General specification

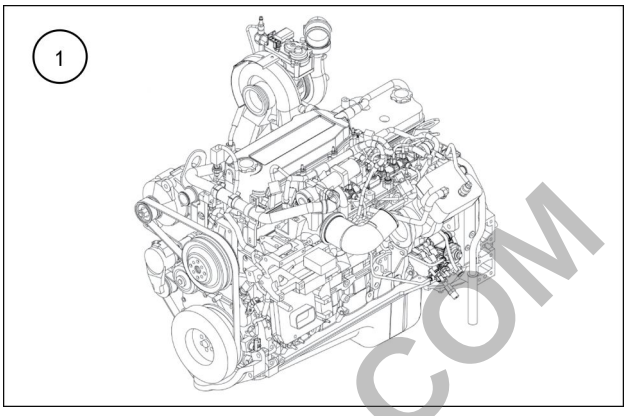
Model SP.295F	
Engine	Cummins QSB Tier 4 Final **300 Hp** — power bulge to **310 Hp**
Fuel capacity and type	**568 l** (**150 US gal**) Ultra low sulfur diesel
Diesel Exhaust Fluid (DEF) Capacity	**56.8 L** (**15.0 US gal**)
Cooling package	Stacked side by side single pass design, hydraulically driven fan
Engine/transmission	Located in rear - ISO mounted
Transmission	Torq-Trac® hydrostatic drive system with Twin Sauer-Danfoss heavy duty pumps
Hydro pump displacement	75 cc each
Final drives	Poclain® - MW 14 (front) and Poclain® - MS 18 (rear)
Parking brake	4 wheel
Service brake	4 wheel internal wet disc
Steering	
Standard front wheel	Hydrostatic with two steering cylinders, no tie rods, **4.1 m** (**13.5 ft**) turning radius
Optional 4 wheel steer	**4.1 m** (**13.5 ft**) turn radius in 4 wheel steer, **5.3 m** (**17.5 ft**) turn radius in 2 wheel steer
HYDRALINK™ Suspension	Full suspension travel of **51 cm** (**20 in**) . 4-wheel independent with integrated hydraulic leveling/shock absorbers, auto leveling for each wheel leg.
Crop clearance	**183 cm** (**72 in**)
Wheel width adjustment	**305 - 406 cm** (**120 - 160 in**), hydraulic adjust, wheels move in/out equally on both sides. Operator remains centered.
Air system	Direct engine driven, water cooled air compressor and air storage tank.
Auxiliary hydraulic circuit	**117 l/min** (**31 US gpm**) - Optional **193 l/min** (**51 US gpm**) closed center
Product tank options	
Poly or Stainless steel	**3785 L** (**1000 US gal**)
Poly or Stainless steel	**4542 L** (**1200 US gal**)
Product pump standard	Hypro 9306C - **795 l/min @ 5.5 bar** (**210 US gpm @ 80 psi**)
Product pump optional	Hypro 9307C high capacity - **1173 l/min @ 5.5 bar** (**310 US gpm @ 80 psi**)
Rinse tank standard	**568 l** (**150 US gal**), Poly
Boom options	**60 ft**, **75 ft/60 ft**, **80 ft/60 ft**, **90 ft/60 ft**, **100 ft/60 ft**, **120 ft/ 70 ft**, **27 m/ 18 m**, **30 m/ 18 m**, **32 m/ 18 m**, **36 m/ 22 m**
Boom lines	Standard **2.54 cm** (**1 in**) stainless steel — Optional **3.81 cm** (**1.5 in**) stainless steel
Cab	SprayView Cab or Premium SprayView Cab
Height	**401 cm** (**158 in**)
Width (transport)	**368 cm** (**145 in**)
Length (boom unfolded)	**859 cm** (**338 in**)
Wheel base	**389 cm** (**153 in**)
Boom travel	Lowered **56 cm** (**22 in**) — Raised **300 cm** (**118 in**)
Weight (approximate)	**12927 kg** (**28500 lb**)

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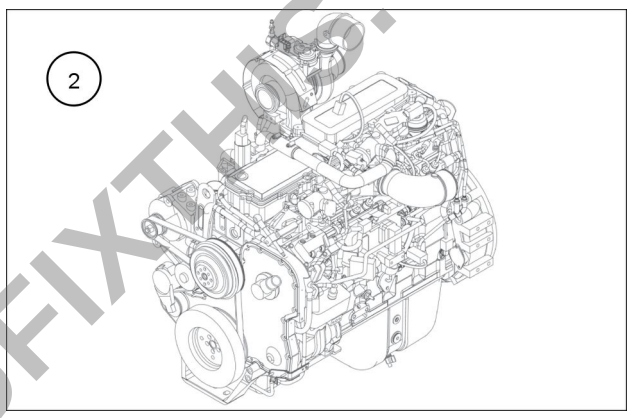
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Engine - Remove

1. Two different types of engine are used on Guardian sprayers.
   The sprayer model numbers SP.295F and the SP.300F use the Cummins QSB engine **(1)**.
   The sprayer model numbers SP.345F and SP.400F use the Cummins QSL engine **(2)**.
2. Move the vehicle to a hard level surface
3. Turn the ignition key to the OFF position. Remove the key from the ignition.
4. Allow the engine to cool before proceeding.
5. Access the battery disconnect switch located at the left rear of the vehicle. Turn the switch to the OFF position.



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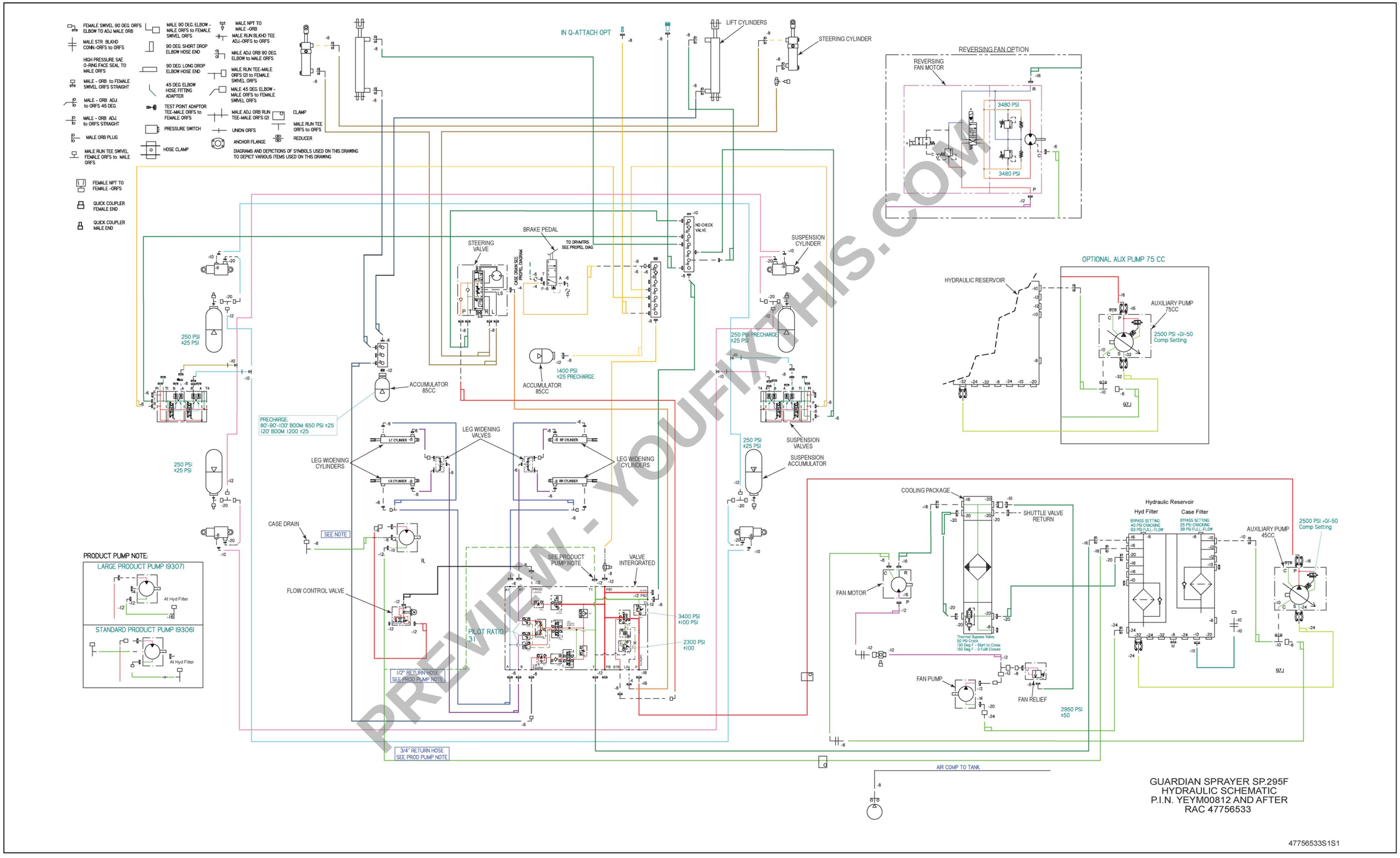


RAIL15SP00249FA 2

6. Drain the hydraulic reservoir. Refer to **Reservoir, cooler, and filters - Remove (35.300)**
7. Drain the engine coolant from the cooling package. Refer to **Engine cooling system - Remove (10.400)**
8. Remove the engine enclosure panels. Refer to **Engine hood and panels - Remove (90.100)**
9. Disconnect and remove the deaeration tank, which is attached to the SCR mounting enclosure.
10. Remove the SCR system and the mounting enclosure. Refer to **Selective Catalytic Reduction (SCR) muffler and catalyst - Remove (10.500)**
11. Remove the air cleaner and the mounting frame. Refer to **Air cleaners and lines - Remove (10.202)**
12. Remove the Auxiliary pump from the hydrostatic tandem pump assembly. Refer to **Auxiliary hydraulic pump - Remove (35.220)**
13. Remove the hydrostatic tandem pump assembly from the engine.
    Refer to **Pump - Remove (29.218)** for QSB engines.
    Refer to **Pump - Remove (29.218)** for QSL engines.
14. Disconnect the fuel line attached to the engine. Plug the fuel line and mark the connection point for reattachment.
15. Disconnect any lines connected to the SCR system from the engine. Plug the lines and mark the connection points for reattachment.

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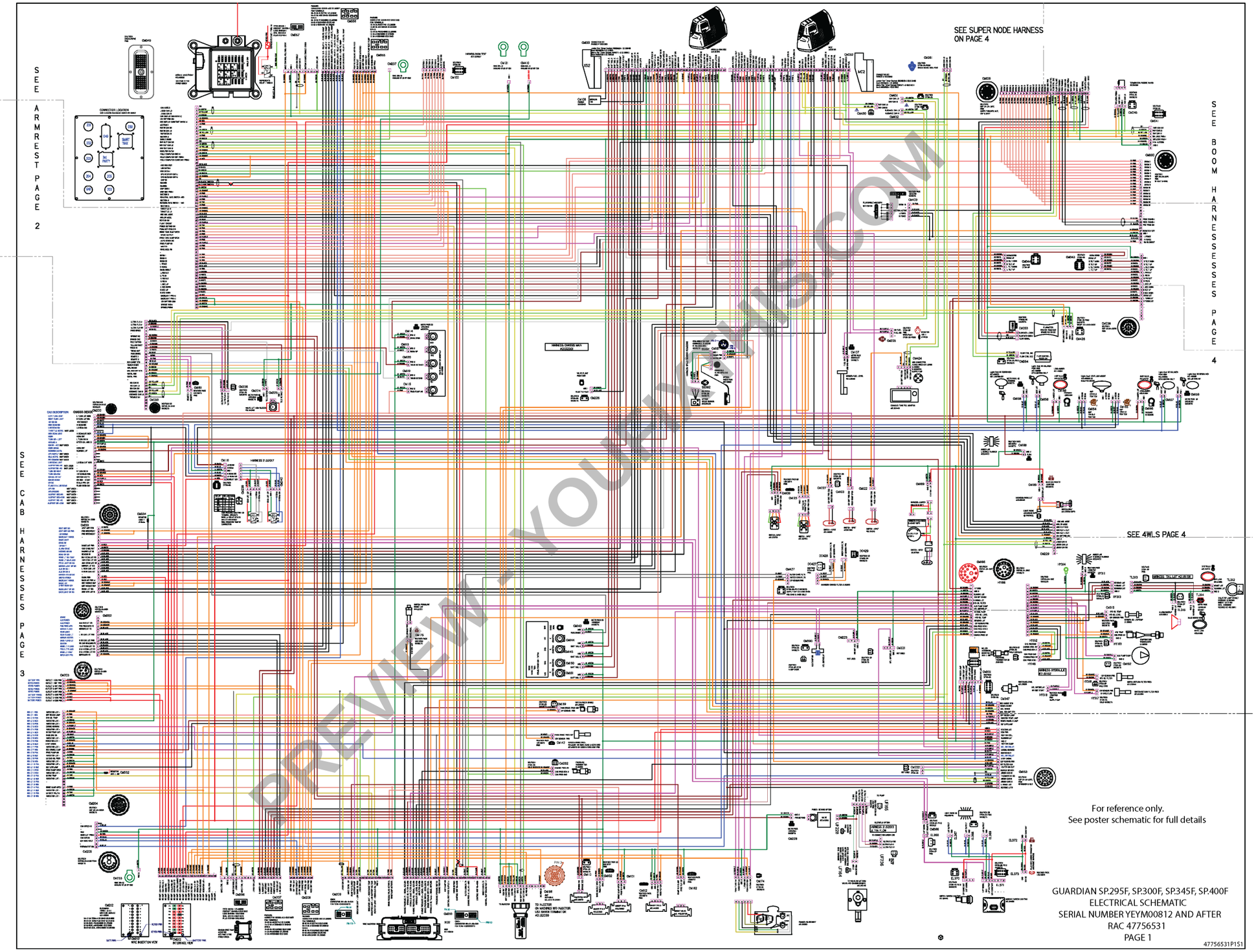
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RAIL14SP01327JA 1

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Engine Control Unit (ECU) - View - Engine diagnostic fault codes

Code	SPN	FMI	Lamp color	Reason for fault	Effect (only when code is active)	Action
111	629	12	red	Error internal to the Engine Control Module (ECM) related to memory hardware malfunctions or internal ECM voltage supply circuits	Engine may not start or may be difficult to start	Call Cummins Service
115	612	2	red	The ECM has detected the primary and backup speed sensor signals are connected backwards	The engine will shut down or will not start	Call Cummins Service
122	102	3	amber	High signal voltage detected at the intake manifold pressure circuit	Possible reduced engine performance	Call Cummins Service
123	102	4	amber	Low signal voltage or open circuit at the intake manifold pressure circuit	Possible reduced engine performance	Call Cummins Service
124	102	16	amber	Intake manifold pressure has exceeded the maximum limit for the given engine rating	Engine power derate	Call Cummins Service
135	100	3	amber	High signal voltage detected at the engine oil pressure circuit	None on performance	Call Cummins Service
141	100	4	amber	Low signal voltage or open circuit at the engine oil pressure circuit	None on performance	Call Cummins Service
143	100	18	amber	Engine oil pressure signal indicates engine oil pressure is below the engine protection warning limit	Possible reduced engine performance	Call Cummins Service
144	110	3	amber	High signal voltage or open circuit detected at engine coolant temperature circuit	Fan will stay on if controlled by the Engine Control Module (ECM)	Call Cummins Service
145	110	4	amber	Low signal voltage or open circuit detected at engine coolant temperature circuit	Fan will stay on if controlled by the Engine Control Module (ECM)	Call Cummins Service
146	110	16	amber	Engine coolant temperature is above engine protection warning limit	Progressive power and/or speed derate increasing in severity from time of alert	Check coolant level, clean cooling package
151	110	0	red	Engine coolant signal indicates engine coolant temperature is above engine protection critical limit	Progressive power and/or speed derate increasing in severity from time of alert	Check coolant level, clean cooling package
153	105	3	amber	High signal voltage or open circuit detected at intake manifold air temperature circuit	Fan will stay on if controlled by the Engine Control Module (ECM)	Call Cummins Service
154	105	4	amber	Low signal voltage or open circuit at the intake manifold air temperature circuit	Fan will stay on if controlled by the Engine Control mModule (ECM)	Call Cummins Service

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Torque - Minimum tightening torques for normal assembly

Decimal hardware

Grade 5 bolts, nuts and studs

Size	Nm	lb in/lb ft
1/4 in	12 - 15 Nm	108 - 132 lb in
5/16 in	23 - 28 Nm	204 - 252 lb in
3/8 in	48 - 57 Nm	420 - 504 lb in
7/16 in	73 - 87 Nm	54 - 64 lb ft
1/2 in	109 - 130 Nm	80 - 96 lb ft
9/16 in	149 - 179 Nm	110 - 132 lb ft
5/8 in	203 - 244 Nm	150 - 180 lb ft
3/4 in	366 - 439 Nm	270 - 324 lb ft
7/8 in	542 - 651 Nm	400 - 480 lb ft
1 in	787 - 944 Nm	580 - 696 lb ft
1-1/8 in	1085 - 1193 Nm	800 - 880 lb ft
1-1/4 in	1519 - 1681 Nm	1120 - 1240 lb ft
1-3/8 in	1980 - 2278 Nm	1460 - 1680 lb ft
1-1/2 in	2631 - 2983 Nm	1940 - 2200 lb ft

Grade 8 bolts, nuts and studs

Size	Nm	lb in/lb ft
1/4 in	16 - 20 Nm	144 - 180 lb in
5/16 in	33 - 39 Nm	288 - 348 lb in
3/8 in	61 - 73 Nm	540 - 648 lb in
7/16 in	95 - 114 Nm	70 - 84 lb ft
1/2 in	149 - 179 Nm	110 - 132 lb ft
9/16 in	217 - 260 Nm	160 - 192 lb ft
5/8 in	298 - 358 Nm	220 - 264 lb ft
3/4 in	515 - 618 Nm	380 - 456 lb ft
7/8 in	814 - 976 Nm	600 - 720 lb ft
1 in	1220 - 1465 Nm	900 - 1080 lb ft
1-1/8 in	1736 - 1953 Nm	1280 - 1440 lb ft
1-1/4 in	2468 - 2712 Nm	1820 - 2000 lb ft
1-3/8 in	3227 - 3688 Nm	2380 - 2720 lb ft
1-1/2 in	4285 - 4827 Nm	3160 - 3560 lb ft

NOTE: *Use thick nuts with Grade 8 bolts.*

Metric hardware

Grade 8.8 bolts, nuts and studs

Size	Nm	lb in/lb ft
4 mm	3 - 4 Nm	24 - 36 lb in
5 mm	7 - 8 Nm	60 - 72 lb in
6 mm	11 - 12 Nm	96 - 108 lb in
8 mm	26 - 31 Nm	228 - 276 lb in
10 mm	52 - 61 Nm	456 - 540 lb in
12 mm	90 - 107 Nm	66 - 79 lb ft
14 mm	144 - 172 Nm	106 - 127 lb ft
16 mm	217 - 271 Nm	160 - 200 lb ft
20 mm	434 - 515 Nm	320 - 380 lb ft
24 mm	675 - 815 Nm	500 - 600 lb ft
30 mm	1250 - 1500 Nm	920 - 1100 lb ft
36 mm	2175 - 2600 Nm	1600 - 1950 lb ft

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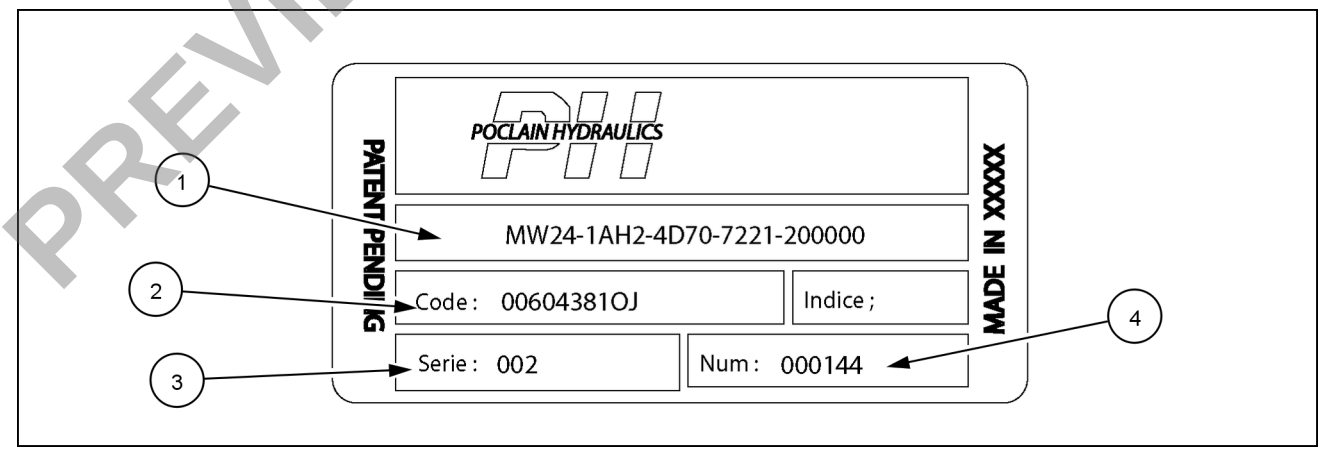
Motor - Identification - MW-24 Wheel motor trouble shooting and identification

SP.400F	

Symptom	Probable cause	Corrective action
Motor is noisy without load	Regular rumbling : worn bearing support	Replace the bearing support
	Vibrations : mountings and/or hydraulic piping become loose	Tighten to torque
Motor is noisy under load	Clattering : boost pressure too low	Set the counterpressure valve
	Cavitation: excessive internal leaks	Replace the cylinders block and valving assembly
The motor does not revolve	No flow to the motor	Check the pump drive and pump inlet
	The circuit does not reach working pressure	Check the safety valve condition (regulator)
	Excessive internal leaks	Replace the cylinders block and valving assembly
	The brake reminds engaged	Check the brake pilot circuit
The motor does not revolve at its normal speed under load	Pump flow is too low	Check the pump drive speed
	Working pressure is too low	Check the safety valve setting pressure (regulator)
	Bad working of the replenishing circuit	Check the replenishing circuit
	Excessive internals leaks	Replace the cylinders block and valving assembly
The motor revolves irregularly	Pump flow is irregular	Check the pump flow
	Excessive internals leaks	Replace the cylinders block and valving assembly
The motor leaks	The housing pressure is too high	Check the drain circuit and filter condition
	The seals are deteriorated	Replace the seals
	The assembly is incorrect	Check tightening of mounting screws, bleed screws and hydraulic fittings

MW-24 Component identification

Identification of the hydrostatic motor can be made by reviewing the nameplate attached to the motor. The part number and the chronological serial number must be specified to order spare parts.



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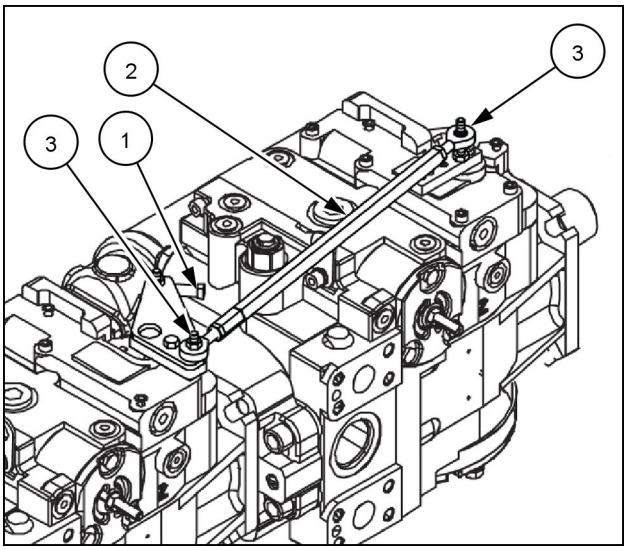
Item	Designation
1	Commercial description
2	Part number

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Hydraulic pump drive coupler - Remove - Hydrostatic pump drive coupler

Prior operation:
Remove the right hand engine compartment enclosure and panels. Refer to **Engine hood and panels - Remove (90.100)**
Prior operation:
Apply a vacuum to the hydraulic fluid tank. Refer to **Oil reservoir - Service instruction - Tank vacuum procedure (35.300)**
Prior operation:
Remove the Auxiliary pump assembly. Refer to **Auxiliary hydraulic pump - Remove (35.220)**

1. Park the vehicle on a flat, level surface. Release the parking brake and lower the suspension completely.
2. Apply the parking brake and swing the right side boom outward, or raise the boom up and out of the saddle.
3. Shut off the engine, remove the ignition key, and allow the engine and hydraulic oil to cool.
4. Tag and mark all hydrostatic pump hydraulic hoses. Record the hose connections and hose routing to aid in reinstallation of the hoses.
5. Remove all hydraulic hoses, and disconnect any electrical connections from hydrostatic tandem pump set.
6. Cap and plug the lines and fittings. Use plastic covers to cover lower ports on hydrostatic pump units.
7. Disconnect the cable connection to the ball joint **(1)** of the turnbuckle assembly.
8. Disconnect pump turnbuckle **(2)** from the pump set by removing the nuts **(2)**. Lift the turnbuckle assembly from the pump set.

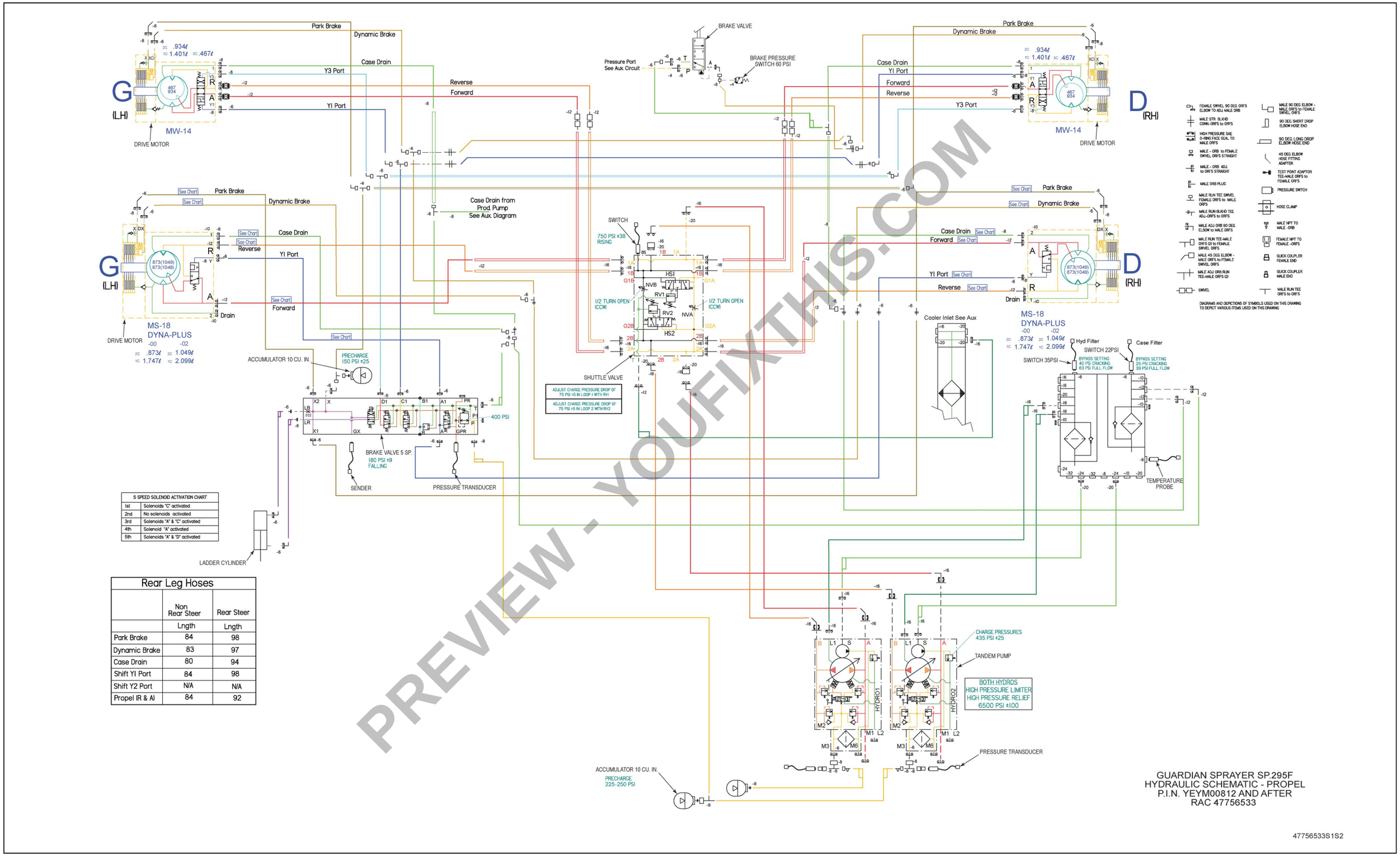


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9. Attach a suitable lifting device to the hydrostatic tandem pump set **(2)**, ensuring strap routing will evenly balance the assembly, once lifted. Remove slack from strapping, but do not lift assembly at this time.

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5 SPEED SOLENOID ACTIVATION CHART	
1st	Solenoids "C" activated
2nd	No solenoids activated
3rd	Solenoids "A" & "C" activated
4th	Solenoid "A" activated
5th	Solenoids "A" & "D" activated

Rear Leg Hoses		
	Non Rear Steer	Rear Steer
	Lngth	Lngth
Park Brake	84	98
Dynamic Brake	83	97
Case Drain	80	94
Shift YI Port	84	98
Shift Y2 Port	N/A	N/A
Propel IR & Al	84	92

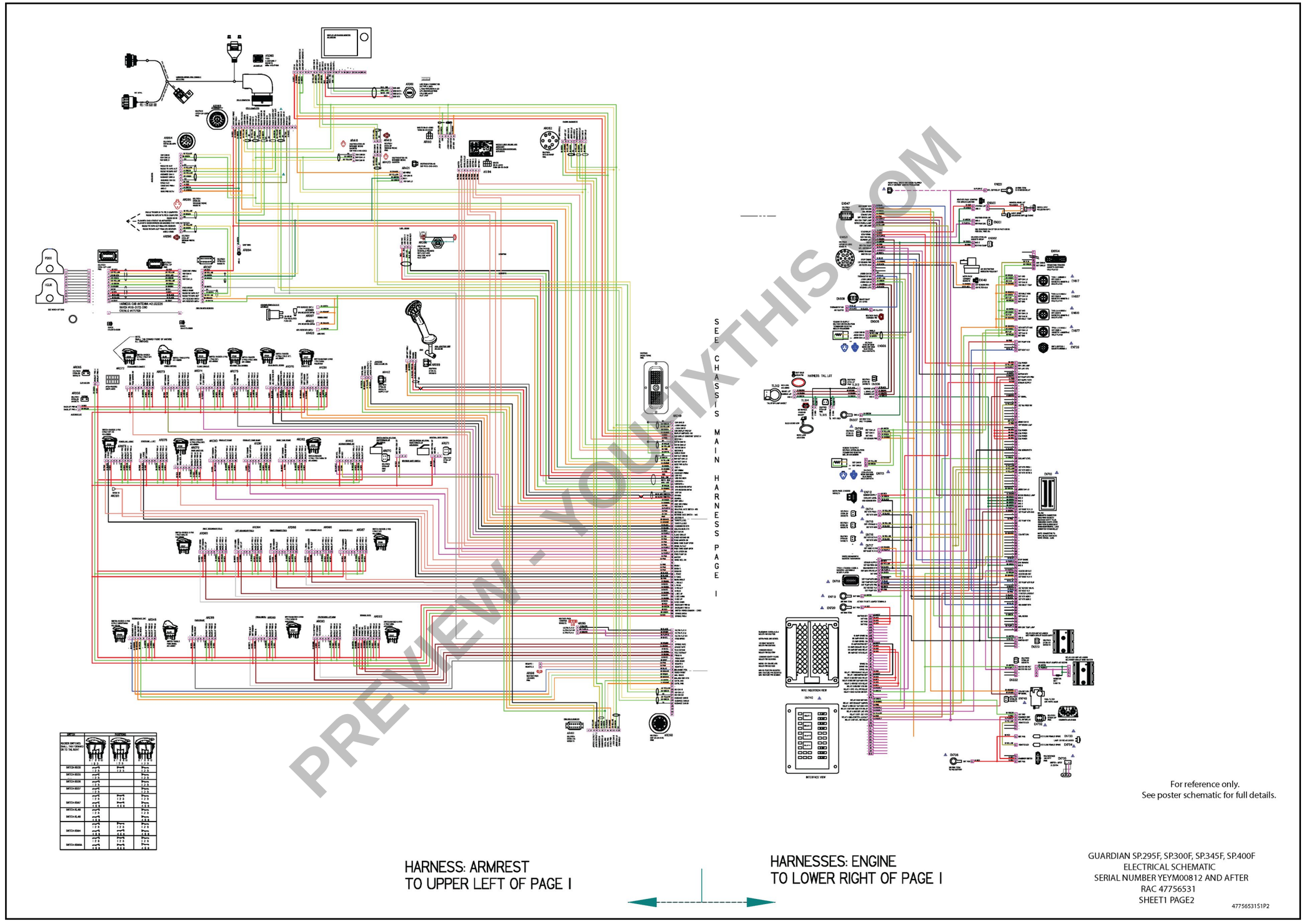
GUARDIAN SPRAYER SP.295F
HYDRAULIC SCHEMATIC - PROPEL
P.I.N. YEYM00812 AND AFTER
RAC 47756533

47756533S1S2

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155	105	0	red	Intake manifold air temperature signal indicates intake manifold air temperature above engine protection critical limit	Progressive power and/or speed derate increasing in severity from time of alert	Clean cooling package
187	3510	4	amber	Low voltage detected at the sensor supply number 2 circuit	Possible reduced engine performance	Call Cummins Service
195	111	3	amber	High signal voltage or open circuit detected at coolant level circuit	None on performance	Check wire harness, check level sensor
196	111	4	amber	Low signal voltage or open circuit detected at coolant level circuit	None on performance	Check wire harness, check level sensor
197	111	18	amber	Low engine coolant level detected	Possible reduced engine performance	Check coolant level
221	108	3	amber	High voltage detected at barometric pressure circuit	Possible reduced engine performance	Call Cummins Service
222	108	4	amber	Low voltage detected at barometric pressure circuit	Possible reduced engine performance	Call Cummins Service
227	3510	3	amber	High voltage detected at sensor supply number 2 circuit	Possible reduced engine performance	Call Cummins Service
234	190	0	red	Engine speed signal indicates engine speed above engine protection limit	Possible reduced engine performance	Reverse powering of the engine
235	111	1	red	The engine coolant is severely low	Engine will be shut down	Check coolant level
238	3511	4	amber	Low voltage detected on the +5 volt sensor supply circuit to the engine speed sensor	Engine may run rough, may stop running, may not start or may be difficult to start	Call Cummins Service
239	3511	3	amber	High voltage detected on the +5 volt sensor supply circuit to the engine speed sensor	Engine may run rough, may stop running, may not start or may be difficult to start	Call Cummins Service
271	1347	4	amber	Low signal voltage is detected at the fuel pump actuator circuit	Possible reduced engine performance	Call Cummins Service
272	1347	3	amber	High signal voltage is detected at the fuel pump actuator circuit	Engine may run rough, may stop running, may not start or may be difficult to start	Call Cummins Service
285	639	9	amber	The ECM expected information from a multiplexed device but did not receive it soon enough or did not receive it at all	At least one multiplexed device will not operate properly	Check chassis J1939 wiring connections, terminating resistors and nodes
286	639	13	amber	The ECM expected information from a multiplexed device but only received a portion of the necessary information	At least one multiplexed device will not operate properly	Check chassis J1939 wiring connections, terminating resistors and nodes

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Grade 10.9 bolts, nuts and studs

Size	Nm	lb in/lb ft
4 mm	4 - 5 Nm	36 - 48 lb in
5 mm	9 - 11 Nm	84 - 96 lb in
6 mm	15 - 18 Nm	132 - 156 lb in
8 mm	37 - 43 Nm	324 - 384 lb in
10 mm	73 - 87 Nm	54 - 64 lb ft
12 mm	125 - 150 Nm	93 - 112 lb ft
14 mm	200 - 245 Nm	149 - 179 lb ft
16 mm	310 - 380 Nm	230 - 280 lb ft
20 mm	610 - 730 Nm	450 - 540 lb ft
24 mm	1050 - 1275 Nm	780 - 940 lb ft
30 mm	2000 - 2400 Nm	1470 - 1770 lb ft
36 mm	3500 - 4200 Nm	2580 - 3090 lb ft

Grade 12.9 bolts, nuts and studs

Size	Nm	lb in/lb ft
Typically the torque values specified for grade 10.9 hardware can be used satisfactorily on grade 12.9 hardware.		

Steel hydraulic fittings

37° flare fitting

Tube outside diameter/Hose inside diameter		Thread size	Nm	lb in/lb ft
mm	inch			
6.4 mm	1/4 in	7/16-20 in	8 - 16 Nm	72 - 144 lb in
7.9 mm	5/16 in	1/2-20 in	11 - 22 Nm	96 - 192 lb in
9.5 mm	3/8 in	9/16-18 in	14 - 34 Nm	120 - 300 lb in
12.7 mm	1/2 in	3/4-16 in	20 - 57 Nm	180 - 504 lb in
15.9 mm	5/6 in	7/8-14 in	34 - 79 Nm	300 - 696 lb in
19.0 mm	3/4 in	1-1/16-12 in	54 - 108 Nm	40 - 80 lb ft
22.2 mm	7/8 in	1-3/16-12 in	81 - 135 Nm	60 - 100 lb ft
25.4 mm	1 in	1-5/16-12 in	102 - 158 Nm	75 - 117 lb ft
31.8 mm	1-1/4 in	1-5/8-12 in	169 - 223 Nm	125 - 165 lb ft
38.1 mm	1-1/2 in	1-7/8-12 in	285 - 338 Nm	210 - 250 lb ft

Straight threads with O-ring

Tube outside diameter/Hose inside diameter		Thread size	Nm	lb in/lb ft
mm	inch			
6.4 mm	1/4 in	7/16-20 in	16 - 26 Nm	144 - 228 lb in
7.9 mm	5/16 in	1/2-20 in	22 - 34 Nm	192 - 300 lb in
9.5 mm	3/8 in	9/16-18 in	34 - 54 Nm	300 - 480 lb in
12.7 mm	1/2 in	3/4-16 in	57 - 91 Nm	540 - 804 lb in
15.9 mm	5/6 in	7/8-14 in	79 - 124 Nm	58 - 92 lb ft
19.0 mm	3/4 in	1-1/16-12 in	108 - 174 Nm	80 - 128 lb ft
22.2 mm	7/8 in	1-3/16-12 in	136 - 216 Nm	100 - 160 lb ft
25.4 mm	1 in	1-5/16-12 in	159 - 253 Nm	117 - 187 lb ft
31.8 mm	1-1/4 in	1-5/8-12 in	224 - 357 Nm	165 - 264 lb ft
38.1 mm	1-1/2 in	1-7/8-12 in	339 - 542 Nm	250 - 400 lb ft

Split flange mounting bolts

Size	Nm	lb in/lb ft
5/16-18 in	20 - 27 Nm	180 - 240 lb in
3/8-16 in	27 - 34 Nm	240 - 300 lb in
7/16-14 in	47 - 61 Nm	420 - 540 lb in
1/2-13 in	74 - 88 Nm	55 - 65 lb ft

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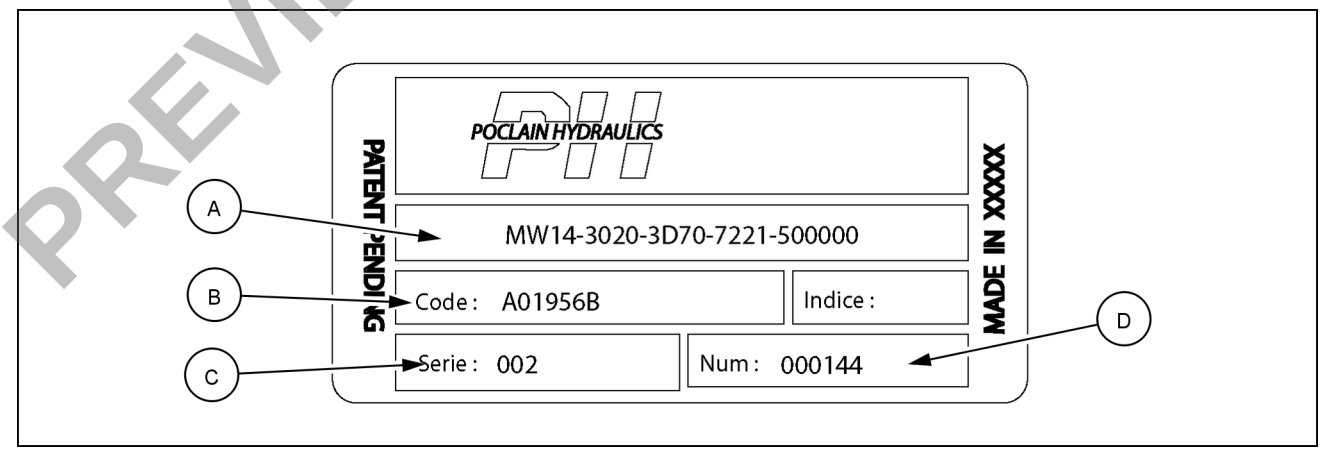
Motor - Identification - MW-14 Wheel motor trouble shooting and identification

SP.295F	

Symptom	Probable cause	Corrective action
Motor is noisy without load	Regular rumbling : worn bearing support	Replace the bearing support
	Vibrations : mountings and/or hydraulic piping become loose	Tighten to torque
Motor is noisy under load	Clattering : boost pressure too low	Set the counterpressure valve
	Cavitation: excessive internal leaks	Replace the cylinders block and valving assembly
The motor does not revolve	No flow to the motor	Check the pump drive and pump inlet
	The circuit does not reach working pressure	Check the safety valve condition (regulator)
	Excessive internals leaks	Replace the cylinders block and valving assembly
	The brake reminds engaged	Check the brake pilot circuit
The motor does not revolve at its normal speed under load	Pump flow is too low	Check the pump drive speed
	Working pressure is too low	Check the safety valve setting pressure (regulator)
	Bad working of the replenishing circuit	Check the replenishing circuit
	Excessive internal leaks	Replace the cylinders block and valving assembly
The motor revolves irregularly	Pump flow is irregular	Check the pump flow
	Excessive internals leaks	Replace the cylinders block and valving assembly
The motor leaks	The housing pressure is too high	Check the drain circuit and filter condition
	The seals are deteriorated	Replace the seals
	The assembly is incorrect	Check tightening of mounting screws, bleed screws and hydraulic fittings

MW-14 Component identification

Identification of the hydrostatic motor can be made by reviewing the nameplate attached to the motor. The part number and the chronological serial number must be specified to order spare parts.



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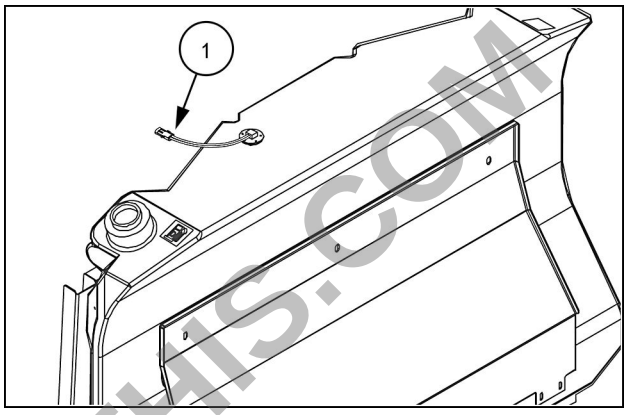
Item	Description
A	Commercial description
B	Part Number

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Fuel tanks - Remove

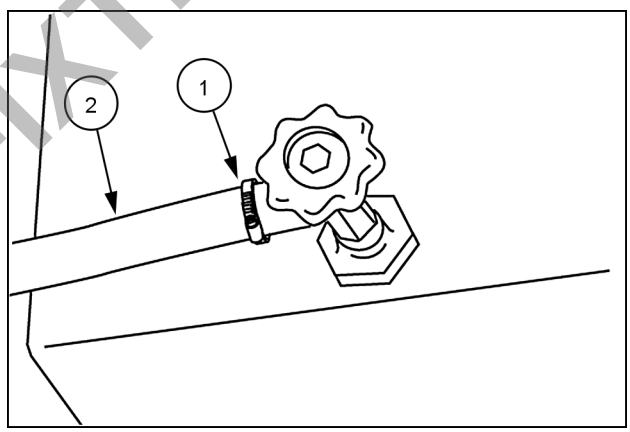
Prior operation:
Remove the product tank **Product tank - Remove (78.110)**
Prior operation:
Remove the hand rinse tank **Rinse tank - Remove - Hand rinse tank (78.110)**

1. Drain the fuel from the fuel tank.
2. Remove the fuel valve.
3. Disconnect the electrical connector **(1)** on the top of the fuel tank.



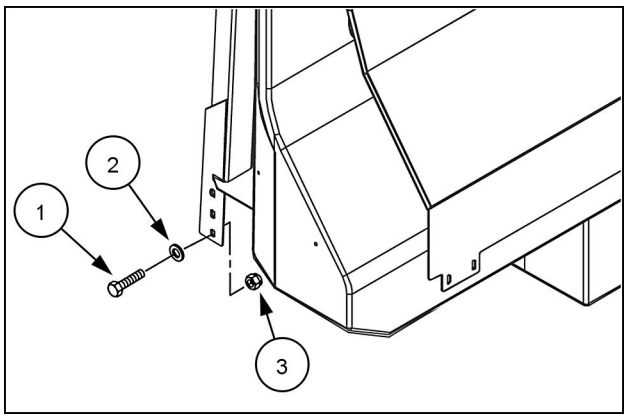
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4. Loosen the clamp **(1)** on the fuel line **(2)**.
5. Remove the fuel line.



RAIL13SP03795AA 2

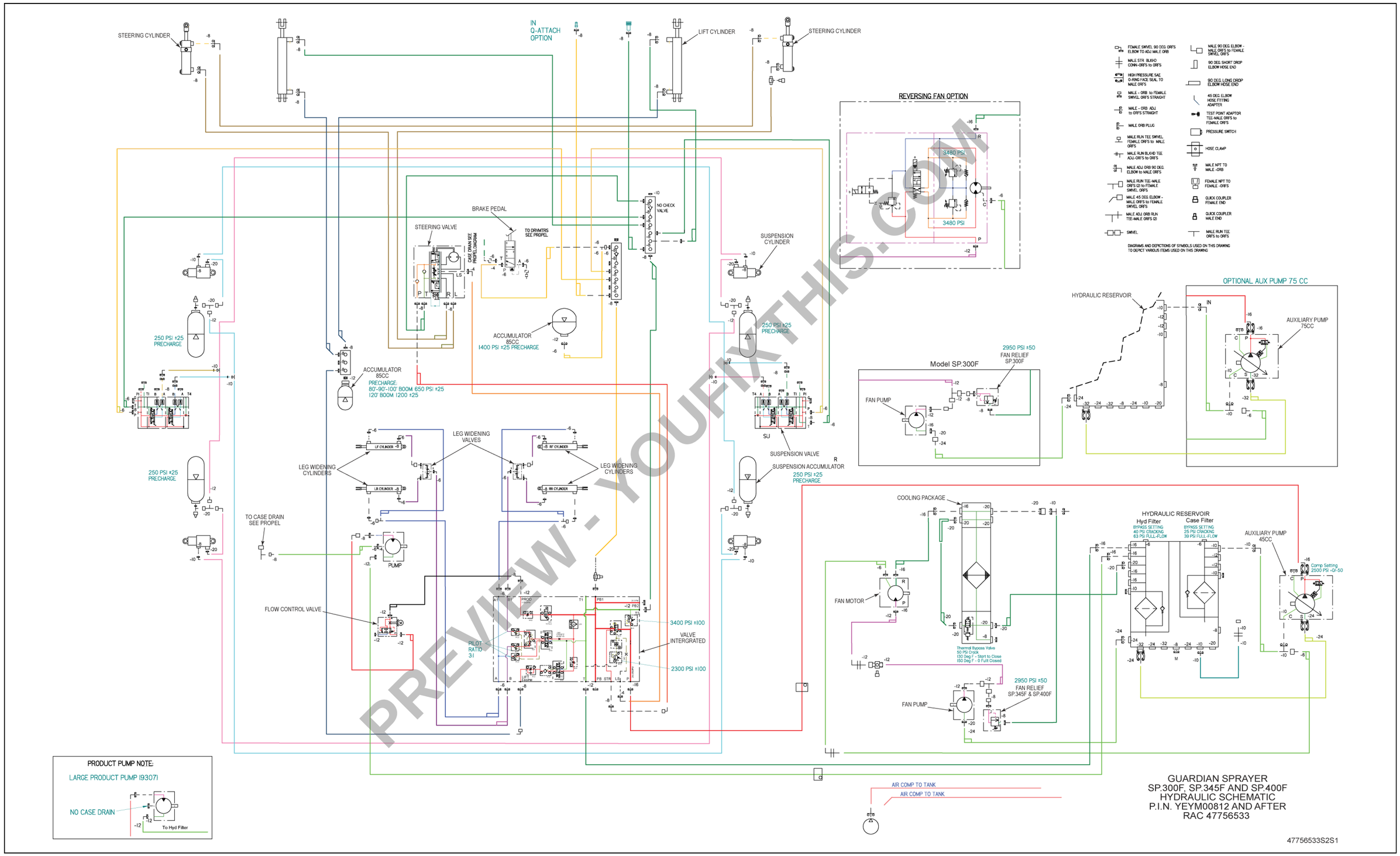
6. Attach a suitable lifting device to the fuel tank and the bracket assembly.
7. Remove the four hex bolts **(1)**, eight flat washers **(2)**, and four locknuts **(3)** that secure the fuel tank and the bracket assembly to the frame.
8. Remove the fuel tank and the bracket assembly from the frame.



RAIL13SP03794AA 3

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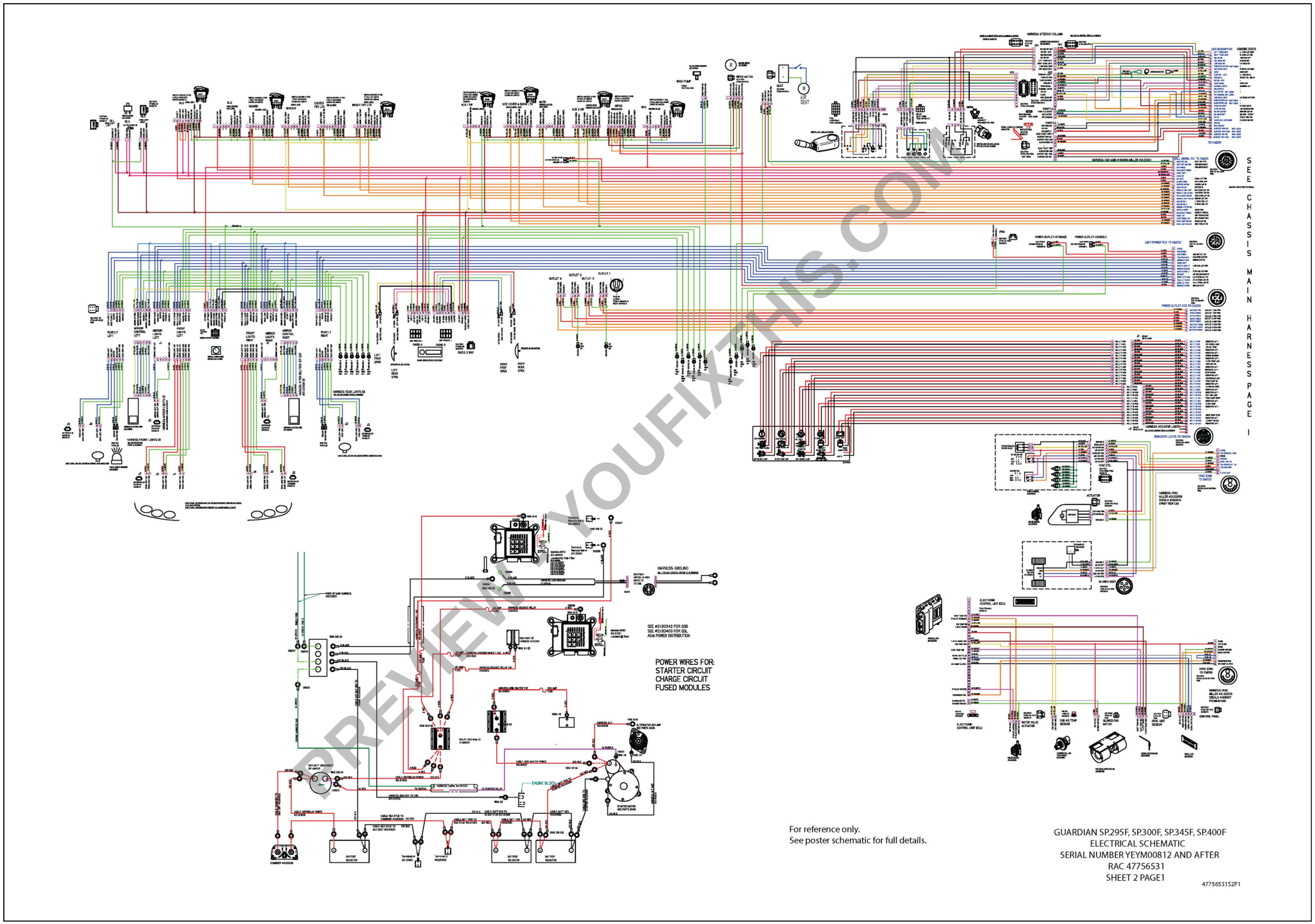
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RAIL14SP01329JA 1

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288	974	19	red	The OEM vehicle electronic control unit (VECU) detected a fault with the remote accelerator	Remote accelerator will not operate	Check chassis J1939 wiring connections, terminating resistors and nodes
322	651	5	amber	Current detected at injector 1 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
323	655	5	amber	Current detected at injector 5 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
324	653	5	amber	Current detected at injector 3 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
325	656	5	amber	Current detected at injector 6 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
331	652	5	amber	Current detected at injector 2 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
332	654	5	amber	Current detected at injector 4 when voltage is turned off	Possible reduced engine performance	Call Cummins Service
334	110	2	amber	The engine coolant temperature sensor is reading an erratic value at initial key on	None on performance	Call Cummins Service
343	629	12	amber	ECM power supply errors have been detected	Possible reduced engine performance	Check ECM power supply
351	3597	12	amber	The ECM measured injector boost voltage is low	Possible reduced engine performance	Call Cummins Service
352	3509	4	amber	Low voltage detected at sensor supply number 1 circuit	Possible reduced engine performance	Call Cummins Service
386	3509	3	amber	High voltage detected at sensor supply number 1 circuit	Possible reduced engine performance	Call Cummins Service
415	100	1	red	Oil pressure signal indicates oil pressure is below the engine protection critical limit	Progressive power and/or speed derate increasing in severity from time of alert	Check oil level
418	97	15	amber	Water has been detected in the fuel filter	None on performance	Drain water from the fuel filter, check filter wire harness
426	639	2	none	Communication between the ECM and another device on the SAE J1939 data link has been lost	None on performance. J1939 devices possibly do not operate.	Check chassis J1939 wiring connections, terminating resistors and nodes
427	639	9	none	Communication between the ECM and another device on the SAE J1939 data link has been lost	Engine speed will ramp down and remain at idle	Check chassis J1939 wiring connections, terminating resistors and nodes
428	97	3	amber	High voltage detected at the water-in-fuel circuit	None on performance	Check filter wire harness
429	97	4	amber	Low voltage detected at the water-in-fuel circuit	None on performance	Check filter wire harness

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Size	Nm	lb in/lb ft
5/8-11 in	**190 - 203 Nm**	**140 - 150 lb ft**

O-ring face seal end						O-ring boss end fitting or lock nut		
Nominal SAE dash size	Tube outside diameter		Thread size	Nm	lb in/lb ft	Thread size	Nm	lb in/lb ft
	mm	in						
-4	**6.4 mm**	**1/4 in**	**9/16-18 in**	**14 - 16 Nm**	**120 - 144 lb in**	**7/16-20 in**	**23 - 27 Nm**	**204 - 240 lb in**
-6	**9.5 mm**	**3/8 in**	**11/16-16 in**	**24 - 27 Nm**	**216 - 240 lb in**	**9/16-18 in**	**34 - 41 Nm**	**300 - 360 lb in**
-8	**12.7 mm**	**1/2 in**	**13/16-16 in**	**43 - 54 Nm**	**384 - 480 lb in**	**3/4-16 in**	**61 - 68 Nm**	**540 - 600 lb in**
-10	**15.9 mm**	**5/8 in**	**1-14 in**	**62 - 76 Nm**	**552 - 672 lb in**	**7/8-14 in**	**81 - 88 Nm**	**60 - 65 lb ft**
-12	**19.0 mm**	**3/4 in**	**1-3/ 16-12 in**	**90 - 110 Nm**	**65 - 80 lb ft**	**1-1/ 16-12 in**	**115 - 122 Nm**	**85 - 90 lb ft**
-14	**22.2 mm**	**7/8 in**	**1-3/ 16-12 in**	**90 - 110 Nm**	**65 - 80 lb ft**	**1-13/ 16-12 in**	**129 - 136 Nm**	**95 - 100 lb ft**
-16	**25.41 mm**	**1.0 in**	**1-7/ 16-12 in**	**125 - 140 Nm**	**92 - 105 lb ft**	**1-5/ 16-12 in**	**156 - 169 Nm**	**115 - 125 lb ft**
-20	**31.8 mm**	**1-1/4 in**	**1-11/ 16-12 in**	**170 - 190 Nm**	**125 - 140 lb ft**	**1`-5/ 6-12 in**	**201 - 217 Nm**	**150 - 160 lb ft**
-24	**38.1 mm**	**1-1/2 in**	**2-12 in**	**200 - 254 Nm**	**150 - 180 lb ft**	**1-7/8-12 in**	**258 - 271 Nm**	**190 - 200 lb ft**

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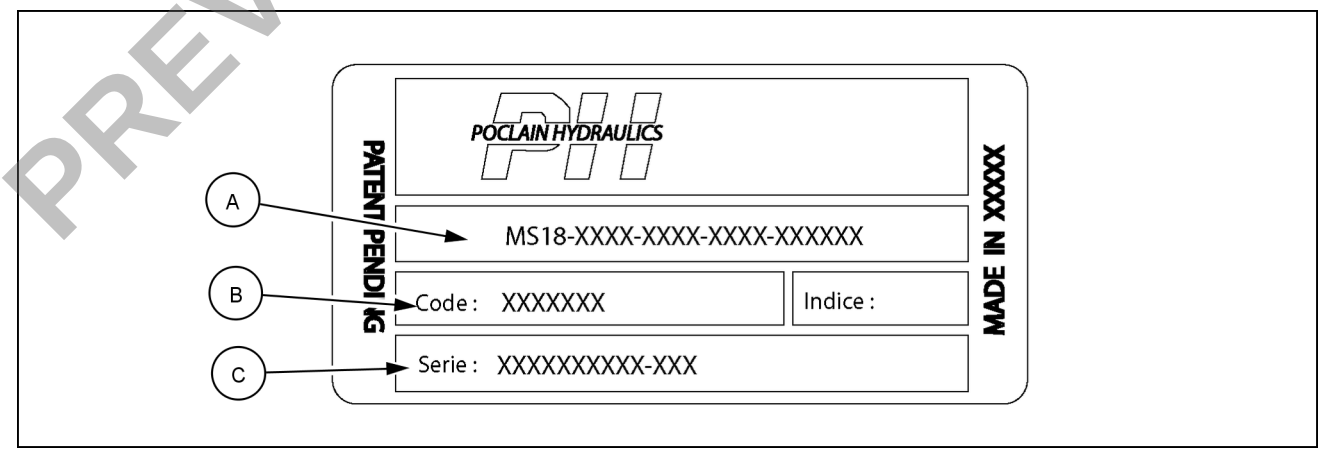
Motor - Identification - MS-18 Wheel motor trouble shooting and identification

SP.295F	
SP.300F	
SP.345F	

Symptom	Probable cause	Corrective action
Motor is noisy without load	Regular rumbling : worn bearing support	Replace the bearing support
	Vibrations : mountings and/or hydraulic piping become loose	Tighten to torque
Motor is noisy under load	Clattering : boost pressure too low	Set the counterpressure valve
	Cavitation: excessive internal leaks	Replace the cylinders block and valving assembly
The motor does not revolve	No flow to the motor	Check the pump drive and pump inlet
	The circuit does not reach working pressure	Check the safety valve condition (regulator)
	Excessive internal leaks	Replace the cylinders block and valving assembly
	The brake reminds engaged	Check the brake pilot circuit
The motor does not revolve at its normal speed under load	Pump flow is too low	Check the pump drive speed
	Working pressure is too low	Check the safety valve setting pressure (regulator)
	Bad working of the replenishing circuit	Check the replenishing circuit
	Excessive internals leaks	Replace the cylinders block and valving assembly
The motor revolves irregularly	Pump flow is irregular	Check the pump flow
	Excessive internals leaks	Replace the cylinders block and valving assembly
The motor leaks	The housing pressure is too high	Check the drain circuit and filter condition
	The seals are deteriorated	Replace the seals
	The assembly is incorrect	Check tightening of mounting screws, bleed screws and hydraulic fittings

MS-18 Component identification

Identification of the hydrostatic motor can be made by reviewing the nameplate attached to the motor. The part number and the chronological serial number must be specified to order spare parts.



RAIL13SP04572AA 1

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Contents

INTRODUCTION

Engine 10

[10.001] Engine and crankcase 10.1

[10.114] Pump drives 10.2

[10.216] Fuel tanks 10.3

[10.206] Fuel filters 10.4

[10.202] Air cleaners and lines 10.5

[10.500] Selective Catalytic Reduction (SCR) exhaust treatment 10.6

[10.400] Engine cooling system 10.7

[10.414] Fan and drive 10.8

Front axle system 25

[25.100] Powered front axle 25.1

Hydrostatic drive 29

[29.218] Pump and motor components 29.1

Brakes and controls 33

[33.202] Hydraulic service brakes 33.1

Hydraulic systems 35

[35.000] Hydraulic systems 35.1

[35.300] Reservoir, cooler, and filters 35.2

[35.220] Auxiliary hydraulic pump and lines 35.3

[35.752] Hydraulic fan drive cooling system 35.4

[35.610] Machine leveling control system 35.5

Pneumatic system 36

[36.100] Pneumatic system 36.1

[36.908] Pneumatic suspension 36.2

Steering 41

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Safety rules

Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

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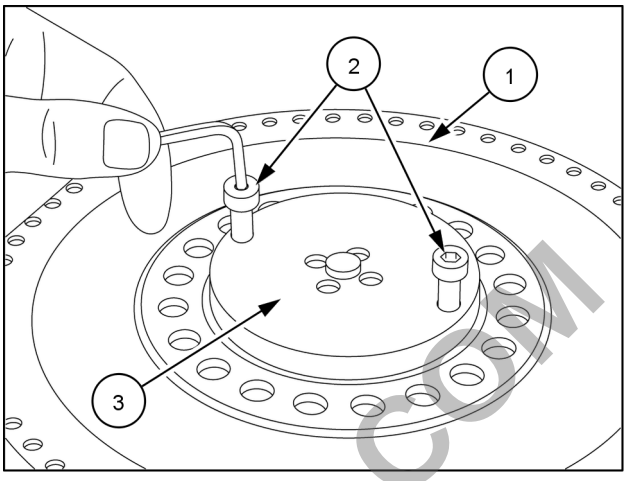
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[41.101] Steering control 41.1
[41.216] Cylinders 41.2
Wheels 44
[44.511] Front wheels 44.1
[44.520] Rear wheels 44.2
Cab climate control 50
[50.100] Heating 50.1
[50.104] Ventilation 50.2
[50.200] Air conditioning 50.3
Electrical systems 55
[55.000] Electrical system 55.1
[55.100] Harnesses and connectors 55.2
[55.015] Engine control system 55.3
[55.201] Engine starting system 55.4
[55.301] Alternator 55.5
[55.302] Battery 55.6
[55.640] Electronic modules 55.7
[55.050] Heating, Ventilation, and Air-Conditioning (HVAC) control system 55.8
[55.047] Steering control system 55.9
Spraying 78
[78.110] Chemical spraying 78.1
[78.111] Spraying pump 78.2
[78.120] Foam marking system 78.3
Platform, cab, bodywork, and decals 90
[90.151] Cab interior 90.1
[90.120] Mechanically-adjusted operator seat 90.2
[90.100] Engine hood and panels 90.3

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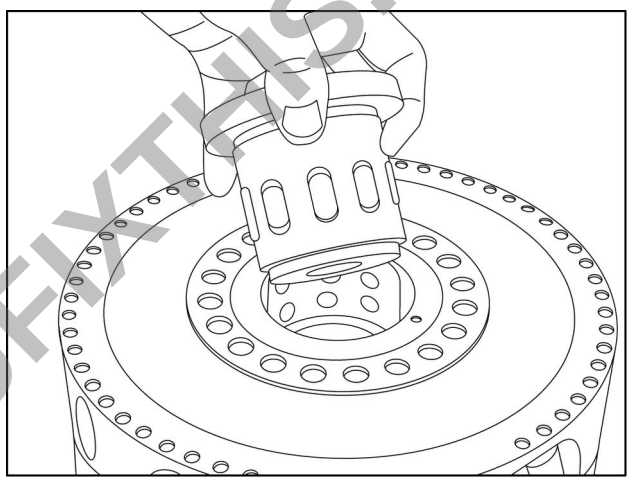
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15. Access the cylinder block assembly **(1)** previously removed and remove the two screws **(2)** attaching the center spool **(3)**.



RAIL13SP03718AA 15

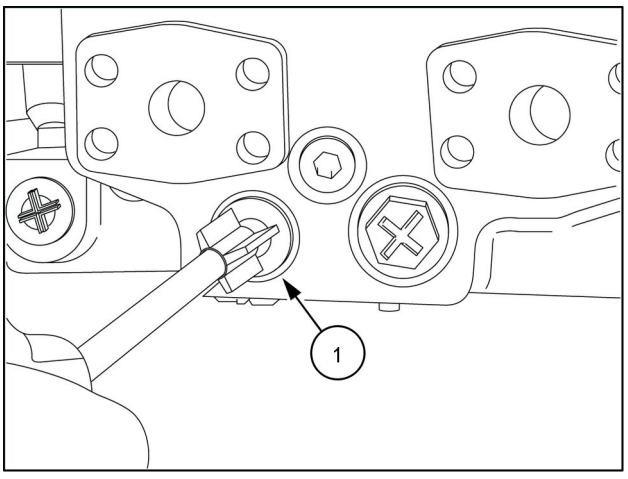
16. Remove the center spool from the cylinder block and retain for reassembly.



RAIL13SP03719AA 16

Valving disassembly:

17. Remove the plastic plug **(1)** in order to decompress the valving.



RAIL13SP03731AA 17

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Index

Steering - 41

Steering control - 101

Steering control - Electrical schema - Four wheel steer 16
Steering control - Dynamic description - Four wheel steer 3
Steering control - Hydraulic schema - Four wheel steer 14
Steering control - Overview - Steering diagnostics-Four wheel steer 11

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3867	3364	18	amber	The diesel exhaust fluid (DEF) has been detected to be below a critical threshold	Possible reduced engine performance	Check for degraded, diluted or incorrect diesel exhaust fluid
3868	3364	9	amber	No communications or an invalid data transfer rate detected on the J1939 data link between the ECM and the aftertreatment DEF quality sensor	Engine power derate	Check engine wiring harness
3876	3364	7	amber		Engine power derate	Fill DEF tank, check for degraded, diluted or incorrect diesel exhaust fluid
3877	3364	12	amber		Engine power derate	Check for degraded, diluted or incorrect diesel exhaust fluid
3878	3364	2	amber	The diesel exhaust fluid pressure sensor has reported a reading too high or too low for the operating conditions	Engine power derate	Check for degraded, diluted or incorrect diesel exhaust fluid
4152	5743	9	amber	No communications on the J1939 data link between the engine ECM and the aftertreatment SCR temperature sensor module	Possible reduced engine performance	Check for poor battery connections, check engine harness for incorrect or damaged J1939 terminating resistor
4155	5746	3	amber	High signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit heater relay circuit	Possible reduced engine performance	Check engine wiring harness
4156	5746	4	amber	Low signal voltage detected at the aftertreatment diesel exhaust fluid dosing unit heater relay circuit	Possible reduced engine performance	Check engine wiring harness
4157	4376	7	amber	A stuck aftertreatment diesel exhaust fluid return valve has been detected	None on performance	Call Cummins Service
4159	5743	12	amber	An internal error has been detected in the aftertreatment SCR temperature sensor module	Possible reduced engine performance	Call Cummins Service
4164	5743	3	amber	High battery supply voltage detected at the aftertreatment SCR temperature sensor module	Possible reduced engine performance	Check charging system and batteries for high voltage
4165	5743	4	amber	Low battery supply voltage detected at the aftertreatment SCR temperature sensor module	Possible reduced engine performance	Check for poor battery connections, check charging circuit for causes for low voltage

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