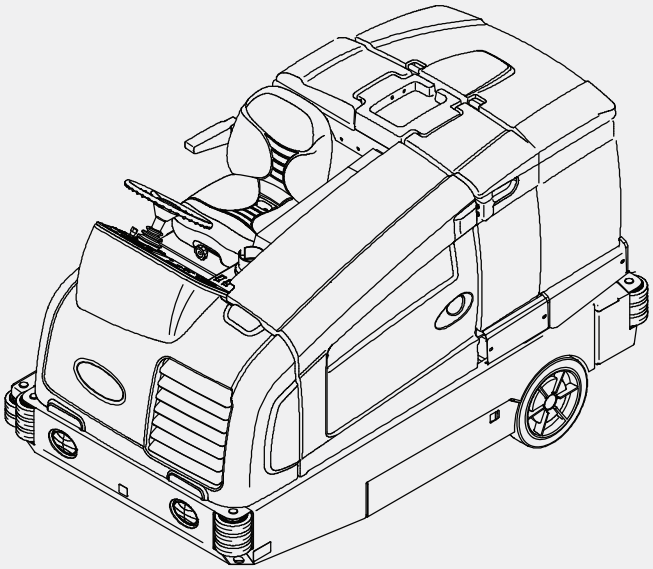
T20



(S/N 008000-)
Rider Scrubber
English (EN)
Service Information Manual

FaST® Foam Scrubbing Technology

ec H2O An ORBIO™ Technology

The Safe Scrubbing Alternative®
ES® Extended Scrub System
Tennant *True®* Parts
Hygenic® Fully Cleanable tanks
FloorSmart® Integrated Cleaning system
IRIS® a Tennant Technology
Pro-Panel™ Controls
Insta-Fit™ Adapter

For the latest Parts Manuals and other language Operator Manuals, visit:

www.tennantco.com/manuals

9016205
Rev. 00 (5-2017)

INTRODUCTION

This manual is available for each new model. It provides necessary operation and maintenance instructions.

Read this manual completely and understand the machine before operating or servicing it.

This machine will provide excellent service. However, the best results will be obtained at minimum costs if:

- The machine is operated with reasonable care.
- The machine is maintained regularly - per the machine maintenance instructions provided.
- The machine is maintained with manufacturer supplied or equivalent parts.

PROTECT THE ENVIRONMENT

Please dispose of packaging materials and used machine components such as batteries in an environmentally safe way according to your local waste disposal regulations.

Always remember to recycle.

INTENDED USE

The T20 is an industrial rider machine designed to scrub hard surfaces (concrete, asphalt, stone, synthetic, etc). Typical applications include industrial warehouses, manufacturing facilities, distribution facilities, stadiums, arenas, convention centers, parking facilities, transportation terminals, and construction sites. Do not use this machine on soil, grass, artificial turf, or carpeted surfaces. Do not use where excessive debris is present such as leaves, paper, etc. This machine can be used both indoors and outdoors, but ensure there is adequate ventilation if used indoors. This machine is not intended for use on public roadways. Do not use this machine other than described in this Manual.

MACHINE DATA

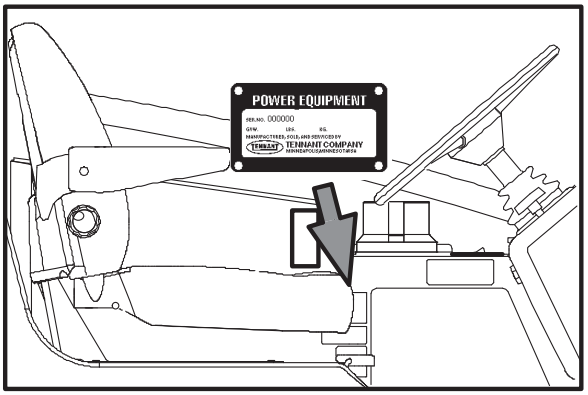
Please fill out at time of installation for future reference.

Model No. - _____

Serial No. - _____

Installation Date - _____

SERIAL NUMBER LOCATION



Tennant Company
PO Box 1452
Minneapolis, MN 55440
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www.tennantco.com

CONTENTS

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.

The following information signals potentially dangerous conditions to the operator. Know when these conditions can exist. Locate all safety devices on the machine. Report machine damage or faulty operation immediately.

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: 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.

WARNING: Do not spray people or animals. Severe personal injury can result. Wear eye protection. Hold sprayer with two hands.

WARNING: This machine contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

This machine may be equipped with technology that automatically communicates over the cellular network. If this machine will be operated where cell phone use is restricted because of concerns related to equipment interference, please contact a Tennant representative for information on how to disable the cellular communication functionality.

FOR SAFETY:

1. **Do not operate machine:**
   - **Unless trained and authorized.**
   - **Unless operator manual is read and understood.**
   - **Under the influence of alcohol or drugs.**
   - **While using a cell phone or other types of electronic devices.**
   - **In dusty environments without the vacuum fan on.**
   - **Without filters in place or with clogged filters.**
   - **Unless mentally and physically capable of following machine instructions.**
   - **If it is not in proper operating condition.**
   - **With pads or accessories not supplied or approved by Tennant. The use of other pads may impair safety.**
   - **In areas where flammable vapors/liquids or combustible dusts are present.**
   - **In areas that are too dark to safely see the controls or operate the machine unless operating / headlights are turned on.**
   - **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:
   - Use only as described in this manual.
   - Use brakes to stop machine.
   - Do not pick up burning or smoking debris, such as cigarettes, matches or hot ashes
   - Go slowly on inclines and slippery surfaces.
   - Do not scrub on ramp inclines that exceed 10% grade or transport (GVWR) on ramp inclines that exceed 14% grade.
   - Reduce speed when turning.
   - Keep all parts of body inside operator station while machine is moving.
   - Always be aware of surroundings while operating machine.
   - Do not access the video / help screens while the machine is moving. (Pro−Panel).
   - Use care when reversing machine.
   - Keep children and unauthorized persons away from machine.
   - Do not carry passengers on machine.
   - Always follow safety and traffic rules.
   - Report machine damage or faulty operation immediately.
   - Follow mixing, handling and disposal instructions on chemical containers.
   - Follow safety guidlines concerning wet floors.

5. Before leaving or servicing machine:
   - Do not park near combustible materials, dusts, gases, or liquids.
   - Stop on level surface.
   - Set parking brake.
   - Turn off machine and remove key.

6. When servicing machine:
   - All work must be done with sufficient lighting and visibility.
   - Keep work area well ventilated.
   - Avoid moving parts. Do not wear loose clothing, jewelry and secure long hair.
   - 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.
   - Do not push or tow the machine without an operator in the seat controlling the machine.
   - Do not power spray or hose off machine near electrical components.
   - 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.
   - All repairs must be performed by a trained service mechanic.
   - Do not modify the machine from its original design.
   - Use Tennant supplied or approved replacement parts.
   - Wear personal protective equipment as needed and where recommended in this manual.


For Safety: wear hearing protection.


For Safety: wear protective gloves.


For Safety: wear eye protection.

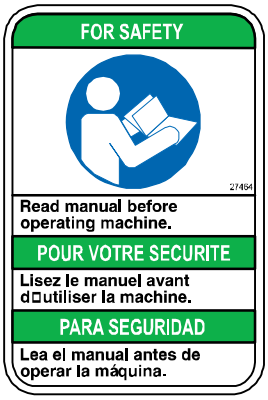

For Safety: wear protective dust mask.

7. When loading/unloading machine onto/off truck or trailer:
   - Drain tanks before loading machine.
   - Lower scrub head and squeegee before tying down machine.
   - Turn off machine and remove key.
   - Use ramp, truck or trailer that will support the weight of the machine and operator.
   - Do not load/unload on ramp inclines that exceed 18% grade.
   - 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.

SAFETY PRECAUTIONS

The following safety labels are mounted on the machine in the locations indicated. If these or any labels become damaged or illegible, install a new label in its place.

WARNING LABEL – Flammable materials or reactive metals can cause explosion or fire. Do not pick up.

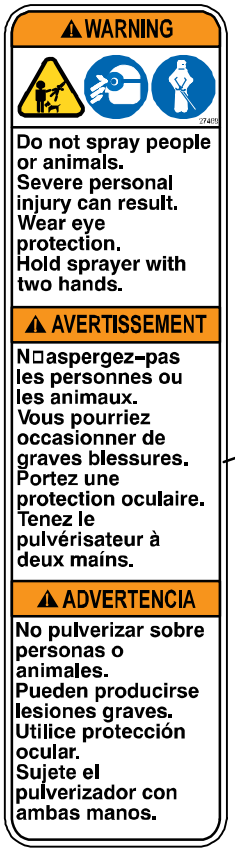


Located on the side of the operator compartment.

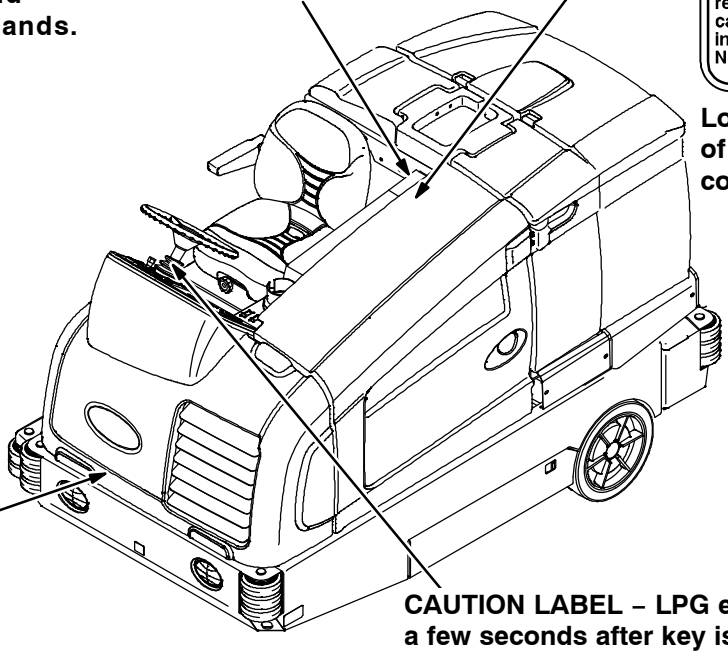
FOR SAFETY LABEL – Read manual before operating machine

Located on the side of the operator compartment.

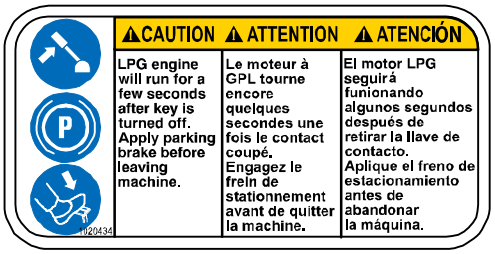
WARNING LABEL – Do not spray people or animals. Severe personal injury can result. Wear eye protection. Hold sprayer with both hands.



Located on frame of machine.

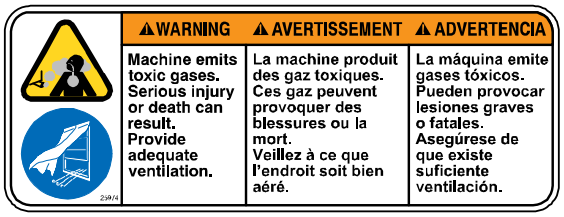


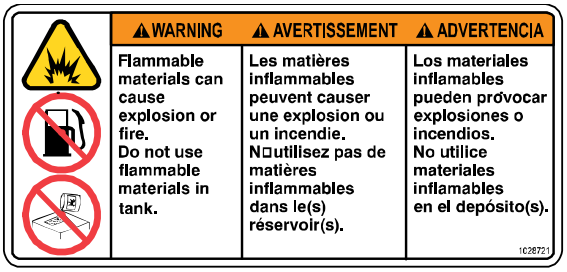
CAUTION LABEL – LPG engine will run for a few seconds after key is turned off. Apply parking brake before leaving machine.



Located next to the ignition switch on the instrument panel. (LPG machines only)

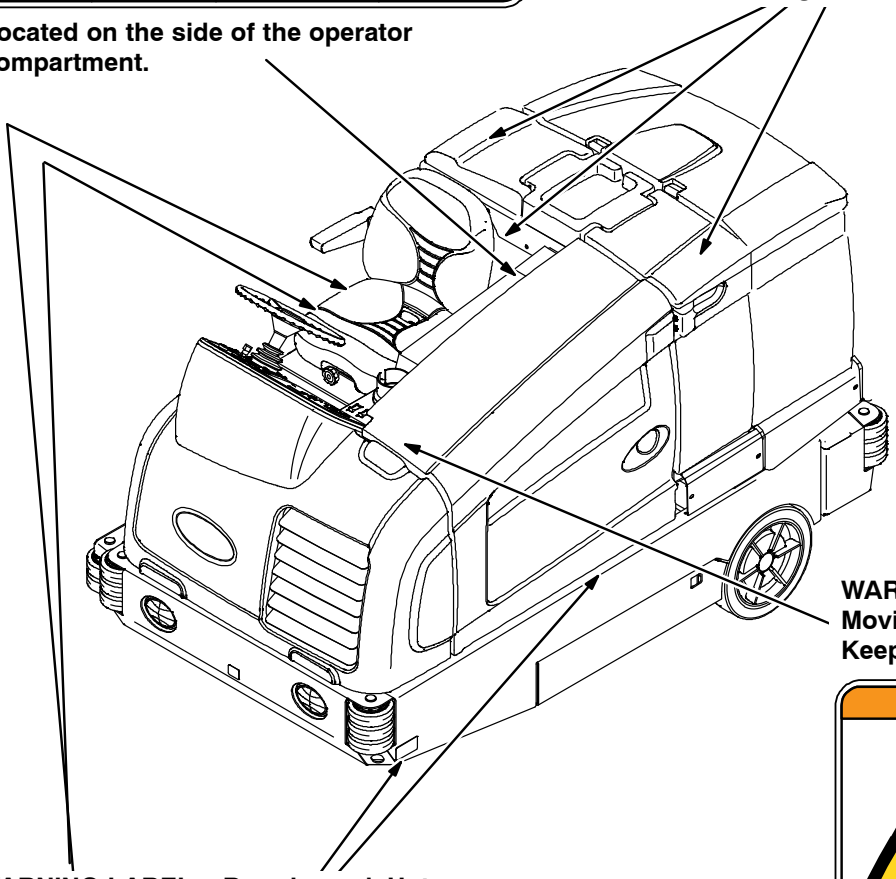
WARNING LABEL – Machine emits toxic gases. Serious injury or death can result. Provide adequate ventilation.





Located next to the solution tank covers and on the detergent tank.

Located on the side of the operator compartment.



WARNING LABEL – Moving belt and fan. Keep away.

Located on engine compartment panel.

WARNING LABEL – Burn hazard. Hot surface. Do NOT touch

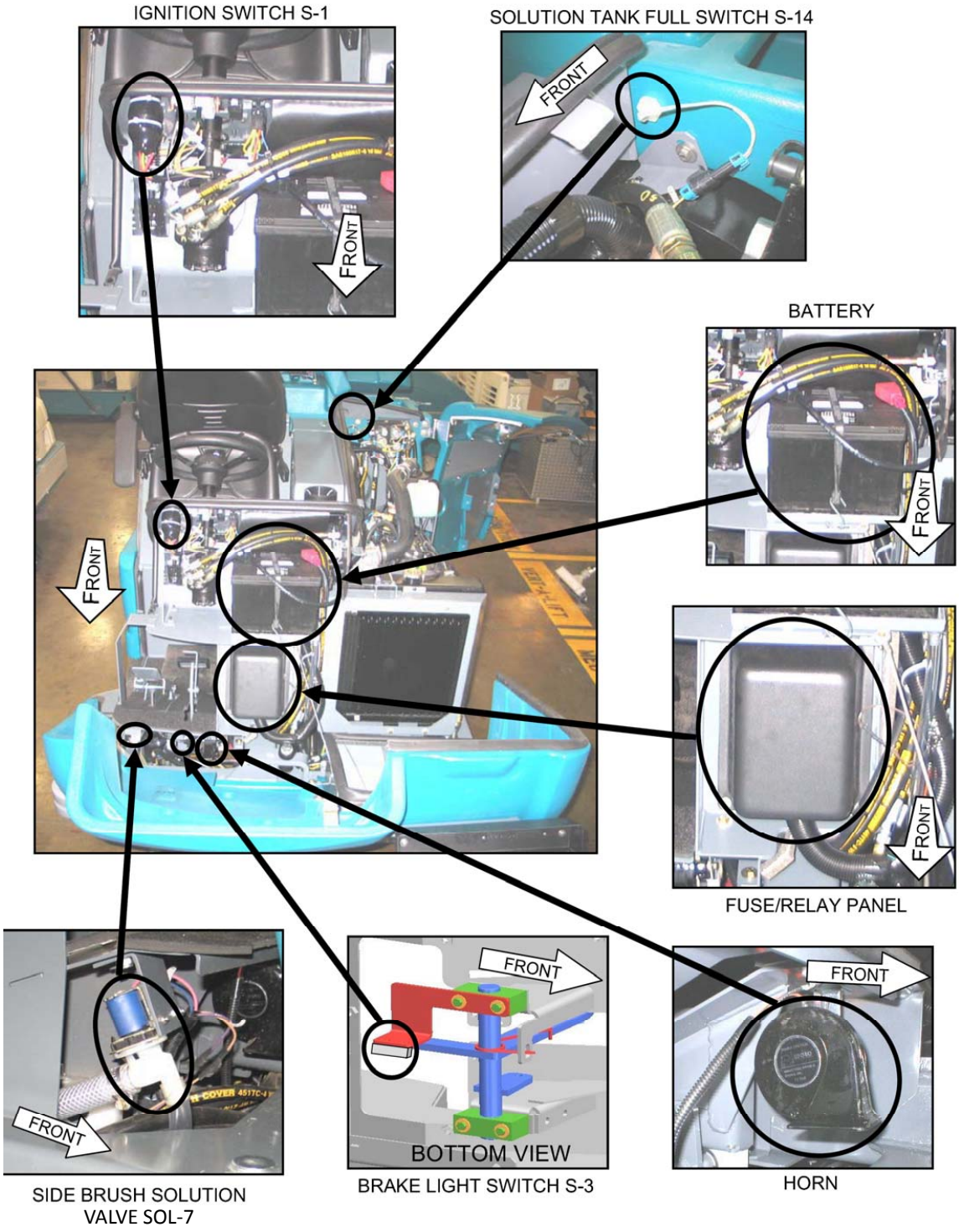
Located on the side of the bumper, on the exhaust shield, on the hydraulic reservoir, and on the scrub head (disk head machines only).

GENERAL INFORMATION

ELECTRICAL COMPONENT LOCATOR

T20 Electrical Component Locator

Page 1 of 10

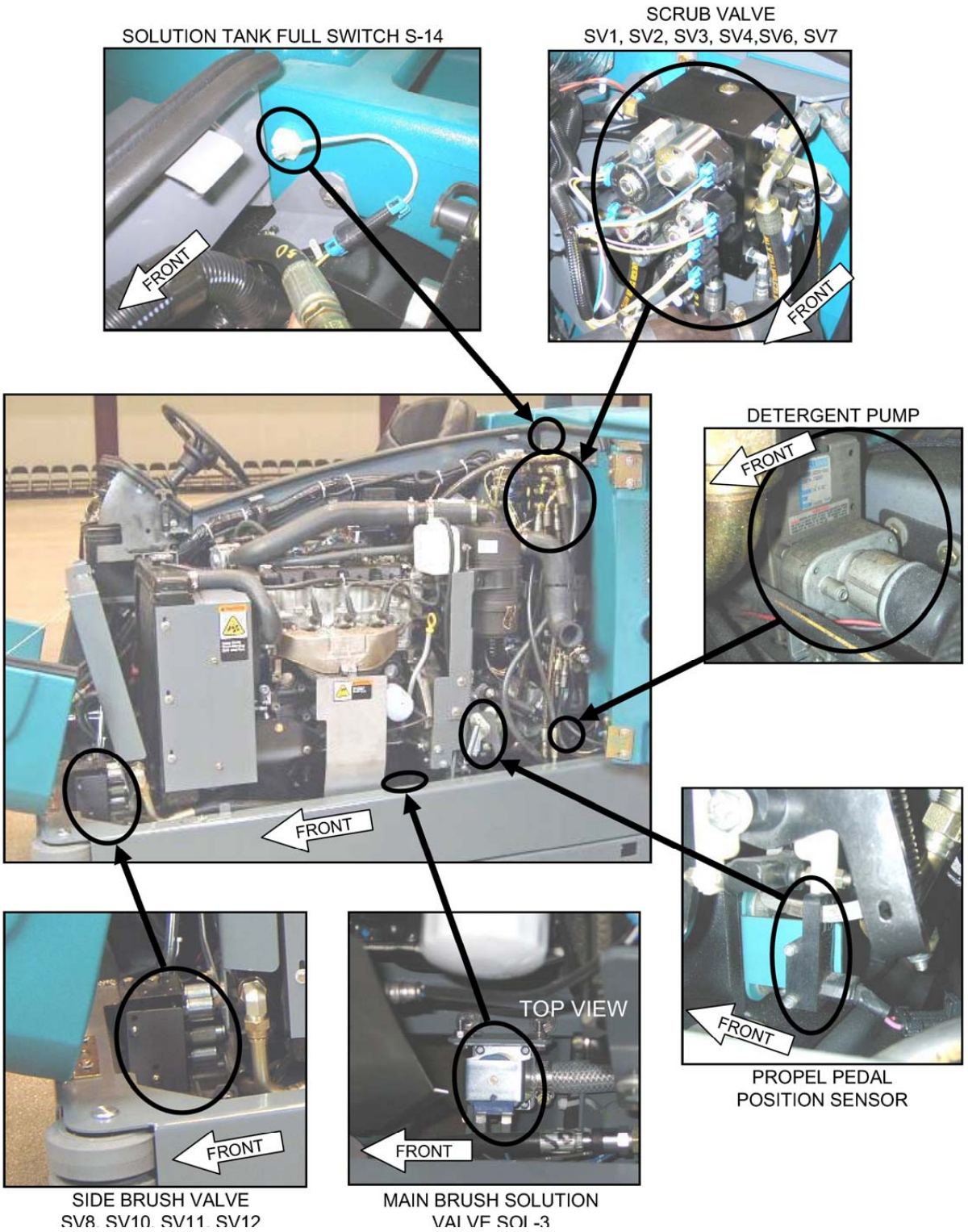


T20 Electrical Component Locator

Page 2 of 10

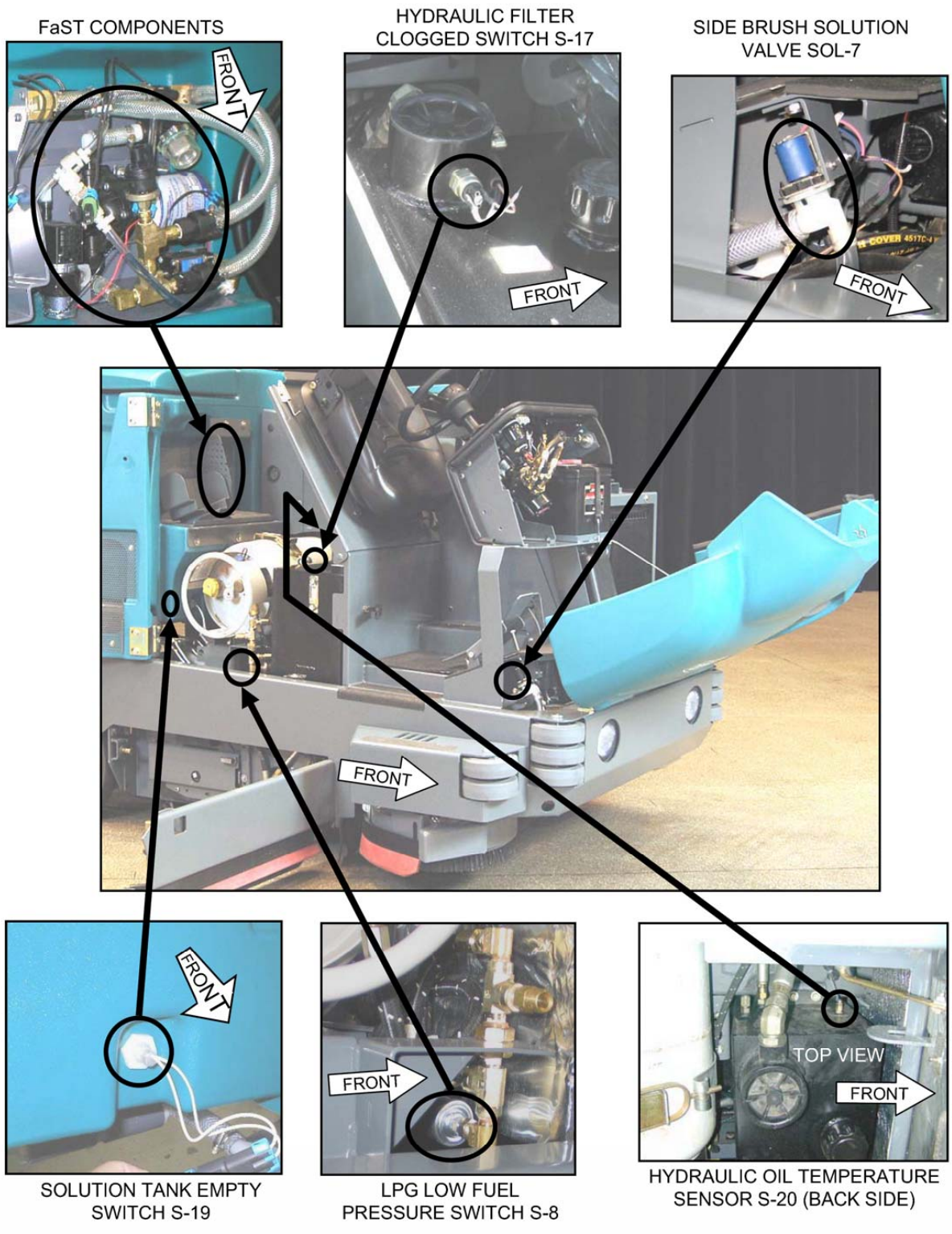
T20 Electrical Component Locator

Page 3 of 10



T20 Electrical Component Locator

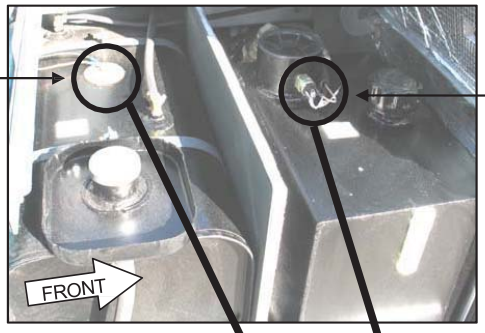
Page 4 of 10



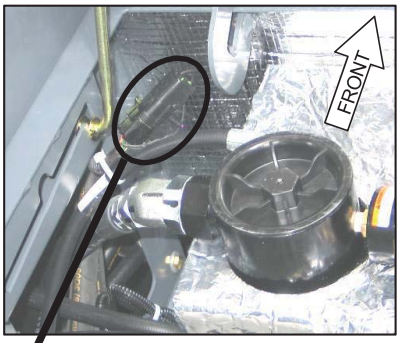
T20 Electrical Component Locator

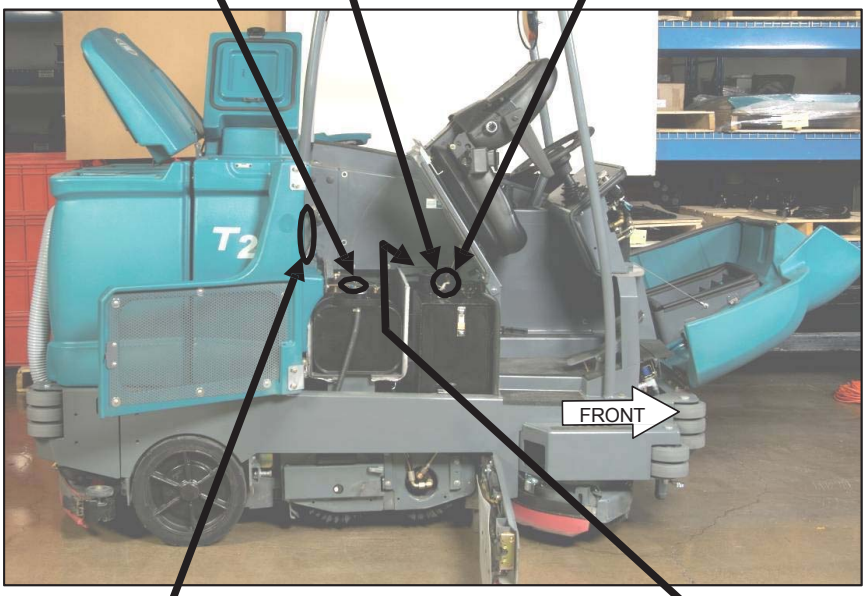
Page 5 of 10

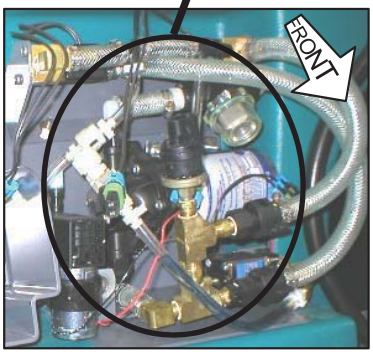
GAS/DIESEL FUEL LEVEL SENDER S-7
HYDRAULIC FILTER CLOGGED SWITCH S-17



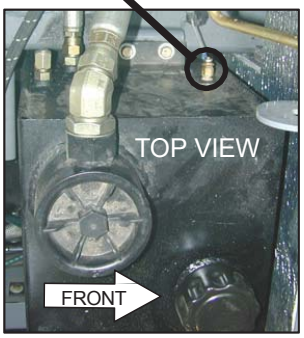
GAS/LPG ENGINE
DIAGNOSTIC CONNECTOR







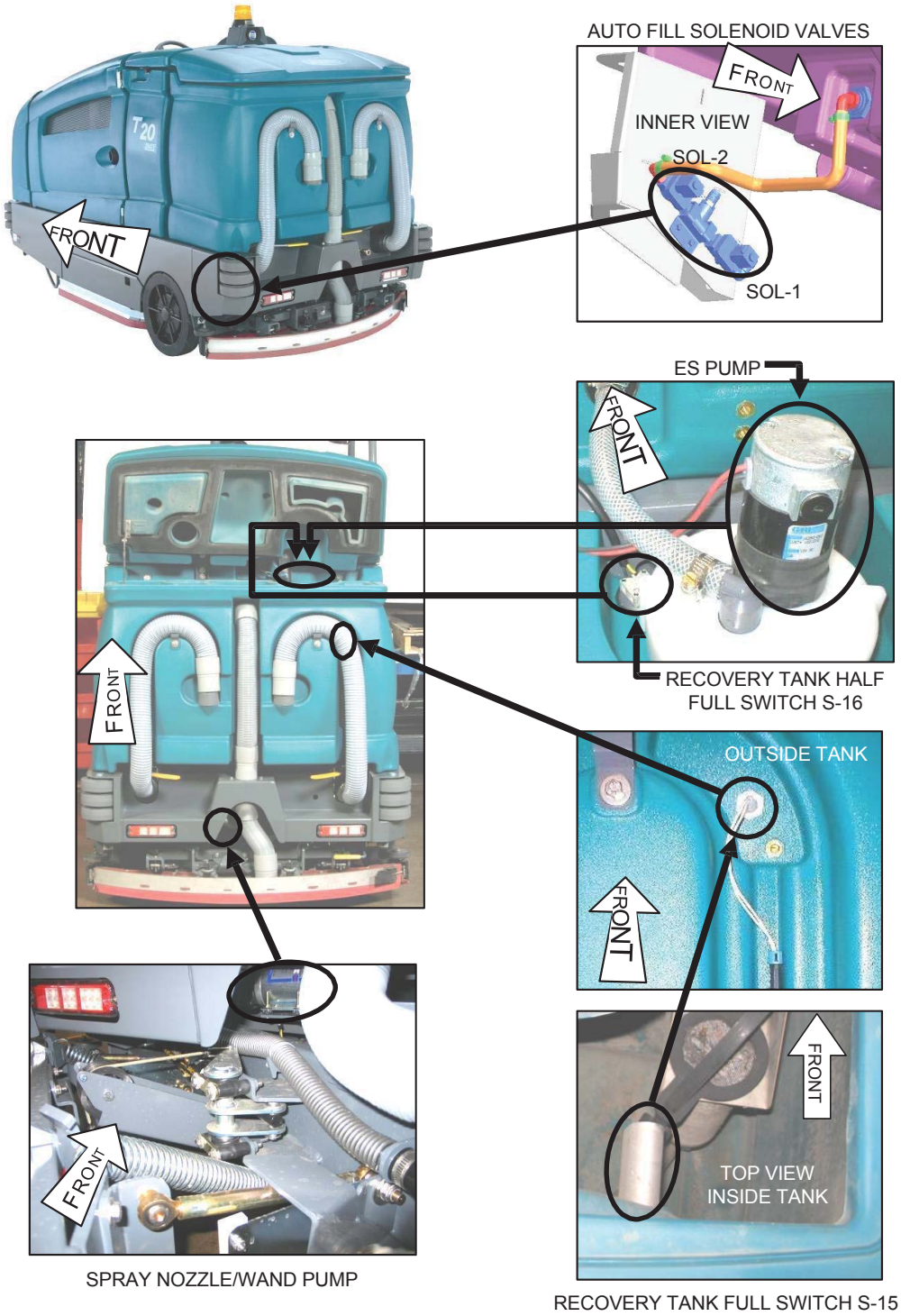
FaST COMPONENTS



HYDRAULIC OIL TEMPERATURE
SENSOR S-20 (BACK SIDE)

T20 Electrical Component Locator

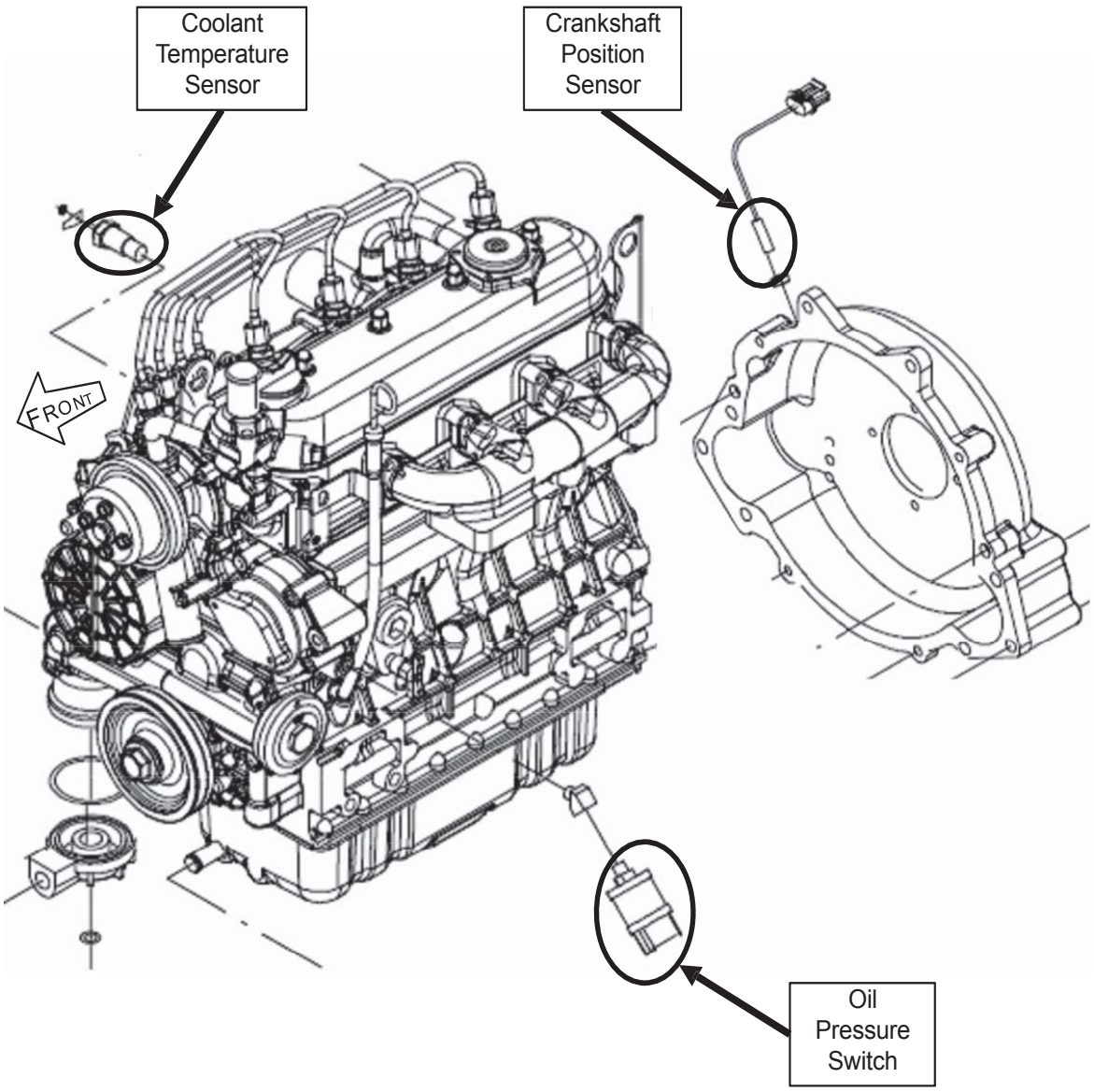
Page 6 of 10



T20 Electrical Component Locator

Page 7 of 10

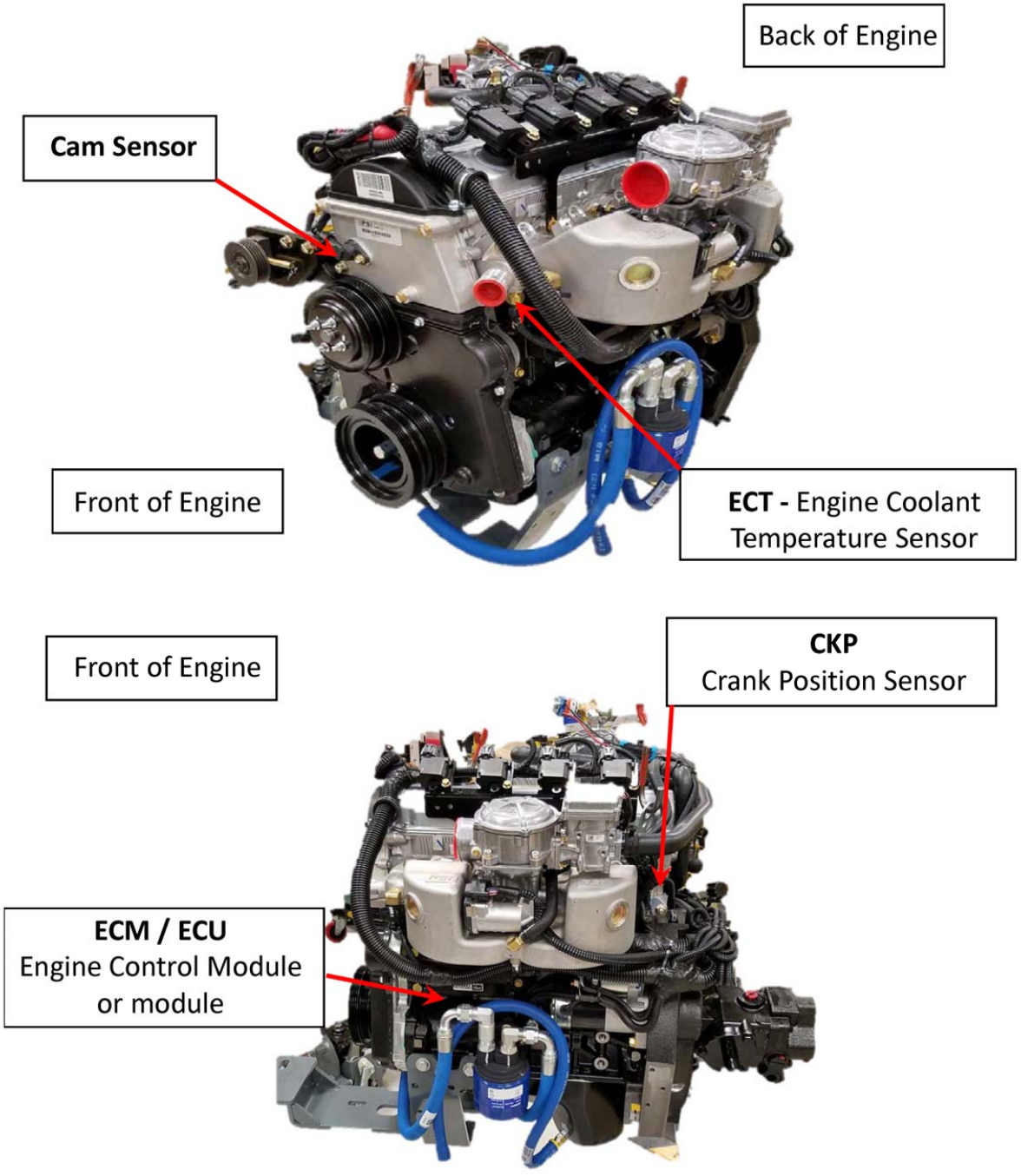
Diesel Engine



T20 Electrical Component Locator

Page 9 of 10

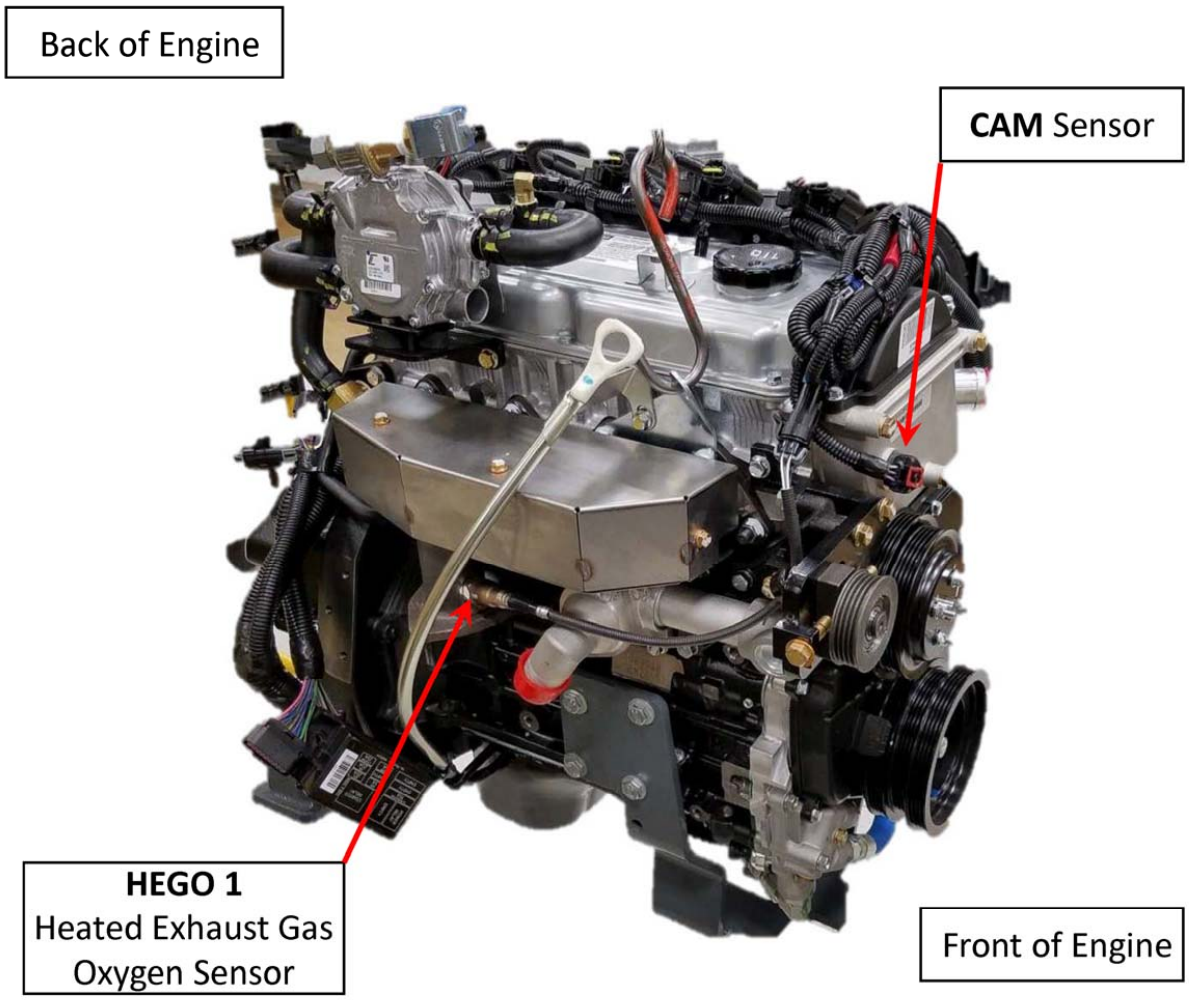
GAS/LPG



T20 Electrical Component Locator

Page 10 of 10

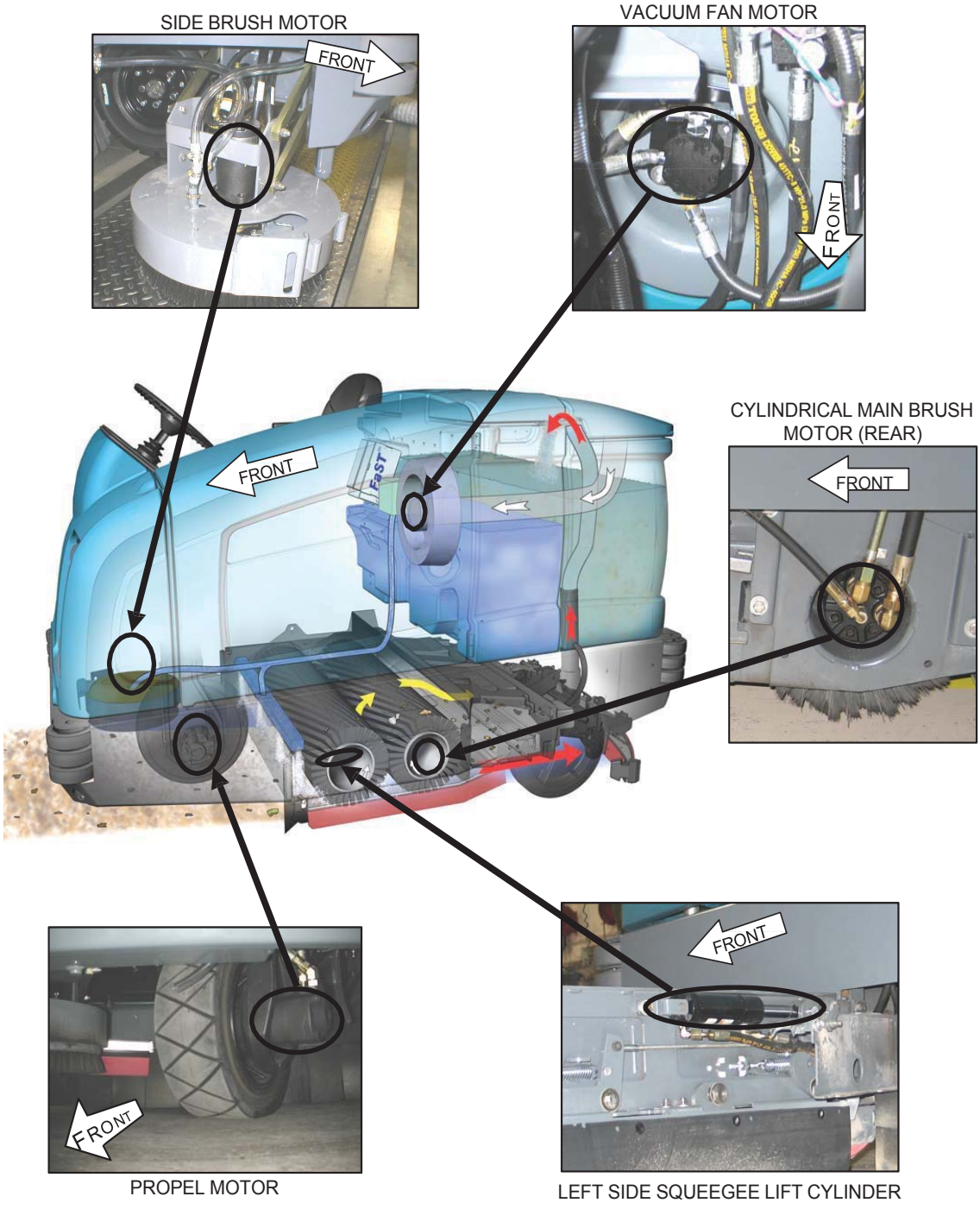
GAS/LPG



HYDRAULIC COMPONENT LOCATOR

T20 Hydraulic Component Locator

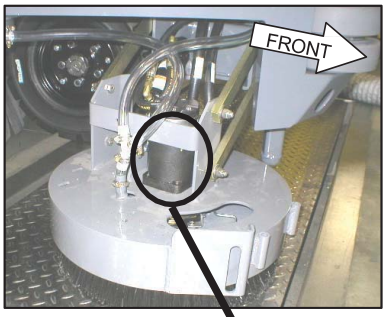
Page 1 of 8



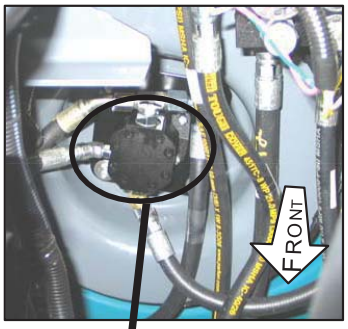
T20 Hydraulic Component Locator

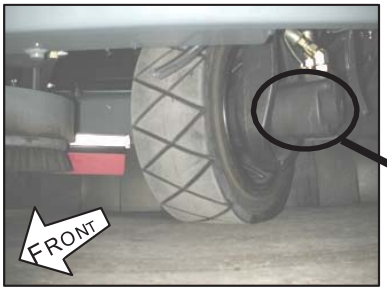
Page 2 of 8

SIDE BRUSH MOTOR

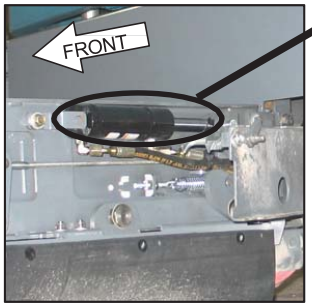


VACUUM FAN MOTOR

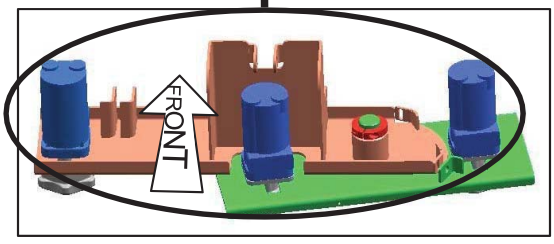




PROPEL MOTOR



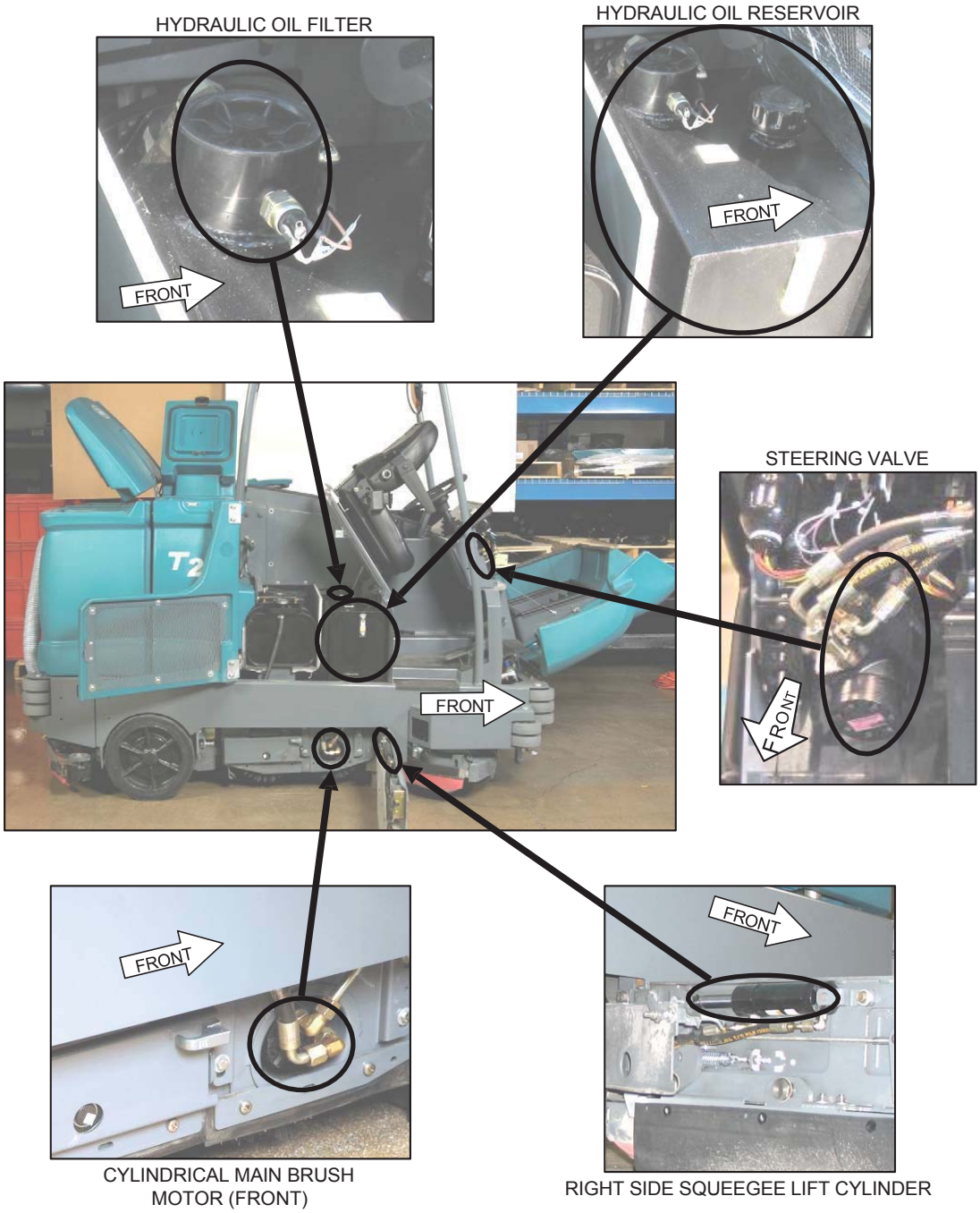
LEFT SIDE SQUEEGEE LIFT CYLINDER



DISK MAIN BRUSH MOTORS

T20 Hydraulic Component Locator

Page 3 of 8



CYLINDRICAL MAIN BRUSH MOTOR (FRONT)

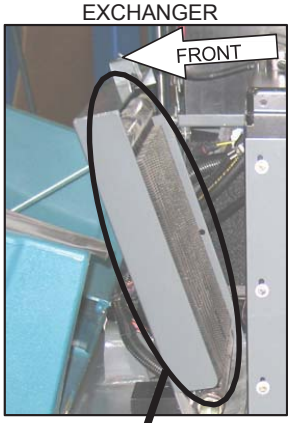
RIGHT SIDE SQUEEGEE LIFT CYLINDER

T20 Hydraulic Component Locator

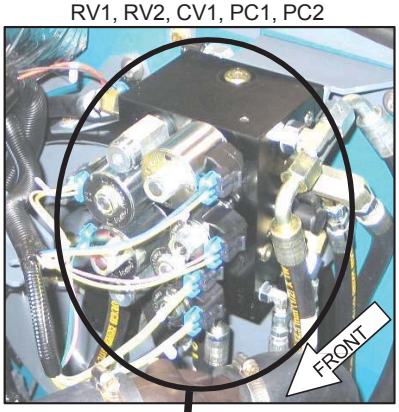
Page 4 of 8

See pages 16 and 17 for more information on the Scrub and Side Brush manifolds

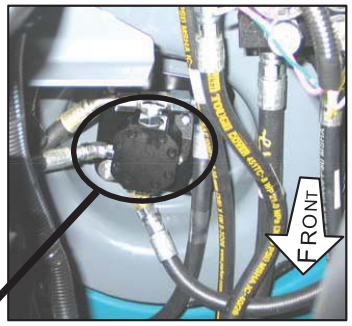
HYDRAULIC OIL HEAT EXCHANGER

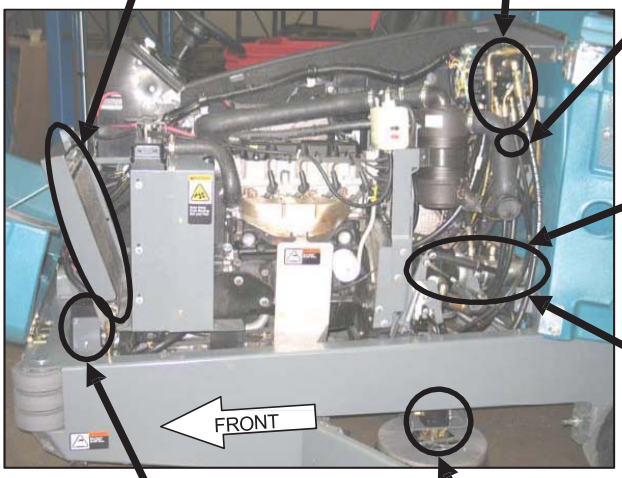


SCRUB MANIFOLD
SV1, SV2, SV3, SV4,SV6, SV7
RV1, RV2, CV1, PC1, PC2

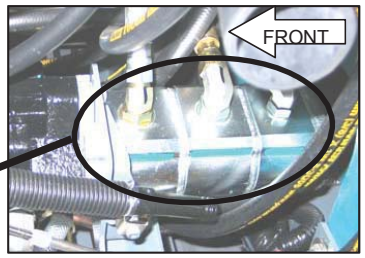


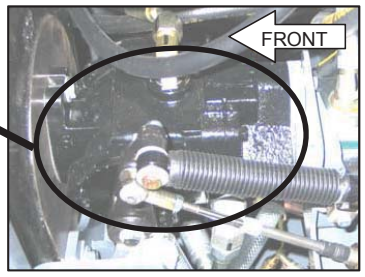
VACUUM FAN MOTOR



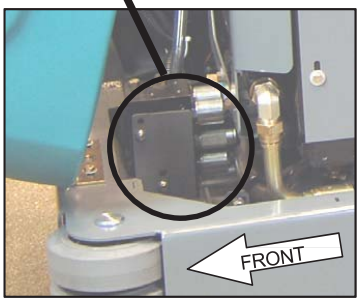


ACCESSORY PUMPS

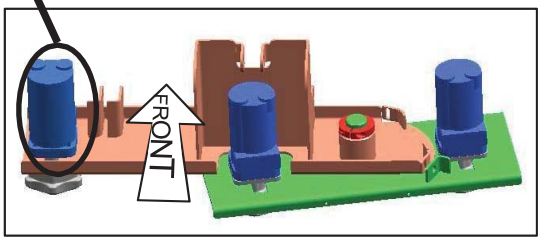




PROPEL PUMP



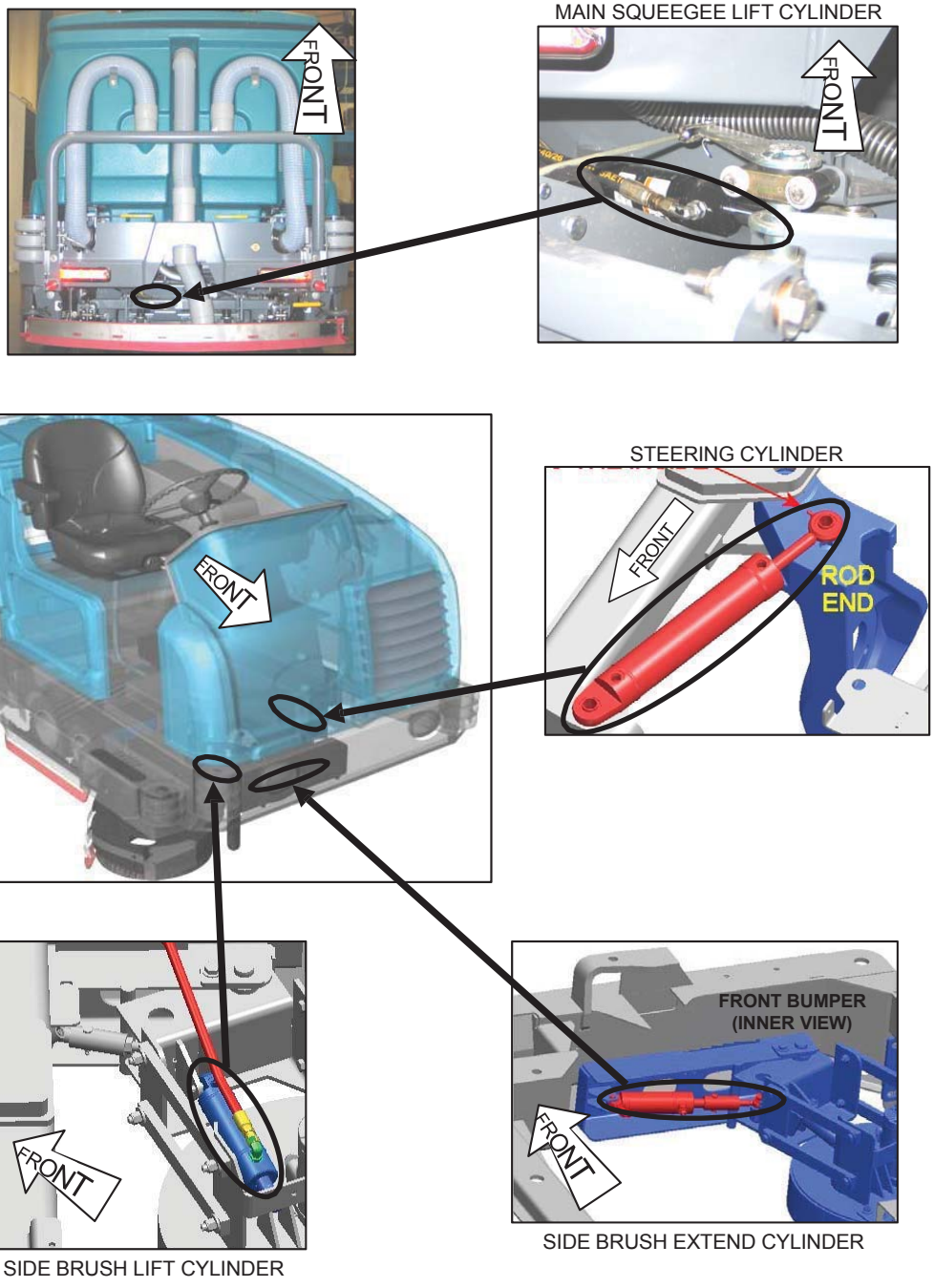
SIDE BRUSH MANIFOLD
SV8, SV10, SV11, SV12, PR1, PC8



DISK MAIN BRUSH MOTORS

T20 Hydraulic Component Locator

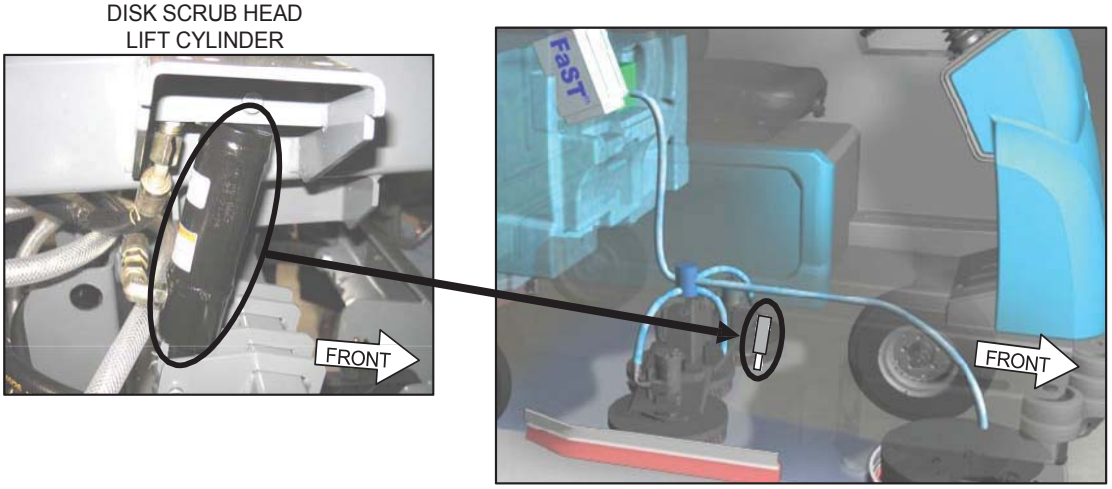
Page 5 of 8



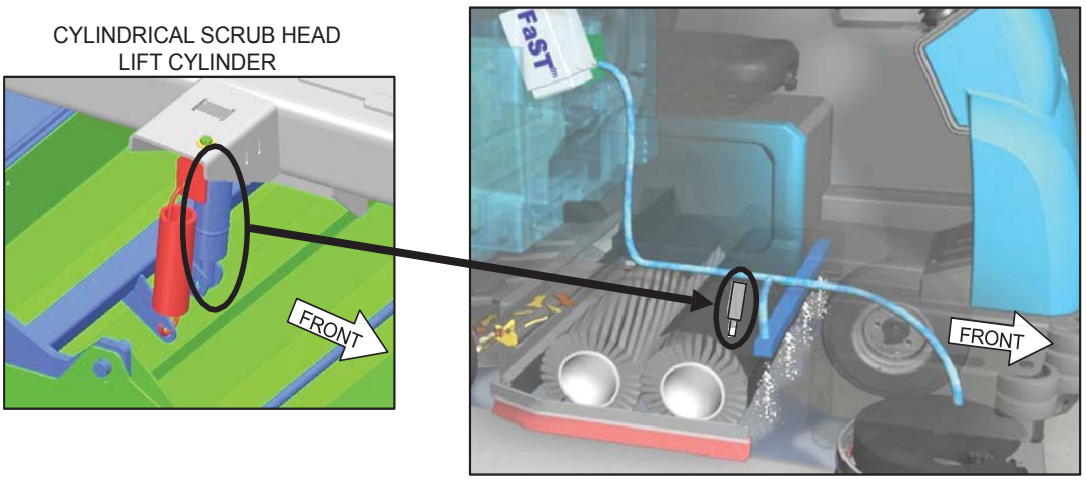
T20 Hydraulic Component Locator

Page 6 of 8

DISK SCRUB HEAD
LIFT CYLINDER



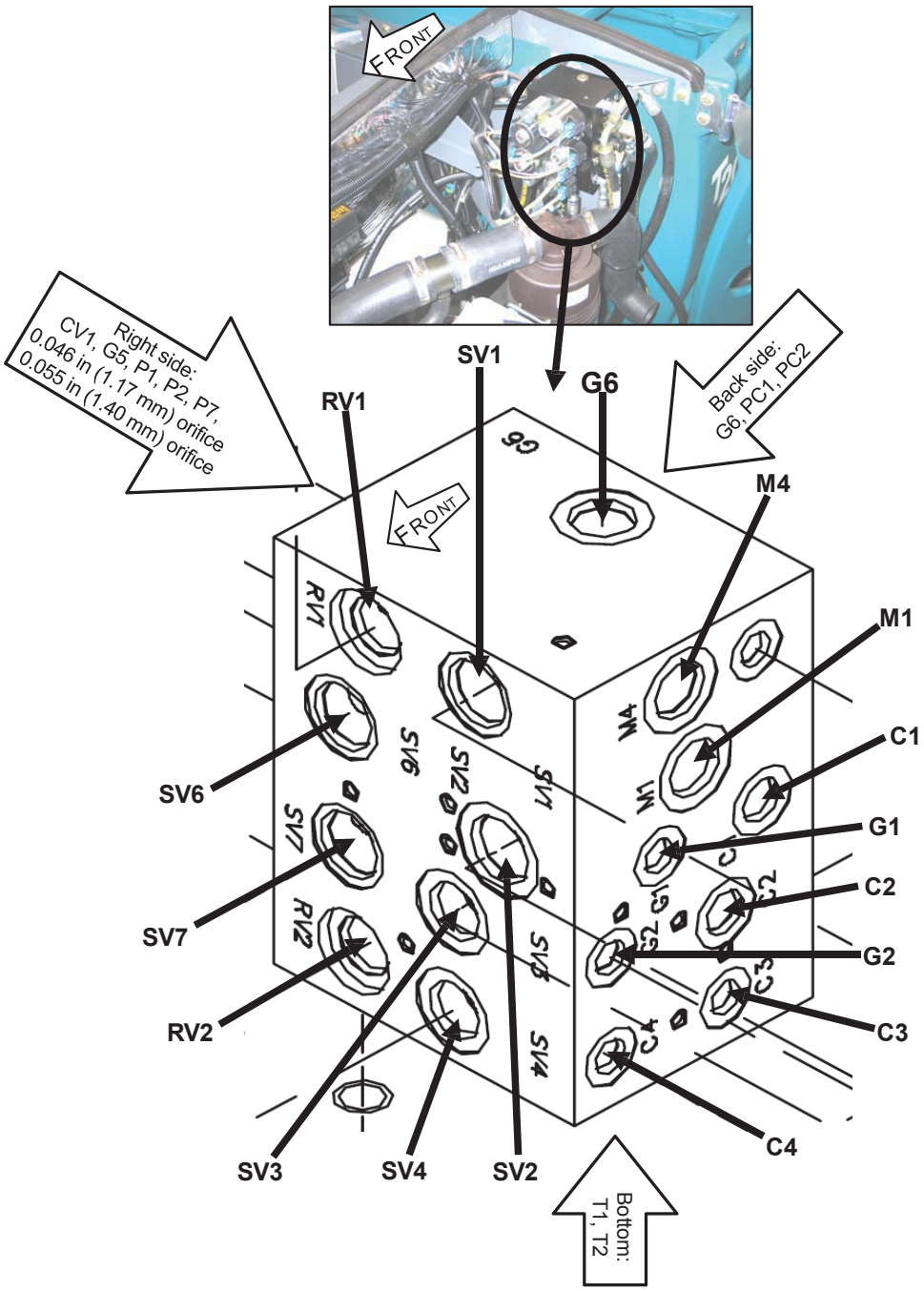
CYLINDRICAL SCRUB HEAD
LIFT CYLINDER



T20 Hydraulic Component Locator

Page 7 of 8

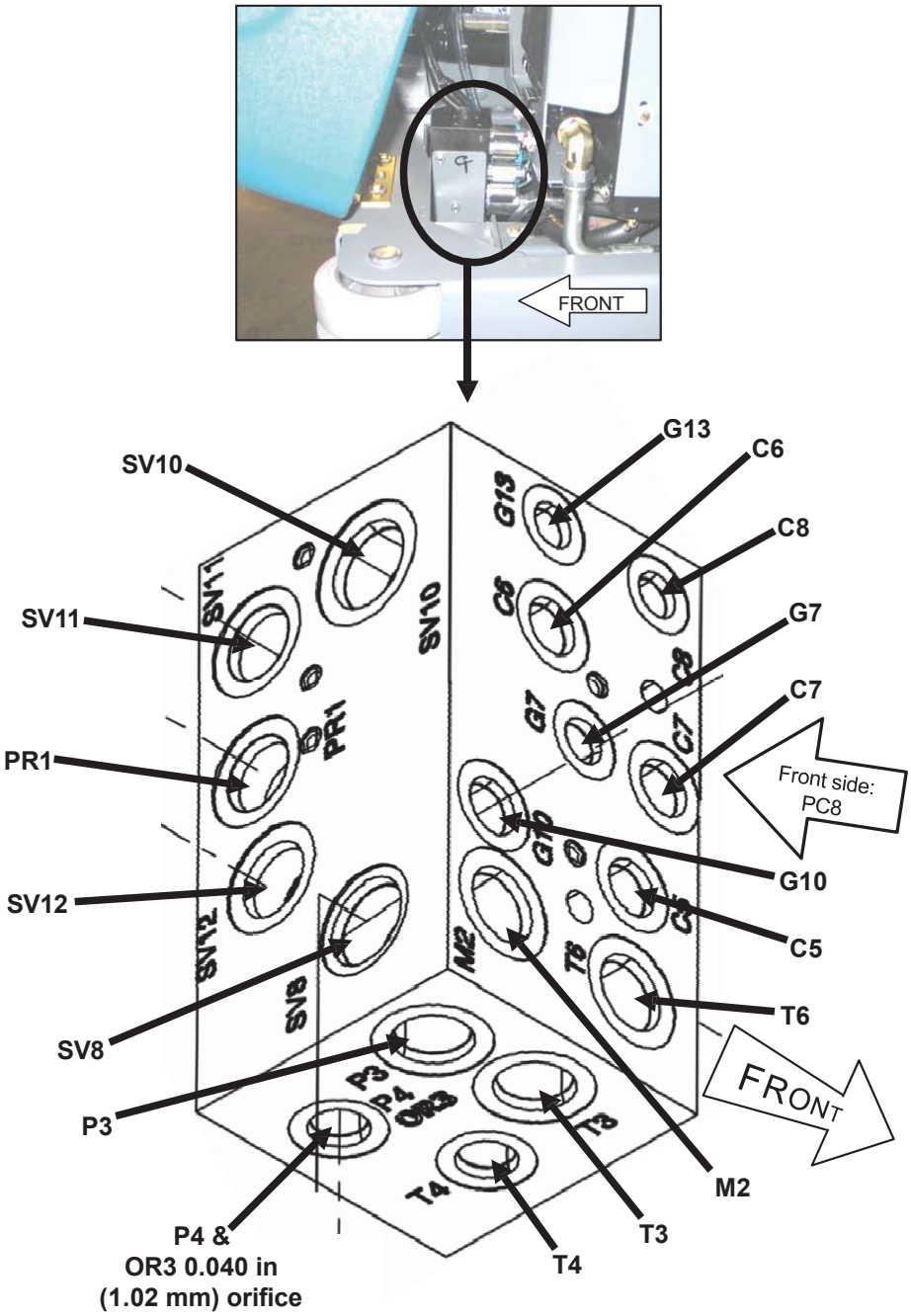
SCRUB MANIFOLD DETAILS



T20 Hydraulic Component Locator

Page 8 of 8

SIDE BRUSH MANIFOLD DETAILS



SPECIFICATIONS

T20 Specifications

Page 1 of 4

GENERAL MACHINE DIMENSIONS/CAPACITIES

Item	Dimension/capacity
Length	2410 mm (95 in)
Height	1470 mm (58 in)
Height (with overhead guard)	2120 mm (83.5 in)
Width/frame (roller to roller)	1270 mm (50 in)
Width (rear squeegee)	1300 mm (51 in)
Width (with side brush)	1470 mm (58 in)
Wheel base	1280 mm (50.38 in)
Track	1270 mm (50 in)
Cleaning path width (main brush length)–Cylindrical Brush	1020 mm (40 in)
Cleaning path width (with scrubbing side brush)–Cylindrical Brush	1370 mm (54 in)
Cleaning path width (with sweeping side brush)–Cylindrical Brush	1420 mm (56 in)
Main brush diameter (2)–Cylindrical Brush	300 mm (12 in)
Cleaning path width (main brush length)–Disk Brush	1070 mm (42 in)
Main brush diameter (3)–Disk Brush	360 mm (14 in)
Side brush diameter–scrubbing	410 mm (16 in)
Side brush diameter–sweeping (cylindrical only)	530 mm (21 in)
Solution tank capacity	303 L (80 gallons)
Recovery tank capacity	360 L (95 gallons)
Debris tray volume capacity	31 L (1.1 ft^3)
Debris tray weight capacity	50 kg (110 lbs)
Weight – empty	1497 Kg (3300 lbs)
GVWR	2223 Kg (4900 lbs)
Transport ground clearance	80 mm (3 in)
Protection Grade	IPX3

Values determined as per IEC 60335–2–72	Measure
Sound pressure level L_{pA}	84 dB(A)
Sound uncertainty K_{pA}	3.0 dB(A)
Sound power level L_{WA} + Uncertainty K_{WA}	106 dB(A)
Vibration – Hand–arm	< 2.5 m/s^2
Vibration – Whole body	< 0.5 m/s^2

GENERAL MACHINE PERFORMANCE

Item	Measure
Minimum aisle turn	2790 mm (110 in)
Travel speed forward (maximum)	12.9 Km/h (8 mph)
Travel speed reverse (maximum)	4.8 Km/h (3 mph)
Maximum ramp incline for loading – Empty tanks	18%
Maximum ramp incline for scrubbing	10%
Maximum ramp incline for transporting (GVWR)	14%
Maximum ambient temperature for machine operation	43° C (110° F)
Minimum temperature for operating machine scrubbing functions	0° C (32° F)

T20 Specifications

System	Capacity	ISO Grade Viscosity Index	Ambient Air Temperature Ranges
Hydraulic reservoir	38 L (10 gal)	ISO 100 VI 126 or higher	19° C (65° F) or higher
Hydraulic total	45 L (12 gal)	ISO 68 VI 155 or higher	7 to 43° C (45 to 110° F)
		ISO 32 VI 163 or higher	16° C (60° F) or lower

POWER TYPE

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke
Mitsubishi 2.0	Piston	Coil @ Plug	4	Natural	4	85 mm (3.35 in)	88 mm (3.46 in)
	Displacement		Tennant governed power			Gross intermittent power per SAE J1995	
	2,0 L (122 cu in)		37.3 kw (50 hp) @ 2300 rpm			44.7 kw (60 hp) @ 3000 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)			75 A alternator	
			Radiator: 3.8 L (1 gal)				
	Idle speed, no load		(Fast) governed speed, under load			Firing order	
	1350 ± 50 rpm		2300 ± 50 rpm			1–3–4–2	
	Spark plug gap		Valve clearance, cold			Engine lubricating oil with filter	
	1.1 mm (0.043 in)		No Adjustment OHC Engine			4.7 L (5 qt) 5W30 SAE–SG/SH	

T20 Specifications

Page 3 of 4

Engine	Type	Ignition	Cycle	Aspiration	Cylinders	Bore	Stroke
Kubota V1505–B	Piston	Diesel	4	Natural	4	78 mm (3.07 in)	78.4 mm (3.09 in)
	Displacement		Tennant governed power			Gross intermittent power per J1995	
	1500 cc (91.4 cu in)		18.5 kw (24.8 hp) @ 2300 rpm			18.5 kw (24.8 hp) @ 2300 rpm	
	Fuel		Cooling system			Electrical system	
	Diesel Fuel tank: 42 L (11.2 gal) low sulfur fuel content less than 500 ppm only		Water/ethylene glycol antifreeze			12 V nominal	
			Total: 7.5 L (2 gal)			37 A alternator	
			Radiator: 3.8 L (1 gal)				
	Idle speed, no load		(Fast) governed speed, under load			Engine lubricating oil without filter	
	950 ± 50 rpm		2400 ± 50 rpm			6 L (6.35 qt) API diesel classification Cf or better	

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	140 mm x 460 mm (5.5 in x 18 in)
Rear (2)	Solid	90 mm x 410 mm (3.5 in x 16 in)

STEERING

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

T20 Specifications

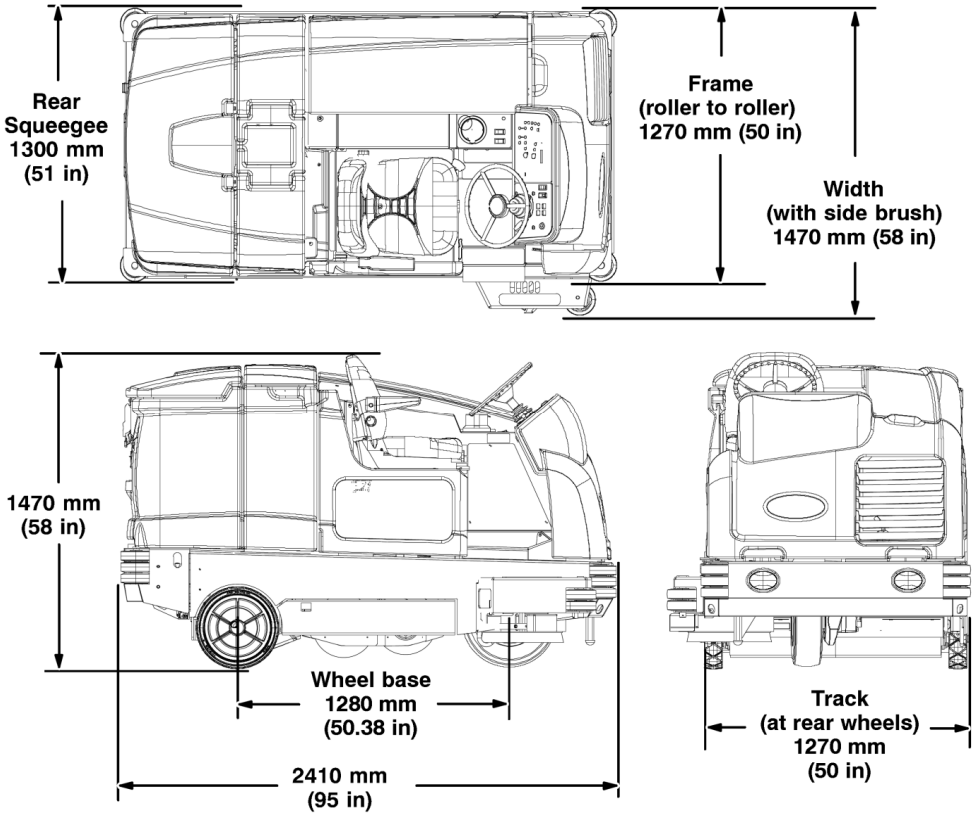
Page 4 of 4

FaST SYSTEM

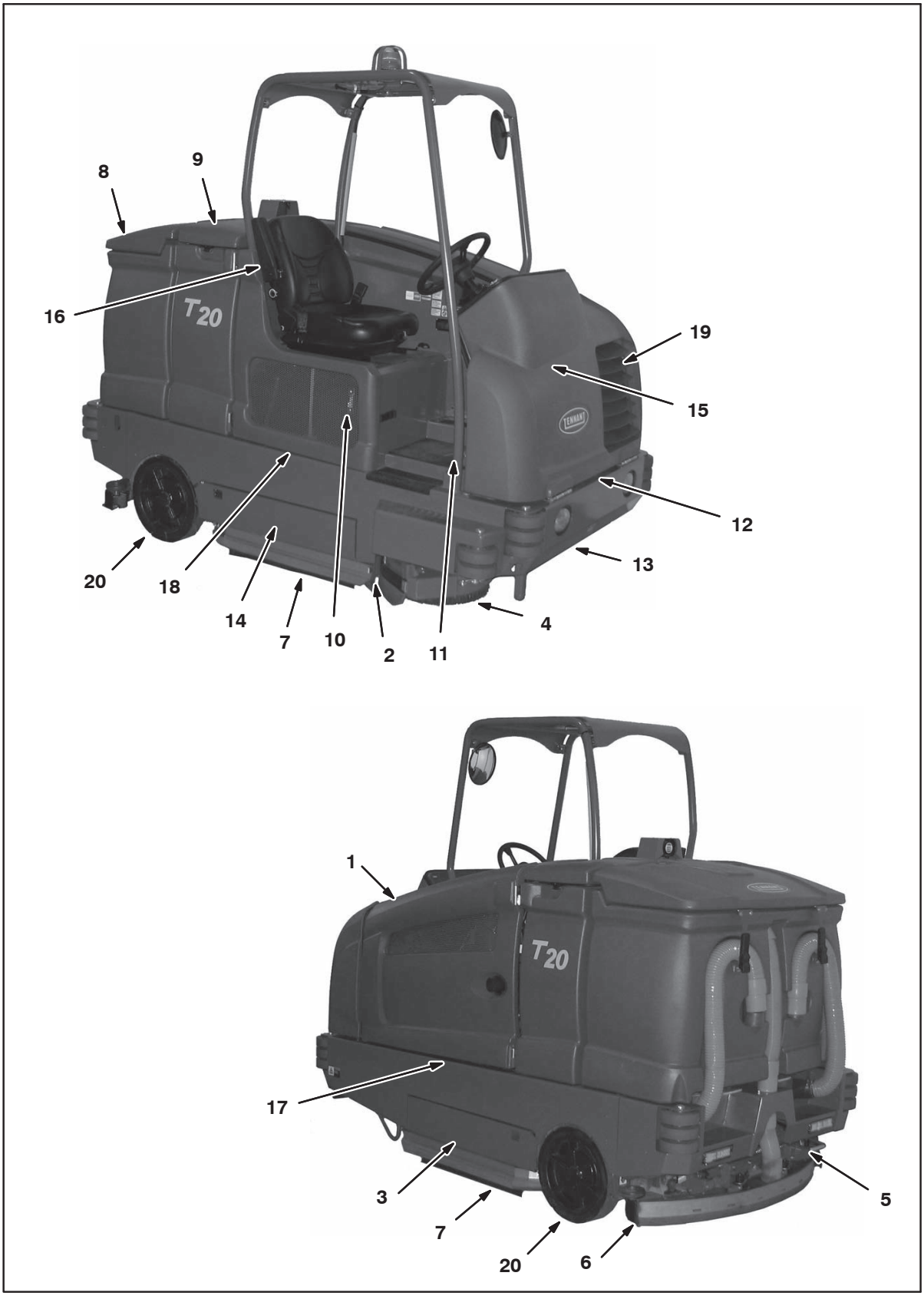
Item	Measure
Solution pump	12 Volt DC, 11A, 0.7 GPM & 1.4 GPM flow, (2 spees), 75 psi high–pressure shutdown
Low solution flow rate	2.7 LPM (0.7 GPM)
High solution flow rate	5.4 LPM (1.4 GPM)
Low concentrate flow rate	2.6 CC/Minute (0.085 Liquid Ounces/Minute)
High concentrate flow rate	5.2 CC/Minute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

***ec–H2O* SYSTEM**

Item	Measure
Solution pump	12 Volt DC, 11A, 0.7 GPM & 1.4 GPM flow, (2 speeds), 75 psi high–pressure shutdown
Solution flow rate	2.65 LPM (0.7 GPM) – Low
	5.30 LPM (1.4 GPM) – High



MAINTENANCE



MAINTENANCE CHART

The table below indicates the *Person Responsible* for each procedure.
O = Operator
T = Trained Personnel

Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
Daily	O	1	Engine	Check oil level	EO	1
				Check coolant level in reservoir	WG	1
	O	10	Hydraulic fluid reservoir	Check fluid level	HYDO	1
	O	8, 9	Tank cover seals	Check for damage or wear	-	3
	O	3, 14	Main brushes (Cylindrical)	Check for damage and wear	-	2
	O	3, 14	Main brushes or pads (Disk)	Check for damage and wear	-	3
	O	4	Side brush (option)	Check for damage and wear	-	1
				Check squeegee blade for damage and wear	-	1
	O	6	Rear squeegee blade	Check for damage and wear	-	1
				Check deflection	-	1
	O	7	Side squeegee blades	Check for damage and wear	-	2
	O	8	Recovery tank	Clean	-	1
	O	8	Recovery tank, ES mode (option)	Clean ES filter	-	1
	O	9	Solution tank, ES mode (option)	Clean	-	1
	O	5	Debris tray	Clean debris tray, screen, and hose	-	1
50 Hours	O	16	FaST/ec-H2O filter screen (Option)	Clean	-	1
	O	3, 14	Main brushes (Cylindrical)	Rotate front to rear	-	2
	T	3, 14	Main brushes or pads (Disk)	Check brush pattern and adjust if needed	-	2
	T	13	Front wheel	Torque wheel nuts (after initial 50 hours only)	-	1
	T	1	Fuel Lines (Diesel machines)	Check for damage and wear and tighten loose clamp bands	-	1
	T	15	Battery	Clean and tighten battery cable connections (after initial 50 hours only)	-	1
	T	1	Engine	Check belt tension	-	1

LUBRICANT/FLUID

EO . . . . Engine oil, 5W30 SAE−SG/SH only.
HYDO . TennantTrue 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.

Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
100 Hours	T	19	Radiator	Clean core exterior	-	1
	T	19	Hydraulic cooler	Clean core exterior	-	1
	T	1	Engine	Change oil and filter	EO	1
				Drain LPG vaporizer oil buildup		1
	O	13, 20	Tires	Check for damage	-	3
	T	6	Rear squeegee casters	Lubricate	SPL	2
	T	6	Rear squeegee	Check leveling	-	1
	O	2	Scrub head skirt	Check for damage or wear	-	1
	T	3, 14	Disk scrub head stop bumper	Check for damage or wear		2
200 Hours	T	12	Front wheel support bearings	Lubricate	SPL	2
	T	17, 18	Torque tube (Cylindrical brushes)	Lubricate	SPL	4
	T	3, 14	Torque tube (Disk brushes)	Lubricate	SPL	4
	T	3	Pivot shaft (Disk brushes)	Lubricate	SPL	4
	T	12	Steering cylinder	Lubricate	SPL	1
	T	1, 19	Radiator hoses and clamps	Check for tightness and wear	-	2
	T	11	Brake pedal	Check adjustment	-	1
400 Hours	T	1	Engine	Replace air filter	-	1
				Replace fuel filter	-	1
	T	20	Rear wheel bearings	Check, lubricate, and adjust	SPL	2
800 Hours	T	10	Hydraulic reservoir	Replace filler cap	HYDO	1
	T	-	Hydraulic hoses	Check for wear and damage	-	ALL
	T	1, 19	Cooling system	Flush	WG	2
	T	13	Propelling motor	Torque shaft nut	-	1
	T	13	Front wheel	Torque wheel nuts	-	1
	T	15	Battery	Clean and tighten battery cable connections	-	1
1000 Hours	T	16	FaST system filters	Replace	-	2
	T	1	Engine (Gas/LPG Machines)	Replace spark plugs	-	4
	T	1	Engine (Gas/LPG Machines)	Inspect PCV system	-	1
	T	1, 19	Radiator hoses	Check for cracks or deterioration	-	2

LUBRICANT/FLUID

EO . . . . Engine oil, 5W30 SAE−SG/SH only.
HYDO . TennantTrue 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.

Interval	Person Resp.	Key	Description	Procedure	Lubricant/ Fluid	No. of Service Points
1200 Hours	T	10	Hydraulic fluid filter	Replace fluid filter	-	1
2400 Hours	T	10	Hydraulic fluid reservoir	Replace strainer outlet	-	1
				Change hydraulic fluid	HYDO	1
5000 hours	1	1	Engine (Gas/LPG Machines)	Replace camshaft and balance shaft belts	-	2

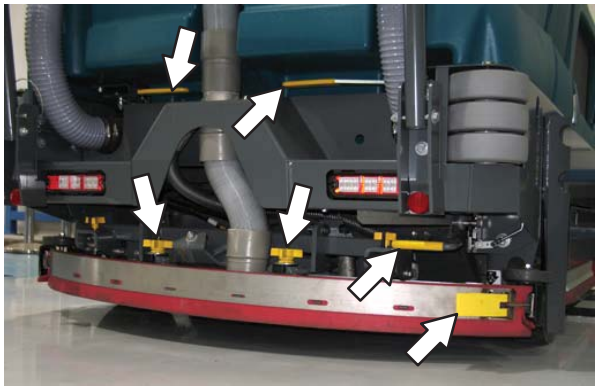
LUBRICANT/FLUID

EO . . . . Engine oil, 5W30 SAE−SG/SH only.
HYDO . TennantTrue 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.

YELLOW TOUCH POINTS

This machine features easy to find yellow touch points for simple service items. No tools are required to perform these maintenance operations.



LUBRICATION

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

ENGINE OIL

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

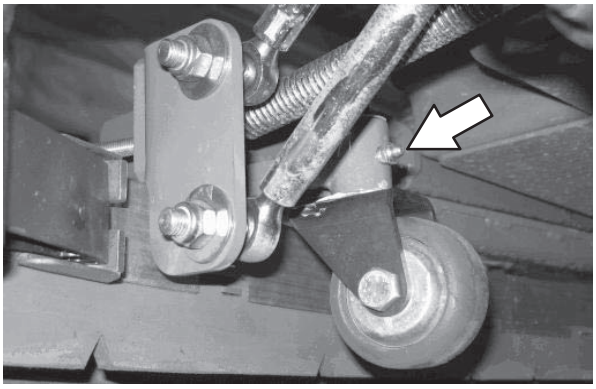
Fill the engine with oil until the oil is between the indicator marks on the dipstick. DO NOT fill past the top indicator mark.

The engine oil capacity for **Mitsubishi engines** is 4.7 L (5 qt) with oil filter.

The engine oil capacity for **diesel engines** is 6L (6.35 qt) with oil filter.

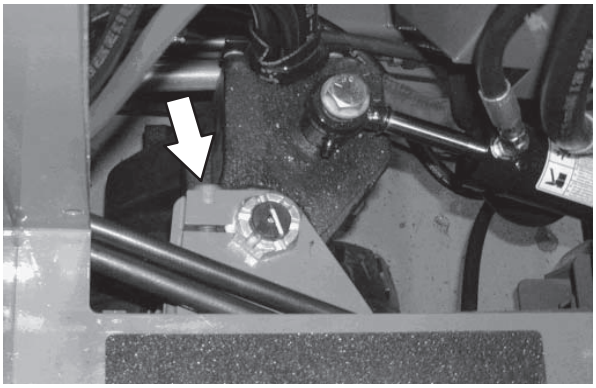
SQUEEGEE CASTER BEARINGS

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



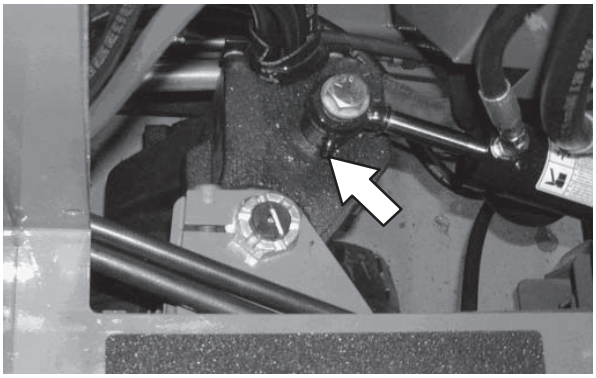
FRONT WHEEL SUPPORT BEARING

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.



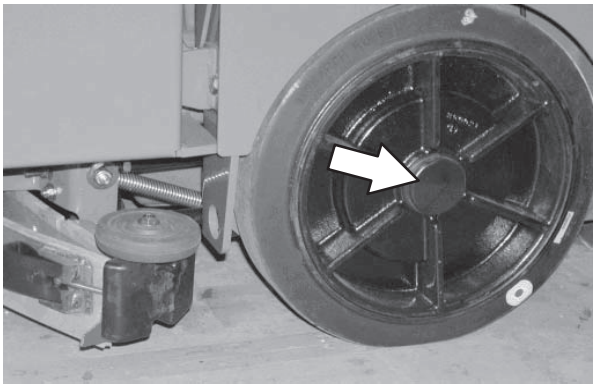
STEERING CYLINDER BEARING

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



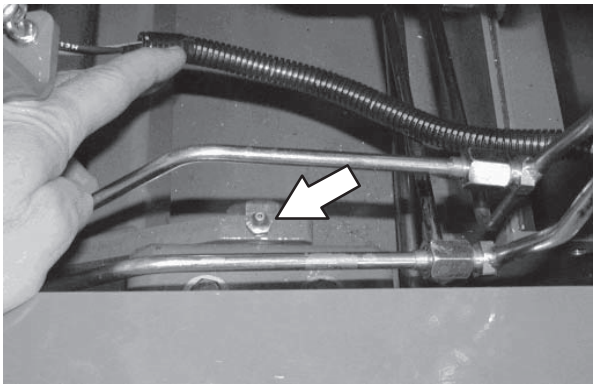
REAR WHEEL BEARINGS

Inspect the rear wheel bearings for seal damage, and repack and adjust every 400 hours of operation. Use Lubriplate EMB grease (Tennant part number 01433–1).

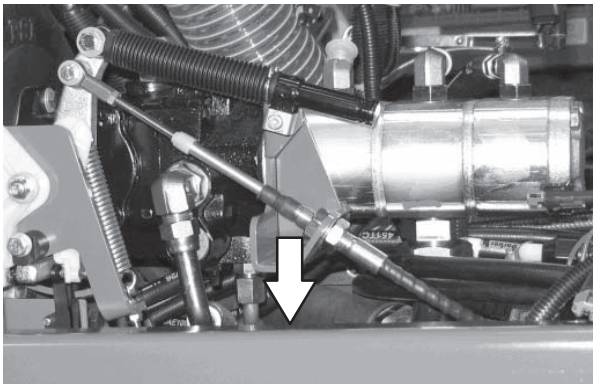


TORQUE TUBES–CYLINDRICAL BRUSHES

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.

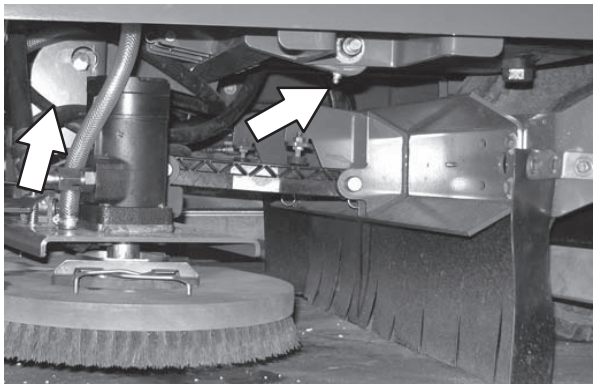


On the other side of the machine the torque tube grease fittings are located beneath the propel pump.



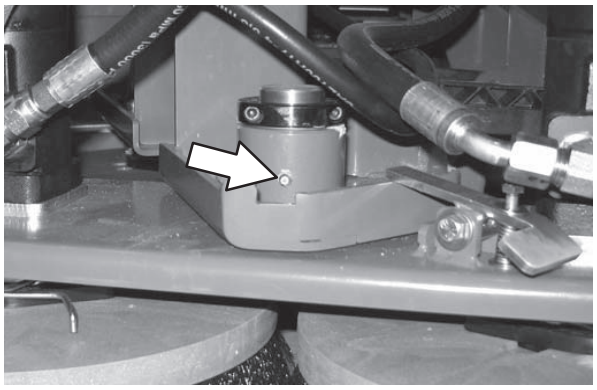
TORQUE TUBES–DISK BRUSHES

Lubricate the three torque tube fittings after every 200 hours of operation. The first two fittings are located on each side of the machine and the third is located above the center brush.



PIVOT SHAFT–DISK BRUSHES

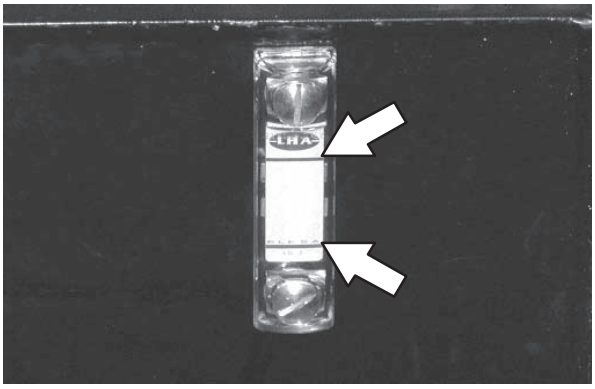
Lubricate the pivot shaft after every 200 hours of operation.



HYDRAULICS

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

Check the hydraulic fluid level at operating temperature daily. The hydraulic fluid level should be between the two lines on the hydraulic gauge.

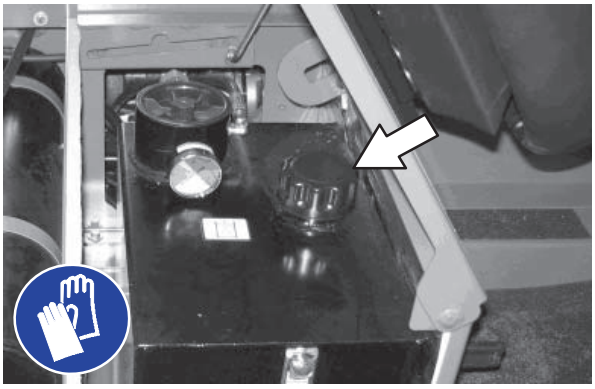


ATTENTION! Do not overfill the hydraulic fluid reservoir or operate the machine with a low level of hydraulic fluid in the reservoir. Damage to the machine hydraulic system may result.

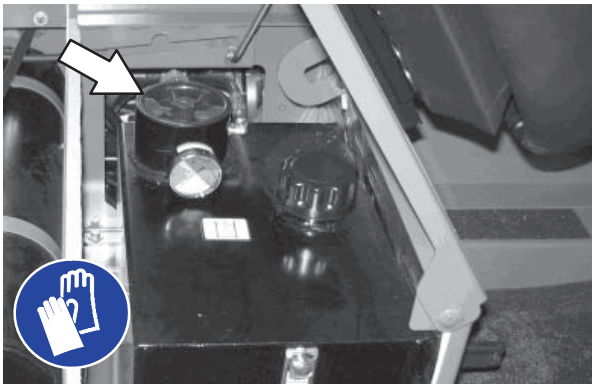
Drain and refill the hydraulic fluid reservoir with new **Tennant*True*** premium hydraulic fluid after every 2400 hours of operation.

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

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 three fluids available for different ambient air temperature ranges:

Tennant*True* premium hydraulic fluid (Extended Life)			
Part Number	**Capacity**	**ISO Grade Viscosity Index (VI)**	**Ambient Air Temperature Ranges**
1057710	3.8 L (1 gal)	ISO 100 VI 126 or higher	19° C (65° F) or higher
1057711	19 L (5 gal)		
1069019	3.8 L (1 gal)	ISO 68 VI 155 or higher	7 to 43° C (45 to 110° F)
1069020	19 L (5 gal)		
1057707	3.8 L (1 gal)	ISO 32 VI 163 or higher	16° C (60° F) or lower
1057708	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.

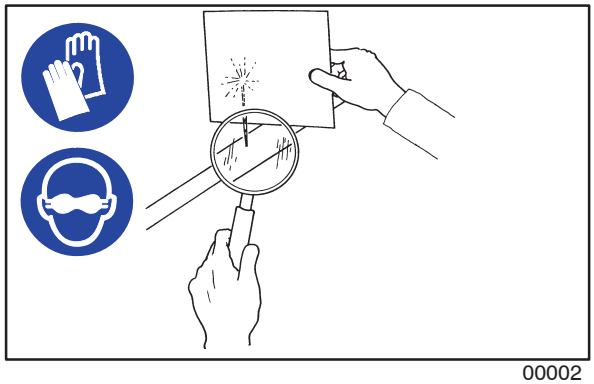
ATTENTION! Hydraulic components depend on system hydraulic fluid for internal lubrication. Malfunctions, accelerated wear, and damage will result if dirt or other contaminants enter the hydraulic system.

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.

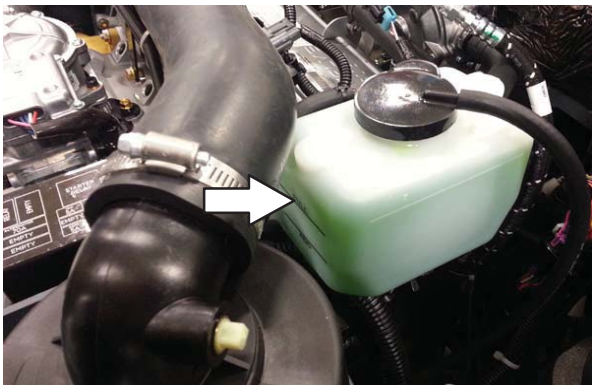
ENGINE - GAS/LPG

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

COOLING SYSTEM

FOR SAFETY: When servicing machine, avoid contact with hot engine coolant. Do not remove cap from radiator when engine is hot. Allow engine to cool.

Check the coolant level in the reservoir daily. The coolant level must be between the indicator marks when the engine is cold. Refer to the coolant manufacture for water/coolant mixing instructions.

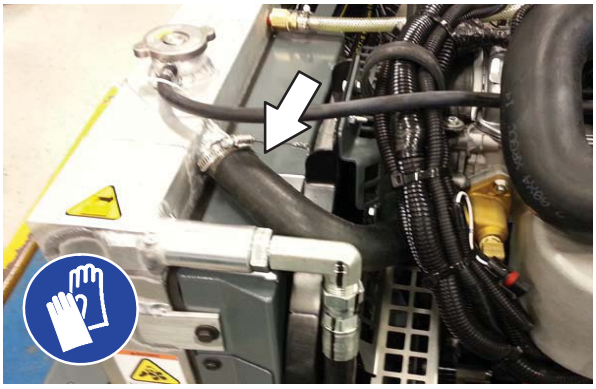


Flush the radiator and the cooling system after every 800 hours of operation.

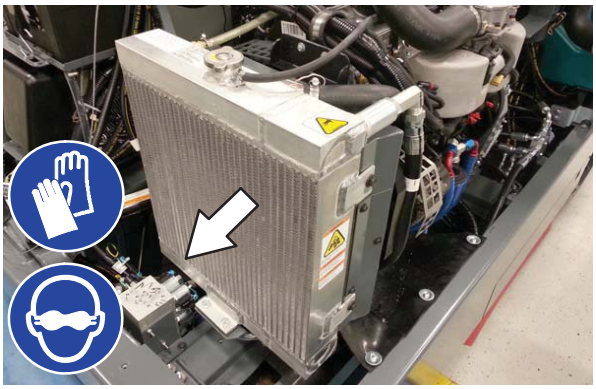
The cooling system must be completely filled with coolant to keep the engine from overheating.

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

Check the radiator hoses for cracks and deteriation after every 1000 hours of operation.

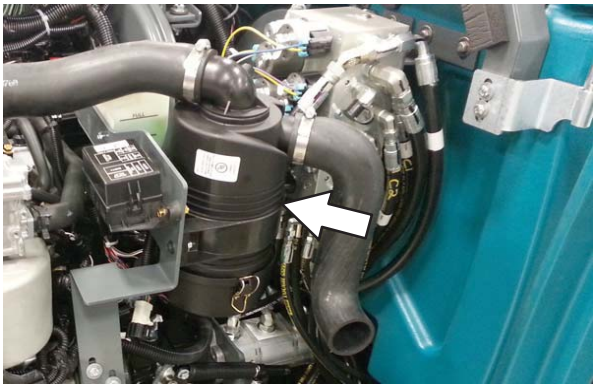


Check the radiator core exterior and hydraulic cooler fins for debris after every 100 hours of operation. Blow or rinse all dust through the grille and radiator fins, in the opposite direction of normal air flow. Be careful to not bend the cooling fins when cleaning. Clean thoroughly to prevent the fins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



AIR FILTER

Replace the air filter after every 400 hours of operation.

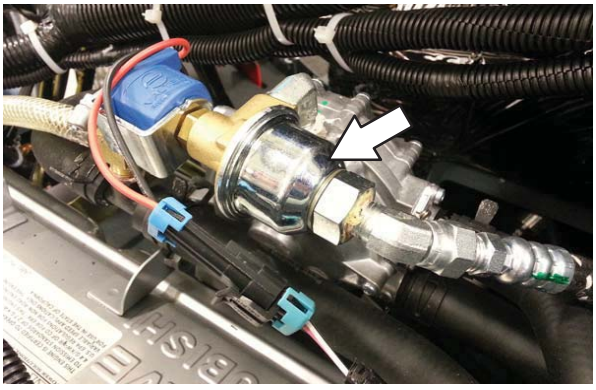


FUEL FILTER (LPG)

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

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

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



LPG VAPORIZER

Drain oil buildup in the LPG vaporizer 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.

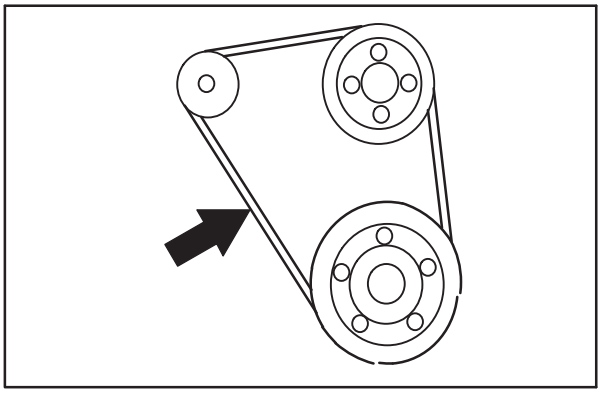
FUEL FILTER (Gasoline)

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

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

ENGINE BELT

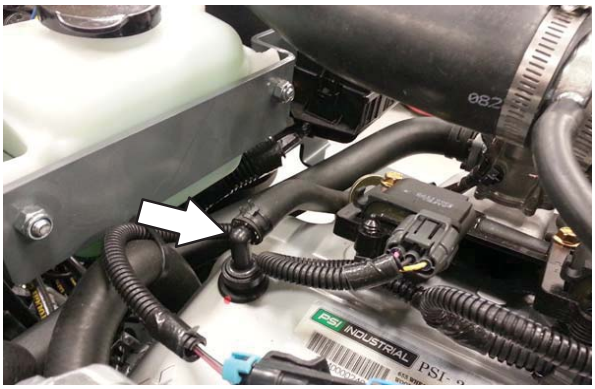
Check the belt tension after every 50 hours of operation. Adjust tension as necessary. Proper belt tension is 13 mm (0.50 in) from a force of 4 to 5 kg (8 to 10 lb) applied at the mid-point of the longest span.



WARNING: Moving belt and fan. Keep away.

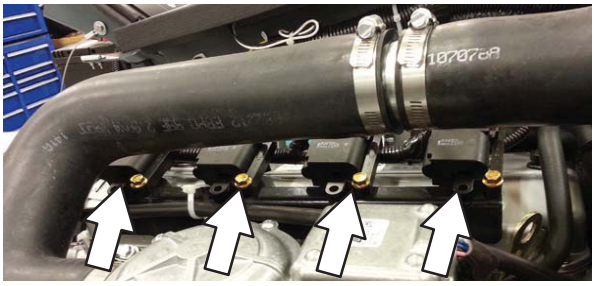
PCV SYSTEM

Inspect the PCV system after every 100 hours of operation.



SPARK PLUGS – MITSUBISHI ENGINES

Replace the spark plugs after every 1000 hours of operation.



CAMSHAFT AND BALANCE SHAFT BELTS – MITSUBISHI ENGINES

Replace the camshaft and balance shaft belts after every 5000 hours of operation.

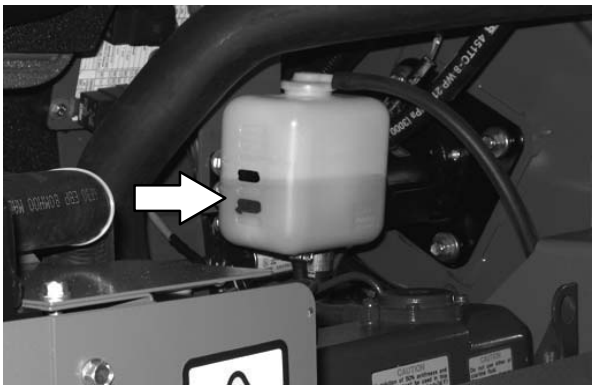
ENGINE - DIESEL

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

COOLING SYSTEM

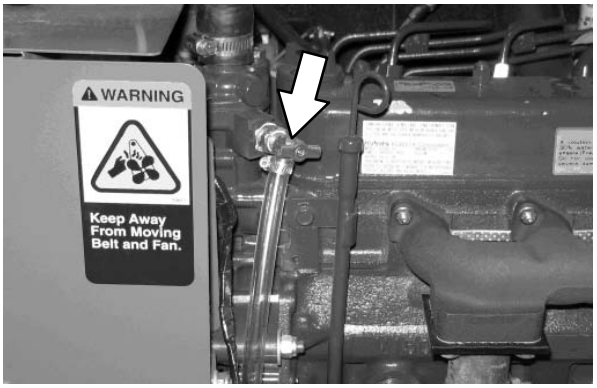
FOR SAFETY: When servicing machine, avoid contact with hot engine coolant. Do not remove cap from radiator when engine is hot. Allow engine to cool.

Check the coolant level in the reservoir daily. The coolant level must be between the indicator marks when the engine is cold. Refer to the coolant manufacture for water/coolant mixing instructions.



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

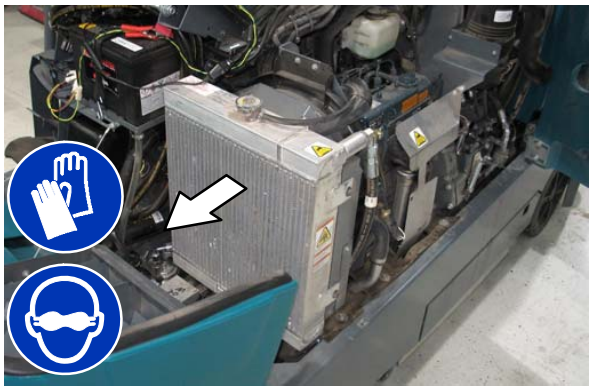
The cooling system must be completely filled with coolant to keep the engine from overheating. When filling the cooling system, open the drain cock to bleed the air from the system.



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

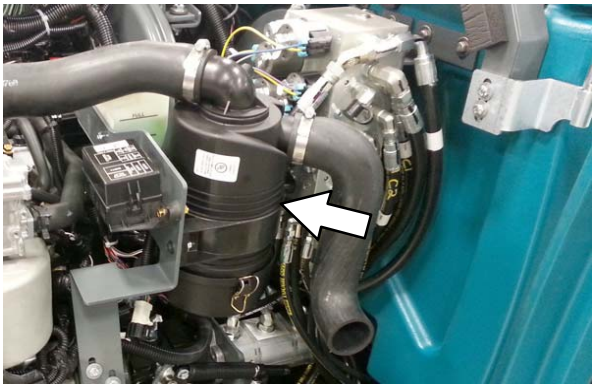
Check the radiator hoses for cracks and deterioration after every 1000 hours of operation.

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.



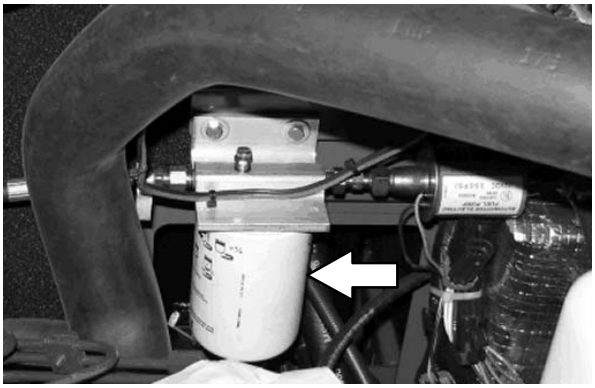
AIR FILTER

Replace the air filter after every 400 hours of operation.



FUEL FILTER

The fuel filter removes impurities 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

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.

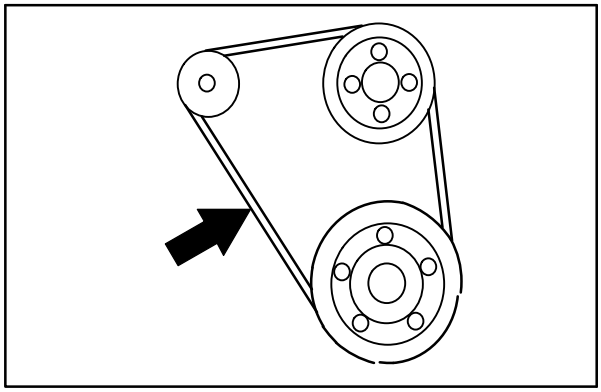
PRIMING THE FUEL SYSTEM

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.

BATTERY

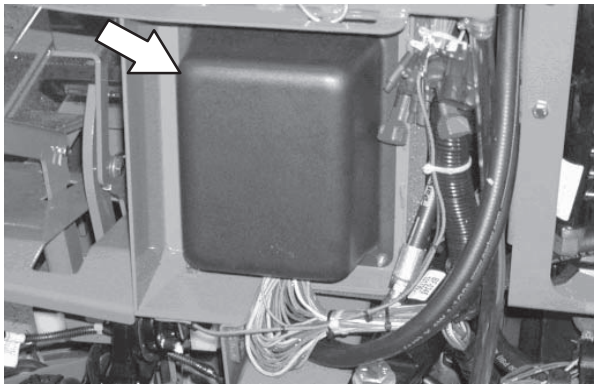
Clean and tighten the battery connections after the first 50 hours of operation and after every 800 hours after that. Do not remove the vent plugs from the battery or add water to the battery.

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

FUSES AND RELAYS

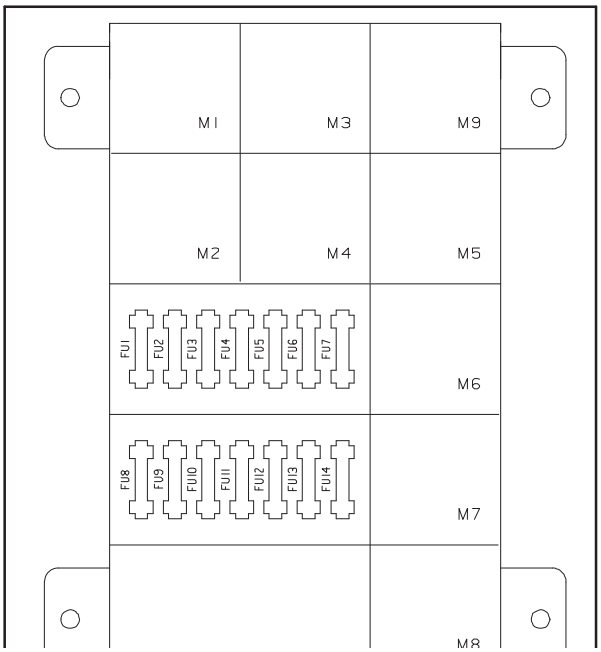
RELAY PANEL FUSES AND RELAYS

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.

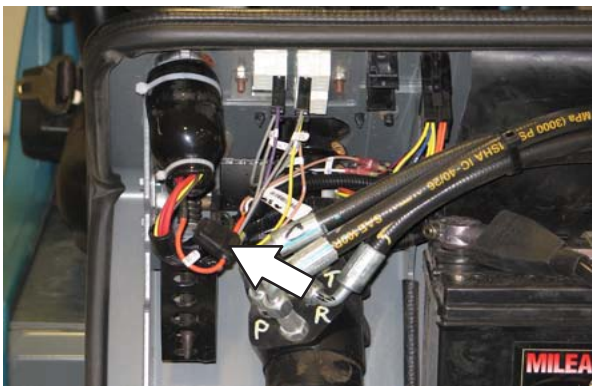
Refer to the diagram below for locations of the *fuses* and *relays* on the relay panel. The M10 relay for the optional spray nozzle is located behind the battery.



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	Not Used
FU3	15 A	Horn
FU4	15 A	Not Used
FU5	15 A	Scrub Vacuum/Main Brush/ Squeegee Down
FU6	15 A	Enable/Side Brush
FU7	15 A	Solution/Auto Fill/Reverse
FU8	15 A	ES/FaST/Detergent/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	Not Used
FU14	15 A	Not Used

–	20 A	*ec–H2O* (near ignition switch)

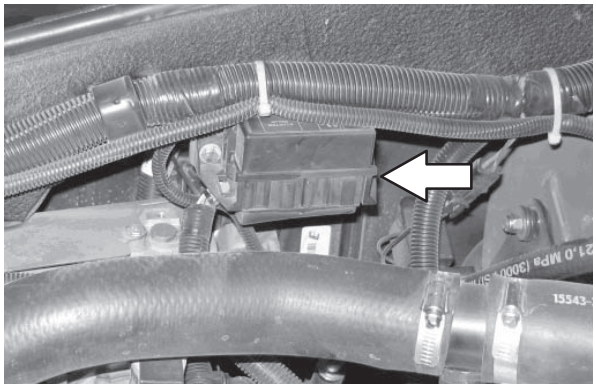


Refer to the table below for the *relays* and circuits controlled.

Relay	Rating	Circuit Controlled
M1	12 VDC, 40 A	Auxiliary 1
M2	12 VDC, 40 A	Auxiliary 2
M3	12 VDC, 40 A	Not Used
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	Not Used

ENGINE HARNESS FUSES AND RELAYS

The *engine harness fuses* and *relays* are located in the fuse box inside the engine compartment. Refer to the fuse box cover for locations of engine harness fuses and relays.



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

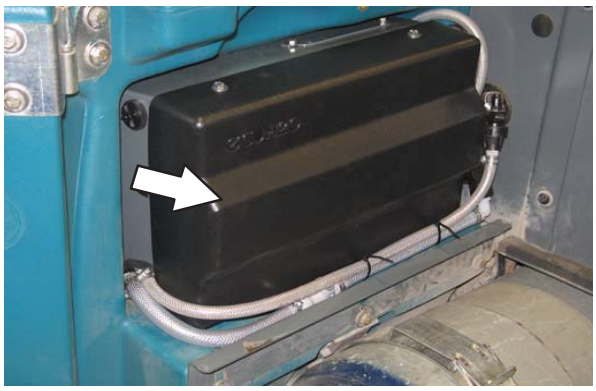
OPTIONAL RELAYS

The optional spray nozzle or pressure wand relay is located behind the battery. The optional FaST scrubbing system relay is located behind the seat.

Relay	Rating	Circuit Controlled
–	12 VDC. 40 A	Spray Wand
–	12 VDC. 40 A	Pressure Washer
–	12 VDC. 40 A	FaST

CIRCUIT BREAKERS (*ec–H2O*)

Circuit breakers are resettable electrical circuit protection devices that stop the flow of current in the event of a circuit overload. Once a circuit breaker is tripped, allow breaker to cool and then press the reset button to manually reset the breaker.

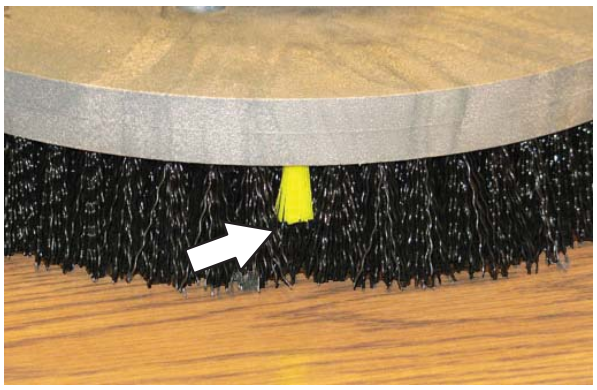


SCRUB BRUSHES AND PADS

The machine can be equipped with either *disk* or *cylindrical* scrub brushes, or cleaning pads. Check scrub brushes or pads daily for wire or string tangled around the brush or brush drive hub. Also check brushes or pads for damage and wear.

DISK BRUSHES

Replace the brush when it no longer cleans effectively or when the bristles are worn down to the yellow indicators.



Cleaning pads must be placed on pad drivers before they are ready to use. The cleaning pad is held in place the center disk.

Cleaning pads need to be cleaned immediately after use with soap and water. Do not wash the pads with a pressure washer. Hang pads, or lay pads flat to dry.

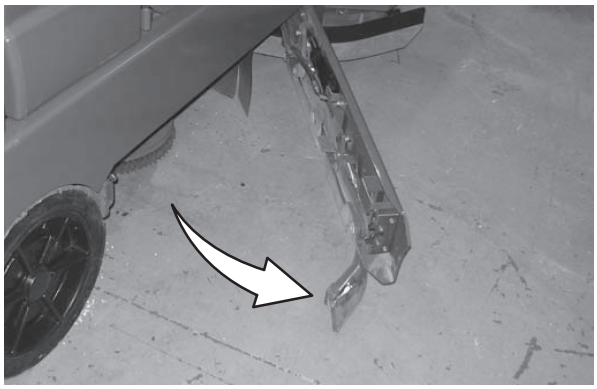
NOTE: Always replace brushes and pads in sets. Otherwise one brush or pad will be more aggressive than the other.

REPLACING DISK BRUSHES OR PAD DRIVER

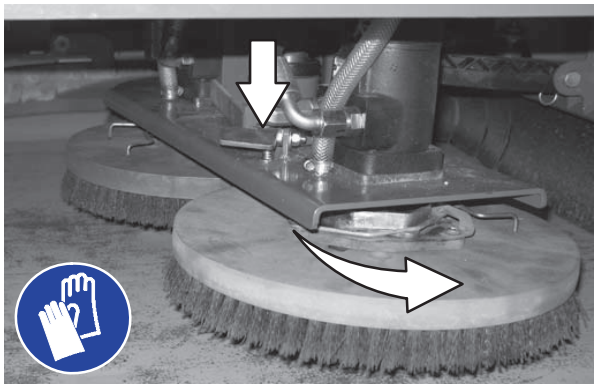
1. Raise the scrub head.

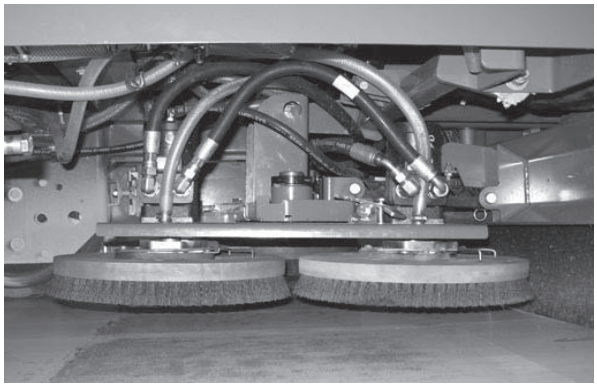
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine, and remove key.

2. Open the right outer brush door.



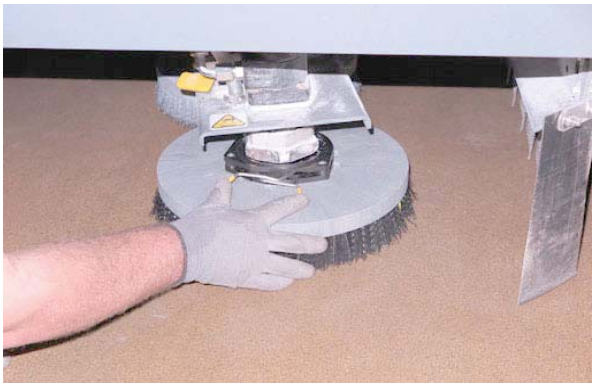
3. Hold down the release lever and rotate the adjustable disk brush head until it is possible to access the center brush.





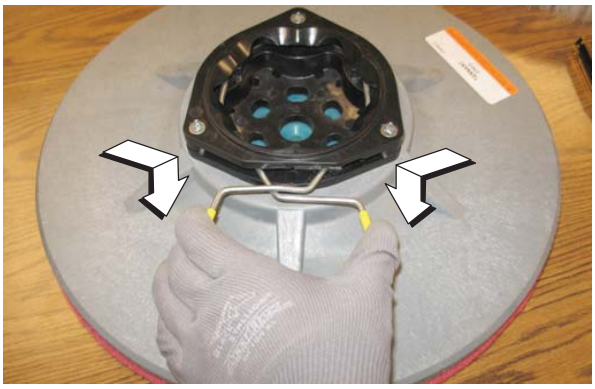
4. Turn the brushes until the spring handles are visible.

5. Squeeze the spring handles and let the brushes drop to the floor.



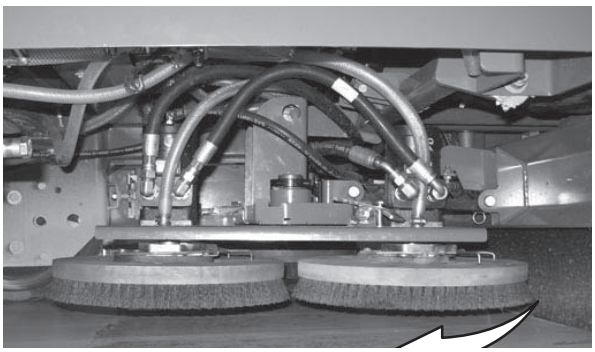
6. Remove the brushes from underneath the scrub head.

7. Set the brush spring open on the new brush to make installation easier.



8. Place the new brushes underneath the scrub head and lift each brush up onto the hub until the brush locks onto the hub.

9. Rotate the disk brush head back to the scrub position until the head locks into place.



10. Close the right outer brush door.

11. Open the left outer brush door and repeat the procedure for the left brush.

NOTE: The center brush can only be accessed from the right side of the machine.

REPLACING DISK PADS

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

1. Remove the pad driver from the machine.

2. Squeeze the spring clip together to remove the center disk.

3. Flip or replace the scrub pad, center the scrub pad on the pad driver. Then reinstall the center disk to secure the pad in place on the pad driver.

4. Reinsert the pad driver into the machine.

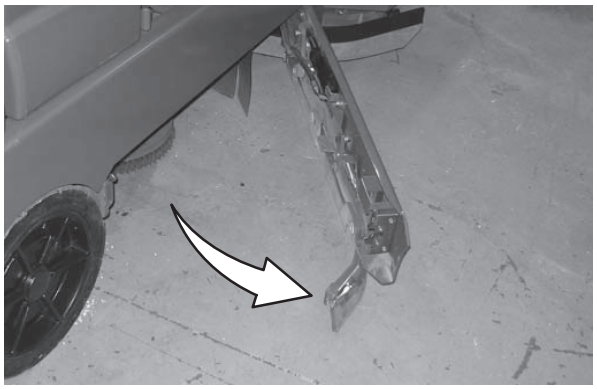
CHECKING THE DISK SCRUB HEAD STOP BUMPERS

The disk scrub head stop bumpers keep the scrub head parallel with the floor when in the raised position. This protects the brushes when transporting. Check the lift stop bumpers after every 100 hours of operation for wear or damage.

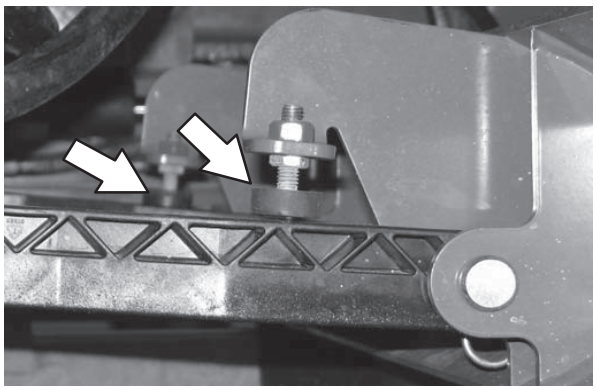
1. Raise the scrub head.

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

2. Open the right and left outer brush doors.



3. Inspect the scrub head stop bumpers. Adjust the bumpers if the scrub head is not parallel with the floor. Replace worn or damaged bumpers.



CYLINDRICAL BRUSHES

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

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

Replace the brushes when they no longer clean effectively.

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.

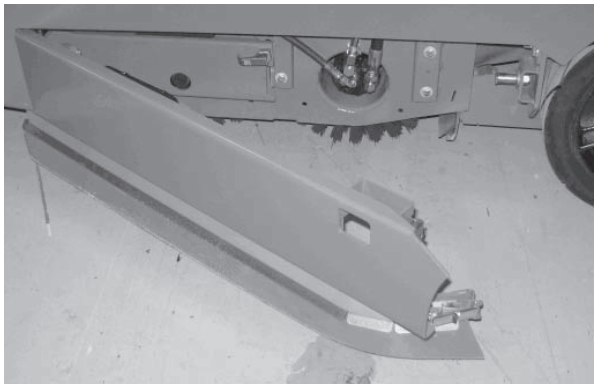
REPLACING OR ROTATING CYLINDRICAL BRUSHES

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.

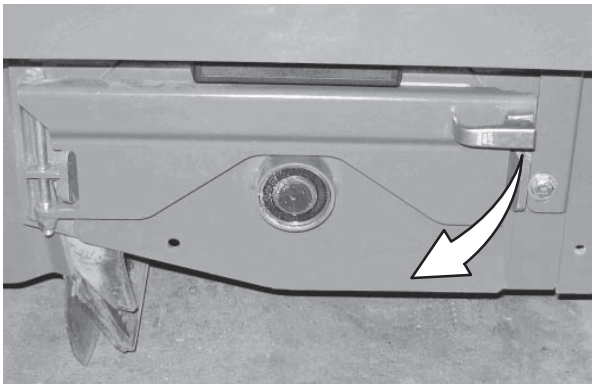
1. Raise the scrub head.

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

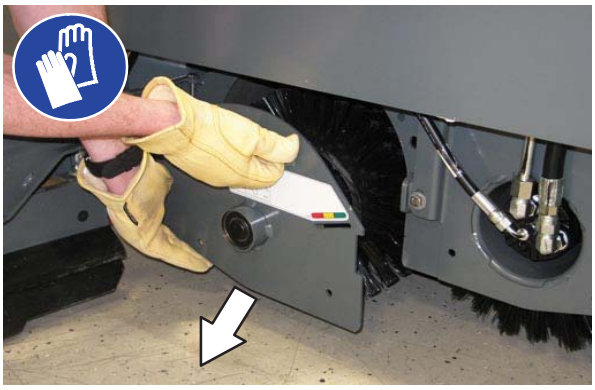
2. Open the outer brush doors.



3. Open the inner brush doors.



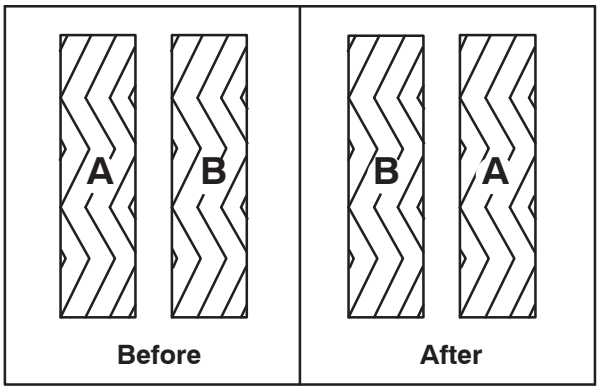
4. Remove the brush idler plates.



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 brushes, always rotate the front with the back so that they wear evenly. They may be rotated end–for–end as well.



8. Reinstall the brush idler plates.

9. Close the inner and outer brush doors.

10. Check the brush pattern and adjust if needed after rotating them. Refer to *CHECKING AND ADJUSTING THE MAIN BRUSH PATTERN*.

11. Check the brush pattern and adjust if needed after rotating them. Refer to *CHECKING CYLINDRICAL BRUSH PATTERN*.

CHECKING CYLINDRICAL 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.

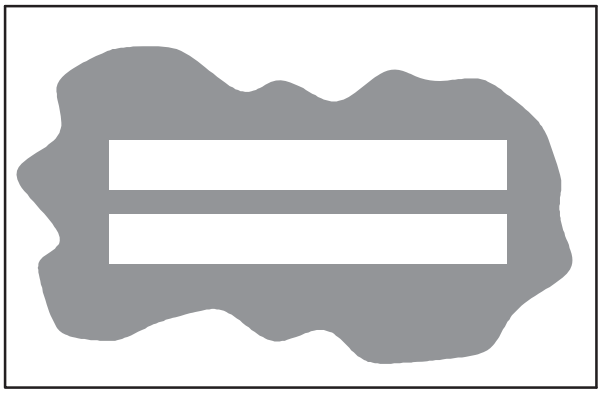
3. Set the parking brake.

4. Press the *1–STEP Scrub 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.

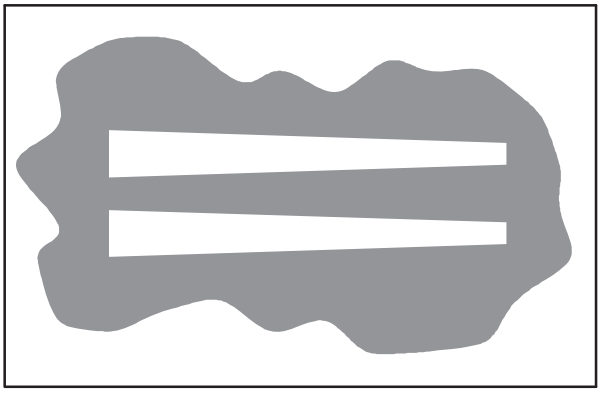
5. Raise the scrub head, release the parking brake, and drive the machine away from the chalked area.

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

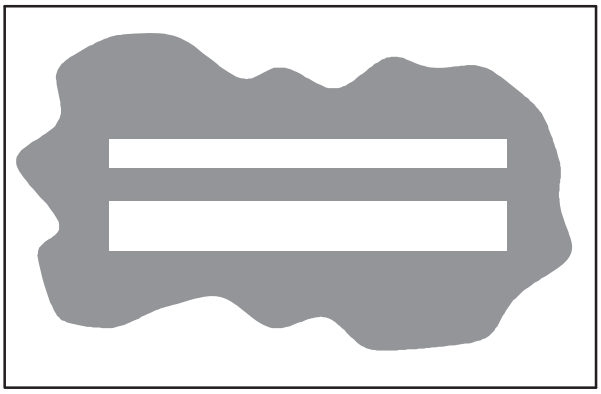
6. Observe the brush patterns. If the brush pattern is the same width across the entire length of each brush and both brushes are the same width, no adjustment is necessary.



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

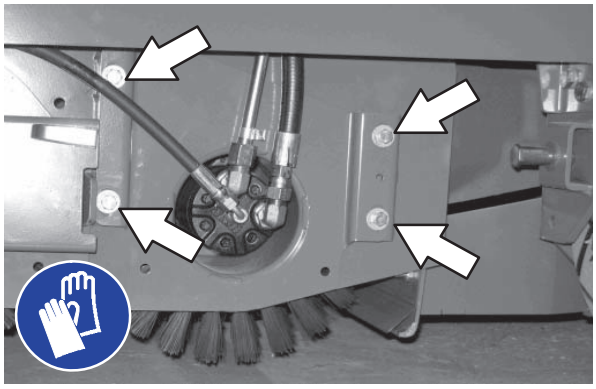


8. The brush patterns should be 50 to 75 mm (2 to 3 in) wide with the brushes in the lowered position and both patterns should be the same width. If the width of the brushes is not the same, see *ADJUSTING THE CYLINDRICAL BRUSH WIDTH* section of this manual.



ADJUSTING THE CYLINDRICAL 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.

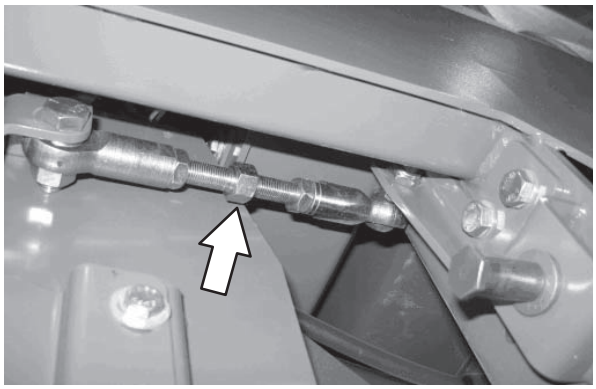
3. Tighten the mounting bolts.

4. Recheck the pattern. Readjust if necessary.

ADJUSTING THE CYLINDRICAL 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.

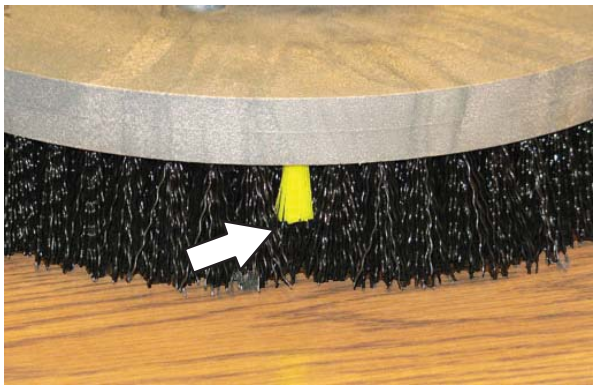
SIDE BRUSH (OPTION)

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

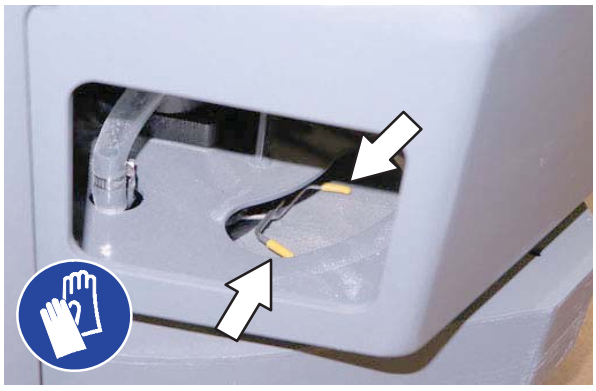
Check the side brush daily for wear or damage. Remove any tangled string or wire from the side brush or side brush drive hub.

REPLACING THE SIDE BRUSH

Replace the brush when it no longer cleans effectively or when the bristles are worn down to the yellow indicators.

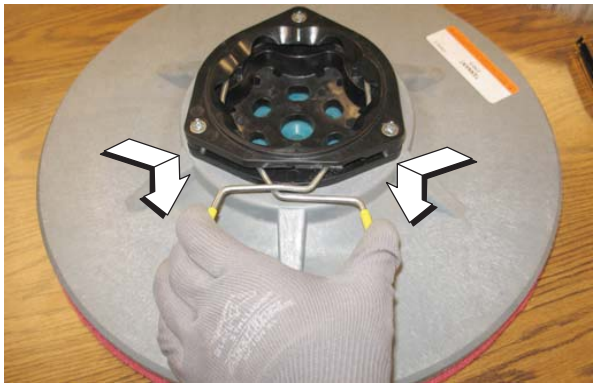


1. If necessary, raise the side brush.
2. Turn the brush until the spring handles are visible through the access hole in the side brush assembly.
3. Squeeze the spring handles and let the side brush drop to the floor.



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

5. Set the brush spring open on the new brush to make installation easier.



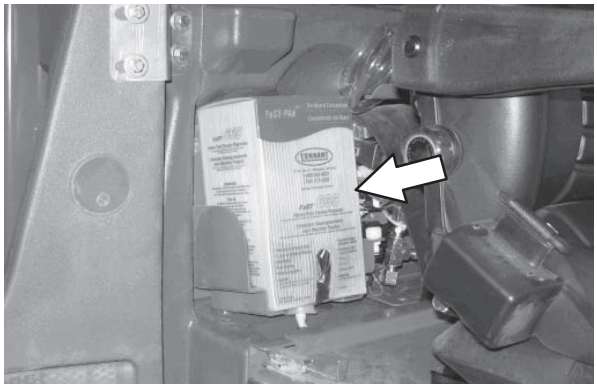
6. Place the new side brush underneath the side brush assembly and lift the side brush up onto the side brush hub until the brush locks onto the hub.

FaST SYSTEM

REPLACING THE FaST−PAK CARTON

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

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.



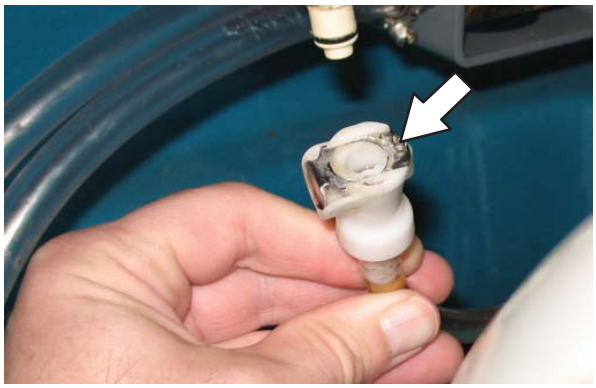
4. Remove the perforated knock outs from the new FaST−PAK carton. Do Not remove the bag from the carton. Pull out the hose connector located on the bottom of the bag and remove the hose cap from the connector.

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

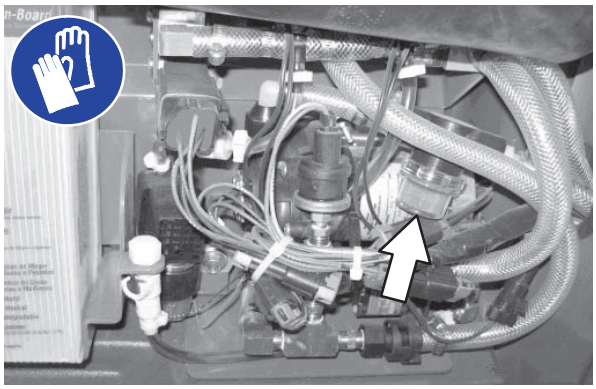
Soak the connector in warm water if detergent buildup is visible. When a FaST−PAK carton is not installed, store the supply hose connector on the storing plug to prevent the hose from clogging.



CLEANING THE FaST SYSTEM FILTER SCREEN

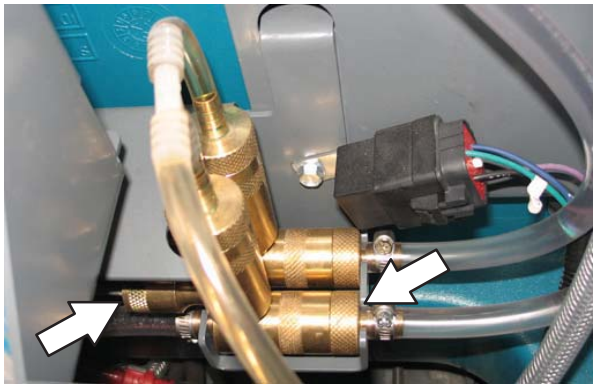
The FaST system filter screen filters water from the solution tank as the water flows into the FaST system.

Remove the filter screen bowl and clean the filter screen after every 50 hours of operation. Empty the solution tank before removing the filter.



REPLACING THE FaST SYSTEM FILTERS

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



ec–H2O MODULE FLUSH PROCEDURE

This procedure is only required when an alarm sounds and the *ec–H2O* system indicator light begins to blink red.

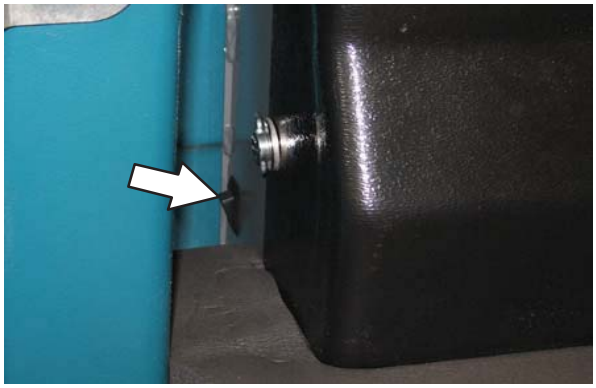
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine.

1. Remove both flush hoses from the storage bag located behind the operator seat.
2. Lock the operator seat cover open.
3. Disconnect the *ec–H2O* system intake hose from the solution supply hose and connect the intake flush hose (gray connector) to the *ec–H2O* system intake hose.

4. Disconnect the *ec–H2O* system outlet hose from the hose to the scrub head and connect the outlet flush hose (black connector) to the *ec–H2O* system outlet hose.

5. Place the *ec–H2O* system intake hose into a container containing 5 gallons (19 liters) of white or rice vinegar. Place the outlet hose into an empty bucket.

6. Turn the key to the on position without starting the engine.
7. Press and release the *ec–H2O module flush switch* to start the flush cycle.



NOTE: The module will automatically shut off when the flush cycle is complete (approx. 7 minutes). The module must run the full 7 minute cycle in order to reset the system indicator light and alarm.

8. After the 7 minute flush cycle, remove the siphon hose from the container of vinegar and place the siphon hose into a container of cool clean water. Press the flush switch again to rinse out any remaining vinegar from the module. After 1–2 minutes, press the flush switch to turn off the module.

9. Disconnect the flush hoses from the *ec–H2O* system intake hose and outlet hose and return the flush hoses to the storage bag.

10. Reconnect *ec–H2O* intake and outlet hoses. If the *ec–H2O* system indicator light continues to flash, repeat the flush procedure. If the problem persists, contact an Authorized Service Center.

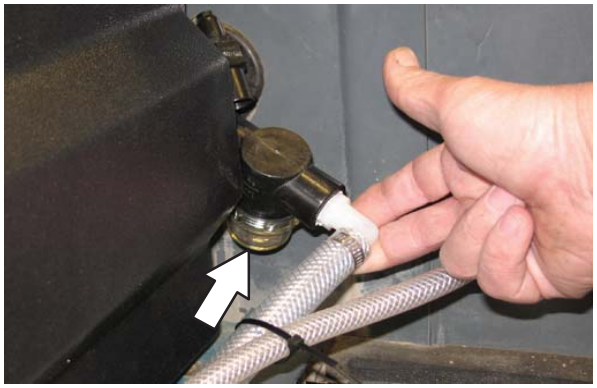
11. Insert the outlet and intake hoses between the *ec–H2O* assembly and the bracket.

NOTE: The outlet and intake hoses must be down between the ec–H2O assembly and the bracket so they are not pinched or damaged when the operator seat cover is closed.

12. Close the operator seat cover.

CLEANING THE *ec–H2O* FILTER SCREEN

Remove and clean the *ec–H2O* filter screen after every 50 hours of operation.



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.

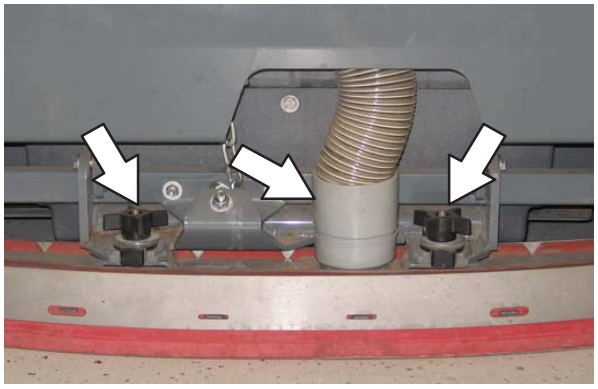
Check the deflection of the squeegee blades daily or when scrubbing a different type of surface. Check the leveling of the rear squeegee every 100 hours of operation.

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.

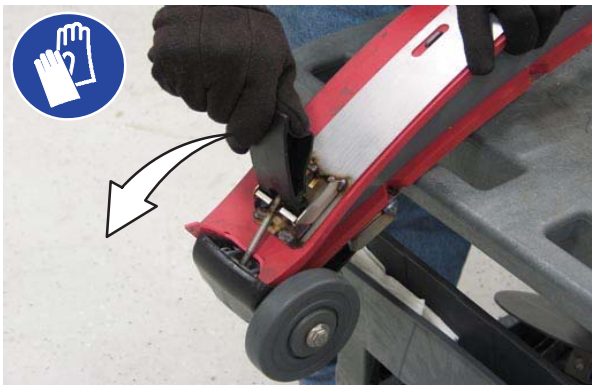


3. Remove both mounting knobs from the rear squeegee assembly.

4. Turn on the machine, raise the scrub head, and turn off the machine.

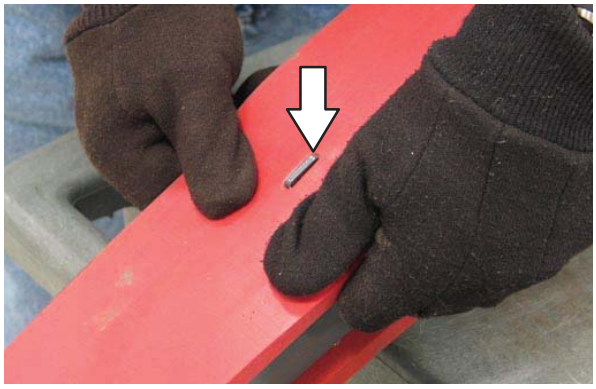
5. Remove the rear squeegee assembly from the machine.

6. Loosen the rear retaining band tension latch and open the retaining band.

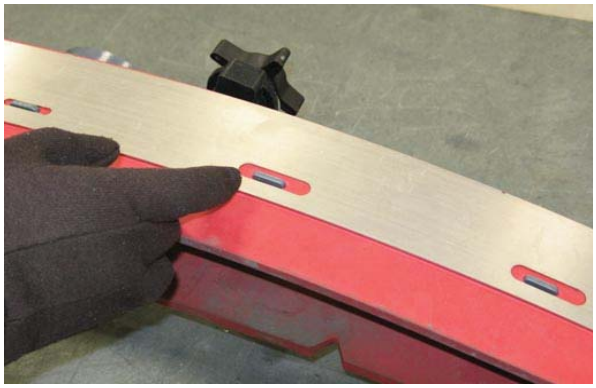


7. Remove the rear squeegee.

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.



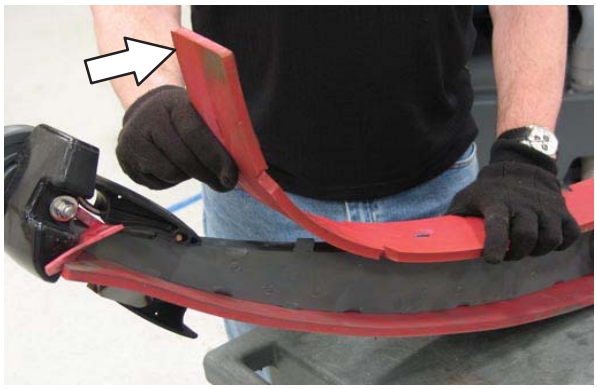
9. Reinstall the rear retaining band aligning the tabs with the holes.



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.

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.

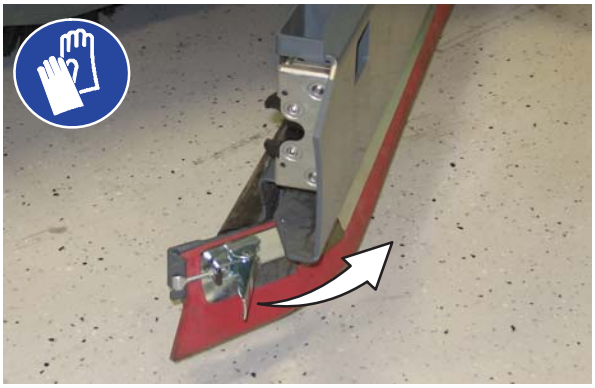
REPLACING OR ROTATING THE SIDE SQUEEGEE BLADES

1. If necessary, raise the scrub head.

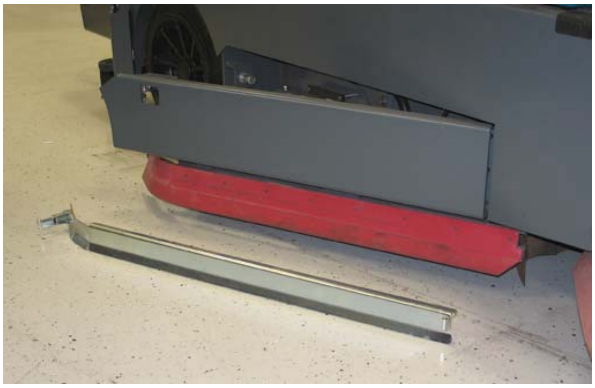
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine, and remove key.

2. Open the outer brush doors.

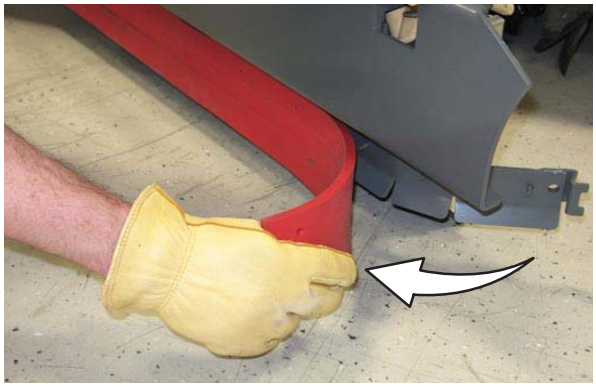
3. Unhook the latch on the side squeegee retaining band from the side squeegee assembly.



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



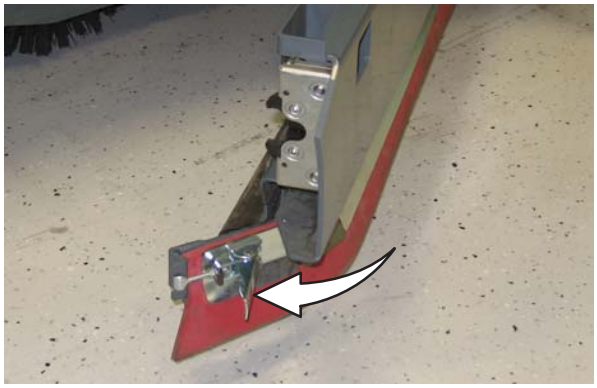
5. Remove the side squeegee blade. If the outer edge of the squeegee blade is not worn, rotate the squeegee blade with the blade from the other side of the machine. Discard the squeegee blade if both edges are worn.



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.



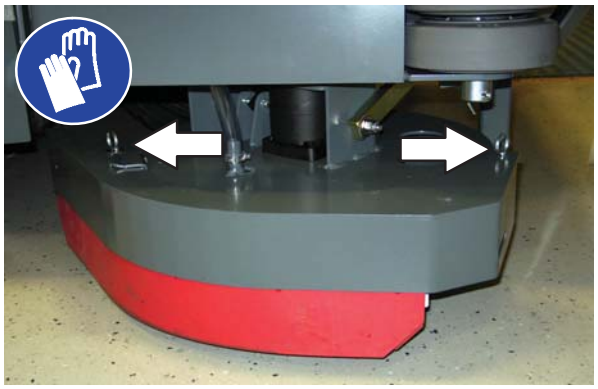
9. Close the outer brush door.

REPLACING OR ADJUSTING THE SIDE BRUSH SQUEEGEE BLADE (OPTION)

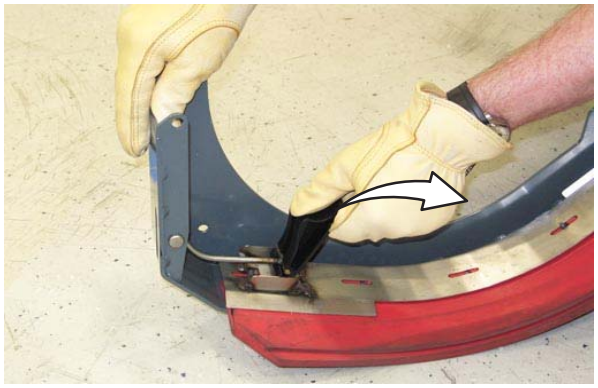
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, turn off machine, and remove key.

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.

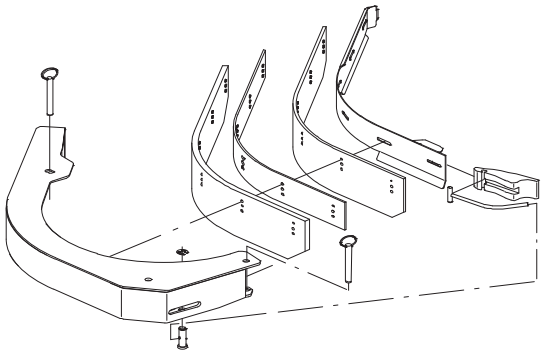
1. Lower the scrub head.
2. Pull the pins and remove the squeegee bumper.



3. Open the retaining band tension latch.

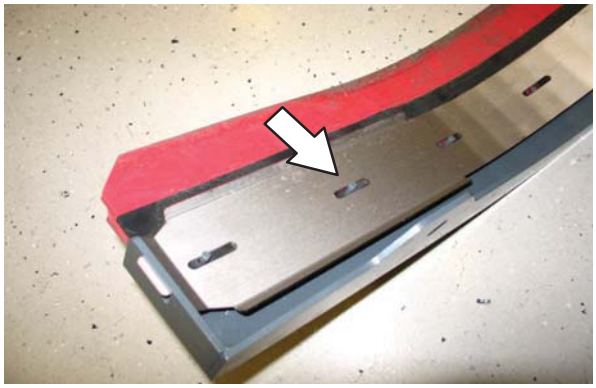


4. Remove the squeegees, spacer, and retainer from the squeegee bumper.



NOTE: The side brush squeegee blades have different holes for changing height adjustment.

5. Reinstall the squeegees, spacer, and retainer to the squeegee bumper by aligning the appropriate holes to the pins on the bumper.



6. Reinstall the retaining band tension latch.
7. Reinstall the squeegee bumper and reinsert the pins.

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.

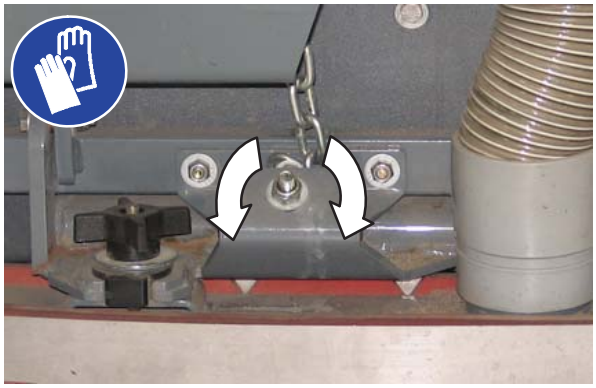
1. Lower the squeegee and drive the machine forward a few meters (feet).

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

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

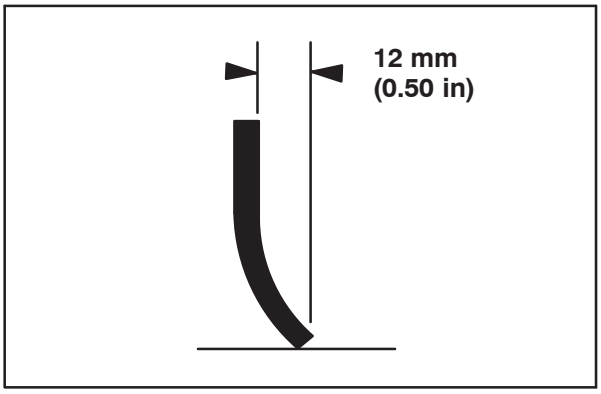
Deflection is the amount of curl the overall squeegee blade has when the machine moves forward. The best deflection is when the squeegee wipes the floor dry with a minimal amount of deflection.

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

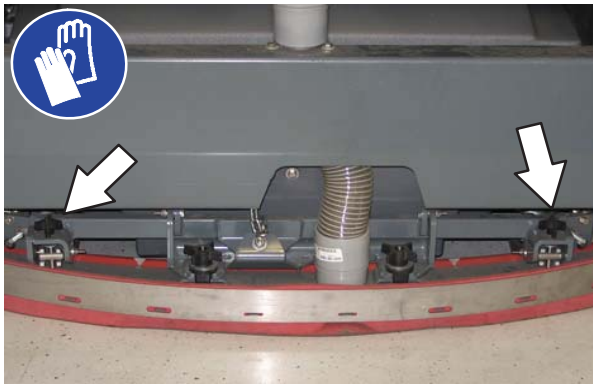
1. Lower the squeegee and drive the machine forward a few meters (feet).

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

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.

SKIRTS AND SEALS

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

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.

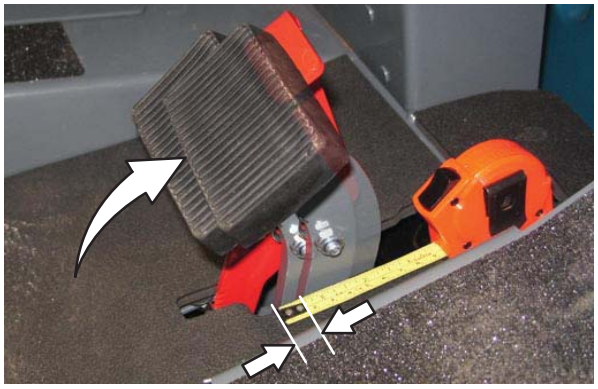
BRAKES AND TIRES

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.

To check the brake adjustment, measure the distance from the stationary brake pedal to the point where there is resistance in the pedal movement. The distance must be between 6 mm (0.25 in) and 19 mm (0.75 in). Adjust the brakes if required.

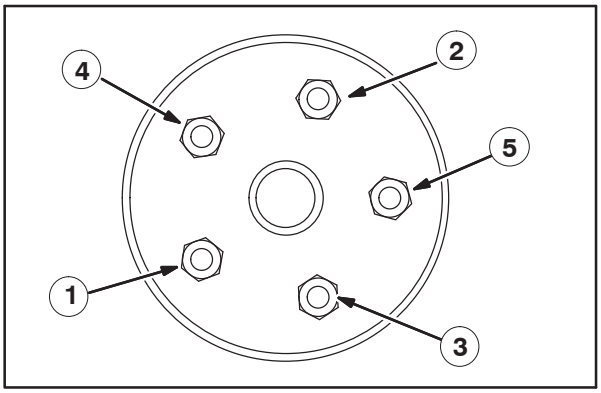


TIRES

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

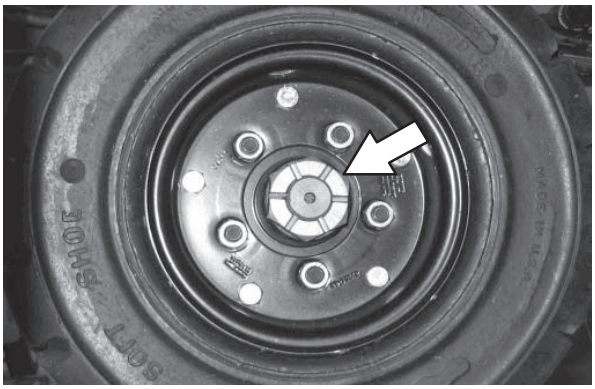
FRONT WHEEL

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.



PUSHING, TOWING, AND TRANSPORTING THE MACHINE

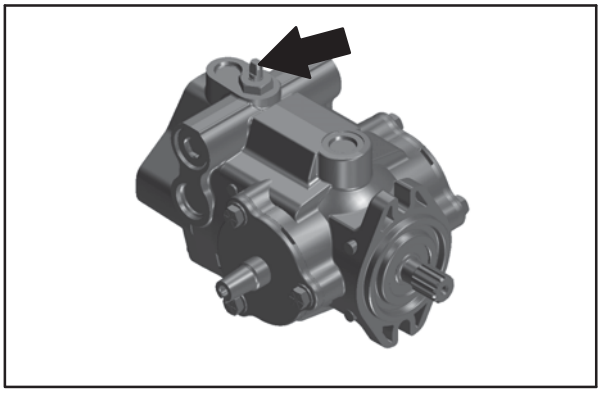
PUSHING OR TOWING THE MACHINE

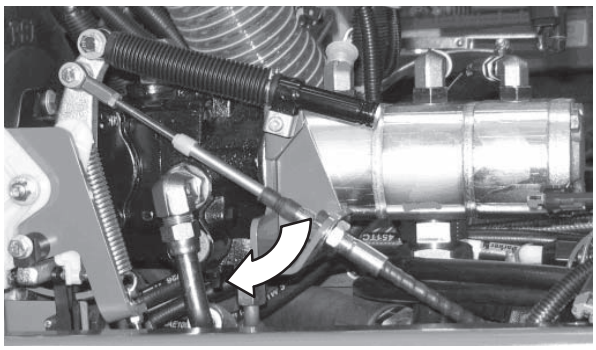
If the machine becomes disabled, it can be pushed from the front or rear, but only towed from the front.

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

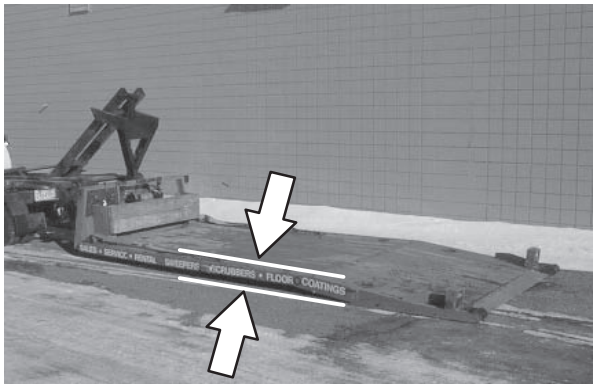
1. Raise the squeegee, scrub head, and brushes.

FOR SAFETY: When loading machine onto truck or trailer, drain tanks before loading machine.

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

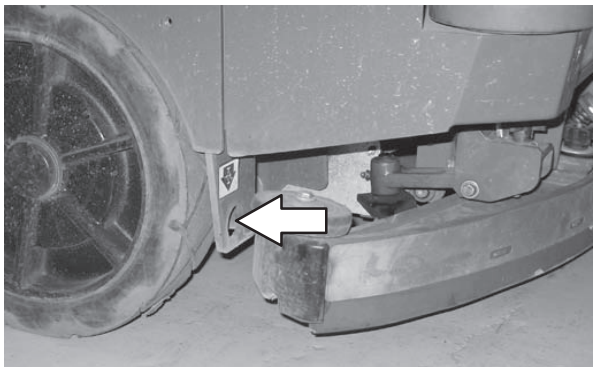
3. If the loading surface is not horizontal or is higher than 380 mm (15 in) from the ground, use a winch to load machine.

   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.



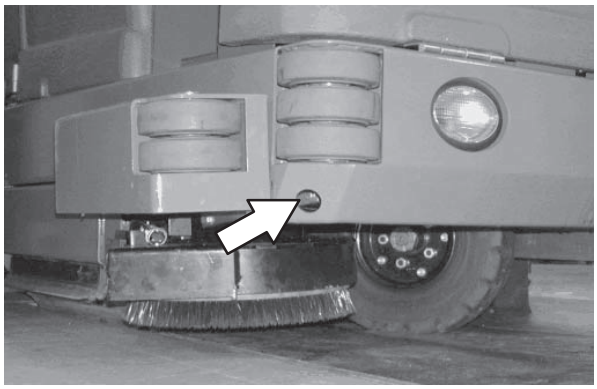
5. Position the machine as close to the front of the trailer or truck as possible.

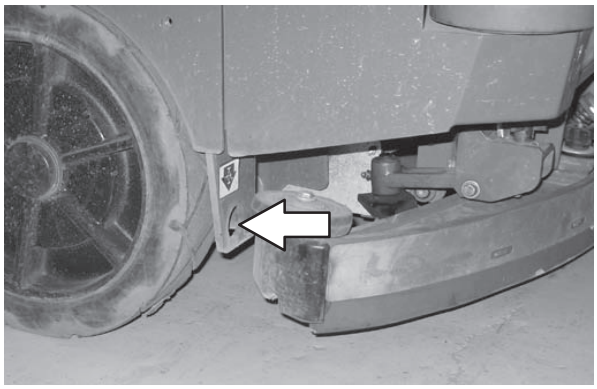
6. Set the parking brake and place a block behind each wheel to prevent the machine from rolling.

7. Lower the scrub head.

FOR SAFETY: When loading/unloading machine onto/off truck or trailer, lower scrub head and squeegee before tying down machine.

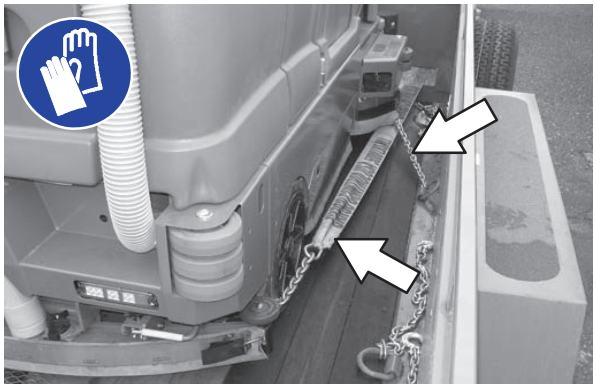
8. Connect the tie−down straps to the holes in the right and left lower corners in front of the machine and the holes in the rear jacking brackets behind the rear tires.





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.

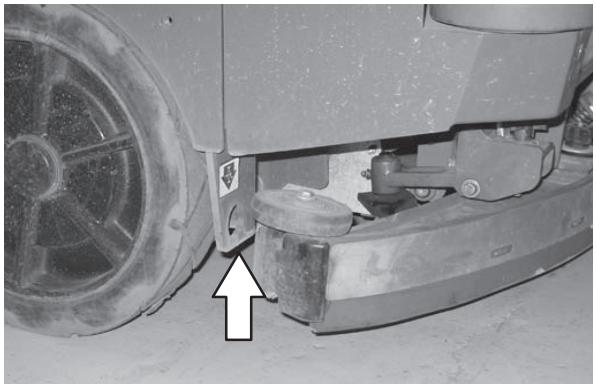
    If the loading surface is horizontal AND is 380 mm (15 in) or less from the ground, the machine may be driven off the truck or trailer.

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.

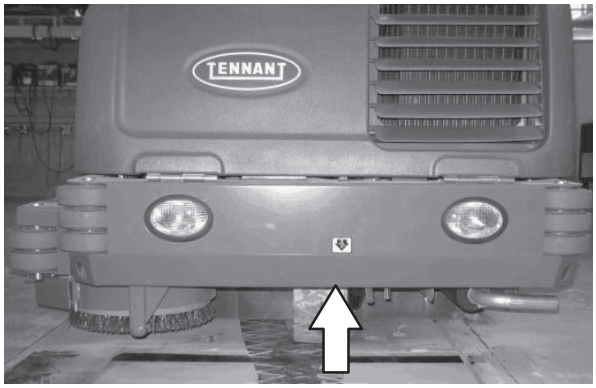
MACHINE JACKING

Empty the debris tray, 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, set parking brake, turn off machine, and remove key.

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 (MACHINES WITHOUT ec–H2O SYSTEM)

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 Propylene Glycol Based / Recreational Vehicle (RV) Antifreeze into the solution tank.
3. Turn the key to the on position **(without starting the machine)**.
4. Press the *scrubbing main brush button*.
5. Press the *1–STEP button*.
6. Repeatedly press the *Solution increase button (+)* until the solution flow is at the highest setting.
7. Press the *directional pedal* to circulate the RV antifreeze completely through the system.
8. Press the *1–STEP Scrub button* to turn off the system.
9. **Machines equipped with the optional spray nozzle only:** Turn on the pump until RV antifreeze solution sprays from the nozzle.
10. Turn the key to the off position.
11. 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.

FREEZE PROTECTION (MACHINES WITH ec–H2O SYSTEM)

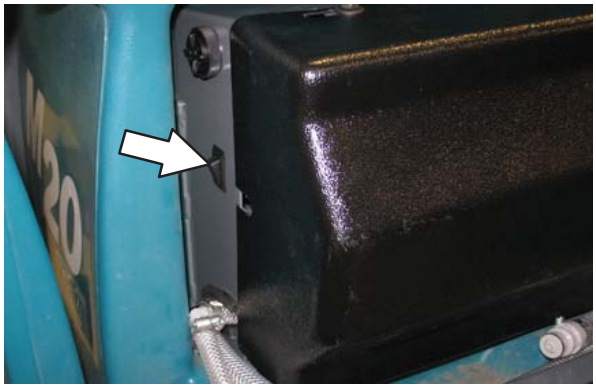
FOR SAFETY: Before leaving or servicing machine, stop on level surface, set parking brake, and turn off machine.

1. Empty the solution tank and recovery tank.
2. Remove the intake flush hose and from the storage bag behind the operator seat.
3. Disconnect the *ec–H2O* system intake hose from the solution supply hose and connect the intake flush hose (gray connector) to the *ec–H2O* system intake hose.

4. Pull the drain tube from the between the ec–H2O unit and the operator compartment, remove the cap from the tube, and place the end of the tube into an empty container. Set the cap aside.

5. Turn the key to the on position **(without starting the machine)**.

6. Press and release the *ec–H2O* module flush switch. Allow the system to drain water into the container for 2 minutes.



7. Press the *ec–H2O* module flush switch to shut off the system.

8. Disconnect the *ec–H2O* system outlet hose from the hose to the scrub head.

9. Blow pressurized air (less than 344 kPa (50 psi)) into the *ec–H2O* system outlet hose. Continue blowing compressed air into the outlet hose until water no longer drains from the drain tube

10. Reinstall the cap onto the drain tube and insert the tube back between the ec–H2O module and the operator compartment.

11. Reconnect the *ec–H2O* system intake hose to the solution supply hose and the *ec–H2O* system outlet hose to the hose to the scrub head.

12. Insert the intake and outlet hoses down between the ec–H2O assembly and the bracket.

13. Return the intake flush hose to the storage bag behind the operator seat.

PRIMING THE *ec–H2O* SYSTEM

Prime the ec–H2O system if the machine has been stored for a long period without water in the solution tank / *ec–H2O* system.

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

1. Fill the solution tank with clean cool water. See *FILLING THE SOLUTION TANK* section of this manual.

2. Remove the outlet flush hose (black connector) from the storage bag behind the operator seat.

3. Disconnect the *ec–H2O* system outlet hose from the hose to the scrub head and connect the outlet flush hose to the *ec–H2O* system outlet hose.

4. Place the *ec–H2O* system outlet hose into an empty container.

5. Turn the key to the on position **(without starting the machine)**.

6. Press and release the *ec–H2O* module flush switch. Allow the system to drain water into the container for 2 minutes.

7. Press the *ec–H2O* module flush switch to shut off the system.

8. Disconnect the outlet flush hose from the *ec–H2O* system outlet hose and return the flush hose to the storage bag.

9. Reconnect the ec–H2O system outlet hose to the hose to the scrub head.

ELECTRICAL TROUBLESHOOTING

T20

ELECTRICAL

Troubleshooting Information

BEFORE CONDUCTING TESTS:

E

***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*.**

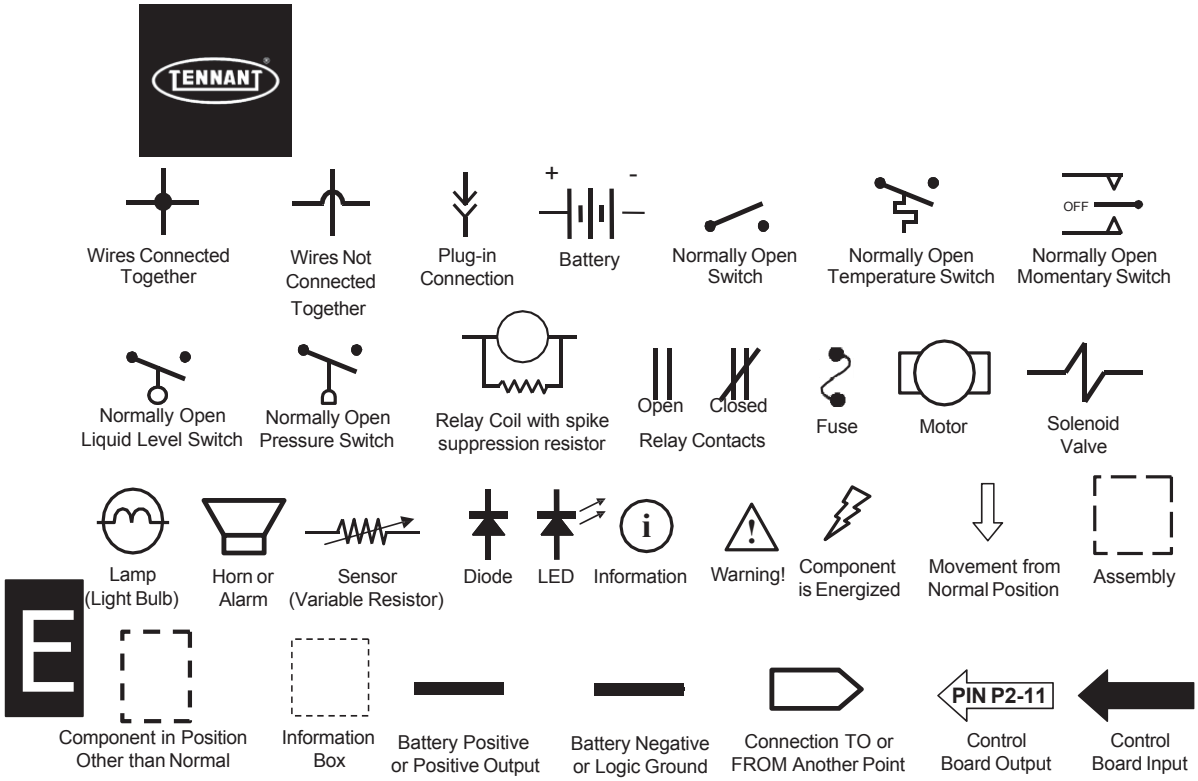
*** Always dis-connect Battery when removing or replacing components.**

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.

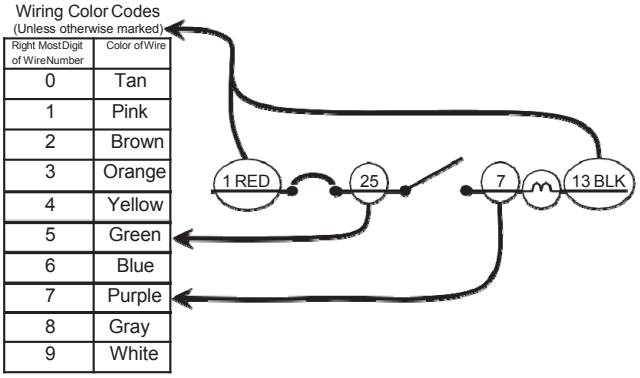
Schematic Symbols Used In This Manual



Terms & Abbreviations

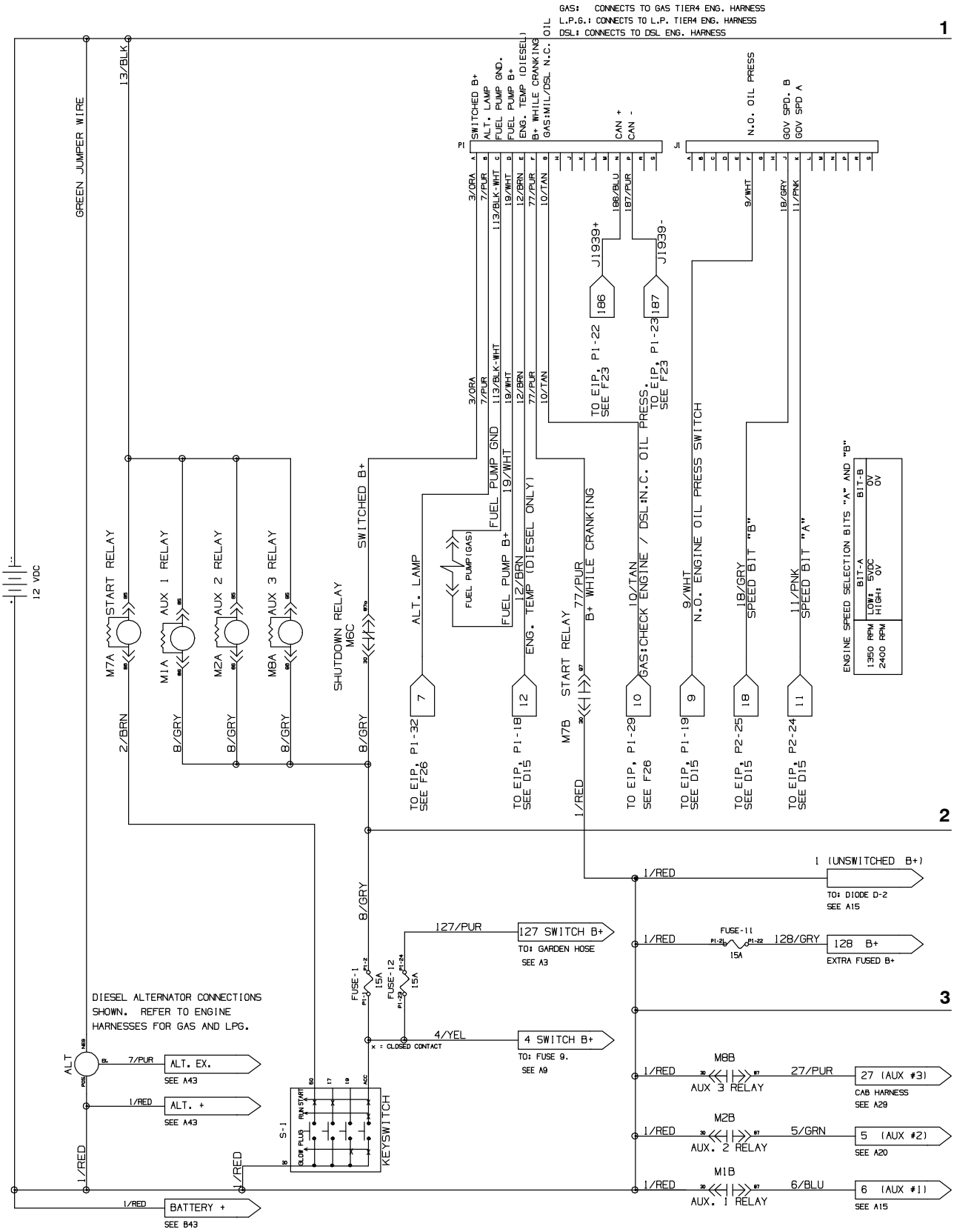
ECM – Engine Control Module
LED – Light Emitting Diode
MIL – Malfunction Indicator Lamp
PWM – Pulse Width Modulation (A method of using controlled on/off times to regulate the voltage and current supplied to an electrical device)
SV – Solenoid Valve
SW – Switch

Example of Wiring Numbers & Colors:



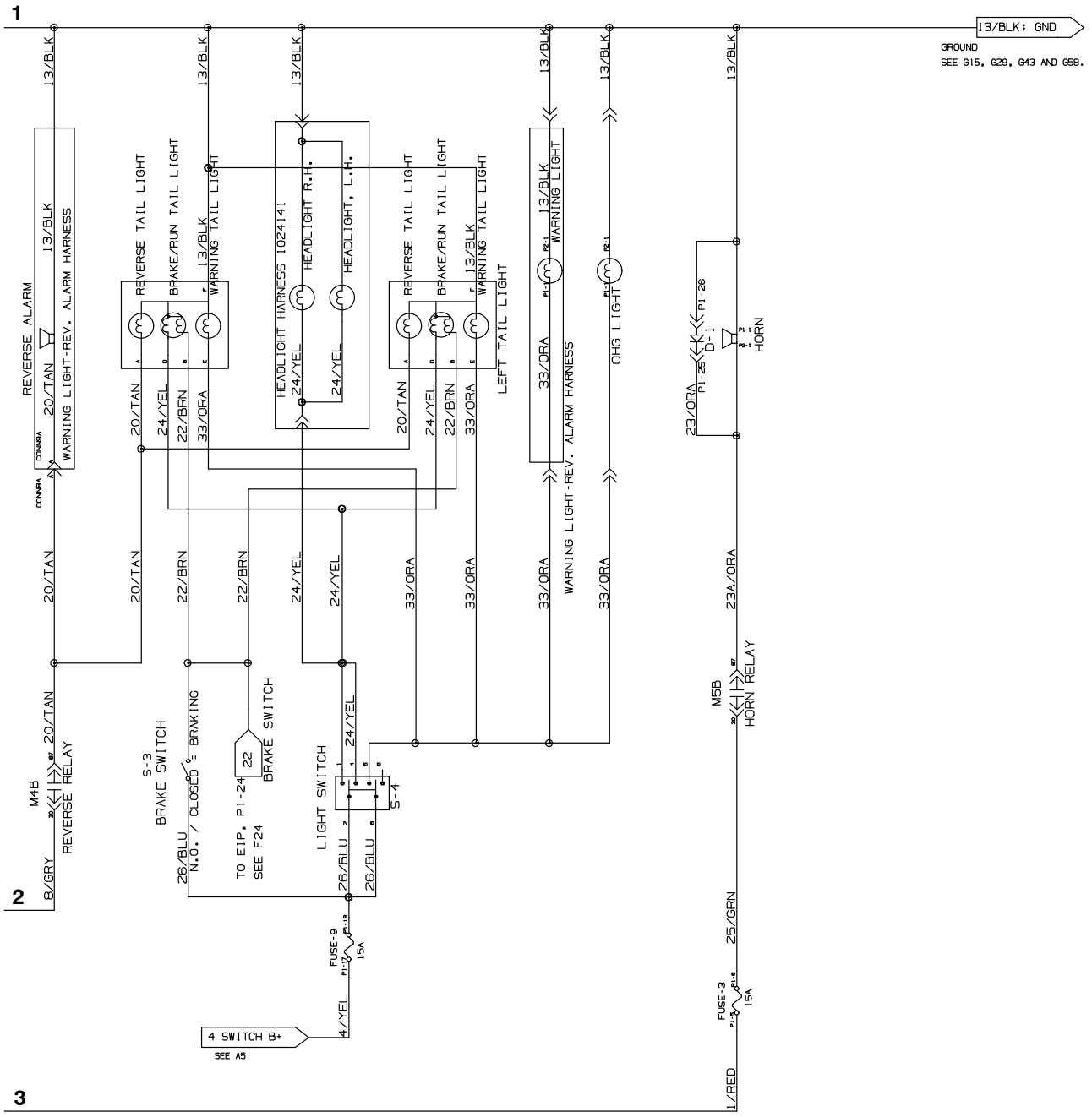
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

MACHINE ELECTRICAL SCHEMATIC



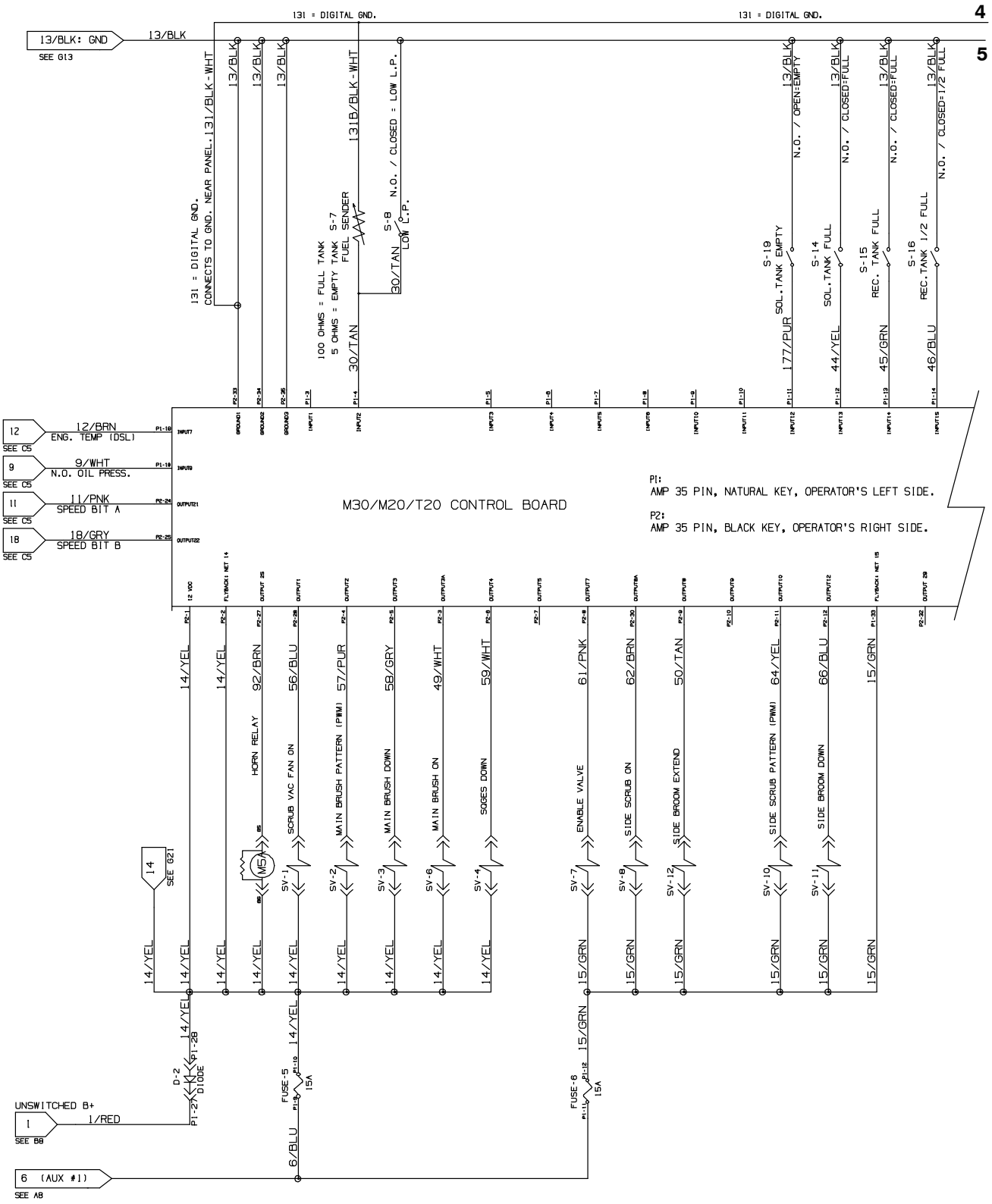
1075421 – 356681 – T20

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



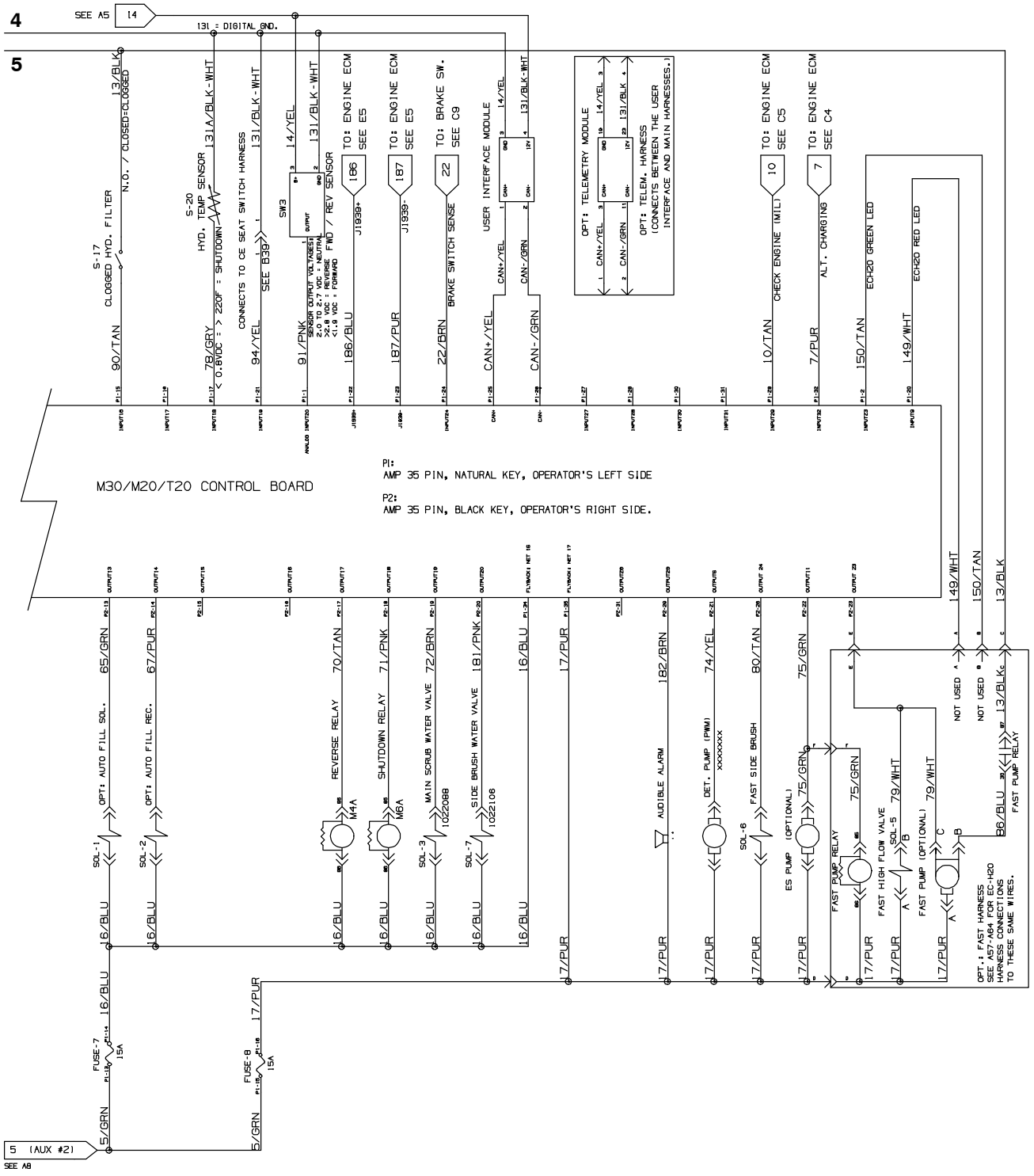
1075421 – 356681 – T20

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



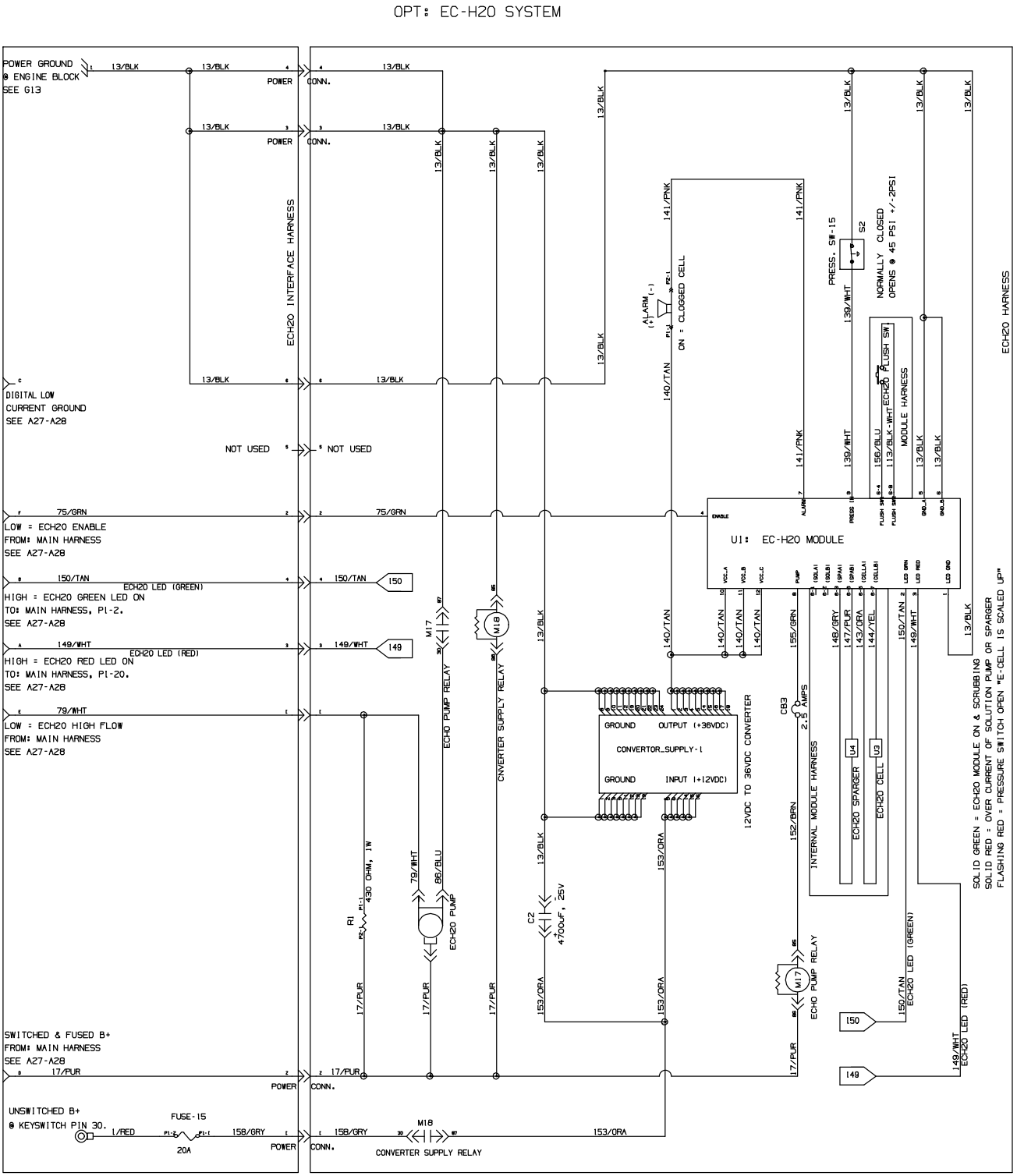
1075421 – 356681 – T20

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



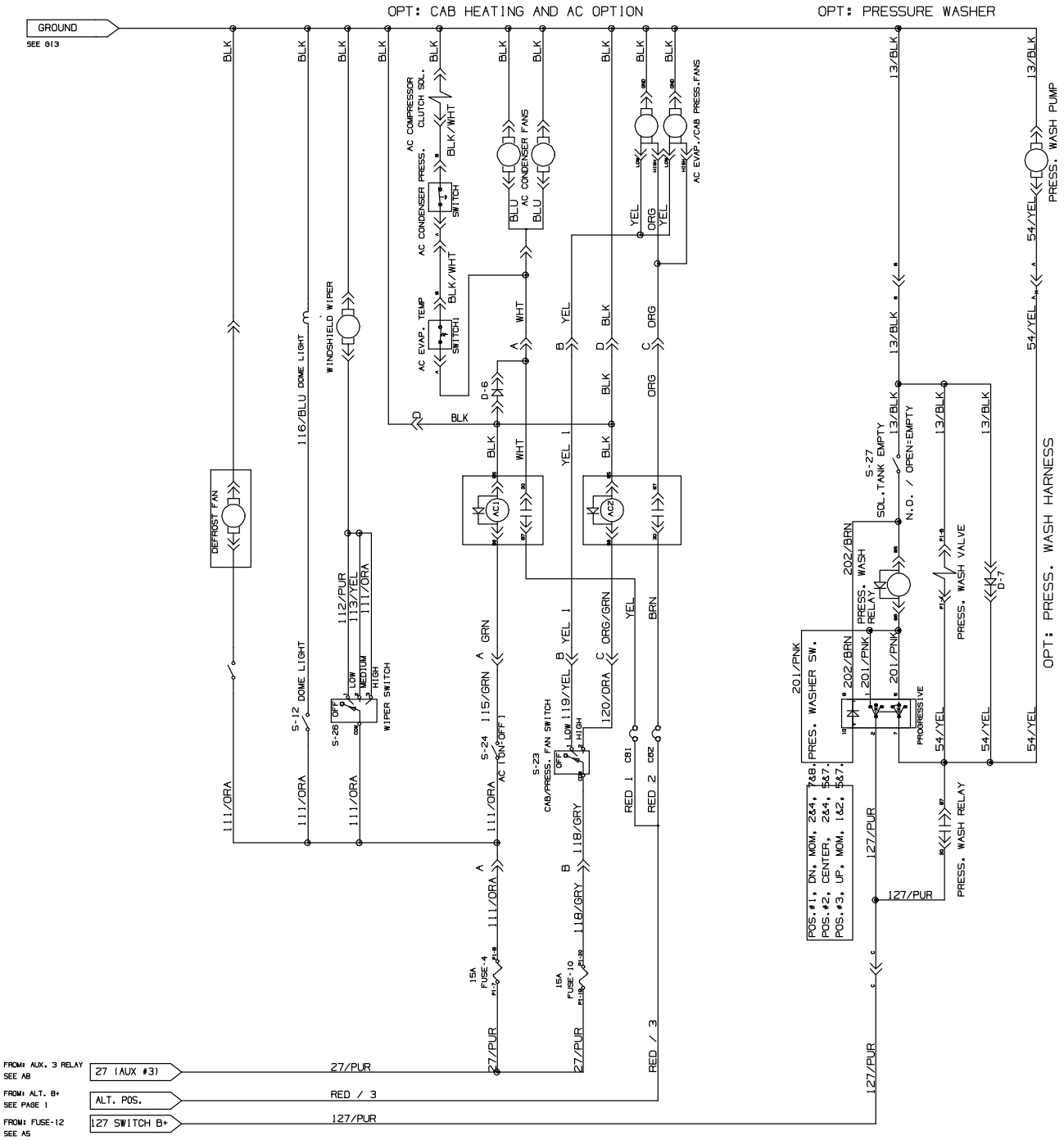
1075421 – 356681 – T20

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



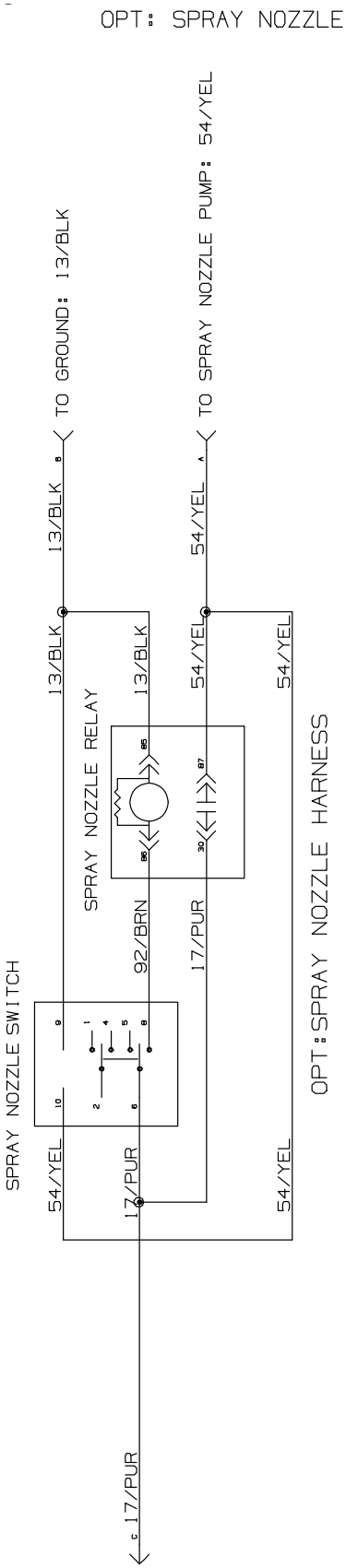
1075421 – 356681 – T20

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



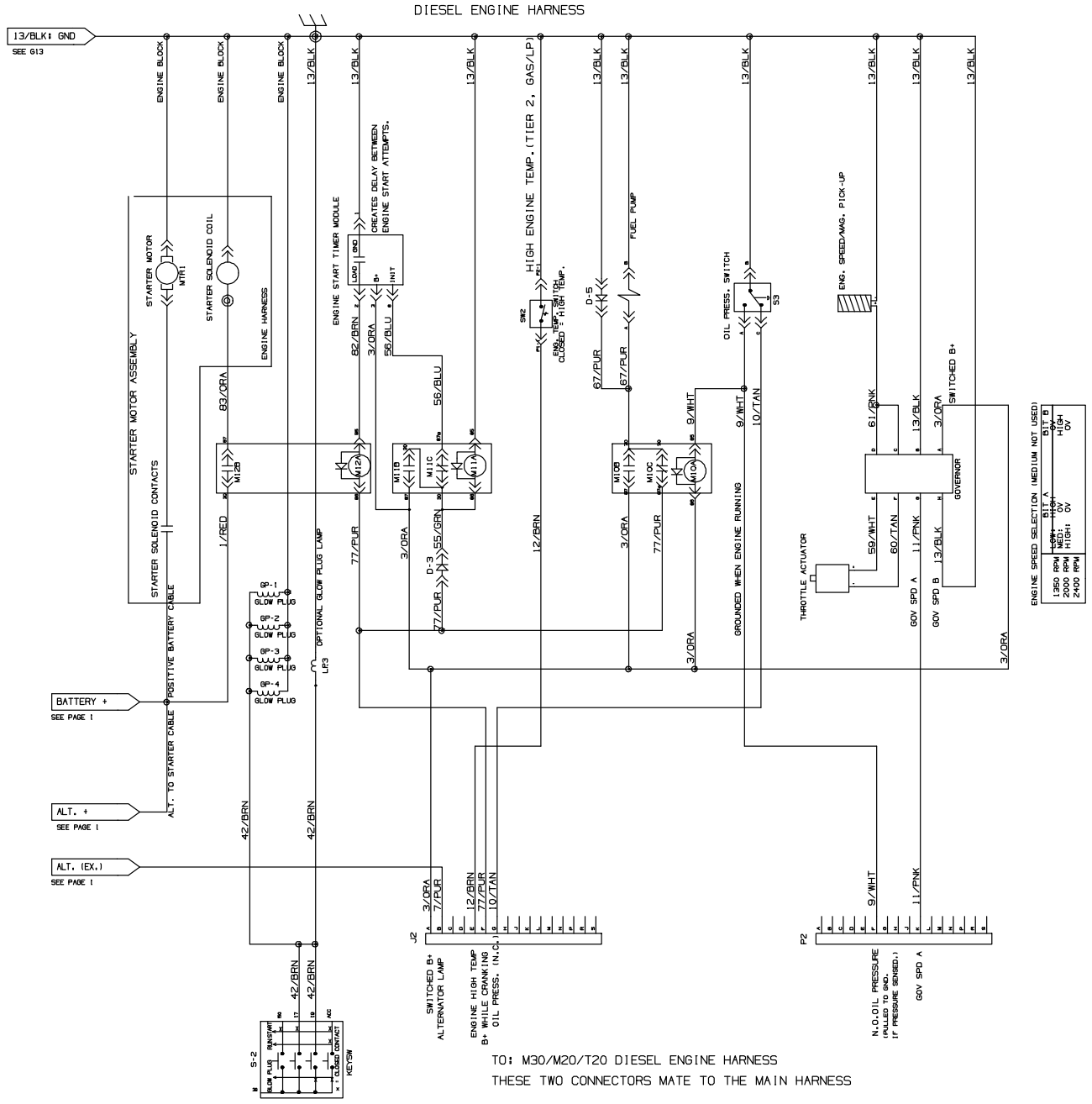
1075420 – 356680

MACHINE ELECTRICAL SCHEMATIC (CONTINUED)



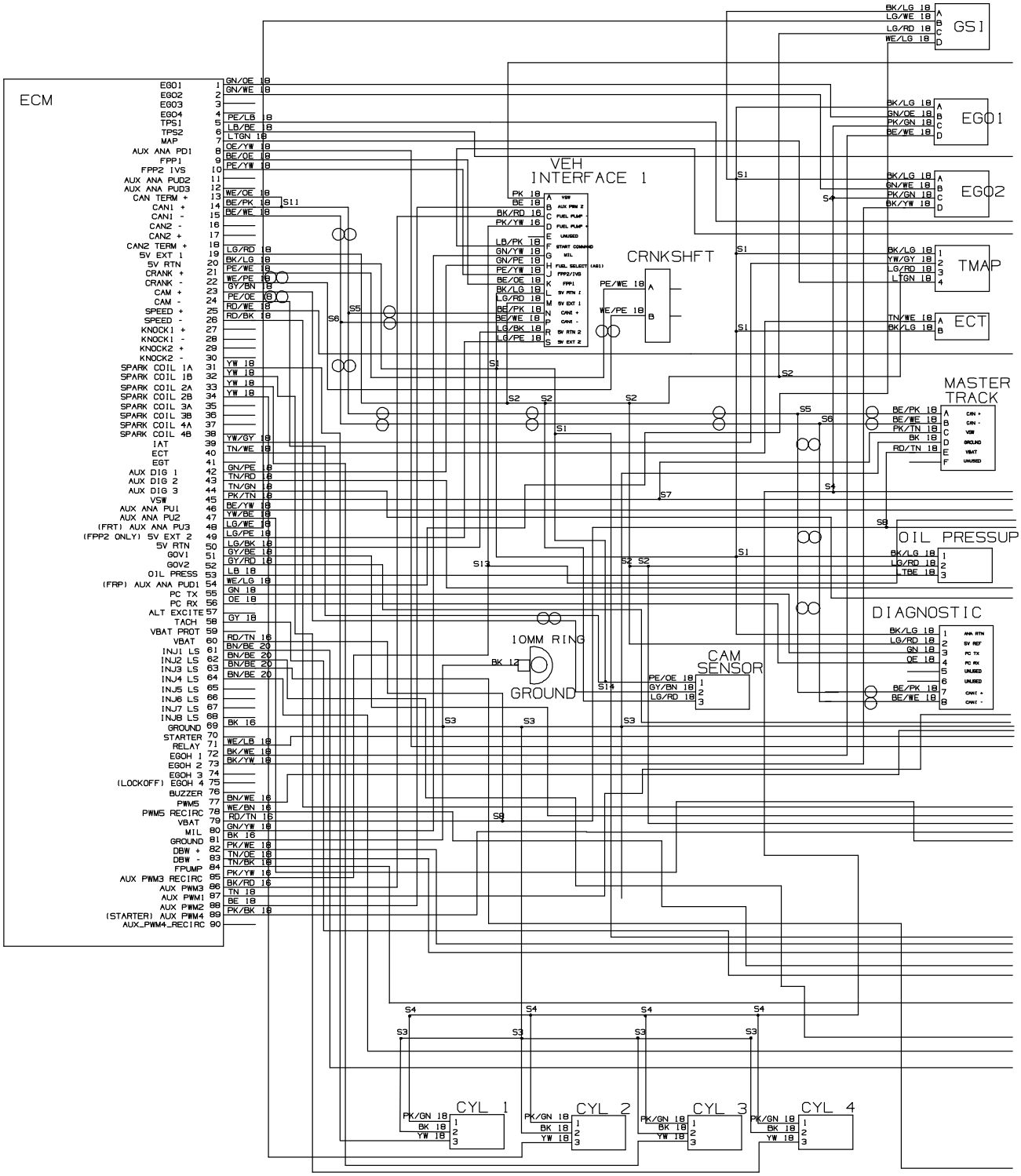
1075421 – 356681 – T20

DIESEL ENGINE HARNESS ELECTRICAL SCHEMATIC



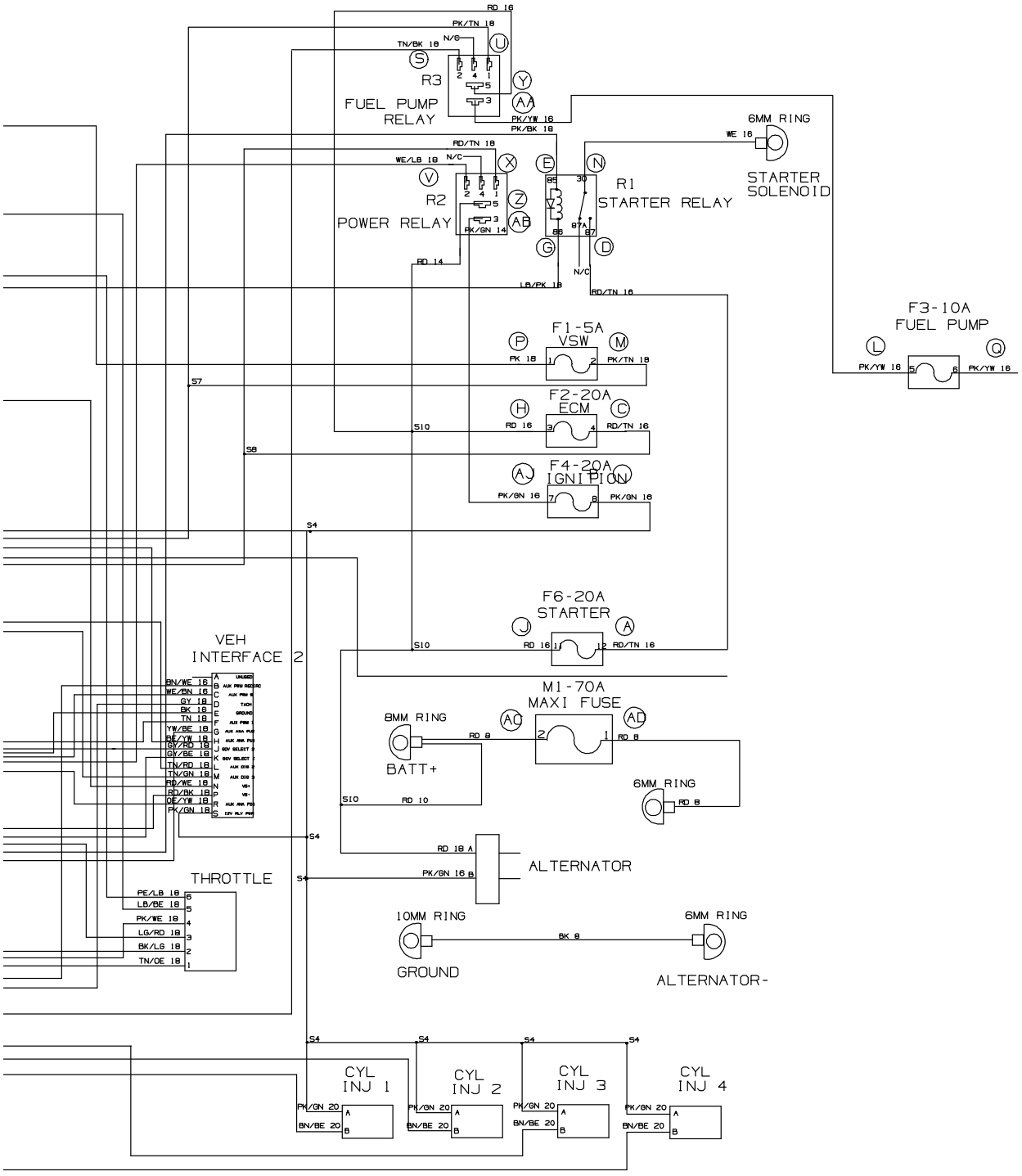
1075420 – 356680

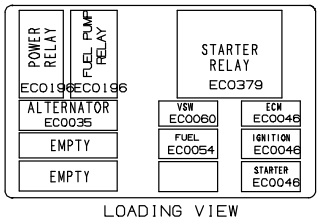
GAS ENGINE HARNESS ELECTRICAL SCHEMATIC (MITSUBISHI)



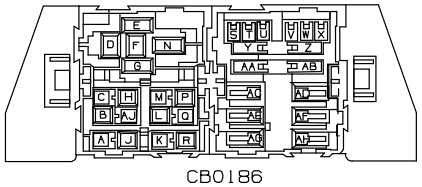
1071653– 356303

GAS ENGINE HARNESS ELECTRICAL SCHEMATIC (MITSUBISHI) (CONTINUED)





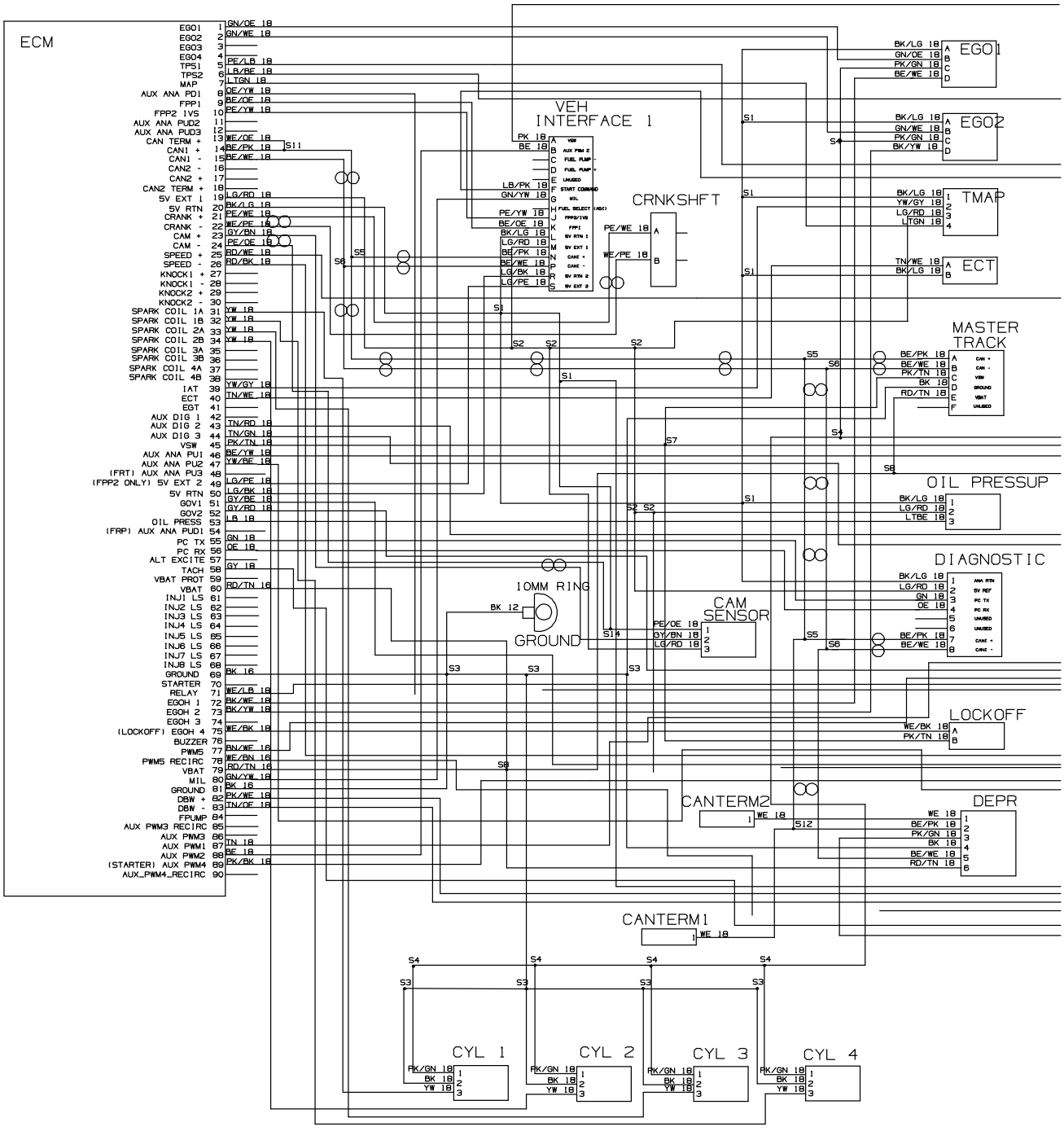
LOADING VIEW



CB0186
WIRE INSERTION VIEW

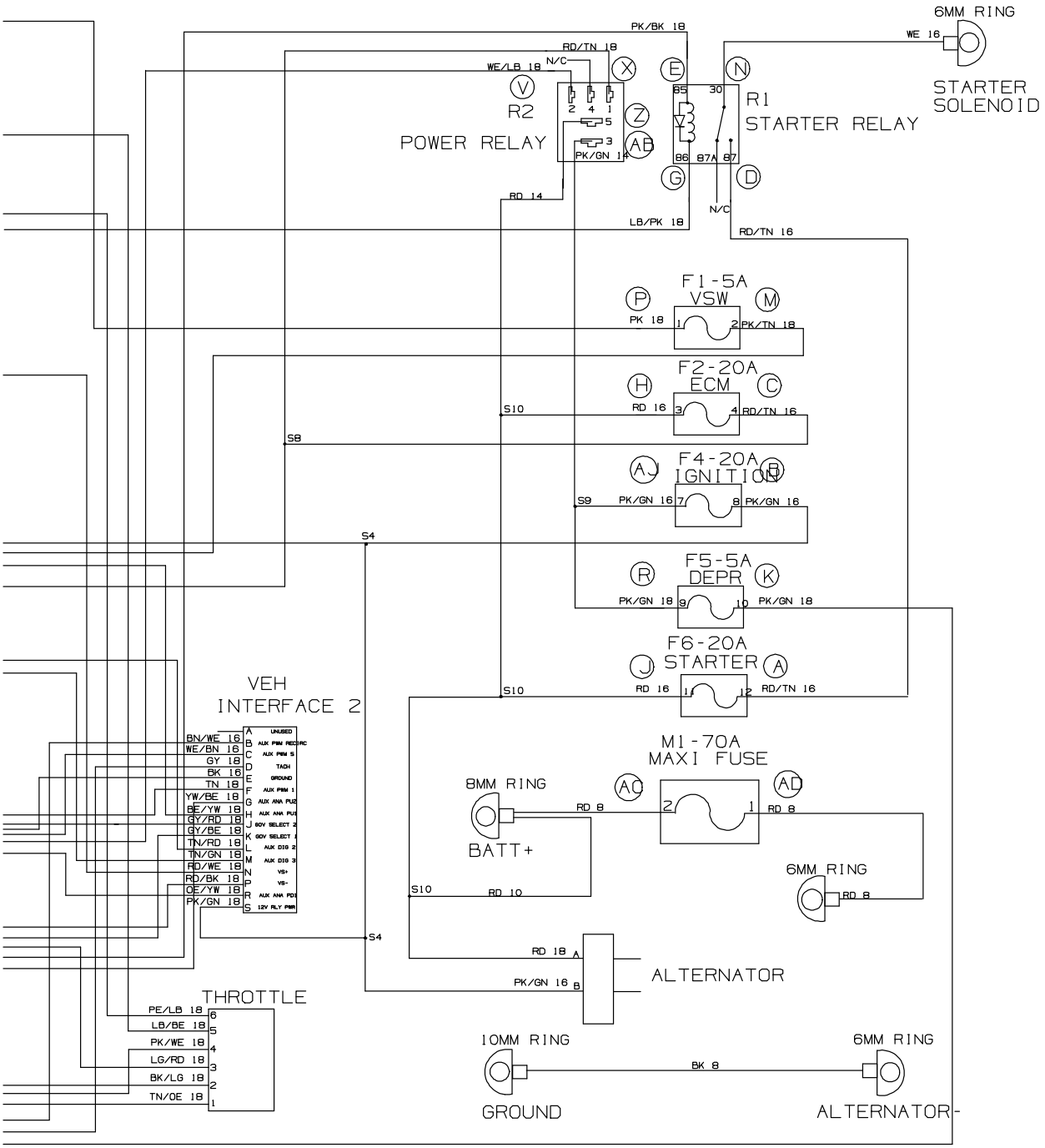
1071653– 356303

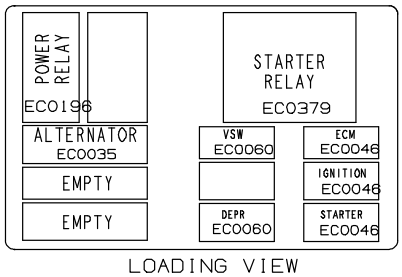
LPG ENGINE HARNESS ELECTRICAL SCHEMATIC (MITSUBISHI)



1071654– 356304

LPG ENGINE HARNESS ELECTRICAL SCHEMATIC (MITSUBISHI) (CONTINUED)





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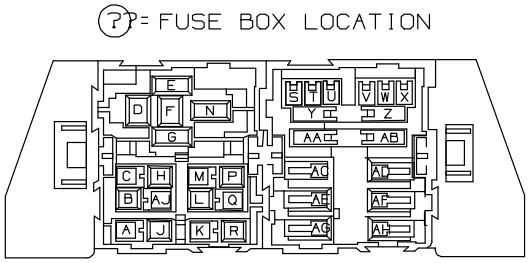


CB0186
WIRE INSERTION VIEW

1071654– 356304

T20 Option Components

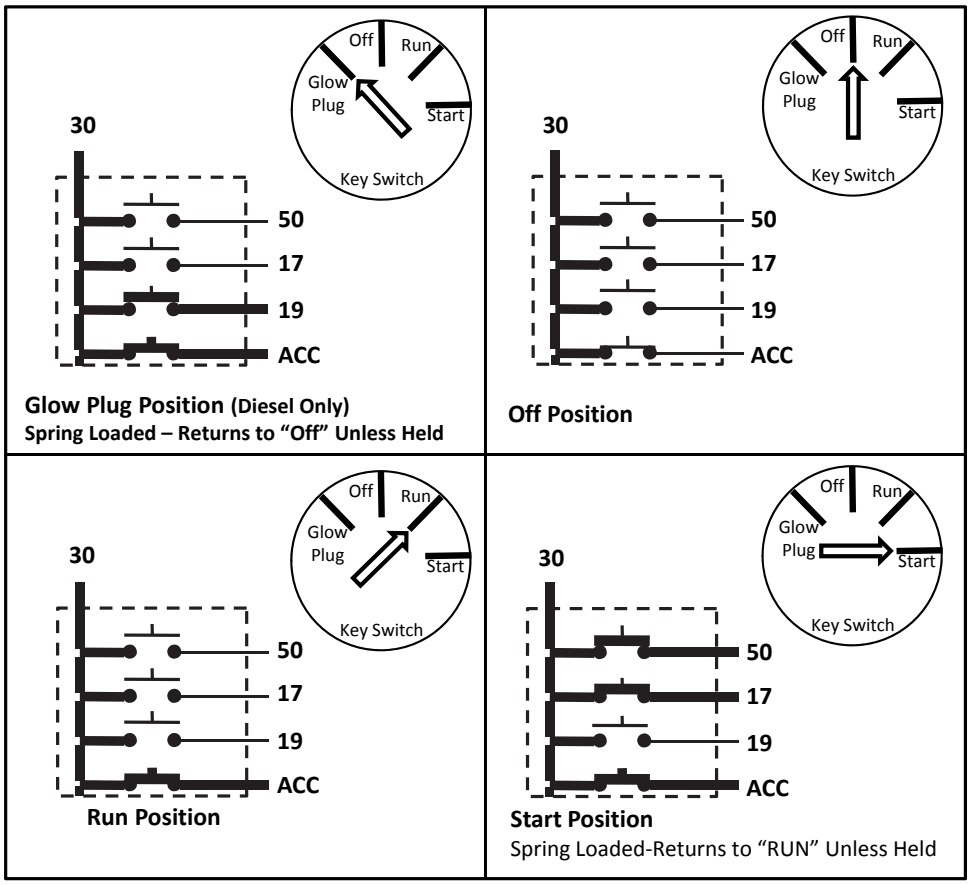
The following chart lists various options and the electrical and/or hydraulic components that are associated with the option. Refer to the “notes” section for any components that are deleted from a standard machine in order to have the installed option.

option	added components	E or H	component #	notes
Side Brush	Side Brush ON Solenoid Valve	E,H	SV-8	
	Side Brush Pressure Solenoid Valve	E,H	SV-10	
	Side Brush Down Solenoid Valve	E,H	SV-11	
	Side Brush Extend Solenoid Valve	E,H	SV-12	
	FaST Side Brush Valve	E	SOL-6	
	Side Brush Water Valve	E	SOL-7	
	Side Brush Manifold	H	x	
	Side Brush Lift Cylinder	H	x	
	Side Brush Extend Cylinder	H	x	
	Side Brush Motor	H	x	
ES (Extended Scrub)	Solution Tank Auto Fill Water Valve	E	SOL-1	If machine has ES option, the following components will ***not*** be on the machine: FaST Water Pump, FaST Water Pump Relay (M11), FaST Detergent Pump, FaST Air Pump, FaST Enable Valve (SOL-4), FaST High Flow Valve (SOL-5), FaST Side Brush Valve (SOL-6)
	Recovery Tank Auto Fill Water Valve	E	SOL-2	
	Solution Tank Full Switch	E	S-14	
	Recovery Tank Half Full Switch	E	S-16	
	Detergent Pump	E	x	
	ES Pump	E	x	
Spray Hose	Spray Hose Pump	E	x	
	Spray Hose Relay	E	M12	
	Spray Hose Switch	E	S-25	

E = Electrical Component
H = Hydraulic Component

T20 Key Switch

Conditions: Glow Plug, Key Off, Run, Start Positions



SWITCH TERMINAL MARKING

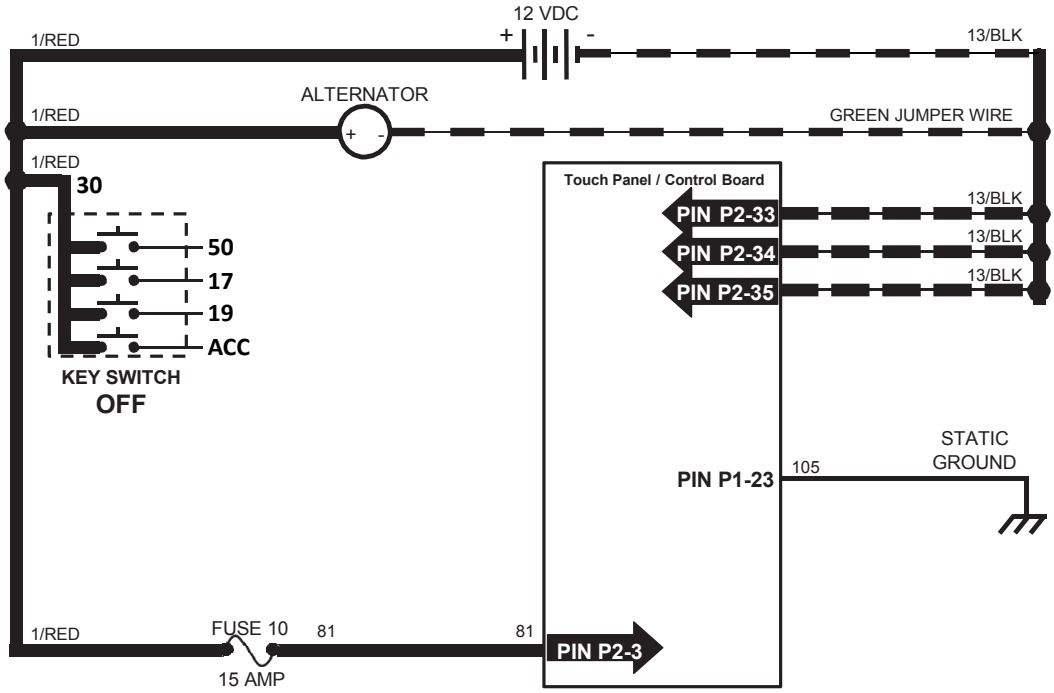
KEY SWITCH POSITION	30	50	17	19	ACC
GLOW PLUG	●			●	●
OFF	NO CONNECTIONS				
RUN	●				●
START	●	●	●		●

"●—●" Indicates a common connection

ⓘ Common connections in various switch positions should be less than one (1) ohm resistance.

T20 Key OFF Power Distribution

Conditions: Key off



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.

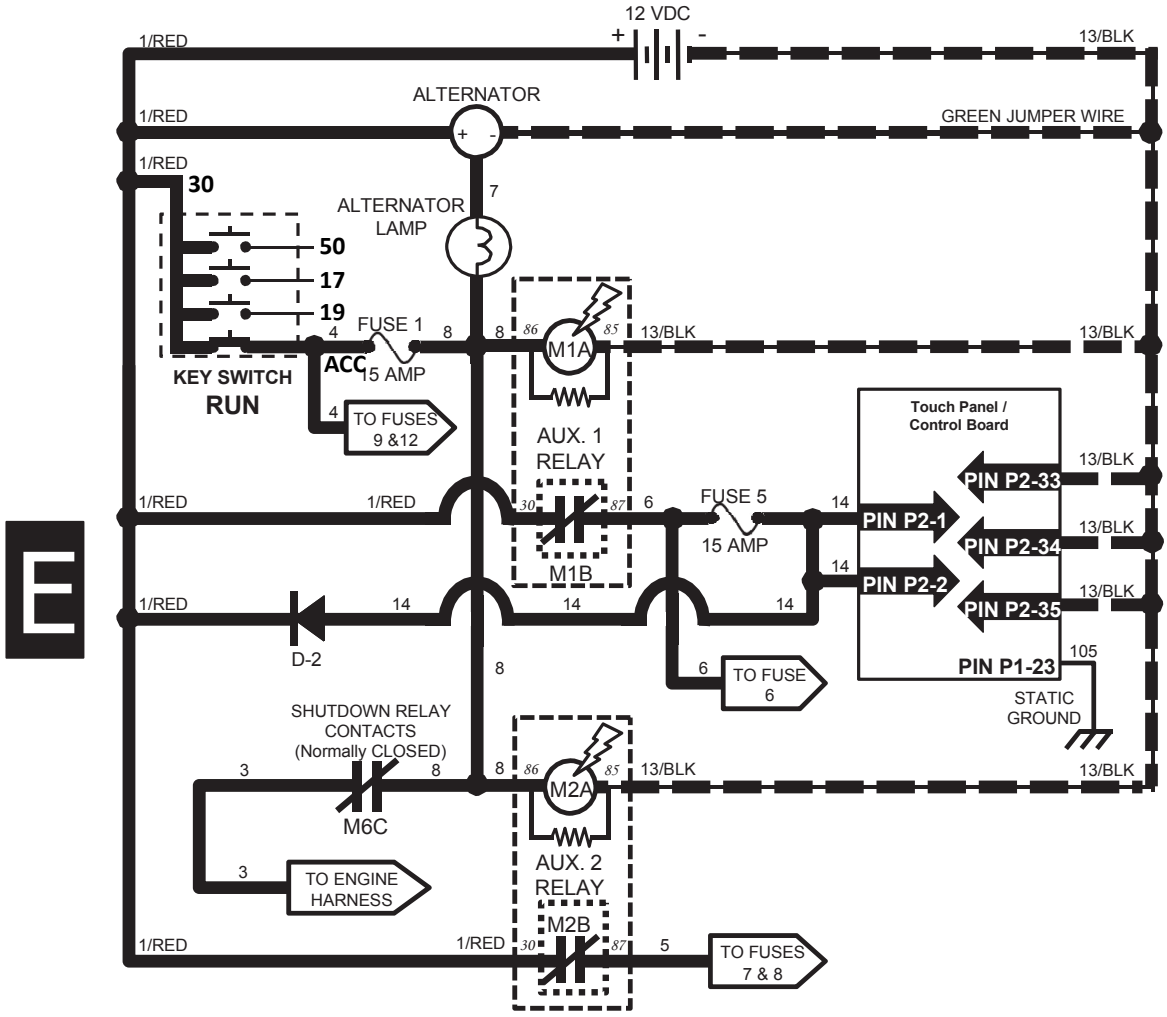
Wiring Color Codes
(Unless otherwise marked)

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

T20 Key ON Power Distribution

Conditions: Key on, engine off

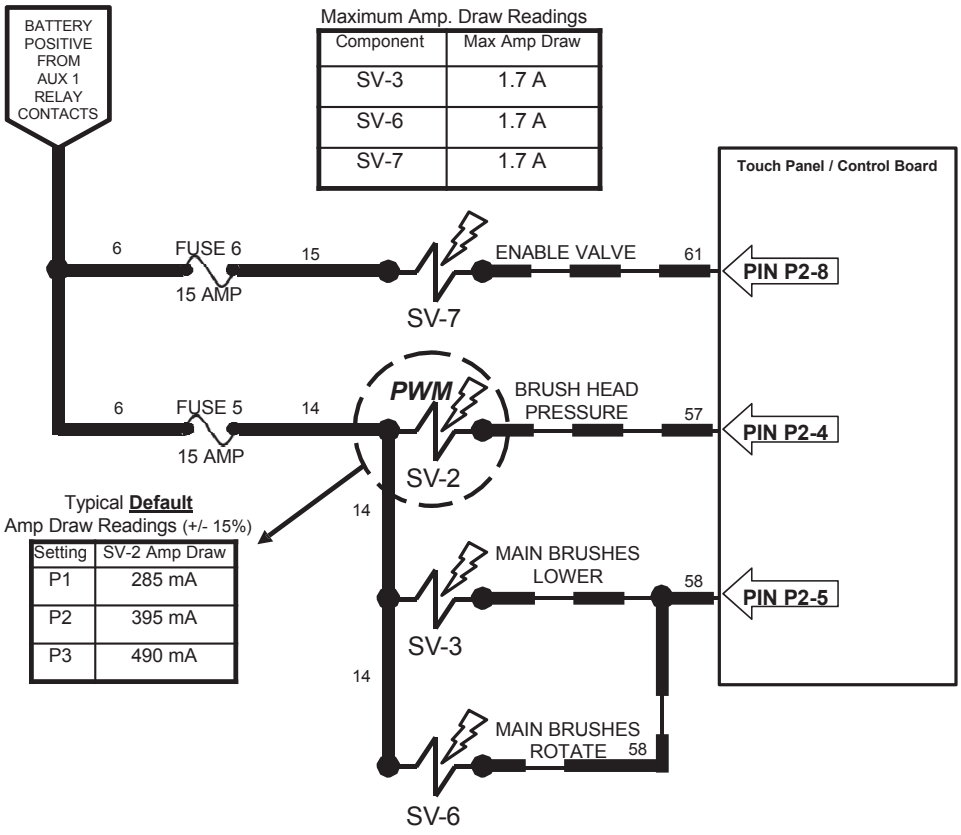


Wiring Color Codes
(Unless otherwise marked)

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

T20 Main Brushes ON

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



Maximum Amp. Draw Readings

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

Typical **Default** Amp Draw Readings (+/- 15%)

Setting	SV-2 Amp Draw
P1	285 mA
P2	395 mA
P3	490 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

Pressure settings P1, P2, & P3 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.

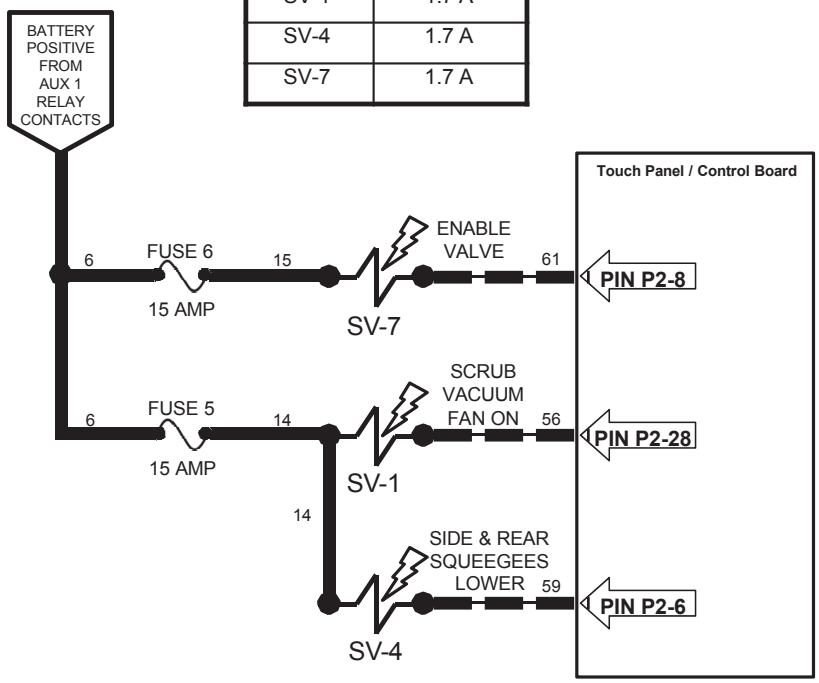
E

T20 Scrub Vacuum Fan ON & Squeegees DOWN

Conditions: Key ON, Engine Running, Scrubbing System & Scrub Vacuum On, Propelling Forward

Maximum Amp Draw Readings

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



E

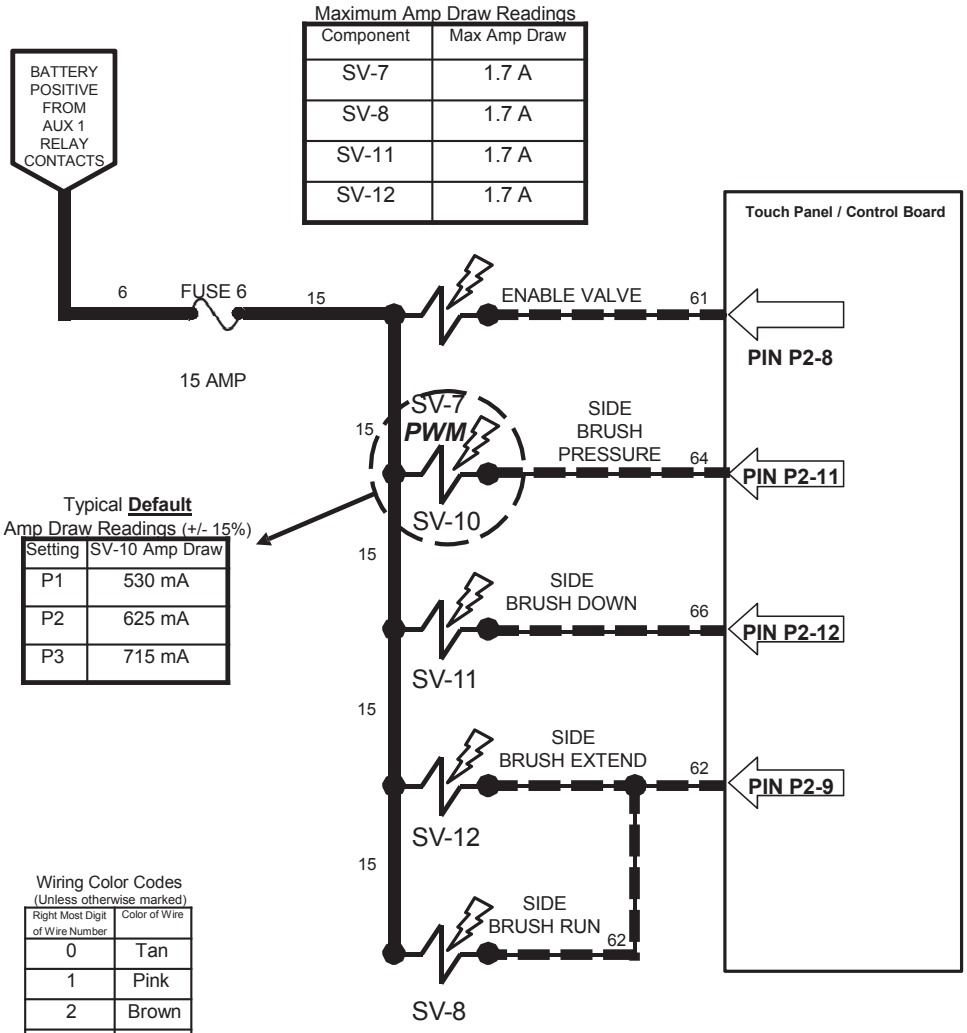
Reverse propel will turn OFF SV-4 (Pin P2-6) and raise the side and rear squeegees.

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

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

T20 Side Brush ON

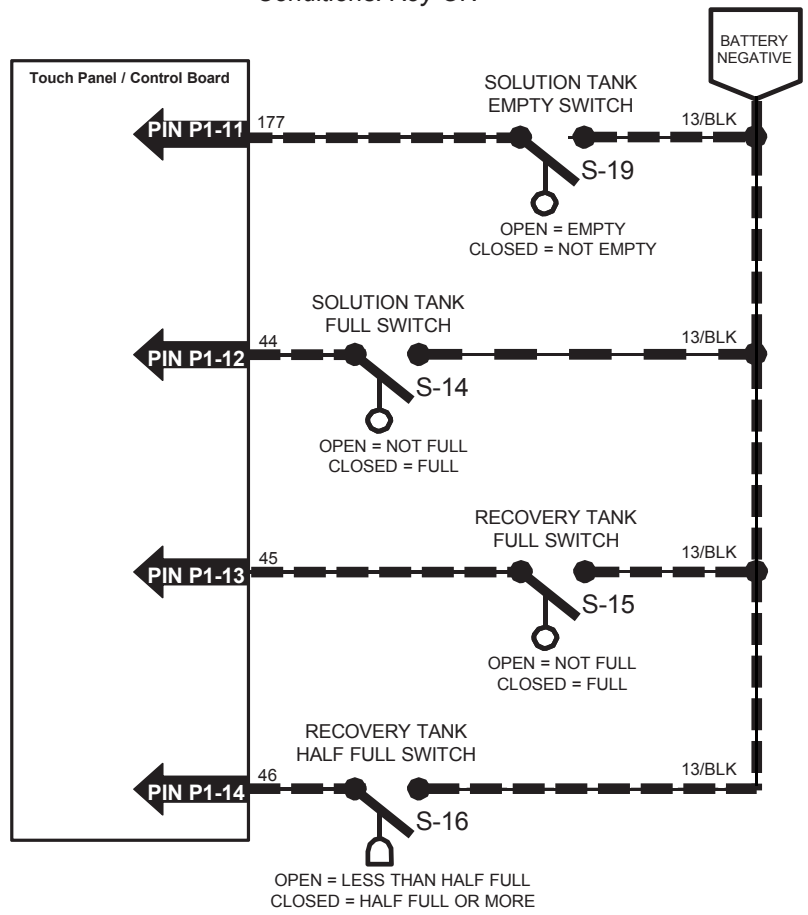
Conditions: Key ON, Engine Running, Scrubbing System & Scrub Vacuum On, Propelling Forward or Back



E

T20 Tank Level Switches

Conditions: Key ON



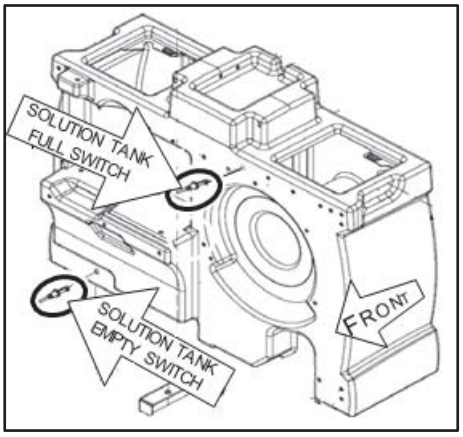
Wiring Color Codes
(Unless otherwise marked)

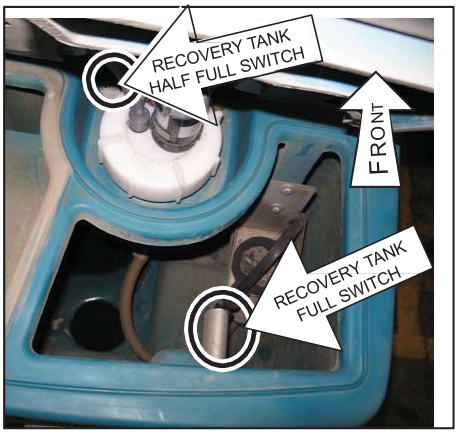
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

E

S-14, SA-15, & S-19 are Float Switches. S-16 is a Pressure Tube Switch.

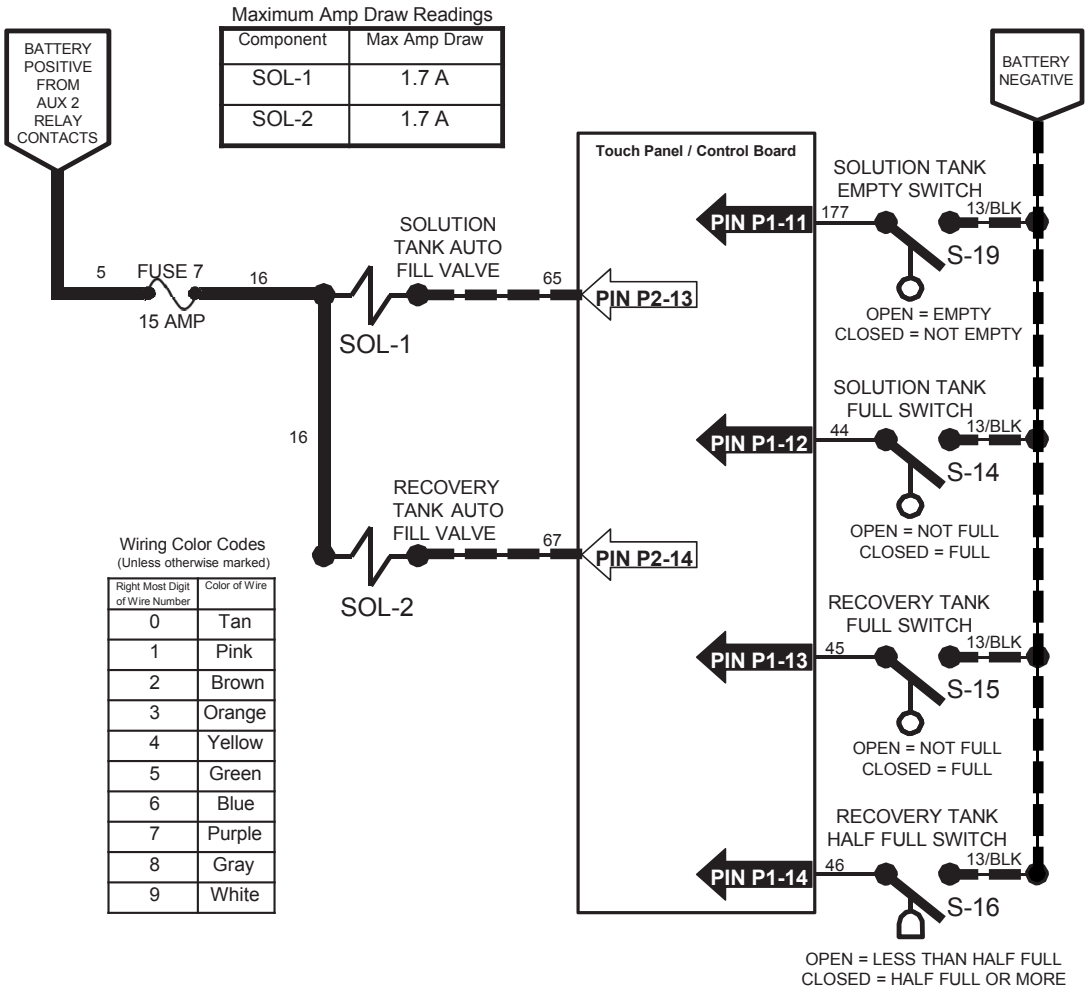
The Tank Level Switches must be closed for five (5) seconds before any output is affected.





T20 Auto Fill Solenoids (ES Equipped Machines Only)

Conditions: Key ON, Water Source Connected To Machine, Solution Tank NOT Full, Recovery Tank Less Than Half Full



E

i S-14, S-15, & S-19 are Float Switches.S-16 is a Pressure Tube Switch.

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

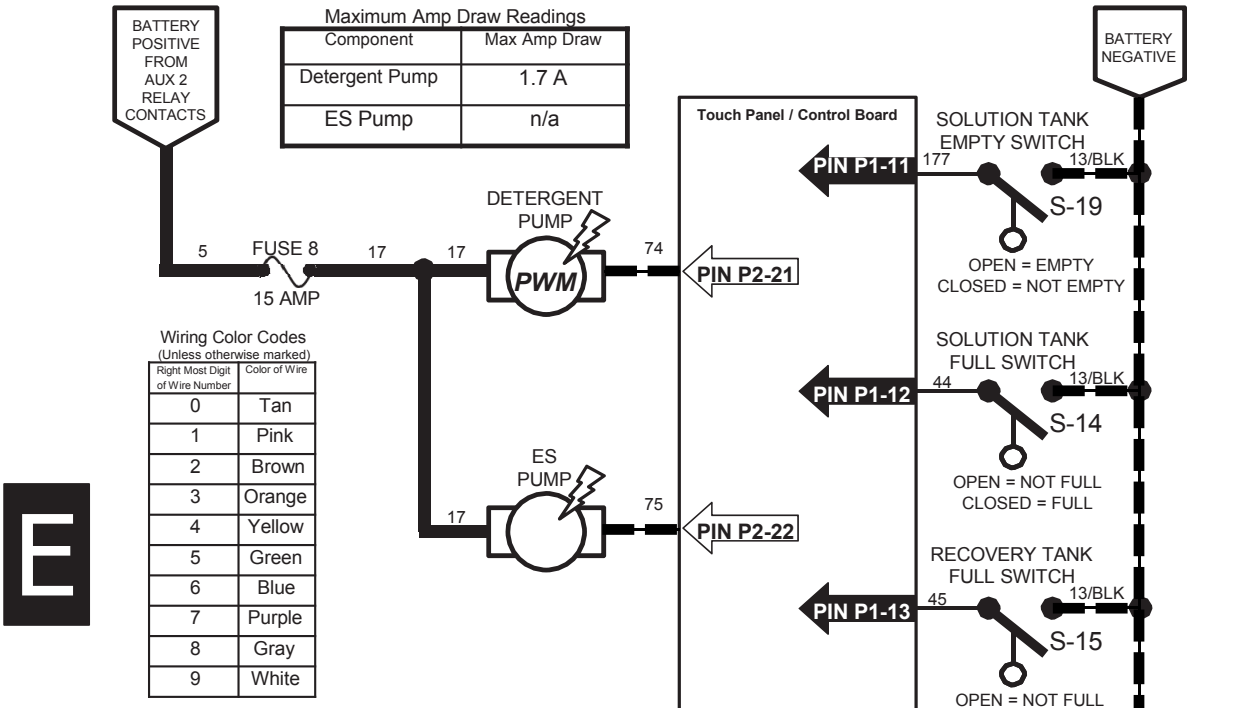
i Machine must be in neutral and Solution Tank Full Switch OPEN (tank not full) to activate Solution Tank Auto Fill Valve (SOL-1)..

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 Tank Level Switch must be closed for five (5) seconds before any output is affected..

T20 Conventional Detergent Pump & ES Pump

Conditions: Key ON, Engine Running, Scrubbing System ON, Recovery Tank Half Full or More, Solution Tank Not Full, Two or Three Solution LED's Lit.



E

S-14, S-15, & S-19 are Float Switches, S-16 is a Pressure Tube Switch

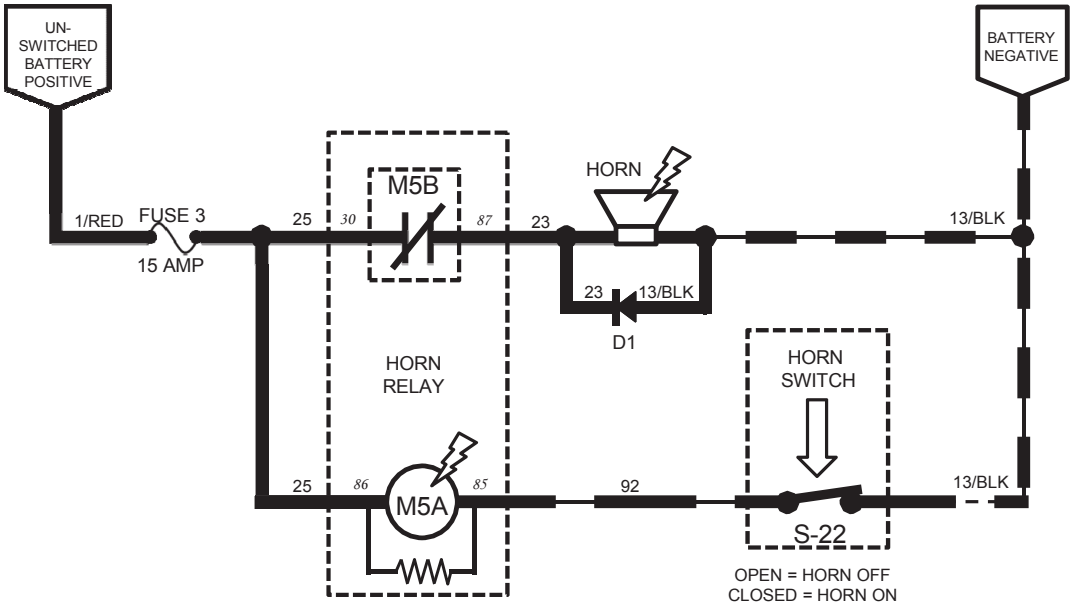
The Tank Level Switches must be closed for 5 seconds before any output is affected.

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

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.

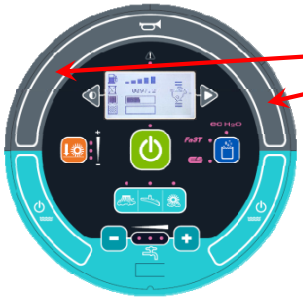
T20 Horn

Conditions: Key on, switch activated



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



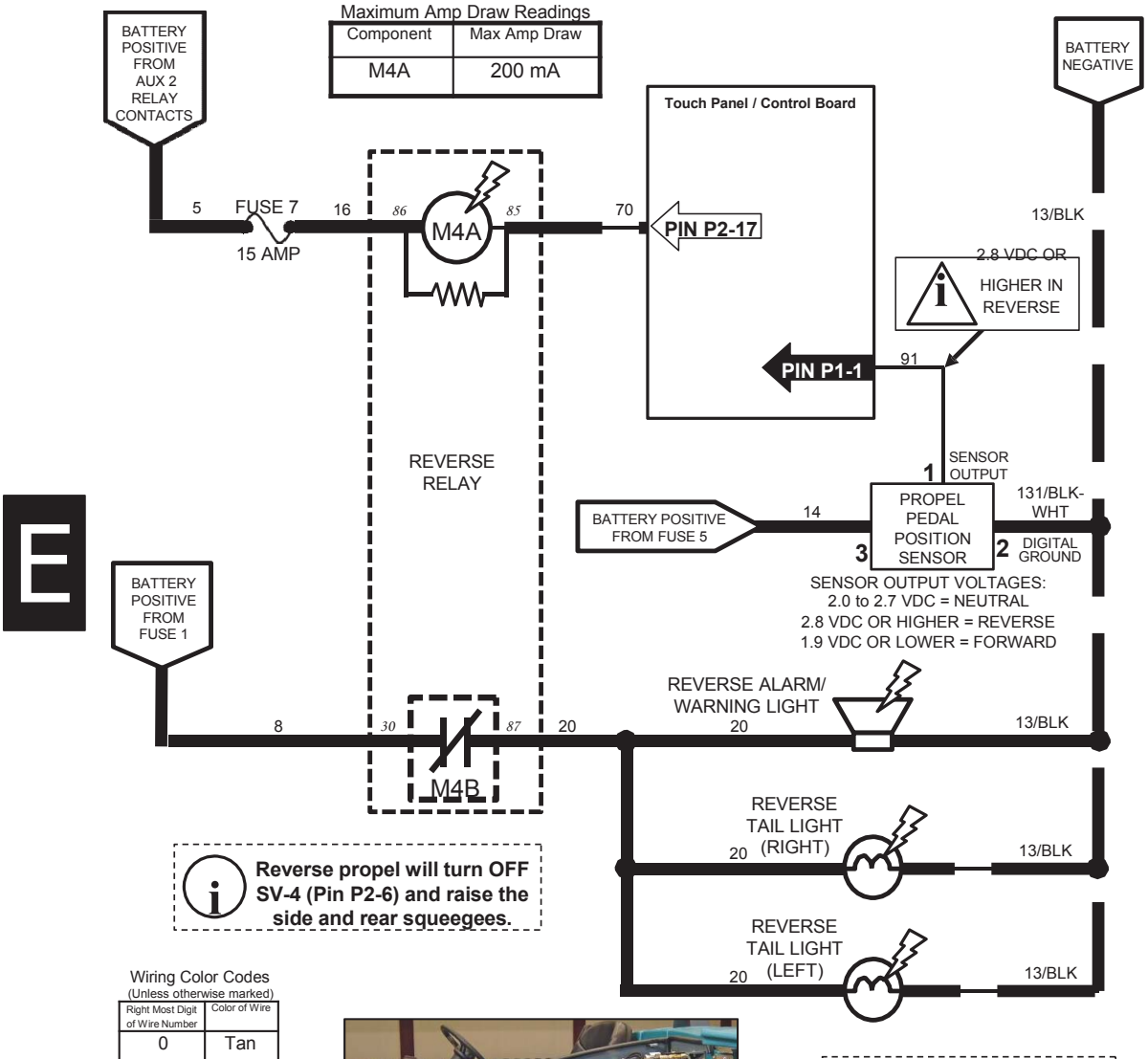
Horn Location
Membrane Panel

Horn Location
Pro Panel

E

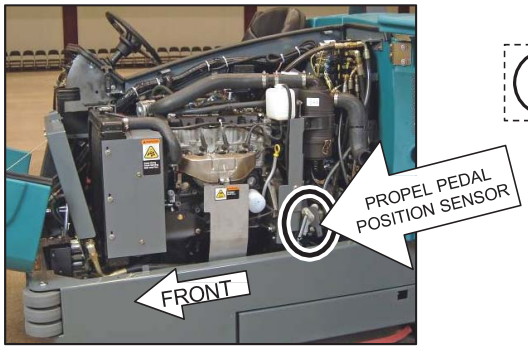
T20 Reverse Propel

Conditions: Key ON, Propel Pedal Pushed For Reverse Travel



Wiring Color Codes
(Unless otherwise marked)

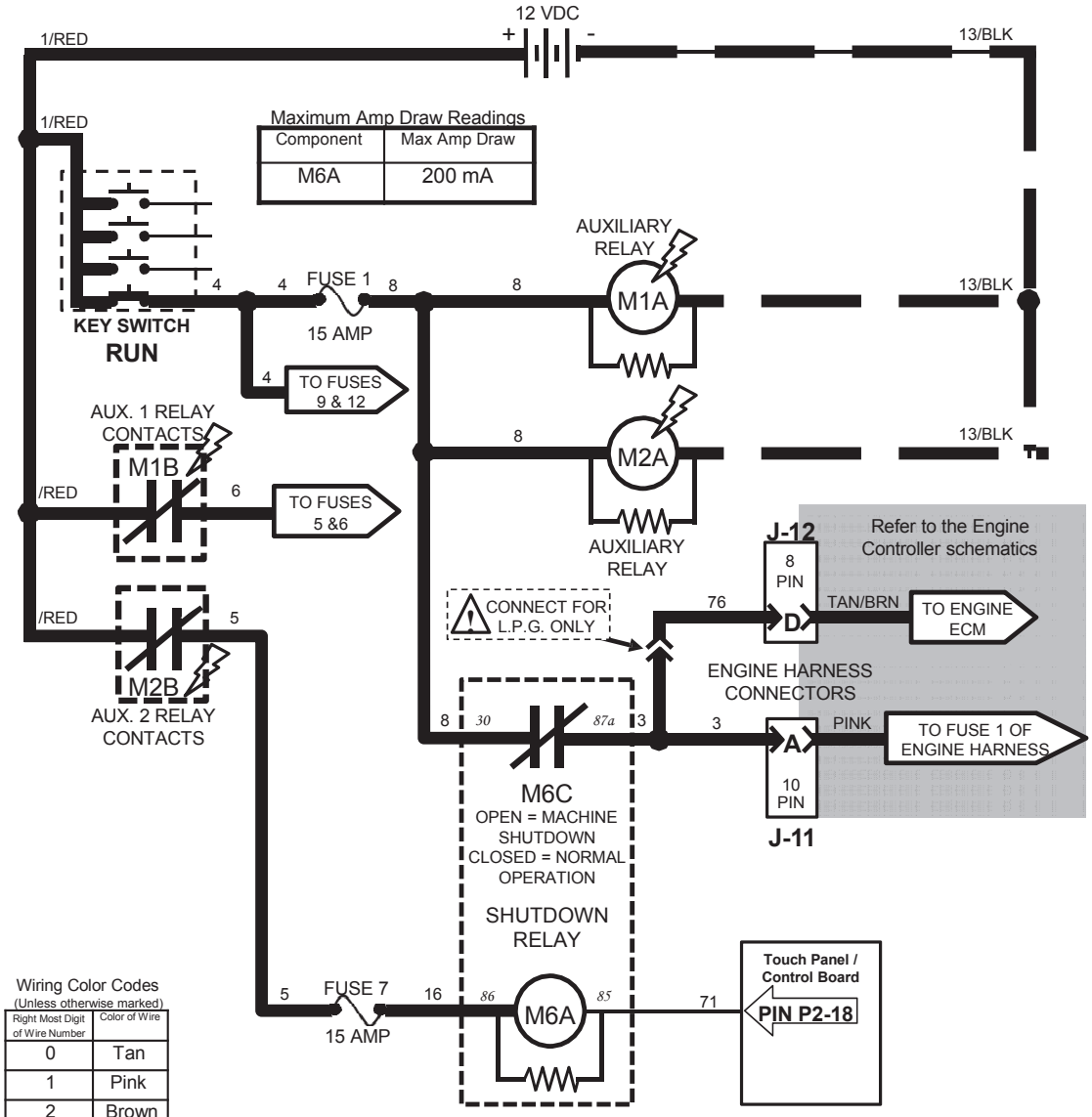
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White



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

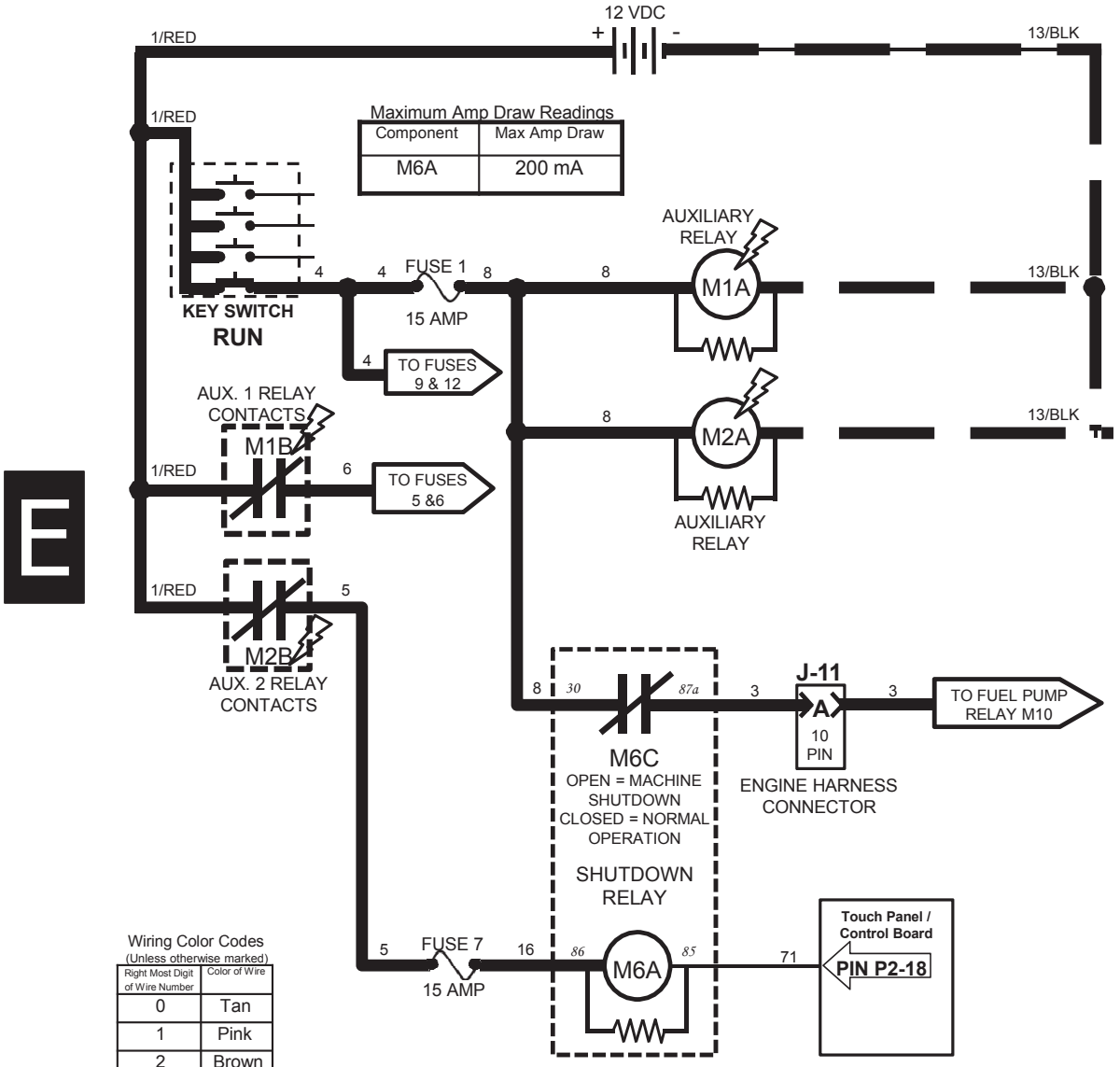
T20 Shutdown Relay (Normal Machine Operation)

(GAS / LPG)



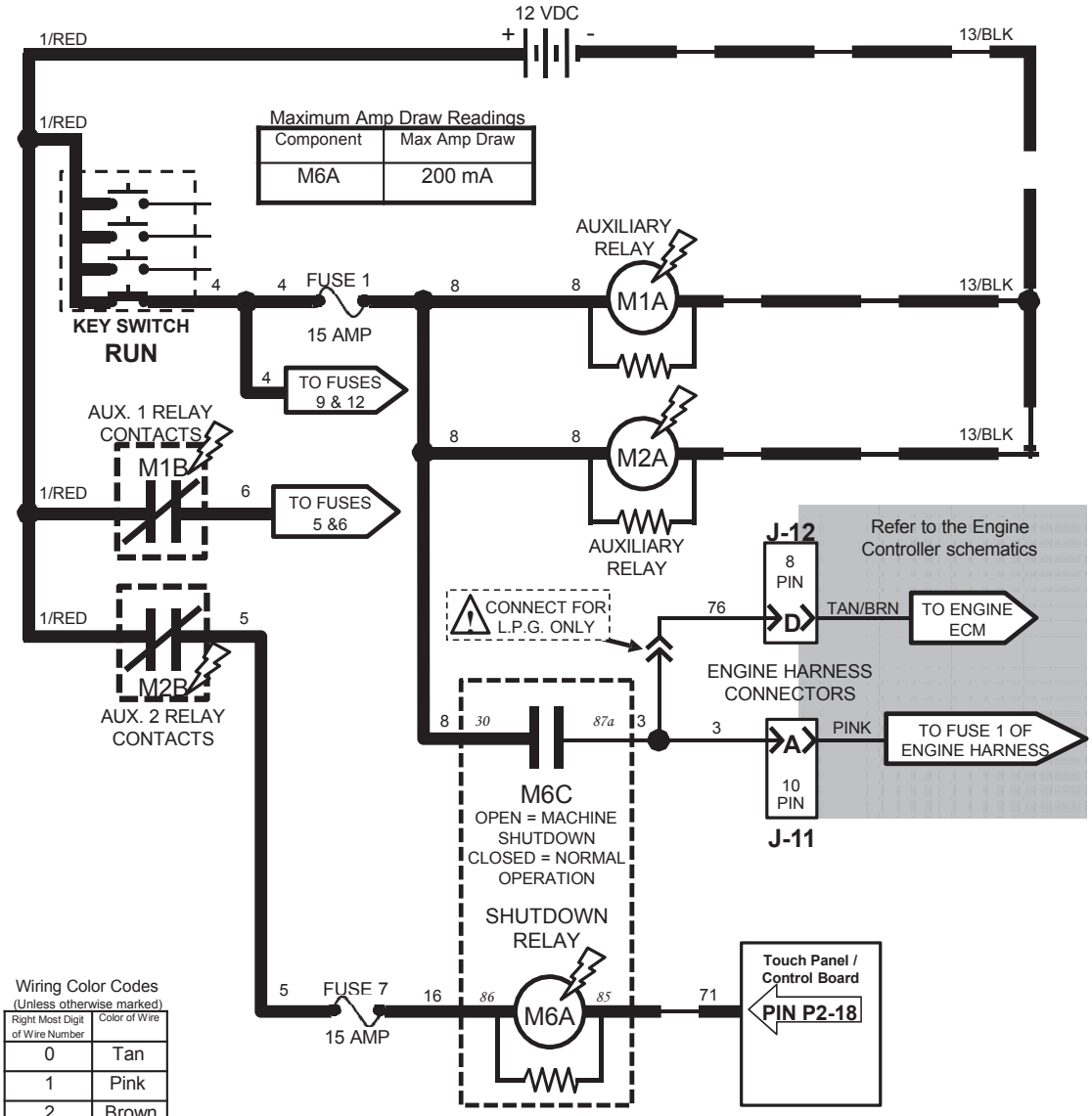
T20 Shutdown Relay (Normal Machine Operation)

(Diesel)



T20 Shutdown Relay (Shutdown Mode)

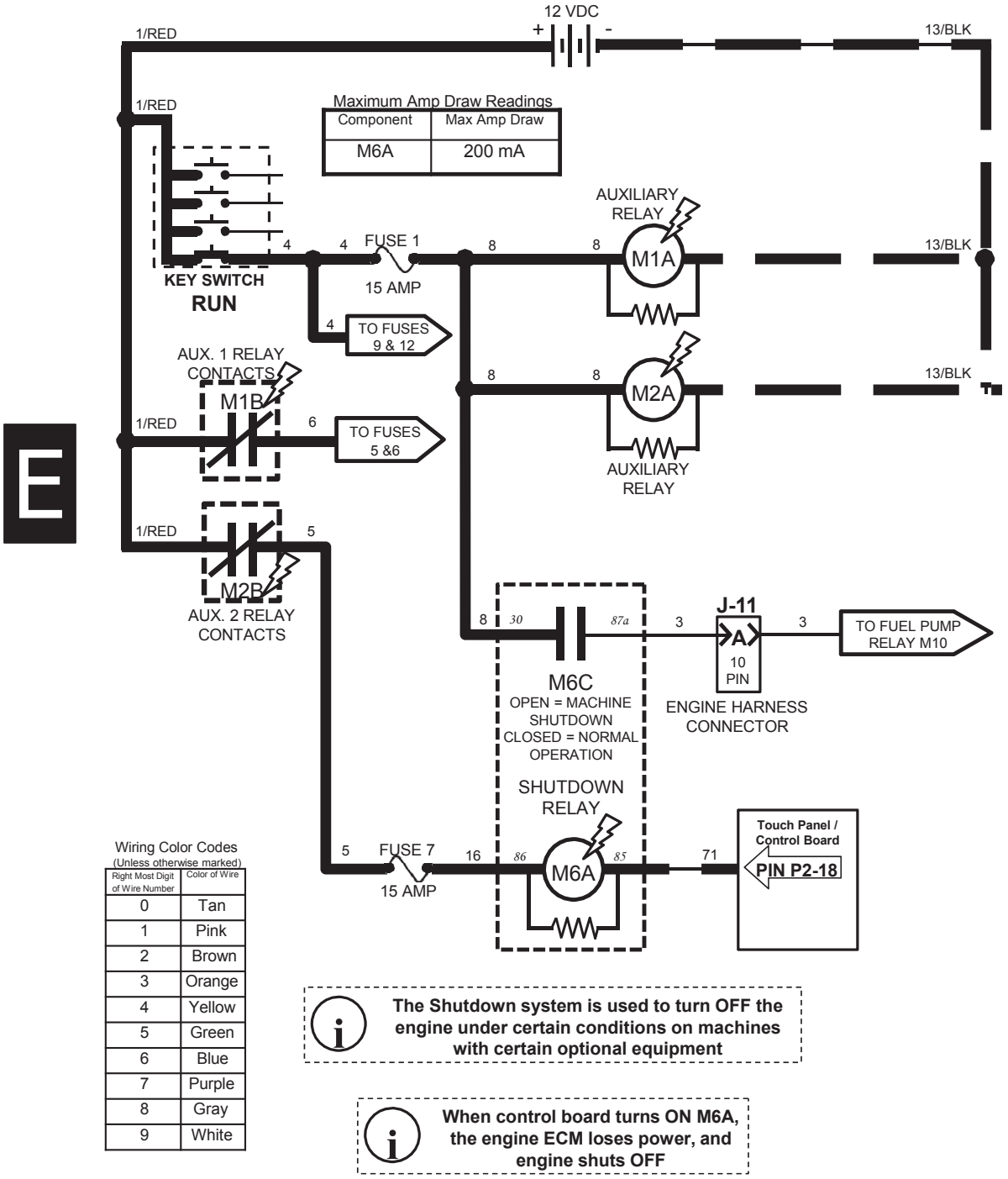
(GAS / LPG)



E

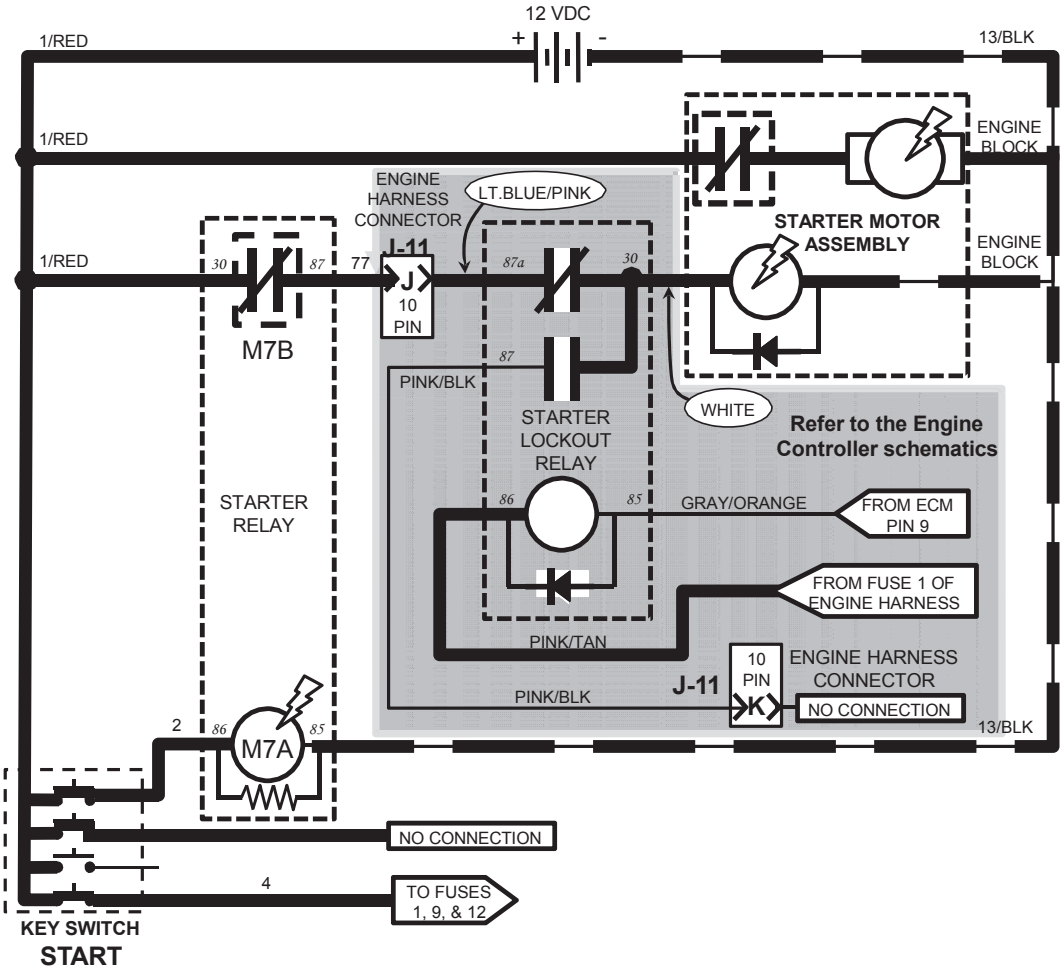
T20 Shutdown Relay (Shutdown Mode)

(Diesel)



T20 Starting System ON

Conditions: Key Turned To Start Position
(Gas – LPG)



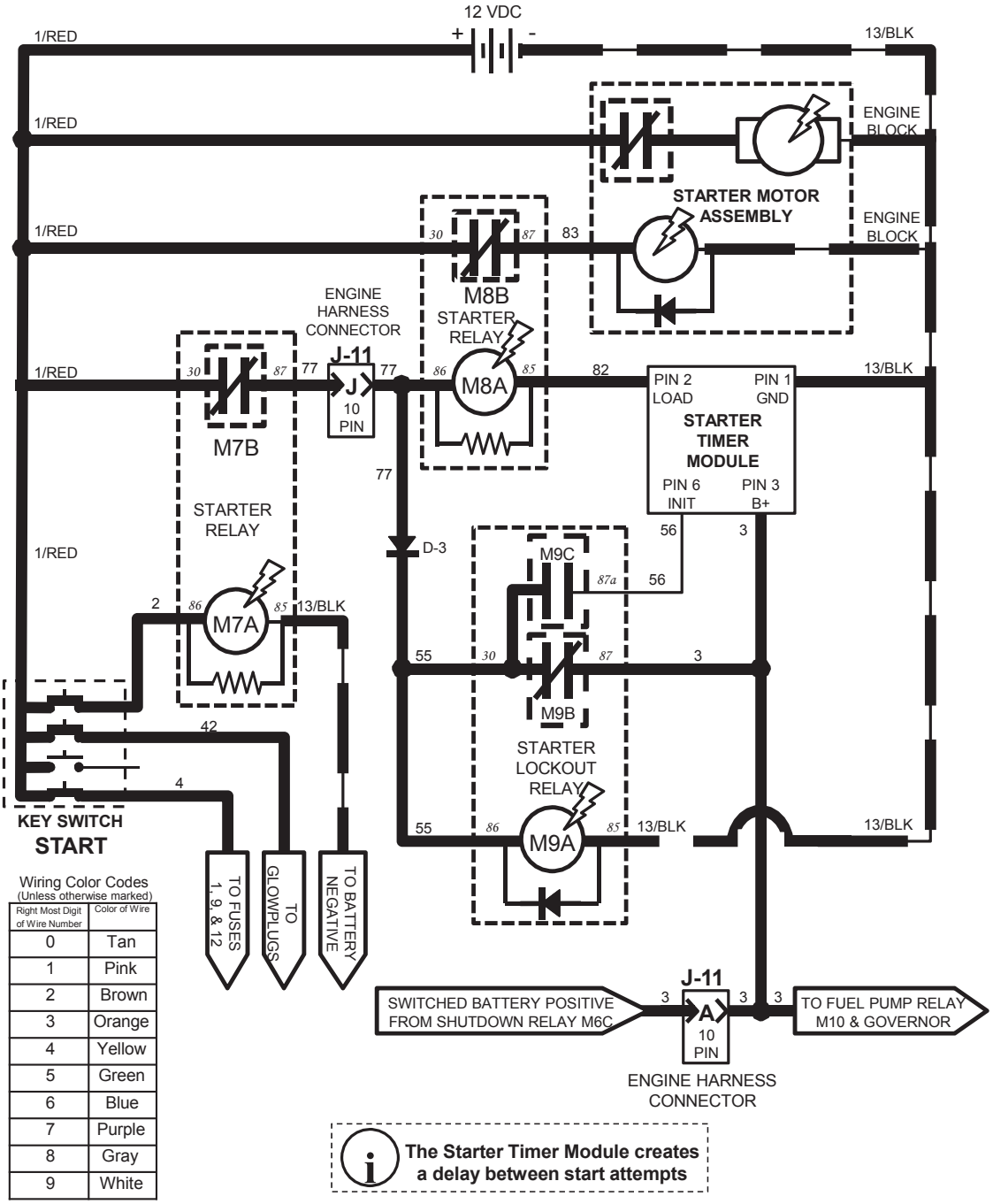
Wiring Color Codes
(Unless otherwise marked)

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

T20 Starting System ON

Conditions: Key Turned To Start Position
(Diesel)

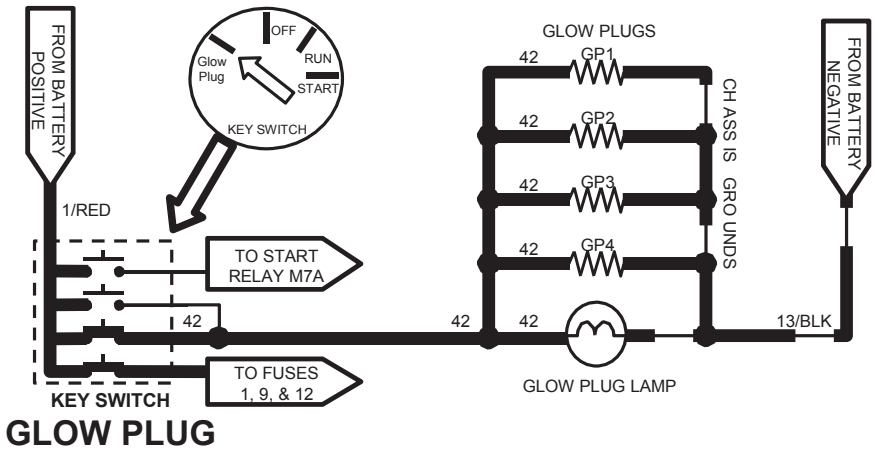


Wiring Color Codes
(Unless otherwise marked)

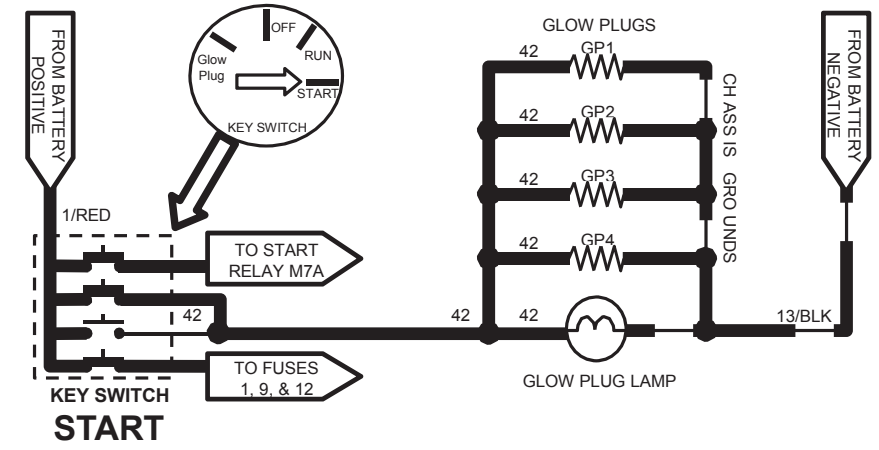
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

T20 Glow Plugs ON

Conditions: Key Turned To Start Position / Glow Plug (Diesel)



GLOW PLUG



START

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

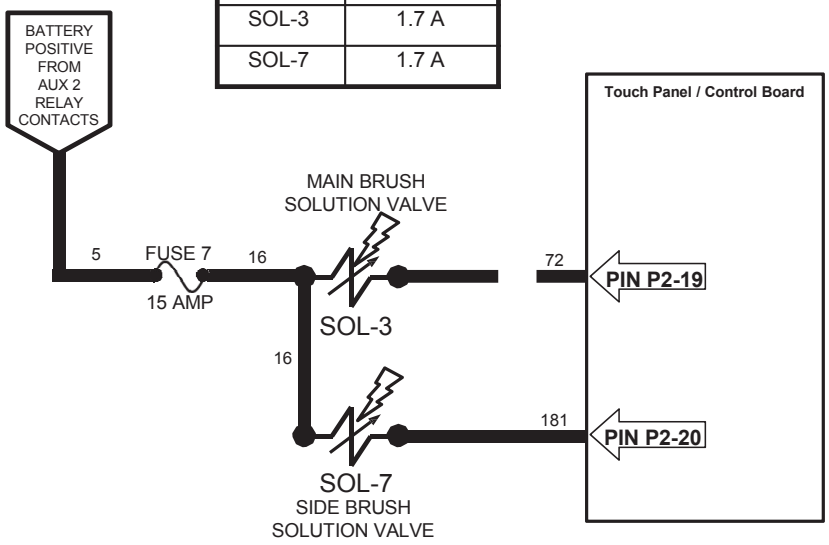
E

T20 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.

Maximum Amp Draw Readings

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



The Solution Valves are pulsed slowly to adjust the solution volume. Less OFF time (more Solution LED's lit on Control Pad will result in more solution applied to floor

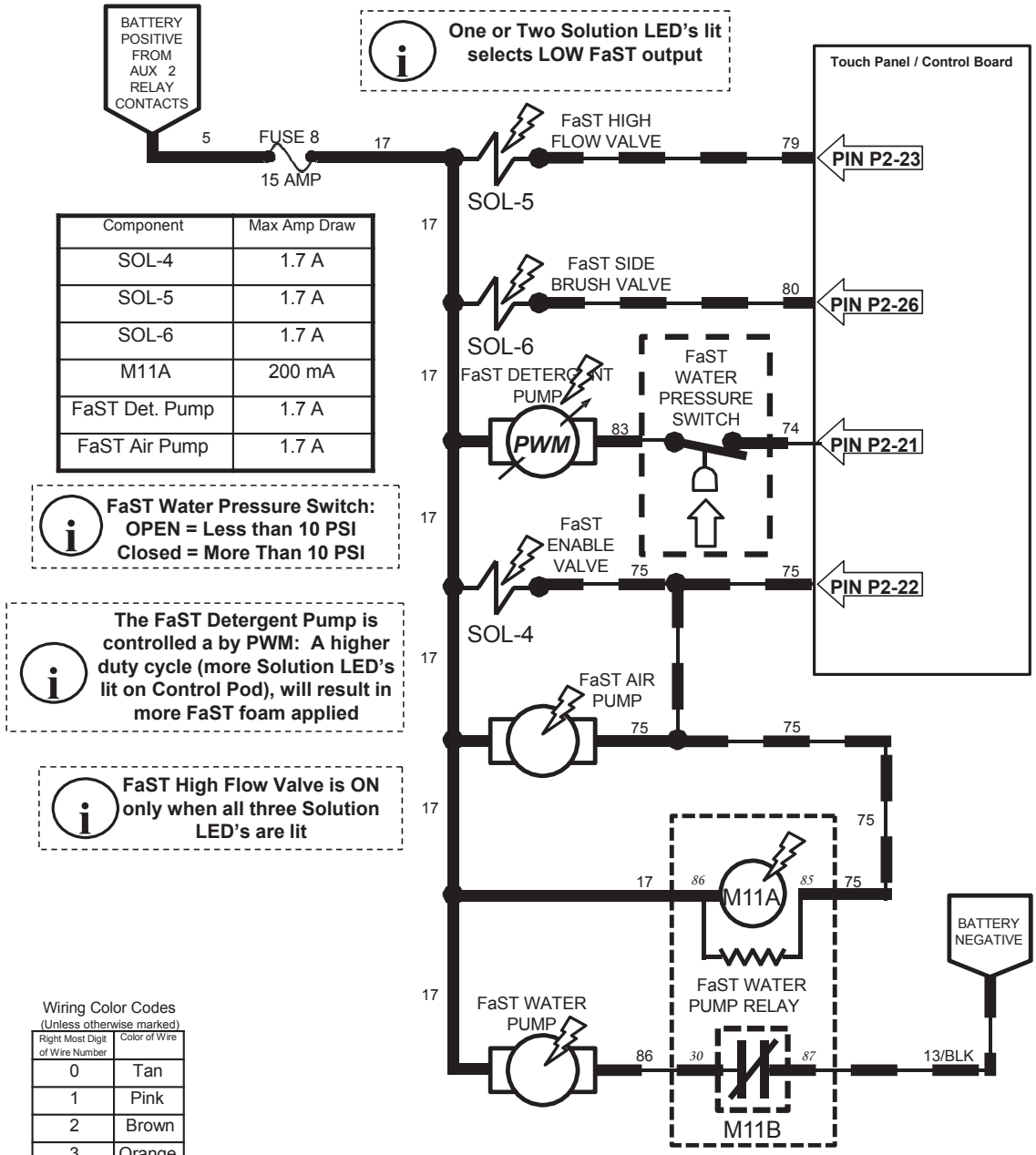
The Solution Valves will function only while propelling forward or reverse during scrub operation

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

T20 FaST System ON

Conditions: Key On, Scrubbing System On, Side Brush On, Forward or Reverse Propel, Three Solution LED's Lit



Component	Max Amp Draw
SOL-4	1.7 A
SOL-5	1.7 A
SOL-6	1.7 A
M11A	200 mA
FaST Det. Pump	1.7 A
FaST Air Pump	1.7 A

FaST Water Pressure Switch: OPEN = Less than 10 PSI Closed = More Than 10 PSI

The FaST Detergent Pump is controlled a by PWM: A higher duty cycle (more Solution LED's lit on Control Pod), will result in more FaST foam applied

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

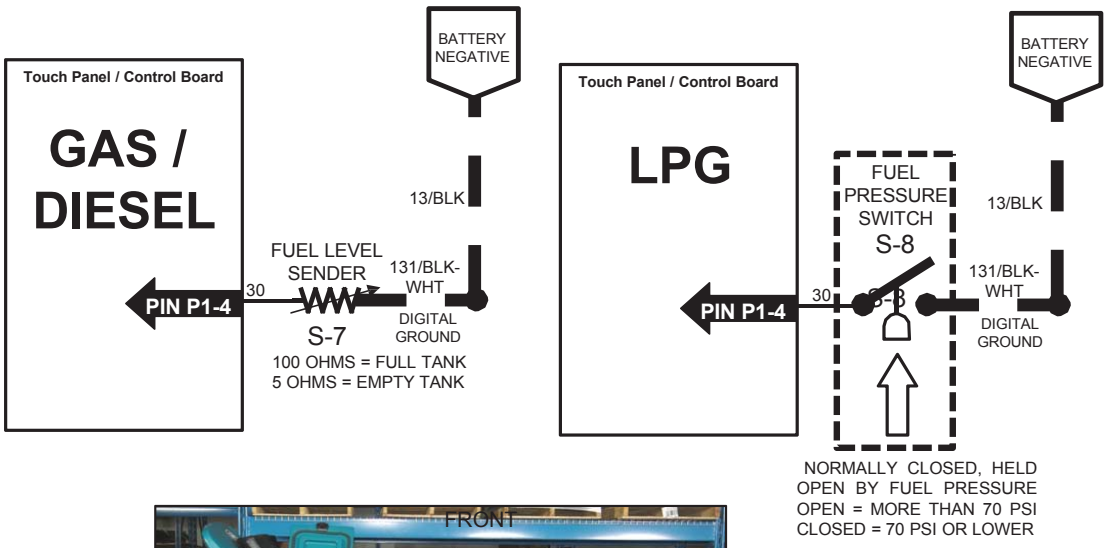
Wiring Color Codes
(Unless otherwise marked)

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

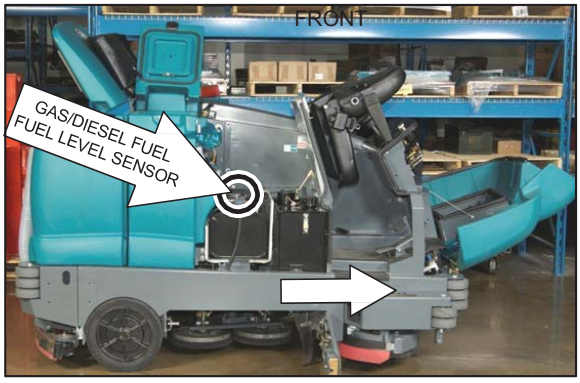
E

T20 Fuel Level Sensors

Conditions: Key On

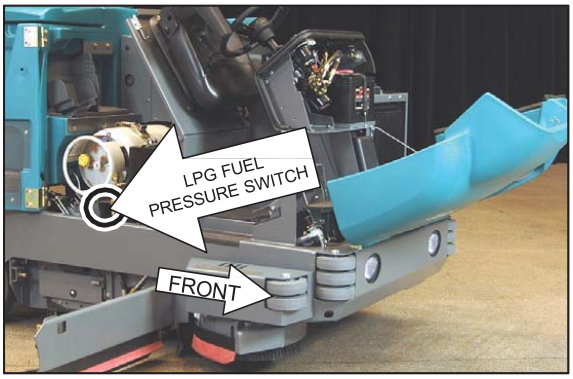


E



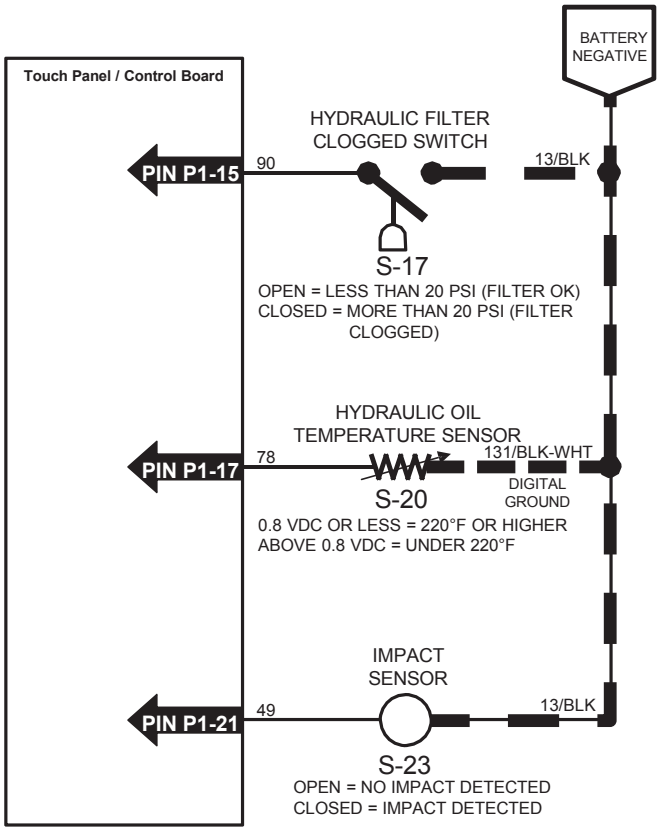
Wiring Color Codes
(Unless otherwise marked)

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



T20 Impact, Hydraulic Temp & Filter Sensor

Conditions: Key On

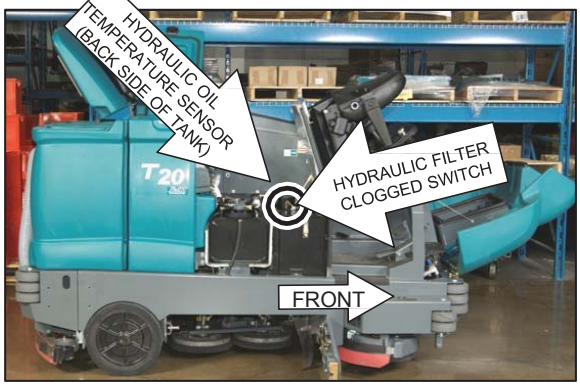


Impact Sensor S-23 is used only on machines with certain optional equipment

The hydraulic Filter Clogged switch will not be sensed until after the machine has run for five 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

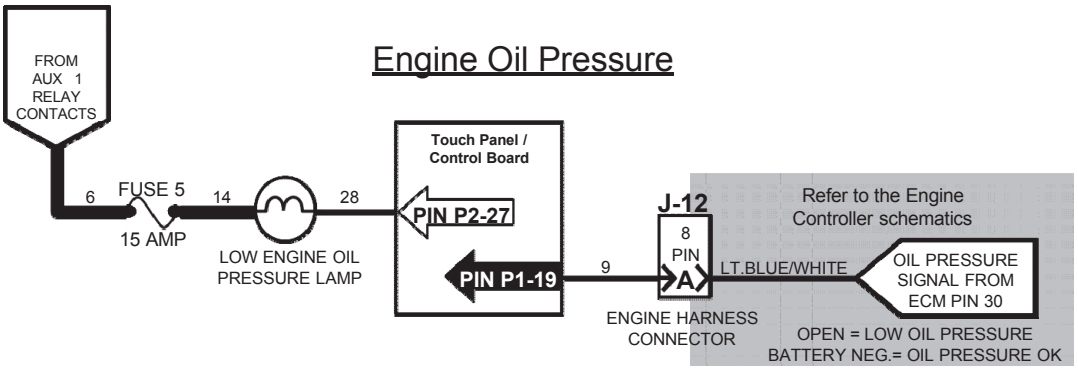


E

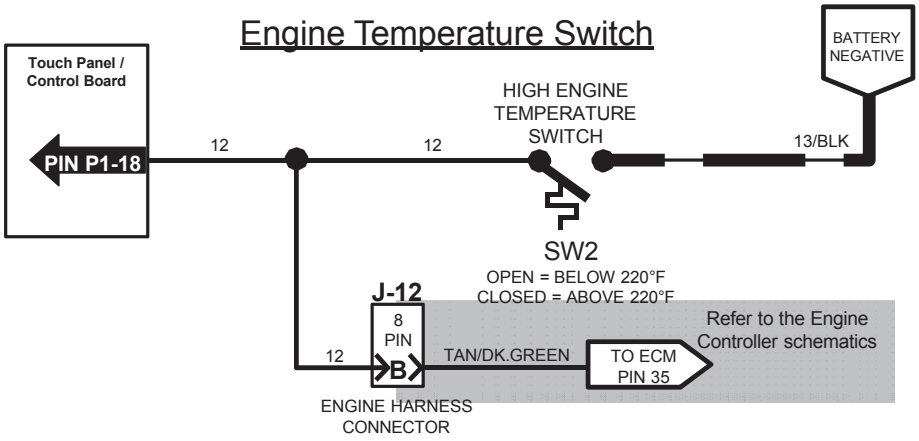
T20 Engine Oil Pressure, Temperature, and MIL System

(Gas / LPG)

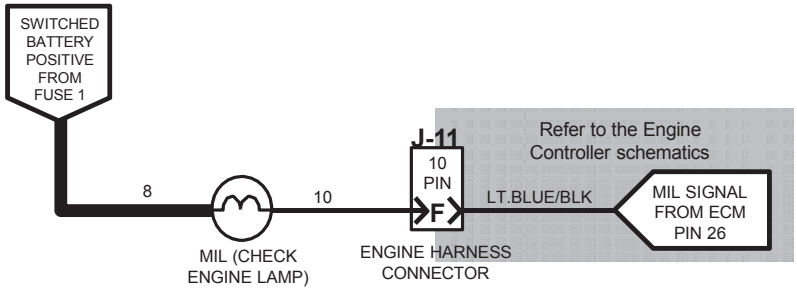
Engine Oil Pressure



Engine Temperature Switch



Malfunction Indicator Lamp



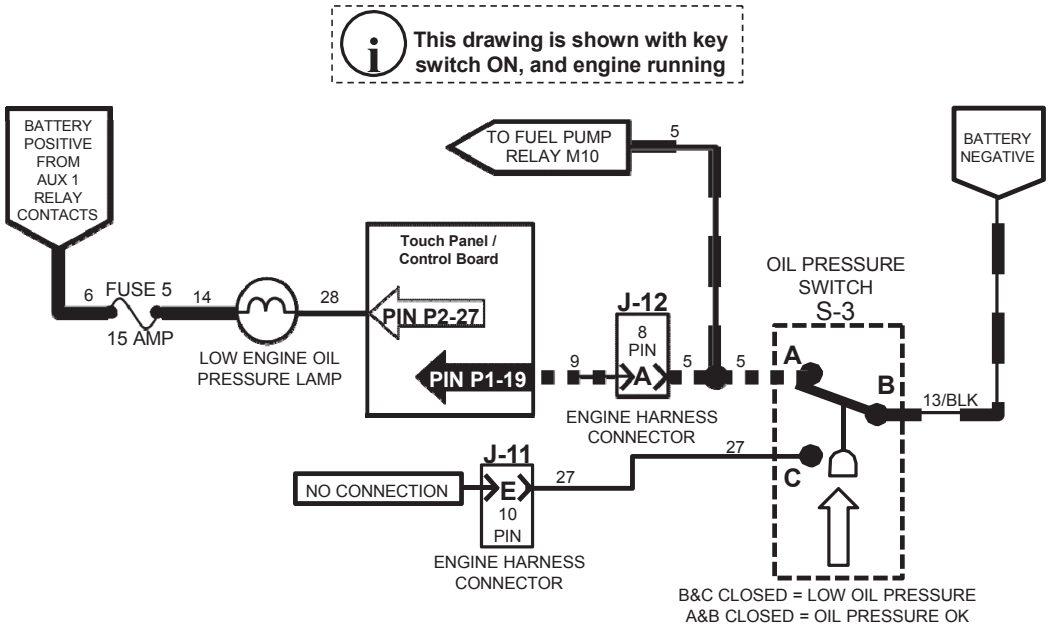
Wiring Color Codes
(Unless otherwise marked)

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

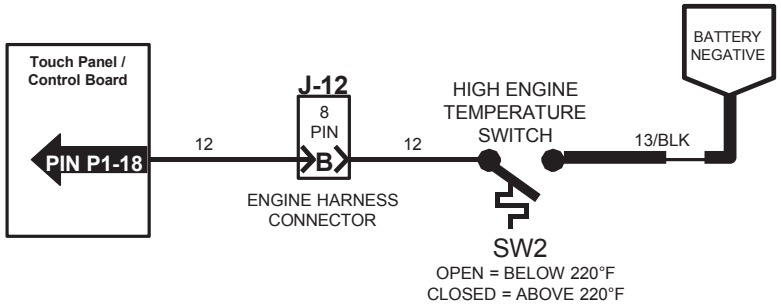
T20 Engine Oil Pressure, Temperature, and MIL System

(Diesel)

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

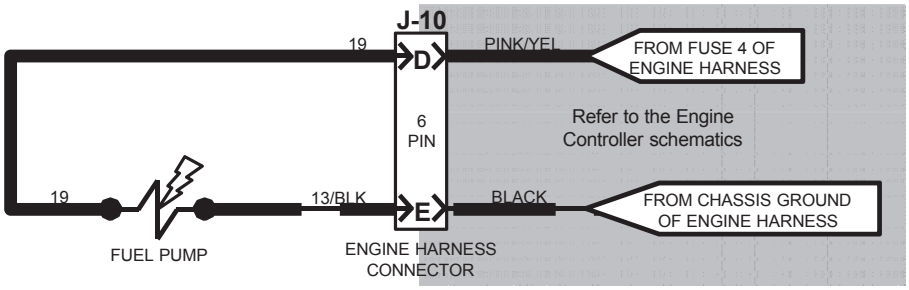
E

T20 Fuel Pump & Engine Speed Control

(Gas / LPG)

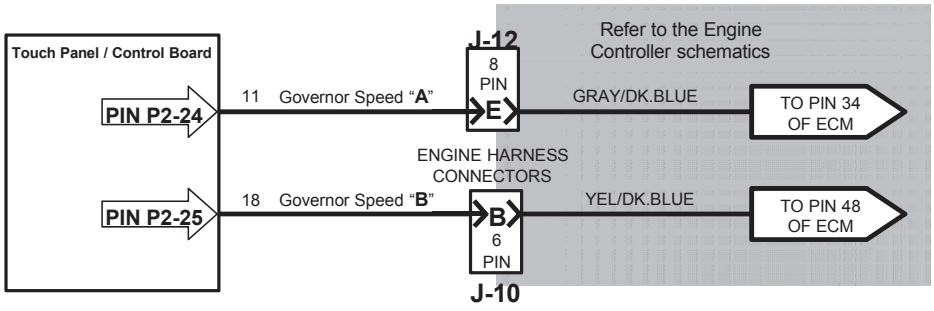
Fuel Pump (Gasoline Only)

This drawing is shown with key switch ON, and engine running



E

Speed Control Output



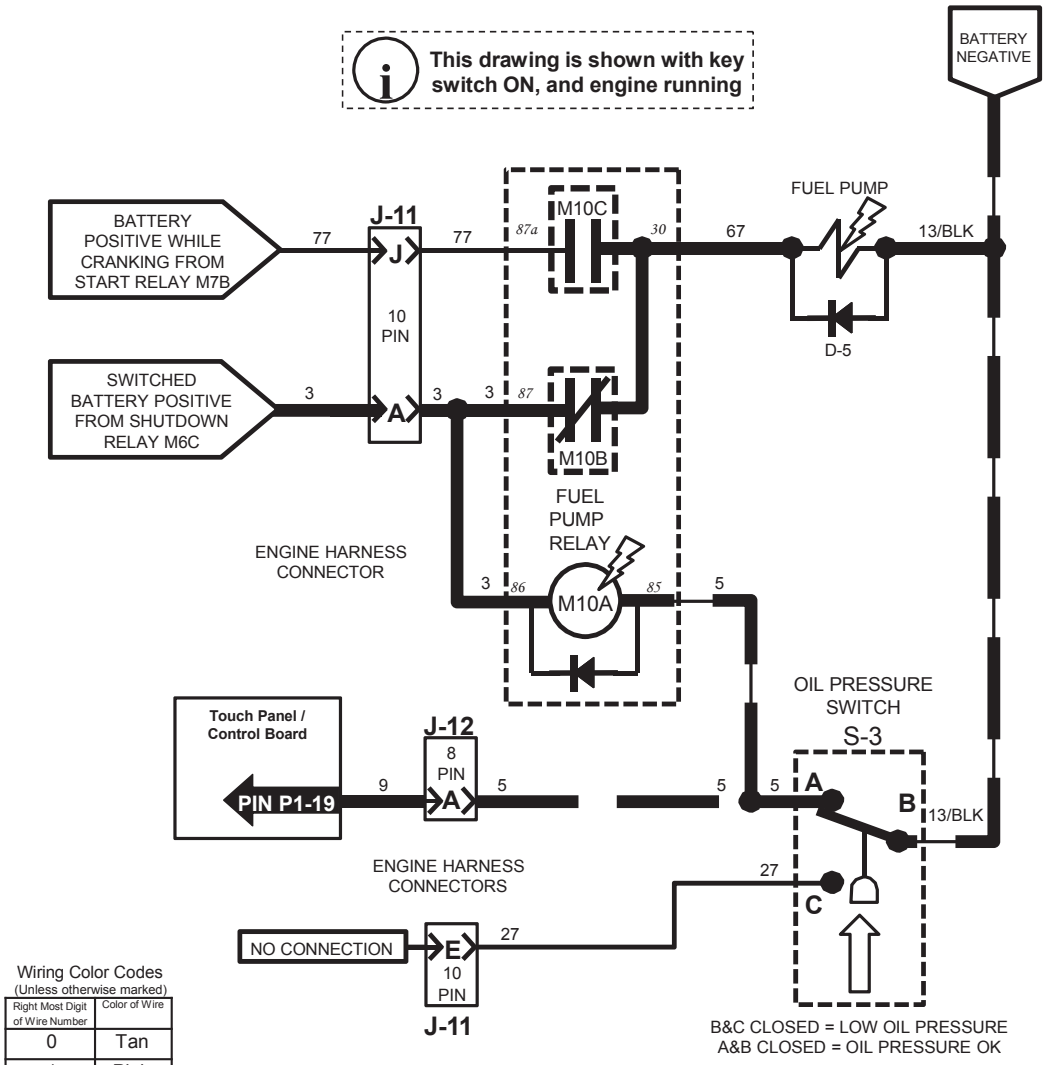
Wiring Color Codes
(Unless otherwise marked)

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	950 (+/- 25)	2400 (+/- 25)
Voltage Speed "A"	5 VDC	0 VDC
Voltage Speed "B"	0 VDC	0 VDC

T20 Fuel Pump

(Diesel)



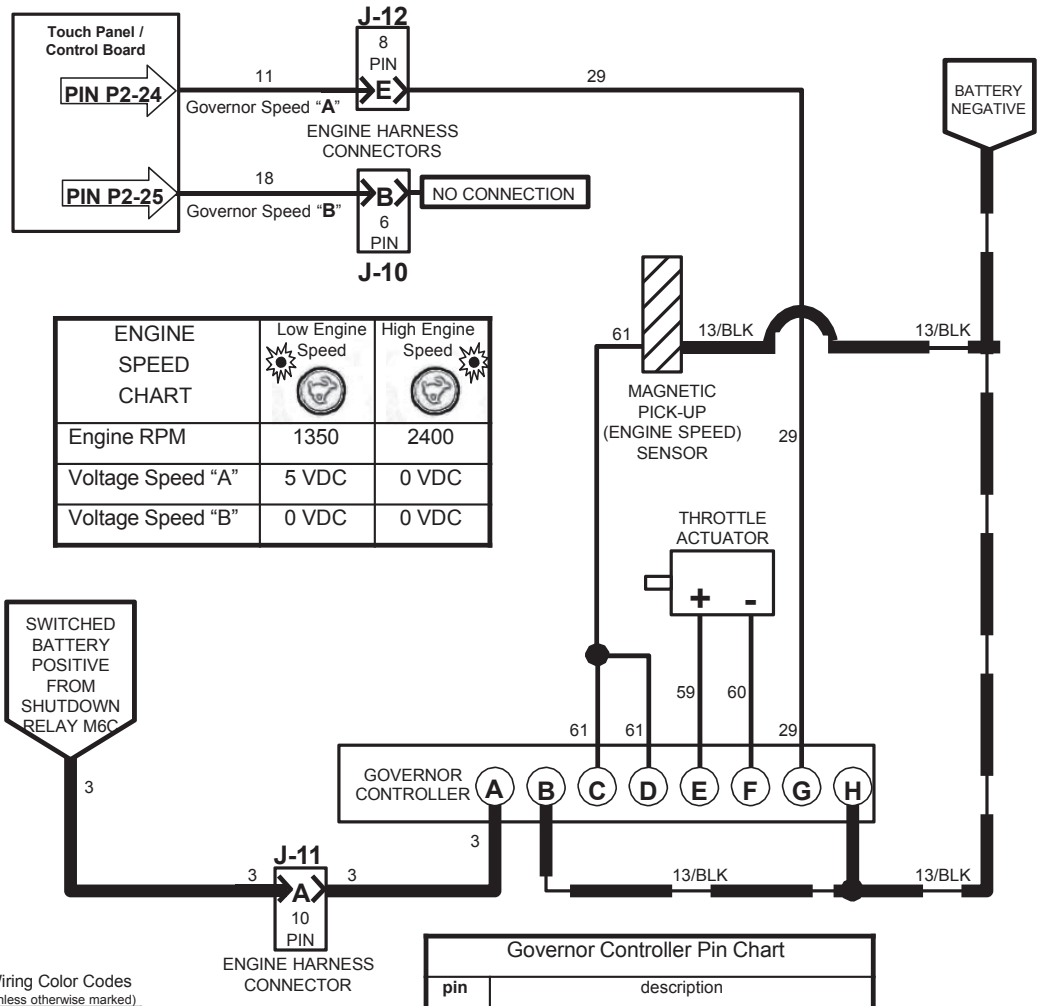
E

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

T20 Engine Speed Control

(Diesel)



ENGINE SPEED CHART	Low Engine Speed	High Engine Speed
Engine RPM	1350	2400
Voltage Speed "A"	5 VDC	0 VDC
Voltage Speed "B"	0 VDC	0 VDC

E

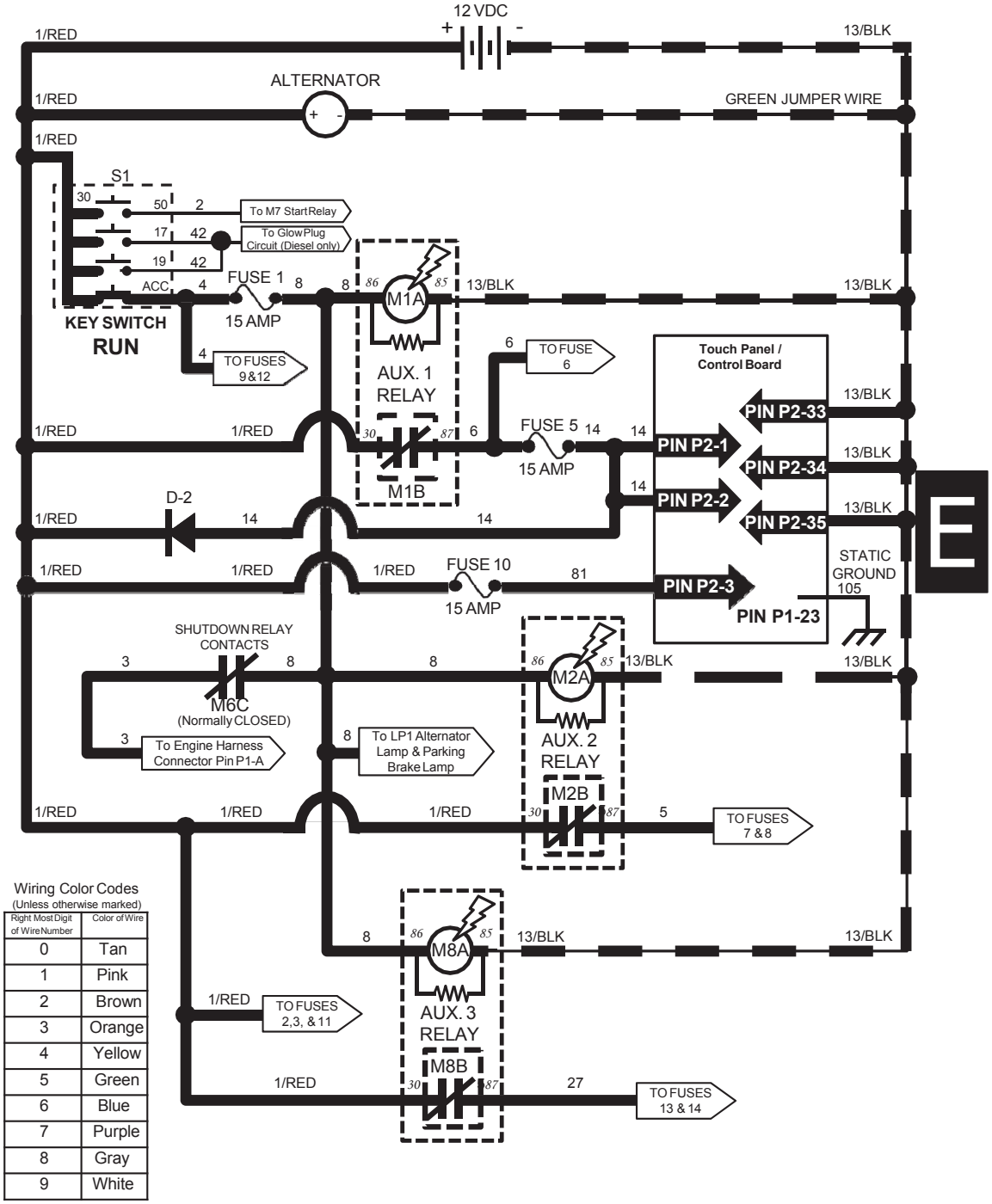
Wiring Color Codes
(Unless otherwise marked)

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

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"

T20 Key On Power Distribution

Conditions: Key On, Engine Off

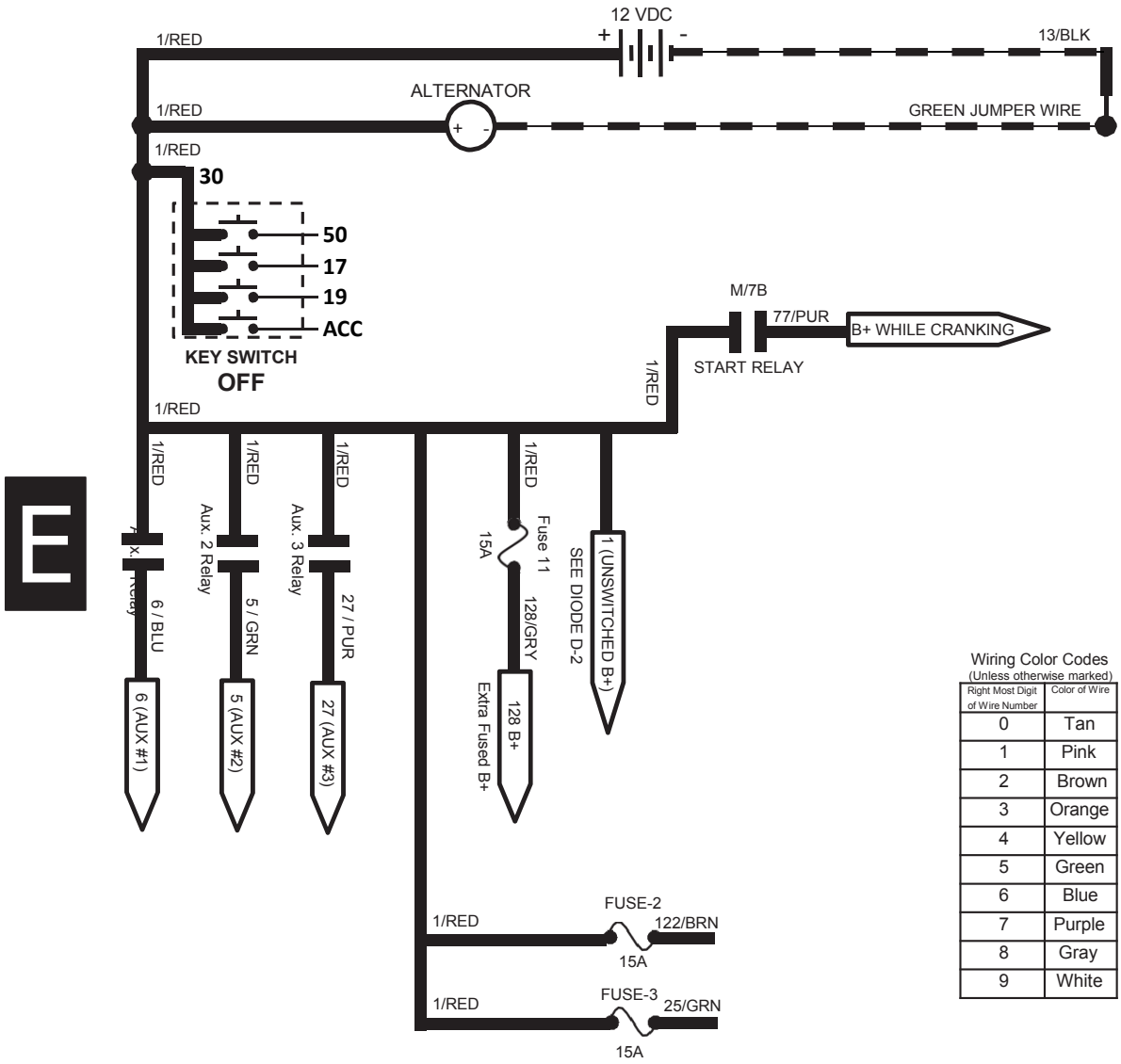


Wiring Color Codes
(Unless otherwise marked)

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

T20 Key Off Power Distribution

Conditions: Key Off



Wiring Color Codes
(Unless otherwise marked)

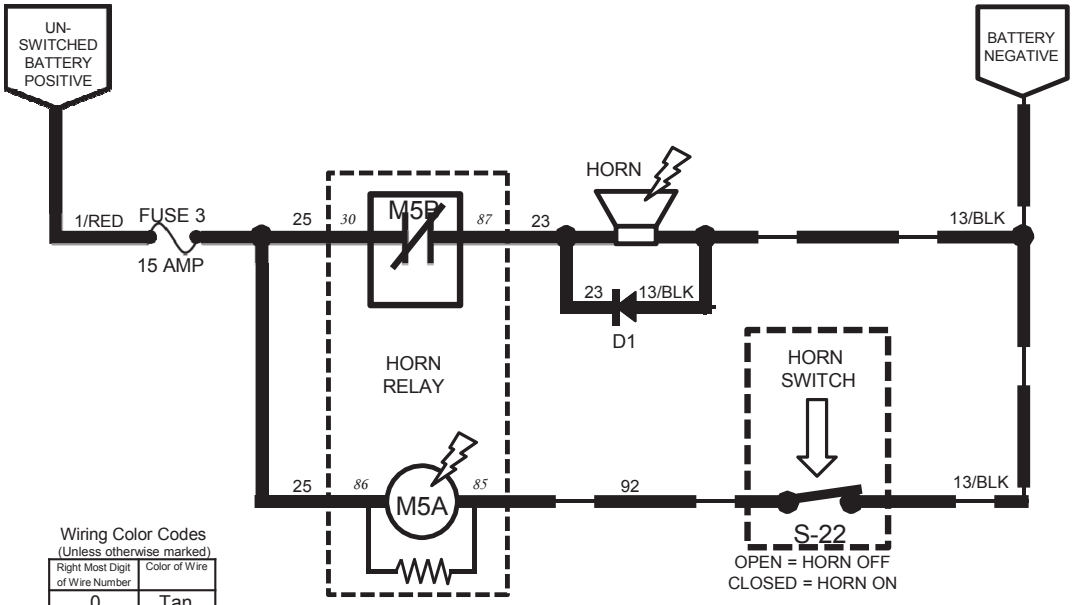
Right Most Digit of Wire Number	Color of Wire
0	Tan
1	Pink
2	Brown
3	Orange
4	Yellow
5	Green
6	Blue
7	Purple
8	Gray
9	White

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.

T20 Horn

Conditions: Key On, Switch Activated



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

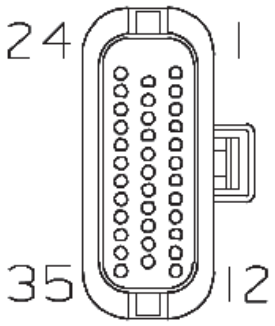
E

T20 Enable/Disable Chart

M20 Control Board Inputs and the Outputs they Control	Input →		Fuel Level Sender (Gas, Diesel)	Fuel Pressure Switch Closed (LPG)	Solution Tank Full Switch Closed	Recovery Tank Full Switch Closed	Recovery Tank Half Full Switch Closed	Clogged Hydraulic Filter Switch Closed	Soution Tank Empty Switch Closed	Hydraulic Oil Temperature Sensor above 230F	Impact Sensor Closed	Propel Pedal Sensor FORWARD	Propel Pedal Sensor REVERSE	Propel Pedal Sensor NEUTRAL	Touch Panel Input(s) Required to **ENABLE**	Touch Panel Input(s) Required to **DISABLE**	Notes
Output ↓	com ponent #		S-7	S-8	S-14	S-15	S-16	S-17	S-19	S-20	S-23	n/a	n/a	n/a			
		pin	P1-4	P1-4	P1-12	P1-13	P1-14	P1-15	P1-11	P1-17	P1-21	P1-1	P1-1	P1-1			
Scrub Vacuum Fan Valve ON	SV-1	P2-28				D									OneStep Scrub ON; Squeegee/Scrub Vacuum ON	OneStep Scrub OFF; Squeegee/Scrub Vacuum OFF; Low Engine Speed Selected	
Main Brush Head Down Pressure Valve ON	SV-2	P2-4				D						E see notes	E see notes	Refer to Notes	OneStep Scrub ON	OneStep Scrub OFF; Low Engine Speed Selected	Propel required to to get full operational down pressure
Main Brush Head Lower Valve ON	SV-3	P2-5				D						E see notes	E see notes	Refer to Notes	OneStep Scrub ON	OneStep Scrub OFF; Low Engine Speed Selected	Propel required to to get full operational down pressure
Rear and Side Squeegees Lower Valve ON	SV-4	P2-6				D						E	D	E	OneStep Scrub ON; Squeegee/Scrub Vacuum ON	OneStep Scrub OFF; Low Engine Speed Selected; Squeegee/Scrub Vacuum OFF	
Main Brushes Spin Valve ON	SV-6	P2-5				D						E see notes	E see notes	Refer to Notes	OneStep Scrub ON	OneStep Scrub OFF; Low Engine Speed Selected	Propel required to to get full operational down pressure
Hydraulic Enable Valve ON	SV-7	P2-8													Turning ON Any Touch Panel Function OR Selecting High Engine Speed	Refer to Notes	Turns OFF automatically if not required (SV-7 is required for all hydraulic functions EXCEPT sweep and scrub vacuum fans)
Side Brush Spin Valve ON	SV-8	P2-9				D						E	E		Side Brush ON (after OneStep Scrub ON)	OneStep Scrub OFF; Low Engine Speed Selected; Side Brush OFF	
Side Brush Down Pressure Valve ON	SV-10	P2-11				D						E	E		Side Brush ON (after OneStep Scrub ON)	OneStep Scrub OFF; Low Engine Speed Selected; Side Brush OFF	
Side Brush Lower Valve ON	SV-11	P2-12				D											
Side Brush Extend Valve ON	SV-12	P2-9				D						E	E		Side Brush ON (after OneStep Scrub ON)	OneStep Scrub OFF; Low Engine Speed Selected; Side Brush OFF	
Auto-Fill Solution Tank Valve ON	SOL-1	P2-13			D												
Auto-Fill Recovery Tank Valve ON	SOL-2	P2-14					D										
Main Brushes Solution Valve ON	SOL-3	P2-19				D											
ES Pump ON ***OR*** FaST Enable Valve, Air Pump & Water Pump Relay ON	SOL-4, M11	P2-22			D ES only	D	E ES only										
FaST High Flow Valve ON	SOL-5	P2-23				D											
FaST Side Brush Valve ON	SOL-6	P2-26				D											
Side Brush Solution Valve ON	SOL-7	P2-20				D											
Reverse Propel Relay ON	M4A	P2-17															
Shut Down Relay ON	M6A	P2-18															
Detergent Pump ON ***OR*** FaST Detergent Pump ON	n/a	P2-21				D											
Audible Alarm	n/a	P2-29	E when low	E when low				E	E	E							
Low Engine Oil Pressure Lamp	n/a	P2-27															If low oil pressure, engine ECM will shutdown the engine after a time delay
Governor Speed Bit "A"	n/a	P2-24															
Governor Speed Bit "B"	n/a	P2-25															

E = Input required to ENABLE output D = Input req

T20 Control Board Connectors
P1 Connector

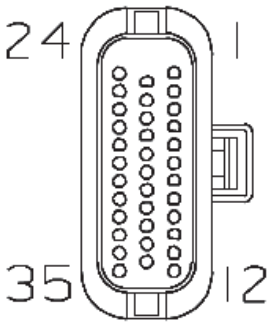


Viewed from wire side of connector

Socket #	Wire #	Color	Type	Goes To:
P1-1	91	Pink	Input	Forward/Reverse Propel Sensor
P1-2	150	Tan	Input	ec-H20 Green LED
P1-3	89	White	Input	Switch 6 Hopper Position
P1-4	30	Tan	Input	Fuel Sensor
P1-5	129	White	Input	Thermal Sentry
P1-6	39	White	Input	Shaker Switch (Partial)
P1-7	35	Green	Input	Hopper Up/Dn Switch (Signal Down)
P1-8	36	Blue	Input	Hopper Up/Dn Switch (Signal Up)
P1-9	42	Brown	Input	Hopper Door Switch (Signal Door Open)
P1-10	43	Orange	Input	Hopper Door Switch (Signal Door Close)
P1-11	177	Purple	Input	Solution Tank Empty
P1-12	44	Yellow	Input	Solution Tank Full
P1-13	45	Green	Input	Recovery Tank Full
P1-14	46	Blue	Input	Recovery Tank 1/2 Full
P1-15	90	Tan	Input	Clogged Hydraulic Filter
P1-16	48	Gray	Input	Clogged Shaker Filter (N.O. / Closed=Clogged)
P1-17	78	Gray	Input	Hydraulic Temp Sensor
P1-18	12	Brown	Input	Engine Temp. DSL
P1-19	9	White	Input	N.O. Oil Pressure
P1-20	149	White	Input	ec-H20 Red LED
P1-21	94	Yellow	Input	Connects to CE Seat Switch Harness
P1-22	186	Blue	Input	To: Engine ECM
P1-23	187	Purple	Input	To: Engine ECM
P1-24	22	Brown	Input	Brake Sitch Sense
P1-25	- -	CAN+/Yellow	- -	User Interface Module
P1-26	- -	CAN-/Green	- -	User Interface Module
P1-27	XXX	XXX	XXX	XXX
P1-28	XXX	XXX	XXX	XXX
P1-29	10	Tan	Input	To: Engine ECM
P1-30	XXX	XXX	XXX	XXX
P1-31	XXX	XXX	XXX	XXX
P1-32	7	Purple	Input	Alternator Charging
P1-33	XXX	XXX	XXX	XXX
P1-34	16	Blue	Output	Flyback Net 17
P1-35	17	Purple	Output	Flyback Net 18

T20 Control Board Connectors
P2 Connector

Socket #	Wire #	Color	Type	Goes To:
P2-1	14	Yellow	12 VDC	Board
P2-2	14	Yellow		Flyback Net: 14
P2-3	49	White	Output	Main Brush On
P2-4	57	Purple	Output	Main Brush Pattern (PWM)
P2-5	58	Gray	Output	Main Brush Down
P2-6	59	White	Output	Squeegees Down
P2-7	60	Tan	Output	Hopper Up
P2-8	61	Pink	Output	Enable Valve
P2-9	50	Tan	Output	Side Broom Extend
P2-10	63	Orange	Output	Sweep Vac Fan On
P2-11	64	Yellow	Output	Side Srub Pattern (PWM)
P2-12	66	Blue	Output	Side Broom Down
P2-13	65	Green	Output	Opt: Auto Fill Sol
P2-14	67	Purple	Output	Opt: Auto Fill Rec
P2-15	68	Gray	Output	Hopper Door Open
P2-16	69	White	Output	Shaker Relay
P2-17	70	Tan	Output	Reverse Relay
P2-18	71	Pink	Output	Shutdown Relay
P2-19	72	Brown	Output	Main Scrub Water Valve
P2-20	181	Pink	Output	Side Brush Water Valve
P2-21	74	Yellow	Output	Detergent Pump (PWM)
P2-22	75	Green	Output	ES Pump (Opt.)
P2-23	79	White	Output	Fast High Flow Valve / Fast Pump (Opt.)
P2-24	11	Pink	Output	Speed Bit A
P2-25	18	Gray	Output	Speeed Bit B
P2-26	80	Tan	Output	Fast Side Brush
P2-27	92	Brown	Output	Horn Relay
P2-28	56	Blue	Output	Scrub Vac Fan On
P2-29	182	Brown	Output	Audibile Alarm
P2-30	62	Brown	Output	Side Scrub On
P2-31	53	Orange	Output	Hopper Down
P2-32	138	Green	Output	Hopper Latch Sol.
P2-33	13	Black	Output	Ground1
P2-34	13	Black	Output	Ground2
P2-35	13	Black	Output	Ground3



Viewed from wire side of connector

T20 Fault Indicators

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
Hydraulic Filter Clogged	**F3: CLOGGED HYD**	Indicates the hydraulic filter is clogged.
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.

T20 Condition & Warning Indicators

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
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 T20 machine is NOT programmed to operate with only the side brush ON.

HYDRAULIC TROUBLESHOOTING

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

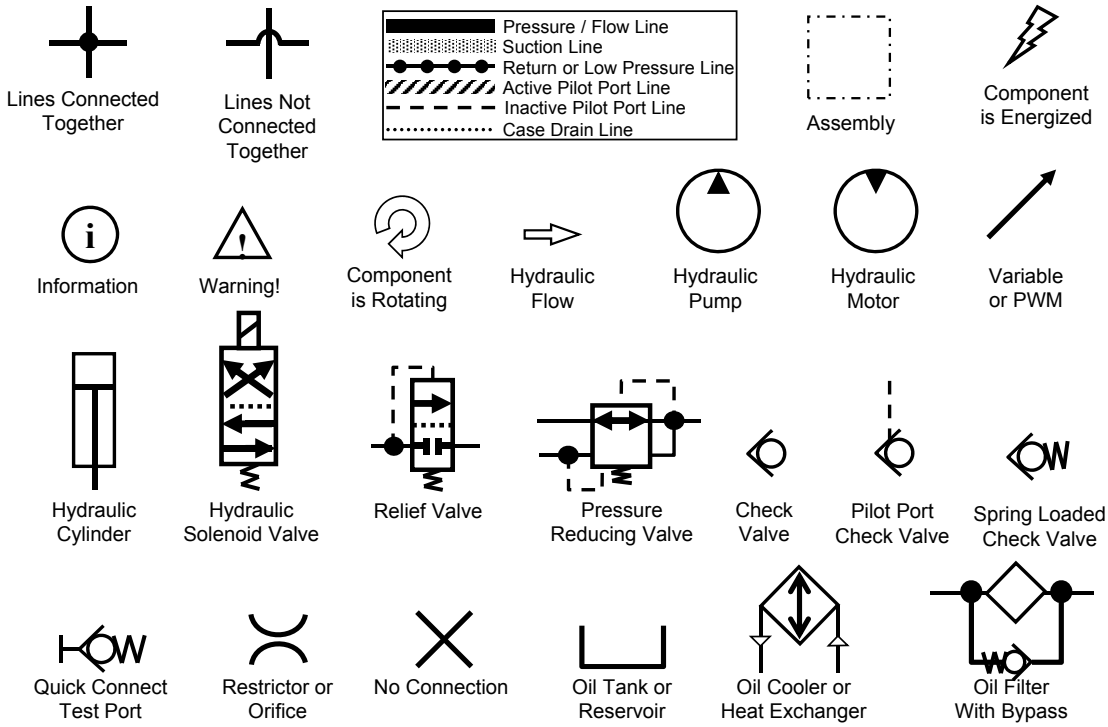
- DURING TESTS:

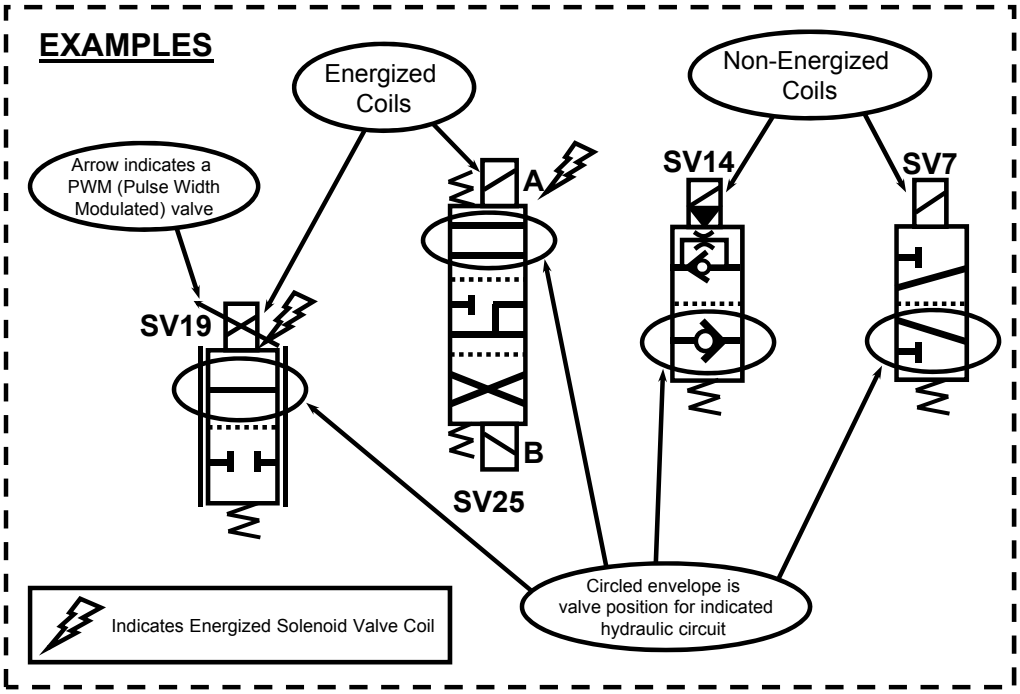
* Call Technical Services if Diagnostic Time Exceeds One Hour With Unknown Cause or Course of Action
* Maintain Normal Main Brush Pressure as Listed in Operator's Manual

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.

T20 General Information

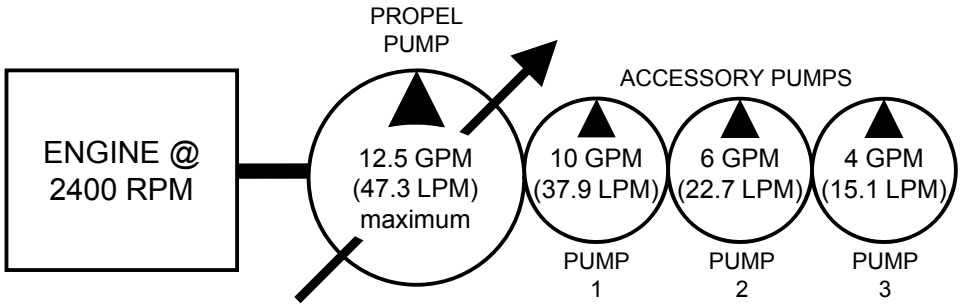
Commonly Used Hydraulic Symbols





T20 General Information

T20 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)

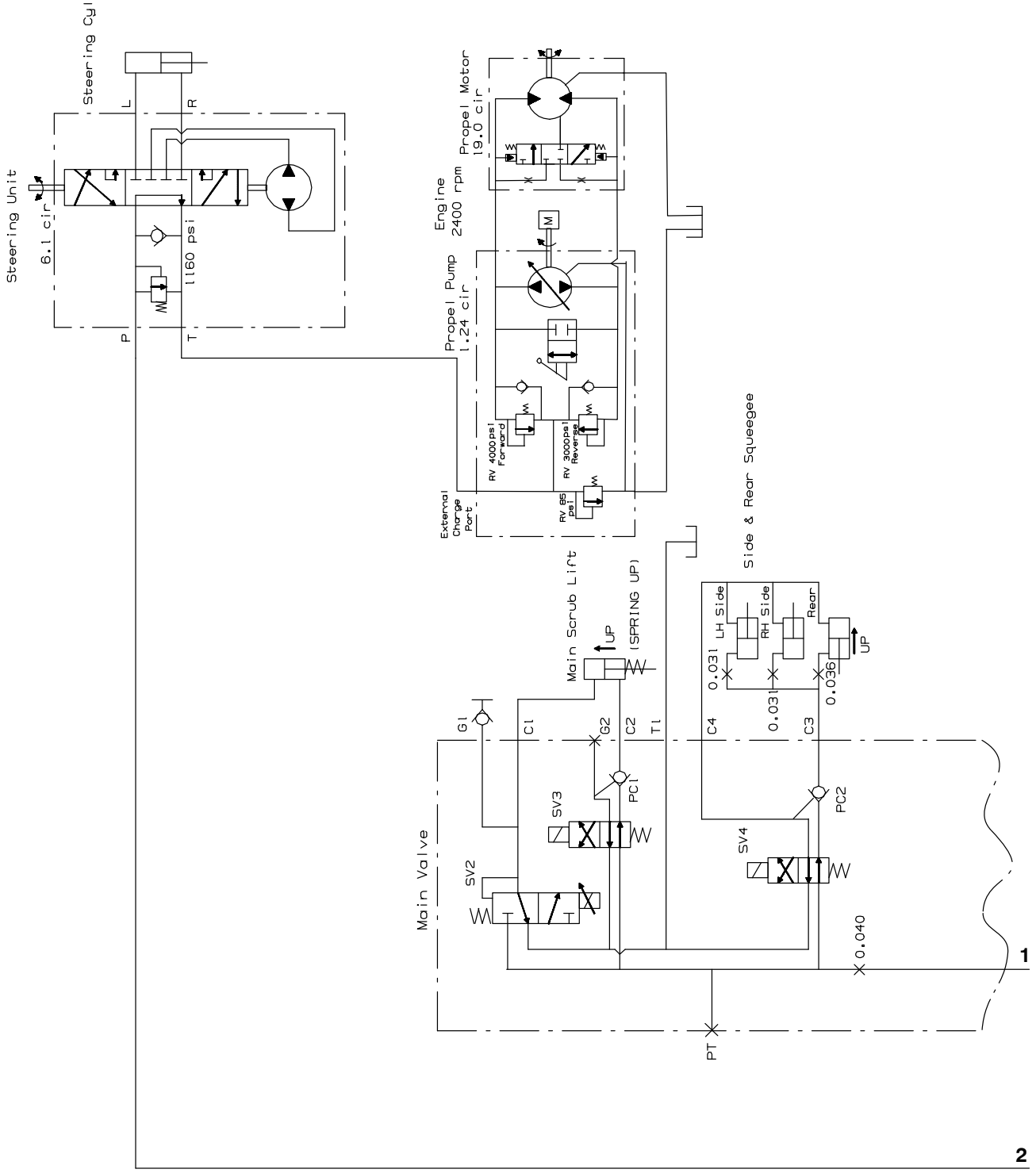
MFLD	Manifold
MTR	Motor (Hydraulic)
OR	Orifice
PC	Pilot Port Check Valve
PMP	Pump
PR	Pressure Relief Valve
PSI	Pounds Per Square Inch
PTO	Power Take Off
PWM	Pulse Width Modulation
RES	Reservoir
RH	Right Hand
RPM	Revolutions Per Minute
RV	Relief Valve
SC	Spring Loaded Check Valve
STRN	Strainer
SV	Solenoid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

Typical Hydraulic Manifold Port Markings

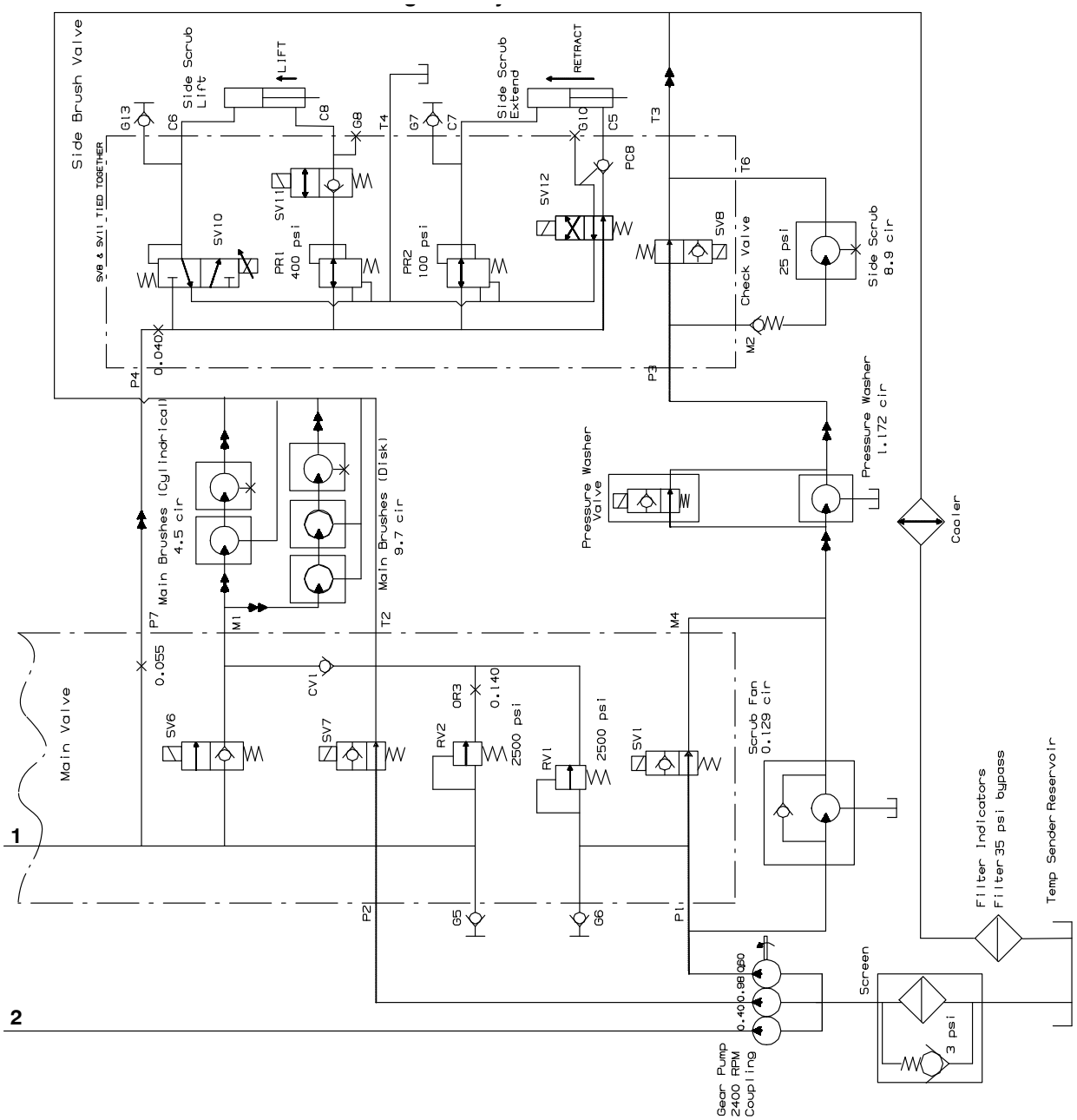
C	Hydraulic Cylinder Connection
G	Test Port
LS	Load Sense Port

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

HYDRAULIC SCHEMATIC



354520 – T20


Side Brush Valve
SV8 & SV11 TIED TOGETHER
Side Scrub Lift
LIFT
Side Scrub Extend
RETRACT
G13
C6
C8
G8
T4
G7
C7
G10
C5
T3
PC8
T6
SV11
SV10
PR1 400 psi
PR2 100 psi
SV12
SV8
Check Valve
25 psi
Side Scrub 8.9 cir
P4
0.040
M2
P3
Pressure Washer Valve
Pressure Washer 1.172 cir
Cooler
Main Brushes (Cylindrical) 4.5 cir
Main Brushes (Disk) 9.7 cir
P7
M1
T2
M4
0.055
CV1
OR3
0.140
2500 psi
RV2
RV1
2500 psi
SV1
Scrub Fan 0.129 cir
SV6
SV7
Main Valve
1
2
P2
G5
G6
P1
Filter Indicators
Filter 35 psi bypass
Temp Sender Reservoir
Screen
3 psi
0.400
Gear Pump 2400 RPM Coupling

354520 – T20

T20 Operating Matrix

Component / System	Function	Test Port	Test Port Location	Energized Coil(s)	Notes	Manifold(s) containing Solenoid Valve(s)	Location	Feed Port	Exit Port	Relief Valve in circuit	Relief Valve Pressure Setting (PSI)	Notes
Scrub Head	Down	G1	Scrub Manifold	SV2, SV3, SV7*	SV2 is PWM controlled; Down pressure varies with current to SV2; SV3 and SV6 are tied together electrically	Scrub Manifold	Left side, engine compartment, beside vacuum fan	C1	C2	RV2	2500	Operating Flow from accessory Pump # 1 (inner most pump)
	Up	G5	N/A	SV7*				C2	C1			
Squeegees, Side and Rear	Down	G5	Scrub Manifold	SV4, SV7*	Use Manual Mode during testing	Scrub Manifold	Left side, engine compartment, beside vacuum fan	C4	C3	RV2	2500	Operating Flow from accessory Pump # 1 (inner most pump)
	Up	G5	N/A	SV7*				C3	C4			
Main Brushes	Operate	G5	Scrub Manifold	SV6, SV7*	Use Manual Mode during testing to obtain full down pressure; SV3 and SV6 are tied together electrically	Scrub Manifold	Left side, engine compartment, beside vacuum fan	M1	Tank	RV2	2500	Operating Flow from accessory Pump # 1 (inner most pump)
Scrub Fan	Operate	G6	Scrub Manifold	SV1		Scrub Manifold	Left side, engine compartment, beside vacuum fan	Accessory Pump # 2	P3	RV1	2500	Operating Flow from accessory Pump # 2 (middle pump)
Side Brush	Operate	G6	Scrub Manifold	SV8	Use Manual Mode during testing	Side Brush Manifold	Left front corner of frame	M2	T6	RV1	2500	Operating Flow from accessory Pump # 2 (middle pump)
Side Brush	Up	G5	Side Valve	SV7*	Operate Side Brush up and down using Manual Mode--Watch change in pressure on G5 and/or G13; SV8 and SV11 tied together electrically	Side Brush Manifold	Left front corner of frame	C8	C6	RV2	2500	Operating Flow from accessory Pump # 1 (inner most pump)
	Down	G13		SV10, SV11, SV7*				C6	C8			
	Retract	G5		SV7*				C5	C7			
	Extend	G7		SV12, SV7*				C7	C5			

* SV7 is Enable Solenoid for the given functions

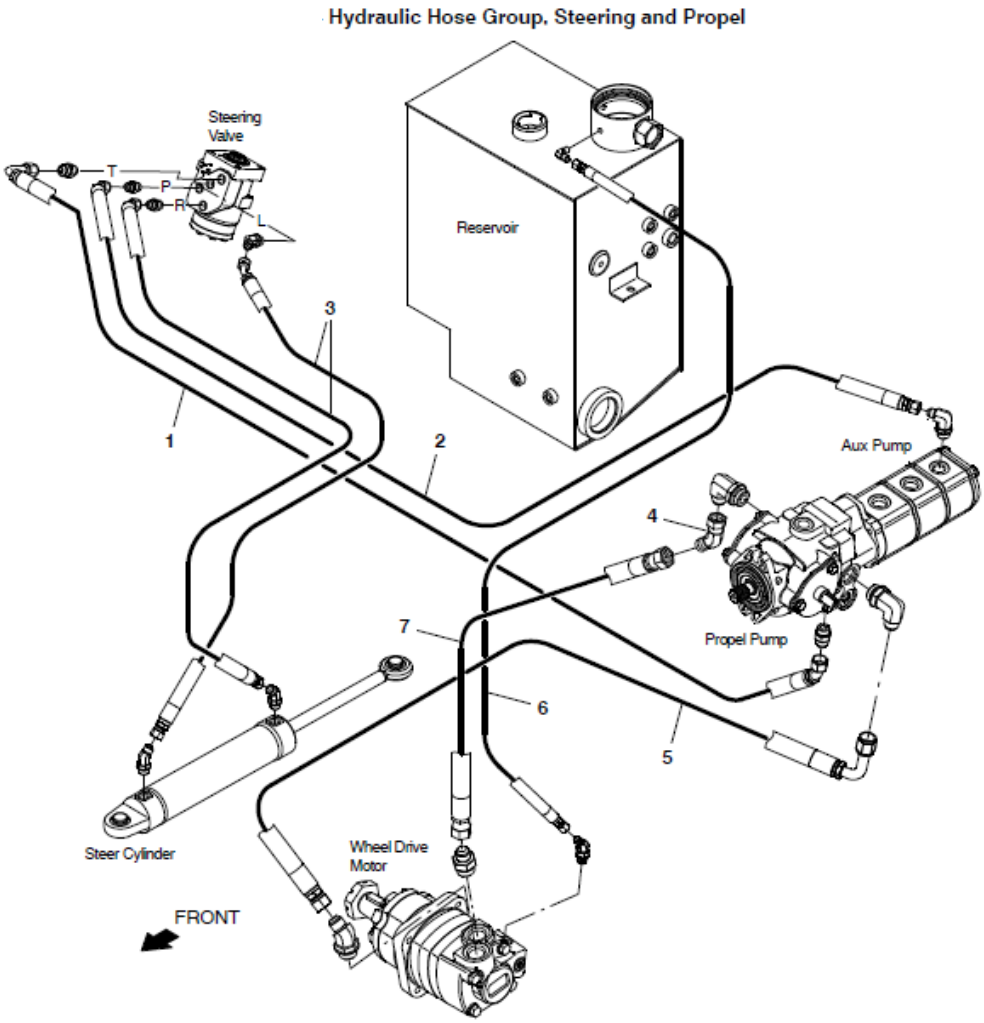
T20 Option Components

The following chart lists various options and the electrical and/or hydraulic components that are associated with the option. Refer to the “notes” section for any components that are deleted from a standard machine in order to have the installed option.

option	added components	E or H	component #	notes
Side Brush	Side Brush ON Solenoid Valve	E,H	SV-8	
	Side Brush Pressure Solenoid Valve	E,H	SV-10	
	Side Brush Down Solenoid Valve	E,H	SV-11	
	Side Brush Extend Solenoid Valve	E,H	SV-12	
	FaST Side Brush Valve	E	SOL-6	
	Side Brush Water Valve	E	SOL-7	
	Side Brush Manifold	H	x	
	Side Brush Lift Cylinder	H	x	
	Side Brush Extend Cylinder	H	x	
	Side Brush Motor	H	x	
ES (Extended Scrub)	Solution Tank Auto Fill Water Valve	E	SOL-1	If machine has ES option, the following components will ***not*** be on the machine: FaST Water Pump, FaST Water Pump Relay (M11), FaST Detergent Pump, FaST Air Pump, FaST Enable Valve (SOL-4), FaST High Flow Valve (SOL-5), FaST Side Brush Valve (SOL-6)
	Recovery Tank Auto Fill Water Valve	E	SOL-2	
	Solution Tank Full Switch	E	S-14	
	Recovery Tank Half Full Switch	E	S-16	
	Detergent Pump	E	x	
	ES Pump	E	x	
Spray Hose	Spray Hose Pump	E	x	
	Spray Hose Relay	E	M12	
	Spray Hose Switch	E	S-25	

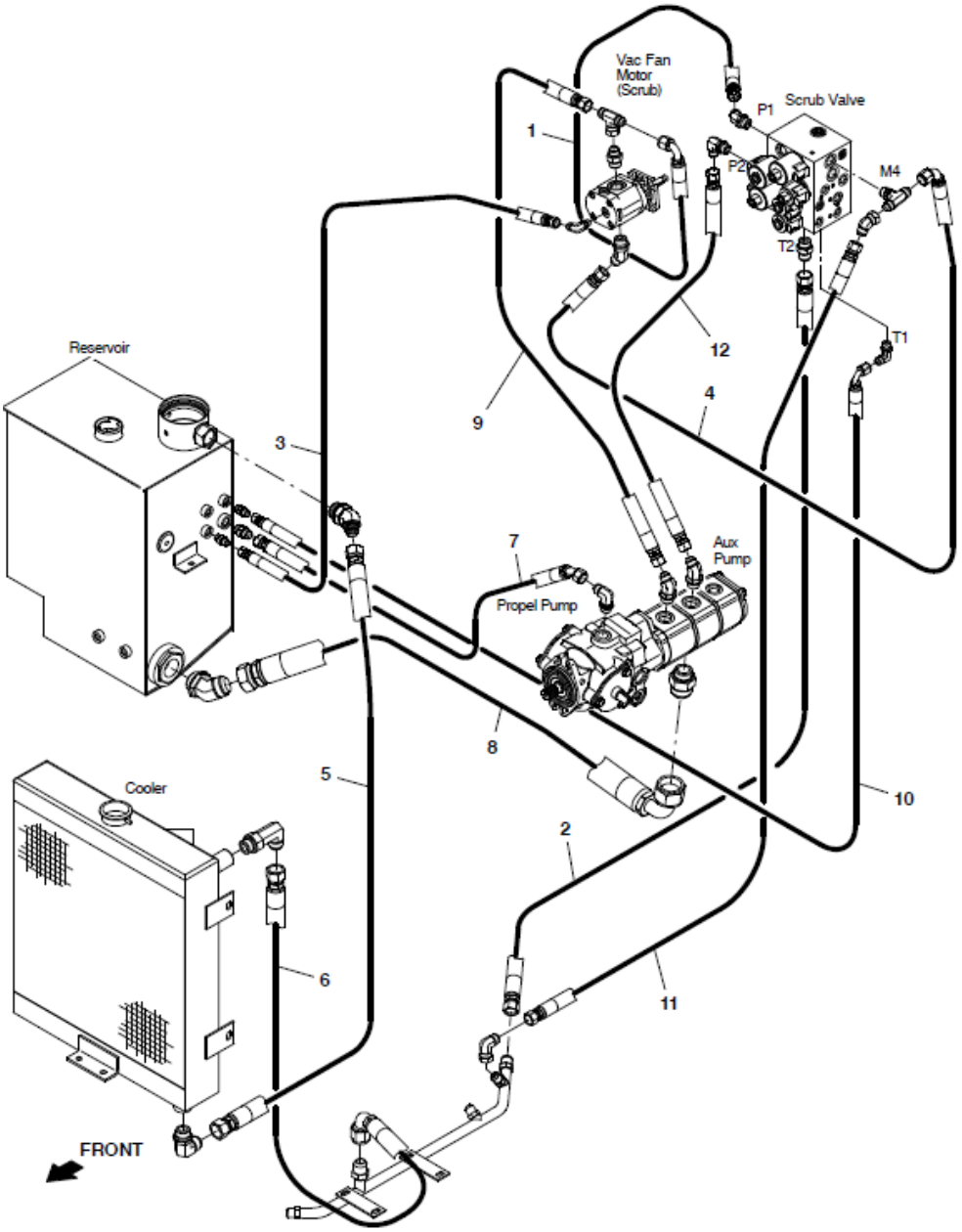
E = Electrical Component
H = Hydraulic Component

Hose Group: Steering and Propel



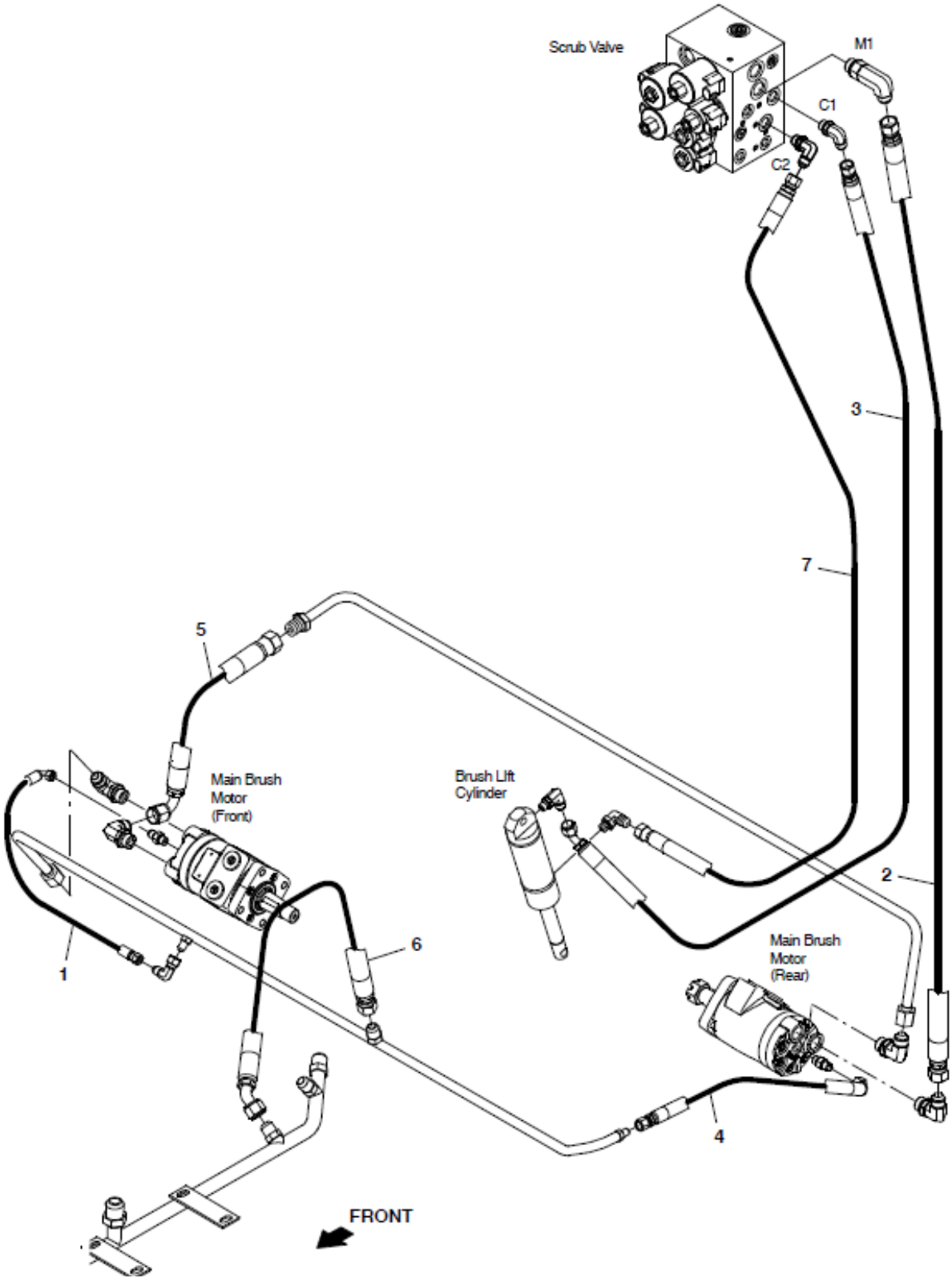
Hose Group: Pump and Vacuum Fan

Fig. 52 – Hydraulic Hose Group, Pump and Vacuum Fan

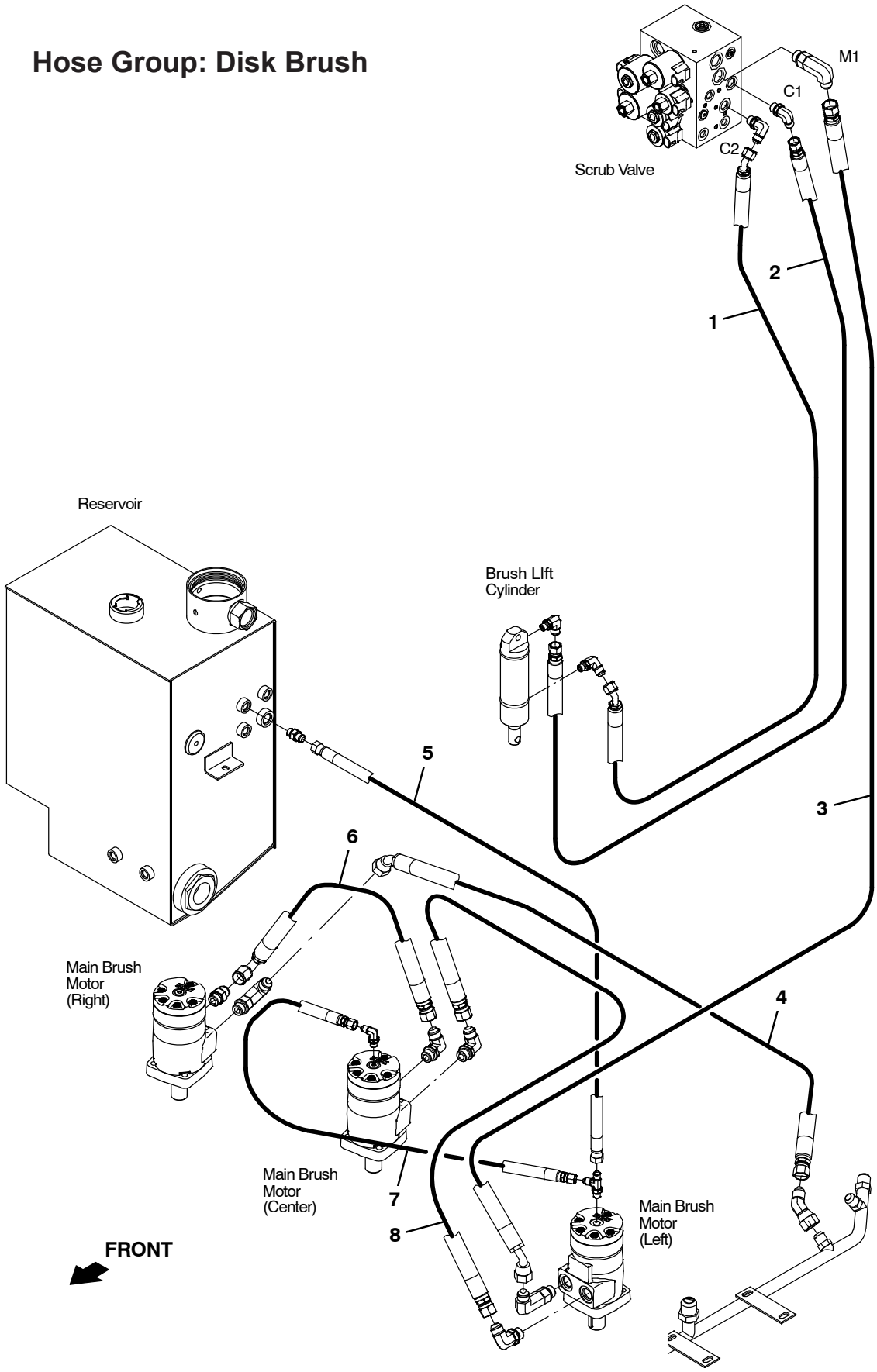


Hose Group: Cylindrical Brush

Fig. 53 – Hydraulic Hose Group, Cylindrical Brush

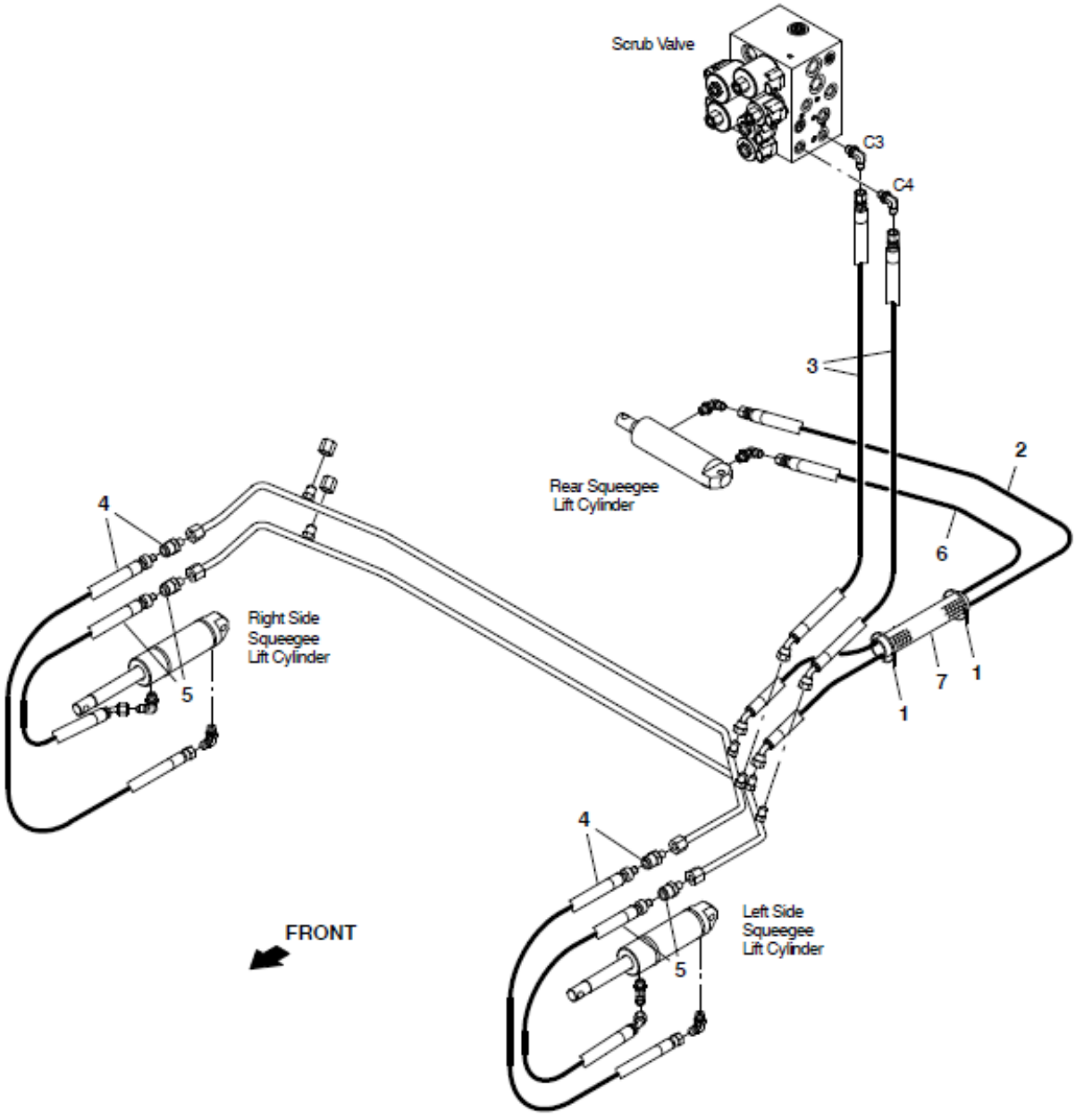


Hose Group: Disk Brush



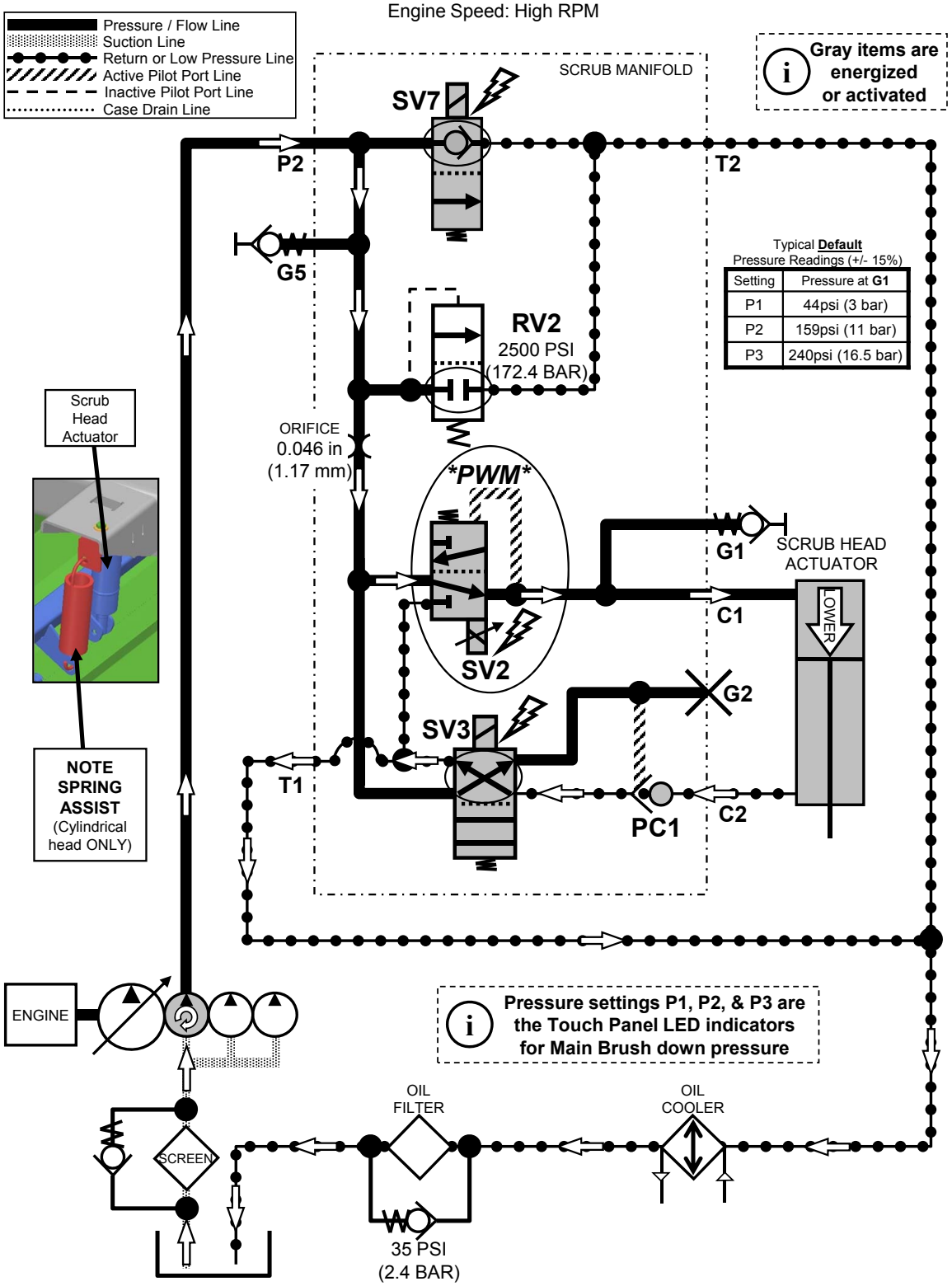
Hose Group: Squeegee Lift

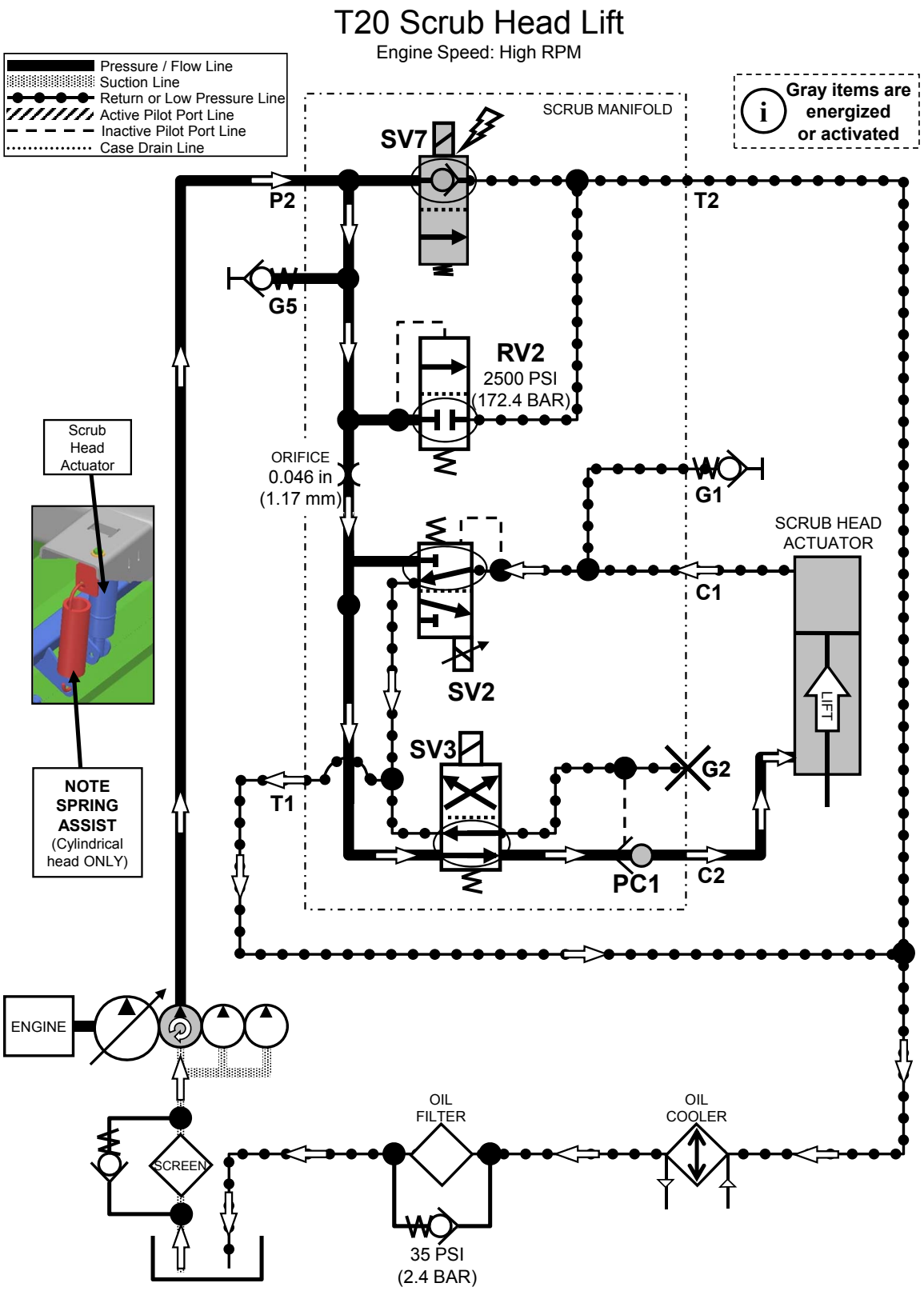
Fig. 55 – Hydraulic Hose Group, Squeegee Lift



T20 Scrub Head Lower

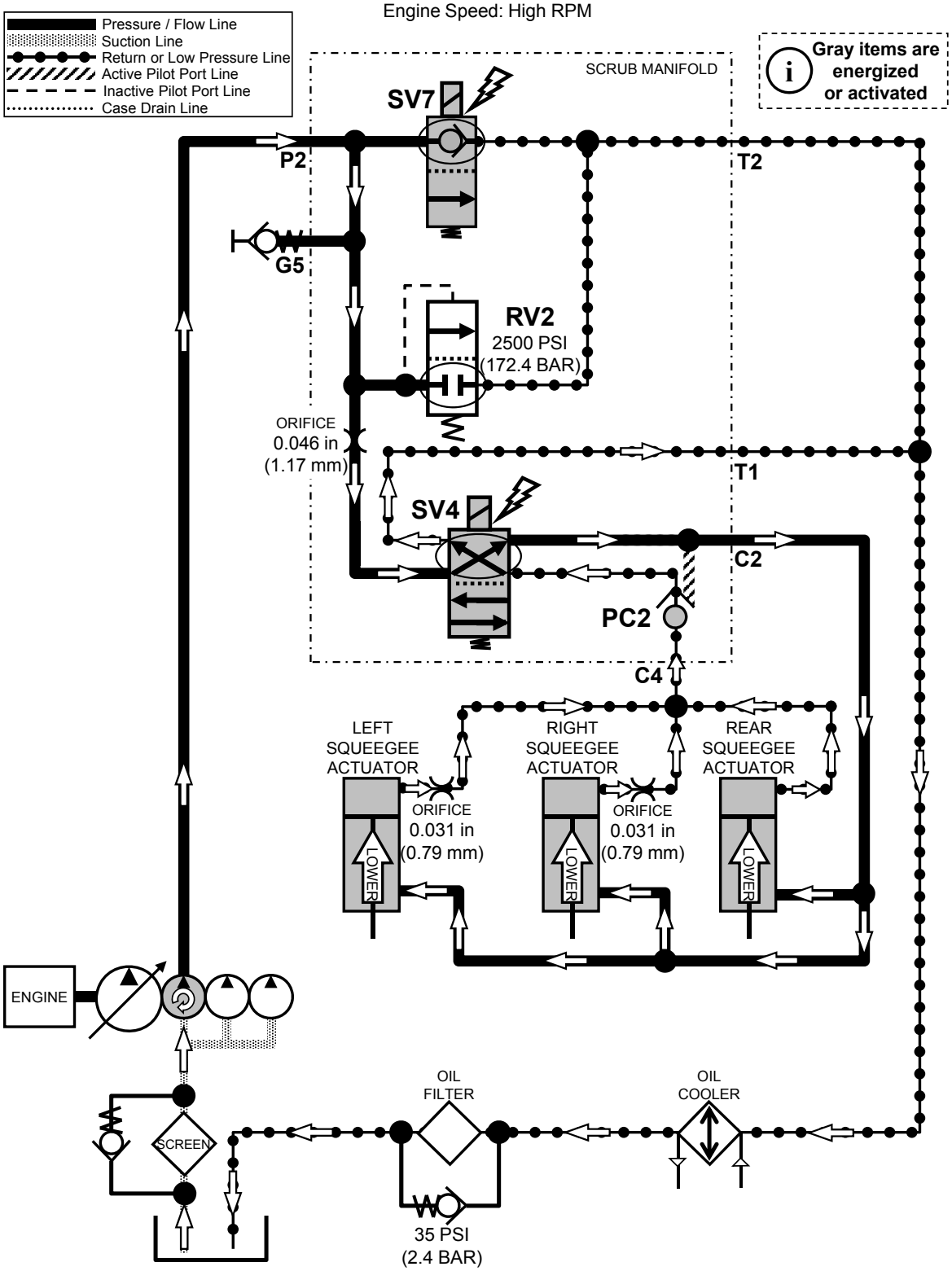
Engine Speed: High RPM




T20 Scrub Head Lift
Engine Speed: High RPM
Pressure / Flow Line
Suction Line
Return or Low Pressure Line
Active Pilot Port Line
Inactive Pilot Port Line
Case Drain Line
SCRUB MANIFOLD
Gray items are energized or activated
SV7
P2
T2
G5
RV2
2500 PSI
(172.4 BAR)
Scrub Head Actuator
ORIFICE
0.046 in
(1.17 mm)
G1
SCRUB HEAD ACTUATOR
C1
SV2
LIFT
SV3
G2
T1
PC1
C2
NOTE SPRING ASSIST
(Cylindrical head ONLY)
ENGINE
OIL FILTER
OIL COOLER
SCREEN
35 PSI
(2.4 BAR)

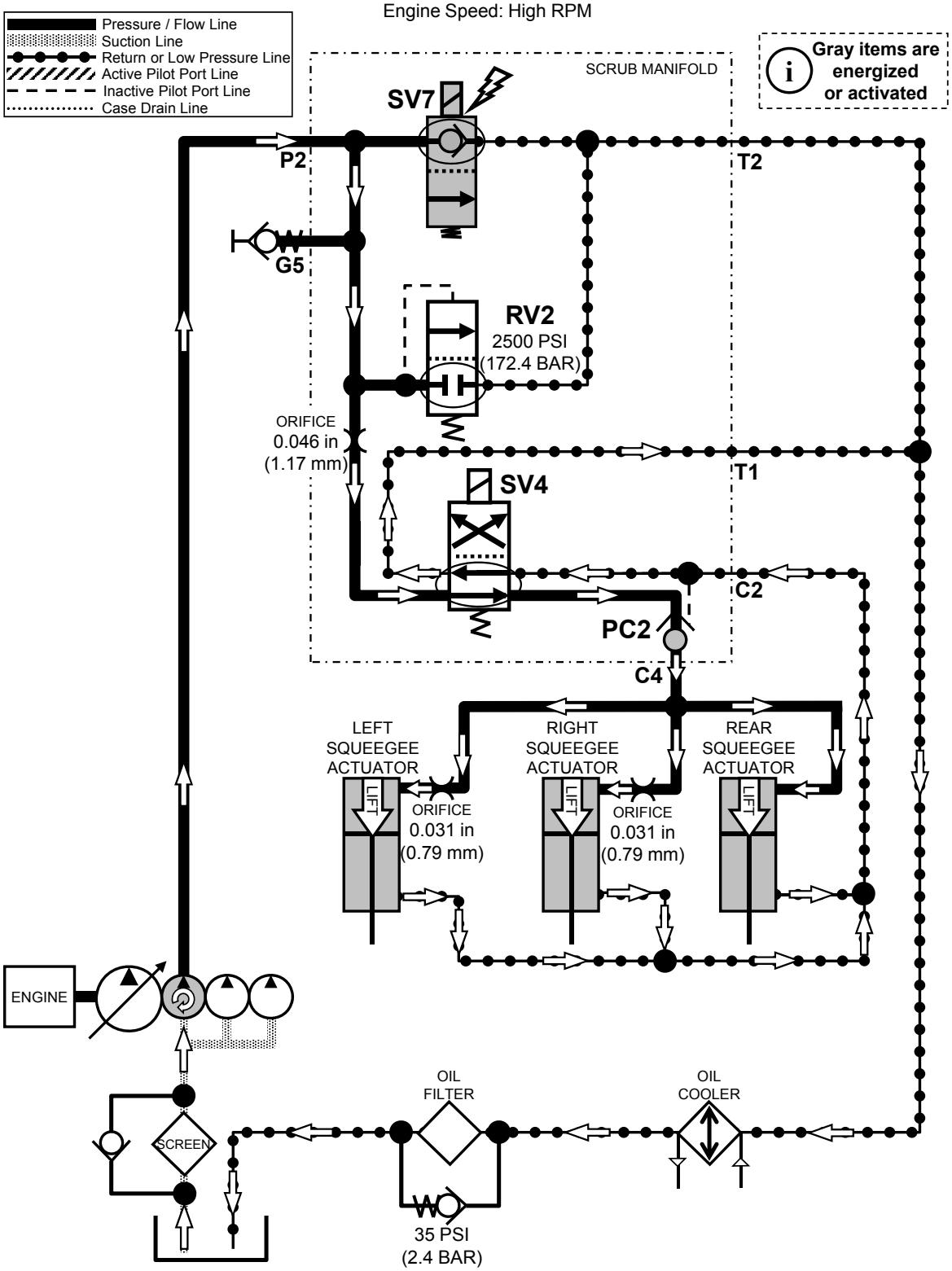
T20 Squeegees Lower

Engine Speed: High RPM



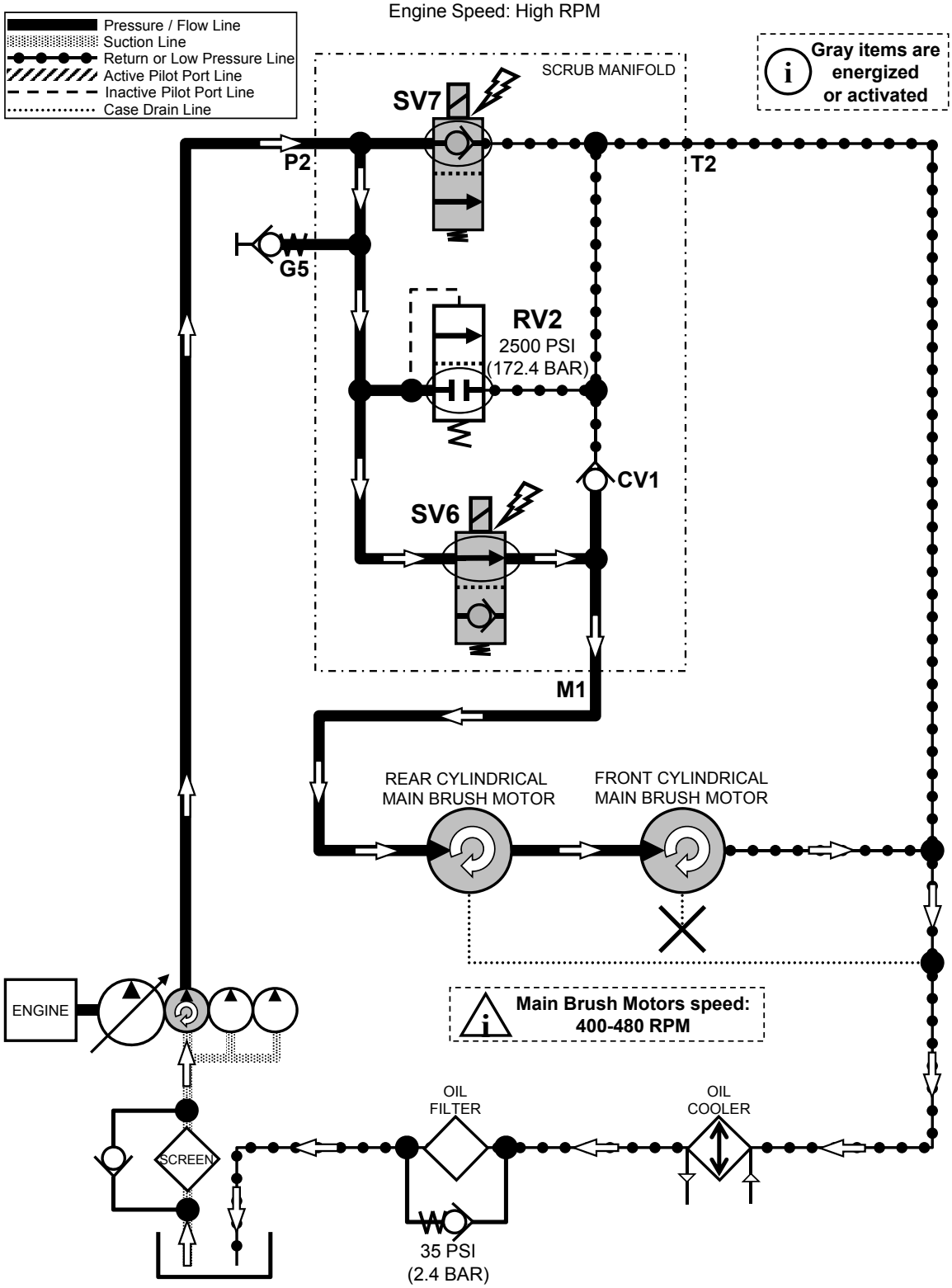
T20 Squeegees Lift

Engine Speed: High RPM



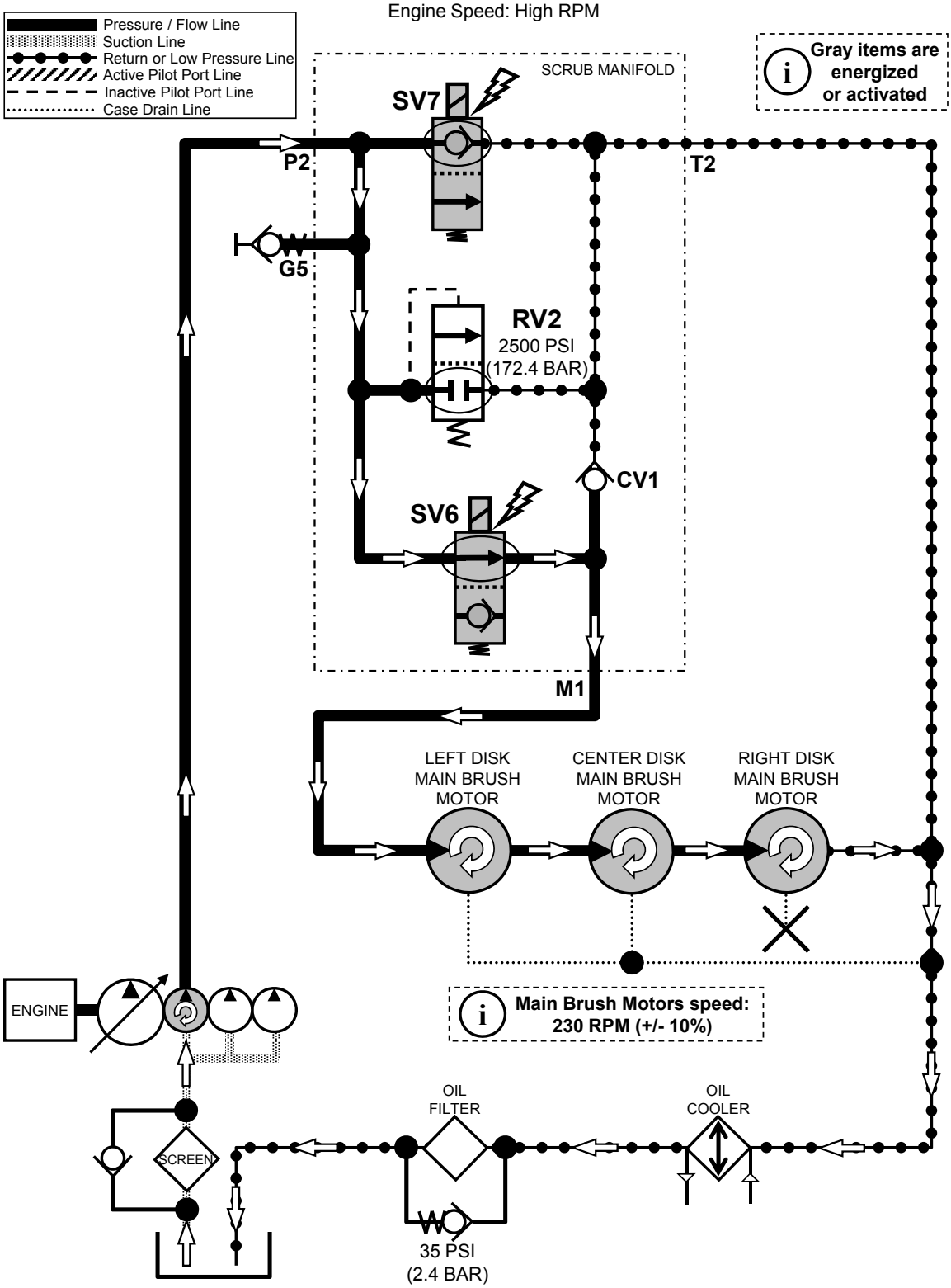
T20 Main Brushes ON (Cylindrical Only)

Engine Speed: High RPM



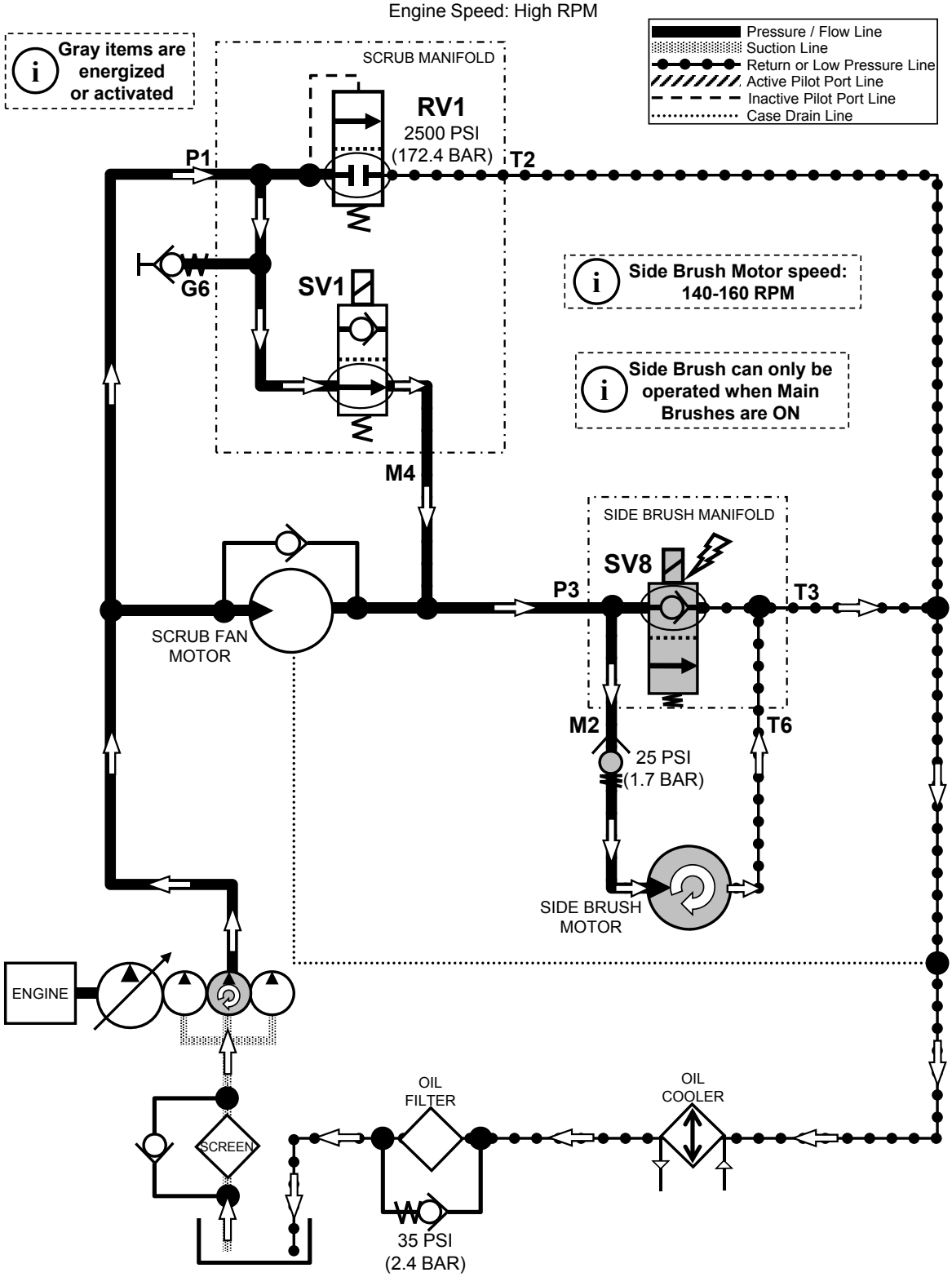
T20 Main Brushes ON (Disk Only)

Engine Speed: High RPM



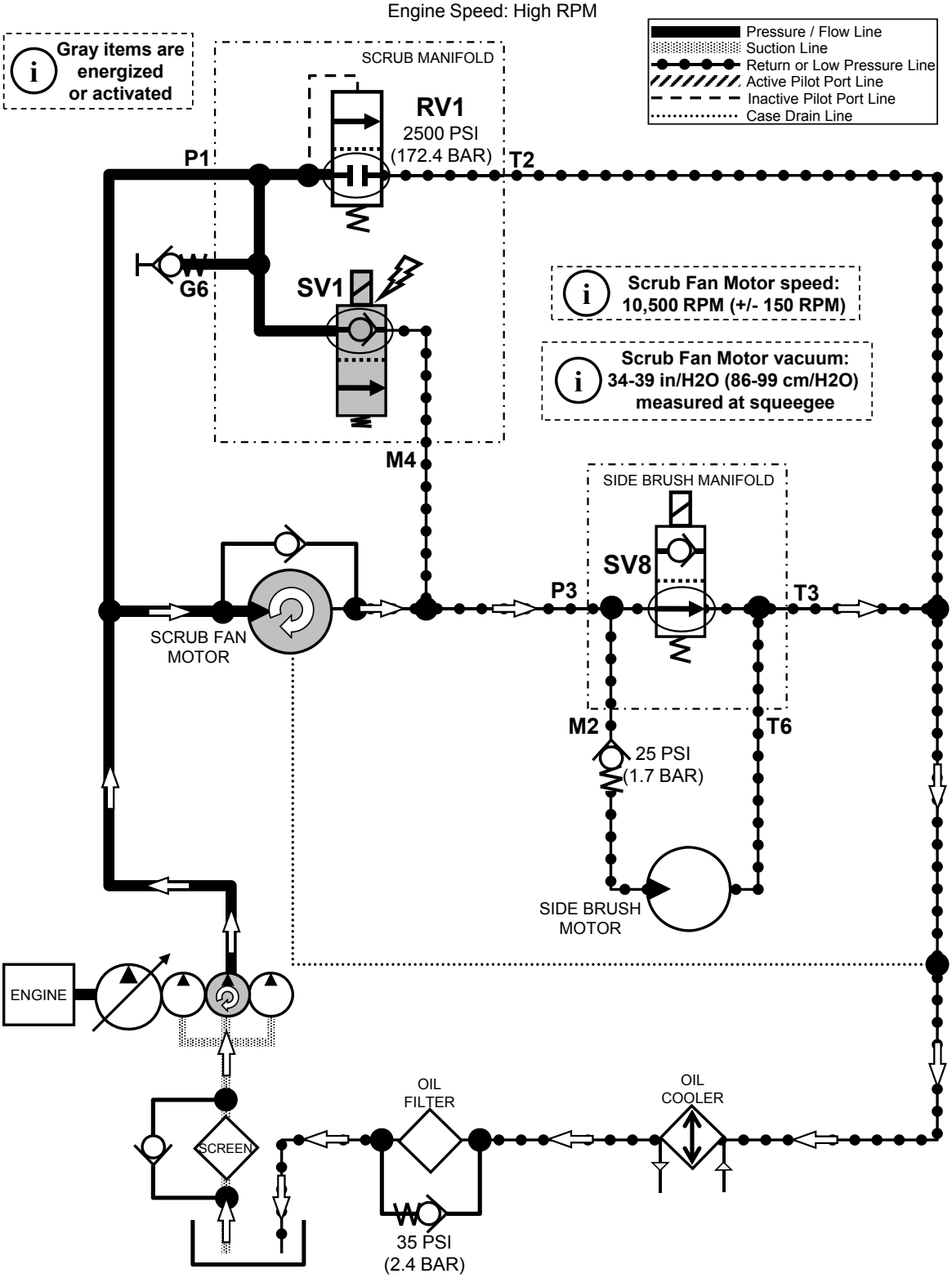
T20 Side Brush ON

Engine Speed: High RPM



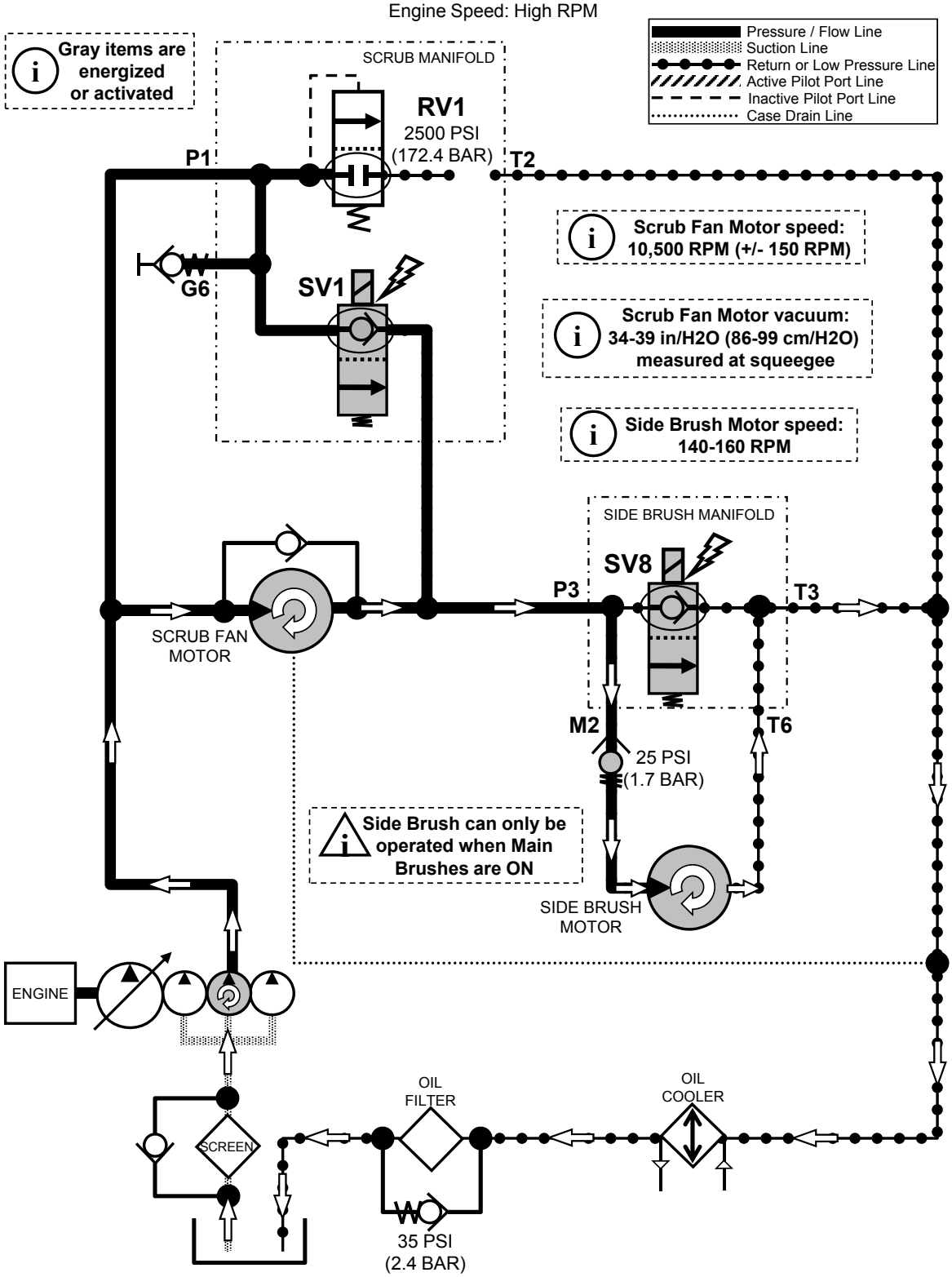
T20 Scrub Vacuum Fan ON

Engine Speed: High RPM



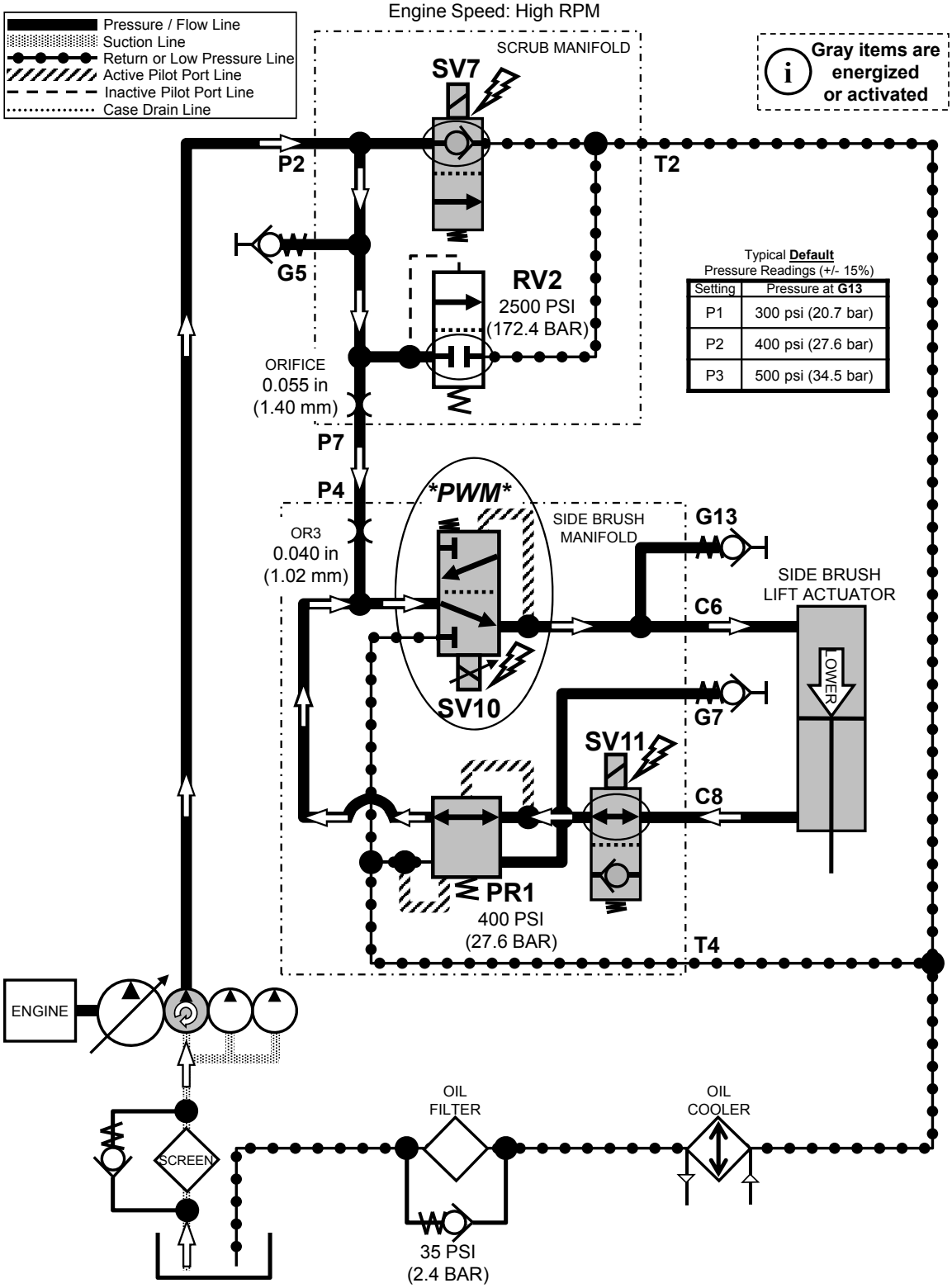
T20 Scrub Vacuum Fan & Side Brush ON

Engine Speed: High RPM



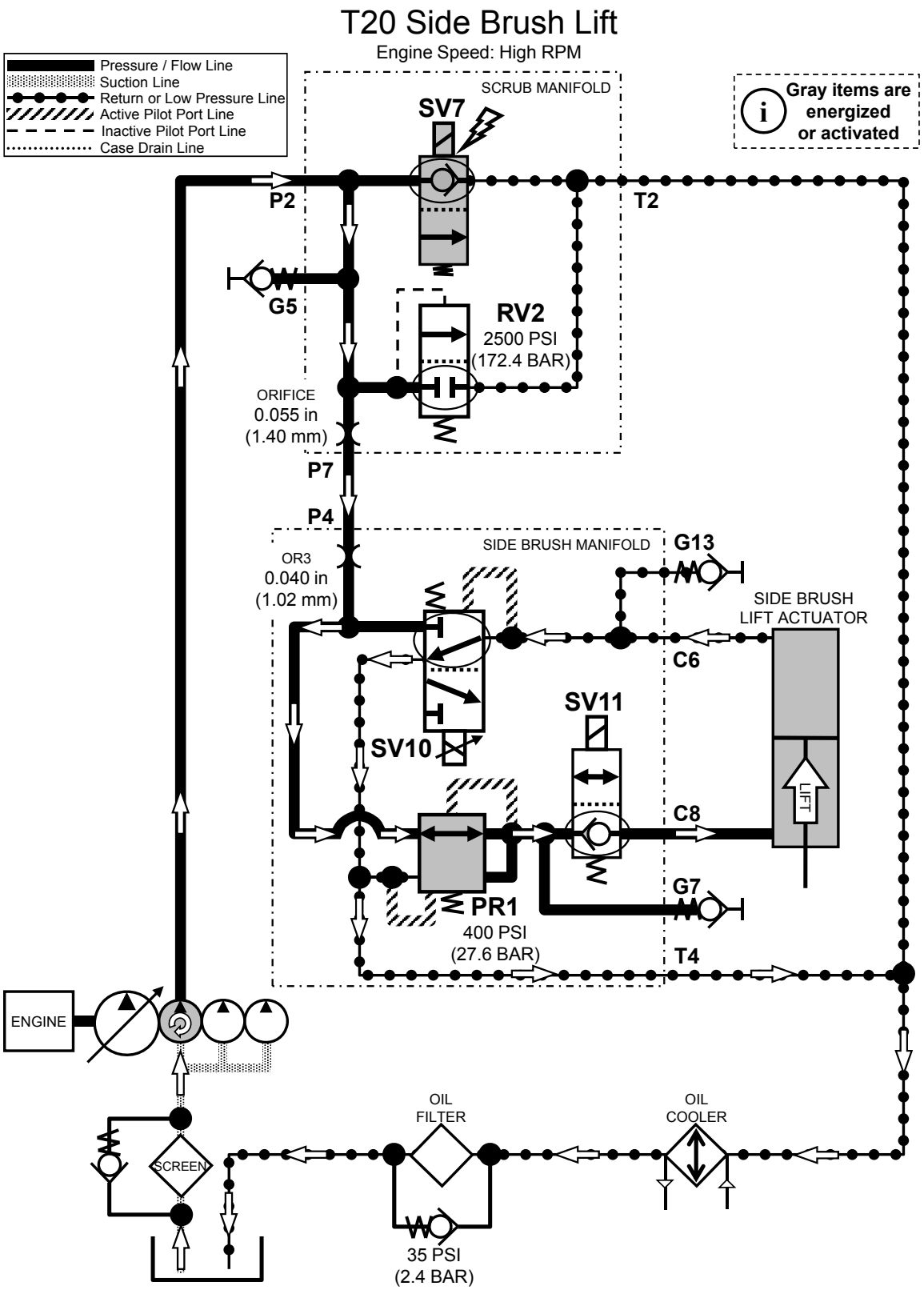
T20 Side Brush Lower

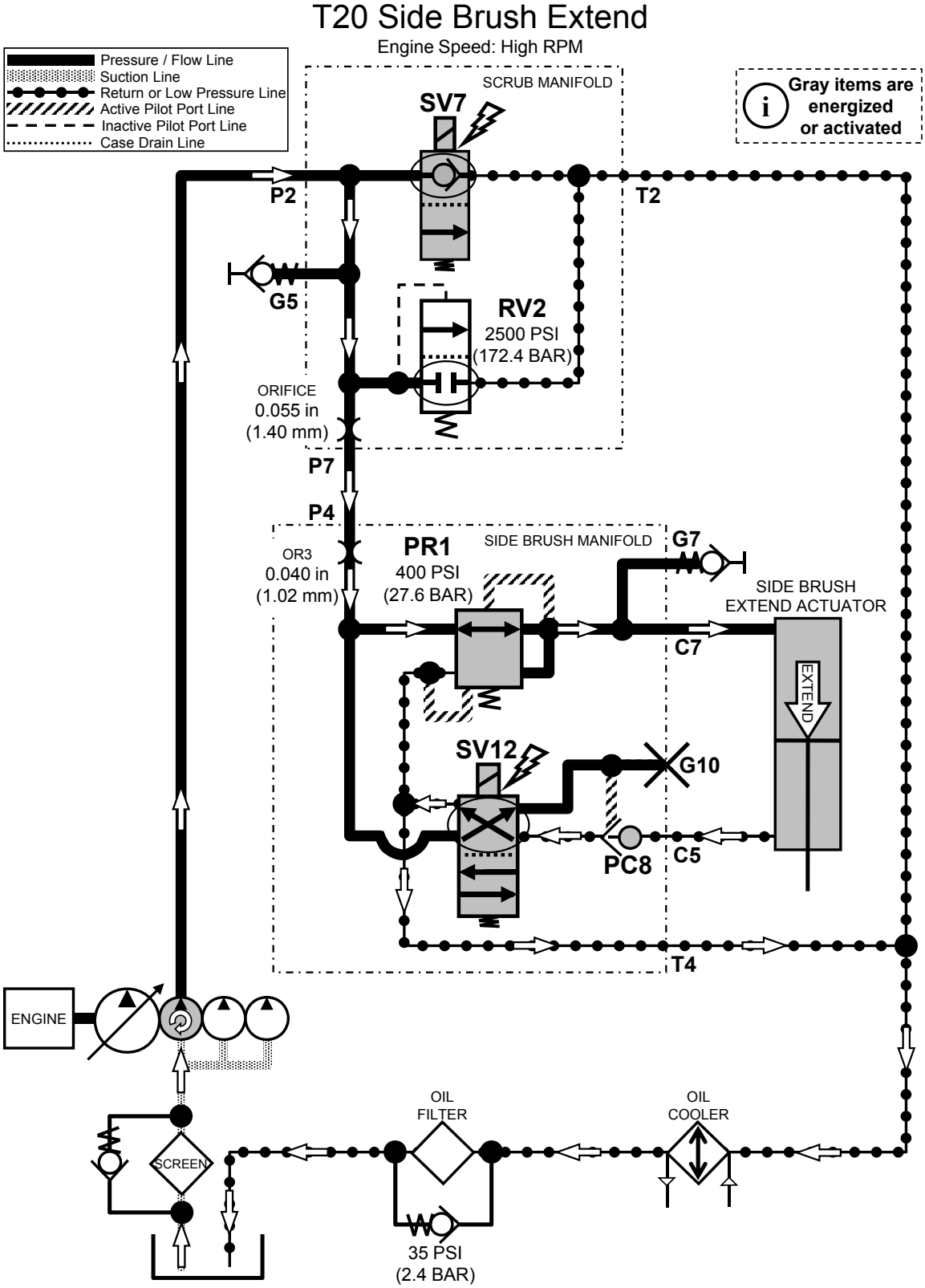
Engine Speed: High RPM



Typical **Default**
Pressure Readings (+/- 15%)

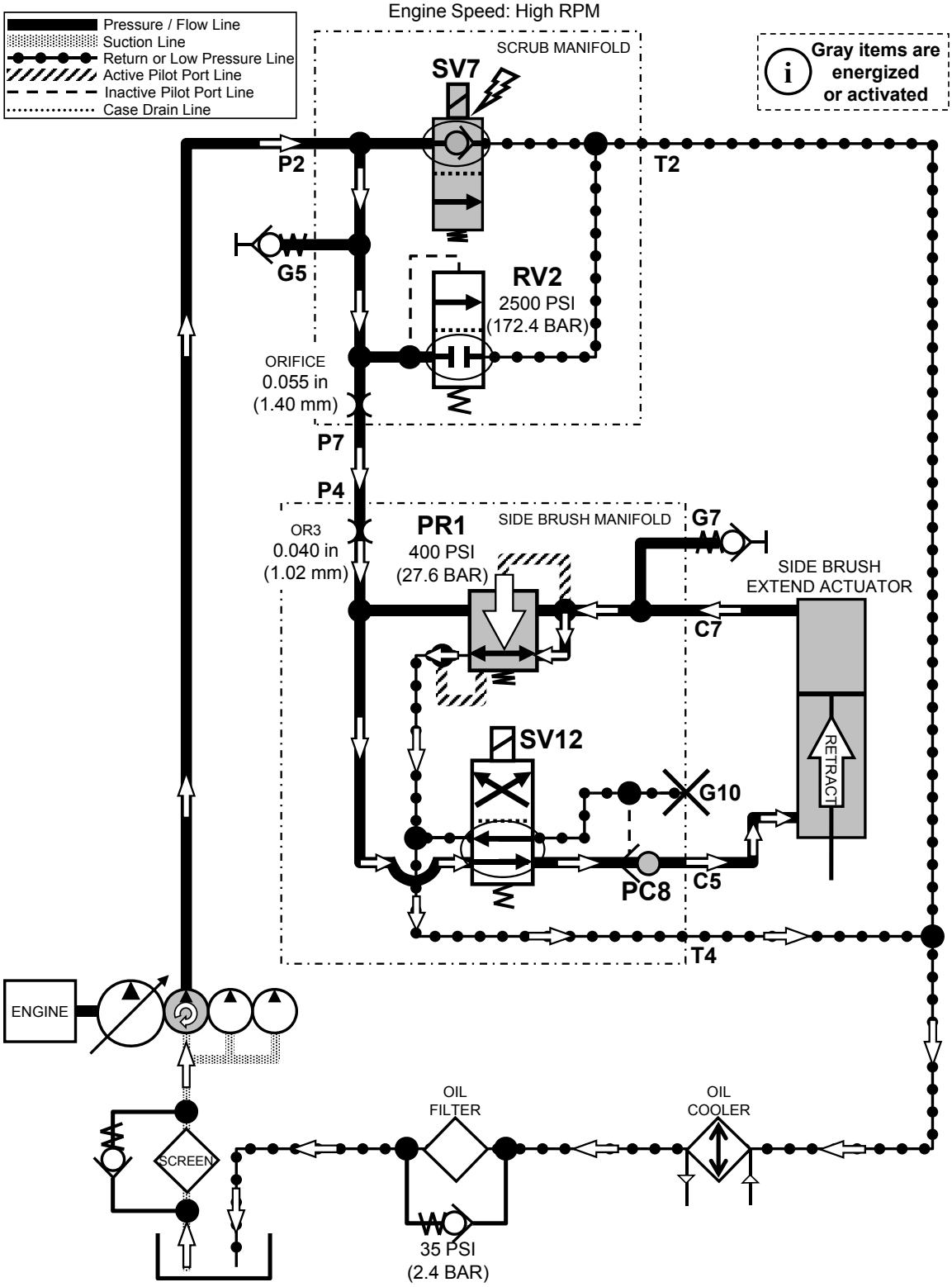
Setting	Pressure at **G13**
P1	300 psi (20.7 bar)
P2	400 psi (27.6 bar)
P3	500 psi (34.5 bar)


T20 Side Brush Lift
Engine Speed: High RPM
Pressure / Flow Line
Suction Line
Return or Low Pressure Line
Active Pilot Port Line
Inactive Pilot Port Line
Case Drain Line
SCRUB MANIFOLD
Gray items are energized or activated
SV7
P2
T2
G5
RV2
2500 PSI
(172.4 BAR)
ORIFICE
0.055 in
(1.40 mm)
P7
P4
SIDE BRUSH MANIFOLD
G13
OR3
0.040 in
(1.02 mm)
SIDE BRUSH
LIFT ACTUATOR
C6
SV11
SV10
LIFT
C8
G7
PR1
400 PSI
(27.6 BAR)
T4
ENGINE
OIL
FILTER
OIL
COOLER
SCREEN
35 PSI
(2.4 BAR)

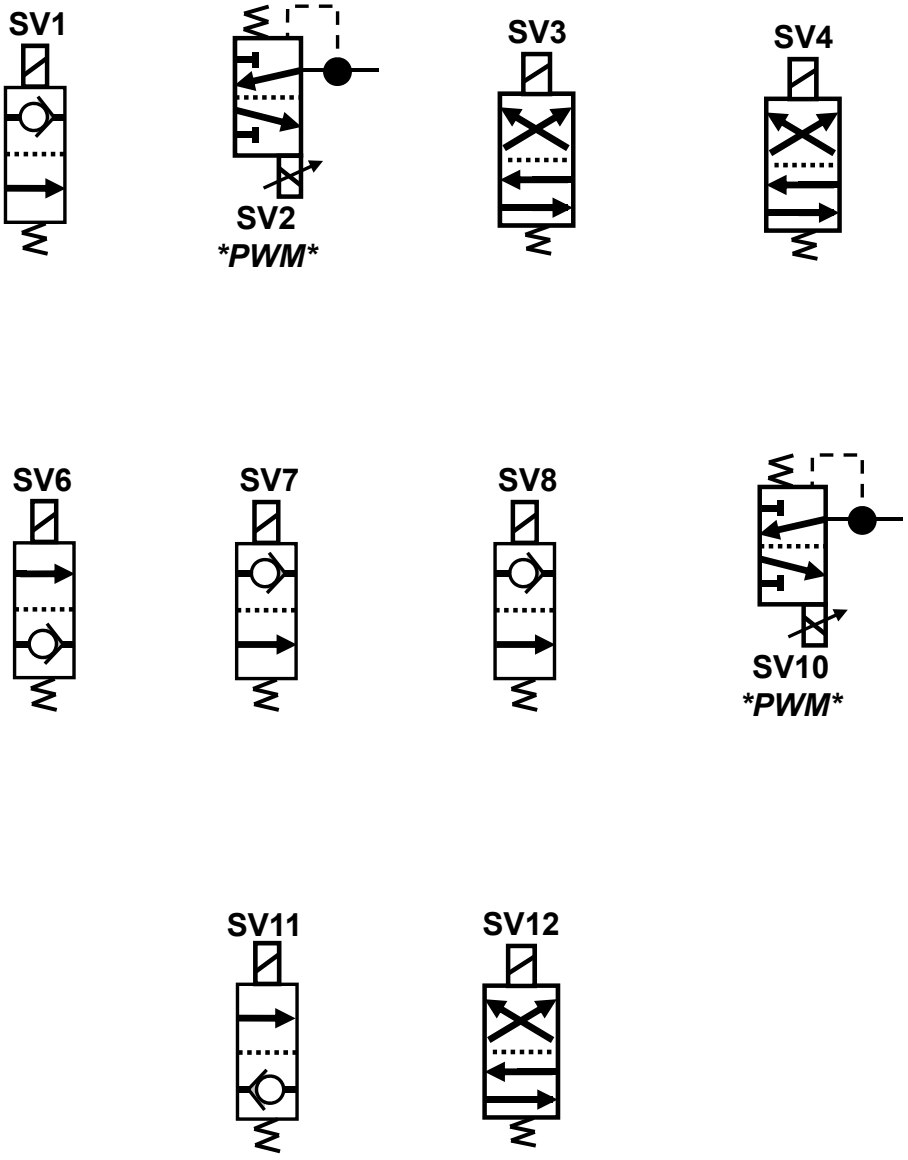

T20 Side Brush Extend
Engine Speed: High RPM
Pressure / Flow Line
Suction Line
Return or Low Pressure Line
Active Pilot Port Line
Inactive Pilot Port Line
Case Drain Line
SCRUB MANIFOLD
SV7
Gray items are energized or activated
P2
T2
G5
RV2
2500 PSI
(172.4 BAR)
ORIFICE
0.055 in
(1.40 mm)
P7
P4
OR3
0.040 in
(1.02 mm)
PR1
400 PSI
(27.6 BAR)
SIDE BRUSH MANIFOLD
G7
SIDE BRUSH
EXTEND ACTUATOR
C7
EXTEND
SV12
G10
PC8
C5
T4
ENGINE
OIL
FILTER
OIL
COOLER
SCREEN
35 PSI
(2.4 BAR)

T20 Side Brush Retract

Engine Speed: High RPM



T20 Hydraulic Solenoid Valve Details



SERVICE

PROPANEL SERVICE MODES

SERVICE MODE

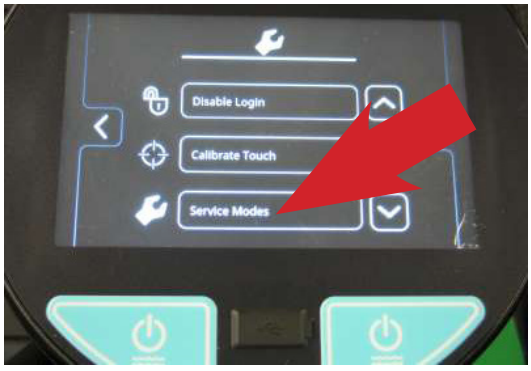
The Service Modes are designed for Service Technician use only. A qualified Service Technician can interface with the machine to configure the machine and to test specific components.

1. Key switch on. With the machine display powered on, press the 'Question Mark' Icon.

2. Press the Login Icon and enter the Service Mode Login number and press the enter icon. (**083957530)**

3. Press the 'Gears' icon.

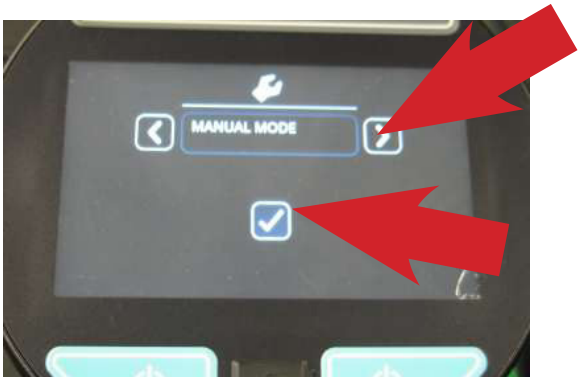
4. Using the down arrow, scroll to the bottom of the listed functions.



MANUAL MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the MANUAL MODE screen.

2. To enter the Manual Mode, press the 'Check Mark' icon.



3. Manual Mode allows viewing many component amperage draws or RPM. This includes:

- M01: Hyd Enable = Hydraulic Enable
- M02: MB Down Act = Main Brush Dwn Actuator
- M03: MB ON Motor = Main Brush Motor ON
- M04: MB DP PWM = Main Brush Down Pressure
- M05: MB WaterVlv - Main Brush Water Valve
- M06: SB Ext. Act = Side Brush Extend Actuator
- M07: SB Down Act = Side Brush Down Actuator
- M08: SB ON Motor = Side Brush Motor ON
- M09: SB DP PWM = Side Brush Down Pressure
- M10: SB WaterVlv = Side Brush Water Valve
- M11: Water Vac = Water Vacuum
- M12: Dust Vac = Dust Vacuum
- M13: Squeegee Act = Squeegee Actuator
- M14: Hopper Valve1 -= Hopper Valve 1
- M14: Hopper Valve2 = Hopper Valve 2
- M15: Hp Latch = Hopper Latch
- M16: Hp Door = Hopper Door
- M17: Shaker - Shaker
- M18: Reverse = Reverse Sensor
- M19: Shutdown = Shutdown Relay
- M20: Alarm = Alarm
- M21: Horn = Horn
- M22: Det Pump = Detergent Pump
- M23: Alt Pump = Alternate Pump
- M24: AltHighFlow = Alternate High Flow
- M25: AltSideBrush = Alternate Side Brush
- M26: Sol AutoFill = Solution Auto Fill
- M27: Rec AutoFill = Recovery Auto Fill
- M28: Engine Speed = Engine RPM

Note: If a component is not installed on the machine, the message 'Not Installed' is displayed.

4. To activate a component, press the check mark. To deactivate a component, press the check mark again.

Note: When a component is active, the amperage output to that component or the RPM of that component is displayed.

5. To exit Manual Mode, use the right arrow to scroll to the Exit Manual Mode screen and press the 'Check Mark' icon twice.

CONFIGURATION MODE

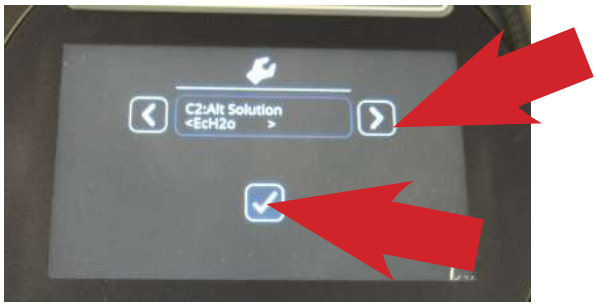
Configuration Mode is an onboard diagnostic utility that configures controller software to operate optional equipment and to electronically adjust certain output functions.

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the CONFIG MODE screen.
2. To enter the CONFIG MODE, press the ‘Check Mark’ icon.

3. The C1: MainBrushHead choice feature is used on the T20 machines. You can choose Disk or Cylindrical Head Type.

4. Press the right arrow to scroll to the next configuration option and the ‘Check Mark’ icon to change settings.

5. Continuously press the right arrow to scroll to the desired configuration option and press the ‘Check Mark’ icon to choose a setting.



6. If no change is required, press the right arrow until you see the 'Exit' option and press the 'Check Mark' icon twice, to exit.

7. Follow the same procedure for other optional equipment and water flow rate setup.

Including:

- C1: Main Brush Head
- C2: Alt Solution
- C5: Side Brush
- C6: Seat Switch
- C7: Water Level
- C8: IRIS Module
- C9: Run-In Mode
- C10: Neut. Scrub

Additional Water Level Setting Information:

There are three water level range setting options.

- Economy
- Normal
- Heavy

When a settings is chosen, the operator can adjust three flow rate settings within that range.

SELF TEST MODE

Self Test Mode is an onboard diagnostic utility that tests for open or shorted output circuits. Once completed, open and/or shorted output faults, are displayed.

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the SELF TEST MODE screen.

2. To enter the SELF TEST MODE, press the 'Check Mark' icon.

3. The self test will automatically begin.

CAUTION: Many of the machine functions will automatically turn on. Stay clear of the machine during the self test.

These are a few examples of the tests performed during the Self Test process. The table on the next page shows all of the test names and descriptions.

- Test Hydraulic Enable Valve
- Test Main Brush Down Actuator
- Test Main Brush Motor
- Test Main Brush PWM Valve
- Test Alternate Solution Pump

Some of the tests listed will only be performed if the machine has that specific option and it is configured correctly.

4. When the self test is completed, faults found will be displayed as an open or shorted load.

5. If faults exist, continually press the right arrow icon to display all faults found.

If there are no other faults found or no faults found initially, 'Self Test End' is displayed. Pressing the right arrow again will display any faults found again.

All successful tests performed will result in the message 'Done'. This indicates that test passed.

If a fault is found during the 'Self Test' , either 'Open' or 'Short' will be displayed for that test.

"Open" (Indicates current could not be delivered to that circuit)

"Short" (The current draw is over the threshold, indicating a short circuit)

Follow the diagnostic steps in this manual for diagnosing an open or shorted circuit.

To exit the self test mode, turn off the machine key. The machine will return to normal operational mode when the key switch is turned on again.

Self Test Name:	Test Description:
1:Enable Hydraulic Valve	Test the valve which enables machine hydraulics.
2:MBrush Down	Tests the valve which controls 'Main Brush Down' actuation.
3:MBrush Motor	Tests the valve which controls the Main Brush motor
4:MBrush PWM Valve	Tests PWMed control of the Main Brush Down valve (for down pressure control).
5:MBrush Water Valve	Tests the valve which controls solution delivery to the Main Brush.
6:SBrush Down Actuator	Tests the valve which controls 'Side Brush Down' actuation.
7:SBrush Ext Actuator	Tests the valve which controls 'Side brush Extension' actuation.
8:SBrush Motor	Test the valve which controls the Side Brush motor.
9:SBrush PWM Valve	Tests PWMed control of the Side Brush Down valve (for down pressure control).
10:SBrush Water Valve	Tests the valve which controls solution delivery to the Side Brush
11:Scrub Vac Fan	Tests the vacuum fan for the scrub subsystem ('water pickup fan).
12:Sweep Vac Fan	Tests the vacuum fan for the sweep subsystem.
13: Squeegee Act	Tests the valve which controls the Squeegee Actuator.
14: SolTnk AF	Tests the Autofill valve for the Solution Tank. (If Equipped)
15:RecTnk AF	Tests the Autofill valve for the Recovery Tank. (If Equipped)
16:ReverseRelay	Tests the relay for reverse driving.
17:ShakerRelay	Tests the relay for the filter shaker.
18:Horn	Horn test.
19:Alarm	Backup alarm test.
28: ShudownRelay	Tests the emergency engine shutdown relay.

INPUT DISPLAY MODE

Input Display Mode is an onboard diagnostic utility that displays controller input conditions. Input Display Mode displays text messages for hard-wired switch, sensor, and touch panel button inputs.

6. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the INPUT DISPLAY MODE screen.

7. To enter the INPUT DISPLAY MODE, press the 'Checkmark' icon.

8. The display will indicate the switch or sensor being tested. When the position of the switch or the state of the sensor is changed, the results of that change is displayed.

The components that can be tested with Input Display Mode Include:

- I1: SolTnk Empty
- I2: SolTnk Full
- I3: RecTnk Full
- I4: RedTank 1/2Full
- I5: Clogged HpFlt
- I6: CloggedHydFlt
- I7: ThermalSentry Hopper Fire
- I8: Seat Switch
- I9: Brake Switch
- I10: HighEngTemp
- I11: Low Oil Psr
- I12: Check Engine
- I13: EcH2o Green
- I14: EcH2o Red
- I15: Hp Position
- I16: FilterShaker
- I17: Hp Up Rocker
- I18: HPDownRocker
- I19: HpDoor Open
- I20: HPDoor Close
- I21: Alternator
- I22: Throttle
- I23: Fuel Sender
- I24: Hyd Temp

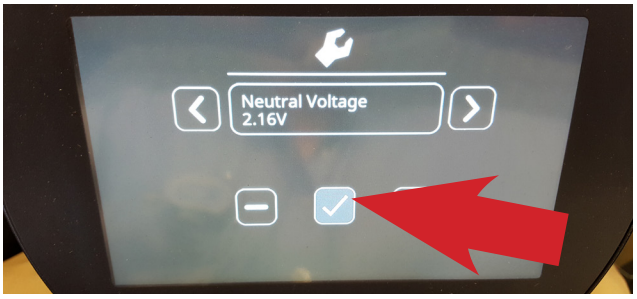
THROTTLE ADJUST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the THROTTLE ADJUST MODE screen.

2. To enter the THROTTLE ADJUST MODE, press the 'Check Mark' icon.

3. The actual 'Neutral Voltage' value of the throttle position sensor is displayed. Pressing the 'Check Mark' sets the Forward and Reverse sense voltage values, based on this Neutral Voltage value.

The machine operation should be tested to confirm the rear squeegee raises and lowers at the proper times when the machine is propelled forward and backward.



4. If the rear squeegee raises and lowers too soon or too late, you will need to adjust the Reverse voltage value and/or the Forward voltage value. Press the right arrow to proceed to the Forward Threshold voltage value.

Note: the 'C' indicates the Current voltage value and the 'N' indicates the New voltage value you are setting. Press the 'minus' icon to reduce the N (New) value and the 'Positive' icon to increase the N value.

The higher the value (a value closer to the Neutral Voltage value), the quicker the system will react to forward direction movement. Press the 'Check Mark' to make your 'N' New value the 'C' Current value.

5. Press the right arrow to proceed to the Reverse Threshold voltage value.

6. If the Reverse Threshold requires adjustment press either the 'minus' icon to reduce the N voltage or the 'plus' icon to increase the N voltage. The lower the value (a value closer to the Neutral Voltage value), the quicker the system will react to reverse direction movement.

Once the desired setting is achieved, press the 'Check Mark' to accept the change and confirm proper machine operation. Scroll to Exit and press the 'Check Mark' twice.

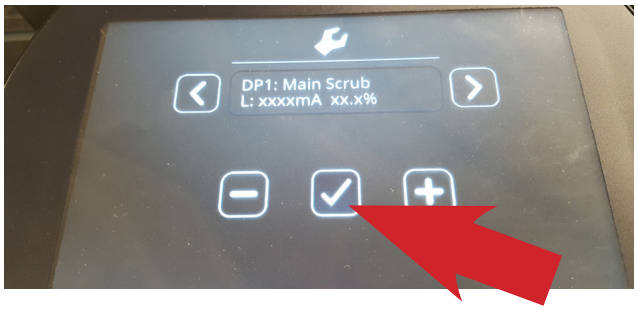
DOWN PRESSURE ADJUST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the DOWN PRESSURE ADJUST MODE screen.

2. To enter the DOWN PRESSURE ADJUST MODE, press the 'Check Mark' icon.

3. To enter the DOWN PRESSURE ADJUST MODE for the Main Scrub Brushes, press the 'Check Mark' icon.

4. To enter the 'L' (Low Down Pressure Setting Mode) for the Main Scrub Brushes, press the 'Check Mark' icon.



5. To increase the Low Setting Down Pressure for the Main Scrub Brushes, press the 'Plus' icon to increase the mA setting for the control valve. To decrease the pressure, press the 'Minus' icon to decrease the mA setting for the control valve. Each time an icon is pressed, the electrical signal to the solenoid is changed. This electrical signal is measured in mA (milliamperes).

6. Press the 'Check Mark' icon to move backwards, then the 'Right Arrow' to move to the M: (Medium Down Pressure Setting) then press the 'Check Mark' to allow you to set the Medium down pressure setting, if desired.

7. Press the 'Check Mark' icon to move backwards, then the 'Right Arrow' to move to the H: (High Down Pressure Setting) then press the 'Check Mark' to allow you to set the High down pressure setting, if desired.

8. Press the 'Check Mark' icon to move backwards, then the 'Right Arrow' to move to move to Main Scrub Exit.

9. Press the 'Check Mark' icon to Exit the Main Scrub Down Pressure Setting Mode.

10. Press the 'Right Arrow' icon to move to the Side Scrub Brush Down Pressure Adjust Mode. Follow the same process as above to make adjustments to the Side Scrub Brush Down pressure, if desired.

NOTE: Refer to the 'Default Down Pressure List' below, for the factory default down pressure settings.

DEFAULT DOWN PRESSURE LIST

Note: There is a low limit of 100mA and a high limit of 950mA for each brush pressure setting.

Main Scrub Brushes:

- Disk Low Pressure Default Setting, 358mA.
- Disk Medium Pressure Default Setting, 458mA.
- Disk High Pressure Default Setting, 548mA.
- Cyl. Low Pressure Default Setting, 340mA.
- Cyl. Medium Pressure Default Setting, 440mA.
- Cyl. High Pressure Default Setting, 530mA.

Side Scrub Brush:

- Low Pressure Default Setting, 600mA.
- Medium Pressure Default Setting, 675mA.
- High Pressure Default Setting, 730mA.

11. To exit the Down Pressure Adjust Modes, press the Right Arrow until you see Exit DP Adjust. Press the 'Check Mark' two times to exit this mode.

12. To exit the Service Modes, turn off the key switch and then turn it on again.

MEMBRANE TEST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the MEMBRANE TEST MODE screen.

2. To enter the MEMBRANE TEST MODE, press the ‘Check Mark’ icon.

3. The MEMBRANE TEST MODE allows you to test the touch button functions, on the control panel. When you are in the Membrane Test Mode, you are directed to press each Membrane Button to test it’s functionality.

4. When you press a button as directed, if the button functions properly, you will be directed to press another button.

Note: If you delay pressing the requested button too long, you may see a ‘FAILED’ message displayed. If this happens, restart the testing procedures.

If a button fails to function as designed, you will receive the message ‘FAILED’ in the display window.

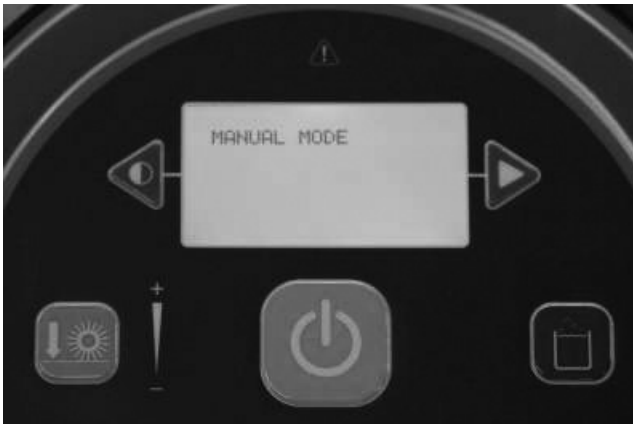
5. To exit the Service Modes, turn off the key switch and then turn it on again.

MEMBRANE PANEL SERVICE MODES

SERVICE MODE

The Service Modes are designed for Service Technician use only. A qualified Service Technician can interface with the machine to configure the machine and to test specific components.

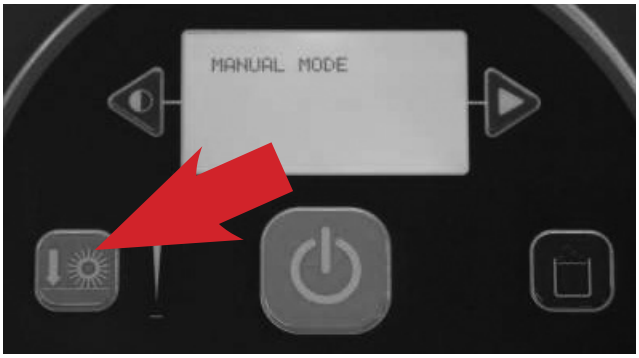
1. Hold the Right Arrow next to the display down and turn the key switch on. Continue to hold the Right Arrow down until you see the message 'Manual Mode'.



2. You can continue to press the right arrow until you see the mode you want to enter. The available modes are:

- Manual Mode
- Configure Mode
- Self Test Mode
- Input Display
- Throttle Adjust
- Down Pressure Adjust
- Membrane Test

3. When you see the mode you want to enter, press the Orange Down Pressure Button to enter that mode.



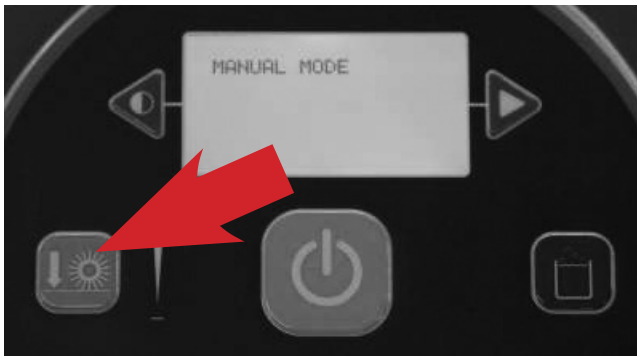
Note: The image below is the first message displayed when you enter the Manual Mode.

4. After the key switch is turned off, the machine will return to 'Normal Mode' when the key is turned on again.

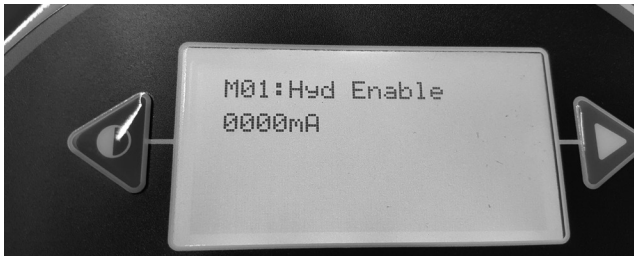
MANUAL MODE

1. Enter the Service Mode (See SERVICE MODE) and if needed, press the right arrow to scroll to the ‚MANUAL MODE screen.

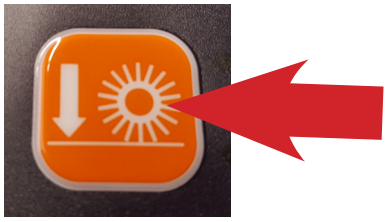
2. To enter the Manual Mode, press the ‘Orange Down Pressure Button’ .



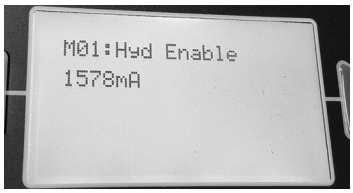
3. The first Component displayed in Manual Mode is the Hydraulic Enable Valve. It is turned off so there is 0000mA being delivered to the solenoid valve.



4. To turn on the Hydraulic Enable solenoid valve, press the Orange Down Pressure Button.



5. When a component is turn on, the amperage being output to that component, or the RPM of that component is displayed and testing can be done.



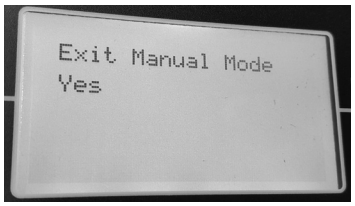
6. With the current component turned off, you can advance to another component by pressing the right arrow.

7. There are many components that can be turned on and off, so testing can be done.

- M01: Hyd Enable = Hydraulic Enable
- M02: MB Down Act = Main Brush Down Actuator
- M03: MB ON Motor = Main Brush Motor ON
- M04: MB DP PWM = Main Brush Down Pressure
- M05: MB WaterVlv - Main Brush Water Valve
- M06: SB Ext. Act = Side Brush Extend Actuator
- M07: SB Down Act = Side Brush Down Actuator
- M08: SB ON Motor = Side Brush Motor ON
- M09: SB DP PWM = Side Brush Down Pressure
- M10: SB WaterVlv = Side Brush Water Valve
- M11: Water Vac = Water Vacuum
- M12: Dust Vac = Dust Vacuum
- M13: Squeegee Act = Squeegee Actuator
- M14: Hopper Valve1 -= Hopper Valve 1
- M14: Hopper Valve2 = Hopper Valve 2
- M15: Hp Latch = Hopper Latch
- M16: Hp Door = Hopper Door
- M17: Shaker - Shaker
- M18: Reverse = Reverse Sensor
- M19: Shutdown = Shutdown Relay
- M20: Alarm = Alarm
- M21: Horn = Horn
- M22: Det Pump = Detergent Pump
- M23: Alt Pump = Alternate Pump
- M24: AltHighFlow = Alternate High Flow
- M25: AltSideBrush = Alternate Side Brush
- M26: Sol AutoFill = Solution Auto Fill
- M27: Rec AutoFill = Recovery Auto Fill
- M28: Engine Speed = Engine RPM

Note: If a component is not installed on the machine, the message ‘Not Installed’ is displayed.

8. To Exit Manual Mode, press the right arrow until you see ‘Exit Manual Mode’, then press the Orange Down Pressure Button **Twice**, or turn off the key switch.

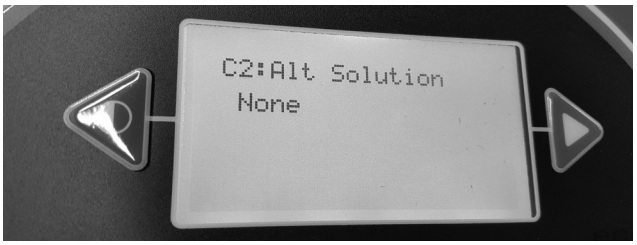


CONFIGURATION MODE

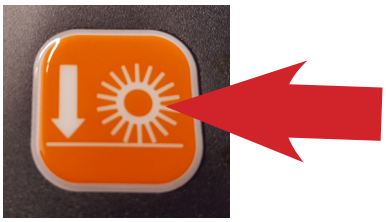
Configuration Mode is an onboard diagnostic utility that configures controller software to operate optional equipment and to electronically adjust certain output functions.

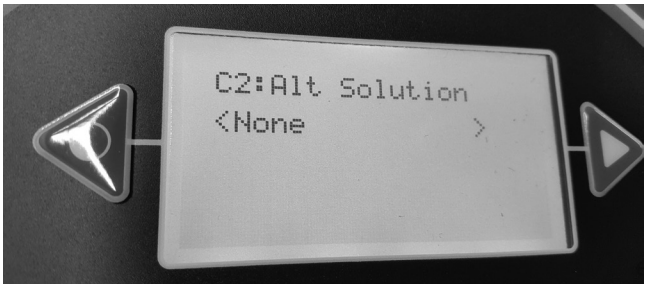
1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the CONFIG MODE screen.
2. To enter the CONFIG MODE, press the Orange Down Pressure Button'.

3. The C1: MainBrushHead choice feature is used on the T20 machines. You can choose Disk or Cylindrical Scrub Head Type..
4. Press the right arrow to scroll to the next configuration option, in this example we will explore setting the 'Alternate Solution Options'.



5. Press the 'Orange Down Pressure Button' to allow changing the Alternate Solution setting.





6. Press the 'right arrow until the correct Alternate Solution' is displayed and press the Orange Down Pressure Button to accept the change.

The Alternate Solution Options are:

- None
- EcH2O
- ES
- FaST

Choose the option that is installed on the machine.

7. To configure other options on the machine, continuously press the right arrow to scroll to the desired configuration option and press the 'Orange Down Pressure Button ' to choose that option and adjust the settings.

The configuration options are:

- C1: MainBrushHead = Scrub Head Type
- C2: Alt Solution = Alternate Solution
- C5: Side Brush = Side Brush Type
- C6: Seat Switch = Seat Switch Installed?
- C7: Water Level = Solution Flow Rate
- C8 IRIS Module = IRIS Module Installed?
- C9: Run-In. Mode = End of Line Factory Use
- C10: Neut. Scrub = Neutral Scrub Enabled?

Additional Water Level Setting Information:

There are three water level range setting options.

- Economy
- Normal
- Heavy

When a settings is chosen, the operator can adjust three flow rate settings within that range.

8. After all of the 'Configuration' settings have been made. Press the right arrow until you see 'Exit Configuration Mode', then press the Orange Down Pressure Button Twice, or turn off the key switch.

SELF TEST MODE

Self Test Mode is an onboard diagnostic utility that tests for open or shorted output circuits. Once completed, open and/or shorted output faults, are displayed.

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the SELF TEST MODE screen.

2. To enter the SELF TEST MODE, press the 'Orange Down Pressure Button'.

3. The self test will automatically begin.

   CAUTION: Many of the machine functions will automatically turn on. Stay clear of the machine during the self test.

These are a few examples of the tests performed during the Self Test process. The table on the next page shows all of the test names and descriptions.

- Test Hydraulic Enable Valve
- Test Main Brush Down Actuator
- Test Main Brush Motor
- Test Main Brush PWM Valve
- Test Main Brush Water Valve

Some of the tests listed will only be performed if the machine has that specific option and it is configured correctly.

4. When the self test is completed, faults found will be displayed as an open or shorted load.

5. If faults exist, continually press the right arrow icon to display all faults found.

If there are no other faults found or no faults found initially, 'Self Test End' is displayed. Pressing the right arrow again will display any faults found again.

All successful tests performed will result in the message 'Done'. This indicates that test passed.

If a fault is found during the 'Self Test', either 'Open' or 'Short' will be displayed for that test.

"Open" (Indicates current could not be delivered to that circuit). There is an Open Load.

"Short" (The current draw is over the threshold, indicating a short circuit)

Follow the diagnostic steps in this manual for diagnosing an open or shorted circuit.

6. To exit the self test mode, turn off the machine key. The machine will return to normal operational mode when the key switch is turned on again.

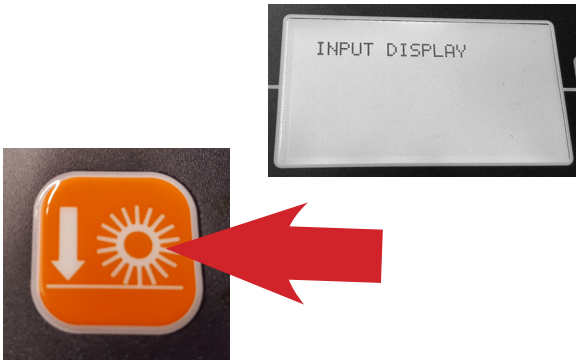
Self Test Name:	Test Description:
1:Enable Hydraulic Valve	Test the valve which enables machine hydraulics.
2:MBrush Down Actuator	Tests the valve which controls 'Main Brush Down' actuation.
3:MBrush Motor...	Tests the valve which controls the Main Brush motor
4:MBrush PWM Valve	Tests PWM control of the Main Brush Down valve (for down pressure control).
5:MBrush Water Valve	Tests the valve which controls solution delivery to the Main Brush.
6:SBrush Down Actuator	Tests the valve which controls 'Side Brush Down' actuation.
7:SBrush Ext Actuator	Tests the valve which controls 'Side brush Extension' actuation.
8:SBrush Motor...	Test the valve which controls the Side Brush motor.
9:SBrush PWM Valve	Tests PWM control of the Side Brush Down valve (for down pressure control).
10:SBrush Water Valve	Tests the valve which controls solution delivery to the Side Brush
11:Scrub Vacuum Fan	Tests the vacuum fan for the scrub subsystem ('water pickup fan).
12:Sweep Vacuum Fan	Tests the vacuum fan for the sweep subsystem.
13: Squeegee Actuator	Tests the valve which controls the Squeegee Actuator.
14: SolTnk AF	Tests the Autofill valve for the Solution Tank. (If Equipped)
15:RecTnk AF	Tests the Autofill valve for the Recovery Tank. (If Equipped)
16:Reverse Relay	Tests the relay for reverse driving.
17:Shaker Relay	Tests the relay for the filter shaker.
18:Horn	Horn test.
19:Alarm	Backup alarm test.
24:Detergent Pump	Tests the detergent pump.
25:Alt Pump	Tests the Alternative Solution pump (FAST). (If Configured)
26:Alt High Flow	Tests the High Flow Rate function of FAST. (If Configured)
27:Alt Side Brush	Tests the valve which controls alternative solution (FAST/ECH2O) to the Side Brush. (If Configured)
28:Shutdown Relay	Tests the emergency engine shutdown relay.

INPUT DISPLAY MODE

Input Display Mode is an onboard diagnostic utility that displays controller input conditions. Input Display Mode displays text messages for hard-wired switch, sensor, and touch panel button inputs.

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the INPUT DISPLAY MODE screen.

2. To enter the INPUT DISPLAY MODE, press the 'Orange Down Pressure Button'.



3. The display will indicate the switch or sensor being tested. When the position of the switch or the state of the sensor is changed, the results of that change is displayed.

The components that can be tested with Input Display Mode Include:

- I1: SolTnk Empty
- I2: SolTnk Full
- I3: RecTnk Full
- I4: RedTank 1/2Full
- I5: Clogged HpFlt
- I6: CloggedHydFlt
- I7: ThermalSentry - Hopper Fire
- I8: Seat Switch
- I9: Brake Switch
- I10: HighEngTemp
- I11: Low Oil Psr
- I12: Check Engine
- I13: EcH2o Green
- I14: EcH2o Red
- I15: Hp Position
- I16: FilterShaker
- I17: Hp Up Rocker
- I18: HPDownRocker
- I19: HpDoor Open
- I20: HPDoor Close
- I21: Alternator
- I22: Throttle
- I23: Fuel Sender
- I24: Hyd Temp
- Exit

4. To Exit the Input Display Mode, press the right arrow until you see 'Exit Input Display Mode', then press the Orange Down Pressure Button **Twice**, or turn off the key switch.

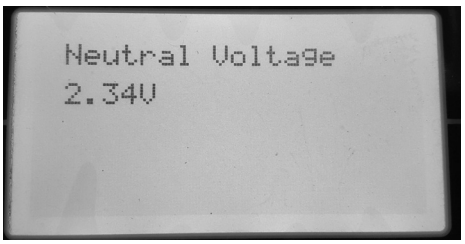
THROTTLE ADJUST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the THROTTLE ADJUST MODE screen.

2. To enter the THROTTLE ADJUST MODE, press the 'Orange Down Pressure Button'.

3. The actual 'Neutral Voltage' value of the throttle position sensor is displayed. Pressing the 'Orange Down Pressure Button' sets the Forward and Reverse sense voltage values, based on this Neutral Voltage value.

The machine operation should be tested to confirm the rear squeegee raises and lowers at the proper times when the machine is propelled forward and backward.



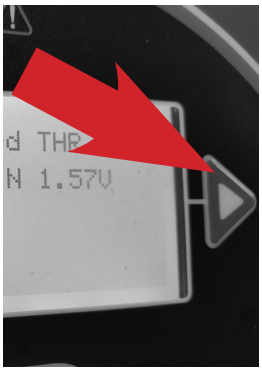
4. If the rear squeegee raises and lowers too soon or too late, you will need to adjust the Forward voltage value and/or the Reverse voltage value. Press the right arrow to proceed to the Forward Threshold voltage value.

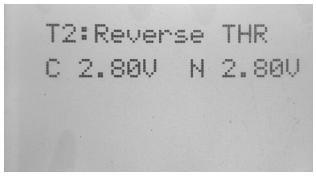
Note: the 'C' indicates the Current voltage value and the 'N' indicates the New voltage value you are setting.

5. Press the 'minus' icon to reduce the N (New) value and the 'Positive' icon to increase the N value.

The higher the Forward THR value, the quicker the system will react to forward direction movement. Press the Orange Down Pressure Button' to make your 'N' New value the 'C' Current value.

6. Press the right arrow to proceed to the Reverse Threshold voltage value.





7. If the Reverse Threshold requires adjustment press either the 'minus' icon to reduce the N voltage or the 'plus' icon to increase the N voltage.

The lower the value, the quicker the system will react to reverse direction movement.

Once the desired setting is achieved, press the 'Check Mark' to accept the change and confirm proper machine operation.

8. To Exit the Throttle Adjust Mode, press the right arrow until you see 'Exit Throttle Adjust Mode', then press the Orange Down Pressure Button **Twice**, or turn off the key switch.

DOWN PRESSURE ADJUST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the DOWN PRESSURE ADJUST MODE screen.

2. To enter the DOWN PRESSURE ADJUST MODE, press the ‘Orange Down Pressure Button’.

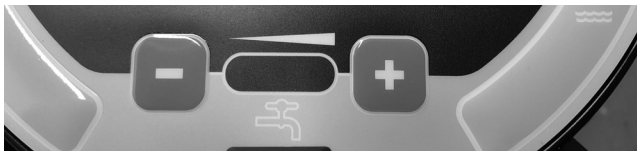
3. To enter the DOWN PRESSURE ADJUST MODE for the Main Scrub Brushes, press the ‘Orange Down Pressure Button’ , again.

4. To enter the ‘L’ (Low Down Pressure Setting Mode) for the Main Scrub Brushes, press the ‘Orange Down Pressure Button’ , again.

Note: With the setting numbers displayed for the Low main Scrub Brush Pressure adjustments can be made to that setting.

Note: The electrical signal transmitted to the control solenoid is measured in mA (milliamperes).

5. To increase the Low Setting Down Pressure for the Main Scrub Brushes, press the ‘Plus’ icon to increase the mA setting for the control valve. To decrease the pressure, press the ‘Minus’ icon to decrease the mA setting for the control valve. Each time an icon is pressed, the electrical signal to the solenoid is changed.



6. To allow adjustment to the Medium down pressure setting, press the ‘Orange Down Pressure Button’ to move backwards, then the ‘Right Arrow’ to move to the M: (Medium Down Pressure Setting) then press the ‘Orange Down Pressure Button’ to allow you to set the Medium down pressure setting, if desired.

7. To allow adjustment to the High down pressure setting, press the ‘Orange Down Pressure Button’ to move backwards, then the ‘Right Arrow’ to move to the H: (Heavy Down Pressure Setting) then press the ‘Orange Down Pressure Button’ to allow you to set the Heavy down pressure setting, if desired.

8. When all down pressure adjustments are completed for the Main Scrub Brushes, press the ‘Orange Down Pressure Button’ to move backwards, then the ‘Right Arrow’ to move to the Main Scrub Exit.

9. Press the ‘Orange Down Pressure Button’ to Exit the Main Scrub Down Pressure Setting Mode.

10. Press the ‘Right Arrow’ button to move to the Side Scrub Brush Down Pressure Adjust Mode. Follow the same process as above to make adjustments to the Side Scrub Brush Down pressure, if desired. You can press the ‘Right Arrow’ button again to move to the Main Sweeping Brush Down Pressure Adjust Mode and again for the Side Sweeping Brush Down Pressure Adjust Mode.

Follow the same adjustment procedures outlined for the Main Scrub Brush Down Pressure Settings.

NOTE: The factory default down pressure settings are shown in the list below.

Default Down Pressure List:

Note: There is a low limit of 100mA and a high limit of 950mA for each brush pressure setting.

Main Scrub Brushes:

- Disk Low Pressure Default Setting, 358mA.
- Disk Medium Pressure Default Setting, 458mA.
- Disk High Pressure Default Setting, 548mA.

- Cyl. Low Pressure Default Setting, 340mA.
- Cyl. Medium Pressure Default Setting, 440mA.
- Cyl. High Pressure Default Setting, 530mA.

Side Scrub Brush:

- Low Pressure Default Setting, 600mA.
- Medium Pressure Default Setting, 675mA.
- High Pressure Default Setting, 730mA.

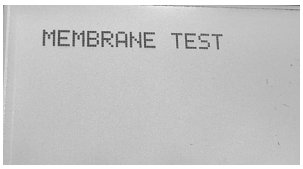
11. To exit the Down Pressure Adjust Modes, press the Right Arrow until you see Exit DP Adjust. Press the 'Orange Down Pressure Button' twice to exit this mode.

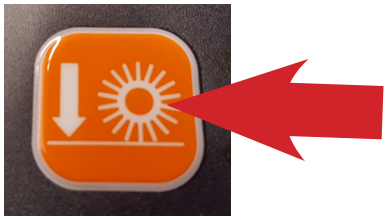
12. To exit the Service Modes, turn off the key switch and then turn it on again.

MEMBRANE TEST MODE

1. Enter the Service Mode (See SERVICE MODE) and press the right arrow to scroll to the MEMBRANE TEST MODE screen.

2. To enter the MEMBRANE TEST MODE, press the ‘Orange Down Pressure Button’.

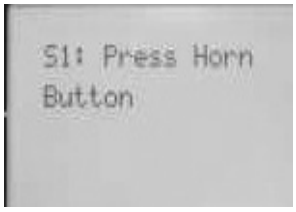




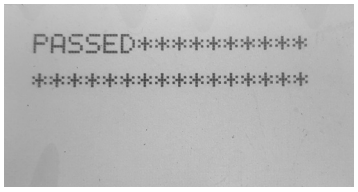
3. The MEMBRANE TEST MODE allows you to test the touch button functions, on the control panel.

When you are in the Membrane Test Mode, you are directed to press each Membrane Button to test it’s functionality.

NOTE: If you delay too long prior to pressing the required button, this delay may be reported with a ‘Failed’ message, in the display. If this happens, turn off the key switch and restart all Membrane testing procedures.



4. When you press a button as directed, if the button functions properly, you will be directed to press another button until all button tests are completed. If all of the tests were completed successfuly, you will receive the message ‘Passed’ in the display window.

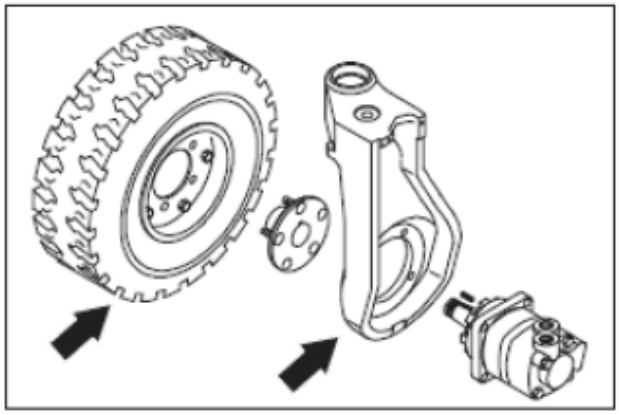


5. If a button fails to function as designed, you will receive the message ‘FAILED’ in the display window.

6. To exit the Service Modes, turn off the key switch and then turn it on again.

FRONT TIRE AND WHEEL SUPPORT

The front wheel support pivots the front wheel. The support has one grease fitting for the bearings. The front wheel support bearings must be lubricated every 200 hours of operation. Use Lubriplate EMB grease (TENNANT part no. 01433-1). Torque the front wheel nuts to 142 -156 Nm (105 -115 ft. lb.) after the first 50-hours of operation, and every 800 hours thereafter. Torque the front wheel hub nut to (375 ft. lb.).



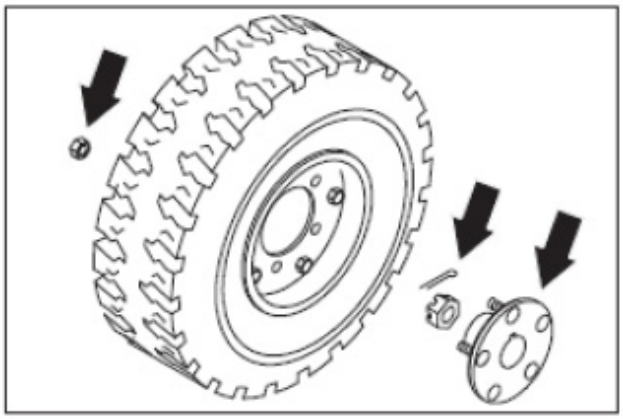
TO REPLACE FRONT DRIVE MOTOR

FOR SAFETY: Before Leaving Or Servicing Machine; Stop On Level Surface, Set Parking Brake, Turn Off Machine And Remove Key.

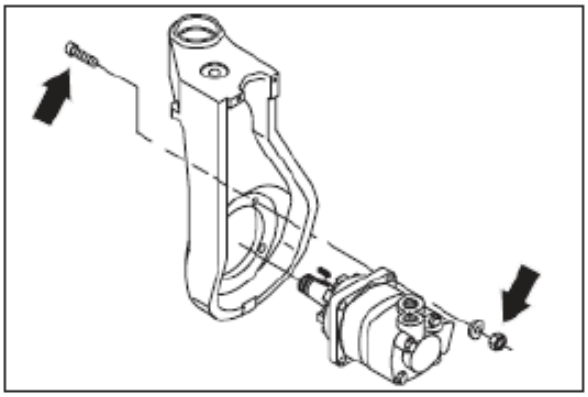
1. Engage parking brake, block rear tires.
2. Jack up front of machine. Use jack stands to support machine.

FOR SAFETY: Block machine tires before jacking machine up. Jack machine up at designated locations only. Block machine up with jack stands.

3. Remove the front tire and wheel assembly.
4. Remove the cotter pin and slotted nut from the front wheel drive motor shaft.



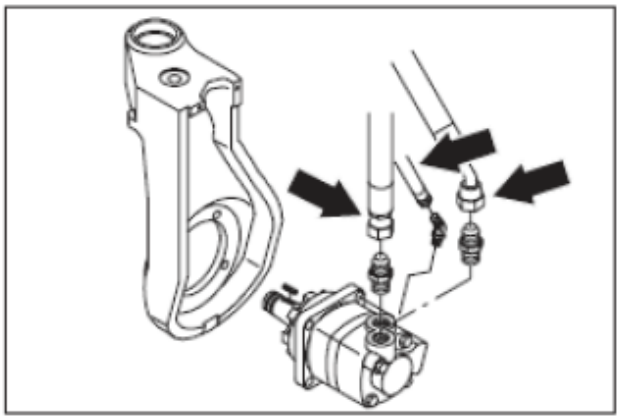
5. Use a puller to remove the drive hub from the tapered shaft of the drive motor.
6. Remove and plug the hydraulic hoses leading to the front wheel drive motor.
7. Remove the four drive motor mounting bolts.



8. Slide the motor out of front wheel housing.

NOTE: Observe hydraulic cleanliness requirements when opening hydraulic lines.

9. Remove the hydraulic fittings from the old motor and install in the new motor in the same orientation.



10. Slide the new motor in the front wheel housing. Note the orientation of the motor.
11. Reinstall the four socket-head screws. Torque to 90 - 117 Nm (70 - 85 ft lb).
12. Reconnect the hydraulic hoses to the drive motor.

NOTE: Make sure the square key is in place on the shaft of the new motor.

13. Mount the drive hub to tapered motor shaft. Tighten slotted nut to 500 Nm (375 ft. lb). Install the cotter pin.
14. Install the front tire. Torque the front wheel nuts to 142 - 156 Nm (105 -115 ft. lb).
15. Remove jack stands and lower machine.
16. Operate the machine and check the front drive motor for any leaks.