SEE ARMREST PAGE 2

SEE CAB HARNESSES PAGE 3

SEE BOOM HARNESSES PAGE 2

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GUARDIAN, SP240F, SP275F
SP333F, SP365F
ELECTRICAL SCHEMATIC
SERIAL NUMBER: YDYM0596 and after
RAC 47654938

IN Q-ATTACH OPT

LIFT CYL.

CYLINDER-STEERING

STEERING CYL.

INCL W/ MANIFOLD

BRAKE PEDAL

TO DRVMTRS

NO CHECK VALVE

STEERING VALVE

CASE DRAIN SEE PROPEL DIAGRAM 215105

LS

P T R L

SUSPENSION CYL.

ORIFICE (2)

250 PSI ±25 PSI

PLUGS INCL W/ VALVE

ORIFICE DISK

ACCUMULATOR 85CC

PRECHARGE: 80'-90'-100' BOOM 650 PSI ±25 120' BOOM 1200 ±25

1400 PSI ±25 PRECHARGE

ACCUMULATOR 85CC

250 PSI PRECHARGE ±25 PSI

ORIFICE (2)

SUSPENSION VALVE

250 PSI ±25 PSI

SUSPENSION ACCUMULATOR (4)

LEG WIDENING VALVE

LF CYLINDER -8

RF CYLINDER -8

LR CYLINDER -8

RR CYLINDER -8

LEG WIDE CYL

CASE DRAIN

PUMP YD.DR. SEE NOTE

FLOW CONTROL VALVE

SEE PRODUCT PUMP NOTE

INC W/ VALVE

VALVE- INTEGRATED

PILOT RATIO 3:1

3400 PSI ±100 PSI

2300 PSI ±100

1/2" RETURN HOSE

3/4" RETURN HOSE

PRODUCT PUMP NOTE:

LARGE PRODUCT PUMP

INCL W/ PUMP

At Hyd Filter

STANDARD PRODUCT PUMP

At Hyd Filter

STANDARD PUMP W/DUMP 45CC

2500 PSI ±100

To 'T'

STANDARD PUMP 45CC

INCL W/ PUMP

2700 PSI ±100

To 'T'

AUX PUMP NOTE:

HYD RESV.

OPTIONAL PUMP 62 CC

INCL W/ PUMP

3000 PSI ±100

To 'T'

HYD RESV.

OPTIONAL PUMP 75 CC

INCL W/ PUMP

3000 PSI ±100

To 'T'

REV FAN OPT 21.40135

TO LH OF FAN MOTOR

TO RH OF FAN MOTOR

3050 PSI ±50

3050 PSI ±50

MANIFOLD - REV FAN

TO TANK

1800 PSI ±50 10 GPM

TO FAN PUMP

Propel Circuit Case Drain

BYPASS SETTING: 25 PSI CRACKING 39 PSI FULL-FLOW

Case Filter

SEE OPTION DETAILS FOR COMPENSATOR SETTING

COOLING PKG.

FAN MOTOR

To 'T' Port of Shuttle See Propel Diag 21-43609

Hyd Filter

BYPASS SETTING: 40 PSI CRACKING 63 PSI FULL-FLOW

AUX. PUMP

85 PSI ±8

COOLER BYPASS

Hydraulic Reservoir Rear View

OPENING TEMP: 112° - 128°F FULL OPEN TEMP: 145°F

1600 PSI ±50

FAN PUMP

FAN RELIEF

DIAGRAMS AND DEPICTIONS OF SYMBOLS USED ON THIS DRAWING TO DEPICT VARIOUS ITEMS USED ON THIS DRAWING

- FEMALE SWIVEL 90 DEG. ORFS ELBOW TO ADJ. MALE ORB
- MALE STR. BLKHD CONN.-ORFS to ORFS
- HIGH PRESSURE SAE O-RING FACE SEAL TO MALE ORFS
- MALE - ORB to FEMALE SWIVEL ORFS STRAIGHT
- MALE - ORB ADJ. to ORFS 45 DEG.
- HOSE CLAMP
- PRESSURE SWITCH
- MALE - ORB ADJ. to ORFS STRAIGHT
- MALE ORB PLUG
- MALE RUN TEE SWIVEL FEMALE ORFS to MALE ORFS
- MALE 90 DEG. ELBOW - MALE ORFS to FEMALE SWIVEL ORFS
- 90 DEG. SHORT DROP ELBOW HOSE END
- 90 DEG. LONG DROP ELBOW HOSE END
- 45 DEG. ELBOW HOSE FITTING ADAPTER
- TEST POINT ADAPTOR TEE-MALE ORFS to FEMALE ORFS
- UNION ORFS
- ANCHOR FLANGE
- MALE NPT TO MALE -ORB
- MALE RUN BLKHD TEE ADJ.-ORFS to ORF
- REDUCER
- MALE ADJ. ORB 90 DEG. ELBOW to MALE ORFS
- MALE RUN TEE-MALE ORFS to FEMALE SWIVEL ORFS
- MALE 45 DEG. ELBOW - MALE ORFS to FEMALE SWIVEL ORFS
- MALE ADJ. ORB RUN TEE-MALE ORFS
- FEMALE NPT TO FEMALE -ORFS
- QUICK COUPLER FEMALE END
- QUICK COUPLER MALE END
- CLAMP
- MALE RUN TEE ORFS to ORFS
- FEMALE CAP ORFS
- MALE RUN TEE SWIVEL FEMALE ORFS to MALE ORFS
- REDUCER - FEMALE ORFS to MALE ORFS
- MALE ADJ. ORB MALE ORFS RUN TEE
- SWIVEL

GUARDIAN SP240F
MAIN HYDRAULIC SCHEMATIC
SERIAL NUMBER: YDYM0596 AND AFTER
RAC 47650171

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Torque - Minimum tightening torques for normal assembly

SP.240F	
SP.275F	
SP.333F	
SP.365F	

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

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Engine control system - Overview - Engine fault codes QSB engines

SP.240F	
SP.275F	

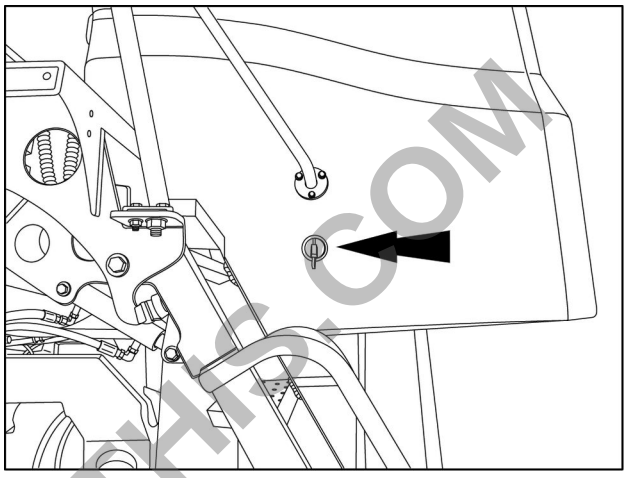
SPN#	FMI#	Code	Lamp color	Reason for fault	Effect (only when code is active)	Action
94	0	2216	amber	Fuel pump delivery pressure - data valid but above normal operating range - moderately severe level.	None or possible engine noise associated with higher injection pressures especially at idle or light load. Engine power is reduced.	Check for air in fuel supply line. Check fuel return line restriction. Call Cummins service.
94	1	2215	amber	Fuel pump delivery pressure - data valid but below normal operating range - moderately severe level.	Possible smoke, loss of power or hard starting. Engine can possibly not start.	Check for fuel inlet restriction. Check for air in fuel supply line. Check for plugged fuel filter. Check fuel return line restriction. Call Cummins service.
94	2	268	amber	Injector metering rail 1 pressure - data erratic, intermittent or incorrect.	The ECM will estimate fuel pressure and power is reduced.	Call Cummins service.
94	3	546	amber	Fuel delivery sensor circuit - voltage above normal or shorted to high source.	Power and or speed derate.	Call Cummins service.
94	4	547	amber	Fuel delivery sensor circuit - voltage below normal or shorted to low source.	Power and or speed derate.	Call Cummins service.
97	3	428	amber	Water-In-Fuel indicator - voltage above normal or shorted to high source.	None on performance. No water-in-fuel warning available.	Change water-in fuel filter. Check wiring. Call Cummins service.
97	4	429	amber	Water-In-Fuel indicator - voltage below normal or shorted to low source.	None on performance. No water-in-fuel warning available.	Change water-in fuel filter. Check wiring. Call Cummins service.
97	15	418	amber	Water-In-Fuel indicator - data valid but above normal operational range - least severe level.	Possible white smoke, loss of power or hard starting.	Drain water-in fuel filter. Call Cummins service.
97	16	1852	amber	Water-in-fuel indicator - date valid but above normal operational range - moderately severe level.	Possible smoke, loss of power or hard starting. Engine can possibly not start.	Check for water in fuel. Drain or replace filter. If fault does not clear call Cummins service.
100	1	415	red	Engine oil rifle pressure - data valid but below normal operational range - most severe level.	Progressive power derate.	Check oil level. Call Cummins service.
100	2	435	amber	Oil pressure switch sensor circuit - data erratic, intermittent or incorrect.	None on performance. No engine protection for oil pressure.	Call Cummins service.

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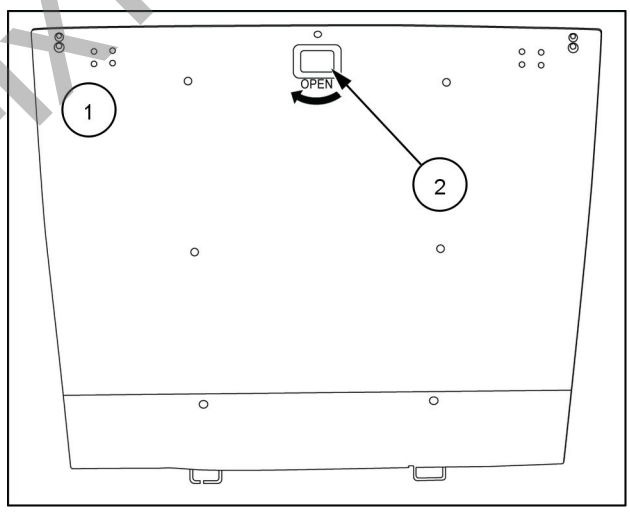
Engine and crankcase - Remove

1. Move the machine to a hard and level surface.
2. Turn the ignition key to the “OFF” position and remove the key from the ignition.
3. Turn the power to the batteries off by turning the switch attached to the engine panel to the “OFF” position.



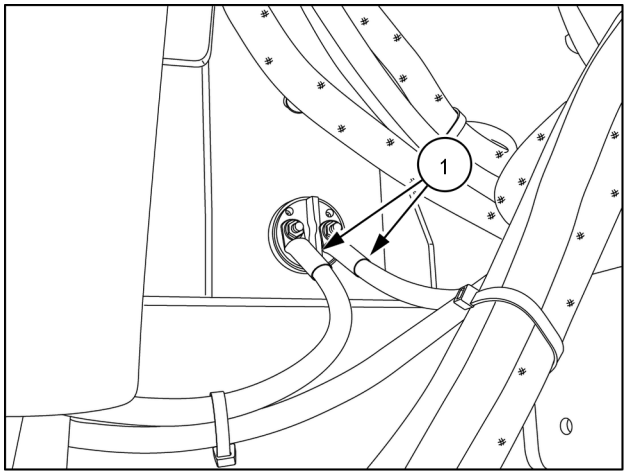
RAIL13SP05120AA 1

4. Open the bottom engine access door **(1)** by turning the handle **(2)** and carefully lowering the engine door to the stop point.



RAIL13SP03419AA 2

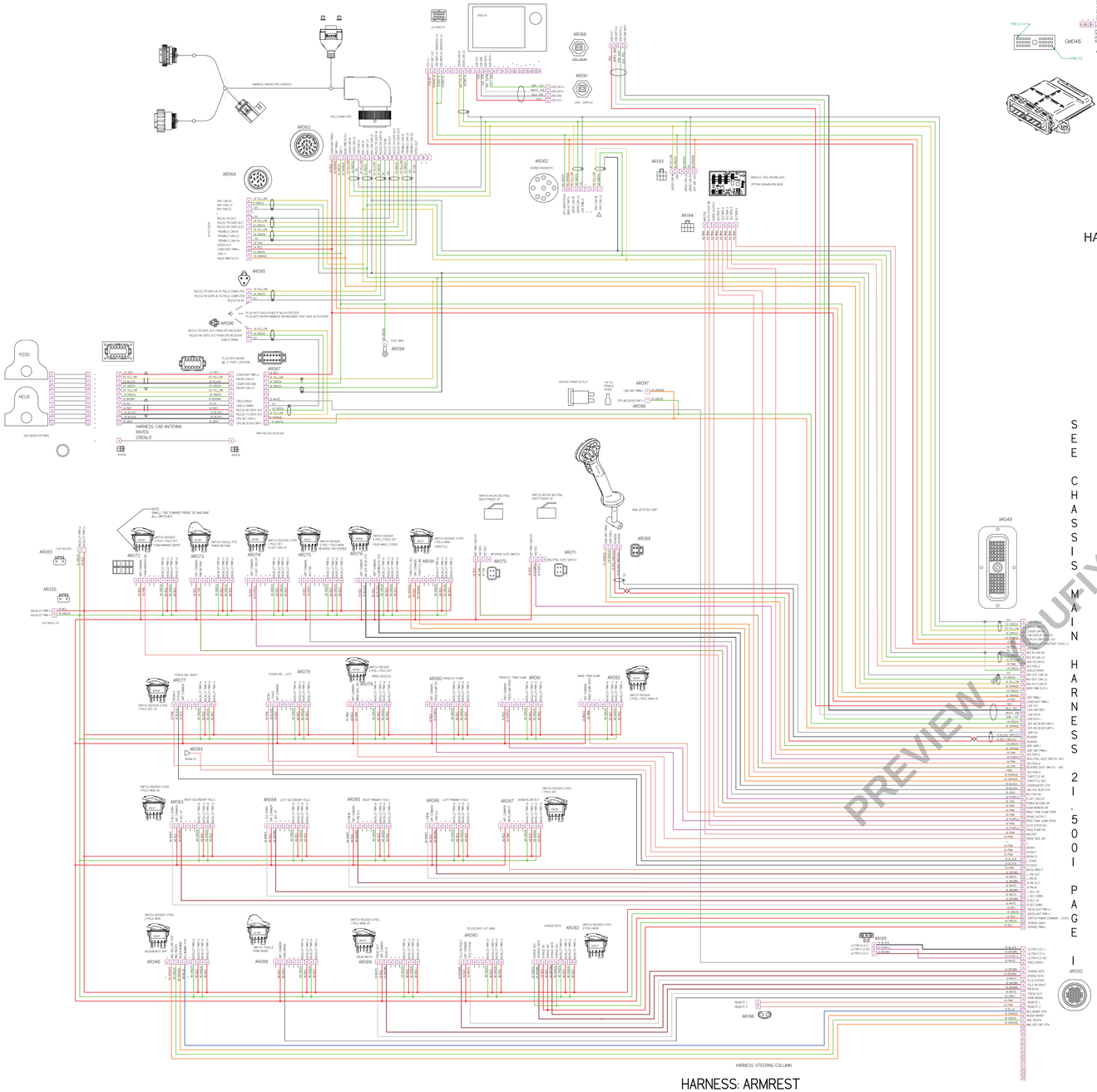
5. Mark and tag the two electrical lines **(1)** that are attached to the back of the battery shut off switch.

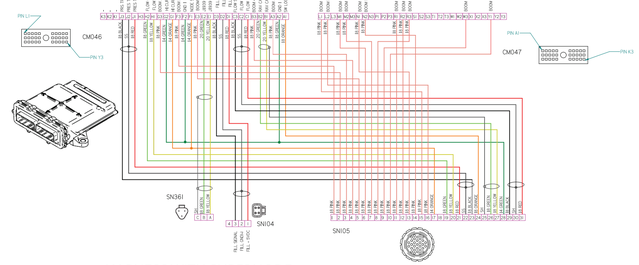


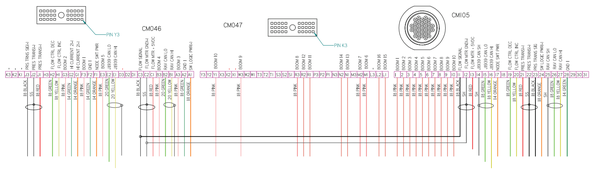
RAIL13SP05121AA 3

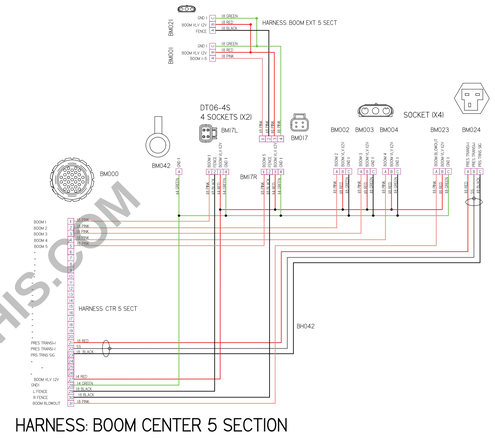
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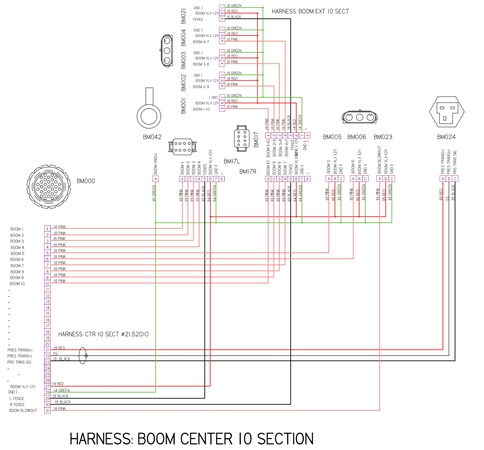
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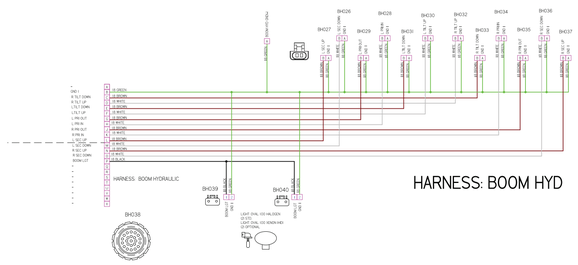


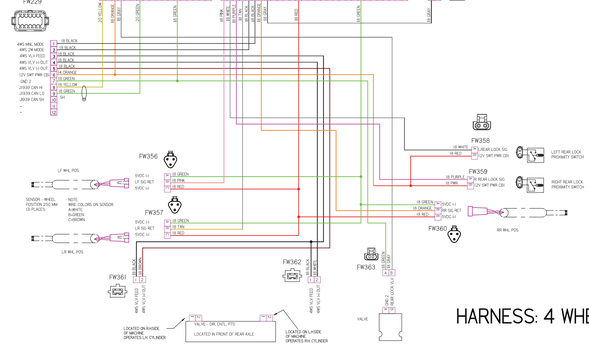


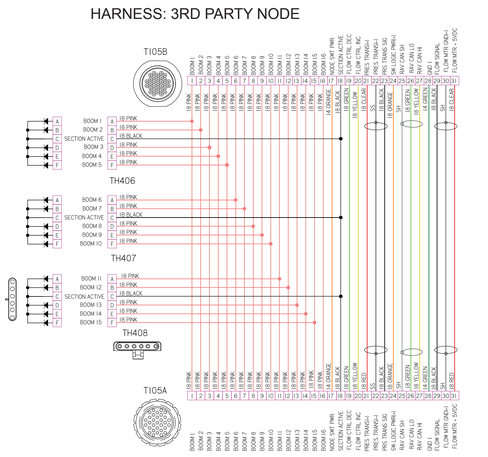


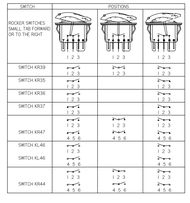












GUARDIAN, SP240F, SP275F
SP333F, SP365F
ELECTRICAL SCHEMATIC
SERIAL NUMBER: YDYM0596 and after
RAC 47654938

HARNESS: LEFT SIDE PAGE I

HARNESSES: RIGHT SIDE PAGE I

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IN
Q-ATTACH
OPTION

CYLINDER-STEERING

LIFT CYL.

CYLINDER-STEERING

STEERING CYL.

MANIFOLD - REV FAN

TO LH OF FAN MOTOR

TO RH OF FAN MOTOR

3050 PSI ±50

3050 PSI ±50

1800 PSI ±50
10 GPM

TO TANK

TO FAN PUMP

INCL W/ MANIFOLD

NO CHECK VALVE

STEERING VALVE

BRAKE PEDAL

CASE DRAIN

TO DRVMTRS

SUSPENSION CYL.

ACCUMULATOR 85CC

1400 PSI ±25 PRECHARGE

250 PSI ±25
PRECHARGE

ORIFICE

PLUGS INCL
W/ VALVE

ORIFICE DISK

PRECHARGE:
80'-90'-100' BOOM 650 PSI ±25
120' BOOM 1200 ±25

ACCUMULATOR 85CC

LEG WIDENING VALVE

LF CYLINDER -8

-8 RF CYLINDER

LEG WIDE CYL

LR CYLINDER -8

-8 RR CYLINDER

250 PSI ±25
PRECHARGE

ORIFICE

SUSPENSION VALVE

SUSPENSION ACCUMULATOR

250 PSI ±25
PRECHARGE

TO CASE DRAIN

PUMP ISTDI

FLOW CONTROL VALVE

INC W/ VALVE

PILOT
RATIO
3:1

3400 PSI ±100

2300 PSI ±100

VALVE- INTEGRATED
21.40618

21.24835ZJ
W/VALVE

PRODUCT PUMP NOTE:

LARGE PRODUCT PUMP

NO CASE DRAIN

At Hyd Filter

FAN PUMP NOTE:

NITRO MODEL 275

NITRO MODEL 333 & 365

HYD RESV

To 'T'

AUX. PUMP 75CC

INCL W/ PUMP

BYPASS SETTING
25 PSI CRACKING
39 PSI FULL FLOW

Propel Circuit Case Drain

Case Filter

COOLING PKG.

FAN MOTOR

BYPASS SETTING
40 PSI CRACKING
63 PSI FULL FLOW

Hyd Filter

To 'T' Port of
Shuttle

AUX. PUMP 45CC

85 PSI ±8

COOLER BYPASS

Hydraulic Reservoir
Rear View

OPENING TEMP: 112° - 128°
FULL OPEN TEMP: 145°

FAN RELIEF

1600 PSI ±50
2800PSI ±50

FAN PUMP

AIR COMP TO TANK

DIAGRAMS AND DEPICTIONS OF SYMBOLS USED ON THIS DRAWING
TO DEPICT VARIOUS ITEMS USED ON THIS DRAWING

- FEMALE SWIVEL 90 DEG. ORFS ELBOW TO ADJ. MALE ORB
- MALE STR. BLKHD CONN.-ORFS to ORFS
- HIGH PRESSURE SAE O-RING FACE SEAL TO MALE ORFS
- MALE - ORB to FEMALE SWIVEL ORFS STRAIGHT
- MALE - ORB ADJ. to ORFS 45 DEG.
- HOSE CLAMP
- PRESSURE SWITCH
- MALE - ORB ADJ. to ORFS STRAIGHT
- MALE ORB PLUG
- MALE RUN TEE SWIVEL FEMALE ORFS to MALE ORFS
- MALE 90 DEG. ELBOW - MALE ORFS to FEMALE SWIVEL ORFS
- 90 DEG. SHORT DROP ELBOW HOSE END
- 90 DEG. LONG DROP ELBOW HOSE END
- 45 DEG. ELBOW HOSE FITTING ADAPTER
- TEST POINT ADAPTOR TEE-MALE ORFS to FEMALE ORFS
- UNION ORFS
- ANCHOR FLANGE
- MALE NPT TO MALE -ORB
- MALE RUN BLKHD TEE ADJ.-ORFS to ORF
- REDUCER
- MALE ADJ. ORB 90 DEG. ELBOW to MALE ORFS
- MALE RUN TEE-MALE ORFS to FEMALE SWIVEL ORFS
- MALE 45 DEG. ELBOW - MALE ORFS to FEMALE SWIVEL ORFS
- MALE ADJ. ORB RUN TEE-MALE ORFS
- FEMALE NPT TO FEMALE -ORFS
- QUICK COUPLER FEMALE END
- QUICK COUPLER MALE END
- CLAMP
- MALE RUN TEE ORFS to ORFS
- FEMALE CAP ORFS
- MALE RUN TEE SWIVEL FEMALE ORFS to MALE ORFS
- REDUCER - FEMALE ORFS to MALE ORFS
- MALE ADJ. ORB MALE ORFS RUN TEE
- SWIVEL

GUARDIAN SP275F, SP333F, SP365F
MAIN HYDRAULIC SCHEMATIC
SERIAL NUMBER: YDYM0596 AND AFTER
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Size	Nm	lb in/lb ft
30 mm	1250 - 1500 Nm	920 - 1100 lb ft
36 mm	2175 - 2600 Nm	1600 - 1950 lb ft

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

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SPN#	FMI#	Code	Lamp color	Reason for fault	Effect (only when code is active)	Action
100	3	135	amber	Oil pressure switch sensor circuit - voltage above normal or shorted to high source.	None on performance. No engine protection for oil pressure.	Call Cummins service.
100	4	141	amber	Oil pressure switch sensor circuit - voltage below normal or shorted to low source.	None on performance. No engine protection for oil pressure.	Call Cummins service.
100	18	143	amber	Engine oil rifle pressure - data valid but below normal operational range - moderately severe level.	None on performance.	Call Cummins service.
102	2	433	amber	Intake manifold pressure sensor circuit - data incorrect.	Engine power derate.	Call Cummins service.
102	2	2973	amber	Intake manifold pressure sensor circuit - data erratic, intermittent or incorrect.	Engine power derate.	Call Cummins service.
102	3	122	amber	Intake manifold pressure sensor circuit - voltage above normal or shorted to high source.	Engine power derate.	Call Cummins service.
102	4	123	amber	Intake manifold pressure sensor circuit - voltage below normal or shorted to low source.	Engine power derate.	Call Cummins service.
102	16	124	amber	Intake manifold 1 pressure circuit - data valid but above normal operational range - moderately severe level.	Engine power derate.	Call Cummins service.
103	0	595	amber	Turbocharger number 1 speed high - warning level.	Engine power derate. The ECM uses an estimated turbocharger speed.	Call Cummins service.
103	10	2345	amber	Turbocharger speed - invalid rate of change detected.	Possible low power. Estimated turbocharger speed will be used.	Call Cummins service.
103	18	687	amber	Turbocharger number 1 speed low - warning level.	Engine power derate. The ECM uses an estimated turbocharger speed.	Call Cummins service.
105	0	155	red	Intake manifold 1 temperature - data valid but above normal operating range - most severe level.	Progressive power derate.	Make sure airflow through charge air cooler is not obstructed. Call Cummins service.
105	2	436	amber	Intake manifold 1 temperature - data erratic, intermittent or incorrect.	The ECM will estimate engine intake manifold temperature.	Call Cummins service.

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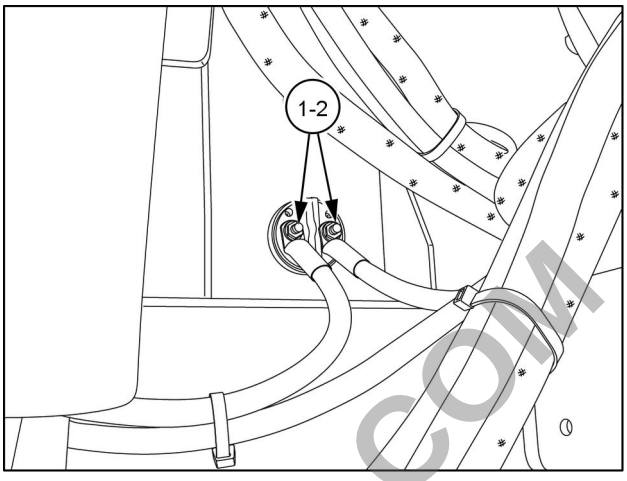
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6. **⚠ WARNING**

   Improper operation or service of this machine can result in an accident.
   Before working on any component(s) of the electrical circuit, put the ignition key in the off (shut down) position. When disconnecting batteries, always disconnect the negative (-) cable first. When reconnecting batteries, always connect the negative (-) cable last.
   Failure to comply could result in death or serious injury.

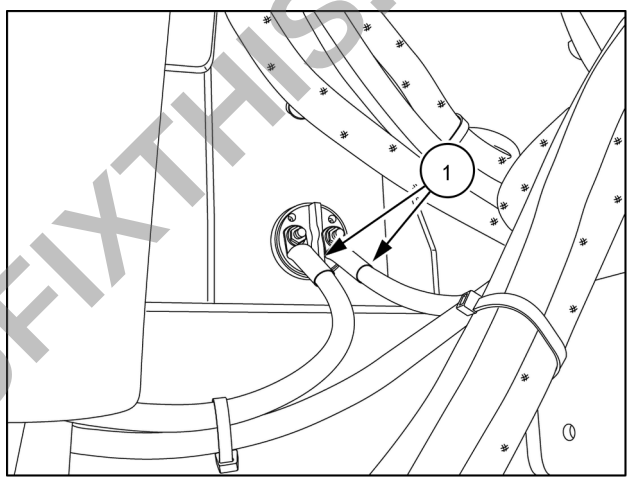
   W0943A

   Remove the two nuts **(1)** and lock washers **(2)** securing the power lines to the back of the battery switch.



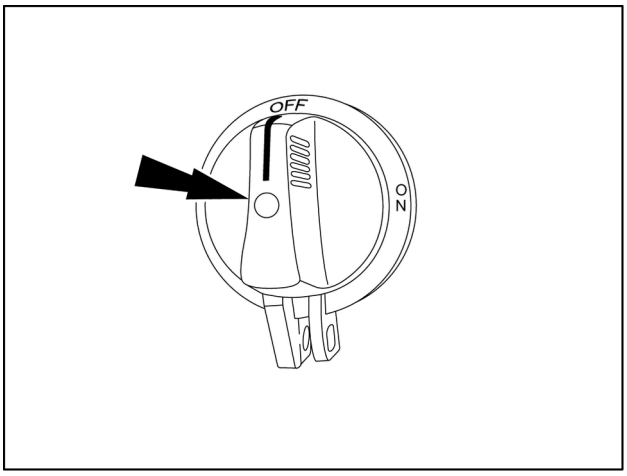
RAIL13SP05121AA 4

7. Remove the two electrical lines **(1)** running to the back of the battery switch from the posts where the nuts and the lock washers were removed.



RAIL13SP05121AA 5

8. Using a small pick, pry the rubber stopper out of the middle of the front of the battery switch.



RAIL13SP05158AA 6

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SEE CONNECTORS ON PAGE I

CAB WIRING
GOES TO LEFT BOTTOM CONNECTORS

POWER WIRES FOR:
STARTER CIRCUIT
CHARGE CIRCUIT
FUSED MODULES

THIS ROUTING WAS USED UNTIL 12-12-13

THIS ROUTING WAS STARTED ON 12-12-13
TIER 4i MODELS

A/C FOR STANDARD CAB

A/C FOR PREMIUM CAB

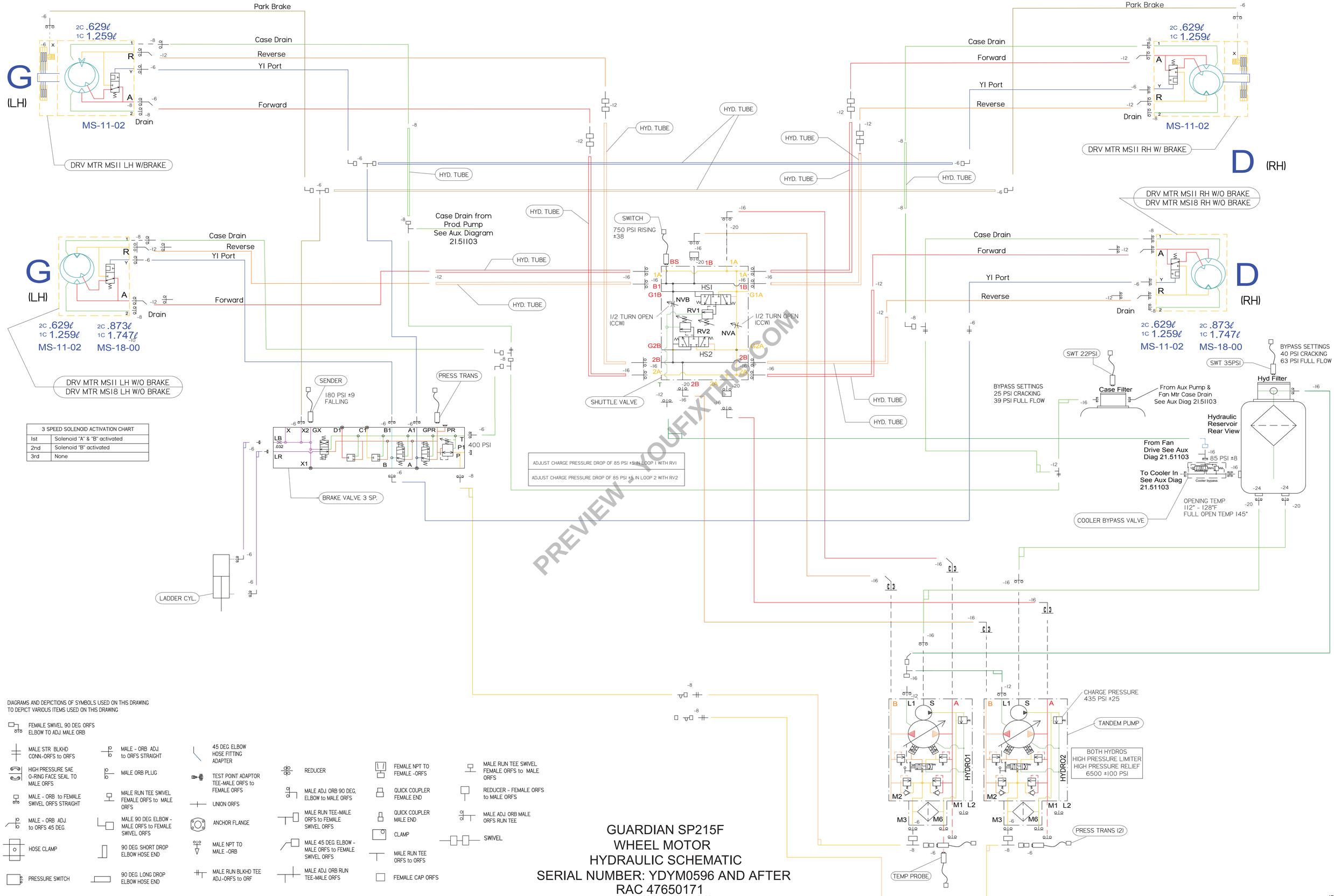
GUARDIAN, SP240F, SP275F
SP333F, SP365F
ELECTRICAL SCHEMATIC
SERIAL NUMBER: YDYM0596 and after
RAC 47654938

47654939P2S1

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SEE CHASSIS MAIN HARNESS 21.5001 PAGE I



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GUARDIAN SP215F
WHEEL MOTOR
HYDRAULIC SCHEMATIC
SERIAL NUMBER: YDYM0596 AND AFTER
RAC 47650171

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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**
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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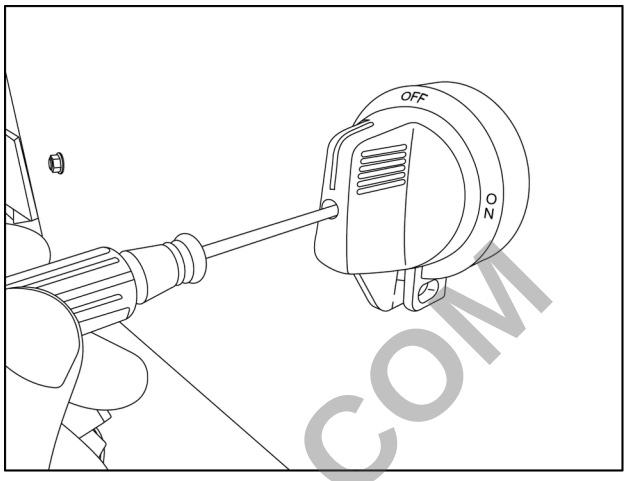
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SPN#	FMI#	Code	Lamp color	Reason for fault	Effect (only when code is active)	Action
105	3	153	amber	Intake manifold air temperature sensor circuit - voltage above normal or shorted to high source.	Possible white smoke. No engine protection for intake manifold air temperature.	Check for multiple fault codes. Call Cummins service.
105	4	154	amber	Intake manifold air temperature sensor circuit - voltage below normal or shorted to low source.	Possible white smoke. No engine protection for intake manifold air temperature.	Check for multiple fault codes. Call Cummins service.
105	10	1848	amber	Intake manifold 1 temperature - abnormal rate of change.	The ECM will estimate engine intake manifold temperature.	Call Cummins service.
105	15	2964	none	Intake manifold temperature high - data valid but above normal operating range - least severe level.	Progressive power derate.	Make sure airflow through charge air cooler is not obstructed. Call Cummins service.
105	16	488	amber	Intake manifold 1 temperature - data valid but above normal operating range - most severe level.	Progressive power derate.	Make sure airflow through charge air cooler is not obstructed. Call Cummins service.
108	2	295	amber	Barometric pressure - data erratic, intermittent or incorrect.	Engine power derate.	Call Cummins service.
108	3	221	amber	Barometric pressure sensor circuit - voltage above normal or shorted to high source.	Engine power derate.	Call Cummins service.
108	4	222	amber	Barometric pressure sensor circuit - voltage below normal or shorted to low source.	Engine power derate.	Call Cummins service.
110	0	151	red	Engine coolant temperature - data valid but above normal operating range - most severe level.	Progressive power derate.	Check coolant level. Make sure airflow through the radiator is not obstructed. Call Cummins service.
110	2	334	amber	Engine coolant temperature - data erratic, intermittent or incorrect.	The ECM will estimate engine coolant temperature.	Call Cummins service.
110	3	144	amber	Engine coolant temperature 1 sensor circuit - voltage above normal or shorted to high source.	Possible white smoke. No engine protection for engine coolant temperature.	Check for multiple fault codes. Call Cummins service.
110	4	145	amber	Engine coolant temperature 1 sensor circuit - voltage below normal or shorted to low source.	Possible white smoke. No engine protection for engine coolant temperature.	Check for multiple fault codes. Call Cummins service.
110	15	2963	none	Engine coolant temperature high - data valid but above normal operating range - least severe level.	Progressive power derate.	Check coolant level. Make sure airflow through the radiator is not obstructed. Call Cummins service.

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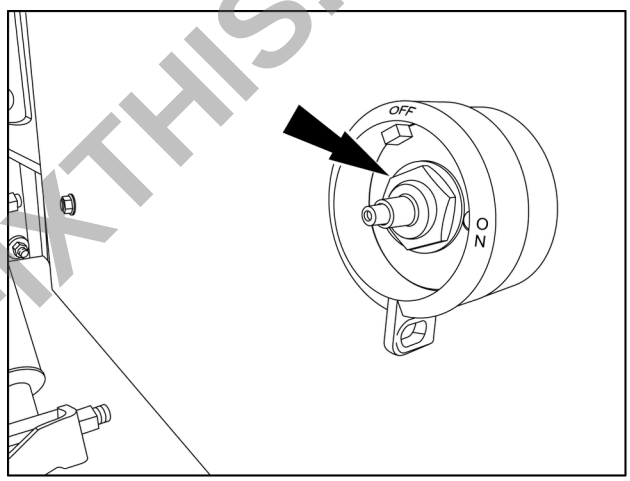
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9. Using a small screwdriver, loosen the screw that is seated where the stopper was removed from the front of the battery switch.



RAIL13SP05159AA 7

10. Pull the front of the battery switch off of the base of the battery switch to access the nut and lock washer securing the base of the battery switch to the engine panel.
11. Remove the nut and lock washer securing the base of the battery switch to the engine panel and remove the base of the battery switch from the engine panel.



RAIL13SP05160AA 8

12. Remove the exhaust muffler. Refer to **Exhaust muffler - Remove — Diesel particulate filter an exhaust muffler (10.254)**.
13. Remove the air cleaner. Refer to **Air cleaner - Remove (10.202)**.
14. Remove the engine hood and panels. Refer to **Engine hood and panels - Remove (90.100)**.
15. Remove the cooling package. Refer to **Radiator - Remove — Cooling package (10.400)**
16. Remove the two hydraulic pumps. Refer to **Pump - Remove (29.218)**
17. Mark and tag the four coolant lines and the electrical connection that are attached to the deaeration tank.

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[90.160] Cab interior trim and panels 90.7

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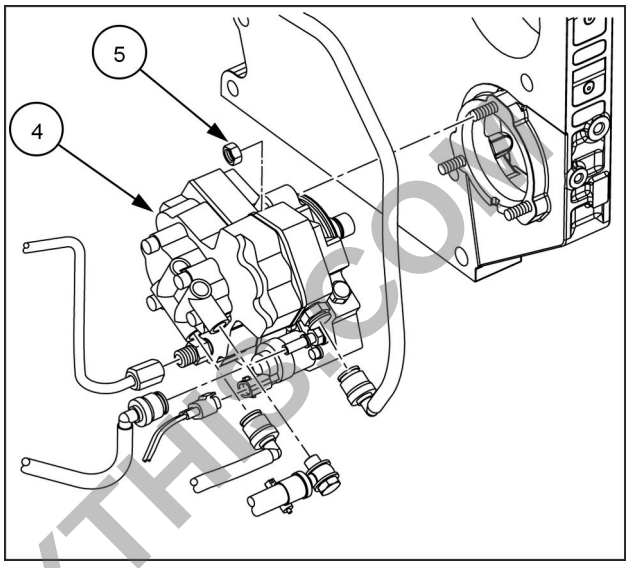
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Fuel lift pump - Install

Guardian front boom	

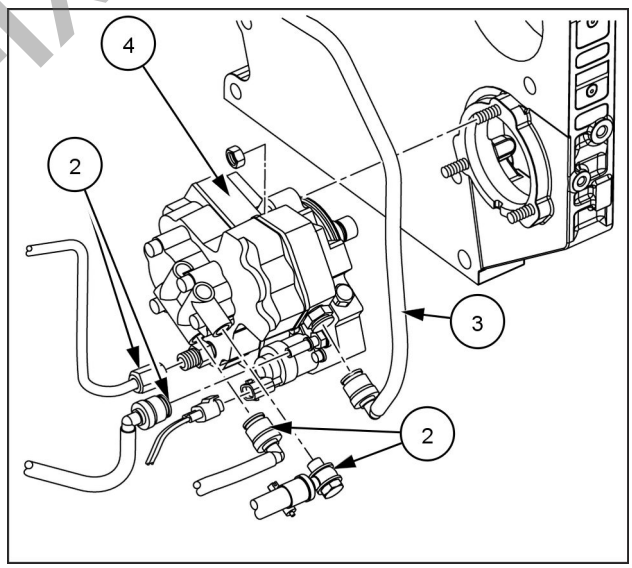
NOTE: *Ensure splines on fuel pump are properly aligned prior to installing fuel pump on engine.*

1. Install fuel pump **(4)** to engine using three nuts **(5)**. Tighten the nuts securely.



RAIL13SP01111AA 1

2. Connect four fuel lines **(2)** and fuel return line **(3)** to fuel pump **(4)**.



RAIL13SP01111AA 2

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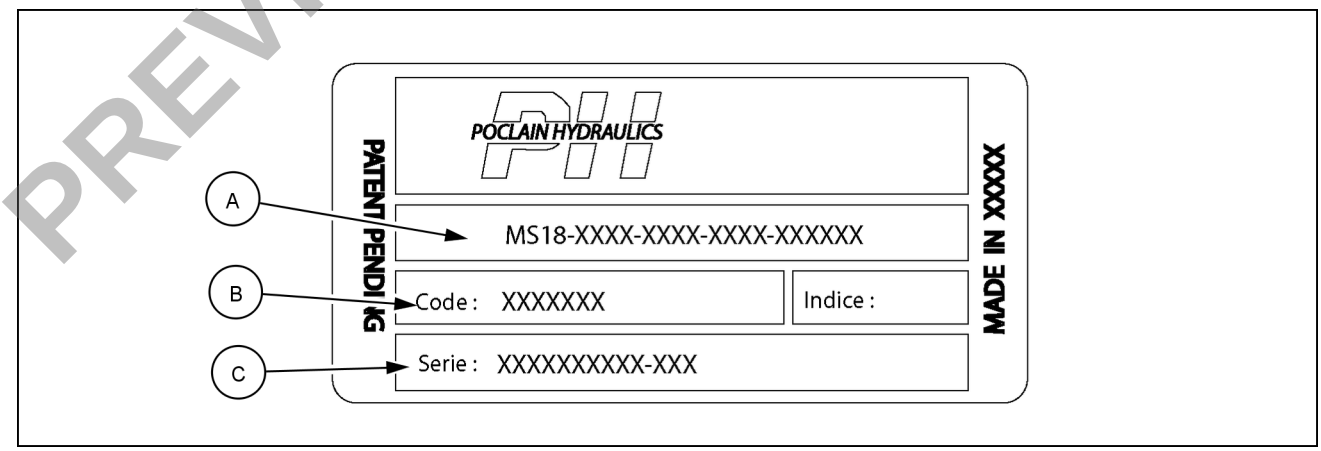
Motor - Identification - SP.240F and SP.275F MS-18 Wheel motor trouble shooting and identification

SP.240F [YDYM00596 -] Model year 2014 units	
SP.275F [YDYM00596 -] Model year 2014 units	

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 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

Item	Description
A	Model code
B	Part number

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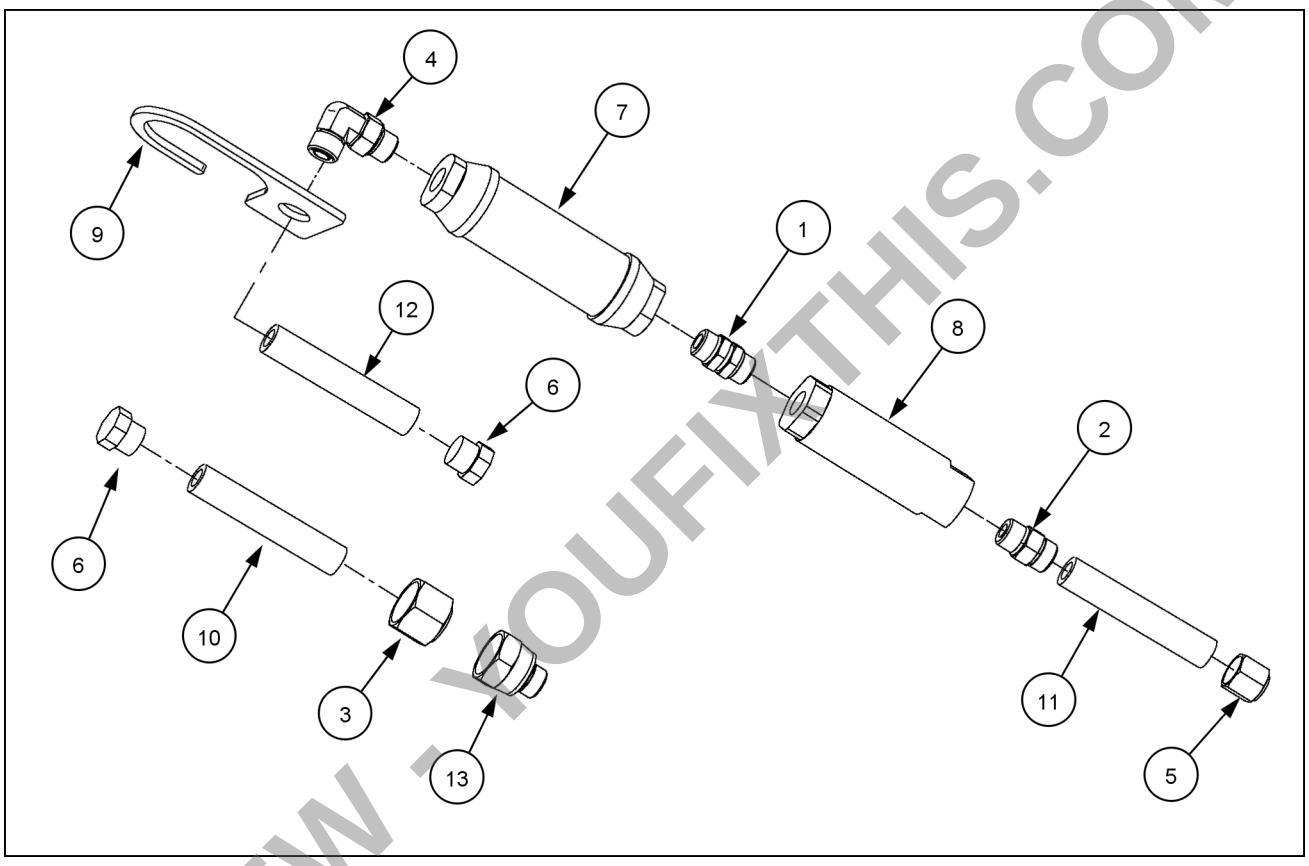
Motor - Install - Case drain test kit

⚠ WARNING

Pressurized hydraulic fluid can penetrate the skin and cause severe injuries.
Tighten all of the connections before starting the engine. If hydraulic fluid has penetrated the skin, seek medical assistance immediately.
Failure to comply could result in death or serious injury.

W0117A

NOTE: *Case drain leak test may be performed using the following specified test kit or comparable components.*



RAIL13SP05090AA 1

Case drain testing kit

Item	Part Number	Description	Qty.
1	mlr09.74147	**3/4 in**–16 union	1
2	mlr21.00327	–08 ORB X –08 ORFS connector	1
3	mlr21.00339	–12 ORFS cap (MW-24 motors only)	1
4	mlr21.00342	8 ORFS **90 °** elbow	1
5	mlr21.20866	–8 ORFS cap	1
6	mlr21.21050	8 ORFS plug	2
7	mlr21.52154	Case drain flowmeter	1
8	mlr21.52155	Case drain kit strainer	1
9	mlr21.52157	Case drain hanger hook	1
10	mlr21.52356	**12 in** case drain adaptor hose (MW-24 motors only)	1
11	mlr21.52357	**296 in** case drain supply hose	1
12	mlr21.52358	**312 in** case drain return hose	1
13	mlr44.02399	12 X 8 ORFS reducer (MW-24 motors only)	1

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Machine leveling control system - Adjust - Suspension cylinders

Guardian front boom	

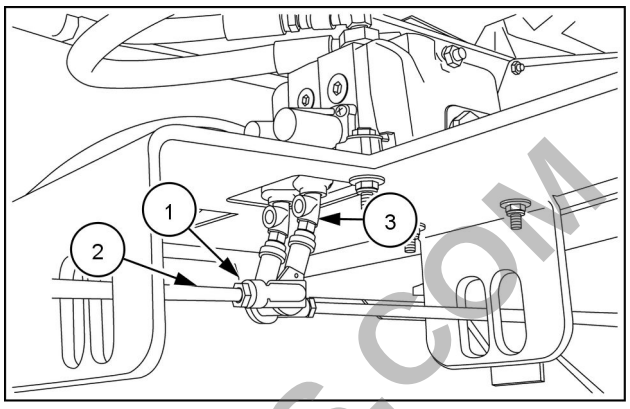
1. Park the vehicle on level ground.

NOTE: *The adjustment procedure requires two people, one person to remain in the operators cab and the second person to adjust the suspension.*

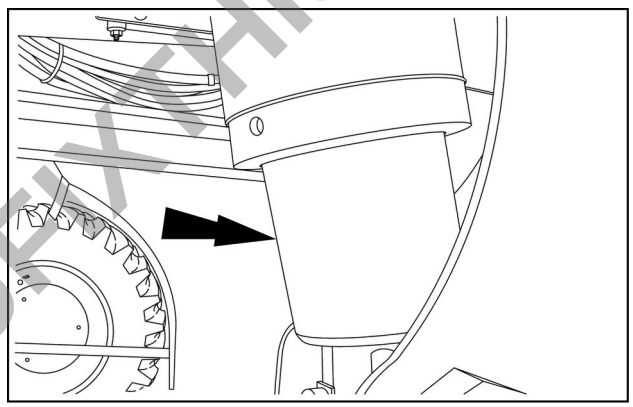
2. Start the engine.
3. Reduce the engine speed to idle.
4. Release the parking brake.
5. Have the person on the ground loosen the jam nut **(1)** at each linkage rod **(2)**. Detach the two right and two left side suspension valve linkage rods from the valve arms **(3)**. Allow the rods to rest in the bottom of the guide slots.
6. Actuate each valve arm manually fore or aft until **101.6 mm** (**4.0 in**) of unpainted suspension cylinder rod is exposed on each of the four suspension cylinders.

NOTE: *Actuating a given cylinder may affect the exposed rod length of the opposite (diagonal) cylinder.*

7. After setting all four cylinders to **101.6 mm** (**4.0 in**) , recheck the other cylinders.
8. Repeat as required until the exposed rod on all four cylinders remains at **101.6 mm** (**4.0 in**).

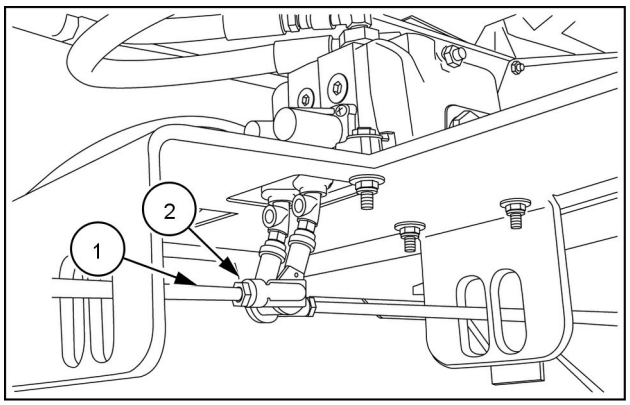


RAIL13SP00997AA 1



RAIL13SP00998AA 2

9. Reattach the linkage rods **(1)** to the valve arms, adjusting the length of each linkage rod by turning the clevis on each rod. Each rod should be adjusted until the retainer pin can be reinserted through the clevis and valve arm ball without shifting either the valve arm ball or the linkage (valve arm ball and clevis are aligned).
10. Insert the retainer pin through the clevis and valve arm ball and secure in place.
11. Tighten the jam nuts **(2)** against each clevis to hold it in place.

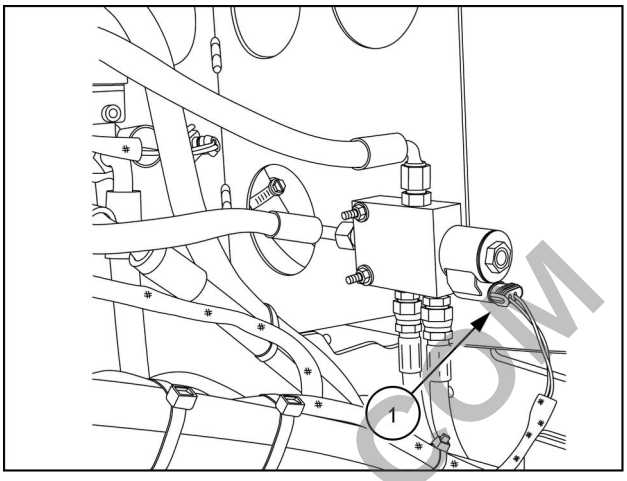


RAIL13SP00997AA 3

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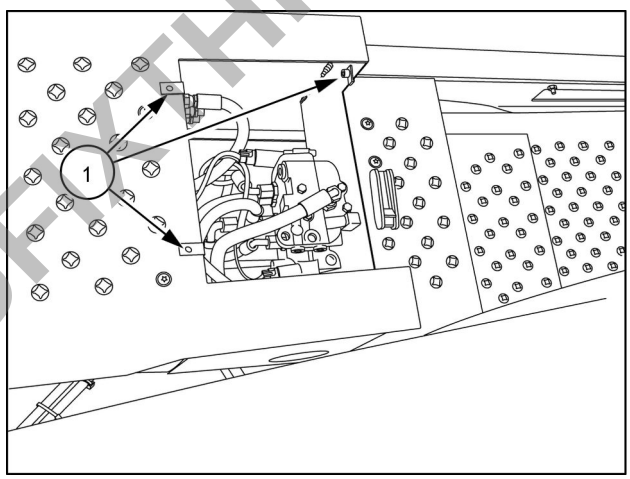
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5. Install the electrical connection **(1)** to the proper position on the lock valve.



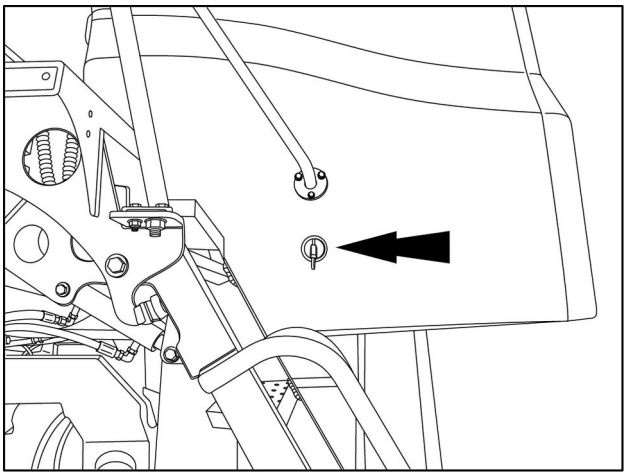
RAIL13SP05057AA 11

6. Remove all of the tagging on the hydraulic lines and the electrical connections that was applied during removal.
7. Install the access panel into the proper position on the walkway and secure tightly with the access panel mounting bolts **(1)**.



RAIL13SP05042AA 12

8. Turn the power to the batteries on by turning the switch attached to the engine panel to the “ON” position.



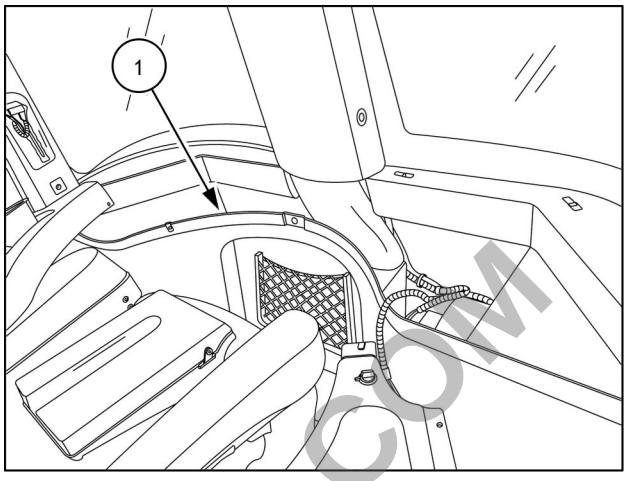
RAIL13SP05120AA 13

9. Start the machine and cycle the hydraulic system multiple times to ensure the proper component functionality.

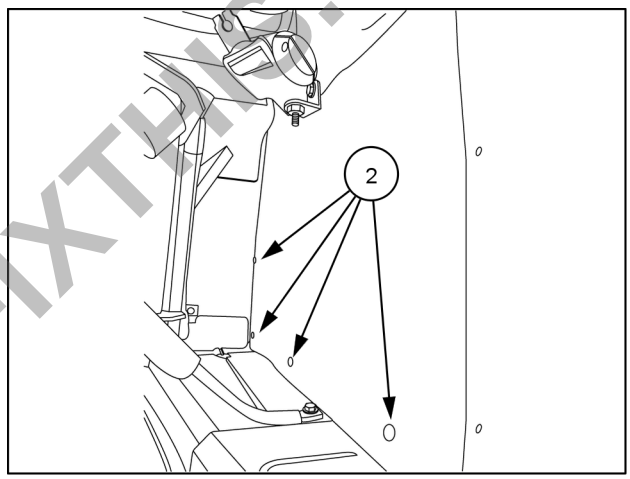
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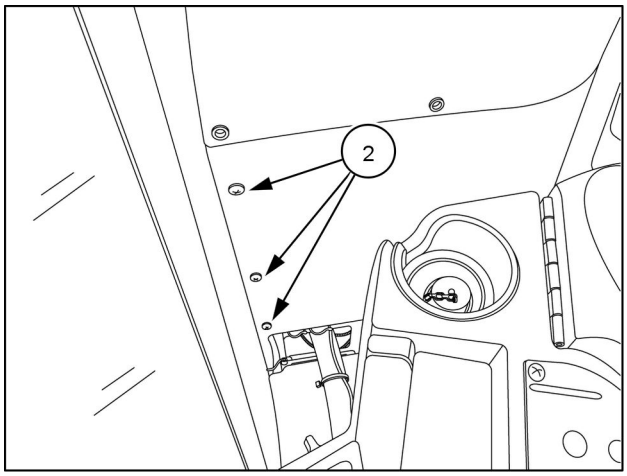
2. Install the back panel **(1)** into the proper position and secure with the back panel mounting screws **(2)**.



RAIL13SP04731AA 12



RAIL13SP04732AA 13



RAIL13SP04734AA 14

3. Install the floor mat.

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Blower - Remove - Pressurize blower motor 3
Blower motor - Install 14
Blower motor - Remove 10

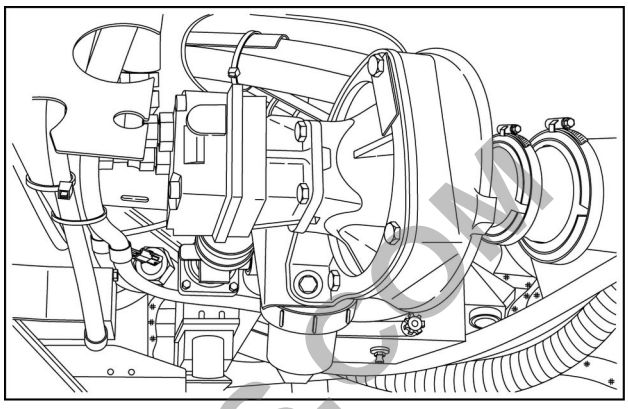
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Product pump - Install

Guardian front boom	

1. Install the pump assembly into the frame.
2. Connect all the product hoses to the pump.
3. Uncap all hose ends and motor ports.
4. Attach the three hydraulic hoses (feed, return, case drain) to the hydraulic motor.



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