



Specifications Systems Operation Testing and Adjusting

14M, 16M Motor Graders Machine Systems

B9H 1-UP (Machine)
R9H 1-UP (Machine)
B9J 1-UP (Machine)
R9J 1-UP (Machine)

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards, including human factors that can affect safety. This person should also have the necessary training, skills and tools to perform these functions properly.

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

Do not operate or perform any lubrication, maintenance or repair on this product, until you verify that you are authorized to perform this work, and have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

A non-exhaustive list of operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Cat dealers have the most current information available.

NOTICE

When replacement parts are required for this product Caterpillar recommends using original Caterpillar® replacement parts.

Other parts may not meet certain original equipment specifications.

When replacement parts are installed, the machine owner/user should ensure that the machine remains in compliance with all applicable requirements.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

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Testing and Adjusting

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Specifications Section

i02602015

Radiator

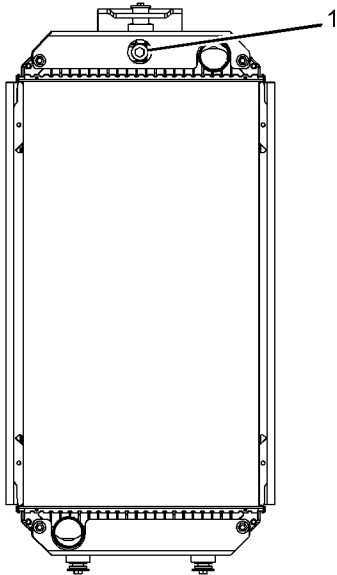
SMCS Code: 1353**Part No. :** 249-7367
S/N: B9H1-Up**Part No. :** 249-7367
S/N: R9H1-Up**Part No. :** 231-2315
S/N: B9J1-Up**Part No. :** 231-2315
S/N: R9J1-Up

Illustration 1

g01213190

14M is shown in the illustration.

(1) Apply 5P-3413 Pipe Sealant to the threads of the plug.

i08072712

Toggle Switch (Ground Level Shutdown)

SMCS Code: 7332

Part No. : 139-2116

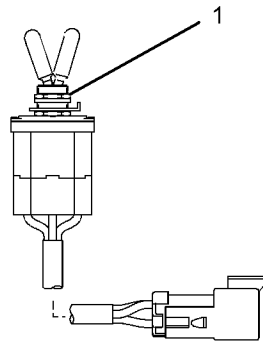


Illustration 2

g03512205

Table 1

Item	Qty	Part	Specification Description
1	1	-	Tighten the hex nut to 3.8 N·m (33.6 lb in).

i04034992

Battery

SMCS Code: 1401; 1402

Part No. : 257-8027

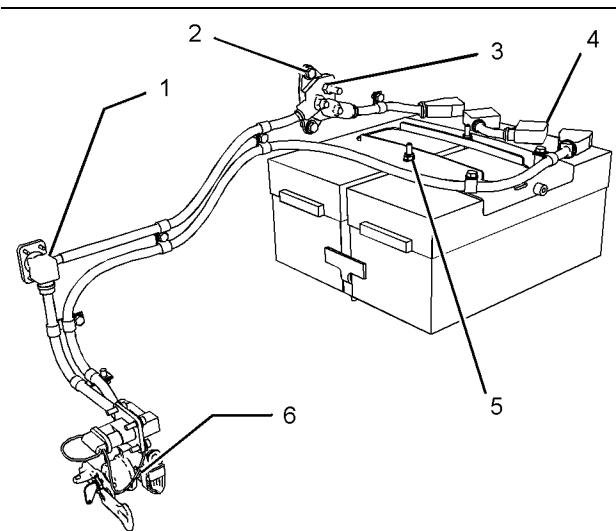


Illustration 3

g01279956

- (1) Torque for bolt 35 ± 5 N·m ((310 ± 45 lb in))
- (2) Torque for bolt 50 ± 10 N·m ((37 ± 7 lb ft))
- (3) Torque for five nuts . . . 70 ± 15 N·m ((52 ± 11 lb ft))

(4) Torque for battery terminal nuts $12 \pm 2 \text{ N}\cdot\text{m}$
(($106 \pm 18 \text{ lb in}$))

(5) Torque for two locknuts $7 \pm 2 \text{ N}\cdot\text{m}$
(($64 \pm 14 \text{ lb in}$))

Note: Apply Loctite 242 to the threads of the rod.

(6) Torque for two nuts $8 \pm 2 \text{ N}\cdot\text{m}$ (($71 \pm 18 \text{ lb in}$))

i04034999

Battery

SMCS Code: 1401; 1402

Part No.: 236-1924

S/N: B9J1-Up

Part No.: 236-1924

S/N: R9J1-Up

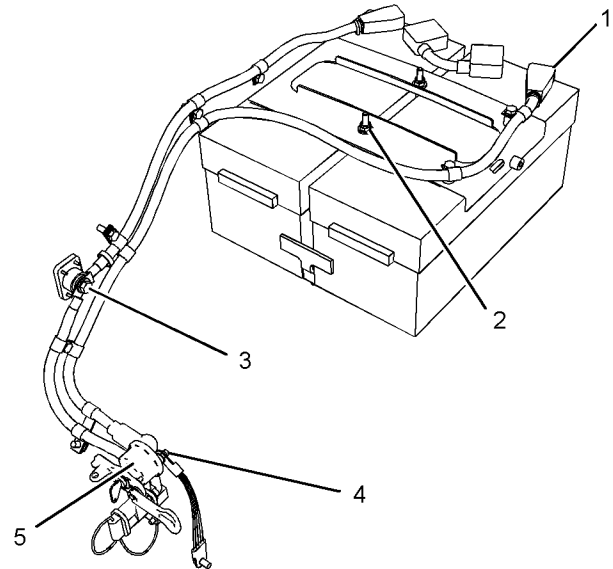


Illustration 4

g01279938

(1) Torque for battery terminal nuts $12 \pm 2 \text{ N}\cdot\text{m}$
(($106 \pm 18 \text{ lb in}$))

(2) Torque for two locknuts $7 \pm 2 \text{ N}\cdot\text{m}$
(($64 \pm 14 \text{ lb in}$))

Note: Apply Loctite 242 to the threads of the rod.

(3) Torque for bolt $35 \pm 5 \text{ N}\cdot\text{m}$ (($26 \pm 4 \text{ lb ft}$))

(4) Torque for two nuts $8 \pm 2 \text{ N}\cdot\text{m}$ (($71 \pm 18 \text{ lb in}$))

(5) Torque for switch $23 \pm 4 \text{ N}\cdot\text{m}$ (($17 \pm 3 \text{ lb ft}$))

i02557452

Air Cleaner

SMCS Code: 1051

Part No. : 249-7319

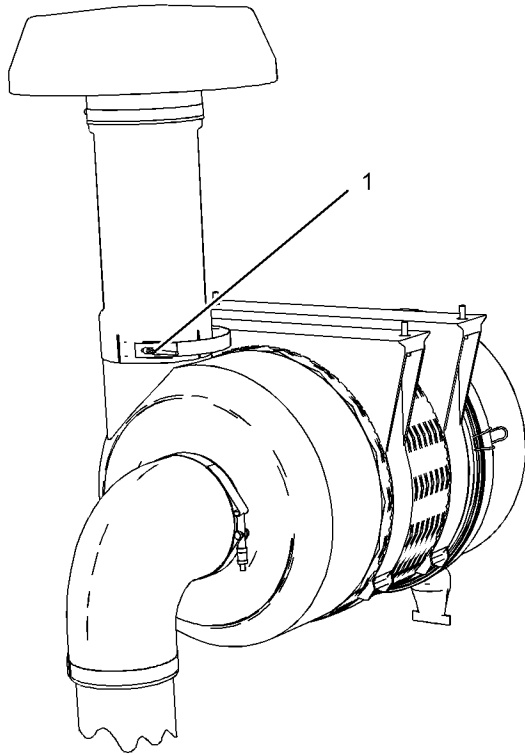


Illustration 5

g01279997

(1) Torque for clamp 5 N·m ((44 lb in))

i05583535

Air Cleaner

SMCS Code: 1051

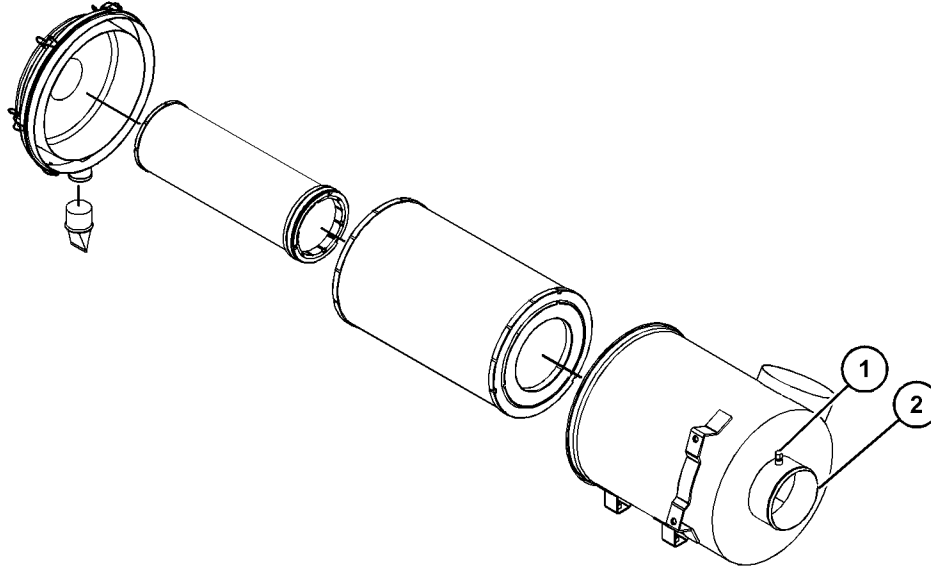


Illustration 6

g03542545

Table 2

Specification for 439 - 5331 Air Cleaner Gp			
Item	Qty	Part	Specification Description
1	-	-	Tighten the indicator to 2.0 ± 0.5 N·m (17.7 \pm 4.4 lb in).
2	-	-	Tighten the connections to 3.5 ± 0.5 N·m (31.0 \pm 4.4 lb in).

i05583571

Air Cleaner

SMCS Code: 1051

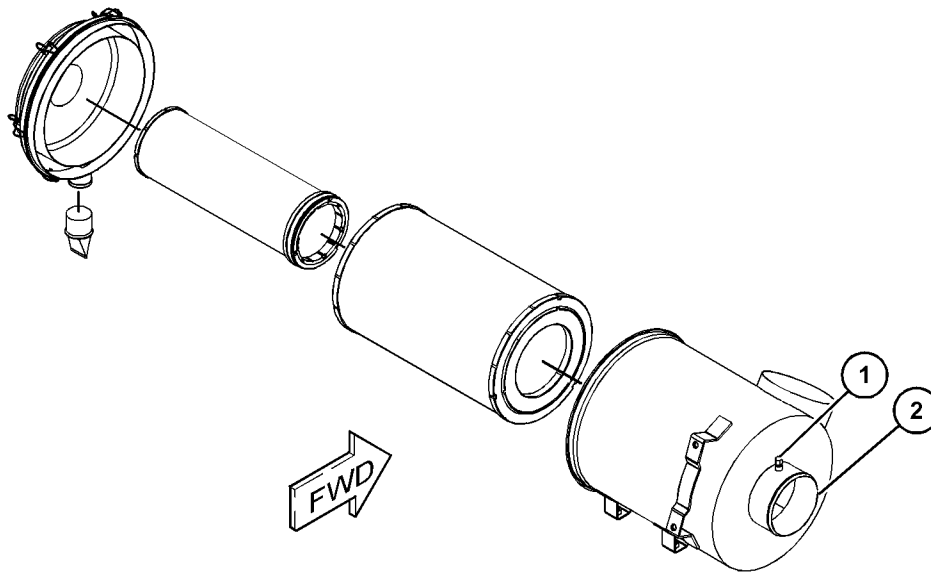


Illustration 7

g03542556

Table 3

Specification for 439 - 5332 Air Cleaner Gp			
Item	Qty	Part	Specification Description
1	-	-	Tighten the indicator to 2.0 ± 0.5 N·m (17.7 ± 4.4 lb in).
2	-	-	Tighten the connections to 3.5 ± 0.5 N·m (31.0 ± 4.4 lb in).

i08072685

Air Cleaner

SMCS Code: 1051

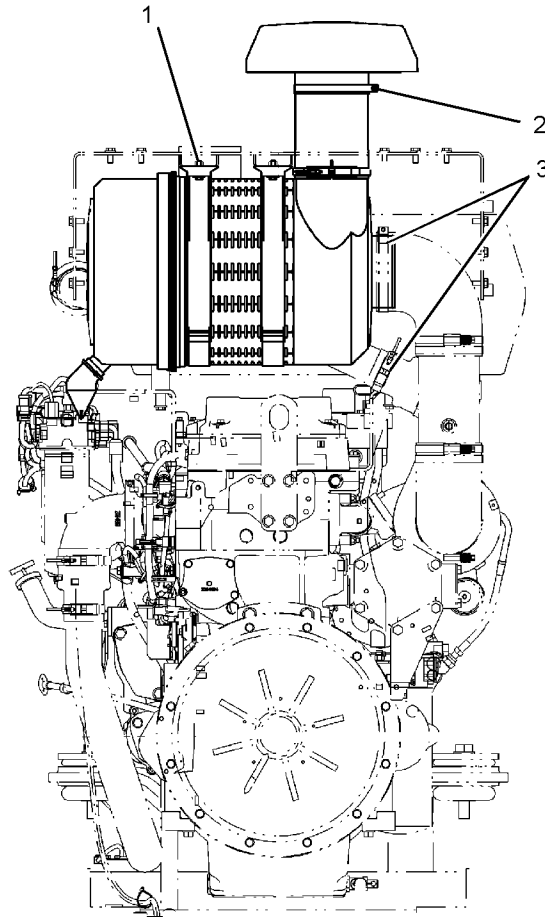


Illustration 8
Rear view

g02849638

Table 4

Item	Qty	Part	Specification Description
-	-	235 - 1075 Air Cleaner Gp	-
1	4	7X - 2537 Bolt	Torque to 15 ± 3 N·m (133 ± 27 lb in).
2	-	-	Installation torque for steel is 5 N·m (44 lb in). Installation torque for plastic is 3 N·m (27 lb in).
3	2	-	Tighten the clamps to 5 ± 1 N·m (44 ± 9 lb in).

i02554981

i02554983

Air Lines

SMCS Code: 1058; 1071

Part No.: 231 - 2137
S/N: B9J1-Up

Part No.: 231 - 2137
S/N: R9J1-Up

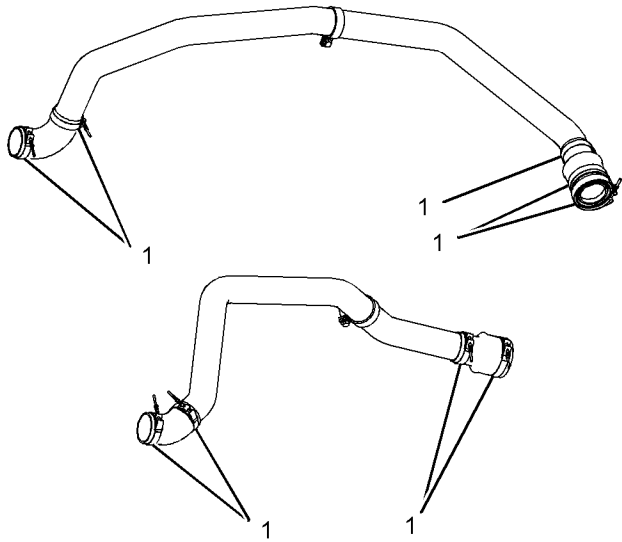


Illustration 9

g01212937

(1) Torque for nuts $8.5 \pm 1 \text{ N}\cdot\text{m}$ ($75 \pm 9 \text{ lb in}$)

Air Lines

SMCS Code: 1058; 1071

Part No.: 249 - 7322
S/N: B9H1-Up

Part No.: 249 - 7322
S/N: R9H1-Up

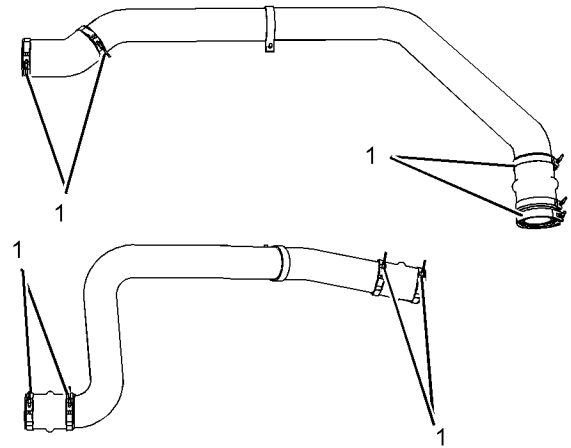


Illustration 10

g01278868

(1) Torque for nuts $12 \pm 1 \text{ N}\cdot\text{m}$ ($105 \pm 10 \text{ lb in}$)

i07979374

Air Lines

SMCS Code: 1058; 1071

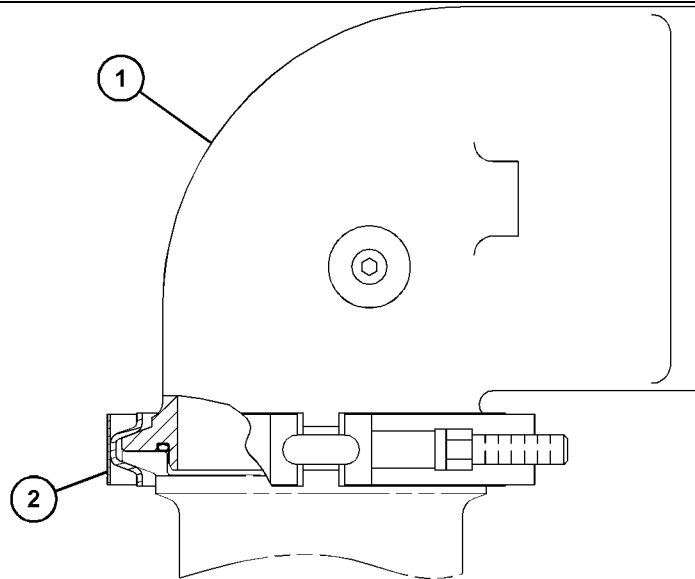


Illustration 11

g06497691

Table 5

Item	Qty	Part	Specification Description
1	1	217 - 8946 Elbow	Install the elbow pointing straight towards the front of the engine.
2	1	127 - 0929 Clamp	Torque to 8.5 ± 2.0 N·m (75.2 ± 17.7 lb in).

i08072677

Air Lines

SMCS Code: 1058; 1071

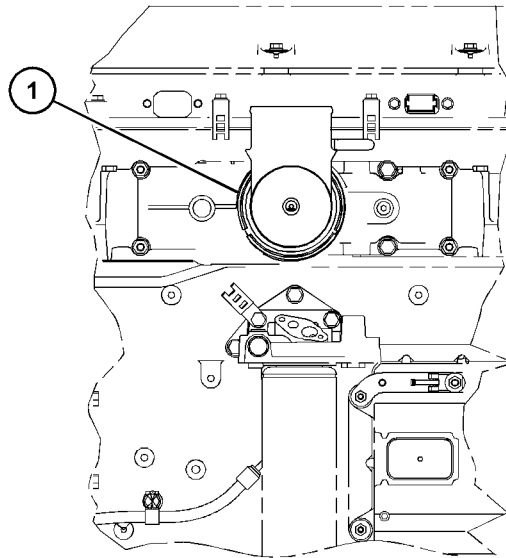


Illustration 12

g06037335

Table 6

Item	Qty	Part	Specification Description
1	1	248 - 4841 Band Clamp	Torque to 8 ± 4 N·m (70 ± 35 lb in).

i04041569

Muffler

SMCS Code: 1062

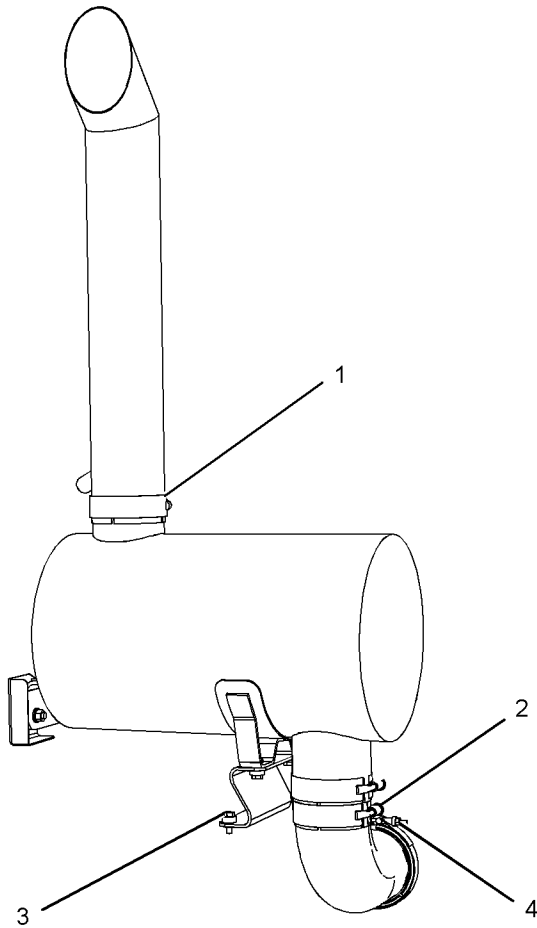


Illustration 13

g02250654

(1) Gaps in the clamp assembly must not align with the slots in the tube.

(2) Torque for the muffler clamp $68 \pm 12 \text{ N}\cdot\text{m}$
(($50 \pm 9 \text{ lb ft}$))

Note: Gap in the muffler clamp (2) is to be oriented between the slots at the final assembly.

(3) Lubricate the threads and the washers of the bolts with 4C-5599 Anti-Seize Compound prior to assembly.

(4) Torque for the V-band clamp . . . $5 \text{ N}\cdot\text{m}$ ((44 lb in))

i05709829

Muffler

SMCS Code: 1062

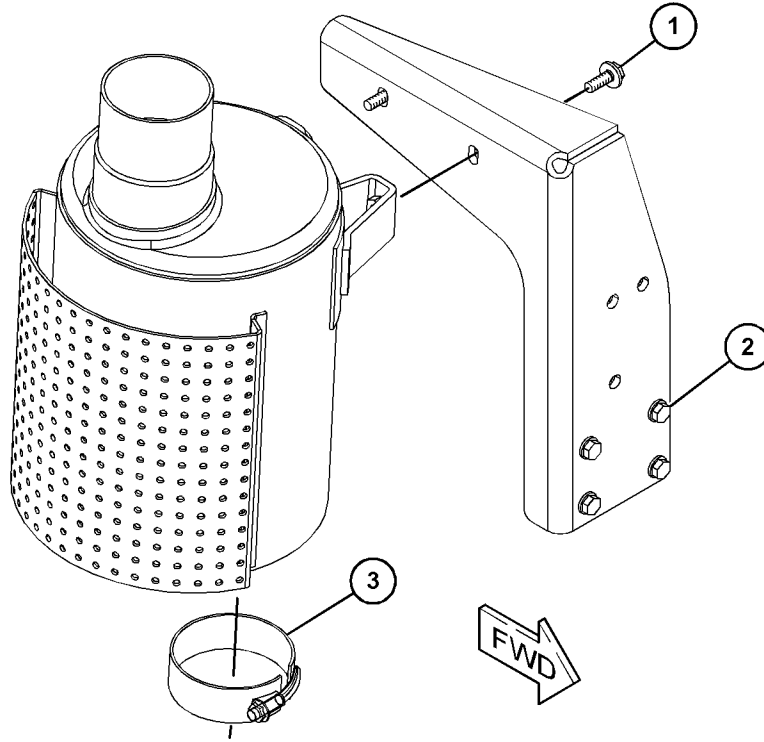


Illustration 14

g03627696

Table 7

Specification for 168-8382 Muffler Gp			
Item	Qty	Part	Specification description
-	-	-	Use the following procedure for tightening the bolts for the muffler assembly and the bracket assembly: 1. Loosen the four bolts (2). 2. Before assembly, apply blue Loctite 242 to the threads. Tighten the two bolts (1) to standard torque. 3. Tighten the wire clamp (3) to standard torque. 4. Tighten the four bolts (2) to standard torque.
-	-	-	The gap in the wire clamp (3) must not be aligned with the slots in the tube.

i05736049

Muffler

SMCS Code: 1062

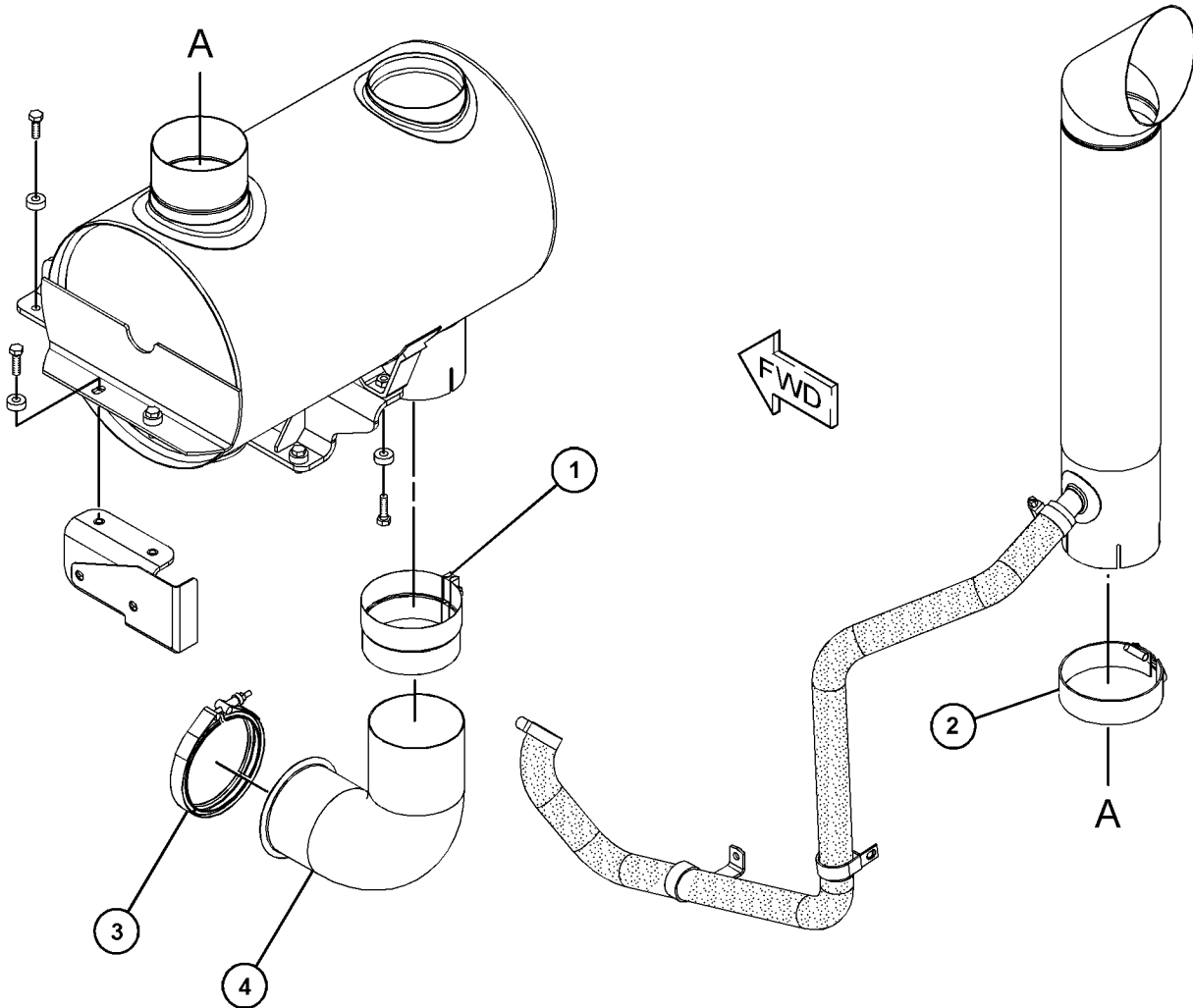


Illustration 15

g03644723

Table 8

Specification for 231 - 2160 Muffler and Mounting Gp			
Item	Qty	Part	Specification Description
1	1	380 - 9871 Muffler Clamp	Torque to 40 ± 5 N·m (30 ± 4 lb ft).
2	1	388 - 7016 Bent Bolt Clamp	Gaps in the clamp assembly must not align with the slots in the ejector. Torque to 47 ± 5 N·m (35 ± 4 lb ft).
3	1	9N - 1941 V Band Clamp	Torque to 8.5 ± 1.0 N·m (75.2 ± 8.9 lb in).
4	1	250 - 0832 Tube	Before assembly, lubricate thread and bearing surfaces with Loctite C5A Copper Anti-Seize.

i02564871

Air Compressor

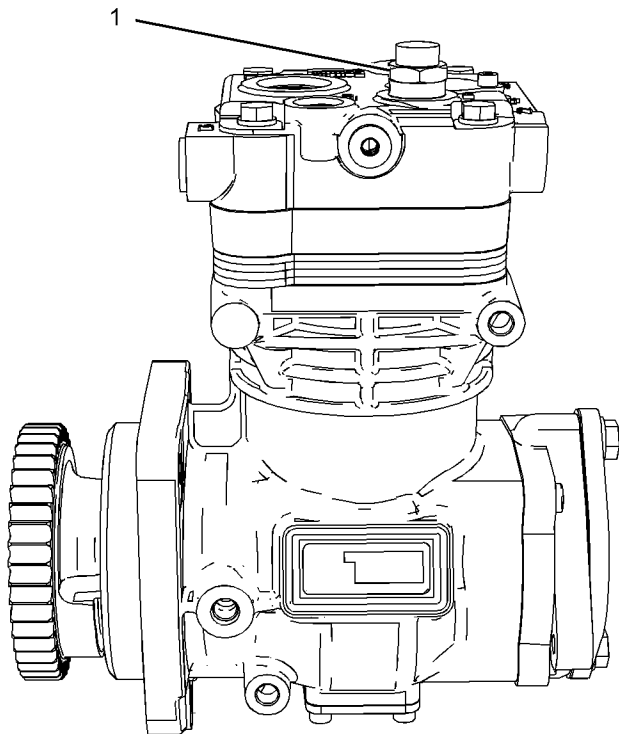
SMCS Code: 1803**Part No.:** 255-4160**S/N:** B9J1-Up**Part No.:** 255-4160**S/N:** R9J1-Up

Illustration 16

g01284076

(1) 225-5222 Pressure Relief Valve Assembly

Pressure to open valve . . . 1724 kPa ((250 psi))

i04938150

Governor (Air Compressor)

SMCS Code: 1803; 1804

Part No. : 205-7187

S/N: B9J1-Up

Part No. : 205-7187

S/N: R9J1-Up

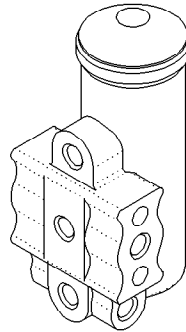


Illustration 17

g00852607

Table 9

Specification for 205-7187 Governor		
Item	Part	Specification Description
-	Cut in pressure	793 kPa (115 psi)
-	Cut out pressure	1000 ± 34 kPa (145 ± 5 psi)

i04938161

Relief Valve (Air Tank)

SMCS Code: 5505-PV

Part No. : 2G-1034

S/N: B9J1-Up

Part No. : 2G-1034

S/N: R9J1-Up

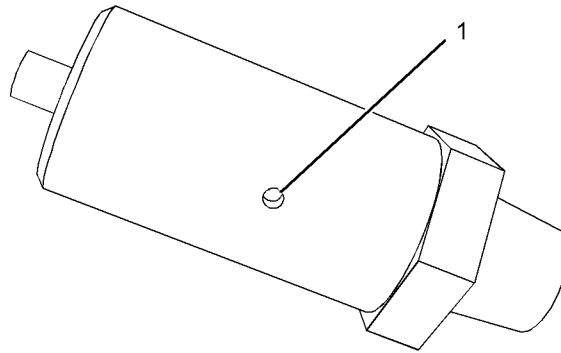


Illustration 18

g01212840

Table 10

Specification for 2G-1034 Air Relief Valve		
Item	Part	Specification Description
1	Pressure to open valve	1207 ± 55 kPa (175 ± 8 psi)
-	Install the relief valve so that the exhaust port (1) is oriented downward.	

i04938177

Window Wiper and Wiper Motor

SMCS Code: 7305; 7305-MQ

Part No. : 233-3138, 295-1114

233 - 3138 Window Wiper and Washer

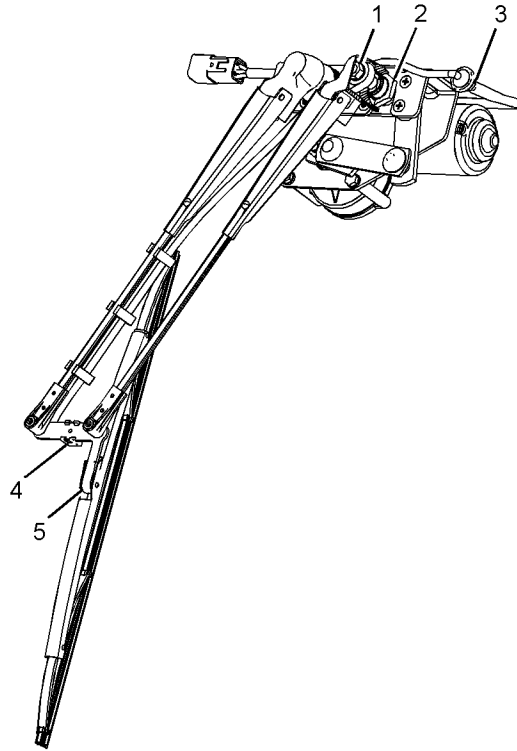


Illustration 19

g01178260

Table 11

Specification for 233 - 3138 Window Wiper and Washer			
Item	Qty	Part	Specification Description
1	2	Nuts	Torque to 24 ± 1 N·m (17.7 ± 0.7 lb ft)
-	Install the wiper arm and torque nuts (1) to 24 ± 1 N·m (17.7 ± 0.7 lb ft). Run the wipers for a minimum of one half of an hour and torque nuts (1) to 24 ± 1 N·m (17.7 ± 0.7 lb ft).		
2	2	Nuts	Torque to 38 ± 2 N·m (28 ± 1 lb ft)
3	1	Connector	Torque to 0.35 ± 0.05 N·m (3 ± 0.5 lb in)
4	Use a 0.5 mm (0.0197 inch) wire to adjust the jets of the nozzle assembly, as required.		
5	-	Wiper arm	Tension at the tip 5 ± 0.5 N (1 ± 3.6 oz)

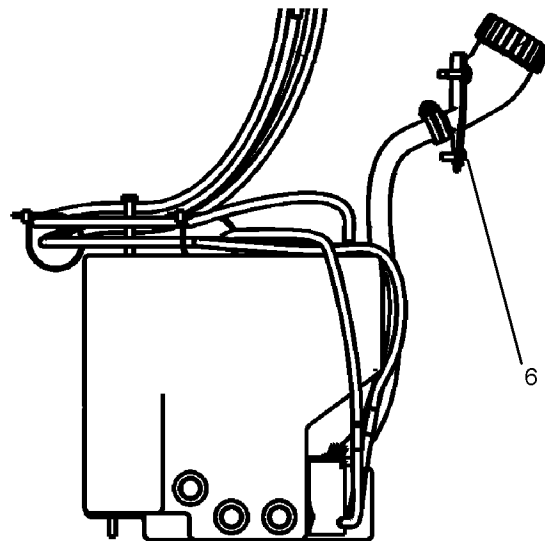


Illustration 20

g01332165

Table 12

Specification for 233 - 3138 Window Wiper and Washer			
Item	Qty	Part	Specification Description
6			Apply blue Loctite 242 to the threads of the bolt.

295 - 1114 Window Wiper Gp

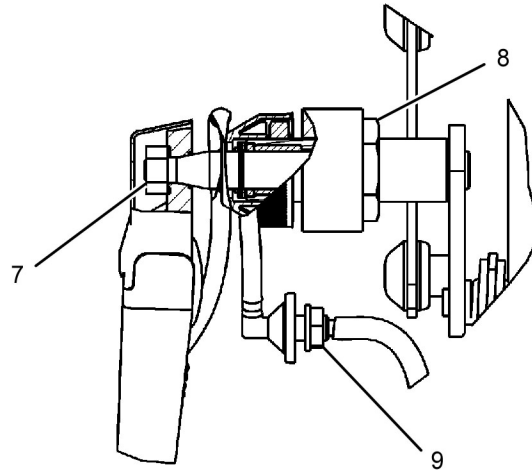


Illustration 21

g02471156

Table 13

Specification for 295 - 1114 Window Wiper Gp			
Item	Qty	Part	Specification Description
1	2	Nuts	Torque to 24 ± 1 N·m (17.7 ± 0.7 lb ft)
-	Install the wiper arm and torque nut (7) to 24 ± 1 N·m (17.7 ± 0.7 lb ft). Run the wipers for a minimum of one half of an hour and torque nut (7) to 24 ± 1 N·m (17.7 ± 0.7 lb ft).		
2	2	Nuts	Torque to 38 ± 2 N·m (28 ± 1 lb ft)
3	1	Connector	Torque to 0.35 ± 0.05 N·m (3 ± 0.5 lb in)
4	Use a 0.5 mm (0.0197 inch) wire to adjust the jets of the nozzle assembly, as required.		

i05766301

Articulated Hitch

SMCS Code: 7051; 7057; 7066; 7100

Part No.: 235-8119

S/N: B9J1-Up

Part No.: 235-8119

S/N: R9J1-Up

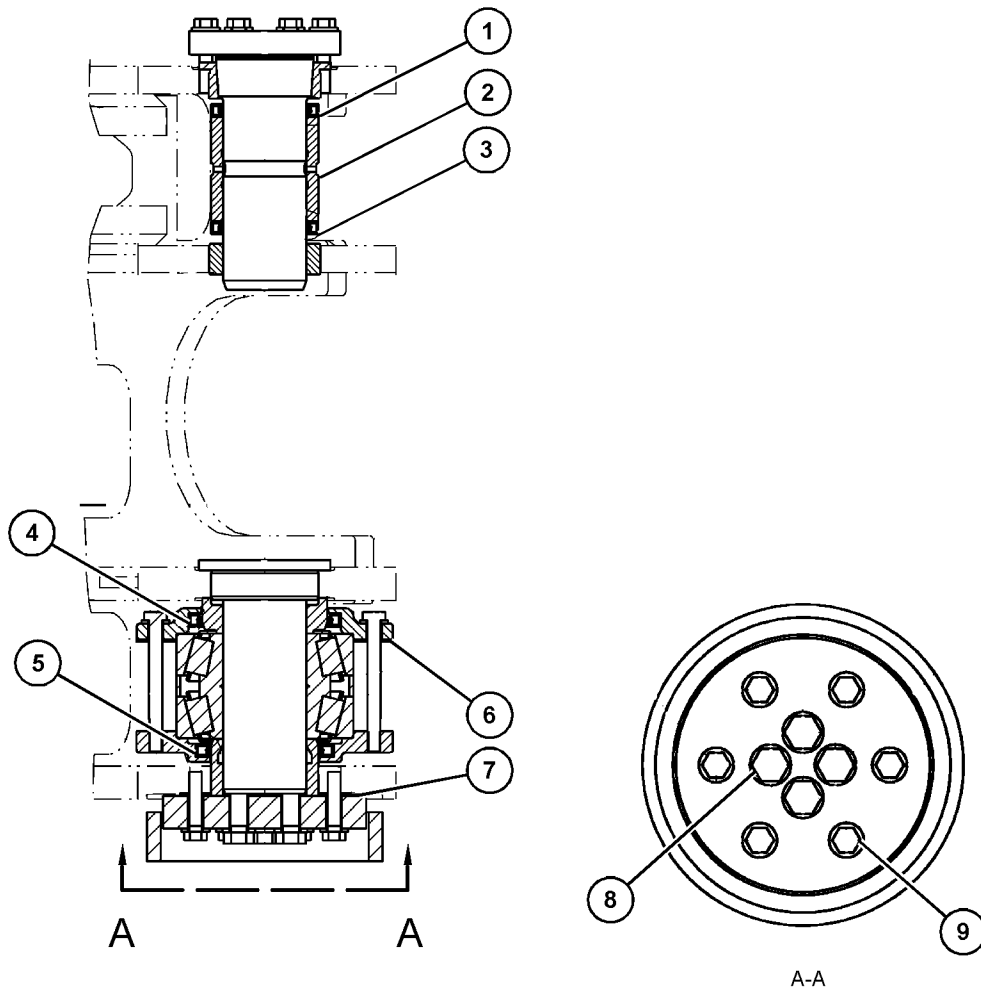


Illustration 22

g03658576

Table 14

Specification for 235-8119 Articulating Hitch Gp				
Item	Qty	Part	Specification Description	

(continued)

Specifications Section

(Table 14, contd)

1	2	4K-7463 Lip Type Seal	Lubricate lightly with lubricant that is being sealed.
2	1	252-0990 Bushing	Bore before assembly is 76.403 ± 0.013 mm (3.0080 ± 0.0005 inch).
3	1	4K-8734 Bearing	Bore before assembly is 76.340 ± 0.013 mm (3.0055 ± 0.0005 inch).
4	1	4K-7461 Lip Type Seal	Lubricate lightly with lubricant that is being sealed.
5	1	4K-7462 Lip Type Seal	Lubricate lightly with lubricant that is being sealed.
6	1	4K-7465 Shim Pack	Thickness is 2.54 ± 0.08 mm (0.100 ± 0.003 inch).
7	1	4K-7464 Shim Pack	Thickness is 2.54 ± 0.08 mm (0.100 ± 0.003 inch).
8	4	8T-4140 Bolt	Before assembly, apply blue Loctite 243 to the threads.
9	6	096-9986 Bolt	Torque to 105 ± 20 N·m (77 ± 15 lb ft).

i05767397

Articulated Hitch

SMCS Code: 7051; 7057; 7066; 7100

Part No.: 250-2283

S/N: B9H1-Up

Part No.: 250-2283

S/N: R9H1-Up

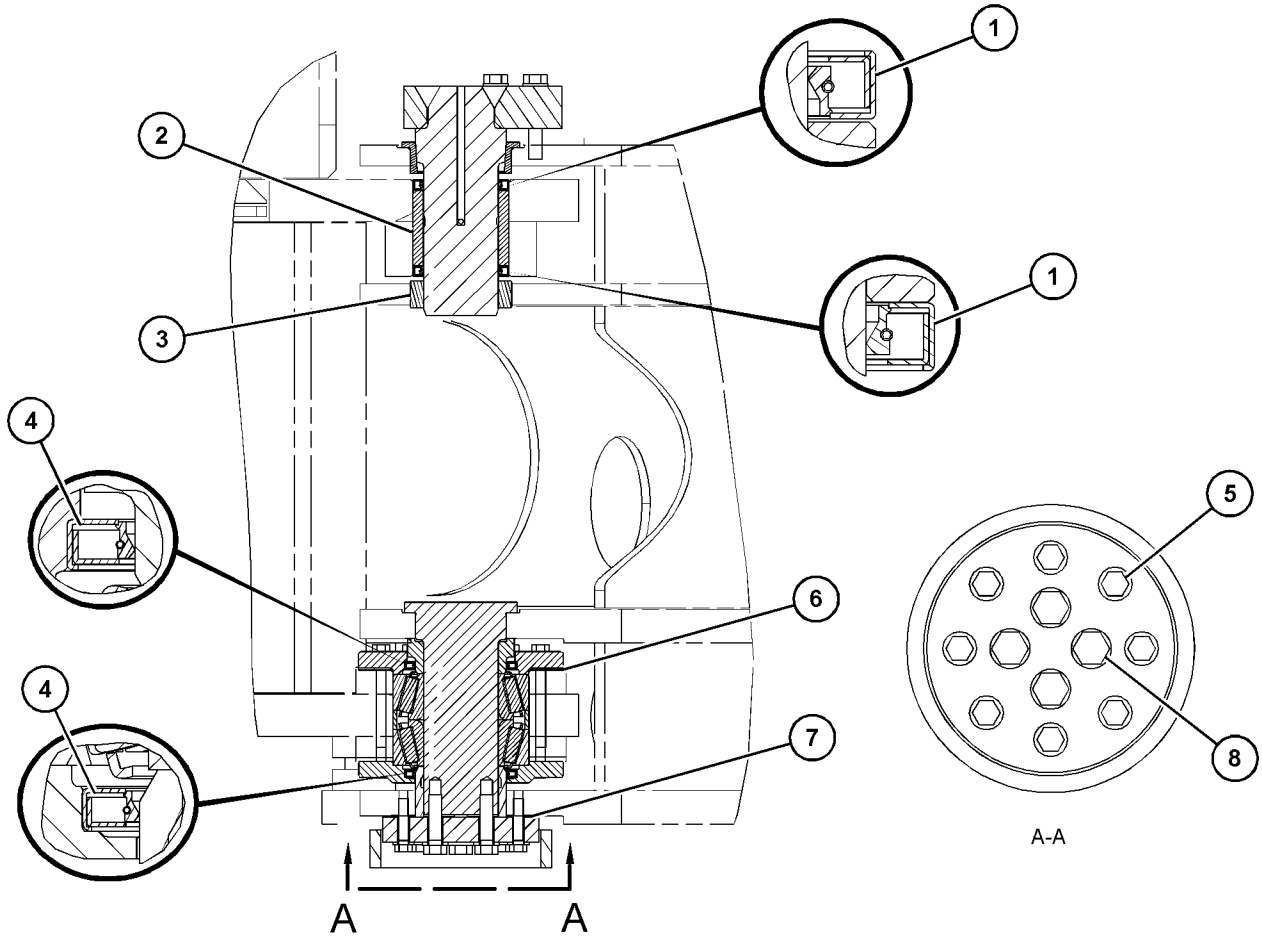


Illustration 23
Left side view

g03658616

Table 15

Specification for 250-2283 Articulating Hitch Gp			
Item	Qty	Part	Specification Description
1	2	1J-2150 Lip Type Seal	Lubricate lightly with lubricant that is being sealed.
2	1	5K-3496 Bushing	Bore before assembly is 89.103 ± 0.013 mm (3.5080 ± 0.0005 inch).
3	1	5K-3494 Bushing	Bore before assembly is 89.027 ± 0.013 mm (3.5050 ± 0.0005 inch).

(continued)

(Table 15, contd)

4	2	3K-6454 Lip Type Seal	Lubricate lightly with lubricant that is being sealed.
5	8	096-9986 Bolt	Torque to 105 ± 20 N·m (77 ± 15 lb ft).
6	1	5K-3492 Shim Pack	Total thickness of shim pack is 2.54 ± 0.08 mm (0.100 ± 0.003 inch).
7	1	5K-3489 Shim Pack	Total thickness of shim pack is 2.03 ± 0.08 mm (0.080 ± 0.003 inch).
8	4	8T-4140 Bolt	Before assembly, apply blue Loctite 243 to the threads.

i02556451

i02556689

Position Sensor (Articulation)

SMCS Code: 7476-PSN

Part No. : 287-6156
S/N: B9H1-Up

Part No. : 287-6156
S/N: R9H1-Up

Part No. : 288-9443
S/N: B9J1-Up

Part No. : 288-9443
S/N: R9J1-Up

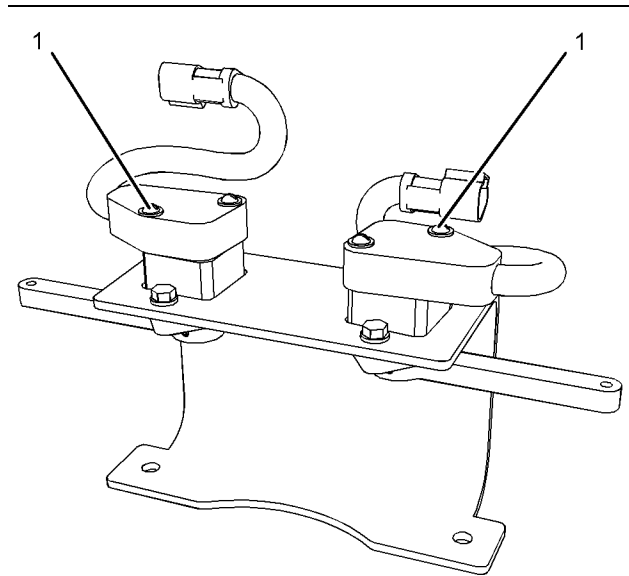


Illustration 24

g01279730

(1) Torque for four screws 2.0 ± 0.5 N·m
 ((18 ± 4 lb in))

Drawbar

SMCS Code: 6153

Part No. : 257-4930
S/N: B9H1-Up

Part No. : 257-4930
S/N: R9H1-Up

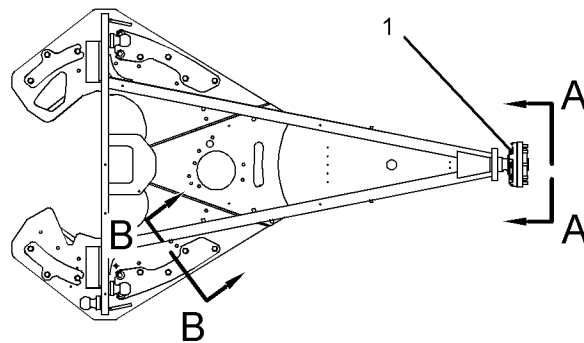


Illustration 25

g01279828

(1) Torque for 8 bolts 540 ± 25 N·m
 ((400 ± 18 lb ft))

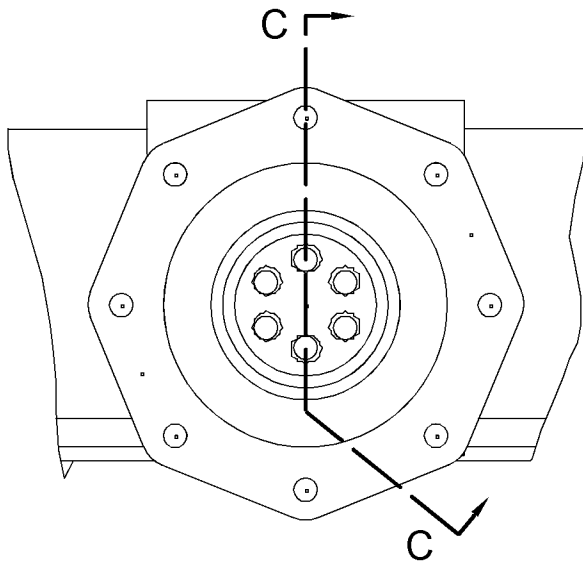


Illustration 26
View A-A

g01192523

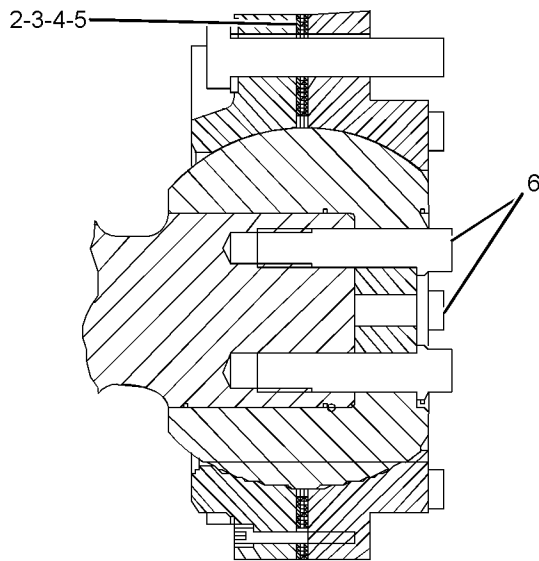


Illustration 27
Section C-C

g01295137

- (2) Thickness of one 259-4470 Shim 0.12 mm ((0.005 inch))
- (3) Thickness of one 259-4471 Shim 0.25 mm ((0.010 inch))
- (4) Thickness of one 259-4472 Shim 0.76 mm ((0.030 inch))
- (5) Thickness of one 259-4473 Shim 1.52 mm ((0.060 inch))

- (6) Torque for 6 bolts 500 ± 65 N·m ((370 ± 50 lb ft))

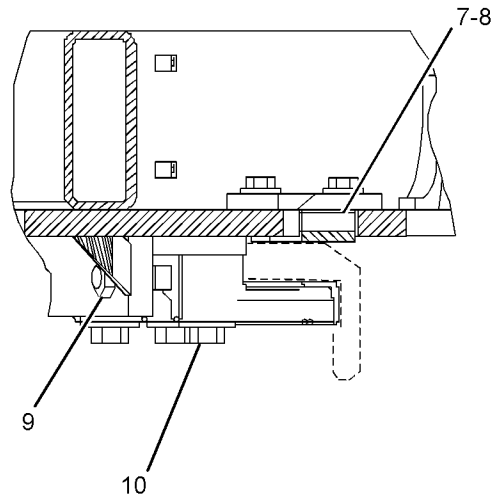


Illustration 28
Section B-B

g01295141

- (7) Thickness of one 185-7115 Shim 0.5 mm ((0.02 inch))
- (8) Thickness of one 257-4932 Shim 0.25 mm ((0.010 inch))
- (9) Torque for 12 nuts 570 ± 80 N·m ((420 ± 60 lb ft))
- (10) Torque for 18 bolts 900 ± 100 N·m ((660 ± 75 lb ft))

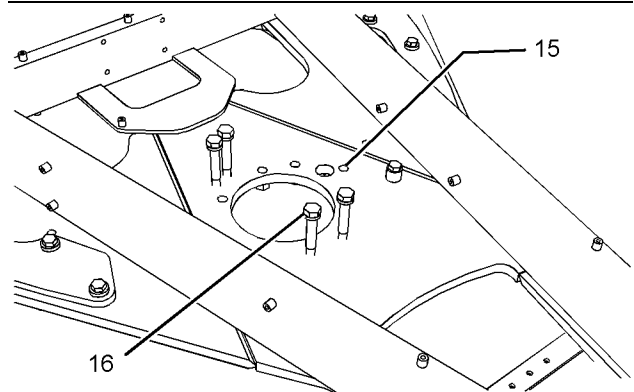


Illustration 29

g01279870

- (11) Torque for four nuts 850 ± 25 N·m ((630 ± 18 lb ft))
- (12) Torque for four bolts 850 ± 25 N·m ((630 ± 18 lb ft))

i02556731

Drawbar

SMCS Code: 6153

Part No.: 257-4929
S/N: B9J1-Up

Part No.: 257-4929
S/N: R9J1-Up

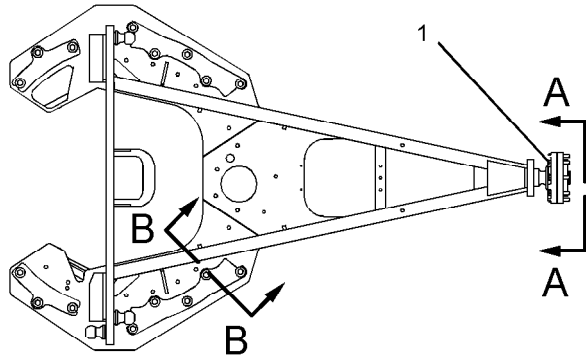


Illustration 30 g01103155

(1) Torque for 8 bolts 540 ± 25 N·m
(400 ± 18 lb ft)

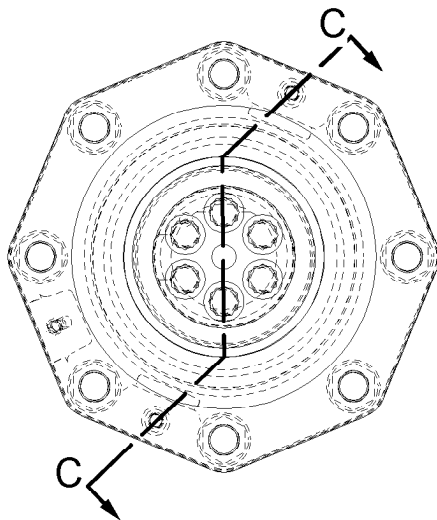


Illustration 31 g01103161
View A-A

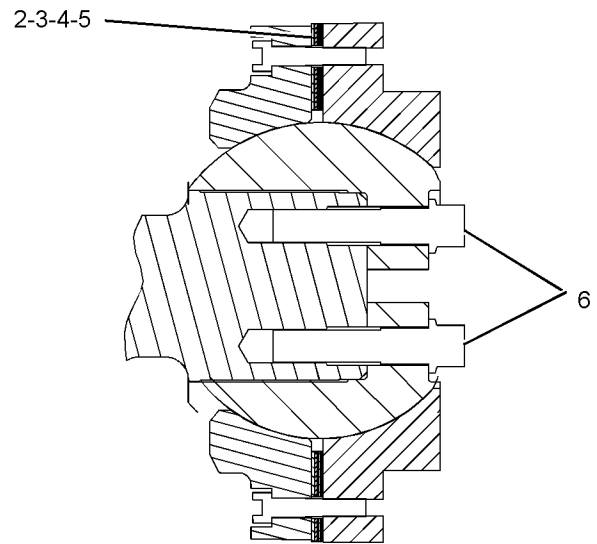


Illustration 32 g01295123
Section C-C

- (2) Thickness of one 259-4470 Shim 0.12 mm
(0.005 inch)
- (3) Thickness of one 259-4471 Shim 0.25 mm
(0.010 inch)
- (4) Thickness of one 259-4472 Shim 0.76 mm
(0.030 inch)
- (5) Thickness of one 259-4473 Shim 1.52 mm
(0.060 inch)
- (6) Torque for 6 bolts 500 ± 65 N·m
(370 ± 48 lb ft)

i02555381

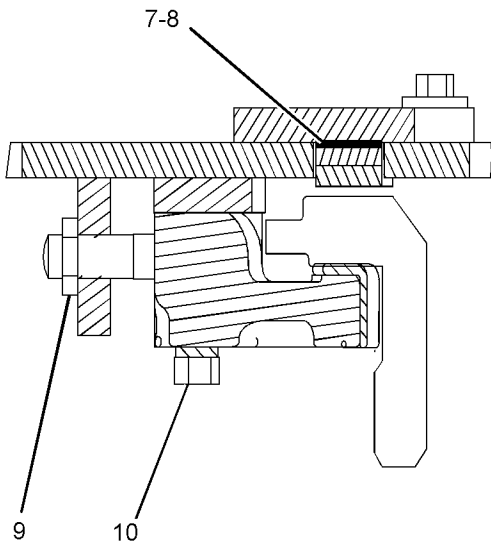


Illustration 33 g01295124

Section B-B

- (7) Thickness of one 185-7115 Shim 0.5 mm
((0.02 inch))
- (8) Thickness of one 257-4932 Shim 0.25 mm
((0.010 inch))
- (9) Torque for 12 nuts 570 ± 80 N·m
((420 ± 59 lb ft))
- (10) Torque for 18 bolts 920 ± 60 N·m
((679 ± 44 lb ft))

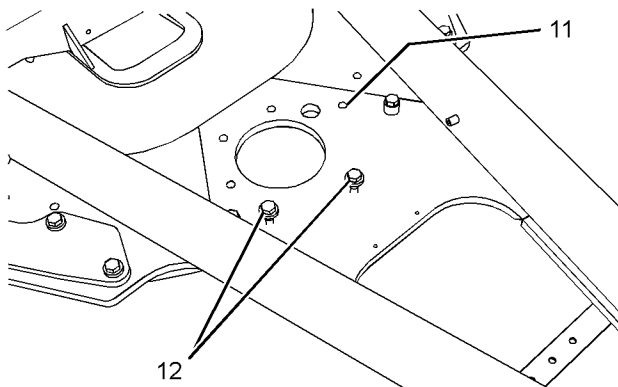


Illustration 34 g01279853

- (11) Torque for four nuts 530 ± 70 N·m
((390 ± 50 lb ft))
- (12) Torque for two bolts 485 ± 25 N·m
((360 ± 18 lb ft))

Centershift Cylinder Mounting

SMCS Code: 5223-MT

Part No. : 274-2141
S/N: B9J1-Up

Part No. : 274-2141
S/N: R9J1-Up

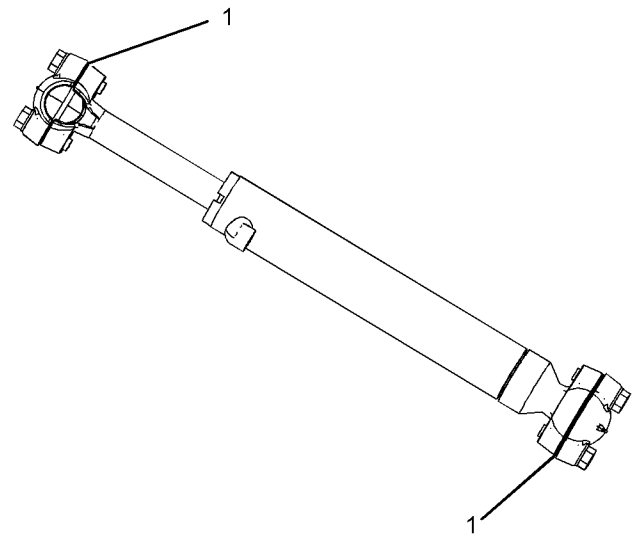


Illustration 35 g01212393

- (1) 2G-9104 Shim

Thickness of one shim 0.5 mm ((0.02 inch))

Apply 5P-0960 Grease between the inserts and the ball studs.

i02555383

Centershift Cylinder Mounting

SMCS Code: 5223-MT

Part No. : 261 - 2373

S/N: B9H1-Up

Part No. : 261 - 2373

S/N: R9H1-Up

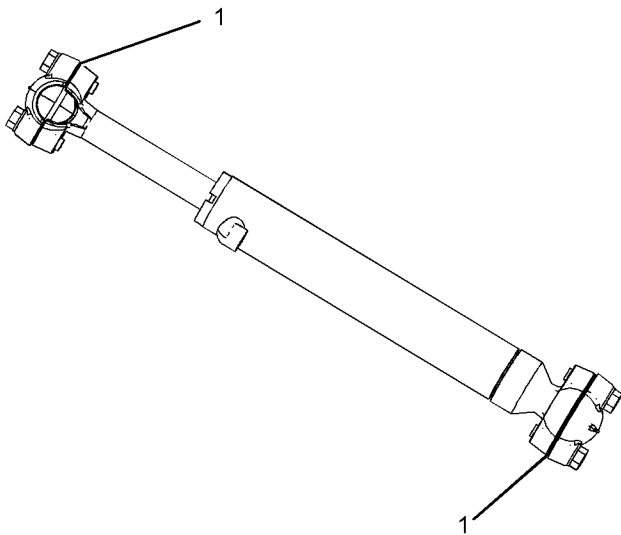


Illustration 36

g01212393

(1) 2G-9106 Shim

Thickness of one shim0.5 mm ((0.02 inch))

Apply 5P-0960 Grease Cartridge between the inserts and the ball studs.

i04940494

Ball Switch (Centershift Indicator)

SMCS Code: 1408-ZS; 5221-ZS

Part No. : 3E - 3636

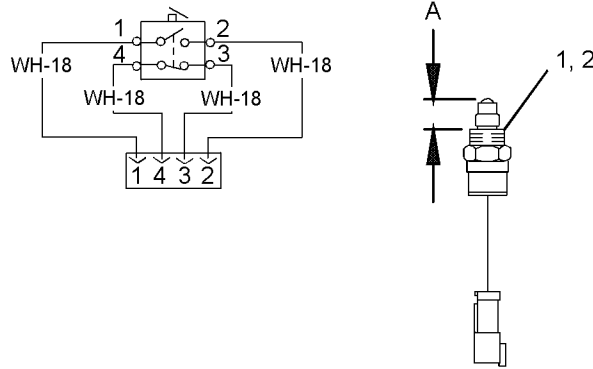


Illustration 37

g02732147

Table 16

Specification for 3E - 3636 Ball Switch			
Item	Qty	Part	Specification Description
1	-	Switch	Torque to $7 \pm 1 \text{ N}\cdot\text{m}$ ($62 \pm 9 \text{ lb in}$)
2	10	8F - 1974 Shim	Thickness of one shim 3.23 mm (0.127 inch)
-	During installation use the shims as required to allow the switch to be turned 1/2 turn after the circuit is open.		
-	-	Actuation force	$13.35 + 8.90 - 4.45 \text{ N}$ ($3.0 + 2.0 - 1.0 \text{ lb}$)
-	-	Maximum actuation force for overtravel	75.65 N (17 lb)
A	-	Measurement	$18.85 \pm 0.25 \text{ mm}$ ($0.742 \pm 0.010 \text{ inch}$)
-	The switch should make contact within Dimension (A).		
-	-	Switch position for contacts 1 and 2	Normally open
-	-	Switch position for contacts 3 and 4	Normally closed

i03902258

Solenoid Valve (Centershift Lock)

SMCS Code: 1408; 5220; 5479

Part No. : 152 - 8346

i0255429

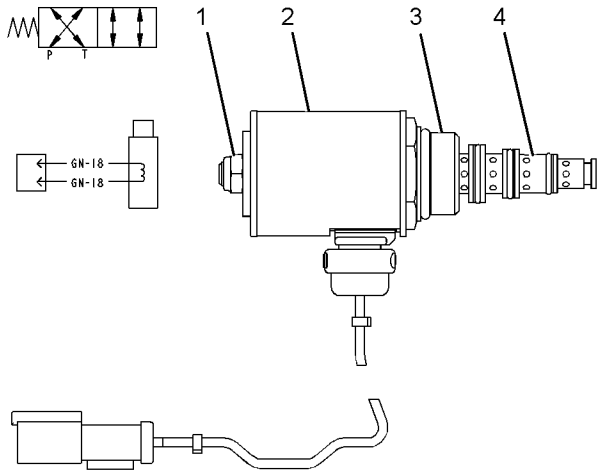


Illustration 38

g01398527

(1) Final installation torque for the locknut
 9.0 ± 0.5 N·m ((80 ± 4 lb in))

(2) 218-9894 Coil

Nominal voltage 24 VDC
 Maximum voltage at 25 °C (77 °F) ambient
 temperature and 121 °C (250 °F) fluid
 temperature 28.5 VDC
 Coil resistance at 25 ± 5 °C (77 ± 9 °F) .. 32.6 ±
 1.6 ohms

Operating temperature range -40 to 121 °C
 ((-40 to 250 °F))

(3) Final installation torque for the solenoid valve
 group 115 ± 7 N·m ((85 ± 5 lb ft))

Note: Position the lead wire of the solenoid valve at a
 minimum of 15 degrees lower than horizontal.
 Positioning the lead wire lower will reduce the entry
 of moisture into the solenoid valve.

(4) 170-7485 Valve Spool As

At a pressure drop of 690 kPa (100 psi), you will
 achieve the following flow with SAE 10 oil at 105 °C
 (221 °F). 8.1 L/min ((2.1 US gpm))

Blade Lift Cylinder Mounting

SMCS Code: 5102-MT

Part No. : 271-6420
 S/N: B9J1-Up

Part No. : 271-6420
 S/N: R9J1-Up

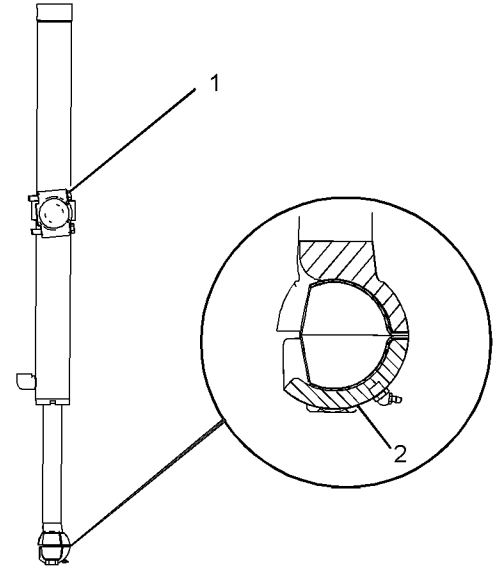


Illustration 39

g01212591

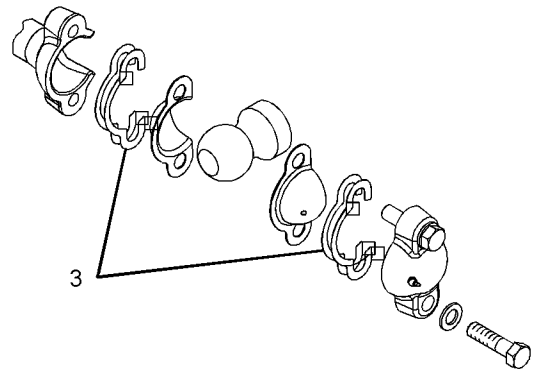


Illustration 40

g01212592

(1) Torque for eight bolts 115 ± 7 N·m
 ((85 ± 5 lb ft))

(2) Hand pack the cap with 9X-6489 Lubricant.

(3) Thickness of 2G-9104 Shim 0.5 mm
 ((0.020 inch))

Note: Refer to Operation and Maintenance Manual, "Center Cylinder Socket - Check/Adjust/Replace" for information regarding the adjustment of the blade lift cylinder socket.

i0255443

Blade Lift Cylinder Mounting

SMCS Code: 5102-MT

Part No. : 261 - 2372

S/N: B9H1-Up

Part No. : 261 - 2372

S/N: R9H1-Up

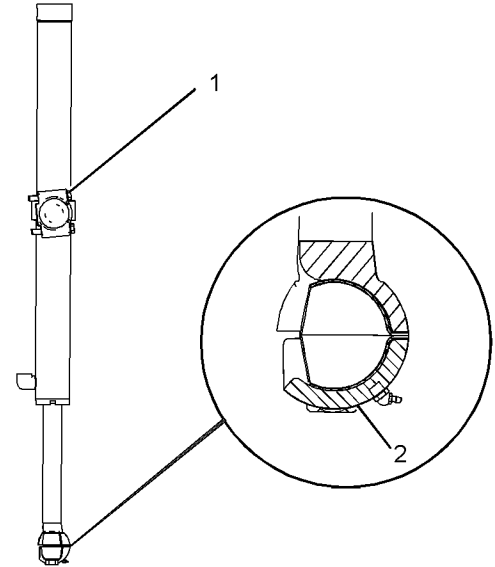


Illustration 41

g01212591

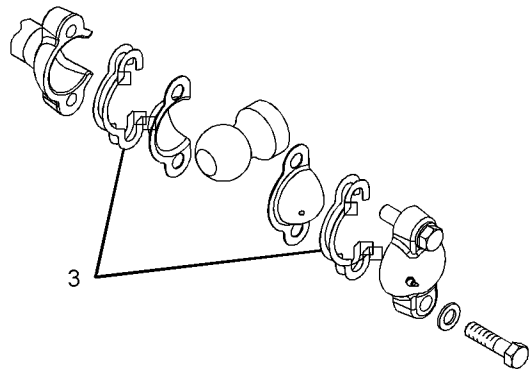


Illustration 42

g01212592

(3) Thickness of 2G-9106 Shim 0.5 mm
((0.020 inch))

Note: Refer to Operation and Maintenance Manual, "Center Cylinder Socket - Check/Adjust/Replace" for information regarding the adjustment of the blade lift cylinder socket.

i02586945

Blade Lift

SMCS Code: 6151

Part No.: 265-6710

S/N: B9H1-Up

Part No.: 265-6710

S/N: R9H1-Up

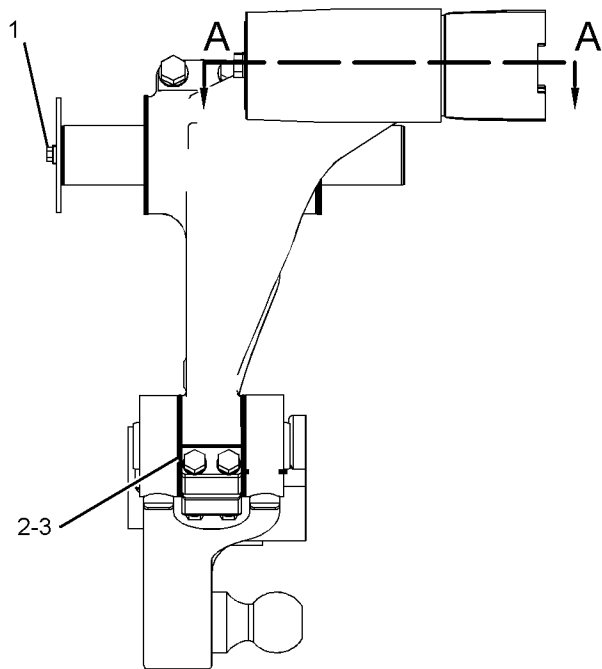


Illustration 43

g01192430

(1) Torque for bolt $115 \pm 10 \text{ N}\cdot\text{m}$ (($85 \pm 7 \text{ lb ft}$))

(2) 8D-3251 Washer

Thickness of one washer 1.22 mm
((0.048 inch))

(3) 8D-3252 Washer

Thickness of one washer 0.76 mm
((0.030 inch))

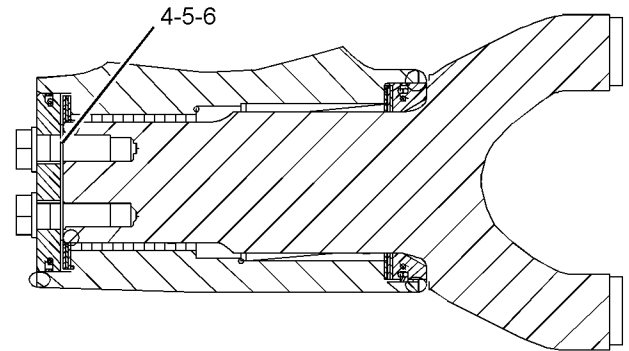


Illustration 44

g01192703

(4) 265-6718 Shim

Thickness of one shim . . 0.13 mm ((0.005 inch))

(5) 265-6719 Shim

Thickness of one shim . . 0.25 mm ((0.010 inch))

(6) 265-6720 Shim

Thickness of one shim 0.5 mm ((0.02 inch))

i07963968

Blade Lift

SMCS Code: 6151

Part No. : 265 - 6710

S/N: B9H1-Up

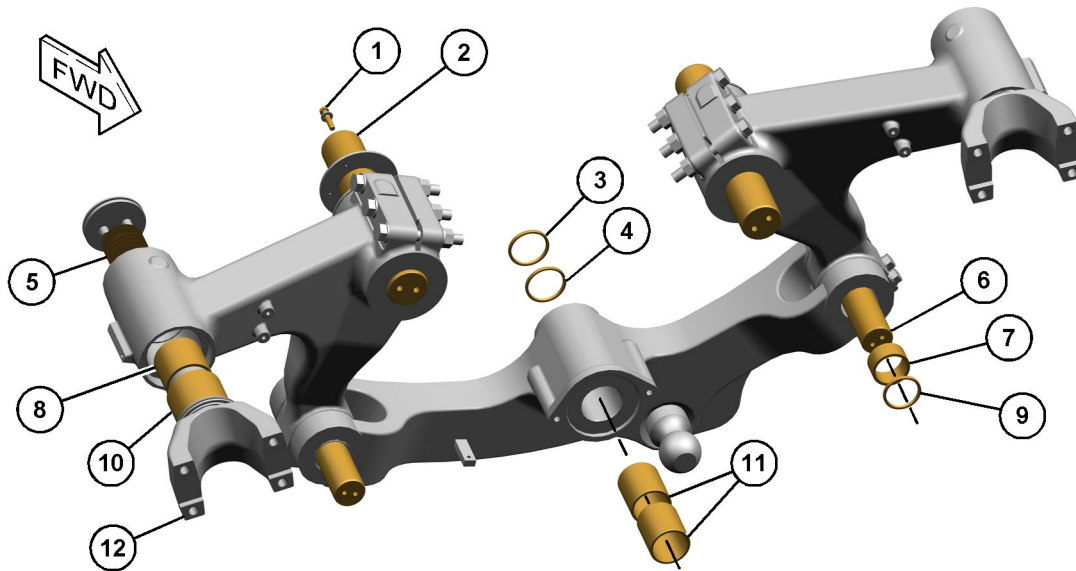


Illustration 45

g06495857

Table 17

Item	Qty	Part	Specification Description
1	1	288 - 0735 Bolt	Torque to 115 ± 10 N·m (85 ± 5 lb ft).
2	2	265 - 1099 Pin	Diameter is 89.20 ± 0.10 mm (3.512 ± 0.004 inch).
3	1	9D - 6589 Lip Type Seal	Lubricate the seal lightly with the lubricant that is being sealed.
4	10	Use as required to maintain 2.28 ± 0.76 mm (0.089 ± 0.029 inch) clearance between link bar and lock plate.	
		8D - 3252 Washer	Thickness of ine plate is 0.76 mm (0.029 inch).
5	As required, use shims in order to permit the yoke assembly to rotate without binding. Maximum shaft end play of yoke assembly (11) is 0.25 mm (0.010 inch).		
	8	265 - 6718 Shim	Thickness is 0.13 mm (0.005 inch).
	6	265 - 6719 Shim	Thickness is 0.25 mm (0.010 inch).
	2	265 - 6720 Shim	Thickness is 0.5 mm (0.020 inch).
6	2	8D - 3329 Pin	Diameter is 70.10 ± 0.08 mm (2.759 ± 0.003 inch).
7	4	8D - 9507 Bushing	Bore before assembly is 70.002 ± 0.050 mm (2.7559 ± 0.00197 inch).
8	2	8D - 3311 Bushing	Bore before assembly is 92.227 ± 0.063 mm (3.6309 ± 0.0024 inch).
9	8	9D - 6588 Lip Type Seal	Lubricate the seal lightly with the lubricant that is being sealed.
10	2	8D - 3309 Bushing	Bore before assembly is 108.102 ± 0.063 mm (4.2559 ± 0.0024 inch).
11	2	9D - 3313 Bushing	Bore before assembly is 76.276 ± 0.013 mm (3.0029 ± 0.0005 inch).

i07988015

Blade Lift

SMCS Code: 6151

Part No. : 253-4631

S/N: B9J1-Up

Part No. : 253-4631

S/N: R9J1-Up

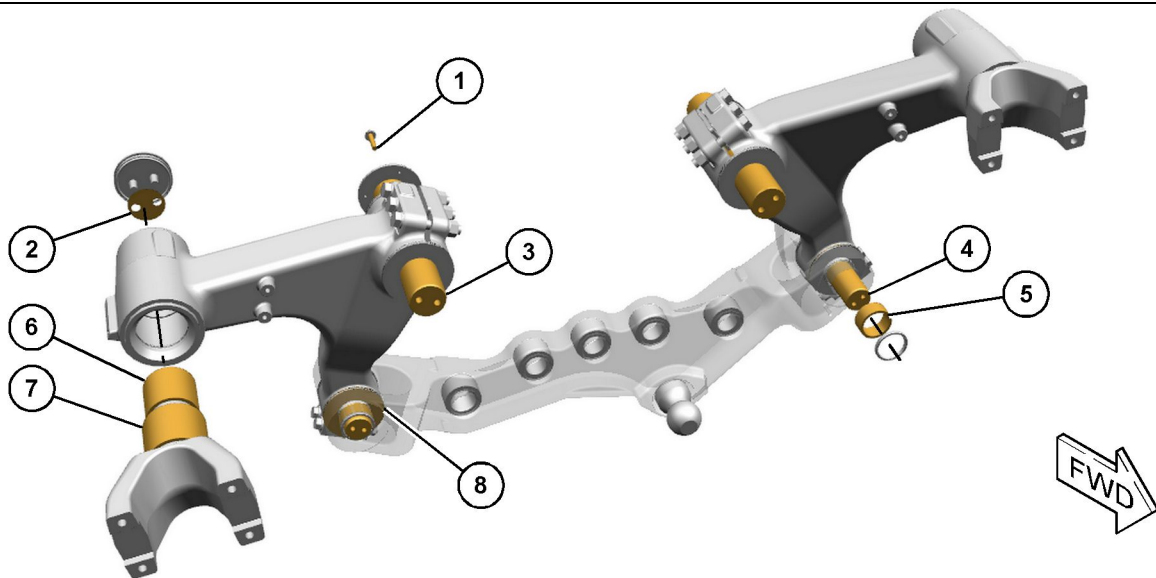


Illustration 46

g06498405

Table 18

Item	Qty	Part	Specification Description
1	1	8T-4910 Bolt	Torque to 130 ± 7 N·m (96 ± 5 lb ft).
2	As required, use shims in order to permit the yoke assembly to rotate without binding. Maximum shaft end play of yoke assembly is 0.25 mm (0.010 inch).		
	8	259-4494 Shim	Thickness of one shim is 0.12 mm (0.005 inch).
	6	259-4495 Shim	Thickness of one shim is 0.25 mm (0.010 inch).
	2	259-4496 Shim	Thickness of one shim is 0.5 mm (0.020 inch).
3	2	259-4483 Pin	Diameter is 76.53 ± 0.08 mm (3.012 ± 0.003 inch).
4	2	8D-4235 Pin	Diameter is 60.68 ± 0.08 mm (2.388 ± 0.00315 inch).
5	4	8D-9652 Bearing	Bore before assembly is 60.477 ± 0.050 mm (2.3809 ± 0.0019 inch). Installation depth is 9.52 ± 0.40 mm (0.374 ± 0.015 inch).
6	2	8D-4137 Bushing	Bore before assembly is 79.527 ± 0.050 mm (3.1309 ± 0.0019 inch).
7	2	8D-4138 Bushing	Bore before assembly is 95.402 ± 0.063 mm (3.7559 ± 0.0024 inch).
8	Use as required to obtain 2.30 ± 0.80 mm (0.090 ± 0.031 inch) clearance between link bar and lock plate.		
	10	8D-4317 Washer	Thickness of one washer is 1.22 mm (0.048 inch).
	10	8D-4321 Washer	Thickness of one washer is 0.70 mm (0.027 inch).

i05765783

Circle

SMCS Code: 6154

Part No. : 253 - 4650

S/N: B9J1-Up

Part No. : 253 - 4650

S/N: R9J1-Up

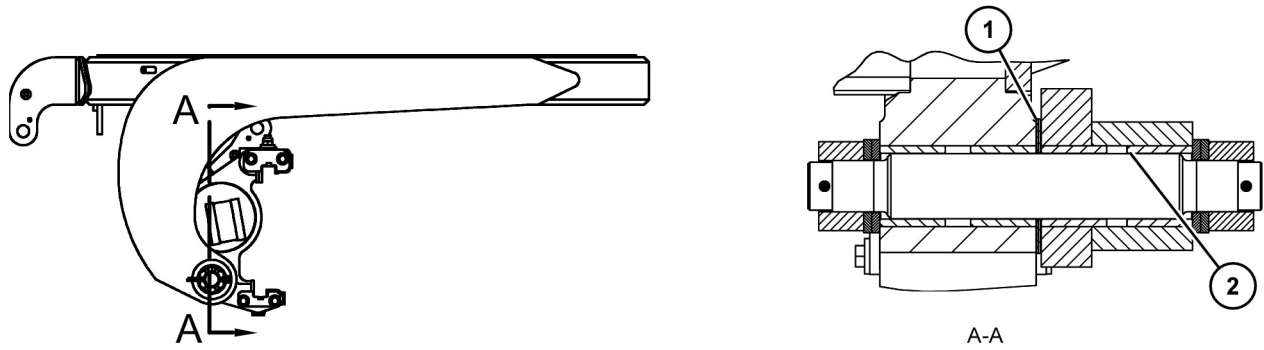


Illustration 47

g03658109

Table 19

Specification for 253 - 4650 Circle Gp and			
Item	Qty	Part	Specification Description
1	6	253 - 4643 Shim	Use as required to provide a sliding fit with a maximum clearance of 1.8 mm (0.07 inch) between bracket and beam. Thickness is 2.0 mm (0.08 inch).
2	8	8W - 4167 Bushing	Bore is 65.164 ± 0.025 mm (2.5655 ± 0.0010 inch).

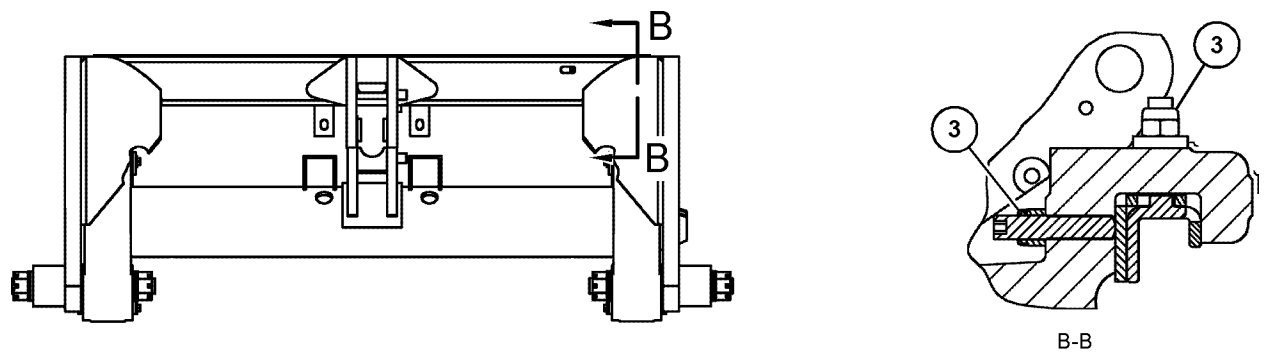


Illustration 48

g03658110

Table 20

Item	Qty	Part	Specification Description
3	6	6V - 7688 Locknut	Torque to 250 ± 40 N·m (184 ± 30 lb ft).

i02556229

Steering Cylinder Mounting

SMCS Code: 4303-MT

Part No. : 264 - 1160
S/N: B9H1-Up

Part No. : 264 - 1160
S/N: R9H1-Up

Part No. : 277 - 0688
S/N: B9J1-Up

Part No. : 277 - 0688
S/N: R9J1-Up

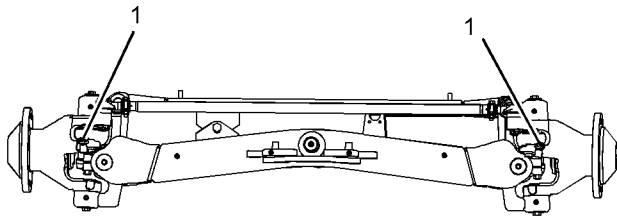


Illustration 49

g01212723

(1) Torque for 2 nuts $220 \pm 14 \text{ N}\cdot\text{m}$
(($160 \pm 10 \text{ lb ft}$))

Note: Additional torque may be required to align the cotter slot.

i06659391

Front Axle

SMCS Code: 3282; 4313-FR

Part No. : 250-2282

S/N: B9H1-Up

Part No. : 250-2282

S/N: R9H1-Up

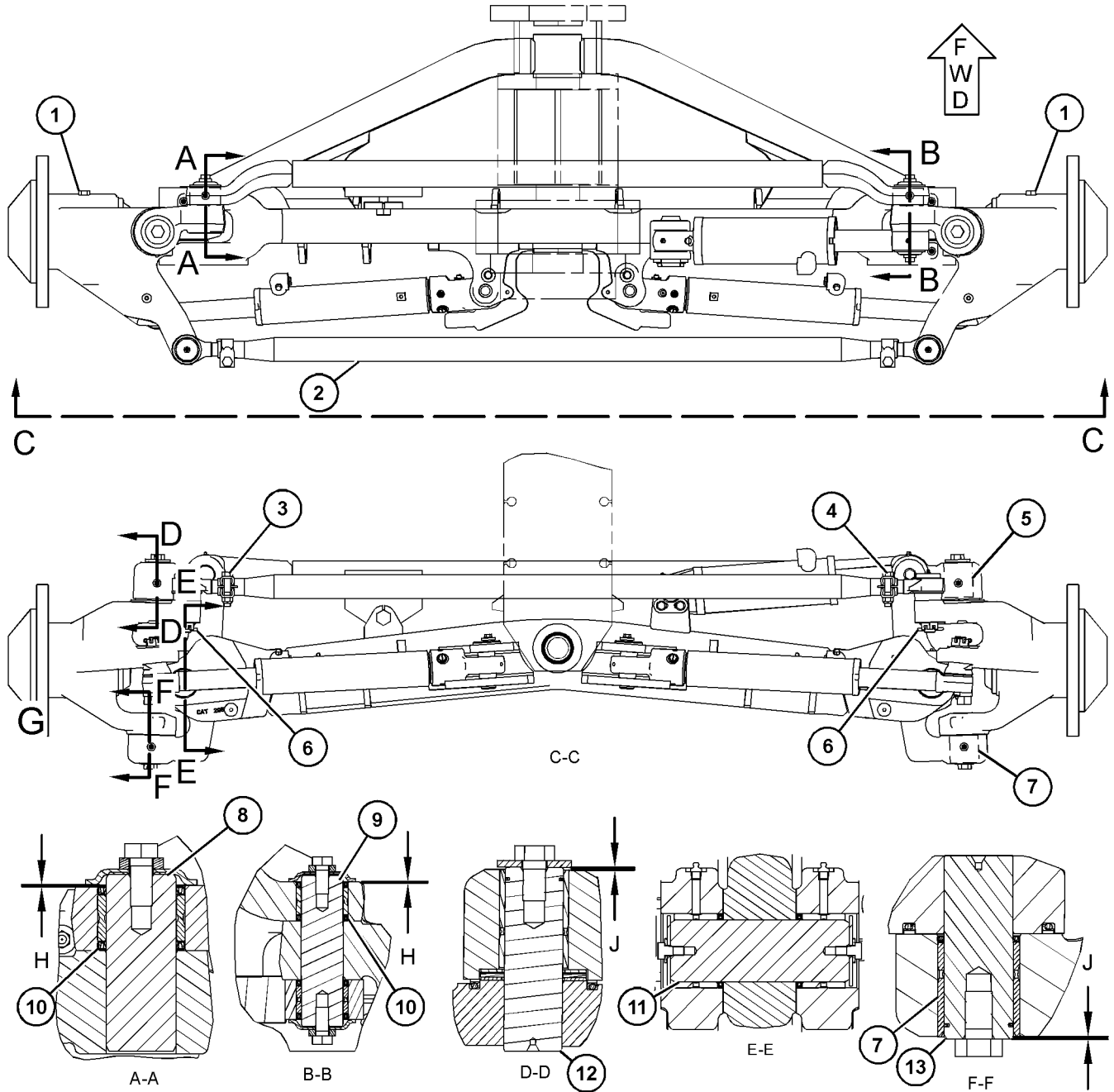


Illustration 50

Top view

Table 21

Specification for 250-2282 Front Axle Gp			
Item	Qty	Part	Specification Description
1	-	-	Fill bearing compartment with 2P-9869 Oil to bottom edge of fill hole in housing.
2	1	361-4430 Steering Link Gp	Adjust tie rod length to obtain 3.0 ± 1.5 mm (0.12 ± 0.03 inch) forward toe-in at centerline of tire on outside diameter. Orient bolt (3) and bolt (4) as shown and tighten nuts on clamps to 75 ± 7 N·m (55 ± 5 lb ft).
5	2	2G-7106 Bushing	Before assembly, inner diameter is 51.016 ± 0.025 mm (2.0085 ± 0.0010 inch).
6	-	-	Tighten nut to 220 N·m (162 lb ft) plus torque required to align cotter slot.
7	2	2G-8738 Bushing	Before assembly, inner diameter is 51.016 ± 0.025 mm (2.0085 ± 0.0010 inch).
8	1	264-1152 Pin	Diameter is 20.0 ± 0.5 mm (0.79 ± 0.02 inch).
9	1	264-1155 Pin	Diameter is 20.0 ± 0.5 mm (0.79 ± 0.02 inch).
H	-	-	Minimum gap under retainer is 0.03 mm (0.001 inch).
J	-	-	Gap between washer and ring is 2.0 ± 0.5 mm (0.08 ± 0.02 inch).
10	2	2G-8635 Bushing	Before assembly, inner diameter is 51.016 ± 0.025 mm (2.0085 ± 0.0010 inch). Installation depth is 7.2 ± 0.4 mm (0.28 ± 0.02 inch).
11	2	264-1168 Pin	Diameter is 63.856 ± 0.050 mm (2.5140 ± 0.0020 inch).
12	2	264-1167 Pin	Diameter is 50.749 ± 0.005 mm (1.9980 ± 0.0002 inch).
13	2	257-9799 Pin	Diameter is 50.749 ± 0.005 mm (1.9980 ± 0.0002 inch).

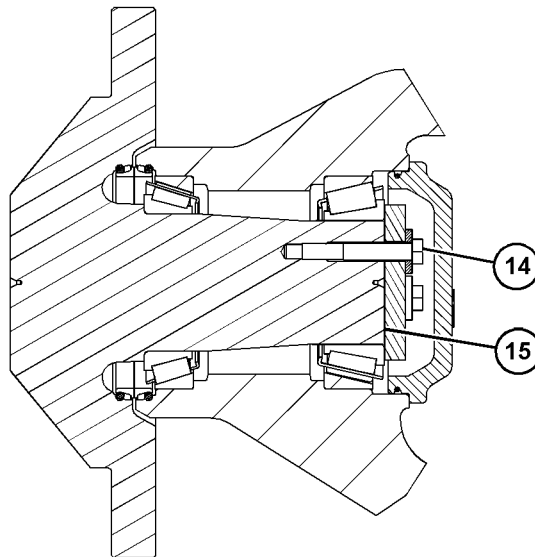


Illustration 51

g06064200

Detailed view of area G

Table 22

Item	Qty	Part	Specification Description
14	6	6V-5696 Bolt	Torque to 125 ± 7 N·m (92 ± 5 lb ft).
15	6	426-4334 Shim	As required, use any three shims to attain the rolling torque between 7 to 20 N·m (62 to 177 lb in). Remove one shim if the torque is less than 7 N·m (62 lb in). Thickness of one shim is 0.127 mm (0.0050 inch)

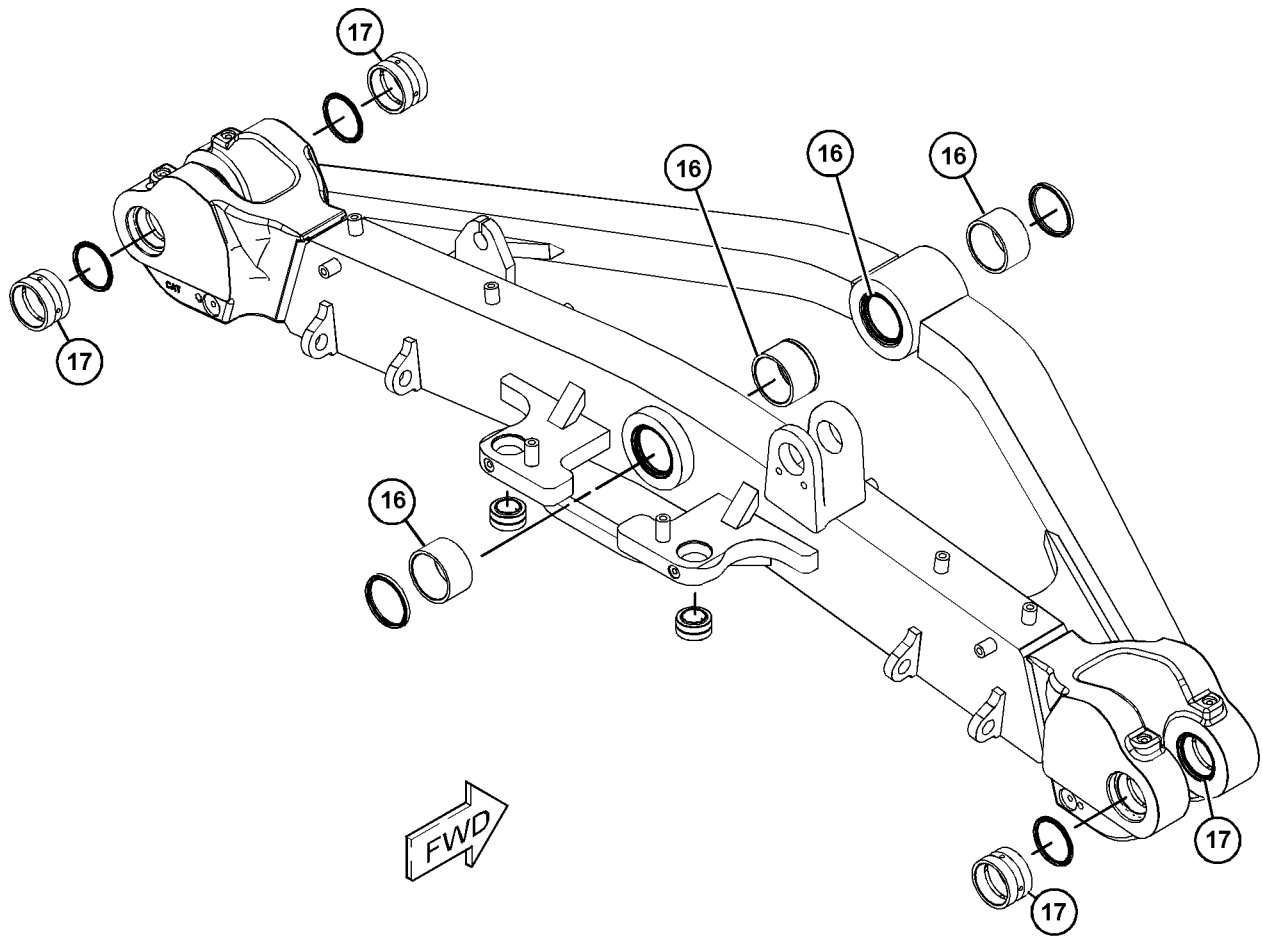


Illustration 52

g06063482

387 - 3127 Front Axle As

Table 23

Item	Qty	Part	Specification Description
16	4	2G-8607 Bushing ⁽¹⁾	Before assembly, inner diameter is 70.079 ± 0.025 mm (2.7590 ± 0.0010 inch). Installation depth is 8.7 ± 0.5 mm (0.34 ± 0.02 inch).
17	4	8J-5778 Bushing	Before assembly, inner diameter is 63.734 ± 0.020 mm (2.5092 ± 0.0008 inch). Installation depth is 5.6 ± 0.5 mm (0.22 ± 0.02 inch).

⁽¹⁾ Install the bushing so that the part number is visible from the outside of the assembly.

i06660534

Front Axle

SMCS Code: 3282; 4313-FR

Part No. : 256-3895

S/N: B9J1-Up

Part No. : 256-3895

S/N: R9J1-Up

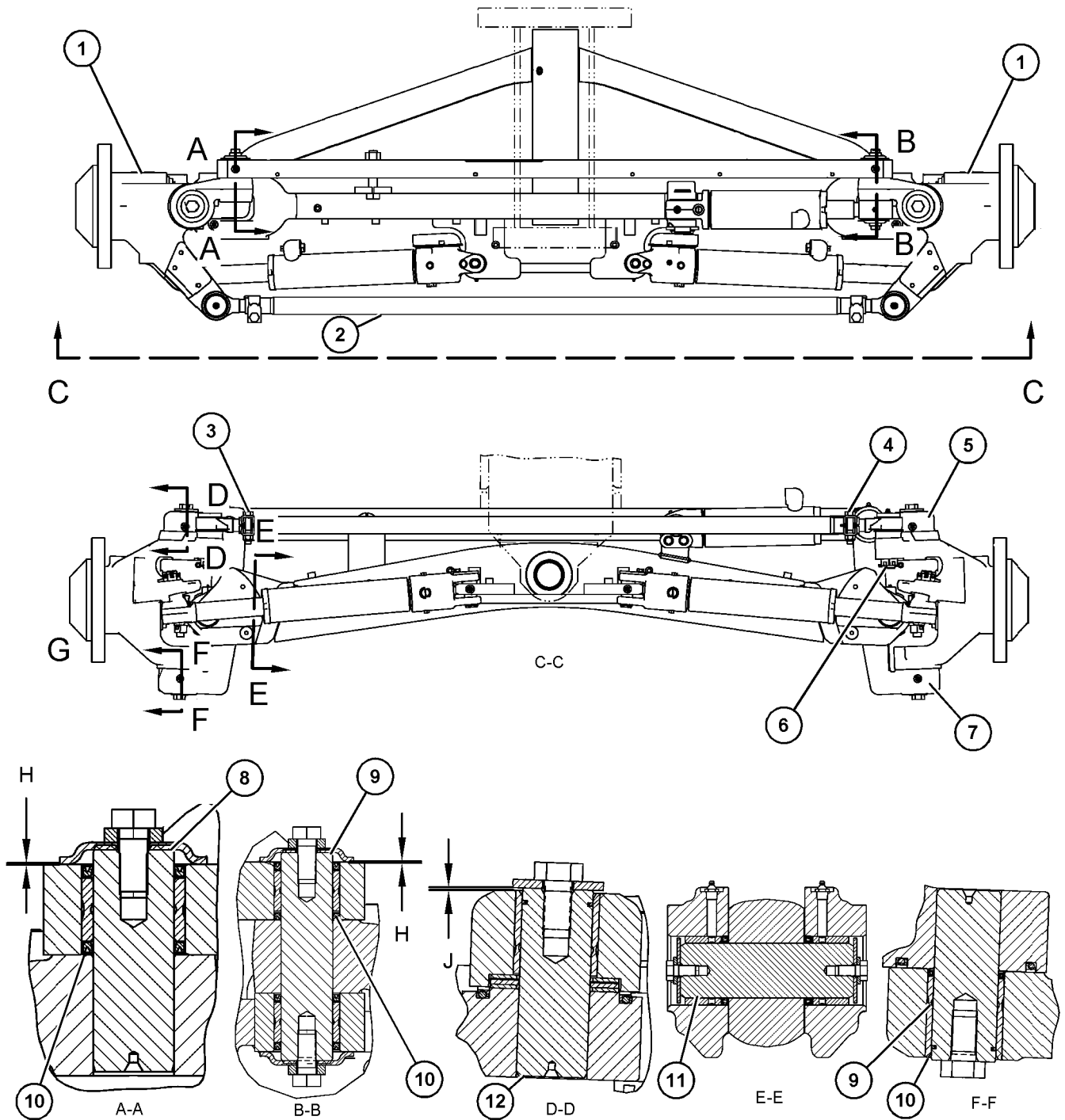


Illustration 53
Top view

Specifications Section

Table 24

Specification for 256-3895 Front Axle Gp			
Item	Qty	Part	Specification Description
1	-	-	Fill bearing compartment with 2P-9869 Oil to bottom edge of fill hole in housing.
2	1	274-6817 Steering Link Gp	Adjust tie rod length to obtain 3.0 ± 1.5 mm (0.12 ± 0.03 inch) forward toe-in at centerline of tire on outside diameter. Orient bolt (3) and bolt (4) as shown and tighten nuts on clamps to 75 ± 7 N·m (55 ± 5 lb ft).
5	2	2G-7387 Bushing	Before assembly, inside diameter is 51.016 ± 0.025 mm (2.0085 ± 0.0010 inch).
6	-	-	Tighten nut to 220 N·m (162 lb ft). As required, tighten nut to align with cotter slot.
7	2	2G-7388 Bushing	Before assembly, inner diameter is 51.016 ± 0.025 mm (2.0085 ± 0.0010 inch).
8	1	257-9796 Pin	Diameter is 20.0 ± 0.5 mm (0.79 ± 0.02 inch).
9	1	257-9795 Pin	Diameter is 20.0 ± 0.5 mm (0.79 ± 0.02 inch).
H	-	-	Minimum gap under retainer is 0.03 mm (0.001 inch).
J	-	-	Gap between washer and ring is 2.0 ± 0.5 mm (0.08 ± 0.02 inch).
10	2	2G-8631 Bushing	Before assembly, inner diameter is 44.65 ± 0.03 mm (1.758 ± 0.001 inch). Installation depth is 8.0 ± 0.5 mm (0.315 ± 0.019 inch).
11	2	258-8739 Pin	Diameter is 51.13 ± 0.05 mm (2.013 ± 0.002 inch).
12	4	257-9799 Pin	Diameter is 50.749 ± 0.005 mm (1.9980 ± 0.0002 inch).

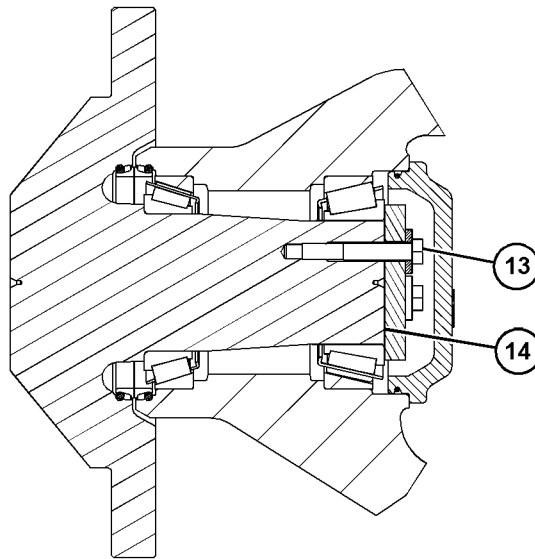


Illustration 54

g06063472

Detailed view of area G

Table 25

Item	Qty	Part	Specification Description
13	6	6V-5696 Bolt	Torque to 125 ± 7 N·m (92 ± 5 lb ft).
14	6	2G-3867 Shim	As required, use any three shims to attain the rolling torque between 7 to 20 N·m (62 to 177 lb in). Remove one shim if the torque is less than 7 N·m (62 lb in). Thickness of one shim is 0.127 mm (0.0050 inch)

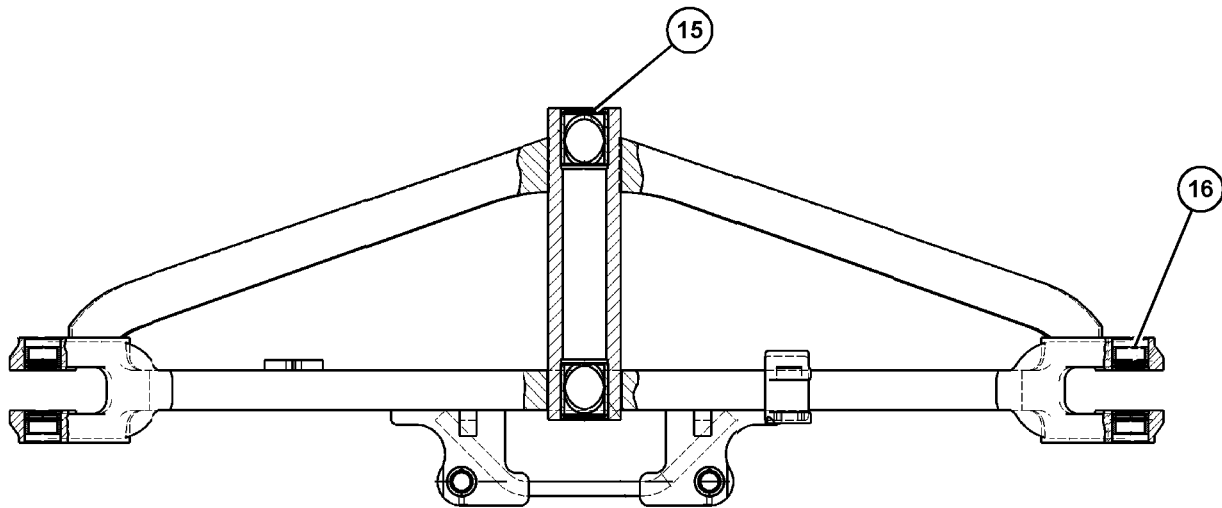


Illustration 55

g06063535

256 - 3904 Front Axle As

Table 26

Item	Qty	Part	Specification Description
15	2	257 - 2289 Bushing ⁽¹⁾	Before assembly, inner diameter is 70.079 ± 0.025 mm (2.7590 ± 0.0010 inch). Installation depth is 8.5 ± 0.5 mm (0.33 ± 0.02 inch).
16	4	2G - 8793 Bushing	Before assembly, inner diameter is 63.627 ± 0.013 mm (2.5050 ± 0.0005 inch). Installation depth is 7.2 ± 0.5 mm (0.28 ± 0.02 inch).

⁽¹⁾ Install the bushing so that the part number is visible from the outside of the assembly.

i02169791

Step Group

SMCS Code: 7254

Part No. : 244 - 2726

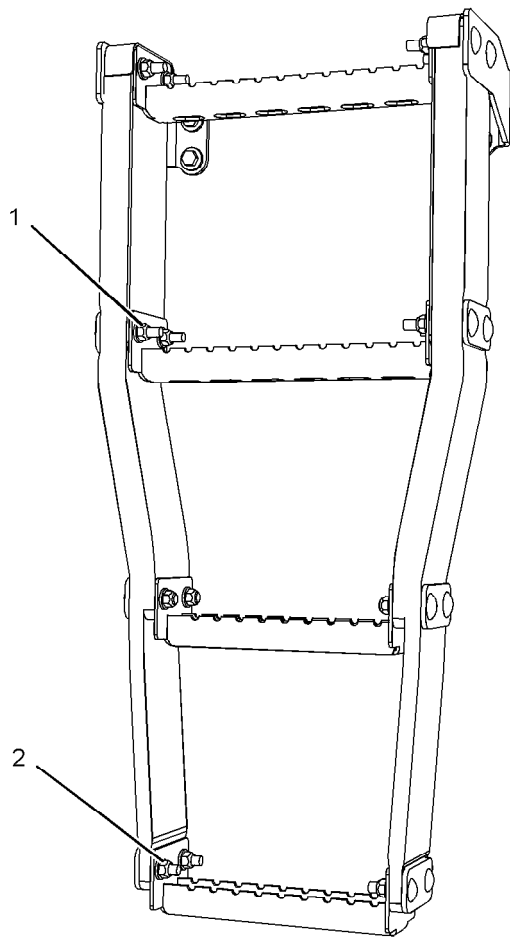


Illustration 56

g01099636

(1) Tighten 12 nuts (1) until contact is made, plus one turn.

(2) Tighten four nuts (2) until one to three threads are visible through the nuts.

Systems Operation Section

i03213627

General Information (Autolube System, If Equipped)

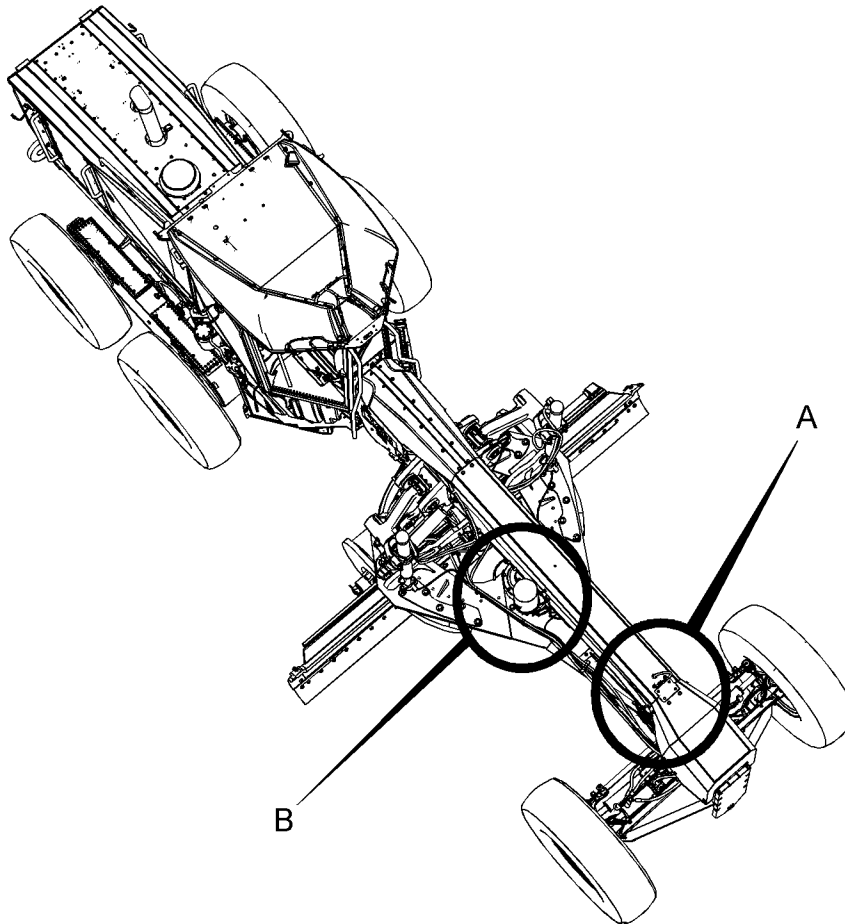
SMCS Code: 7000; 7540**S/N:** B9J1–Up**S/N:** R9J1–Up

Illustration 57

g01407348

The automatic lubrication system is used to lubricate the following components on the motor grader.

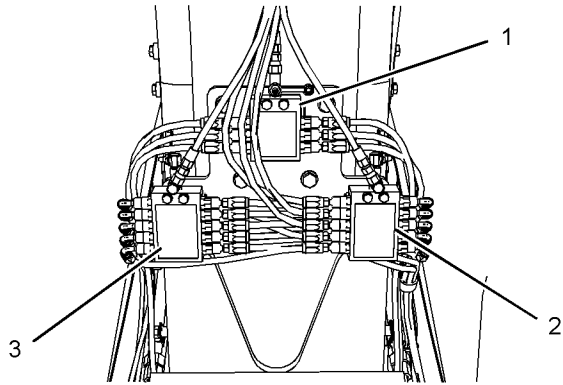


Illustration 58

g01407365

View of Area "A"

- (1) Lubrication distribution valve
- (2) Lubrication distribution valve
- (3) Lubrication distribution valve

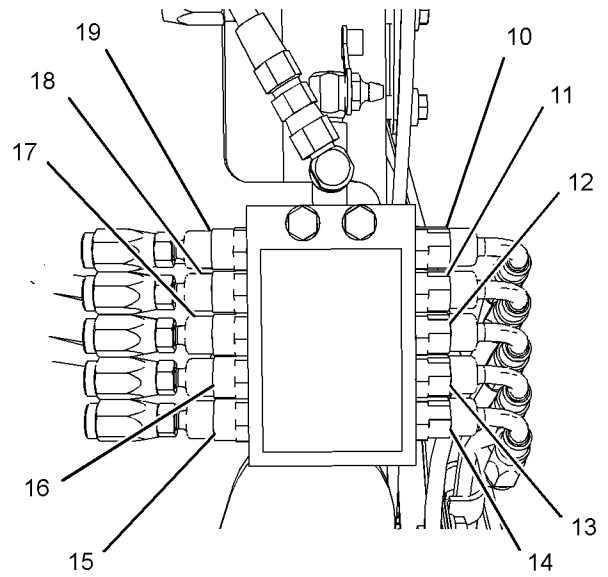


Illustration 60

g01407601

View of lubrication distribution valve (2)

- (10) Port for the back of the pin of the right lean bar
- (11) Port for the head end of the right steering cylinder
- (12) Port for the right bearing for the steering bar
- (13) Port for the rod end of the right steering cylinder
- (14) Port for the front of the pin for the right lean bar
- (15) Port for the front of the pin for the left lean bar
- (16) Port for the rod end of the left lift cylinder
- (17) Port for the bottom of the hitch pin
- (18) Port for the top of the hitch pin
- (19) Port for the rod end of the center shift cylinder

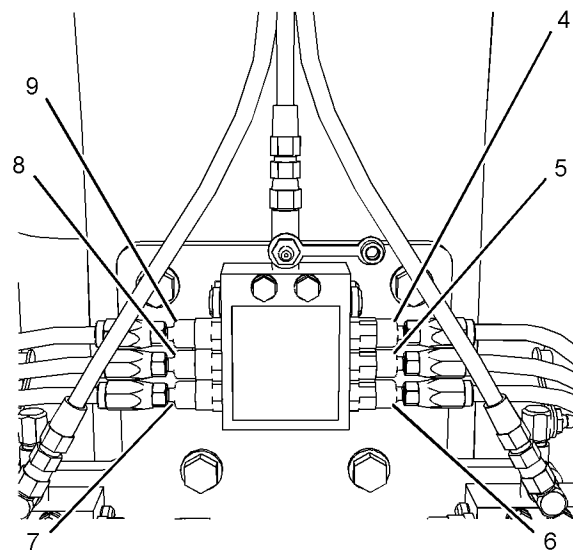


Illustration 59

g01407598

View of lubrication distribution valve (1)

- (4) Port for the ball
- (5) Port for the upper bearing of the right spindle
- (6) Port for the lower bearing of the right spindle
- (7) Port for the lower bearing of the left spindle
- (8) Port for the upper bearing of the left spindle
- (9) Port for the axle pin

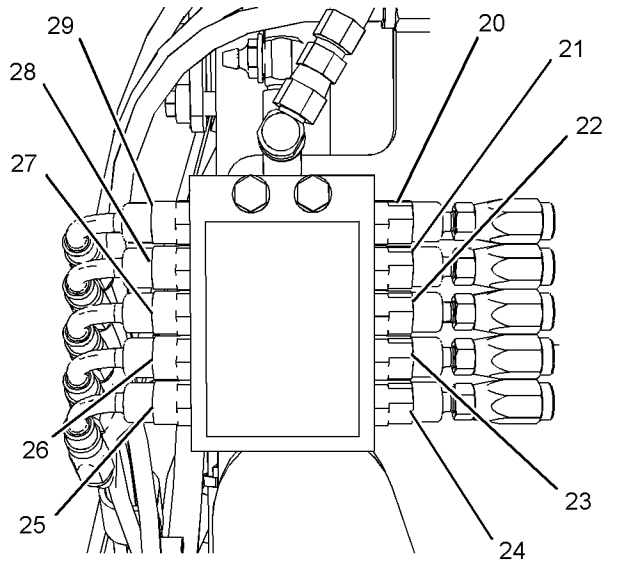


Illustration 61 g01407792

View of lubrication distribution valve (3)

- (20) Port for the head end of the right wheel lean cylinder
- (21) Port for the rod end of the right wheel lean cylinder
- (22) Port for the bearing of the right lean bar
- (23) Port for the head end of the center shift cylinder
- (24) Port for the rod end of the left lift cylinder
- (25) Port for the front of the bearing for the left wheel lean pin
- (26) Port to the rod end of the left steering cylinder
- (27) Port to the left bearing of the steering bar
- (28) Port to the head end of the left steering cylinder
- (29) Port for the back of the bearing for the left wheel lean pin

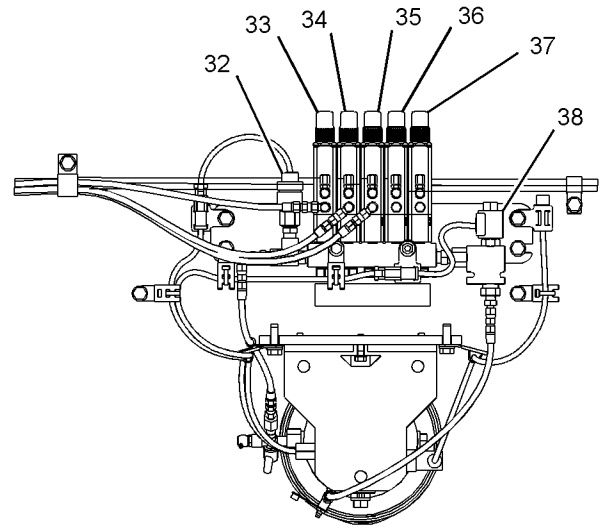


Illustration 63 g01408186

View of Area "C-C"

- (32) Pressure switch
- (33) Lubrication injector for lubrication distribution valve (3)
- (34) Lubrication injector for lubrication distribution valve (1)
- (35) Lubrication injector for lubrication distribution valve (2)
- (36) Lubrication injector for scarifier (if equipped)
- (37) Lubrication injector for ripper (if equipped)

Lubrication to Ripper (If Equipped)

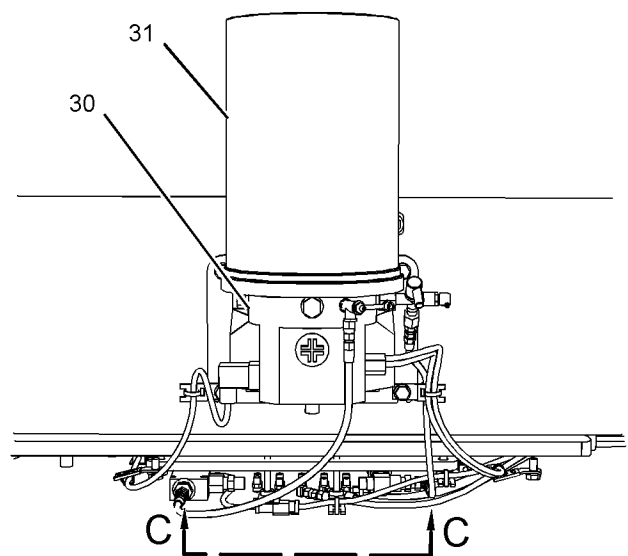


Illustration 62 g01408024

View of Area "B"

- (30) Lubrication pump
- (31) Lubrication tank

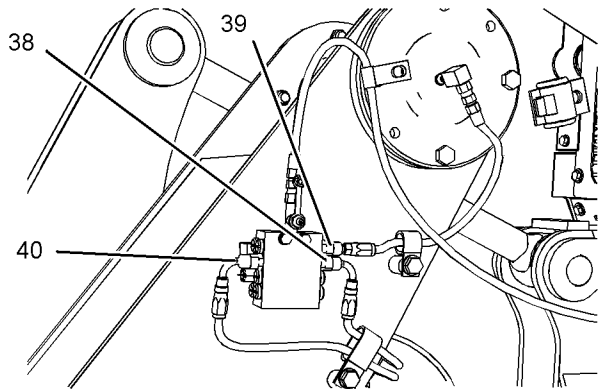


Illustration 64 g01408460

View of the ripper at rear of machine

- (38) Port for the left bearing
- (39) Port for the right bearing
- (40) Port for the pin

i03213628

General Information (Autolube System, If Equipped)

SMCS Code: 7000; 7540

S/N: B9H1-Up

S/N: R9H1-Up

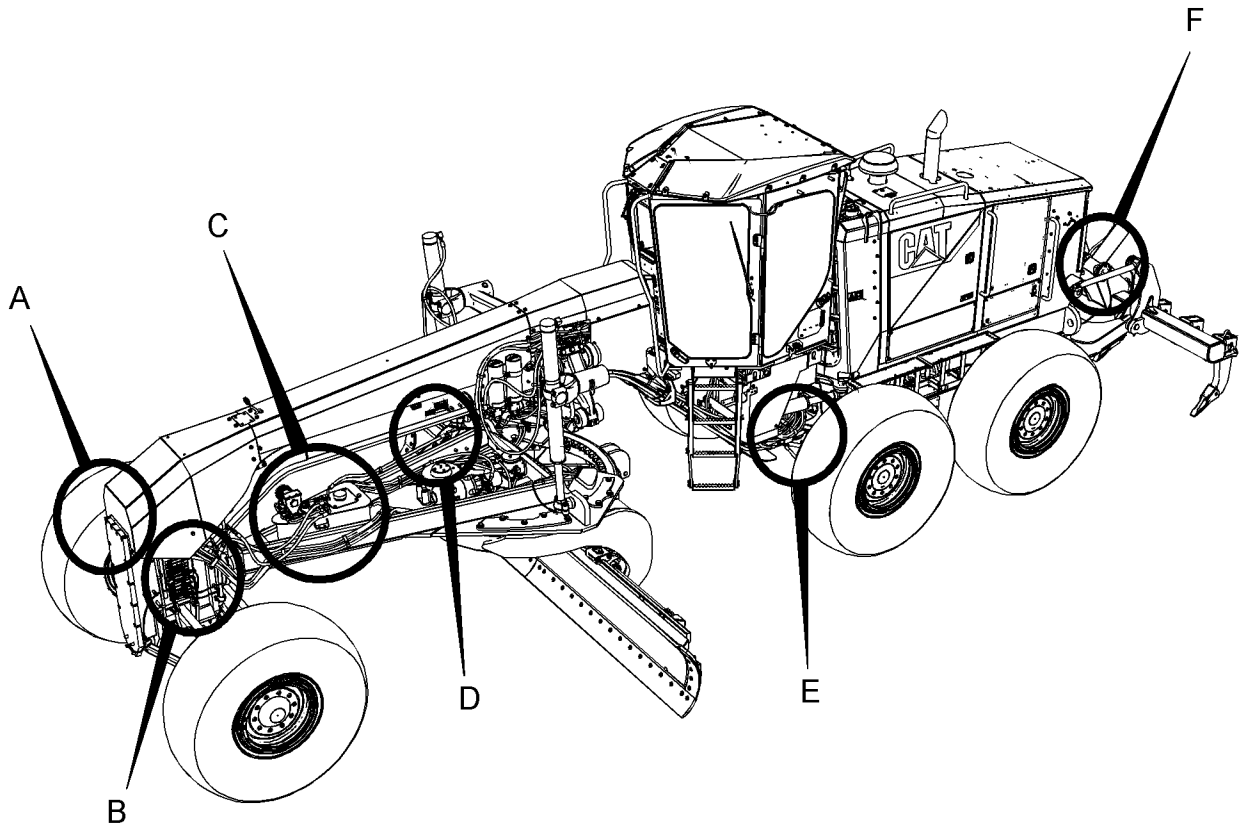


Illustration 65

Location of the lubrication system components

g01408708

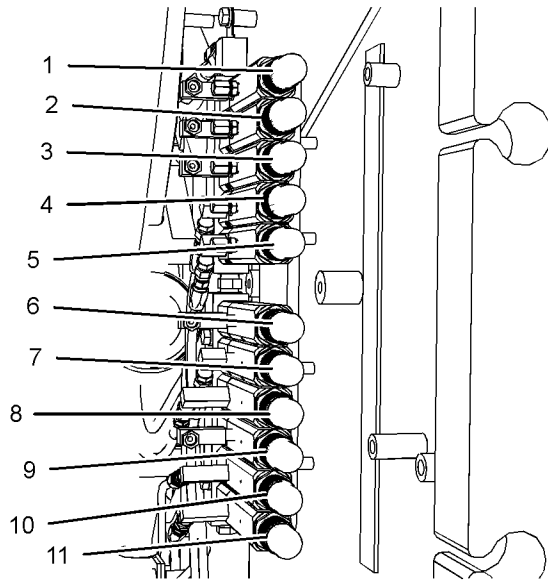


Illustration 66

g01408858

View of Area "A"

- (1) Port for the rod end of the wheel lean cylinder
- (2) Port for the upper bearing of the right steering pivot
- (3) Port for the bearing of the right lean arm
- (4) Port for the front bearing of the right axle mounting
- (5) Port for the rear bearing of the right axle mounting
- (6) Port for the rod end of the right steering cylinder
- (7) Port for the lower bearing of the right steering pivot
- (8) Port for the ball of the drawbar
- (9) Port for the right bearing on the steering link
- (10) Port for the cylinder end of the right steering cylinder
- (11) Port for the cylinder end of the wheel lean cylinder

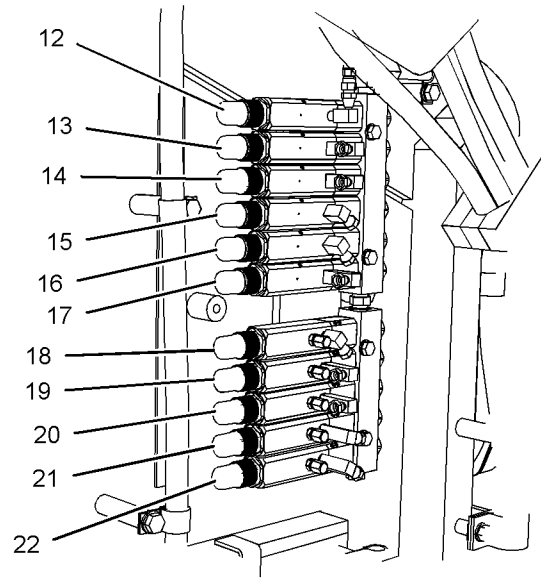


Illustration 67

g01409367

View of Area "B"

- (12) Port for the rod end of the center shift cylinder
- (13) Port for the upper bearing of the left steering pivot
- (14) Port for the bearing of the left lean arm
- (15) Port for the front bearing of the left axle mounting
- (16) Port for the rear bearing of the left axle mounting
- (17) Port for the rod end of the left steering cylinder
- (18) Port for the lower bearing of the left steering pivot
- (19) Port for the front bearing of the axle assembly
- (20) Port for the left bearing of the steering link
- (21) Port for the rear bearing of the axle assembly
- (22) Port for the cylinder end of the steering cylinder

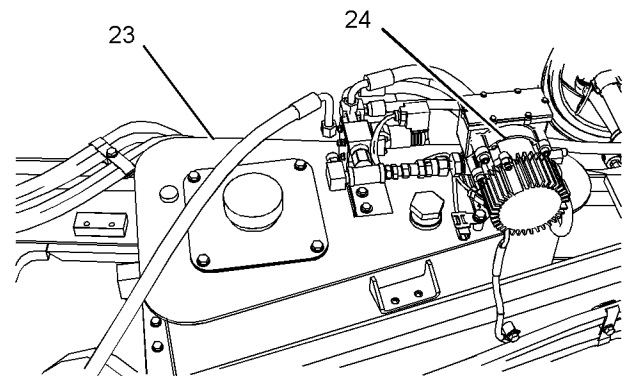


Illustration 68

g01409689

View of Area "C"

- (23) Lubrication tank
- (24) Electric pump motor

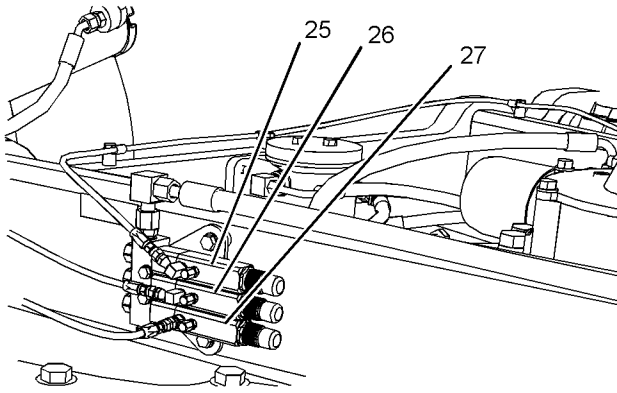


Illustration 69

g01409749

View of Area "D"

- (25) Port for the rod end of the left lift cylinder
- (26) Port for the cylinder end of the center shift cylinder
- (27) Port for the rod end of the right lift cylinder

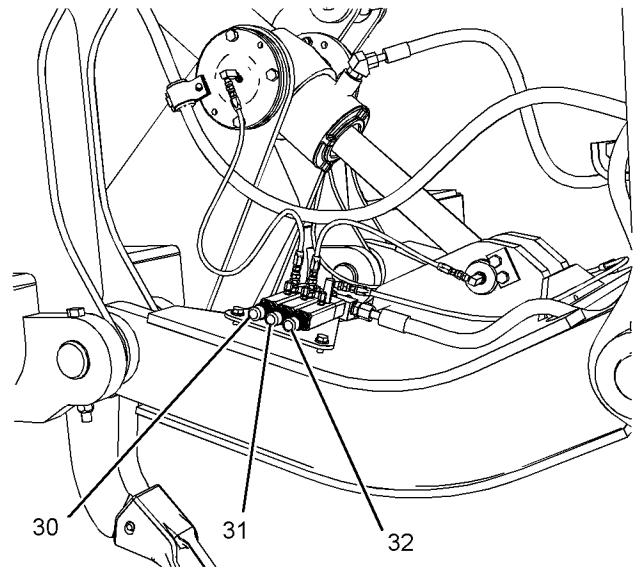


Illustration 71

g01409802

View of Area "F"

- (30) Port for the right bearing for the cylinder support
- (31) Port for the shaft of the rod end of the cylinder
- (32) Port for the left bearing of the cylinder support

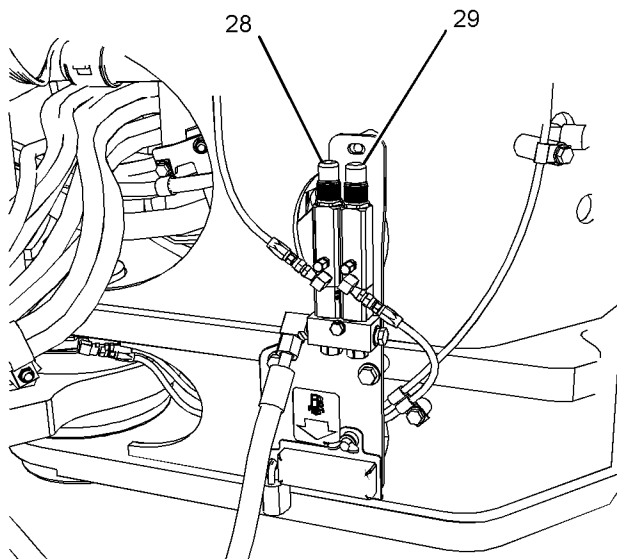


Illustration 70

g01409789

View of Area "E"

- (28) Port for the upper bearing of the articulation hitch
- (29) Port for the lower bearing of the articulation hitch

i03215429

General Information

SMCS Code: 7000; 7540

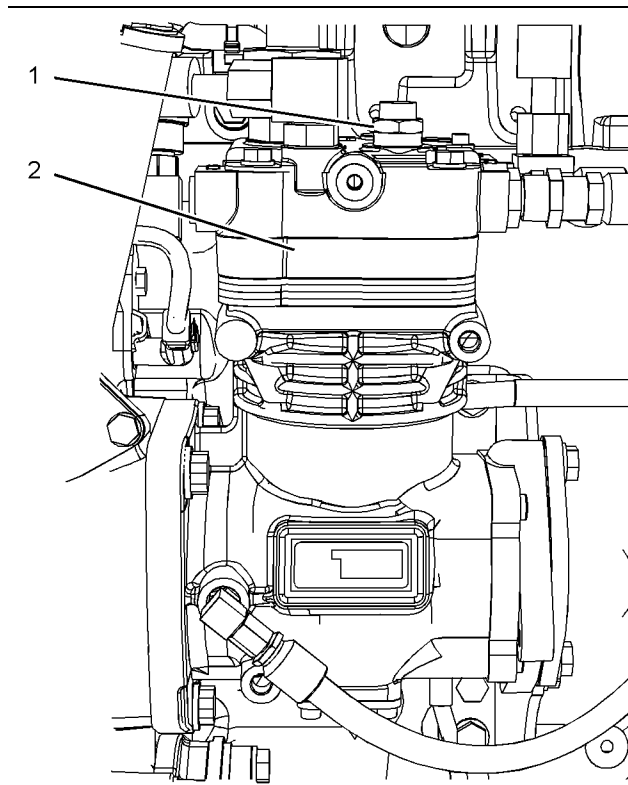


Illustration 72

g01280380

- (1) Relief valve
- (2) Air compressor

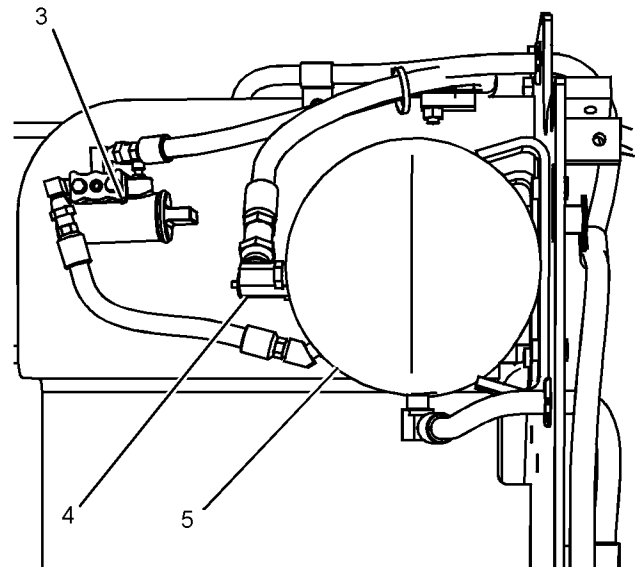


Illustration 73

g01116085

- (3) Air compressor governor
- (4) Relief valve
- (5) Air tank

The air system has two functions. The air system is used for the following functions:

- Inflate tires that are low.
- Blow off the machine.

Air compressor (2) is driven by the engine through the timing gears. Air compressor governor (3) regulates the air pressure for the system.

When the engine is started, the air compressor operates. The air compressor will operate until the pressure reaches the cut out pressure of the governor. At this pressure, the pressure air moves the piston in the air compressor governor. This allows the air to flow through the air compressor governor. Then, the air flows to the unloading valves in the air compressor. Pressurized air will hold the unloading valves open in order to stop the flow of air from the air compressor.

The pressurized air in the air tank (5) provides the signal to the governor. When the system air pressure reaches the cut-in pressure setting, the force of the spring in the governor moves the piston in the governor. This action stops the flow of air to the unloading valve. The unloading valves close and the air compressor will send air to the air tank.

Relief valve (4) is located in air tank (5). If the governor does not operate correctly, relief valve (4) will open in order to prevent damage to the air system.

Relief valve (1) is located on air compressor (2). If both the governor (3) and the relief valve (4) fail, relief valve (1) will open in order to prevent damage to the air system.

Note: For more information on the relief valve settings, refer to the Specifications section.

i02822930

Lubrication System (If Equipped)

SMCS Code: 7540

S/N: B9J1–Up

S/N: R9J1–Up

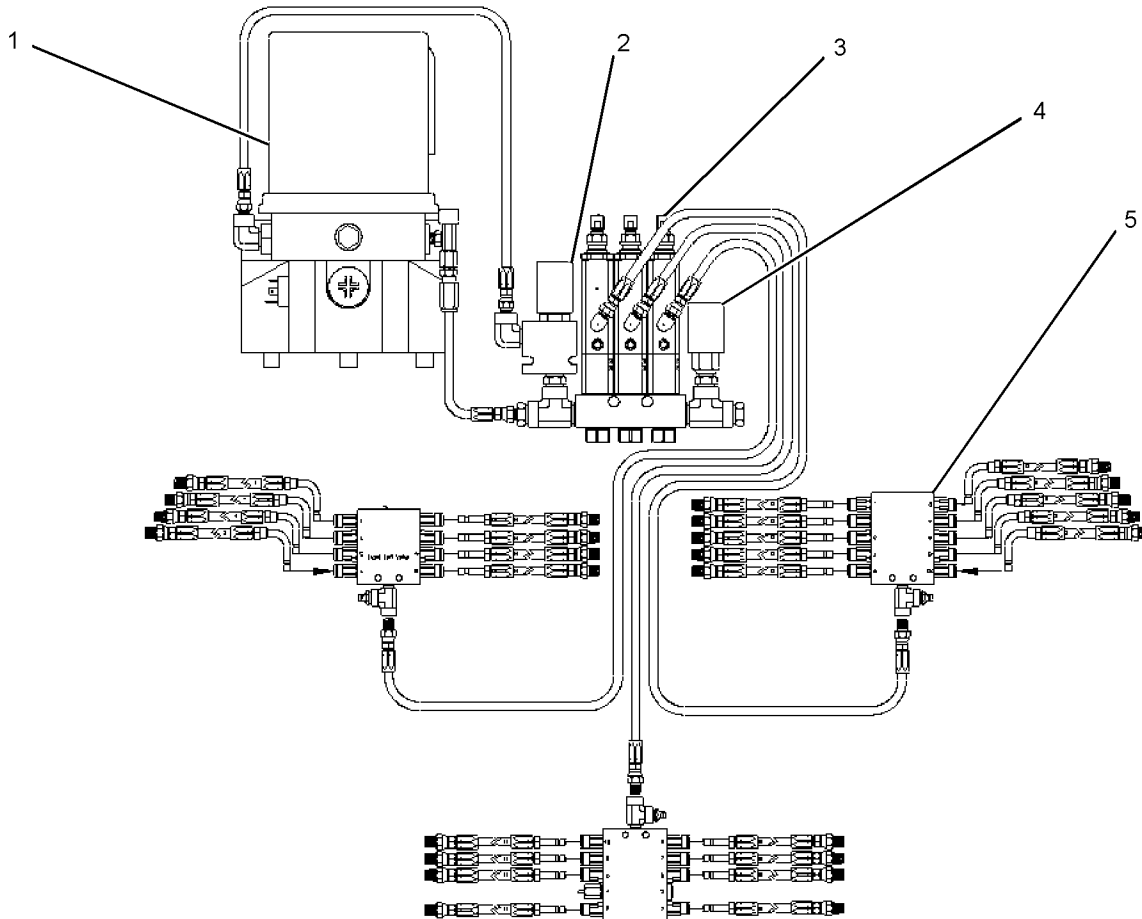


Illustration 74

g01410328

Typical Example

(1) Automatic lubrication pump
(2) Solenoid valve

(3) Lubrication injectors
(4) Pressure switch

(5) Distribution valve

Automatic lubrication pump (1) supplies lubricant to lubrication injectors (3). The lubrication injectors supply lubricant to distribution valves (5). Distribution valve (3) dispenses lubricant to the bearings and joints of the machine.

Note: The number of distribution valves may vary per machine.

The automatic lubrication pump is equipped with an integrated timer. When the timer reaches the preset value the pump will turn ON. Solenoid valve (2) will turn ON. Solenoid valve (2) will close the path of the lubricant to the tank. Pump (1) will dispense lubricant to injectors (3). Lubrication injectors (3) will dispense lubricant to distribution valves (5) when the pressure of the lubricant is at 12400 kPa (1800 psi).

Distribution valves (5) dispense the lubricant to the joints and bearings of the machine. Pressure switch (4) will turn the pump OFF when the pressure setting has been reached. The supply line will remain pressurized for a period of time until the duration of the timer. Solenoid valve (2) will turn OFF when the timer for the pump turns OFF. Solenoid valve (1) will open and the lubricant will flow back to the tank. The pressure in the supply line will drop and the injectors and the pressure switch will reset for the next lubrication cycle.

Lubrication Injectors

When the pump is activated, the lubrication injectors will cycle one time. A complete cycle for the injectors consists of four stages.

Stage 1

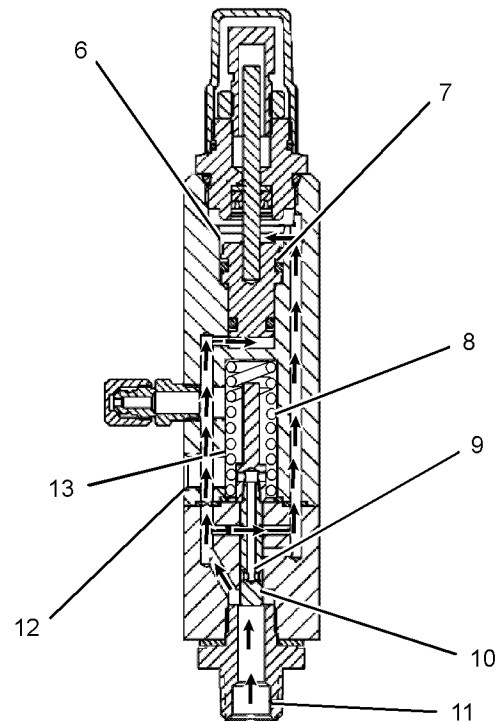


Illustration 75

g01410639

Stage 1

- (6) Measuring chamber
- (7) Piston for the injection
- (8) Spring
- (9) Valve port
- (10) Slide valve
- (11) Supply port for the lubricant
- (12) Outlet port
- (13) Discharge chamber

The injector is in the normal position or the rest position. Discharge chamber (13) is filled with lubricant from the previous cycle. Lubricant is directed to both sides of piston (7) through the port in slide valve (10).

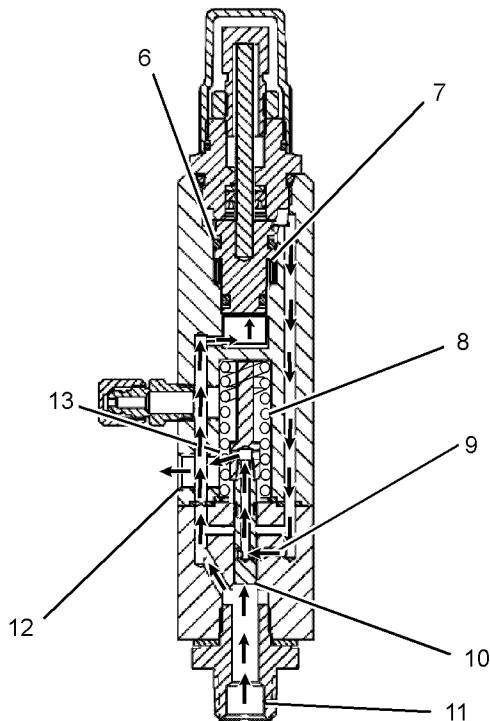
Stage 2


Illustration 76

g01410647

Stage 2

- (6) Measuring chamber
- (7) Piston for the injection
- (8) Spring
- (9) Valve port
- (10) Slide valve
- (11) Supply port for the lubricant
- (12) Outlet port
- (13) Discharge chamber

Slide valve (10) will move up when the lubrication pressure builds up. Lubricant will flow past the slide valve to the bottom of piston (7). Piston (7) will move up. This will force lubricant from measuring chamber (6) through outlet port (12). The discharge from outlet port (12) will provide lubricant to the bearing or the joint.

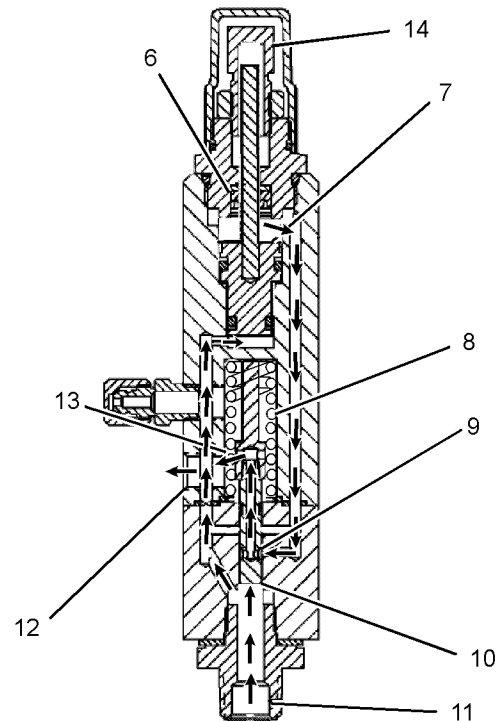
Stage 3


Illustration 77

g01410648

Stage 3

- (6) Measuring chamber
- (7) Piston for the injection
- (8) Spring
- (9) Valve port
- (10) Slide valve
- (11) Supply port for the lubricant
- (12) Outlet port
- (13) Discharge chamber
- (14) Adjustment screw

Piston (7) will dispense lubricant until the indicator stem hits the stop of adjusting screw (14). Adjusting screw (14) can adjust the volume of lubricant that is dispensed. Piston (7) and slide valve (10) will remain in the same position until the supply line is vented.

Stage 4

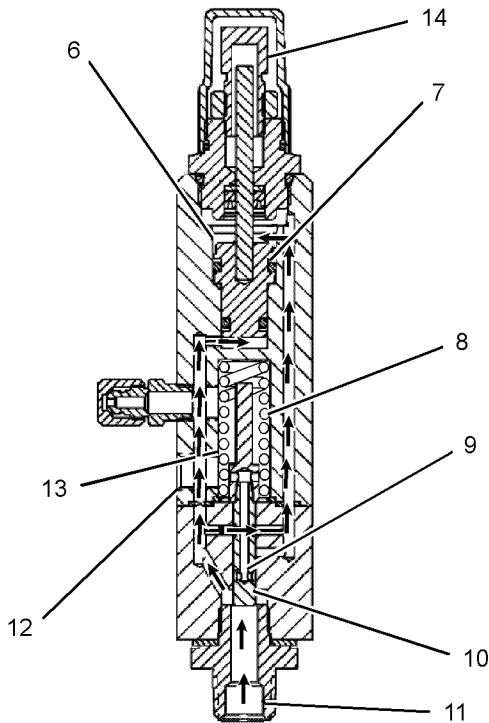


Illustration 78

g01410649

Stage 4

- (6) Measuring chamber
- (7) Piston for the injection
- (8) Spring
- (9) Valve port
- (10) Slide valve
- (11) Supply port for the lubricant
- (12) Outlet port
- (13) Discharge chamber
- (14) Adjustment screw

After venting, spring (8) expands. This will move slide valve (10) so that passage (9) is closed. The lubrication pressure acts on both sides of piston (7). This causes piston (7) to move down. Some of the lubricant on the bottom of the piston will move across the slide valve and to the top of the piston into measuring chamber (6). The injector is now ready for the next cycle.

i02920614

Lubrication System

SMCS Code: 7540

S/N: B9H1-Up

S/N: R9H1-Up

Pump Operation

The lubrication system consists of the lubrication pump and lubrication injectors. The pump is driven by an electric motor. The pump cycles ON and OFF. The pump supplies the injectors with grease. The injectors supply lubricant to bearings and to joints.

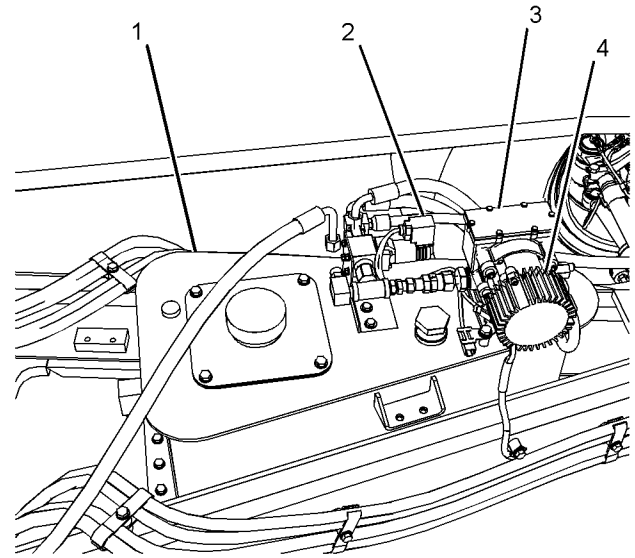


Illustration 79

g01410087

- (1) Lubrication tank
- (2) Solenoid valve for venting
- (3) Lubrication pump
- (4) Electric motor

In the default setting, the electric motor (4) is cycled on every 120 minutes of machine operation. The lubrication cycle duration and the delay time can be adjusted using Caterpillar Electronic Technician (ET). Electric motor (4) drives lubrication pump (3). Lubrication pump (2) will provide lubricant that is pressurized to the injectors. The lubrication pump (3) will activate for a duration of 240 seconds. Solenoid valve (2) will activate. Solenoid valve (2) will vent the grease at 18600 kPa (2700 psi). Pump (3) will turn OFF when solenoid valve (2) is venting. The cycle will be repeated at the next 120 minute interval of machine operation.

Electrical Operation

The transmission Electronic Control Module (ECM) uses the following two inputs for the Autolube system:

- Autolube pressure sensor
- Machine Speed

Before the pump can run through a complete cycle, the status of the Autolube system must be set to **INSTALLED**. Cat ET must be used in order to change the parameter in the transmission ECM. By using Cat ET, the following parameters will also be able to be customized: interval of Autolube, duration of Autolube and minimum Autolube pressure. All of these values will have default settings. All of these settings are able to be changed in order to match specific applications.

The transmission ECM keeps track of the amount of time that has passed since the last lubrication cycle. The transmission will not energize the Autolube relay in order to begin a new cycle until the correct amount of time has passed since the last lubrication cycle. The transmission ECM will also make sure that the machine speed is above zero before starting the next lubrication cycle.

The transmission ECM keeps track of the amount of time that has passed since the lubrication cycle has started. If the minimum Autolube pressure is reached within the preset time, the transmission ECM will end the lubrication cycle. If the preset minimum lubrication pressure is not met in the time that is specified, the lubrication cycle will be aborted. This will activate the E334 Low Autolube Pressure event.

The transmission ECM is constantly monitoring the lubrication pressure in the system while the Autolube system is not active. If the lubrication pressure does not drop below 7600 kPa (1100 psi) before the next cycle, the E521 Auto Lube Pressure Not Decreasing After Cycle event will be activated.

Note: The Monitoring System may be used to cycle the Autolube system manually.

Lubrication Injectors

When the pump is activated, the lubrication injectors will cycle one time. A complete cycle for the injectors consists of four stages.

Stage 1

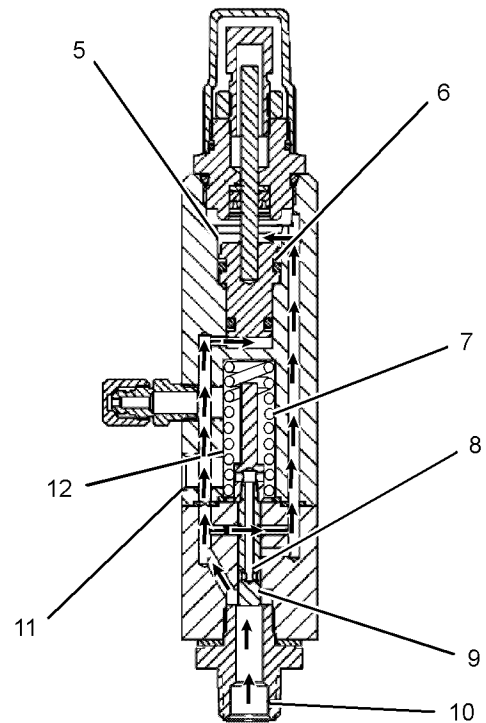


Illustration 80

g01410269

Stage 1

- (5) Measuring chamber
- (6) Piston for the injection
- (7) Spring
- (8) Valve port
- (9) Slide valve
- (10) Supply port for the lubricant
- (11) Outlet port
- (12) Discharge chamber

The injector is in the normal position or the rest position. Discharge chamber (12) is filled with lubricant from the previous cycle. Lubricant is directed to both sides of piston (6) through the port in slide valve (9).

Stage 2

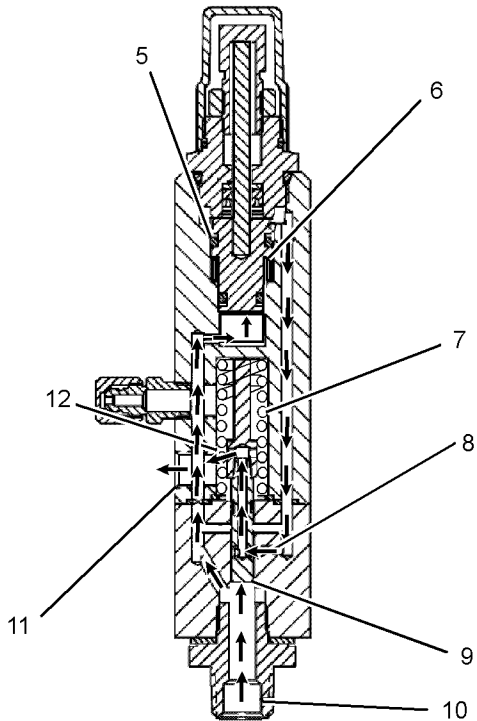


Illustration 81 g01410278

Stage 2

- (5) Measuring chamber
- (6) Piston for the injection
- (7) Spring
- (8) Valve port
- (9) Slide valve
- (10) Supply port for the lubricant
- (11) Outlet port
- (12) Discharge chamber

Slide valve (9) will move up when the lubrication pressure builds up. Lubricant will flow past the slide valve to the bottom of piston (6). Piston (6) will move up. This will force lubricant from measuring chamber (5) through outlet port (11). The discharge from outlet port (11) will provide lubricant to the bearing or the joint.

Stage 3

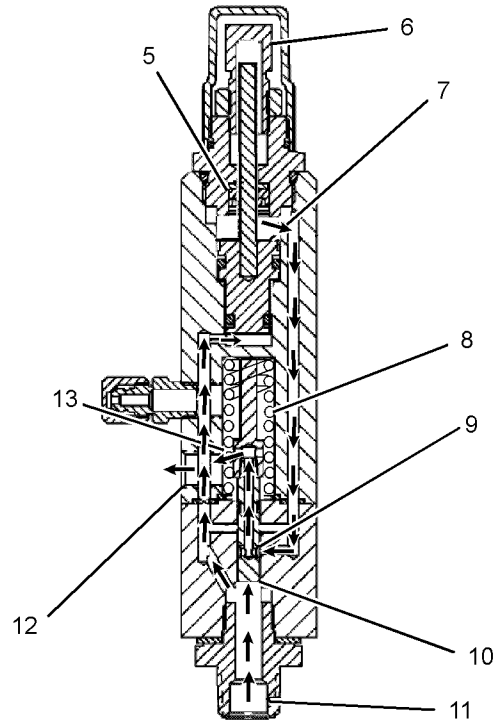


Illustration 82 g01451641

Stage 3

- (5) Measuring chamber
- (6) Adjustment screw
- (7) Piston for the injection
- (8) Spring
- (9) Valve port
- (10) Slide valve
- (11) Supply port for the lubricant
- (12) Outlet port
- (13) Discharge chamber

Piston (7) will dispense lubricant until the indicator stem hits the stop of adjusting screw (6). Adjusting screw (6) can adjust the volume of lubricant that is dispensed. Piston (7) and slide valve (10) will remain in the same position until the supply line is vented.

Stage 4

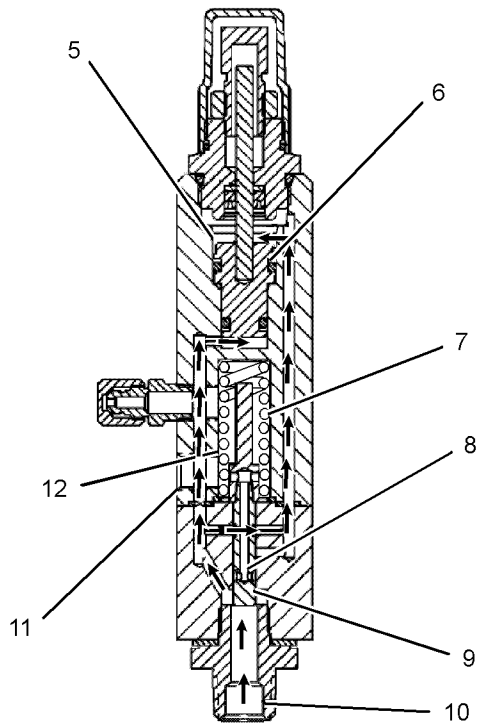


Illustration 83

g01452201

Stage 4

- (5) Measuring chamber
- (6) Piston for the injection
- (7) Spring
- (8) Valve port
- (9) Slide valve
- (10) Supply port for the lubricant
- (11) Outlet port
- (12) Discharge chamber

After venting, spring (7) expands. This will move slide valve (9) so that passage (8) is closed. The lubrication pressure acts on both sides of piston (6). This causes piston (6) to move down. Some of the lubricant on the bottom of the piston will move across the slide valve and to the top of the piston into measuring chamber (5). The injector is now ready for the next cycle.

Testing And Adjusting Section

Troubleshooting

i02490916

General Information

SMCS Code: 7000; 7540-035

Visual inspections are the first steps in order to troubleshoot a problem. When the visual inspections are complete and the problem is not fully understood, perform operational checks. After visual inspections and operational checks are complete and the problem is not fully understood, perform test procedures. These procedures will help identify system problems. These procedures are located in the Testing and Adjusting module for your machine.

For the locations of your individual system components, refer to the Systems Operation module for your machine.

For more information on the electrical system, refer to the Electrical Schematic for your machine.

For more information on the hydraulic system, refer to the Hydraulic Schematic for your machine.

i02804131

Machine Preparation for Troubleshooting

SMCS Code: 7540-035

WARNING

Personal injury or death can result from sudden machine movement.

Sudden movement of the machine or release of oil under pressure can cause injury to persons on or near the machine.

To help prevent possible injury, perform the procedure that follows before testing and adjusting the hydraulic and steering system:

WARNING

Check valves in the hydraulic system may allow pressure to exist in the hydraulic lines after the engine has been stopped. Pressure must be relieved prior to servicing the components of the hydraulic system. Failure to relieve pressure prior to servicing may result in personal injury.

NOTICE

Care must be taken to ensure that fluids are contained during performance of inspection, maintenance, testing, adjusting and repair of the product. Be prepared to collect the fluid with suitable containers before opening any compartment or disassembling any component containing fluids.

Refer to Special Publication, NENG2500, "Caterpillar Dealer Service Tool Catalog" for tools and supplies suitable to collect and contain fluids on Caterpillar products.

Dispose of all fluids according to local regulations and mandates.

1. Move the machine to a smooth horizontal location. Move away from operating machines and move away from all personnel. Lower all implements to the ground. Place the joystick control for the blade lift control valve in the FLOAT position.
2. Install the wheel lean locking bolt in the front axle. Install the frame lock pin. Engage the parking brake and stop the engine.
3. Permit only one operator on the machine. Keep all other personnel away from the machine. Also, all personnel should be visible to the operator.
4. Place chocks in front of the wheels and behind the wheels.
5. Make sure that all hydraulic pressure is released before you perform any of the following procedures:
 - Loosen any fitting, any hose, or any component.
 - Tighten any fitting, any hose, or any component.
 - Remove any fitting, any hose, or any component.
 - Adjust any fitting, any hose, or any component.

6. After the pressure in the system has been released, carefully loosen fittings and remove lines or components.

i02490923

Visual Inspection

SMCS Code: 7540-535

A visual inspection of the automatic lubrication system and components is the first step in diagnosing a problem. Stop the engine. Lower attachments to the ground. Make the following inspections:

1. Inspect the lubrication injector banks and all of the lubrication lines for lubrication leaks.
2. Inspect all of the hydraulic lines and all of the connections for damage and for leaks.
3. Inspect the electrical system for worn wiring or frayed wiring. Also, inspect the electrical system for damaged connectors or a bad fuse.

i02932353

Automatic Lubrication System Troubleshooting

SMCS Code: 5057-035; 7540-035

A problem must be identified and the problem must be defined before the problem can be corrected. When the problem is identified and the problem is defined proceed to the "Performance Checks" section. The following procedure should be used in order to help identify the problem. Also, use the following procedure in order to define the problem.

1. Perform visual checks in order to help identify the problem.
2. Check within "Performance Checks" in order to help identify the problem.

Note: The grade of grease needs to be matched to the ambient temperature in order to prevent possible damage to the pump and damage to the system.

Performance Checks

Problem: No lubricant at bearing

Probable Cause

- Broken lube line or restricted lube line
- An empty lubricant tank
- The injector is malfunctioning.

- The lubricant pump is malfunctioning.
- The injector needs to be adjusted.

Problem: There is excessive lubricant escaping from the injector

Probable Cause

- The internal seals are worn in the injector.

Problem: Pump pressure rises very slowly or there is no pump pressure

Probable Cause

- An empty lubricant tank
- No pulsing signal at the solenoid valve
- The lubricant pump is operating at a temperature that is too high for the viscosity of the grease.
- The solenoid valve is inoperative.
- The lubricant supply line has breaks or leakage.
- Failed lubricant pump
- The electric motor to the lubricant pump has failed.
- The electric signal to the motor has failed.

Problem: The lubricant pump does not run

Probable Cause

- The solenoid valve is inoperative.
- Failed electrical system
- Failed lubricant pump
- The electric signal to the motor has failed.

Testing and Adjusting

i04032629

Timer (Cycle) - Adjust

SMCS Code: 7540-025

S/N: B9H1–Up

S/N: R9H1–Up

Introduction

The following procedure is used in order to adjust the timer cycle for the Autolube system.

Required Tools

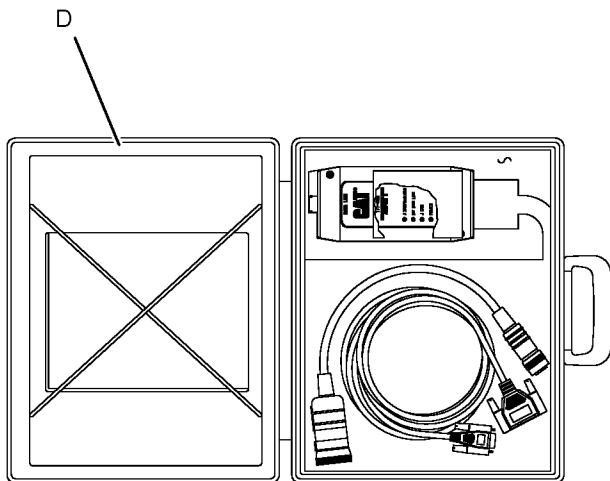


Illustration 84

g02112000

Table 27

Required Tools		
Tool	Description	Qty
D	Caterpillar Electronic Technician (ET)	1

Machine Preparation

Reference: Before you perform this adjustment, refer to Testing and Adjusting, “Machine Preparation for Troubleshooting”.

1. Stop the machine on a hard level surface. Move the transmission control lever to the NEUTRAL position. Shut off the engine. Place blocks in front of the wheels and place blocks behind the wheels.

2. Engage the parking brake.
3. Connect tooling (D) to the machine. In order to configure the settings for the lubrication, go to the transmission/chassis Electronic Control Module (transmission/chassis ECM) in Cat ET. Select “Lube Parameters” in order to configure the settings for the lubrication system.

Adjustment Procedure

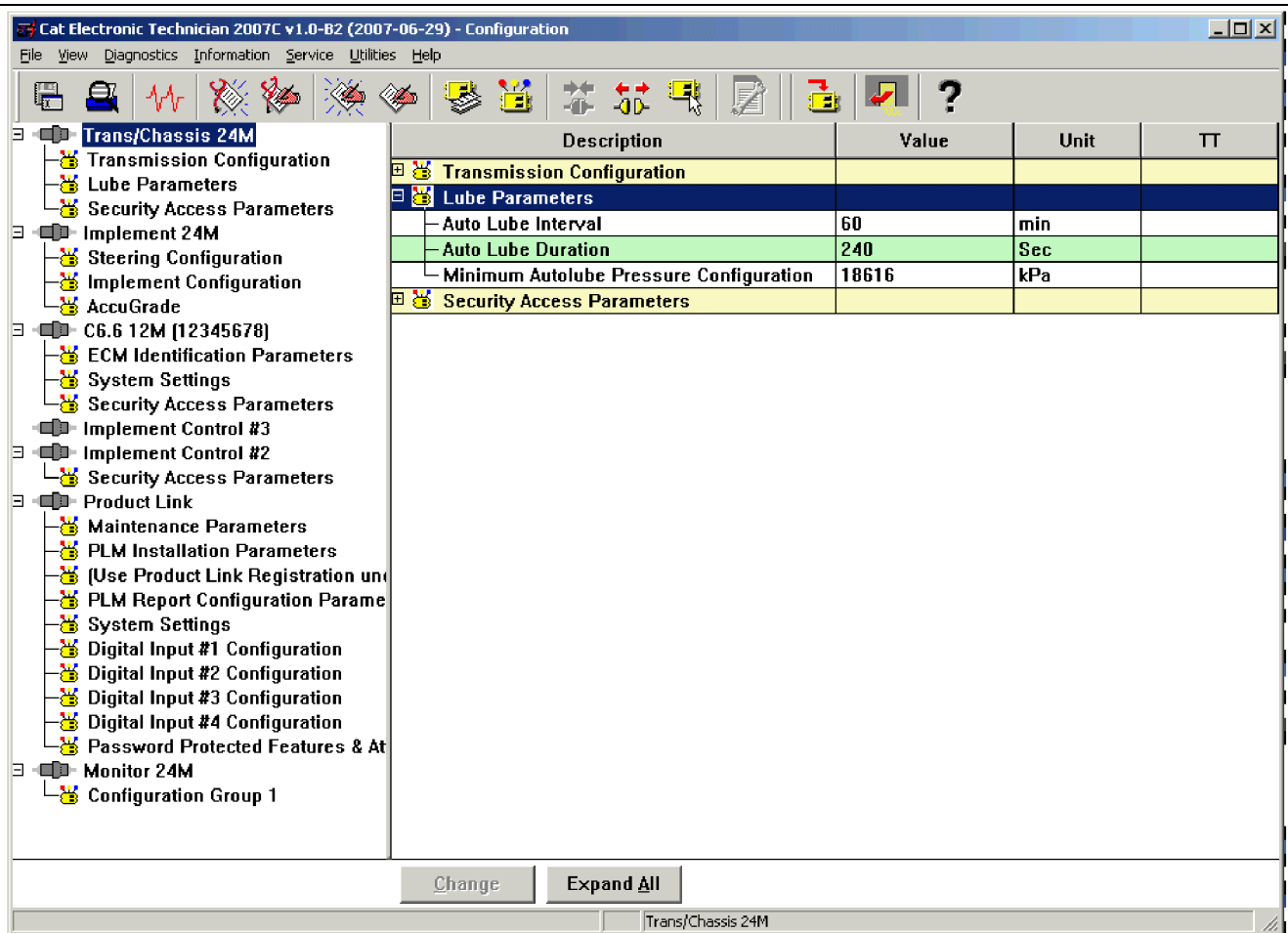


Illustration 85

g01400210

Typical Example

The interval between the lubrication cycles has a default setting of 120 minutes. The cycle time can be adjusted using Caterpillar Electronic Technician (ET).

The default setting for the duration of the lubrication pump is 240 seconds. The default setting can be adjusted with Cat ET. The pressure setting for the lubrication pump to turn OFF can also be changed in Cat ET. The default pressure setting is 18616 kPa (2700 psi).

i04032569

Lubrication Injectors - Check and Adjust

SMCS Code: 7540-025; 7540-535; 79PK-025; 79PK-535

Introduction

The following procedure is used in order to adjust the amount of lubricant that is supplied by the automatic lubrication system.

Machine Preparation

Reference: Before you perform this adjustment, refer to Testing and Adjusting, “Machine Preparation for Troubleshooting”.

1. Stop the machine on a hard level surface. Move the transmission control lever to the NEUTRAL position. Shut off the engine. Place blocks in front of the wheels and place blocks behind the wheels.
2. Engage the parking brake.

Adjustment Procedure

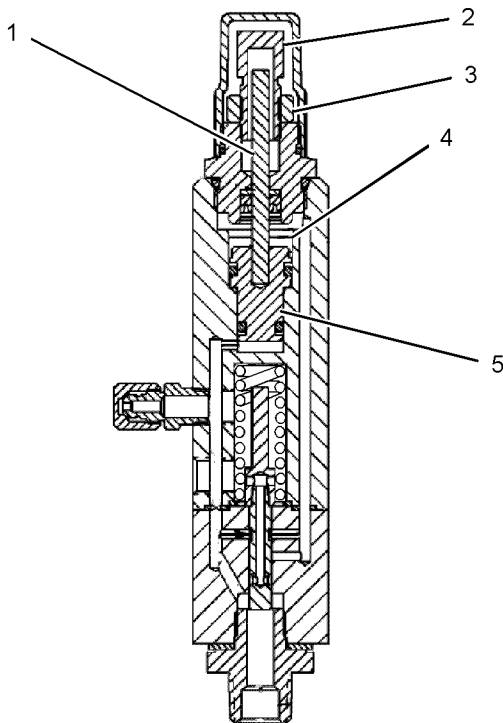


Illustration 86

g01400182

- (1) Stem
- (2) Adjustment screw
- (3) Locknut
- (4) Discharge chamber
- (5) Piston

The amount of lubricant that is supplied to the bearing is determined by the volume of discharge chamber (4). This volume is controlled by adjustment screw (2). Adjustment screw (2) controls the travel of piston (5). When you turn adjustment screw (2) clockwise, the lubricant that is injected decreases. When you turn adjustment screw (2) counterclockwise, the lubricant that is injected increases.

Movement of stem (1) indicates that the injector is working. When the injector discharges lubricant, stem (1) moves into the body of adjustment screw (2). When the injector is filling with lubricant, stem (2) moves back out of the body of adjustment screw (1) until piston (5) rests against the stop.

If an injector has been repaired or an injector has been replaced, proper adjustment of the measuring chamber is required. Proper adjustment of adjustment screw (2) and the measuring chamber will depend on the bearing that is being lubricated.

Note: The lubrication system should be in the vented condition when the injectors are adjusted. Make sure that the lines are not pressurized when the injectors are adjusted.

1. Remove the cap that covers adjustment screw (2) and loosen locknut (3).
2. Hand tighten adjustment screw (2) clockwise into the lubrication injector. Turn adjustment screw (2) counterclockwise to the specified number of turns.
3. Tighten locknut (3) to 75 ± 10 N·m (55 ± 7 lb ft) after the adjustment has been made. Replace the cap.

i06595586

Front Spindle - Test

SMCS Code: 4305-081; 4313-081; 5225-081

S/N: B9H1-Up

S/N: R9H1-Up

Reference: Refer to Special Instruction, M0068684, “Procedure for Ultrasonic Inspection of Front Spindles for Certain 16H, 16M, and 16M 3 Motor Graders”.

i08197118

Axle Toe-In (Front) - Adjust

SMCS Code: 4313-025

Introduction

The following procedure will explain the steps for adjusting the front axle toe-in.

Before you perform this adjustment, refer to Testing and Adjusting, “Machine Preparation”.

Required Tools

Table 28

Tool	Part Number	Description	Qty
F	1U-9366	Automatic Tape Measure	1

Adjustment Preparation

1. Move the machine to a smooth horizontal location.
2. Chock the wheels.
3. Lower all of the implements.
4. Raise the front wheels off the ground.
5. Stop the engine.
6. Install the wheel lean locking bolt into the lean bar.

Adjustment Procedure

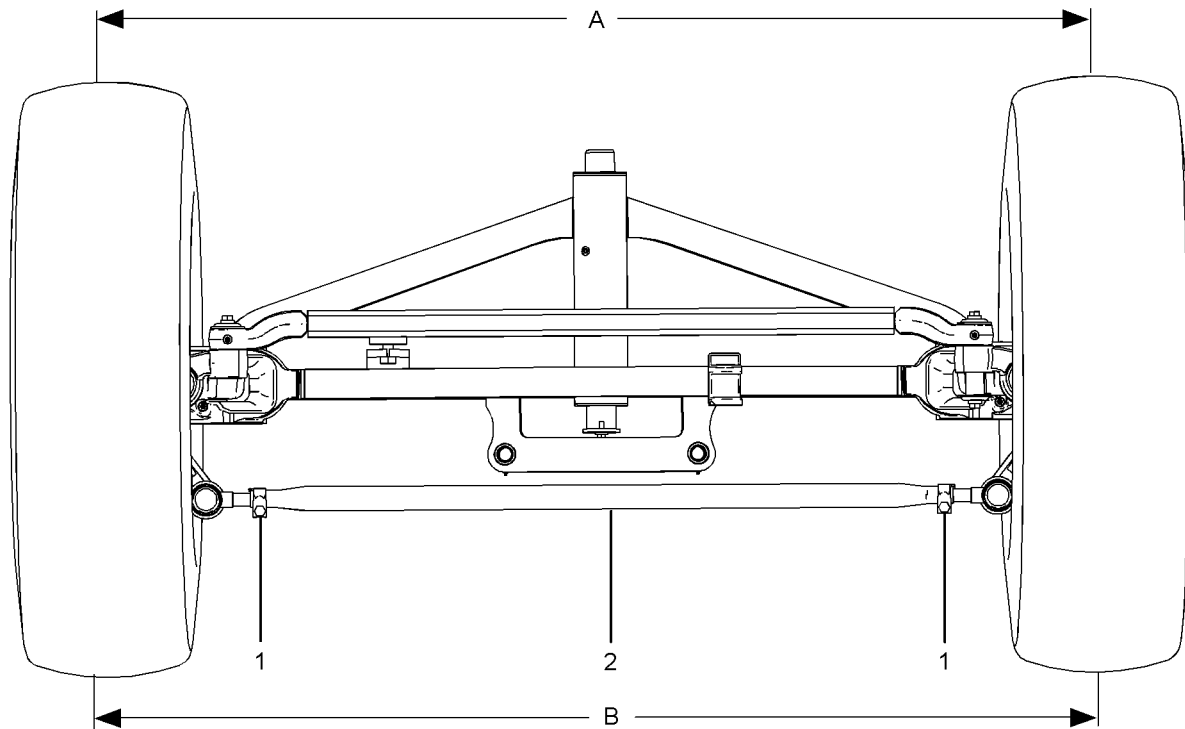


Illustration 87

g01100244

Top view of the front axle

- (1) Clamps
(2) Tie rod
- (A) Distance
(B) Distance

1. Attach a short level with a magnetic base to the outside of each front wheel spindle or rim.
2. Rotate the tires until the levels are both horizontal. Mark a V on the front of each front tire at spindle height near the center of the tread.
3. With Tooling (F) measure the distance (A) between the V marks on each tire. Use the sharp point on the inside of each V for the measuring points.
4. Without touching the levels, rotate the tires so that the V marks are at the rear and the levels are again horizontal.
5. With Tooling (F) measure the distance (B) between the V marks.
6. Compare measurements (A) and (B). The toe-in is correct if measurement (A) at the front of the front tires is less than the measurement (B) at the rear of the front tires. Measurement (A) should be 6.0 ± 3.0 mm (0.24 ± 0.12 inch) smaller than measurement (B).
7. Adjust the toe-in, as needed. Loosen clamps (1) on tie rod (2). Rotate tie rod (2) in the direction that is needed in order to achieve the correct toe-in for the front wheels. When the toe-in adjustment is correct, orient clamps (1), as shown. Tighten clamps (1) to the specified torque.
8. After the adjustment is complete, remove tooling (F).
9. Start the engine and lower the front wheels to the ground.

i08197121

Governor (Air Compressor) - Test and Adjust

SMCS Code: 1804-081; 1804-025

S/N: B9J1-Up

S/N: R9J1-Up

Introduction

The following procedure is used to adjust the governor for the air compressor.

Required Tools

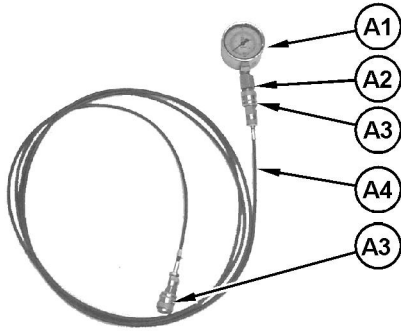


Illustration 88

g01089423

Table 29

Tool	Item	Part No	Description	Qty
A	A1	8T-0854	Pressure Gauge (0 to 1,000 kPa (0 to 145 psi))	1
	A2	6V-3989	Fitting	1
	A3	6V-4143	Quick Connect Coupler	2
	A4	177-7860	Hose As (3.0 m (10 ft))	1
D	D1	3B-7722	Pipe Bushing	1
	D2	6V-3966	Fitting As	1

Machine Preparation

1. Stop the machine on a hard level surface. Move the transmission control lever to the NEUTRAL position. Shut off the engine. Place blocks in front of the wheels and place blocks behind the wheels.
2. Engage the parking brake.

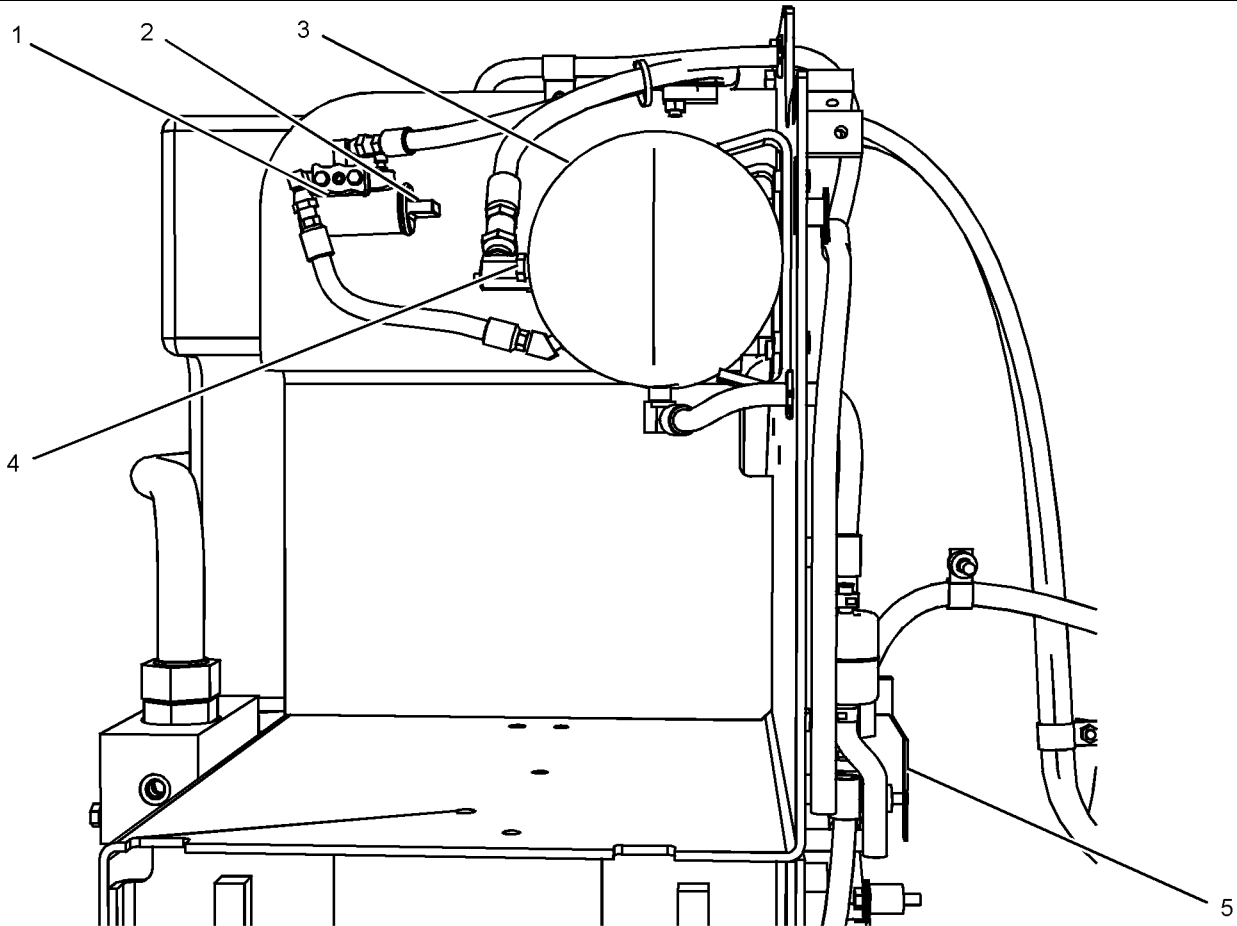


Illustration 89

g01115757

3. Open drain valve (5) to release the air pressure from air tank (3).
4. Remove plug (4) from air tank (3) and install Tooling (C).
5. Connect Tooling (A) to Tooling (C).

Test Procedure

1. Start the engine. Allow the air pressure to increase to the cut-out pressure. Record the pressure. Refer to Specifications, "Governor (Air Compressor)" for the correct cut-out pressure.
2. Slowly open drain valve (5). Continue to release air pressure from air tank (3) until the air compressor turns on. Record the pressure. Refer to Specifications, "Governor (Air Compressor)" for the correct cut-in pressure.

Adjustment Procedure

1. If necessary, make the following adjustments to air compressor governor (1) :

- a. With the engine off, remove cover (2).
 - b. Loosen the locknut on the adjustment screw.
 - c. Turn the adjustment screw counterclockwise in order to raise the cut-out pressure.
 - d. Turn the adjustment screw clockwise in order to lower the cut-out pressure.
 - e. Start the engine and check the pressure again.
2. If the adjustment screw does not change the cut-out pressure, the unloading valves in the air compressor are operating incorrectly.
 3. If the difference between the cut-in pressure and the cut-out pressure is incorrect, the air compressor governor is operating incorrectly.
 4. Stop the engine.
 5. Open drain valve (5) in order to remove the air pressure from air tank (3).
 6. Remove the test equipment and install plug (4) into the original position.

7. Close drain valve (5).

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