MMP4-CAT(T4)-MX-2

SPECIALTY HAULAGE SOLUTIONS FOR CONSTRUCTION AND MINING

Maintenance Manual

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MANUAL USAGE

This technical manual only contains information required to safely maintain the MMP4 powered by a CAT 2.2l TIER 4 diesel engine. See the CAT Engine Maintenance and Operators Safety Manual (SEBU8312-02) for specific vehicle system information and maintenance procedures. If your system is not covered in this manual please contact MEGA Corp. Product Support at:
1-800-345-8889 or visit our web site at www.megacorpinc.com for more detailed information.

Descriptions of the hazards are reviewed in this section. All personnel working on or operating the machine must become familiarized with all the safety messages.

⚠ WARNING

Due to the nature of these processes, ensure that all safety information, warnings and instructions are read and understood before any operation or any maintenance procedures are performed. Some procedures take place with heavy components and at moderate heights, ensure proper safety procedures are maintained when performing these actions. Failure to use and maintain proper safety equipment and procedures will cause injury, death or damage to equipment.

WARNING, CAUTION AND NOTES

The following definitions are found throughout the manual and apply as follows:

⚠ WARNING

Operating procedures and techniques, which could result in personal injury and/or loss of life if not carefully followed.

CAUTION

Operating procedures and techniques, which could result in damage to equipment if not carefully followed.

NOTE

Operating procedures and techniques that are considered essential to emphasize.

USE OF SHALL, WILL, SHOULD AND MAY

Shall and **Will** – Used when application of a procedure is mandatory.

Should – Used when application of a procedure is recommended.

May - Used to indicate an acceptable or suggested means of accomplishment.

SECTION 1
Definitions and Abbreviations

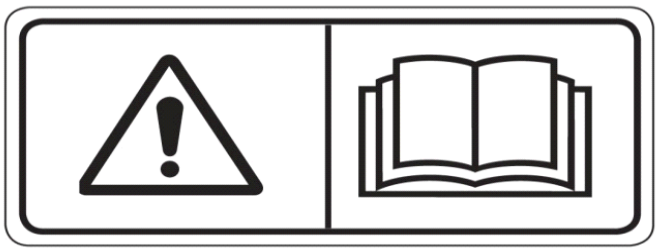
SAFETY MESSAGES

There are several specific safety messages in this section that are applicable to the MMP4. These hazards are reviewed in this section. All personnel working on or operating the machine must become familiarized with all the safety messages.

(Applicable to safety labels on machine) Make sure that all of the safety messages are legible. Clean the safety messages or replace the safety messages if you cannot read the words. Replace the illustrations if the illustrations are not legible. When you clean the safety messages, use a cloth, water and soap. Do not use solvent, gasoline or other harsh chemicals to clean the safety messages. Solvents, gasoline or harsh chemicals could loosen the adhesive that secures the safety messages. Loose adhesive will allow the safety messages to detach.

Replace any safety message that is damaged or missing. If a safety message is attached to a part that is replaced, install a new safety message on the replacement part.

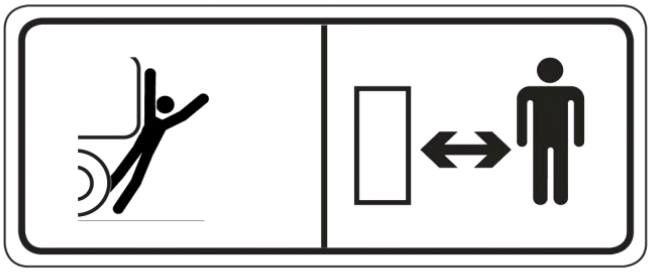
DO NOT OPERATE (2)



⚠ WARNING

Do not open this control box unless you read and understand the instructions and warnings in the Operator and Maintenance Manual. Failure to follow instructions or heed the warnings could result in serious injury or death.

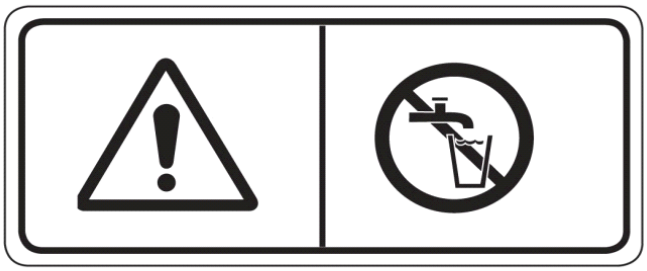
BACKING RUNOVER HAZARD (3)



⚠ WARNING

The vehicle is equipped with a back-up alarm. Alarm must sound when operating this vehicle in reverse. Failure to maintain a clear view in the direction of travel could result in serious injury or death.

NON-POTABLE (5)



⚠ WARNING

Water held within the MMP4 is not potable. Do not use the MMP4 for transport of water intended for human or animal consumption, as serious injury or death may result.

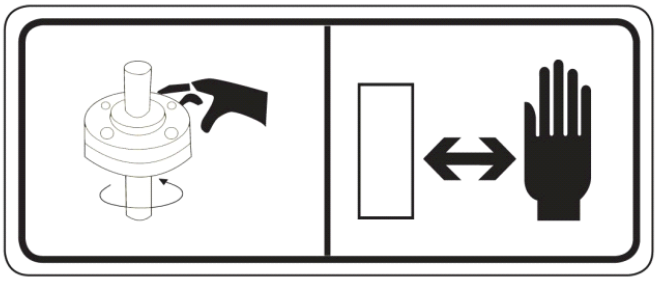
SECTION 1
Definitions and Abbreviations

FALL HAZARD (7)

⚠ WARNING

Do not walk on the top of tank without fall arrest PPE. Serious injury or death could occur from a fall.

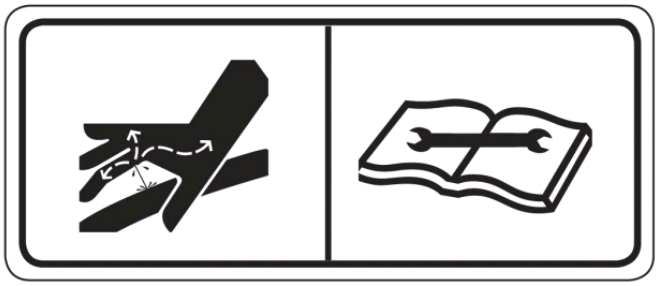
ROTATING SHAFT (8)



⚠ WARNING

Do not place your hand or tools within pump bell while pump is rotating and/or pressure held within the motor supply hose. Refer to the Operator and Maintenance Manual for the procedures to operate and maintain the pump. Failure to follow proper procedures could result in serious injury.

HIGH PRESSURE MOTOR (11)



⚠ WARNING

Hydraulic motor and supply lines contain oil under high pressure. Improper removal and repair procedures could cause severe injury. To remove or repair, instructions in the Maintenance Manual must be followed.

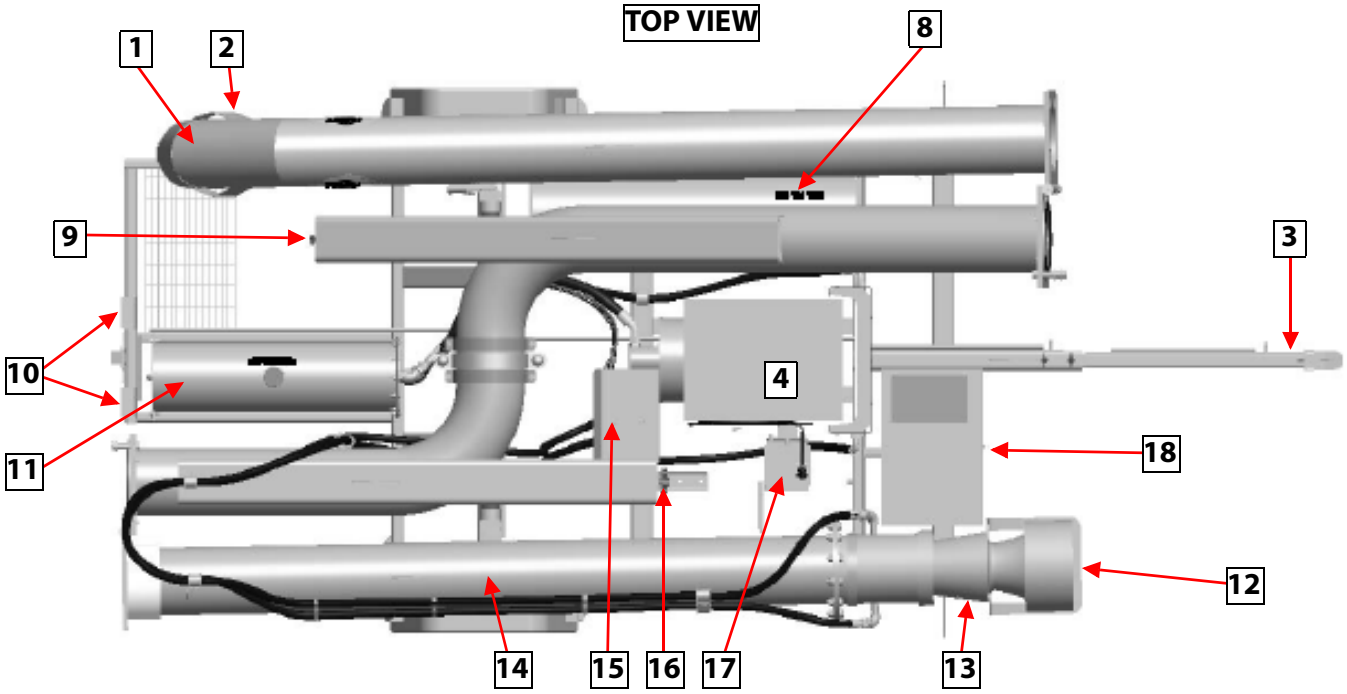
ABBREVIATIONS

cc - Cubic Centimeters
CCW - Counter Clockwise
CW - Clockwise
fl. oz. - Fluid Ounce
FT - Feet
FPM - Feet Per Minute
GPM - Gallons Per Minute
IN/SQ FT - Inches per Square Feet
KM-H - Kilometers Per Hour
Kg - kilograms
kPa - Kilopascals
l - liters
lpm - Liters per minute
LT - Left as viewed from the operator's position facing forward
m - meters
MPH - Miles Per Hour
MMP - MEGA Mobile Pump
Nm - Newton meters of torque
psi - pounds per square inch
RPM - Revolutions Per Minute
RT - Right as viewed from the operator's position facing forward
SQ FT - Square Feet
VDC - Volts, Direct Current

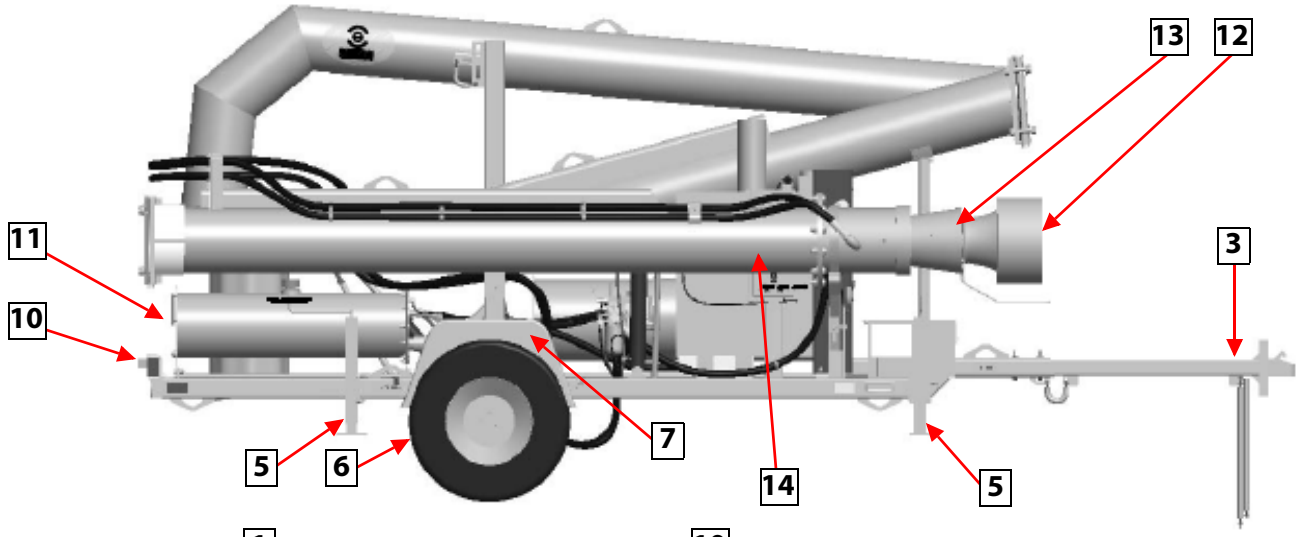
SECTION 1
Definitions and Abbreviations

MMP4 GENERAL OVERVIEW (TYPICAL)

TOP VIEW



SIDE VIEW



1	DISCHARGE BOOM
2	VACUUM BREAK
3	TOW HITCH
4	CAT C2.2T DIESEL ENGINE
5	LANDING GEAR (QTY 3)
6	TIRE AND RIM ASSEMBLY
7	FENDER
8	50 GAL. DIESEL FUEL TANK
9	DISCHARGE BOOM LIFT CYLINDER
10	TAIL LIGHTS
11	HYDRAULIC OIL TANK
12	INLET DEBRIS SCREEN AND SAFETY CHAIN
13	AXIAL WATER PUMP
14	INLET BOOM
15	HYDRAULIC CONTROL VALVE
16	INLET BOOM CYLINDER
17	ENGINE CONTROL BOX
18	BATTERY BOX

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System Description

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DESCRIPTION

The MEGA Mobile Pump (MMP4) is a towable water lifting station. The MMP4 may be towed by a vehicle capable of at least a 6,000 pound (2,725 kg) towing capacity, 1,000 pound (450 kg) tongue weight, and equipped with the appropriate weight rated Class IV trailer hitch with a 2 5/16 inch ball. The MMP4 can be transported to a water holding pond and be set up by one individual.

The MMP4 is a self-contained pumping station fitted with a hydraulically driven 12 inch axial water pump that has the potential to lift water 25 feet (7.6 meters) from pump level to fill water distribution equipment (maximum height: 17 feet or 5.2 meters above ground level).

MMP4s are equipped with: hydraulically lifted inlet and discharge booms with safety retaining chains and travel locking devices, DOT rated lighting, 16 inch load range 'E' on-highway trailer tires, a fold away hitch with safety chains, a vacuum break with an anti-siphon discharge sock on the discharge boom, 23 gallon (87 liter) hydraulic oil tank filled with Chevron Clarity AW 46 hydraulic oil, a gear type hydraulic pump driven by a Caterpillar C2.2T series diesel engine, and a 50 gallon (190 liter) capacity diesel fuel tank equipped with shut off valves.

The MMP4 needs a minimum of 2.5 feet (0.76 meters) of water above the inlet of the water pump for proper operation.

INSPECTION

1. Inspect MMP4 exterior paint for wear and corrosion.
2. Inspect piping for damage and leaks.
3. Inspect frame, landing gear and suspension for damage and missing parts.
4. Inspect engine assembly for loose, missing, damaged or leaking parts.
5. Inspect all hydraulic hoses and couplings for security, damage and leaking.
6. Inspect fuel, engine oil, anti freeze and hydraulic oil for contamination and proper level.
7. Inspect lighting, lug nuts, fenders and hitch safety equipment for operation, damage and missing parts.
8. Inspect electrical system for corrosion, damage and missing parts.

SECTION 2
System Description

REPAIR

Paint
Remove corrosion, prime and paint.

Engine Fluid Levels and Inspections
Adjust, repair or service according to CAT C2.2T manuals (SEBU8312-02) for engine service schedule.

Leaks
1. Remove paint and corrosion from suspected area.

2. Prep surface to be welded, weld over leak.

3. Prime and paint over weld.

4. Tighten or replace damaged or leaking component.

Lighting
Repair as required to maintain DOT compliance.

Missing parts
Contact MEGA Corp Parts sales for assistance.

Structure
Contact the MEGA Corp. Product Support Group at:
Toll free US 1-800-345-8889
Direct 1-505-345-2661
or visit our website at www.megacorpinc.com for more detailed contact information or assistance on major structural repairs.

SECTION 3
Engine Control System

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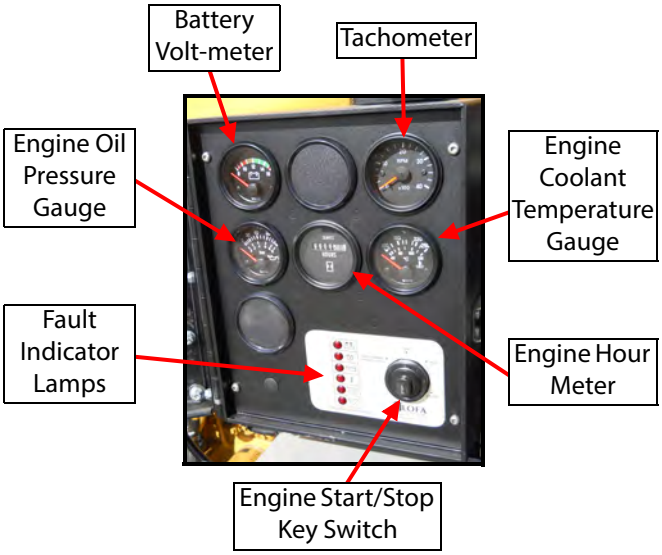
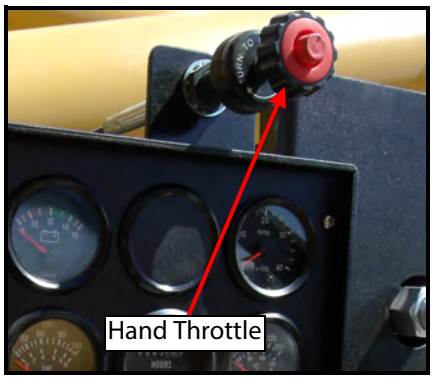
Inspection 3-1
Repair 3-1

DESCRIPTION

The Engine Control System consists of: A control box with lockable cover, ignition switch with key, throttle control, battery voltage gauge, engine oil pressure gauge, engine coolant temperature gauge, hour meter, fault indicator lamps, and an engine tachometer.





The engine control box controls and monitors the main engine functions. It is equipped with:

- Oil pressure gauge to monitor the engine oil pressure.
- Engine coolant temperature to monitor the engine coolant temperature.
- Tachometer to monitor the engine RPM's or speed.
- Battery voltage meter to monitor the battery voltage.
- Battery voltage meter to indicate the state of charge and electrical operation of system.
- Engine hour meter to indicate engine operational hours.
- Fault Indicator Lamps to indicate potential unsafe operating conditions and to show fault in individual systems.
- Hand throttle to adjust the engine operating RPM's.
- Remote Engine Stop Button

INSPECTION

1. Inspect control box and cabling for security, condition and mounting.

2. Inspect switches, gauges and throttle control for security, damage and operational condition.

REPAIR

SWITCH REPLACEMENT

1. Remove power to the engine control.

2. Remove engine control face plate to gain access to the switch.

3. Mark wiring on old switch before removal to ensure correct wiring configuration is maintained.

4. Remove old switch and replace with the same type of switch.

5. Install wiring on new switch as previously marked.

6. Install engine control face plate in control box.

7. Apply power to the engine control and perform functional check of the newly installed switch.

SECTION 3
Engine Control System

INDICATOR GAUGE REPLACEMENT

1. Remove power to the engine control.
2. Remove engine control face plate to gain access to gauge and wiring.
3. Mark wiring on old gauge before removal to ensure correct wiring configuration is maintained.
4. Remove old gauge and replace with the same type of gauge.
5. Install wiring on new gauge as previously marked.
6. Install engine control face panel in control box
7. Apply power to the engine control and perform functional check of newly installed indicator gauge.

ENGINE TACHOMETER REPLACEMENT

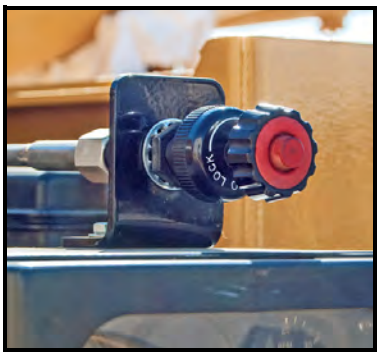
1. Remove power to the engine control.
2. Remove engine control face plate to gain access to the backside of the tachometer.
3. Mark wiring on old tachometer before removal to ensure correct wiring configuration is maintained.
4. Remove old tachometer and replace with the same type tachometer.
5. Installed wiring on new tachometer as previously marked.
6. Install engine control plate in control box.
7. Apply power to engine control and perform functional check of newly installed tachometer.

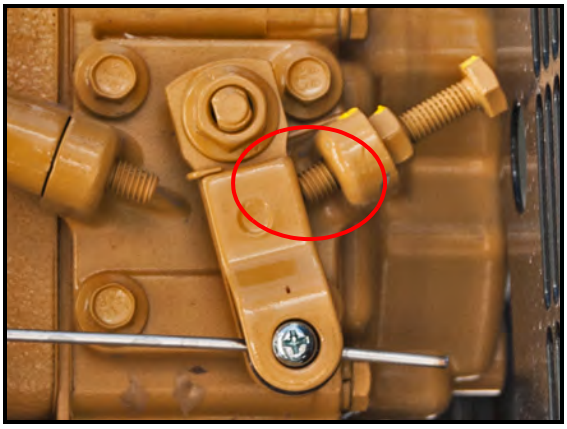
THROTTLE CONTROL REPLACEMENT

1. Remove power to the engine and engine control system.
2. Loosen cable locking screw on throttle lever on fuel injection pump.
3. Remove cable jam nut on lever side of the fuel pump mounting bracket.
4. Remove cable jam nut on throttle adjusting end of cable.
5. Remove cable assembly.
6. Install new throttle cable assembly in mounting bracket.
7. Thread jam nut on throttle cable adjusting end behind mounting bracket.
8. Route throttle cable to the fuel pump cable mounting bracket.
9. Run cable through fuel pump mounting bracket.
10. Install jam nut on fuel pump throttle lever side of bracket.
11. Insert throttle cable in the pivot on the throttle lever of the fuel pump.
12. Ensure throttle cable and fuel pump throttle lever is in the idle position.
13. Secure the throttle cable locking screw on the new cable.
14. Ensure the new throttle cable is routed away from moving parts.
15. Ensure throttle cable is secure.
16. Check operation of newly installed cable for smooth operation.

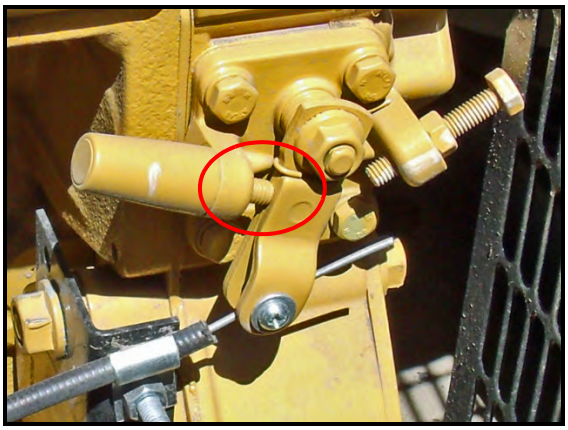
SECTION 3
Engine Control System

17. Ensure newly installed throttle cable allows engine throttle lever to fully contact the LOW idle stop.





18. Ensure the newly installed throttle cable allows engine throttle to fully contact the HIGH idle stop.



19. Place throttle control cable in the low idle position.

20. Apply power to engine control box and engine.

21. Ensure hydraulic ball valve at hydraulic tank is OPEN.

22. Perform functional check to ensure proper engine low and high idle RPMs. If engine RPMs are out of specified range, check throttle cable adjustment again and refer to CAT C2.2T engine manual (SEBU8312-02) for correct RPM specifications and adjustment procedures.

SECTION 3
Engine Control System

SECTION 4
Basic Hydraulics System

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DESCRIPTION

The MMP4 hydraulic system originates at a hydraulic pump coupled to a CAT C2.2T Diesel engine. The system draws hydraulic oil from a hydraulic tank mounted at the rear of the MMP4 frame through an inlet screen inside of the tank and a shut off valve on the outside of the tank. The hydraulic pump moves the oil to a hydraulic control valve mounted to the right side of the unit. The control valve diverts and regulates the oil flow and pressure through the MMP4 system. The Hydraulic control valve is used to control the raising and lowering of the 2 hydraulic cylinders attached to the inlet and discharge booms. The hydraulic control valve also controls the hydraulic drive motor inside of the water pump at the end of the inlet boom; this control feature is equipped with a detent to allow the lever to stay in the ON position during water pump operation, and is equipped with a pressure relief valve to protect against over-pressurization of the hydraulic system. The return hydraulic oil is passed through a hydraulic oil filter, oil cooler, and then a diffuser mounted inside of the hydraulic oil tank.

HYDRAULIC TANK ASSEMBLY

DESCRIPTION

The hydraulic tank consists of an inlet screen, return oil diffuser, internal baffle, shut off valve, oil level sight gauge, reservoir cap and breather. The system draws oil from the bottom of the tank through an inlet screen to pre-filter the oil. The shut off valve (if equipped) holds the oil inside of the tank when servicing the hydraulic system. The sight gauge is used as a visual indicator of the hydraulic oil quality and quantity. The Internal baffle allows for oil movement with in the tank to evenly distribute the return oil trough out the reservoir. The return diffuser inside of the hydraulic tank just below the normal oil level reduces the potential for hydraulic oil foaming in the tank. The reservoir cap and breather allow filling of the hydraulic tank and prevent dirt and debris from entering the hydraulic system.

INSPECTION

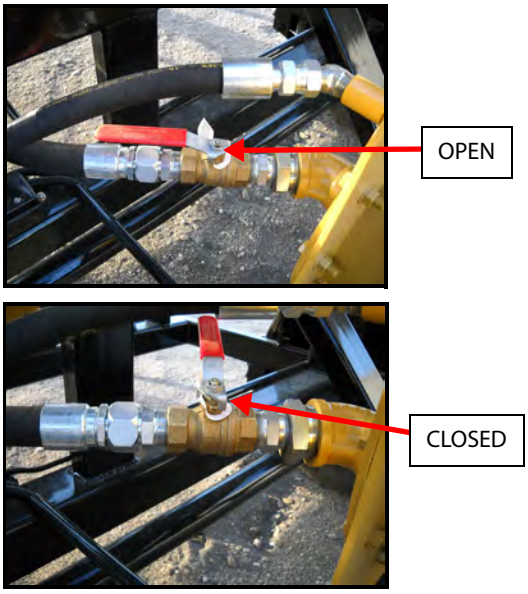
1. Inspect hydraulic oil tank for security, damage, and leaks.

SECTION 4
Basic Hydraulics System

2. Check hydraulic oil level and quality. The level should be between 80% and 90% of the level visible in the sight glass and clear.

3. Check hydraulic tank filler cap, breather and bolt on end cover for security, damage and leaks.

4. Check hydraulic hose fittings and shut off valve, ensure shut off valve is open.



5. Check tank mounting bolts, ensure the bolts are tight.

REPAIR
Repair, secure or adjust as required.

HYDRAULIC PUMP

DESCRIPTION
The hydraulic pump is coupled to the flywheel end of the engine. The hydraulic pump moves the oil through the system to generate flow and pressure needed to operate the water pump and boom cylinders. The pump draws oil from the hydraulic tank and moves it to the hydraulic control valve where the control valve directs the oil flow to the selected components.

INSPECTION
Inspect hydraulic pump, adapter and hosing for vibrations, unusual noises, security, damage and leaks.

REPAIR
Repair or replace as required.

WATER PUMP HYDRAULIC DRIVE MOTOR

The hydraulic drive motor is coupled to the water pump drive shaft inside the water pump. The drive motor is controlled by the hydraulic control valve, water pump spool. When the lever is moved to the ON position the fluid is directed to the drive motor causing the water pump impeller to rotate, moving water up the inlet boom.

INSPECTION
1. Check water pump drive motor fittings for security, damage and leaks.

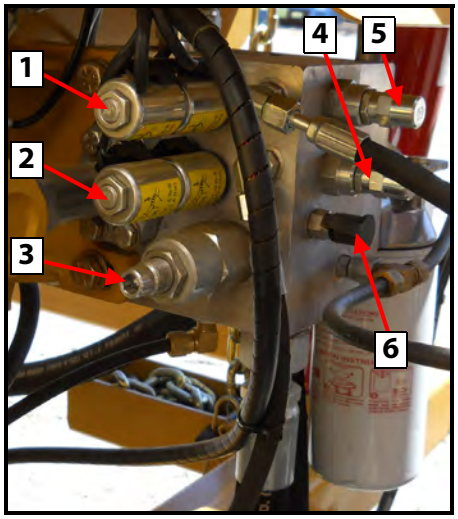
2. Check for an oily film on water surface (indications of hydraulic oil leak below the surface of the water). If water pump is submerged.

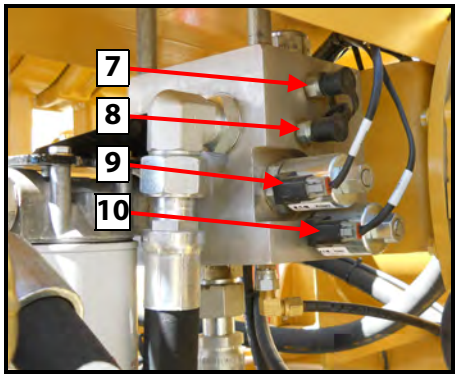
3. Check for oil residue inside of the inlet to the water pump. If water pump is in the travel position.

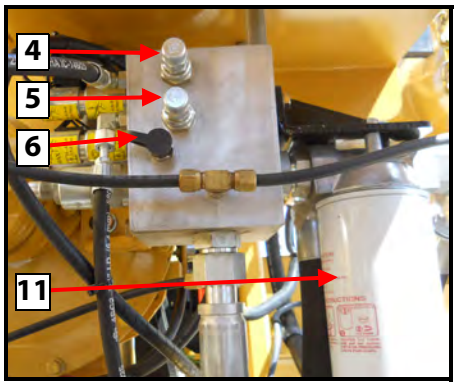
REPAIR
Repair or replace as required.

SECTION 4
Basic Hydraulics System

HYDRAULIC CONTROL VALVE







The hydraulic control valve controls all of the oil flowing from the hydraulic oil pump and controls its flow and pressures. The valve is attached to the rear of the accessory drive housing of the engine. The control valve consists of:

1	Discharge Boom Valve
2	PUMP Boom Valve
3	Main System Pressure Relief
4	Discharge Boom Speed Control
5	Pump Boom Speed Control
6	System Pressure Test Port
7	System Return Test Port
8	Pump Motor Test Port
9	Dump Valve
10	Water Pump Start Valve
11	Hydraulic Oil Filter

INSPECTION

1. Check hydraulic control valve mounting for security, damage and leaks.

2. Check control valve levers for ease of operation, security, damage and missing parts.

3. Check control valve fittings and metering valves for security, damage and leaks.

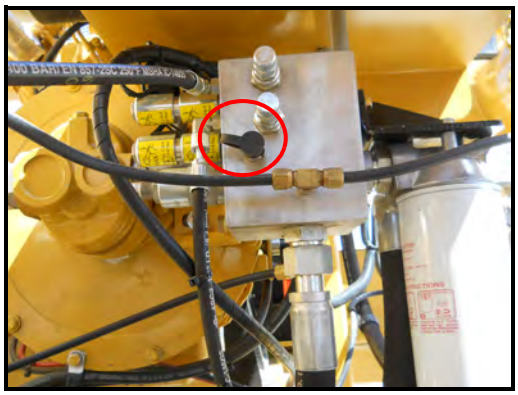
4. Check pressure regulator for proper relief pressure (2,800 psi/19,300 kpa), security and leaks.

REPAIR

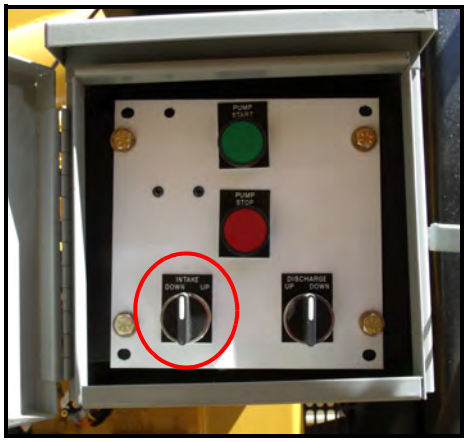
Hydraulic Control Valve

1. Repair, adjust or replace as required.

2. To set hydraulic relief pressure, install a 0 – 3,000 psi (0 – 21,000 kpa) pressure gauge on the test fitting located on the side of the control valve as shown below.

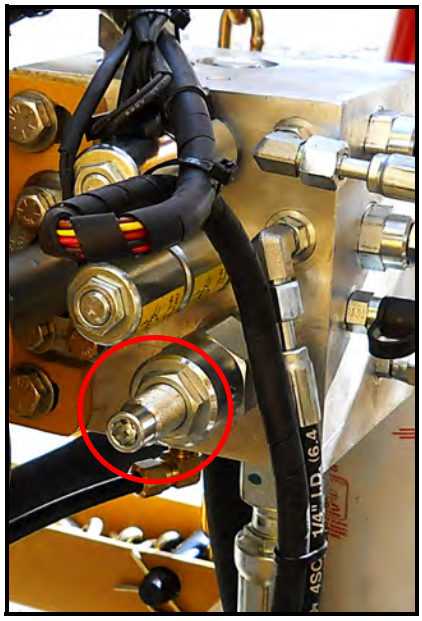


3. With the engine operating at high idle, operate the inlet boom UP switch and observe the reading on the pressure gauge.



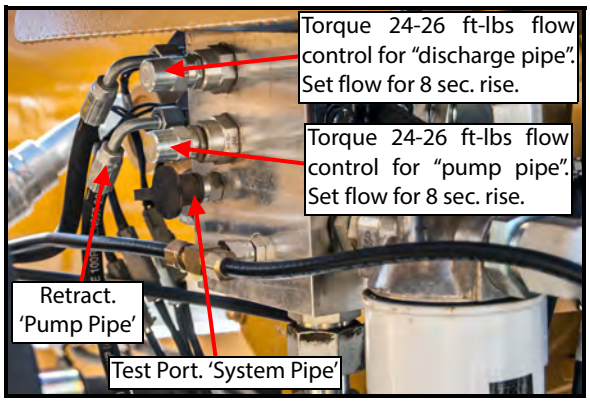
SECTION 4
Basic Hydraulics System

4. If the hydraulic oil pressure is not within the specifications, adjust the pressure regulator cartridge as follows:
   a. To increase the pressure, loosen the lock nut on the regulator stem and screw in the stem clockwise (CW) until the pressure is at 2,800 psi (19,300 kpa), tighten lock nut on stem.
   b. To reduce the pressure, loosen the lock nut on the regulator stem and unscrew the stem counter clockwise (CCW) until the proper pressure is obtained, tighten lock nut on stem.
   c. Recheck hydraulic pressure.
   d. Shut unit off.
   e. Remove pressure gauge from test port.

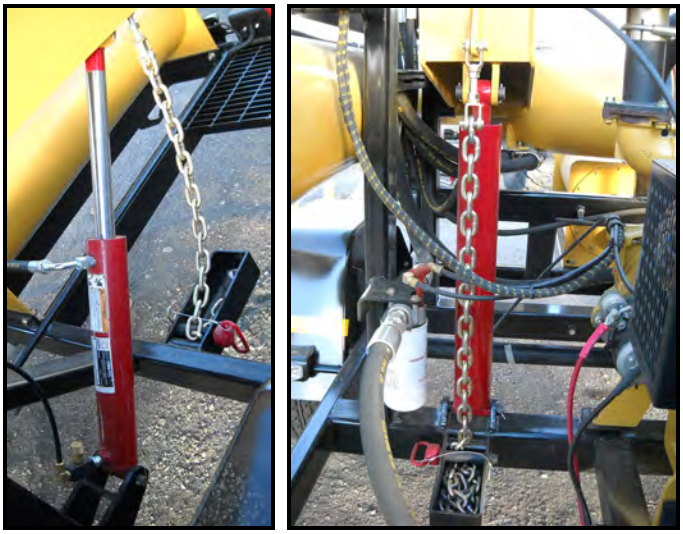


Hydraulic Cylinder Speed Control Valve

1. If the hydraulic boom cylinders raise too slowly or lower too fast, check the adjustment as follows;
   a. Remove protective cap.
   b. Loosen jam nut.
   c. Fully seat the flow control on the hydraulic control valve for the cylinder with the travel speed that needs adjustment.
   d. Rotate knob 1/2 turn CCW.
   e. Raise boom, check speed to ensure speed is desired, if speed is too fast turn knob CW 1/16th of a turn at a time, if the speed is too slow turn knob CCW 1/16th of a turn at a time until desired speed is achieved (8 seconds to full rise).
   f. Tighten jamb nut.
   g. Reinstall cap.



HYDRAULIC CYLINDERS



The 2 hydraulic cylinders are used for lifting the inlet and discharge booms to either the 'stow/travel' position or to the 'fill' position. When the boom control switch is operated in the 'UP' position, the pressurized oil retracts the cylinder and lifts the boom. The speed of the lifting and lowering is controlled by metering valves built into the hydraulic control valve. There are safety chains at each cylinder to prevent any unwanted movement in the boom when it is filled with water and as a safety precaution in case the control valve lever is operated accidentally. The cylinder operates in the boom down mode by activating the control valve in the 'DOWN' position, the weight of the boom makes the cylinder extend, lowering the boom, the built in metering valve controls the lowering speed of the boom.

SECTION 4
Basic Hydraulics System

INSPECTION
1. Check hydraulic cylinders for security, damage and leaks.

2. Check hydraulic cylinder safety chains for security, missing parts and damage.

3. Check hydraulic hoses and metering valves for security, damage and leaks.

4. Check for proper operation and alignment.

REPAIR
Repair, adjust or replace as required.

HYDRAULIC FILTER

The spin on hydraulic oil filter is in the return to tank hydraulic circuit. All hydraulic oil passing through the system passes through the filter prior to the hydraulic oil cooler. The filter is rated at 400 psi (2,758 kpa). The filter is rated at 10 microns and the filter housing has a built in bypass valve to bypass the filter element when the inlet pressure is too high or the filter becomes restricted.

INSPECTION
1. Inspect hydraulic oil filter mounting for security and damage.

2. Check hydraulic filter for leaks and damage.

3. Check hydraulic filter assembly hose fitting adapters for security and leaks.

REPAIR
Repair, adjust or replace as required.

HYDRAULIC OIL COOLER

The hydraulic oil cooler is attached to the front of the engine radiator. The engine cooling fan draws cool air through the oil cooler lowering the oil temperature. The oil cooler is in the return to tank hydraulic circuit. Built into the oil cooler is a bypass valve that allows oil to bypass the cooler if the return oil pressures are too great (e.g; when the hydraulic oil is cold). The oil cooler and engine coolant radiator are protected by a steel mesh guard to prevent damage to the cooler and radiator.

INSPECTION
1. Check hydraulic oil cooler and radiator guard for security and damage.

2. Check hydraulic oil cooler and fittings for leaks.

3. Check hydraulic oil cooler for blockage and debris that may interfere with proper cooling of oil passing through cooler assembly.

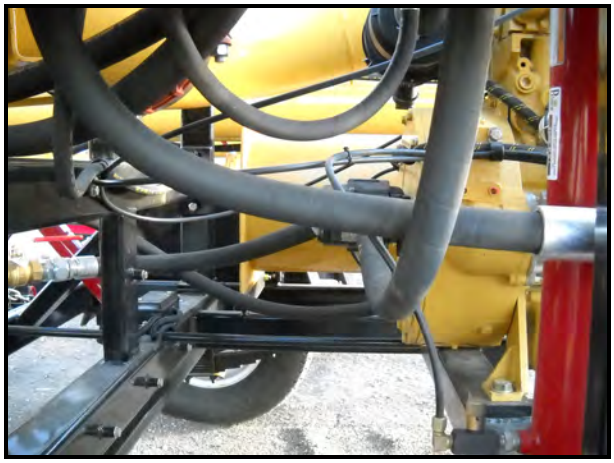
REPAIR
1. If cooling fins are dirty or plugged with debris, remove, replace or clean cooler as required.

2. Tighten or replace leaking or damage adapter fittings as required.

3. Replace radiator guard if damage is present.

SECTION 4
Basic Hydraulics System

HYDRAULIC HOSES



The MMP4 is equipped with hydraulic hosing to convey the hydraulic oil pressure and flow to components that are operated by the hydraulic control valve. These hoses are sized according to the volume and pressure requirements of the component. The hydraulic drive motor for the water pump utilizes a 1 inch (-16) hose to direct the volume of oil required to turn motor that drives the impeller of the water pump at the rated speed. The hydraulic cylinder hoses require a smaller volume of fluid and do not require as large of a hose. The makeup oil requirement for the lift cylinders (when the booms move down) are low pressure and low volume. The suction side of the hydraulic pump requires suction rated hydraulic hose, this prevents the hose from collapsing under suction loads.

INSPECTION
Inspect for damage, security, and leaks.

REPAIR
1. Remove and replace damaged hose assembly if damage to outer covering is present or leaks are present.

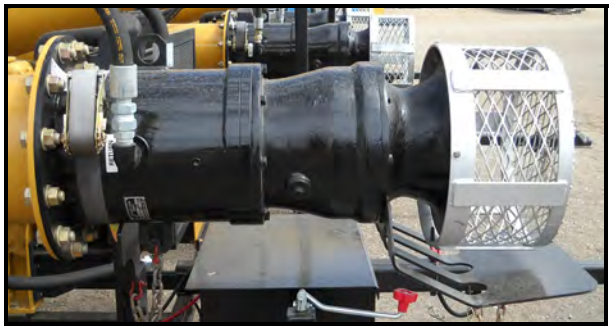
2. Replace hose assembly if hose end is unserviceable due to leaks or damage.

SECTION 5
Water Pump Assembly

Contents

Description 5-1
Hydraulic Drive Motor 5-1
Inspection 5-1
Service 5-1
Disassembly 5-5
Assembly 5-6

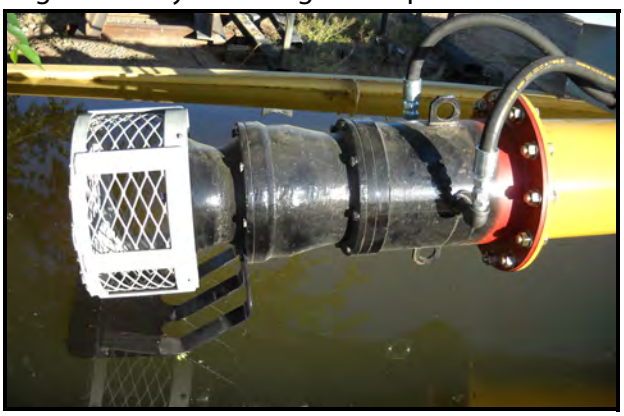
DESCRIPTION



The water pump assembly is comprised of; hydraulic drive motor, water pump housing, impeller, shaft and bearings and an inlet screen. The water pump assembly uses hydraulic oil flow produced by the engine driven hydraulic oil pump to turn the hydraulic drive motor which is directly coupled to the water pump impeller. Water pump speed is controlled by the hydraulic control valve and pressure relief cartridge which diverts the oil flow to the inlet port (pressure) of the hydraulic drive motor to the return oil hose for the hydraulic system. The pressure relief cartridge diverts excessive oil pressure directly to the hydraulic return hose, returning back to the hydraulic oil to the tank for system protection.

HYDRAULIC DRIVE MOTOR

A gear-type hydraulic motor mounted inside the water pump assembly. The hydraulic motor receives hydraulic oil flow from the hydraulic system controlled by the hydraulic control valve at 1,900 - 2,800 PSI (13,000 - 19,300 kpa) and flow rates up to 35 GPM (135 lpm) for operation. The hydraulic motor is coupled directly to the water pump shaft and rotates in a clockwise (CW) direction as viewed from the inlet of the pump. The speed and volume of the water pump is dependent on the engine RPMs, [e.g: higher engine RPMs yields a higher output volume of water].



INSPECTION

1. Check for excessive vibration and noise.
2. Check water pump for security and leaks.
3. Check and adjust fluid levels.
4. Check hydraulic system for security and leaks.

SERVICE

1. Park unit on level ground, lower and secure stabilizing jacks to make unit stable for maintenance.

⚠ WARNING

Ensure the MMP4 is properly positioned and configured before maintenance is performed. Units not configured properly or stabilized, may rollover and cause serious personal injury or death.

2. Remove all electrical and hydraulic power to make the unit safe for maintenance.

⚠ WARNING

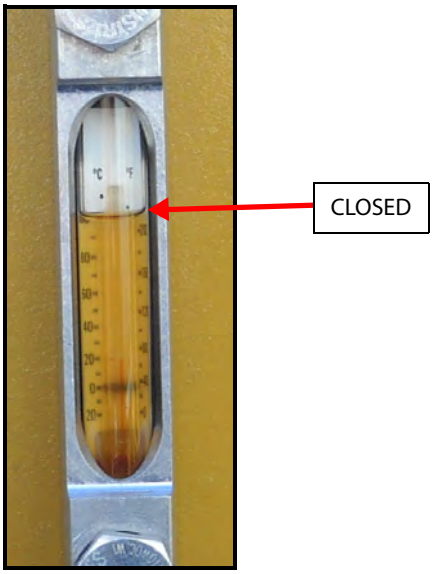
Ensure the MMP4 is made safe for maintenance. Performing maintenance on a unit with hydraulic and electrical power applied may result in serious personal injury or death.

SECTION 5
Water Pump Assembly

3. Ensure the use of only clean, compatible hydraulic oil. The hydraulic system must have a filter rated at 10 micron filtration.

4. When disconnecting and reconnecting the hydraulic hoses to the pump, ensure the fittings are kept clean.

5. Check hydraulic fluid levels. Fluid levels must be maintained at 80% to 90% of the level shown in the sight glass.



6. Check hydraulic fluid for excessive bubbles, foaming and water contamination.

7. Use hydraulic oils with anti-wear additives such as these recommended oils or their equivalent:
   - Pennzoil AW46 Hydraulic Oil
   - Texaco Rando HDAZ
   - Shell Tellas Hydraulic Oils
   - Mobil D.T.E. 20 Series
   - Chevron EP Hydraulic Oils
   - Exxon Univis N Hydraulic Oils

NOTE

When using this equipment in environmentally sensitive areas the use of bio-degradable or non-hazardous oils such as: Chevron Clarity, Exxon Univis Bio 40 or Mobil EAL 224H are recommended.

8. Remove Item 40 on Figure 1 to gain access to the bearing housing reservoir fill plug (Item 34 in Figure 1) and item 23 on the discharge bowl, with the water pump in a vertical position.

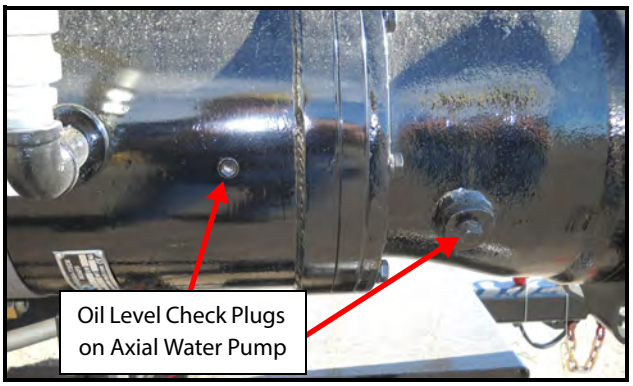
CAUTION

The water pump must be removed from the boom and set in a vertical position on the inlet end when performing this action. Any other position will result in incorrect servicing and improper component oil level will decrease the service life of the water pump, shaft and bearings.

NOTE

There are 2 bearing fluid reservoirs in the MMP4 water pump housing.

9. Check oil in the 2 bearing housings.



10. Slight dark discoloration of the oil in the bearing housing is normal. This is due to the wearing of the carbon face seal.

11. Presence of water or emulsified oil in the bearing housing indicates immediate need for seal replacement and inspection of bearing. If this condition is present, refer to MMP4 Disassembly Instructions.

12. **(If required)** Change oil in the bearing housing if no contamination or fluid loss is present. Use clean non-detergent 10W, 20W oil, AW32 or AW46 hydraulic oil.

SECTION 5
Water Pump Assembly

13. The level should be at the spill point of the fill plug. DO NOT OVERFILL

NOTE

If there is a difficulty in checking these fluid levels, ensure that FSB-9 (Water Pump Lube Level Modification) has been completed, and contact the MEGA Corp. Product Support Group at:
Toll free US 1-800-345-8889
Direct 1-505-345-2661

14. Use a liquid pipe sealant to seal and reinstall pipe plugs in bearing housings and water pump housings.

NOTE

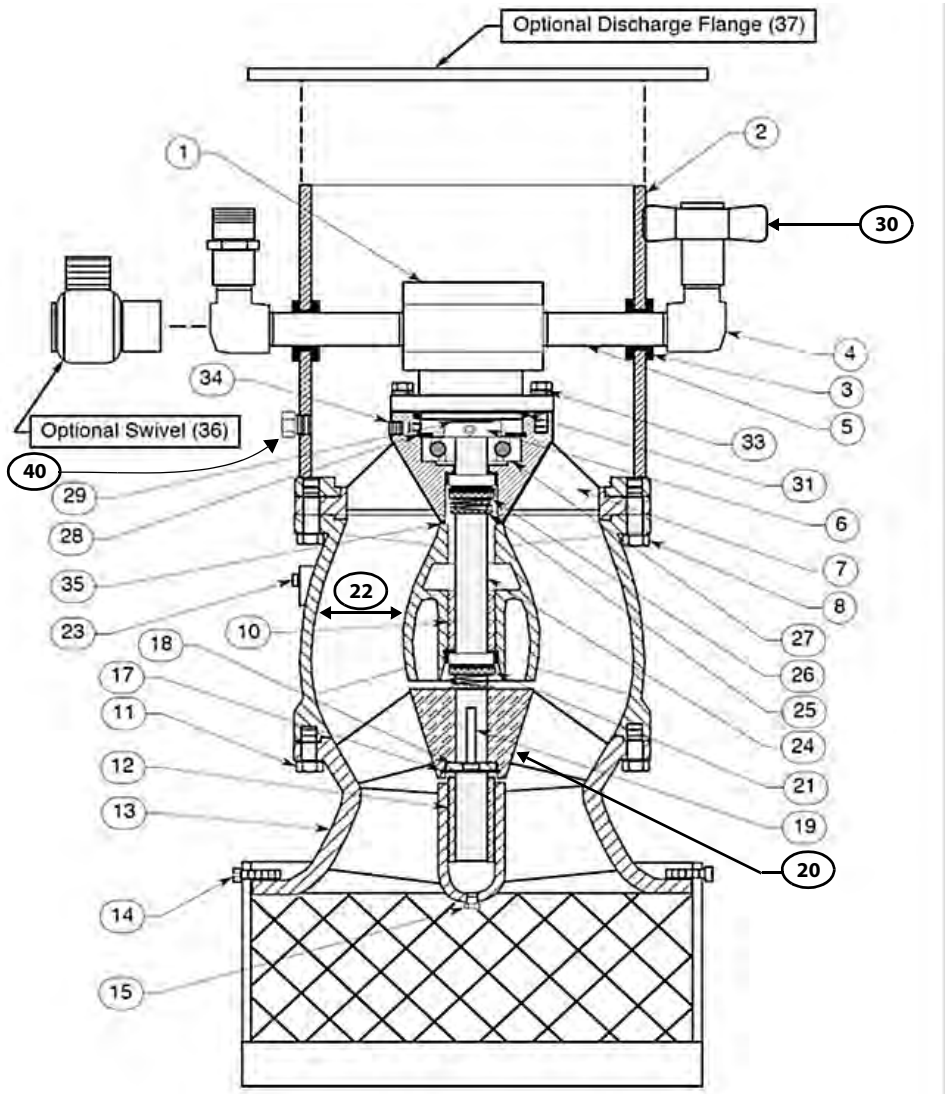
The use of a high strength thread sealant may make it difficult to remove plugs at the next service interval. A Liquid Teflon pipe sealant is recommended.

15. **(If required)** Lube suction bowl bushing (Mystic 5496 Marine Grease or equivalent). 1 each 3/8 inch NPT grease fitting may be required to perform this operation.

NOTE

More frequent service intervals may be required if the quality of the water being transferred is of poor quality containing: salts, dirt, sediments or other contaminants.

SECTION 5
Water Pump Assembly



Item	Part Number	Description
1	303910-01	Hydraulic Motor
2	303910-02	Discharge pipe with flange
3	303910-03	Grommet
4	303910-04	1" Elbow
5	303910-05	Pipe
6	303910-06	Shaft collar
7	303910-07	Bearing Housing
8	303910-08	Bolt
10	303910-09	Bushing Lower Discharge Bowl
11	303910-10	Bolt
12	303910-11	Bushing Suction Bowl
13	303910-12	Suction Bowl
14	303910-13	Screw 3/8" x 1-1/2" Sq. Head Set Screw
15	303910-14	Pipe Plug
16	303910-15	Strainer Assembly
17	303910-16	Snap-Ring
18	303910-17	Thrust Collar
19	303910-18	Key
20	303910-19	Impeller

Item	Part Number	Description
21	303910-20	Lower Seal
22	303910-21	Discharge Bowl Assembly
23	303910-22	Pipe Plug
24	303910-23	Shaft
25	303910-24	Snap-Ring
26	303910-25	Upper Seal
27	303910-26	Bearing
28	303910-27	Snap-Ring
29	303910-28	Snap-Ring
30	303910-29	Coupler (male) 1"
30	303910-30	Coupler (female) 1"
31	303910-31	O-Ring
33	303910-32	Bolt
34	303910-33	Plug Bearing Housing
35	303910-34	O-Ring
36	303910-35	Swivel Union (Optional) 2 req.
37	303910-36	Discharge Flange (Optional)
40	N/A	Pipe Plug

SECTION 5
Water Pump Assembly

DISASSEMBLY

⚠ WARNING

Removal of the water pump assembly from the inlet boom is necessary to properly service or repair the water pump. The water pump assembly is heavy (greater than 200 pounds or 91 kg). Use proper lifting devices and techniques for this operation to preclude personnel injury or death.

1. Place MMP4 on a firm hard packed, level work surface.
2. Set and secure 3 landing gear legs.
3. Remove electrical power from unit.
4. Disconnect and cap hydraulic hoses from water pump drive motor fittings.
5. Remove water pump from inlet boom.
6. Remove strainer by loosening four screws (14).

NOTE

To inspect impeller (Item 20) remove (8) bolts (Item 11) holding suction bowl (Item13) to discharge bowl (Item 22).

7. Remove suction bowl and check impeller and suction bowl face for excessive wear. Replace if obvious wear is present or if pump performance is poor.
8. To inspect hydraulic motor (Item 1) upper bearing (Item 27) and upper seal (Item 26), use the following procedure:
9. Remove hydraulic pipes (Item 5) from drive motor.
10. Remove (8) bolts (Item 8) holding discharge bowl to discharge pipe (Item 2).
11. Remove discharge pipe assembly.

NOTE

Remove (4) bolts (Item 33) holding hydraulic motor to bearing housing (Item 7).

12. Remove and inspect hydraulic motor.
13. Inspect motor O-Ring (Item 31) and replace if necessary.
14. Drain oil from bearing housing by tilting unit on side and removing drain plug (Item s 23, 34 and 40). Inspect condition of oil.

NOTE

If oil is low or is emulsified with water, the upper seal should be replaced (Item 26).

15. Remove snap ring (Item 29) near end of shaft (Item 24).
16. Remove shaft collar (Item 6) by loosening set screws on collar by inserting the appropriate Allen wrench through the oil plug hole in the bearing housing.
17. Remove bearing housing by lifting straight up (bearing will remain in housing).
18. Remove snap ring (Item 28) and slide bearing (Item 27) out of housing. Inspect for rough spots and replace if necessary.
19. Inspect lower O-Ring (Item 35) and upper shaft seal for damage or wear, replace if necessary.
20. Remove upper shaft seal and retainer (Item 26) by sliding off shaft.
21. To remove impeller, shaft and lower seal, use the following procedure:
22. Remove snap ring (Item 17) from end of impeller (Item 20).
23. Push and hold drive end of shaft (Item 24) toward discharge bowl (Item 22).
24. Slide impeller back and remove split thrust collar (Item 18) from shaft.
25. Slide impeller forward to remove.

SECTION 5
Water Pump Assembly

26. Remove shaft key (Item 19) and gently slide shaft out of discharge bowl toward drive end.

27. Inspect lower shaft seal (Item 21) and replace if necessary.

28. Inspect shaft and bronze discharge bowl bushing (Item 10) and replace if worn. (Moderate wear [e.g: shiny areas or ridges not more than 0.010 inch (0.254 mm) deep] on shaft are acceptable, the upper bearing takes most of the loading).

29. Inspect bushing (Item 12) in suction bowl (Item 13) and replace if worn.

ASSEMBLY

1. Assembly is performed in reverse order of disassembly:

2. Ensure O-Rings are properly installed in grooves (Items 31 and 35).

CAUTION

Use only clean grease when assembling new seal on shaft and when installing new seal seat in bearing housing. Apply a light film of clean oil to seal faces when assembling to prevent scratching surfaces. (Extreme care and cleanliness must be used when installing shaft seals to prevent possible component damage). Failure to keep items clean and use clean grease to perform this function may result in seal, bearing or shaft damage.

NOTE

The following is the required filling procedure for the bearing reservoirs when the pump is in a vertical position resting on the inlet end:

3. Fill suction bowl bushing area to bottom of bushing with waterproof grease.

4. Fill oil hole (1/2 inch pipe plug) in discharge bowl (Item 22) to spill point (pump in vertical position) with clean hydraulic oil. Refer to line 5 above for oil specifications.

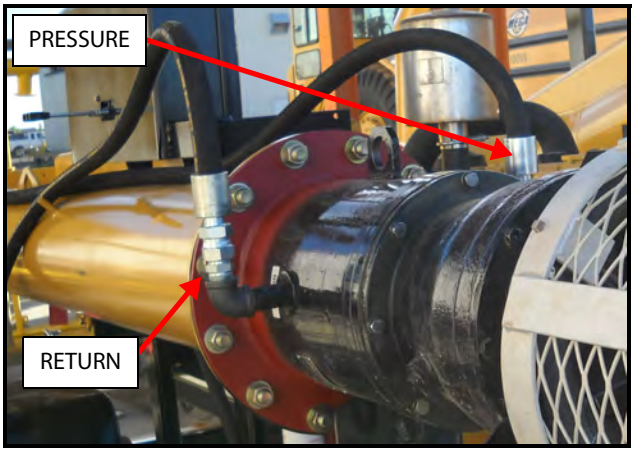
5. Fill oil hole (1/4 inch plug) in upper bearing housing (Item 7) to spill point with clean hydraulic oil. Refer to line 5 for above for oil specifications.

6. Use anti-seize compound on all threaded fasteners when re-assembling pump.

CAUTION

Do not use anti-seize on seals or bearings. If an anti-seize compound is used in this application bearing and/or seal failure will result.

7. Ensure pressure and return pipes are connected to proper ports on the hydraulic motor.



8. Install strainer to pump inlet, tightening (4) retaining bolts (Item 14).

9. Inspect mounting gasket for damage, replace as necessary.

10. Install pump assembly to suction pipe, tighten fasteners.

11. Hook up hydraulic hoses.

12. Check hydraulic fluid level, adjust level as required.

13. Check to ensure hydraulic pump inlet valve is OPEN.

SECTION 5
Water Pump Assembly

14. Run unit, engage water pump control, ensure proper rotation of water pump and no leaks are present.

NOTE

Motor rotation is counter-clockwise looking from discharge end of pump.

15. Shut unit off and recheck hydraulic fluid level, at 80% to 90% of the level shown in the sight glass, adjust level as required.

SECTION 5
Water Pump Assembly

SECTION 6
Axle and Suspension

Contents

Description 6-1
Service 6-1
Inspection 6-2
Repair 6-2
Reassembly 6-3

DESCRIPTION

The MMP4 is equipped with a 6,000 lb (2,725 kg) rated single axle utilizing a double eye leaf spring suspension. The springs are attached to the frame by welded spring hangers. The axle is attached to the springs by U-bolts with weld on axle mounts. Mounted to the axle hubs by 8 lug nuts are load range E tire and rim assemblies. Each tire and rim assembly is protected by a steel fender that contains a front amber marker lamp and rear red marker lamp assembly. Current production models are not equipped with brakes.

SERVICE

1. Park MMP4 on firm level ground, lower forward landing gears, raise hitch, uncouple MMP4 from tow vehicle.

2. Lower rear landing gear until the MMP4 is stable.

3. With a jack of adequate capacity raise 1 tire in the air high enough to remove the tire.

4. Place a jack stand under axle to prevent axle from falling.

CAUTION

Do not lift the axle for the center, place jack under the U-bolts towards the axle end. Ensure jack stands of proper capacity is used to secure the axle prior to removing the tire assembly. Failure to properly lift and secure the MMP4 properly may result in an unstable load, over loading of the jack or damaging an MMP4 component causing damage to the MMP4.

5. Lower the landing gear to re-stabilize the MMP4.

⚠ WARNING

MMP4 must be stable and secure on adequate capacity jack stands and the jack removed prior to servicing the hub assembly. Failure to secure and ensure the MMP4 is stable and secure will result in serious personal injury or death if the unit falls.

6. Semi-annually (every 6 months), remove rubber plug at the center of the wheel bearing cap.

7. Pump grease into the grease fitting in the spindle end with a manual type grease gun only.

CAUTION

Do not mix Lithium, Calcium, Sodium or Barium complex greases due to possible compatibility problems. When changing from one type of grease to another, it is necessary to disassemble the wheel bearing and ensure all grease is removed prior to re-packing or servicing the wheel bearing. Failure to ensure greases are not mixed may result in wheel bearing, axle end, hub, MMP4 or tow vehicle damage.

8. Rotate wheel while pumping grease into fitting.

SECTION 6
Axle and Suspension

9. Continue to pump grease until clean grease is extruded through the outer bearing.

10. Rotate wheel while pumping grease into fitting.

11. Clean old grease from around the bearing cap.

12. Install the rubber plug in the grease cap.

13. Repeat on the other wheel bearing.

CAUTION

Manual wheel bearing greasing is only a semi-annual service point. Failure to perform annual wheel bearing service and inspection may result in damage to the axle, wheel bearings or MMP4 if not preformed.

INSPECTION

1. Inspect axle for cracking, damage and security.

2. Inspect springs for worn eye bushings, bent, loose or broken shackles, mounts and bolts, sagging or broken leafs, loose or damaged U-bolts.

3. Check for loose wheel bearings.

4. Inspect lug nuts to ensure all are present and torque properly to 80 to 90 ft/lbs (110 to 125 Nm).

5. Inspect for wheel seal leakage.

6. Inspect tires for inflation to 80 psi (550 kpa), cracking, uneven wear, tread and side wall damage.

7. Inspect fender assembly for security and damage.

REPAIR

1. Axle tube, replace as required.

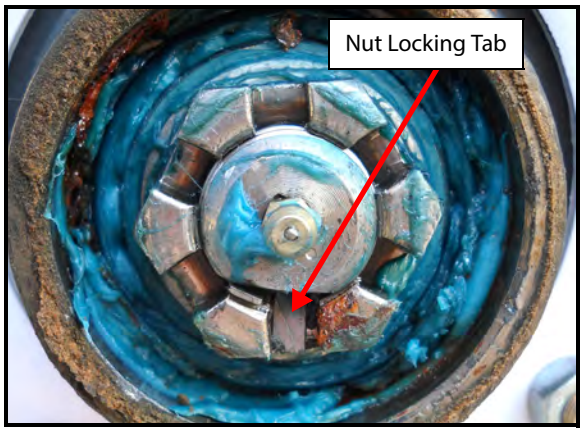
2. Damaged springs or mounting hardware, replace as required.

3. Worn spring eye bushings, loose spring bolts and damaged or worn shackles, replace as required.

4. Fender damage, repair as required.

5. Tire for wear or damage, replace as required.

6. Wheel bearings:
   a. Secure MMP4 with jack stands and wheel chocks.
   b. Jack up 1 tire and secure axle.
   c. Remove tire and rim assembly.
   d. Remove wheel bearing grease cap.
   e. Remove cotter pin or bend clear the nut locking tab.



   f. Remove spindle nut by turning nut CCW.
   g. Remove hub assembly.
   h. Inspect hub for damaged threads, missing or damaged studs. Replace as required.
   i. Inspect grease seal for damage (e.g; tears, cracks, leaks and distortion).
   j. To remove grease seal; pry out of hub with a long handled screwdriver.
   k. Clean and inspect wheel bearings and bearing races for corrosion, pitting, wear, heat discoloration and free/smooth movement. Replace as required.

⚠ WARNING

Never spin the wheel bearing with compressed air. The bearing may be damaged, causing the bearing explode causing severe personal injury or death.

SECTION 6
Axle and Suspension

REASSEMBLY

1. Pack wheel bearings with a premium, water resistant, high speed wheel bearing grease.

2. Apply a light coat of grease on the bearing races.

NOTE

Recommended Wheel Bearing Lubrication Specifications are as follows:

Thickener Type	Lithium Complex
Dropping Point	215°C (419°F) Minimum
Consistency	NLGI No. 2
Additives	EP, Corrosion & Oxidation Inhibitors
Viscosity Index	80 Minimum

3. Install inner wheel bearing in hub.

4. Install new grease seal in hub using a small hammer or proper seal installation tool.

5. Install hub on spindle.

6. Install outer wheel bearing onto the spindle.

7. Install bearing retaining washer and spindle nut.

8. Tighten spindle nut to 50 ft/lbs (68 Nm).

9. Loosen nut to remove the torque. Do not rotate the hub

10. Finger tighten until just snug.

11. Install and secure cotter pin or nut locking tab.

12. Install wheel bearing grease cap.

13. Install tire and rim assembly.

14. Tighten lug nut using a cross tightening sequence to 15 to 20 ft/lbs (20 to 27 Nm).

NOTE

Use an anti-seize compound on the threads of the lug studs. This will prevent galling and seizure of the lug nut to the stud.

15. Final torque lug nuts to 80 to 90 ft/lbs (110 to 125 Nm).

16. Remove jack stands and lower wheel to ground.

CAUTION

Re-torquing of lug nuts is required after initial 50 miles (80 km) of travel and then again after 200 miles (320 km) of travel. Failure to ensure proper lug nut torque may result in tire, wheel or hub failure that will cause damage to MMP4 and tow vehicle.

SECTION 6
Axle and Suspension

SECTION 7
Frame and Booms

Contents

Description 7-1
Inspection 7-1
Repair 7-4

DESCRIPTION

The MMP4 frame is constructed from steel tubing welded together to form a rigid mounting platform that the components of the MMP4 are attached to. The frame is equipped with 3 adjustable stabilizing jacks, a movable hitch, mounting pads for the diesel engine, hydraulic and fuel tanks, travel lock mounts for the inlet and discharge booms, safety chain lock anchors, hydraulic cylinder mounts, suspension mounts, mounting structures for the boom pivot and hydraulic control valve mounting, fenders and lighting.

INSPECTION

1. Inspect frame for damage and missing parts.

2. Inspect all welds for cracks, rust or damage.

3. Inspect hitch assembly and coupling for security, serviceability, damage and missing parts.

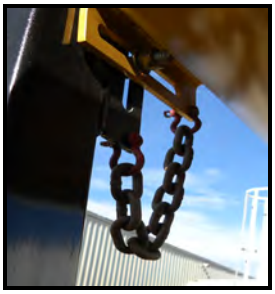
4. Inspect battery box for security and damage.

5. Inspect landing gear/stabilizer legs for security, serviceability and damage.

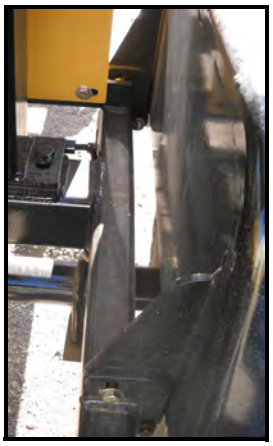
6. Inspect engine mounting bolts for security.

SECTION 7
Frame and Booms

7. Inspect discharge boom, travel locks and mounts for security and damage.

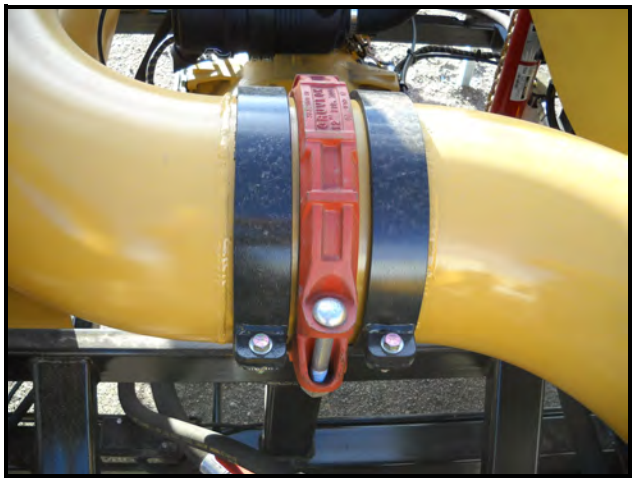


8. Inspect fenders for security and damage.



9. **(If equipped)** Inspect lighting for security, damage and function.

10. Inspect boom mounting, pivot point, travel locks and Victaulic coupling for lubrication, security, damage and leaks.

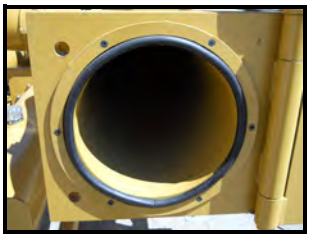


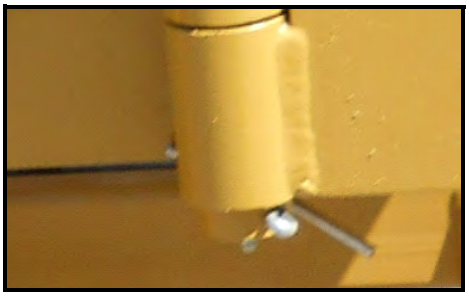
SECTION 7
Frame and Booms

11. Inspect fuel tank for mounting security and damage, fuel level, fuel level gauge and filler cap serviceability and damage, fuel shut off valve for security, damage and leaks.

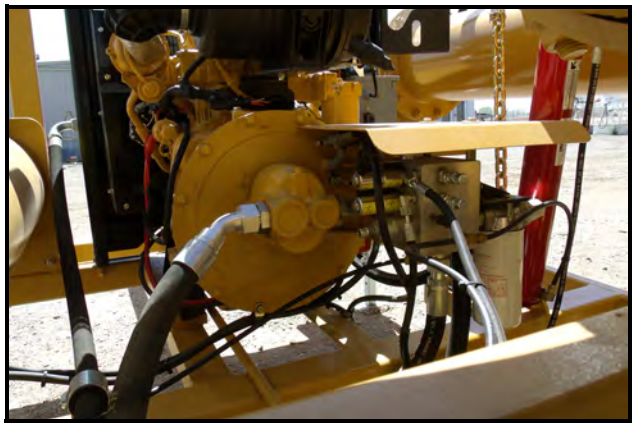
12. Inspect inlet boom, travel locks and mounting for lubrication, security, damage and serviceability.

13. Inspect hinge pins, flanges gaskets for lubrication, security, wear and damage.





14. Inspect hydraulic control valve, switches and mount for operation, security, damage, leaks and missing parts.

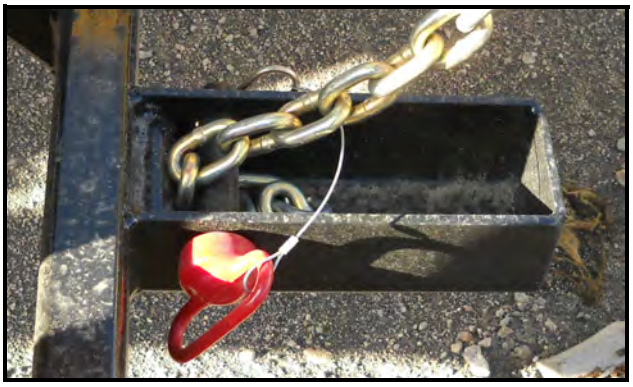


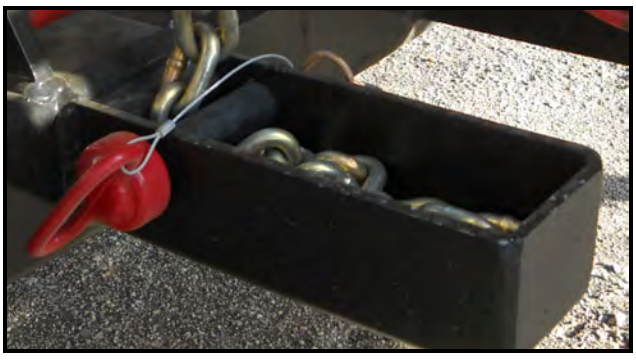
15. Inspect suspension spring mounts for security, damage and wear.

SECTION 7
Frame and Booms

16. Inspect hydraulic cylinder mounting for lubrication, security, cracks, damage, worn pins, and missing parts.

17. Inspect safety chains and safety chain locks for security, damage and missing parts.





REPAIR

1. Replace damaged or missing parts as required.

2. If frame damage is noted, or you have a question about the MMP4 contact:
   The MEGA Corp. Product Support Group at:
   Toll free US 1-800-345-8889
   Direct 1-505-345-2661
   www.megacorpinc.com for more contact information or repair options and procedures.

3. Adjust, secure or replace parts as required.

SECTION 8
Scheduled Inspections

Contents

Description 8-1
Frame and Suspension 8-1
Hydraulic System 8-2
Water Pump Assembly 8-2
Engine and Engine Control 8-3

DESCRIPTION

This section establishes scheduled maintenance inspections of the MMP4 at designated frequencies. Performing these inspections will identify potential system discrepancies and allow preventative maintenance to be performed before a component or system is rendered totally inoperative. Refer to CAT Publication SEBU8312-02 for specific engine maintenance requirements and schedules.

****NOTE:** Vehicles operated in extremely low quality water environments may require more frequent inspections.

		FREQUENCY					
STEP	FRAME AND SUSPENSION	DAILY	BEFORE TRANSPORT	EVERY 50 MILES	EVERY 200 MILES	SEMI-ANNUALLY	ANNUALLY
1	Check frame and suspension for cracks, damaged or missing components.Repair or replace as required.	X					
2	Verify lug nut torque (80 to 90 ft/lbs or 110 to 125 Nm). Re-Torque as required.		X	X			
3	Check tires and wheels for security, damage, inflation (80 psi or 550 kpa) and missing parts. Repair as required.		X				
4	Service wheel bearings with grease.					X	
5	Remove and repack wheel bearings.						X
6	Check travel locking components for serviceability, damage, proper installation and missing parts. Repair as required.		X				
7	Check lighting system.Repair as required.		X				
8	Check hitch assembly for security, damage, proper installation and missing parts.Repair as required.		X				
9	Check landing gear for security, damage and operation.Repair as required.	X					
10	Check pipe work to include: the Victaulic coupling, boom flanges and gaskets, cylinder mounting and pivot points for security, damage, leaks, serviceability, and missing parts. Repair as required.	X					
11	Check hydraulic tank mounting bolts for security, damage and missing parts.Repair as required.	X					
12	Check fuel tank mounting bolts for security, damage and missing parts.Repair as required.	X					
13	Check engine mounting bolts for security, damage and missing parts.Repair as required.	X					

SECTION 8
Scheduled Inspections

		FREQUENCY					
STEP	FRAME AND SUSPENSION	DAILY	BEFORE TRANSPORT	EVERY 50 MILES	EVERY 200 MILES	SEMI-ANNUALLY	ANNUALLY
14	Check battery box and contents for security, damage and missing parts.Repair as required.	X					
15	Check safety chains, safety chain mounting and safety chain locking pins for security, damage and missing parts.Repair as required.	X					

		FREQUENCY			
STEP	HYDRAULIC SYSTEM	DAILY	EVERY 250 HOURS	EVERY 500 HOURS	EVERY 1000 HOURS
1	Check hydraulic oil for proper level, clarity, foaming and signs of contamination.Repair, adjust or replace as required.	X			
2	Check hydraulic control valve and switch box for security, damage, function and leaks.Repair as required.	X			
3	Check hydraulic pump for security, damage and leaks.Repair as required.	X			
4	Check hydraulic oil cooler for security, damage and leaks.Repair as required.	X			
5	Check hydraulic hosing for security, damage and leaks.Repair as required.	X			
6	Check hydraulic cylinders and flow controls for security, damage and leaks.Repair as required.	X			
7	Check hydraulic oil filter for security, damage and leaks.Repair as required	X			
8	Check hydraulic pressure regulator for function and pressure setting (2,800 psi or 19,300 kpa).Adjust or repair as required.				X
9	Drain and refill hydraulic reservoir and replace hydraulic filter element.				X
10	Check hydraulic pump drive coupling for wear, security and damage.Repair as required.				X

		FREQUENCY		
STEP	WATER PUMP ASSEMBLY	DAILY	EVERY 250 HOURS	EVERY 500 HOURS
1	Check water pump for security, damage, obstructions and operation.Repair as required.	X		
2	Check water pump trash screen for security, obstructions and damage.Repair as required.		X	
3	Check for excessive vibrations and noise.Repair as required.	X		

SECTION 8
Scheduled Inspections

		FREQUENCY		
STEP	WATER PUMP ASSEMBLY	DAILY	EVERY 250 HOURS	EVERY 500 HOURS
4	Remove water pump assembly from inlet boom and check for: • Hydraulic drive motor security, damage and leaks. • Bearing oil reservoir levels. • Bearing oil reservoirs for contamination. • Impeller damage. • Water pump housing bolts for security, damage and missing parts.Repair, adjust or replace as required.		X	
5	Grease water pump suction bowl bearing.		X	
6	Remove water pump from inlet boom and change bearing reservoir oil.			X

		FREQUENCY		
STEP	ENGINE AND ENGINE CONTROL	DAILY	EVERY 250 HOURS	EVERY 500 HOURS
1	Refer to the correct engine Operation and Maintenance Manual for required service intervals and procedures.Use SEBU8312-02 for engine maintenance requirements.Follow and perform all required service procedures, operations, conditions and schedules.	X		
2	Check and ensure all engine control functions are in proper working order.Repair as required.		X	
3	Check all engine safety guards for security, damage and missing parts.Repair as required.	X		
4	Check engine start battery and cables for security, damage, corrosion, water level (if required) and condition.Repair as required.		X	
5	Check engine throttle control for security, damage and proper operation.Repair as required.		X	
6	Check engine control box for security, damage and proper operation.Repair as required.			X
7	Check engine muffler and intake system for security, damage, and condition.Repair as required.			X
8	Check diesel fuel level to ensure proper level to allow unit to run for daily operation.Refill as required.			X
9	Check engine control cable for security and damage.Repair as required.			X

SECTION 8
Scheduled Inspections

SECTION 9
Special Inspections

Contents

Description 9-1
Storage/Winterization 9-1

DESCRIPTION

This section contains special inspection requirements for a specific system after use, an unusual event or storage.

STORAGE/WINTERIZATION

ENTERING

1. Remove any exterior dirt, grease and grime that may trap moisture.
2. Flush all water suction and discharge tubes (e.g. water pump,).
3. Ensure all water is drained from the tubes and water pump.
4. Ensure all covers/caps for fluid reservoirs are in proper operating condition and are secured to the openings.
5. Fill Fuel tank to capacity, close fuel shut off valves at bottom of fuel tank.
6. Check tires for proper inflation.
7. Check Boom retaining hardware, ensure it is operational and secure.
8. Lubricate all grease points (e.g. Hinge pins, cylinder pins, water pump suction bowl).
9. Check battery fluid level and charge.
10. Disconnect battery cables from battery.
11. Service all engine systems per CAT C2.2T Diesel engine service manual (SEBU8312-02).
12. If possible, shelter entire unit from the elements.

REMOVING

1. Remove all covers and seals from all fill/discharge openings and components.
2. Inspect piping for debris that may damage unit that water will be pumped into.
3. Check to ensure all water pump reservoirs are filled to the correct level and the fluid is not contaminated.
4. Remove any exterior dirt, grease and grime and treat any corrosion.
5. Service all Engine systems per CAT C2.2T Diesel engine service manual (SEBU8312-02).
6. Check all fluid levels for condition and level, replace or adjust as necessary.
7. Check Braking system (if equipped) repair as necessary.
8. Check safety chains for damage.
9. Check lighting system for proper operation, repair as necessary.
10. Clean and connect battery cables to battery.
11. Perform all ‘Daily’ maintenance checks, repair as necessary.
12. Perform a full functional check of all MMP4 control systems.

SECTION 9
Special Inspections

SECTION 10
Recommended Support Parts

Contents

Description 10-1
Axial Water Pump Group, 303910 10-1
Hydraulic Group 10-1
Water Piping (Boom) Group 10-1
Frame and Suspension Group 10-2
CAT C2.2 Engine Support Parts Group 10-2

DESCRIPTION

This section contains a listing of recommended support parts that should be available in the supply warehouse. Once parts are issued from warehouse stock ensure depleted quantities are replenished to keep the recommended support parts package at 100%. The tables are categorized by specific sub system of the MMP. **Do not forget** that all MMPs are not configured the same and there are some variations in systems due to changes in equipment and actual production dates. Ensure MMP serial numbers and actual component part numbers are checked before ordering any parts.

If your system is not covered in this manual or are having difficulties please contact the MEGA Corp. Product Support Group with the unit serial number at: Toll free US 1-800-345-8889, Direct 1-505-345-266, or visit our website at www.megacorpinc.com for more detailed contact information.

A. Axial Water Pump Group, 303910

PART DESCRIPTION	PART NO.	QTY
1. Gasket, 12 inch	304174	2
2. Grommet	303910-03	2
3. Thrush Collar	303910-17	1
4. Lower Seal	303910-20	1
5. Upper Seal	303910-25	1
6. O-Ring, Bearing, (Lower)	303910-31	2
7. O-Ring, Hydraulic Motor, (Upper)	303910-35	2

B. Hydraulic Group

PART DESCRIPTION	PART NO.	QTY
1. Cylinder, 12 inch, Discharge Boom	303923	1
2. Cylinder, 20 inch, Inlet Boom	303924	1
3. Filter, Hydraulic, 400 psi	304704	2
4. Oil, Hydraulic, Clarity (35 Gallon Capacity)	USE LOCAL SUPPLIER	35 gal

C. Water Piping (Boom) Group

PART DESCRIPTION	PART NO.	QTY
1. Sock, Down spout, tapered	304196	2
2. Tie Down Strap, 2 inch	304291	1
3. Pin, Hinge pivot	037627-05	1
4. Neoprene gasket, P-Ring, Boom flange	306209	2
5. Pin, Hitch, 1 inch	303935	2
6. Chain, 3/8 inch, GR 70, 6 ft.	038453-11	1
7. Shackle, 3/8 inch	355020	4

SECTION 10
Recommended Support Parts

D. FRAME AND SUSPENSION GROUP		
PART DESCRIPTION	**PART NO.**	**QTY**
1. Wheel and Tire Assembly	303933	1
2. Hitch pin, 1 inch	303935	2
3. Chain, 3/8 inch, GR 70, 2.4 ft	038453-13	1
4. Shackle, 3/8 inch	355020	2
5. Bearing, Wheel, Inner	304157	2
6. Bearing, Wheel, Outer	304158	2
7. Seal, Wheel Bearing	304159	2
8. Jack stand	037708	1

E. CAT C2.2 ENGINE SUPPORT PARTS GROUP **REFER TO ENGINE MANUAL FOR SPECIFIC PARTS AND SERVICE INFORMATION		
PART DESCRIPTION	**PART NO.**	**QTY**
******For Most CAT C2.2T Parts, See CAT Manual SEBU8312-02 ******		
1. Hydraulic Pump, CAT C2.2T Engine	306815	1
2. Hydraulic Pump, CAT C2.2TA Engine	306815	1

If your system is not covered in this manual or are having difficulties locating the necessary components please contact MEGA Corp. Product Support Group at:
US Toll Free: 1-800-345-8889 or
Direct: 1-505-345-2661 or visit our website at www.megacorpinc.com for more detailed contact information.

SECTION 11
Appendix A: MMP4 Build Drawings

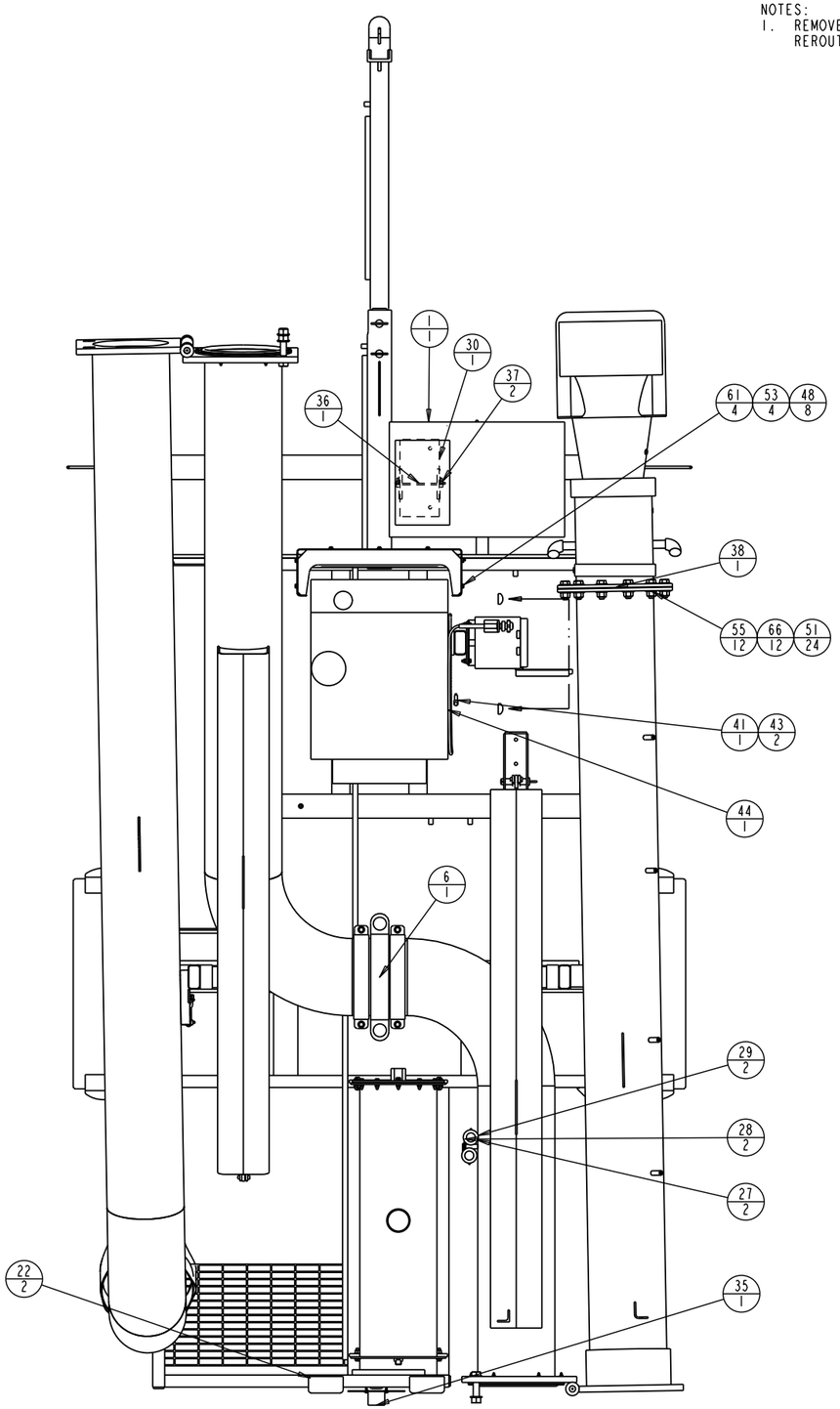
DESCRIPTION

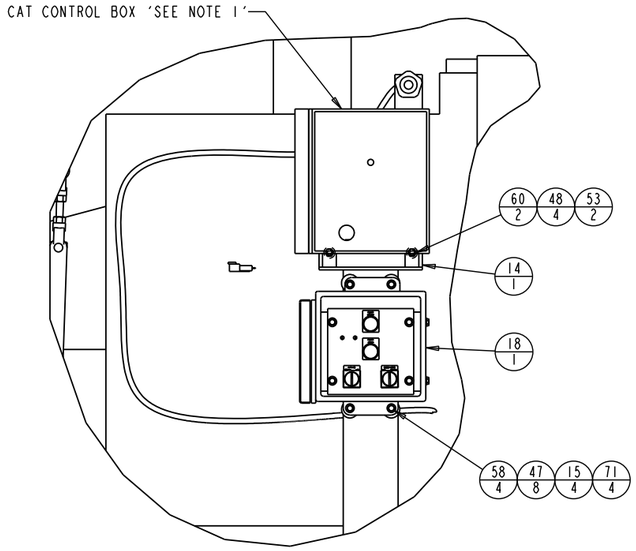
This section contains all the drawings required to set up the MMP4 (Tier 4). These drawings are serial number specific and are designed to be used in conjunction with previous section information to successfully produce a fully operational MMP4 system.

If your system is not covered in this manual, you are having difficulties with the installation or need additional information or assistance, please contact The MEGA Corp. Product Support Group at:
U.S. Toll Free: 1-800-345-8889
Direct: 1-505-345-2661
or visit our website at www.megacorpinc.com for more contact information.

SECTION 11
Appendix A: MMP4 Build Drawings

NOTES:
1. REMOVE ENGINE CONTROL BOX. MOUNT AS INDICATED REUSING BOLTS AND GROMMETS. REROUTE THROTTLE & CONTROL CABLES.





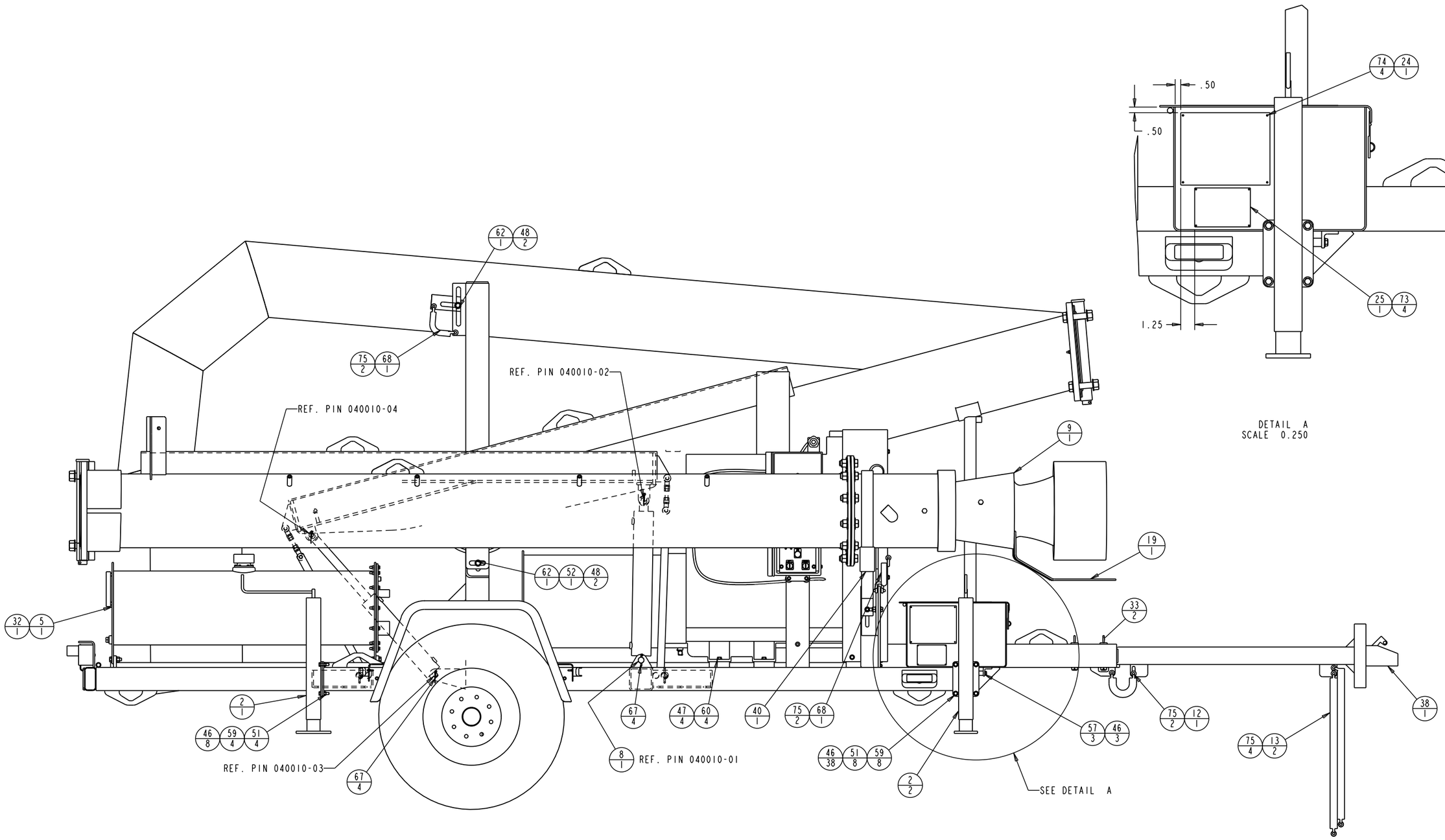
SECTION D-D
SCALE 0.200

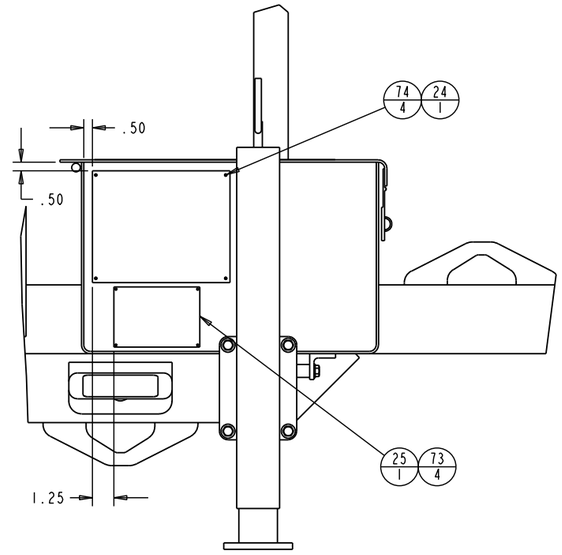
ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	037634	BATTERY BOX ASSY.	1	037634	REF
2	037708	JACK STAND ASSY.	3	037708	REF
3	037852	FENDER ASSY.	2		REF
4	038137	DIESEL TANK ASSY. 50GAL	1		REF
5	038138	HYDRAULIC TANK ASSY. 23GAL	1		REF
6	038452	PIPE ASSY.	1		REF
7	038454	AXLE & SUSPENSION ASSY.	1		REF
8	040010	CYLINDER PIN KIT	1		REF
9	040032	WATER PUMP	1		REF
10	045660-02	CHAIN, 3/8" GR70	1	355028	3'
11	045660-03	CHAIN, 3/8" GR70	1	355028	6'
12	045660-04	CHAIN, 3/8" GR70	1	355028	9"
13	045660-05	CHAIN, 3/8" GR70	2	355028	2.4'
14	045660-07	PLATE A36 10GA	1		4.960
15	045660-08	TUBE, RUBBER, Ø1.25	4	306427	.13'
16	045661	FRAME, CAT-C22T ENGINE	1		REF
17	045664	RETAINER, GASKET	2		REF
18	045666	C22T ENG. CONTROL BOX ASSY.	1		REF
19	045667	A36 PL. .25	1		REF
20	300160	SHACKLE, 3/8"	4		STK
21	300222	JUNCTION BOX	1	300222	STK
22	302607	STOP/TURN LIGHT	2		STK
23	302974	CLEARANCE LIGHT, AMBER	4		STK
24	302975	CLEARANCE LIGHT, RED	2		STK
25	303229	MEGA NAME PLAQUE	1		STK
26	303230	MEGA ID PLATE	1		STK
27	303721	CLAMP, HOSE SLOT #16	2	302721	STK
28	303722	CLAMP, HOSE, TAB #16	2	303722	STK
29	303723	CLAMP, HOSE, GROMMET #16	2	303976	STK
30	303908	BATTERY 12V	1		STK
31	303923	CYLINDER 12"	1		STK
32	303924	CYLINDER 20"	1		STK
33	303926	HYD. OIL, Mobil DTE 10 Excel 46	1		40gal
34	303935	HITCH PIN 1"	4		STK
35	304124	LIGHT, L.P.	1		PO
36	304140	BATTERY HOLD DOWN	1		STK
37	304141	BATTERY BOLT	2		STK
38	304174	GASKET 12" 150#	1		STK
39	304196	SOCK, DOWNSPOUT TAPERED	1		STK
40	304231	HITCH, 2-5/16	1		STK
41	304284	RECP. 2 PIN	1		STK
42	304291	TIE DOWN, STRAP 2"	1		STK
43	304471	SEALING PLUG	2		STK
44	306161	ENGINE CAT-C22T W/ PUMP&COOLER	1		STK
45	306207	FLAT HEAD HEX DRIVE 1/4 X 2.00	12	305995	STK
46	306209	GASKET, P-RING NEOPRENE	2		STK
47	350001	WASHER, FLAT 1/4	24	350000	SPLY
48	350003	WASHER, FLAT 3/8	68	350000	SPLY
49	350004	WASHER, FLAT 7/16	4	350000	STK
50	350005	WASHER, FLAT 1/2	28	350000	SPLY
51	350009	WASHER, FLAT 1.00	32	350000	SPLY
52	350023	NUT, HEX 1/4-20 UNC	14	350023	SPLY
53	350025	NUT, HEX 3/8-16 UNC	33	350023	SPLY
54	350027	NUT, HEX 1/2-13 UNC	10	350023	SPLY
55	350031	NUT, HEX 7/8-9 UNC	12	350023	SPLY
56	350032	NUT, HEX 1.0-8 UNC	4	350023	SPLY
57	350044	NUT, HEX 1/2-20 UNF	4	350023	SPLY
58	350065	SCREW, CAP 1/4-20 UNC X2.00	4	350057	STK
59	350144	SCREW, CAP 3/8-16 UNC X0.88	3	350141	SPLY
60	350146	SCREW, CAP 3/8-16 UNC X1.25	2	350141	SPLY
61	350147	SCREW, CAP 3/8-16 UNC X1.50	30	350141	SPLY
62	350188	SCREW, CAP 7/16-14 X1.25	4	350183	STK
63	350232	SCREW, CAP 1/2-13 UNC X1.75	8	350225	STK
64	350233	SCREW, CAP 1/2-13 UNC X2.00	2	350225	SPLY
65	350234	SCREW, CAP 1/2-13 UNC X2.25	4	350225	STK
66	350391	SCREW, CAP 7/8-9 UNC X2.50	12	350381	STK
67	350450	SCREW, CAP 1.00-8 UNC X4.50	4	350433	STK
68	352677	NUT, LOCK 1/2-13	4	352583	SPLY
69	353515	PIN, COTTER 3-16X2.00	8	353509	STK
70	354465	CHAIN, 1/4" X 5 LNK.	2	353939	STK
71	354512	NUT, LOCK 1/4-20	4	352583	SPLY
72	354581	ROD, THRD 1/2-20UNFx3.00 GR8	2	354077	.41'
73	354647	SCREW, PAN 10-24 UNC X0.75	18	353713	STK
74	354648	NUT, KLOCK 10-24	18	354648	STK
75	354775	DRIVE SCREW 1/8" X 3/8"	4	354775	SPLY
76	354776	DRIVE SCREW 1/8" X 1/2"	4	354775	SPLY
77	355020	SHACKLE, 3/8"	10		STK

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADD ITEM 22, 23, 65, 66	03-06-12	DE
B	ADD NEW ITEM 04566-08	04-12-12	DE

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 C22T ENGINE BOLT-ON		
SCALE 0.026	DATE: Nov-28-11	DWG. NO.: 045660
DRAWN BY: DE	NOTE:	SHEET 1 OF 3

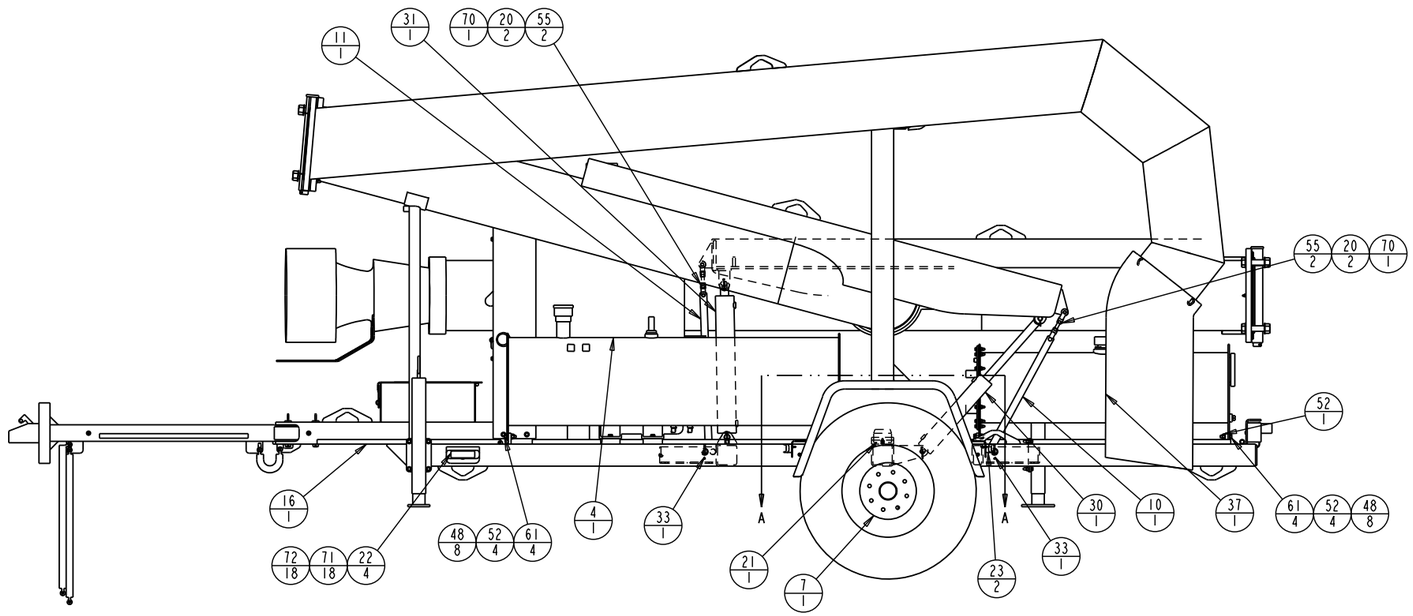


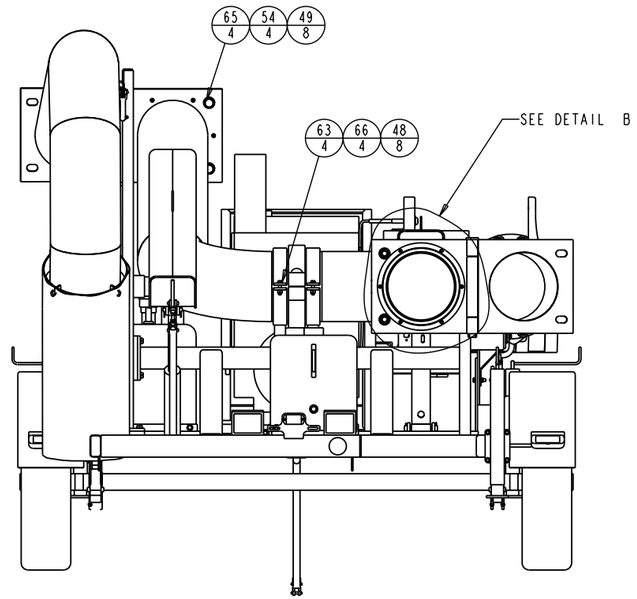


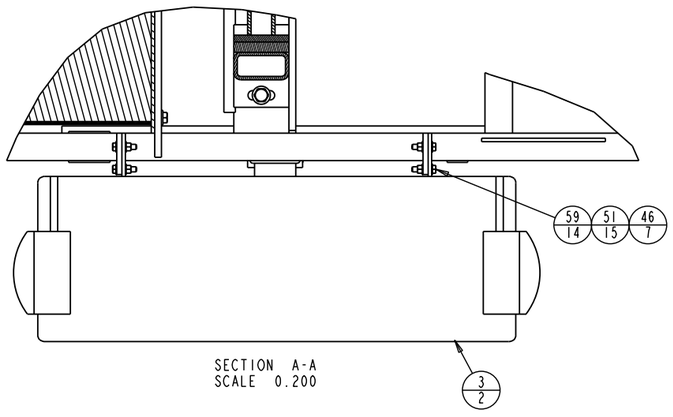
DETAIL A
SCALE 0.250

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

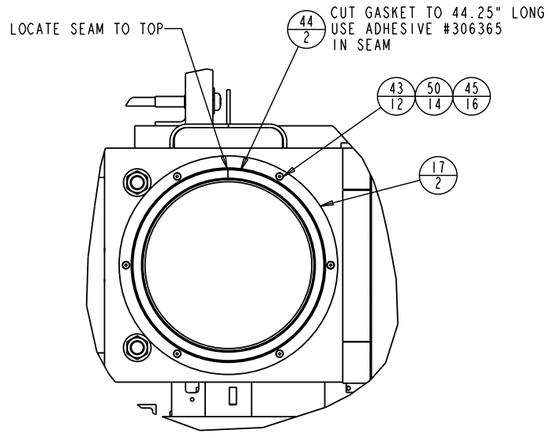
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 C22T ENGINE BOLT-ON		
SCALE: 0.026	DATE: Dec-08-11	DWG. NO.: 045660
DRAWN BY: DE	NOTE:	SHEET 2 OF 3







SECTION A-A
SCALE 0.200

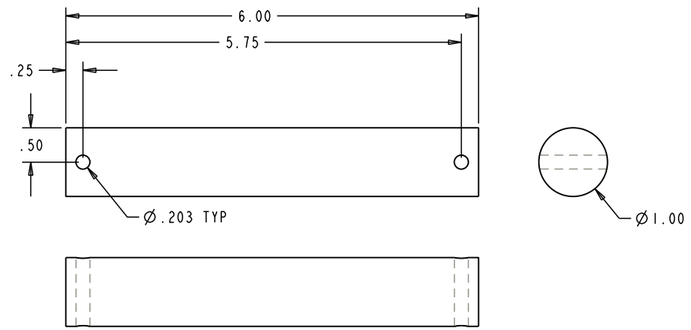


DETAIL B
SCALE 0.200

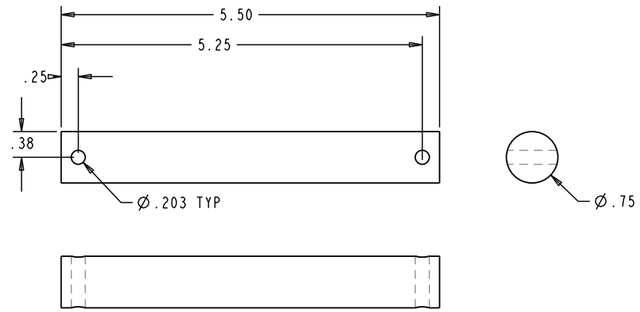
MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 C22T ENGINE BOLT-ON		
SCALE: 0.026	DATE: Dec-15-11	DWG. NO.: 045660
DRAWN BY: DE	NOTE:	SHEET 3 OF 3

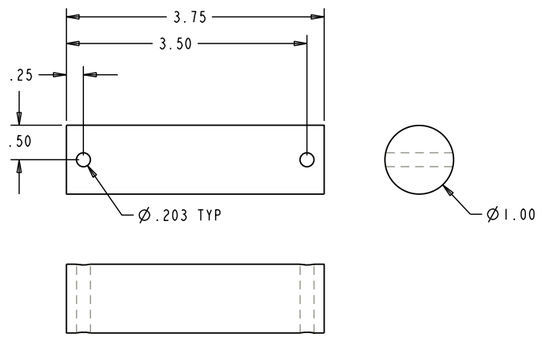
ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	040010-01	BAR RND. 1.00	1		1.315
2	040010-02	BAR RND. 1.00	1		0.816
3	040010-03	BAR RND. .75	1		0.674
4	040010-04	BAR RND. .75	1		0.424



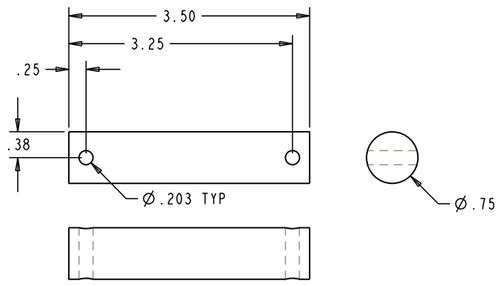
1 BAR RND. 1.00
040010-01 1 AS SHOWN



3 BAR RND. .75
040010-03 1 AS SHOWN



2 BAR RND. 1.00
040010-02 1 AS SHOWN

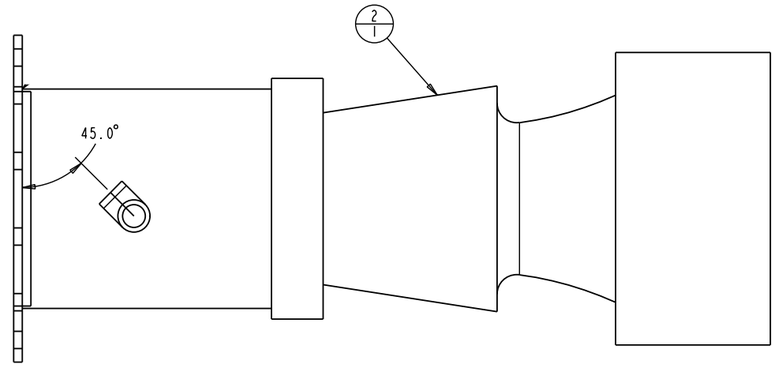


4 BAR RND. .75
040010-04 1 AS SHOWN

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: CYLINDER PIN KIT		
SCALE 0.077	DATE: 19-Oct-06	DWG. NO.: 040010
DRAWN BY: DE	NOTE:	SHEET 1 OF 1

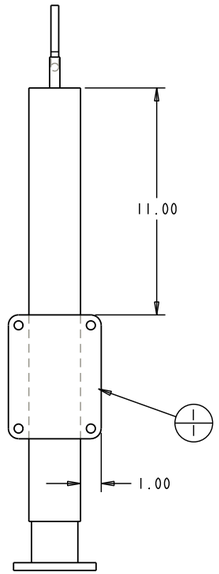
ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	037713	A36 PL. .50	1	038452	STK
2	303910	WATER PUMP, 12"	1		STK

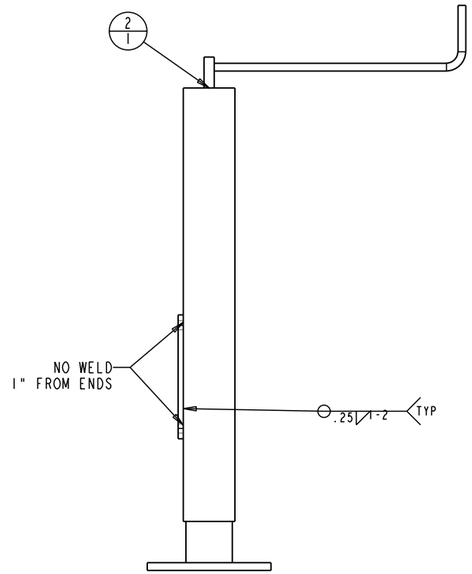


700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: AXIAL WATER PUMP ASSY.		
SCALE 0.125	DATE: 01-May-06	DWG. NO.: 040032
DRAWN BY: DE	NOTE:	SHEET 1 OF 1

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	037719	A36 PL. .25	1		STK
2	303936	JACK STAND	1		STK





700 Osuna Rd. N.E.
P.O. Box 26146
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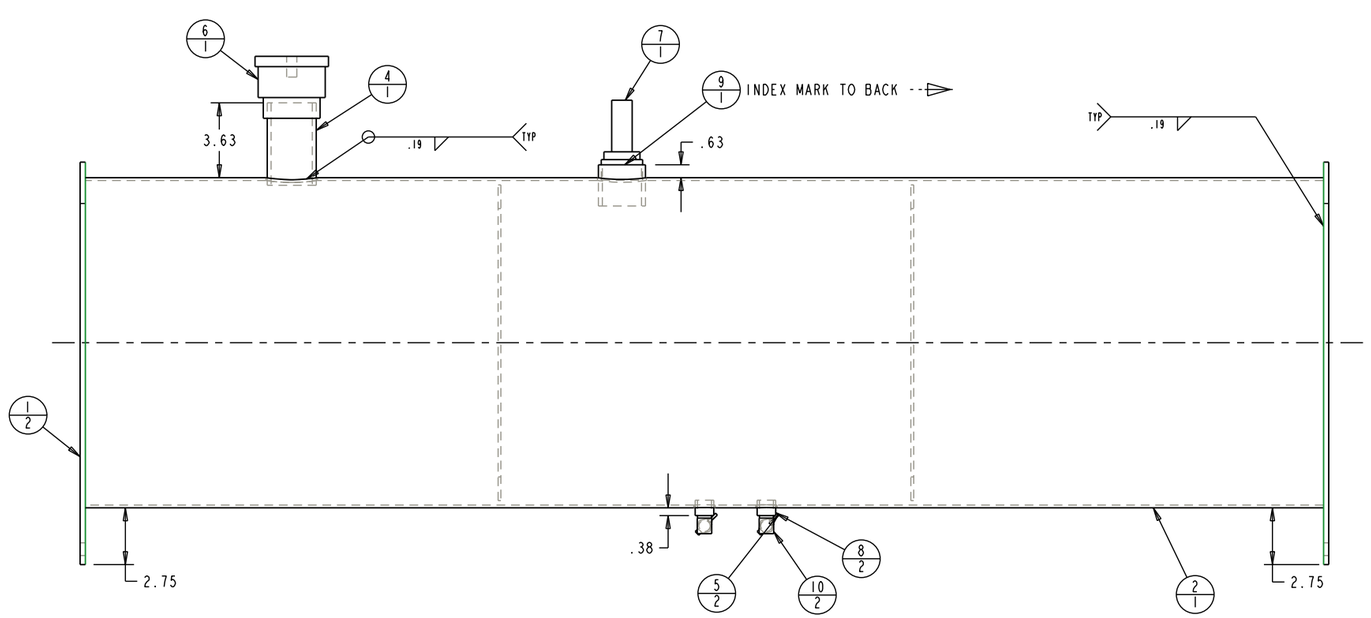
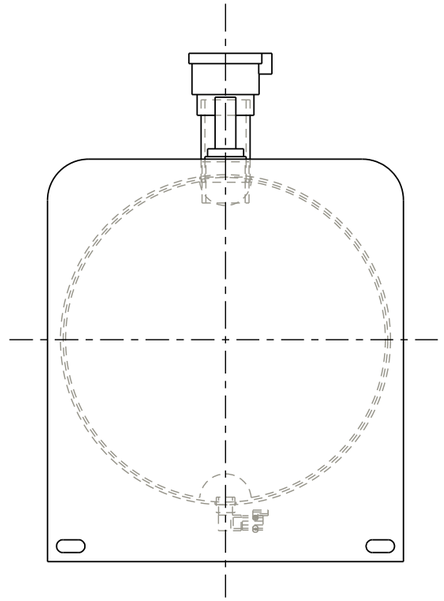
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: JACK STAND ASSY., FRONT		
SCALE 0.200	DATE: 13-Aug-03	DWG. NO.: 037708
DRAWN BY: DE	NOTE:	SHEET 1 OF 1

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	038137-01	PLATE A36 .25	2		23.567
2	038137-02	TUBE 16" X 10GA.	1		5'
3	038137-03	PLATE A36 .25	2		7.002
4	038137-04	PIPE 2" X 5.00 SCH40 TOE	1	351407	REF
5	300296	PETCOCK, 1/4"	2	300295	STK
6	304091	FUEL CAP/VENT	1		STK
7	304515	FUEL GAUGE	1		STK
8	350828	COUPLING 3/8"NPT SCH40	2	350827	STK
9	350833	PIPE COUPLING, 1 1/2"	1	350827	STK
10	352892	ELL, 2089 4-6 90°	2	352887	STK





REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REPLACE 038460 W/ 304515	11-15-04	DE
B	REMOVE; 354315, 353171,304388 ADD 350828	09-21-05	
C	MAT'L 038137-02 SCH10. MODIFY 038137-03	11-16-06	
D	ADD 351407	03-24-10	
E	MAT'L 038137-02 TO TUBE 10GA	08-11-10	DE

MEGA
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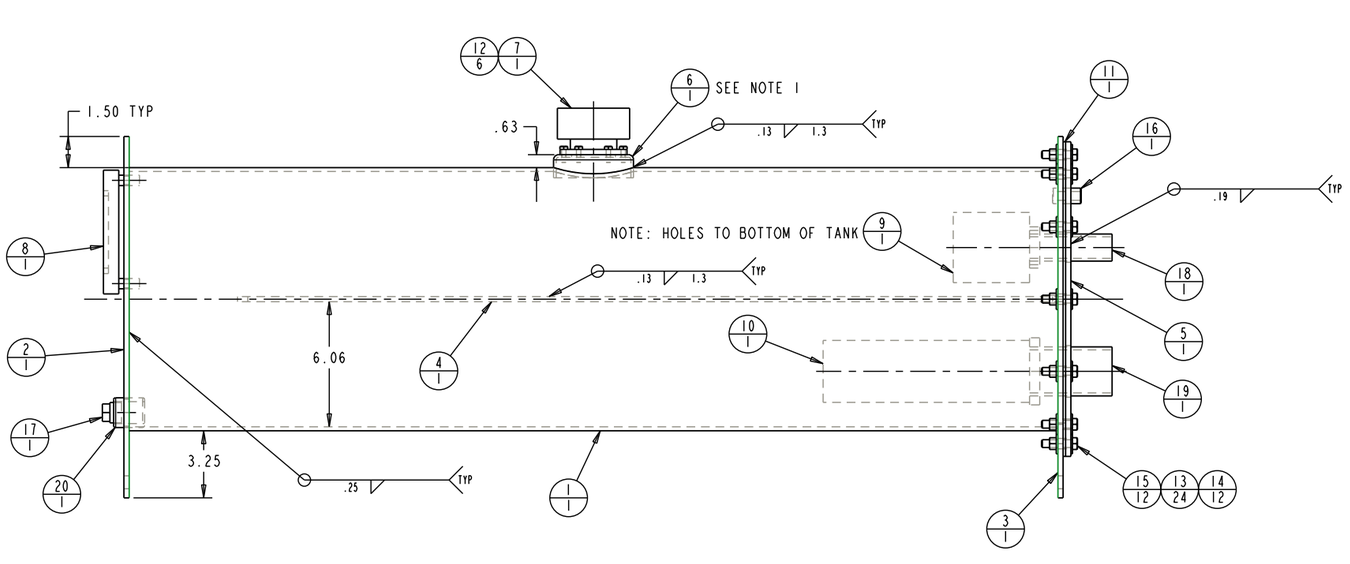
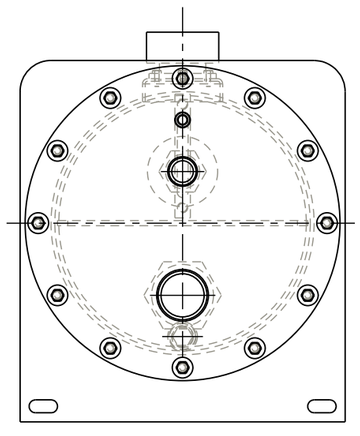
TOLERANCE: UNLESS OTHERWISE SPECIFIED
3 PLACES ± 0.010 | 2 PLACES ± 0.030 | ANGULAR ± 1°

DWG. TITLE: FUEL TANK ASSY. 50GAL
SCALE 0.111 | DATE: 15-Jan-04 | DWG. NO.: 038137
DRAWN BY: DE | NOTE: | SHEET 1 OF 2

NOTES:
1. TAP MOUNT HOLES BEFORE INSTALL

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	038138-01	PIPE 12" SCH10	1		3.75'
2	038138-02	PLATE A36 .25	1		19.207
3	038138-03	PLATE A36 .25	1		11.154
4	038138-05	PLATE A36 .25	1		34.258
5	038138-06	PLATE A36 .25	1		12.262
6	045670	FLANGE HYD. FILL/VENT CAP MOD.	1	302098	REF
7	302624	HYD. FILL/VENT CAP	1		STK
8	304094	HYD. LEVEL GAUGE	1		STK
9	304097	DIFFUSER, HYDRAULIC	1		STK
10	304100	STRAINER, HYD. 2"NPT	1		STK
11	304116	NEOPRENE 1/8"	1		STK
12	306031	SCREW, CAP 12-24 UNC X0.63	6	306030	STK
13	350003	WASHER, FLAT 3/8	24	350000	SPLY
14	350025	NUT, HEX 3/8-16 UNC	12	350023	SPLY
15	350147	SCREW, CAP 3/8-16 UNC X1.50	12	350141	SPLY
16	350827	COUPLING, PIPE 1/4	1	350827	STK
17	350853	3/4" PIPE PLUG	1	350849	STK
18	351392	PIPE NIPPLE 1" SCH40 X 4"	1	351388	STK
19	351405	PIPE NIPPLE 2" SCH40 X 4"	1	351404	STK
20	354249	PIPE COUPLING 3/4"	1	350827	STK





REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADD 1/4" NPT COUPLING	07-15-10	DE

MEGA
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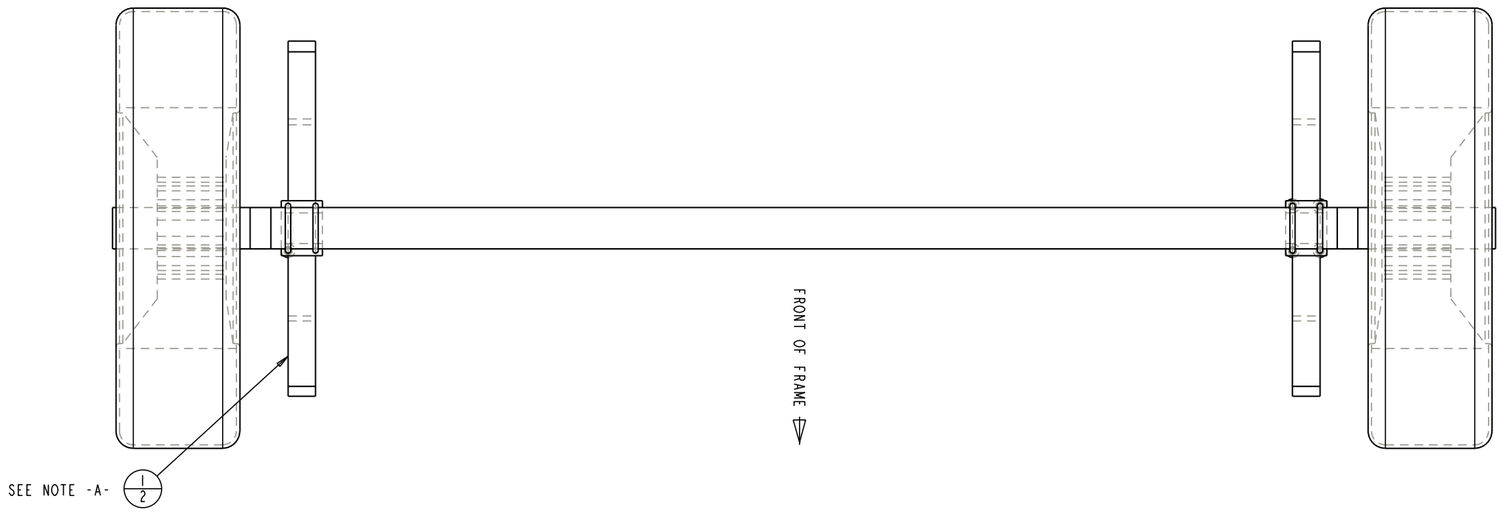
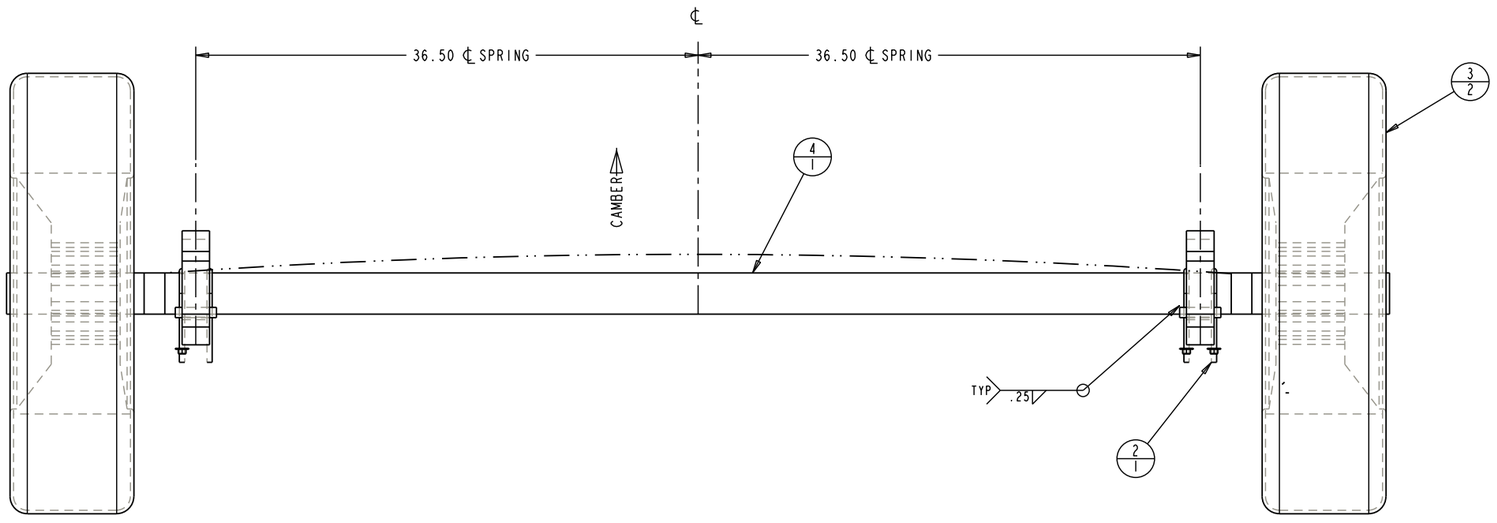
(505) 345-2661

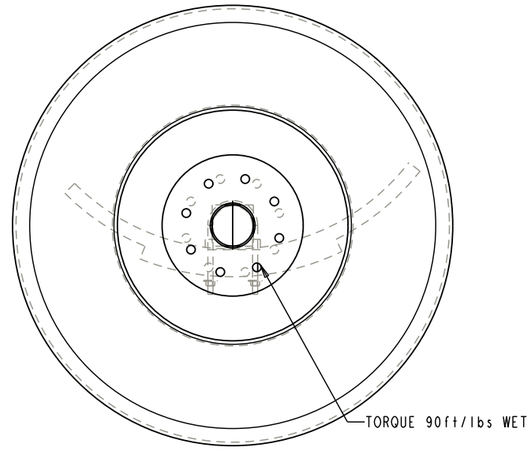
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: HYDRAULIC TANK ASSY. 30GAL		
SCALE 0.125	DATE: 15-Jan-04	DWG. NO.: 038138
DRAWN BY: DE	NOTE:	SHEET 1 OF 2

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	303928	SUSPENSION, SPRING	2		STK
2	303929	U BOLT KIT	1		STK
3	303933	WHEEL & TIRE	2		STK
4	304237	AXLE, 6000# CAP	1		STK

NOTE A: INSTALL SPRINGS MARKED LEFT & RIGHT CORRESPONDING TO FRONT OF FRAME







REAR OF FRAME

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED

MEGA
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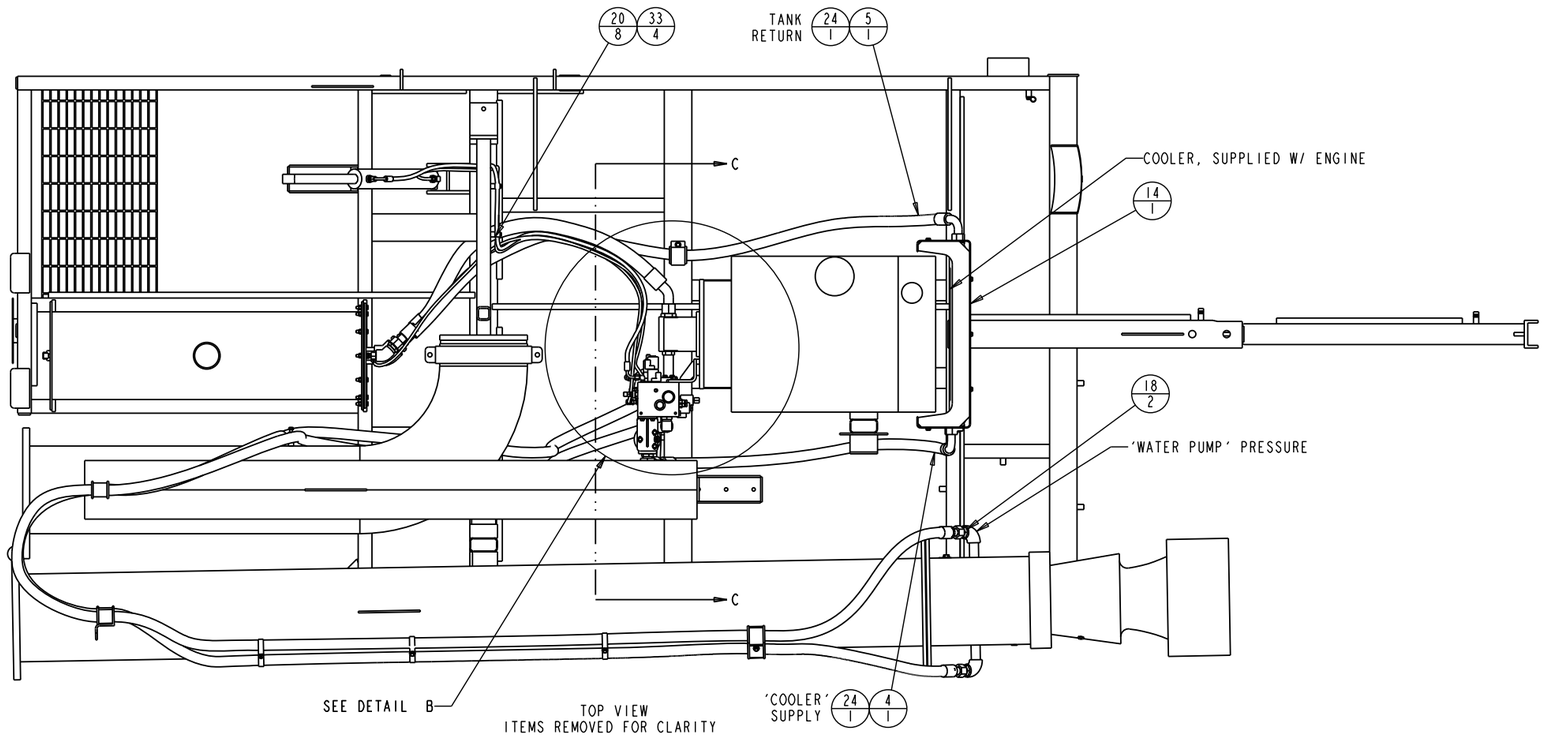
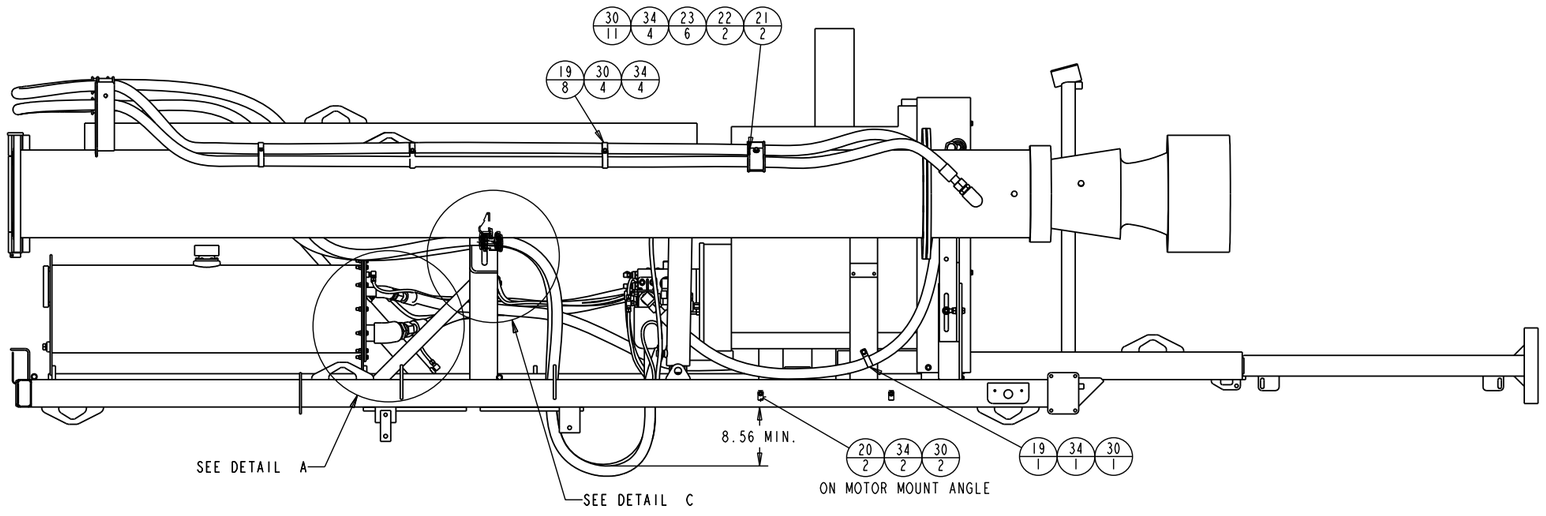
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED

3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°

DWG. TITLE: AXLE & SUSPENSION ASSY.		
SCALE 0.059	DATE: 14-Oct-03	DWG. NO.: 038454
DRAWN BY: DE	NOTE:	SHEET 1 OF 1





ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	043999	MANIFOLD, CONTROL, HYDRAULIC	1		REF
2	045662-01	HOSE, GH493 -16	1		REF
3	045662-02	HOSE, GH493 -16	1		REF
4	045662-03	HOSE, GH493 -16	1		REF
5	045662-04	HOSE, GH493 -16	1		REF
6	045662-05	HOSE, FC318 -20	1		REF
7	045662-06	HOSE, GH493 -4	1		REF
8	045662-07	HOSE, GH493 -4	1		REF
9	045662-08	TUBING, NYLON 3/8 X 78.00	1	351141	STK
10	045662-09	TUBING, NYLON 3/8 X 50.00	1	351141	STK
11	045662-10	TUBING, NYLON 3/8 X 71.00	1	351141	STK
12	045662-11	PLATE A36 .50	1		1.678
13	045663	BRACKET, CONTROL MANIFOLD	1		REF
14	045665	BRACKET, COOLER GUARD	1		REF
15	045801	SAE B4 PLATE MODIFIED	1		REF
16	300451	ADP, ORS/NPT 16-16	1		STK
17	300452	ADP. ORS/NPT 20-20	1	354047	STK
18	300473	ADP. ORS-NPT 16-16	2		STK
19	301060	CLAMP, 1.50 I.D.	9	300231	SPLY
20	303058	CLAMP, 0.63 I.D.	14	300231	SPLY
21	303721	CLAMP, HOSE SLOT #16	7	302721	STK
22	303722	CLAMP, HOSE, TAB #16	7	303722	STK
23	303723	CLAMP, HOSE, GROMMET #16	11	303976	STK
24	305343	ADP. ORS-ORB 16-16	2		STK
25	305390	ADP. ORS/NPT 4-6	1	354047	STK
26	305391	ADP. ORS/NPT 4-8	1	354047	STK
27	305784	FLANGE-HALF -16	2		STK
28	306210	ADP. ORB/S.F. CODE61 -16-16	1		STK
29	306246	SEAL, NITRILE -20	1		0.000
30	350003	WASHER, FLAT 3/8	43	350000	SPLY
31	350005	WASHER, FLAT 1/2	4	350000	SPLY
32	350025	NUT, HEX 3/8-16 UNC	10	350023	SPLY
33	350144	SCREW, CAP 3/8-16 UNC X0.88	4	350141	STK
34	350146	SCREW, CAP 3/8-16 UNC X1.25	15	350141	STK
35	350147	SCREW, CAP 3/8-16 UNC X1.50	14	350141	STK
36	350231	SCREW, CAP 1/2-13 UNC X1.50	2	350225	STK
37	350233	SCREW, CAP 1/2-13 UNC X2.00	2	350225	STK
38	350736	ADP. NPT/NPT 16-16 45°	1	350731	STK
39	350739	ADP. NPT/NPT 16-16 45°	1	350731	STK
40	351082	ADP. TUBE/NPT 6-4 90	1	351079	STK
41	351086	ADP. TUBE/NPT 6-6	1	351079	STK
42	351087	ADP. TUBE/NPT 6-8	1	351079	STK
43	352885	ADP. NPT/NPT 32-20	1	352867	STK
44	353906	O-RING, S.F. -16	1	353905	0.019
45	354978	SEAL, ORS -4	2		STK
46	355097	SEAL, ORS -20	2		STK
47	355270	O-RING ORS-16	7	354976	STK
48	355964	ADP. ORS-ORB 20-20	1	303194	STK

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	REPLACE 305465 W/305343	02-09-12	DE
B	MOD. HOSE LENGTHS -01, -02	02-23-12	DE
C	MOD. QTY. HODE END 354897 & 354904	03-07-12	DE

MEGA
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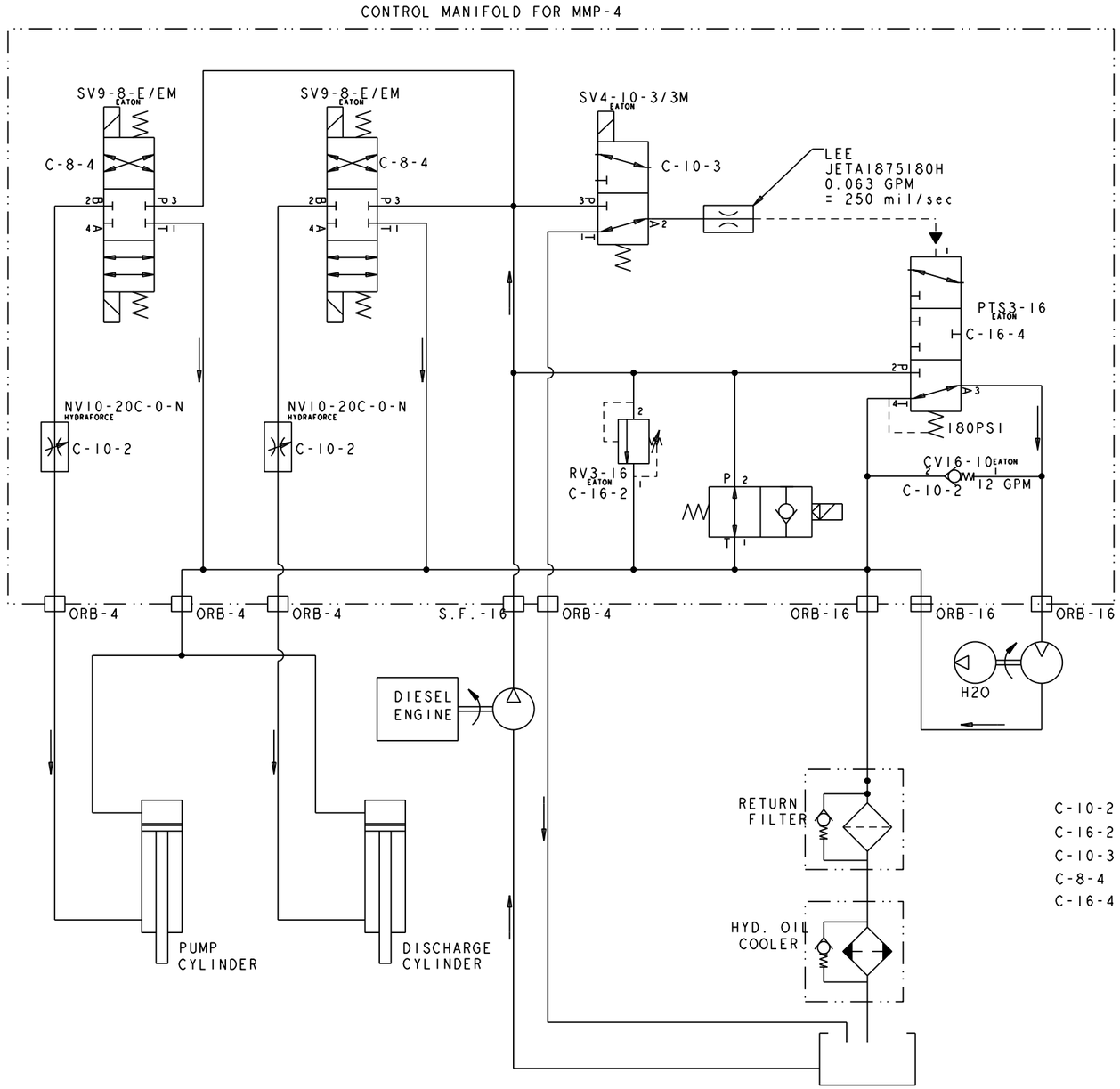
TOLERANCE: UNLESS OTHERWISE SPECIFIED	
3 PLACES ± 0.010 | 2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 CAT-C22T ENG. HYDRAULIC INSTALL	
SCALE 0.024 | DATE: Nov-28-11	DWG. NO.: 045662
DRAWN BY: DE | NOTE:	SHEET 1 OF 5

CONTROL MANIFOLD FOR MMP-4



C-10-2
C-16-2
C-10-3
C-8-4
C-16-4

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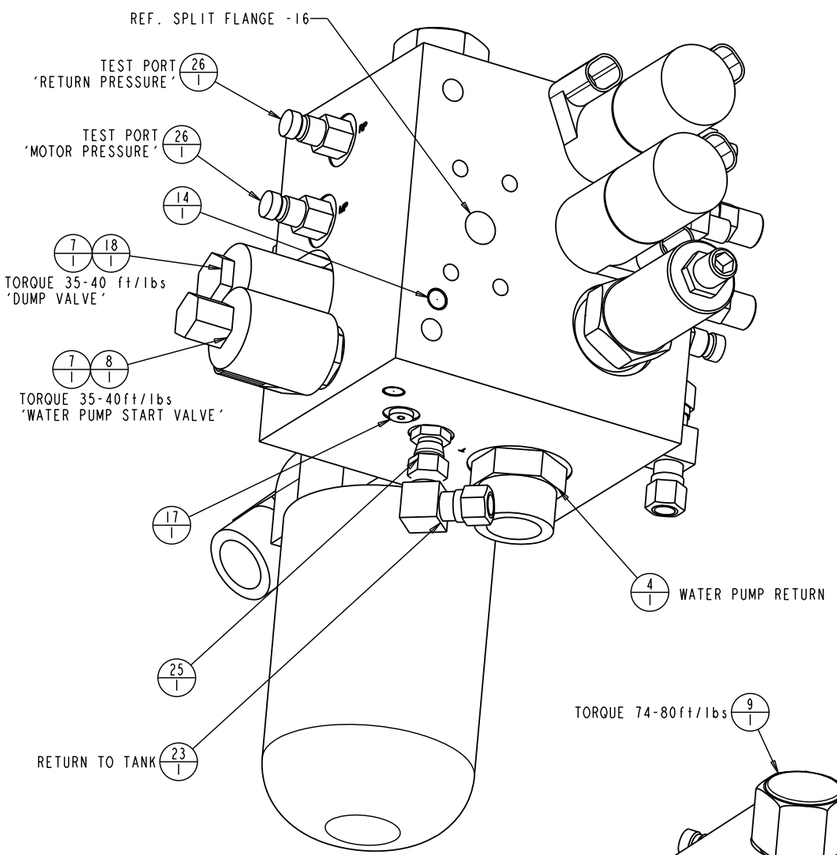
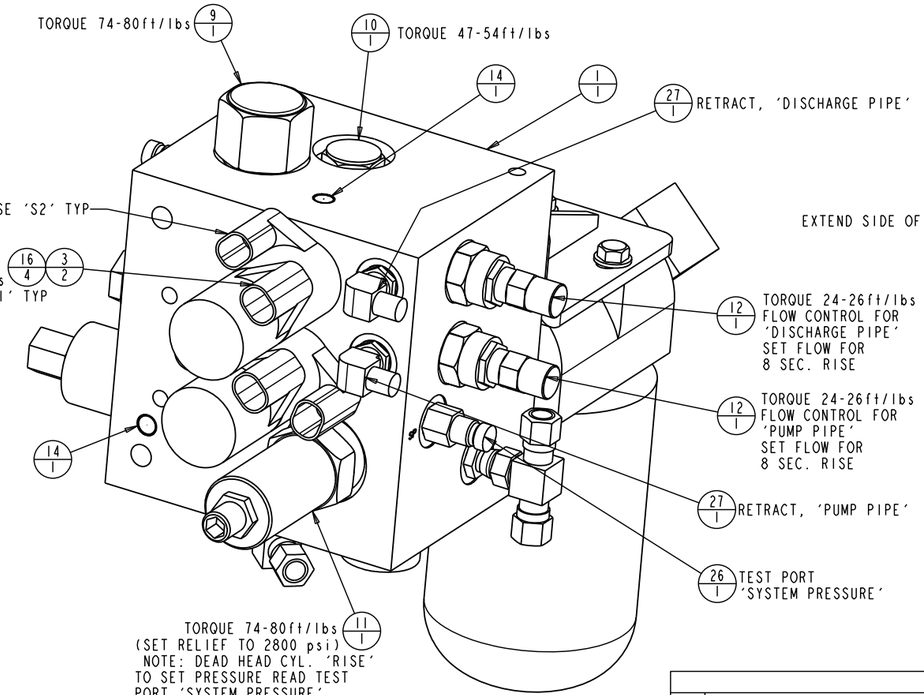
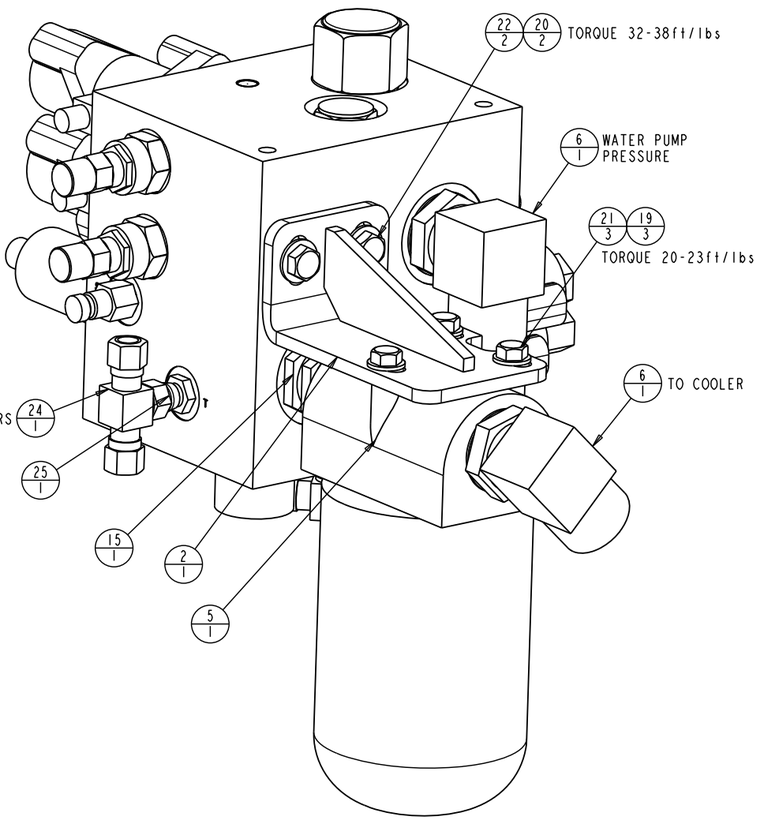
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 HYDRAULIC CONTROL MANIFOLD SCHEMATIC		
SCALE: 1.000	DATE: 25-Jun-10	DWG. NO.: 043998
DRAWN BY: DE	NOTE:	SHEET 3 OF 3





INSTALLATION INSTRUCTIONS:

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	043998	MANIFOLD, ALUM 6061-T6511	1		REF
2	044013	BRACKET, HYD. FILTER	1		REF
3	304858	SOLENOID VALVE 4WAY, 3POS	2		STK
4	305343	ADP. ORS-ORB 16-16	1		STK
5	305374	FILTER, HYDRAULIC	1	039384	STK
6	305465	ADP. ORB-ORS 16-16 90°	2		STK
7	305968	COIL, 12VDC, 10 SER.	2		STK
8	305971	SOLENOID VALVE, 3WAY-2POS	1		STK
9	305972	VALVE, PILOT	1		STK
10	305973	VALVE, CHECK	1		STK
11	305974	VALVE, RELIEF, 2.8k PSI	1		STK
12	305975	VALVE, NEEDLE	2		STK
13	305976	RESTRICTOR, FLOW, 18k LOHM	1		STK
14	305977	PLUG, .406, LEE CO.	3		STK
15	305984	ADP. ORB 16-16	1		STK
16	306247	COIL, 12VDC, 8 SER.	4		STK
17	306320	PLUG ORB-2	1		STK
18	306370	SOLENOID VALVE, 2WAY-2POS	1		STK
19	350002	WASHER, FLAT 5/16	3	350000	STK
20	350003	WASHER, FLAT 3/8	2	350000	SPLY
21	350103	SCREW, CAP 5/16-18 UNC X1.00	3	350099	STK
22	350145	SCREW, CAP 3/8-16 UNC X1.00	2	350141	SPLY
23	351082	ADP. TUBE/NPT 6-4 90	1	351079	STK
24	351109	ADP. TEE TUBE/NPT 6-4-6	1	351108	STK
25	353191	ADP. ORB-NPT 4-4	2	353191	STK
26	354745	TEST PORT, ORB-4	3		STK
27	354983	ADP. ORB-ORS 4-4 90°	2		STK



REVISIONS			
REV		DATE	APPROVED
A	ADD PART 306247	1-31-12	DE
B	ADD PART 306320, QTY-1 354745, REMV. 352869&354588	2-23-12	DE
C	MOD. QTY. ITEM 4 & 6	3-07-12	DE
D	ADD 306370 & QTY 1 OF 305968	3-14-12	DE

MEGA
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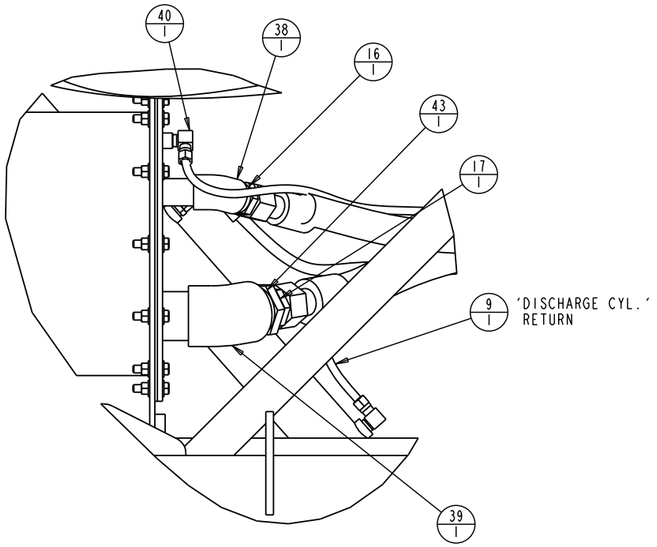
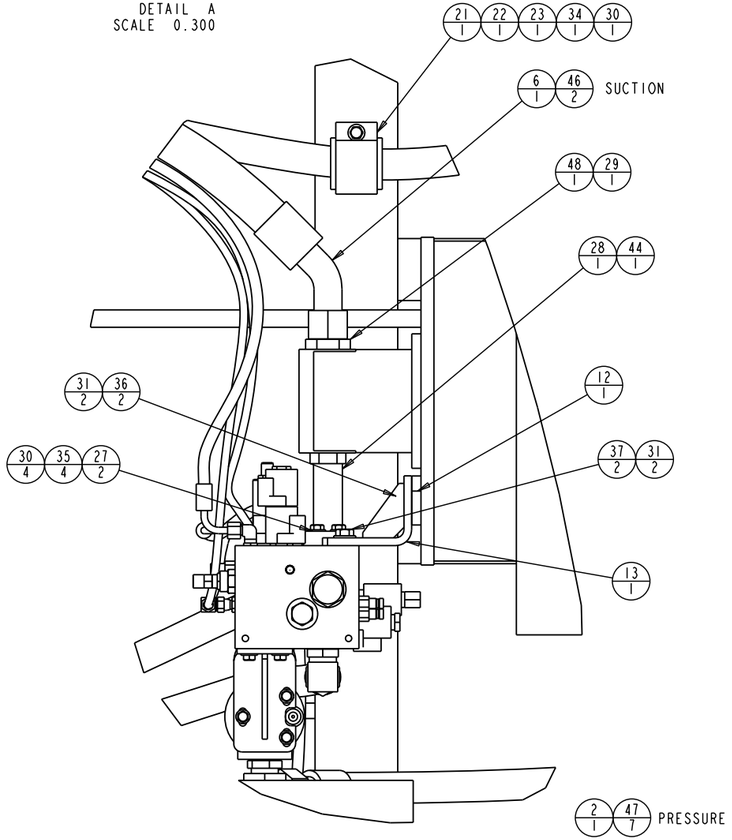
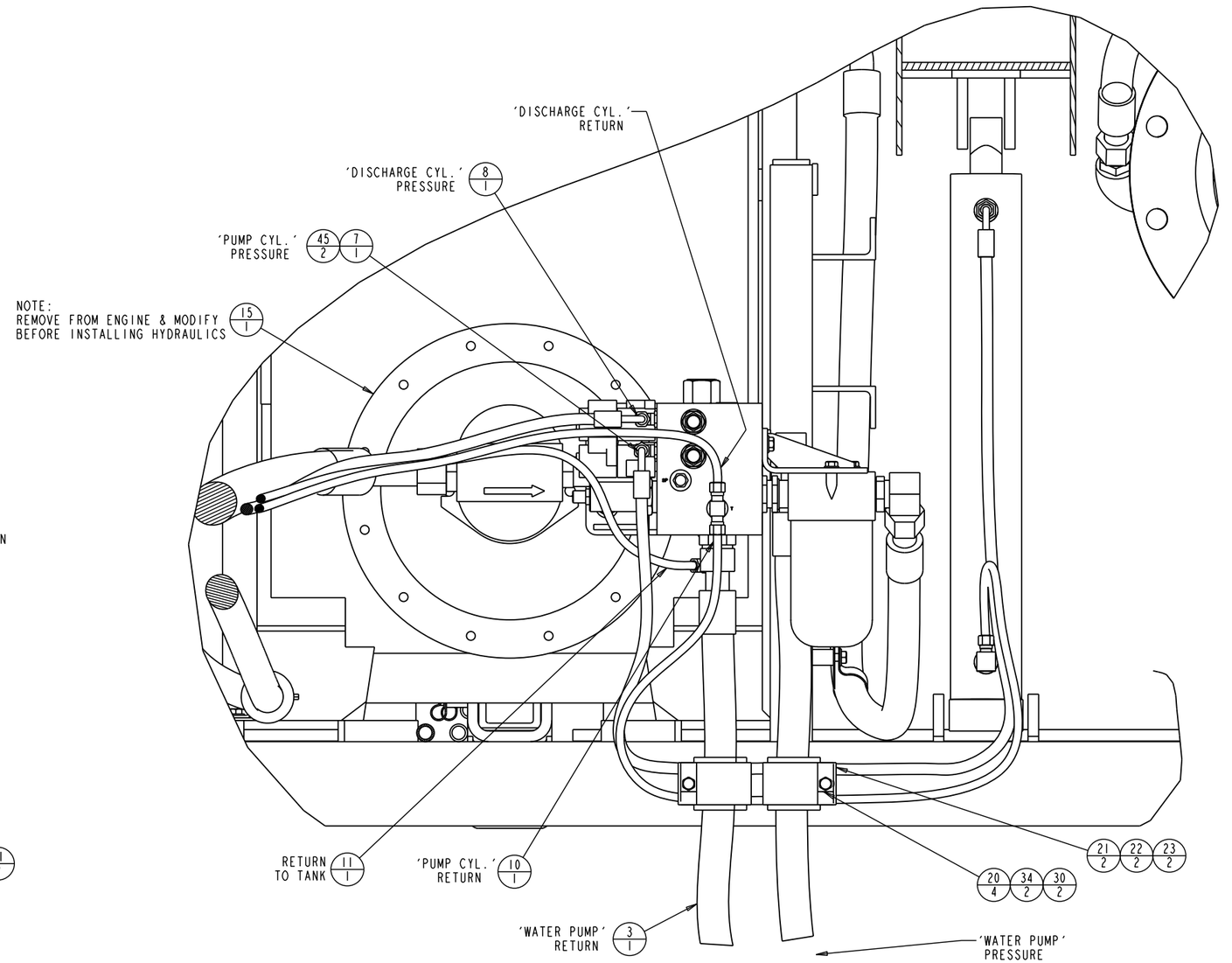
TOLERANCE: UNLESS OTHERWISE SPECIFIED			
3 PLACES + 0.010	2 PLACES + 0.030	ANGULAR + 1°	
DWG. TITLE: MMP4 CONTROL MANIFOLD ASSY.			
SCALE 0.500	DATE: 08-Jun-10	DWG. NO.: 043999	
DRAWN BY: DE	NOTE:	SHEET 1 OF 1	



DETAIL A
SCALE 0.300



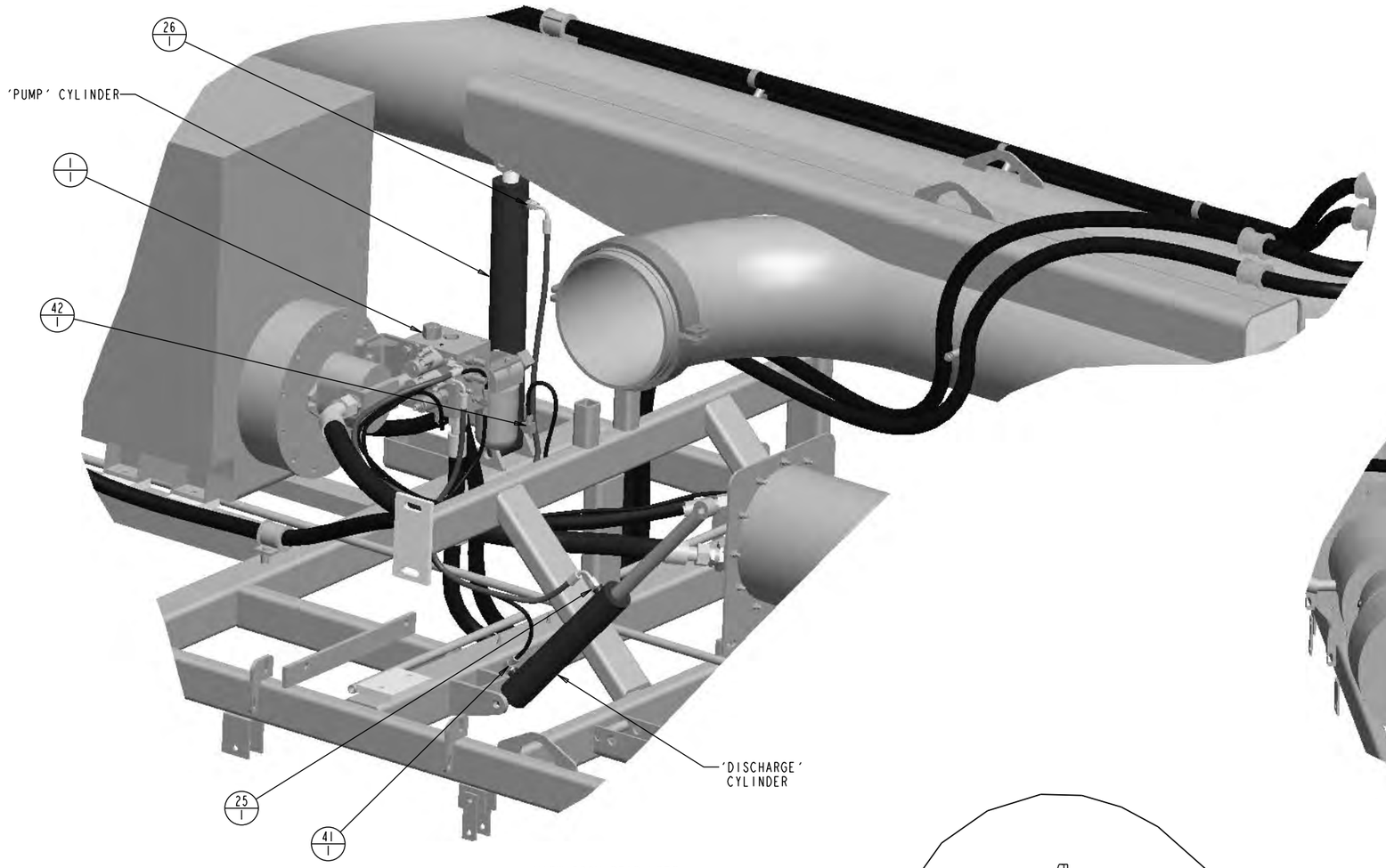
DETAIL B
SCALE 0.300



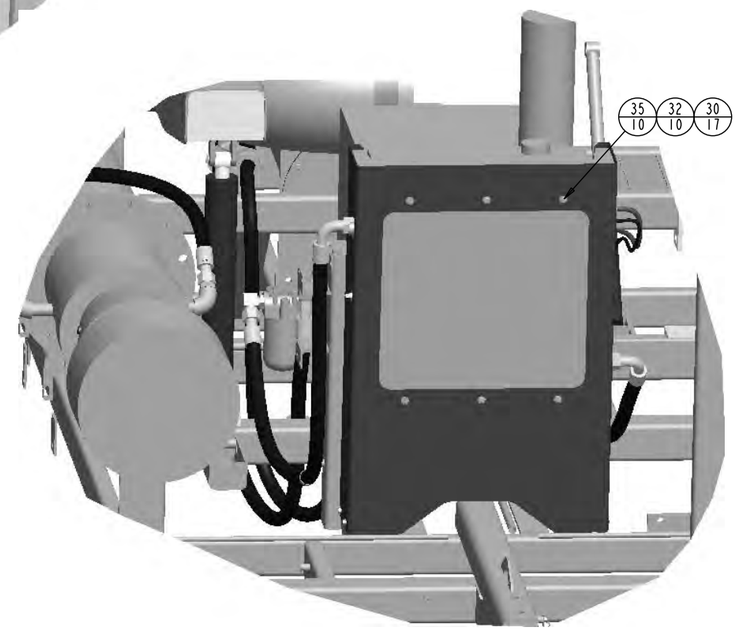
SECTION C-C
SCALE 0.350

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

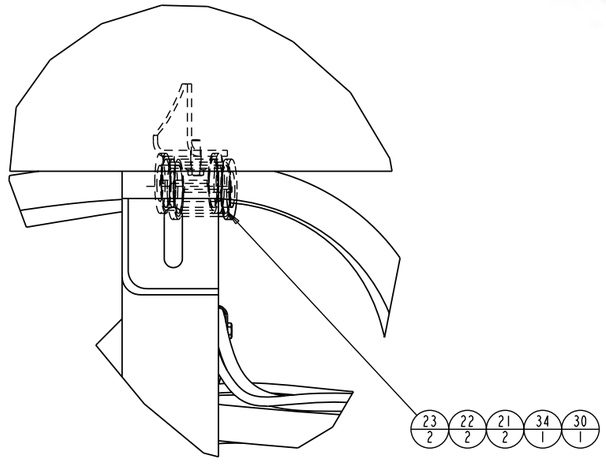
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 CAT-C22T ENG. HYDRAULIC INSTALL		
SCALE: 0.024	DATE: Dec-15-11	DWG. NO.: 045662
DRAWN BY: DE	NOTE:	SHEET 2 OF 5



VIEW FROM REAR LEFT
ITEMS REMOVED FOR CLARITY
SCALE 0.180



VIEW FROM FRONT
ITEMS REMOVED FOR CLARITY
SCALE 0.140



DETAIL C
SCALE 0.350

MEGA
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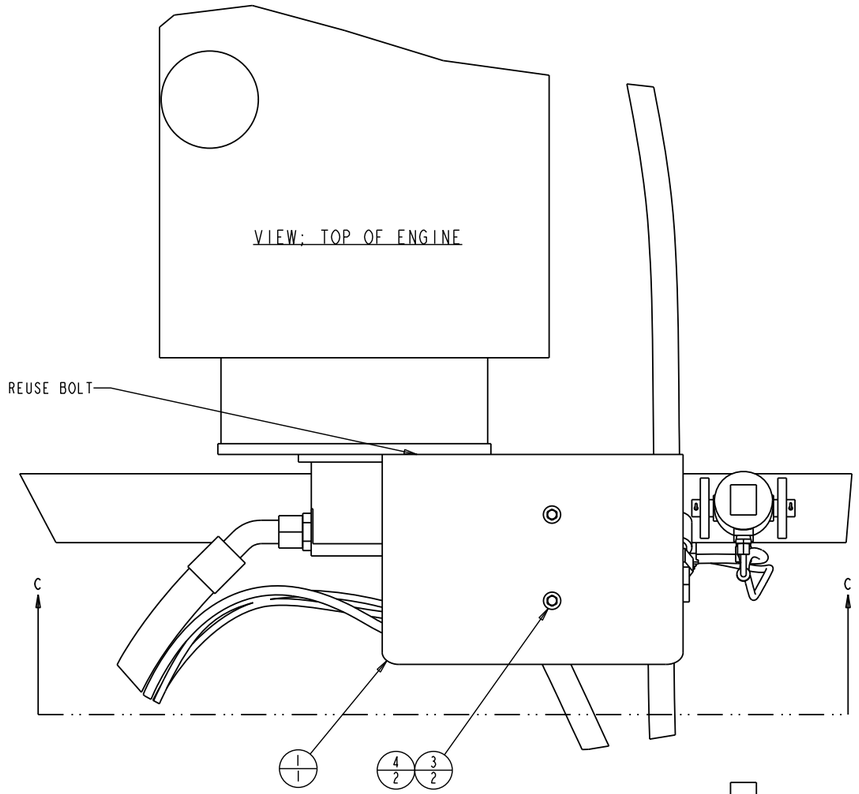
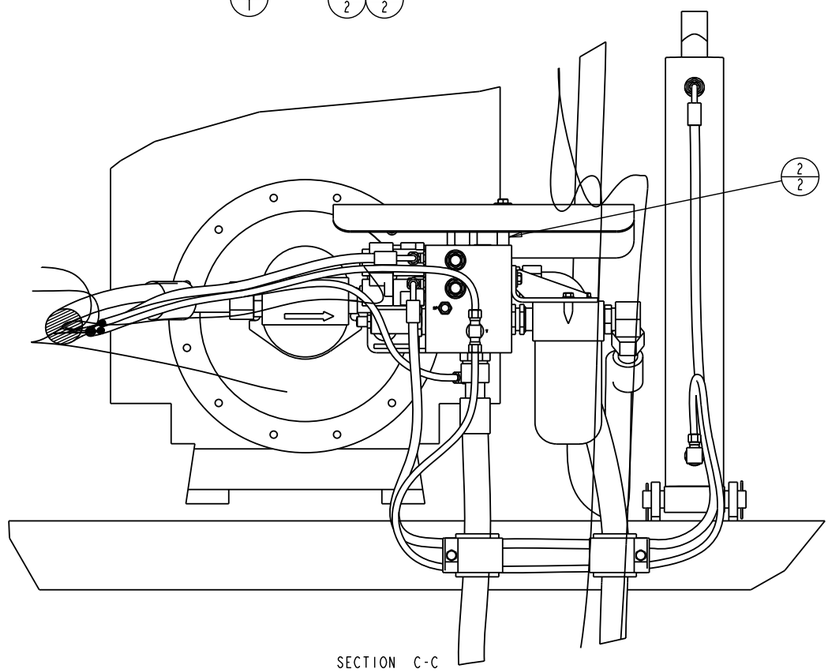
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 CAT-C22T ENG. HYDRAULIC INSTALL		
SCALE: 0.024	DATE: Dec-15-11	DWG. NO.: 045662
DRAWN BY: DE	NOTE:	SHEET 3 OF 5

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	045914-01	PLATE A36 12GA	1		7.887
2	045914-02	PIPE 3/8 SCH40	2		0.106
3	350003	WASHER, FLAT 3/8	2	350000	SPLY
4	350153	SCREW, CAP 3/8-16 UNC X3.00	2	350141	STK

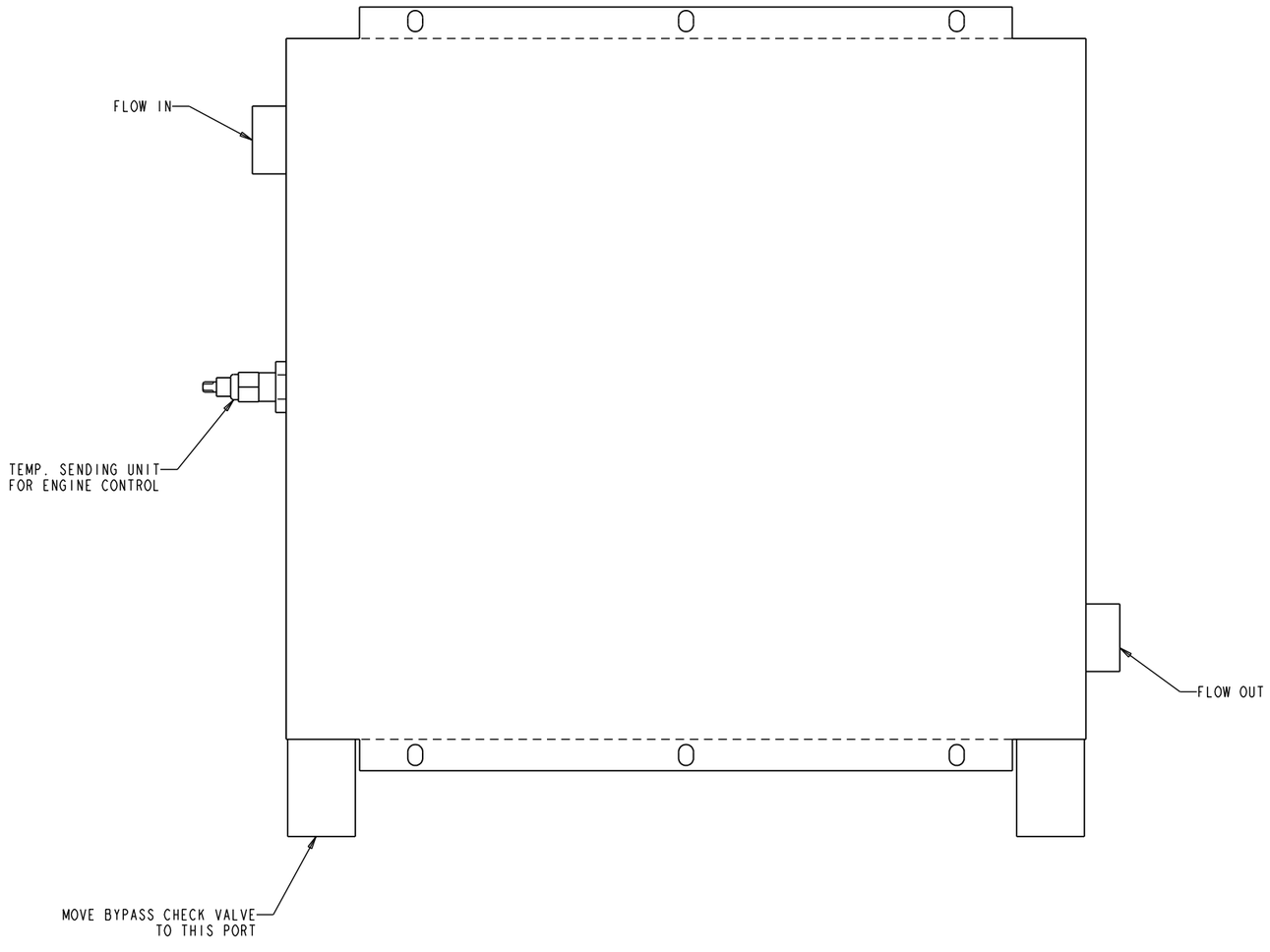




SECTION C-C

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 CATC22T ENG. HYD. COVER INSTALL		
SCALE 0.032	DATE: Feb-23-12	DWG. NO.: 045914
DRAWN BY: DE	NOTE:	SHEET 1 OF 1

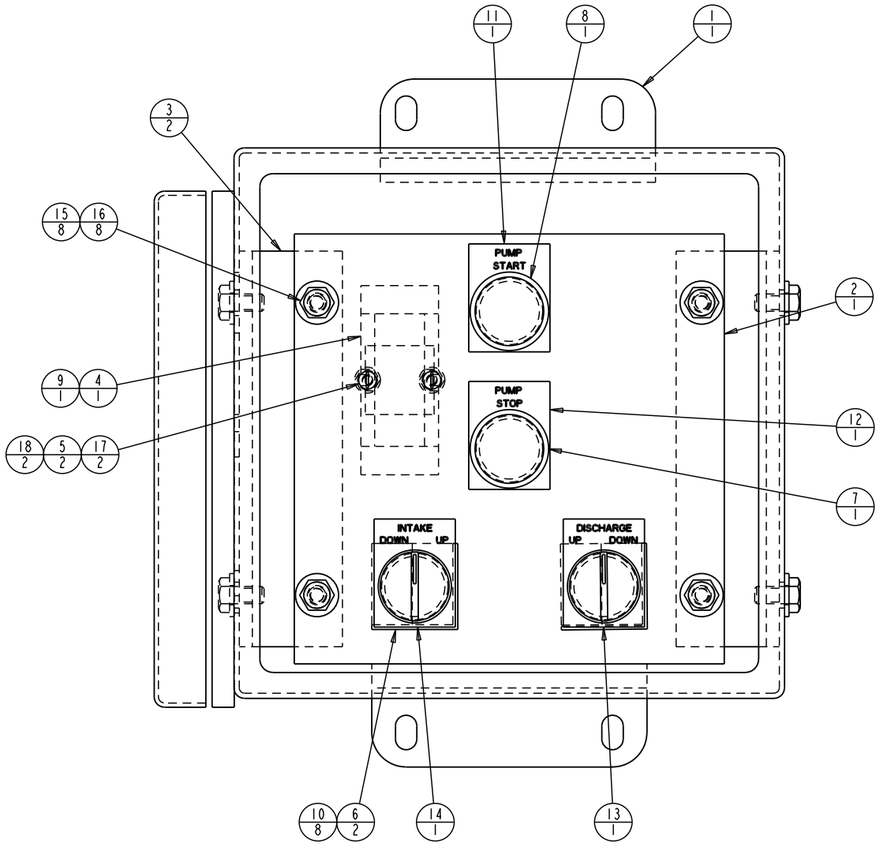


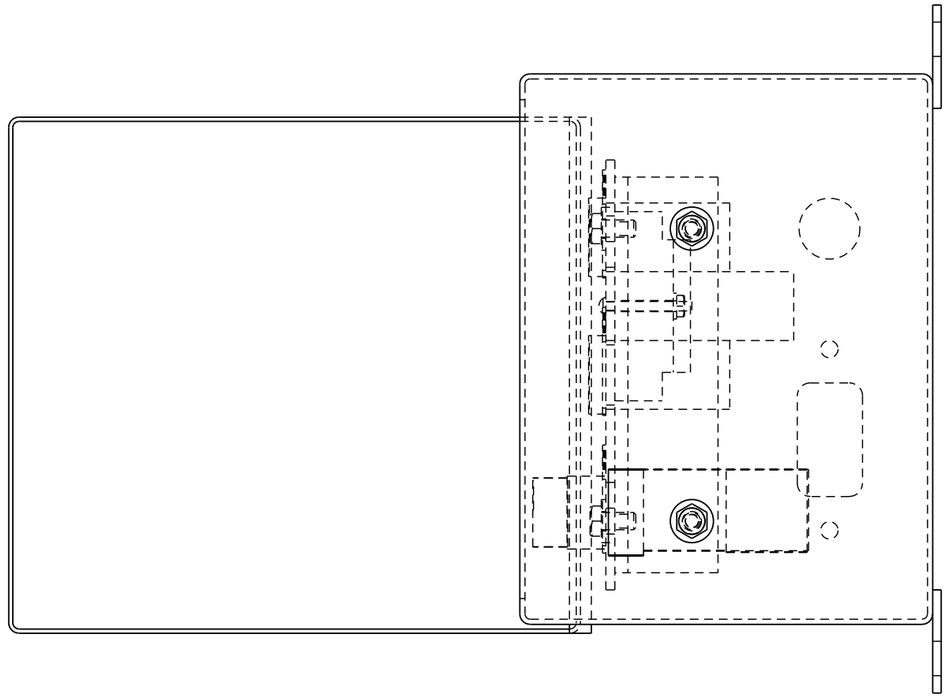
COOLER SUPPLYED WITH CAT-C22T ENGINE (MAT-48-2)

MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.003	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 CAT-C22T ENG. HYDRAULIC INSTALL		
SCALE: 0.024	DATE: Feb-09-12	DWG. NO.: 045662
DRAWN BY: DE	NOTE:	SHEET 5 OF 5

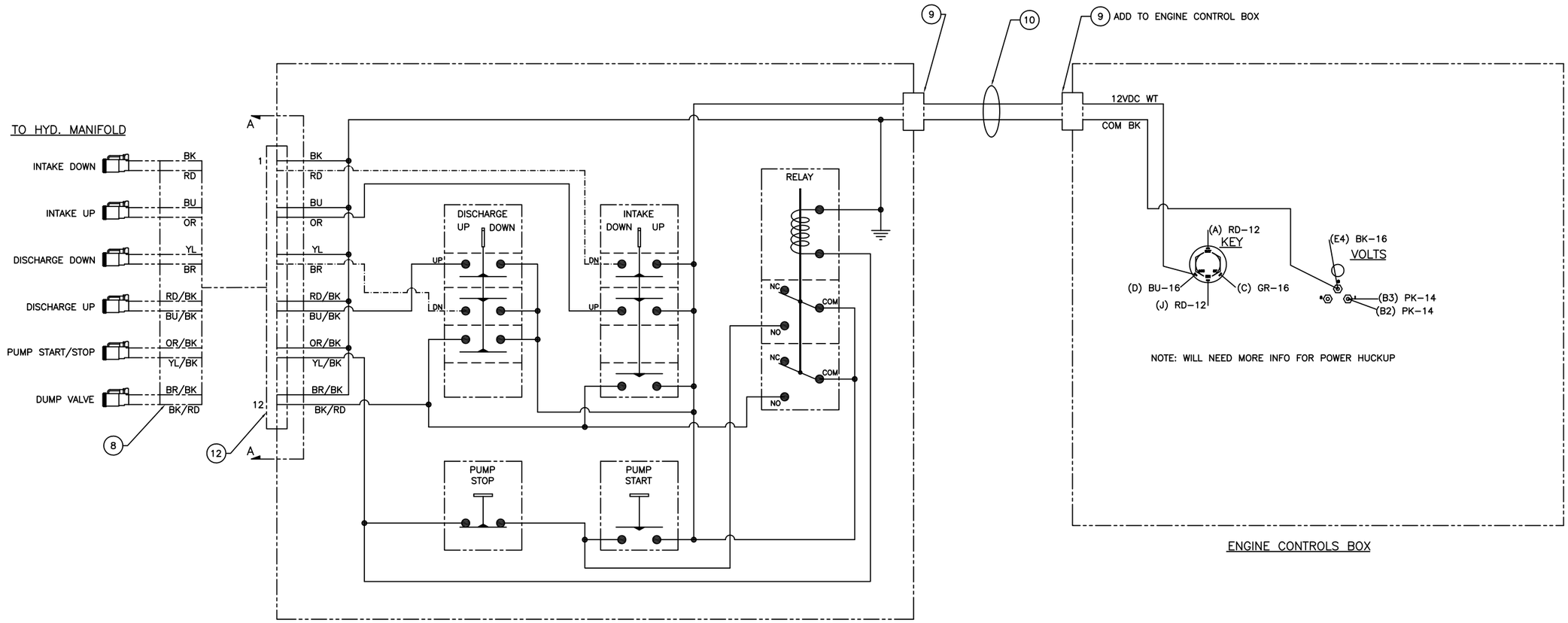
ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	045666-01	JUNCTION BOX, CONTROL	1	306217	REF
2	045666-02	PANEL, CONTROL	1	306218	REF
3	045666-03	ANGLE .19 X 1.50 X 1.50	2		0.913
4	301847	BASE, RELAY	1		STK
5	305306	WASHER, FLAT #6	2	350000	STK
6	305929	SWITCH, 3 POS	2		STK
7	305930	SWITCH, RED, N.C.	1		STK
8	305931	SWITCH, GREEN, N.O.	1		STK
9	305947	RELAY, 12V, 2P	1		STK
10	305948	CONTACT BLOCK, N.O.	8	305929	STK
11	305964-01	LEGEND PLATE, PUMP START	1	305964	0.016
12	305964-02	LEGEND PLATE, PUMP STOP	1	305964	0.016
13	305964-03	LEGEND PLATE, DISCHR. UP DOWN	1	305964	0.015
14	305964-04	LEGEND PLATE, INTAKE DOWN UP	1	305964	0.015
15	350001	WASHER, FLAT 1/4	8	350000	SPLY
16	350057	SCREW, CAP 1/4-20 UNC X0.50	8	350057	SPLY
17	352802	SCREW R.H 6-32 X1.25	2		STK
18	355305	NUT, HEX #6-32 UNC	2	350023	SPLY

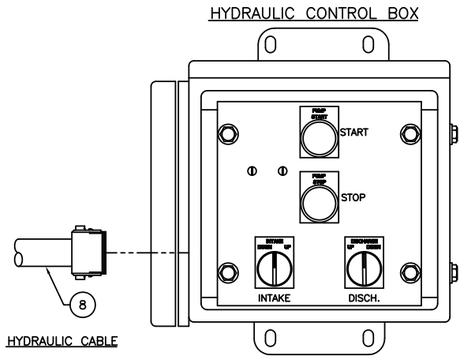


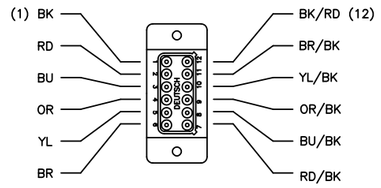


700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 C22T ENG. CONTROL BOX ASSY.		
SCALE 0.500	DATE: Dec-15-11	DWG. NO.: 045666
DRAWN BY: DE	NOTE:	SHEET 1 OF 3





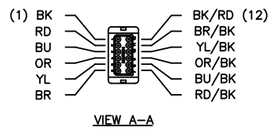


MEGA
700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

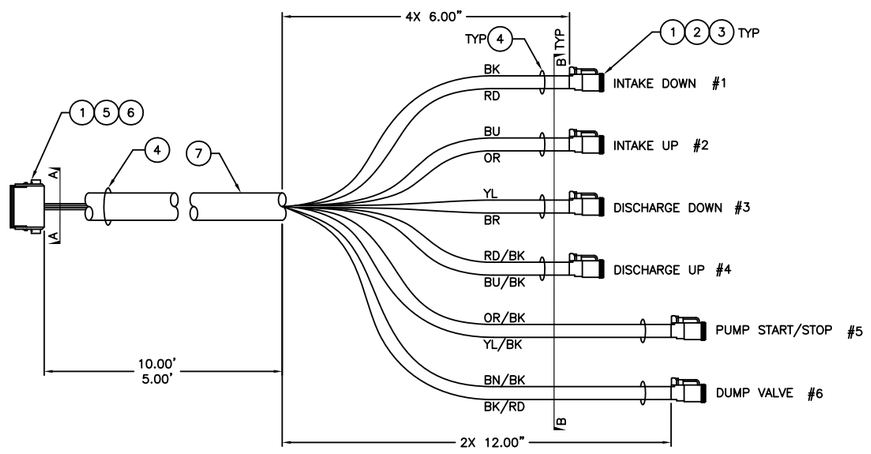
TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.03	ANGULAR ± 1°
NAME OF JOB: MMP4 CAT C22T ENGINE		
DRAWING TITLE: ELECTRICAL & LIGHT ASSEMBLY		
SCALE: NONE	DATE: 12-22-11	DWG. No.: 045668
DRAWN BY: DE	SHEET 2 OF 2	

BILL OF MATERIAL

	No.	Part No.	PART NAME	QTY	REF No.	WT.
	1	304285	PLUG, 2 PIN (DEUTSCH)	6	303349	STK
	2	304288	SOCKET, FEMALE, (DEUTSCH)	24	303349	STK
	3	304385	SECONDARY LOCK, 2 SOCKET	6	303349	STK
	4		SHRINK WRAP			SUP
	5	305190	PLUG., 12, (DEUTSCH)	1	303349	STK
	6	305192	SECONDARY LOCK, 12 PIN	1	303349	STK
044067	7	303204	CABLE, 16 COND' 16GA	12'	300483	STK
045669	7	303204	CABLE, 16 COND' 16GA	6'	300483	STK
	8					



VIEW A–A



#1
BK(1) (2)RD
VIEW B–B
INTAKE DOWN

#2
BU(1) (2)OR
VIEW B–B
INTAKE UP

#3
YL(1) (2)BR
VIEW B–B
DISCHARGE DOWN

#4
RD/BK(1) (2)BU/BK
VIEW B–B
DISCHARGE UP

#5
OR/BK(1) (2)YL/BK
VIEW B–B
PUMP START/STOP

#6
BR/BK(1) (2)BK/RD
VIEW B–B
DUMP VALVE

700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

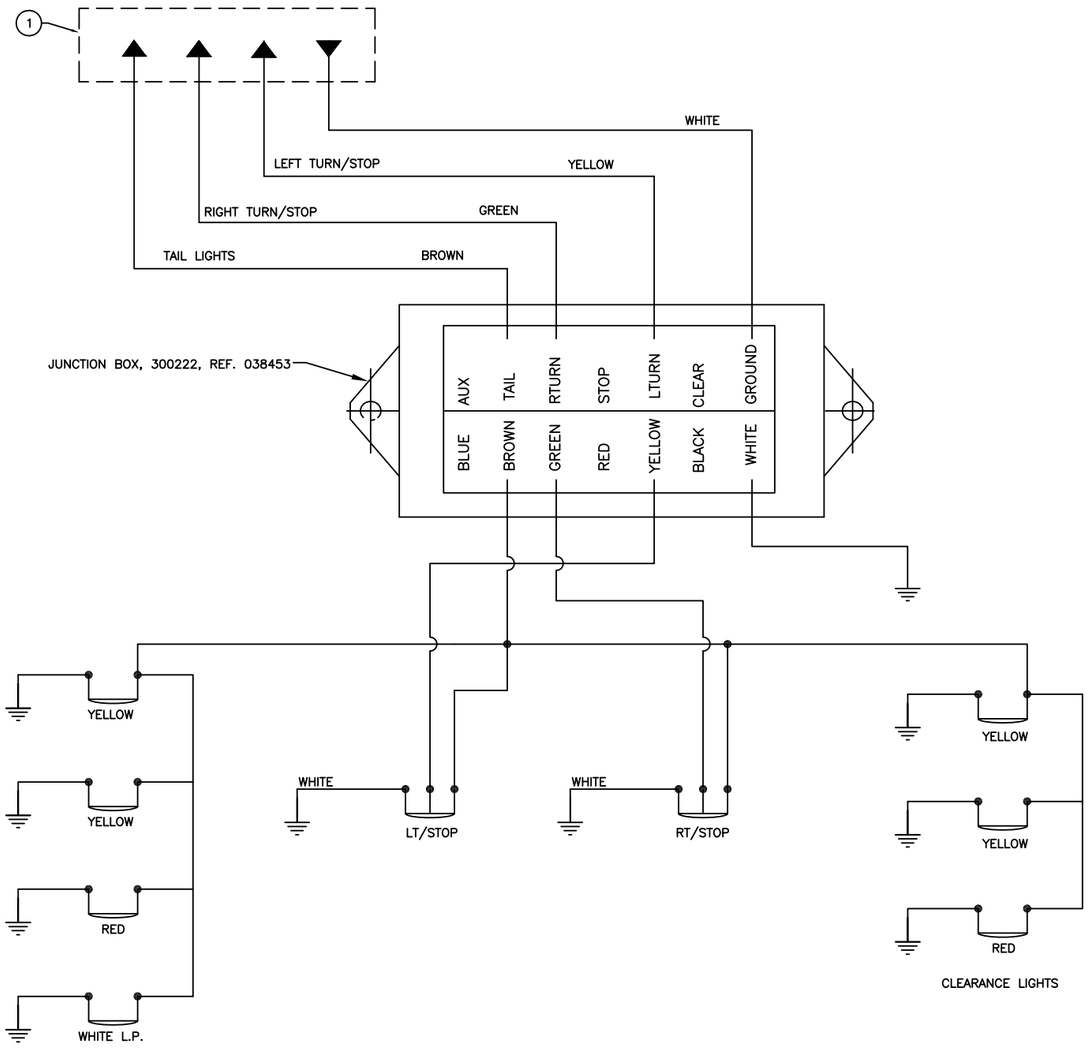
TOLERANCE: UNLESS OTHERWISE SPECIFIED
3 PLACES ± 0.010 | 2 PLACES ± 0.03 | ANGULAR ± 1°

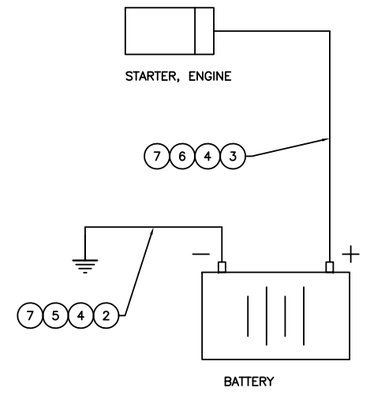
REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADD TO QTY. ITEMS 1, 2, 3	03-15-12	DE

NAME OF JOB: MMP4
DRAWING TITLE: CONTROL CABLE, HYD. 5 PLUG, 2 CONN
SCALE: NONE | DATE: 07-22-10 | DWG. No.: 044067
DRAWN BY: DE | SHEET 1 OF 1

BILL OF MATERIAL

No.	Part No.	PART NAME	QTY	REF No.	WT.
1	304119	WIRING HARNESS, 4 COND.	1		STK
2	304185	CABLE, 2GA X 4' BK	1	300483	4'
3	304185	CABLE, 2GA X 5' RD	1	300483	5'
4		RING TERMINAL 3/8 X 2GA	4		SUP
5		HEAT SHRINK, BLACK	2		SUP
6		HEAT SHRINK, RED	2		SUP
7	355119	NUT, BATTERY 3/8-16	2		STK
8	045669	CABLE ASSY. HYDRAULIC CONTROL	1	044067	REF
9	303556	STRAIN RELIEF, CABLE	2		STK
10	300484	CABLE 14GA-2, 5FT	1	300483	STK
11		BUTT SPLICE	2		SUP
12	305926	CONNECTOR, 12PIN B.H.	1		STK
13					
14					
15					
16					
17					





LIGHTING WIRING DIAGRAM

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	CHANGE SWITCH BLOCK LOCATIONS ON 3 WAY SWITCHES	03/29/12	DE

700 Osuna Rd. N.E.
P.O. Box 26146
Albuquerque, NM 87125
(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED

3 PLACES ± 0.010 | 2 PLACES ± 0.03 | ANGULAR ± 1°

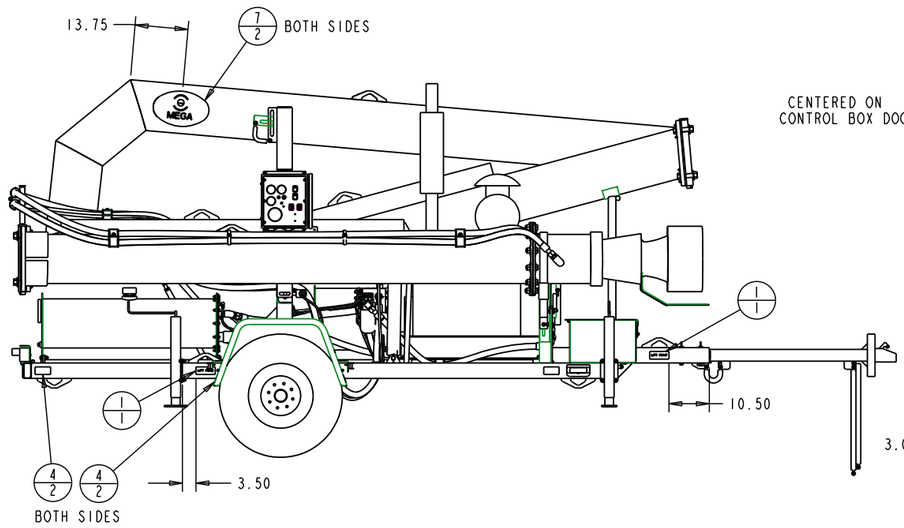
NAME OF JOB: MMP4 CAT C22T ENGINE

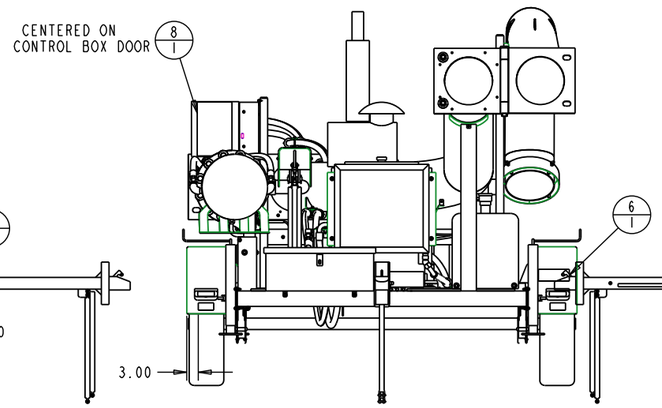
DRAWING TITLE: ELECTRICAL & LIGHT ASSEMBLY

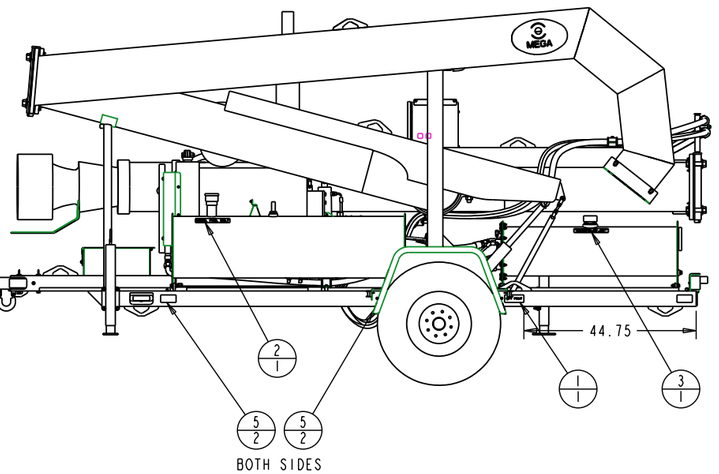
SCALE: NONE | DATE: 12-22-11 | DWG. No.: 045668

DRAWN BY: DE | SHEET 1 OF 2

ITEM	PART NO.	PART NAME	QTY	REF NO.	IND. WT.
1	306267	LABEL, LIFT POINT	3		STK
2	355061	DECAL, DIESEL	1		STK
3	355062	DECAL, HYD. OIL	1		STK
4	355063	DECAL, REFLECT, RED	4		STK
5	355064	DECAL, REFLECT, YELLOW	4		STK
6	355072	DECAL, SPEED LIMIT	1		STK
7	355160	DECAL, 14" MEGA	2		STK
8	355212	DECAL, MACHINE INSTR.	1		STK







REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	ADD LIFT POINT LABEL	02-13-12	DE

700 Osuna Rd. N.E.
P.O. Box 26146
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(505) 345-2661

TOLERANCE: UNLESS OTHERWISE SPECIFIED		
3 PLACES ± 0.010	2 PLACES ± 0.030	ANGULAR ± 1°
DWG. TITLE: MMP4 DECAL INSTALL		
SCALE 0.023	DATE: 28-Jul-10	DWG. NO.: 044081
DRAWN BY: DE	NOTE:	SHEET 1 OF 1

SECTION 12
Appendix B: Hydraulic Pump and Engine Control

DESCRIPTION

This section contains supplementary documentation regarding hydraulic pump service and CAT C2.2T engine operation, service, maintenance, and troubleshooting.

If your system is not covered in this manual, you are having difficulties with the installation or need additional information or assistance, please contact The MEGA Corp. Product Support Group at:
U.S. Toll Free: 1-800-345-8889
Direct: 1-505-345-2661
or visit our website at www.megacorpinc.com for more contact information.

SECTION 12
Appendix B: Hydraulic Pump and Engine Control

Thermal Transfer Products
A ThermaSys® Company

Product Warranty

Thermal Transfer Products warrants its products to be free of any defects in workmanship or materials under what is considered to be normal service for 12 months from the date of manufacture from our plant in Racine, Wisconsin.

All obligations and liabilities are limited to the repair or replacement of the defective part at our option. Thermal Transfer Products accepts no liability for consequential damage or reinstallation labor.

Any accessories or components furnished by other manufactures shall be subject to the manufacture's particular warranty.

Thermal Transfer Products reserves the right to revise or improve any products with no obligation to incorporate these changes in any products manufactured prior to such revisions or improvements. The company will not assume responsibility for contingent liability through any alleged failure or failure of any of its products or accessories.

This 12-month warranty **does not** apply to failures, which result from:

* Over-pressurization.
* Improper application.
* Improper installation or mounting design, which permits excessive vibration and causes failure or breakage of parts due to material fatigue or deterioration.
* Damages as a result of freezing.
* Shipping Damage.
* Failure due to corrosion or damage from storage in corrosive atmospheric conditions.
* Failure to follow the factory provided installation and service instructions.

To obtain warranty approval, the customer must first obtain a Return Goods Authorization (RGA) number from the Thermal Transfer Products distributor through whom the product was originally purchased.

All units must be held for inspection by a factory representative or at the discretion of the Thermal Transfer Products Service Department returned to the factory for evaluation. (See the Warranty Return Policy for further details.)

UNAUTHORIZED FIELD SERVICE

If a buyer secures unauthorized field service on a product or its accessory, the buyer shall be responsible for all time and expenses incurred therein. This includes charges for freight, labor and service, together with any other expenses incurred.

Questions?
Refer all questions about this policy to:
Warranty & Returns
Phone: (262) 554-8330
Fax: (262) 554-8773

Air Cooled Oil Coolers — AOL/BOL/MA/OCA Models

General Information

1. Air cooled oil coolers are built for operation with maximum oil pressure of 250 psi (17.2 BAR) and temperatures of 300°F (148°C). OCA limited to 350°F (176°C)

2. The motors furnished are built for fan duty. Consideration should be given to the installation location so motors are not subjected to extreme temperatures or additional static pressure restrictions above that of the core.

3. Oil coolers are not to be operated in ambient temperatures below 35°F (1°C).

4. The fan cannot be cycled.

5. Coolers operated outdoors must be protected from weather. Consult factory for recommendations.

6. If the unit is to be stored for longer than 6 months, the unit should be oil flushed and all openings sealed with plastic plugs.

Installation

1. Air cooled oil coolers should not be located in corrosive atmospheres as rapid deterioration of fan shroud, cooling coil, fan and motor may take place.

2. The cooler should be mounted securely with its designed mounts.

3. Piping should be sized based on oil flow and pressure drop requirements, not on the oil cooler's supply and return connection sizes.

4. A filter located ahead of the oil cooler should be installed to trap dirt or sludge that may be present in piping and equipment, or that may accumulate with use.

5. A temperature controlled bypass valve is recommended for cold start-up. The bypass valve should be plumbed at the oil inlet to the unit in-order to function properly. Failure to plumb the bypass valve correctly could result in damage or failure of the unit.

6. Flexible connectors should be installed to prevent the stressing of manifolds. (Must be properly installed to validate warranty)

7. For proper air flow, a minimum of 12" should be allowed between the oil cooler fan and any walls or obstructions. Sufficient ventilation is required in closed areas.

Electrical

1. CAUTION To prevent possible electrical shock, it is important to make sure this unit is properly grounded.

2. Connect motor only to a power supply of the same characteristics as shown on the motor nameplate. Be sure to provide proper fusing to prevent possible motor burnout. Before starting motor, follow manufacturer's recommendations. Turn fan manually to eliminate possible motor burnout in the event the fan has been damaged in shipment. Observe operation after motor is started for the first time.

Maintenance Inspect the unit regularly for loose bolts and connections, rust and corrosion, and dirty or clogged heat transfer surfaces (cooling coil).

Heat Transfer Surface Dirt and dust should be removed by brushing the fins and tubes and blowing loose dirt off with an air hose. Should the surface be greasy, the motor should be removed and the fins and tubes brushed or sprayed with a non-flammable degreasing fluid. Follow with a hot water rinse and dry thoroughly. A steam hose may also be used effectively. Do not clean with caustic cleaners. Only cleaners compatible for use with aluminum are to be used.

Fan Shroud, Fan and Motor Dirt and grease should be removed from these parts. Rusty or corroded surfaces should be sanded clean and repainted.

Internal Cleaning Once a year piping should be disconnected and a degreasing agent or flushing oil circulated through the unit to remove sludge from turbulators and internal tube surfaces to return the unit to full capacity. Do not clean with caustic cleaners. Only cleaners compatible for use with aluminum are to be used. A thorough cleaning of the entire system in the same manner is preferable to avoid carry-over from uncleaned piping, pump and accessories. The strainer of any filtering devices should be removed and serviced following this cleaning operation.

Motor Keep outside surface free of dirt and grease so motor will cool properly. Ball bearing equipped motors are sealed, and do not require greasing. Motors with Alemite fittings require lubrication every 6 months. Clean tip of fitting and apply grease gun. Use 1 to 2 full strokes on motors in NEMA 215 frame and smaller. Use 2 to 3 strokes on NEMA 254 through NEMA 365 frame. Use 3 to 4 strokes in NEMA 404 frame or larger. CAUTION Keep grease clean. Lubricate motors at standstill. Do not mix petroleum grease and silicone grease in motor bearings. DC Motors are not serviceable.

Repair or Replacement of Parts When ordering replacement parts or making inquiry regarding service, mention model number, serial number and the original purchase order number. Any reference to the motor must carry full nameplate data.

Form 409 CP/7-11-11

USE ORING FITTINGS

CROSS

TECHNICAL/SERVICE MANUAL

GEAR PUMPS AND MOTORS

FOR CROSS SERIES 40, 50, 50G, 50T, 53 & 60 GEAR PUMPS AND MOTORS

The CROSS fixed displacement, gear type pumps and motors have been designed, manufactured and tested to insure the highest quality. This manual has been prepared to assist in the application and installation in order to obtain optimum performance.

Rated working pressure ..... up to 3000 psi
Maximum shock and surge pressure ..... up to 3500 psi
Maximum speed, continuous ..... see charts
Minimum speed recommended ..... 600 rpm

SERIES	TYPE	OPTIONS	SIZE CU. IN./REV. X 10				ROTATION	MOUNTING	SHAFT	PORTS
			40	50	60	50G				
40	P	O	5	15	40	81	D	A	SEE INDIVIDUAL SPECIFICATION SHEETS	
50	(pump)	20 psi	7	19	51	104	(dual	(SAE A, 2 bolt)		
53	M	pump seal)	10	23	61	124	L	B		
60	(motor)	B	12	27	71	146	(left hand)	(SAE B, 2-bolt)		
	G	(100 psi	15	33	81	176	R	C		
	mtr. W/	shaft seal)	18	38	92	203	(right hand)	(SAE C, 2-bolt)		
	reducer	H		52		277		4-bolt comb.)		
	T	(250 psi								
	(pump/inc.)	shaft seal)								

NOTE: PUMP AND MOTOR MODEL NUMBERS ARE STAMPED ON THE FRONT COVER OF EACH UNIT.

PERFORMANCE DATA - PUMPS: GPM/RPM						PERFORMANCE DATA - MOTORS: RPM/GPM						
RPM	1000	1500	2000	2500	3000	GPM	5	10	15	20	30	50
MODEL	GPM	GPM	GPM	GPM	GPM	MODEL	RPM	RPM	RPM	RPM	RPM	RPM
40P005	1.7	2.6	3.5	4.3	5.2	40M005	1732					
40P007	2.8	4.1	5.5	6.9	8.3	40M007	1155	2310				
40P010	3.7	6.5	7.4	9.2	11.0	40M010	866	1732	2599			
40P012	4.9	7.3	9.7	12.1	14.6	40M012	693	1386	2079	2772		
40P015	5.8	8.8	11.7	14.6	17.5	40M015	577	1155	1732	2310		
40P018	7.0	10.5	14.0	17.5		40M018	481	962	1443	1925	2887	
50P015	5.9	8.8	11.8	14.6	17.8	50M015	684	1368	2052	2736		
50P019	7.6	11.4	15.2	19.0	22.8	50M019	533	1066	1599	2132		
50P023	9.0	13.6	18.1	22.6	27.1	50M023	448	896	1344	1792	2688	
50P027	10.7	16.0	21.4	26.7	32.0	50M027	379	759	1138	1518	2276	
50P033	12.9	19.3	25.7	32.1	38.6	50M033	315	630	945	1260	1890	
50P038	14.8	22.2	29.6	37.0		50M038	274	547	821	1094	1641	2736
50P052	20.3	30.4	40.6			50M052	199	400	600	800	1199	1999
60P040	15.8	23.7	31.6	39.4	47.3	60M040	257	513	770	1027	1540	2567
60P051	20.1	30.1	40.1	50.2	60.2	60M051	202	404	606	807	1211	2018
60P061	24.0	36.0	47.9	59.9	71.8	60M061	169	338	507	676	1014	1690
60P071	27.9	41.8	55.7	69.6	83.6	60M071		291	436	582	872	1454
60P081	31.8	47.6	63.5	79.4		60M081		255	383	510	765	1275
60P092	36.0	54.1	72.1	90.1		60M092		225	337	450	674	1124

NOTE: ABOVE PERFORMANCE FIGURES ARE APPROXIMATE AND ARE BASED ON 2000 PSI OPERATING PRESSURE. OPERATION IN SHADED AREAS IS NOT RECOMMENDED.

FOR DRIVE HP REQUIRED: Multiply flow (gpm) by pressure (psi) and divided by 1714.

FOR MAX. PUMP SIZE (for use with gas engine): Multiply rated engine HP by 1028 and divide by pressure (psi). This gives max. flow rate (gpm). Select the nearest pump size from the above chart according to drive speed.

FOR MOTOR DRIVE TORQUE: Multiply HP by 5252 and divide by RPM.

FOR HYD. MOTOR SIZE: Multiply torque (ft. lbs.) by 88 and divide by pressure (psi). This gives motor size in cu.in./rev. Select the nearest motor size from the above chart. For full load starting, use a 10% larger motor size.

$$HP = \frac{GPM \times PSI}{1714}$$

$$GPM = \frac{1028\ HP}{PSI}$$

$$TORQUE\ (ft.\ lbs.) = \frac{5252\ HP}{RPM}$$

$$DISP = \frac{88T}{PSI}$$

OIL RECOMMENDATIONS: Premium quality anti-wear type oil with a viscosity between 100 and 200 SSU at operating temperatures. Automatic transmission fluids are acceptable. Do not use synthetic fluids.

FILTRATION: 25 micron filters are required with 10 micron preferred. If pump inlet filters are used, be certain inlet flow is not restricted. Cavitation will severely reduce pump life.

PUMP SPEED/PORT SIZE LIMITATIONS: If pumps are operated at speeds higher then shown below, cavitation and pump damage can occur.

SERIES & SIZE		PUMP INLET PORT SIZE				
		1 1/16 - 12 3/4"(-12)	1 5/16 - 12 1" (-16)	1 5/8 - 12 1 1/4" (-20)	1 7/8 - 12 1 1/2"(-24)	2" S.F. 2"
40 SERIES	5	3500	3500			
	7	3400	3500			
	10	2500	3500			
	12	2000	3500			
	15	1750	3000			
	18	1400	2500			
50 SERIES	15		3000	3000	3000	
	19		2300	3000	3000	
	23		2000	3000	3000	
	27		1700	2600	3000	
	33		1400	2100	3000	
	38		1200	1800	2700	
	52		1000	1600	2200	
60 SERIES	40			2000	3000	3000
	51			1750	2500	3000
	61			1400	2200	3000
	71			1000	1900	3000
	81			800	1600	2600
	92			600	1400	2500

BASED ON NO INLET RESTRICTION (6" HG MAX. VACUUM)

PLUMBING SIZE RECOMMENDATIONS: The following is based on 4 ft./sec. inlet velocity and 15 ft./sec. outlet velocity.

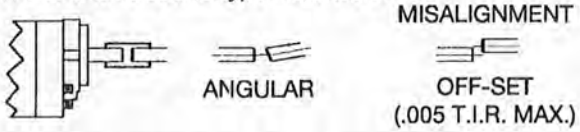
GPM	PUMP INLET			PUMP OUTLET		
	PIPE	TUBE	HOSE	PIPE	TUBE	HOSE
5	3/4"	7/8"	3/4"	1/4"	3/8"	3/8"
10	1"	1"	1"	3/8"	1/2"	1/2"
15	1 1/4"	1 1/4"	1 1/4"	1/2"	5/8"	1/2"
20	1 1/2"	1 1/2"	1 1/2"	3/4"	3/4"	3/4"
25	1 1/2"	1 1/2"	1 1/2"	3/4"	7/8"	3/4"
30	1 3/4"	1 3/4"	1 3/4"	1"	1"	1"
35	2"	2"	2"	1"	1 1/4"	1"
40	2 1/4"	2 1/4"	2 1/4"	1 1/4"	1 1/4"	1 1/4"
50	2 1/2"	2 1/2"	2 1/2"	1 1/4"	1 1/2"	1 1/4"
75	3"	3"	3"	1 1/2"	1 3/4"	1 1/2"

Tube sizes are OD. Hose sizes are ID.
Reduce plumbing size to match pump port size AT PUMP.

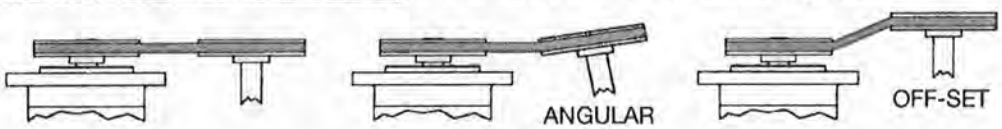
MOUNTING: Pumps and motors may be mounted in any position.

DIRECT FLANGE MOUNTING: Mount directly to gear ox or engine PTO, carefully inserting shaft and pilot into mating holes. Make certain that shaft size and type matches drive.

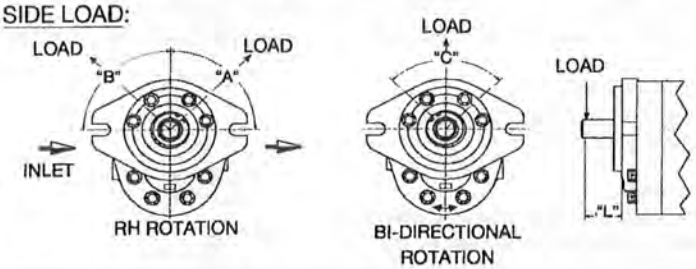
FOOT MOUNT WITH COUPLING: Excessive wear and reduced life will occur due to misalignment. Minor misalignment can be compensated for by using a flexible coupling.



FOOT MOUNT WITH BELT OR CHAIN DRIVE: Excessive wear will occur with misalignment.

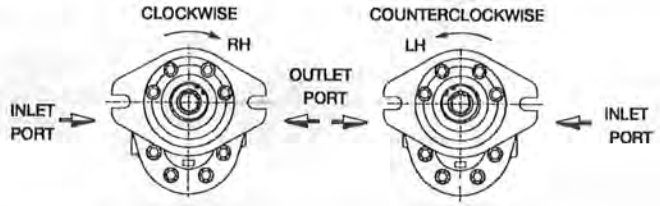


SIDE LOAD:

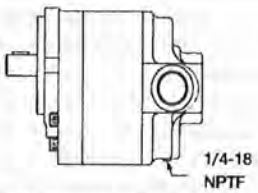


Side loads resulting from belt or chain drives should be kept as close to the housing as possible (i.e., keep dimension 'L' to a minimum). For maximum life, loads should be applied at quadrant 'A' for pumps (RH), quadrant 'B' for motors (RH), 'A' for LH motors, 'B' for LH pumps, and 'C' for bi-rotational motors.

DIRECTION OF ROTATION:
Right hand (RH) or left hand (LH) pumps or motors, if operated in the wrong direction, will result in THE IMMEDIATE FAILURE of the shaft seal. Pump and motor rotation is NOT field reversible. Dual rotation (D) units may be operated in either direction. They also can be operated as either a pump or motor. The correct direction of rotation can be determined by the model number stamped on the front cover.



DRAIN PORT CONNECTION: If the motor outlet port pressure exceeds the rating of the shaft seal (20 psi standard), the drain port must be connected directly to the reservoir. Dual rotation pumps have drain port connections for use as motors.



START-UP PROCEDURES:
1. Prior to installation, check pump or motor for possible damage in shipping or handling.
2. Install unit, tighten fittings and fill reservoir with clean fluid.
3. Fill pump/motor with fluid thru drain port connection or inlet port.
4. Start engine and run at lowest possible speed. Check system for air (suction) leaks and oil leaks. (Use a piece of cardboard or wood when searching for possible oil leaks. DO NOT USE HANDS). Bleed air from system if necessary. Operate system at normal speed.
5. Gradually increase load to normal, checking for leaks, abnormal noises, binding, etc. Operate system for 15 minutes. Shut off and check filters. Clean or replace as necessary.

MAINTENANCE:
1. Clean or replace filters on a regular basis, as necessary.
2. Check for presence of water in oil (cloudy or milky appearance) and for presence of air (foamy oil). A rancid odor indicated excessive heating of the oil.
3. Check reservoir regularly for proper level. Fill as needed. Repair leaks.

REPAIR: Pumps and motors are not field repairable except for replacement of shaft seals, pressure seals and thrust plates. See next page for replacement instructions

50G SERIES MOTORS: This is the standard series 50 motor combined with a 5.33 to 1 planetary gear reduction unit. Output torque is approximately 5 times that of a standard motor and speed is 1/5 of the speeds shown in the chart on page 1. Mounting is SAE 'C' 4-bolt flange. Dual rotation is standard. The planetary gear reducer uses EP 90 weight gear lubricant (approx. 5 1/2 oz.). Check level by removing the pipe plug at the side of the front cover. To change oil, remove the pipe plug from the bottom, clean plug, drain oil thoroughly. Replace plug and add oil.

50T SERIES PUMPS: This is the basic 50 series pump combined with a 3 to 1 speed increaser for use with 540 rpm PTO drives. The 50T series pumps are not directly interchangeable with the 50 series due to special shaft and shaft seal. System hydraulic oil is used to lubricate the speed increaser.

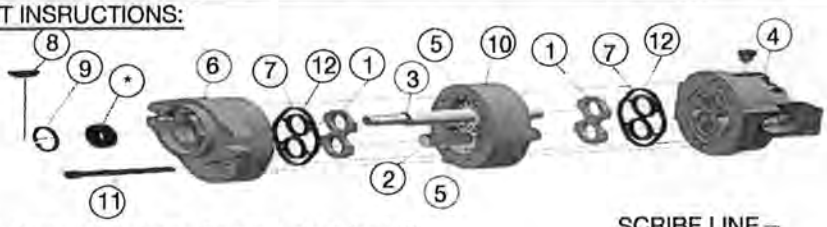
53 SERIES PUMPS: This is a tandem (dual) pump version of the basic series 50 unit. Each pump section is essentially the same as the standard series 50 pump and data shown in the chart on page 1 applies accordingly.

FOR ALL PUMPS AND MOTORS, REFER TO SPECIFIC SPECIFICATION SHEETS FOR ADDITIONAL DATA AND LIST OF OPTIONS AVAILABLE. WRITTEN WARRANTY AND PARTS LIST AVAILABLE UPON REQUEST.

NOTE: If chronic shaft seal failure occurs.
1. Check direction of rotation.
2. Check outlet port or drain port pressure.
3. Replace shaft seal with higher pressure rating seal. (See available seal kits)

SEAL REPLACEMENT INSRUCTIONS:

Series 50, typical



A. DISASSEMBLY:

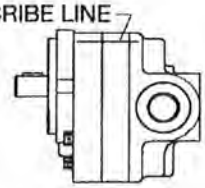
1. Remove unit and thoroughly clean. Remove shaft key (8) and any nicks or burrs on shaft.
2. Scribe line on outside of unit across front cover, body and rear cover to assure proper reassembly.
3. Lightly clamp rear cover (4) in vise, shaft up. EXCESSIVE CLAMPING PRESSURE CAN CAUSE DISTORTION.
4. Remove cap screws (11) from front cover (6). (Nuts on series 60).
5. Tap upwards, underneath front cover flange and remove front cover. As unit separates, the body may remain with either the front or rear cover. Remove loose parts (rings, plates, etc.)

*6. To separate body from front cover, clamp body in vise and again tap upwards on front cover flange. To separate body from rear cover, clamp body in vise and tap downward on shaft. Remove static seals (12) and loading seals (7) from grooves. DO NOT DAMAGE GROOVE OR COVER SURFACE.

7. Remove snap rings (9) from shaft seal cavity in front cover using internal snap ring pliers.
8. Clamp front cover in vise, seal down, and drive shaft seal out of cavity using screwdriver held at about a 45° angle. USE CAUTION NOT TO DAMAGE CAVITY.

* Step 6 can be by-passed if only the shaft seal is being replaced.

SCRIBE LINE



B. PARTS INSPECTION:

1. Thoroughly clean all parts in solvent and dry with compressed air.
2. Inspect all parts for damage and unusual or excessive wear. If gears, bushings or body are damaged or badly worn, replace unit (only plates and seals are replaceable).

C. REASSEMBLY:

1. Install new shaft seal (*) in front cover (6). Be sure bearing drain hole is not blocked.
2. Install snap rings (9) and new seals (7, 12) in covers (if needed).
3. Assemble body (10) and rear cover (4) aligning dowel pins (5) and scribed line.
4. Insert thrust plate (1) into body (10) flat side toward seal (7). Lubricate gears and insert.
5. Insert thrust plate (1) over shaft, flat side toward seal (7).
6. Lubricate shaft and slide front cover (6) over shaft and dowel pins (5). Tap if needed.
7. Insert cap screws (11) (or nuts) and tighten evenly as follows:
   Series 40: 35/40 ft. lbs. Series 50: 35/40 ft. lbs. Series 60: 65/80 ft. lbs.
8. Rotate shaft, the maximum torque is:
   Series 40: 15 ft. lbs. Series 50: 20 ft. lbs. Series 60: 25 ft. lbs.
   If greater torque is required, disassemble unit, re-clean and reassemble.

SEAL KIT NUMBERS:

UNIT TYPE	ROTATION	SERIES 40	SERIES 50	SERIES 53	SERIES 60
P or M	L or R	4P0017-001	5P0017-002	5P0017-007	6P0017-001
P or M	D	4P0017-002	5P0017-004	5P0017-008	6P0017-002
T			5P0017-006	5P0017-009	
P or M	D, L or R	4P0017-003*	5P0017-012*		6P0017-003*
T	Increaser Gear Box 5P0017-005				
G	Planetary Gear Box 5P0017-010				

*250 psi rated Shaft Seal Kits

CROSS MANUFACTURING, INC.
100 James H. Cross Blvd.
Lewis, Kansas 67552
Phone 620/324-5525; Fax 620/324-5737; e-mail: info@crossmfg.com

LBPM/1008

HYDRAULIC PRODUCT SAFETY

WARNING: Valve lever (spool) may "stick" (not center) under certain conditions allowing the hydraulic equipment to continue to operate and could cause serious injury, death or equipment failure.

VALVE SAFETY: Read and follow instructions carefully. Failure to observe instructions and guidelines may cause serious injury, death or equipment failure. A sticking valve (spool bind) may be caused by one or more of the following factors:

DIRTY OIL: Oil must be filtered to a minimum of 25 microns. Filters should be changed regularly - spin-on types after 50 hours of initial use and then after every two hundred fifty hours of use. Use of a condition indicator is recommended. Consult your tractor or implement owner's manual for filtration and changing recommendations for internal systems.

OIL REQUIREMENTS: Premium quality anti-wear type oil with a viscosity between 100 and 200 SSU at operating temperatures. Certain synthetic oils may cause spool seals to swell and the valve to stick. If in doubt, call CROSS Engineering.

IMPROPER HOOK UP OR MOUNTING: Always use the proper size fittings. Hook up "in" & "out" as noted on the valve body. Do not over torque pipe fittings. (Use liquid pipe sealant only - cracked ports are not covered under warranty.) Mounting surfaces should be flat and care should be used when tightening mounting bolts. Over-tightened bolts can cause spool bind and casting breakage. When hooking a valve in series, always use a power beyond sleeve. Consult your tractor or implement manual to make sure you have the proper quick disconnect line connected to the inlet of the remote valve.

MISAPPLICATION: Always use the proper valve for the job. CONVERTA, CD, CS or CA valves should never be used for metered heavy load lifting - loaders or similar applications. Use and open center valve for open center applications and a closed center valve for closed applications. If in doubt, check with your tractor dealer. Contact CROSS if the valve allows the hydraulic equipment to creep excessively.

MAINTENANCE: Make sure all bolts are tightened and torqued to the recommended specification. Bent or broken parts should not be used. Replace immediately. Always use exact replacements. Always protect valve spool from paint over spray.

Faulty quick disconnects can cause high back pressures and sticking spools. Check quick disconnects periodically to make sure they are functioning properly. If valve spool does not center or appears to stick, do not use!

DO NOT Use Teflon Tape
Use Liquid Pipe Sealant Only

PUMPS & MOTORS SAFETY:

A relief or bypass in your hydraulic system is necessary to prevent pump from breakage due to overpressurization. Use correct fittings and proper oil as noted in the technical service manual packed with each unit. Change oil as recommended by your implement or tractor manufacturer.

CYLINDER SAFETY:

Check clevis clearances before, during and after extending the cylinder and before using the cylinder under pressure to avoid possible injury, or bent or broken rods caused by binding. (Bent or broken rods are not covered under warranty.) Never operate a cylinder above recommended pressures. Never use a cylinder as a safety device when transporting equipment.

PINHOLE LEAKS:

If you observe a pinhole leak, discontinue use of the component. If oil has penetrated your skin or contacted your eye, seek medical attention immediately!

CROSS TROUBLE SHOOTING TIPS

FINDING AND SOLVING PROBLEMS:

Please read and observe the HYDRAULIC PRODUCT SAFETY SHEET before proceeding further. Your safety is important to us!

Gradual or sudden loss of pressure or flow resulting in a loss of power is common in hydraulic system failure. Any one of the system's components may be at fault. These step-by-step procedures should help you locate and remedy the problem quickly.

1. **SYSTEM INOPERATIVE**
   - **No oil in system, insufficient oil in system.** Fill system. Check for leaks.
   - **Wrong oil in system.** Refer to specifications. Change oil.
   - **Filter dirty or clogged.** Drain oil and replace filter or filter element
   - **Oil line restriction.** Oil lines dirty or collapsed. Clean or replace.
   - **Air leaks in pump suction line.** Repair or replace as necessary.
   - **Worn or dirty pump.** Clean, repair or replace. Check alignment. Check for contaminated oil. Drain and flush system.
   - **Badly worn components (valves, cylinders, etc.)** Examine and test for internal or external leakage. Replace faulty components. Check for cause of wear.
   - **Leakage.** Check all components, particularly the relief valve for proper settings. Refer to technical manuals.
   - **Excessive load.** Check unit specifications for load limits.
   - **Slipping or broken pump drive.** Repair or replace belts, couplings, etc. Check for proper alignment or tension.

2. **SYSTEM OPERATES ERRATICALLY**
   - **Air in system.** Check suction side of system for leaks. Repair
   - **Cold Oil.** Allow ample warm-up period.
   - **Dirty or damaged components.** Clear or repair as necessary.
   - **Restrictions in filters or lines.** Clean and/or replace elements or lines.

3. **SYSTEMS OPERATES SLOWLY**
   - **Oil viscosity too high, cold oil.** Allow oil to warm up before operating machine.
   - **Low pump drive speed.** Increase engine speed (check manual for recommendations.)
   - **Air in system.** Check suction side for leaks. Repair.
   - **Badly worn pump, valves, cylinders, etc.** Repair or replace as needed.
   - **Restrictions in filters or lines.** Clean and/or replace elements or lines.
   - **Improper adjustments.** Check orifices, relief valves, etc. Adjust per manual.
   - **Oil leaks.** Tighten fittings. Replace seals or damaged lines.

4. **SYSTEM OPERATES TOO FAST**
   - **Wrong size or incorrectly adjusted restrictor.** Replace or adjust as necessary.
   - **Engine running too fast.** Reduce engine speed.

5. **OVERHEATING OF OIL IN SYSTEM.**
   - **Oil passing thru relief valve for excessive time.** Return control valve to neutral when not in use.
   - **Incorrect oil, low oil, dirty oil.** Use recommended oil, fill reservoir, clean oil, replace filter elements.
   - **Engine running too fast.** Reduce engine speed.
   - **Excessive component internal leakage.** Repair or replace component as necessary.
   - **Restriction in filters or lines.** Clean and/or replace elements or lines.
   - **Malfunctioning oil cooler.** Clean or repair.

5. **OVERHEATING OF OIL IN SYSTEM (cont'd.)**
   - **Insufficient heat radiation.** Clean dirt and mud from reservoir and components.
   - **Malfunctioning component.** Repair or replace.
   - **Reservoir too small.** Recommended size is 1 1/2 times pump gpm.

6. **FOAMING OF OIL**
   - **Incorrect, low or dirty oil.** Replace, clean or add oil as needed.
   - **Air leaks.** Check suction line and component seals for suction leaks. Replace

7. **NOISY PUMP**
   - **Low oil level, incorrect oil, foamy oil.** Replace, clean or add oil as needed.
   - **Suction line plugged or too small, inlet screen plugged.** Clean or replace. Follow instructions packed with unit.
   - **Use of pipe fitting in inlet.** Replace with correct fitting.

8. **BLOWN SHAFT SEAL**
   - **Pump: wrong pump shaft rotation.** Replace seal. Refer to installation instructions.
   - **Motor: failure to hook up drain line.** Replace seal. Refer to installation instructions.

9. **LEAKY PUMP OR MOTOR**
   - **Damaged or worn shaft seal.** Replace seal. Check for misalignment.
   - **Loose or broken parts.** Tighten or replace.

10. **LOAD DROPS WITH CONTROL VALVE IN NEUTRAL**
    - **Leaking cylinder seals or fittings.** Replace worn parts.
    - **Control valve not centering when released.** Check linkage. Check for spool binding. Repair.

11. **CONTROL VALVE DOES NOT CENTER (Binding)**
    - **See Hydraulic Product Safety Sheet.**
    - **Valve linkage misaligned.** Repair.
    - **Tie-bolts too tight (stack valves).** Loosen as necessary.
    - **Valve damaged.** Repair or replace.
    - **Handle bracket screws loose.** Tighten.

12. **CONTROL VALVE LEAKS EXTERNALLY**
    - **Tie-bolts too loose (stack valves).** Tighten as necessary.
    - **Seals damaged or worn.** Replace.
    - **Back pressure or restriction in tank line.** Check quick couplers. Use power beyond when necessary.
    - **Cracked port or body.** Replace. (See Hyd. Prod. Safety)

13. **CYLINDER LEAKS EXTERNALLY**
    - **Seals damaged or worn.** Replace.
    - **Rod damaged.** Replace.

14. **CYLINDER LOWERS WITH VALVE IN "METER UP" POSITION**
    - **Damaged or leaky load check.** Replace check.
    - **Leaking cylinder seal.** Replace seal.
    - **Use of a valve without load check.** Replace with recommended valve.

LBPSafety/1008

LOFA EP250 Operation and Troubleshooting

Introduction

This document provides general information on LOFA Industries EP250 control systems operation and troubleshooting. EP250 control systems are a very flexible platform for diesel engine control, monitoring, and protection, featuring LOFA's powerful First Fault Diagnostics (FFD). After pinpointing the initial failure, FFD stores it in memory and alerts the end user via a single bright LED. FFD monitors battery charge, low oil pressure, high temperature, overspeed and up to three additional contact closure inputs. The field configurable, expandable microprocessor-based solid-state design uses high-power semiconductors instead of outdated electromechanical relays to ensure reliable high-current switching.

The EP250 features LOFA's new modular Function Enhancement Packs (FEP). The plug-and-play FEP modules allow various feature upgrades to be easily added to the standard platform. FEPs include:

- Diagnostic Program Gauge (DPG)
- Auto-Start with Real-time Clock
- Data Logging
- Closed Loop Speed Control
- Precision Actuator Control
- Custom OEM Solutions

The Diagnostic Program Gauge (DPG) features a backlit LCD display with three push buttons all in a compact 2 inch gauge. The LCD is clearly readable in both bright sunlight as well as total darkness. The DPG provides a complete user interface for other Function Enhancement Packs and allows each system to be field configured to suit the customer's unique requirements. After configuring, the DPG can be removed in cost-sensitive applications.

Some of the EP250 configurable features include:

- Automatic preheat duration
- Afterglow duration
- Failure indication with shutdown or indication only
- Over-speed shutdown
- Normally open or normally closed shutdown switches

All standard panels include feature a 12 inch wiring harness terminating into a sealed weather proof plug. This robust universal wiring connection performs well in harsh environments and allows interchanging a number of different panels and harnesses. This design allows for simplified installation as well as a flexible means to incorporate custom plug-and-play engine wiring harnesses and standard harness extension

Note

The engine harness is not included with the panel.

A number of standard engine harnesses are available or LOFA can develop a custom harness for you exact needs.

Generic harnesses in various lengths are available for field customization.

Warning

When replacement parts are required, LOFA Industries recommends using replacement parts supplied by LOFA or parts with equivalent specifications.

Failure to heed this warning can lead to premature failure, product damage, personal injury or death.

Important Safety Information

The warnings in this publication are not all inclusive.

LOFA Industries cannot anticipate every potential hazard.

Appropriate safety rules and precautions should be followed with any tool, work method or operating procedure.

Improper procedures, tools and materials may cause damage or make the equipment unsafe to operate.

Only persons with appropriate training, skills and tools should perform these functions.

Improper operation, maintenance or repair of this product can be dangerous and may result in injury or death.

Do not operate or perform any maintenance or repair on this product until all operation, maintenance and repair information is read and understood.

The information, specifications, and illustrations in this publication are based on information available at the time of publication.

All items are subject to change at any time without notice.

Operation

Turning the control system key to the run position starts a self-test which causes all LEDs to illuminate once, activates the alarm output for one second and enables the fuel run/stop solenoid output. After self-test, the LEDs indicate the state of the inputs they monitor. The normal indications are battery charge and oil pressure on most applications. If these LEDs are not illuminated at this time it may indicate the inputs are not properly connected.

The Preheat LED is illuminated when the key switch is turned to the run position if automatic preheat is configured or if an external preheat control is connected (See Preheat Options). Preheat time varies from application to application. After waiting for the Preheat LED to extinguish, the engine is cranked by turning and holding the key switch in the start position until the engine starts. The key switch is spring loaded to return automatically to the run position when released. The Preheat LED is illuminated during afterglow if enabled.

Note

The key switch is equipped with a mechanical start locking device. An attempt to re-crank the engine can only be made by turning the key switch to the off position to reset the start locking mechanism.

If the engine is not started within 10 seconds of turning on the system, the fuel run/stop solenoid output is turned off to prevent battery discharge when the key switch is left in the run position. The fuel run/stop solenoid output is turned off after 10 seconds even if preheating. As soon as the key switch is turned to the start position the solenoid output is enabled. The afterglow cycle begins when the key switch returns to the run position.

Note

If conditions do not warrant preheat, the engine may be started by turning the key to the start position without waiting for the preheat time to expire.

Control system instrument power, including the hourmeter and voltmeter, is provided by the fuel run/stop solenoid output. If the instruments do not power up when the key is turned to the run position, this indicates a problem with the solenoid circuit (see Troubleshooting).

After the engine starts, the control system electronics ignore all shutdown conditions for the first 10 seconds. This delay eliminates the requirement to hold a by-pass override button during starting and allows the system conditions such as oil pressure to normalize. The 10 second timer starts when the key switch returns to the run position.

Note

Starter input is required for correct system operation. If the starter motor input is not activated (connected to battery positive) and the engine is started through another means (i.e. air starter) the engine will shutdown 10 seconds after the key switch is turned to the run position.

To prevent unintentional engine shutdowns caused by intermittent conditions (i.e., pressure spikes, coolant movement) the control system requires a constant 1 second fault input to cause engine shutdown.

Warning

When used in combination with mechanical float type switches engine vibrations may prevent constant contact closure. The control system can be configured to shutdown with no delay.

See the *EP250 Configuration Guide* for detailed preheat control instructions.

The control system has the ability to shut down the engine for over speed. Over speed will be indicated via a blinking *Battery Charge* LED. If the control system is equipped with the DPG, the display will also indicate over speed shutdown. The control system senses RPM either by the frequency terminal of the alternator, proximity switch or magnetic pick-up.

Preheat Options

Preheat Output

Preheat is a 1A output for control of an external power relay with predetermined preheat and afterglow times. A relay should be selected with appropriate amperage capacity for the installed cold starting aid (glowplug, intake air heater, etc.). Applications using multiple cold starting aids may require multiple relays. Optional or additional components may allow preheat time to be modified by sensing ambient temperature. Depending on specific configuration, this output may provide either high side (battery positive) or low side (ground) control.

Note

Consult engine documentation when selecting cold starting aid, power relay and heating specifications.

Preheat Indication Input

With this option, the preheat LED provides indication for an external preheat control system. Depending on specific controls and configuration, this input can be configured to accept either high side (battery positive) or low side (ground) control.

Indicators

Battery LED (Red)

A solidly illuminated Battery LED indicates a battery charge failure. A battery charge failure may be caused by a faulty alternator, broken drive belt or the alternator not excited. A battery voltage reading of approximately 14 volts on a 12 volt system (28 volts on a 24 volt system) while the engine is running indicates the battery is charging properly. Irregular blinking of the Battery LED may indicate a failing charge circuit. The system can be configured for battery charge failure to indicate only.

Overspeed Indication

A regularly blinking Battery LED indicates the configured overspeed RPM has been exceeded. The overspeed RPM can be verified, changed or disabled (see the *EP250 Configuration Manual* for details).

Oil Pressure LED (Red)

A solidly illuminated Oil Pressure LED indicates low oil pressure failure. The control system typically senses low oil pressure from a ground contact switch on the engine. When a sender/switch combination is used on the engine, the marking *WK* generally indicates the switch terminal. This input typically expects a normally closed switch (ground contact when oil pressure is low). A defective switch or shorting the shutdown input to ground can cause low pressure fault indication. Additionally, when using sender/switch combinations, swapping the *WK* and *G* terminal can cause unintended shutdowns. The system can be configured for oil pressure failure to indicate only.

Warning

Low oil pressure is not an indication of low oil level.

For best possible protection LOFA recommends using our solid-state oil level shutdown switch.

Note

Most shutdown switches are grounded through the switch body. Do not use insulating sealant (i.e. Teflon tape) when installing switches.

Temperature LED (Red)

A solidly illuminated Temperature LED indicates high engine temperature failure. The control system typically senses high temperature from a ground contact switch on the engine. When a sender/switch combination is used on the engine, the marking *WK* or *W* generally indicates the switch terminal. This input typically expects a normally open switch (ground contact when engine temperature is too high). A defective switch or shorting the shutdown input to ground can cause over temperature fault indication. Additionally, when using sender/switch combinations, swapping the *WK* or *W* and *G* terminal can cause unintended shutdowns. The system can be configured for temperature failure to indicate only.

Warning

If the temperature switch is not in contact with coolant due to coolant loss the engine is not protected from overheating.

For best possible protection, LOFA recommends using our solid-state coolant level shutdown switch.

Note

Most shutdown switches are grounded through the switch body. Do not use insulating sealant (i.e. Teflon tape) when installing switches.

Some thermostat housings are composites and do not provide ground for the switch.

AUX 1 LED (Red)

A solidly illuminated AUX 1 LED indicates auxiliary 1 failure (i.e., coolant level, oil level, belt breakage, hydraulic pressure, etc.). The control system typically senses failure using a ground contact switch. Auxiliary inputs are equipment specific and determined by the equipment manufacturer. A defective switch or shorting

the shutdown input to ground can cause fault indications. The system can be configured for auxilary 1 failure to indicate only.

A blinking AUX 1 LED indicates SW input failure. The control system typically senses failure using a ground contact switch. The SW input is equipment specific and determined by the equipment manufacturer. A defective switch or shorting the shutdown input to ground can cause fault indications.

AUX 2 LED (Red)

A solidly illuminated AUX 2 LED indicates auxiliary 2 failure (i.e., air flow restriction, fuel level, etc.) but by default does not cause a shutdown. The control system typically senses failure using a ground contact switch. Auxiliary inputs are equipment specific and determined by the equipment manufacturer. A defective switch or shorting the shutdown input to ground can cause fault indications. The system can be configured for auxilary 2 failure to indicate only.

Preheat LED (Red)

A solidly illuminated Preheat LED is the system preheat indication. When the LED extinquishes the preheat period is complete and the engine may be cranked. The LED illuminates again to indicate afterglow.

Gauges

Voltmeter

The voltmeter is connected to the fuel run/stop solenoid output. If the voltmeter does not indicate in the run position, this indicates a problem with the solenoid circuit. A battery voltage reading of approximately 14 volts on a 12 volt system (28 volts on a 24 volt system) while the engine is running indicates the battery is charging properly.

Tachometer

The tachometer indicates engine RPM using a frequency signal derived from the engine. This signal may be provided by an alternator frequency tap, proximity switch. An optional amplifier/divider can be added for use with a magnetic pickup.

Note

If the alternator is not excited (not charging), no frequency is generated and the tachometer will indicate 0 RPM.

The tachometer is factory calibrated to indicate correctly when the panel is preconfiguring or field calibrated with a Diagnostic Programming Gauge (DPG). The tachometer can be calibrated using standard procedures if the configuration is not performed (see *Tachometer Calibration Instuctions* for details).

Oil Pressure Gauge

The gauge measures oil pressure with a resistance sender on the engine referenced to ground. When a sender/switch combination is used on the engine, the marking G generally indicates the gauge terminal. The gauge expects a low resistnace for low pressure and a higher resitance for higher pressure. If the gauge is not connected to the sender, the gauge will read full scale (pegged). A defective sender or shorting the gauge input to ground will cause the gauge to read 0 pressure. When using sender/switch combinations, swapping the WK and G terminal prevents the gauge from working and may cause unintended shutdowns.

Warning

Low oil pressure is an indication of engine wear,
not an accurate indication of low oil level.

Note

Senders and gauges must be matched to indicate correctly.

Most senders are grounded through the sender body.
Do not use insulating sealant (i.e. Teflon tape) when installing senders.

Temperature Gauge

The gauge measures engine temperature with a resistance sender on the engine referenced to ground. When a sender/switch combination is used on the engine, the marking *G* generally indicates the gauge terminal. The gauge expects a high resistnace for low temperatures and a lower resitance for higher temperatures. If the gauge is not connected to the sender, the gauge will read 0. A defective sender or shorting the gauge input to ground will cause the gauge to read full scale (pegged). When using sender/switch combinations, swapping the *WK* and *G* terminal prevents the gauge from working and may cause unintended shutdowns.

Warning

If the temperature sensor is not in contact with coolant due to coolant loss
the gauge will not accurately indicate engine temperature.

Note

Senders and gauges must be matched to indicate correctly.

Most senders are grounded through the sender body.
Do not use insulating sealant (i.e. Teflon tape) when installing senders.

Some thermostat housings are composites and do not provide ground for the sender.

Hourmeter

The hourmeter is connected to the fuel run/stop solenoid output. If the hourmeter does not count in the run position, this may indicate a faulty hourmeter or a problem with the solenoid circuit. If the engine shutsdown or is not started within 10 second the hourmeter stops counting.

Additional Gauges

Additional gauges can be added by removing blind covers and installing the gauge. Power connections are provided with the standard configuration.

Harness

Sealed Connectors

The provided sealed weather proof plug includes a grey locking device which must be released to separate the connectors. Press the tab on the connector housing to release the connectors.

Warning

LOFA does not recommend using dielectric grease or sealant with sealed connectors. These chemicals may cause seal damage and allow water entry.

Use LOFA provided cavity plugs to seal the connector if wires are removed.

Unsealed Connectors

For unsealed connectors exposed to the elements, LOFA recommends using dielectric grease to protect contacts.

Warning

LOFA does not recommend using sealant with unsealed connectors. Sealant traps moisture in the connector and encourages corosion.

Harness Routing

The minimum routing of radius of the wiring harnesses should be at least two times the diameter of the wiring harness. Bends should be avoided within 1 inch (25 mm) of any connector in order to avoid seal distortion allowing moisture to enter the connector.

Note

For harness length in excess of 10 ft a relay must be added to the start solenoid circuit.

LOFA offers starter relay kits for mounting near the engine.

Battery Circuit Requirements

Battery Positive Connection

The electronic control system operates on either a 12 VDC or 24 VDC electrical systems. The unswitched battery positive connection to the control system is made at the weather proof connector. The control system provides switched positive battery protected by a 15 Amp fuse (12 V or 24 V system).

Protection for the unswitched battery positive circuit is dependent on specific equipment configuration. The overload protection should not exceed 125% of the sum of all output currents plus 5 Amps for the control system. Powering the control system through dedicated circuits with appropriate overload protection reduces the possibility of system damage.

Circuit breakers are preferred over in-line fuses for circuit protection. Over current protection devices should ideally be located in a central location. If automatic reset circuit breakers are used, consideration of the environment of the breaker is critical and may affect the trip point. The trip point of some circuit breakers can be significantly reduced below the rated trip point if the circuit breaker is exposed to high temperatures.

Warning

Disconnecting the battery while the engine is running may damage electrical components.

When using a battery disconnect switch, LOFA recommends using a 2 pole switch to disconnect both the battery and alternator output.

Battery Negative Connection (Grounding)

Warning

Improper grounding can cause electrical noise, unreliable operation and may damage the control system or other components. All ground connections must be free from foreign materials, including paint, which may interfere with proper grounding.

A reliable ground must be provided for the control system. LOFA recommends the ground connection be made directly to the battery negative. Grounding through frame members is not recommended.

All ground paths must be capable of carrying any likely fault currents.

Do not reverse the battery polarity. Attempting to crank the engine when the polarity of the battery connections is reversed may damage the control system.

Note

A maximum of three ring terminals should be connected to a ground stud in order to ensure integrity of the ground connection. The use of more than three terminals can cause the connection to become loose.

Voltage Drop

If control system voltage drops below 6 volts for more than one tenth of a second, the control system may reset causing the self test to reactivate and the engine to shutdown after 10 seconds. Resetting the control

system is equivalent to quickly turning the key switch to off and back to run without starting the engine. Since the control system did not sense a start signal, the fuel run/stop solenoid deactivates after 10 seconds. Voltage drops can be caused by transients from external equipment, improper wire sizes, faulty wiring or nearby lightning strikes. In the absence of a *LOFA Power Box*, relays may be needed for long wire runs.

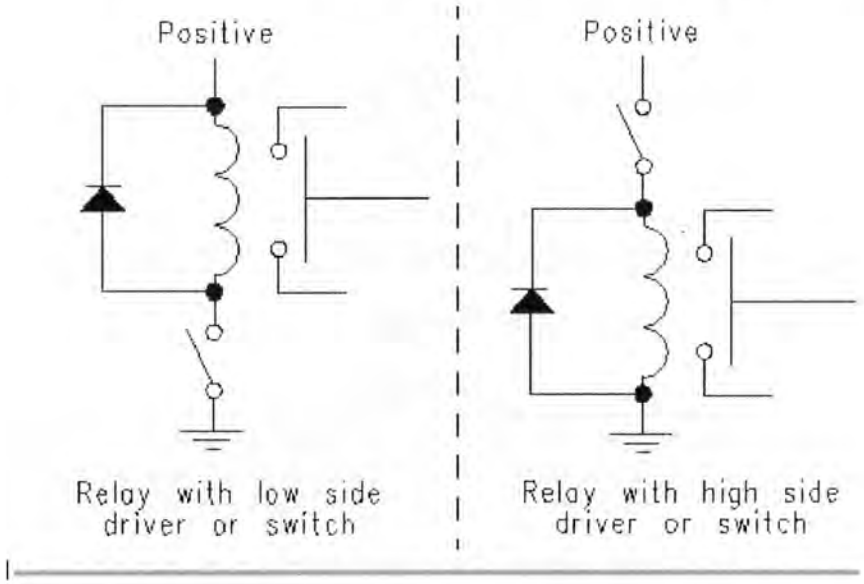
Suppression of Voltage Transients (Spikes)

Warning

The installation of voltage transient suppression at the transient source is required.

LOFA follows SAE recommended electrical environment practices.

Inductive devices such as relays, solenoids and motors generate voltage transients and noise in electrical circuits. Unsuppressed voltage transients can exceed SAE specifications and damage electronic controls.



Relays and solenoids with built-in voltage transient suppression diodes are recommended whenever possible. Refer to the illustration for proper installation of diodes when built-in voltage transient suppression is not available.

Locate inductive devices as far as possible from the components of the electronic control system. When using electric motors it may also be necessary to add isolation relays to eliminate voltage transients, noise and prevent back feed.

Note

LOFA harness assemblies typically include all required engine control suppression devices. Added equipment will require additional protection.

Welding on Equipment with Electronic Controls

Proper welding procedures are required to avoid damage to electronic controls, sensors, and associated components. The component should be removed for welding if possible.

The following procedure must be followed if the component must be welded while installed on equipment with electronic controls. This procedure will minimize the risk of component damage.

Warning

Do not ground the welder to electrical components such as the control ground or sensors. Improper grounding can cause damage to electrical components

Clamp the ground cable from the welder to the component being welded. Place the clamp as close as possible to the weld to reduce the possibility of damage.

1. Stop the engine. Turn the key switch to the OFF position.
2. Disconnect the negative battery cable from the battery.
3. Open any installed battery disconnect switch.
4. Unplug the control system if possible.
5. Connect the welding ground cable as close as possible to the area to be welded.
6. Protect the wiring harness from welding debris and spatter.
7. Use standard welding methods to weld the materials.

General Troubleshooting

For additional information, refer to engine manufacturer troubleshooting guide.

No response from starter motor

Possible Cause	Possible Remedy
No battery voltage to starter	Verify wiring and battery connection (power and ground)
Battery discharged	Charge or replace battery, verify alternator charging
Tripped overcurrent protection	Correct fault, replace or reset overcurrent protection
No signal from control system	No power to control system (see Control System Troubleshooting below)
Defective starter solenoid	Replace starter solenoid
Defective starter motor	Replace starter motor

Engine will crank but not start

Possible Cause	Possible Remedy
Engine not getting fuel	Check fuel level, filter, fuel pump, verify no air in fuel lines
Fuel run/stop solenoid not engaged	See Fuel Solenoid Run/Stop Troubleshooting (below)
Tripped overcurrent protection	Correct fault, replace or reset overcurrent protection
No preheat (cold condition)	See Preheat Troubleshooting

Engine runs for 10 seconds and shuts down

Possible Cause	Possible Remedy
Shutdown switch input active	Verify shutdown source exists, correct condition or correct faulty circuit
Battery not charging	Verify alternator charging (see Alternator not charging battery below)
Control board did not sense start signal	Engine started through alternate method (i.e., manual air start, push start, etc.)
Defective control system	See Control Panel Troubleshooting (below)

Engine runs longer than 10 seconds and shuts down

Possible Cause	Possible Remedy
Shutdown switch input active	Correct engine fault, verify shutdown switch wiring
Circuit overload protection tripped	Correct overload, keep control system from overheating (over 185° F/85° C)
Voltage transients (spikes)	Add suppressor diodes, protect from nearby lightening strikes, shield induced spikes from other equipment, add electric motor control relay
Defective control system	See Control System Troubleshooting (below)

Alternator not charging battery

Possible Cause	Possible Remedy
Broken or slipping alternator drive belt	Adjust or replace alternator drive belt
Alternator not excited	Verify excitation circuit connected, replace faulty regulator, add additional excitation resistor
Alternator output not connected	Install charge wire
Alternator not grounded	Clean or add ground connection
Alternator faulty	Replace faulty alternator

Fuel Run/Stop Solenoid Troubleshooting

Engine does not stop immediately

Possible Cause	Possible Remedy
Back feed from motor (i.e., cooling fan)	Add relay or blocking diode
Sticking solenoid linkage	Repair or replace solenoid linkage
Fuel valve without check valve	Install or repair check valve

Fuel run/stop solenoid does not engage

Possible Cause	Possible Remedy
No power to solenoid	Locate reason for lack of power and correct (Circuit overloaded? Failed suppressor diode? Faulty wiring?)
No power to solenoid pull coil	Correct faulty wiring, check pull control circuit (see Power Box Troubleshooting below)
Incorrect linkage adjustment	Adjust solenoid linkage
Faulty solenoid	Replace solenoid
Failed suppressor diode	Correct wiring (diode reversed?), replace suppressor diode
Optional e-stop engaged	Disengage e-stop

Engine not getting fuel

Possible Cause	Possible Remedy
Empty fuel tank	Fuel engine
Clogged filter	Replace filter
Air in fuel lines	Bleed fuel lines
Low fuel pressure	Replace faulty fuel pump and/or clogged filter
Faulty fuel pump	Replace fuel pump, correct wiring fault (electric fuel pump)

Preheat Troubleshooting

Engine is hard to start in cold conditions

Possible Cause	Possible Remedy
Start attempt before preheat complete	Wait for preheat time to elapse, crank as soon as time elapses
Incorrect preheat specification	Correct control system configuration, install correct control system
Heater faulty	Replace heater
Heater relay faulty	Replace relay
Preheat control not functioning	Correct wiring, correct control system configuration
Faulty control system	See Control System Troubleshooting (below)

Engine produces excessive white smoke after starting

Possible Cause	Possible Remedy
Afterglow not enabled	Reconfigure control system
Heater faulty	Replace heater
Heater relay faulty	Replace relay
Preheat control not functioning	Correct wiring, correct control system configuration
Faulty control system	See Control System Troubleshooting (below)

Control System Troubleshooting

Control system does not perform self test

Possible Cause	Possible Remedy
Tripped overcurrent protection	Correct fault, replace or reset overcurrent protection
Faulty connection to battery	Correct battery connections (see Battery Circuit Requirements above)

Control system performs normal self test, engine cranks, runs and shuts down

Possible Cause	Possible Remedy
Only Battery LED illuminated	Correct battery charge failure (see Battery not charging above)
Only Oil Pressure LED Illuminated	Correct low oil pressure condition or faulty switch, correct wiring fault
Only Temperature LED Illuminated	Correct overheating condition or faulty switch, correct wiring fault
Only Aux LED Illuminated	Correct fault condition (i.e. v-belt, coolant level) or faulty switch, correct wiring fault
All normally closed shutdowns illuminate for one second (control system reset)	Add suppressor diodes, protect from nearby lightening strikes, shield induced spikes from other equipment, add electric motor control relay

Testing Shutdown Inputs

Shutdown switches signal a fault by ground contact in most systems. Shutdown operation can be verified by grounding the shutdown inputs individually. It may be necessary to remove the wire from the shutdown switch to perform this test.

Note

Most shutdown switches are grounded through the switch body.
Do not use insulating sealant (i.e. Teflon tape) when installing switches.

Some thermostat housings are composites and do not provide ground for the switch.

Revision History

Initial Release.

Rev A – 22-May-2006. Corrected typographical errors.

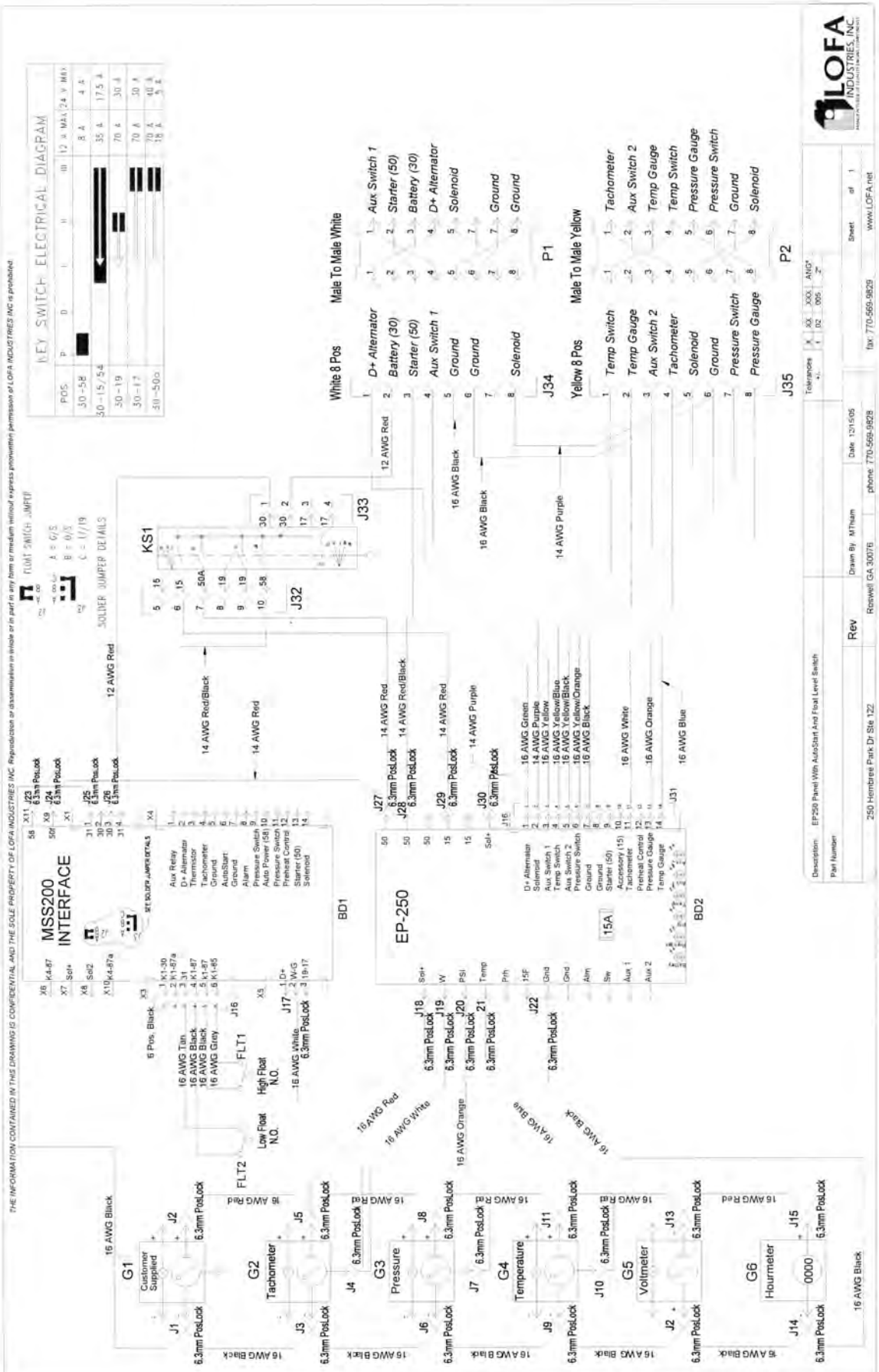
Rev B – 26-Oct-2006. Add symbols to *Indicators*, corrected typographical errors.

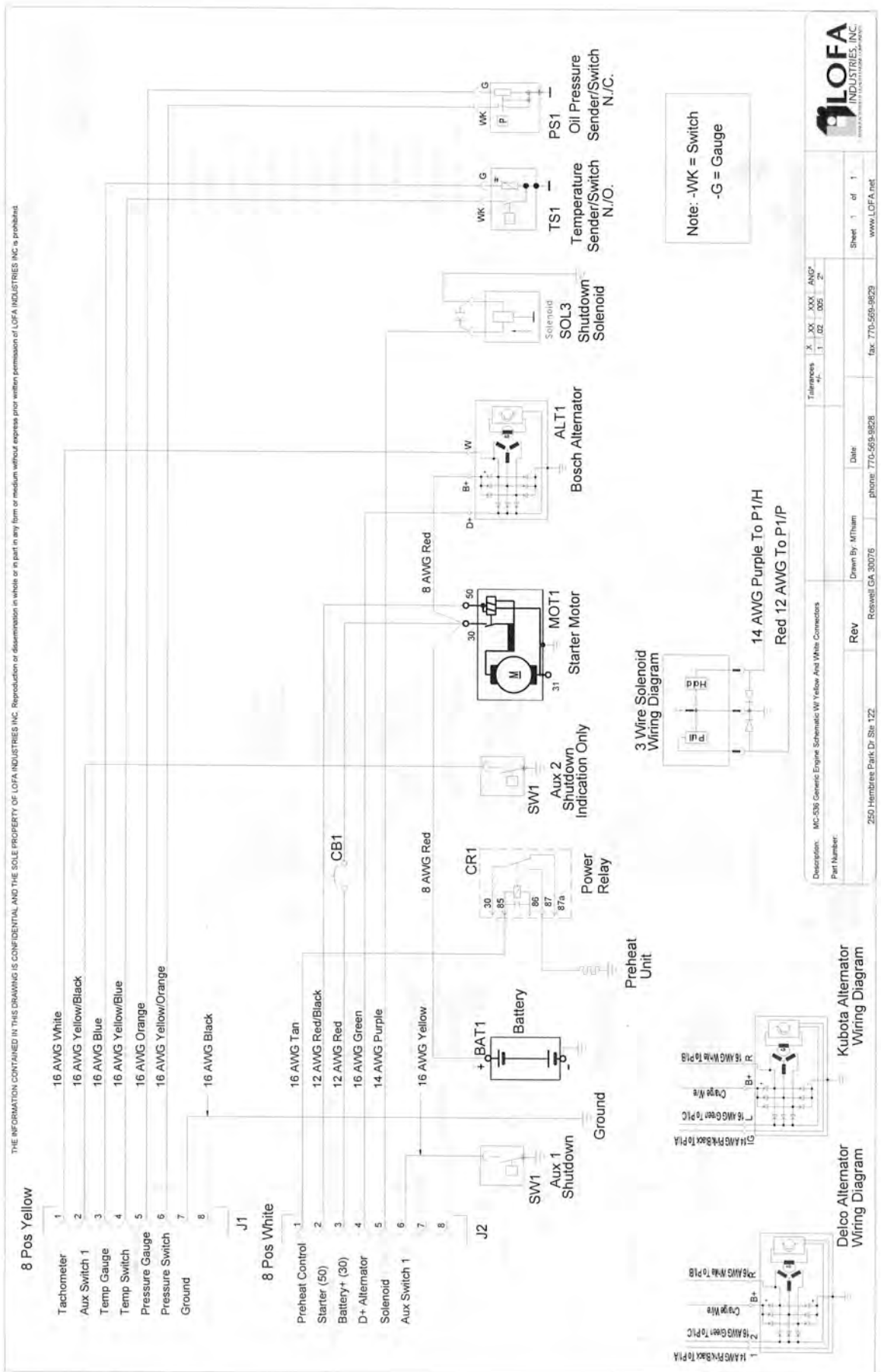
Rev C – 8-Jan-2007. Updated schematics, removed Power Box information.

Rev C.1 – 28-Feb-2007. Added part numbers.

Typical Schematics

The following pages show typical schematics.
Details vary from installation to installation.
See the specific schematics for installation for details.


LOFA EP250 Operation and Troubleshooting
KEY SWITCH ELECTRICAL DIAGRAM
MSS200 INTERFACE
EP-250
FLT1
FLT2
KS1
BD1
BD2
G1 Customer Supplied
G2 Tachometer
G3 Pressure
G4 Temperature
G5 Voltmeter
G6 Hourmeter
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
J15
J16
J17
J18
J19
J20
J21
J22
J23
J24
J25
J26
J27
J28
J29
J30
J31
J32
J33
J34
J35
P1
P2
White 8 Pos
Male To Male White
Yellow 8 Pos
Male To Male Yellow
D+ Alternator
Battery (30)
Starter (50)
Aux Switch 1
Ground
Solenoid
Temp Switch
Temp Gauge
Aux Switch 2
Tachometer
Pressure Gauge
Pressure Switch
6 Pos, Black
High Float N.O.
Low Float N.O.
12 AWG Red
14 AWG Red
14 AWG Red/Black
14 AWG Purple
16 AWG Black
16 AWG Green
16 AWG Yellow
16 AWG Yellow/Blue
16 AWG Yellow/Black
16 AWG Yellow/Orange
16 AWG White
16 AWG Orange
16 AWG Blue
16 AWG Brown
16 AWG Red
16 AWG White
16 AWG Orange
16 AWG Blue
16 AWG Black
6.3mm PosLock
15A
50A
LOFA INDUSTRIES, INC.
Drawn By MThaim
Date 12/15/05
Rev
Roswell GA 30076
phone: 770-569-9828
fax: 770-569-9829
www.LOFA.net
250 Hembree Park Dr Ste 122
Description: EP250 Panel With AutoStart And Float Level Switch
Part Number
Sheet of 1
463-3000-01 Rev - C.1 - 28-Feb-2007



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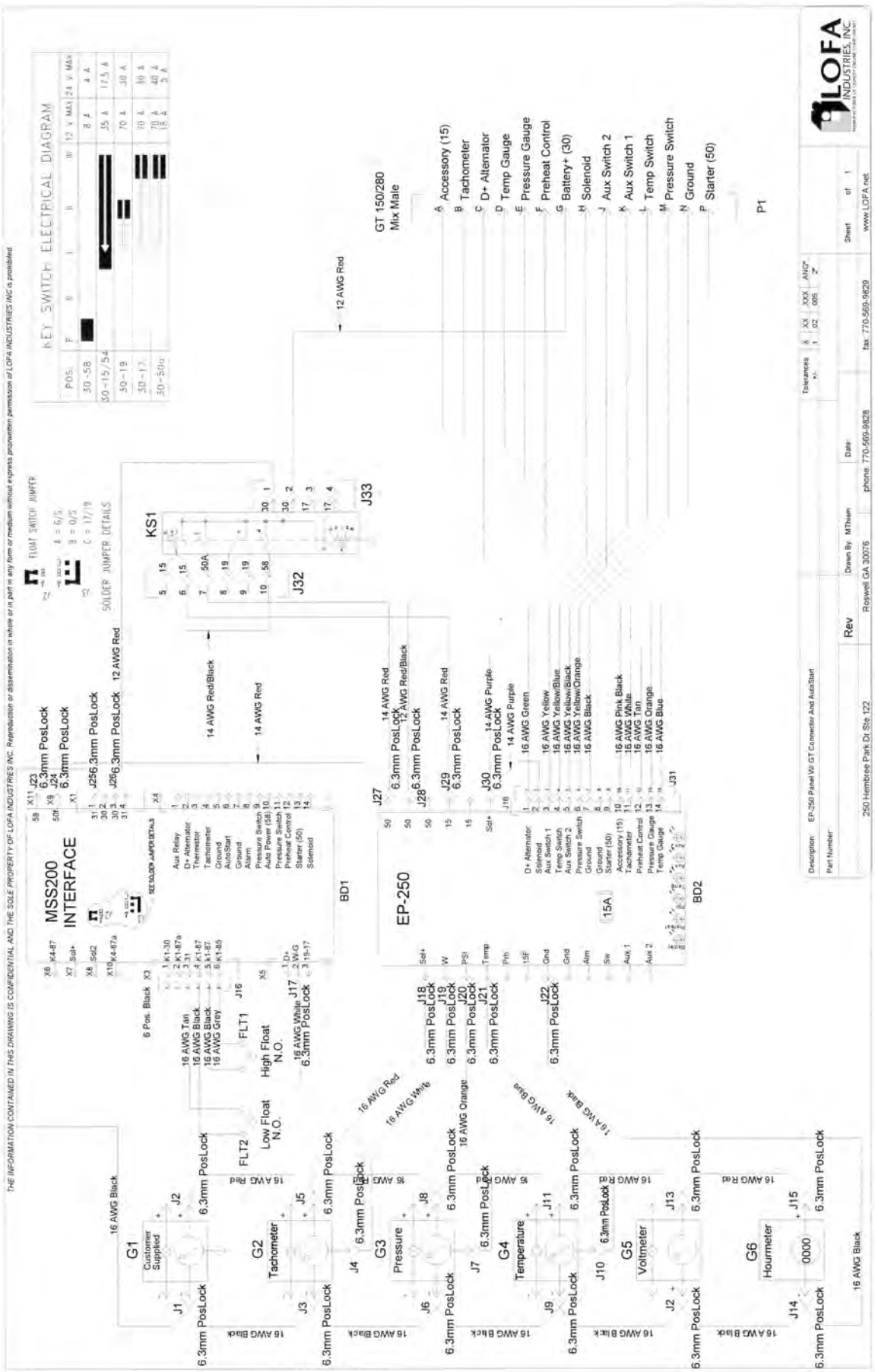
LOFA EP250 Operation and Troubleshooting
MSS200 INTERFACE
EP-250
BD1
BD2
KS1
FLT1
FLT2
High Float N.O.
Low Float N.O.
KEY SWITCH ELECTRICAL DIAGRAM
SOLDER JUMPER DETAILS
FLOAT SWITCH JUMPER
GT 150/280 Mix Male
P1
G1 Customer Supplied
G2 Tachometer
G3 Pressure
G4 Temperature
G5 Voltmeter
G6 Hourmeter
Accessory (15)
Tachometer
D+ Alternator
Temp Gauge
Pressure Gauge
Preheat Control
Battery+ (30)
Solenoid
Aux Switch 2
Aux Switch 1
Temp Switch
Pressure Switch
Ground
Starter (50)
12 AWG Red
14 AWG Red/Black
14 AWG Red
14 AWG Purple
16 AWG Green
16 AWG Yellow
16 AWG Yellow/Blue
16 AWG Yellow/Black
16 AWG Yellow/Orange
16 AWG Black
16 AWG Pink Black
16 AWG White
16 AWG Tan
16 AWG Orange
16 AWG Blue
6.3mm PosLock
LOFA INDUSTRIES, INC.
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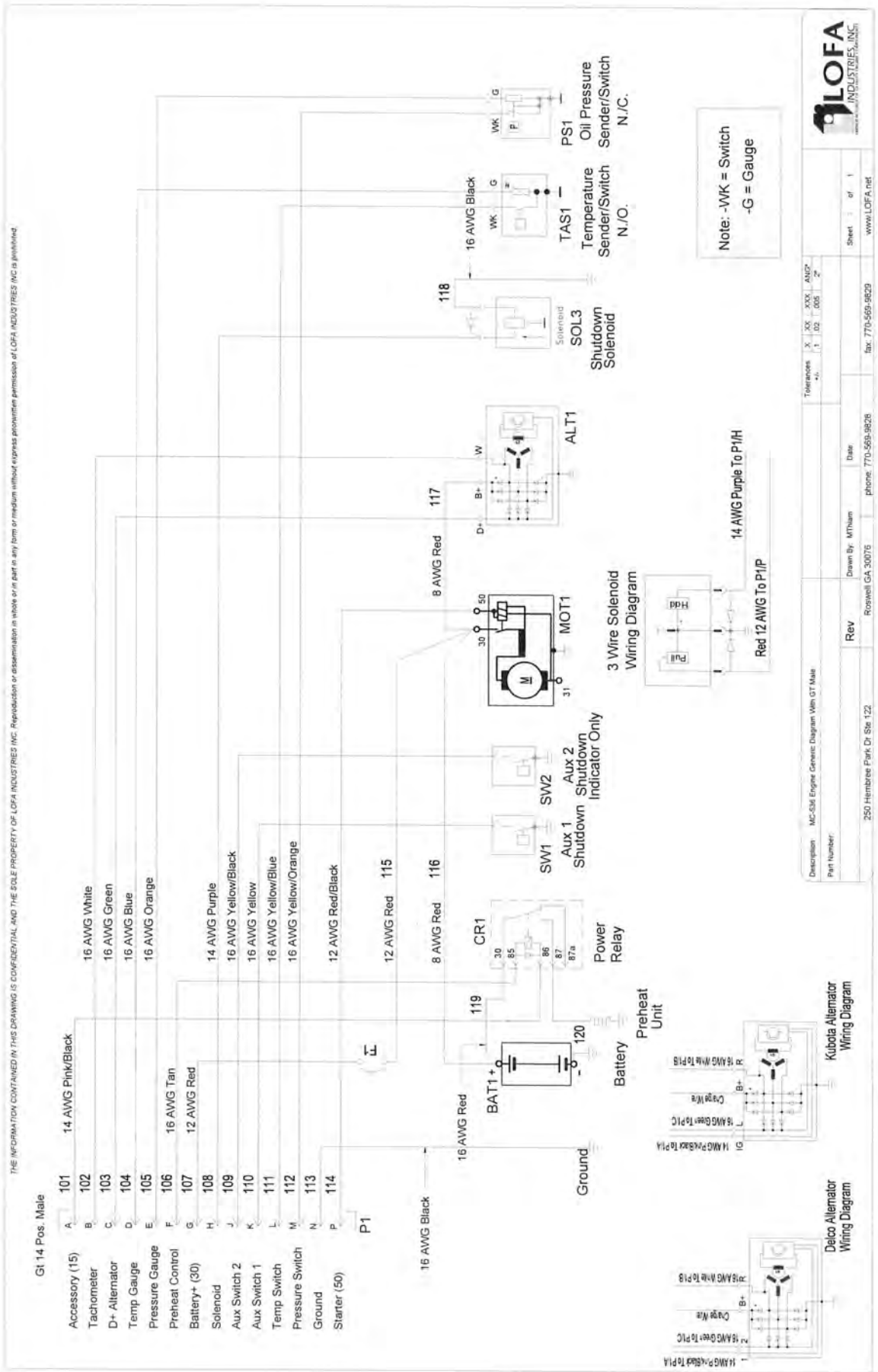
LOFA EP250 Operation and Troubleshooting
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Gt 14 Pos. Male
Accessory (15)
Tachometer
D+ Alternator
Temp Gauge
Pressure Gauge
Preheat Control
Battery+ (30)
Solenoid
Aux Switch 2
Aux Switch 1
Temp Switch
Pressure Switch
Ground
Starter (50)
P1
16 AWG Black
14 AWG Pink/Black
16 AWG White
16 AWG Green
16 AWG Blue
16 AWG Orange
16 AWG Tan
12 AWG Red
14 AWG Purple
16 AWG Yellow/Black
16 AWG Yellow
16 AWG Yellow/Blue
16 AWG Yellow/Orange
12 AWG Red/Black
12 AWG Red
8 AWG Red
16 AWG Red
BAT1
Battery
Ground
CR1
Power Relay
Preheat Unit
SW1
Aux 1 Shutdown
SW2
Aux 2 Shutdown Indicator Only
MOT1
3 Wire Solenoid Wiring Diagram
Pull
Hold
14 AWG Purple To P1/H
Red 12 AWG To P1/P
ALT1
Kubota Alternator Wiring Diagram
Delco Alternator Wiring Diagram
SOL3
Shutdown Solenoid
TAS1
Temperature Sender/Switch N./O.
PS1
Oil Pressure Sender/Switch N./C.
Note: -WK = Switch
-G = Gauge
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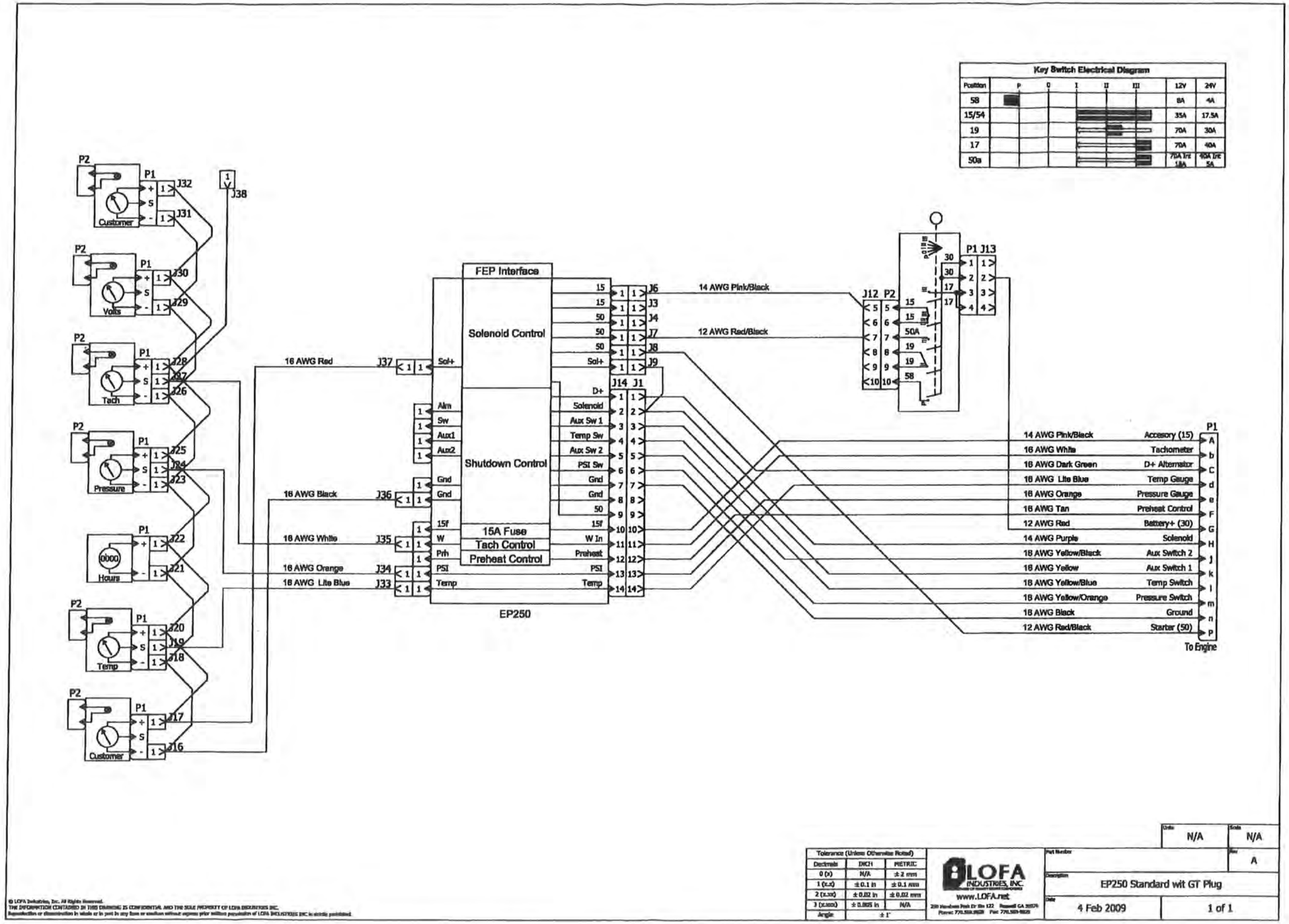

Tolerance (Unless Otherwise Noted)		
Decimals	INCH	METRIC
0 (x)	N/A	± 2 mm
1 (x.x)	± 0.1 in	± 0.1 mm
2 (x.xx)	± 0.02 in	± 0.02 mm
3 (x.xxx)	± 0.005 in	N/A
Angle	± 1°	