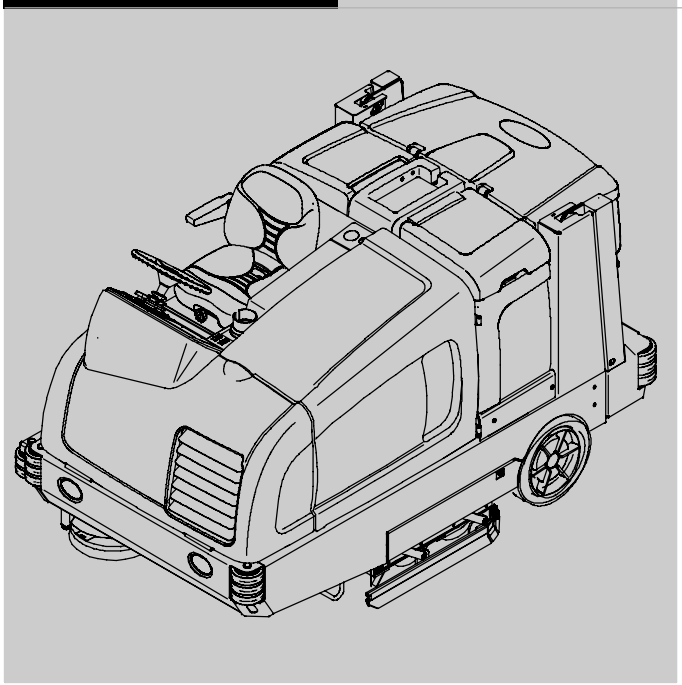
M30

(Gas/LPG/Diesel)



Scrubber-Sweeper
Service Information Manual

FaST® Foam Scrubbing Technology

The Safe Scrubbing Alternative®

Hygenic® Fully Cleanable Tanks
FloorSmart ™ Integrated Cleaning System
ES® Extended Scrub System
Lower Total Cost of Ownership ™

North America / International

9003947
Rev. 00 (06-2008)

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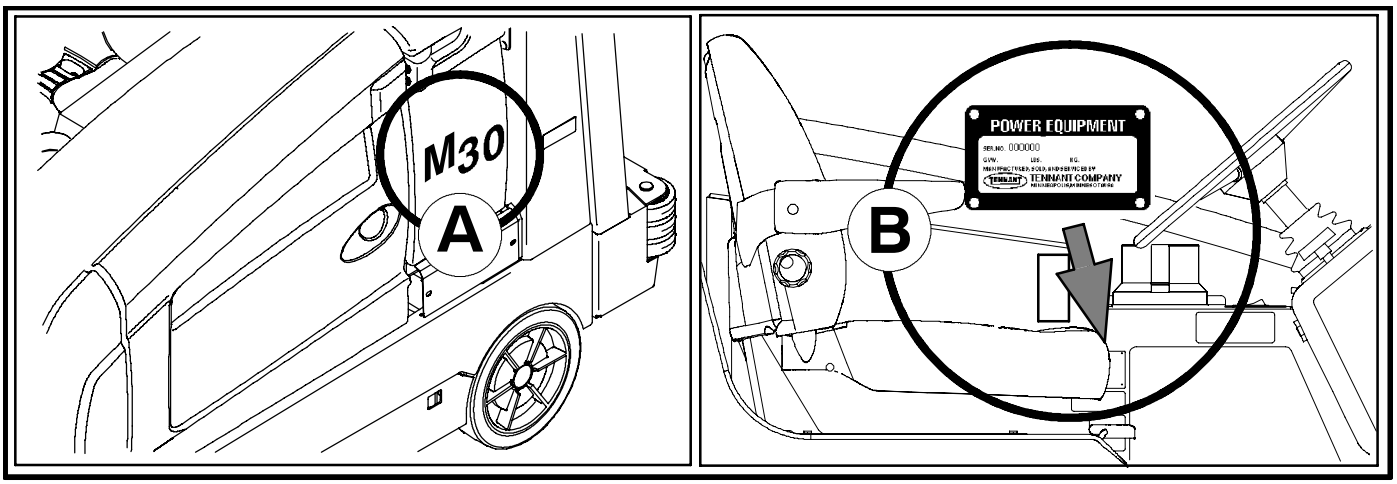


FOR REPLACEMENT PARTS

Identify machine model and serial number.

1. **(A)** Identify the machine model.
2. **(B)** Identify the machine serial number from the data plate.

Refer to the TENNANT Parts Manual.

NOTE: Only use TENNANT Company supplied or equivalent parts. Parts and supplies may be ordered online, by phone, by fax or by mail.

Tennant Company
PO Box 1452
Minneapolis, MN 55440
Phone: (800) 553-8033 or
(763) 513-2850
www.tennantco.com

SAFETY PRECAUTIONS

The following precautions are used throughout this manual as indicated in their description:

WARNING: To warn of hazards or unsafe practices that could result in severe personal injury or death.

CAUTION: To warn of unsafe practices that could result in minor or moderate personal injury.

FOR SAFETY: To identify actions that must be followed for safe operation of equipment.

Do not use the machine other than described in this Operator Manual. The machine is not designed for use on public roads.

The following information signals potentially dangerous conditions to the operator or equipment:

WARNING: Flammable materials can cause an explosion or fire. Do not use flammable materials in tank.

WARNING: Flammable materials or reactive metals can cause an explosion or fire. Do not pickup.

WARNING: Moving belt and fan. Keep away.

WARNING: Engine emits toxic gases. Serious injury or death can result. Provide adequate ventilation.

WARNING: Raised hopper may fall. Engage hopper support pin.

WARNING: Lift arm pinch point. Stay clear of hopper lift arms.

WARNING: Burn hazard. Hot surface. Do NOT touch.

CAUTION: LPG engine will run for a few seconds after key is turned off. Apply parking brake before leaving machine.

CALIFORNIA PROPOSITION 65 WARNING: Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

FOR SAFETY:

1. **Do not operate machine:**
   - **Unless trained and authorized.**
   - **Unless operator manual is read and understood.**
   - **If it is not in proper operating condition.**
   - **In flammable or explosive areas.**
   - **In areas with possible falling objects unless equipped with overhead guard.**

2. **Before starting machine:**
   - **Check for fuel, oil, and liquid leaks.**
   - **Keep sparks and open flame away from refueling area.**
   - **Make sure all safety devices are in place and operate properly.**
   - **Check brakes and steering for proper operation.**
   - **Adjust seat and fasten seat belt.**

3. **When starting machine:**
   - **Keep foot on brake and directional pedal in neutral.**

4. **When using machine:**
   - **Do not pick up burning or smoking debris, such as cigarettes, matches or hot ashes**
   - **Use brakes to stop machine.**
   - **Go slow on inclines and slippery surfaces.**
   - **Use care when reversing machine.**
   - **Move machine with care when hopper is raised.**
   - **Make sure adequate clearance is available before raising hopper.**
   - **Do not carry passengers on machine.**
   - **Always follow safety and traffic rules.**
   - **Report machine damage or faulty operation immediately.**
   - **Follow mixing and handling instructions on chemical containers.**

5. **Before leaving or servicing machine:**
   - **Stop on level surface.**
   - **Set parking brake.**
   - **Turn off machine and remove key.**

6. **When servicing machine:**
   - **Avoid moving parts. Do not wear loose jackets, shirts, or sleeves.**
   - **Block machine tires before jacking machine up.**
   - **Jack machine up at designated locations only. Support machine with jack stands.**
   - **Use hoist or jack that will support the weight of the machine.**
   - **Wear eye and ear protection when using pressurized air or water.**
   - **Disconnect battery connections before working on machine.**
   - **Avoid contact with battery acid.**
   - **Avoid contact with hot engine coolant.**
   - **Do not remove cap from radiator when engine is hot.**
   - **Allow engine to cool.**
   - **Keep flames and sparks away from fuel system service area. Keep area well ventilated.**
   - **Use cardboard to locate leaking hydraulic fluid under pressure.**
   - **Use Tennant supplied or approved replacement parts.**

7. **When loading/unloading machine onto/off truck or trailer:**
   - **Turn off machine.**
   - **Use truck or trailer that will support the weight of the machine.**
   - **Use winch. Do not drive the machine onto/off the truck or trailer unless the load height is 380 mm (15 in) or less from the ground.**
   - **Set parking brake after machine is loaded.**
   - **Block machine tires.**
   - **Tie machine down to truck or trailer.**

GENERAL MACHINE INFORMATION

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

* Always unhook Battery when removing or replacing components

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

SPECIFICATIONS

GENERAL MACHINE DIMENSIONS/CAPACITIES

Item	Dimension/Capacity
Length	2745 mm (108 in)
Height	1475 mm (58 in)
Height (with overhead guard)	2135 mm (84 in)
Width/frame (roller to roller)	1475 mm (58 in)
Width (rear squeegee)	1500 mm (59 in)
Width (with side brush)	1625 mm (64 in)
Cleaning path width (Main brush length)	1220 mm (48 in)
Cleaning path width (with scrubbing side brush)	1575 mm (62 in)
Cleaning path width (with sweeping side brush)	1625 mm (64 in)
Main brush diameter (2)	305 mm (12 in)
Side brush diameter (scrubbing)	410 mm (16 in)
Side brush diameter (sweeping)	535 mm (21 in)
Solution tank capacity	284 L (75 gallons)
Recovery tank capacity	360 L (95 gallons)
Debris hopper volume capacity	198 L (7.0 ft^3)
Debris hopper weight capacity	295 kg (650 lbs)
Dump height (variable to)	1525 mm (60 in)
Minimum ceiling dump height	2620 mm (103 in)
Weight – empty	1815 Kg (4000 lbs)
GVWR	2449 Kg (5400 lbs)
Transport ground clearance	80 mm (3 in)
Operating Sound Level At Operator Ear	84 ±1.5 dBA
Vibration level at steering wheel does not exceed	0.2 m/s^2

GENERAL MACHINE PERFORMANCE

Item	Measure
Minimum aisle turn	3175 mm (125 in)
Travel speed forward (maximum)	13 Km/h (8 mph)
Travel speed reverse (maximum)	4.8 Km/h (3 mph)
Maximum rated climb and descent at GVWR	8°/14%
Maximum rated climb and descent angle when scrubbing	6°/10%

HYDRAULIC SYSTEM

System	Capacity	Fluid Type
Hydraulic reservoir	38 L (10 gal)	TENNANT part no. 65869 – above 7° C (45° F)
Hydraulic total	45 L (12 gal)	TENNANT part no. 65870 – below 7° C (45° F)

STEERING

Type	Power source
Front wheel, hydraulic cylinder and rotary valve controlled	Hydraulic accessory pump

POWER TYPE

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke
GM 1.6	Piston	Distributorless-type spark	4	Natural	4	79 mm (3.11 in)	81.5 mm (3.21 in)

Displacement	Net power, governed	Net power, maximum
1600 cc (98 cu in)	41 kw (55 hp) @ 2700 rpm	39.5 kw (53 hp) @ 4000 rpm
Fuel	**Cooling system**	**Electrical system**
Gasoline, 87 octane minimum, unleaded Fuel tank: 42 L (11.2 gal)	Water/ethylene glycol antifreeze	12 V nominal
LPG, Fuel tank: 15 kg (33 lb)	Total: 7.5 L (2 gal) Radiator: 3.8 L (1 gal)	75 A alternator
Idle speed, no load	**(Fast) governed speed, under load**	**Firing order**
1350 ± 50 rpm	2700 ± 50 rpm	1-3-4-2
Spark plug gap	**Valve clearance, cold**	**Engine lubricating oil with filter**
1 mm (0.035 in)	No Adjustment OHC Engine	3.5 L (3.7 qt) 5W30 SAE-SG/SH

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke
Kubota V1505-B	Piston	Diesel	4	Natural	4	78 mm (3.07 in)	78.4 mm (3.08 in)

Displacement	Net power, governed	Net power, maximum
1500 cc (91.4 cu in)	25.4 kw (34 hp) @ 2800 rpm	27.2 kw (44.2 hp) @ 3000 rpm
Fuel	**Cooling system**	**Electrical system**
Diesel Fuel tank: 42 L (11.2 gal)	Water/ethylene glycol antifreeze	12 V nominal
	Total: 7.5 L (2 gal) Radiator: 3.8 L (1 gal)	37 A alternator
Idle speed, no load	**(Fast) governed speed, under load**	**Engine lubricating oil without filter**
1350 ± 50 rpm	2800 ± 50 rpm	6 L (6.35 qt) Diesel rated engine oil above CD grade only

BRAKING SYSTEM

Type	Operation
Service brakes	Mechanical drum brakes (2), one per rear wheel, cable actuated
Parking brake	Utilize service brakes, cable actuated

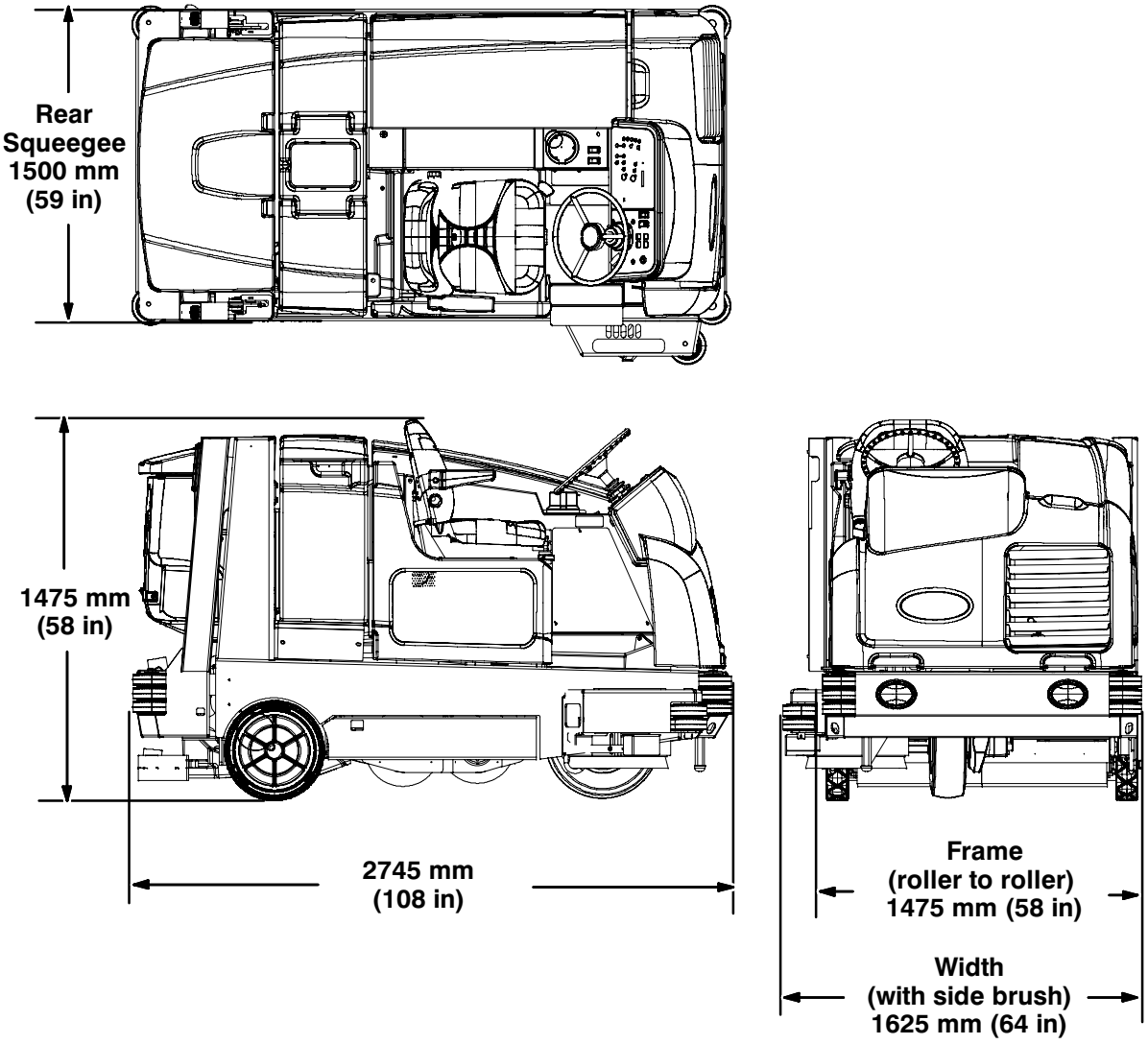
TIRES

Location	Type	Size
Front (1)	Solid	150 mm x 460 mm (6 in x 18 in)
Rear (2)	Solid	127 mm x 460 mm (5 in x 18 in)

FaST SYSTEM

Item	Measure
Solution pump	12 Volt DC, 11A, 0.7 GPM & 1.4 GPM flow (2 speed), 75 psi high-pressure shutdown
Low solution flow rate	2.7 LPM (0.7 GPM)
High solution flow rate	5.4 LPM (1.4 GPM)
Low concentrate flow rate	2.6 CC/Minute (0.085 Liquid Ounces/Minute)
High concentrate flow rate	5.2 CC/Minute (0.17 Liquid Ounces/Minute)

MACHINE DIMENSIONS



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Component Locator

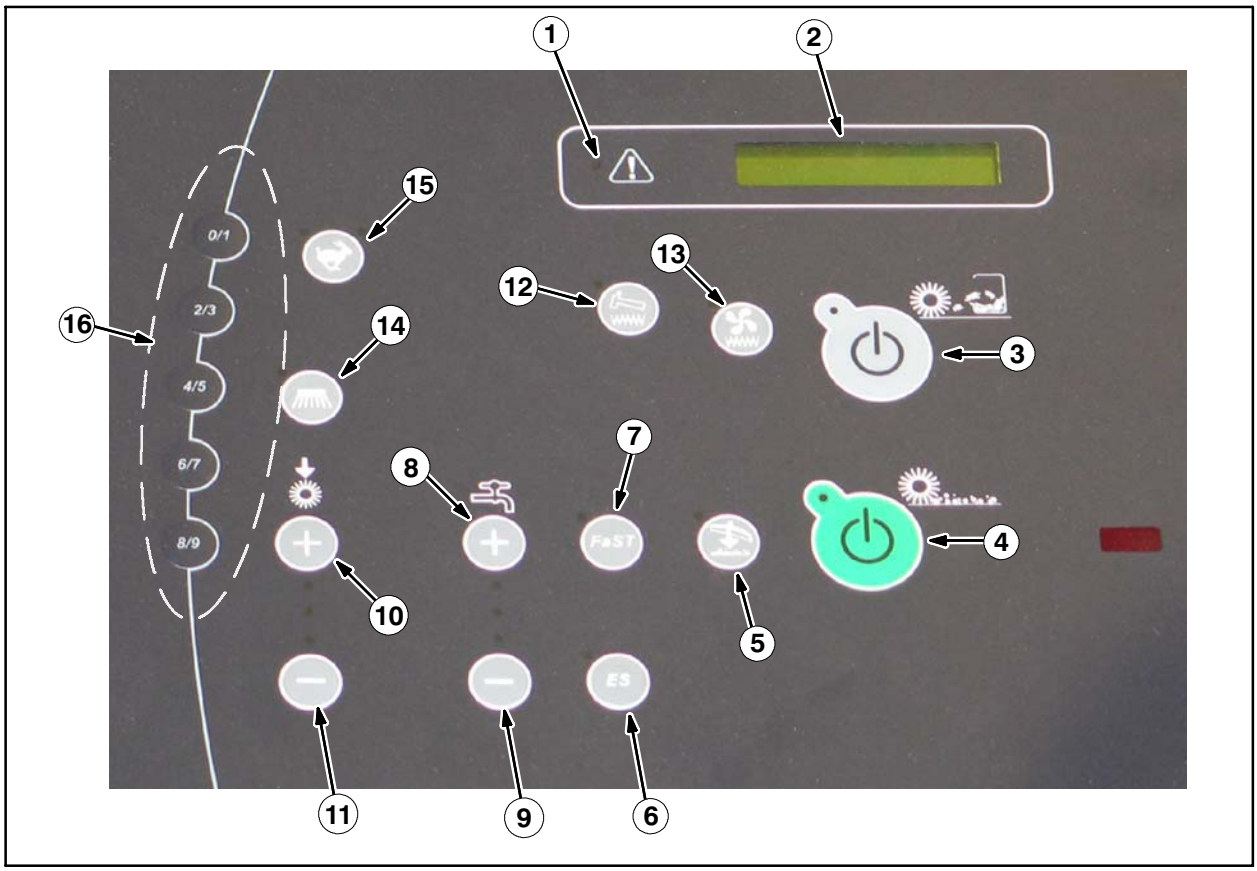
(page 1 of 8)

1. **Instrument (Touch) panel** (see next page)
2. **Indicator panel**
3. **Operating / hazard light switch** (S-4)
4. **Spray nozzle or Pressure washer switch** (S-25)
5. **Engine Indicator lights** (Charging, Oil Pressure, Check Engine, Glow Plugs)
6. **Ignition switch** (S-1)
7. **Horn Switch** (S-22)
8. **Audible Alarm**
9. **Hopper door open / close switch** (S-13)
10. **Hopper raise / lower switch** (S-5)

G

Component Locator

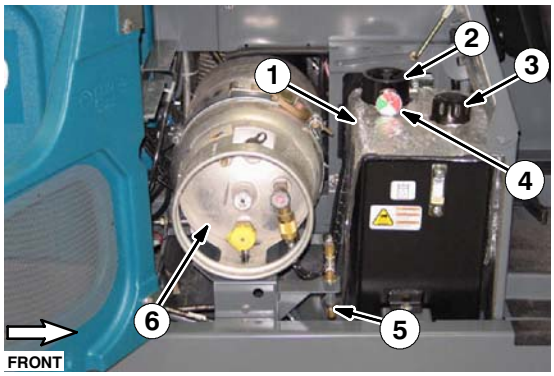
(page 2 of 8)

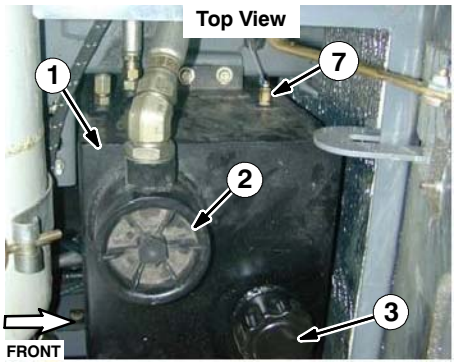


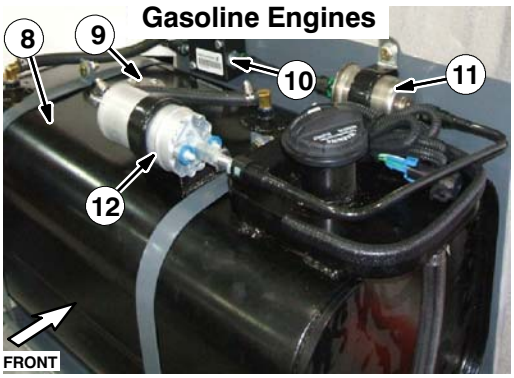
1. Fault indicator light
2. Hour meter / fuel indicator / fault code indicator
3. 1-STEP sweep button
4. 1-STEP scrub button
5. Scrub vacuum fan / squeegee button
6. ES (Extended Scrub) button (option)
7. FaST button (option)
8. Solution increase button (+)
9. Solution decrease button (-)
10. Brush pressure increase button (+)
11. Brush pressure decrease button (-)
12. Filter shaker button
13. Sweep vacuum fan button
14. Side brush button (option)
15. Engine speed button
16. Supervisor control buttons

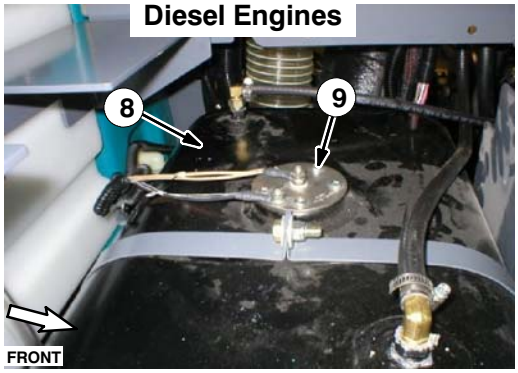
Component Locator

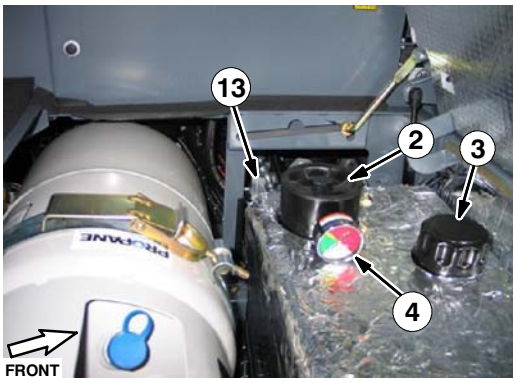
(page 3 of 8)

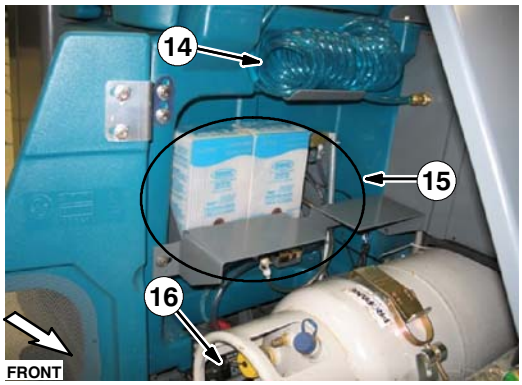










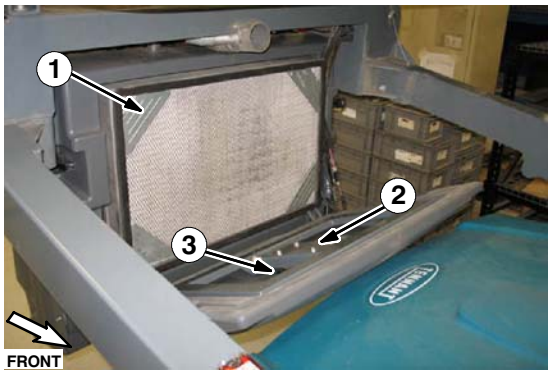


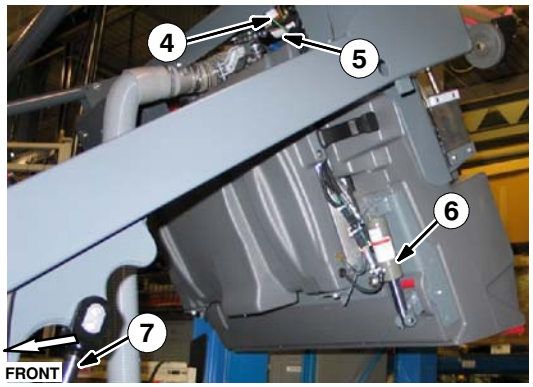
1. **Hydraulic Oil Reservoir**
2. **Hydraulic Oil Filter**
3. **Reservoir Cap & Oil Level Indicator**
4. **Filter Restriction Gauge or Switch** (S-17)
5. **Low LPG Fuel Pressure Switch** (S-8)
6. **LPG Fuel Tank**
7. **Hydraulic Oil Temperature Sensor** (S-20)
8. **Fuel Tank**
9. **Fuel Sending Unit** (S-7)
10. **Fuel Pressure Regulator**
11. **Fuel Filter**
12. **Fuel Pump**
13. **Pressure Washer Hydraulic Valve**
14. **Spray Nozzle Hose**
15. **FaST System Components**
16. **FaST Water Pump**

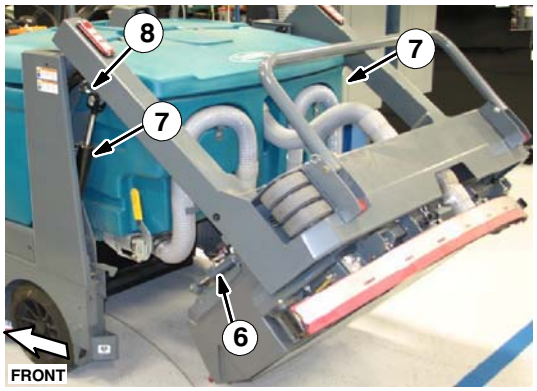
G

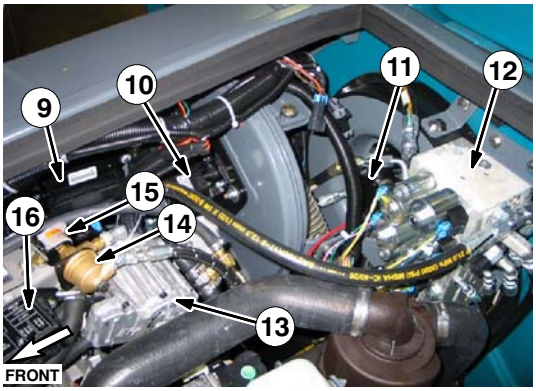
Component Locator

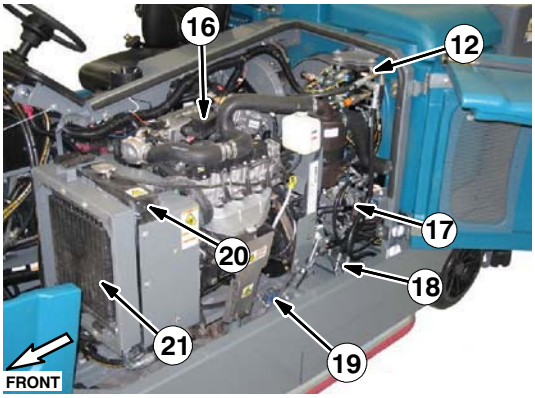
(page 4 of 8)

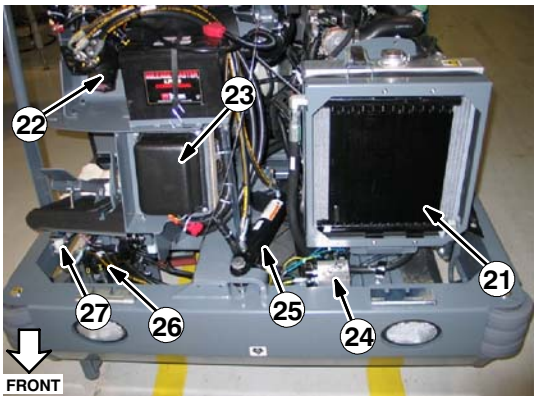








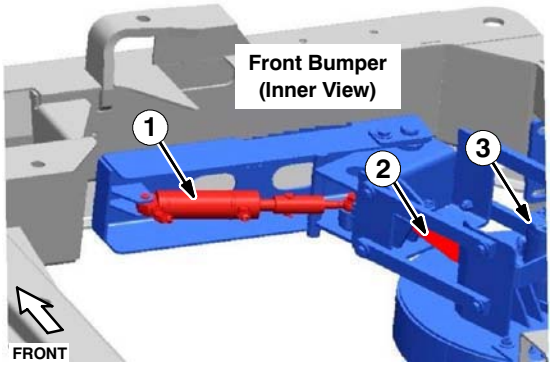


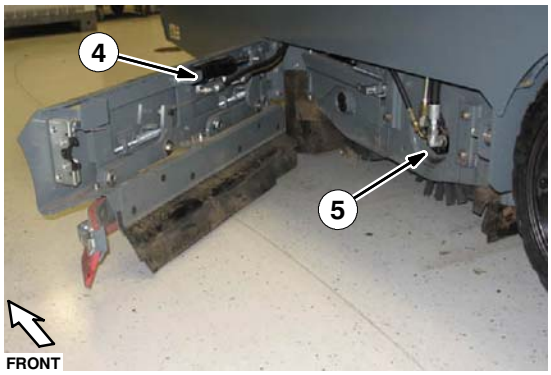


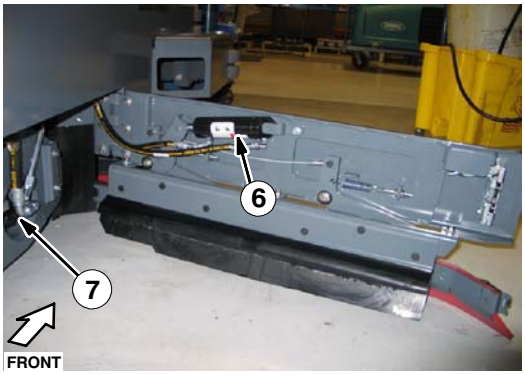
1. **Sweeping Panel Filter**
2. **Thermo-Sentry Switch** (S-9)
3. **Shaker Motor**
4. **Clogged Shaker Filter Switch** (S-18)
5. **Rear Squeegee Lift Cylinder**
6. **Hopper Door Cylinder**
7. **Hopper Lift Cylinder**
8. **Hopper Position Switch** (S-6)
9. **Engine Control Module** (Gas/LPG only)
10. **Sweeping Vacuum Fan Motor**
11. **Scrubbing Vacuum Fan Motor**
12. **Main Hydraulic Valve Manifold**
13. **Electronic Pressure Regulator** (LPG only)
14. **Fuel Filter** (LPG only)
15. **Fuel Lock-Off** (LPG only)
16. **Engine Fuse & Relay Panel** (Gas/LPG only)
17. **Hydraulic Pumps**
18. **Propel Pedal Position Sensor** (SW3)
19. **Scrub Head Solution Valve** (SOL-3)
20. **Engine Coolant Radiator**
21. **Hydraulic Oil Heat Exchanger**
22. **Steering Valve**
23. **Fuse & Relay Panel**
24. **Side Brush Valve Manifold**
25. **Steering Cylinder**
26. **Side Brush Motor**
27. **Side Brush Solution Valve** (SOL-7)

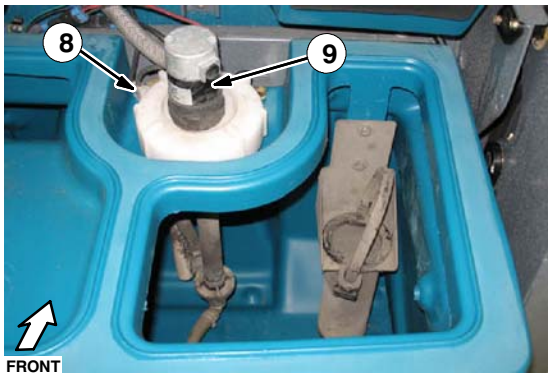
Component Locator

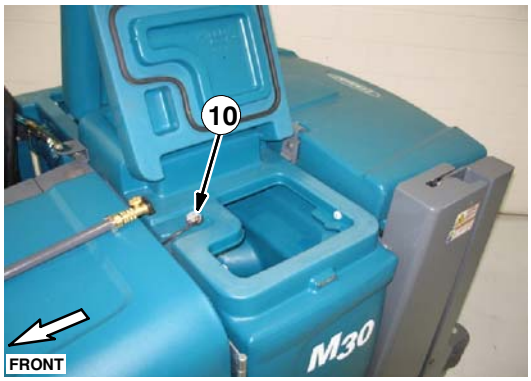
(page 5 of 8)

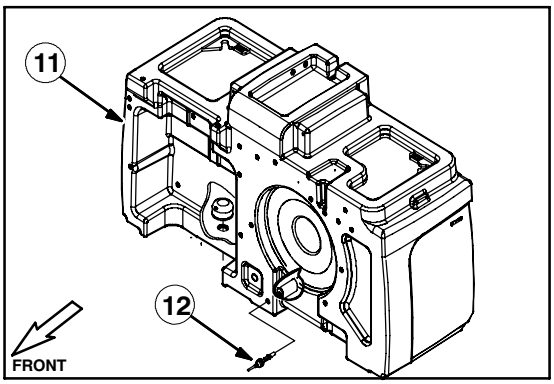












1. **Side Brush Extend Cylinder**
2. **Side Brush Lift Cylinder**
3. **Side Brush Motor**
4. **Left Side Squeegee Lift Cylinder**
5. **Main Brush Motor** (Rear)
6. **Right Side Squeegee Lift Cylinder**
7. **Main Brush Motor** (Front)
8. **Recovery Tank Full/Half Full Switches** (S-15, S-16)
9. **ES Pump**
10. **Solution Tank Full Switch** (S-14)
11. **Solution Tank**
12. **Solution Tank Empty Switch** (S-19)

Component Locator

(page 6 of 8)

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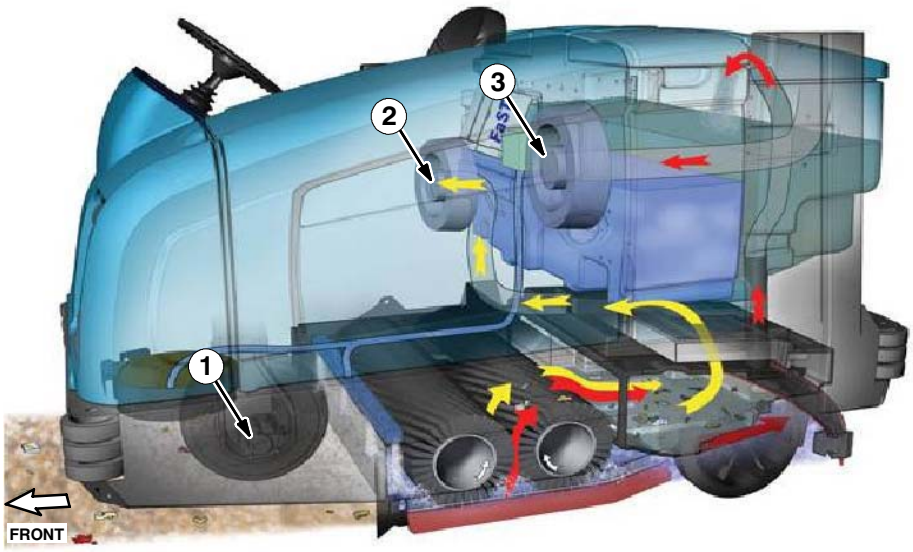
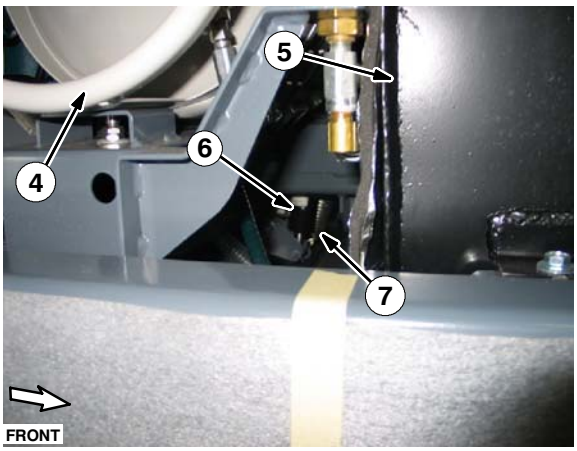


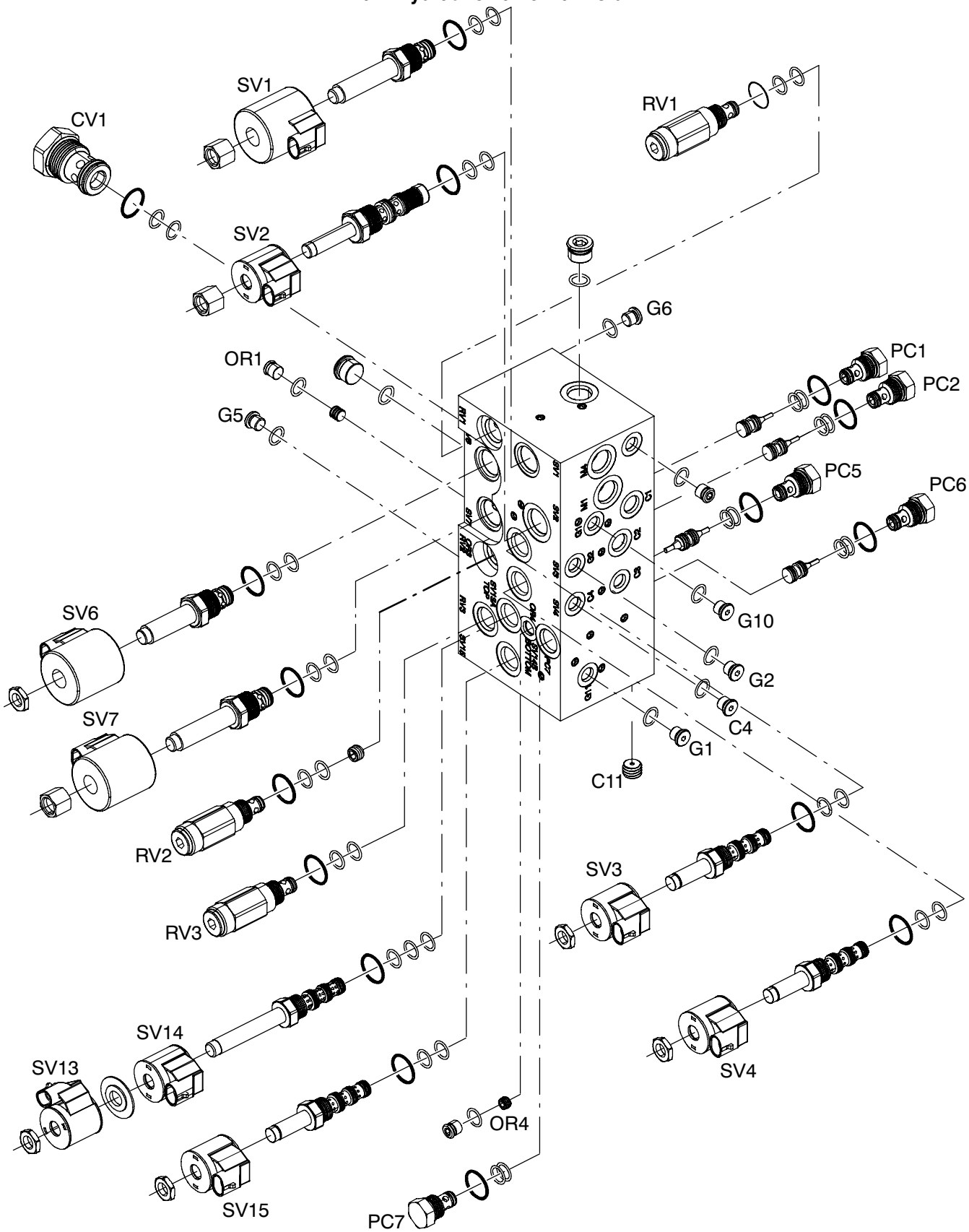


1. **Propel Motor**
2. **Sweeping Vacuum Fan Motor**
3. **Scrubbing Vacuum Fan Motor**
4. **Fuel Tank** (LPG Shown)
5. **Hydraulic Oil Reservoir**
6. **Scrub Head Lift Cylinder**
7. **Scrub Head Lift Assist Spring**

Component Locator

(page 7 of 8)

Main Hydraulic Valve Manifold



Component Locator

(page 8 of 8)

Side Brush Valve Manifold

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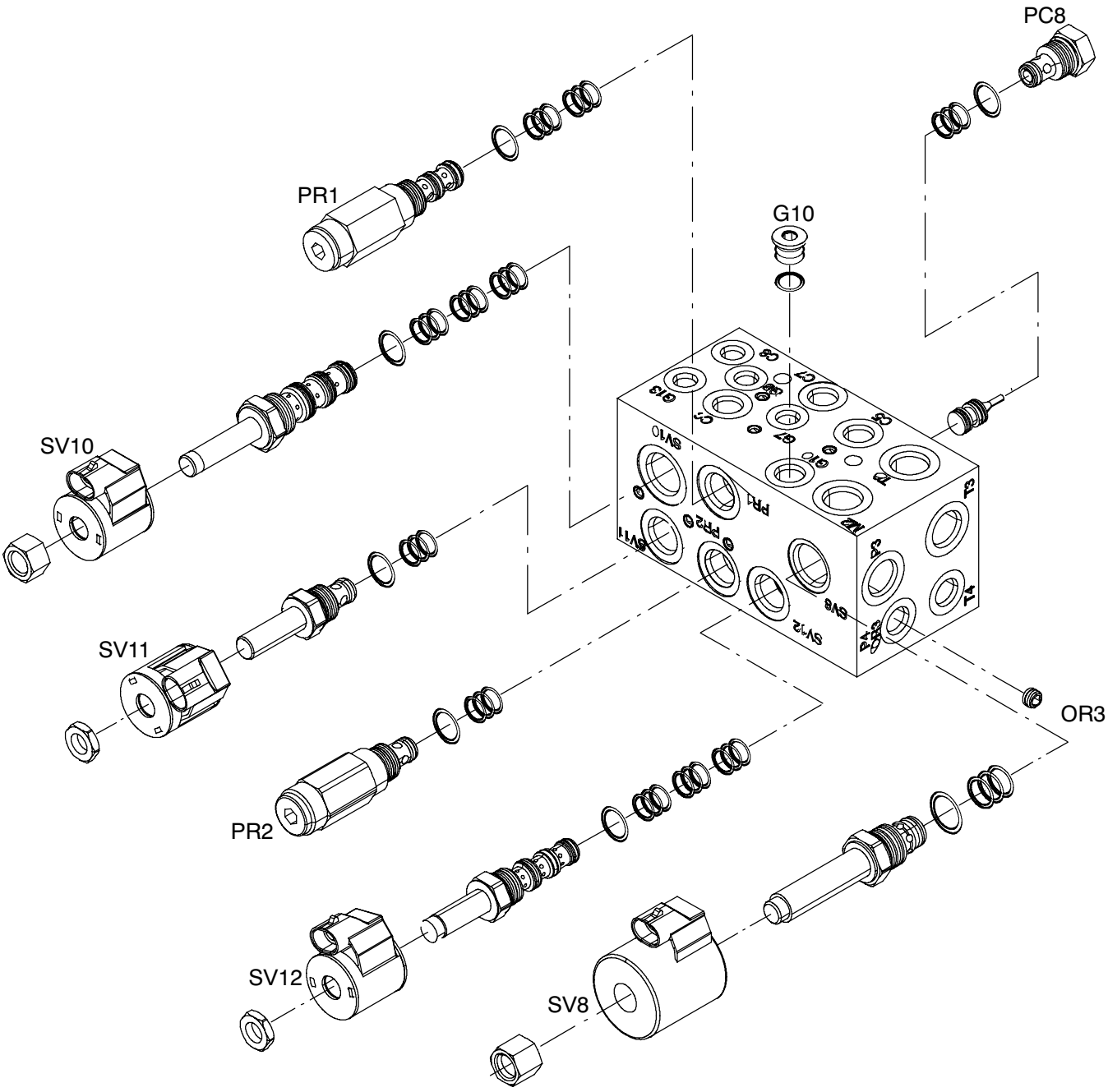


MAINTENANCE & REPAIR

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual
* Always unhook Battery when removing or replacing electrical components

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

MAINTENANCE

MAINTENANCE CHART

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	1	Engine	Check oil level	EO	1
			Check coolant level in reservoir	WG	1
	10	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	8, 9	Tank cover seals	Check for damage or wear	–	3
	3	Main brushes	Check for damage and wear	–	2
	4	Side brush (option)	Check for damage and wear	–	1
			Check squeegee blade for damage and wear	–	1
	5	Hopper dust filter	Shake to clean	–	1
	6	Rear Squeegee Blade	Check for damage and wear	–	1
			Check deflection	–	1
	7	Side Squeegee Blades	Check for damage and wear	–	2
	8	Recovery tank	Clean	–	1
	8	Recovery tank, ES mode (option)	Clean ES filter	–	1
	9	Solution tank, ES mode (option)	Clean	–	1
	5	Hopper	Clean hopper, debris screen, and hose	–	1
20 Hours	5	Hopper dust filter	Check for damage, clean, replace if necessary	–	1
50 Hours	16	FaST / ec–H2O filter screen	Clean	–	1
	3	Main brushes	Check brush pattern and rotate front to rear	–	2
	13	Front wheel	Torque wheel nuts **(after initial 50 hours only)**	–	1
	15	Battery	Clean and tighten battery cable connections **(after initial 50 hours only)**	–	1
	1	Engine	Check belt tension	–	1
100 Hours	18	Radiator	Clean core exterior	–	1
			Check coolant level	WG	1
	18	Hydraulic cooler	Clean core exterior	–	1
	1	Engine	Change oil and filter	EO	1
			Drain oil from electronic pressure regulator (EPR)	–	1
	13, 19	Tires	Check for damage	–	3
	6	Rear squeegee casters	Lubricate	SPL	2
	6	Rear squeegee	Check leveling	–	1
	2	Scrub head skirt	Check for damage or wear	–	1

Interval	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
200 Hours	12	Front wheel support bearings	Lubricate	SPL	2
	1, 17	Torque tube	Lubricate	SPL	4
	12	Steering cylinder	Lubricate	SPL	1
	1, 18	Radiator hoses and clamps	Check for tightness and wear	–	2
	11	Parking brake	Check adjustment	–	1
	11	Brake pedal	Check adjustment	–	1
	14	Hopper lift arm pivots	Lubricate	SPL	2
	5	Hopper door pivots	Lubricate	SPL	2
400 Hours	1	Engine	Clean and re–gap or replace spark plugs	–	4
			Replace air filter	–	1
			Replace fuel filter	–	1
800 Hours	10	Hydraulic reservoir	Replace filler cap	–	1
	1	Engine	Check timing belt	–	1
	–	Hydraulic hoses	Check for wear and damage	–	All
	1, 18	Cooling system	Flush	WG	2
	13	Propelling motor	Torque shaft nut	–	1
	13	Front wheel	Torque wheel nuts	–	1
	15	Battery	Clean and tighten battery cable connections	–	1
1000 Hours	16	FaST system filters	Replace	–	2
1200 Hours	10	Hydraulic fluid filter	***** Replace fluid filter	–	1
2000 Hours	1	Engine	Replace timing belt	–	1
2400 Hours	10	Hydraulic fluid reservoir	***** Replace strainer outlet	–	1
			***** Change hydraulic fluid	HYDO	1

NOTE: Change the hydraulic fluid, filter, and suction strainer, indicated (*****), after every 800 hours for machines NOT originally equipped with **Tennant*True*** *premium hydraulic fluid. (See Hydraulics section).*

LUBRICANT/FLUID

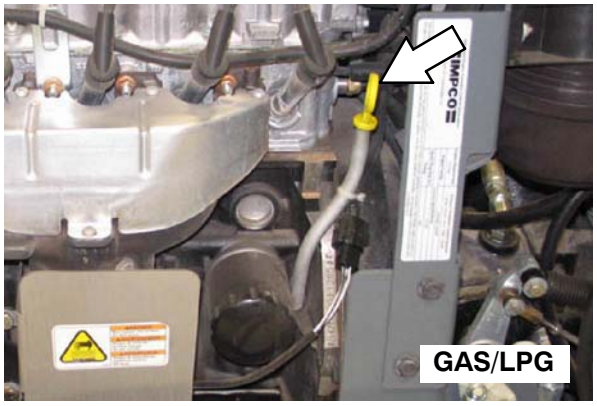
EO . . . . Engine oil, 5W30 SAE–SG/SH only.
HYDO . **Tennant*True*** premium hydraulic fluid or equivalent
WG . . . Water and ethylene glycol anti-freeze, –34° C (–30° F)
SPL . . . Special lubricant, Lubriplate EMB grease (Tennant part number 01433–1)

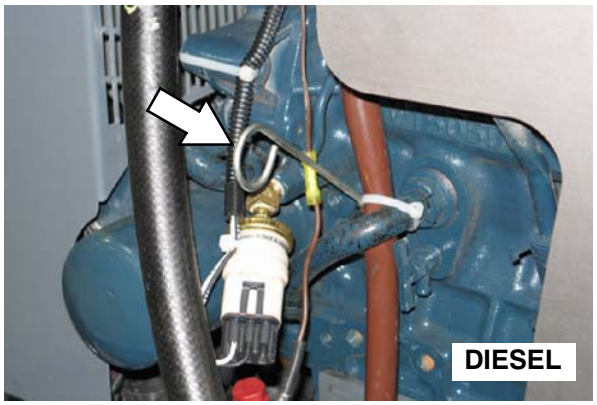
NOTE: More frequent maintenance intervals may be required in extremely dusty conditions.

LUBRICATION

ENGINE OIL

Check the engine oil level daily. Change the oil and oil filter after every 100 hours of operation.

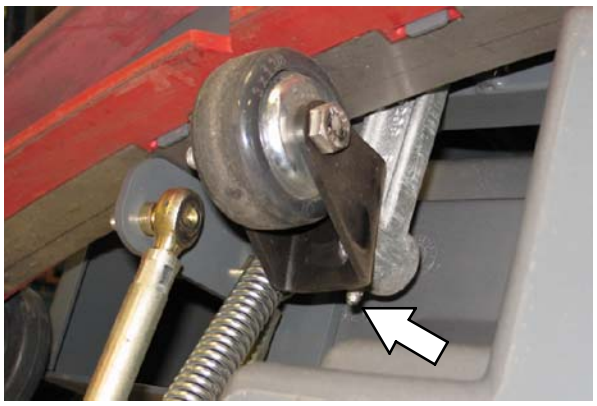




Fill the engine with oil until the oil is between the indicator marks on the dipstick. DO NOT fill past the top indicator mark. The engine oil capacity for Gas & LPG engines is 3.5 L (3.7 qt) with oil filter. The engine oil capacity is 6 L (6.35 qt) with oil filter.

SQUEEGEE CASTER BEARINGS

Lubricate the squeegee caster bearings after every 100 hours of operation.



FRONT WHEEL SUPPORT BEARING

Lubricate the front wheel support bearings after every 200 hours of operation. Both front wheel support grease fittings are located underneath the frame support plate.

STEERING CYLINDER BEARING

Lubricate the steering cylinder after every 200 hours of operation. The steering cylinder bearing is located next to the front wheel support.

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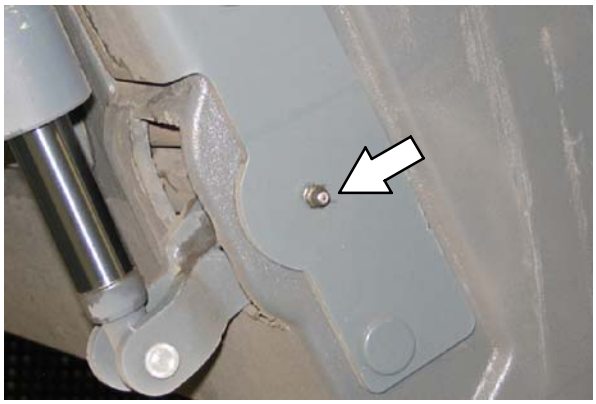
HOPPER LIFT ARM PIVOTS

Lubricate the hopper lift arm pivots after every 200 hours of operation.

HOPPER DOOR PIVOTS

Lubricate the hopper door pivots after every 200 hours of operation.



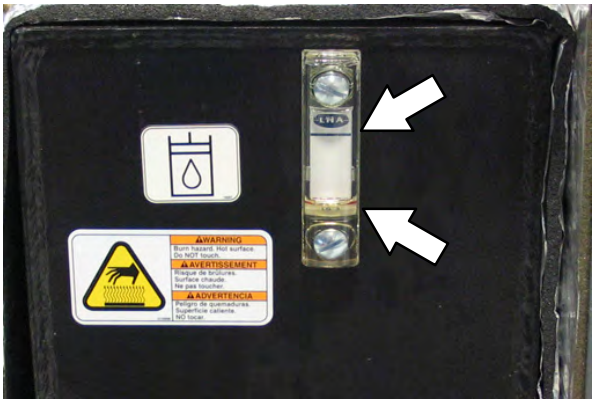
TORQUE TUBES

Lubricate the torque tubes after every 200 hours of operation. The torque tube grease fittings on the operator side of the machine are located beneath the fuel tank.

On the other side of the machine the torque tube grease fittings are located beneath the propel pump.

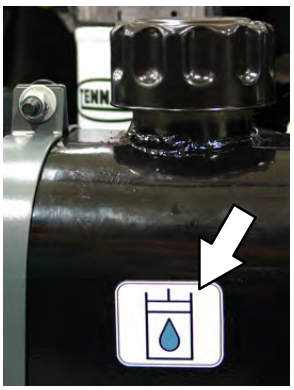
HYDRAULICS

Check the hydraulic fluid level at operating temperature daily. The hydraulic fluid level should be between the two lines on the hydraulic gauge. The hopper must be down when checking hydraulic fluid level.

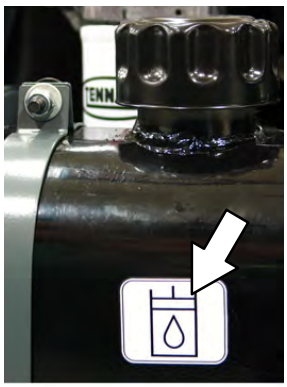


ATTENTION! Do not overfill the hydraulic fluid reservoir or operate the machine with a low level of hydraulic fluid in the reservoir. Damage to the machine hydraulic system may result.

Drain and refill the hydraulic fluid reservoir with new **Tennant*True*** premium hydraulic fluid after every 2400 hours of operation. Machines have a blue colored drop (left photo) on the hydraulic fluid label if originally equipped with **Tennant*True*** premium hydraulic fluid.

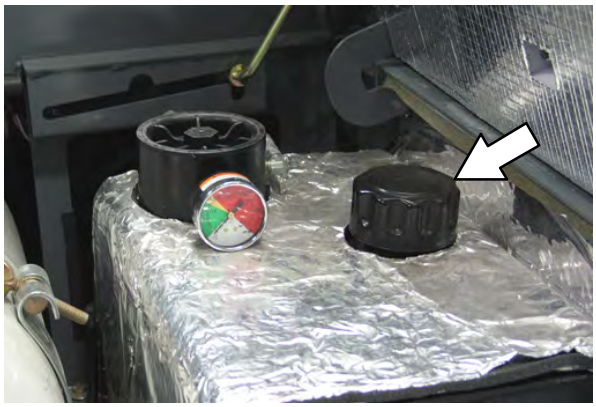


Tennant*True* Fluid



Previous Fluid

Replace the filler cap after every 800 hours of operation. Apply a light film of hydraulic fluid onto the filler cap gasket before installing the cap onto the reservoir.



Replace the hydraulic fluid filter after every 1200 hours of operation or if the hydraulic reservoir gauge is in the yellow/red zone when the reservoir hydraulic fluid is approximately 32° C (90° F).

Replace the hydraulic strainer outlet after every 2400 hours of operation.

HYDRAULIC FLUID

There are two fluids available for different temperature ranges:

Tennant*True* premium hydraulic fluid (Extended Life)			
Part number	Ambient temperature	ISO Grade	Capacity
1057710	above 7° C (45° F)	100	3.8 L (1 gal)
1057711	above 7° C (45° F)	100	19 L (5 gal)
1057707	below 7° C (45° F)	32	3.8 L (1 gal)
1057708	below 7° C (45° F)	32	19 L (5 gal)

If using a locally-available hydraulic fluid, be sure the specifications match Tennant hydraulic fluid specifications. Substitute fluids can cause premature failure of hydraulic components.

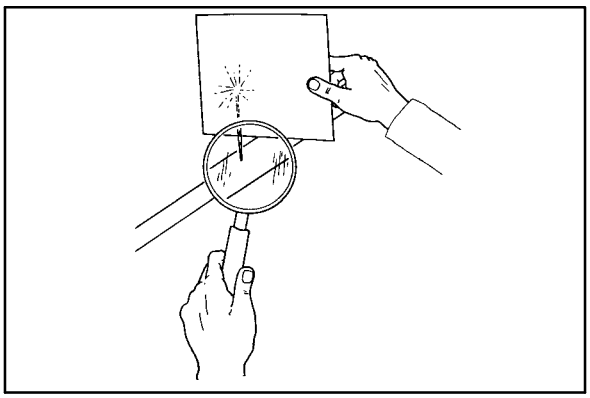
ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

HYDRAULIC HOSES

Check the hydraulic hoses after every 800 hours of operation for wear or damage.

FOR SAFETY: When servicing machine, use cardboard to locate leaking hydraulic fluid under pressure.

High pressure fluid escaping from a very small hole can almost be invisible, and can cause serious injuries.



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Consult a physician immediately if injury results from escaping hydraulic fluid. Serious infection or reaction can occur if proper medical treatment is not given immediately.

Contact a mechanic or supervisor if a leak is discovered.

ENGINE

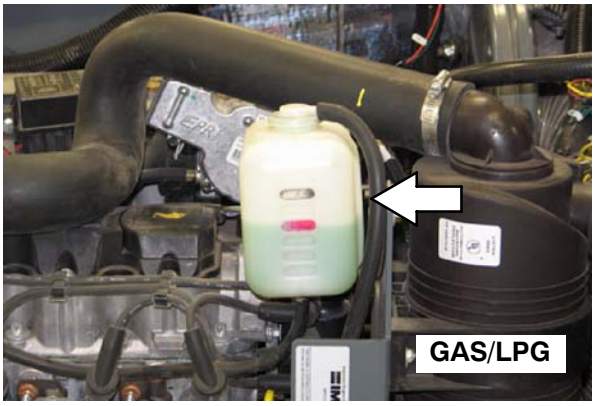
COOLING SYSTEM

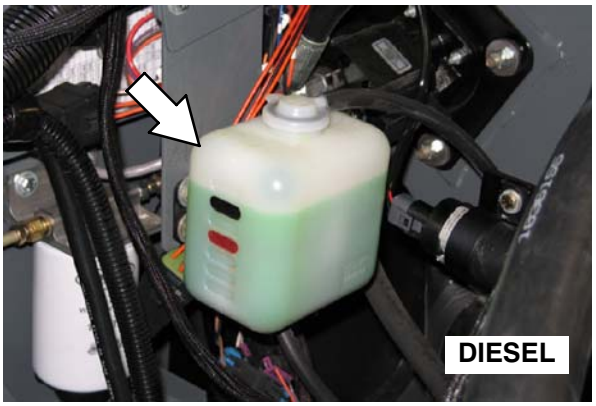
FOR SAFETY: When servicing machine, avoid contact with hot engine coolant.

Check the coolant level in the reservoir daily. The coolant level must be between the two indicator marks when the engine is cold. The cooling system must be completely filled with coolant to keep the engine from overheating.

FOR SAFETY: When servicing machine, do not remove cap from radiator when engine is hot. Allow engine to cool.

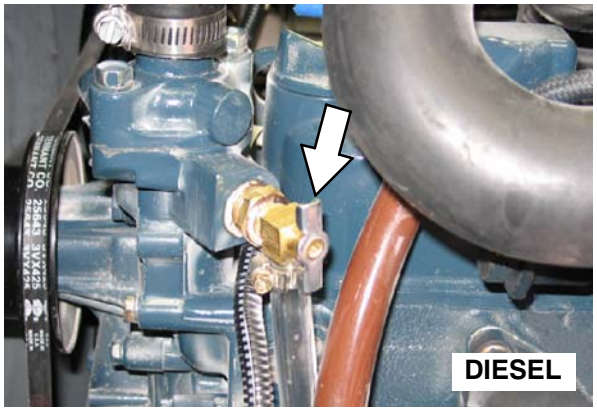
Check the coolant level in the radiator after every 100 hours of operation. Refer to the label on the coolant container for water/coolant mixing instructions.



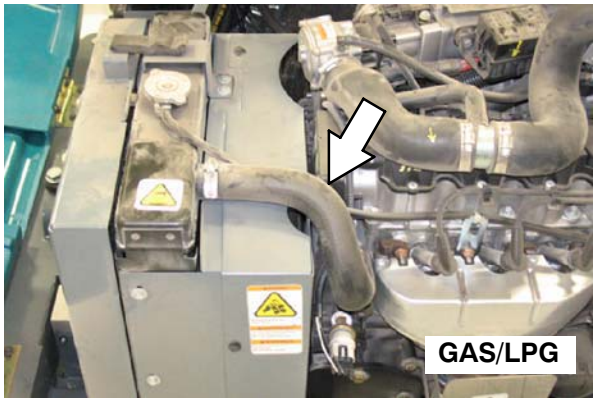


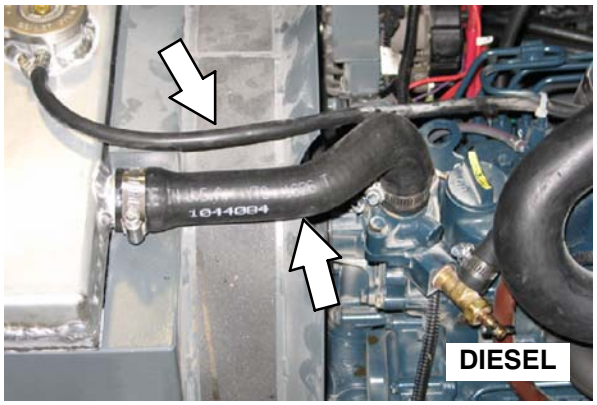
Flush the radiator and the cooling system after every 800 hours of operation.

When filling the cooling system on a diesel engine, open the drain cock to bleed the air from the system.

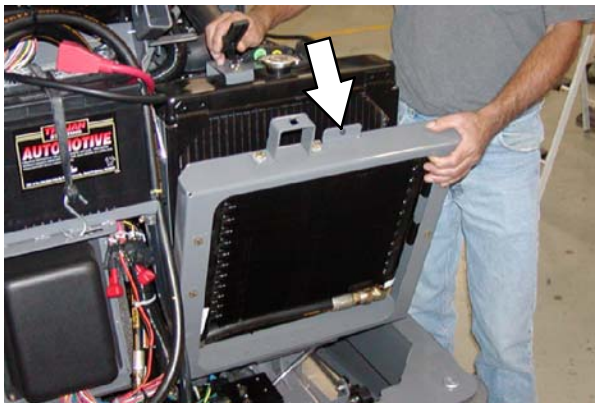


Check the radiator hoses and clamps after every 200 hours of operation. Tighten loose clamps. Replace damaged hoses and clamps.





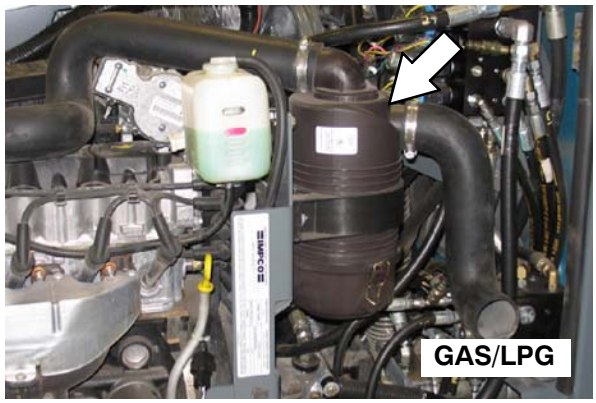
Check the radiator core exterior and hydraulic cooler fins for debris after every 100 hours of operation. Blow or rinse all dust through the grille and radiator fins, in the opposite direction of normal air flow. Be careful to not bend the cooling fins when cleaning. Clean thoroughly to prevent the fins from becoming encrusted with dust. To avoid cracking the radiator, allow the radiator and cooler fins to cool before cleaning.

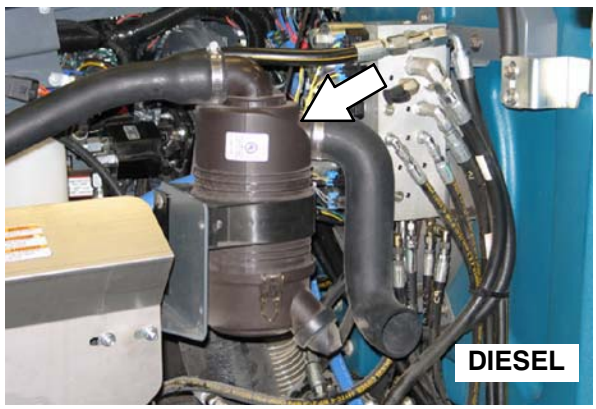


FOR SAFETY: When servicing machine, wear eye and ear protection when using pressurized air or water.

AIR FILTER

Replace the air filter after every 400 hours of operation.





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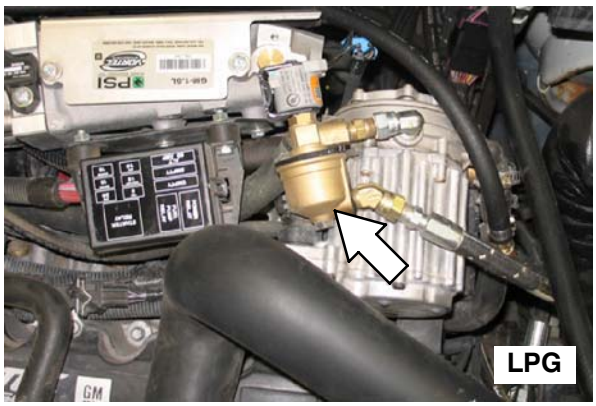
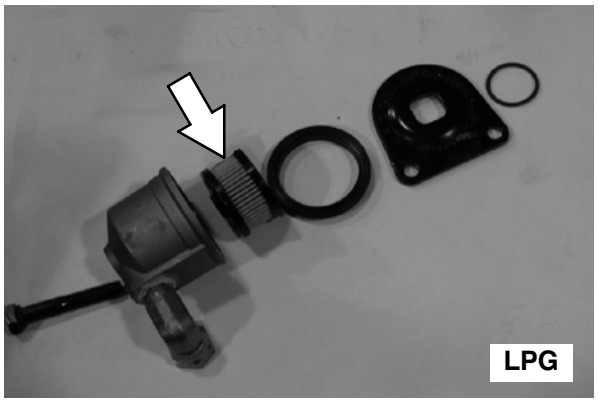
FUEL FILTER (LPG)

Replace the LPG fuel filter after every 400 hours of operation.

FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.



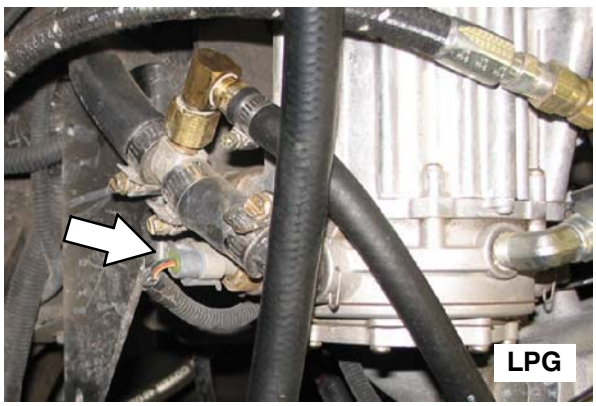
Disassemble the fuel lock off valve to access the LPG fuel filter.



ELECTRONIC PRESSURE REGULATOR (LPG)

Remove the sensor and drain the oil from the LPG electronic pressure regulator after every 100 hours of operation.

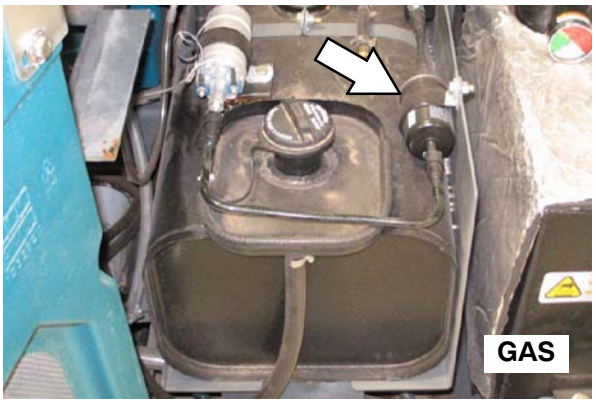
FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.



FUEL FILTER (Gasoline)

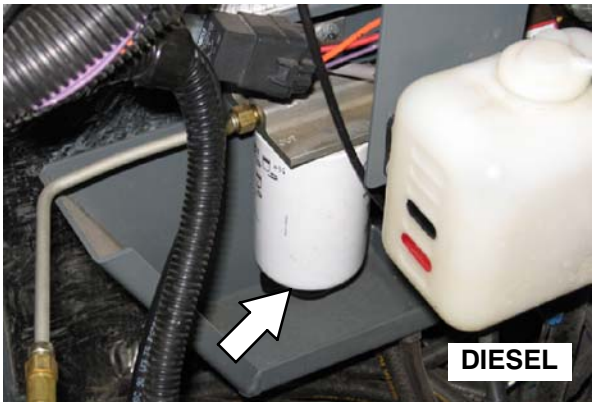
Replace the gasoline fuel filter after every 800 hours of operation.

FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.



FUEL FILTER (Diesel)

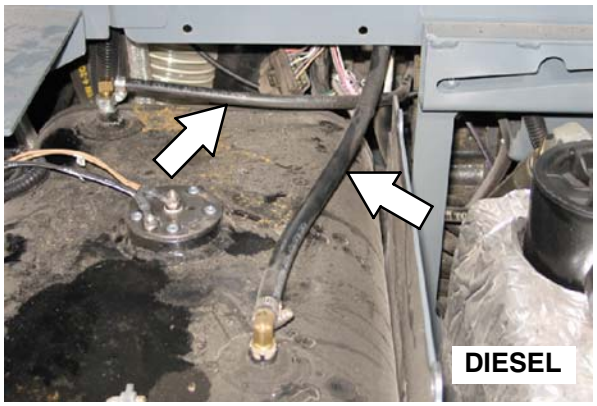
The fuel filter removed imputities from the fuel. Replace the fuel filter after every 400 hours of operation.



FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.

FUEL LINES (Diesel)

Check the fuel lines every 50 hours of operation. If the clamp band is loose, apply oil to the screw of the band and securely tighten the band.



The rubber fuel lines can become worn-out whether the engine has been used much or not. Replace the fuel lines and clamp bands every two years.

FOR SAFETY: When servicing machine, keep flames and sparks away from fuel system service area. Keep area well ventilated.

If the fuel lines and clamp bands are found worn or damaged before two years' time; replace or repair them at once. Bleed the fuel system after replacement of any fuel lines, see PRIMING THE FUEL SYSTEM. When the fuel lines are not installed, plug both ends with clean cloth or paper to prevent dirt from entering the lines. Dirt in the lines can cause fuel injection pump malfunction.

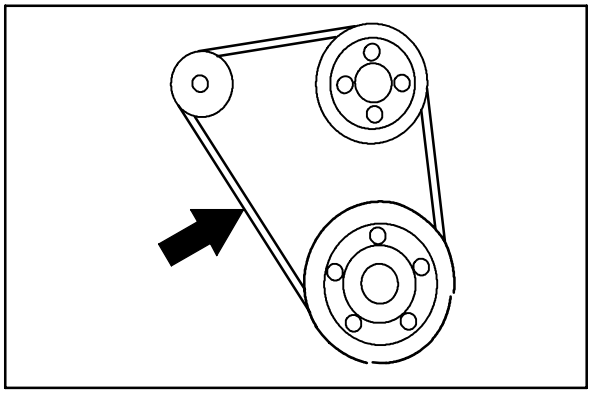
PRIMING THE FUEL SYSTEM (Diesel)

Typical diesel fuel systems require priming to remove pockets of air from the fuel lines and fuel components. This is usually required after running out of fuel, changing fuel filter elements or repairing a fuel system component. Air in the fuel prevents smooth engine operation.

This fuel system however is self-priming. The return line comes from the top of the injector that allows the air to escape through the return line.

ENGINE BELT

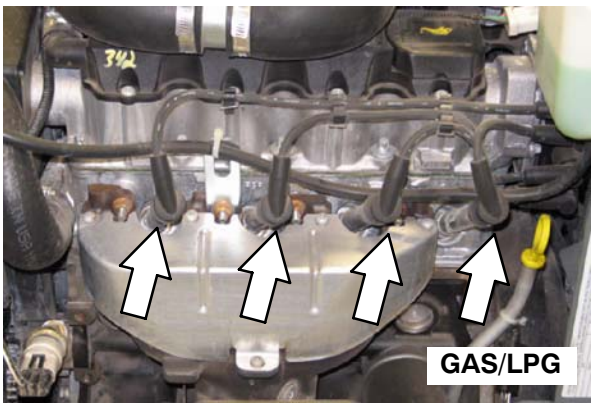
Check the belt tension after every 50 hours of operation. Adjust tension as necessary. Proper belt tension is 13 mm (0.50 in) from a force of 4 to 5 kg (8 to 10 lb) applied at the mid-point of the longest span.



WARNING: Moving belt and fan. Keep away.

SPARK PLUGS (Gas/LPG)

Clean or replace, and set the gap of the spark plugs after every 400 hours of operation. The proper spark plug gap is 1 mm (0.042 in).



TIMING BELT (Gas/LPG)

Check the timing belt after every 800 hours of operation.

Replace the timing belt after every 2000 hours of operation.

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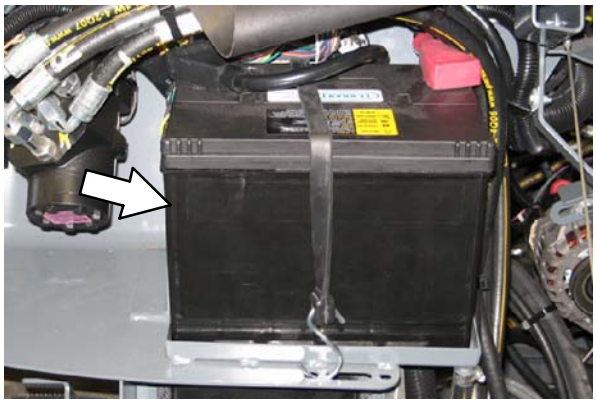
BATTERY

Clean and tighten the battery connections after the first 50 hours of operation and after every 800 hours after that. Do not remove the vent plugs from the battery or add water to the battery.

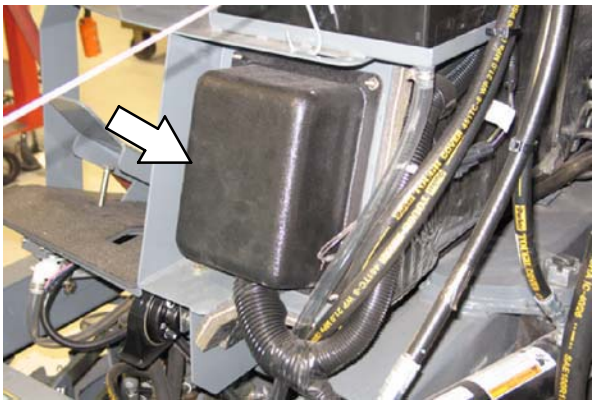


FOR SAFETY: When servicing machine, avoid contact with battery acid.

FUSES AND RELAYS

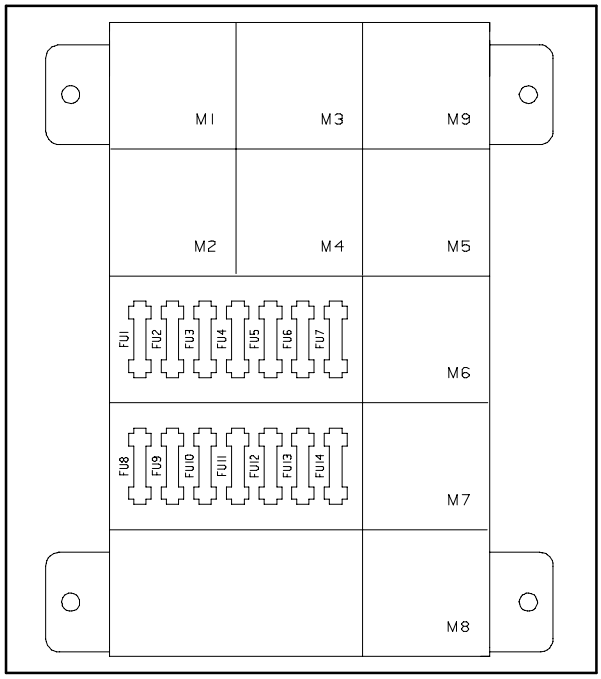
RELAY PANEL FUSES AND RELAYS

Fuses are one-time protection devices designed to protect the wire harness by stopping the flow of current in the event of a circuit overload. *Relays* switch the electrical power going to the machine electrical systems on/off. Remove the relay panel cover to access *fuses* and *relays*.



NOTE: Always replace a fuse with a fuse of the same amperage. Extra 15 Amp fuses are provided inside the relay panel drawer on the relay panel.

Refer to the diagram below for locations of the *fuses* and *relays* on the relay panel. The M10 relay for the optional spray nozzle is located behind the battery.



Refer to the table below for the *fuses* and circuits protected.

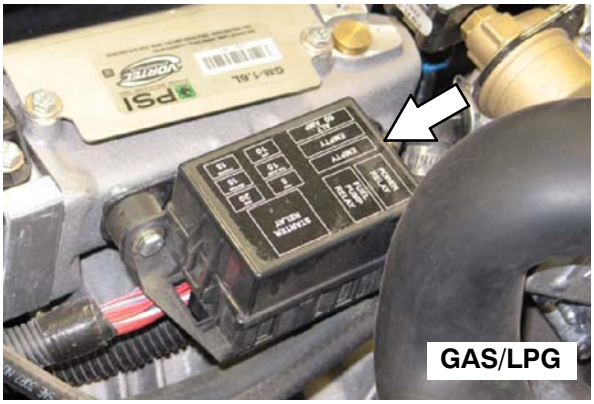
Fuse	Rating	Circuit Protected
FU1	15 A	Auxiliary Relays/Engine Controls
FU2	15 A	Shaker
FU3	15 A	Horn
FU4	15 A	Not Used
FU5	15 A	Scrub Vacuum/Main Brush/ Squeegee Down/Hopper Up
FU6	15 A	Enable/Side Brush/Sweep Vacuum
FU7	15 A	Solution/Hopper Latch and Door/ Auto Fill/Reverse/Shaker
FU8	15 A	ES/FaST/Detergent/ Hopper Down/Spray Wand
FU9	15 A	Lights
FU10	15 A	Unswitched B+ for controller board
FU11	15 A	Not Used: Options
FU12	15 A	Spray Nozzle Pump
FU13	15 A	AC/Heater Option
FU14	15 A	Not Used

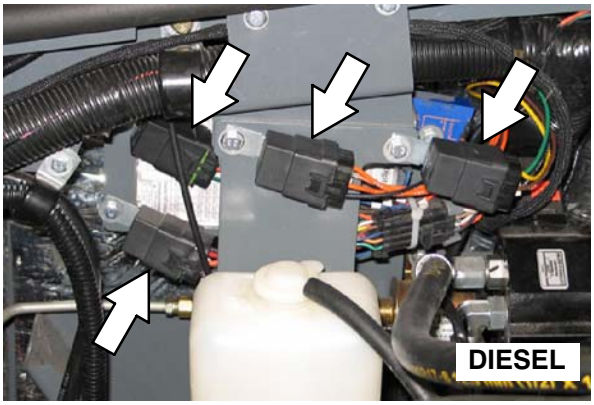
Refer to the table below for the *relays* and circuits controlled.

Relay	Rating	Circuit Controlled
M1	12 VDC, 40 A	Auxiliary 1
M2	12 VDC, 40 A	Auxiliary 2
M3	12 VDC, 40 A	Shaker
M4	12 VDC, 40 A	Reverse
M5	12 VDC, 40 A	Horn
M6	12 VDC, 40 A	Shutdown
M7	12 VDC, 40 A	Starter
M8	12 VDC, 40 A	Not Used
M9	12 VDC, 40 A	Not Used
M10	12 VDC. 40 A	Spray Wand (Separate Relay)

ENGINE HARNESS FUSES AND RELAYS

The *engine harness fuses* and *relays* are located inside the engine compartment.





NOTE: Always replace a fuse with a fuse of the same amperage.

M

CLEANING THE HOPPER DUST FILTER

Shake the dust filter before emptying the hopper and at the end of every shift. Inspect and clean the filter after every 20 hours of operation. Replace damaged dust filters.

NOTE: The dust filter may need to be cleaned at more frequent intervals if the machine is used in extremely dusty conditions.

Use one of the following methods to clean the dust filter:

SHAKING–Press the *filter shaker button*.

TAPPING–Tap the filter, with the dirty side down, gently on a flat surface. **Do not damage the edges of the filter.** The filter will not seal properly in the filter frame if the edges of the filter are damaged.

AIR–Always wear eye protection when using compressed air. Blow air through the dust filter opposite the direction of the arrows. Never use more than 690 kPa (100 psi) of air pressure and never hold the nozzle closer than 50 mm (2 in) to the filter. This may be done with the dust filter in the machine.

FOR SAFETY: When servicing machine, wear eye and ear protection when using pressurized air or water.

WATER–Rinse the dust filter with a low pressure garden hose through the dust filter opposite the direction of the arrows.

*NOTE: If water is used to clean the dust filter, be sure the filter is completely dry before reinstalling it into the hopper. **Do Not** reinstall a wet dust filter.*

THERMO-SENTRY

The Thermo–Sentry, located inside the hopper, senses the temperature of the air pulled up from the hopper. If there is a fire in the hopper, the Thermo–Sentry stops the vacuum fan and cuts off the air flow. The Thermo–Sentry automatically resets after cooling down.

MAIN BRUSHES

Check the main brushes daily for tangled wire or string, wear, and damage.

Replace the brushes if large portions of the bristles are missing or if the remaining bristles are 19 mm (0.75 in) or less in length.

Check the brush pattern and rotate the brushes from front to rear after every 50 hours of machine operation for maximum brush life and best scrubbing performance.

NOTE: Replace brushes in sets of two. Otherwise one scrub brush may scrub more aggressively than the other.

REPLACING OR ROTATING THE MAIN BRUSHES

The front brush can be accessed on the left side of the machine and rear brush can be accessed on the right side of the machine.

1. Raise the scrub head.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Open the outer brush doors.

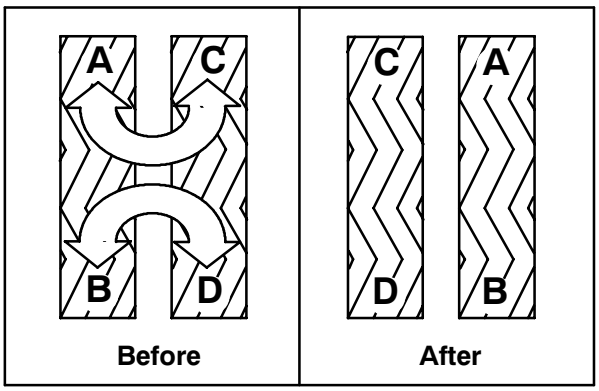
3. Open the inner brush doors.

4. Remove the brush idler plates.

5. Pull the brushes out from the scrub head.

6. Install the new or rotated brushes by pushing down on the ends while sliding them onto the drive motor hubs.

7. If rotating the existing brushes, only rotate front to rear. Do NOT rotate end-for-end.



8. Reinstall the brush idler plates.

9. Close the inner and outer brush doors.

10. Check and adjust the brush pattern if needed. Refer to *CHECKING THE MAIN BRUSH PATTERN*.

M

CHECKING THE MAIN BRUSH PATTERN

1. Apply chalk, or a similar marking material, to a smooth and level section of the floor.

NOTE: If chalk or other material is not available, allow the brush to spin on the floor for two minutes. A polish mark will remain on the floor.

2. Raise the scrub head, then position the brushes over the chalked area.

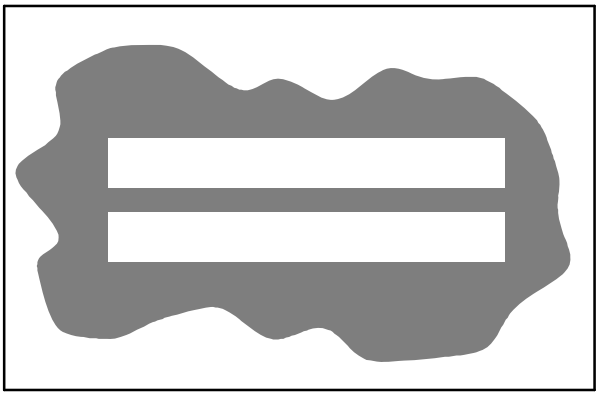
3. Set the parking brake.

4. Press the *1-STEP Sweep button* to lower the scrub head. Set the brush pressure to the lowest setting and allow the brushes to operate for 15 to 20 seconds. Keep the scrub head in one spot in the chalked area.

5. Raise the scrub head, release the parking brake, and drive the machine away from the chalked area.

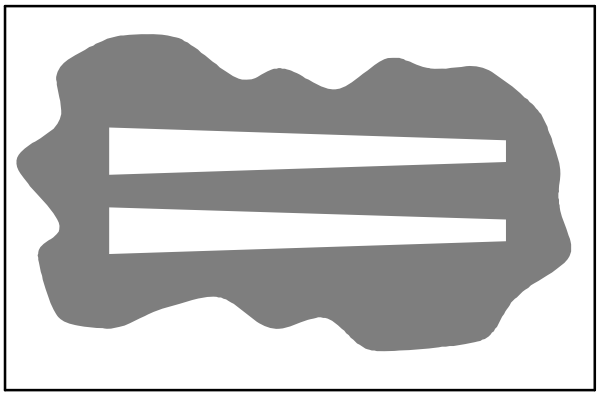
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

6. Observe the brush patterns. If the brush pattern is the same width across the entire length of each brush and both brushes are the same width, no adjustment is necessary.



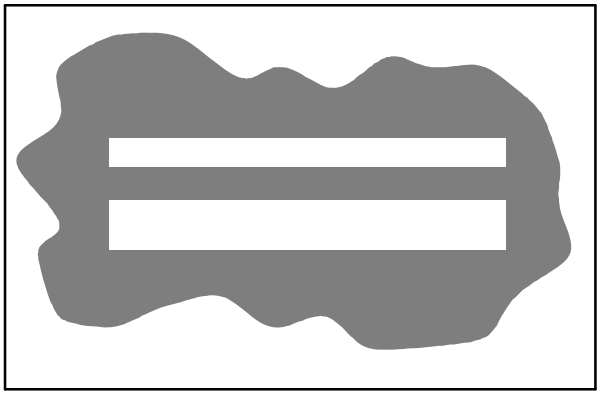
10355

7. If the brush patterns are tapered, see *ADJUSTING THE MAIN BRUSH TAPER* section of this manual.



10652

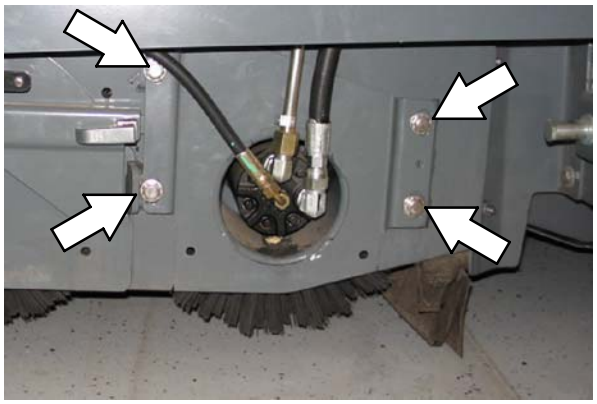
8. The brush patterns should be 75 to 130 mm (3 to 5 in) wide with the brushes in the lowered position and both patterns should be the same width. If the width of the brushes is not the same, see *ADJUSTING THE MAIN BRUSH WIDTH* section of this manual.



10653

ADJUSTING THE MAIN BRUSH TAPER

1. Loosen the four mounting bolts on the brush drive housing.



2. Move the brush drive housing up to decrease the pattern width on that side of the scrub head or down to increase the pattern width on that side of the scrub head.
3. Tighten the mounting bolts.
4. Recheck the pattern. Readjust if necessary.

ADJUSTING THE MAIN BRUSH WIDTH

1. Adjust the length of the drag links on both sides of the scrub head. Lengthen the drag links to increase the rear brush pattern width. Shorten the drag links to increase the front brush pattern. Always adjust the nut on each drag link an equal number of turns.

NOTE: Two full turns of the drag link adjustment bolt will change the brush pattern approximately 25 mm (1 in).

2. Recheck the pattern. Readjust if necessary.

SIDE BRUSH (OPTION)

Check the side brush daily for wear or damage. Remove any tangled string or wire from the side brush or side brush drive hub.

REPLACING THE SIDE BRUSH

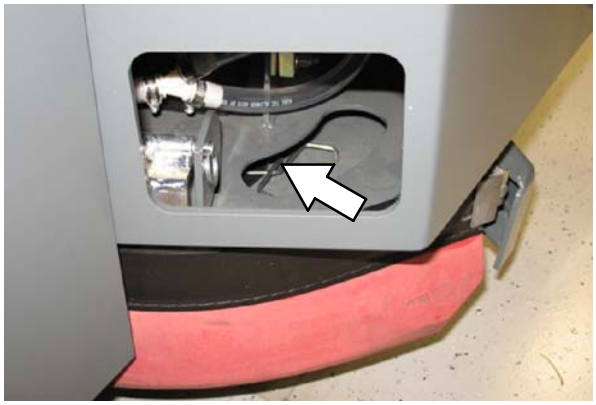
Replace the side brush when it no longer cleans effectively or when the remaining bristles are 19 mm (0.75 in) or less in length for the scrub brush or 64 mm (2.5 in) or less in length for the sweep brush. The side brush may be changed sooner if sweeping light litter. The bristles may be worn shorter if sweeping heavy debris.

1. If necessary, raise the side brush.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Turn the brush until the spring handles are visible through the access hole in the side brush assembly.

3. Squeeze the spring handles and let the side brush drop to the floor.



4. Remove the side brush from underneath the side brush assembly.

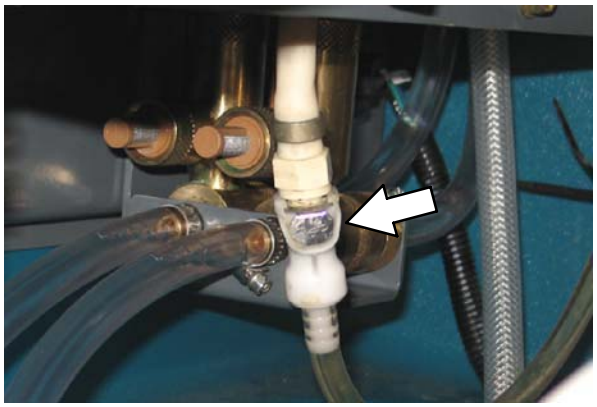
5. Place the new side brush underneath the side brush assembly and lift the side brush up onto the side brush hub until the brush locks onto the hub.

FaST SYSTEM

REPLACING THE FaST-PAK CARTON

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

1. Open the side access door.
2. Slide the seat completely forward.
3. Squeeze the button on the FaST supply hose connector, then pull the empty FaST-PAK carton out from the compartment and discard.



4. Remove the perforated knock outs from the new FaST-PAK carton. Do Not remove the bag from the carton. Pull out the hose connector located on the bottom of the bag and remove the hose cap from the connector.

NOTE: The FaST-PAK Floor Cleaning Concentrate is specially designed for use with the FaST system scrubbing application. NEVER use a substitute. Other cleaning solutions may cause FaST system failure.

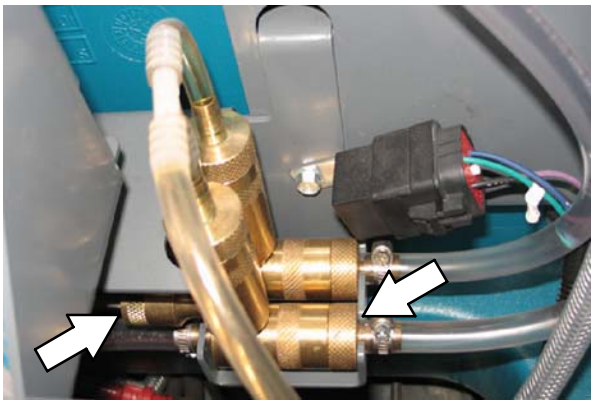
5. Slide the FaST-PAK carton into the FaST-PAK bracket.
6. Connect the FaST supply hose to the FaST-PAK hose connector.
7. Scrub with the FaST system for a few minutes to allow the detergent to reach maximum foaming.

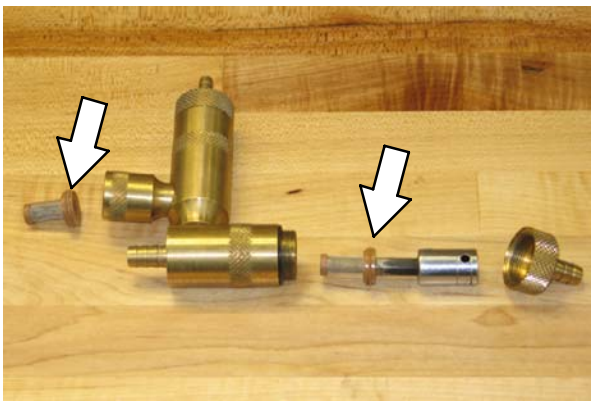
CLEANING THE FaST SUPPLY HOSE CONNECTOR

Soak the connector in warm water if detergent buildup is visible. When a FaST-PAK carton is not installed, store the supply hose connector on the storing plug to prevent the hose from clogging.

REPLACING THE FaST SYSTEM FILTERS

Replace the FaST system filters after every 1000 hours of operation. Empty the solution tank before replacing the filters.





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SQUEEGEE BLADES

Check the squeegee blades for damage and wear daily. When the blades become worn, rotate the blades end-for-end or top-to-bottom to a new wiping edge. Replace blades when all edges are worn.

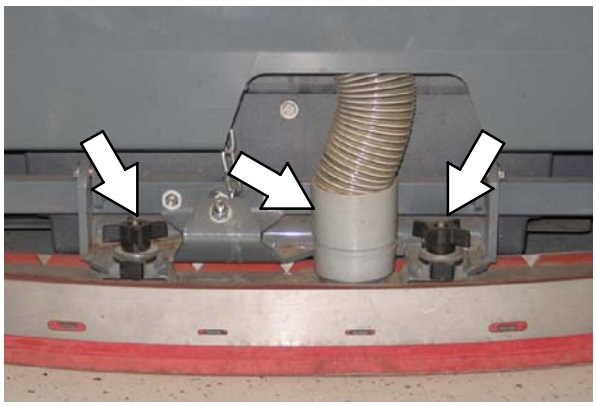
Check the deflection of the squeegee blades daily or when scrubbing a different type of surface. Check the leveling of the rear squeegee every 100 hours of operation.

REPLACING (OR ROTATING) THE REAR SQUEEGEE BLADES

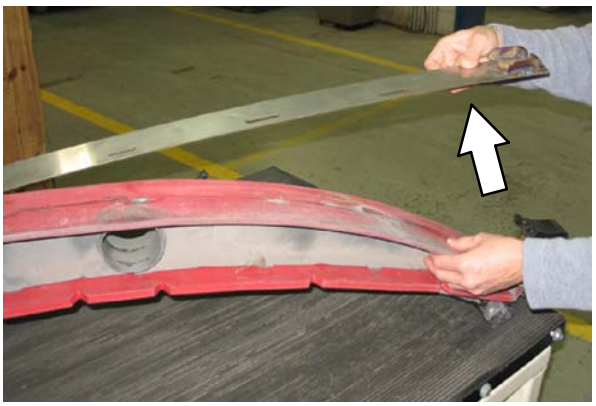
1. Lower the scrub head.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

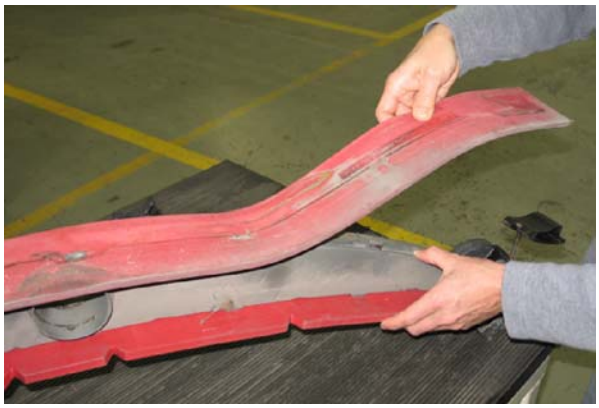
2. Disconnect the vacuum hose from the rear squeegee assembly.



3. Remove both mounting knobs from the rear squeegee assembly.
4. Turn on the machine, raise the scrub head, and turn off the machine.
5. Remove the rear squeegee assembly from the machine.
6. Loosen the rear retaining band tension latch and open the retaining band.



7. Remove the rear squeegee.



8. Install the new rear squeegee blade or rotate the existing blade to the new edge. Be sure all the holes in the squeegee blade are hooked onto the tabs.

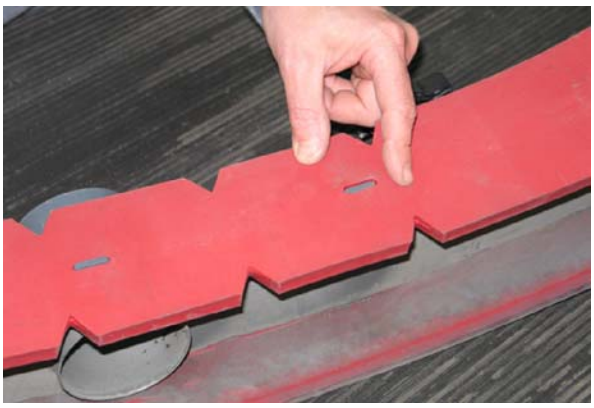
9. Reinstall the rear retaining band aligning the tabs with the holes.

10. Tighten the rear retaining band tension latch.

11. Loosen the front retaining band tension latch and open the retaining band.

12. Remove the front squeegee.

13. Install the new front squeegee blade or rotate the existing blade to the new edge. Be sure the holes in the squeegee blade are hooked onto the tabs.



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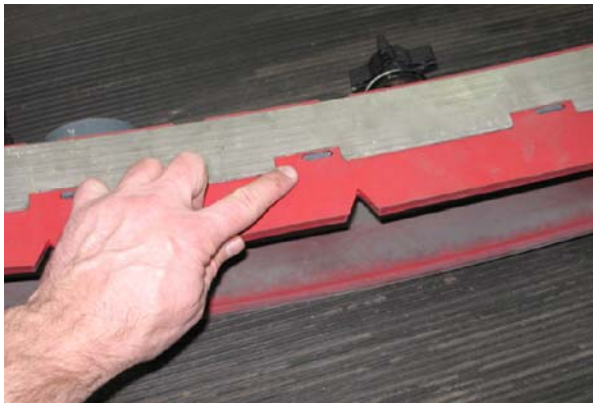
14. Reinstall the front retaining band aligning the tabs with the notches.



15. Tighten the front retaining band tension latch.

16. Reinstall the rear squeegee assembly onto the machine.

17. Check and adjust the rear squeegee if necessary. Refer to *ADJUSTING THE REAR SQUEEGEE BLADE DEFLECTION* and *LEVELING THE REAR SQUEEGEE* sections of this manual.

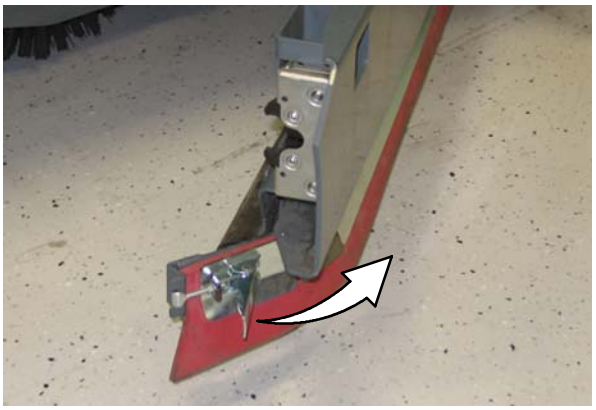
REPLACING OR ROTATING THE SIDE SQUEEGEE BLADES

1. If necessary, raise the scrub head.

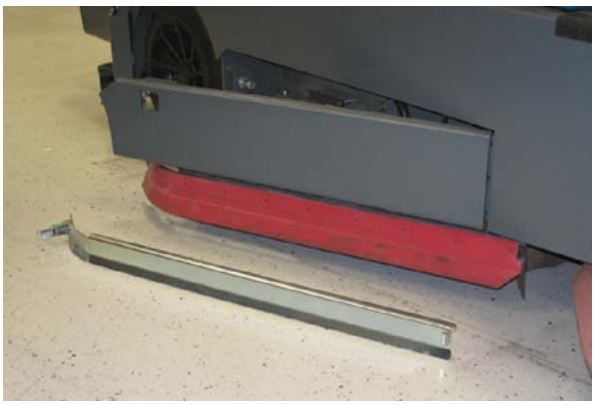
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Open the outer brush doors.

3. Unhook the latch on the side squeegee retaining band from the side squeegee assembly.



4. Remove the retaining band from the side squeegee assembly.

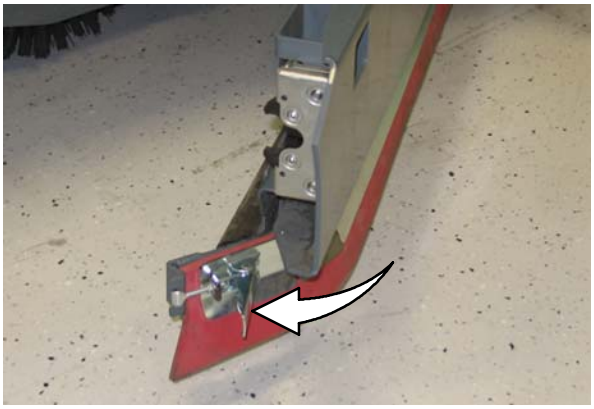


5. Remove the side squeegee blade. If the outer edge of the squeegee blade is not worn, rotate the squeegee blade with the blade from the other side of the machine. Discard the squeegee blade if both edges are worn.

6. Install the new or rotated squeegee blades.

7. Reattach the side squeegee retaining band to the side squeegee assembly.

8. Hook the latch on the side squeegee retaining band.



9. Close the outer brush door.

REPLACING THE SIDE BRUSH SQUEEGEE BLADE (OPTION)

Check the side brush squeegee blade for damage and wear daily. Replace the blade if the leading edge is torn or worn half-way through the thickness of the blade.

1. If necessary, raise the scrub head.

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Pull the pin from the squeegee bumper and open the squeegee bumper.

M

3. Remove the clevis pin and squeegee retainer.

4. Pull the squeegee out from the side brush assembly.

5. Slide the new squeegee into the side brush assembly.

6. Reinstall the squeegee retainer and clevis pin.

7. Close the squeegee bumper and reinsert the pin.

LEVELING THE REAR SQUEEGEE

Leveling the squeegee assures the entire length of the squeegee blade is in even contact with the surface being scrubbed. Perform this adjustment on an even and level floor.

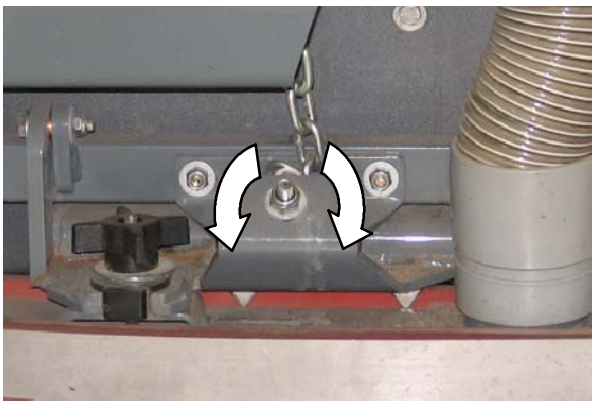
1. Lower the squeegee and drive the machine forward a few meters (feet).

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Look at the deflection of the squeegee over the full length of the squeegee blade.

3. If the deflection is not the same over the full length of the blade, turn the squeegee levelling nut to make adjustments.

   DO NOT *disconnect the suction hose from the squeegee frame when leveling squeegee.*



4. Turn the squeegee leveling nut counter-clockwise to decrease the deflection at the ends of the squeegee blade.

   Turn the squeegee leveling nut clockwise to increase the deflection at the ends of the squeegee blade.

5. Drive the machine forward with the squeegee down to recheck the squeegee blade deflection if adjustments were made.

6. Readjust the squeegee blade deflection if necessary.

ADJUSTING THE REAR SQUEEGEE BLADE DEFLECTION

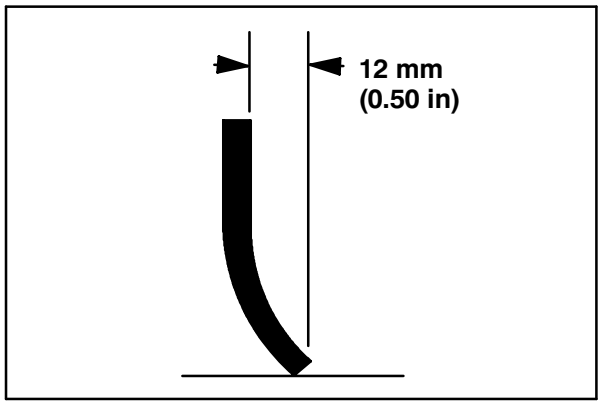
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

NOTE: Make sure the squeegee is level before adjusting the deflection. See LEVELING THE REAR SQUEEGEE.

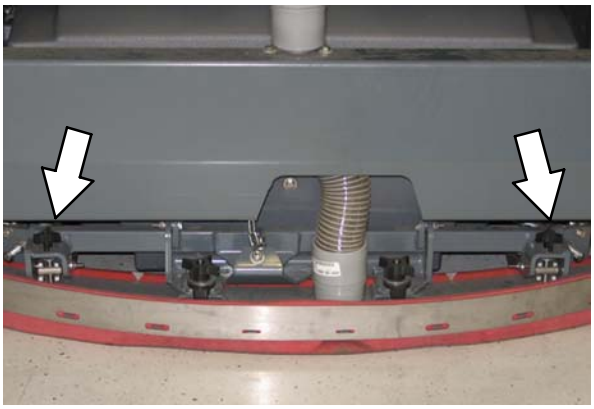
1. Lower the squeegee and drive the machine forward a few meters (feet).

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

2. Look at the amount of deflection or “curl” of the squeegee blade. The correct amount of deflection is 12 mm (0.50 in) for scrubbing smooth floors and 15 mm (0.62 in) for rough floors.



3. To adjust the overall squeegee blade deflection, turn the adjustment knobs counterclockwise to increase deflection or clockwise to decrease deflection.



4. Drive the machine forward again to recheck the squeegee blade deflection after adjustments are made.

5. Readjust the squeegee blade deflection if necessary.

M

SKIRTS AND SEALS

SCRUB HEAD SKIRT

Check the skirt for damage and wear after every 100 hours of operation.

The skirts should be between 0 to 6 mm (0 to 0.25 in) from the floor when the scrub head is down.

RECOVERY TANK SEAL

Check the recovery tank cover seal for damage and wear daily.

SOLUTION TANK SEALS

Check each solution tank cover seal for damage and wear daily.

BRAKES AND TIRES

BRAKES

The mechanical brakes are located on the rear wheels. The brakes are operated by the foot brake pedal and connecting cables.

Check the brake adjustment after every 200 hours of operation.

PARKING BRAKE

The parking brake is set with the parking brake pedal that activates the brakes.

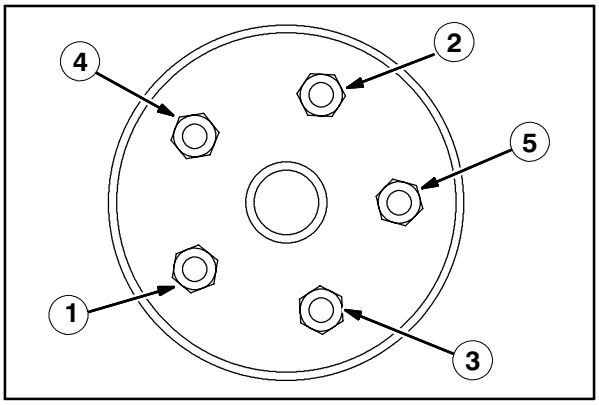
Check the parking brake adjustment after every 200 hours of operation.

TIRES

Check tires for damage and wear after every 100 hours of operation.

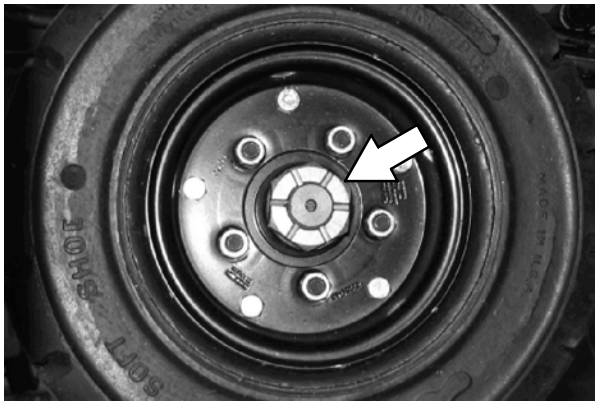
FRONT WHEEL

Torque the front wheel nuts twice in the pattern shown to 122 to 149 Nm (90 to 110 ft lb) after the first 50 hours of operation, and after every 800 hours there after.



PROPELLING MOTOR

Torque the shaft nut to 508 Nm (375 ft lb) lubricated, 644 Nm (475 ft lb) dry, after every 800 hours of operation.



M

PUSHING, TOWING, AND TRANSPORTING THE MACHINE

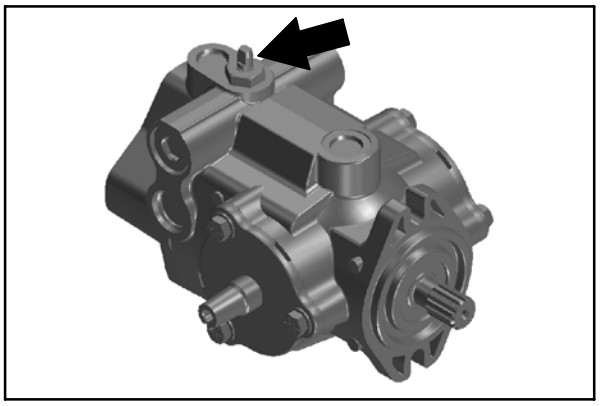
PUSHING OR TOWING THE MACHINE

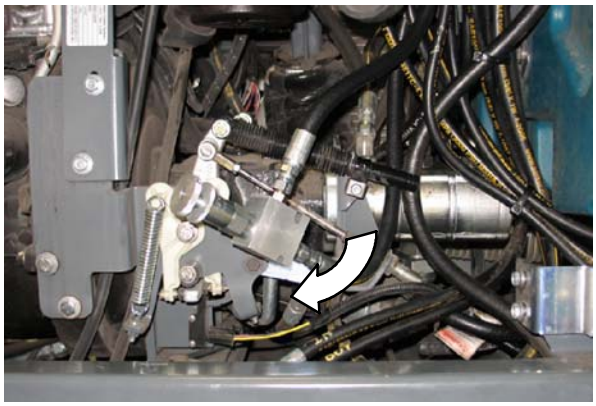
If the machine becomes disabled, it can be pushed from the front or rear, but only towed from the front.

The propelling pump has a bypass valve to prevent damage to the hydraulic system when the machine is being pushed or towed. This valve allows a disabled machine to be moved for a *very short distance* and at a speed to not exceed 1.6 kp/h (1 mph). The machine is NOT intended to be pushed or towed a long distance or at a high speed.

ATTENTION! Do not push or tow machine for a long distance or damage may occur to the propelling system.

Turn the bypass valve located on the bottom of the propelling pump 90° (either direction) from the normal position before pushing or towing the machine. Return the bypass valve back to the normal position when through pushing or towing the machine. **Do Not** use the bypass valve during normal machine operation.





TRANSPORTING THE MACHINE

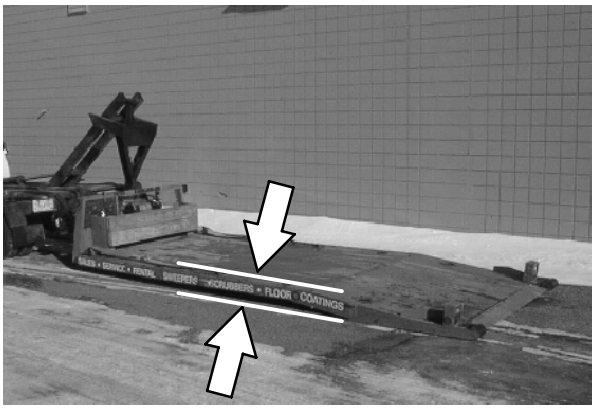
1. Raise the squeegee, scrub head, and brushes. If necessary, raise the hopper for additional ramp clearance.

NOTE: Empty the hopper, the recovery tank, and the solution tank before transporting.

2. Position the rear of the machine at the loading edge of the truck or trailer.

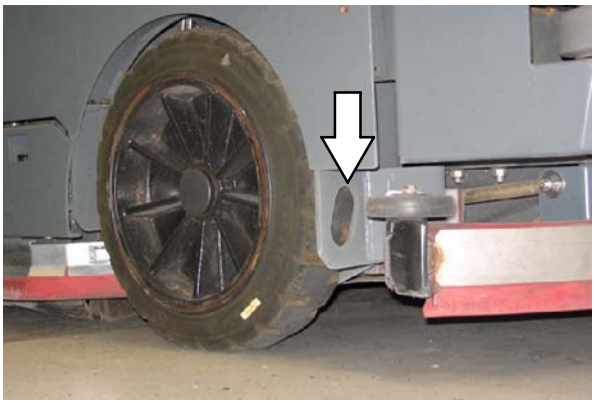
3. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to load machine.

   If the loading surface is horizontal and 380 mm (15 in) or less from the ground, the machine may be driven onto the truck or trailer.



FOR SAFETY: When loading machine onto truck or trailer, use winch. Do not drive the machine onto the truck or trailer unless the loading surface is horizontal AND is 380 mm (15 in) or less from the ground.

4. To winch the machine onto the truck or trailer, attach the winching chains to the holes in the rear jacking brackets behind the rear tires.

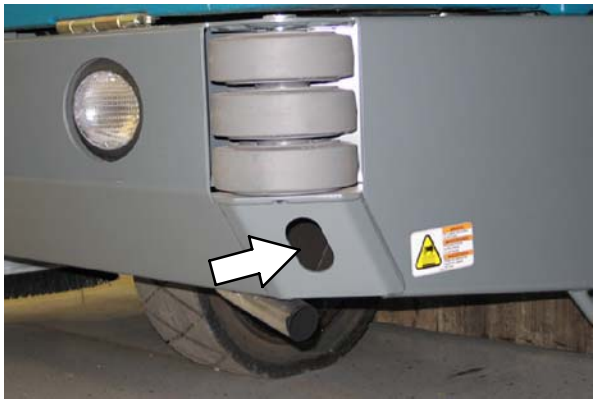


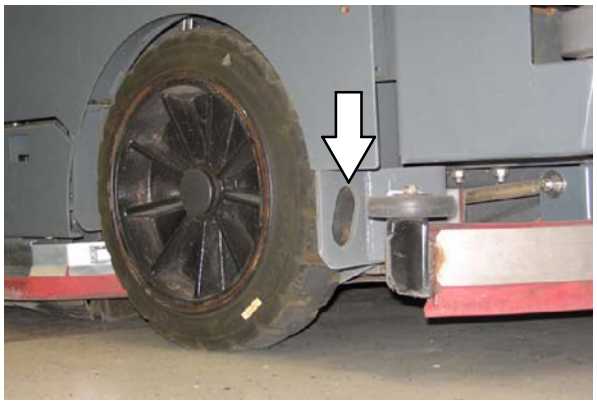
5. Position the machine as close to the front of the trailer or truck as possible.

6. Set the parking brake and place a block behind each wheel to prevent the machine from rolling.

7. Lower the scrub head.

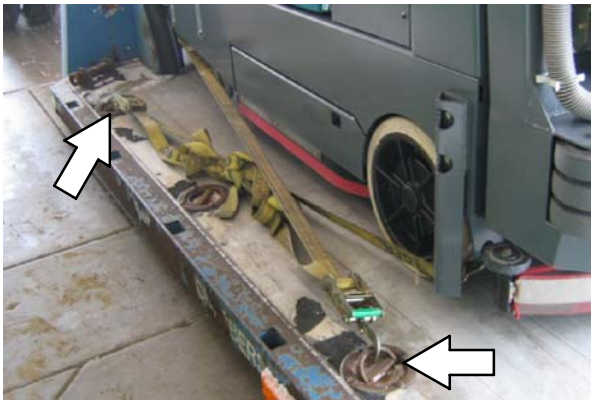
8. Connect the tie-down straps to the holes in the right and left lower corners in front of the machine and the holes in the rear jacking brackets behind the rear tires.





9. Route the tie-downs to the opposite ends of the machine and hook them to the brackets on the floor of the trailer or truck. Tighten the tie-down straps.

NOTE: It may be necessary to install tie-down brackets to the floor of the trailer or truck.



10. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to unload machine.

    If the loading surface is horizontal AND is 380 mm (15 in) or less from the ground, the machine may be driven off the truck or trailer.

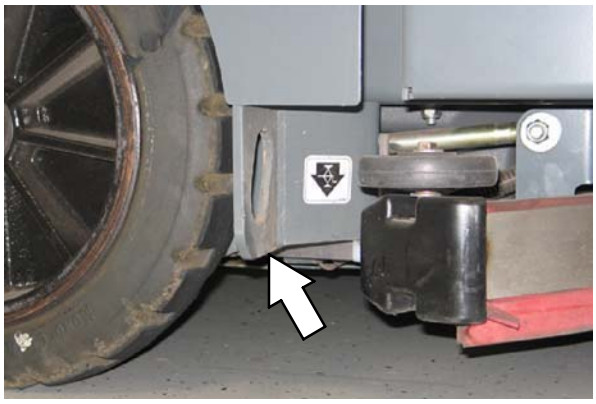
FOR SAFETY: When unloading machine off truck or trailer, use winch. Do not drive the machine off the truck or trailer unless the loading surface is horizontal AND 380 mm (15 in) or less from the ground.

M

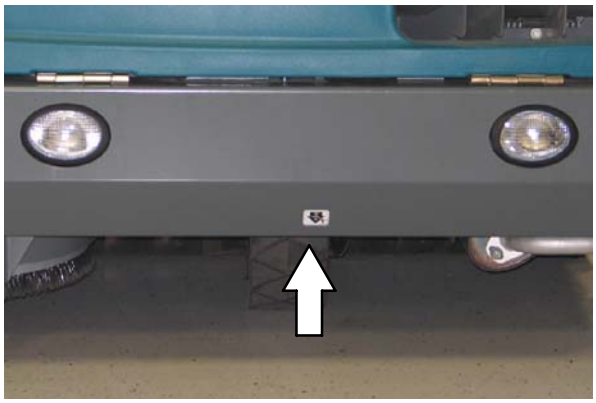
MACHINE JACKING

Empty the hopper, recovery tank, and solution tank before jacking up the machine. Jack up the machine at the designated locations. Use a hoist or jack capable of supporting the weight of the machine. Use jackstands to support the machine. Always stop the machine on a flat, level surface and block the tires before jacking up the machine.

Rear jacking locations are located directly behind the rear tires on each side of the machine.



Front jacking locations are located on the frame directly in front of the front tire.



FOR SAFETY: Before leaving or servicing machine, stop on level surface.

FOR SAFETY: When servicing machine, block machine tires before jacking machine up. Use a hoist or jack that will support the weight of the machine. Jack machine up at designated locations only. Support machine with jack stands.

STORAGE INFORMATION

The following steps should be taken prior to storing the machine for extended periods.

1. Drain and clean the solution and recovery tanks. Open the recovery tank and solution tank covers to allow the air to circulate.
2. Park the machine in a cool, dry area. Do not expose the machine to rain. Store indoors.
3. Remove the battery, or charge battery every three months.

FREEZE PROTECTION

FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

1. Be sure the solution tank and recovery tank are empty.
2. Pour 3.8 L (1 gal) of RV antifreeze into the solution tank.
3. Turn the key to the on position **(without starting the machine)**.
4. Press the *1-STEP Scrub button*.
5. Repeatedly press the *Solution increase button (+)* until the solution flow is at the highest setting.
6. Press the *directional pedal* to circulate the RV antifreeze completely through the system.
7. Press the *1-STEP Scrub button* again to turn off the system and turn the key to the off position.
8. If equipped with a spray nozzle, turn on pump until RV antifreeze solution sprays from the nozzle.
9. The remaining RV antifreeze does not need to be drained from the solution tank.

NOTE: Storing or transporting machines equipped with the ES or the FaST system in freezing temperatures requires special procedures. Consult a TENNANT representative for more information.

ELECTRICAL

Troubleshooting Information

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

* Always use an ESD (Electrostatic Discharge) strap when working near the Control Board

* Be cautious when working near Control Board – ***Battery voltage is always present, even with Key OFF***

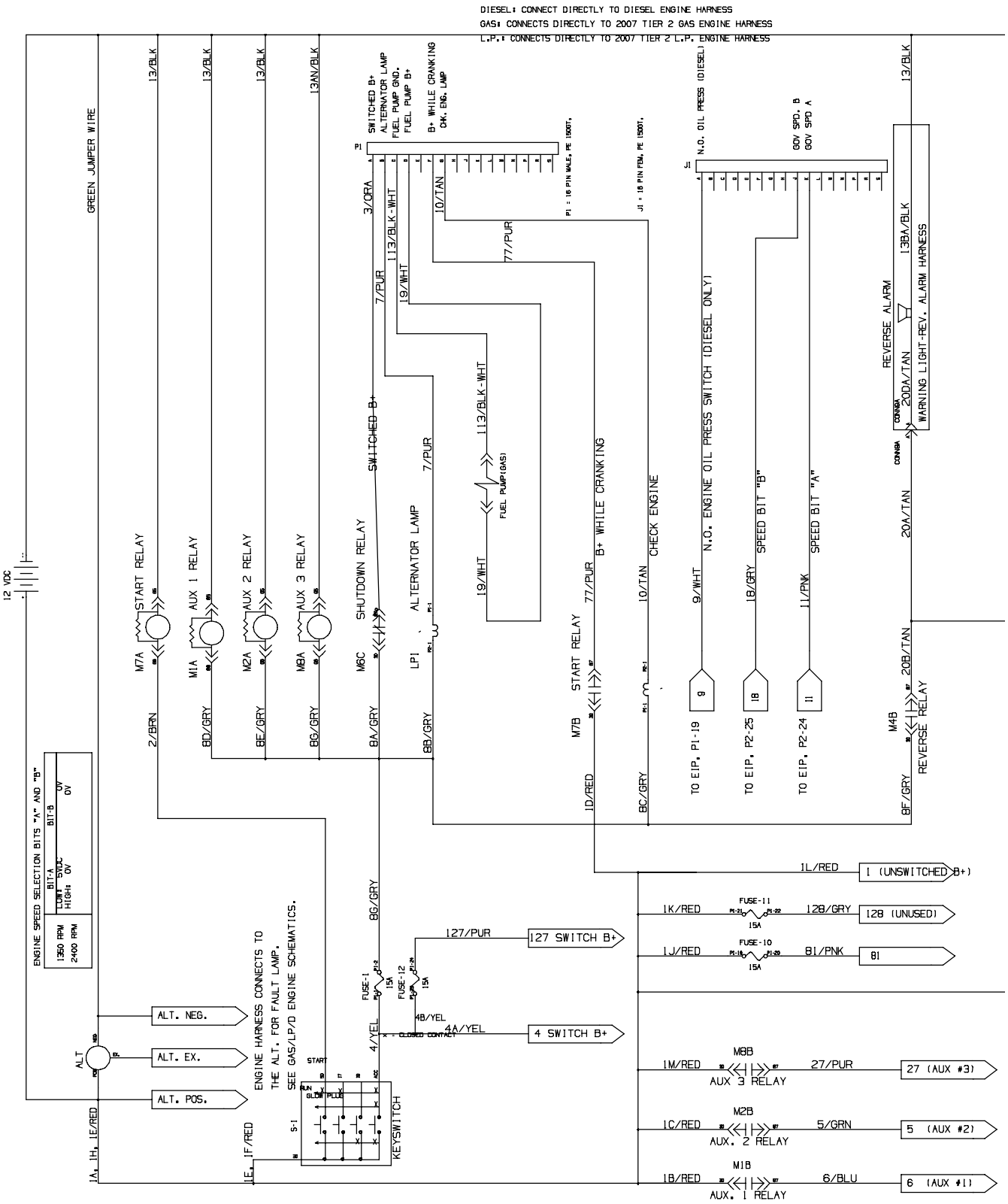
* Always unhook Battery when removing or replacing components

DURING TESTS:

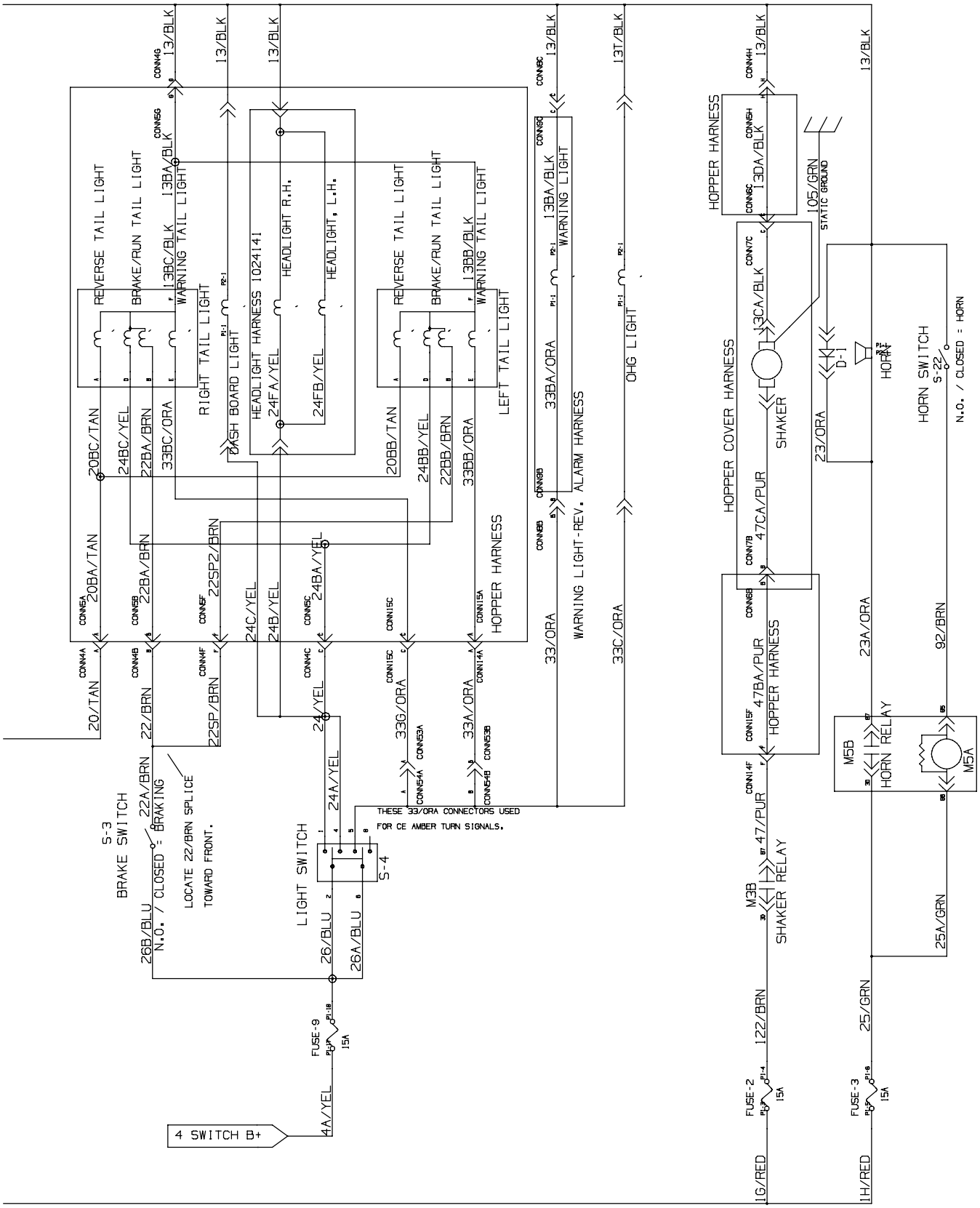
* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

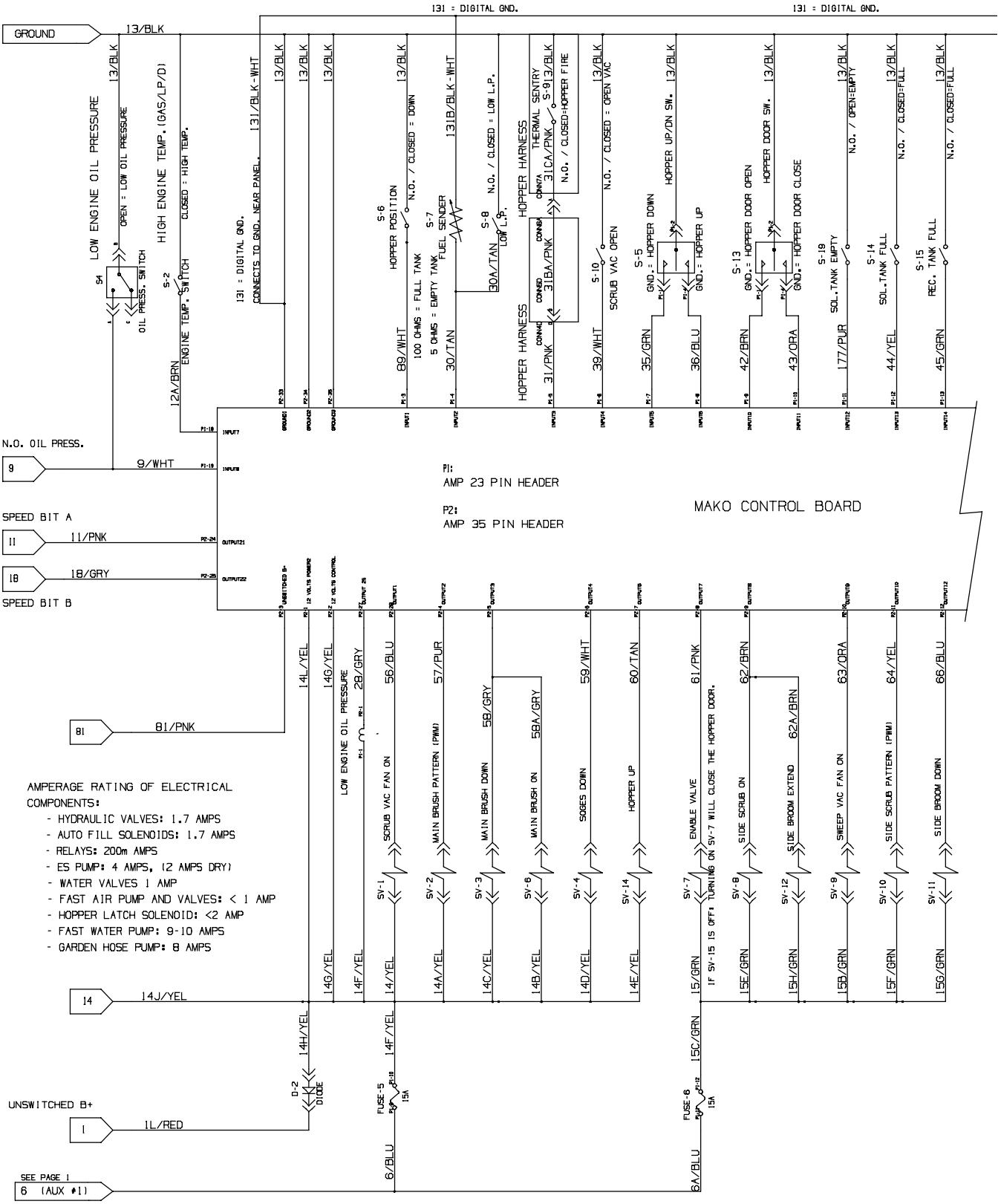
Electrical Schematic (1 of 8)



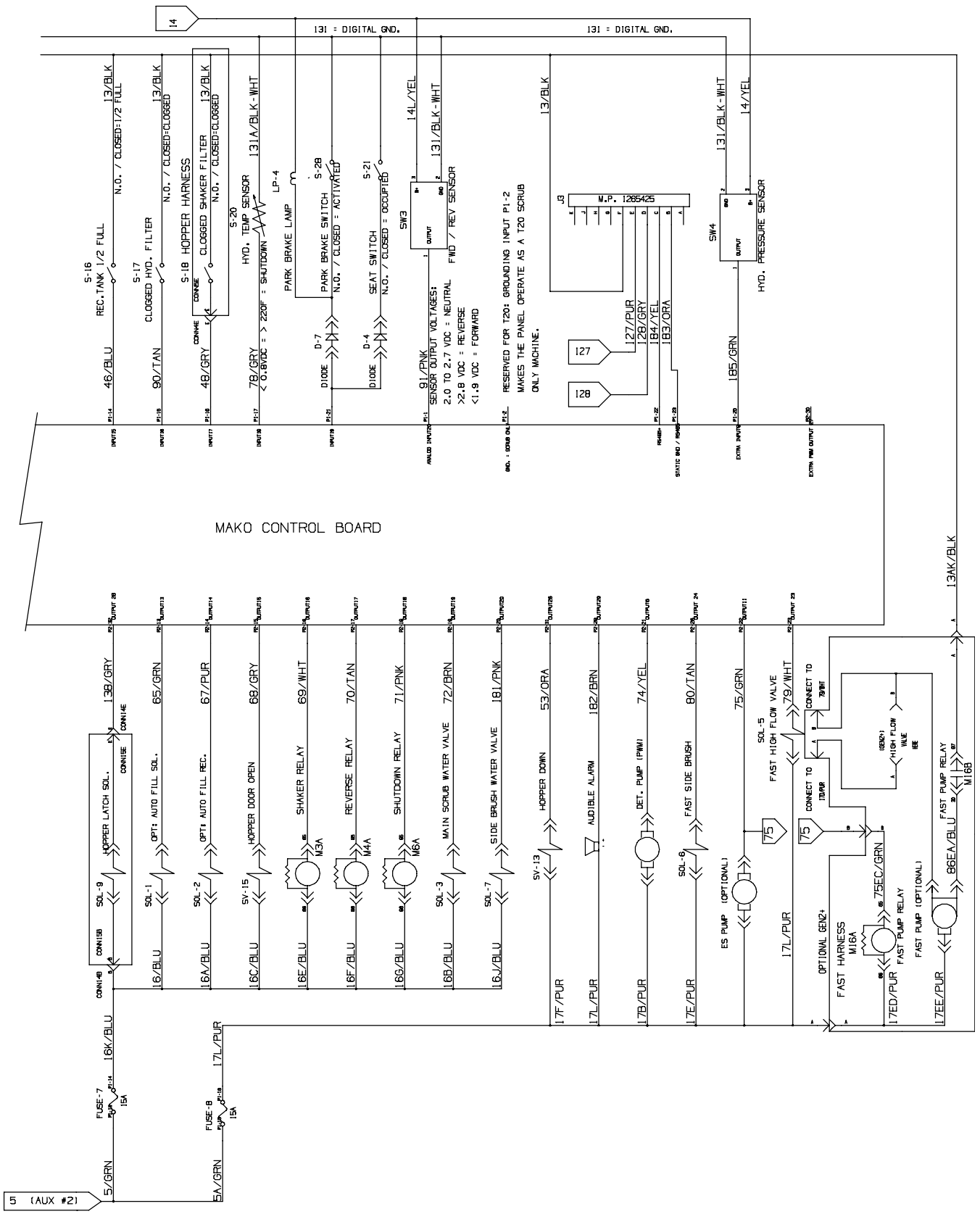
Electrical Schematic (2 of 8)



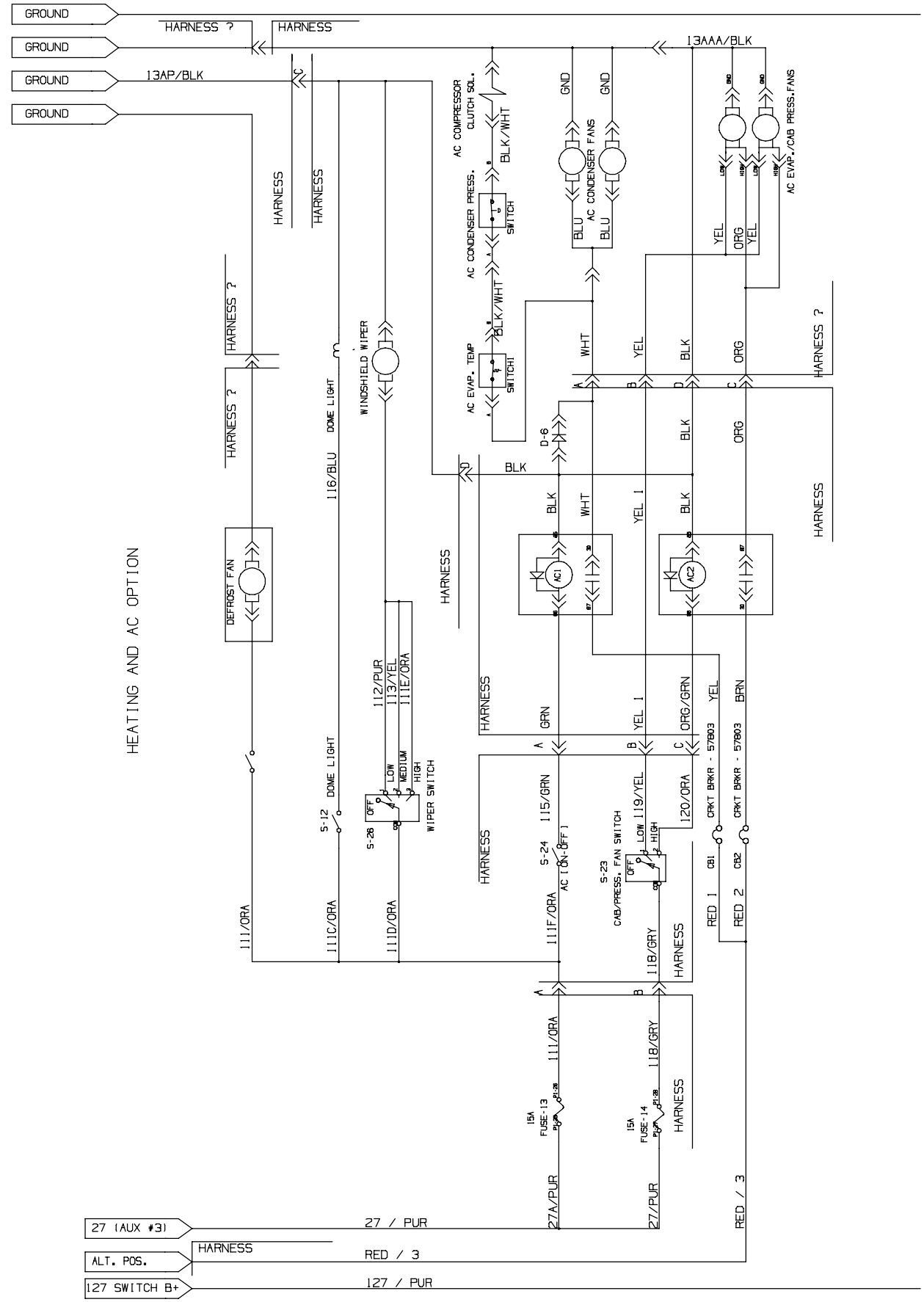
Electrical Schematic (3 of 8)



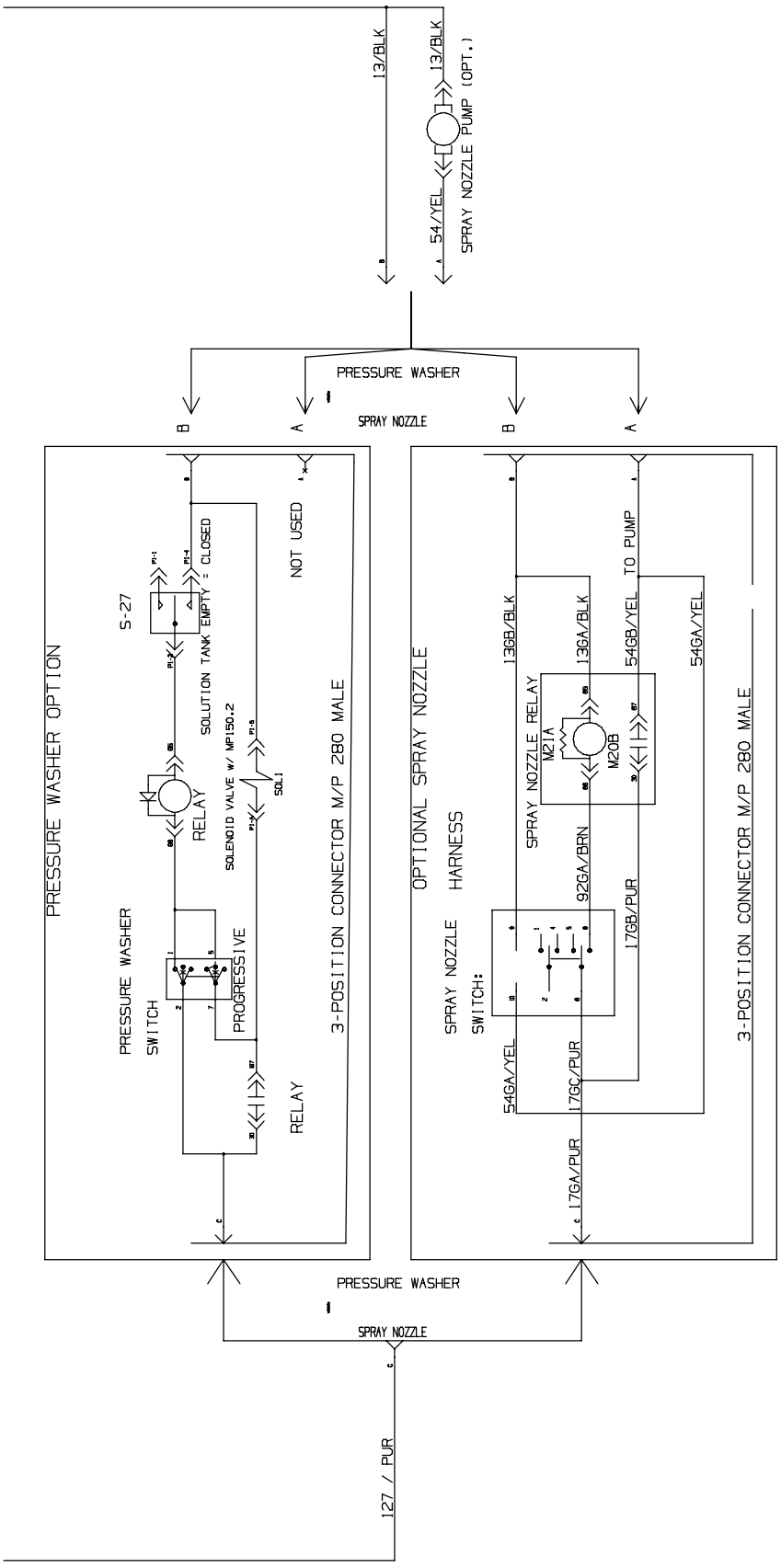
Electrical Schematic (4 of 8)



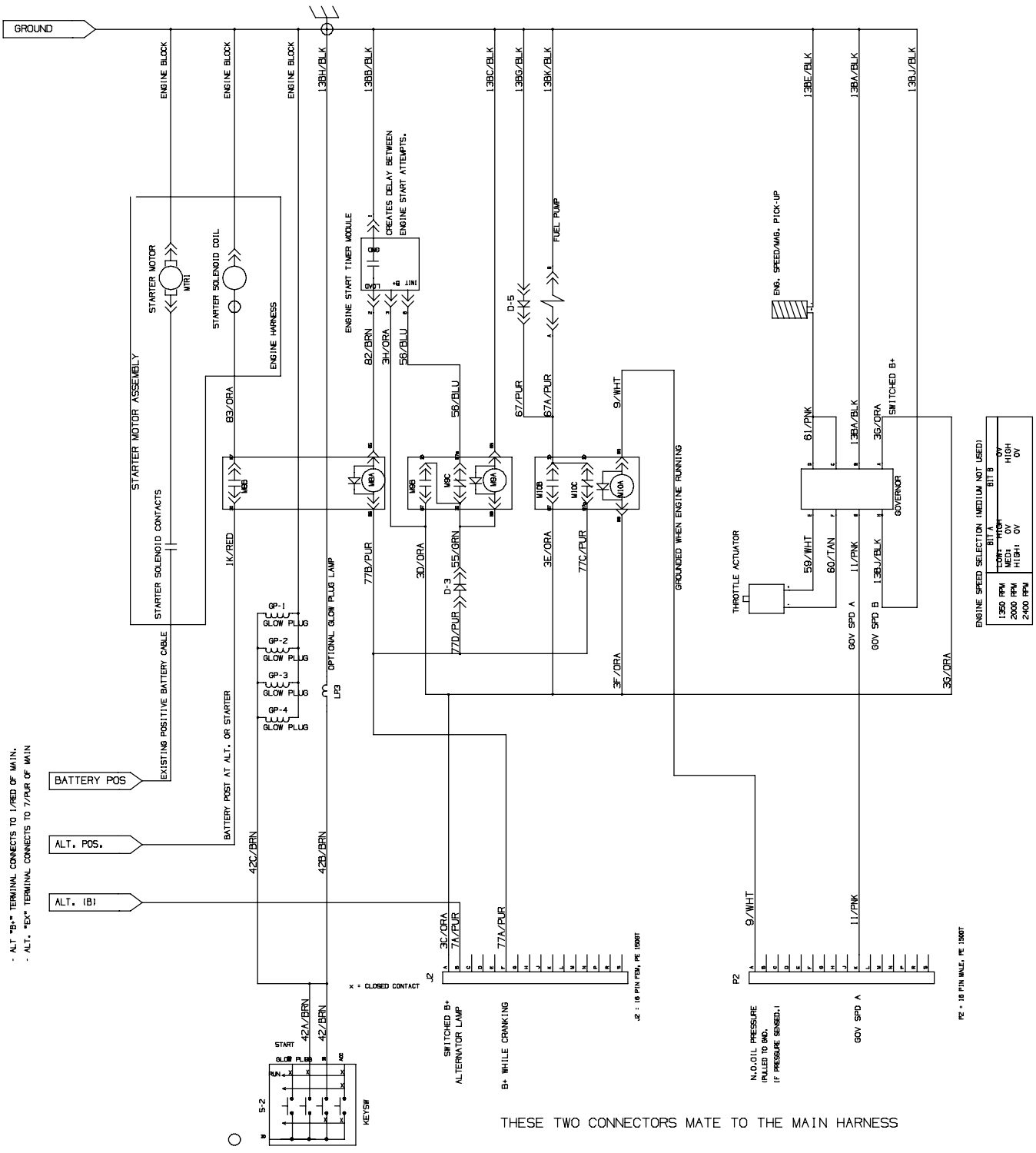
Electrical Schematic (5 of 8)



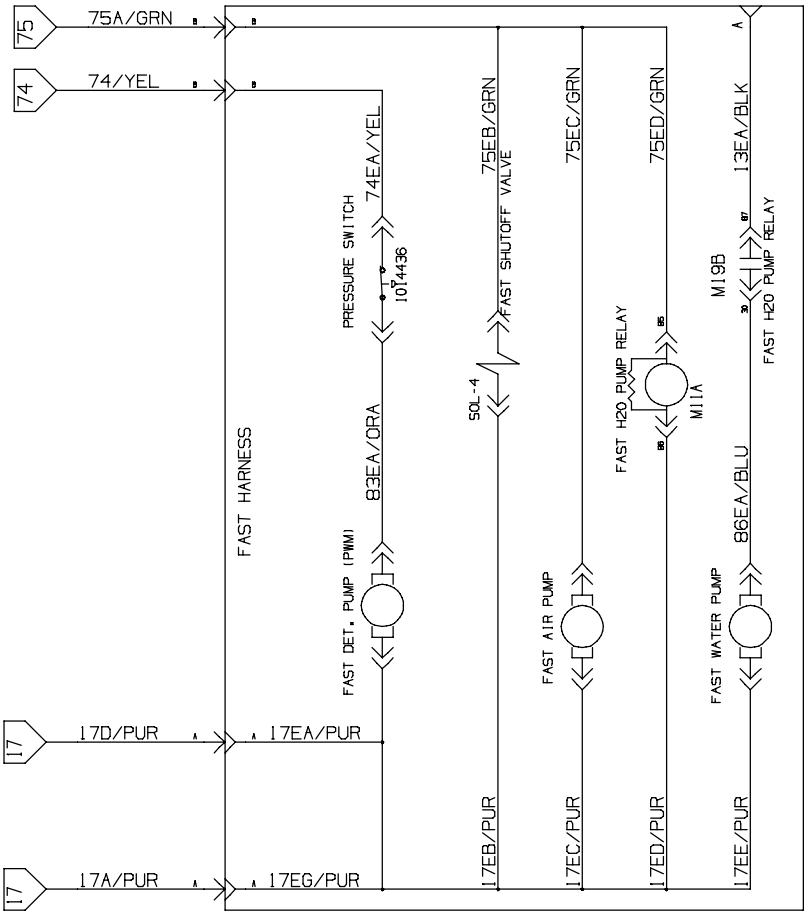
Electrical Schematic (6 of 8)

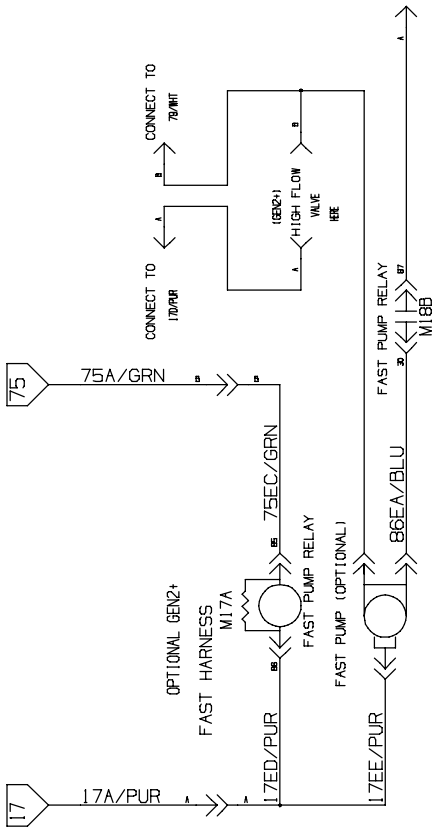


Electrical Schematic (7 of 8)



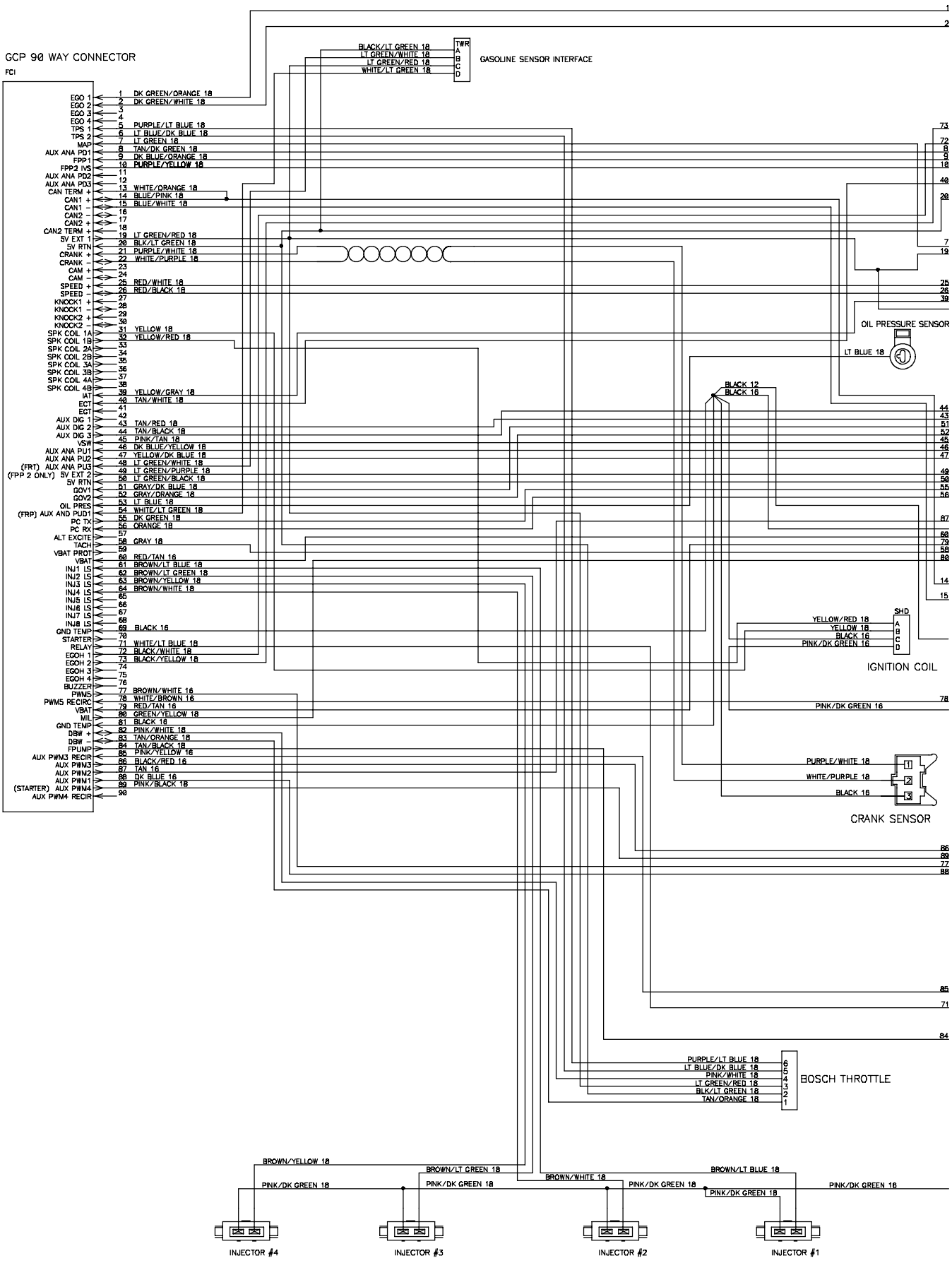
Electrical Schematic (8 of 8)



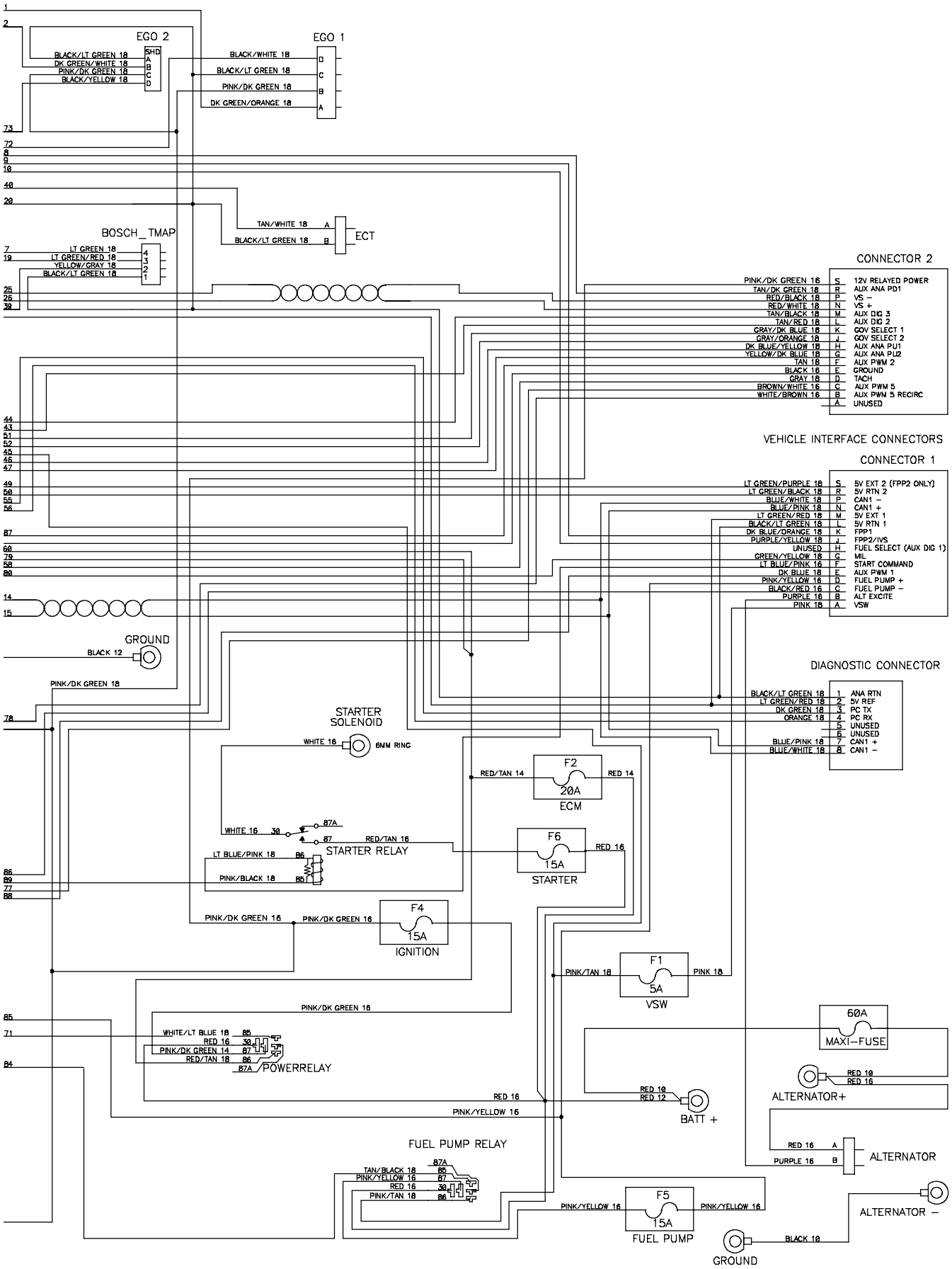


E

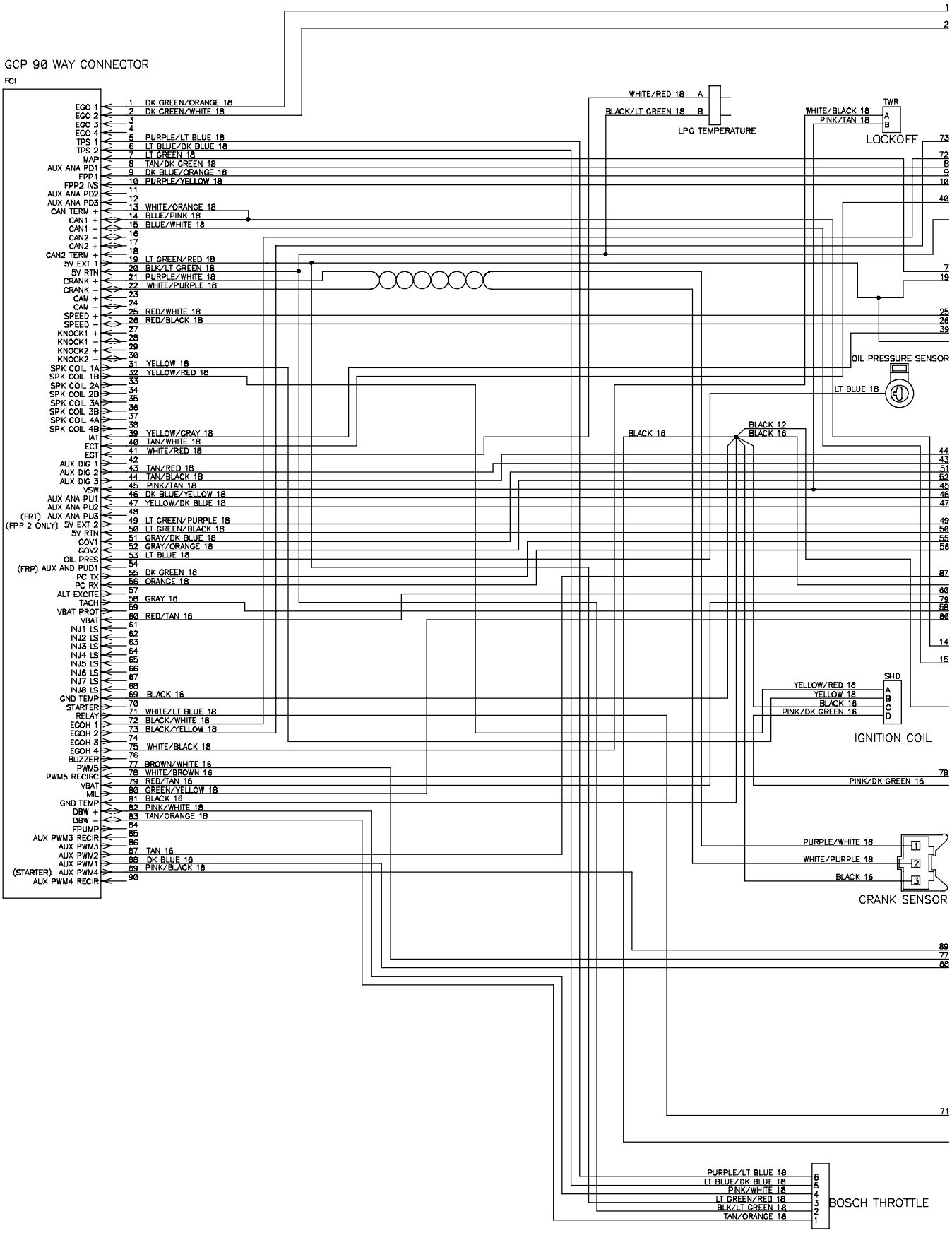
Gas Engine Harness Electrical Schematic (1 of 2)



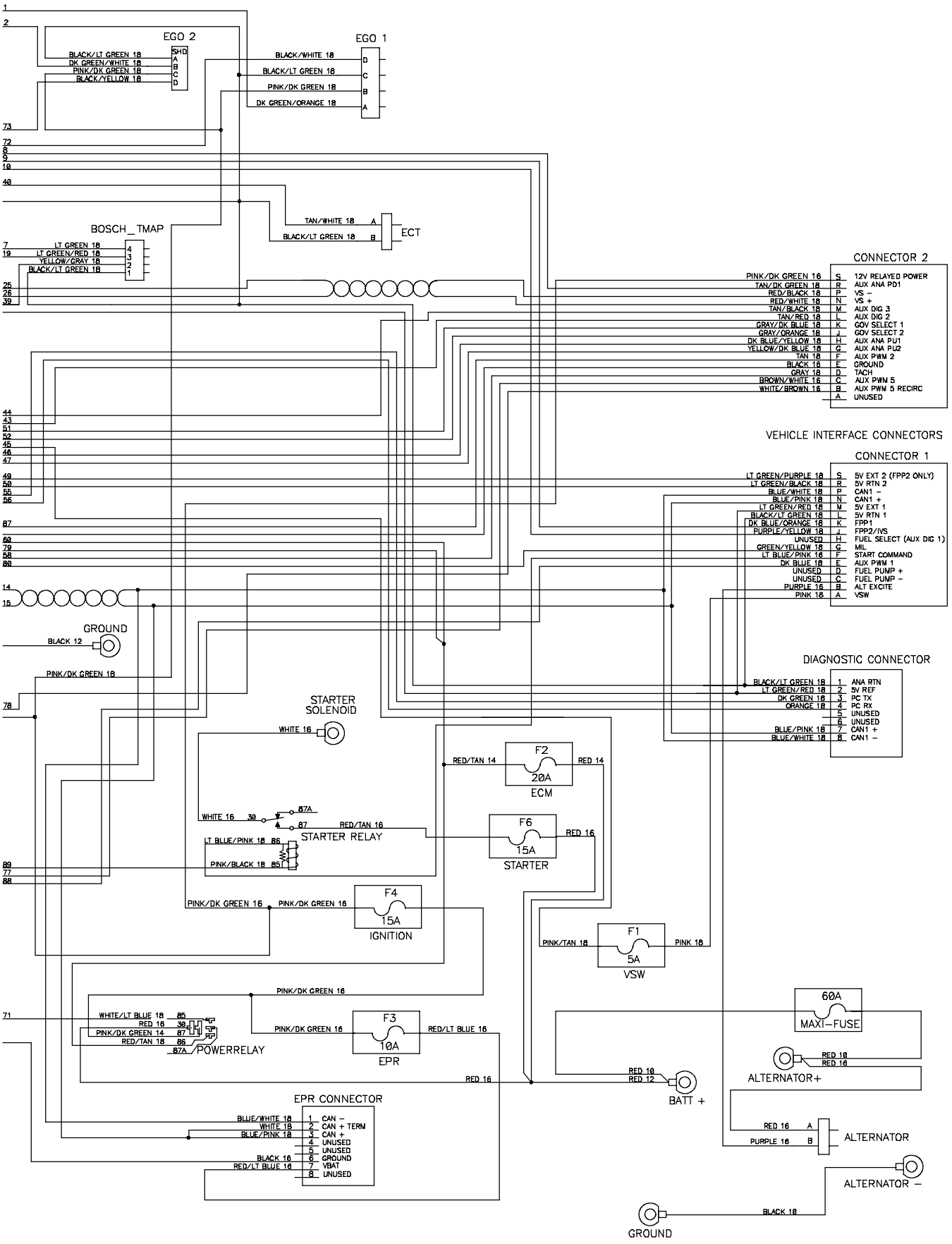
Gas Engine Harness Electrical Schematic (2 of 2)



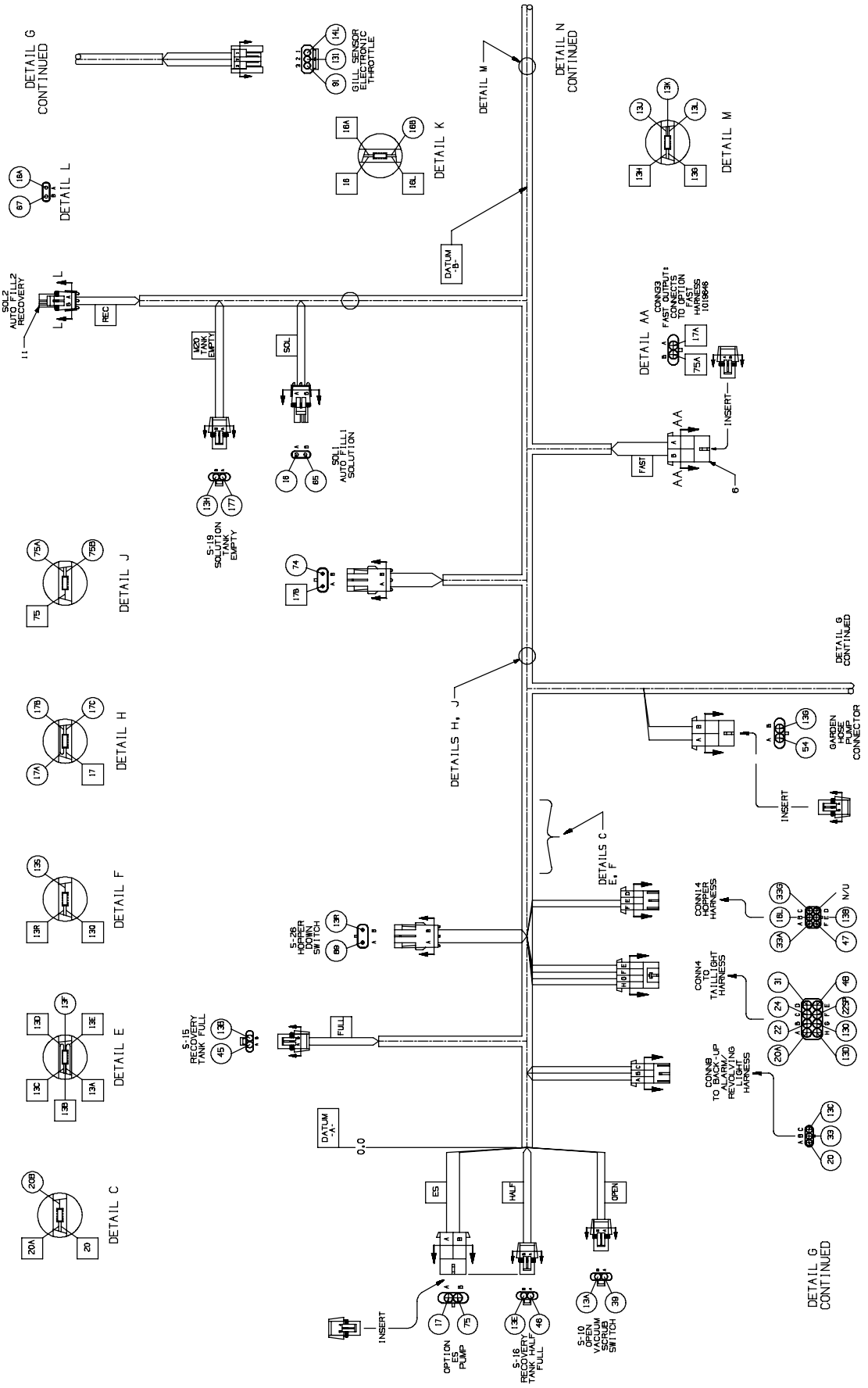
LPG Engine Harness Electrical Schematic (1 of 2)



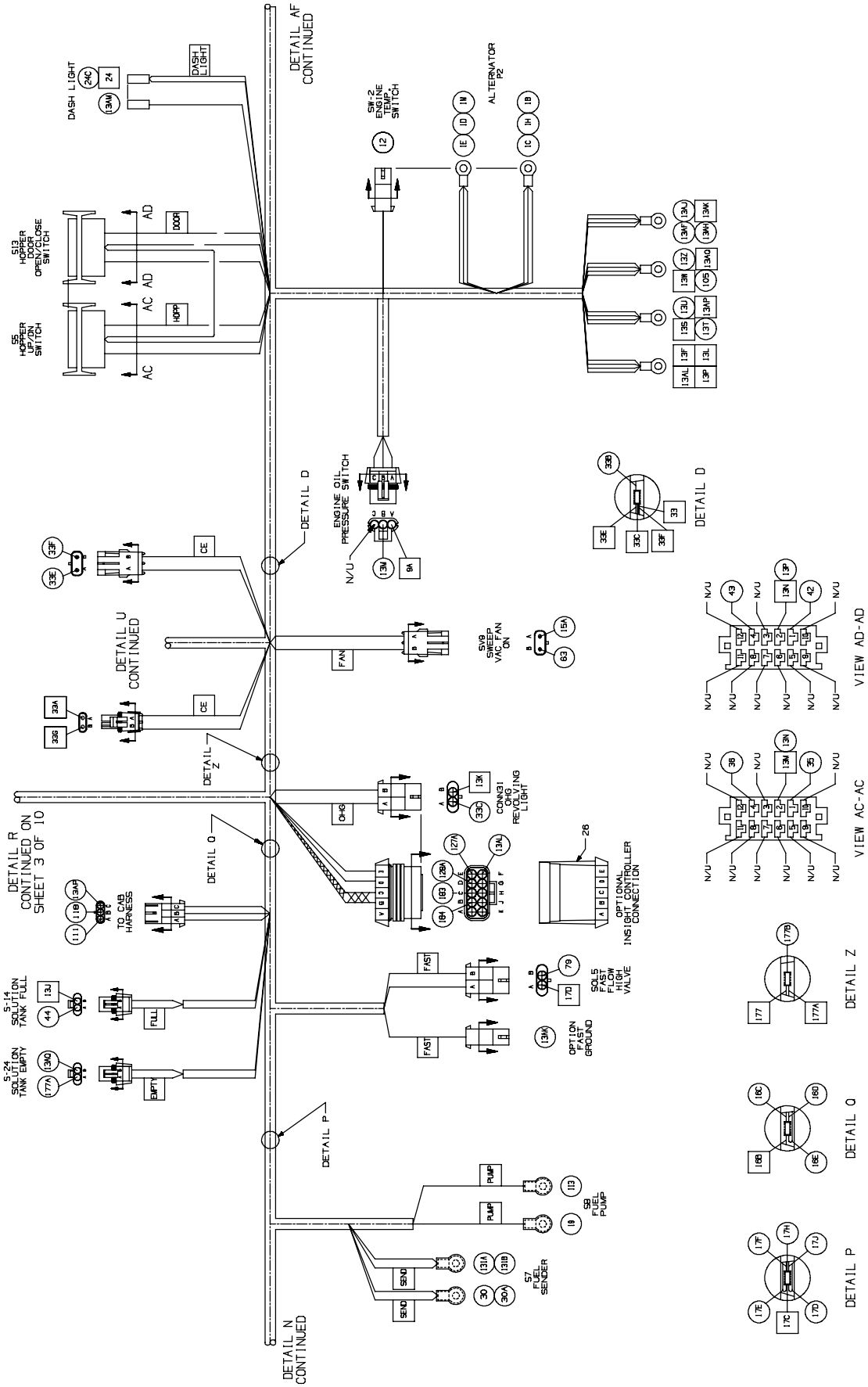
LPG Engine Harness Electrical Schematic (2 of 2)



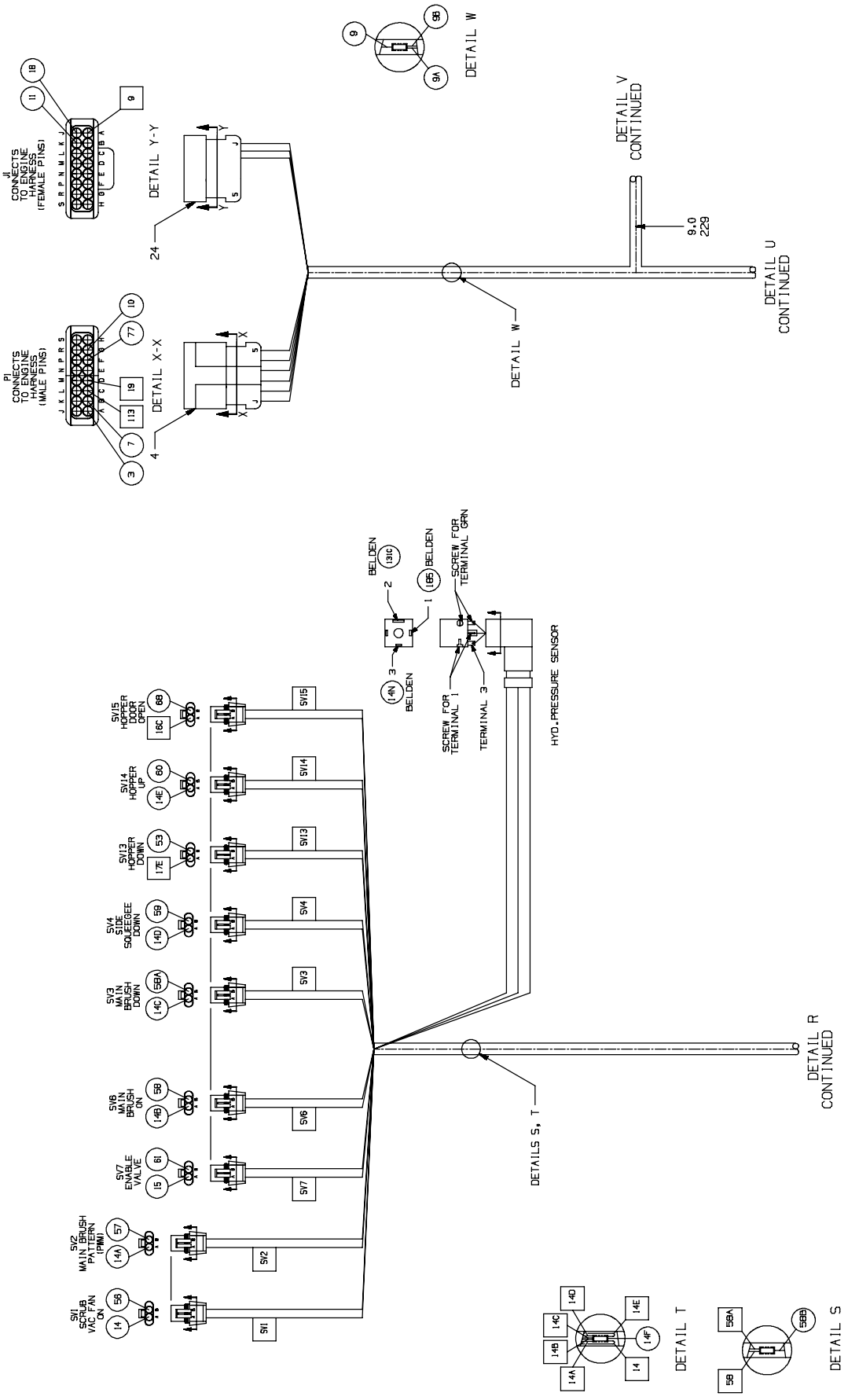
Main Wire Harness Diagram (1 of 7)



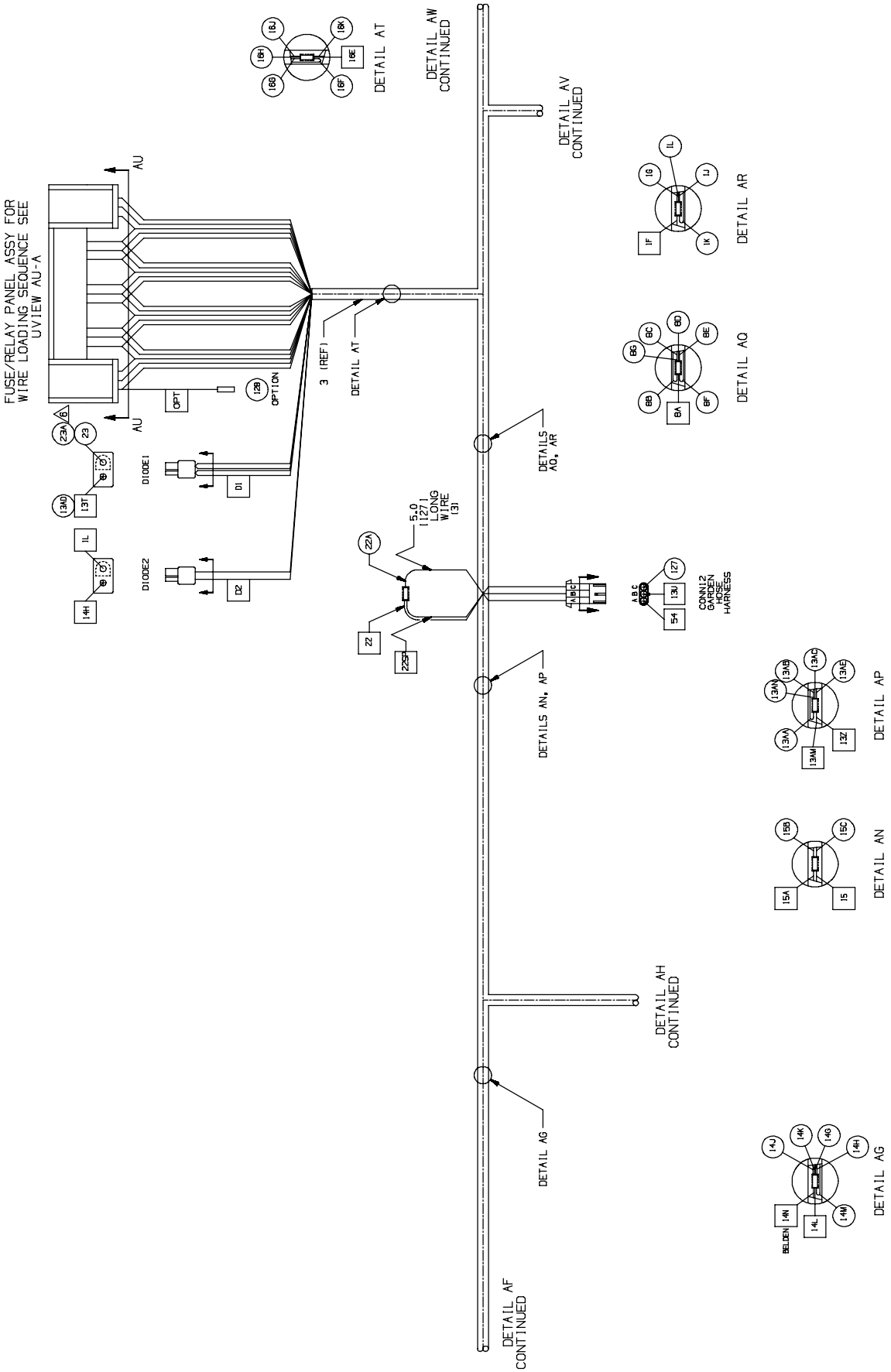
Main Wire Harness Diagram (2 of 7)



Main Wire Harness Diagram (3 of 7)

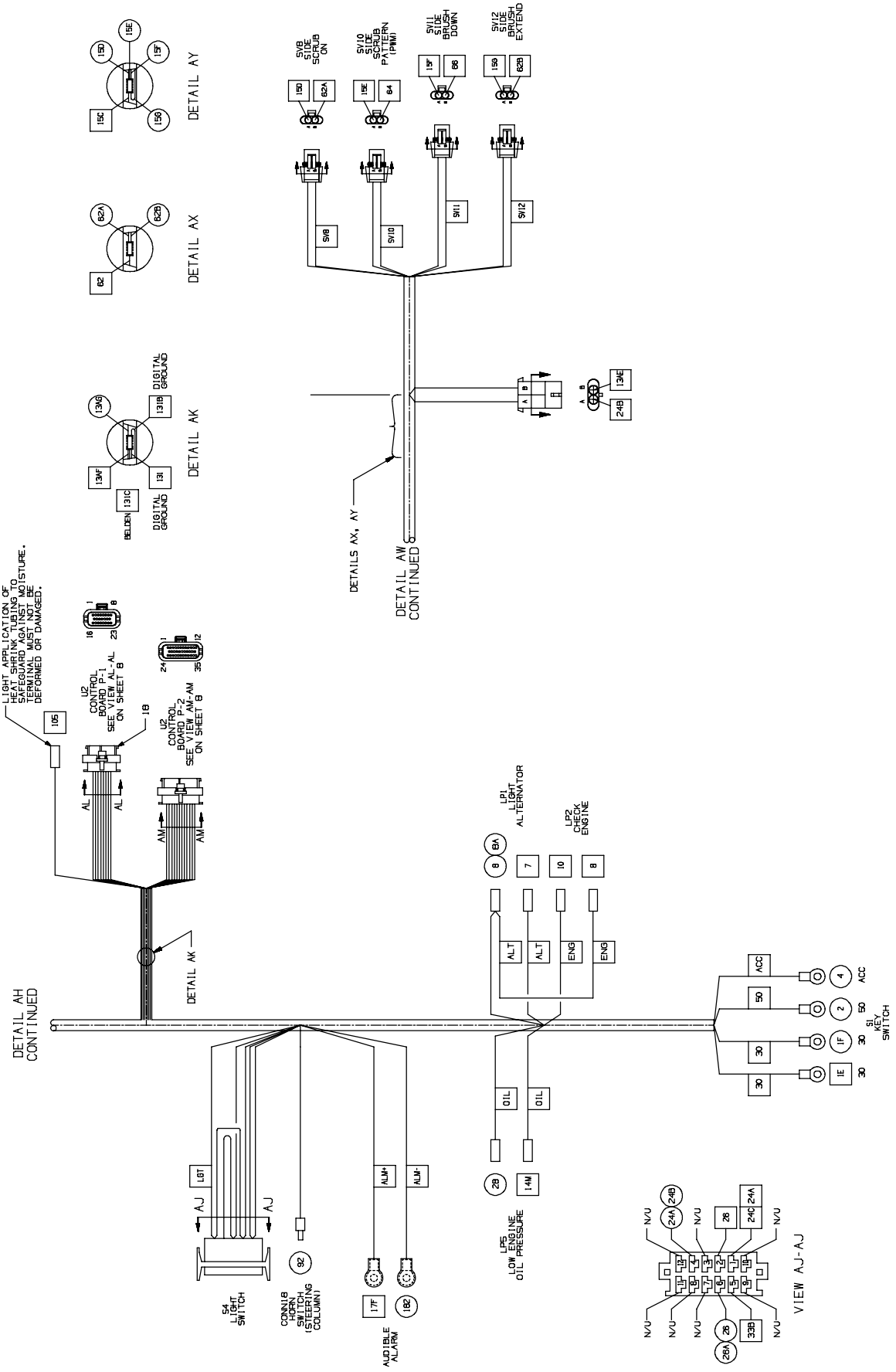


Main Wire Harness Diagram (4 of 7)

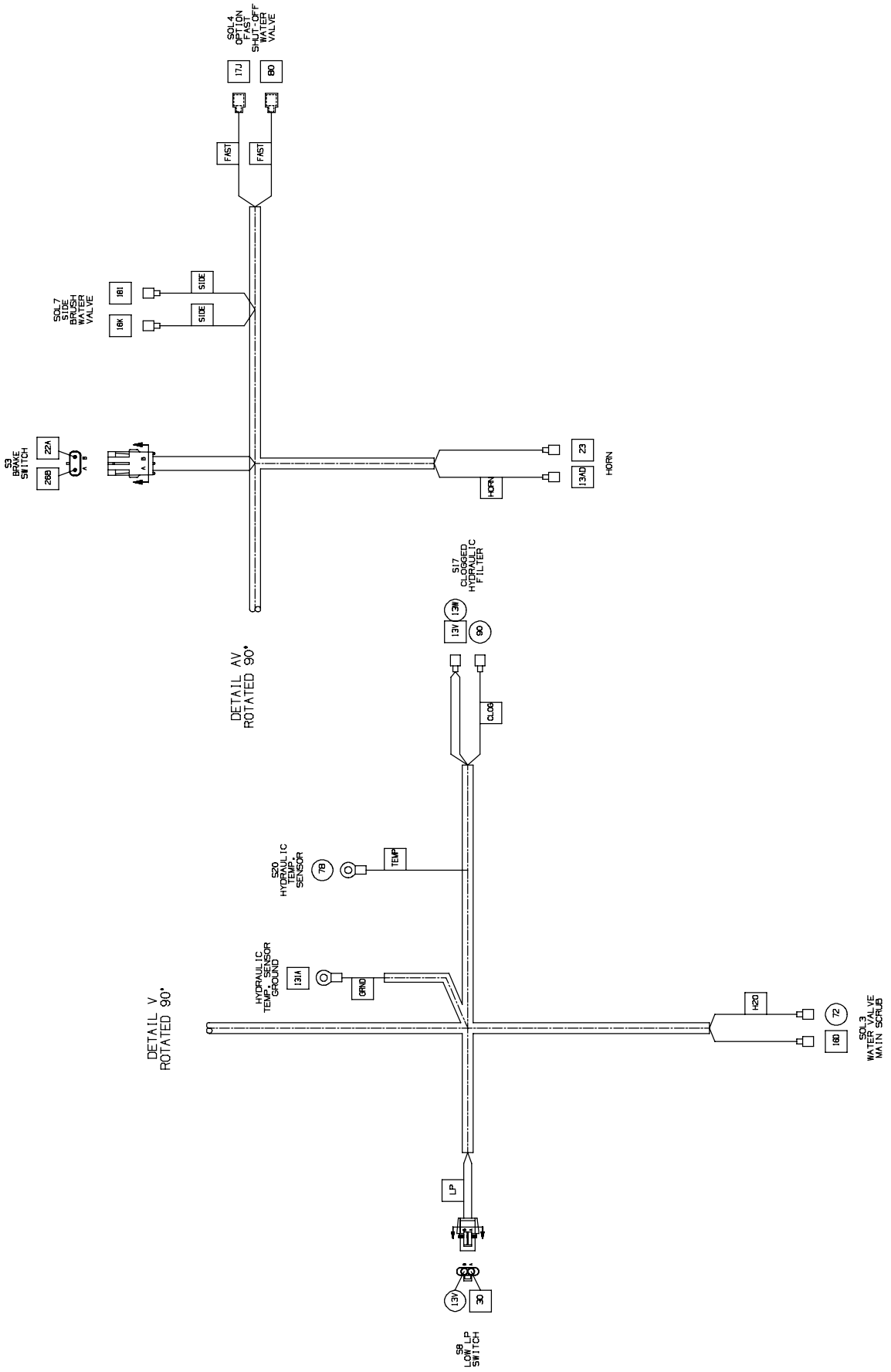


E

Main Wire Harness Diagram (5 of 7)

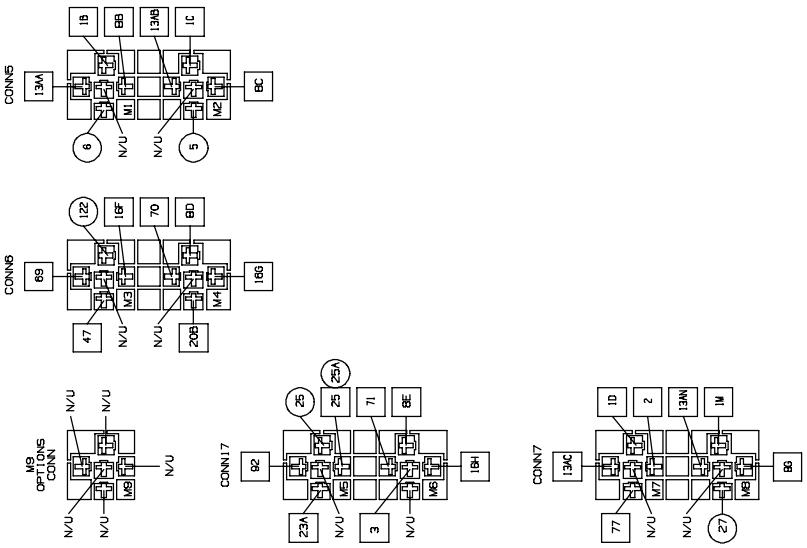


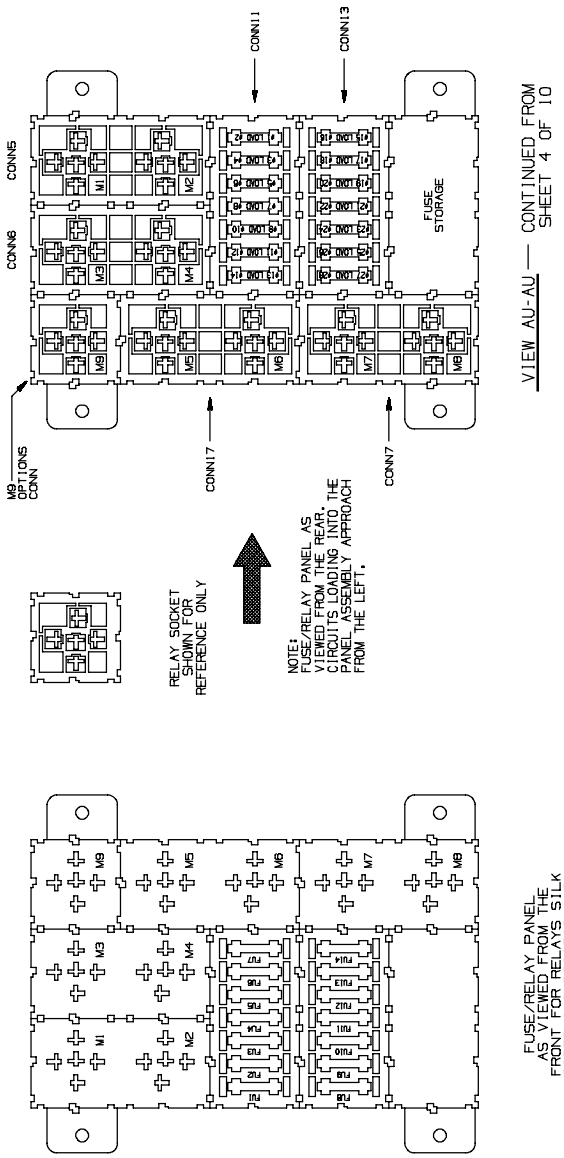
Main Wire Harness Diagram (6 of 7)



E

Main Wire Harness Diagram (7 of 7)



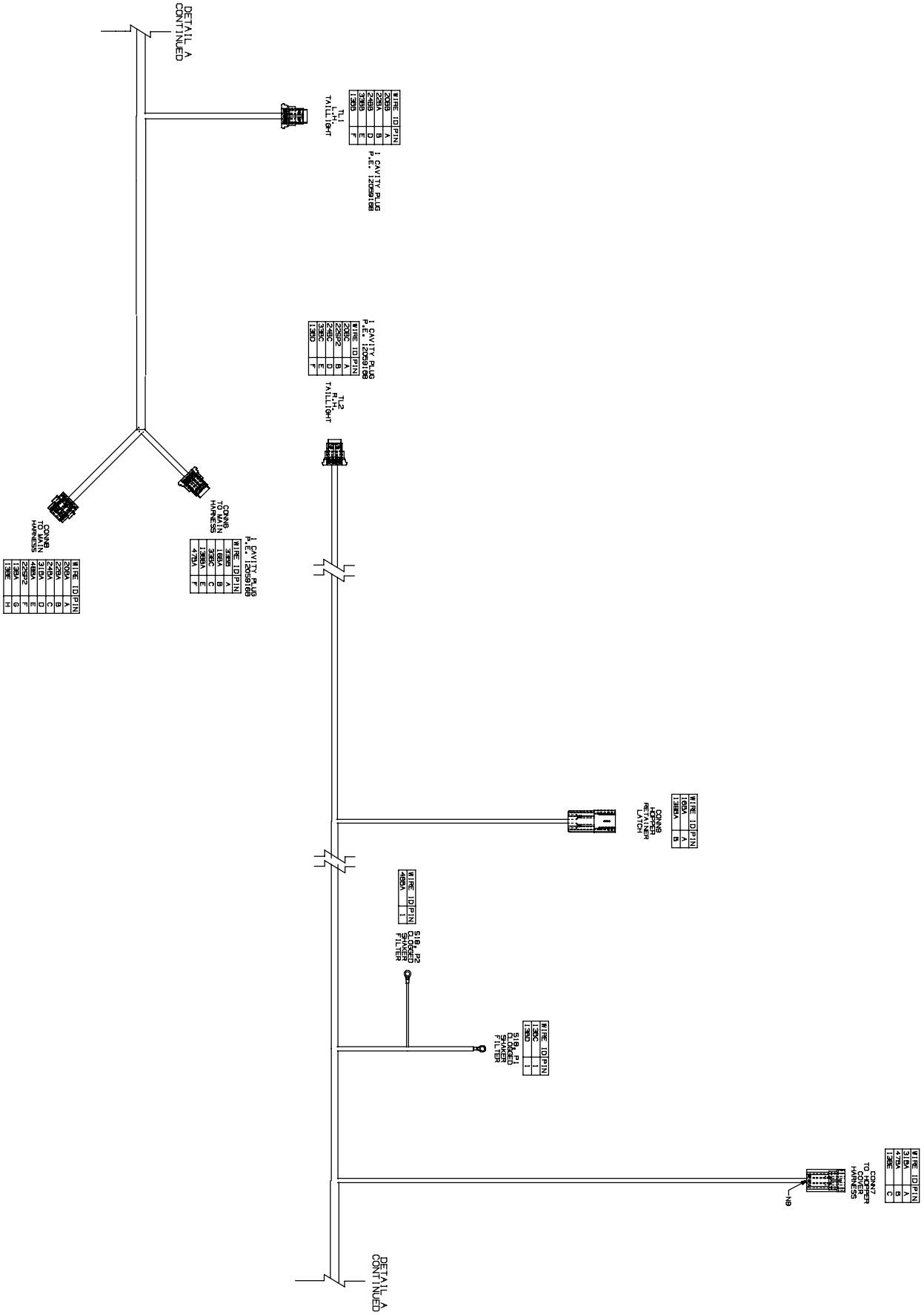


VIEW AU-AU — CONTINUED FROM SHEET 4 OF 10

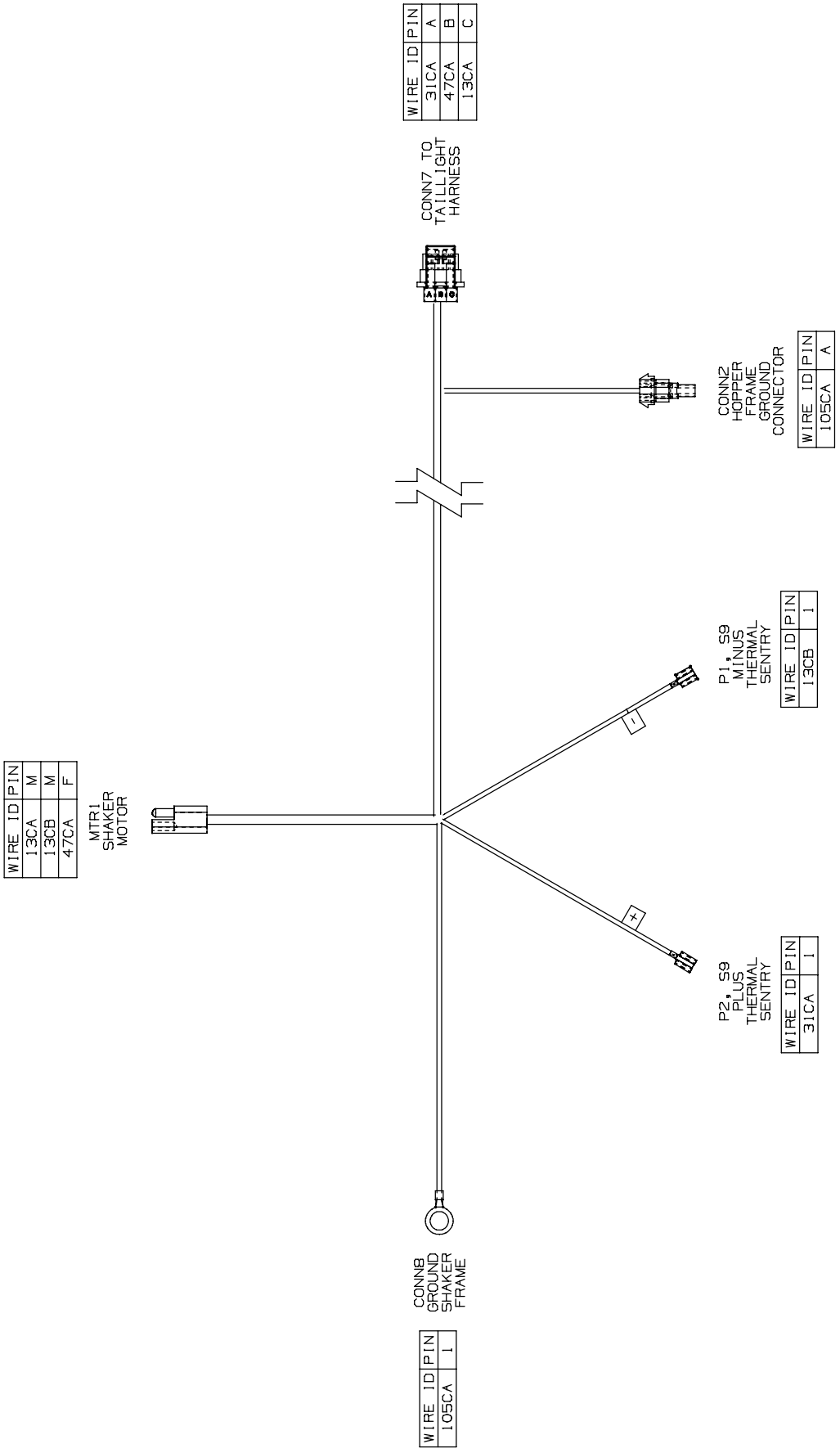
FUSE PANEL ASSEMBLY WIRING

	CONN11 PIN POSITION	CONN11 TERMINAL LOADING BOTTOM HALF	CONN11 PIN POSITION	CONN11 TERMINAL LOADING TOP HALF
FUSE 1	1	□ □ 4 & ○ 4A	2	□ □ 8F
FUSE 2	3	□ □ 1G	4	□ □ 122
FUSE 3	5	□ □ 1H	6	□ □ 25A
FUSE 4	7	X N/U	8	X N/U
FUSE 5	9	□ 6 & ○ 6A	10	□ 14F & □ 14G
FUSE 6	11	□ 6A	12	□ 15B
FUSE 7	13	□ 5 & ○ 5A	14	□ 16J
	CONN13 PIN POSITION	CONN13 TERMINAL LOADING BOTTOM HALF	CONN13 PIN POSITION	CONN13 TERMINAL LOADING TOP HALF
FUSE 8	15	□ 5A	16	□ 17H
FUSE 9	17	□ □ 4A & ○ 4B	18	□ □ 28A & ○ 26B
FUSE 10	19	□ □ 1J	20	□ □ 81
FUSE 11	21	□ □ 1K	22	□ □ 128 □ 128A
FUSE 12	23	□ 4B	24	□ □ 127 □ 127A
FUSE 13	25	□ □ 27 & ○ 27A	26	□ □ 111
FUSE 14	27	□ 27A	28	□ □ 118

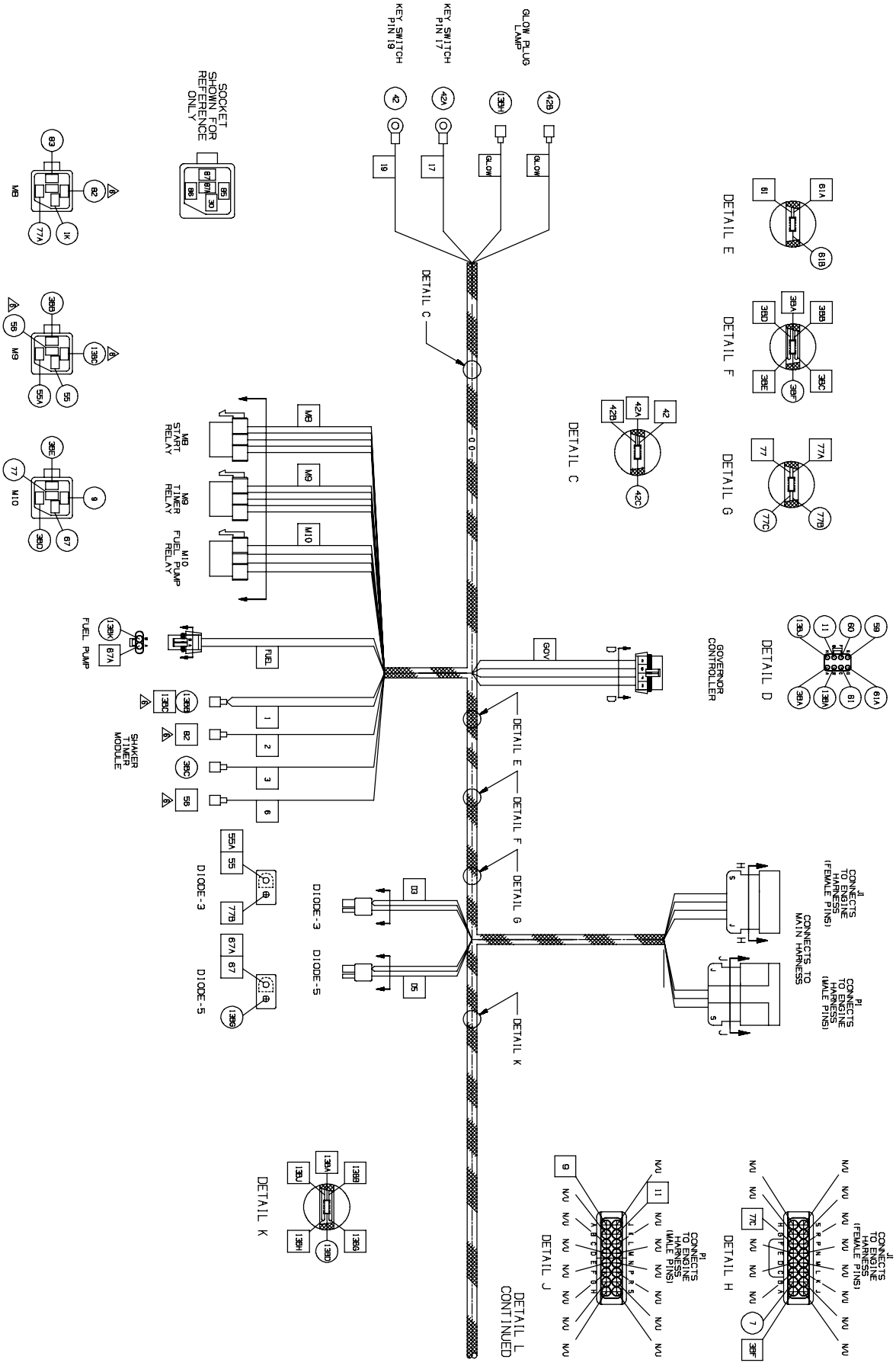
Hopper Harness Diagram



Hopper Cover Harness Diagram

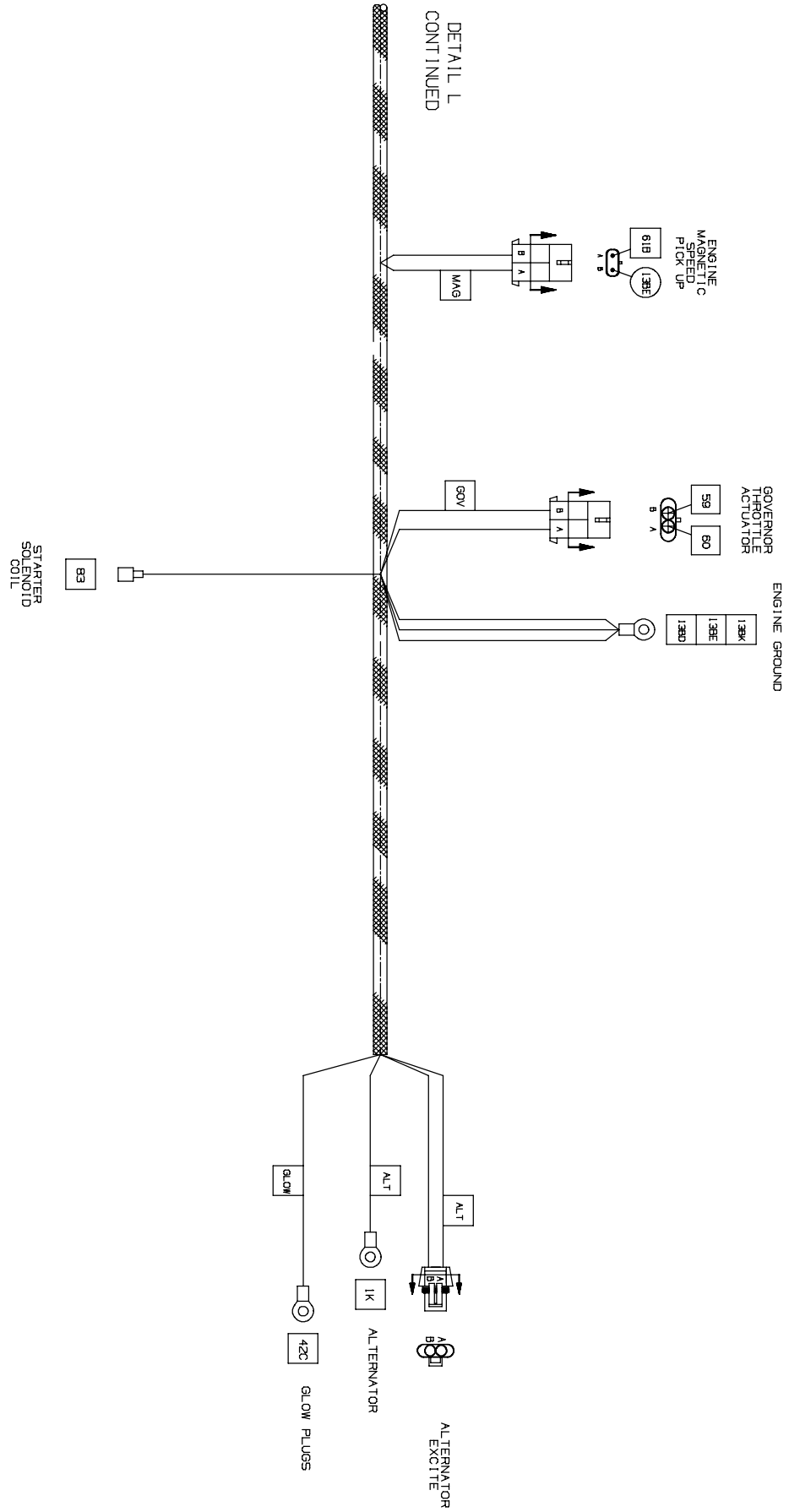


Diesel Engine Wire Harness Diagram (1 of 2)

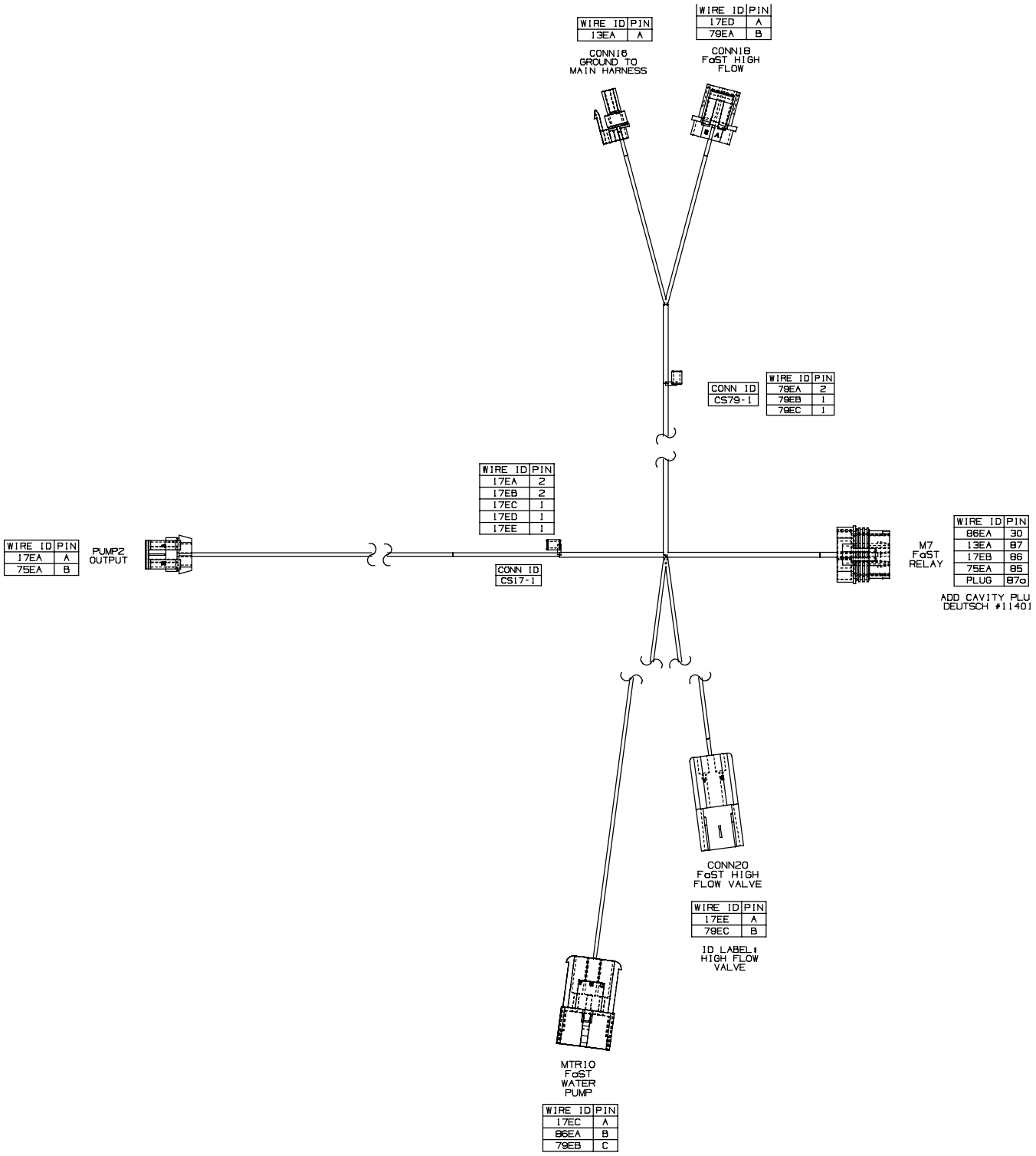


E

Diesel Engine Wire Harness Diagram (2 of 2)



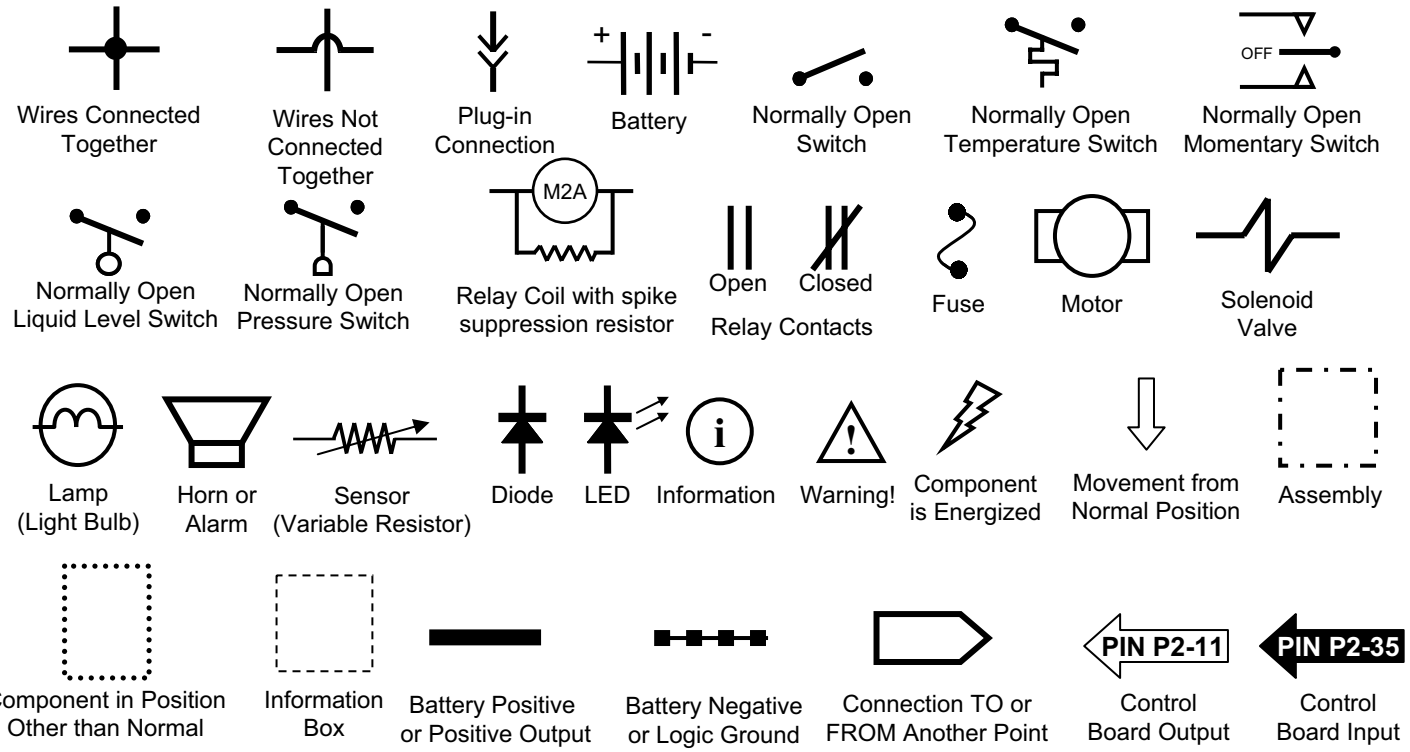
FaST Wire Harness Diagram



E

Electrical Symbols & Abbreviations

NOTE: The term “NORMALLY” refers to the component’s “at rest” or “de-energized” position

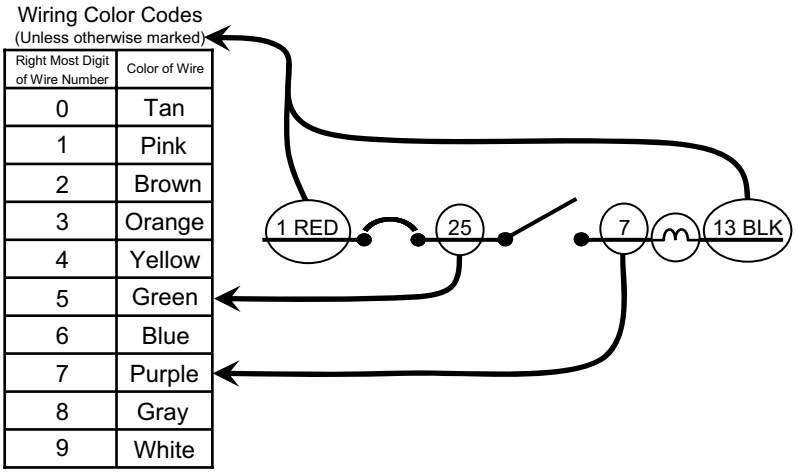


E

Terms & Abbreviations

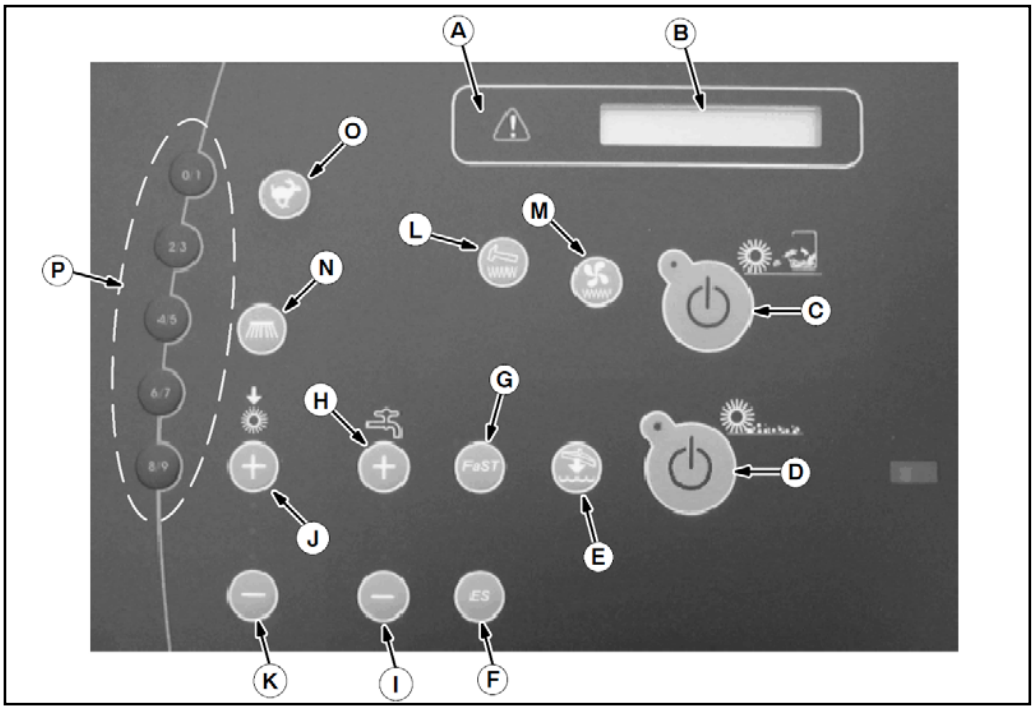
ECM – Engine Control Module
LED – Light Emitting Diode
MIL – Malfunction Indicator Lamp
PWM – Pulse Width Modulation (A method of using controlled on/off times to regulate the voltage and current supplied to an electrical device)
SV – Solenoid Valve
SW – Switch

Example of Wiring Numbers & Colors:



Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

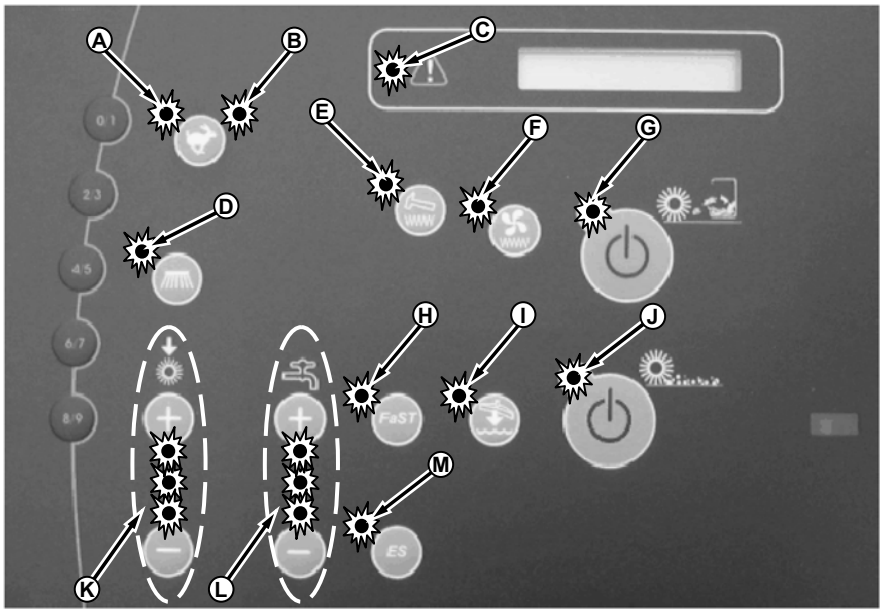
Touch Panel Detail



E

A. Fault indicator light
B. Hour meter / fuel indicator / fault code indicator
C. 1-STEP sweep button
D. 1-STEP scrub button
E. Scrub vacuum fan / squeegee button
F. ES (Extended Scrub) button (option)
G. FaST button (option)
H. Solution & detergent increase button (+)
I. Solution & detergent decrease button (-)
J. Brush pressure increase button (+)
K. Brush pressure decrease button (-)
L. Filter shaker button
M. Sweep vacuum fan button
N. Side brush button
O. Engine speed button
P. Supervisor control buttons

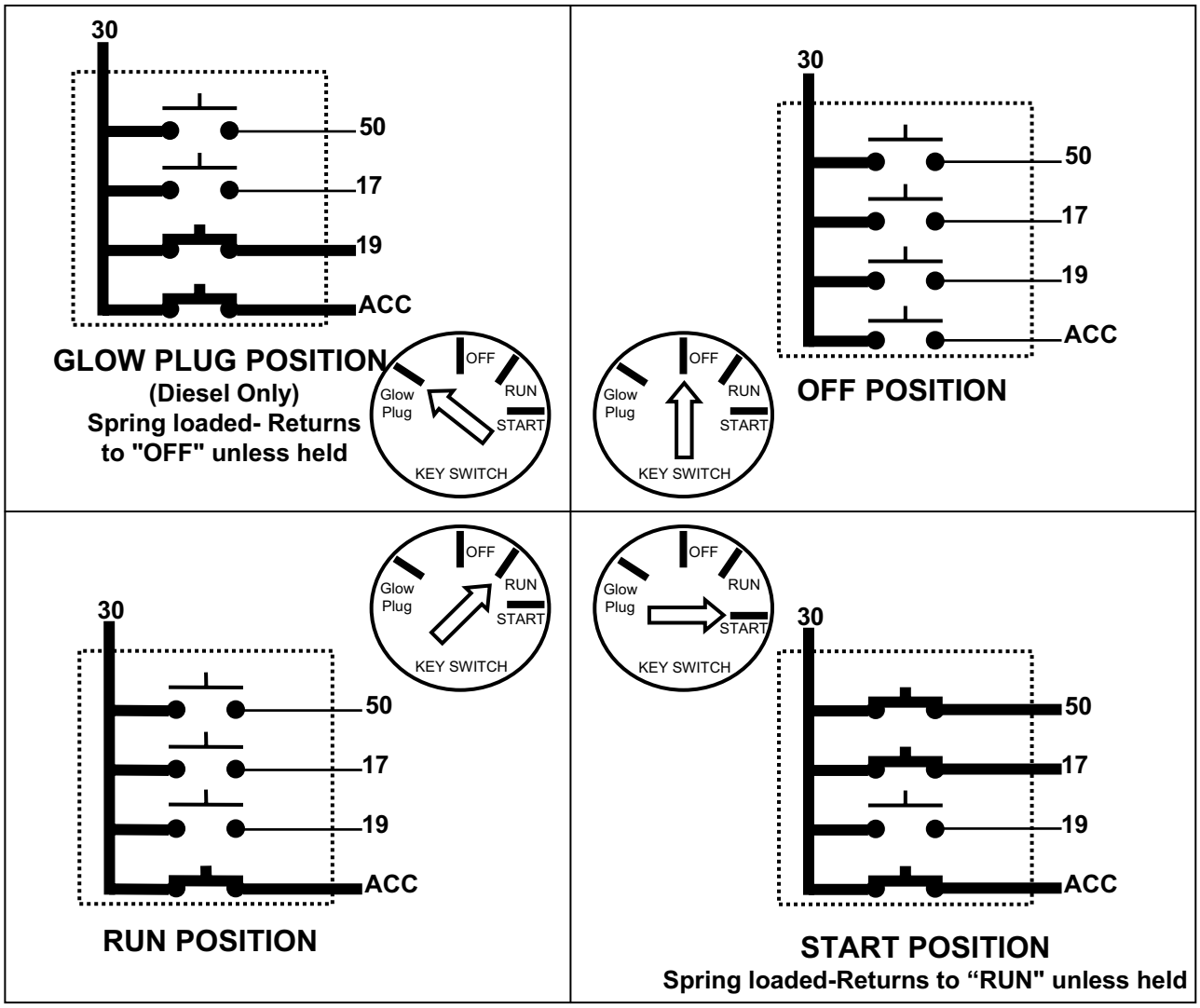
Touch Panel LEDs



E

A. Low Engine Speed Indicator
B. High Engine Speed Indicator
C. Fault/Condition Indicator
D. Side Brush ON Indicator
E. Filter Shaker ON Indicator
F. Sweeping Vacuum Fan ON Indicator
G. 1-STEP Sweep ON Indicator
H. FaST System ON Indicator
I. Scrubbing Vacuum Fan ON & Squeegee System ON Indicator
J. 1-STEP Scrub ON Indicator
K. Brush Pressure Indicators (1 LED=Low, 2 LED's=Medium, 3 LED's=High)
L. Solution Volume Indicators (1 LED=Low, 2 LED's=Medium, 3 LED's=High)
M. ES (Extended Scrub) System ON Indicator

Key Switch



KEY SWITCH POSITION	SWITCH TERMINAL MARKING				
	30	50	17	19	ACC
GLOW PLUG	●			●	●
OFF	NO CONNECTIONS				
RUN	●				●
START	●	●	●		●

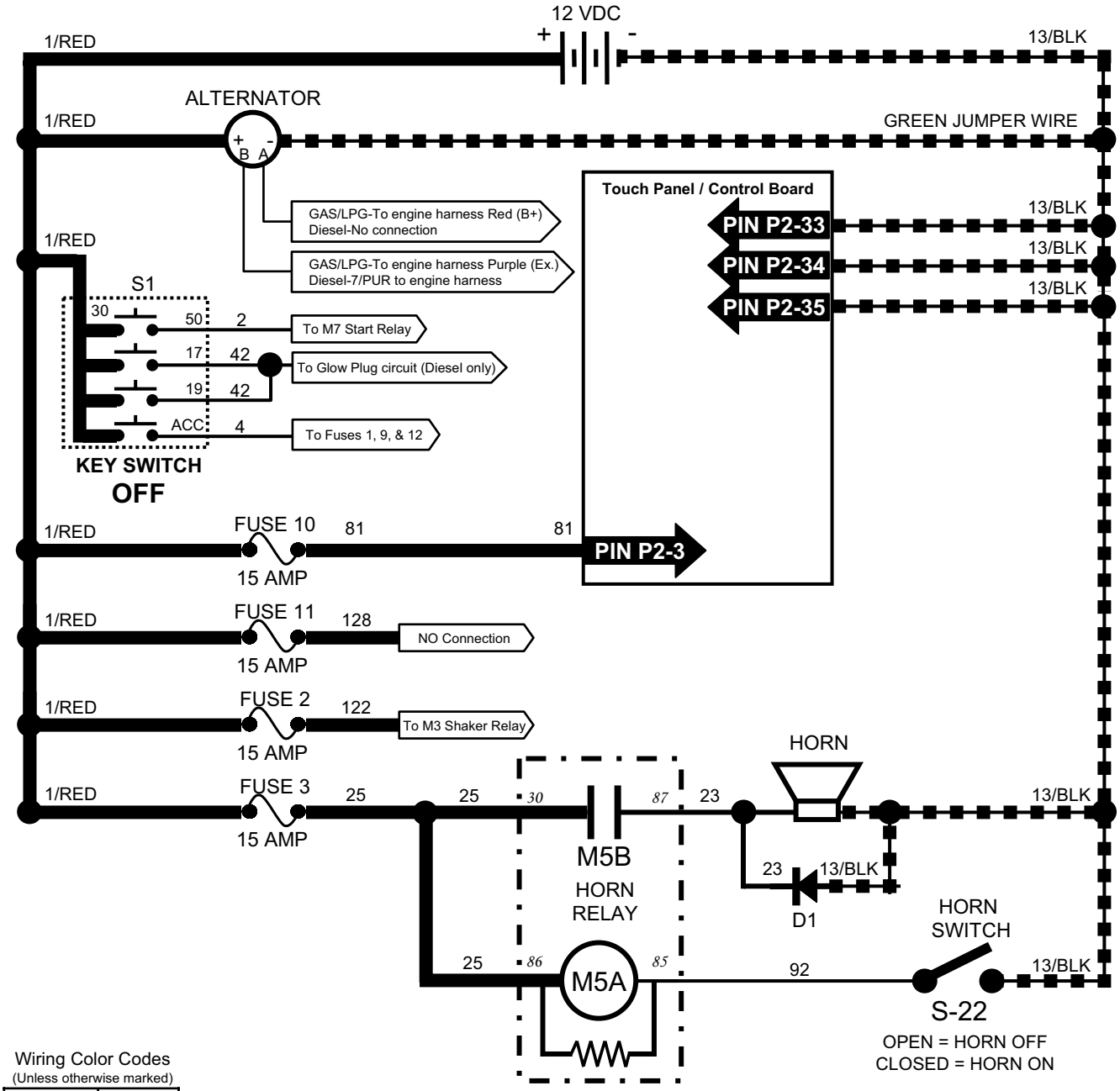
“●—●“ Indicates a common connection

ⓘ Common connections in various switch positions should be less than 1Ω

E

Key OFF Power Distribution

Conditions: Key off



Wiring Color Codes
(Unless otherwise marked)

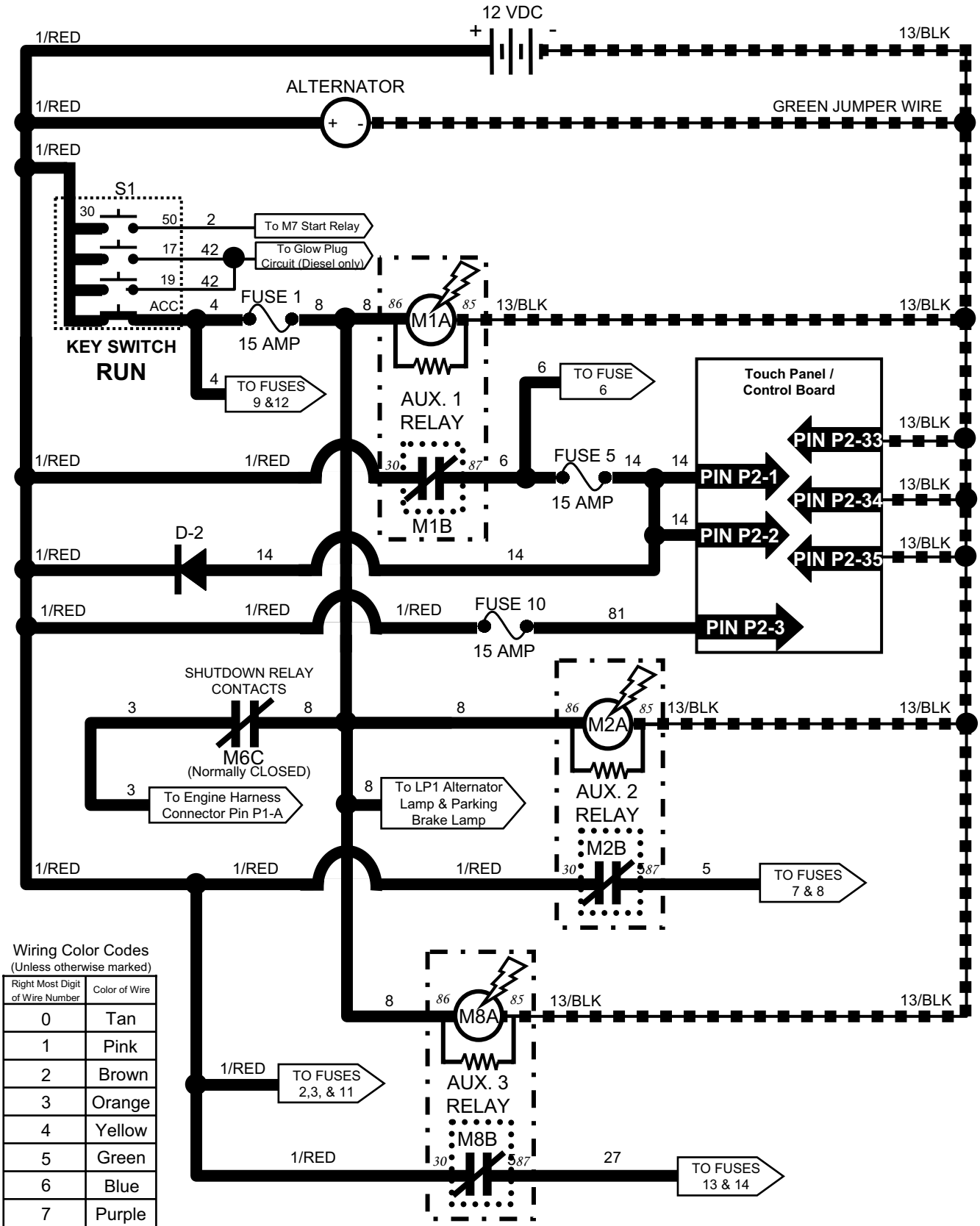
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Be cautious when working near Control Board -
Battery voltage is always present, even with Key OFF

Pin P2-3 supplies power to the on-board clock only. Disconnecting battery, removing Fuse 10, or removing connector P2 from Control Board will require the clock to be reset.

Key ON Power Distribution

Conditions: Key on, engine off



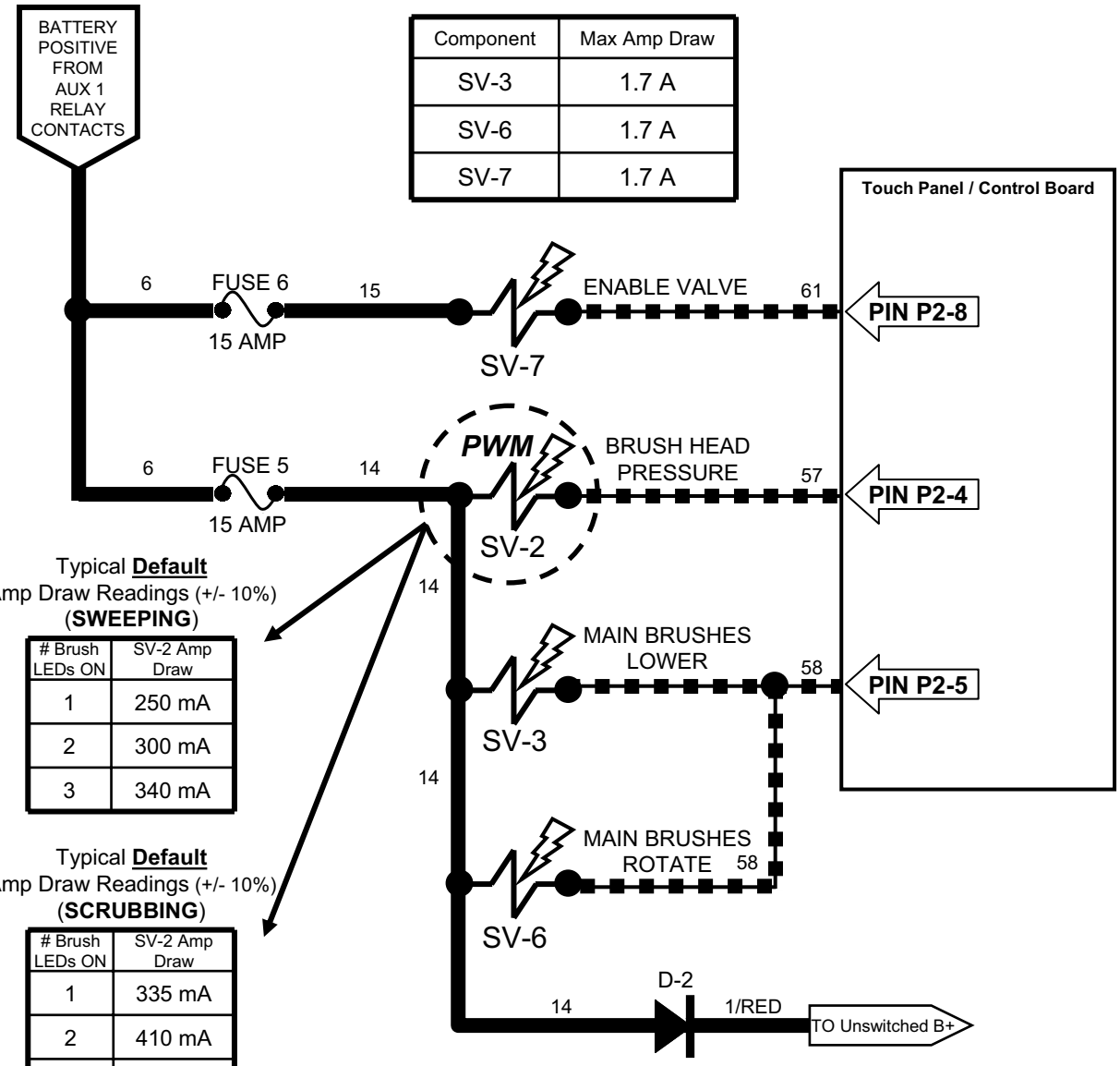
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

E

Main Brushes ON

Conditions: Key on, engine running, scrubbing or sweeping system on, propel forward or reverse



Component	Max Amp Draw
SV-3	1.7 A
SV-6	1.7 A
SV-7	1.7 A

Typical **Default** Amp Draw Readings (+/- 10%) (**SWEEPING**)

# Brush LEDs ON	SV-2 Amp Draw
1	250 mA
2	300 mA
3	340 mA

Typical **Default** Amp Draw Readings (+/- 10%) (**SCRUBBING**)

# Brush LEDs ON	SV-2 Amp Draw
1	335 mA
2	410 mA
3	495 mA

Wiring Color Codes (Unless otherwise marked)

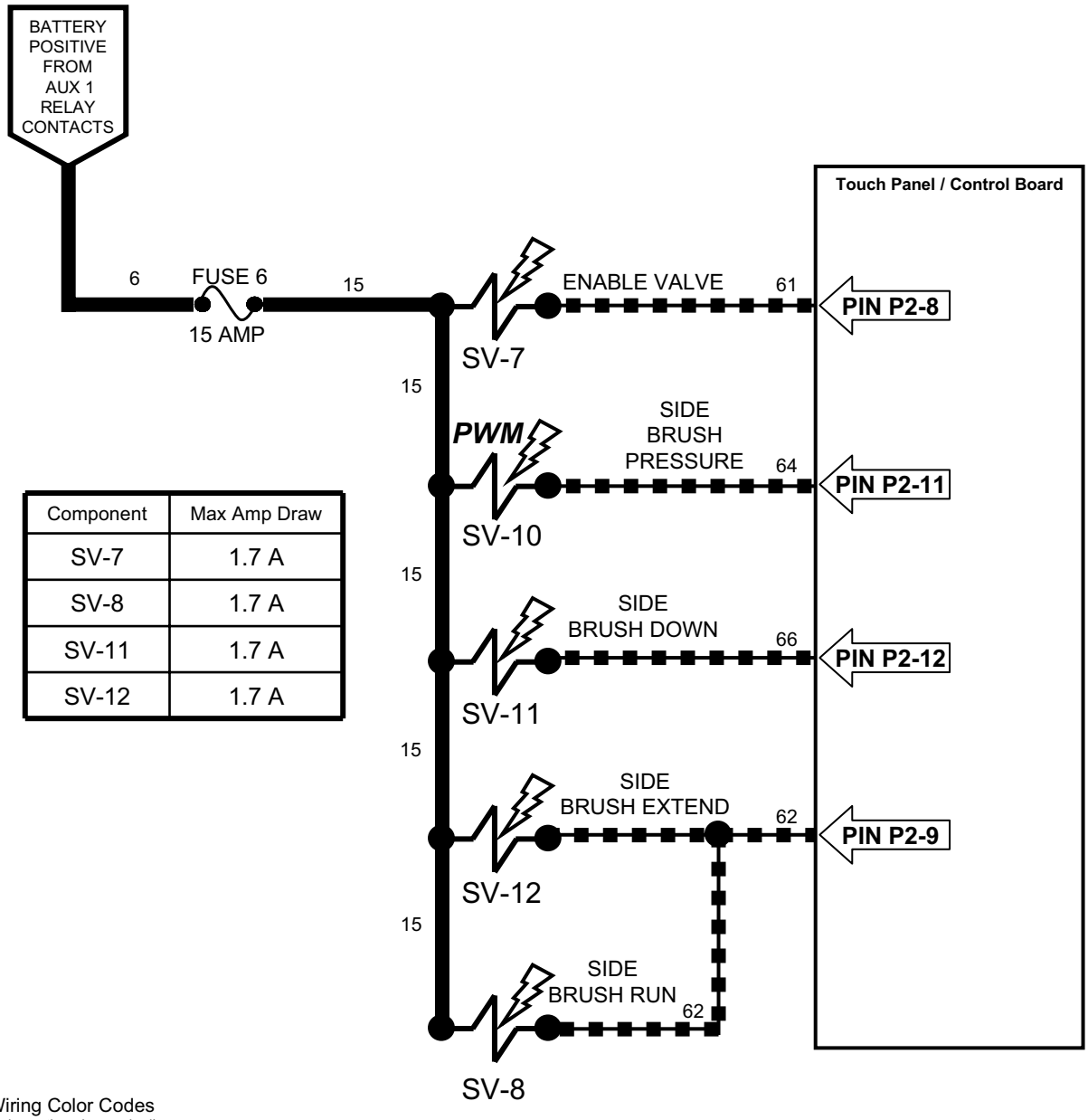
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The "# Brush Pressure LEDs ON" are the Touch Panel LED indicators for Brush down pressure

SV-2 is controlled by PWM; A higher duty cycle (more Brush Pressure LED's lit on Touch Panel) will result in more brush down pressure

Side Brush ON

Conditions: Key on, engine running, scrubbing or sweeping system on, side brush on, propel forward or reverse



Component	Max Amp Draw
SV-7	1.7 A
SV-8	1.7 A
SV-11	1.7 A
SV-12	1.7 A

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

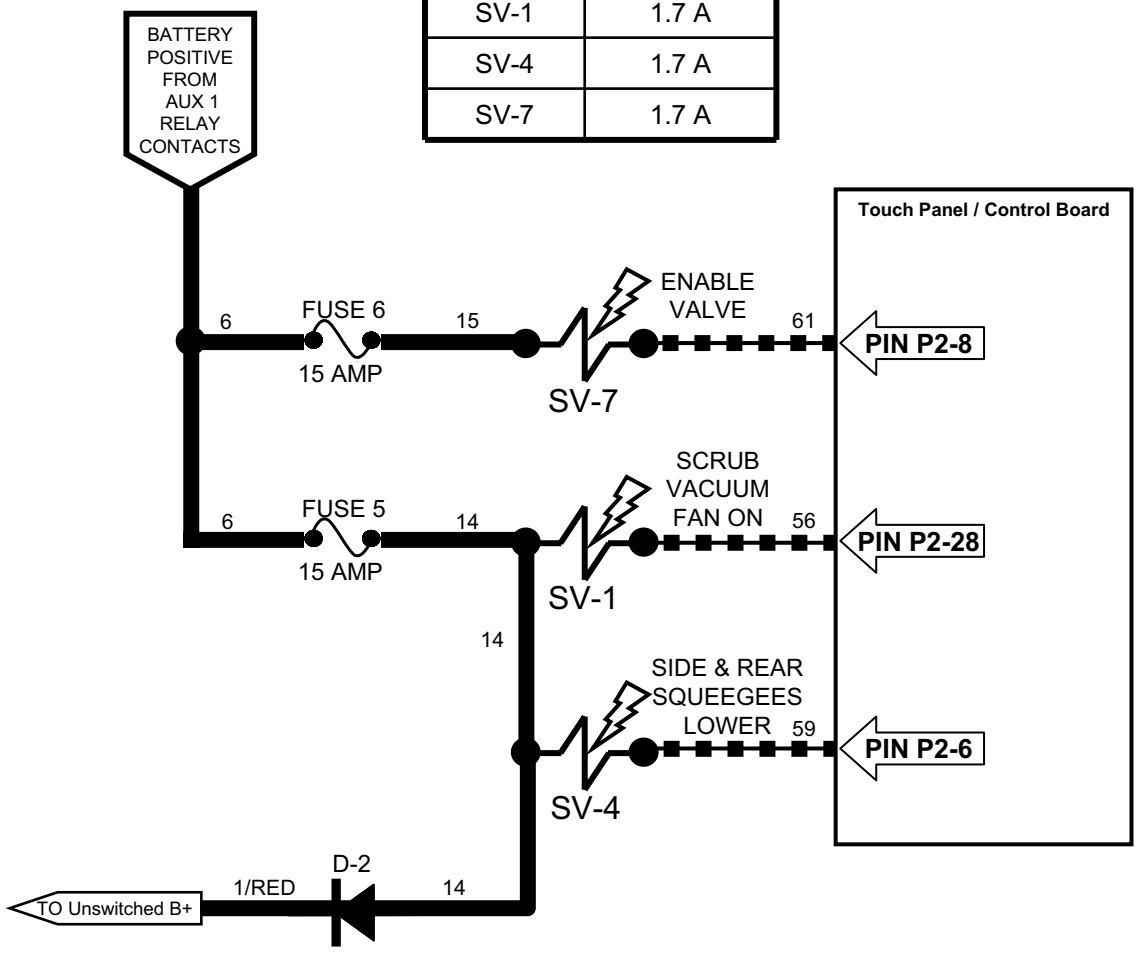
SV-10 is controlled by PWM; A higher duty cycle (more Brush Pressure LED's lit on Touch Panel) will result in more brush down pressure

E

Scrub Vacuum Fan ON & Squeegees DOWN

Conditions: Key on, engine running, scrubbing system & scrub vacuum on, propel forward

Component	Max Amp Draw
SV-1	1.7 A
SV-4	1.7 A
SV-7	1.7 A



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

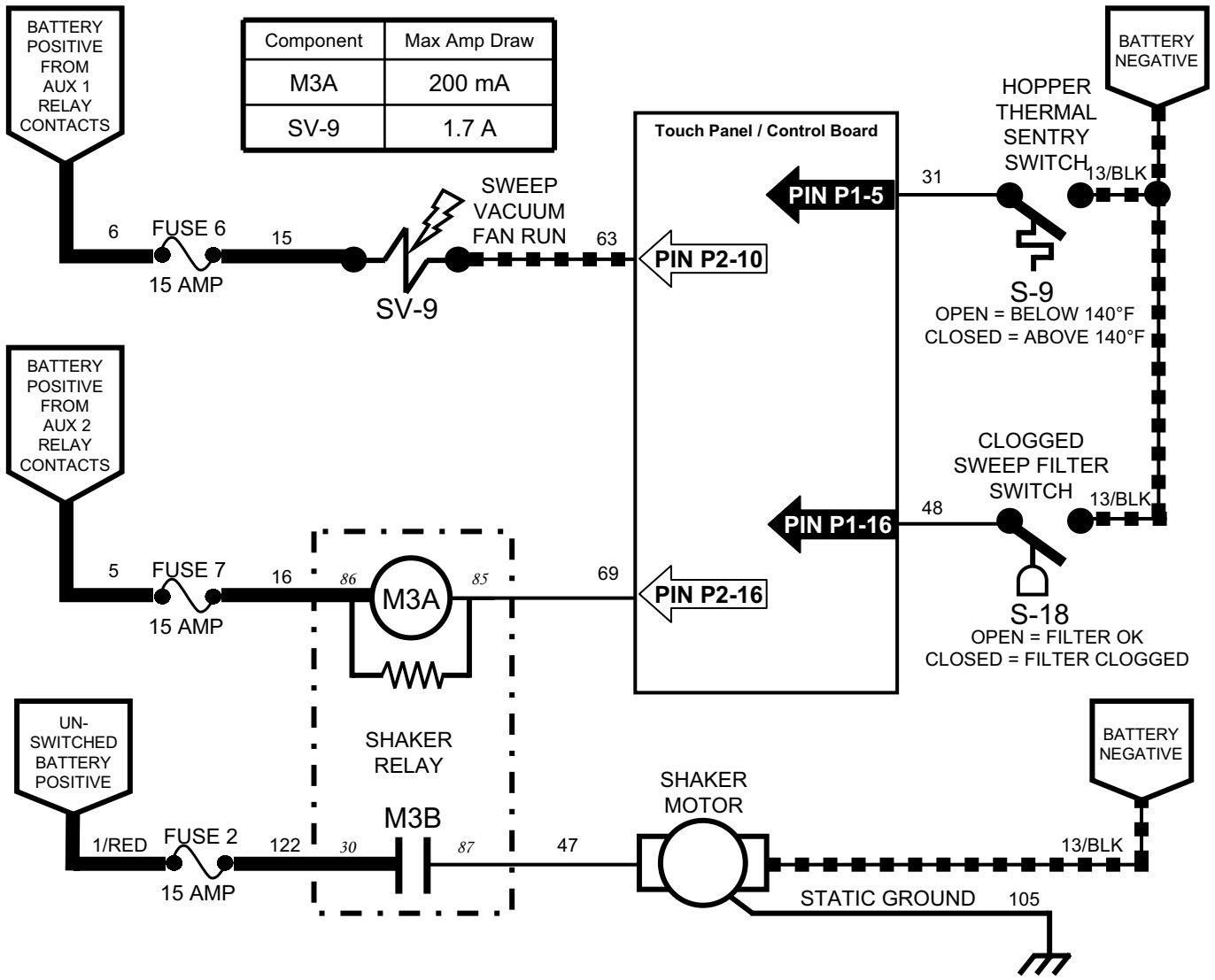
Reverse propel will turn OFF SV-4 (Pin P2-6) and raise the side and rear squeegees.

Any condition that cancels the scrub functions will also turn OFF the scrub vacuum fan and raise squeegees.

Sweep Vacuum Fan ON

Conditions: Key on, engine running, sweeping system and/or sweep vacuum fan on

Component	Max Amp Draw
M3A	200 mA
SV-9	1.7 A

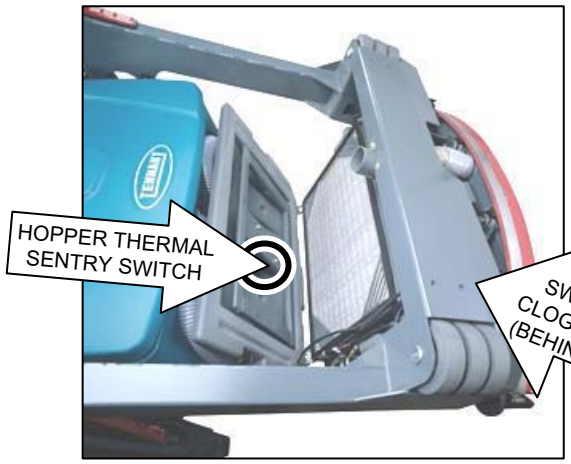


i **If the shaker system is manually selected when Sweep Vacuum Fan is ON, the fan is turned OFF during the shaker cycle, and turned back ON when shaker cycle is complete**

i **If Sweep Filter Clogged Switch closes (restriction in filter), a fault condition will be displayed, but vacuum fan will continue operating normally.**

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

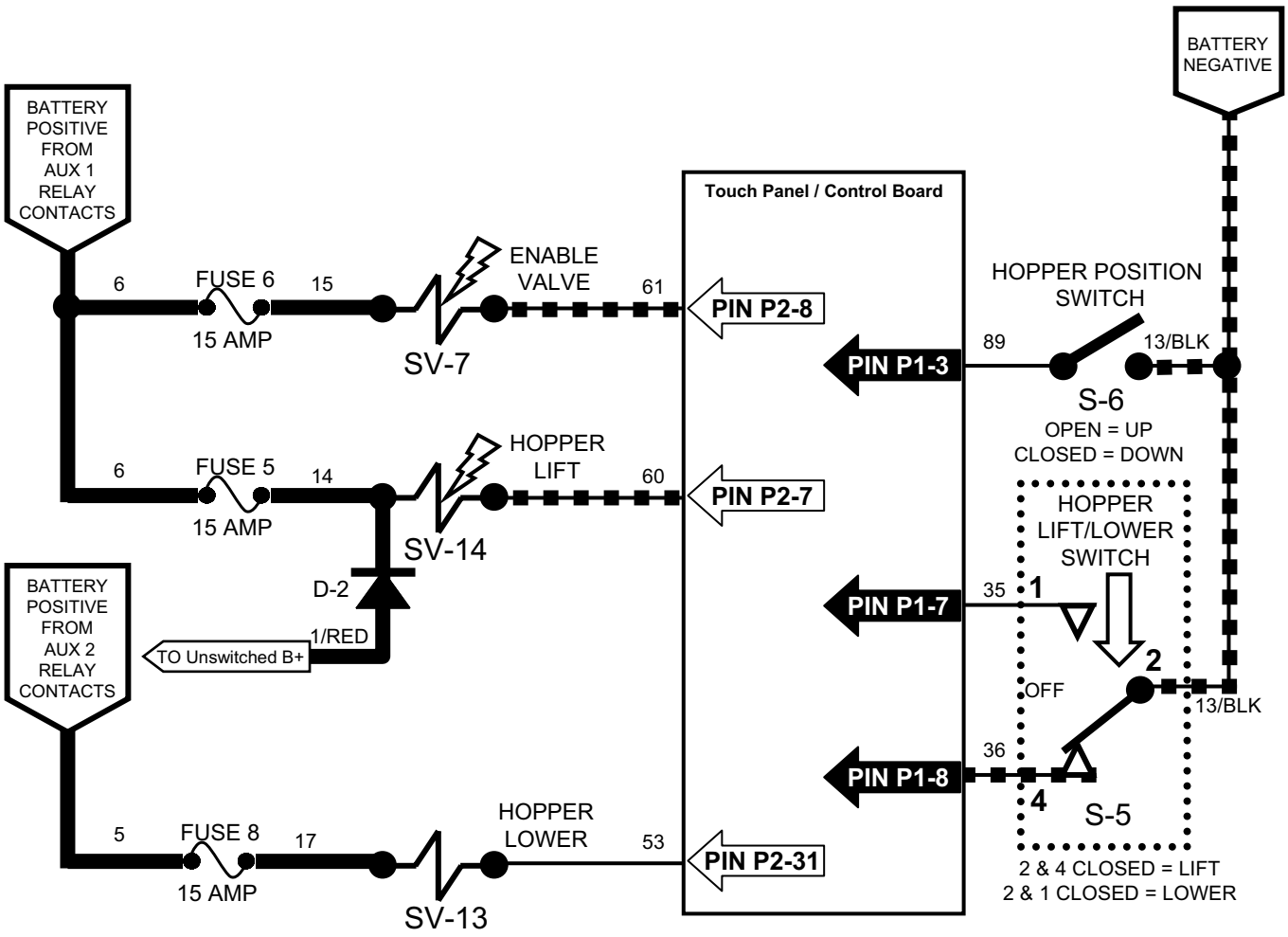


i **If the Hopper Thermal Sentry Switch closes (above 140°F in hopper), all sweep functions are cancelled.**

i **A short shaker cycle is automatically performed each time the Sweep Vacuum is turned OFF**

Hopper LIFT

Conditions: Key on, engine running, hopper lift switch activated

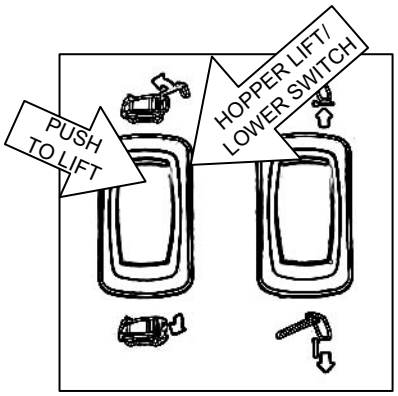


Activating the Hopper Lift/Lower Switch will cancel the sweep or scrub systems and automatically selects HIGH engine speed

Wiring Color Codes
(Unless otherwise marked)

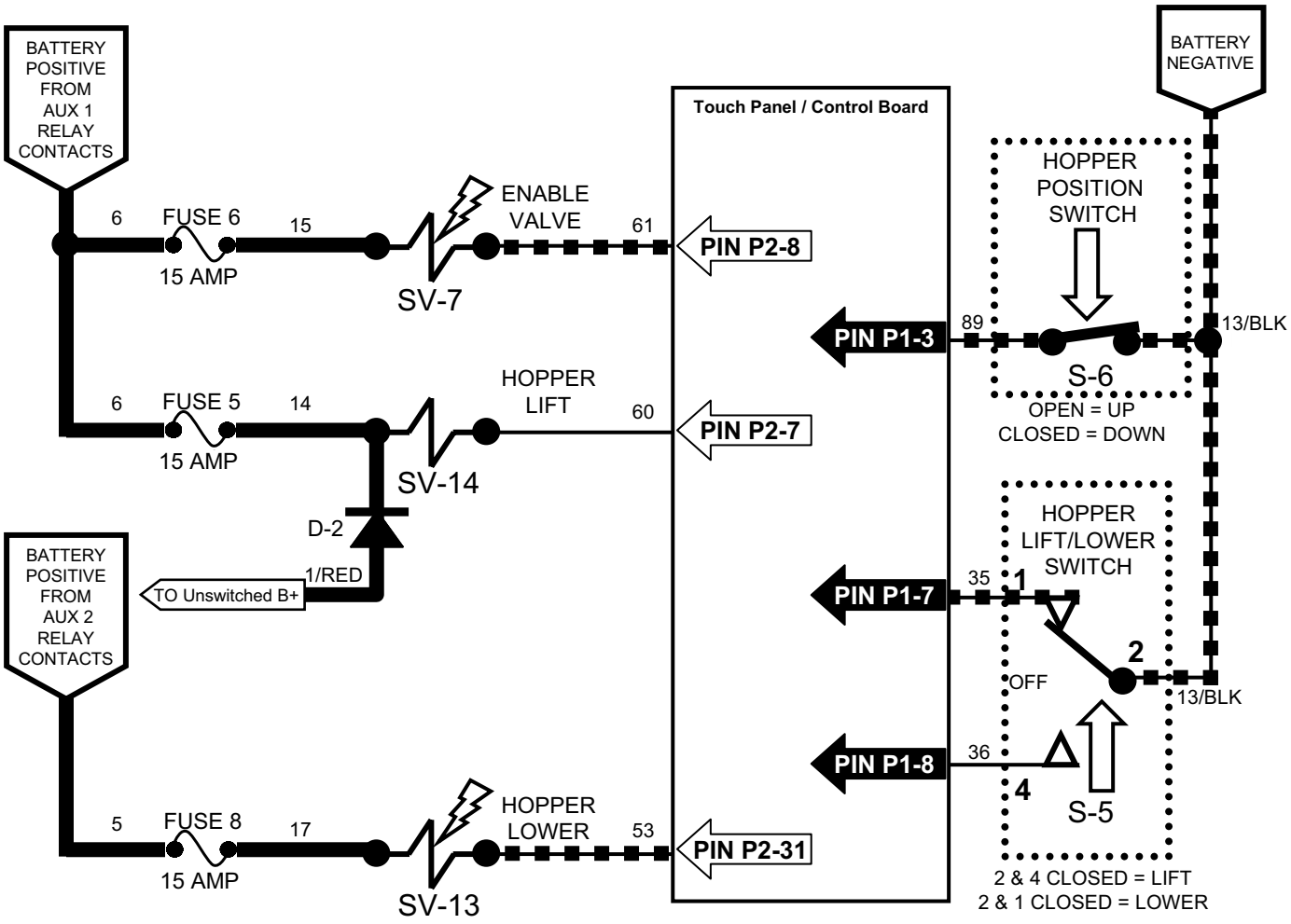
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Component	Max Amp Draw
SV-7	1.7 A
SV-13	1.7 A
SV-14	1.7 A



Hopper LOWER

Conditions: Key on, engine running, hopper lower switch activated

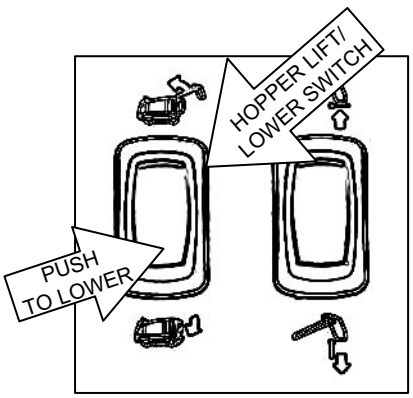


Activating the Hopper Lift/Lower Switch will cancel the sweep or scrub systems and automatically selects HIGH engine speed

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

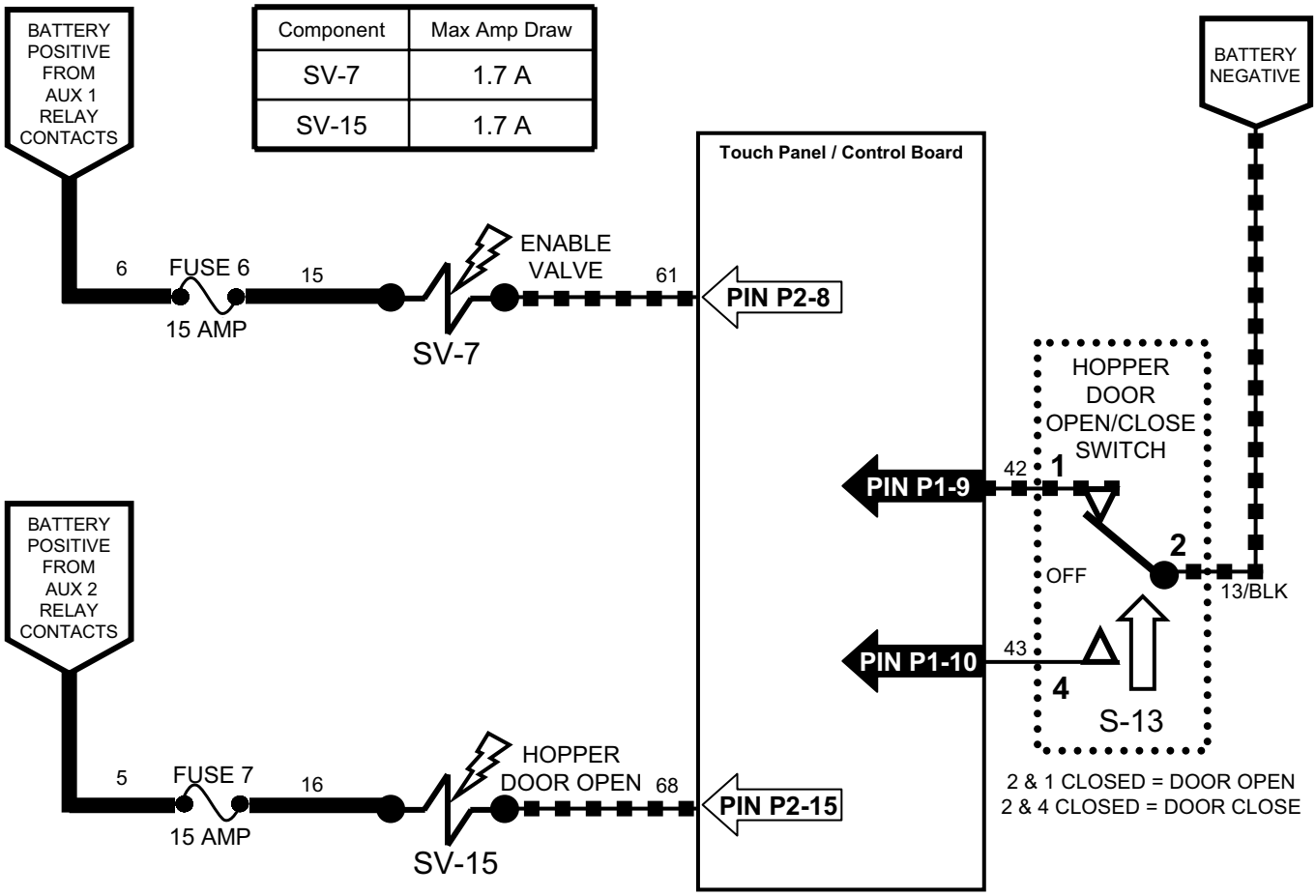
Component	Max Amp Draw
SV-7	1.7 A
SV-13	1.7 A
SV-14	1.7 A



Hopper Door OPEN

Conditions: Key on, engine running, hopper door open switch activated

Component	Max Amp Draw
SV-7	1.7 A
SV-15	1.7 A

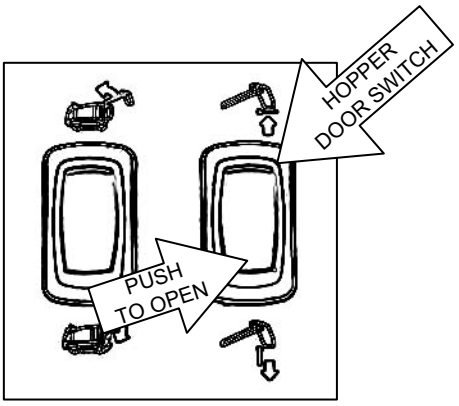


Anytime the Enable Valve (SV-7) is ON and the Hopper Door Open Valve (SV15) is OFF, the hopper door will close

Activating the Hopper Door Switch to open or close the door will cancel the sweep or scrub systems and automatically selects HIGH engine speed

Wiring Color Codes
(Unless otherwise marked)

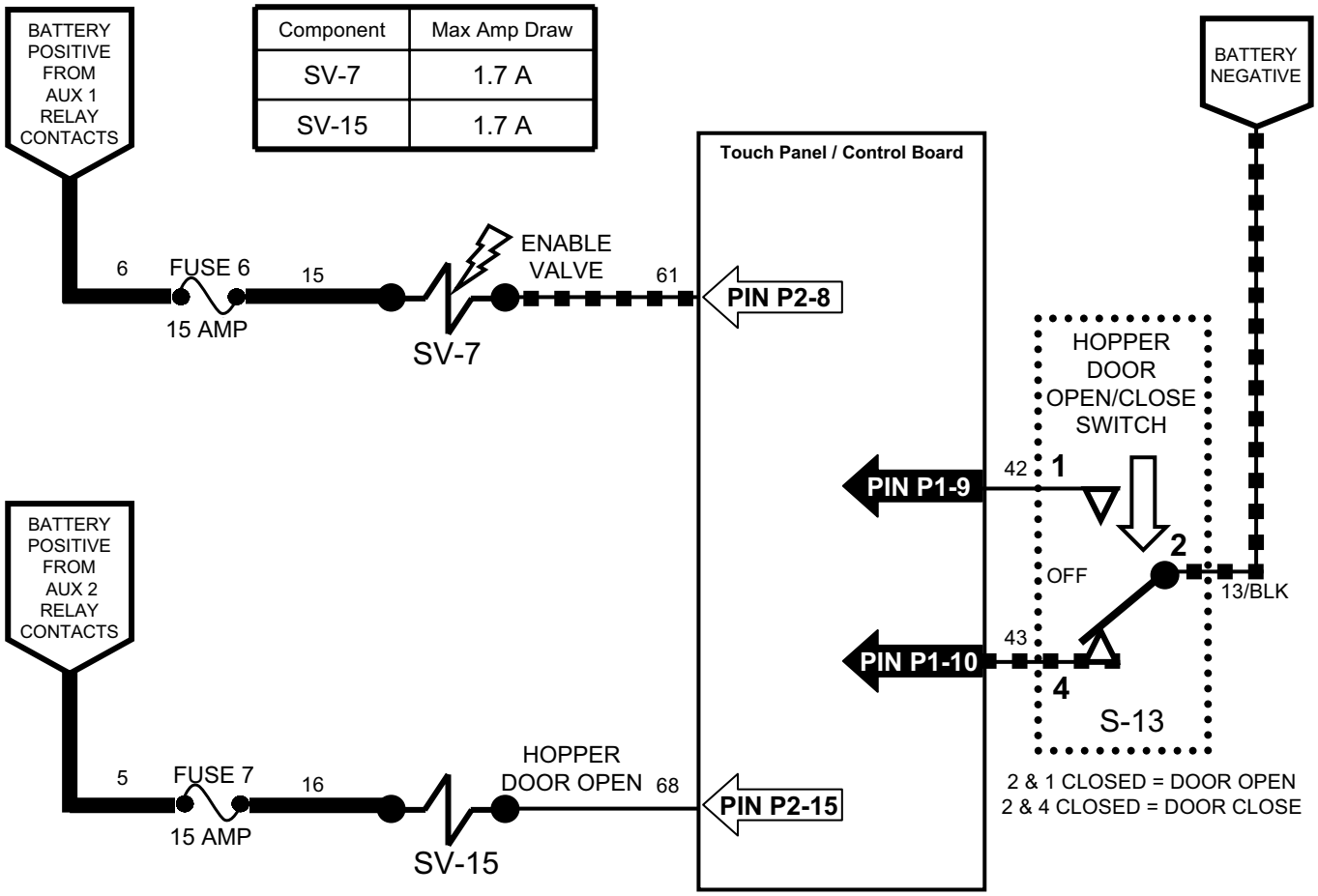
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



Hopper Door CLOSE

Conditions: Key on, engine running, hopper door close switch activated

Component	Max Amp Draw
SV-7	1.7 A
SV-15	1.7 A

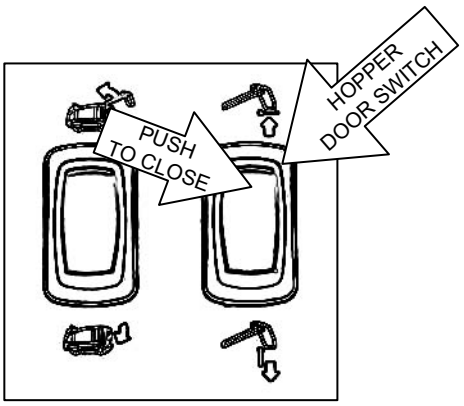


Anytime the Enable Valve (SV-7) is ON and the Hopper Door Open Valve (SV15) is OFF, the hopper door will close

Activating the Hopper Door Switch to open or close the door will cancel the sweep or scrub systems and automatically selects HIGH engine speed

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

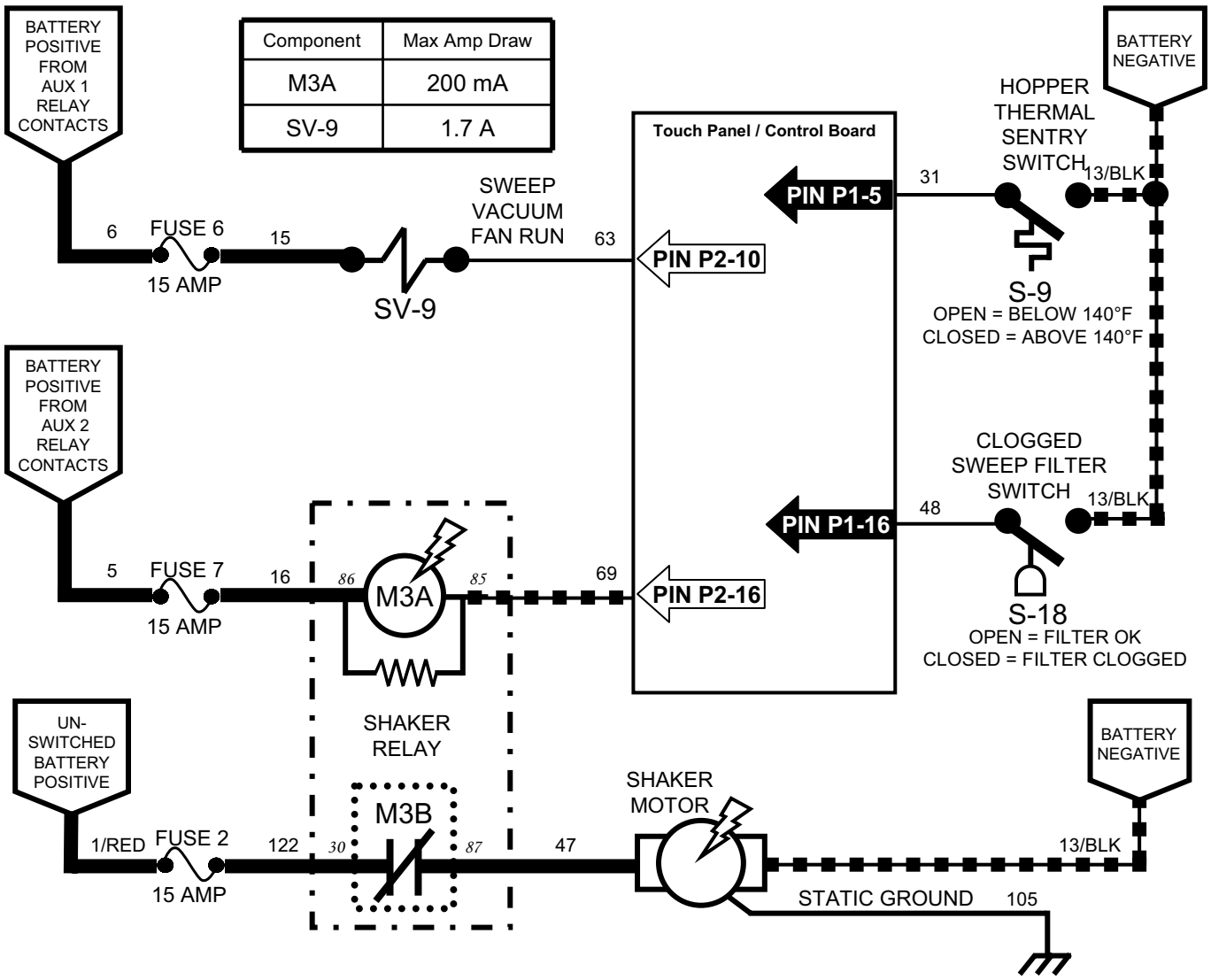


E

Shaker Motor ON

Conditions: Key on, One-Step sweeping turned off or shaker system on

Component	Max Amp Draw
M3A	200 mA
SV-9	1.7 A

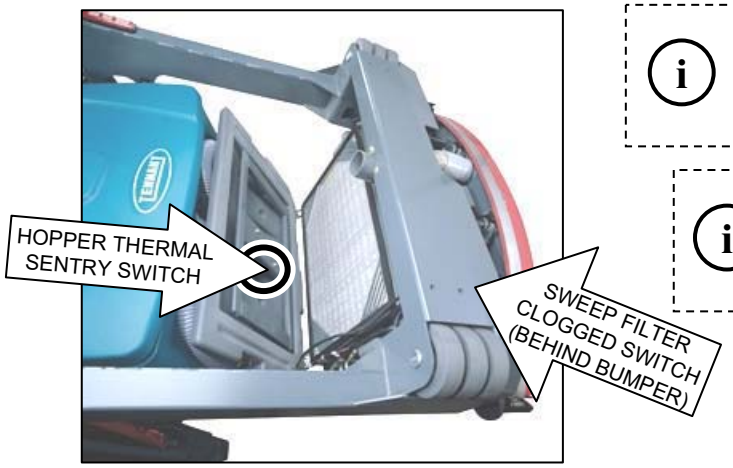


If the shaker system is manually selected when Sweep Vacuum Fan is ON, the fan is turned OFF during the shaker cycle, and turned back ON when shaker cycle is complete

If Sweep Filter Clogged Switch closes (restriction in filter), a fault condition will be displayed, but vacuum fan will continue operating normally.

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

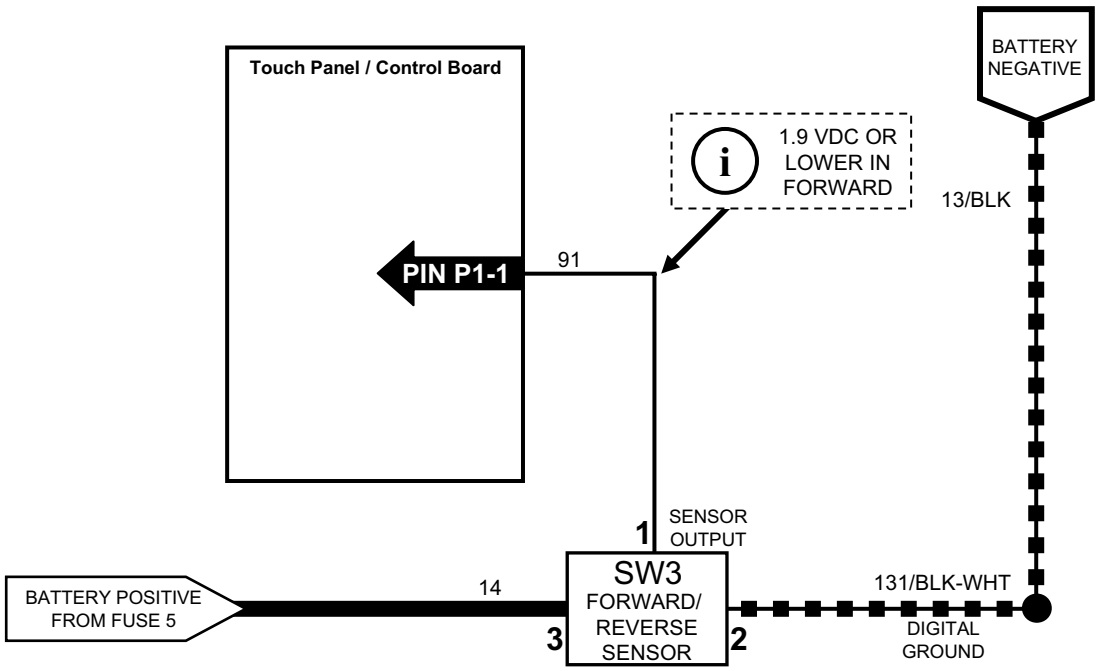


If the Hopper Thermal Sentry Switch closes (above 140°F in hopper), all sweep functions are cancelled.

A short shaker cycle is automatically performed each time the Sweep Vacuum is turned OFF

Forward Propel

Conditions: Key on, propel pedal pushed for forward travel

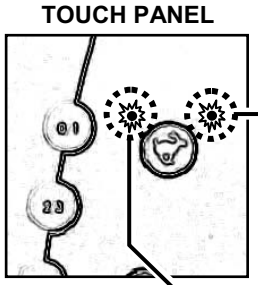


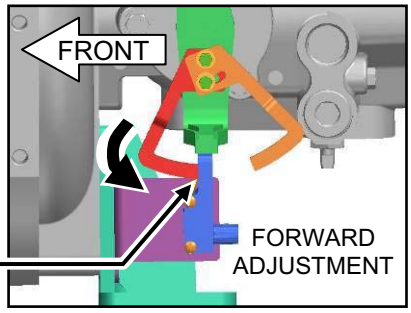
SENSOR OUTPUT VOLTAGES:
2.0 to 2.7 VDC = NEUTRAL
2.8 VDC OR HIGHER = REVERSE
1.9 VDC OR LOWER = FORWARD

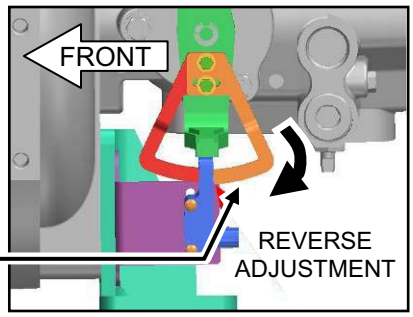
Propel Pedal Position Sensor Arms Adjustment

1) Enter Input Diagnostics Mode
2) Loosen sensor arms hardware
3) Tighten top bolt to snug
4) Slide arm until the light goes ON
5) **Back arm out until the light goes OFF**
6) Retighten all hardware

NOTE: Use the High Engine Speed LED to adjust the arm closest to the front of machine (forward adjustment), and the Low Engine Speed LED to adjust the arm closest to the rear of machine (reverse adjustment).

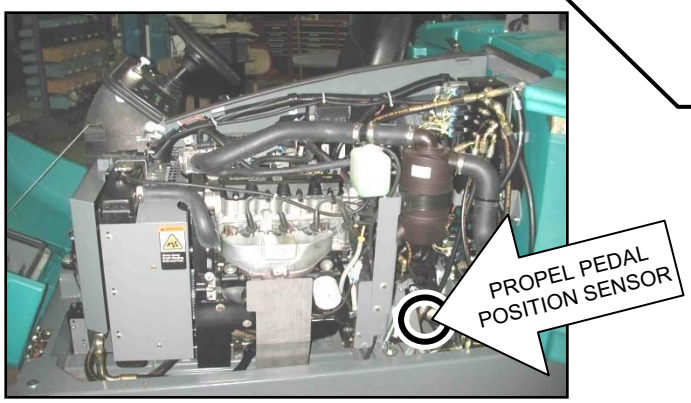






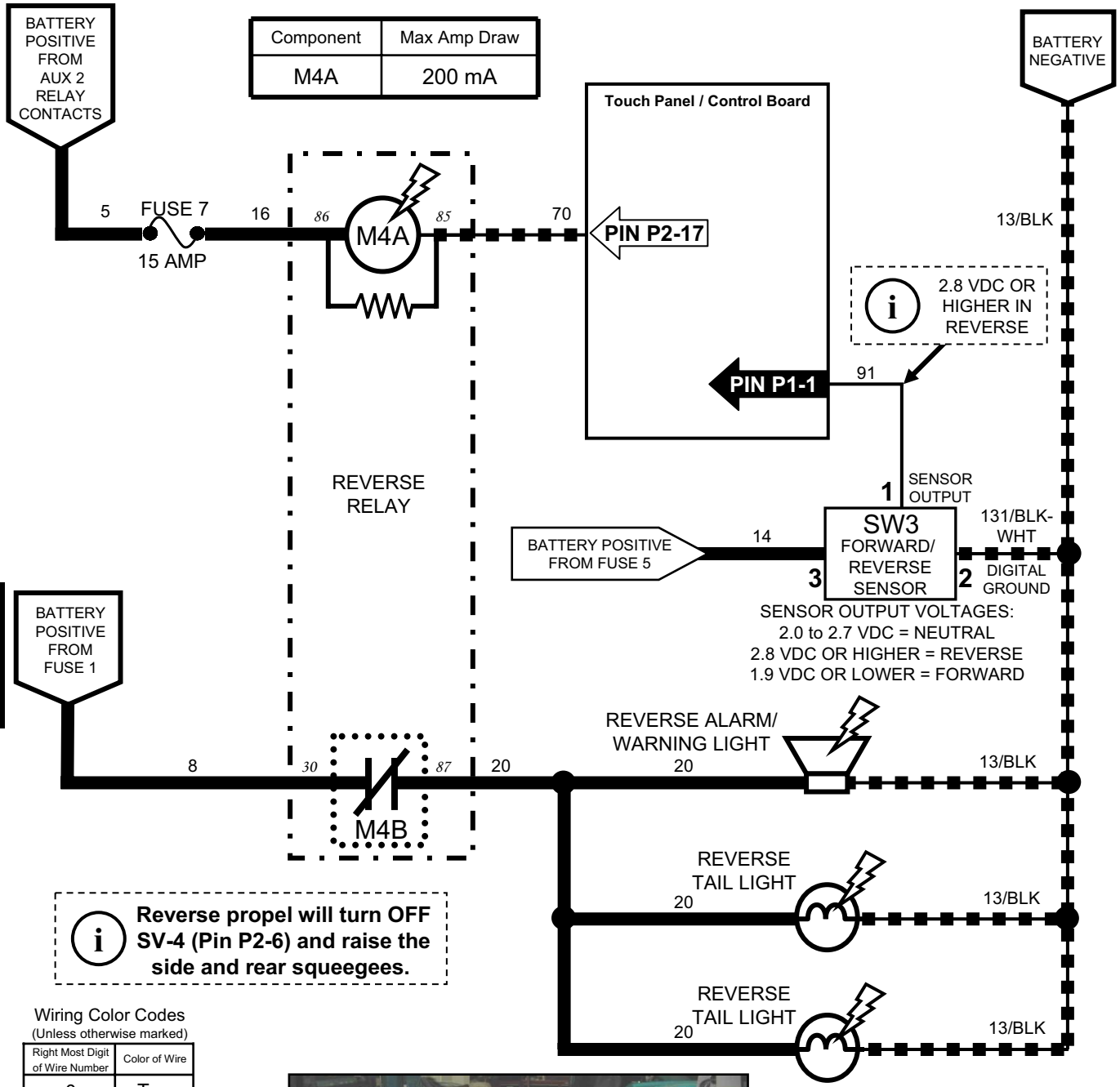
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



Reverse Propel

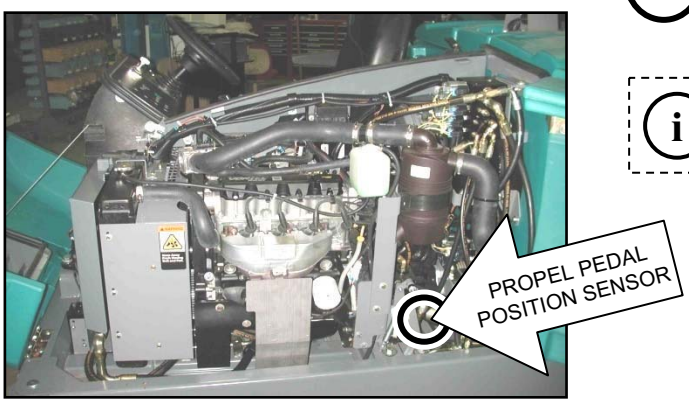
Conditions: Key on, propel pedal pushed for reverse travel



Reverse propel will turn OFF SV-4 (Pin P2-6) and raise the side and rear squeegees.

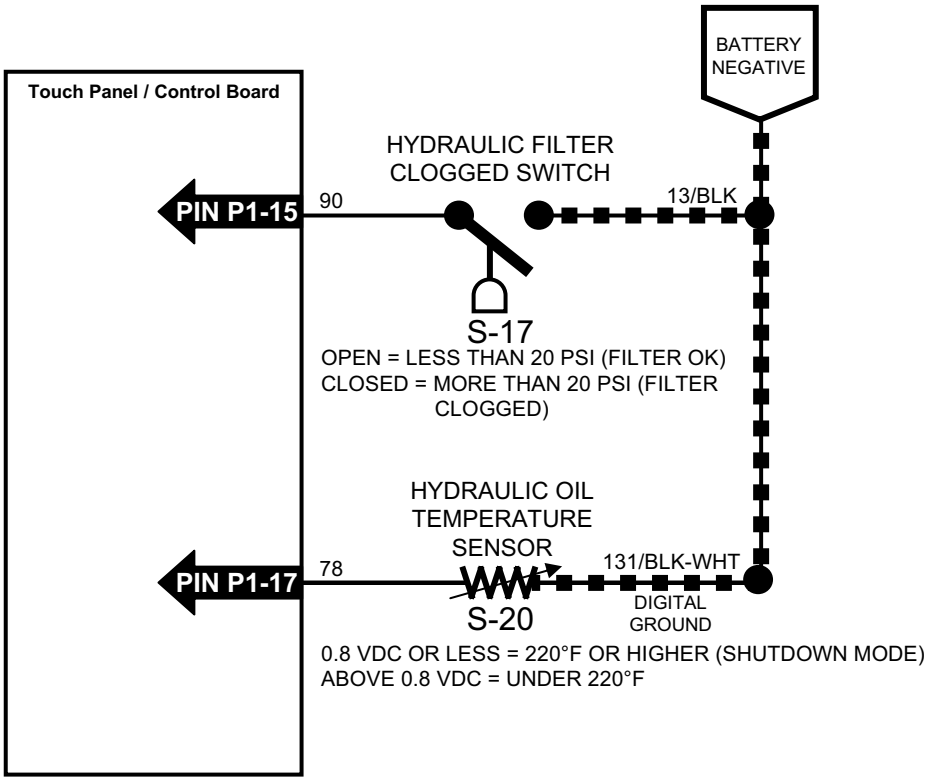
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



See Forward Propel page for information on adjusting Propel Pedal Position Sensor

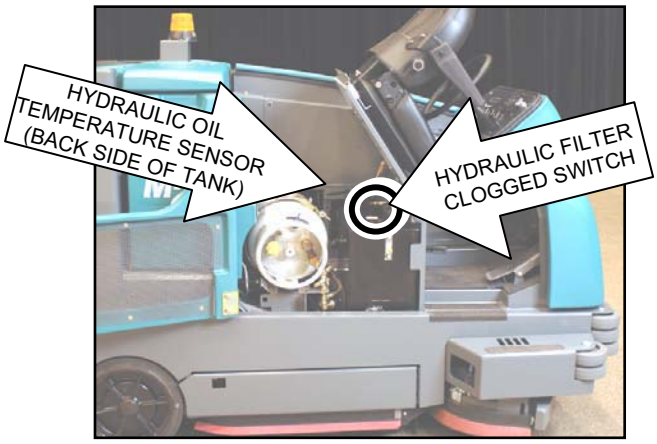
Hydraulic Oil Temperature & Hydraulic Oil Filter Clogged Sensors



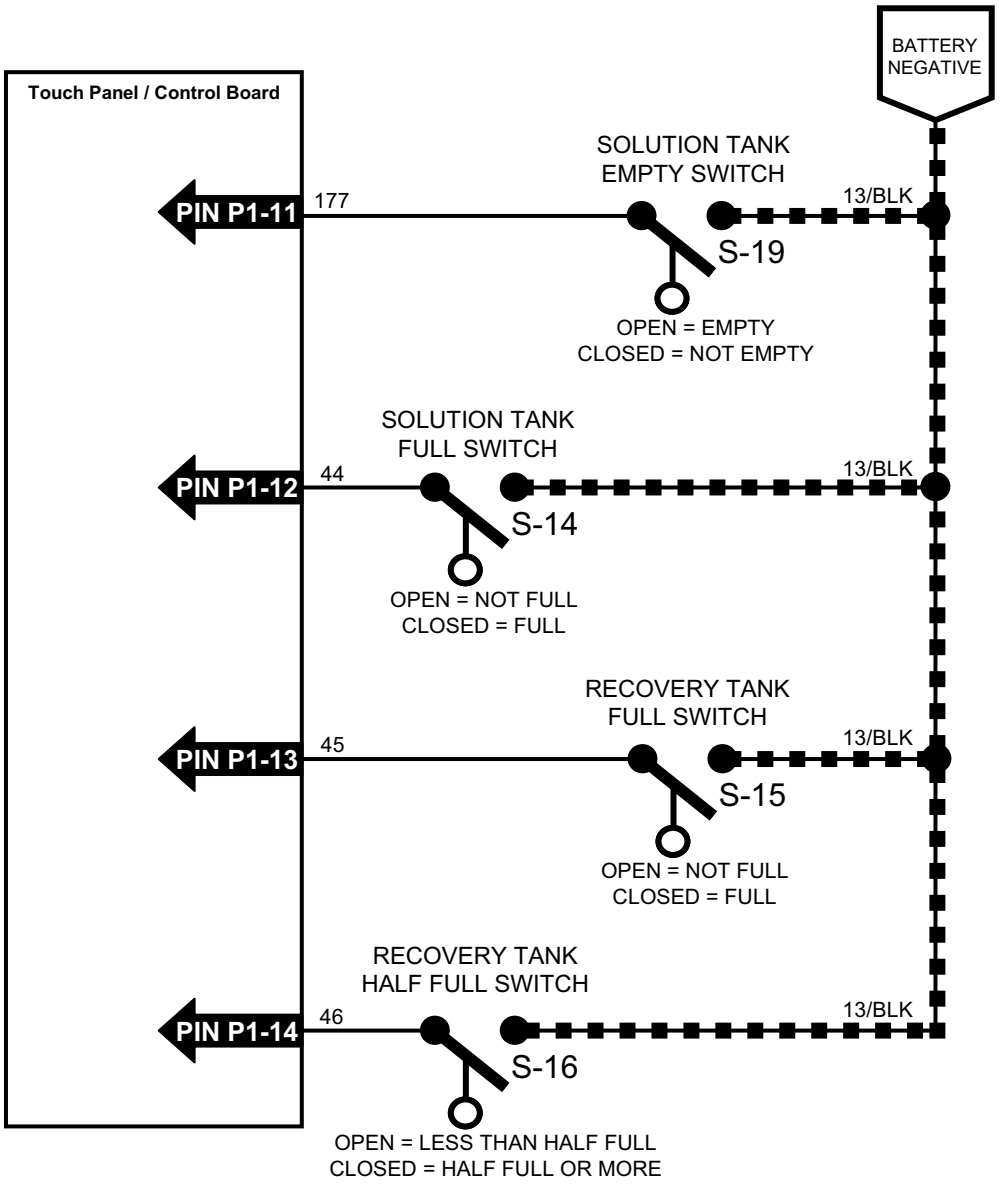
The Hydraulic Filter Clogged Switch will not be sensed until after the machine has run for 5 minutes to allow the hydraulic oil to warm up

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



Solution & Recovery Tank Level Switches



Wiring Color Codes
(Unless otherwise marked)

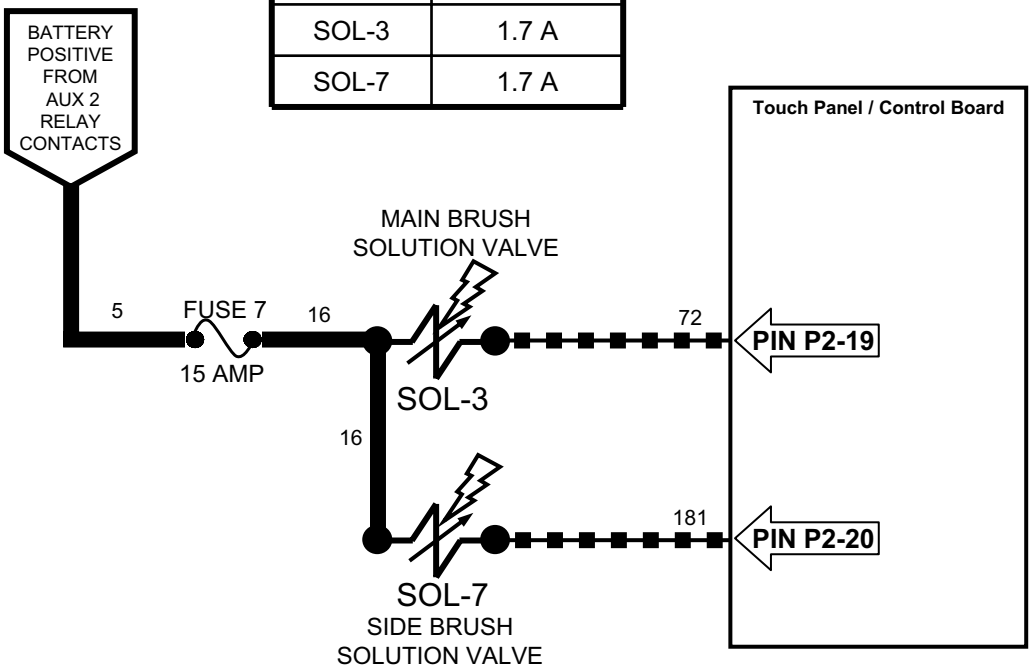
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The Float Switches must be closed for 5 seconds before any output is affected

Conventional Main & Side Brush Solution Valves

Conditions: Key on, scrubbing system on, side brush on, forward or reverse propel, one or more solution LED's lit

Component	Max Amp Draw
SOL-3	1.7 A
SOL-7	1.7 A



E

i **The Solution Valves are pulsed slowly to adjust the solution volume. Less OFF time (more Solution LED's lit on Touch Panel) will result in more solution applied to floor**

i **The Solution Valves will function only while propelling forward or reverse during scrub operation**

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

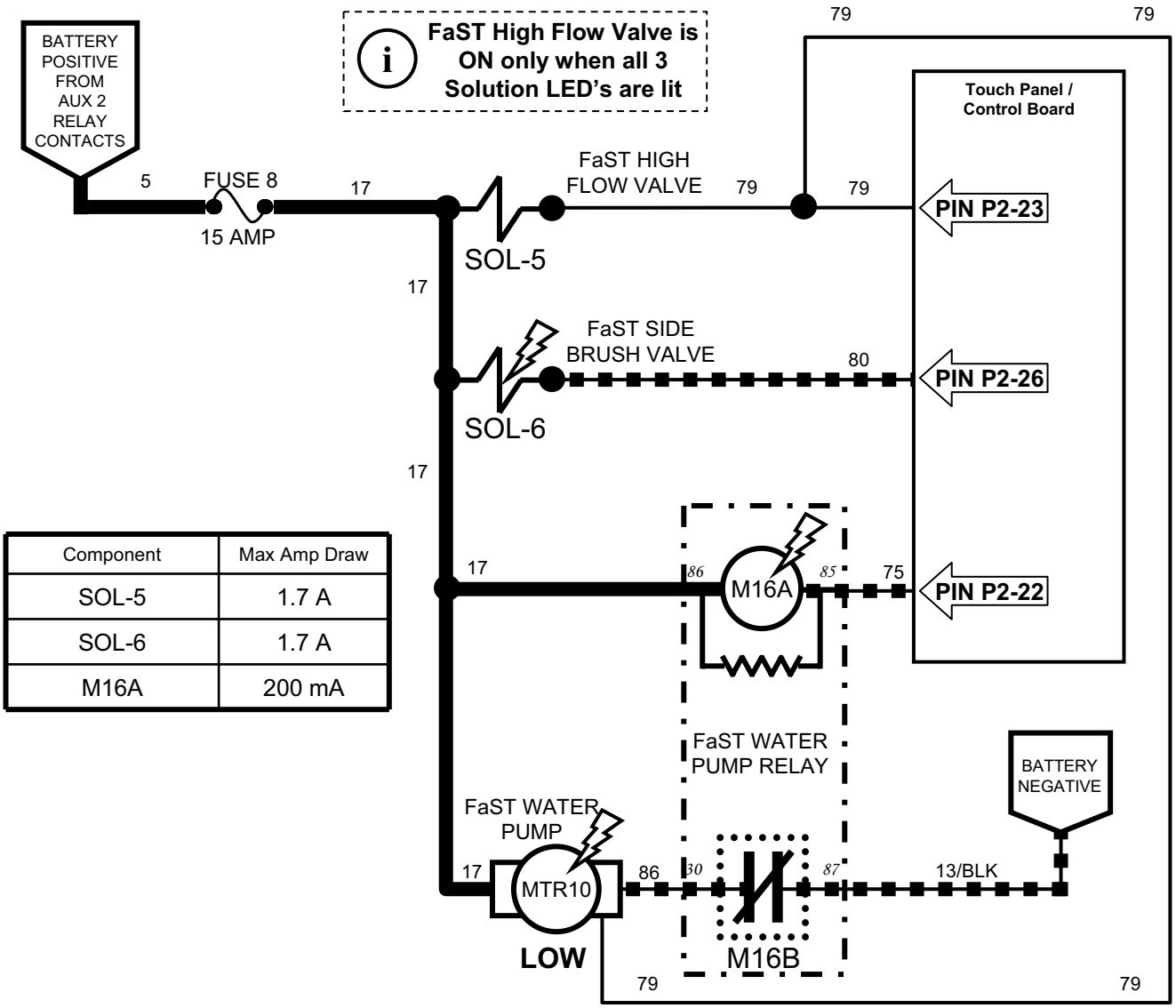
Low Solution

Medium Solution

High Solution

FaST System ON (Low Flow)

Conditions: Key on, scrubbing system on, side brush on, forward or reverse propel, one or two solution LED's lit



Component	Max Amp Draw
SOL-5	1.7 A
SOL-6	1.7 A
M16A	200 mA

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The FaST Water Pump has two speeds (Low Flow & High Flow). When there is no input to the pump on Wire 79/White (open), Low Flow is selected. When Battery Negative is input to the pump on Wire 79/White, High Flow is selected.

Low FaST

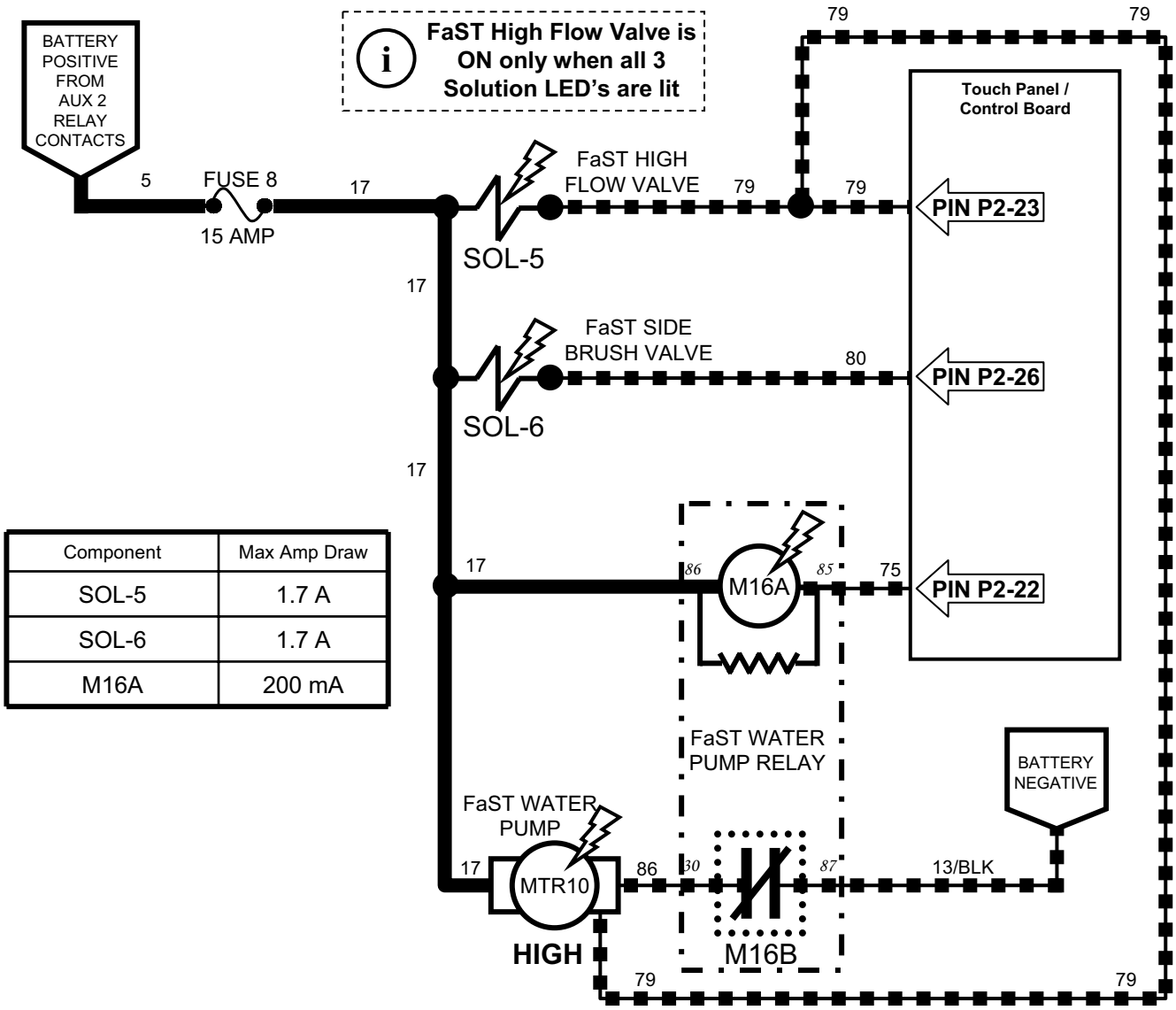
Low FaST

High FaST

One or two Solution LED's lit selects Low FaST output

FaST System ON (High Flow)

Conditions: Key on, scrubbing system on, side brush on, forward or reverse propel, three solution LED's lit



Component	Max Amp Draw
SOL-5	1.7 A
SOL-6	1.7 A
M16A	200 mA

FaST High Flow Valve is ON only when all 3 Solution LED's are lit

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The FaST Water Pump has two speeds (Low Flow & High Flow). When there is no input to the pump on Wire 79/White (open), Low Flow is selected. When Battery Negative is input to the pump on Wire 79/White, High Flow is selected.

Low FaST

Low FaST

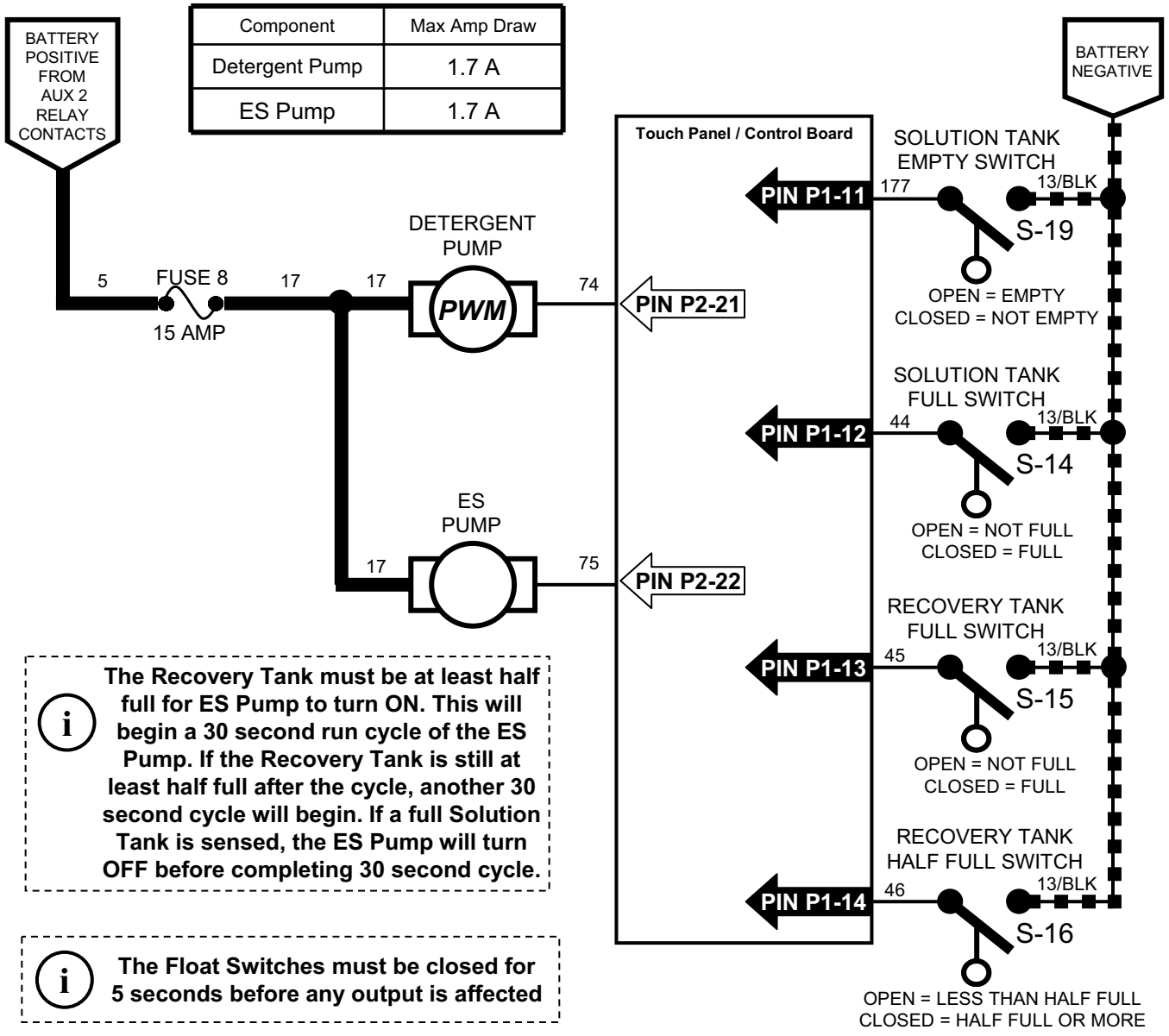
High FaST

One or two Solution LED's lit selects Low FaST output

Extended Scrub (ES) System

Conditions: Key on, engine running, scrubbing system on, ES system on, two or three solution LED's lit

Component	Max Amp Draw
Detergent Pump	1.7 A
ES Pump	1.7 A



i **The Recovery Tank must be at least half full for ES Pump to turn ON. This will begin a 30 second run cycle of the ES Pump. If the Recovery Tank is still at least half full after the cycle, another 30 second cycle will begin. If a full Solution Tank is sensed, the ES Pump will turn OFF before completing 30 second cycle.**

i **The Float Switches must be closed for 5 seconds before any output is affected**

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

i **The Detergent Pump is controlled by PWM; A higher duty cycle (more Solution LED's lit on Touch Panel) will result in more detergent & solution applied to floor**

Low Water and Detergent Pump OFF

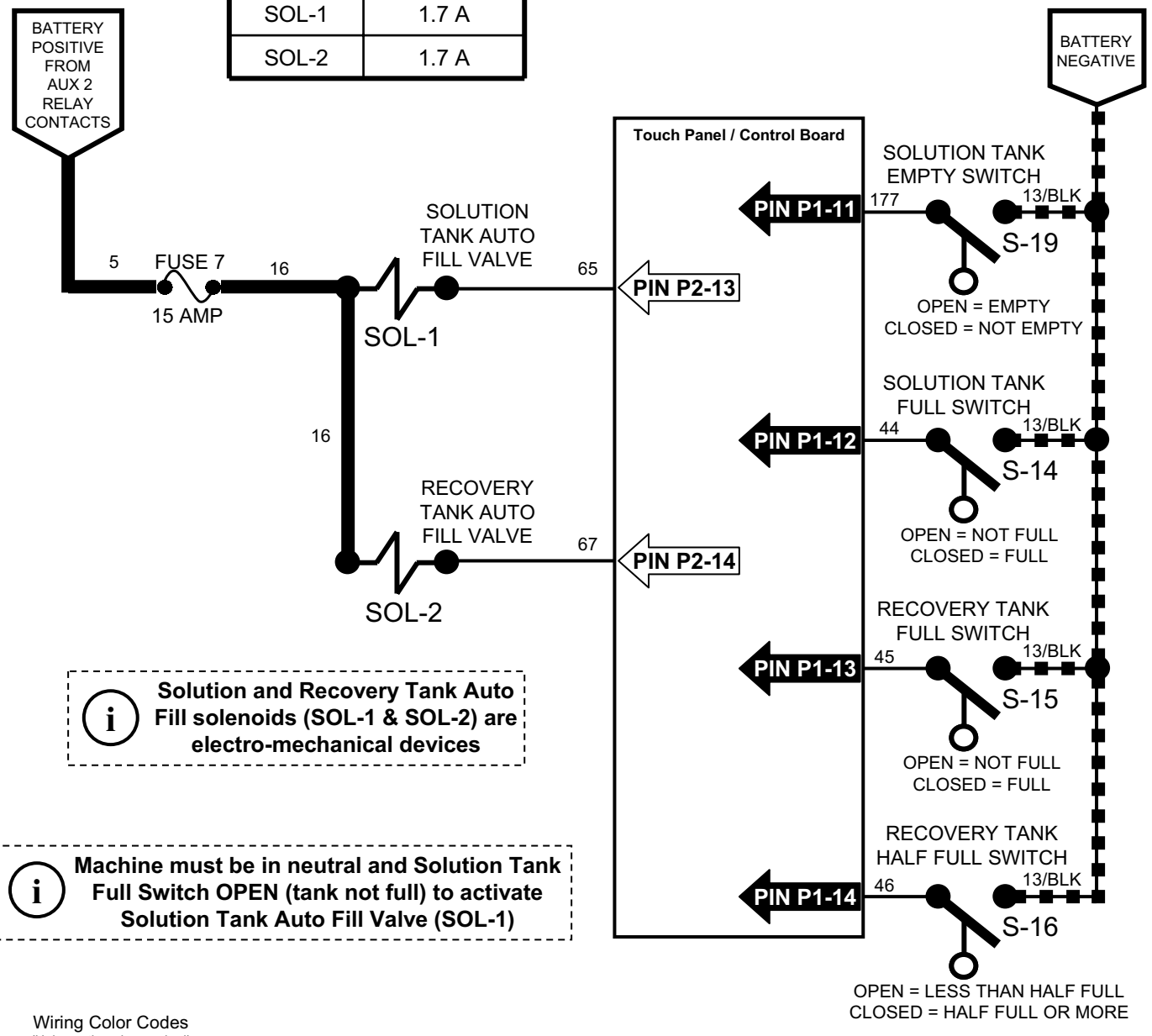
Medium Water and Detergent Pump LOW

High Water and Detergent Pump HIGH

Auto Fill Solenoids

Conditions: Key on

Component	Max Amp Draw
SOL-1	1.7 A
SOL-2	1.7 A



i **Solution and Recovery Tank Auto Fill solenoids (SOL-1 & SOL-2) are electro-mechanical devices**

i **Machine must be in neutral and Solution Tank Full Switch OPEN (tank not full) to activate Solution Tank Auto Fill Valve (SOL-1)**

i **Machine must be in neutral and Recovery Tank Half Full Switch OPEN (tank less than half full) to activate Recovery Tank Auto Fill Valve (SOL-2)**

i **The Float Switches must be closed for 5 seconds before any output is affected**

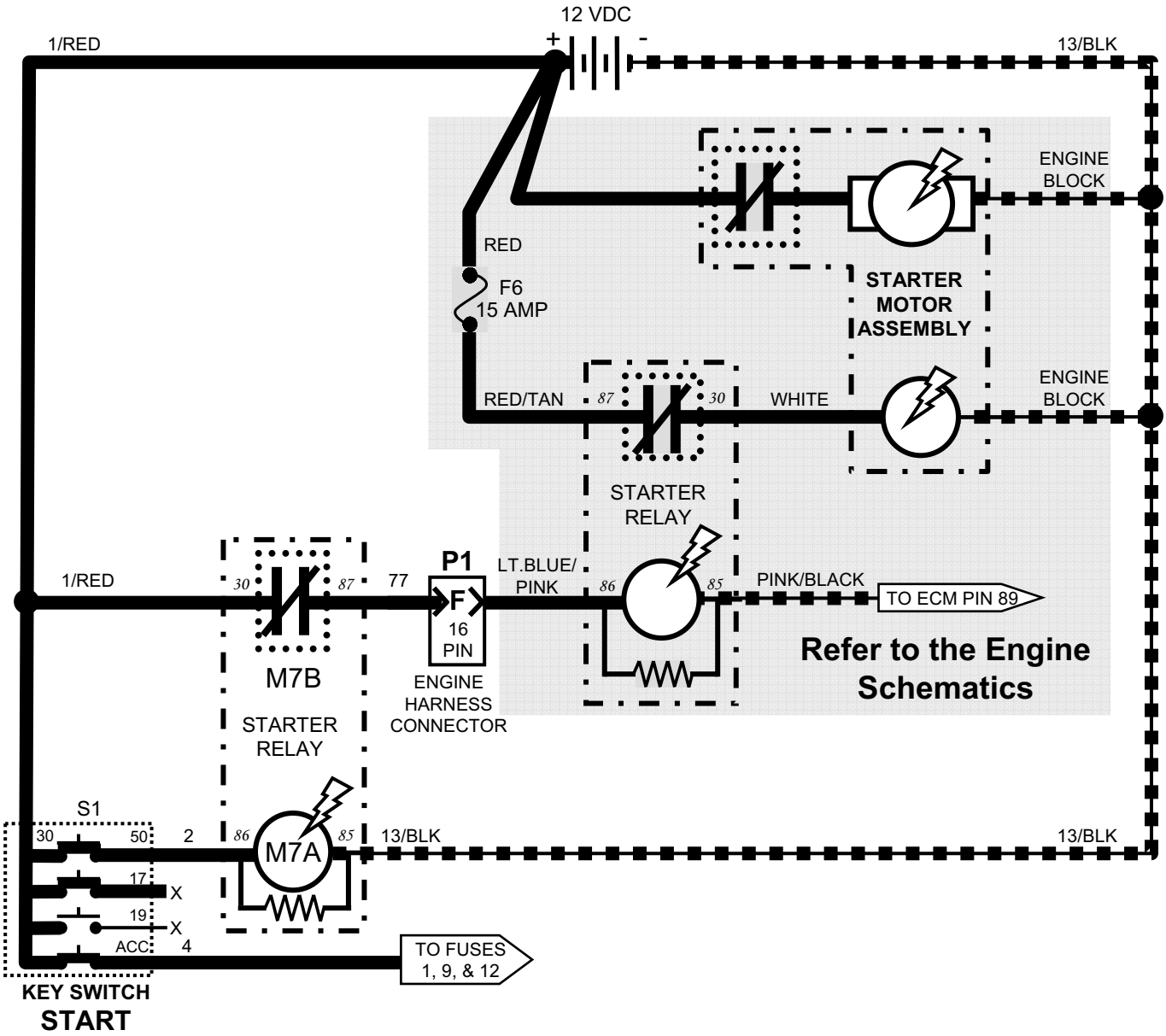
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

E

Starting System ON (Gas/LPG)

Conditions: Key turned to start position

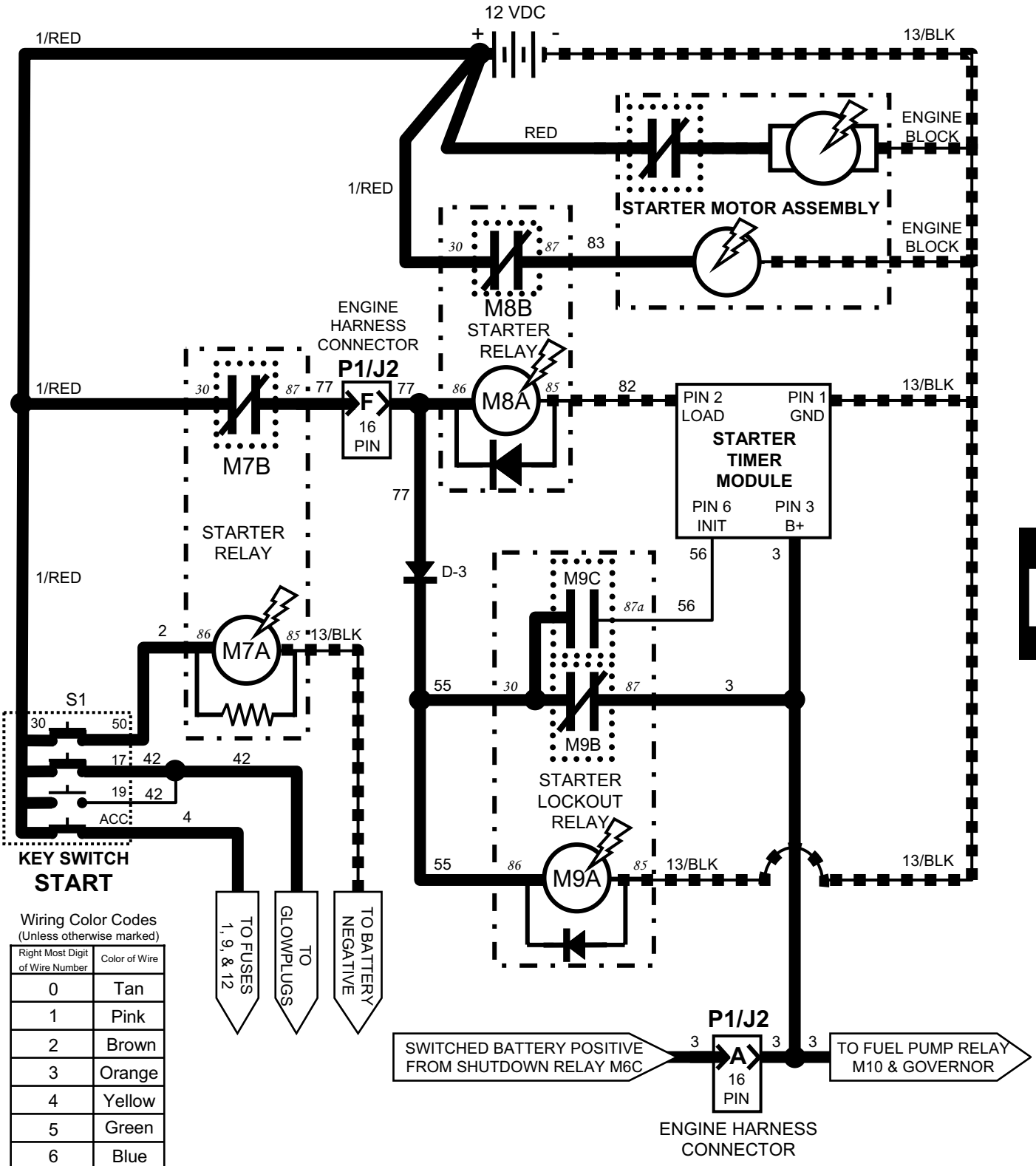


Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Starting System ON (Diesel)

Conditions: Key turned to start position



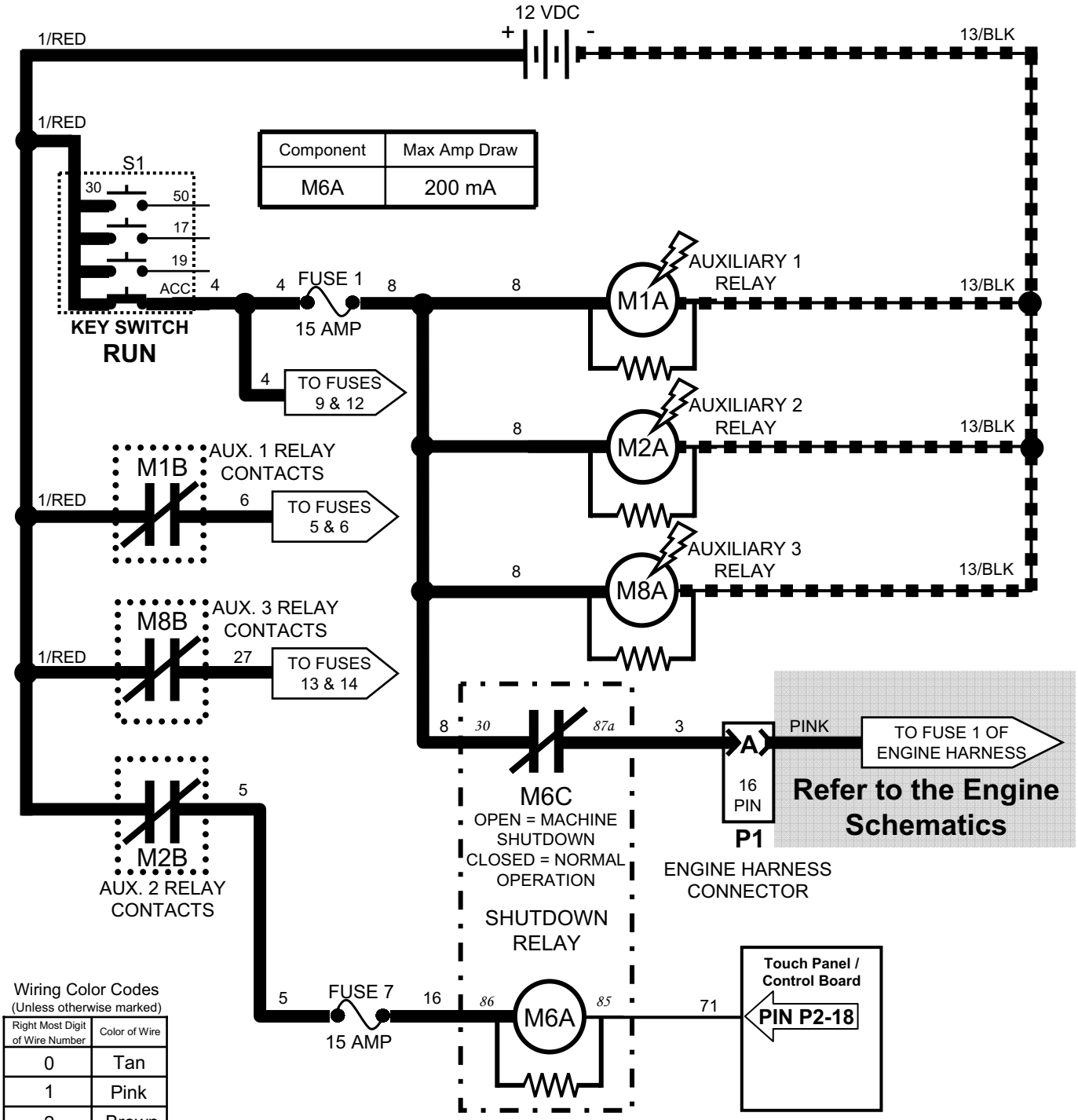
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

i **The Starter Timer Module creates a delay between start attempts**

E

Shutdown Relay - Normal Machine Operation (Gas/LPG)



Component	Max Amp Draw
M6A	200 mA

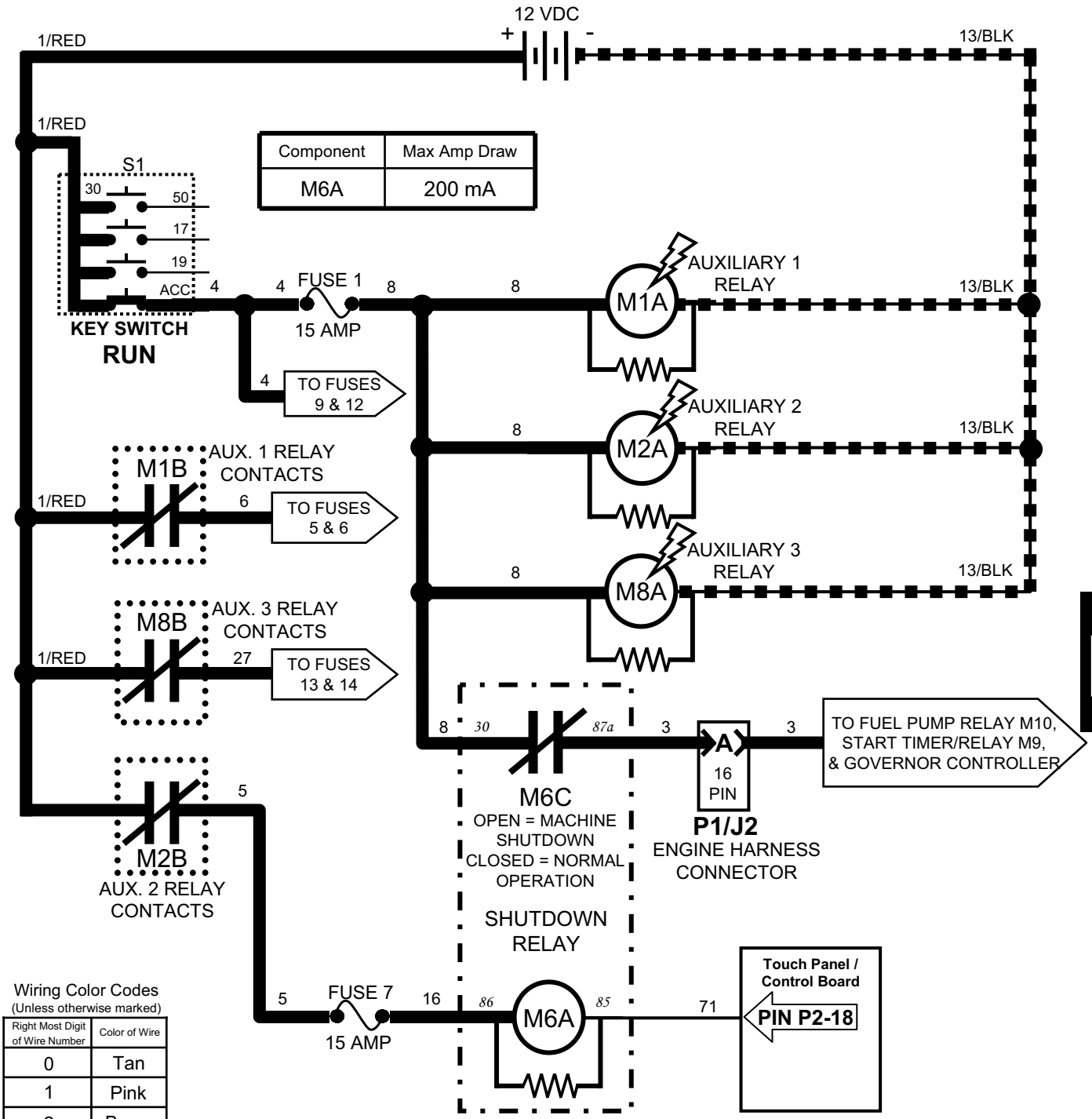
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

i **The Shutdown system is used to turn OFF the engine under certain conditions on machines with certain optional equipment**

i **When control board turns ON M6A, the engine ECM loses power, and engine shuts OFF**

Shutdown Relay - Normal Machine Operation (Diesel)



Component	Max Amp Draw
M6A	200 mA

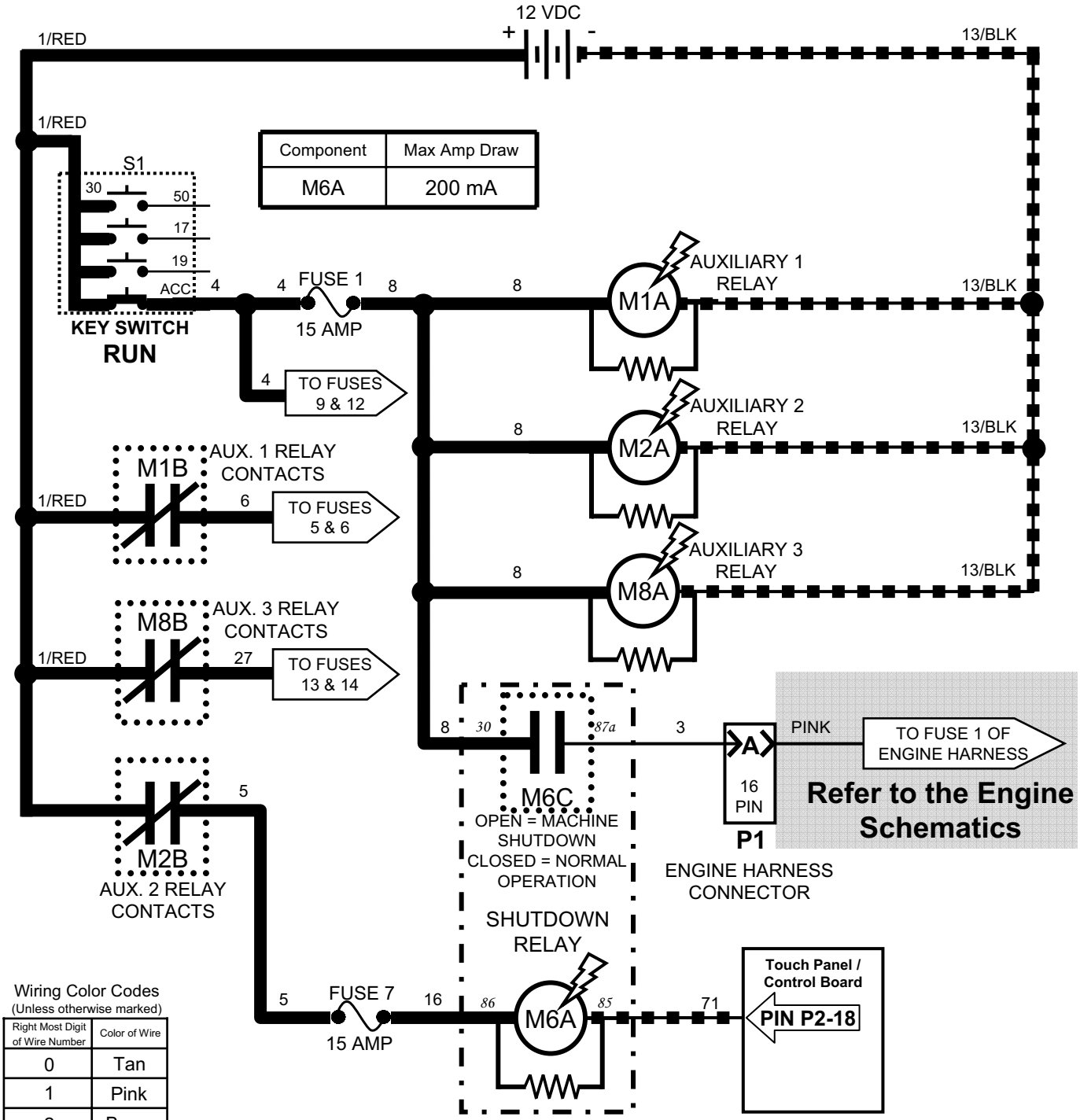
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The Shutdown system is used to turn OFF the engine under certain conditions on machines with certain optional equipment

When control board turns ON M6A, the fuel pump loses power, and engine shuts OFF

Shutdown Relay - Shutdown Mode (Gas/LPG)



Component	Max Amp Draw
M6A	200 mA

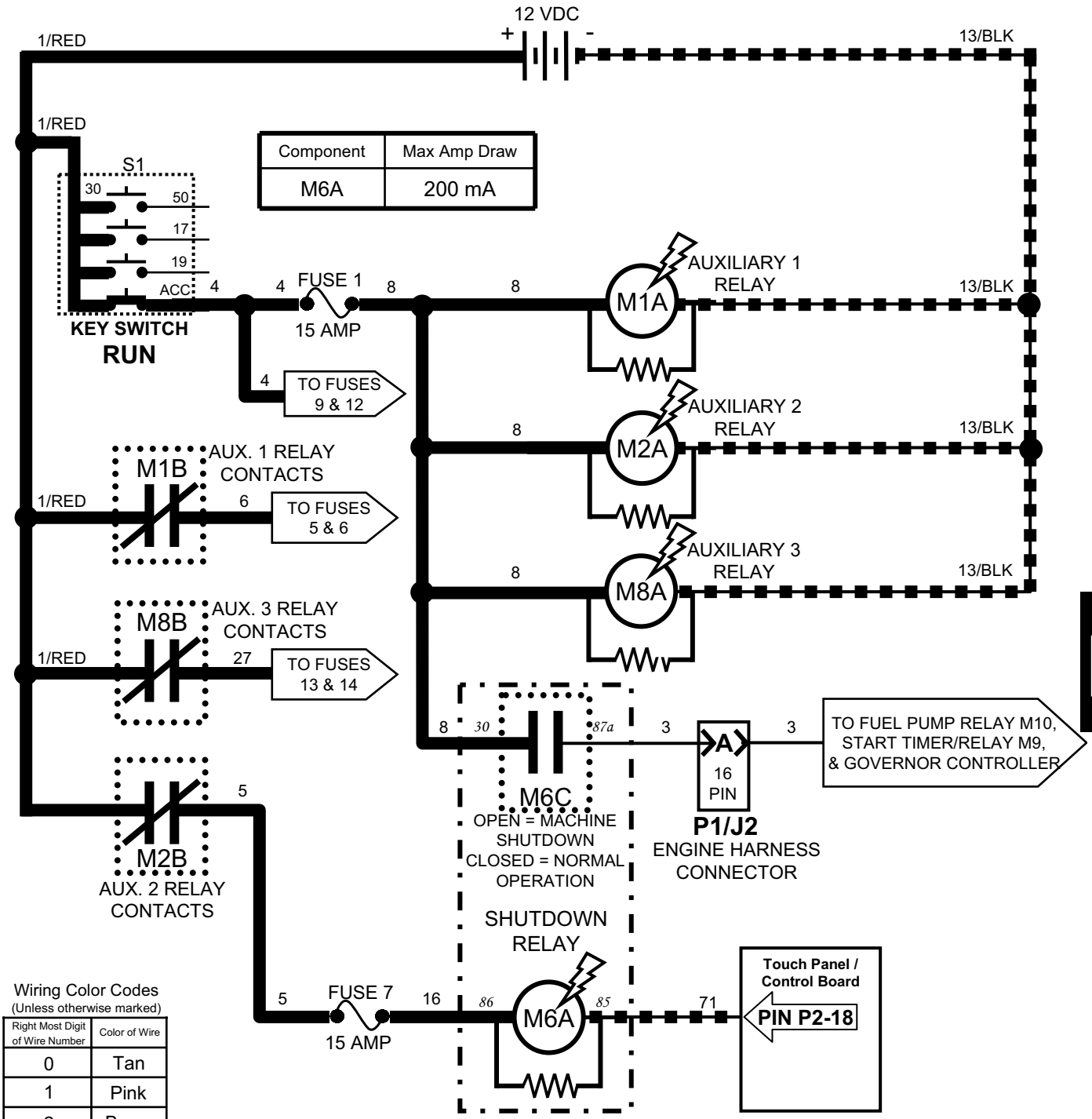
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The Shutdown system is used to turn OFF the engine under certain conditions on machines with certain optional equipment

When control board turns ON M6A, the engine ECM loses power, and engine shuts OFF

Shutdown Relay - Shutdown Mode (Diesel)



Component	Max Amp Draw
M6A	200 mA

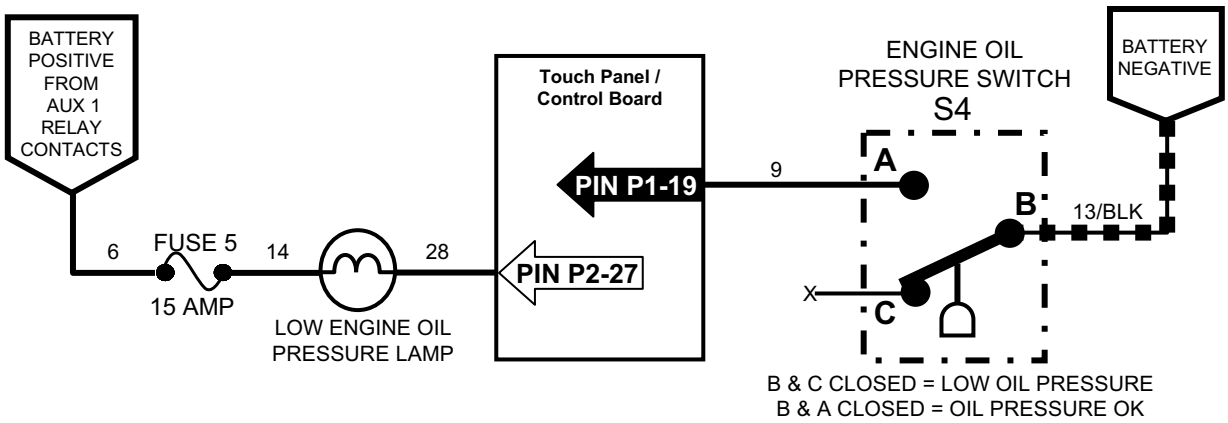
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

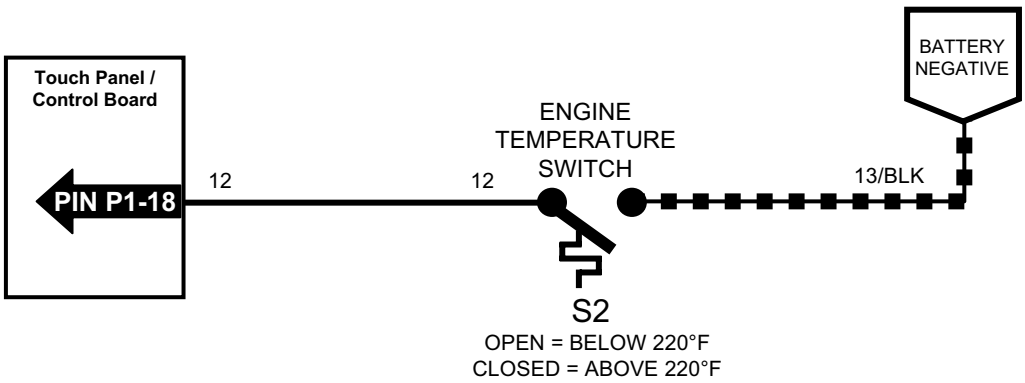
The Shutdown system is used to turn OFF the engine under certain conditions on machines with certain optional equipment

When control board turns ON M6A, the engine ECM loses power, and engine shuts OFF

Engine Oil Pressure



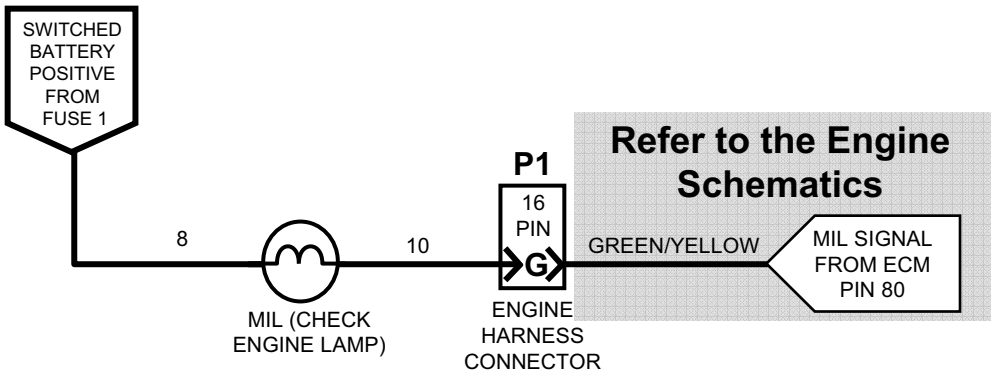
Engine Temperature Switch



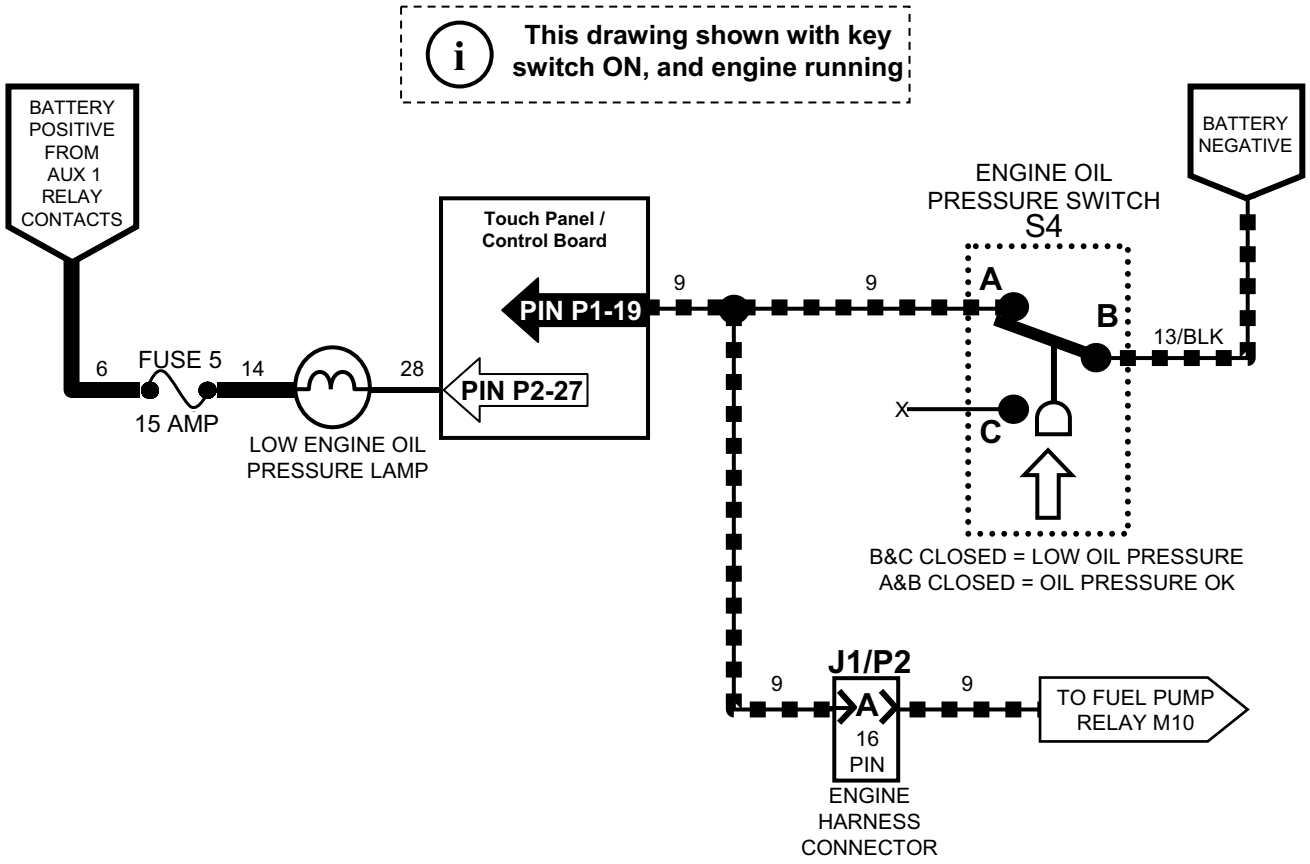
Malfunction Indicator Lamp

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



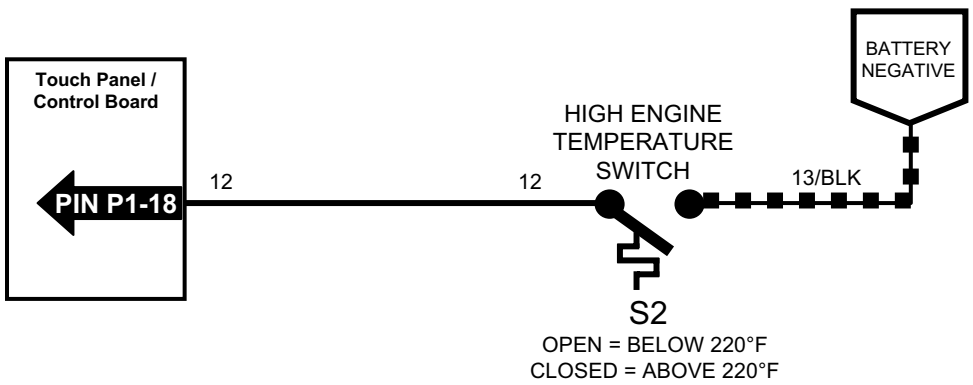
Engine Oil Pressure Switch



Engine Temperature Switch

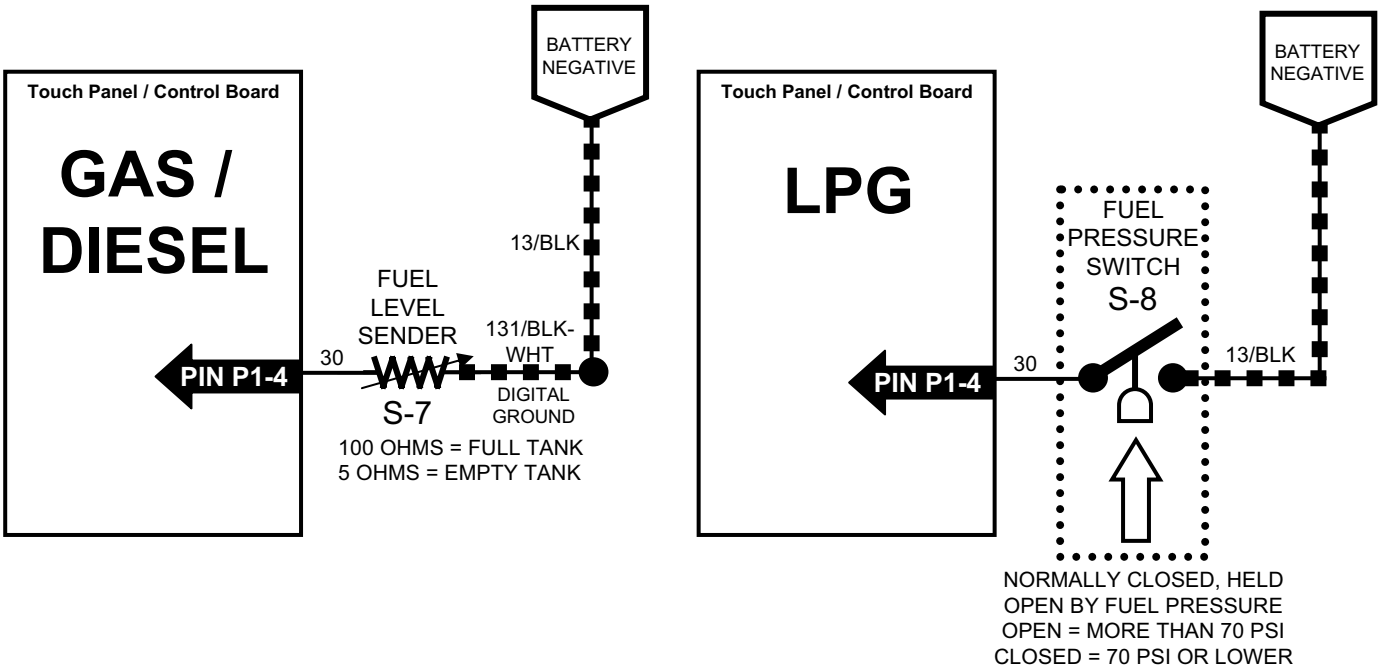
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

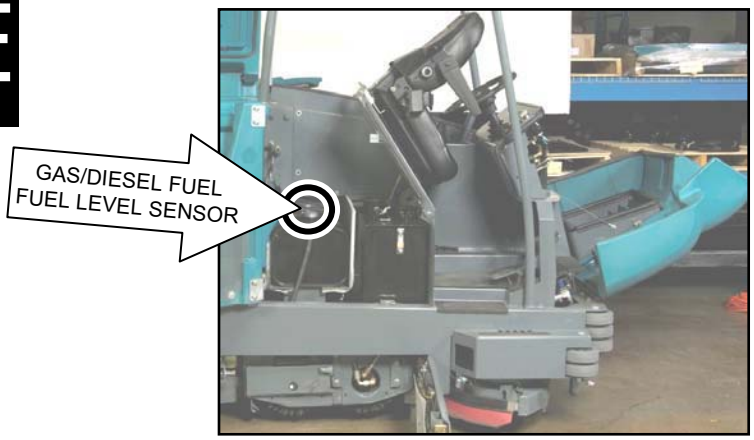


Fuel Level Sensors

Conditions: Key on



E



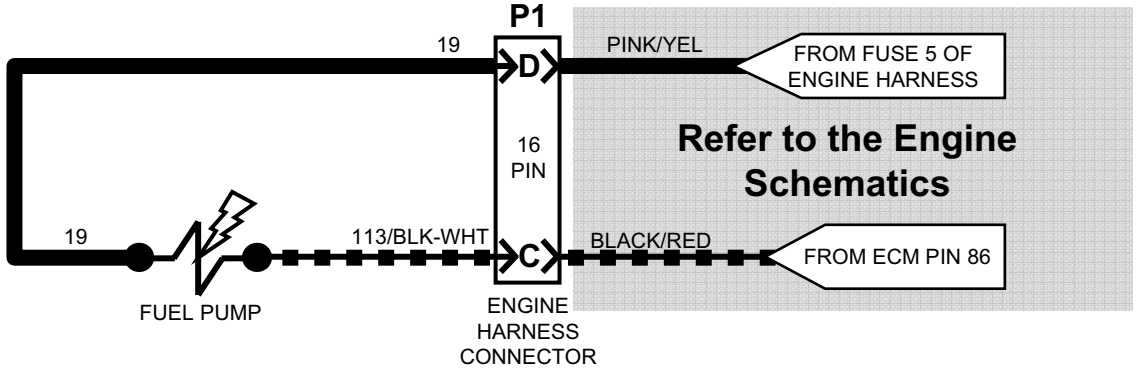
Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

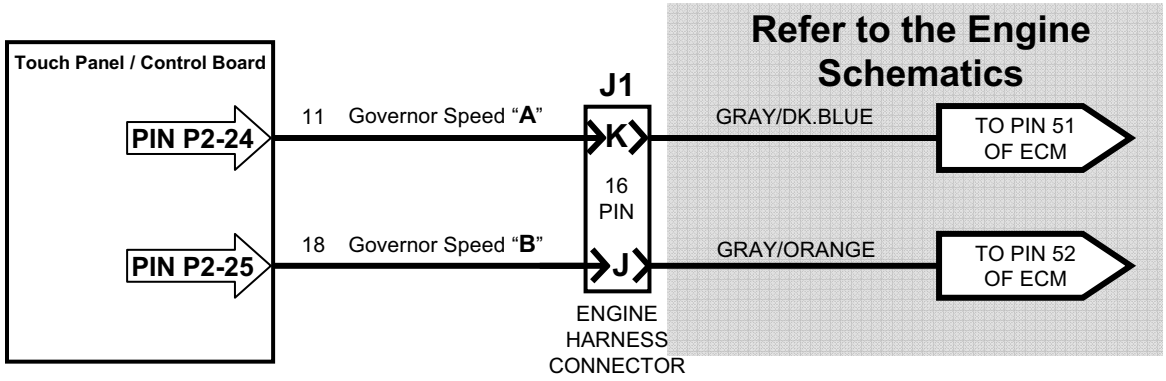
Fuel Pump & Engine Speed Control (Gas/LPG)

Fuel Pump (Gasoline Only)

This drawing shown with key switch ON, and engine running



Speed Control Output

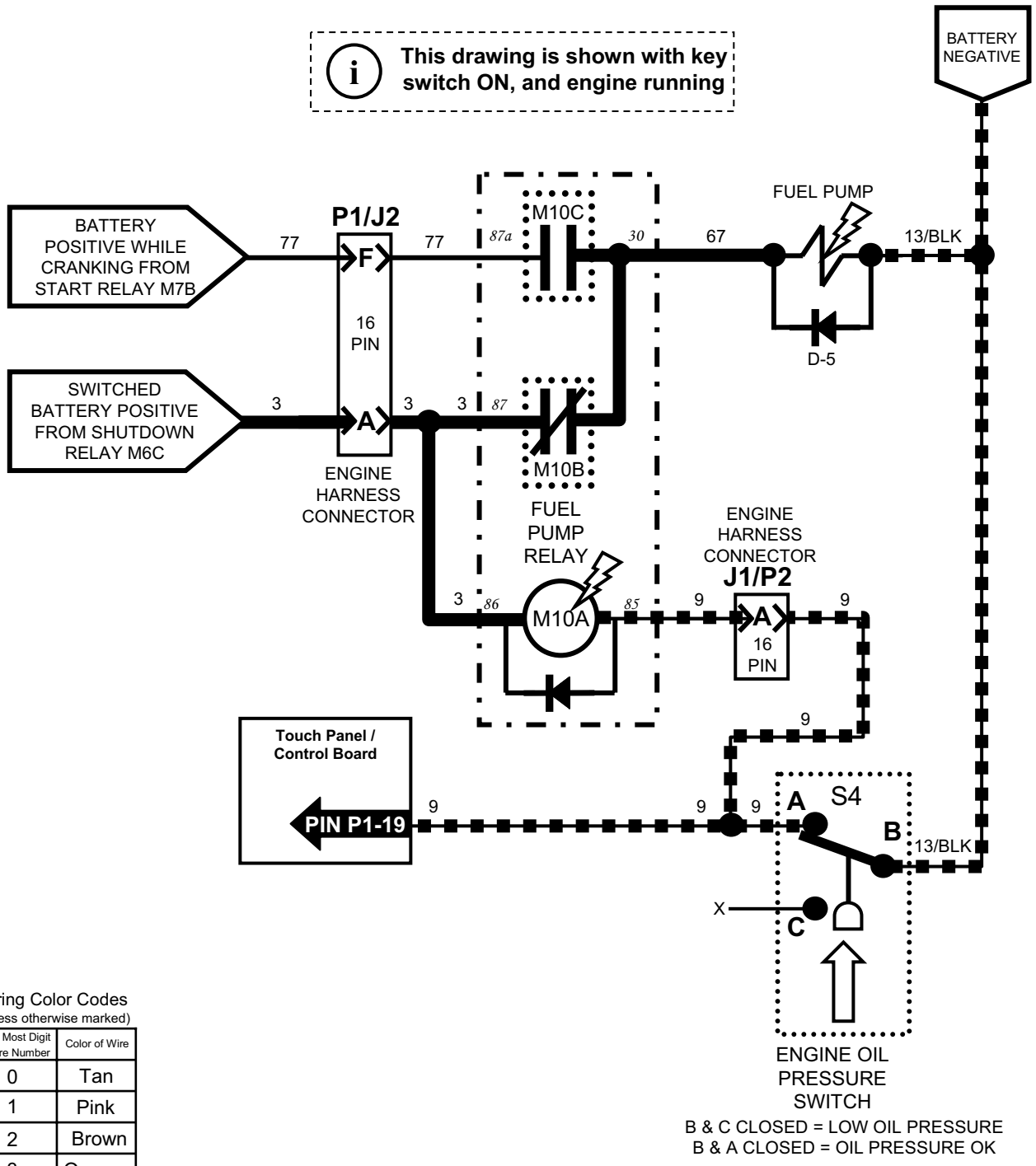


Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

ENGINE SPEED CHART	Low Engine Speed	High Engine Speed
Engine RPM	1350 (+/- 50)	2700 (+/- 50)
Voltage Speed "A"	5 VDC	0 VDC
Voltage Speed "B"	0 VDC	0 VDC

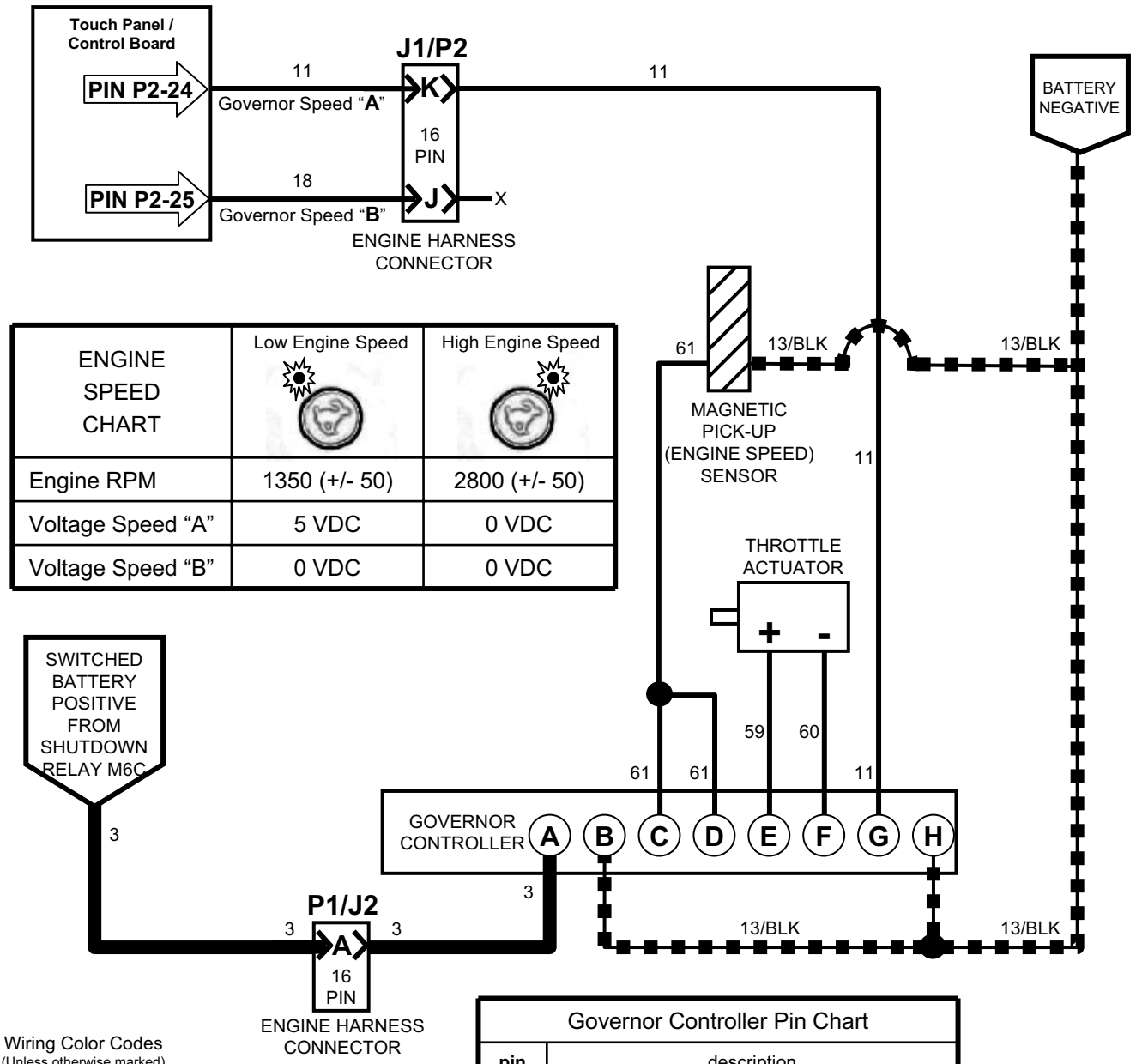
Fuel Pump (Diesel)



Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Engine Speed Control (Diesel)



ENGINE SPEED CHART	Low Engine Speed	High Engine Speed
Engine RPM	1350 (+/- 50)	2800 (+/- 50)
Voltage Speed "A"	5 VDC	0 VDC
Voltage Speed "B"	0 VDC	0 VDC

Wiring Color Codes
(Unless otherwise marked)

Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

Governor Controller Pin Chart	
pin	description
A	INPUT – Battery Positive
B	INPUT – Battery Negative
C	INPUT – Engine Speed Sensor
D	INPUT – Engine Speed Sensor
E	OUTPUT – Throttle Actuator **(PWM)**
F	OUTPUT – Throttle Actuator
G	INPUT – Engine Speed Selection "A"
H	INPUT – Engine Speed Selection "B"

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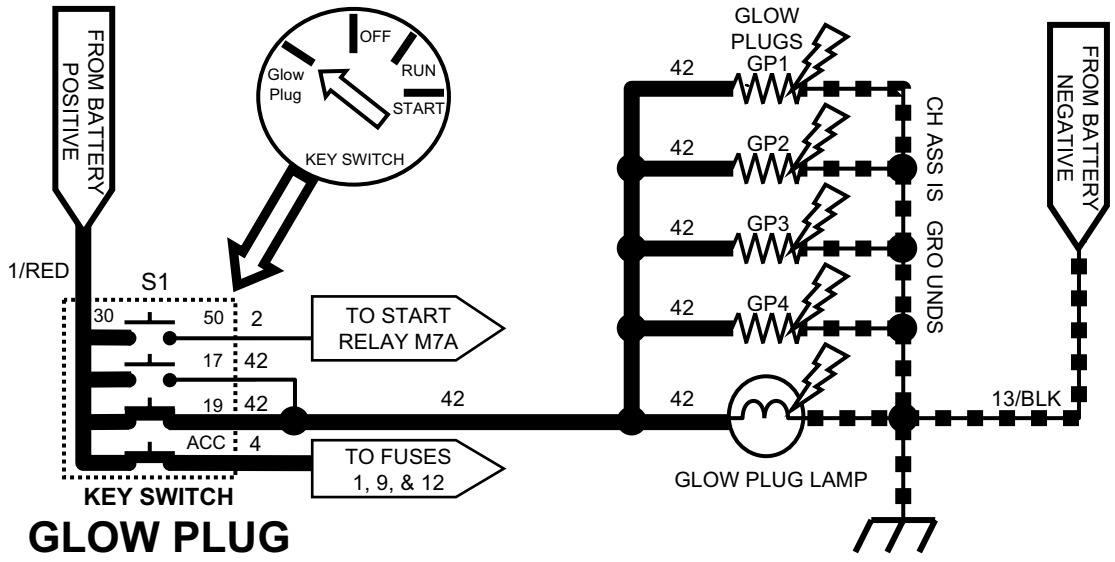
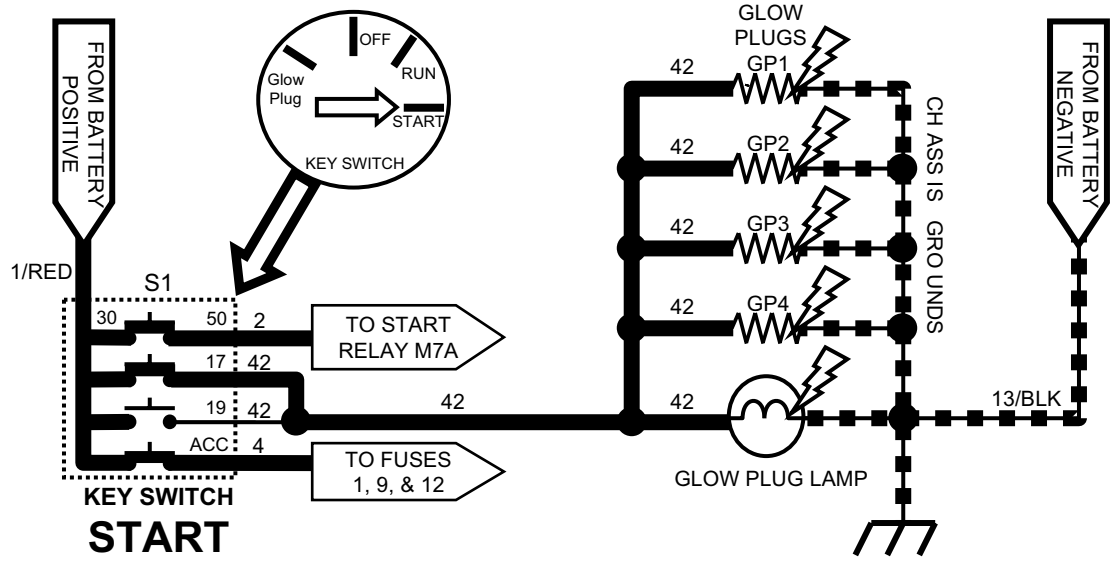
Glow Plugs ON (Diesel)

Conditions: Key turned to start or glow plug position





Wiring Color Codes
(Unless otherwise marked)

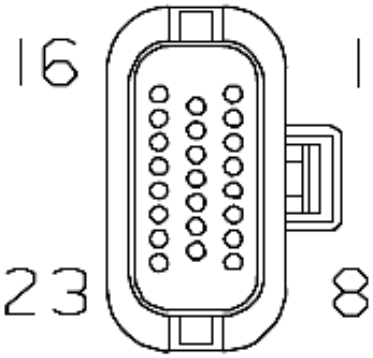
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

The Glow Plugs are ON *only* when ignition switch is in the "Glow Plug" or "Start" position

Control Board Connectors

socket #	wire #	color	type	goes to	
P1-1	91	pink	input	SW3	Forward/Reverse Propel Sensor
P1-2	x	x	x	x	unused
P1-3	89	white	input	S-6	Hopper Position Switch
P1-4	30	tan	input	S-7 or S-8	Gas/Diesel Fuel Sensor OR LPG Pr. Switch
P1-5	31	pink	input	S-9	Thermo Sentry Switch
P1-6	39	white	input	S-10	Scrub Vacuum Open Switch
P1-7	35	green	input	S-5	Hopper Up/Down Switch
P1-8	36	blue	input	S-5	Hopper Up/Down Switch
P1-9	42	brown	input	S-13	Hopper Door Open/Close Switch
P1-10	43	orange	input	S-13	Hopper Door Open/Close Switch
P1-11	177	purple	input	S-19	Solution Tank Empty Switch
P1-12	44	yellow	input	S-14	Solution Tank Full Switch
P1-13	45	green	input	S-15	Recovery Tank Full Switch
P1-14	46	blue	input	S-16	Recovery Tank Half Full Switch
P1-15	90	tan	input	S-17	Clogged Hydraulic Oil Filter Switch
P1-16	48	gray	input	S-18	Clogged Sweep Filter Switch
P1-17	78	gray	input	S-20	Hydraulic Oil Temperature Sensor
P1-18	12	brown	input	S-2	High Engine Temperature Switch
P1-19	9	white	input	S-4	Engine Oil Pressure Switch
P1-20	185	green	input	SW4	Hydraulic Oil Pressure Sensor
P1-21	94	yellow	input	B-	Battery Negative or Seat Switch
P1-22	184	yellow	in/out	J3-C	Insight Connector
P1-23	183	orange	in/out	J3-B	Insight Connector

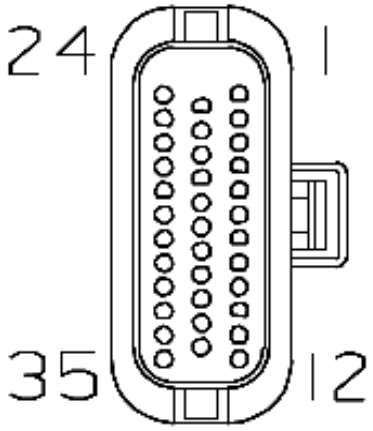
Connector P1



Viewed from wire side of connector

socket #	wire #	color	type	goes to	
P2-1	14	yellow	power	B+	Switched Battery Positive
P2-2	14	yellow	power	B+	Switched Battery Positive
P2-3	81	pink	power	B+	Unswitched Battery Positive
P2-4	57	purple	output	SV-2	Brush Head Pressure Solenoid Valve
P2-5	58	gray	output	SV-3, SV-6	Brush Head Down & ON Solenoid Valves
P2-6	59	white	output	SV-4	Squeegees Down Solenoid Valve
P2-7	60	tan	output	SV-14	Hopper Up Solenoid Valve
P2-8	61	pink	output	SV-7	Hydraulic Enable Solenoid Valve
P2-9	62	brown	output	SV-8, SV-12	Side Brush ON & Extend Solenoid Valves
P2-10	63	orange	output	SV-9	Sweep Vacuum Fan Solenoid Valve
P2-11	64	yellow	output	SV-10	Side Brush Pressure Solenoid Valve
P2-12	66	blue	output	SV-11	Side Brush Down Solenoid Valve
P2-13	65	green	output	SOL-1	Solution Tank Auto Fill Water Valve
P2-14	67	purple	output	SOL-2	Recovery Tank Auto Fill Water Valve
P2-15	68	gray	output	SV-15	Hopper Door Open Solenoid Valve
P2-16	69	white	output	M3A	Shaker Relay
P2-17	70	tan	output	M4A	Reverse Relay
P2-18	71	pink	output	M6A	Shutdown Relay
P2-19	72	brown	output	SOL-3	Main Brush Head Water Valve
P2-20	181	pink	output	SOL-7	Side Brush Water Valve
P2-21	74	yellow	output	x	Detergent Pump
P2-22	75	green	output	M16A	ES Pump or FaST Water Pump Relay
P2-23	79	white	output	SOL-5	FaST High Flow Valve & FaST Pump
P2-24	11	pink	output	x	Gas/LPG ECM OR Diesel Gov.Controller
P2-25	18	gray	output	x	Gas/LPG ECM OR Diesel unused
P2-26	80	tan	output	SOL-6	FaST Side Brush Valve
P2-27	28	gray	output	x	Low Engine Oil Pressure Lamp
P2-28	56	blue	output	SV-1	Scrub Vacuum Fan Valve
P2-29	182	brown	output	x	Audible Alarm
P2-30	x	x	x	x	unused
P2-31	53	orange	output	SV-13	Hopper Down Solenoid Valve
P2-32	x	x	x	x	unused
P2-33	13	black	ground	B-	Unswitched Battery Negative
P2-34	13	black	ground	B-	Unswitched Battery Negative
P2-35	13	black	ground	B-	Unswitched Battery Negative

Connector P2



Viewed from wire side of connector

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The following table describes fault codes communicated to the operator. A fault code is indicated by blinking a Fault LED (red), sounding an alarm, and also by displaying the fault name on the LCD. Faults can be cleared when they are no longer present ***and*** one of the action buttons (i.e. One-Step) is depressed. If there is more than one fault, they are displayed for about a second, one after the other.

Fault	LCD Display	Description
Hopper Up Error	**F1: HOPPER UP**	Indicates and prevents an attempt to engage Scrub/Sweep systems without the hopper down switch engaged.
Hydraulic Filter Clogged	**F3: CLOGGED HYD.**	Indicates the hydraulic filter is clogged.
Sweep Filter Clogged	**F4: SHAKER FILTER**	Indicates the Sweep dust filter is clogged.
Hopper Fire	**F5: HOPPER FIRE**	Indicates that the hopper is too hot due to fire, etc. Turns off entire sweep system.
Solution Tank empty	**F6: SOL. TANK E**	Indicates the solution tank is empty.
Recovery Tank Full	**F7: REC. TANK FULL**	Indicates the recovery tank is full and shuts down the entire Scrub system.
High Engine Temperature	**F8: HIGH ENG TEMP**	Indicates high engine temperature.
High Hydraulic Temperature	**F9: HIGH HYD TEMP**	Indicates excessive hydraulic temperature
Low Fuel	**F10: LOW FUEL**	Low fuel indicator (blinking lowest fuel gauge block).
Squeegee Disconnected (Option)	**F11: OPEN SCB VAC**	Indicates squeegee may have broken free.

The following table describes displayed conditions or warnings. If a condition is sensed, the condition or warning code will be displayed on the LCD. Conditions are typically caused by activating buttons that are unavailable. For example: the Sweep vacuum fan is unavailable when the scrub functions are active.

Condition	LCD DISPLAY	Description
Squeegee Vacuum button is activated with Sweep system active.	**C1: NO SQGE/VAC**	When Sweep system is active, the Scrub vacuum is unavailable.
Sweep Vacuum button is activated with Scrub system active.	**C2: NO SWEEP VAC**	When Scrub system is active, the Sweep vacuum is unavailable.
FaST system is selected by the operator and the machine is not configured with the FaST option.	**C3: NO FAST MODE**	Only machines with the FaST system installed (and programmed to be FaST machines) can turn ON the FaST system.
ES system is selected by the operator and the machine is not configured with the ES option.	**C4: NO ES MODE**	Only machines with the ES system installed (and programmed to be ES machines) can turn ON the ES system.
FaST or ES system is selected by the operator and the machine is not configured with the ES or FaST option.	**C5: NO ES/FAST**	Only machines with the ES or FaST system installed (and programmed to be ES or Fast machines) can turn ON the ES or FaST system.
Side Brush button is activated alone without 1-STEP Sweep/Scrub.	**C6: NO SIDE BRUSH**	The machine is NOT programmed to operate with only the side brush ON.

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Configuration Modes (1 of 3)

Configuration modes are designed for use by a technician for setup purposes.

To enter the Configuration modes:

1) Press "**4/5**" and **Side-Brush** buttons simultaneously.
2) While holding the "**4/5**" and **Side-Brush** buttons, turn the ignition key switch to the "RUN" position.
3) Continue holding the "**4/5**" and **Side-Brush** buttons until "**CONFIG MODE**" is displayed on the screen, then release the buttons.

While In Configuration Mode:

Each single activation of the "**2/3**" button will scroll through the various configurations available. Each configuration is displayed one at a time on the LCD. Once the desired configuration mode is displayed, push the "**0/1**" to select the displayed mode.

To enter Pressure Adjust Mode:

1) Enter Configuration Mode.
2) Press "**2/3**" button until "PRESS. ADJ MODE" is displayed.
3) Press "**0/1**" button again to select pressure adjust mode. "READY" is displayed on LCD screen.

The following table shows the different configuration modes the machine can be placed in.

Mode	Entry Sequence / Indicator	Function / Notes
Reset Default down pressures	1) Put the machine into pressure adjust mode. (See instructions above.) 2) Press "**4/5**" button to reset all the down pressures. "SET TO DEFAULT" is displayed on LCD screen.	Resets all the down pressure defaults to the factory default levels.
Adjusting the Main Scrub brush down pressure	1) Put the machine into pressure adjust mode. (See instructions above.) 2) Press 1-STEP Scrub button to select Scrub pressure adjust. The 1-STEP Scrub LED is ON. 3) Use brush pressure "**+**" or "**-**" buttons to select which pressure level to adjust (Low/Medium/High). 4) Press "**0/1**" button to increase the down pressure OR press "**8/9**" button to decrease the down pressure. 5) Press 1-STEP Scrub button again or turn key switch OFF to save new down pressure settings.	Adjusts main scrub brush down pressures. Bars on bar graph represent solenoid valve current when adjusting the down pressure. Each bar indicates approximately 125mA of valve current.
Adjusting the Main Sweep brush down pressure	1) Put the machine into pressure adjust mode. (See instructions above.) 2) Press 1-STEP Sweep button to select Sweep pressure adjust. The 1-STEP Sweep LED is ON. 3) Use brush pressure "**+**" or "**-**" buttons to select which pressure level to adjust (Low/Medium/High). 4) Press "**0/1**" button to increase the down pressure OR press "**8/9**" button to decrease the down pressure. 5) Press 1-STEP Sweep button again or turn key switch OFF to save new down pressure settings.	Adjusts main sweep brush down pressures. Bars on bar graph represent solenoid valve current when adjusting the down pressure. Each bar indicates approximately 125mA of valve current.

Configuration Modes (2 of 3)

To enter the Configuration mode:

1) Press "**4/5**" and **Side-Brush** buttons simultaneously.
2) While holding the "**4/5**" and **Side-Brush** buttons, turn the ignition key switch to the "RUN" position.
3) Continue holding the "**4/5**" and **Side-Brush** buttons until "**CONFIG MODE**" is displayed on the screen, then release the buttons.

To enter Pressure Adjust Mode:

1) Enter Configuration Mode.
2) Press "**2/3**" button until "PRESS. ADJ MODE" is displayed.
3) Press "**0/1**" button again to select pressure adjust mode. "READY" is displayed on LCD screen.

Mode	Entry Sequence / Indicator	Function / Notes
Adjusting the Side Scrub brush down pressure	1) Put the machine into pressure adjust mode. (See instructions above.) 2) Press Side Brush button to select Side Scrub Brush pressure adjust. The Side Brush LED is ON. 3) Use brush pressure "**+**" or "**-**" buttons to select which pressure level to adjust (Low/Medium/High). 4) Press "**0/1**" button to increase the down pressure OR press "**8/9**" button to decrease the down pressure. 5) Press Side Brush button again or turn key switch OFF to save new down pressure settings.	Adjusts Side Scrub brush down pressures. Bars on bar graph represent solenoid valve current when adjusting the down pressure. Each bar indicates approximately 125mA of valve current.
Adjusting the Side Sweep brush down pressures	1) Put the machine into pressure adjust mode. (See instructions above.) 2) Press Sweep Vacuum Fan button to select Side Sweep Brush pressure adjust. The Sweep Vacuum Fan LED is ON. 3) Use brush pressure "**+**" or "**-**" buttons to select which Side Sweep Brush pressure level is desired (Low/Medium/High). 4) Press Sweep Vacuum Fan button again or turn key switch OFF to save new down pressure settings.	Adjust sweeping side brush down pressure. **Note**: Only one of three Side Sweep down pressure settings can be selected. The Side Brush pressure does not increase when Main Brush pressure is increased during **SWEEP FUNCTION ONLY**.
Disable *BOTH* the ES and FaST systems	1) Enter Configuration Mode. 2) Press "**2/3**" button until "C5: NO ES/FAST" is displayed. 3) Press "**0/1**" button to disable ES and FaST systems. "DONE" is displayed on LCD screen.	This is a set-up mode that disables both ES and FaST functions.
Enable the FaST system (also disables the ES system)	1) Enter Configuration Mode. 2) Press "**2/3**" button until "FAST MODE" is displayed. 3) Press "**0/1**" button to enable the FaST system. "DONE" is displayed on LCD screen.	This is a set-up mode that enables the FaST system, and disables the ES system.

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Configuration Modes (3 of 3)

To enter the Configuration mode:

1) Press "**4/5**" and **Side-Brush** buttons simultaneously.
2) While holding the "**4/5**" and **Side-Brush** buttons, turn the ignition key switch to the "RUN" position.
3) Continue holding the "**4/5**" and **Side-Brush** buttons until "**CONFIG MODE**" is displayed on the screen, then release the buttons.

Mode	Entry Sequence / Indicator	Function / Notes
Enable the ES system (also disables the FaST system)	1) Enter Configuration Mode. 2) Press "**2/3**" button until "ES MODE" is displayed 3) Press "**0/1**" button to enable the ES system. "DONE" is displayed on LCD screen.	This is a set-up mode that enables the ES system, and disables the FaST system.
LCD Display Contrast Adjust mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "CONTRAST ADJUST" is displayed. 3) Press "**0/1**" button to select mode. "SET CONTRAST" is displayed on screen. 4) Press and hold "**0/1**" button to increase screen contrast OR press and hold "**8/9**" to decrease screen contrast.	This allows the setting of the contrast of the LCD screen display.
Detergent delivery level adjustment mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "SET DET LEVEL" is displayed. 3) Press "**0/1**" button to enter mode. "READY" is displayed on screen. 4) Press button shown below to select the desired detergent delivery level: "**0/1**" – HEAVY "**2/3**" – NORMAL "**4/5**" – LIGHT "**6/7**" – OFF The selected level is displayed on screen.	Allows for the adjustment of the Detergent level flow. There are four selections: HEAVY, NORMAL, LIGHT, and OFF. NOTE: "NORMAL" means factory default detergent delivery level.
Water delivery level adjustment mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "SET WATER LEVEL" is displayed. 3) Press "**0/1**" button to enter mode. "READY" is displayed on screen. 4) Press button shown below to select the desired water delivery level: "**0/1**" – HEAVY WATER "**2/3**" – NORMAL WATER "**4/5**" – ECONOMY WATER The selected level is displayed on screen.	Allows for the adjustment of the Water flow. There are three selections: HEAVY, NORMAL, and ECONOMY. NOTE: "NORMAL" means factory default water delivery level.
Side Brush Mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "SIDE_BRUSH _MODE" is displayed. 3) Press "**0/1**" button to observe "SIDE_SWEEP&SCRUB" or "SIDE_SWEEP_ONLY" 4) Press 1-STEP Scrub button to toggle between modes.	This mode allows the machine to be set-up as a Side Sweep ONLY machine **OR** Side Sweep AND Side Scrub machine. **Note**: There will be ***NO*** solution delivery to Side Brush when in Scrub mode if "SIDE_SWEEP_ONLY" is selected.

Diagnostic Modes

To enter the Configuration mode:

1) Press "**4/5**" and **Side-Brush** buttons simultaneously.
2) While holding the "**4/5**" and **Side-Brush** buttons, turn the ignition key switch to the "RUN" position.
3) Continue holding the "**4/5**" and **Side-Brush** buttons until "**CONFIG MODE**" is displayed on the screen, then release the buttons.

Mode	Entry Sequence / Indicator	Function / Notes
Self Test Mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "SELF TEST" is displayed. 3) Press "**0/1**" button to run the self test.	This diagnostic test determines the status of the electrical load on each output. All output pins with open or shorted electrical loads are displayed on the screen with the control board pin number, and the condition of that output. If no faults are detected an "OK" message is displayed.
Manual Mode	1) Enter Configuration Mode. 2) Press "**2/3**" button until "MANUAL MODE" is displayed. 3) Press "**0/1**" button to select Manual Mode. "MANUAL MODE OPR" is displayed on screen.	Allows the technician to turn on machine functions regardless of the status of the sensed inputs. EX: The ES pump will turn on when ES is selected, regardless of the state of the tank float switches.
Input Display Mode (This mode is used to test input sensors and circuitry)	1) Enter Configuration Mode 2) Press "**2/3**" button until "INPUT MODE" is displayed. 3) Press "**0/1**" button to select Input Mode. "READY" is displayed on screen.	Each LED on the panel represents the state of one of the control board inputs. If the input is grounded (0V), the associated LED is turned ON. If the input NOT grounded (open), the associated LED is turned off. Each input (**bold**) has an associated LED as described below:

LED	Input
One Step Scrub LED	**Clogged Hydraulic Filter**
Shaker LED	**Clogged Shaker Filter**
Squeegee/Scrub Vacuum Fan LED	**High Engine Temp**
One Step Sweep LED	**Hopper Up Select**
Sweep Vacuum Fan LED	**Hopper Down Select**
Low Engine Speed LED	**Reverse**
High Engine Speed LED	**Forward**
ES LED	**Thermal Sentry**
FaST LED	**Hopper Down Position**
Side Brush LED	**Impact Sense**
Scrub Pressure High LED	**Hopper Door Open**
Scrub Pressure Medium LED	**Hopper Door Close**
Scrub Pressure Low LED	**Solution Tank Empty**
Solution Level High LED	**Solution Tank Full**
Solution Tank Medium LED	**Recovery Tank Full**
Solution Tank Low LED	**Recovery Tank Half Full**
Red warning LED	**Open Scrub Vacuum**

E

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HYDRAULIC

Troubleshooting Information

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

* Engine & Hydraulic Oil Must Be At Normal Operating Temperatures after Running Machine and Hydraulics a Minimum of 5 Minutes

* Examine Machine For Any Linkage Binding or Mechanical Problems

DURING TESTS:

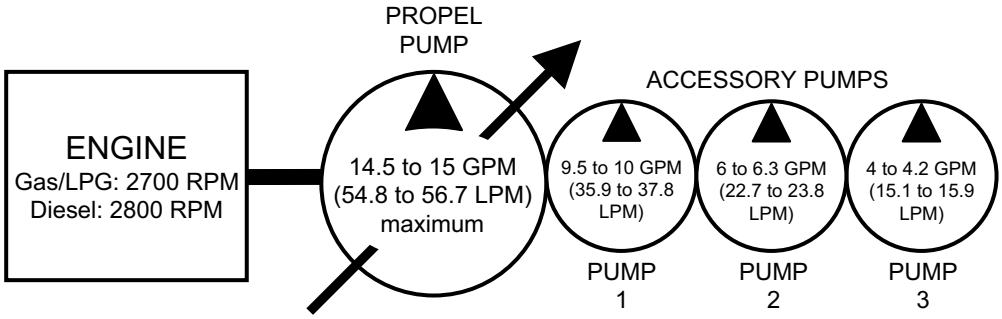
* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

* Maintain Normal Main Brush Pressure as Listed in Operator's Manual

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

Hydraulic Pump Flow Rates, Common Abbreviations

Hydraulic Pump Flow Rates (typical)



Commonly Used Abbreviations

AUX	Auxiliary
CIR	Cubic Inch Displacement per Revolution
CK	Check Valve
CM	Centimeters
CONV	Conveyor
CU	Cubic
CV	Control Valve
CYL	Cylinder
DC	Disconnect Coupler (Hydraulic)
DC	Direct Current (Electrical)
E	Engine (Combustion)
FLTR	Filter
GPM	Gallons Per Minute
HTX	Heat Exchanger
IN	Inches
LH	Left Hand
LPM	Liters Per Minute
LS	Load Sense
M	Motor (Combustion)

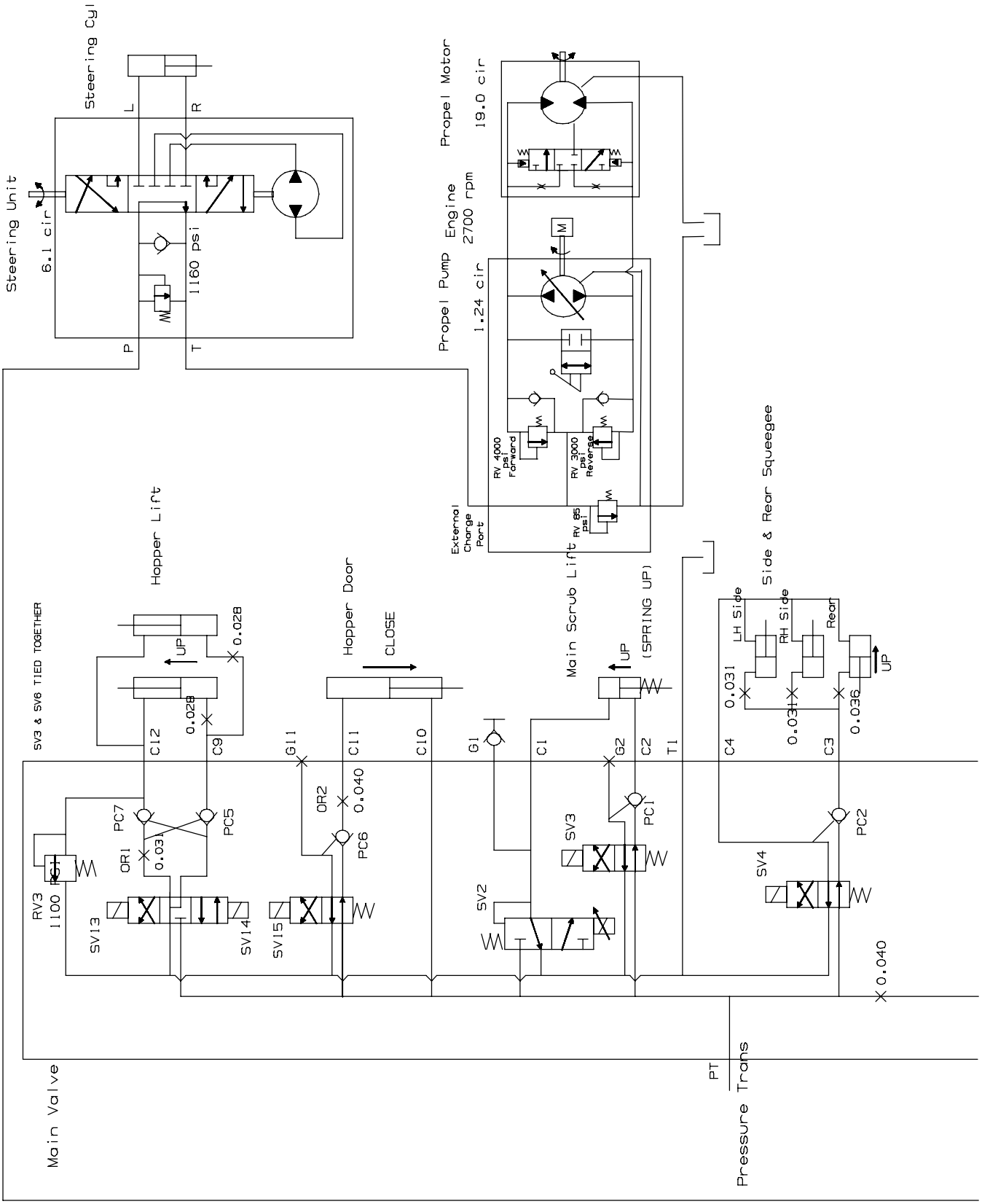
MFLD	Manifold
MTR	Motor (Hydraulic)
OR	Orifice
PC	Pilot Port Check Valve
PMP	Pump
PR	Pressure Relief Valve
PSI	Pounds Per Square Inch
PTO	Power Take Off
PWM	Pulse Width Modulation
RES	Reservoir
RH	Right Hand
RPM	Revolutions Per Minute
RV	Relief Valve
SC	Spring Loaded Check Valve
STRN	Strainer
SV	Solenoid Valve
SW	Switch
TV	Throttle Valve
V	Volts

Typical Hydraulic Manifold Port Markings

C	Hydraulic Cylinder Connection
G	Test Port
LS	Load Sense Port

M	Hydraulic Motor Connection
P	Pump Connection
R or T	Return Port (To Tank)

Hydraulic Schematic (1 of 2)



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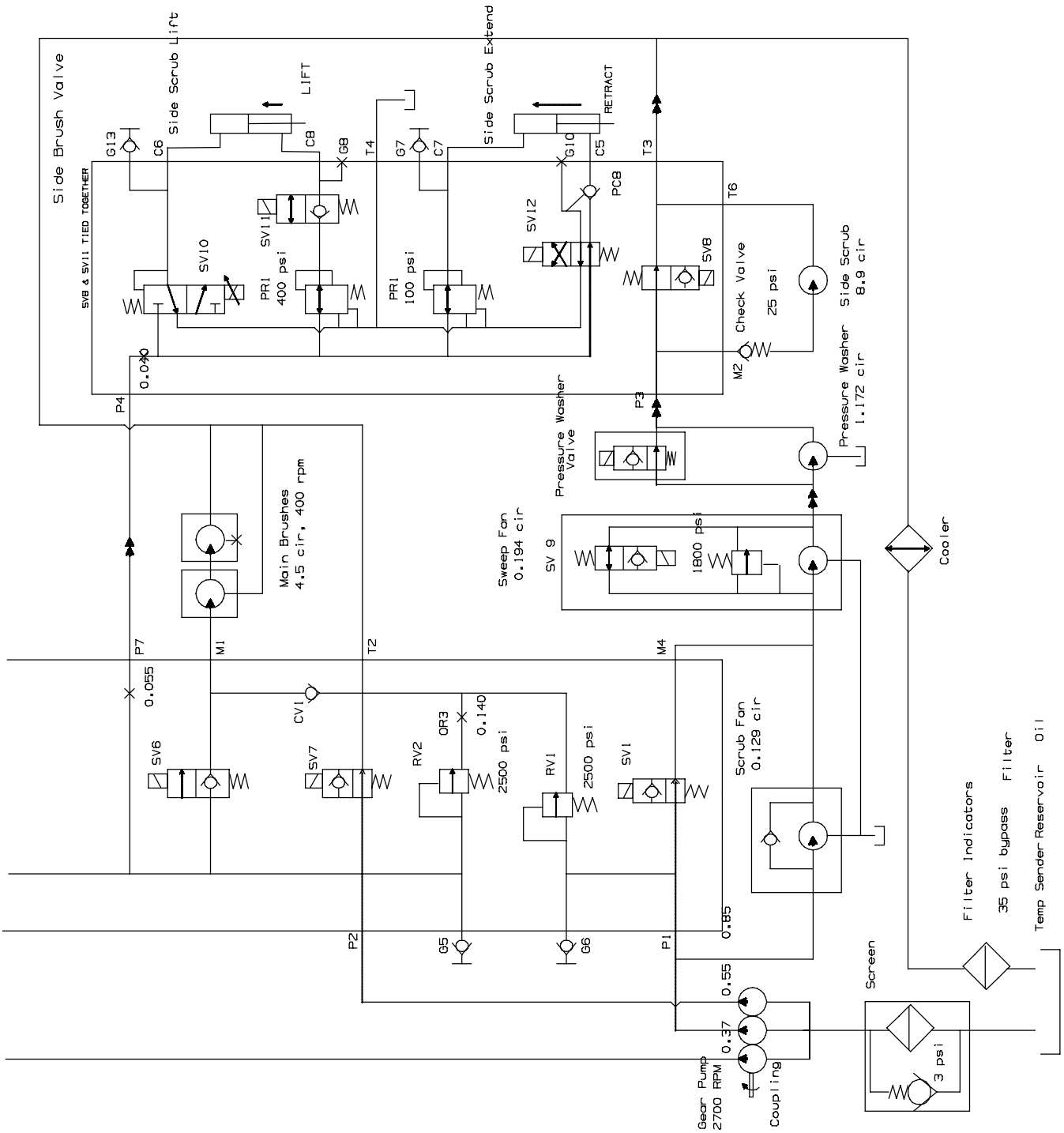
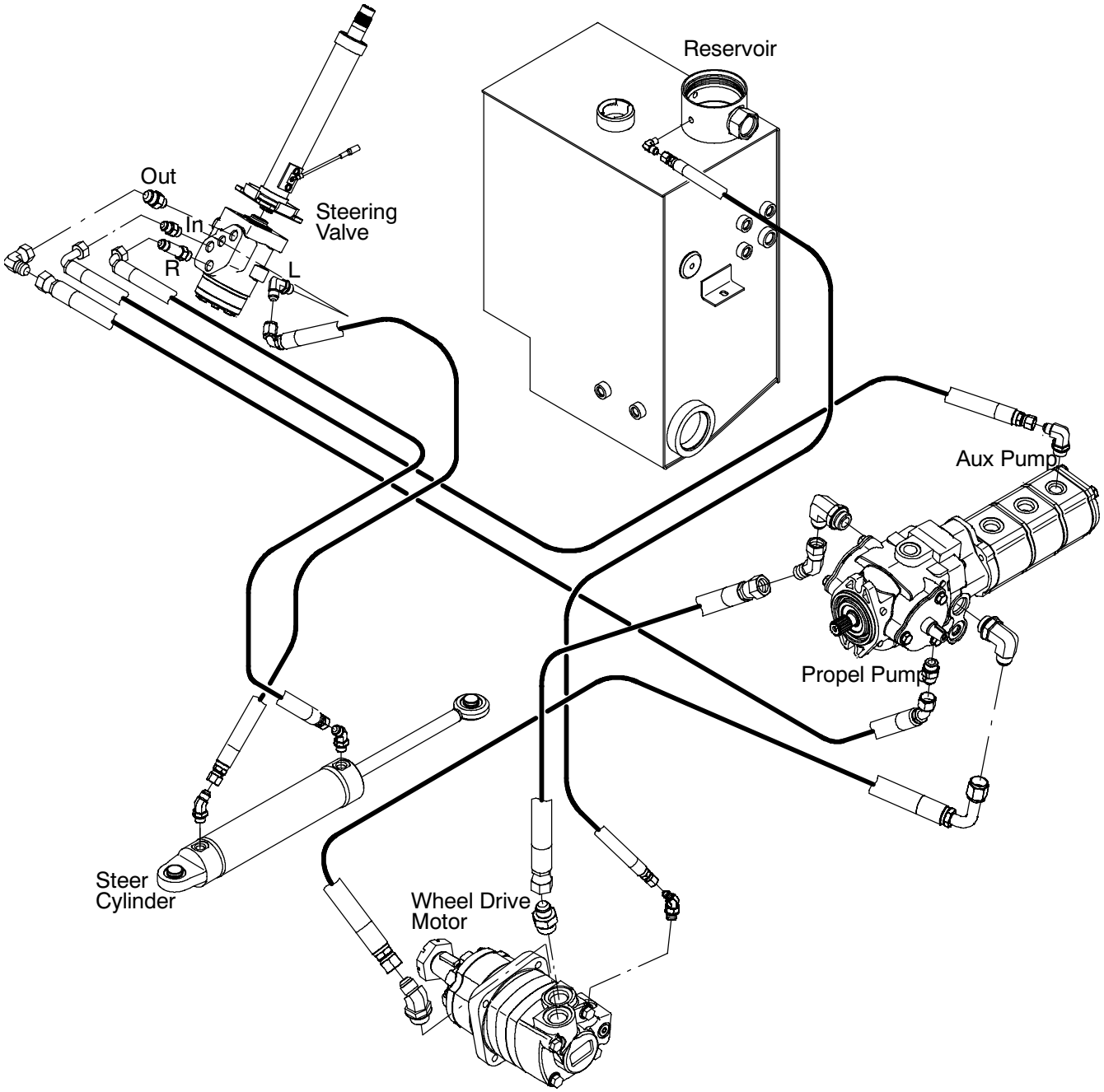
Hydraulic Schematic (2 of 2)

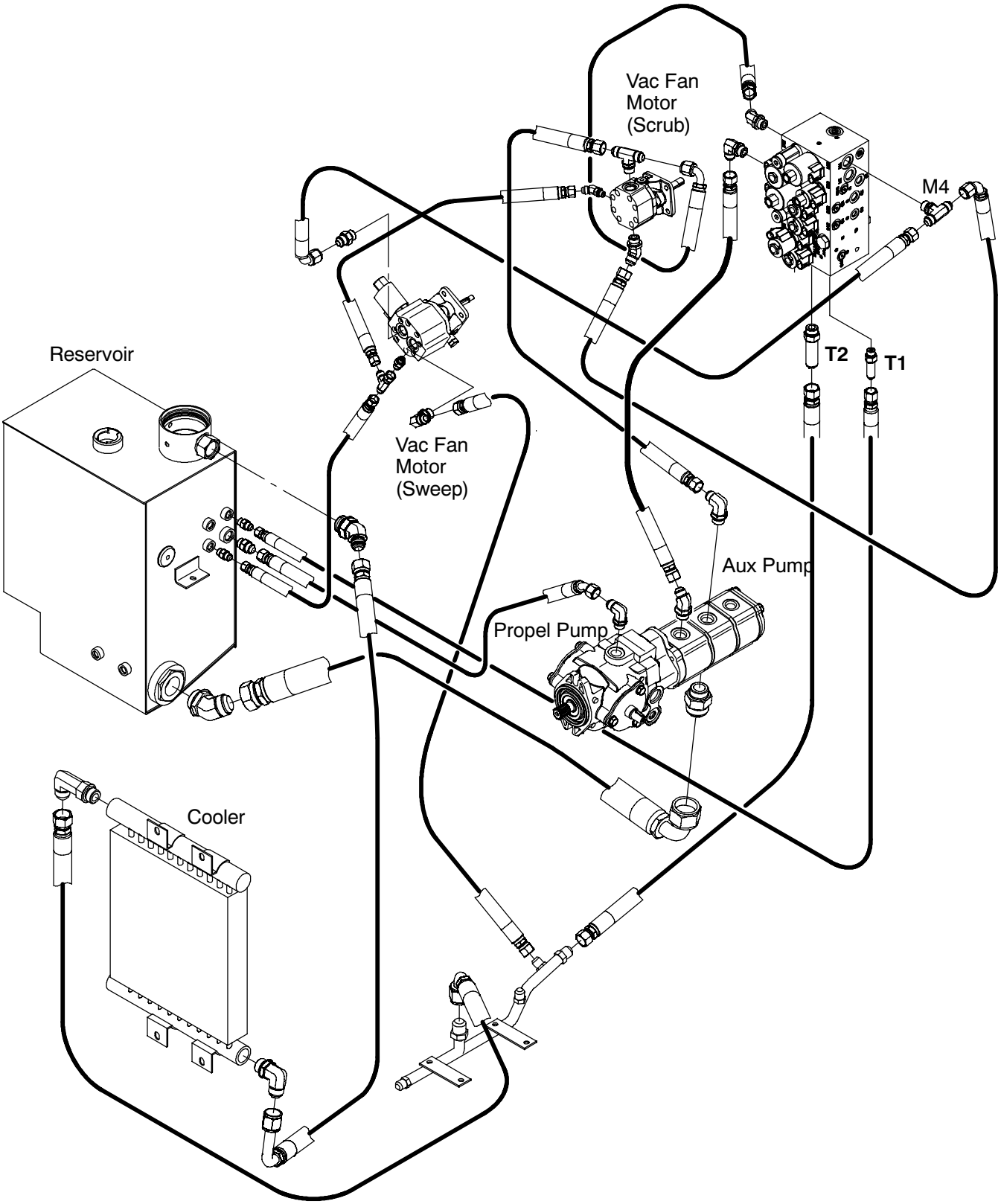


Steering & Propel Hydraulic Hose Diagram



H

Pump & Vacuum Fan Hydraulic Hose Diagram



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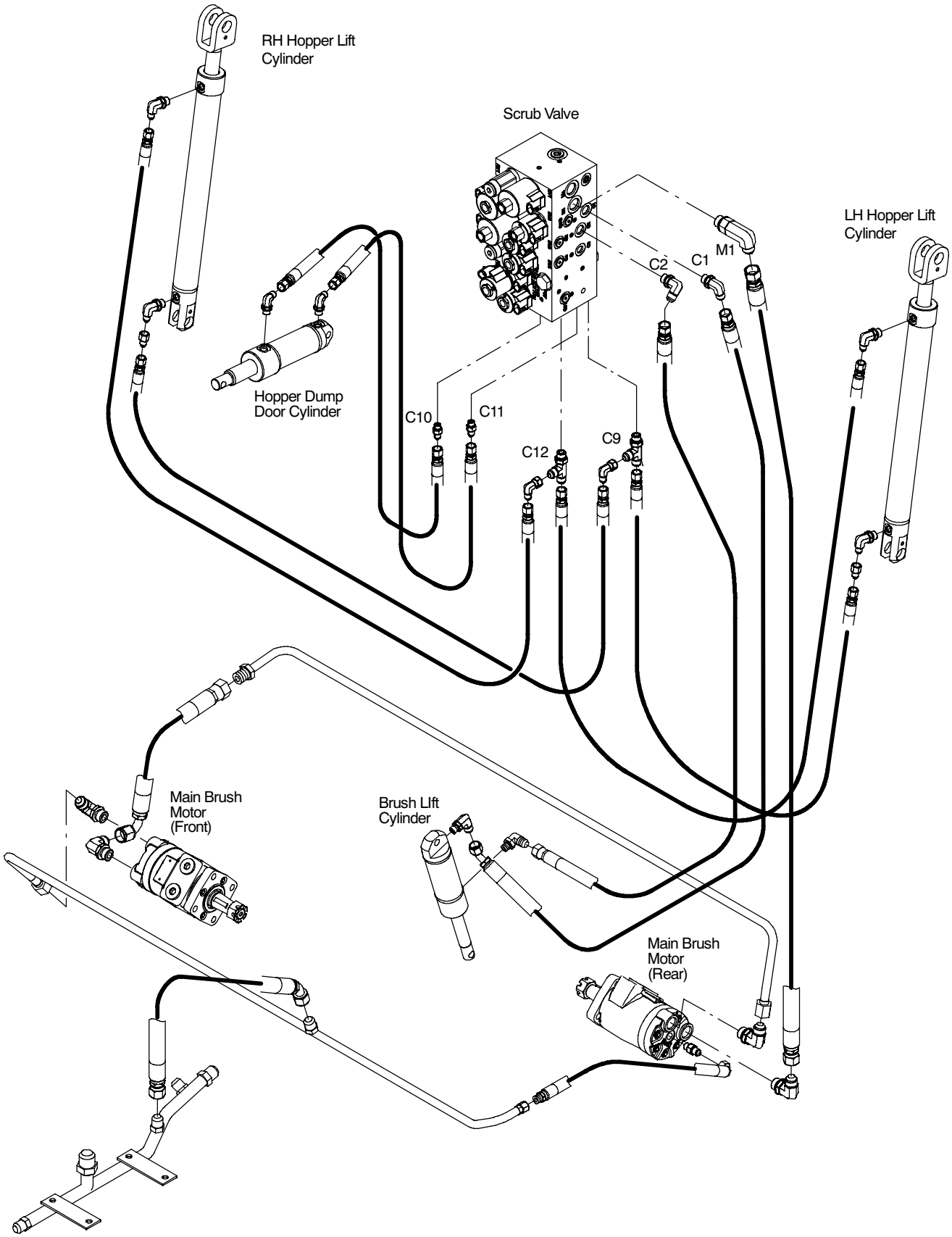
Brush & Hopper Hydraulic Hose Diagram



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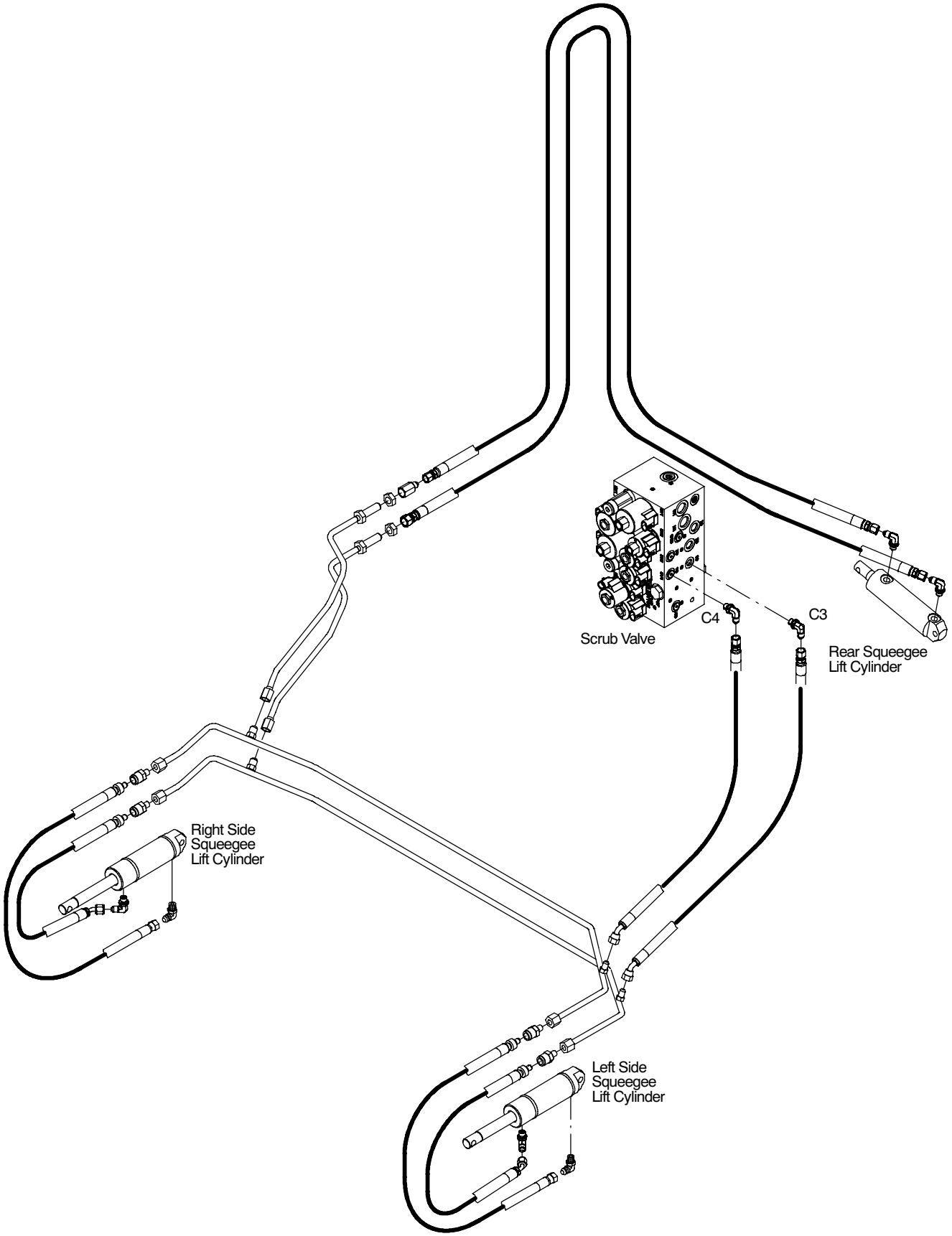
Squeegee Lift Hydraulic Hose Diagram



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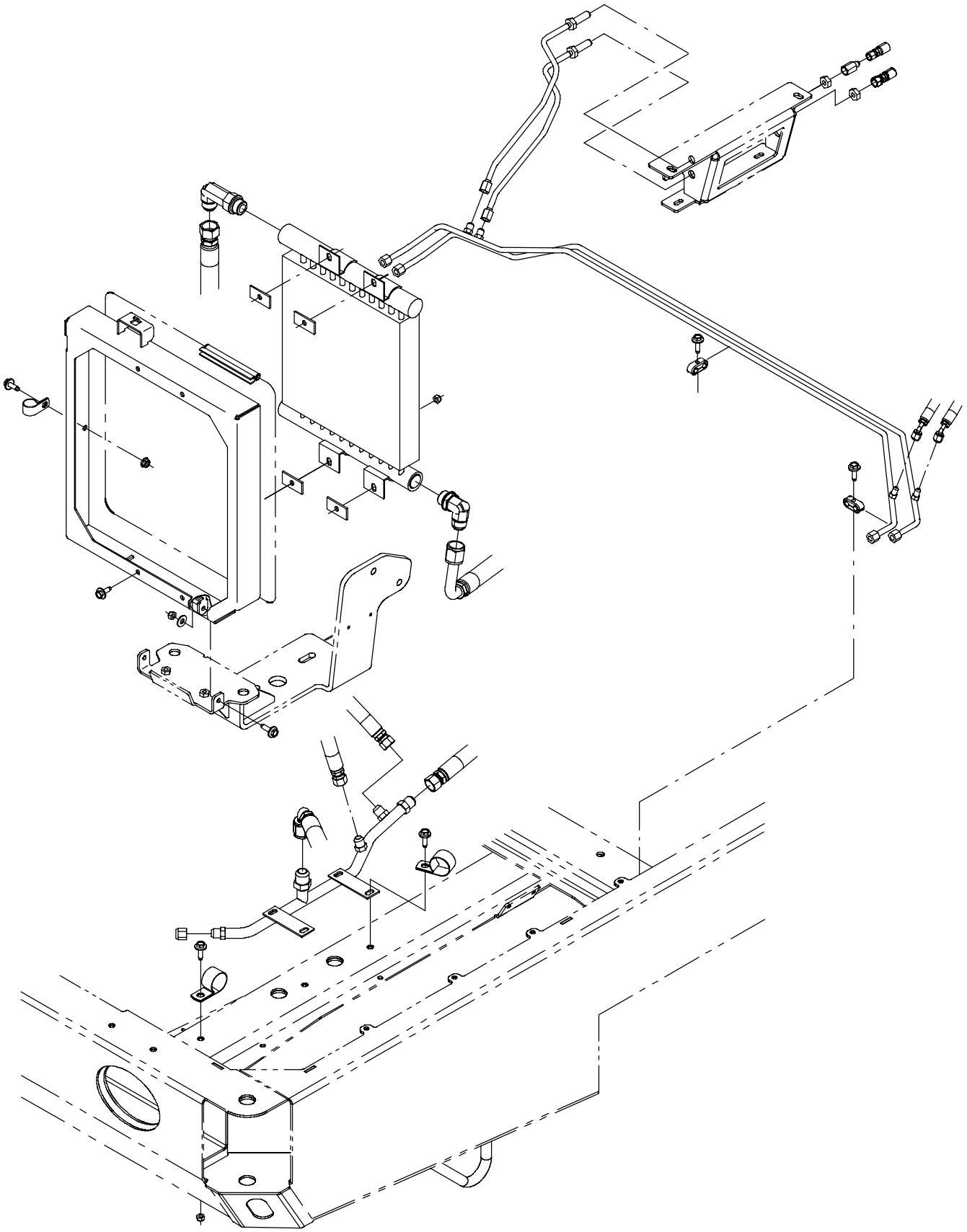
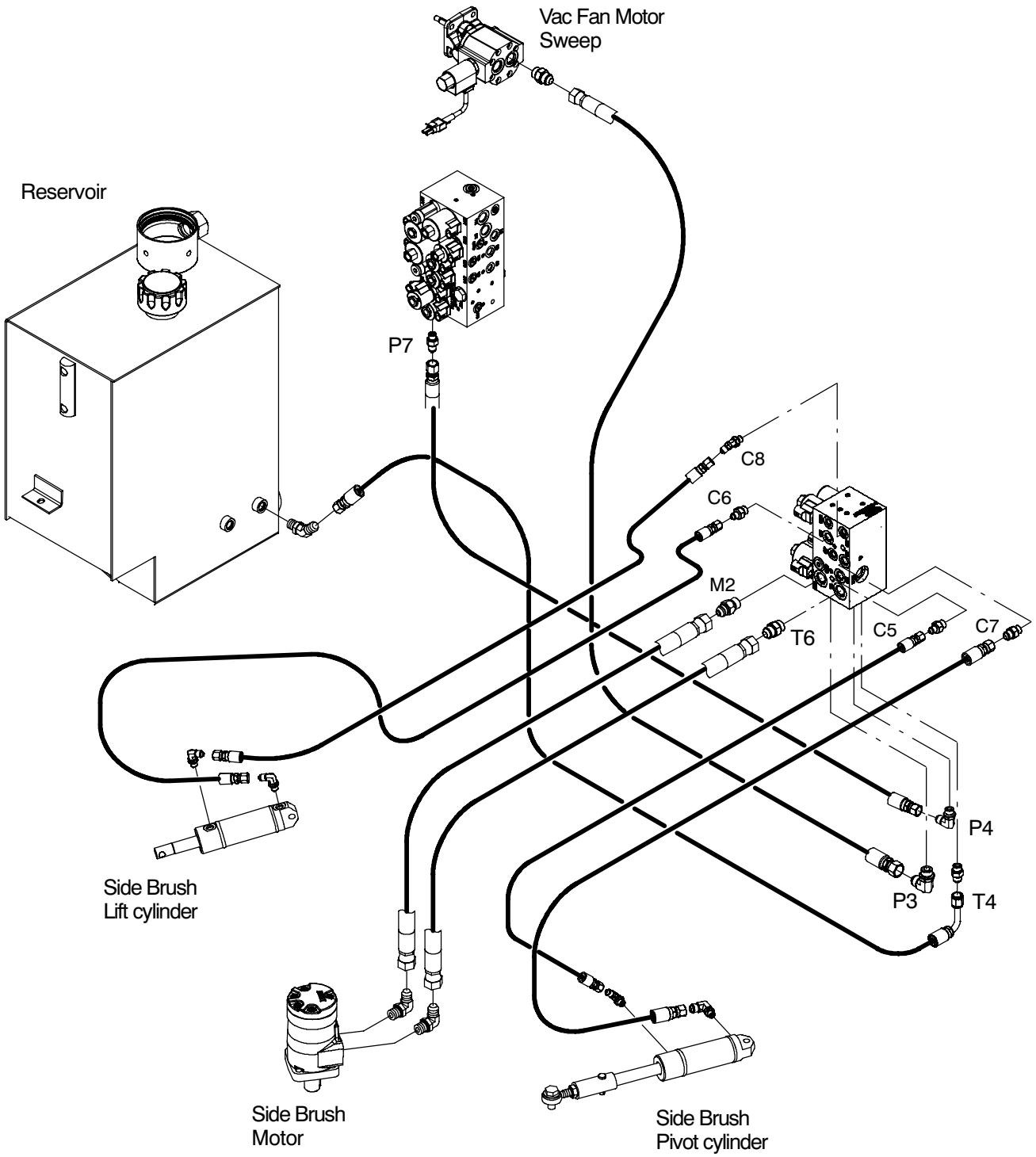
Hydraulic Cooler & Tubes Hose Diagram



Side Brush Hydraulic Hose Diagram



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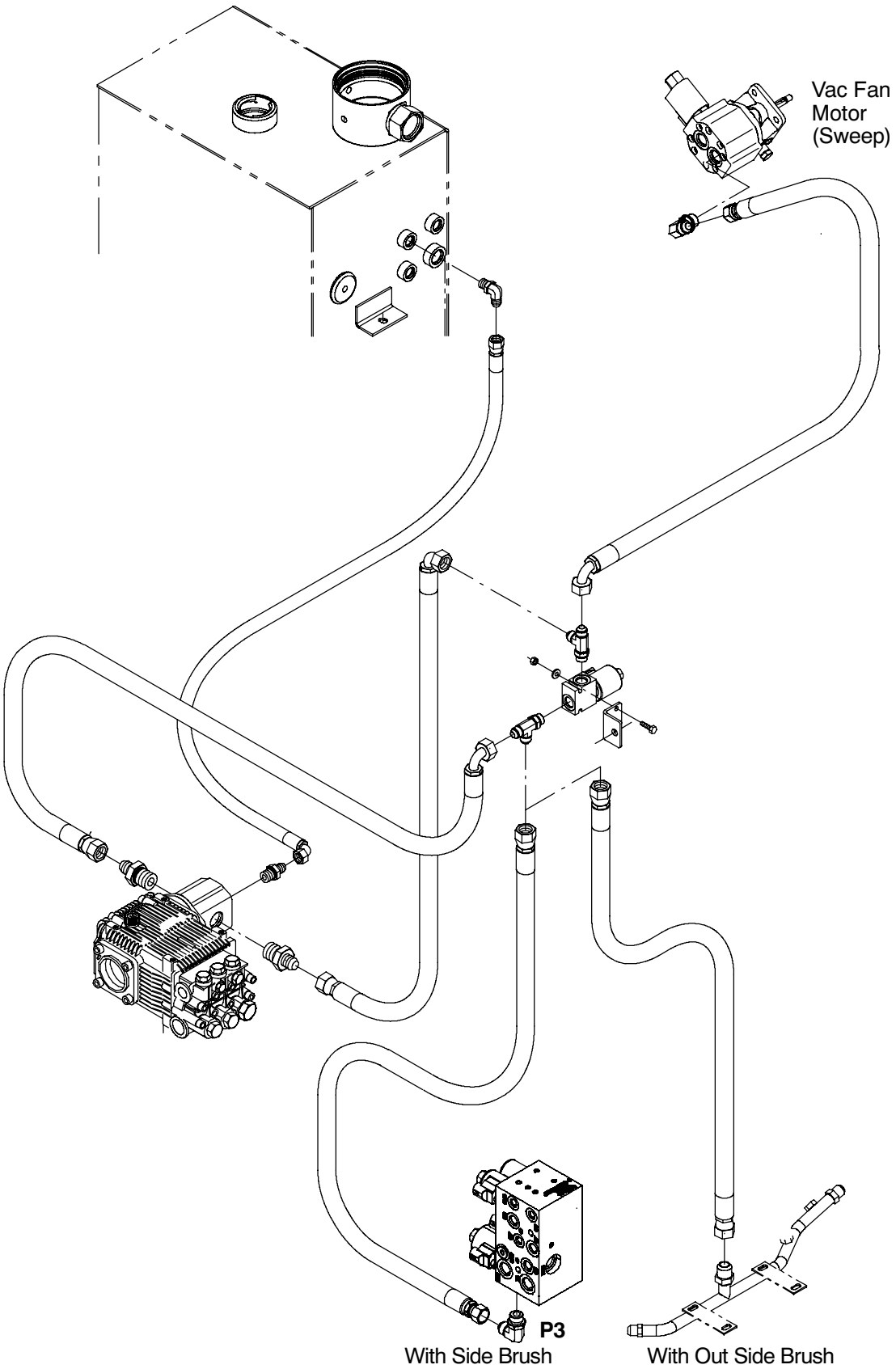
Pressure Washer Motor Hydraulic Hose Diagram



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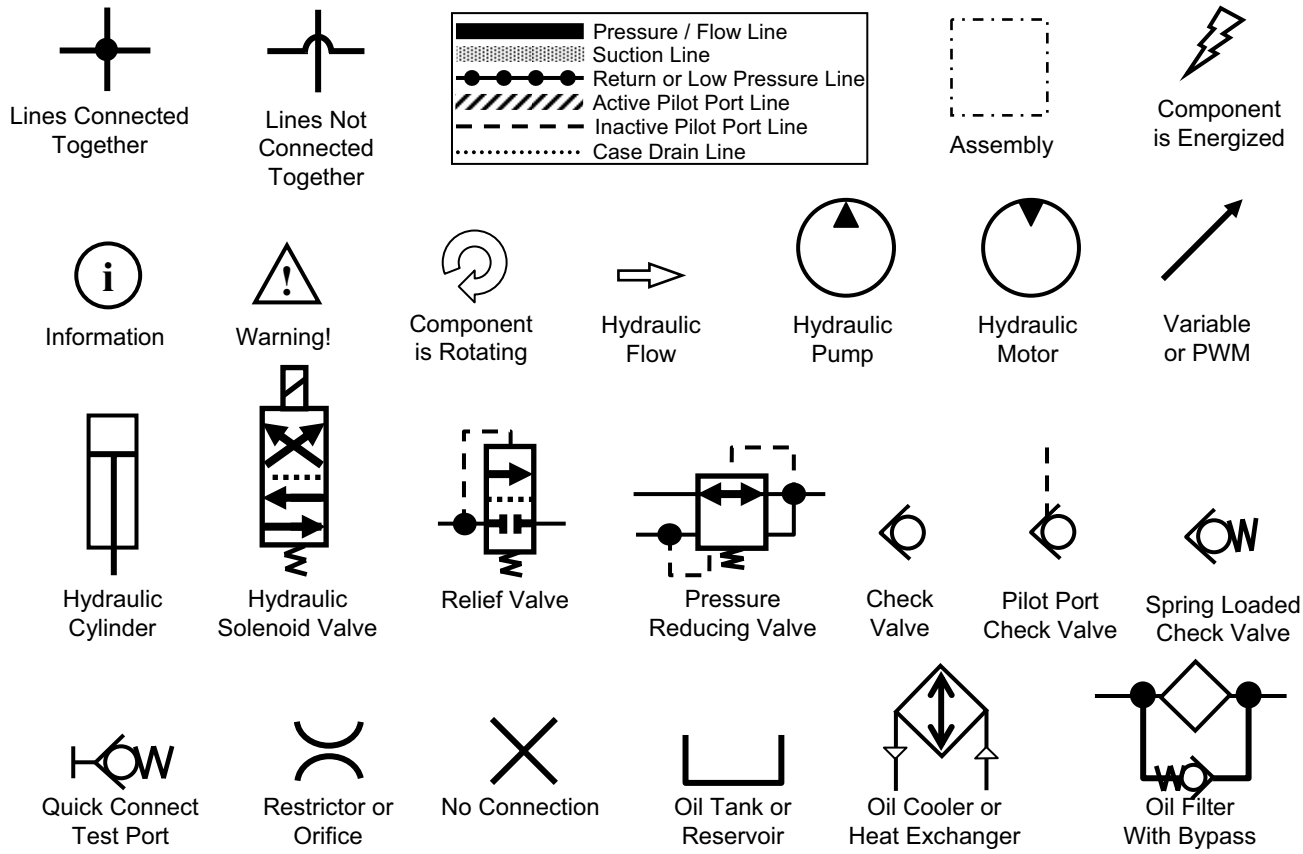
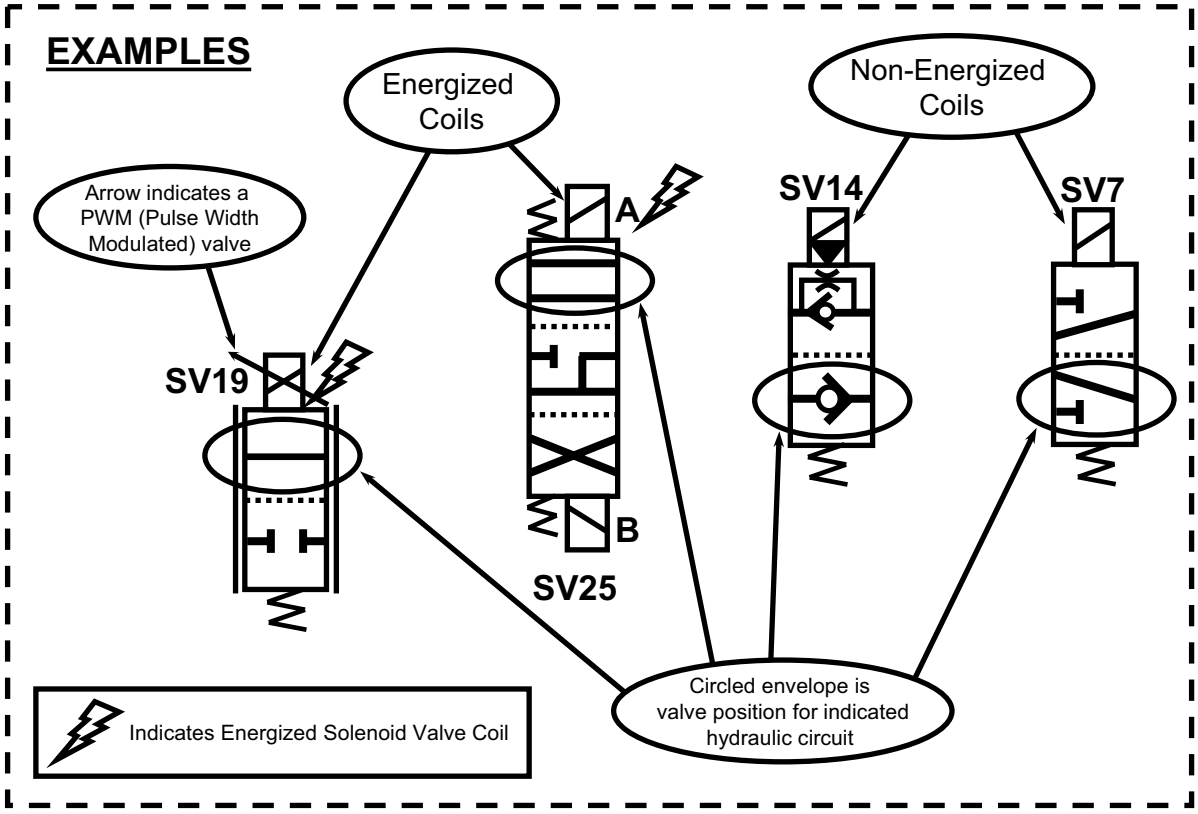
Component / System	Function	Test Port	Test Port Location	Enable Valve	Energized Coil(s)	Notes	Valve Block	Valve Block Number	Location	Feed Port	Exit Port	Pressure Control in Circuit	Pressure Setting PSI (BAR)	Notes
Scrub Head	Down	G1	Main Valve	SV7	SV2, SV3	SV2 is PWM controlled; Down pressure varies with current to SV2; SV3 and SV6 tied together electrically	Main Valve	1038566	Left Side, beside vacuum fan	C1	C2	SV2	0 to 400 (0 to 27.5)	Operating Flow from Pump # 1 (inner most pump)
	Up	G5			default					C2	C1	RV2	2500 (172.3)	
Squeegees, Side and Rear	Down	G5	Main Valve	SV7	SV4	Operate Squeegees "Up and Down" using Manual Mode--Monitor pressure at G5	Main Valve	1038566	Left Side, beside vacuum fan	C4	C3	RV2	2500 (172.3)	Operating Flow from Pump # 1 (inner most pump)
	Up				default					C3	C4			
Hopper Door	Closed	G5	Main Valve	SV7	default	Lift Hopper, Operate Hopper Door "Open and Closed" using Manual Mode--Monitor pressure G5	Main Valve	1038566	Left Side, beside vacuum fan	C11	C10	RV2	2500 (172.3)	Operating Flow from Pump # 1 (inner most pump)
	Open				SV15					C10	C11			
Main Brushes	Run	G5	Main Valve	SV7	SV6	Operate Main Brushes "On" using Manual Mode--Monitor pressure at G5; SV3 and SV6 tied together electrically	Main Valve	1038566	Left Side, beside vacuum fan	M1	Direct to Tank	RV2	2500 (172.3)	Operating Flow from Pump # 1 (inner most pump)
Hopper Lift	Down	G5	Main Valve	SV7	SV13	1100 PSI RV3 keeps hopper pushed tight to frame	Main Valve	1038566	Left Side, beside vacuum fan	C12	C9	RV3	1100 (75.8)	Operating Flow from Pump # 1 (inner most pump)
	Up				SV14					C9	C12	RV2	2500 (172.3)	
Scrub Fan	Run	G6	Main Valve	-	SV1		Main Valve	1038566	Left Side, beside vacuum fan	Direct from Pump	T3 (on Side Valve)	RV1	2500 (172.3)	Operating Flow from Pump # 2 (middle pump)
Sweep Fan	Run	G6	Main Valve	-	SV9		On Sweep Fan Motor	53485	On sweep fan motor	M4 (on Main Valve)	T3 (on Side Valve)	On Sweep Fan Motor	1800 (124.1)	Operating Flow from Pump # 2 (middle pump)
Side Brush (Sweep/Scrub)	Run	G6	Main Valve	-	SV8	Operate Side Brush "On" using Manual Mode--Monitor pressure at G6; SV8 and SV12 tied together electrically	Side Valve	1037805	Left front	M2	T6	RV1	2500 (172.3)	Operating Flow from Pump # 2 (middle pump)
Side Brush	Up	G8	Side Valve	SV7	default	SV10 is PWM controlled; Operate Side Brush up and down using Manual Mode; SV8 and SV12 tied together electrically	Side Valve	1037805	Left front	C8	C6	PR1A	400 (27.5)	Operating Flow from Pump # 1 (inner most pump)
	Down	G13			SV10, SV11					C6	C8	SV10	0 to 800 (0 to 55)	
	Retract	C5			default					C5	C7	RV2	2500 (172.3)	
	Extend	G7			SV12					C7	C5	PR1B	100 (6.9)	

Hydraulic Symbols

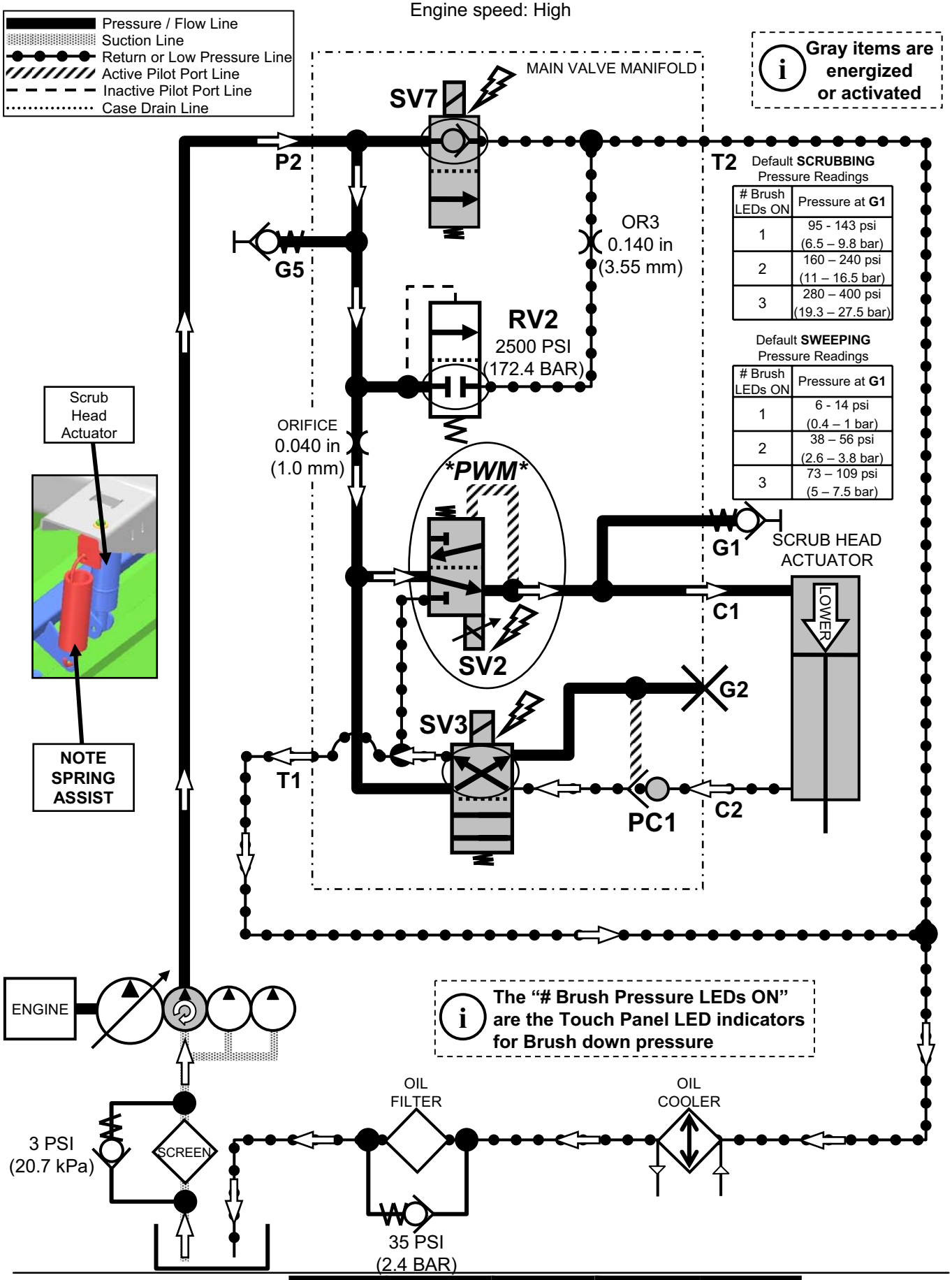




H

Scrub/Sweep Head Lower

Engine speed: High



Default **SCRUBBING** Pressure Readings

# Brush LEDs ON	Pressure at **G1**
1	95 - 143 psi (6.5 – 9.8 bar)
2	160 – 240 psi (11 – 16.5 bar)
3	280 – 400 psi (19.3 – 27.5 bar)

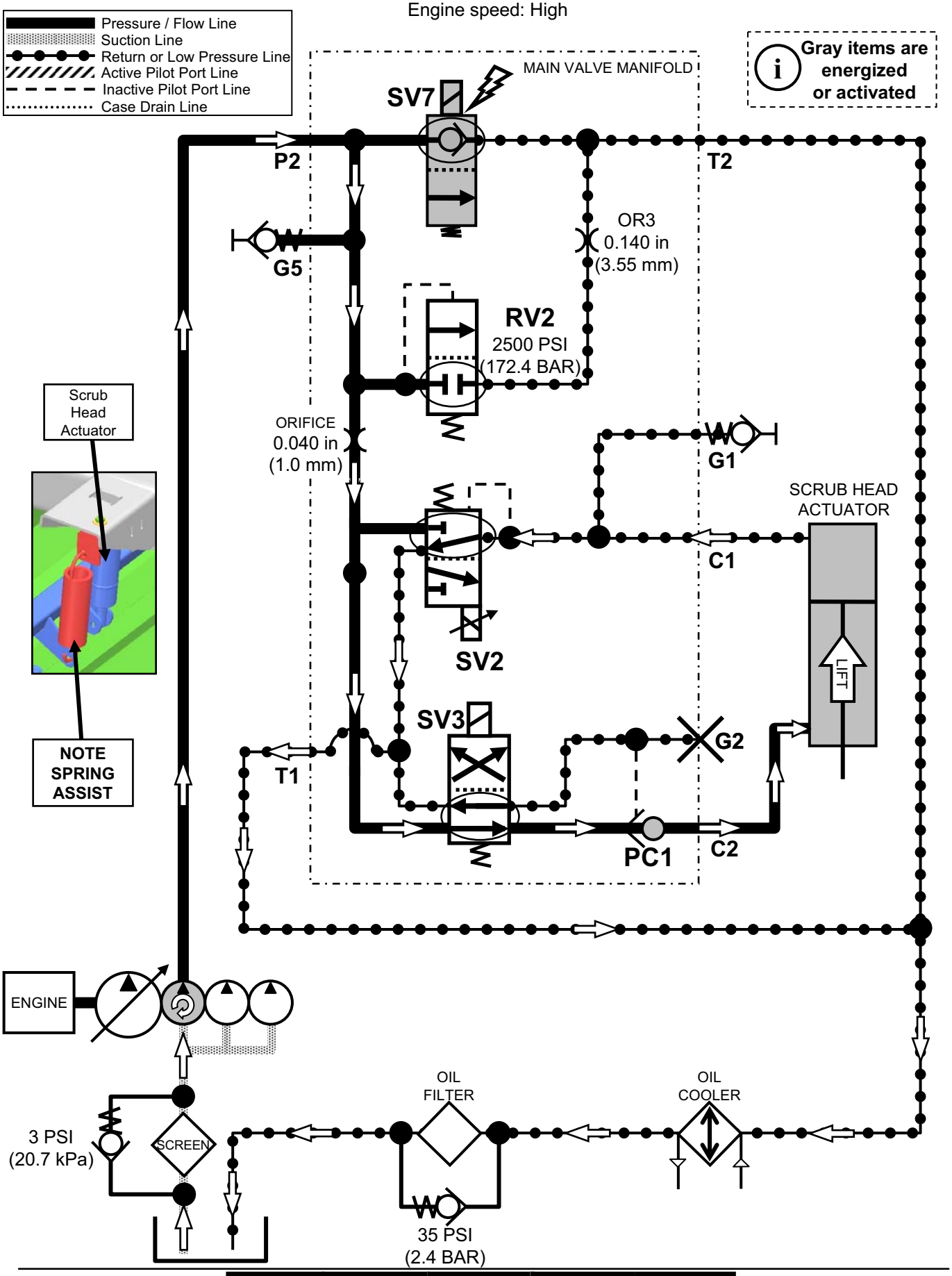
Default **SWEEPING** Pressure Readings

# Brush LEDs ON	Pressure at **G1**
1	6 - 14 psi (0.4 – 1 bar)
2	38 – 56 psi (2.6 – 3.8 bar)
3	73 – 109 psi (5 – 7.5 bar)

H

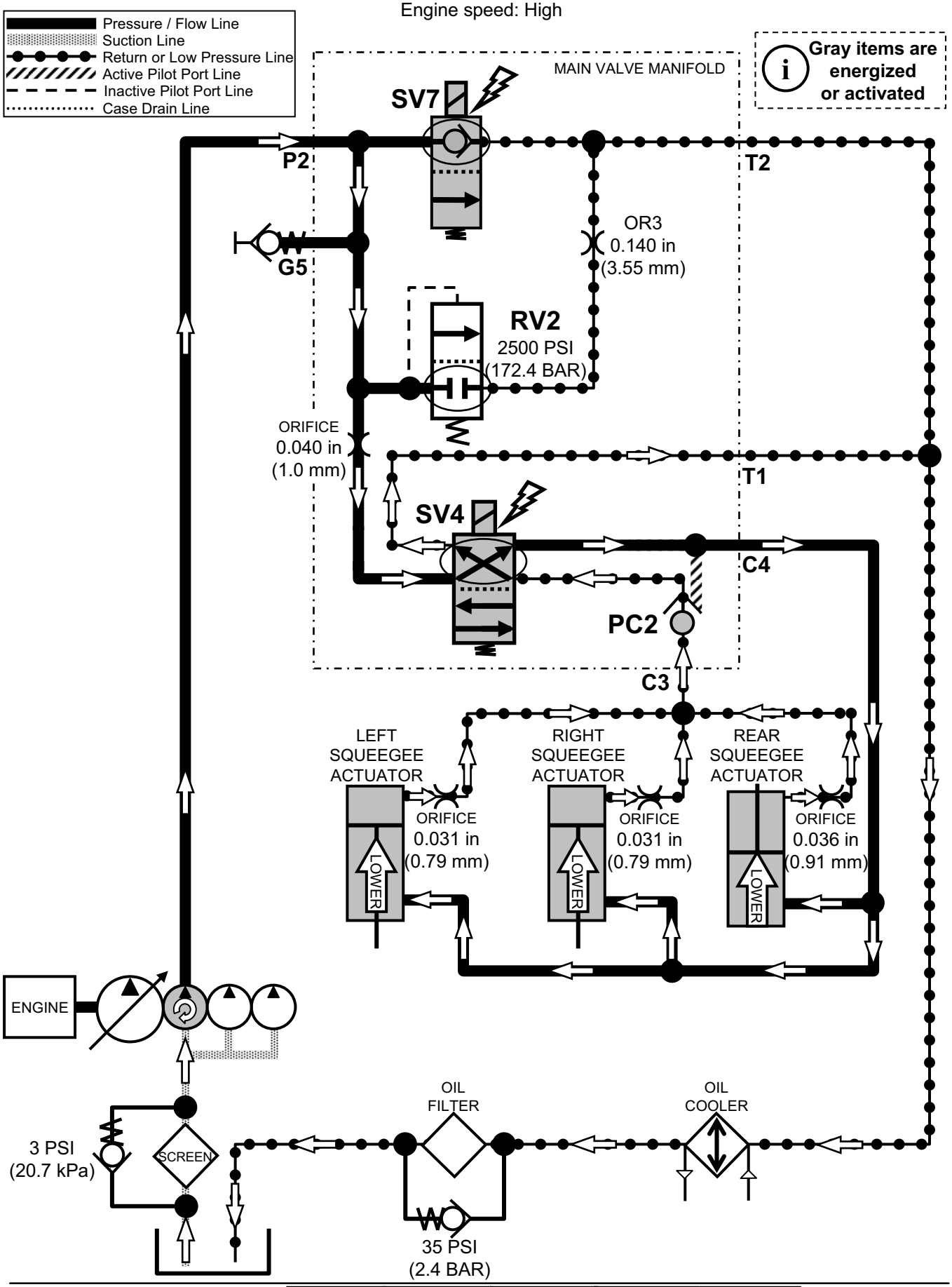
Scrub/Sweep Head Lift

Engine speed: High



H

Squeegees Lower
Engine speed: High



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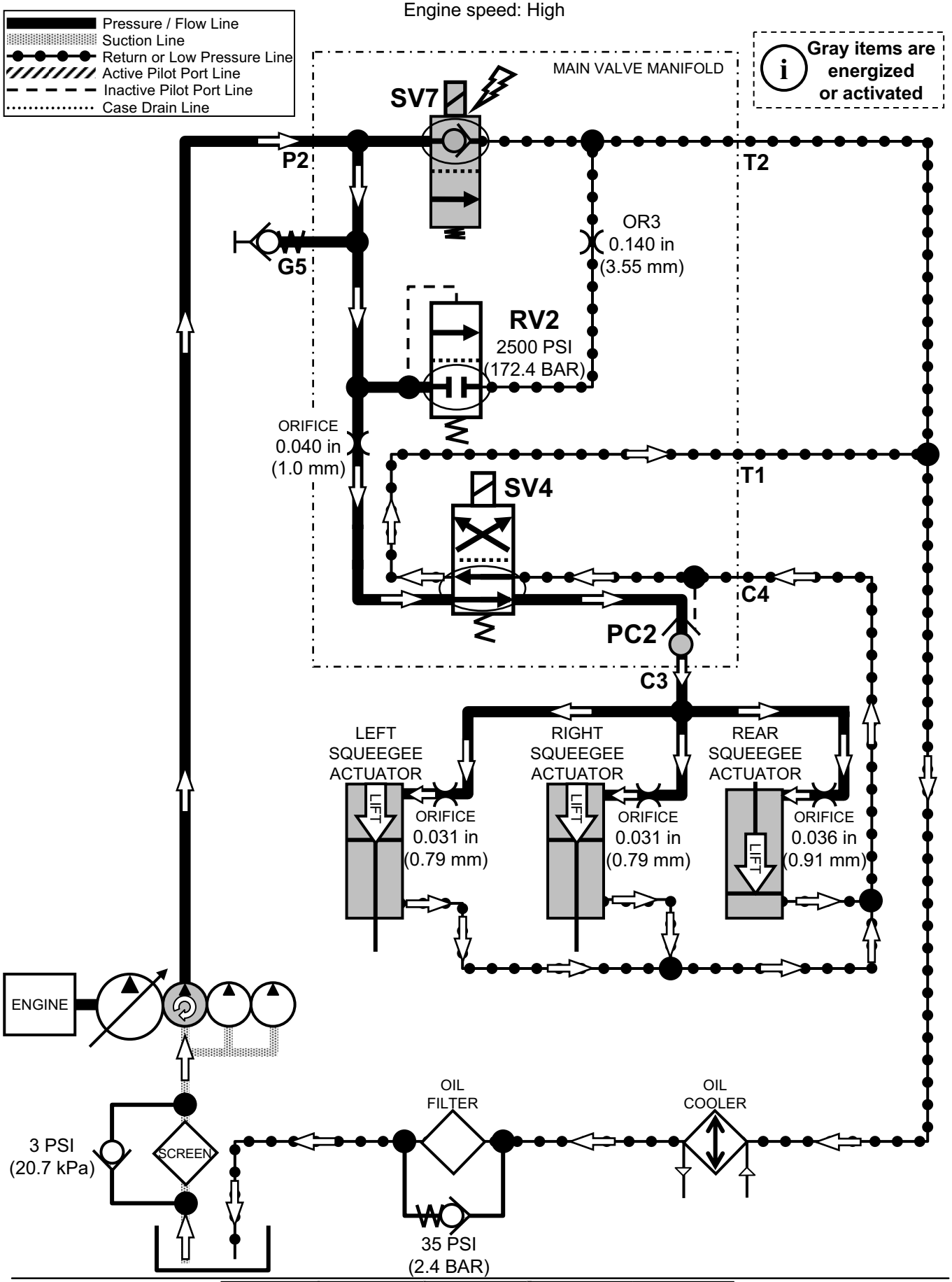
Squeegees Lift

Engine speed: High



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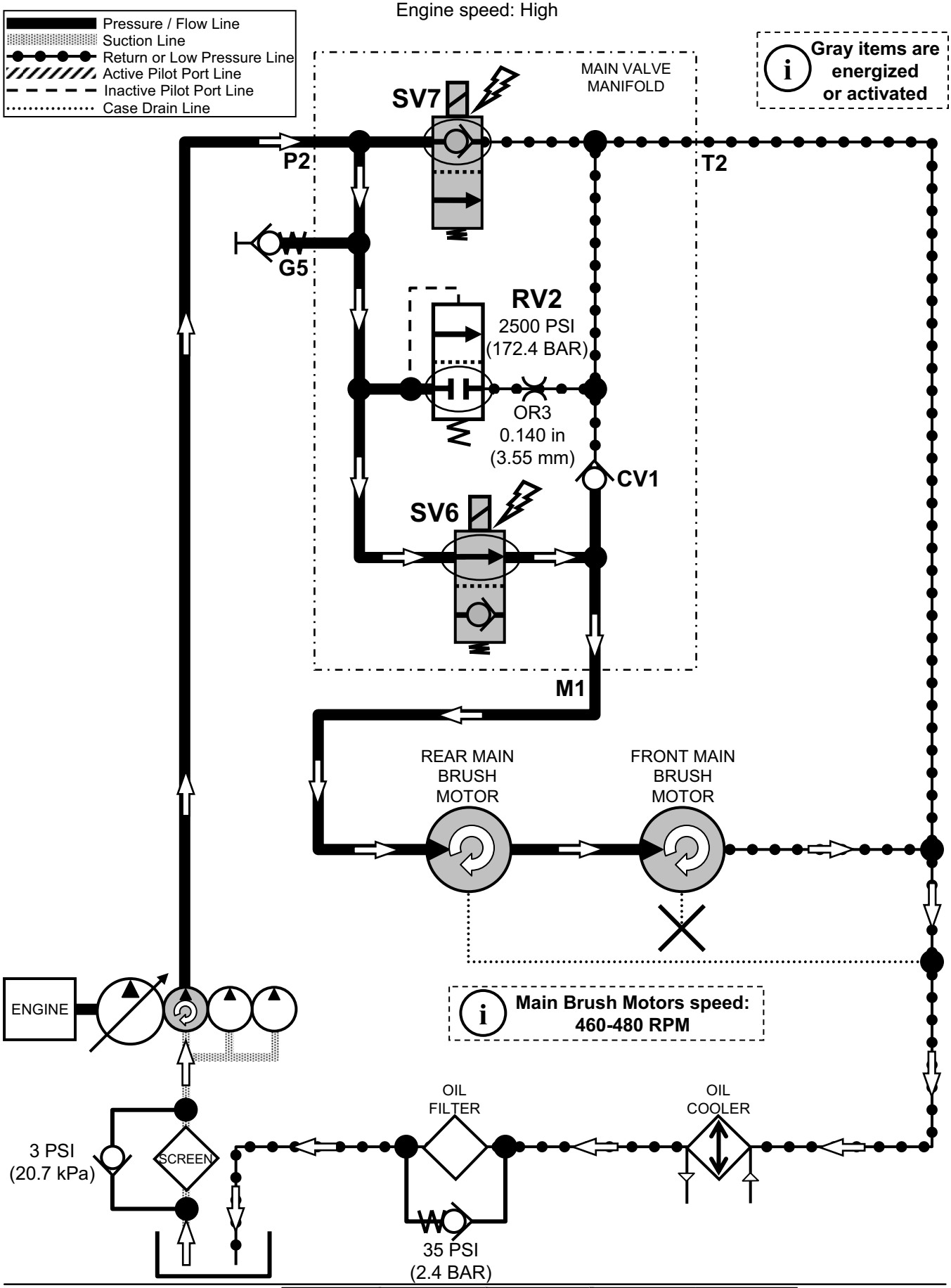
Main Brushes ON
Engine speed: High



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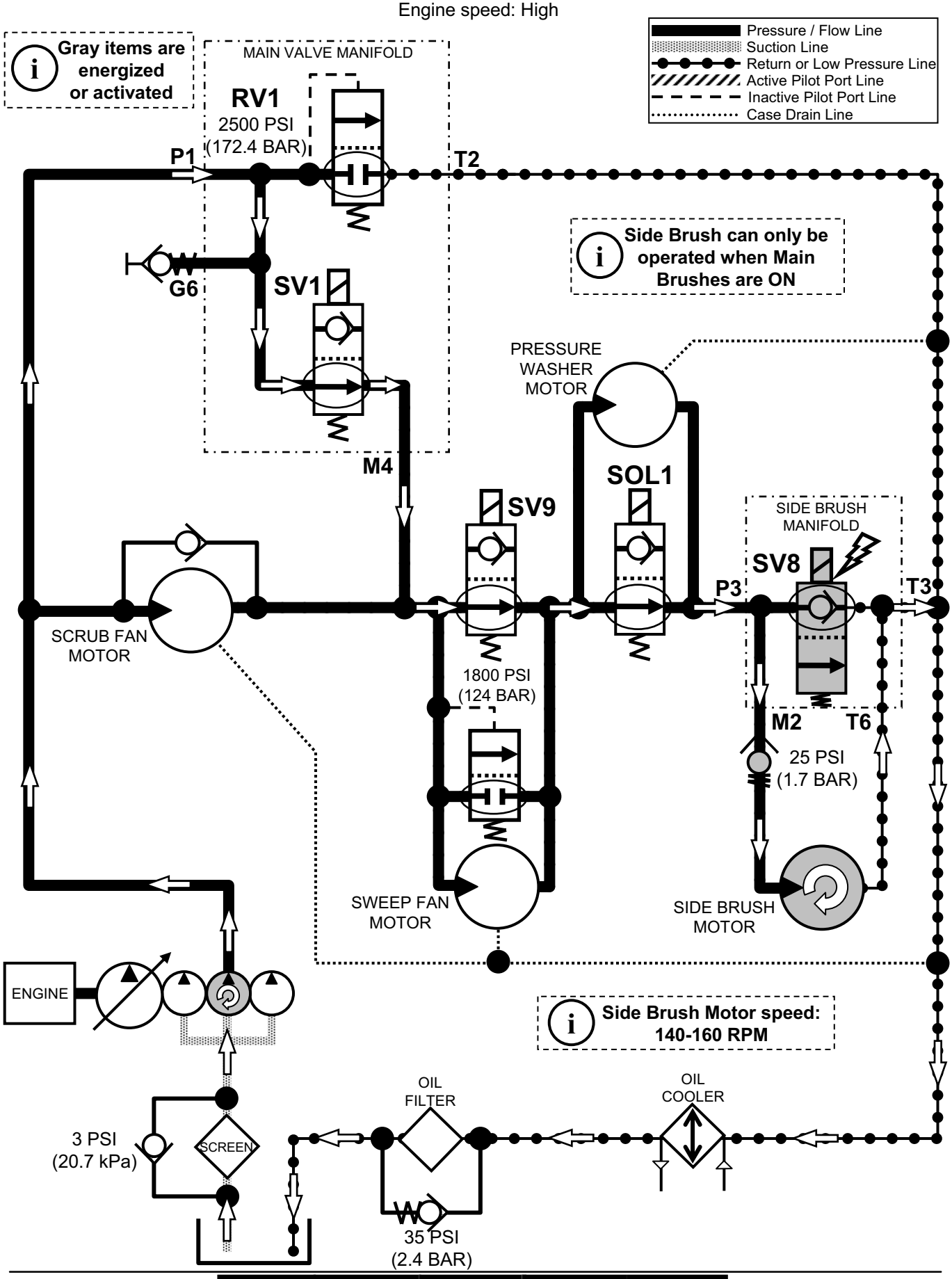
Side Brush ON

Engine speed: High



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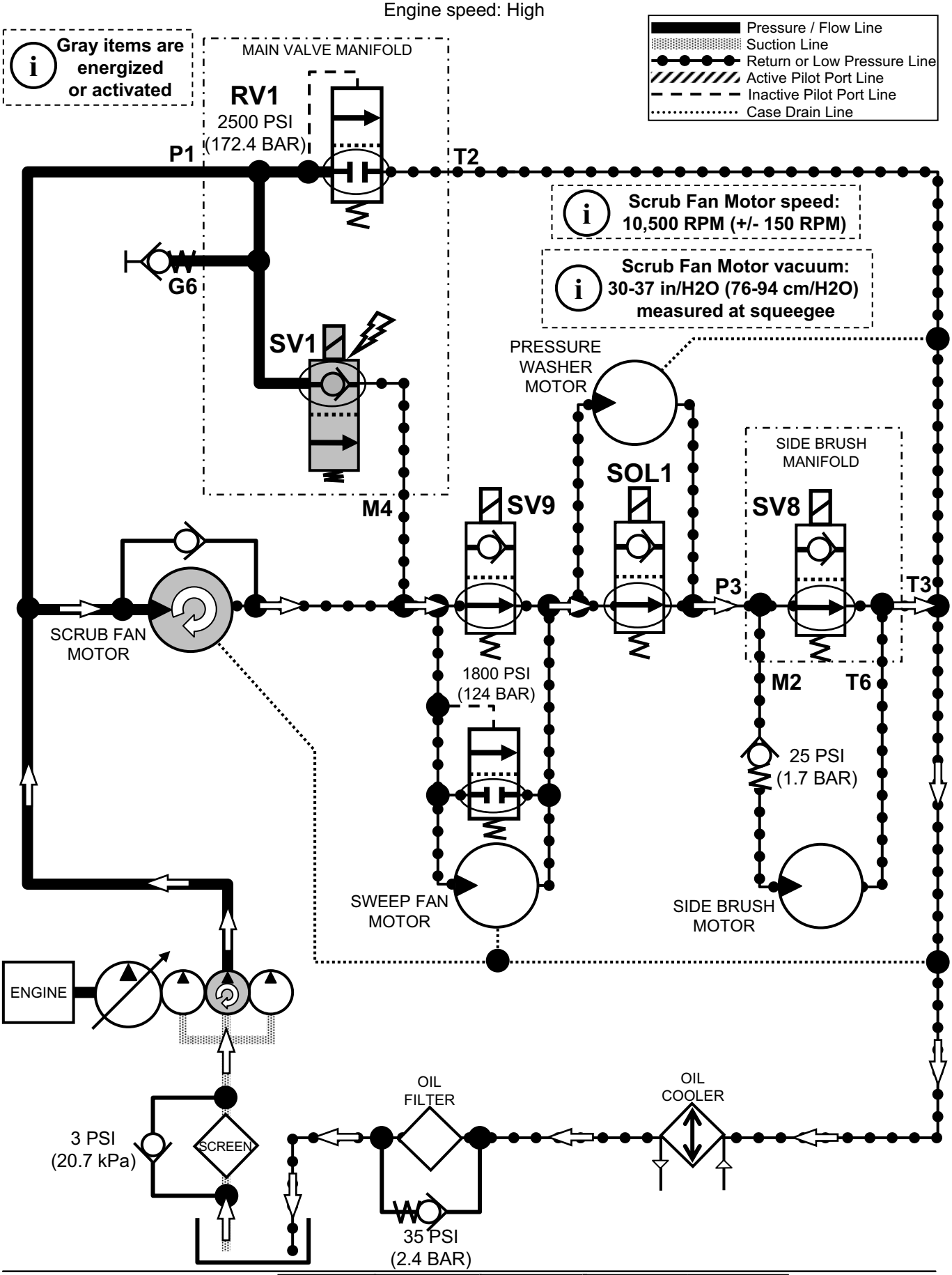
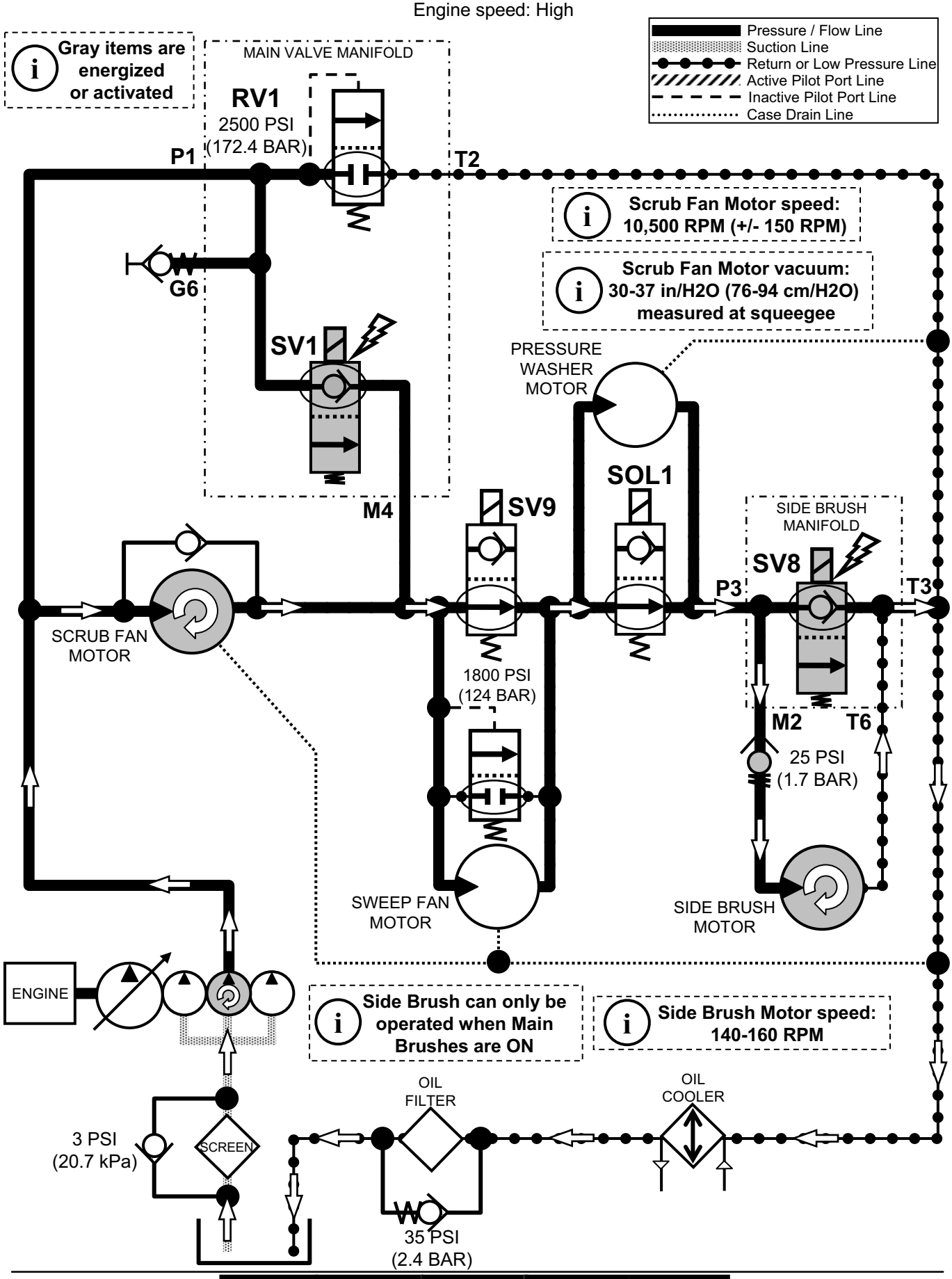
Scrub Vacuum Fan ON

Engine speed: High

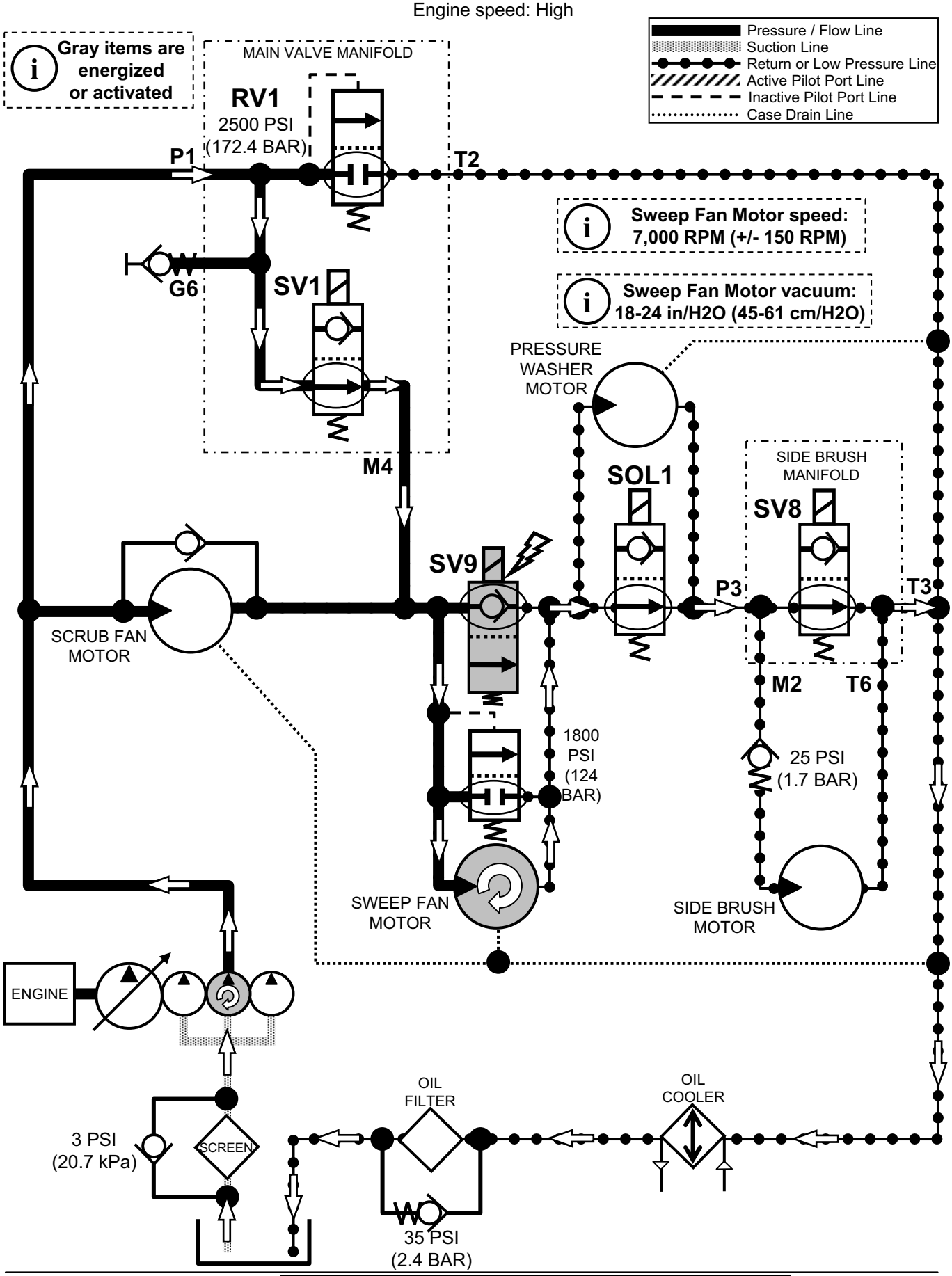


Scrub Vacuum Fan & Side Brush ON

Engine speed: High



Sweep Vacuum Fan ON
Engine speed: High



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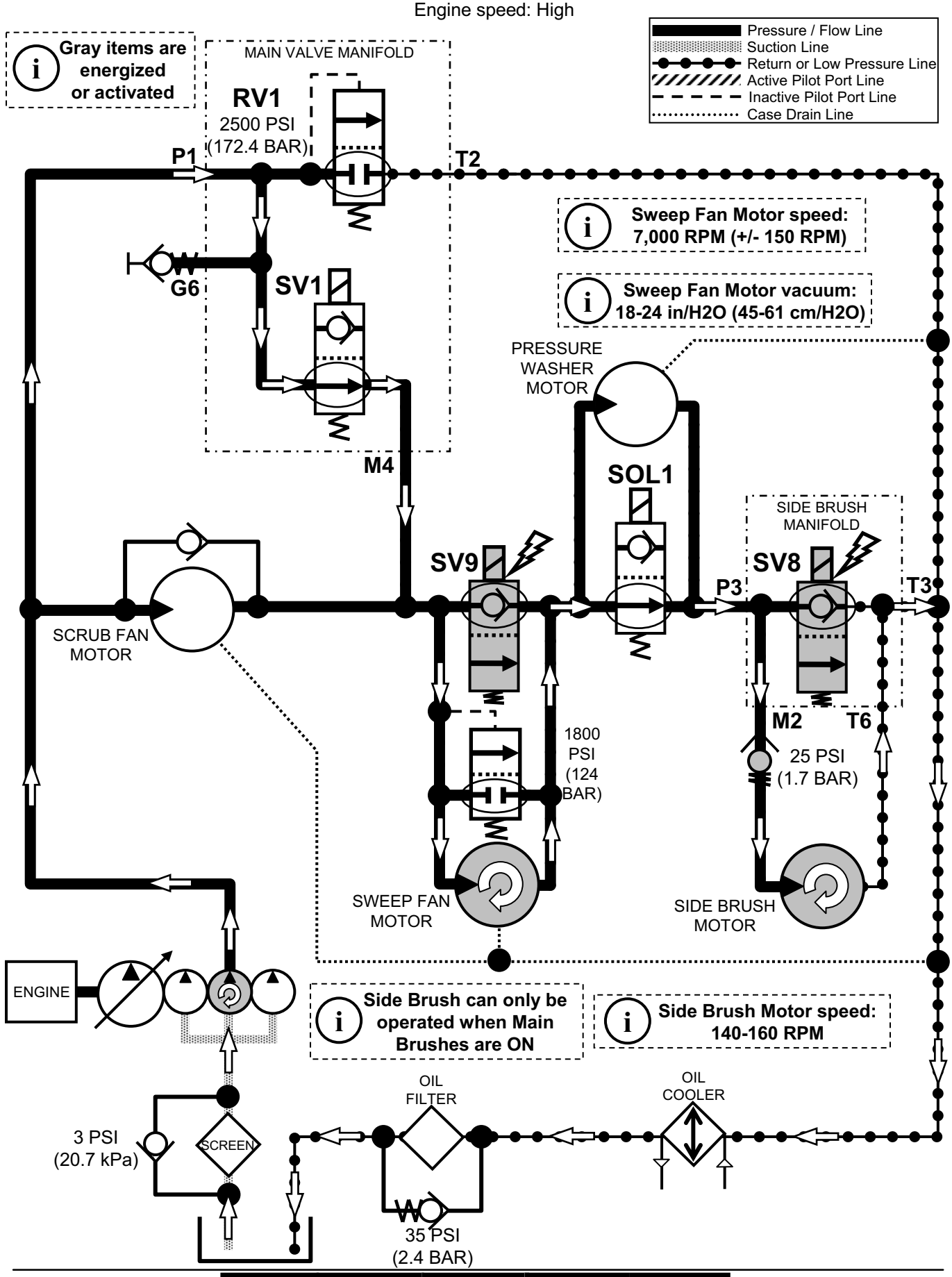
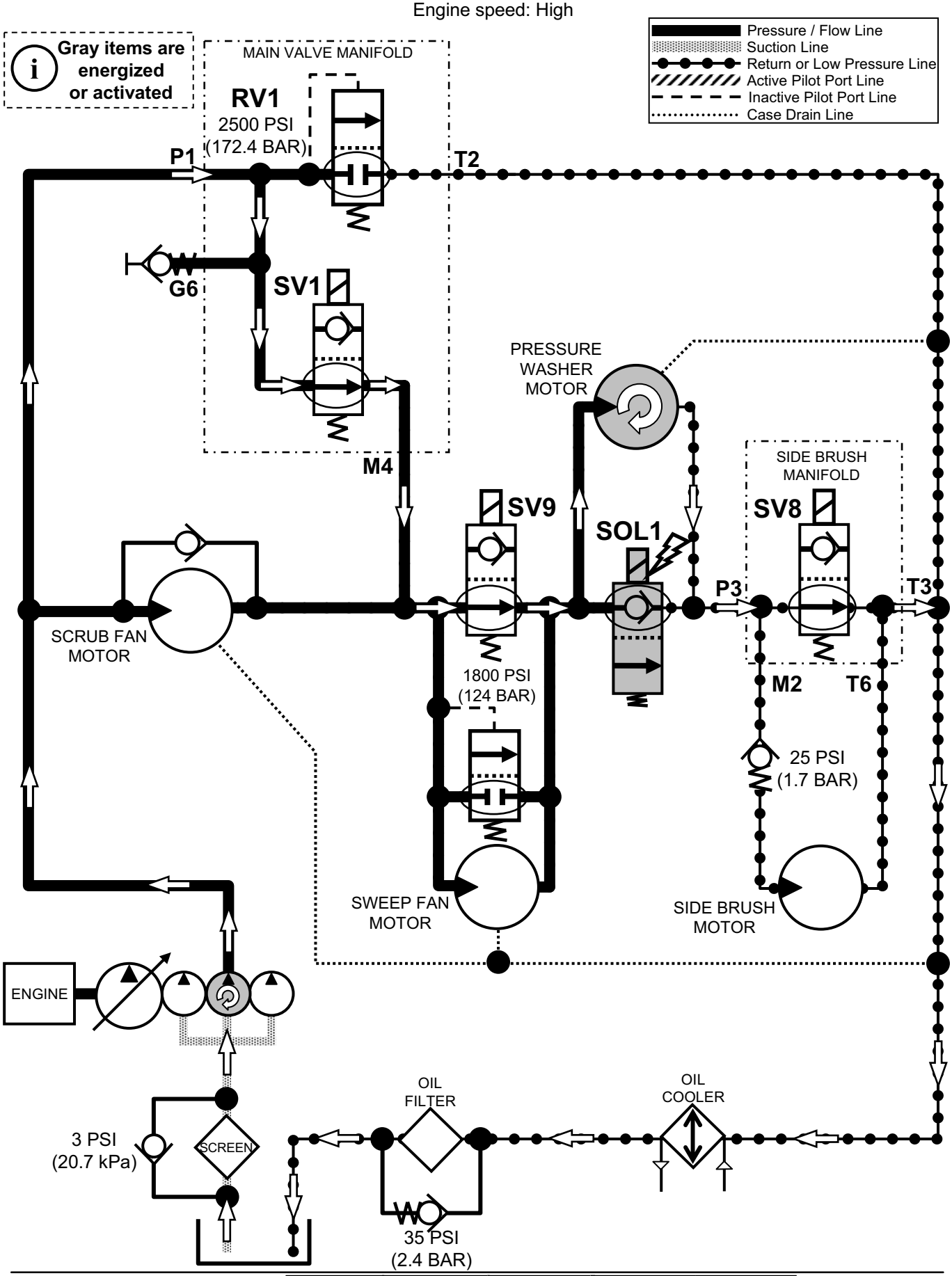
Sweep Vacuum Fan & Side Brush ON

Engine speed: High



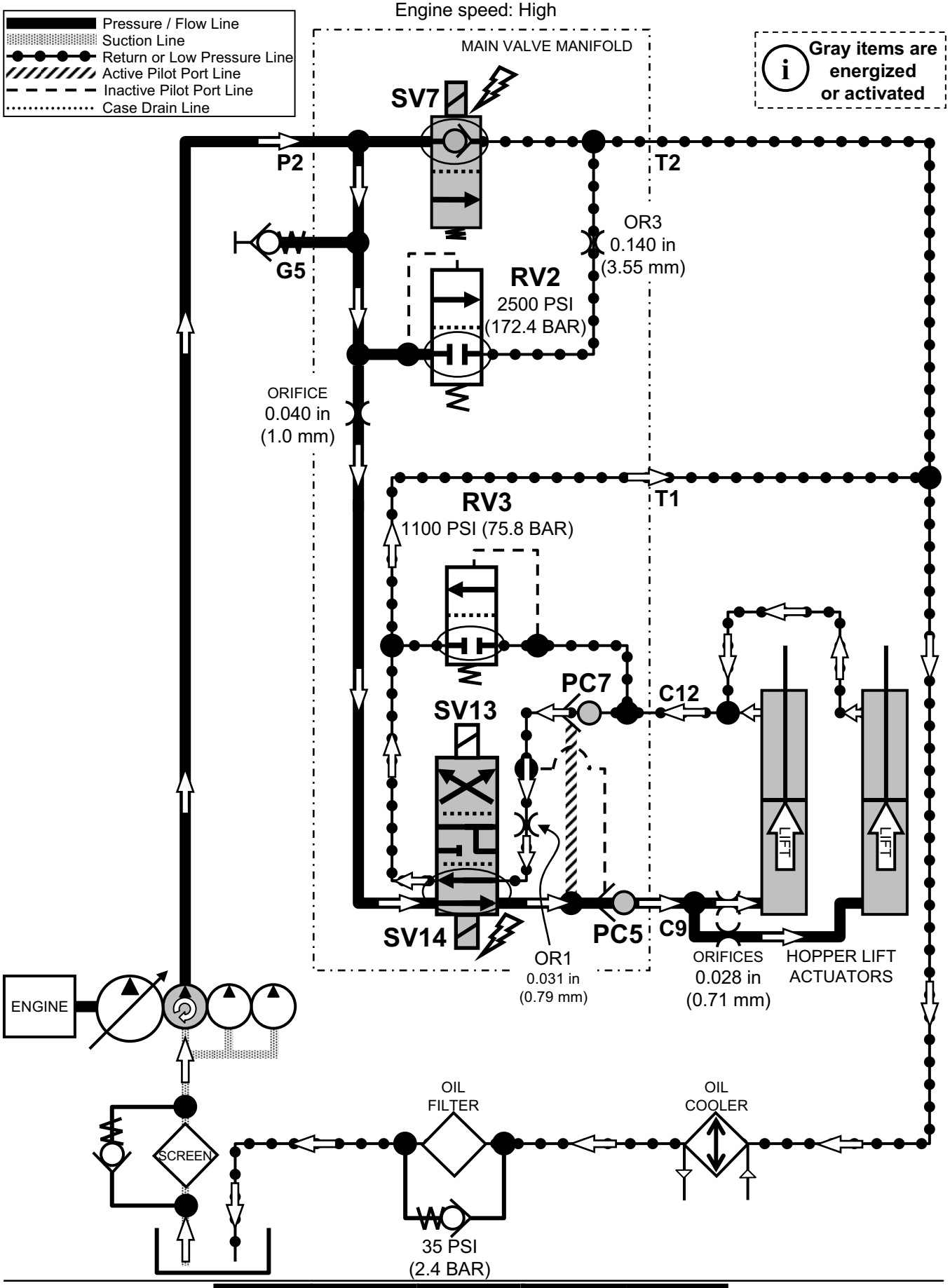
Pressure Washer ON

Engine speed: High



Hopper Lift

Engine speed: High



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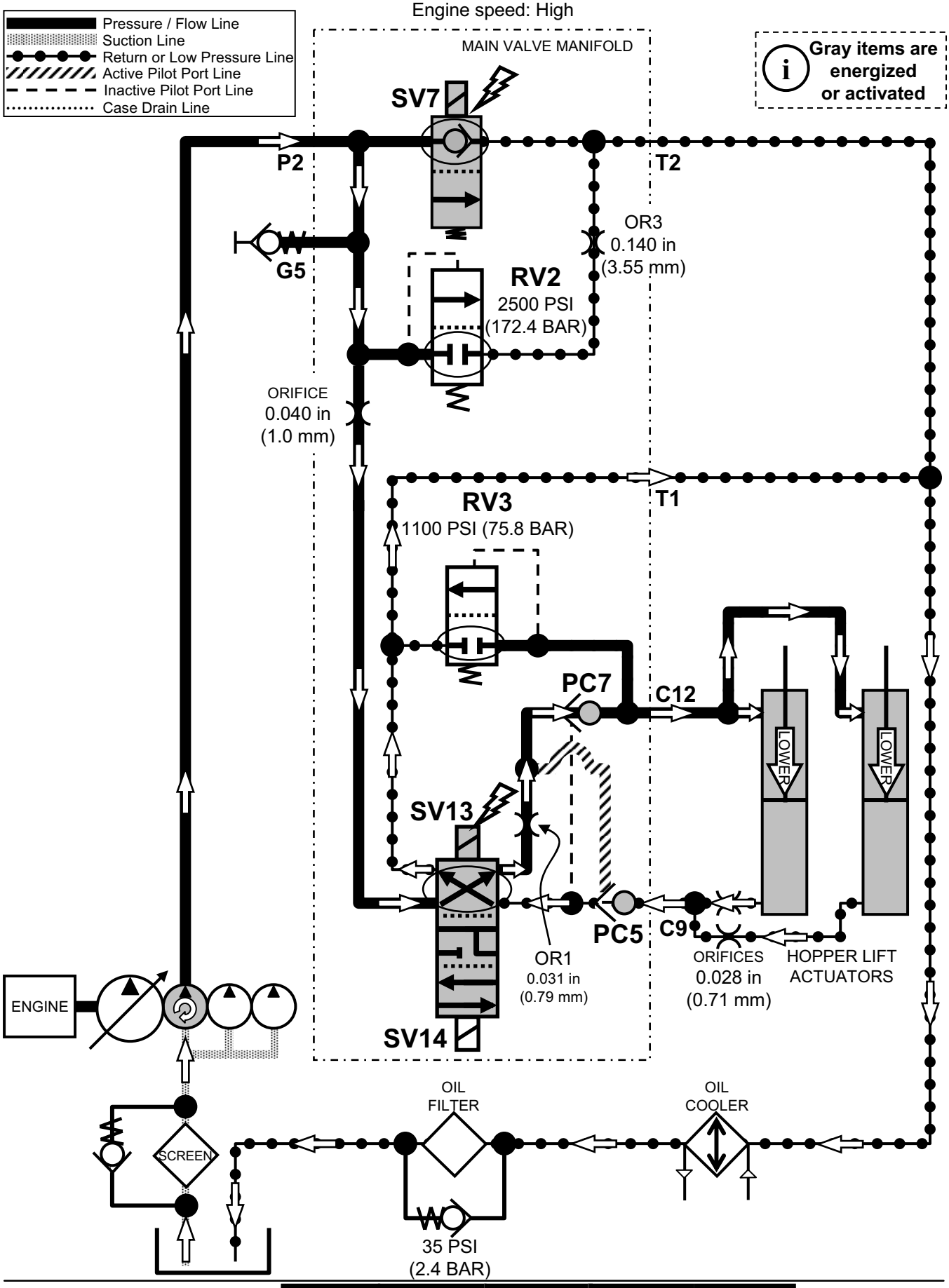
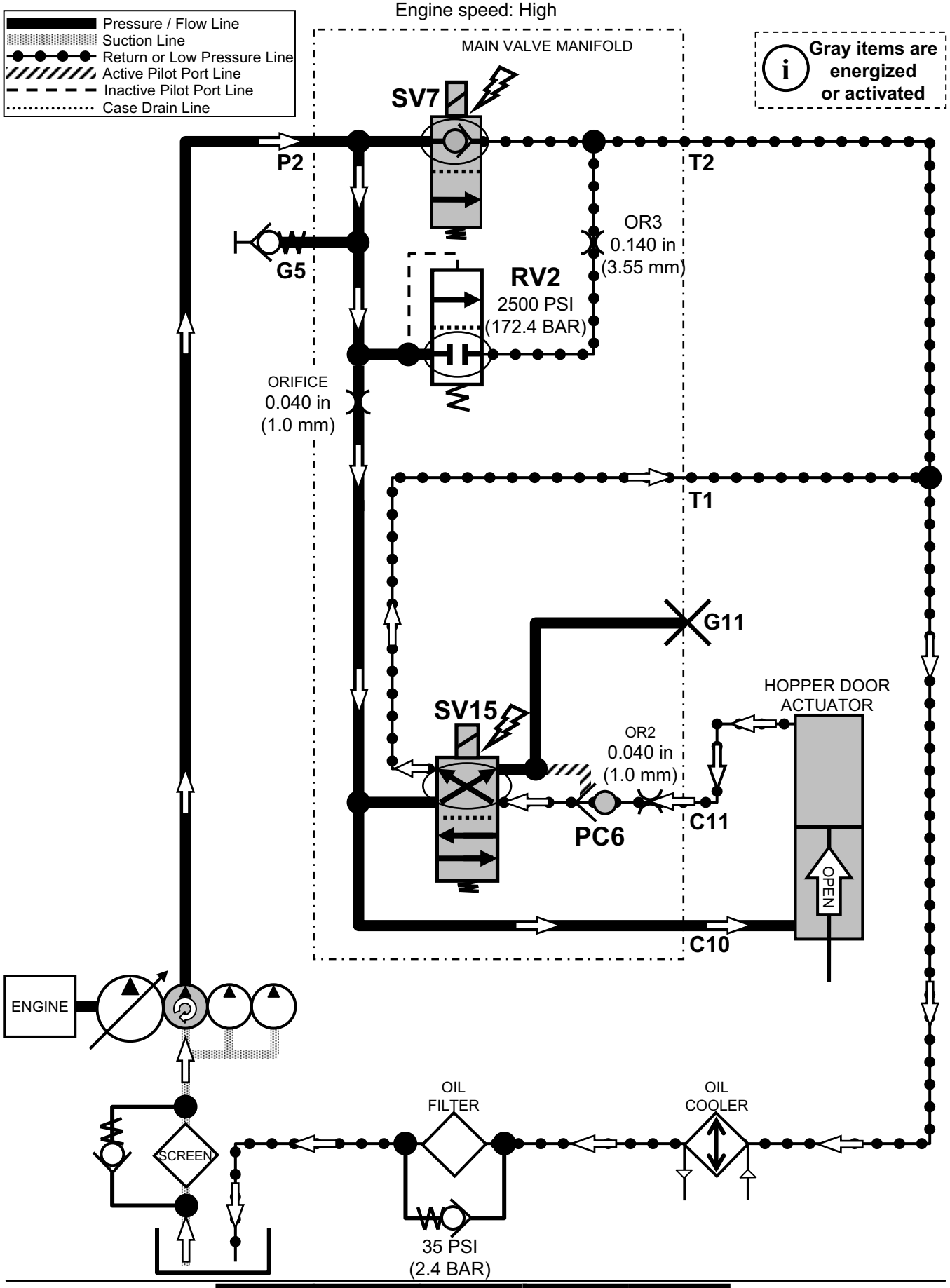
Hopper Lower

Engine speed: High



Hopper Door Open

Engine speed: High



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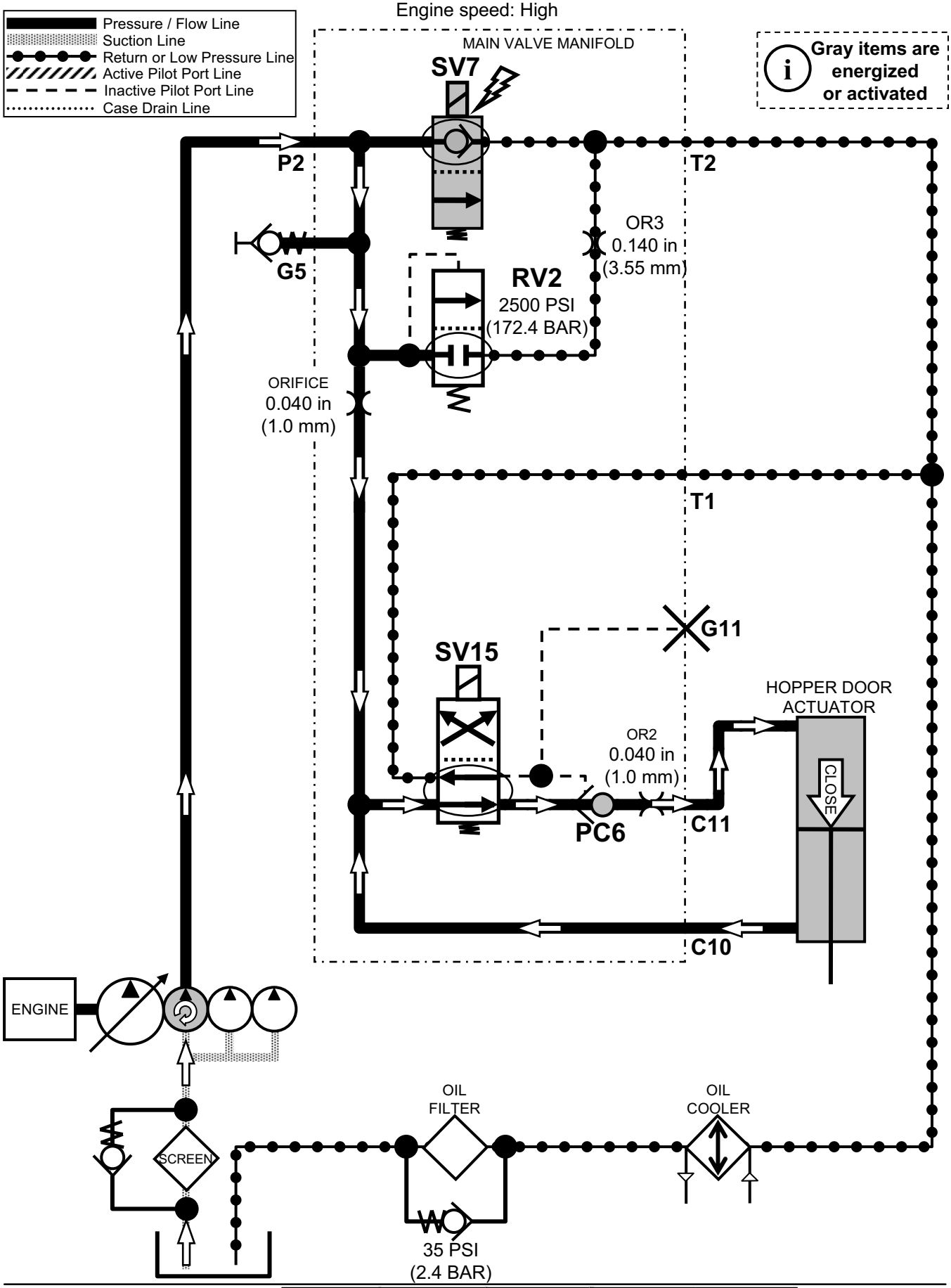
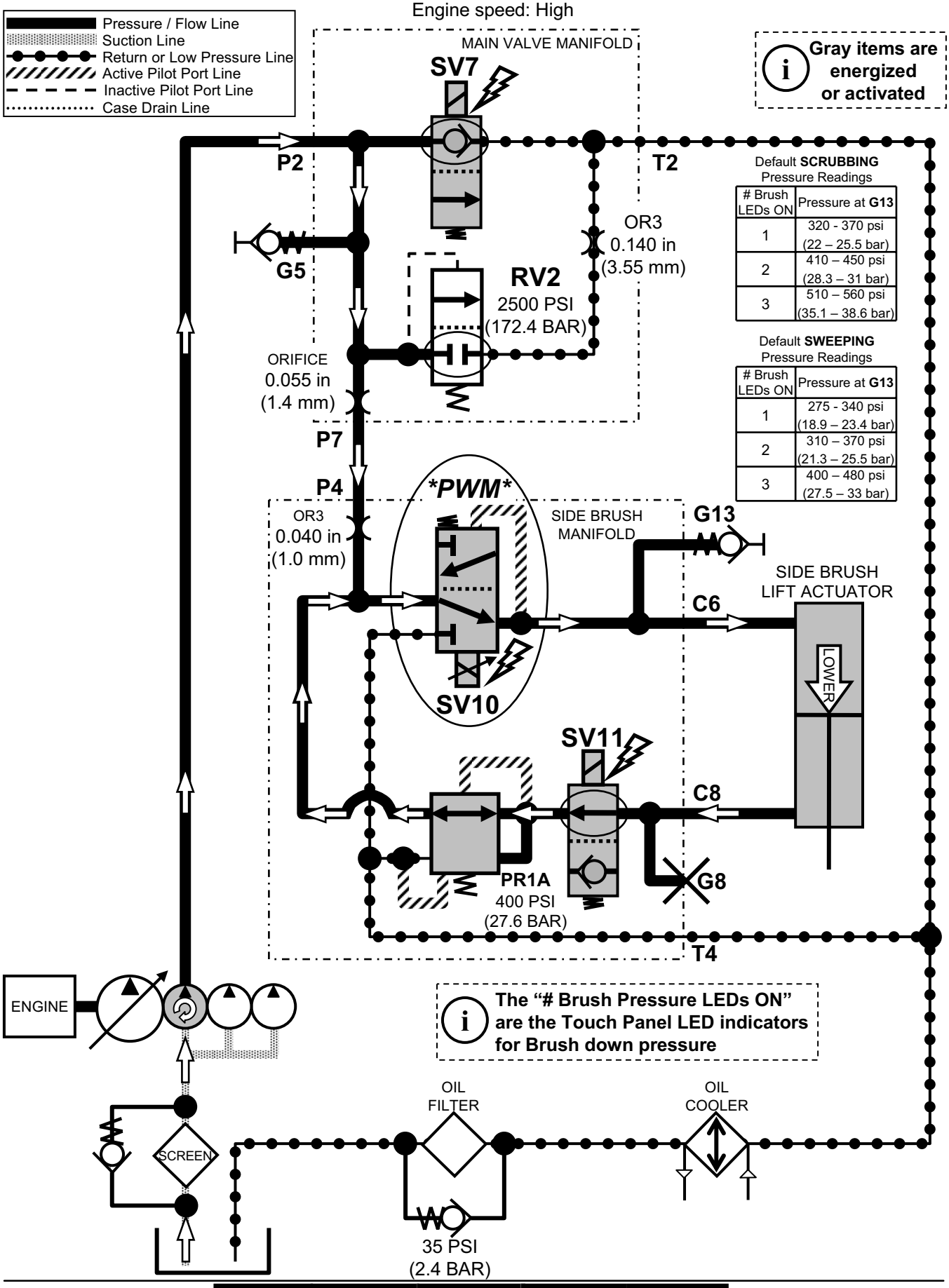
Hopper Door Close

Engine speed: High



Side Brush Lower

Engine speed: High



Default **SCRUBBING** Pressure Readings

# Brush LEDs ON	Pressure at **G13**
1	320 - 370 psi (22 – 25.5 bar)
2	410 – 450 psi (28.3 – 31 bar)
3	510 – 560 psi (35.1 – 38.6 bar)

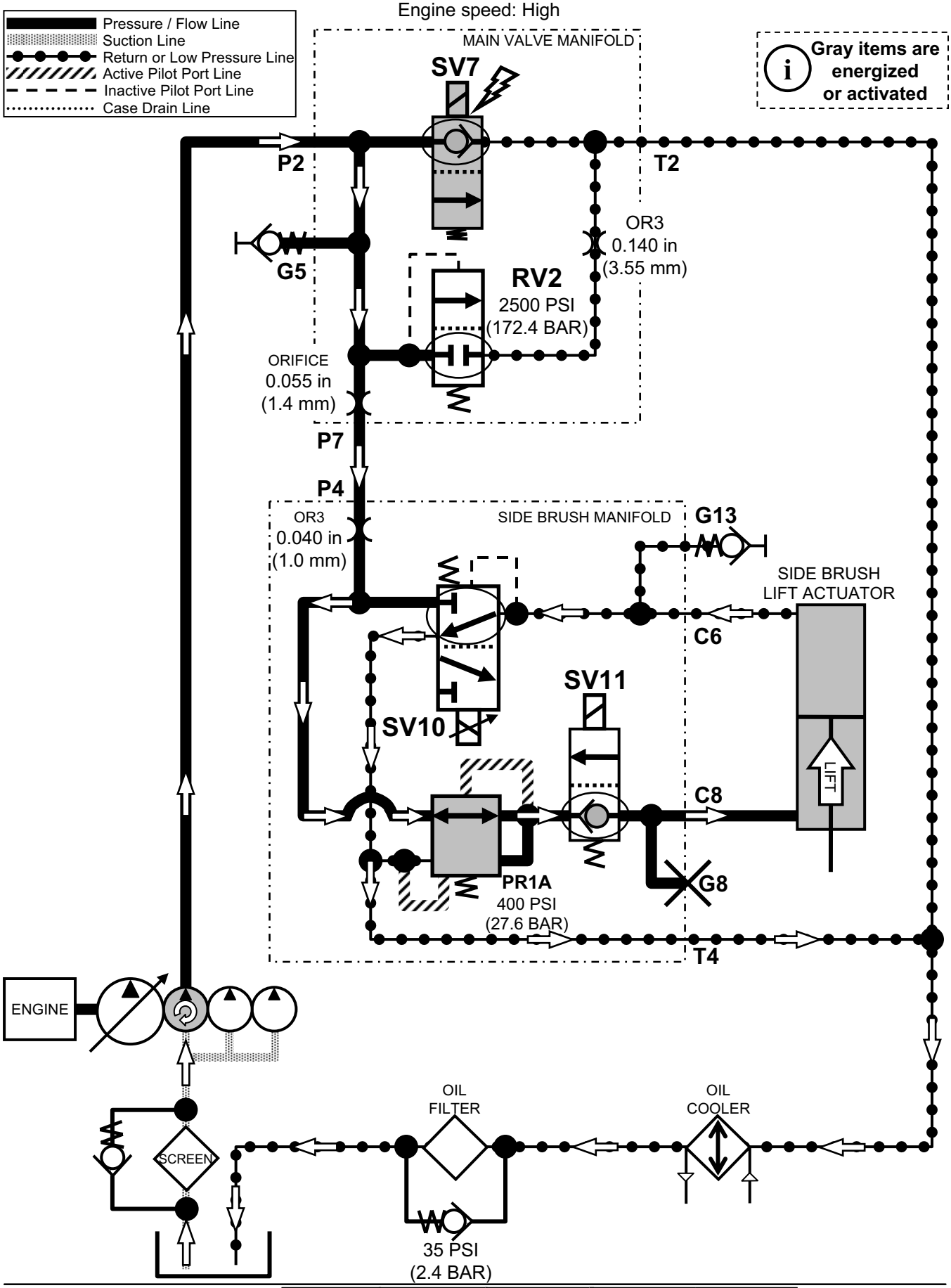
Default **SWEEPING** Pressure Readings

# Brush LEDs ON	Pressure at **G13**
1	275 - 340 psi (18.9 – 23.4 bar)
2	310 – 370 psi (21.3 – 25.5 bar)
3	400 – 480 psi (27.5 – 33 bar)

H

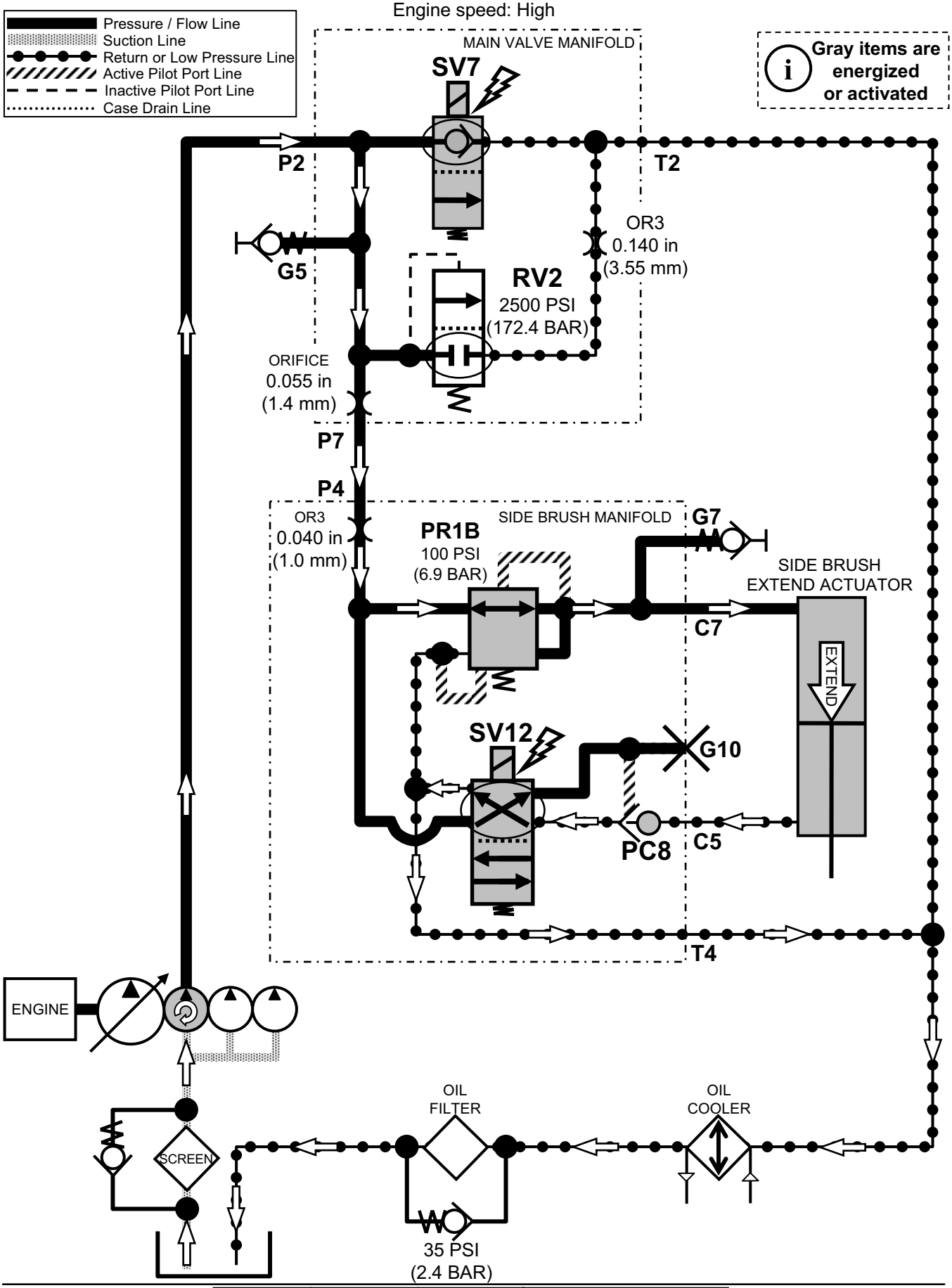
Side Brush Lift

Engine speed: High



Side Brush Extend

Engine speed: High



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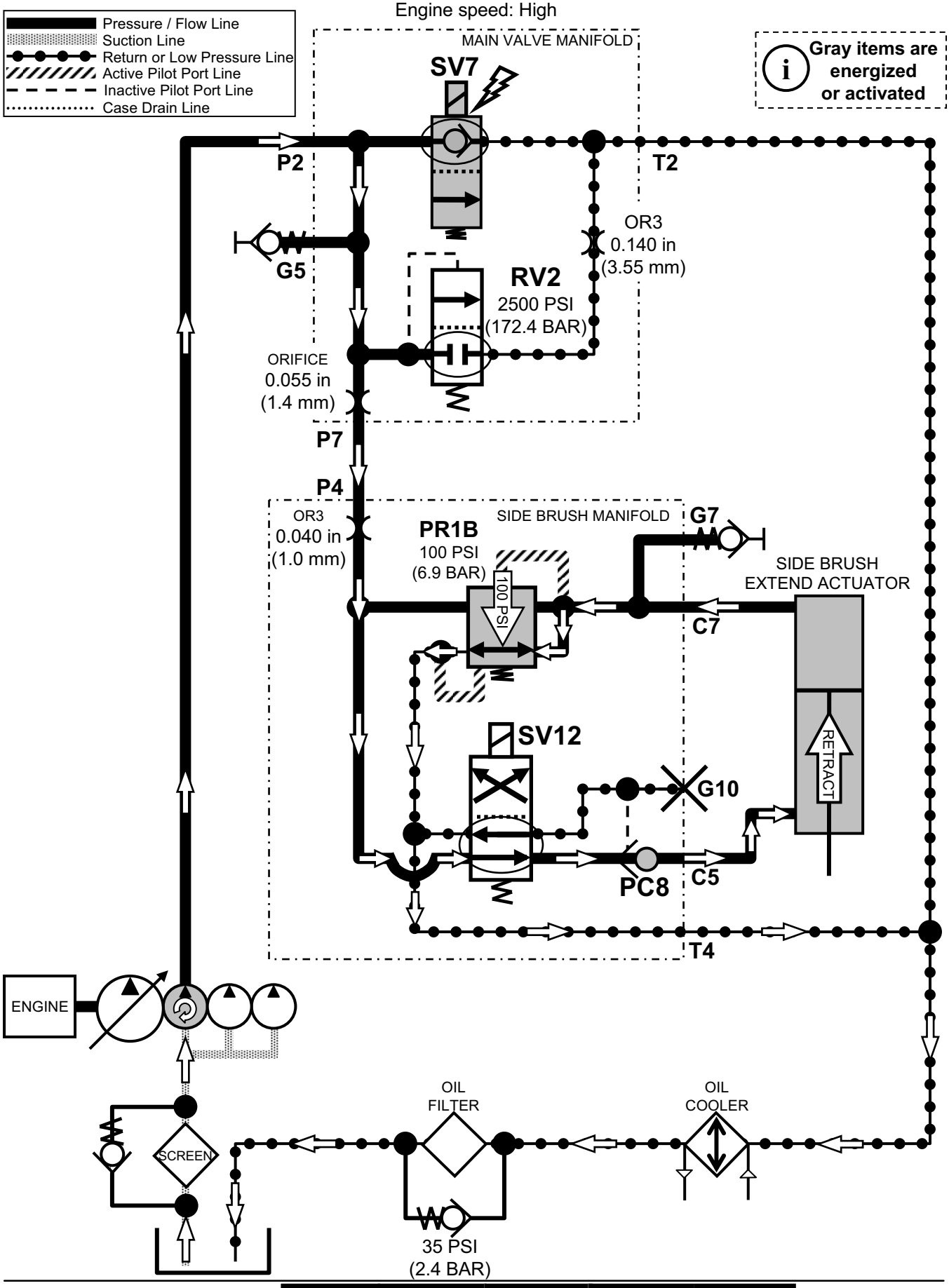
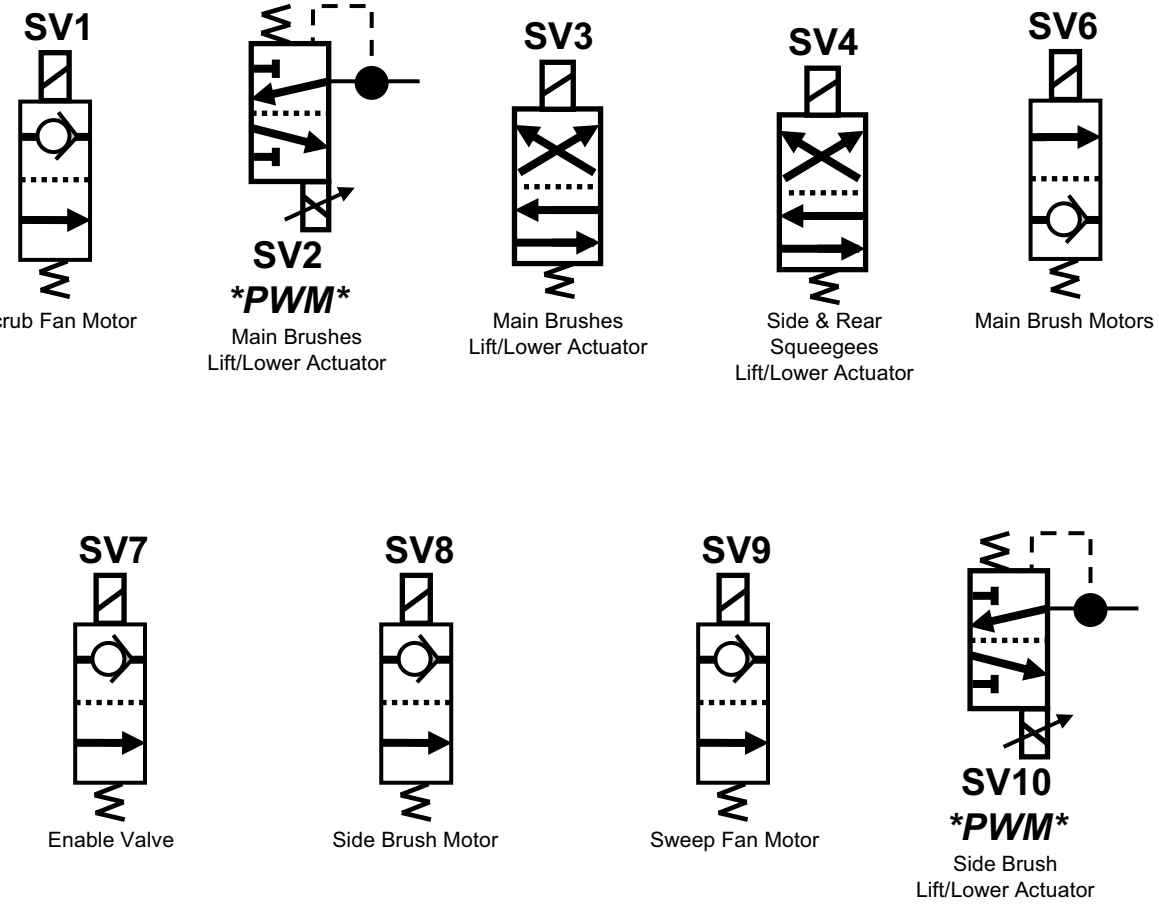
Side Brush Retract

Engine speed: High



Hydraulic Solenoid Valve Details



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PRESSURE WASHER PUMP MAINTENANCE & REPAIR

BEFORE CONDUCTING TESTS:

* Read and Follow ALL Safety Warnings and Precautions as mentioned at the beginning of this manual

DURING TESTS:

* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action

NOTE: Troubleshooting charts may be shown with optional equipment. The optional equipment may not be specified in these charts. Some machines may not be equipped with all components shown.

Formulas

Nozzles:

Impact Force (lbs.) = .0526 x GPM x √PSI

Nozzle # = GPM x $\frac{4000}{\sqrt{PSI}}$

GPM= Nozzle # x $\frac{PSI}{\sqrt{4000}}$

PSI = $(GPM/Nozzle\ \#)^2$ x 4000

Horse Power:

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

$\frac{GPM \times PSI}{1457}$ = EBHP

$\frac{EBHP \times 1457}{PSI}$ = GPM

$\frac{EBHP \times 1457}{GPM}$ = PSI

HP loss due to altitude = 3% per 1000 FT above sea level

Pump Speed and Flow:

$\frac{Rated\ GPM}{Rated\ RPM} = \frac{Desired\ GPM}{Desired\ RPM}$

$\frac{Motor\ Pulley\ Ø}{Pump\ RPM} = \frac{Pump\ Pulley\ Ø}{Motor\ RPM}$

Conversions

Gallons x 3.785412 = Liters

Gallons x 128 = Oz.

PSI x .06896 = Bar

Bar x 14.5038 = PSI

1 inches = 25.4 millimeters

Liters x .2642 = Gallons (US)

Ft. Lbs. x 1.356 = Newton Meters

Inch Lbs. x .11298 = Newton Meters

Newton Meters x .737562 = Ft. Lbs. (force)

Newton Meters x 8.85 = In. Lbs. (force)

Temperature = 1.8(C° + 17.78) = F°,.555(F° - 32) = C°

1 U.S. Gallon of freshwater = 8.33 lbs.

1 PSI = 2.31 feet of water

1 PSI = 2.04 inches of mercury

1 Foot of water = .433 PSI

1 Foot of water = .885 inches of mercury

1 Meter of water = 3.28 feet of water

Kilograms x 2.2 = Lbs.

General Safety Information

⚠ WARNINGS

Gasoline Drive Pumps

The pump is designed to pump non-flammable or non-explosive fluids. These pumps are intended to pump clean filtered water only.

Do not operate in or around an explosive environment.

Always wear safety glasses or goggles and appropriate clothing.

Do not alter the pump from the manufacturers design.

Do not allow children to operate the pump.

Never point the high-pressure discharge at a person, any part of the body or animals.

Do not operate gasoline engines in a confined area; always have adequate ventilation.

Do not exceed the pump specifications in speed or pressure.

PW

General Safety Information (continued)


Maximum water temperature is 140°F.

All positive displacement plunger pumps must have a safety relief valve installed on the discharge side of the pump, this valve could be either an unloader or regulator and must be of adequate flow and pressure for the pump.

Adequate protective guards must cover all moving parts. Perform routine maintenance on the pump and components.

Use only components that are rated for the flow and pressure of the pump, this would include hose, fittings, safety valves, spray guns etc.

Electric Drive Pumps

Your power supply must conform to the system requirements.


The motor must be grounded. Use GFCI plugs and receivers.


Do not handle the pump/motor with wet hands.


Only use power cords that are in good condition.


Never pull the unit by the power cord.

Never spray or clean the unit with water

Failure to follow these warnings may result in personal injury or damage to property.

Special Features

Wet End

Manifold: ***Forged Brass:*** Strength and no porosity – long life. higher hydrostatic pressures – safety, performance.

Inlet and Discharge Ports: Heavy bosses for added strength. ***Offset Discharge Ports:*** High efficiency, smooth flow. ***Bolts:*** Eight bolts, 8mm, grade 8.8.

Valves: ***Valve Caps:*** Stainless steel on pumps rated at 3200 PSI and higher, better hydrostatic loads. Machined brass on pumps <3200 PSI. ***Ultra Form Cages:*** Durable, strength, and long life. ***Poppets, Seat and Spring:*** 303 and 400 series stainless steel.

Packing and Plungers: ***High Pressure Packing:*** "V" style (D-1) Buna-N (cotton duct weave base) strong and tightens under load. ***Low Pressure Seals:*** "U" cup double lip Buna-N for a good positive seat. ***Support and Guides:*** Machined brass, 1-piece construction to assure proper plunger alignment and to maximize packing and seal life. ***Plungers:*** Are a special aluminum oxide blend, solid ceramic for long life, strong durability and more resilient.

Drive End

Bearings: Oversized tapered roller bearing for maximum life and load disbursement.

Bearing Support: Precision die-cast and machined to assure concentricity and alignment.

Special Features (continued)

Crankcase: Precision die-cast, large cooling fins and anodized (for maximum heat dissipation).

Rear Cover: Precision die-cast, O-ring sealed and bayonet style sight glass for positive sealing and locking (no threads to loosen).

Plunger Rods: Stainless steel construction for strength (no plating to scrape off), back-up and O-ring plunger sealing system.

Rod Pins: Precision ground and hardened steel, oversized for load disbursement.

Connecting Rods: One-piece special allow aluminum (3XU51, 3XU60 and 3XU68) or bronze (3XU52, 3XU54, 3XU61and 3XU62) for higher pressure, oversized for maximum strength, load disbursement, and life. Heavy pin area construction, for added load strength.

Crankshaft: Forged, precision ground and hardened for extremely long life and durability.

Oil Seals and O-rings: Triple lip oil seals, long life and much less leak prone. All are constructed of Buna-N rubber. The O-rings have stainless steel garder springs to assure constant tension on the sealing surface.

Oil Drains: Quantity of two (2). One in the rear cover and one in the bottom of the crankcase.

Oil Capacity: 15.5 oz.

Extra Features

Dyno Proven: All pumps are dyno tested to assure the theoretical design meets the actual design.

Valve Design: Each pump series has a valve design that optimizes its highest efficiency.

Installation

Direct Drive Electric and Gasoline Pumps

1. Install the shaft key into the keyway and apply a light coating of anti-seize on the engine shaft.
2. Align the two key ways and push the pump completely onto the engine. (See Figure 4 & 5)
3. Install all four (4) bolts and tighten evenly.
4. Remove the red shipping oil cap and install the black crankcase vent cap. (See Figure 6)
5. Install the appropriate unloader valve and other accessories.
6. Install the appropriate water inlet and discharge fittings.
7. Connect the water supply hose and high-pressure discharge hose/spray gun.
8. Turn on the water supply.

Figure 4

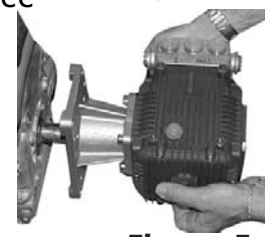


Figure 5

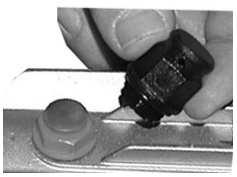


Figure 6

PW

Installation (continued)

9. Open the spray gun to purge the system of any air.
10. Start the engine.
11. Adjust the engine speed and unloader valve.

Belt Drive Systems

1. Mount the pump securely to the base plate. (See Figure 7) For new installation a mounting rail kit is required, refer to parts breakdown.

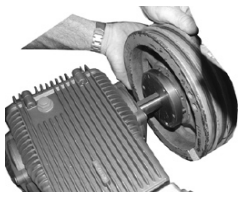


Figure 7

2. Install the pump pulley on the crankshaft. It should be as far onto the shaft as possible.
3. Align the pulleys so they are in line. (See Figure 8)


Figure 8

4. Use a belt tension gauge to assure proper tension (too much tension can cause bearing failure or damage the belts as well as cause other problems). (See Figure 9)


Figure 9

5. Installation complete.

Winter or Long Time Storage

1. Drain all of the water out of the pump.
2. Run a 50% solution of a RV or non-toxic/biodegradable antifreeze through the pump.
3. Flush the pump with fresh water before the next use.
4. In freezing conditions failure to do this may cause internal pump damage.
5. For long periods of storage in non-freezing areas the solution will keep the seals and O-rings lubricated.

Service Pumps

Servicing the Valves

The inlet and discharge valves in this series pumps are all the same. The valves are located under the six 24mm hex plugs. The inlet valves are located on the lower row and the discharge valves are located on the top row of the pump head.

Tools required: 24mm socket, ratchet, needle nose pliers, mechanics pick and torque wrench.

Valve Removal:

1. Remove the valve cap.
2. Inspect the valve cap O-ring for any damage, replace if necessary. (See Figure 10)


Figure 10

3. Use the needle nose pliers to remove the valve. (See Figure 11)

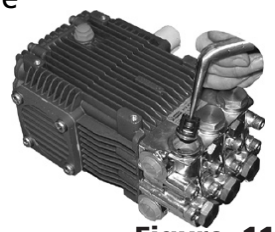


Figure 11

PW

Service Pumps (continued)

4. Use a small probe to move the poppet up and down to assure that the valve is functioning properly and that no debris is stuck in the valve. (See Figure 12)


Figure 12

5. Using the mechanics pick remove the valve seat O-ring and inspect for any damage, replace if necessary. (See Figure 13)

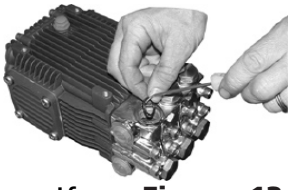


Figure 13

Valve Assembly:

1. Install the valve seat O-ring squarely into the bottom of the manifold. (See Figure 14)


Figure 14

2. Insert the valve assembly squarely into the port pushing it into the O-ring. (See Figure 15)

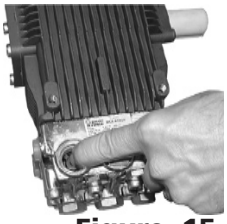


Figure 15

3. Install the valve cap and torque to the proper specification. (See Figure 16) (See parts breakdown)


Figure 16

Servicing the Packings/Seals

To access the water seals for inspection or replacement, you will first need to remove the head of the pump.

Tools required: 6mm hex socket, ratchet, (2) long screwdrivers, reversible pliers, mechanics pick and torque wrench.

Disassembly:

1. First remove the eight 6mm head bolts. (See Figure 17)


Figure 17

2. Place the screwdrivers as shown between the head and crankcase of the pump, lifting one up and the other down. The head should start to lift off of the plungers. (See Figure 18)


Figure 18

3. When you remove the head you may notice that some of the water seals have stayed on the plungers and some in the head. (See Figure 19) To remove the seals from the plungers simple turn the assemblies and pull off.


Figure 19

4. If the seal assemblies are in the head use the reversible pliers to grab the seal retainer on the inside bore

(**NOTE:** Use a rag so you do not mar the piston guide area), twist the retainer in either direction


Figure 20

PW

Service Pumps (continued)

(**NOTE:** This is done to free the retainer O-ring which is stuck to the manifold) and lift out. (See Figure 20 & 21)


Figure 21

5. With your fingers pull the high pressure seal and head ring out of the head. (See Figure 22)


Figure 22

6. The low-pressure seal is located in the brass seal retainer. Using the mechanics pick go in between the seal and retainer, twist and pull, the seal will come out of the gland. (See Figure 23 & 24)

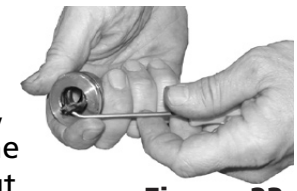


Figure 23


Figure 24

7. Remove the seal retainer O-ring with the mechanics pick. (See Figure 25)

Assembly:

1. Install the plastic head ring into the head *(the flat side is on the bottom).* (See Figure 26)


Figure 25

2. Install the high-pressure seal. Place the seal so the open "V" portion is toward the head ring. You need to place the seal at an angle and pull and push to work the seal into position with your fingers *(do not use and tools you may damage the seal)*. Make sure the seal is totally seated against the head ring. (See Figure 27 & 28)


Figure 26

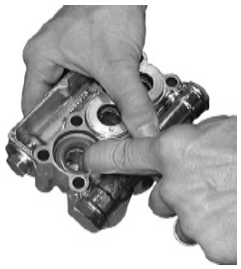


Figure 27


Figure 28

3. Installing the low-pressure seal. You want the open side of the seal to be pointed toward the water side of the head (toward the high-pressure seal) and the flat side toward the drive end of the pump.


Figure 29

Place the seal into the gland at an angle, with your finger push the exposed side of the seal towards the center and work the seal (See Figure 29, 30 & 31) into position. After the seal is in the gland you can work it into it proper position.


Figure 30


Figure 31

4. Install the retainer O-ring. (See Figure 32)


Figure 32

PW

Service Pumps (continued)

5. Squarely seat the retainer into the head and push with even pressure until it snaps into position. (See Figure 33)


Figure 33

Servicing the Plungers

If the plungers are not damaged they do not need any servicing.

Tools required: 16mm socket, ratchet, mechanics pick, taper blade gasket scraper, thread sealant and torque wrench.

NOTE: Be very careful when working with the plungers, they are made from ceramic which is brittle and can be damaged.

Any time you remove a plunger it is recommended you replace the slinger washer, O-ring and top plunger washer. The washers are a cushion for the ceramic plunger and compress when first used and the O-ring will take a set to create a seal and usually will not spring back to its original shape. By not replacing these parts you run the risk of breaking a plunger or having a water leak.

Disassembly:

1. Remove the plunger retainer nut. (See Figure 34)


Figure 34

2. Insert the gasket scraper between the copper washer and plunger to remove the washer. (See Figure 35)

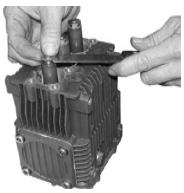


Figure 35

3. Twist and pull the plunger off the plunger rod.
4. Remove the plunger rod O-ring seal and split back-up ring with the mechanics pick. (See Figure 36 & 37)


Figure 36

5. Remove brass slinger. At this point clean any thread locker that is left on the plunger rod and retaining nut threads. (See Figure 38)


Figure 37


Figure 38

Assembly:

1. Install the slinger washer. (See Figure 39)

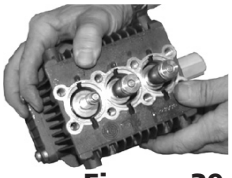


Figure 39

2. Install the plunger rod O-ring and split back-up ring. Place a light film of oil on the O-ring and back-up ring. (See Figure 40)

   NOTE: The O-ring is closest to the threaded end of the rod.


Figure 40

3. Install the plunger by pushing straight down and twisting slightly in either direction (See Figure 41)


Figure 41

(**NOTE:** Be sure that the back-up ring is fully seated). Make sure you fully seat the plunger.

PW

Service Pumps (continued)

4. Install the small copper washer on top of the plunger and place a small quantity of thread sealant in the thread. Install the plunger nut and tighten to the required torque. (See Figure 42 & 43) (See parts breakdown)

Figure 42

Figure 43

Pump head to drive end Installation

1. Turn the crankshaft to align the plungers as shown. (See Figure 44)
2. Place the head evenly onto the plungers and push it until it makes contact with the drive end of the pump. (See Figure 45)
3. Torque the head bolt as shown in the tightening sequence diagram. (See Figure 46 & 47) (See parts breakdown).

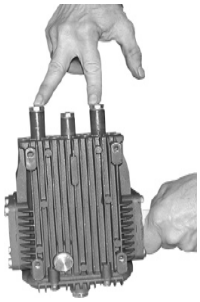


Figure 44

Figure 45

Figure 46

Figure 47

Oil Change

Change oil after first 50 hours of use. Then every 500 hours. Refer to parts breakdown for oil type.

PW

Adjusting Unloader Valve

Instructions for Adjusting Gymatic Unloader Valves

Please follow these easy steps to adjust the pressure:

Step 1: Remove black cap (pos. #1) from knob.

Step 2: Loosen bolt (pos. #2) with 6mm hex wrench.

Step 3: Loosen nut (pos. #3) to top of (pos. #2) bolt.

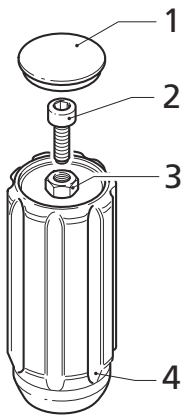
Step 4: Turn the black knob (pos. #4) clockwise until it stops.

Step 5: Start machine hold trigger on open position and turn (pos. #2) bolt until no further increase of pressure is noticed, continue to hold trigger open and turn counter-clockwise until a slight drop in pressure is felt.

Step 6: Spin (pos. #3) nut down. While holder (pos. #2) bolt in place with hex wrench, use special tool (AR1560590) Or extended 13mm socket wrench to hand tighten (pos. #3) nut against (pos. #4) black knob.

Step 7: Replace (pos. #1) black cap.

NOTE: Now pressure can be decreased by turning black knob (pos. #4) counterclockwise, but the pressure cannot be increased to a rating higher than what max is set at by technician.



Mounting Bolt Torque Specifications

Inlet	354 in/lbs	30 ft/lbs
Discharge	221 in/lbs	19 ft/lbs

AR1560590
Nut holder for adjusting Gymatic Unloader

PW

Troubleshooting

Symptom	Possible Cause(s)	Corrective Action
Oil leak between crankcase and pumping section	Worn rod oil seals	Replace crankcase piston rod seals
Frequent or premature failure of the packing	1 Cracked, damaged or worn plunger	1 Replace plungers
	2 Overpressure to inlet manifold	2 Reduce inlet pressure
	3 Material in the fluid being pumped	3 Install proper filtration on pump inlet plumbing
	4 Excessive pressure and/or temperature of fluid being pumped	4 Check pressures and fluid inlet temperature; be sure they are within specified range
	5 Running pump dry	5 Do not run pump without water
Pump runs but produces no flow	Pump is not primed	Flood suction then restart pump
Pump fails to prime	Air is trapped inside pump	Disconnect discharge hose from pump. Flood suction hose, restart pump and run pump until all air has been evacuated
Pump looses prime, chattering noise, pressure fluctuates	1 Air leak in suction hose or inlet	1 Remove suction line and inspect it for a loose liner or debris lodged in hose. Avoid all unnecessary bends. Do not kink hose
	2 Clogged suction strainer	2 Clean strainer
Low pressure at nozzle	1 Unloader valve is by-passing	1 Make sure unloader is adjusted property and by-pass seat is not leaking
	2 Incorrect or worn nozzle	2 Make sure nozzle is matched to the flow and pressure of the pump. If the nozzle is worn, replace
	3 Worn packing or valves	3 Replace packing or valves
Pressure gauge fluctuates	1 Valves worn or blocked by foreign bodies	1 Clean or replace valves
	2 Packing worn	2 Replace packing
Low pressure	1 Worn nozzle	1 Replace with nozzle of proper size
	2 Belt slippage	2 Tighten or replace with correct belt

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Troubleshooting (cont.)

Symptom	Possible Cause(s)	Corrective Action
Low pressure (cont.)	3 Air leak in inlet plumbing	3 Disassemble, reseal and reassemble
	4 Relief valve stuck, partially plugged or improperly adjusted valve seat worn	4 Clean and adjust relief valve; check for worn or dirty valve seats
	5 Worn packing. Abrasive in pumped in cavitation. Inadequate water	5 Install proper filter suction at inlet manifold must be limited to lifting less than 20 feet of water or 8.5 psi vacuum
	6 Worn inlet, discharge valve blocked or dirty	6 Replace inlet and discharge valve
Pump runs extremely rough, pressure very low	1 Inlet restrictions and/or air leaks.	1 Clean out foreign material
	2 Stuck inlet or discharge valve	2 Replace worn valves
Water leakage from under manifold	Worn packing or cracked plunger	Install new packing or plunger
Slight leak, oil leaking in the area of crankshaft	1 Worn crankshaft seal or improperly installed oil seal o-ring	1 Remove oil seal retainer and replace damaged 0-ring and/or seals
	2 Bad bearing	2 Replace bearing
Excessive play in the end of the crankshaft pulley	Worn main bearing from excessive tension on drive belt	Replace crankcase bearing and/or tension drive belt
Water in crankcase	1 Humid air condensing into water inside the crankcase	1 Change oil intervals
	2 Worn packing and/or cracked plunger	2 Replace packing. Replace plunger
Loud knocking noise in pump	1 Cavitation or sucking air	1 Check water supply is turned on
	2 Pulley loose on crankshaft	2 Check key and tighten set screw
	3 Broken or worn bearing	3 Replace bearing

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