTION
CONTROL
RETURN, VENTS AND INTER TANK CONNECT
BRAKE COOLING
BLADE/STEERING SYSTEM RESERVOIR
FILL PORT
SCREEN
5 PSI
10µ
VENT LINE
OIL LEVEL
HYDROSTATIC DRIVE SYSTEM RESERVOIR
149µ
MS
C1
C2
PCS VALVE
FILTER CONDITION INDICATOR GAUGE
PV
PF
MV
HDC
LR
RR
LF
RF
AIR

4

3-90C System Diagram

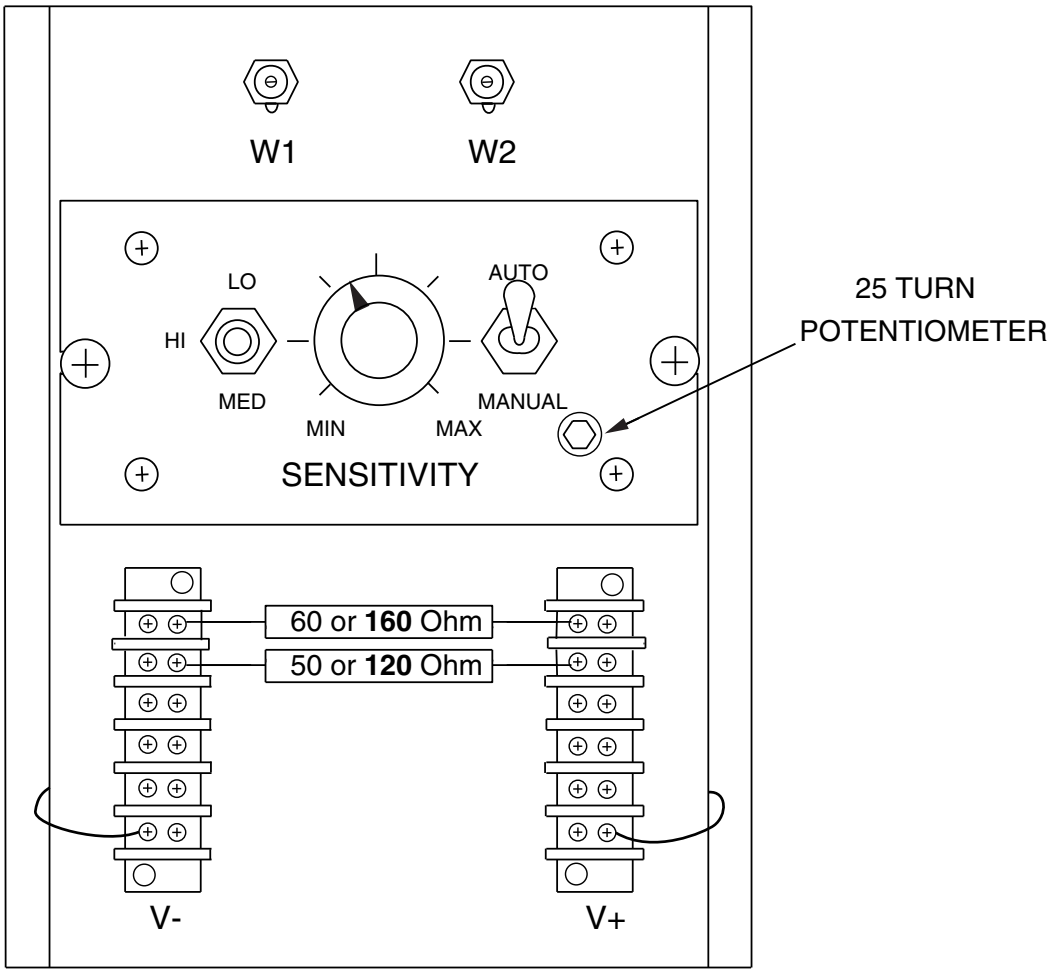
Reservoir - Hydraulic fluid (Mobil DTE® 16M recommended) used in the 3-90C hydrostatic system is supplied from the hydrostatic drive system reservoir located in the rear wheel housing. This tank is connected to the main hydraulic reservoir through an inter-tank line and screen (screen located at the hydrostatic drive reservoir inlet fitting). Because of the inter-tank line, the hydrostatic drive reservoir is filled as the main hydraulic reservoir is filled. Draining the hydrostatic drive system reservoir is accomplished by pumping the oil from the tank since the tank is located below the reservoir drain location. The hydrostatic drive system reservoir is equipped with an inspection/clean-out cover, a non by-pass suction filter, and a filter condition indicator gauge (located along the RH side of the engine compartment). If the filter condition indicator gauge displays a vacuum reading of more than 10 inches of mercury (after the oil temperature has reached a stable operating temperature), the suction filter should be changed. Hydrostatic charge pressure would also be affected by a plugged suction filter.

Charge and Control Circuit - Each hydrostatic circuit is equipped with a charge pump (item PF - integral part of the hydrostatic pump assembly). The charge pumps insure the hydrostatic system receives an adequate volume of oil to cool the system and to make up for internal leakage of the system (to prevent pump cavitation). Flow out of each charge pump is directed through a non by-pass outlet filter to insure only filtered oil is delivered to the hydrostatic circuit. The charge outlet filter is not equipped with a filter indicating gauge. Hydrostatic charge pressure (one circuit only) would also be affected by a plugged charge outlet filter. The right rear charge pump is also used as a supply for hydrostatic displacement control.

Hydrostatic Displacement Control - The right rear charge circuit is used to supply the flow/pressure needed to control the displacement the hydrostatic pumps and motors during operation. This supply is delivered to the Pressure Control Servo (PCS) valve manifold at the P (PRESSURE) port. The PCS valve supplies control circuit pressures to the hydrostatic pumps (from the C1 and C2 ports) and to the hydrostatic motors (from the MS port). Excess volume from the PCS valve manifold is drained from the valve (from the TANK port) into the case drain circuit and back to the reservoir through the oil cooler located near the radiator assembly. The PCS valve manifold also contains two additional solenoid valves (hydraulic disengage valve and W1 Lock-in valve). The purpose of the hydraulic disengage valves is to insure the machine will not drive hydrostatically if the brakes are applied. The W1 Lock-in valve is used to insure maximum motor displacement (and maximum wheel torque) during operation in the W1 operating range.

Shunt Valves - Each hydrostatic circuit is equipped with a mechanical shunt (by-pass) valve/hose. The shunt valve/hose can be used to disengage circuit (s) for troubleshooting, towing, or to allow operation in the event the machine must be moved away from the operation site prior to repair (come-home capability).

Load Controller



4

Load Controller

The load controller is located behind the operation instruction plate panel. Generally, adjustment is not needed. If it becomes necessary to make an adjustment it can be accessed by removing the panel. The load controller includes the following special features:

1. An adjustable set point for limiting engine RPM droop. This set point determines the RPM at which "load shedding" will begin. This set point is pre set at the factory at 2100 RPM. As the 2100 RPM set point is reached and passed with decreasing engine speed, each hydrostatic pumps displacement decreases which will help to control the overload condition. With reduced load, the engine will then be able to recover resulting in an increase in engine RPM. As the engine RPM increases the hydrostatic pump displacement can increases resulting in increased 3-90C ground speed.

2. An adjustable sensitivity switch to control the speed at which the load controller responds to the to changes in engine RPM. If set too high the system will become unstable resulting in a surging condition with the vehicle. If set too low the engine could stall. To adjust, find the unstable set point (surging condition) and decrease slightly.

NOTE

Until the temperature of the hydraulic oil has stabilized, this adjustment will be difficult to make. It is normal for the 3-90C to surge slightly during a cold oil operating condition.

3. An AUTO/MANUAL switch to deactivate the load controller response to the to drops in engine RPM. While operating in limited space situations it may be desirable to deactivate the load controller function by setting this switch to manual.

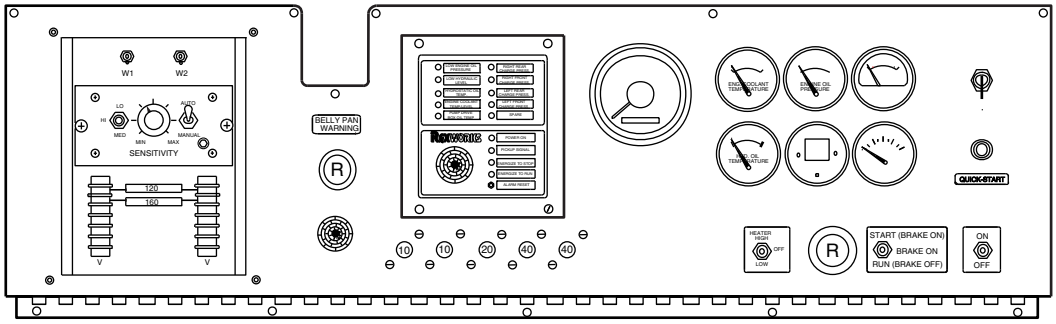
4. LOW/MEDIUM/HIGH mode control switch to allow adjustment to match the operation. When the load is heavy enough that the engine is continually lugged below the desired RPM the switch can be changed to the next lowest setting.

NOTE

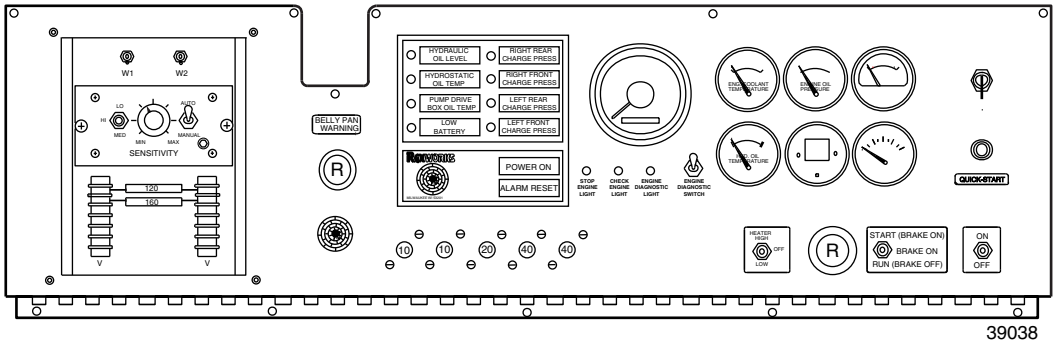
Effective with Serial Number GJ 197 the fixed resistor values within the propulsion circuits were changed. The plain type number in the diagram represents the value of the fixed resistors effective with Serial Numbers GJ 171, 180, 185-196. The bold faced number in the diagram represents the value of the fixed resistors effective with Serial Number GJ 197.

Automatic Shutdown Protection

Serial Number GJ 139 - GJ 229



Serial Number GJ 230 - .....



39038

4

Automatic Shutdown Protection

General - The Rexworks Trashmaster 3-90C is equipped with monitoring and shutdown devices for the engine and hydraulic systems.

The shutdown system used on the 3-90C includes the following major components:

1. Annunciator Panel.
2. Dash mounted warning gauges.
3. Gauge panel located in engine compartment (S/N GJ 139 - GJ 210).
   A. Hydrostatic drive charge pressure gauges.
   B. Hydrostatic drive temperature gauges (4).

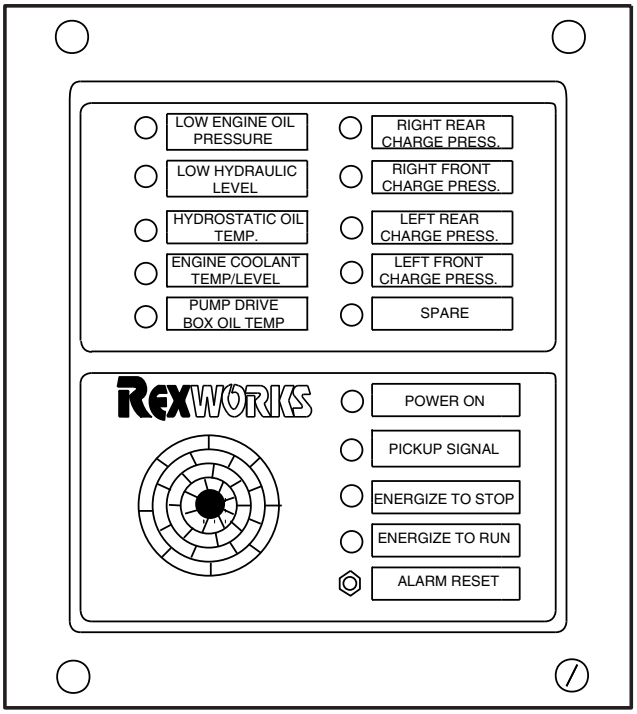
   Cab mounted gauges (S/N GJ 211 - .....).
   A. Hydrostatic drive charge pressure gauges.
   B. Hydrostatic drive temperature gauge (1).

The gauge function is to close an electrical contact whenever a monitored circuit is not operating within a desirable range. Switch contact points may be visible through the gauge face to allow service personnel to observe both the operation of the gauge and the switch simultaneously. These visible contacts can also be used for system testing during maintenance operations.

The shutdown annunciator uses information from the gauges to warn the operator and begin a shutdown sequence should any of the following factors be involved:

Circuit Monitored	Gauge Location
High Engine Coolant Temperature	Instrument Panel
Low Engine Oil Pressure	Instrument Panel
Low Hydraulic Oil Level	Hydraulic Reservoir
Low Hydrostatic Charge Pressure	Engine Compartment or Cab
High Hydrostatic Oil Temperature	Engine Compartment or Cab
High Pump Drive Box Oil Temperature	Eng. Comp. Inst. Panel (Hydr. Oil Temp)
Low Coolant Level	Engine Compartment

Automatic Shutdown Protection Effective S/N GJ 139 - GJ 229



39040

4

Automatic Shutdown Protection Effective S/N GJ 139 - GJ 229

Annunciator - The automatic shutdown annunciator is the heart of the shutdown system. Its function is to monitor selected 3-90C systems and warn the operator with an audible and visual warning if any of the key systems is not within the acceptable operating range. After the operator has been alerted, he can stop the engine with the key switch or depress the reset button to start the alarm over. If the operator takes no action the annunciator allows 15-30 seconds to move the 3-90C to safe location before it will stop the engine automatically.

NOTE

The shutdown warning annunciator is equipped with a reset button. The rest button can be used to deactivate the shut down sequence one time. After the reset button is used one time the reset function is deactivated by the annunciator,

To accomplish the warning/shutdown function the annunciator receives signals from switch input devices (gauges). The annunciator activates warning lights and an audible alarm for the switch monitored circuits. After a 15-30 second delay the annunciator will open the ground portion of control relay 3 (CR-3) circuit. When CR-3 is deactivated the fuel will be shut off to the engine and the engine will stop.

The shutdown annunciator has selectable input delay switches to minimize the number of alarms caused be momentary closing of switch inputs. This delay will require that a switch input be closed a minimum of 6 seconds before it will transferred to the alarm. An input locked out is also included to allow oil pressure in the engine and hydrostatic charge system to build at start-up.

NOTE

All 6 second input delayed switches (on back of annunciator) should be placed in the ON position. Input locked out switches involved with oil pressure warnings should be placed in the ON position. Refer to the electrical section of this manual for input delay and input locked out switch positioning.

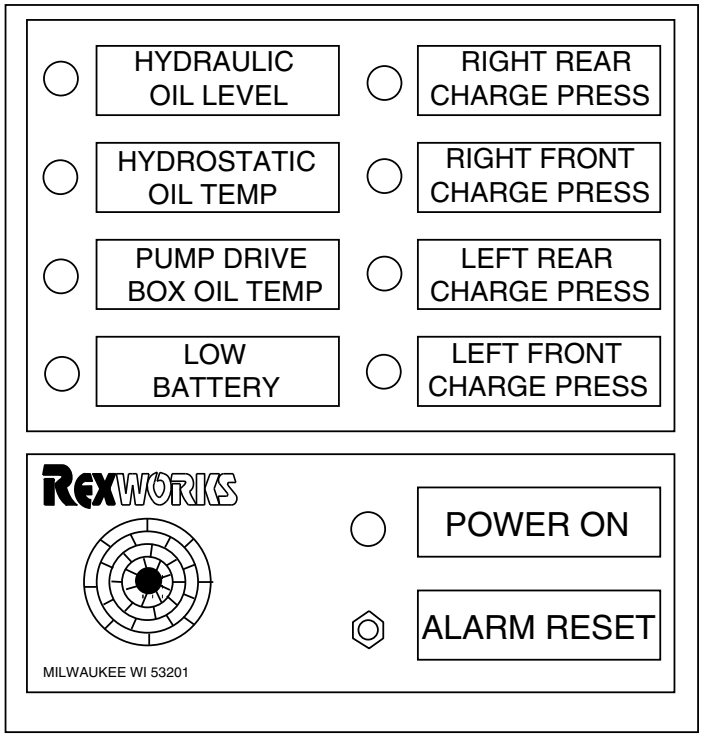
Operation Lights - The following operator lights are available to the operator for informational purposes.

1. Power Light - This green light is on anytime the master disconnect switch is closed.
2. Pickup Signal Light - This green light is on whenever voltage from the pulse pickup sensor (PPU) is available.
3. Energize To Stop Light - This red light is turned on when the 30 second delay is over and the engine is shut off.
4. Energize To Run - This green light will be on whenever the ignition switch and RPM signal are present.

IMPORTANT

The 3-90C electrical system is equipped with diode assemblies to prevent false alarms and intermittent false shutdown of the 3-90C. Refer to the electrical section of this manual for additional information.

Automatic Shutdown Protection Effective S/N GJ 230 - .....



39040B

4

Automatic Shutdown Protection Effective S/N GJ 230 - .....

Annunciator - The basic function of the annunciator on these units is to receive signals from switch input devices (gauges), turn on warning lights for those switch monitored circuits, and activate an audible alarm. After a 30 second delay, the annunciator signals the ECM (Electronic Control Module) of the engine. With less severe operational problems, the ECM will derate the engine speed. The 3-90C will stop (due to the decrease in engine speed) and the engine speed control (throttle) will not operate. When severe operational problems exist, the ECM will shut down the engine (hydraulic oil level).

Annunciator Power up and Activation - The annunciator is equipped with a green POWER ON L.E.D. This L.E.D. will be lit anytime the master disconnect switch is closed. Upon starting the 3-90C engine, the annunciator will deactivate all of the represented systems for a period of 30 seconds. This time is provided to allow monitored systems to stabilize after the engine is started. After the time delay at start up the annunciator will flash all of the L.E.D. lights to signal the annunciator is now functional and will begin to monitor the following circuits:

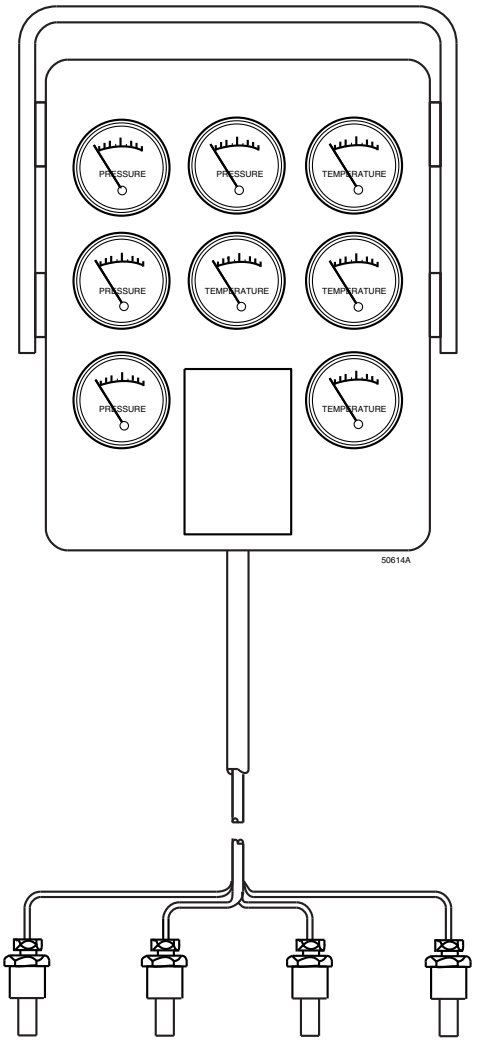
1. Hydraulic Oil Level
2. Hydrostatic Oil Temperature
3. Pump Drive Box Oil Temperature
4. Hydrostatic Charge Pressure (each circuit)

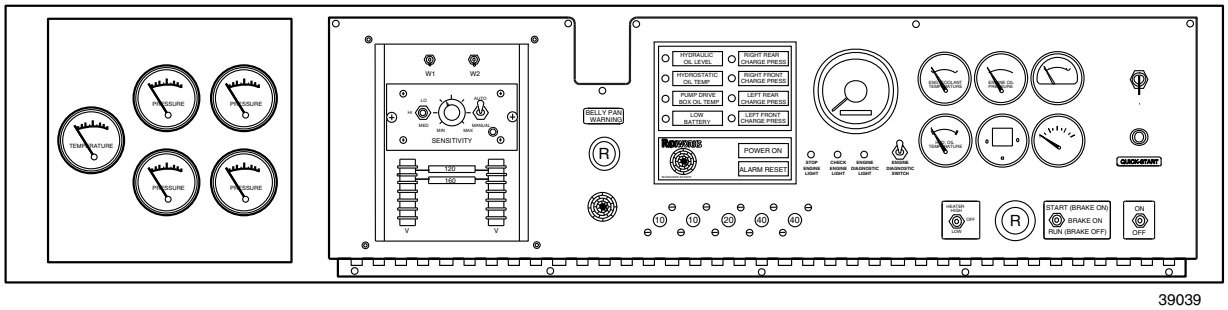
During Normal operation the annunciator monitors the represented circuits. This is done by means of a signal voltage (approximately 5 VDC) at the following terminals of the annunciator:

Circuit	Annunciator Terminal
Hydraulic Oil Level (Immediate Shutdown)	J2-1
Hydrostatic Oil Temperature	J2-2
Pump Drive Box Oil Temperature	J2-3
R.R. Hydrostatic Charge Pressure	J2-5
R.F. Hydrostatic Charge Pressure	J2-6
L.R. Hydrostatic Charge Pressure	J2-7
L.F. Hydrostatic Charge Pressure	J2-8

If any of the input switches closes to ground the signal voltage (5 VDC) will drop. If the value of the signal voltage drops below approximately 1.5 Volts DC, the alarm sequence is activated. Upon activation of the alarm sequence, the annunciator delays operator notification for a period of 5 seconds. After this 5 second delay, the annunciator checks the gauge input a second time. This done to prevent false alarms. If the gauge input is still closed the annunciator notifies the operator by activating the alarm. After the alarm has been activated, the operator has 30 seconds to move the 3-90C to a safe location or reset the alarm. At the end of the 30 second period, if the operator has done nothing the engine (speed) will be derated.

Automatic Shutdown Protection - Gauge Panels





4

Automatic Shutdown Protection - Gauge Panels

Remote Switchgage Panel (Effective S/N GJ 139-210) - The remote switchgage panel is located in the engine compartment on the right hand side of the rear cab wall. It will include gauges which transmit information on the following circuits:

1. Hydrostatic Charge Pressure - Four switchgages set to close at 100 PSI (6.9 Bar). If any of these switches close for a time period in excess of six seconds the annunciator will begin a shut down sequence. The shutdown sequence includes a 15-30 second delay to warn the operator. If, after the time delay, the operator has taken no action the annunciator will take action to stop the engine.

2. Hydrostatic Oil Temperature - Four switchgages set to close at 225 F^o (107.2 C^o). If any of these switches close for a time period in excess of six seconds the annunciator will begin a shut down sequence. The shutdown sequence includes a 15-30 second delay to warn the operator. If, after the time delay, the operator has taken no action the annunciator will take action to stop the engine.

Gauge Location (Effective S/N GJ 211 - .....) - The remote panel functions were replaced with an in cab gauge location. It will include gauges which transmit information on the following circuits:

1. Hydrostatic Charge Pressure
2. Hydrostatic Oil Temperature

General operation of the gauges remains the same as described above. Gauge location in the cab allows the operator to review actual readings in the event of an out of range condition

Wheel Speed Performance Evaluation

NOTE

If it is suspected that the hydrostatic drive is not operating correctly the following chart can be used to gather information, from which, an evaluation can be made. All wheel speed tests should be conducted with the wheels raised off the ground.

1. Warm hydraulic oil to operating temperature by operating the 3-90C.
2. With the engine at high idle, operate the 3-90C in Work Range 1, Forward direction, and record the speeds. Operate the 3-90C in Work Range 1 Reverse direction, and record each wheel speed. Each wheel should be within 1 (One) RPM of all the other wheels.
3. With the engine at high idle, operate the 3-90C in Work Range 2, Forward direction, and record the speeds. Operate the 3-90C in Work Range 2, Reverse direction, and record each wheel speed. Each wheel should be within 1 (One) RPM of all the other wheels.
4. In Work Range 1, the wheel speeds should be close to 14.4 RPM in both forward and reverse.
5. In Work Range 2, the wheel speeds should be close to 20.0 RPM in both forward and reverse directions.

$$\text{Wheel Speed (RPM)} = \frac{1200}{\text{Time in seconds for 20 wheel revolutions}}$$

WHEEL	RPM REVERSE		RPM FORWARD	
	W1	W2	W1	W2
RIGHT REAR				
RIGHT FRONT				
LEFT FRONT				
LEFT REAR				

4

IMPORTANT

The above information will be used to determine if the reported symptom is apparent in an individual drive wheel circuit (circuit problem) or all drive wheel circuits (system problem). Each wheel should be monitored for response when changing direction.

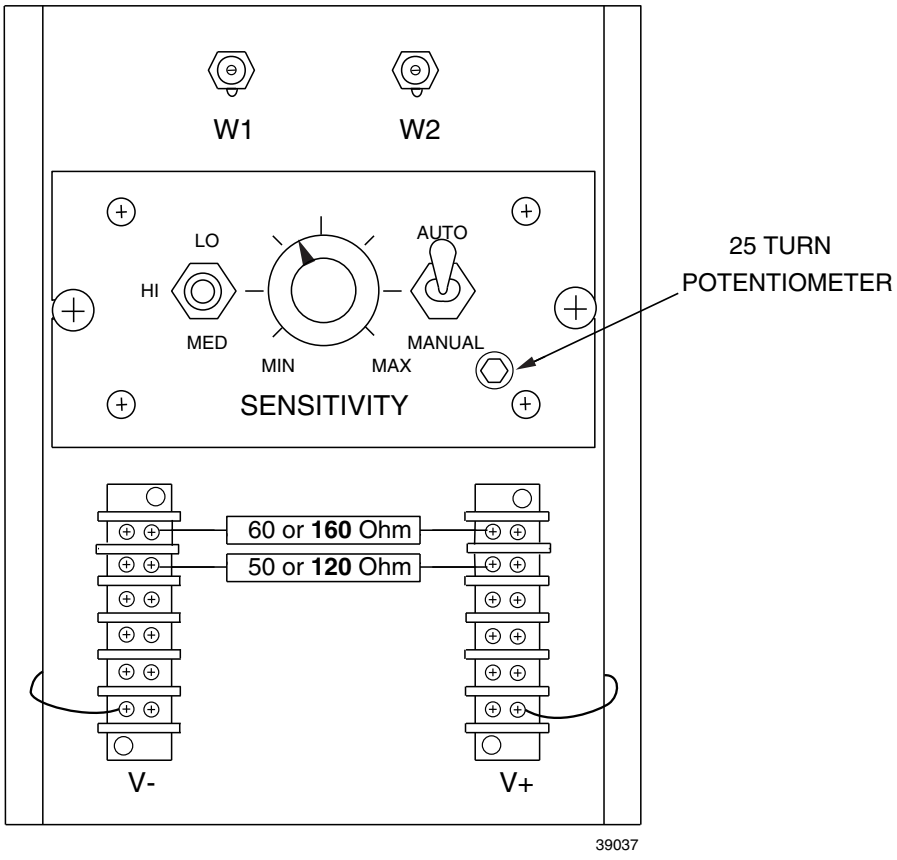
Engine RPM Droop Testing And Adjustment

1. Warm engine to a stable operating temperature by operating the 3-90C.
2. With the 3-90C Trashmaster F-N-R switch in Neutral place Digital Volt Meter leads on the Valve + and Valve - terminals of the load controller.
3. Place the Start/Brake ON/Run switch in the Run position.
4. Set the engine at 2100 RPM.
5. **Effective S/N GJ 185 - 196 and GJ 200:** If the Digital Volt Meter displays **10.5 Volts DC** the Engine RPM droop setting is correct. If the Digital Volt Meter does not display 10.5 Volts DC, it will be necessary to adjust the load controller. Rotate the 25 turn potentiometer (under protective plug) until 10.5 Volts DC is displayed.

   Effective S/N GJ 197 except GJ 200: If the Digital Volt Meter displays **21 Volts DC** the Engine RPM droop setting is correct. If the Digital Volt Meter does not display 21 Volts DC, it will be necessary to adjust the load controller. Rotate the 25 turn potentiometer (under protective plug) until 21 Volts DC is displayed.

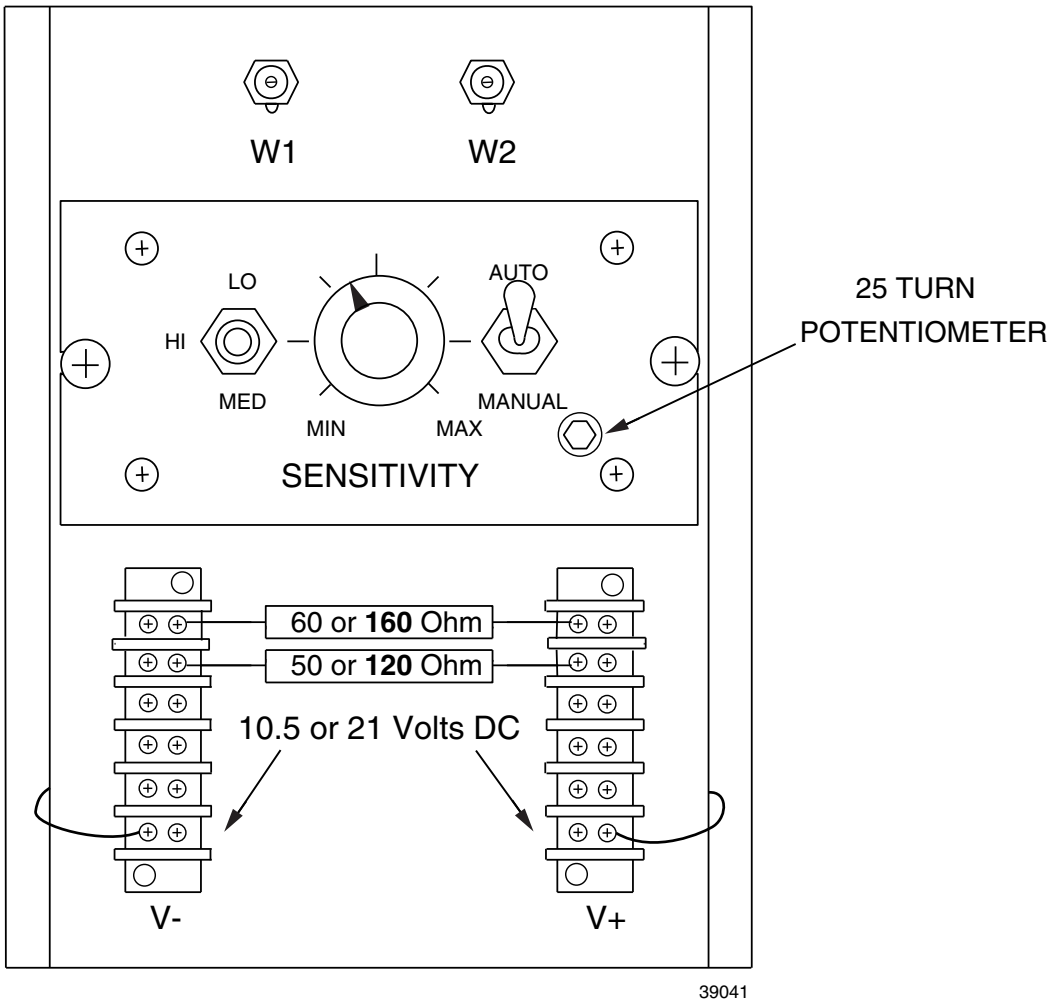
NOTE

To achieve consistent 3-90C performance adjust the 25-turn potentiometer until the reading is as close to 10.5 / 21 Volts DC as possible.



4

Load Controller Adjustments



4

Load Controller Adjustments

CAUTION

The following procedure may be completed with the 3-90C propulsion system in neutral. Be aware of other machines and other people when performing adjustments or testing.

1. Set the load controller Auto/Manual switch in the Auto position.
2. Set the load controller High/Medium/Low switch in the High position.
3. Set the load controller sensitivity dial between the 12:30 and 1:00 positions.
4. Warm engine to a stable operating temperature by operating the 3-90C.
5. With the Trashmaster F-N-R switch in Neutral place Digital Volt Meter leads on the Valve + and Valve - terminals of the load controller.
6. Place the Start/Brake ON/Run switch in the Run position.
7. Set the engine at 2100 RPM.
8. **Effective S/N GJ 185 - 196 and GJ 200:** If the Digital Volt Meter displays **10.5 Volts DC** the Engine RPM droop setting is correct. If the Digital Volt Meter does not display 10.5 Volts DC, it will be necessary to adjust the load controller. Rotate the 25 turn potentiometer (under protective plug) until 10.5 Volts DC is displayed.

   Effective S/N GJ 197 except GJ 200: If the Digital Volt Meter displays **21 Volts DC** the Engine RPM droop setting is correct. If the Digital Volt Meter does not display 21 Volts DC, it will be necessary to adjust the load controller. Rotate the 25 turn potentiometer (under protective plug) until 21 Volts DC is displayed.

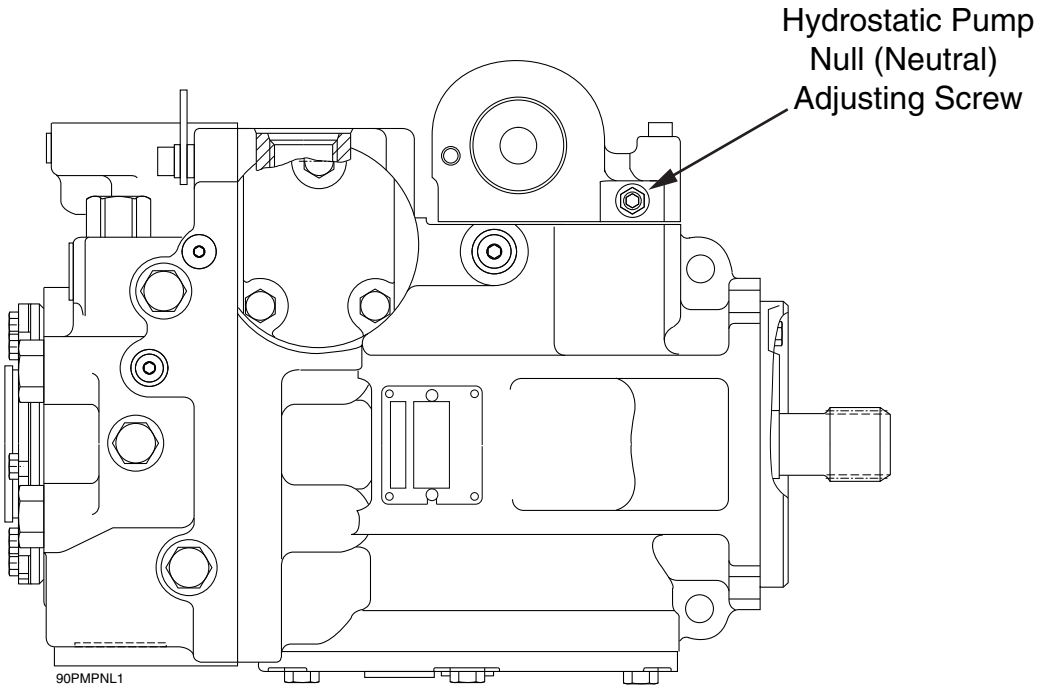
IMPORTANT

To achieve consistent 3-90C performance adjust the 25-turn potentiometer until the reading is as close to 10.5 / 21 Volts DC as possible.

NOTE

The load controller is equipped with an adjustable sensitivity switch to control the speed at which the load controller responds to the to changes in engine RPM. If set too high the system will become unstable resulting in a surging condition with the 3-90C. If set too low the engine could stall. To fine tune this sensitivity control, find the unstable set point (surging condition) and decrease slightly (the 3-90C must be at a stable operating temperature to fine tune this adjustment). If more than one 3-90C is operated at a single site, the sensitivity fine tuning might be required to achieve the same operator "feel" from each machine.

Pump Null (Neutral) Adjustment



Pump Null (Neutral) Adjustment

WARNING

The following procedure may require that the 3-90C be disabled (wheels raised off ground and steering locked) while performing the adjustment to prevent injury.

CAUTION

Due to the close proximity of the pump gear box drive shaft to the hydrostatic pumps caution must be exercised while performing the adjustment to prevent injury.

NOTE

A wheel that turns when the machine is in neutral is the typical symptom of an improperly adjusted Null adjustment.

1. Operate the engine at High Idle.

2. Loosen the jam nuts on the Null adjusting screw.

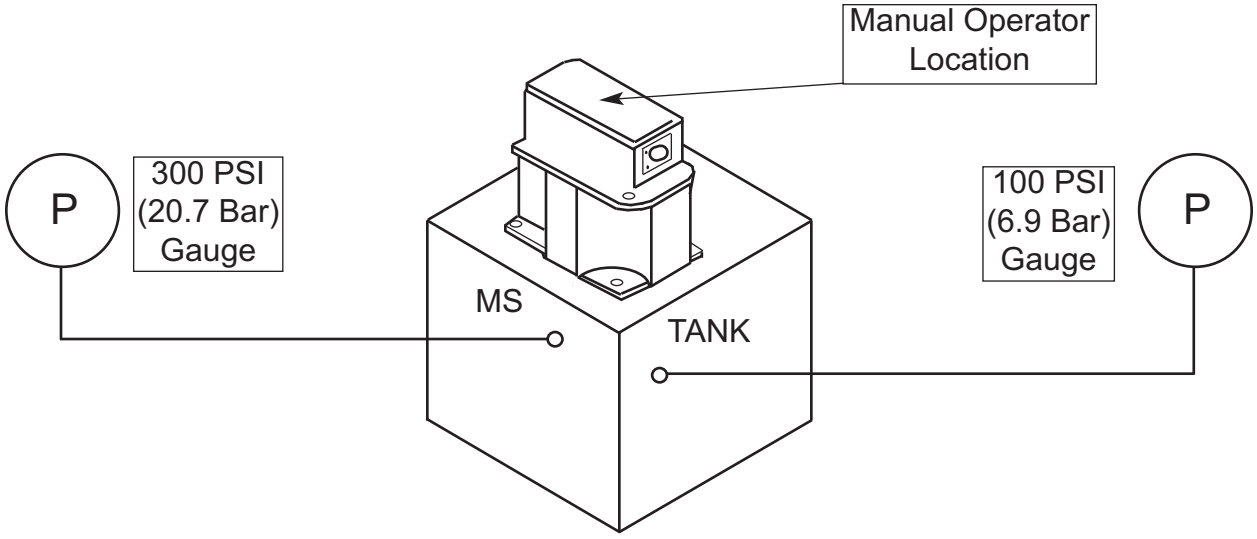
3. Turn the Null adjusting screw in either direction until the wheel or output shaft just begins to rotate.

4. While counting the revolutions of the screw, turn the Null adjusting screw in the opposite direction until the wheel or output shaft just begins to rotate in the opposite direction.

5. Divide the counted revolutions of the Null adjusting screw in step #4 by 2 (two).

6. Turn the Null adjusting screw back in the original direction, the number of turns calculated in step #5.

Testing / Adjusting Differential Pressure



Differential Pressure Worksheet

TEST CONDITIONS: Oil at Operating Temp, W2, Forward			
"MS" Port PSI (Bar)	"TANK" Port PSI (Bar)	Temp. F° (Temp. C°)	Differential Pressure "MS" - "TANK" = 138 △PSI
EXAMPLE: 178	40	170°	178 - 40 = 138 △PSI
EXAMPLE: (12.3)	(2.8)	(76.7°)	12.3 - 2.8 = 9.5 △Bar

4

Testing / Adjusting Differential Pressure

WARNING

The following procedure will require that the 3-90C be disabled (wheels raised off ground and steering locked) while performing the adjustment to prevent injury.

1. Engine off.
2. Install a 300 PSI (20.7 Bar) and a 100 PSI (6.9 Bar) gauge in PCS Valve ports "MS"and "TANK" as shown in diagram.
3. Start engine.
4. Warm hydraulic oil to a stable operating temperature by operating the 3-90C.
5. Place the W1/N/W2 switch in the W2 position. Place the F/N/R switch in the Forward position.
6. Set the engine speed at high idle.
7. Read, record, and calculate the difference between the pressure readings shown on the "MS" port gauge and "TANK" port gauge.
8. Adjust the W2 50 Ohm potentiometer (located above the load controller) until the difference between the readings in the "MS" port and "TANK" port is 138 PSI (9.5 Bar).

IMPORTANT

To accurately read and adjust the differential pressure setting, the 3-90C hydrostatic oil must be at operating temperature. Adjustment will be difficult if the oil temperature has not stabilized.

9. With the engine at high idle, operate the 3-90C in Work Range 1, Forward direction, and record each wheel speed. Operate the 3-90C in Work Range 1, Reverse direction and record each wheel speed. Each wheel should be within 1 (One) RPM of all the other wheels.

   In Work Range 1, the wheel speeds should be close to 14.4 RPM in both forward and reverse.

10. With the engine at high idle, operate the 3-90C in Work Range 2, Forward direction, and record each wheel speed. Operate the 3-90C in Work Range 2, Reverse direction and record wheel speed. Each wheel should be within 1 (One) RPM of all the other wheels.

    In Work Range 2, the wheel speeds should be close to 20.0 RPM in both forward and reverse directions.

4

$$\text{Wheel Speed (RPM)} = \frac{1200}{\text{Time in seconds for 20 wheel revolutions}}$$

3-90C Hydrostatic Gauge Information		
A	System Pressure Port "A"	10,000 PSI (690 Bar) Gauge (9/16"-18 O-ring Fitting)
B	System Pressure Port "B"	10,000 PSI (690 Bar) Gauge (9/16"-18 O-ring Fitting)
C	Charge Pressure	600 PSI (41.4 Bar) Gauge. NOTE: Charge pressure (s) are displayed continuously on gauge display in engine compartment.
D	Case Pressure	100 PSI (6.9 Bar) Gauge (1 1/16"-12 O-ring Fitting)
E	Charge Pump Inlet Vacuum	Vacuum Gauge (9/16"-18 O-ring Fitting). NOTE: Inlet vacuum is displayed on gauge in engine compartment.
F	Servo Pressure	600 PSI (41.4 Bar) Gauge (9/16"-18 O-ring Fitting or 7/16"-20 O-ring Fitting)
G	Servo Pressure	600 PSI (41.4 Bar) Gauge (9/16"-18 O-ring Fitting or 7/16"-20 O-ring Fitting)

Gauge Installation

Using pressure and vacuum gauges may be helpful in troubleshooting problems with 3-90C hydrostatic or support systems. Each of the ports listed on the page at the left can be used to isolate hydrostatic system components. The ports and the components are as follows:

1. A 10,000 PSI (690 Bar) pressure gauge in the system pressure "A" and "B" ports to check multi-function valves.

2. Measuring charge pump inlet vacuum will help locate restrictions in the inlet lines, filter, and screen.

NOTE

A charge pump inlet (filter) vacuum gauge is factory installed in the engine compartment of all 3-90C Trashmasters.

3. Case pressure readings can be used to help locate restrictions in return lines, oil cooler.

NOTE

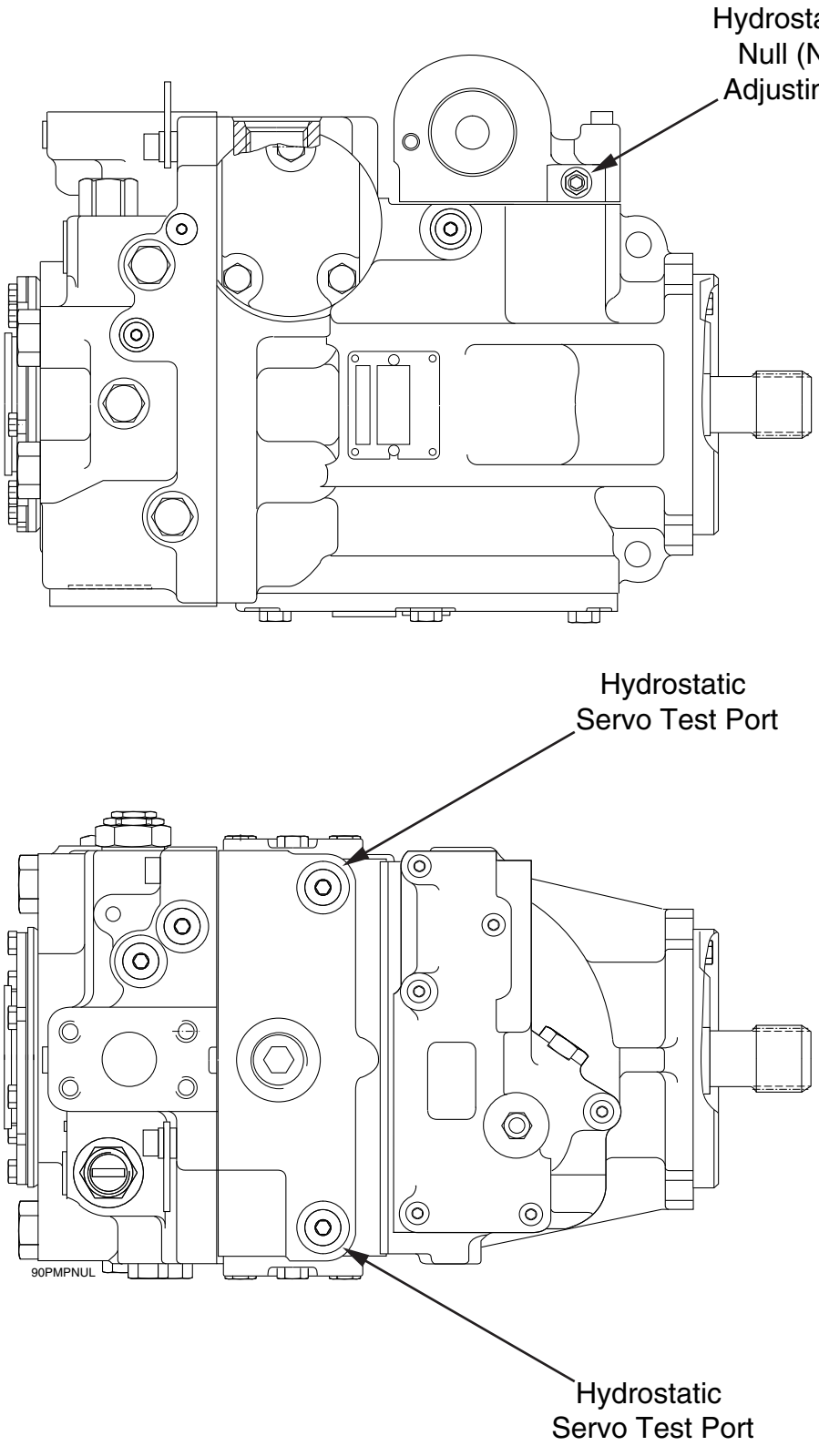
Charge pressure gauges are factory installed in the engine compartment of all 3-90C Trashmasters.

4. Snubber valves are recommended to protect pressure gauges from pressure spikes. For accurate readings, frequent gauge calibration is required.

NOTE

Additional hydrostatic pump and hydrostatic motor test points are shown in this manual. Refer to Pump Null Adjustment and Charge Pressure Relief Valve Adjustment.

Pump Null (Neutral) Adjustment - Hydraulic Gauge Method



4

Pump Null (Neutral) Adjustment - Hydraulic Gauge Method

The hydrostatic pump Null (neutral) setting is the only adjustment that can be made on the hydraulic displacement control valve. To make this adjustment the following conditions must be met:

WARNING

The following procedure may require that the 3-90C be disabled (wheels raised off ground and steering locked) while performing the adjustment to prevent injury.

1. Heat the oil to operating temperature.

2. Install two 600 PSI (41.4 Bar) gauges into the servo gauge test ports.

3. Loosen the jam nuts on the neutral adjusting screw.

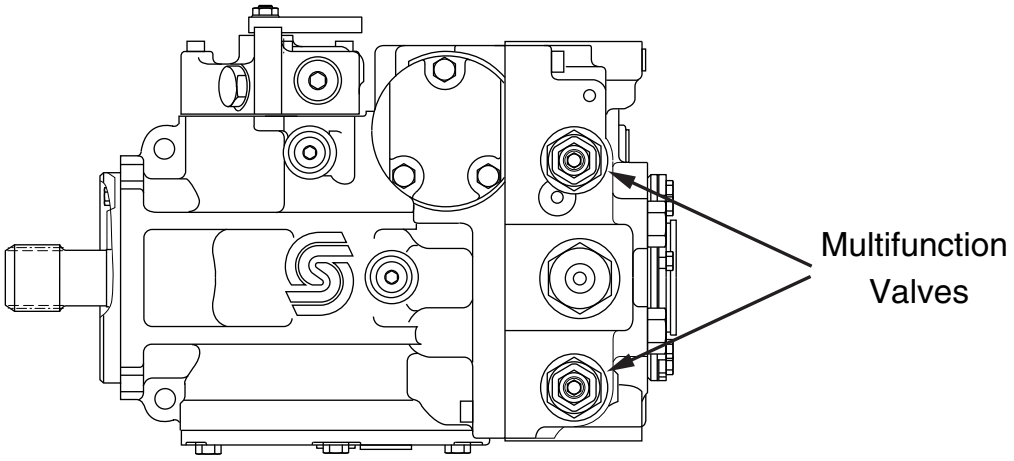
4. Rotate the neutral adjusting screw with an internal hex wrench (Allen wrench) until the pressure in one servo port or the other begins to raise.

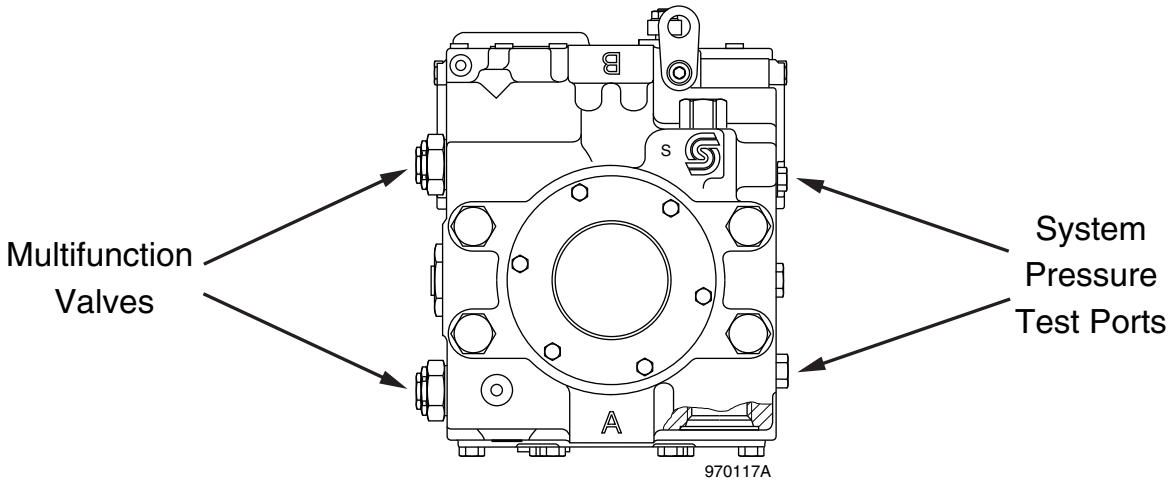
5. Mark the position of the wrench on the pump housing as a reference point. (This reference will be compared to the position of the wrench in a later step.)

6. Without removing the hex wrench, rotate the wrench in the opposite direction until pressure begins to raise on the other gauge.

7. Compare this wrench location with the location marked on the pump housing in step #5. Rotate the neutral adjusting shaft to the midpoint of the two locations and tighten the jam nuts without affecting the neutral adjustment shaft.

Multifunction Valve Pressure Testing / Adjustments





4

Multifunction Valve Pressure Testing / Adjustments

1. Heat the oil to a stable operating temperature.

2. Install a 10,000 PSI (690 Bar) gauge into each system pressure gauge port.

NOTE

The system pressure test ports (A and B) are located on the pump housing in a location directly opposite the respective Multifunction Valve cartridge.

3. Install a 600 PSI (41.4 Bar) gauge into the charge pressure port.

4. Park the 3-90C on a good tractive surface.

5. Open the shunt valves on the three hydrostatic circuits not being pressure tested at this time. Drop the blade to prevent movement of the 3-90C.

6. Start the engine and operate at normal engine speed in Forward.

7. Loosen the jam nut on the pressure adjusting plug.

8. Turn the adjusting screw until a pressure of 4640 △PSI (4640 PSI/320 Bar above charge pressure) is shown on the gauge.

NOTE

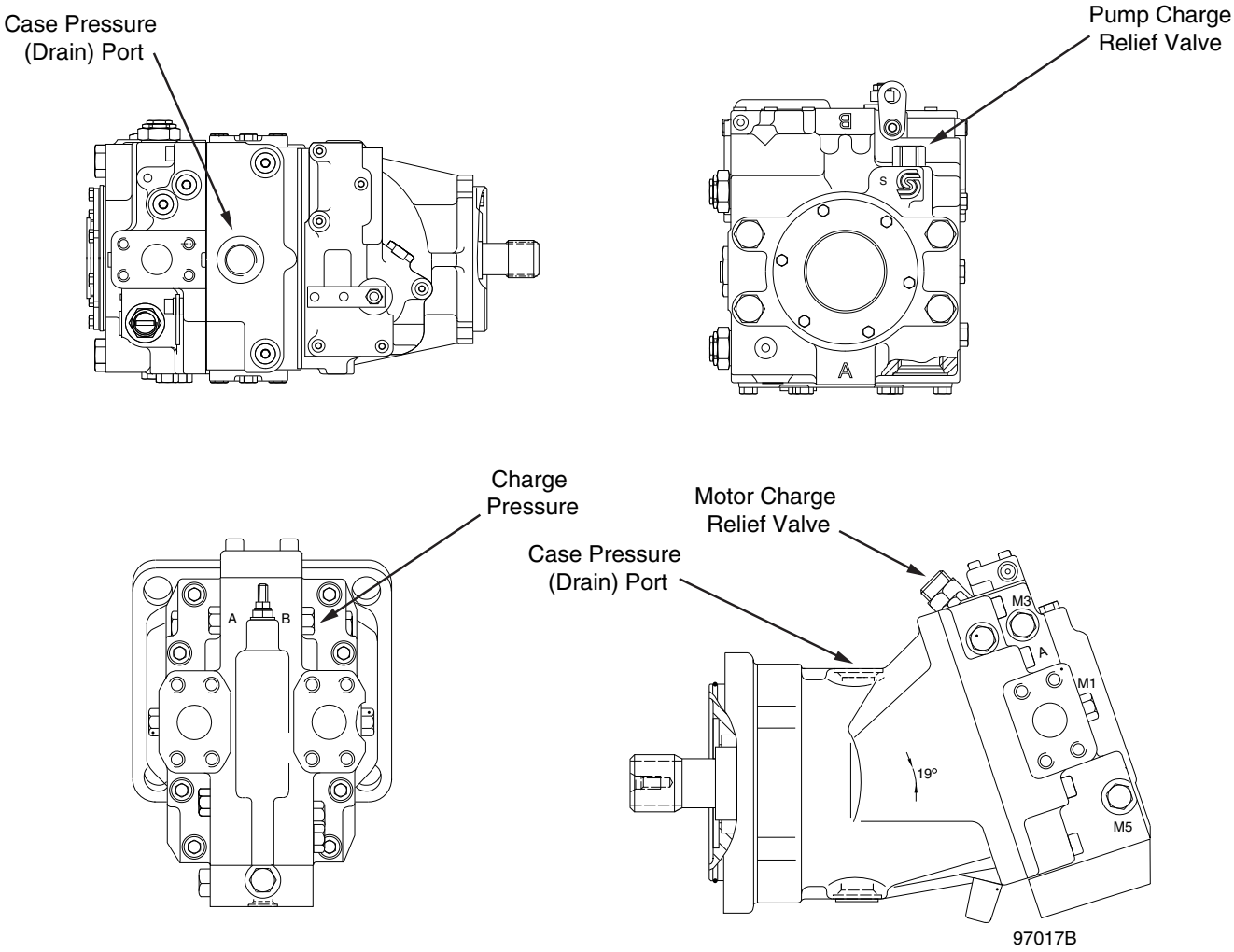
One full turn of the adjusting screw changes the maximum pressure setting by approximately 1350 PSI (93.1 Bar). Turning in the clockwise direction increases the pressure value.

9. Tighten the jam nut (26 lb-in/2.94 N•m) on the adjusting plug.

10. Repeat steps 7 though 9 in Reverse.

11. Remove gauges and close all shunt valves.

Charge Pressure Relief Valve Adjustment



4

Charge Pressure Relief Valve Adjustment

WARNING

The following procedure may require that the 3-90C be disabled (wheels raised off ground and steering locked) while performing the adjustment to prevent injury.

Pump Charge Relief Valve Pressure

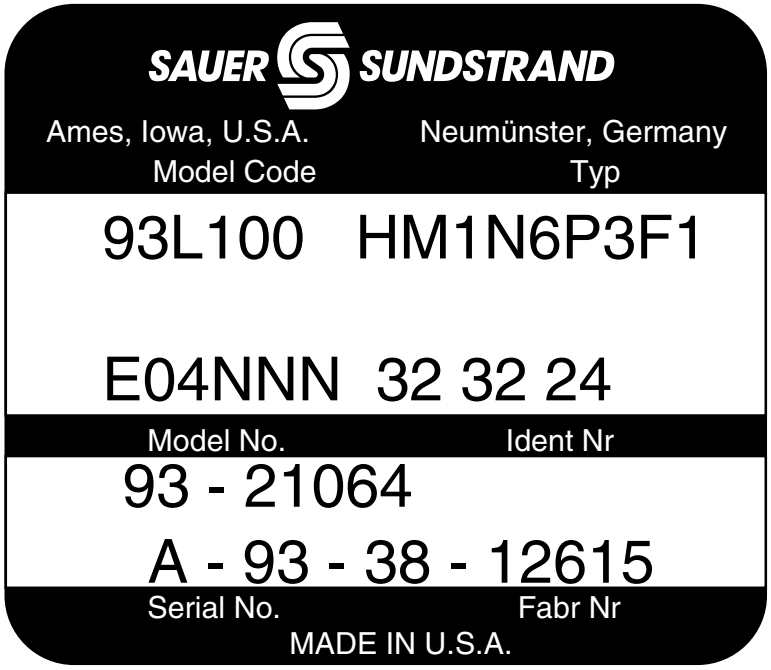
1. Heat the hydraulic oil to a stable operating temperature (120^{o} F/49^{o} C).
2. Use the hydrostatic pump charge pressure gauge installed in the remote gauge panel.
3. Install a 100 PSI (6.9 Bar) gauge into the case pressure test port.
4. Operate with the system in neutral at high idle speed.
5. The pressure shown on the charge pressure gauge should be 348-365 △PSI (348-365 PSI/24-25.2 Bar above case pressure).
6. Adjust as required until the pressure is within the specified range (see diagram opposite).

Motor Charge Relief Valve Pressure

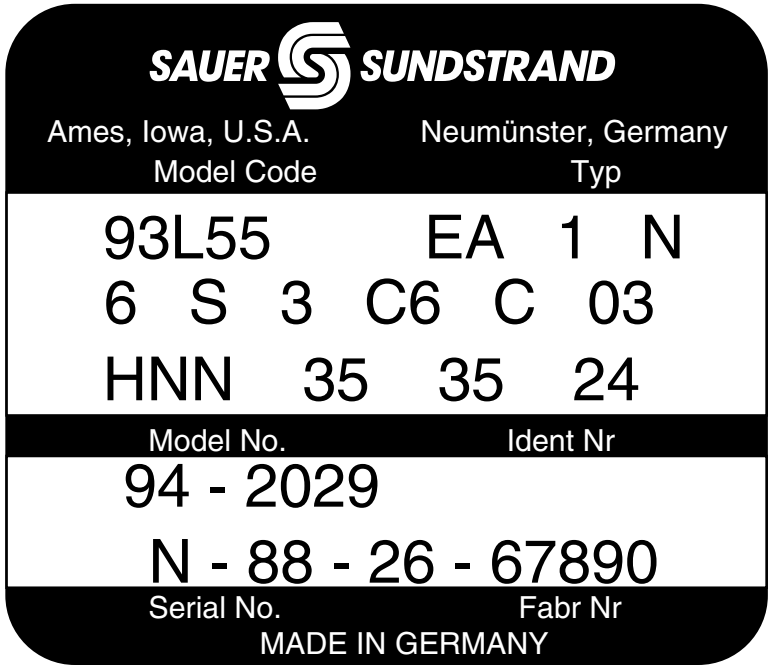
1. Heat the hydraulic oil to operating temperature (120^{o} F/49^{o} C).
2. Use the hydrostatic pump charge pressure gauge installed in the remote gauge panel.
3. Install a 100 PSI (6.9 Bar) gauge into the case pressure test port.
4. Operate the 3-90C with the system in W1 Forward.
5. The pressure shown on the gauge should be 242-282 △PSI (242-282 PSI/16.7-19.4 Bar above case pressure).
6. Adjust as required until the pressure is within the specified range.

Hydrostatic Pump Name Plate

Name Plate (U.S.A. Production)



Name Plate (GERMAN Production)



970117C

4

Hydrostatic Pump Name Plate

All hydrostatic pumps/motors will have a name plate affixed to the housing. The name plate will include the following information:

Model Number (Identification Number) - The model number is used by the factory in manufacturing. On repeat orders, a complete unit could be ordered by Model Number. The Model Number can be cross referenced to the Model Code for the unit.

Model Code - The Model Code can be used to completely define the specific unit and must be used when ordering the complete unit the first time or ordering service parts.

NOTE

The model code is defined on the following pages.

Serial Number - The Serial Number is used to identify the assembly location, the build date, and the unit sequence in the build. The Serial Number is also used to identify the units warranty period and must be referenced when ordering parts.

A "Manufacturing Location" code was added to the Serial Number in 1988. This indicates the original assembly location. Design changes can be implemented at different times at different plants. For this reason it can be a valuable aid if parts are required.

"A" Ames, Iowa
"N" Neumunster, Germany

The first four digits in the Serial Number indicate the Build Date Code. The first two numbers represent the year, and the second two digits represent the calender week. The final five digits represent the sequence in the build.

Hydrostatic Pump Name Plate Code Identification

Model Code

Series 90 Variable Displacement Pump - PV

9	0	L	1	0	0	H	M	1	N	6	P	3

PRODUCT OR SERIES
90 = SERIES 90, Closed Circuit

R: TYPE AND ROTATION
L = Pump, Left Hand (CCW)
R = Pump, Right Hand (CW)

DISPLACEMENT
042 = 42cc/rev (2.56 in^3/rev)
055 = 55cc/rev (3.35 in^3/rev)
075 = 75cc/rev (4.57 in^3/rev)
100 = 100cc/rev (6.10 in^3/rev)
130 = 130cc/rev (9.93 in^3/rev)

M: CONTROL
CA = Cover Plate
DC3 = 3 Position (F-N-R) Solenoid - 12 VDC
MA = Manual Displacement (MDC) (Standard)
MB = Manual Displacement (MDC) w/Neutral Start (NS)
MC = Manual Displacement (MDC) w/12 VDC Sol Override
MD = Manual Displacement (MDC) w/NS and 12 VDC Override
MF = Manual Displacement (MDC) w/24 VDC Sol Override (042 and 055 cc only)
MG = Manual Displacement (HDC) w/NS and 24 VDC Sol Override (042 and 055 cc only)
HA = Hydraulic Displacement (HDC) (1-11 BAR)
HB = Hydraulic Displacement (HDC) (1-6.7 BAR)
HC = Hydraulic Displacement (HDC) (3-11 BAR)
HM = Hydraulic Displacement (EDC) (1.6-6.7 BAR)
EA = Hydraulic Displacement (MDC) w/Packard Connector
NOTE = MC, MD, MF, and MG Controls require .018, .022, or .026 in. Dia Control Orifice

P: PRESSURE REGULATION
CA = Cover Plate
1 = Pressure Limiter (PL) in Port A and B (Standard)
6 = Pressure Limiter (PL) in Port A and/or B (Range 2)

J: AXILLARY MOUNTING PAD
A = SAE A w/Sealed Cover
B = SAE B w/Sealed Cover
C = SAE C w/Sealed Cover
D = SAE D w/Sealed Cover
N = No Axillary Pad
T = SAE A w/Sealed Cover, 11T Shaft (Special)
V = SAE B-B w/Sealed Cover

G: END CAP PORTS (SAE J518c Code 62)
1 = Twin Ports w/Special code 61 Flange Halves
2 = Side Ports w/Special code 61 Flange Halves
6 = Side Ports (Not available on 042 frame size
8 = Twin Ports

N: FILTRATION
S = Suction (Standard)
R = Remote Pressure
P = Pressure Integral (Short Filter)
L = Pressure Integral (Short Filter)

F: DISPLACEMENT LIMITATION
3 = No Limiters (Standard)
4 = Limitation Both Sides (Factory set at maximum displacement)

Hydrostatic Pump Name Plate Code Identification

Model Code

F 1 E 0 4 N N N 3 2 3 2 2 4

Series 90 Variable Displacement Pump - PV

K: CHARGE PRESSURE SETTING
20 = 20 Bar (290 PSI)
24 = 24 Bar (350 PSI)

Z: HIGH PRESSURE SETTING PORT "B"
14 = 140 BAR (2030 PSI)
17 = 170 BAR (2460 PSI)
20 = 200 BAR (2900 PSI)
23 = 230 BAR (3300 PSI)
26 = 260 BAR (3770 PSI)
29 = 290 BAR (4200 PSI)
32 = 320 BAR (4640 PSI)
35 = 350 BAR (5070 PSI)
38 = 380 BAR (5510 PSI)
42 = 420 BAR (6090 PSI)
45 = 450 BAR (6530 PSI)
48 = 480 BAR (6090 PSI)

Y: HIGH PRESSURE SETTING PORT "A"
Same as pressure ranges shown for port "B" above

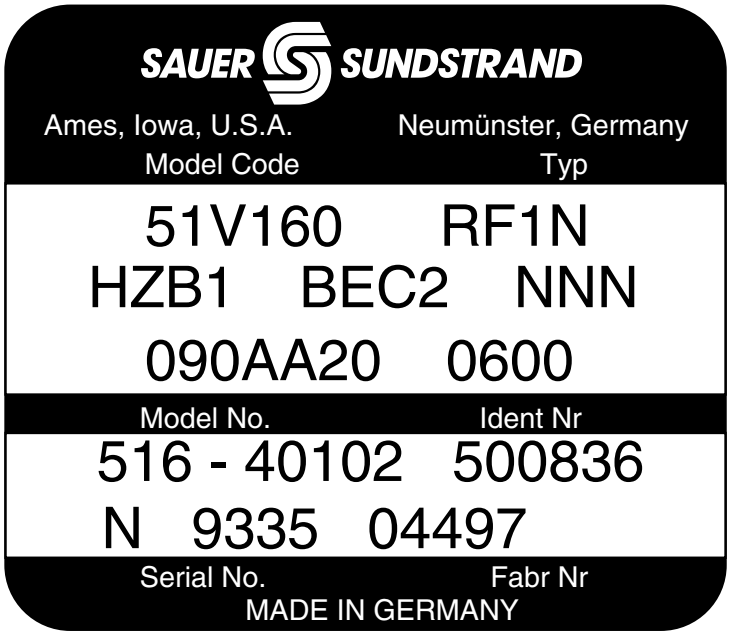
W: SPECIAL HARDWARE
NNN = None

T: CONTROL ORIFICE
00 = No Orifice
01 = .018 in Dia.
02 = .026 in. Dia.
03 = .032 in. Dia.
04 = 040 in. Dia.
05 = .054 in. Dia.
06 = .062 in. Dia.
09 = .092 in. Dia.
22 = .022 in. Dia.

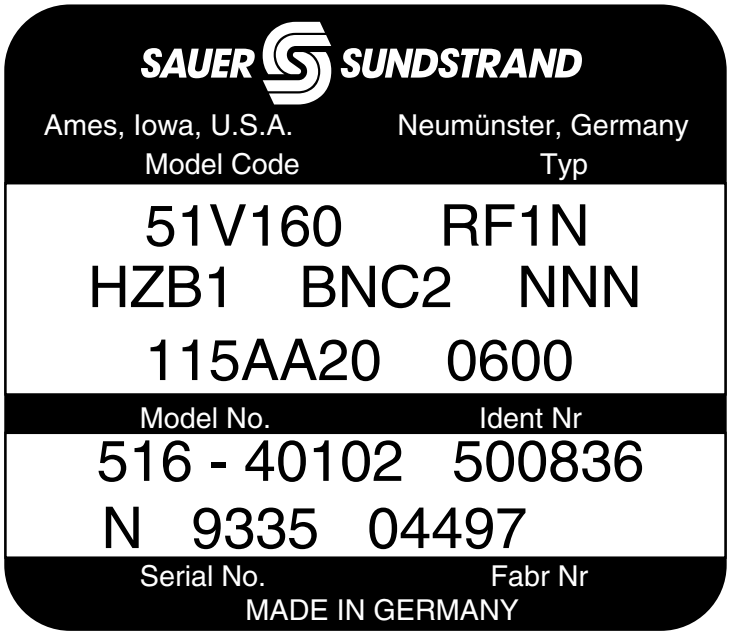
H: CHARGING SYSTEM
B = 11cc/rev (.69 in^3/rev)
C = 14 cc/rev (.86 in^3/rev)
D = 17 cc/rev (1.03 in^3/rev)
E = 20 cc/rev 1.20 in^3/rev)
F = 26 cc/rev 1.60 in^3/rev)
H = 34 cc/rev 2.07 in^3/rev)
L = Ext. Charge w/int. Relief

L: SHAFT CONFIGURATION
S1 = 14T 12/24 P
S3 = 16T 12/24 P
C3 = 15T 16/32 P
C6 = 21T 16/32 P
C7 = 23T 16/32 P
C8 = 27T 16/32 P
F1 = 13T 8/16 P
K1 = 1.375 in. Str. Key
K2 = 1.500 in. Str. Key
K3 = 1.750 in. Str. Key
T1 = 1.375 in. Tapered
T2 = 1.500 in. Tapered
T3 = 1.750 in. Tapered

Hydrostatic Motor Name Plate



Serial Numbers GJ 146 - 184



970117D

Serial Numbers GJ 185 - .....

4

Hydrostatic Motor Name Plate

All hydrostatic pumps/motors will have a name plate affixed to the housing. The name plate will include the following information:

Model Number (Identification Number) - The model number is used by the factory in manufacturing. On repeat orders, a complete unit could be ordered by Model Number. The Model Number can be cross referenced to the Model Code for the unit.

Model Code - The Model Code can be used to completely define the specific unit and must be used when ordering the complete unit the first time or ordering service parts.

NOTE

The model code is defined on the following pages.

Serial Number - The Serial Number is used to identify the assembly location, the build date, and the unit sequence in the build. The Serial Number is also used to identify the units warranty period and must be referenced when ordering parts.

Hydrostatic Pump Name Plate Code Identification

Type Designation

Series 51 Variable Displacement Motor

51	V	160	-	R	F1	N	-	HZ	B1	-	B

PRODUCT OR SERIES
Bent Axis Variable Motor
51 = SERIES 51

DESIGNATION AND ROTATION
V = Variable Motor, Bi-directional)

Frame Size (Displacement)
060 = 60cc/rev (3.66 in^3/rev)
080 = 80cc/rev (3.35 in^3/rev)
110 = 109.9cc/rev (6.71 in^3/rev)
160 = 160.9cc/rev (9.82 in^3/rev)
250 = 250cc/rev (15.26 in^3/rev)

END CAP PORTS (SAE J518c Code 62)
A = Axial Ports, Loop Flushing Valve
B = Axial Ports, Loop Flushing Valve, Code 61
R = Side Ports, Loop Flushing Valve
S = Side Ports, Loop Flushing Valve, Code 61

SHAFT CONFIGURATION
S1 = 14T 12/24 P
C6 = 21T 16/32 P
C7 = 23T 16/32 P
C8 = 27T 16/32 P
F1 = 13T 8/16 P
F2 = 15T 8/16 P

MAXIMUM DISPLACEMENT
N = 100%

CONTROL
N2 = Hydraulic, Two Position Control Direct
E1 = Electrohydraulic Two Position Control, Max To Min Disp. = 12 VDC
E2 = Electrohydraulic Two Position Control, Max To Min Disp. = 24 VDC
HS = Hydraulic Proportional Control (One Line)
H1 = HS with 12 VDC Electric Max Angle Override
H2 = HS with 24 VDC Electric Max Angle Override
HP = Hydraulic Proportional Control (Two Line), Shuttle Spool
EP = Electrohydraulic Proportional Control (PCP / Packard Connector)
EQ = Electrohydraulic Proportional Control (PCP / MS Connector)
PC = Pressure Compensator, Max To Min Disp.

SERVO PRESSURE SUPPLY AND PRESSURE COMP. OVERRIDE

	Servo Press. Supply	Std.	Defeat
A1	Internal	None	With
A2	Internal	With	None
A3	External	None	With
A4	External	With	None
A5	Internal	None	None
A6	External	None	None
B1	External	None	None
NN	For Use With N2 And PC		

CONTROL START(PRESSURE OR CURRENT) - PROPORTIONAL CONTROL
N = Not Applicable (For Any Two Position Control) - HS/H1/H2 Control
A = 2-5 Bar (29-73 PSI) - HS/H1/H2 Control
B = 4-9 Bar (58-131 PSI) - HS/H1/H2 Control
C = 8-35 Bar (116-508 PSI) - HS/H1/H2 Control
D = 10-50 Bar (145-725 PSI) - HS/H1/H2 Control
G = 3-5 Bar (44-73 PSI) - HP Control
H = 5-8 Bar (73-116 PSI) - HP Control
J = 15-50 mA - EP/EQ Control
K = 50-85 mA - EP/EQ Control

Hydrostatic Motor Name Plate Code Identification

Type Designation

E	C2	-	NNN	090	AA	20	-	06	00

Series 51 Variable Displacement Motor

PRESSURE COMPENSATOR SETTING
-2 Digit In 10 Bar Increments
00 = None **20 = 200 Bar (2900 PSI)**
10= 100 Bar (1450 PSI) **35 = 350 Bar (5080 PSI)**

STARTING POINT SETTING (Bar/mA)
-2 Digit In Full Bar
00 = None **20 = 20 Bar (290 PSI)**
6= 6 Bar (87 PSI)
Remark: If EP or EQ is used, the two digit value is in 5 mA increments

CHARGE PRESSURE SETTING (Bar)
10 = 10 Bar (145 PSI) **20 = 20 Bar (290 PSI)**
15 = 15 Bar (220 PSI) **24 = 24 Bar (350 PSI)**
18 = 18 Bar (260 PSI)

HIGH PRESSURE SETTING PORT "A" AND PORT "B"
A = None
B = 140 BAR (2030 PSI) **G = 290 BAR (4210 PSI)**
C = 170 BAR (2460 PSI) **H = 320 BAR (4640 PSI)**
D = 200 BAR (2900 PSI) **J = 350 BAR (5080 PSI)**
E = 230 BAR (3340 PSI) **K = 380 BAR (5510 PSI)**
F = 260 BAR (3770 PSI) **L = 420 BAR (6090 PSI)**
Example:DD A = 200 Bar (2900 PSI)
B = 200 Bar (2900 PSI)

MINIMUM DISPLACEMENT SETTING

Frame Size	Code	Displacement
160	090	90cc/rev (5.49 in^3/rev)
160	115	115 cc/rev (7.02 in^3/rev)

SPECIAL HARDWARE FEATURES
NNN = None **NBN = Bypass Valve**
RNN = System Pressure Relief Valves **NNS = Speed Sensor**

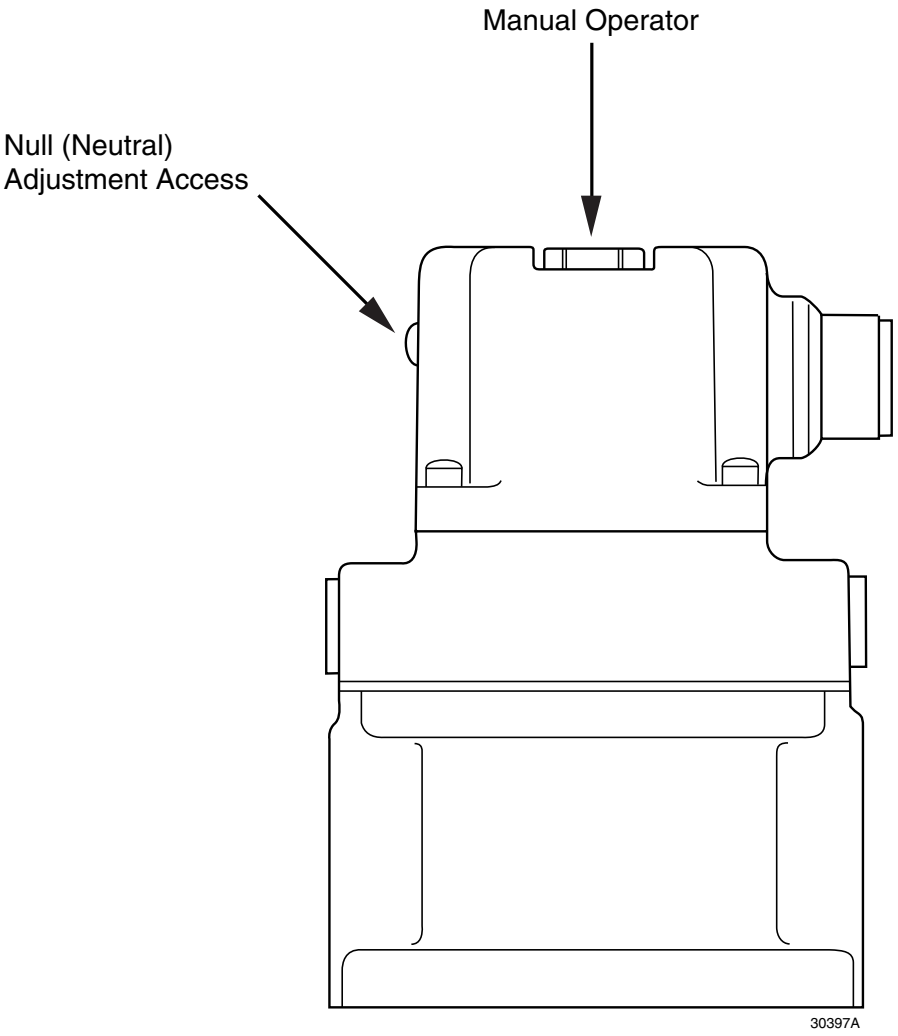
CONTROL ORIFICE
AO=None
A1 = Standard Without PCOR Defeat
A2 =Standard With PCOR Defeat
C2 =T1 .5mm
T2 .8mm
T3 .8mm
T7 .6mm
T8 .6mm

CONTROL RAMP (PRESSURE or CURRENT) PROPORTIONAL CONTROL
Proportional Control [Ramp is from 32° to 6° (full range, 5:1 ratio)]
N = None (0 Bar/PSI)

D = 7 Bar (102 PSI)	**(HP Control)**	
E = 7 Bar (102 PSI)	**(HS/H1/H2 Control)**	
G = 20 Bar (290PSI)	**(HS/H1/H2 Control)**	
U = 50 mA	**(EP/EQ Control)**	**Dual Coil In Series**
Y = 70 mA	**(EP/EQ Control)**	**Single Coil**
Z = 95 mA	**(EP/EQ Control)**	**Single Coil**

4

Pressure Control Servo Valve Troubleshooting



4

Pressure Control Servo Valve Troubleshooting

General - On top of the PCS valve is a manual operator. The manual operator bypasses the 3-90C electrical control of the PCS valve.

WARNING

Ensure everyone and everything is clear of the 3-90C prior to rotating the valve manual operator. As manual operator is rotated the machine may move. Caution must be used to successfully utilize the manual operator for any troubleshooting.

Manual PCS Valve Operation - Slowly rotate the manual operator on top of the PCS valve.

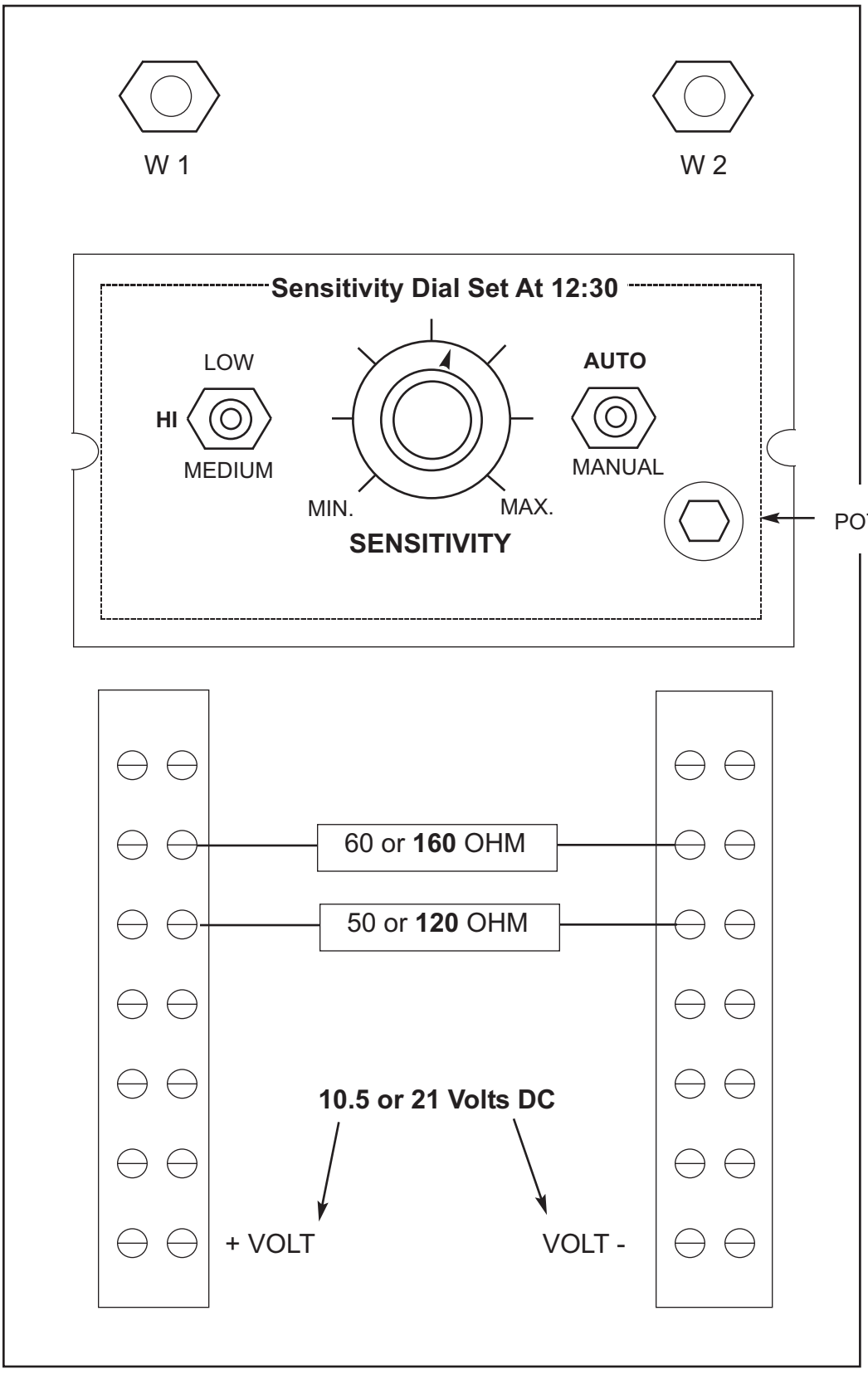
I. If the 3-90C wheels turn as the manual operator is moved, disconnect the connector to the coil. Using an Ohm meter, check the resistance across the coil pins.
   A. If the resistance for either coil is between 15 and 30 Ohms check the following:
      1. Check the resistance between each pin in the connector and the valve case.
      2. Check the load controller output voltage to the valve coils.
      3. Check all wires for continuity and proper connections.
   B. If coil resistance is outside the 15-30 Ohm range the PCS valve should be replaced.

II. If the 3-90C wheels do not turn as the manual operator is moved, measure the supply pressure to the PCS valve at the "P" gauge port on the PCS valve manifold (below valve body).
   A. If the supply pressure is normal, check PCS valve differential pressure at the “MS” and “Tank “ port of the PCS valve manifold. If the PCS valve manifold differential pressure is not correct and can not be adjusted, replace the PCS valve.
   B. If the supply pressure is lower than normal, the problem is in the hydraulic system (charge supply of the R.R. hydrostatic circuit).
      1. Check hydrostatic charge pressure (R.R. hydrostatic pump).

III. If the 3-90C wheels turn in one direction only and the electrical supply from the load controller is correct, and the valve coil resistances are correct the cable, the valve should be replaced.

PCS Valve Replacement - Install the valve leaving the electrical supply disconnected. With the wheels off the ground and the steering locked, start the engine. If the wheels turn slightly in either direction the Null (neutral adjustment) will need fine tuning. Use a 3/32" Allen Wrench in the hole covered by the screw in the pilot cover. Adjust the neutral adjusting screw until the wheels stop (do not turn more than one full turn in either direction). As adjustment is made turn the screw far enough to achieve wheel movement in the opposite direction to allow the springs to settle out, then adjust until no wheel movement is observed.

Load Controller Troubleshooting



4

Load Controller Troubleshooting

General - If troubleshooting the load controller is necessary the following guidelines can be used to help isolate the problem. All load controller tests should be conducted with the output setting on High. Check the system as follows:

WARNING

Ensure everyone and everything is clear of the 3-90C prior to rotating the valve manual operator. As manual operator is rotated the machine may move. Caution must be used to successfully utilize the manual operator for any troubleshooting.

1. With all power connections made, and the load controller set in the MANUAL mode of operation the 3-90C will operate at all engine RPM settings. Attach a DVM across the valve + and valve - terminals on the load controller. With the engine at 2100 RPM, the reading should be near system voltage.

IMPORTANT

If the load controller is placed in the manual position and the 3-90C F/N/R or W1/N/W2 controls are not in the neutral position the machine will move at all engine speeds.

2. With the load controller set in the AUTO mode of operation the 3-90C will operate at engine RPM settings above approximately 1650 RPM. Attach a DVM across the valve + and valve - terminals on the panel. With the engine at 2100 RPM, the reading should be 10.5 / 21 Volts D.C. If not: See Load Controller Adjustments (in this manual) to adjust controller output setting. If 10.5 / 21 Volts D.C. is the output reading, check the throttle, pulse pick-up sensor, brake switch, brake pressure switch, wires and connections.

NOTE

Refer to Load Controller Adjustments in this manual for more information concerning load controller testing and adjustments.

3. If the voltage across the valve + and valve - terminals is correct in MANUAL but low in AUTO, remove the plug for the engine RPM droop set point. In the unloaded high idle condition the LED under the protective plug should be off.

4. If the LED is on, Put a DVM across the pulse pick-up sensor connection. It should read approximately 1-2 Volts A.C. If the pulse pick-up sensor signal does not exist, check adjustment, connections, and wire continuity to the pulse pick-up sensor.

5. If all of the above problems are ruled out, the load controller is not field repairable and will need to be replaced.

NOTE

Additional troubleshooting information can be found in the 3-90C Operation Manual P/N 531 or 531A

3-90C PROPULSION SYSTEM MISCELLANEOUS PARTS LISTING			
KIT	QUANTITY	PART NUMBER	DESCRIPTION
Hydro. Split Flange	8	102-11786	Kit, Split Flange (One Port Only)
	2	102-11786-10	Split Flange Half
	4	102-11786-11	Bolt, Flange Retaining, Grade 8
	4	102-11786-12	Washer, Lock
	1	102-11786-13	Viton O-ring (A port / B port)
Damper Rebuild	1	661-41236-01	Damper Rebuild Kit (Ref. Bulletin #9168)
	1	661-41238-01	Engine Mounts, Front
	1	661-41239-01	Engine Mounts, Rear
	1	661-41237-01	Damper Dust Shield Kit
	1	102-50397-01	Flywheel Drive Damper
Dust Shield	1	661-41237-01	Dust Shield Kit
	1	111-41207-01	Damper Dust Shield
	16	298-00067-97	Dust Shield Washers
Engine Mount (F)	1	661-41238-01	Engine Mount Kit (Front - Fan End)
	2	298-05782-68	Engine Mount, Front
	2	398-02077-46	5/8” X 4” - 11 Bolt, Grade 8
	2	298-00041-97	5/8” Flat Washer, Hardened
	2	298-02066-71	5/8” - 11 Nut, Flange Locking
	4	298-00051-97	Washer, J2049-67
Engine Mount (R)	1	661-41239-01	Engine Mount Kit (Rear - Flywheel End)
	4	298-05738-68	Engine Mount, Rear
	4	298-02004-26	5/8” X 5” - 11 Bolt, Grade 8
Misc. Hydro. O-rings	2	298-03590-68	O-ring Brake Housing To Final Drive
	4	298-03590-68	O-ring Hydro. Motor To Final Dr.
	4	102-13172-11	O-ring Hydro. Motor To Final Dr. (GRN)
	4	298-03587-68	O-ring Hydro. Pump To Pump Drive