SERVICE MANUAL

Road Graders RG80 - RG100
Section 01 Engine



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RG 80 and RG100 ROAD GRADER
Service Manual
75131049
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SAFETY PRECAUTION INFORMATION

UNSAFE OPERATING PRACTICES AND IMPROPER USE OF THE MACHINE AND ITS ATTACHMENTS ON THE PART OF THE OPERATOR OR SERVICE TECHNICIAN CAN RESULT IN INJURIES. OBSERVE THE FOLLOWING SAFETY PRECAUTIONS AT ALL TIMES:

1. **FOR SERVICING, THE LOADER SHOULD BE ON LEVEL TERRAIN, ENGINE STOPPED WITH THE WHEELS BLOCKED OR THE ENTIRE MACHINE SOLIDLY SUPPORTED WITH THE WHEELS OFF THE GROUND BEFORE SERVICING ANY COMPONENT OF THE DRIVETRAIN.**

2. **FOR SERVICING UNDER THE OPERATOR'S SEAT, RAISE THE SEAT AND PAN ASSEMBLY TO THE RAISED LATCHED POSITION AND SECURELY LATCH.**

3. **DO NOT OPERATE THE MACHINE UNLESS THE SEAT IS LATCHED IN THE OPERATE POSITION.**

4. **DO NOT SERVICE THE MACHINE WITH A RAISED BOOM UNLESS THE BOOM IS RESTING ON BOOM LOCK PINS OR CYLINDER LOCKING TOOLS OR FIXTURES.**

5. **DO NOT SERVICE THE LOADER WITH THE ENGINE RUNNING UNLESS THE LOADER IS PROPERLY AND SECURELY SUPPORTED WITH ALL FOUR WHEELS OFF THE GROUND.**

6. **USE CAUTION WHEN SERVICING THE UNIT AROUND MOVING PARTS.**

7. **DO NOT TILT THE BOOM AND CAB WITHOUT PROPER INSTRUCTION.**

8. **DO NOT TILT THE BOOM AND CAB WITHOUT USING THE PROPER CAB TILTING TOOL.**

9. **REINSTALL ALL SHIELDS REMOVED FOR SERVICE.**

10. **NEVER LOOSEN ANY HYDRAULIC CONNECTIONS BEFORE RELIEVING THE PRESSURE IN THE HYDRAULIC SYSTEM.**

11. **WEAR EYE PROTECTION SUCH AS GOGGLES, ETC.**

12. **WEAR EAR PROTECTION SUCH AS EARPLUGS, ETC. WHEN YOU FEEL THE NOISE LEVEL IS UNCOMFORTABLE.**

13. **IF ANY SERVICING OR ADJUSTMENTS REQUIRE THE BATTERY TO BE DISCONNECTED, DISCONNECT THE (-) NEGATIVE GROUND CABLE.**

14. **WHEN SERVICING ELECTRICAL COMPONENTS, DISCONNECT THE (-) NEGATIVE GROUND CABLE.**

15. **IF AN ELECTRONIC INSTRUMENT CLUSTER (EIC) REQUIRES REMOVAL FROM THE DASH AREA OR THE MACHINE, DISCONNECT THE (-) NEGATIVE GROUND BATTERY CABLE. THIS WILL SHUT OFF POWER TO THE EIC AND PREVENT DAMAGE TO THE EIC BOARD OR BLOWING FUSES IF THE BOARD IS ACCIDENTALLY GROUNDED.**

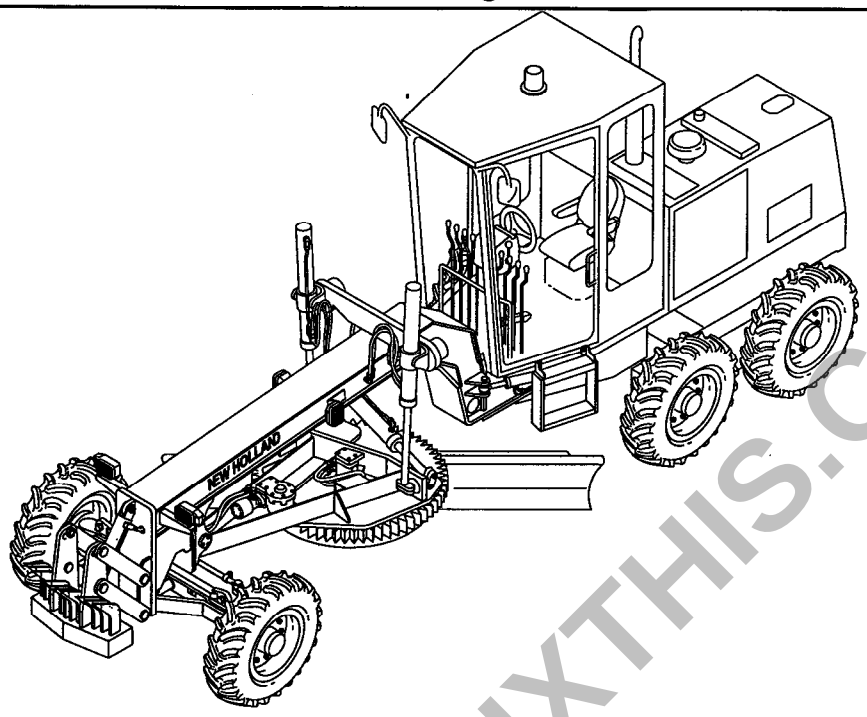
16. **IF WELDING IS REQUIRED ON THE MACHINE, DISCONNECT THE (-) NEGATIVE GROUND CABLE. FAILURE TO DISCONNECT THE BATTERY MAY RESULT IN DAMAGE TO THE EIC (ELECTRONIC INSTRUMENT CLUSTER) MONITORING SYSTEM AND OTHER ELECTRICAL COMPONENTS.**

17. **IF WELDING IS REQUIRED ON AN ATTACHMENT, REMOVE THE ATTACHMENT FROM THE MACHINE.**

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	RG80 ENGINE	RG100 ENGINE
Model	New Holland 450 N/C	New Holland 450 T/PD
Type	Vertical, In-line, 4-Cycle.	Vertical, In-line, 4-Cycle.
Number of Cylinders	4	4
Displacement	4986 cm^3 (304 $in.^3$)	4986 cm^3 (304 $in.^3$)
Bore and Stroke	111.8 x 127.0 mm (4.4 x 5.0 in.)	111.8 x 127.0 mm (4.4 x 5.0 in.)
Aspiration	Normal	Turbocharged
Cooling	Water	Water
Gross Power at Rated Speed	62 kW (83 hp)	80.5 kW (108hp)
Net Power at Rated Speed	56.3 kW (75.6 hp)	76 kW (101 hp)
Maximum Torque	240 lb-ft. @ 1400 rpm	328 lb-ft. @ 1400 rpm
Rated Speed	2200 rpm	2100 rpm
Low Idle Speed	850±50 rpm	850±50 rpm
High Idle Speed	2350±50 rpm	2350±50 rpm
BMEP@Rated Speed	690 kPa (100 psi)	945 kPa (137 psi)
Fuel Pump	Lucas Rotary 1296	Lucas Rotary 1261
Compression Ratio	17.5:1	17.5:1
Intake Valve Clearance (Engine Cold)	0.25 mm (0.010 in.)	0.25 mm (0.010 in.)
Exhaust Valve Clearance (Engine Cold)	0.51 mm (0.020 in.)	0.51 mm (0.020 in.)
Firing Order	1-3-4-2	1-3-4-2
Weight (Dry)	379 kg (834 lb)	379 kg (849 lb)

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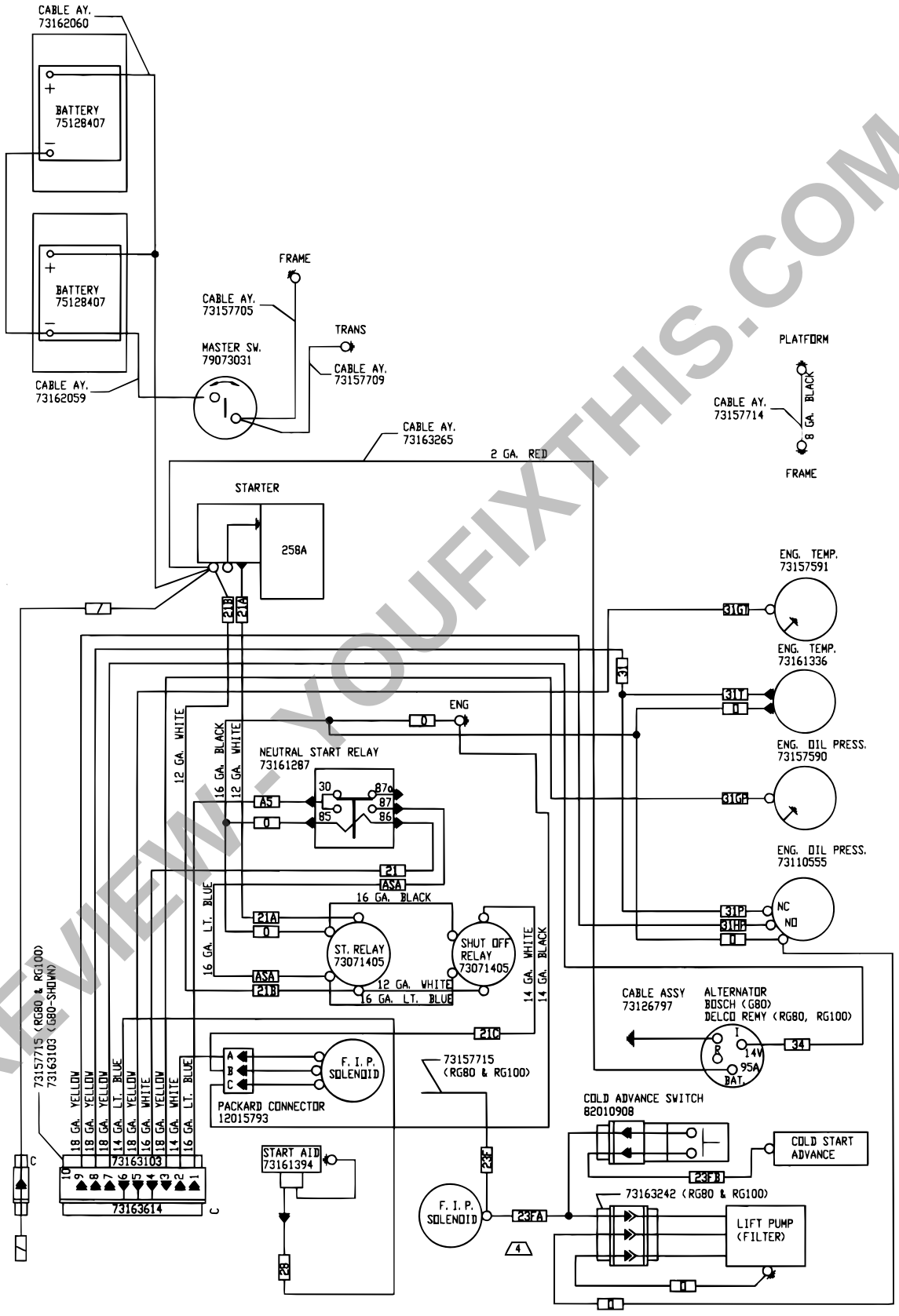
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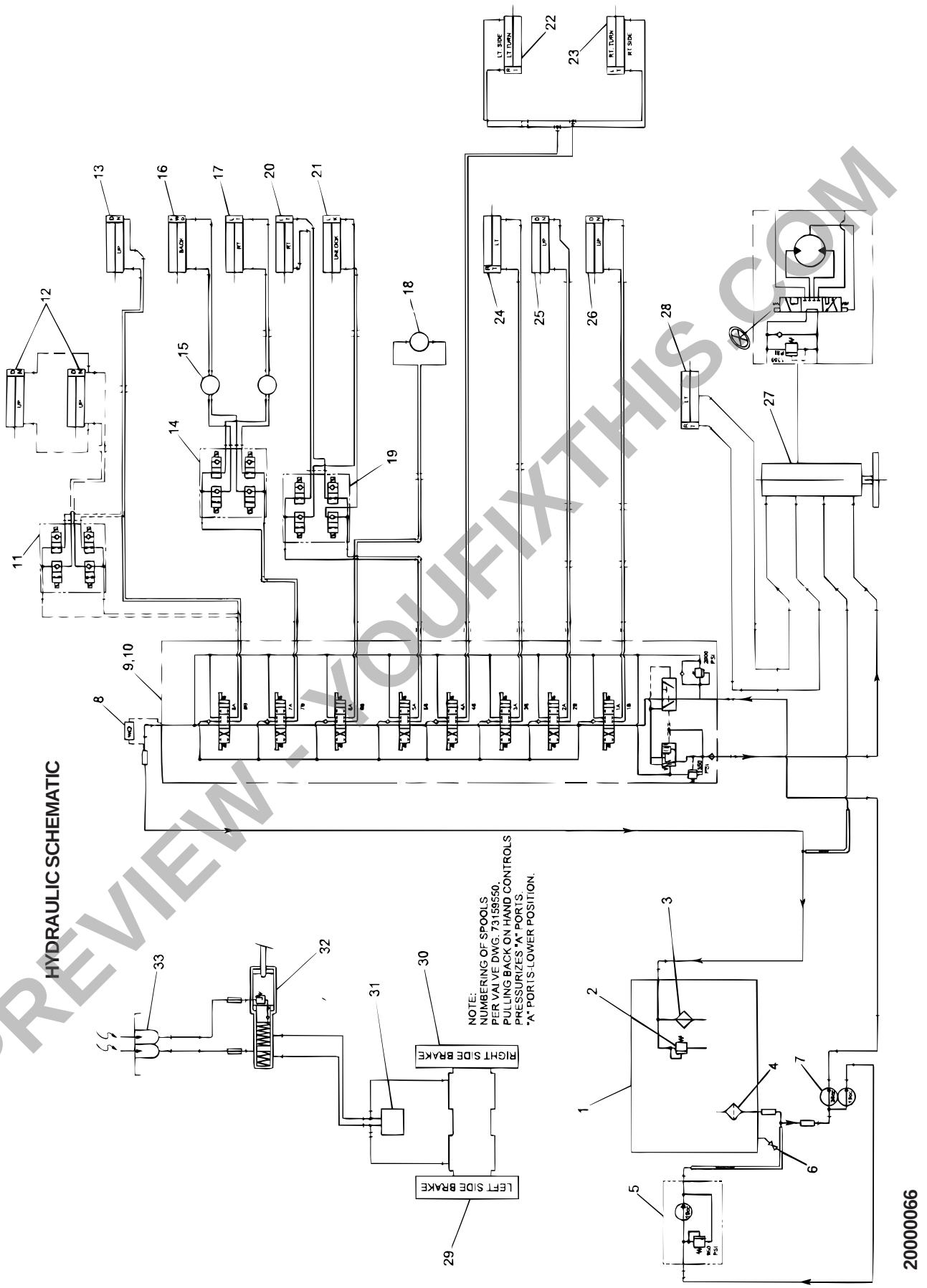
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CRANKING CIRCUIT



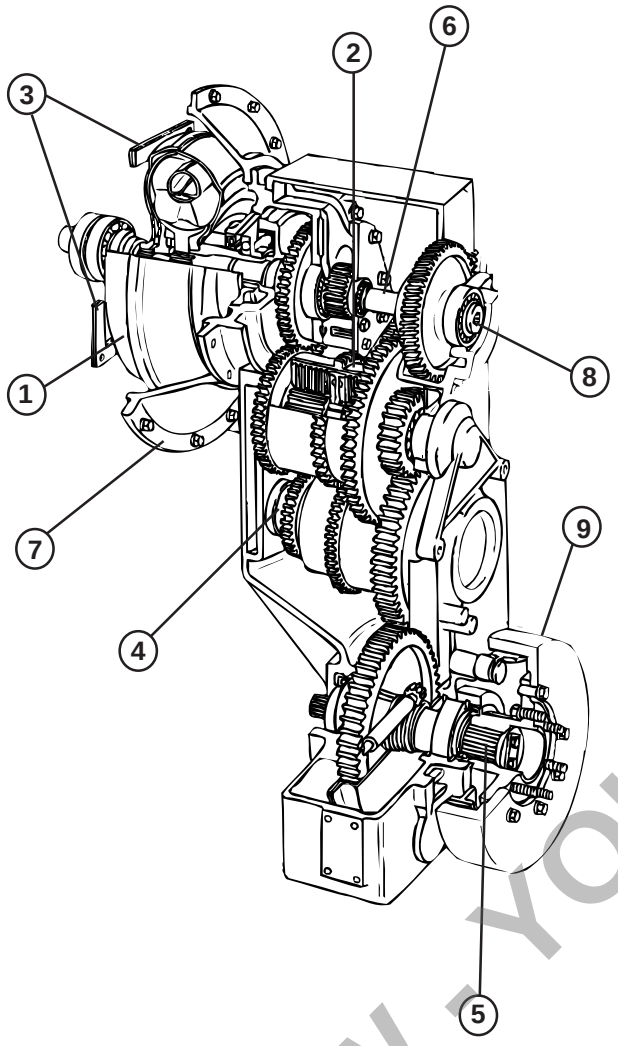
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1 - TORQUE CONVERTER

2 - REVERSE GEARSHIFT CLUTCH

3 - ENGINE ATTACHMENT FLEX PLATES (2)

4 - MULTI-DISC CLUTCH (6)

5 - FINAL DRIVE OUTPUT SHAFT

6 - GEARBOX AXLE (3)

7 - CONVERTER/ENGINE MOUNT HOUSING

8 - TANDEM GEAR PUMP DRIVE

9 - MECHANICAL PARKING BRAKE

TRANSMISSION

GENERAL

The powershift electro-hydraulic transmission has a countershaft design, integral torque converter, and electronic shift control valve unit. The torque converter multiplies and transfers power to the transmission, to which it is attached through a splined shaft. There are six forward and three reverse speeds. The transmission is mounted to the rear of the engine through flex plates and is supported by isolators on each frame rail.

The shift control valve unit receives electrical signals from the shifter. Five solenoid valves pressurize the proper combination of six multi-disc clutch packs to select different gear ratios. Shifting under load (powershift) is modulated by the flow of oil to and from the various clutch packs. A power take-off (PTO) provides the drive for the externally installed hydraulic tandem gear pump. A mechanical parking brake is located on the transmission output shaft.

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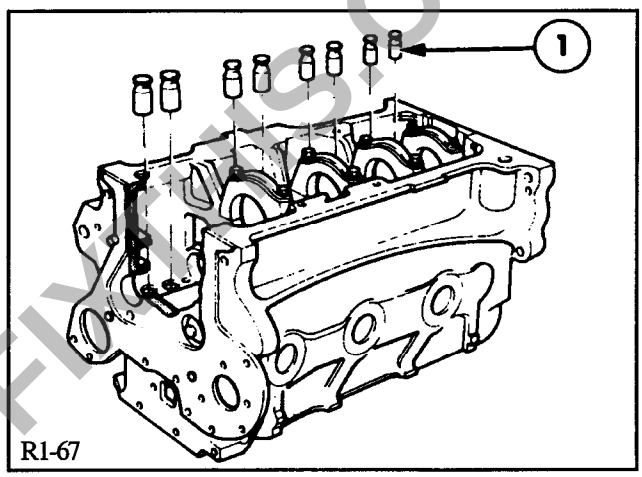
Inspection and Repair

1. Inspect the camshaft journals, lobes, for damage, pitting, or heat discoloration. If any of these conditions exist install a new camshaft.
2. Inspect the oil pump drive gear on camshaft, and the mating gear on the oil pump, for broken or worn teeth. If any wear or damage is apparent fit new gears.
3. Check each tappet, 1, for wear or damage and measure the diameters. Replace any that are not within the following specification:

   Tappet diameter
   25.118 mm – 25.130 mm (0.9889″ – 0.9894″)

   Tappet bore diameter
   25.15 mm – 25.17 mm (0.990″ – 0.991″).
4. Measure the diameter of the bearing journals to determine whether they are out–of–round. Install a new camshaft if the journals exceed the following specifications:

   Bearing journal diameter
   60.693 mm – 60.719 mm (2.3895″–2.3905″).



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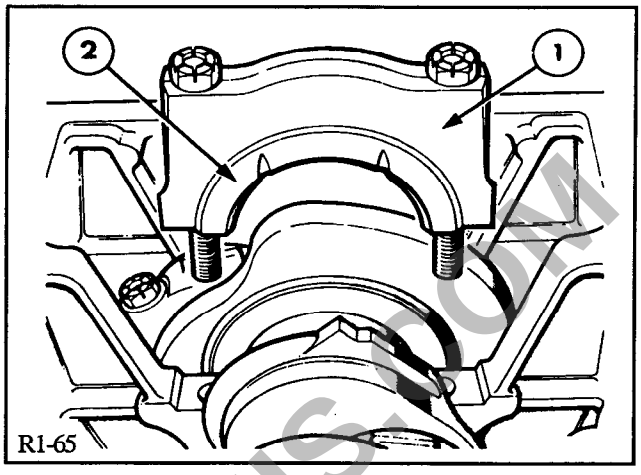
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Problem	Possible Causes	Correction
Engine emits black smoke	Incorrect engine timing	Check for faulty engine valves
	Restricted air intake	Check for restricted air intake
	Engine overheating	Check cooling system
Black smoke (cont'd)	Incorrect timing	Check the pump timing
	Faulty injectors	See injector troubleshooting
	Low compression	Check the engine compression
	Incorrect engine timing	Check the engine valves
	Turbo wheel binding	Repair/replace turbo
Engine does not develop full power or speed	Incorrect throttle adjustment	Check for insufficient throttle control movement
	Incorrect maximum no-load speed	Check maximum no-load speed adjustment
	Fuel starvation	Check and flush clean restricted fuel line and filters.
	Air in system	Check for air leaks on the suction side of the system
	Incorrect timing	Check pump timing
	Low compression	Check engine compression
	Incorrect engine timing	Check for improper valve adjustment or faulty valves
DPS DISTRIBUTOR TYPE FUEL INJECTION PUMP		
Low transfer pressure	Regulating valve inner seal damaged	Replace seal
	Regulating spring or piston missing	Replace spring or piston
	Incorrect regulating spring	Install correct spring
	Worn or damaged transfer pump blades	Replace damaged unit
	Faulty transfer pump seal	Replace seal
	Loose or incorrectly tightened end plate	Tighten or renew damaged unit
	Faulty washer on head locking and head locating screws	Replace washers
	Damaged seals on head locating fitting	Replace seals
High transfer pressure	Sticking regulator piston	Repair or replace piston
	Incorrect regulating spring - too strong	Install correct spring
	Test bench operating on pressure feed	Check maximum pressure feed

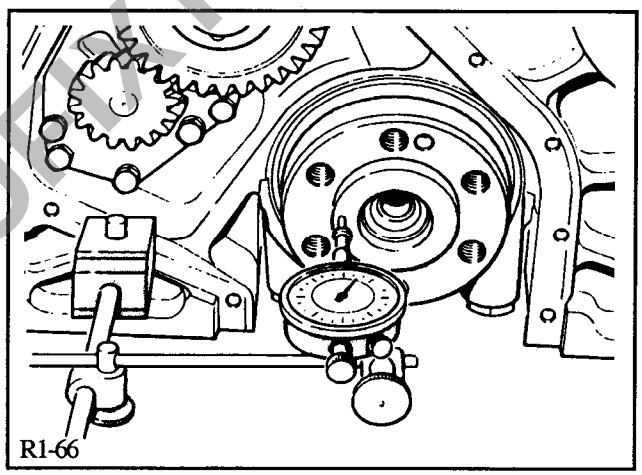
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First install a thrust bearing cap, 1, with a flange type bearing liner, 2. Then install the remaining bearing caps in their original locations. Tighten all bearing caps to 197N·m (145 ft. lbs.) except the thrust bearing cap. Leave the thrust bearing cap finger tight.



5. Pry the crankshaft forward against the thrust surface of the bearing. Holding the crankshaft forward, pry the bearing cap to the rear, taking care not to pry against the flange of the bearing liner. This will align the thrust surfaces of both halves of the bearing.
6. Pushing forward on the crankshaft, tighten the bearing cap bolts to 197 N·m (145 ft. lbs.).



7. To measure crankshaft end play with a dial indicator gauge, pry the crankshaft toward the front of the engine and set the dial indicator to zero. Pry the crankshaft toward the rear of engine. If end play exceeds 0.10 – 0.20 mm (0.004″ – 0.008″) install a new thrust bearing liner.
8. If the end play is less than specification, inspect the thrust bearing for burrs, scratches, or dirt, and realign the thrust bearing as in steps 5 and 6.
9. Install the rear crankshaft oil seal as previously described in back plate removal.

NOTE: Do not pre–install the seal into the retainer. To ensure seal concentricity, it must be assembled with the rear plate and installation tool when installed on crankshaft.

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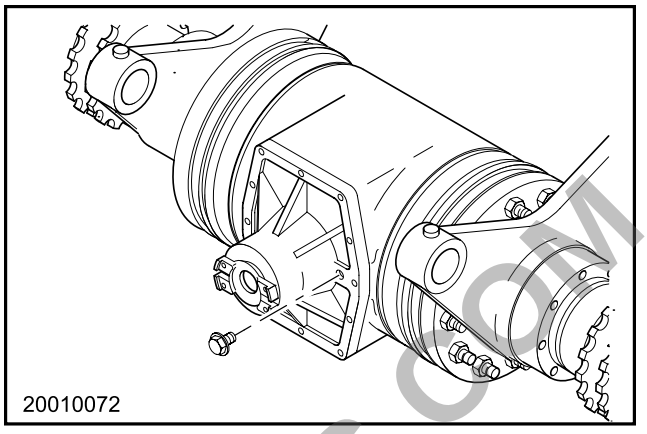
REAR AXLE

PROGRAMMED MAINTENANCE SCHEDULE

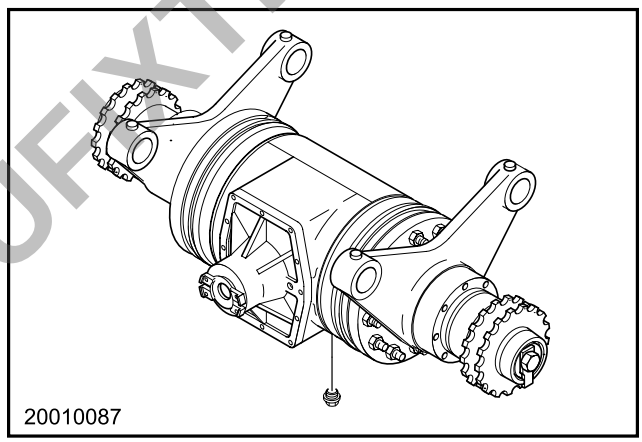
- Every 150 working hours check oil level with axle horizontal. (Refill if required.)
- After first 200 working hours replace oil.
- Every 1500 working hours replace oil.

Replacing Lube Oil

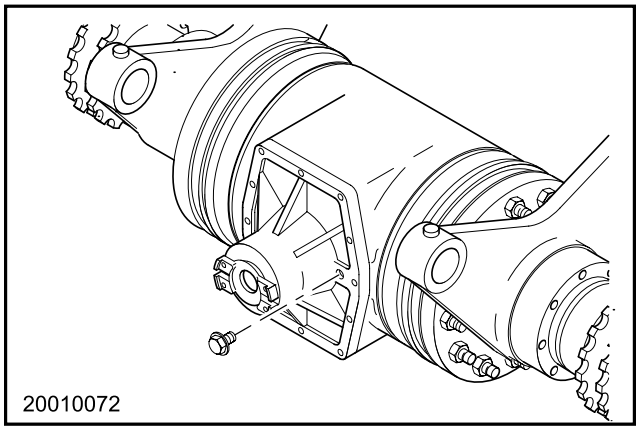
1. Remove oil level plug.



2. Remove oil drain plug and drain used oil.
3. Tighten drain plug.



4. Fill up to edge of level plug until oil overflows. Tighten filling and level plug.



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RG 80
RG 100
ROAD GRADERS

SERVICE MANUAL

SECTION 1 - ENGINE

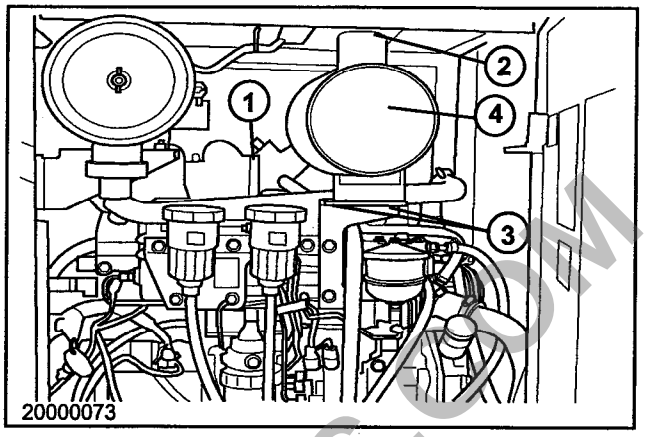
Part Number: 75131050

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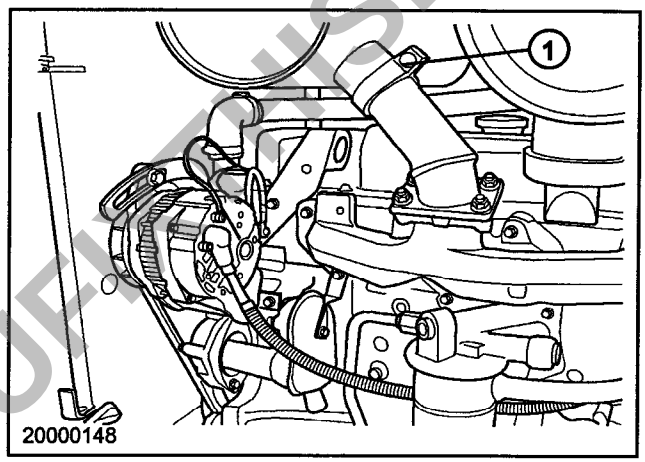
➤ SECTION 1 - ENGINE
SECTION 3 - TRANSMISSION
SECTION 4 - FRONT AXLE
SECTION 5 - REAR AXLE AND TANDOMS
SECTION 6 - ELECTRICAL
SECTION 7 - HYDRAULICS
SECTION 9 - OPERATOR'S PLATFORM
SECTION 19 - MOLDBOARD AND IMPLEMENT

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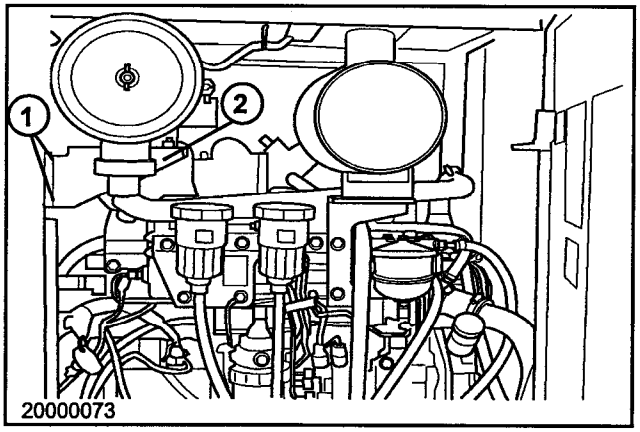
21. On models equiped with a turbocharger attach muffler to the turbocharger, by tightening clamp, 1. Tighten the muffler attaching bolts, 3, after installing the muffler, 4, to the mounting bracket.



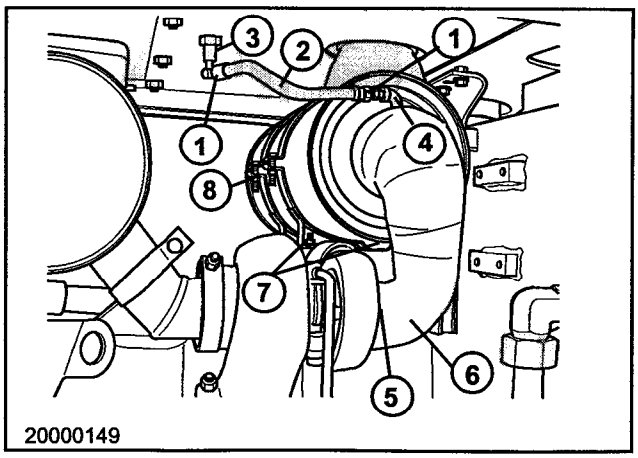
22. To install the muffler on models not equiped with a turbocharger repeat assembly instructions for models equiped with a turbocharger except, tighten clamp, 1, connecting muffler to manifold elbow instead of the turbo-charger.



23. Before installing the air cleaner, tighten the four bolts, 1, connecting the support brackets, 2, to the rear engine panel.



24. To install the air cleaner assembly tighten the four bolts, 7, holding the air cleaner, 8, to the support bracket. Tighten fitting nuts, 1, holding the air restriction indicator hose, 2, between the air restriction indicator, 3, and the air cleaner restriction hose outlet elbow, 4. Install hose. Tighten clamp, 5, holding air cleaner outlet hose, 6, to the turbo-charger, on models so equiped.



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BALANCER GEAR

Inspect the balancer gear teeth. If they are damaged or worn, install a new crankshaft.

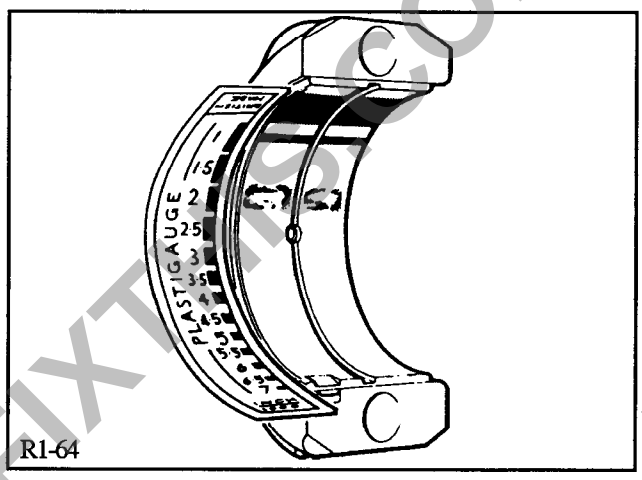
CRANKSHAFT

Reassembly

1. Check the crankshaft bearing clearance using a plastigauge as follows:
   a. Position a piece of the correct size plastigauge across the full width of the bearing cap, about 6.35 mm (0.25″) off–center.
   b. Install the cap and tighten the bolts to 149 N·m (110 ft. lbs.).
   c. Remove the cap and use the scale to check the width of the flattened plastigauge.

   The widest point of the gauge establishes the minimum clearance. The narrowest point of the gauge establishes maximum clearance. The difference between the two readings is the taper.

   NOTE: Normally, main bearing journals wear evenly and will not be out–of–round. If you install a good liner in an out–of–round journal, match the liner to the maximum diameter of the journal.

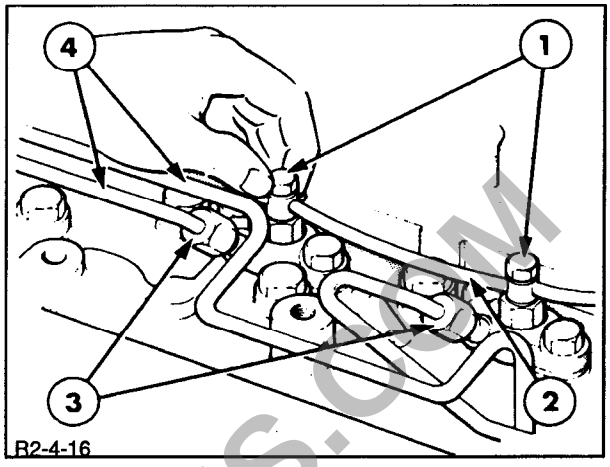


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4. Reconnect the leak–off pipe, 2, using new washers either side of the banjo fittings and tighten banjo bolts, 1, to 10 ft. lbs. (12 N·m) torque.
5. Reconnect high pressure fuel pipes, 4, to the injectors and tighten the gland nuts, 3, to 32 N·m (23 ft. lbs.) torque.
6. Tighten high pressure fuel pipe gland nuts at the injection pump to the 27 N·m (20 ft. lbs.) torque.
7. Bleed the fuel system as needed.
8. If the injectors are to be stored before installation, clean in calibrating oil. Storage for longer than 6 months may require disassembling and cleaning the injectors before installation.



SPECIFICATIONS

Fuel System: RG80/RG100	
Injector Nozzle Opening Pressure:	
Bar	240 – 248 (Reset at 225)
PSI	3480 – 3590 (Reset at 3260)
Injector Change Interva	1200 Hours

GENERAL TORQUES

Description	N·m	ft. lbs.
Injector Nozzle Retaining Nut	46	34
Injector Retaining Bolts	22	17
Injector Leak–Off Line Banjo Bolts	12	8
High Pressure Gland Nuts, at Injector, and Fuel Injection Pump	24	18

Tools

	V L Churchill	Nuday Tools	NH
Injector Nozzle Socket	CT9009	8126	1588
Nozzle Reverse Flush Adapt	CT9024	8124	01727/8
Injector Cleaning Kit	DX730/FT9101	1720	1720
Kit consists of - Nozzle Cleaning Wires, Pressure Chamber Drills, Pressure Chamber Scraper Valve Seat Scraper, Brass Wire Brush, Pin Vice			
Tallow		Obtain Locally	
Polishing Sticks		Obtain Locally	

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Table 3-2 flow rate measuring point, 15.
Location - upper left of control valve unit.

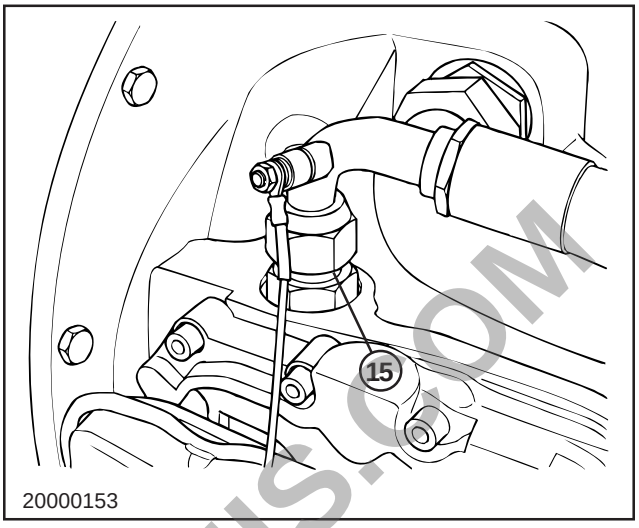


Table 3-2 flow rate measuring point, 16.
Location - forward upper RH side of transmission.

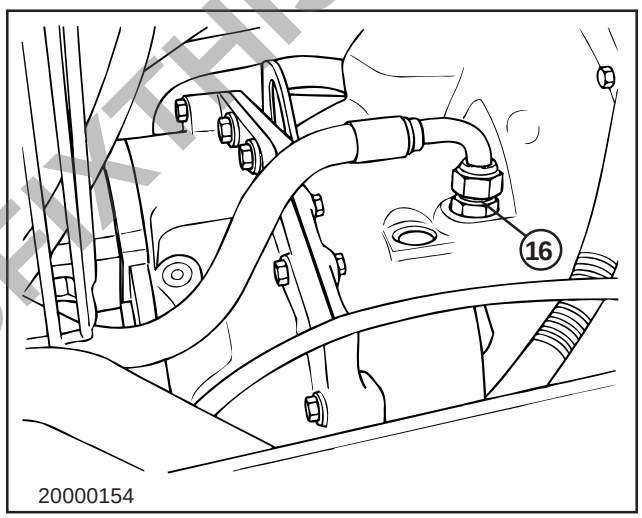
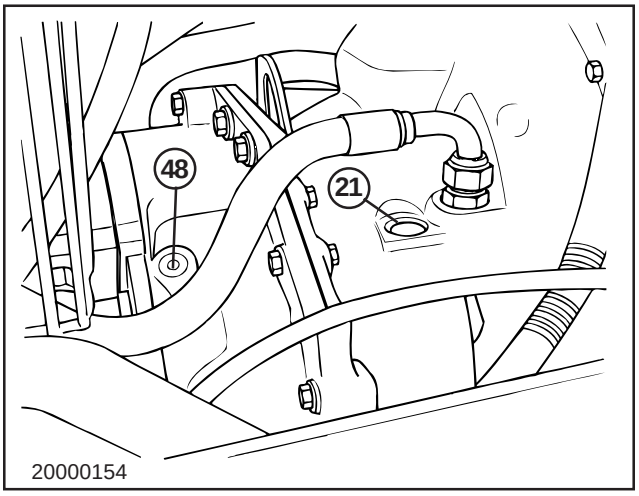
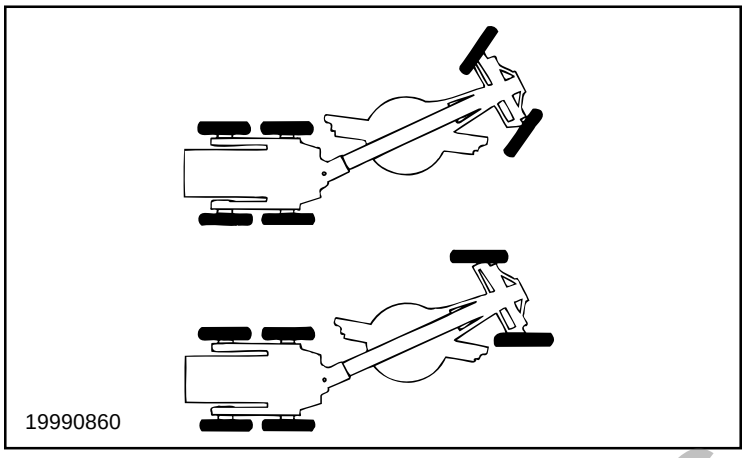


Table 3-3 speed measuring points, 21, 48.
Locations - forward upper RH side and rear upper RH side of transmission.



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FRONT AXLE, STEERING AND ARTICULATION

GENERAL

The motor grader can be turned using either the steering wheel or the articulation lever. Operated together, they provide a high degree of maneuverability. The steering wheel operates a steering valve, causing the front wheels to change angle. The articulation lever operates a pair of cylinders, allowing the front and rear frame modules to pivot. The front axle allows oscillation, wheel lean, and supports the steering linkage.

STEERING

The main steering components are: the forward section of the tandem pump assembly (mounted to auxiliary drive shaft at rear of transmission); steering valve (in front of steering wheel shaft in front console); steering priority valve (in main control valve under operator's platform); and steering cylinder (left rear side of front axle weldment). Hydraulic lines and fittings connect the different components. Turning radius can be further reduced using articulation and wheel lean functions. See Section 07, Hydraulics, for tandem pump, steering priority valve, and steering and wheel lean cylinder replacement and overhaul procedures.

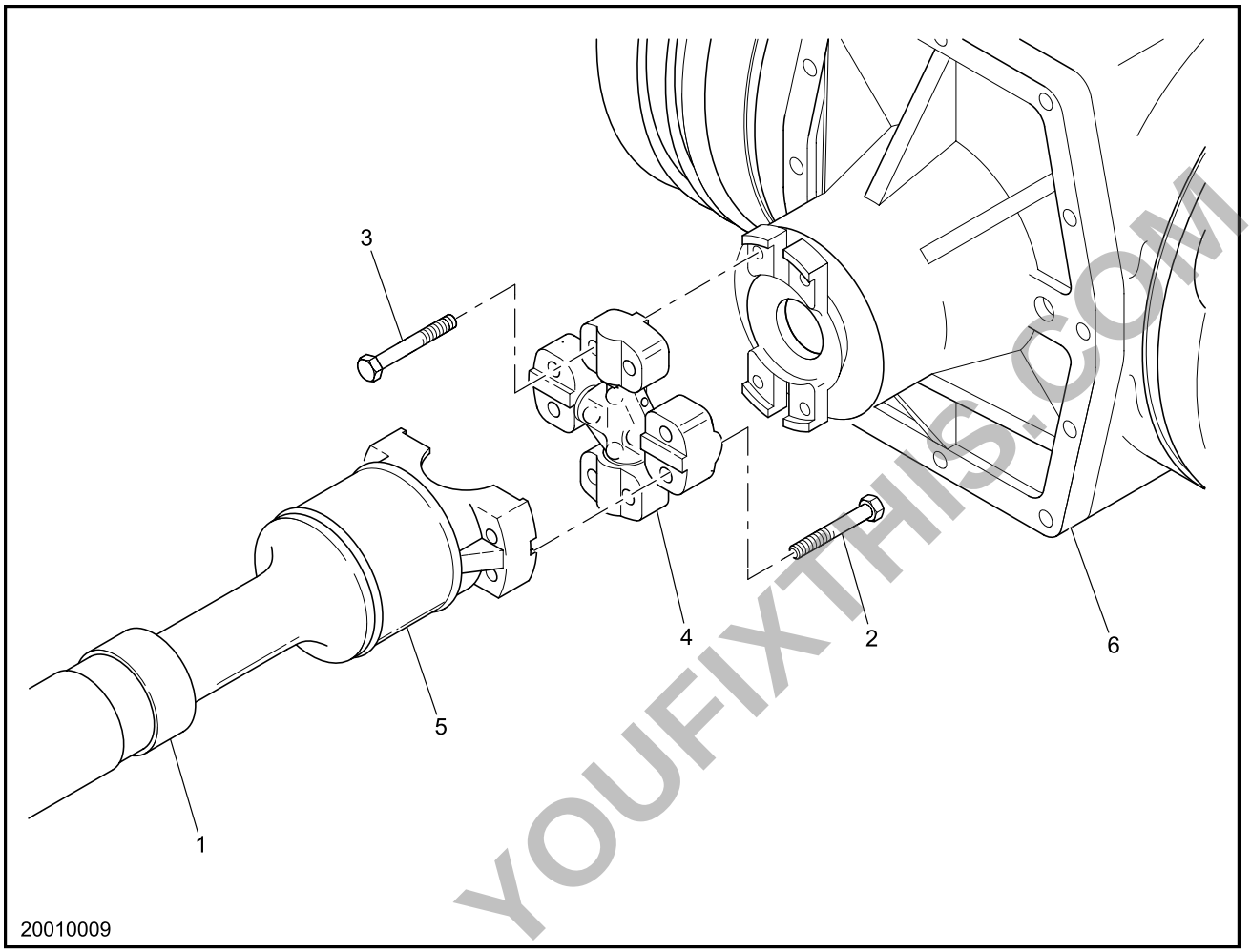
The steering system receives oil from the steering priority valve, which ensures the steering system receives 17 L/min (4.5 gpm) of oil before other hydraulic functions. Oil from the steering priority valve enters the steering valve. The steering valve receives input from the steering wheel. If no input is received by the steering wheel, oil is returned to the tank. When the steering wheel is turned, the steering valve sends oil to the correct side of the steering cylinder. A non-adjustable inlet relief valve is located in the steering valve, limiting pressure to 93.1 bar (1350 psi). Steering pressure can be checked at a test point on the forward RH side of the tandem pump, at the rear of the transmission.

ARTICULATION

Articulation operation is part of the hydraulic system and oil flow is controlled by a section on the main control valve. Input is received by operating the control lever on the front console. Oil is received at the main control valve and passes through each section. Oil flow from the articulation section supplies the cylinders located between the front and rear frame modules. As one cylinder extends, the opposite cylinder retracts. The frame pivots at the upper and lower articulation pins. Refer to Section 07, Hydraulics, for articulation cylinder replacement and overhaul procedures.

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DRIVE SHAFT

Drive shaft removal and installation as described in this paragraph covers only the removal (disconnection) of the drive shaft from the rear axle and the reconnection (installation) of the drive shaft to the rear axle. At this point the drive shaft remains connected to the transmission.

Removal

1. Loosen dust cap, 1, by turning counterclockwise.

2. Remove bolts in universal joint. To remove cross and bearing assembly, 4, with shaft, 5, remove bolts, 3. To remove drive shaft, 5, and leave cross and bearing assembly, 4, attached to rear axle, 6, remove bolts, 2. Take care not to have endcaps come off of cross and bearing assembly, 4.

3. Compress drive shaft, 5, and remove drive shaft from rear axle.

Installation

This procedures assumes the rear axle has been installed in the machine and covers only the reconnection of the drive shaft to the rear axle.

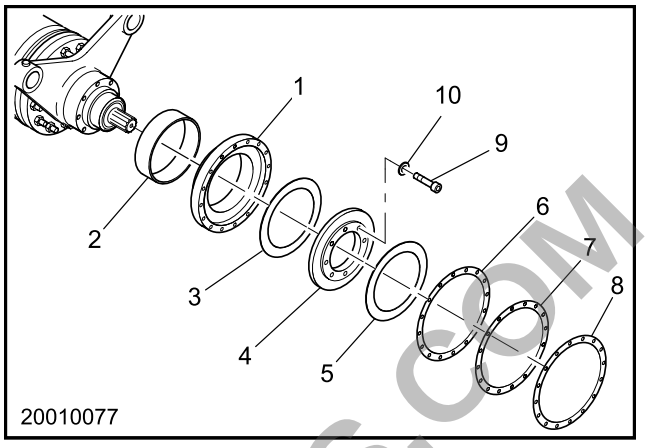
NOTE: The dustcap, 1, should be loosened, by turning counterclockwise, so that the drive shaft can be compressed or extended easily.

1. If the cross and bearing assembly, 4, was left attached to the drive shaft, 5, proceed with sub-step “a” below. If the cross and bearing assembly, 4, was left attached to the rear axle, 6, proceed with sub-step “f” below.

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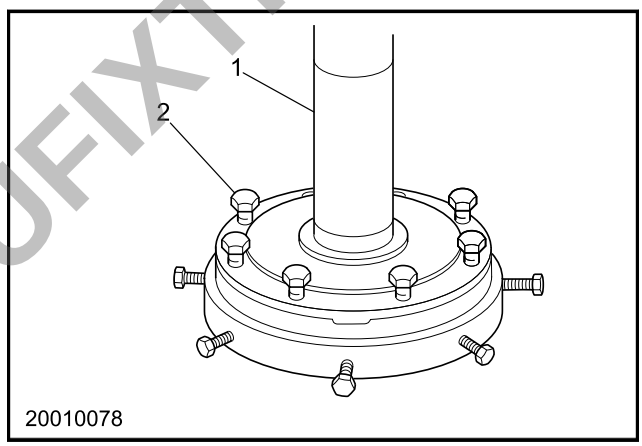
15. Place washers, 10, over cap screws, 9, and fasten cap, 4, in place.

16. Torque cap screws, 9, to 200 ± 20 lb-ft (271.16 ± 27.11 N•m) with a torque wrench.



17. Set shaft, 1, in fixture.

18. Install bolts, 2, into shaft, 1, using fixture to press bolts in place.



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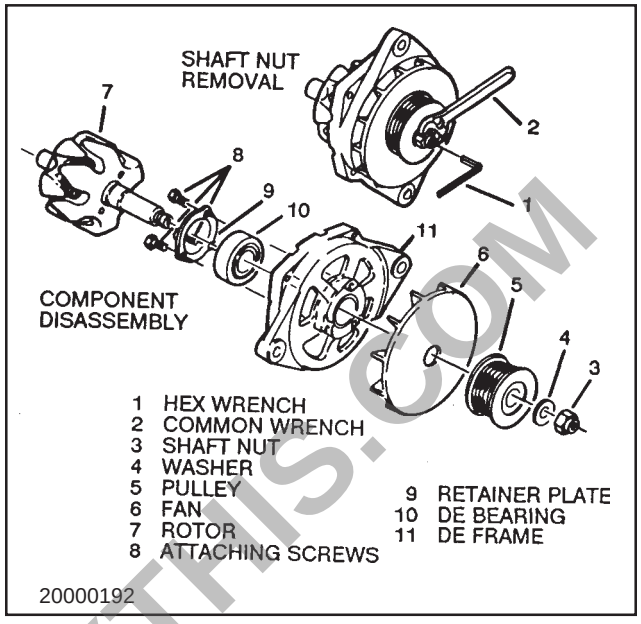
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ALTERNATOR ASSEMBLY

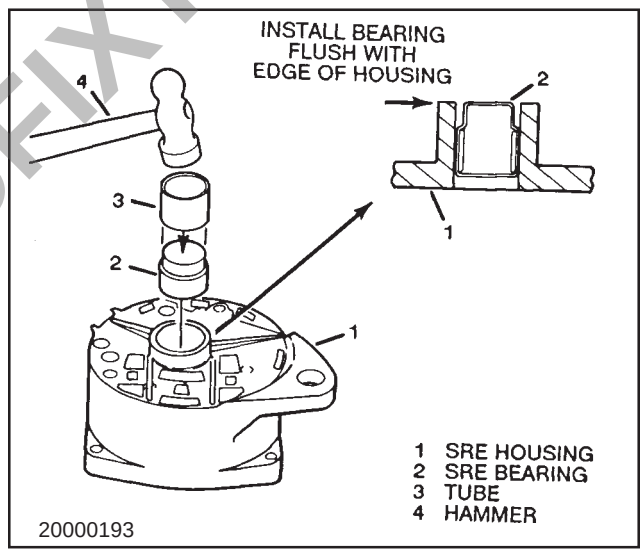
1. Install DE bearing, 10, and bearing retainer plate, 9, to DE frame, 11, with three attaching screws, 8. Torque screws to 3 Nm (26 lb-in).

2. Install rotor, 7, shaft into DE bearing, 10.

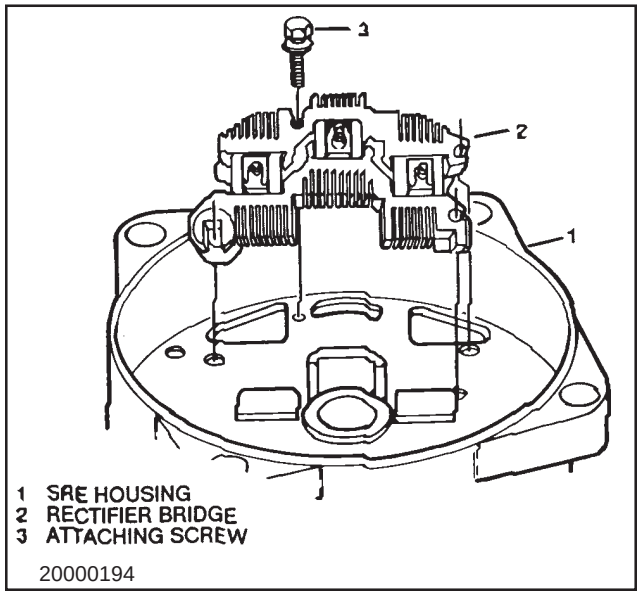
3. Install fan, 6, pulley, 5, washer, 4, and shaft nut, 3, onto rotor shaft. Hold shaft with 8 mm (5/16 in.) hex wrench, 1, in end, or wrap rotor, 7, in shop cloth and tighten in vise just enough to hold while tightening shaft nut with common wrench, 2. Torque shaft nut, 3, to 100 Nm (75 lb-ft).



4. Install SRE bearing, 2, into SRE housing, 1. Use thin-wall socket or tube, 3, slightly smaller than hole in SRE housing to drive bearing in from outside. Position bearing flush with outside lip of SRE housing. Cover opening in bearing with piece of tape to prevent dirt from entering during assembly procedure.



5. Attach rectifier bridge assembly to SRE housing, 1. Install one rectifier bridge, 2, attaching screw/washer assembly, 3, through grounded heat sink into SRE housing. Finger tighten.

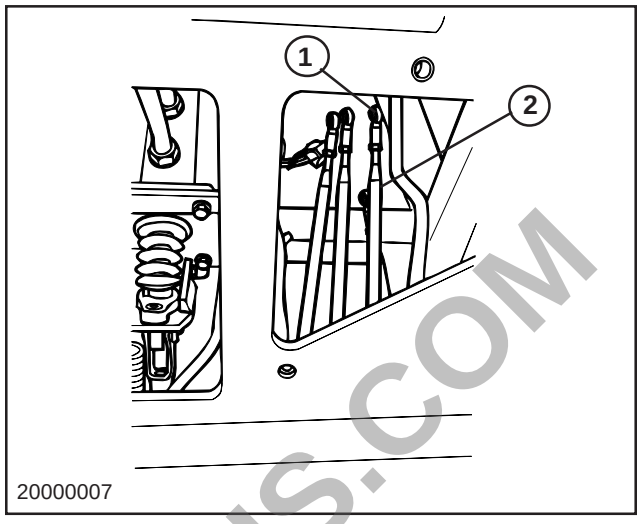


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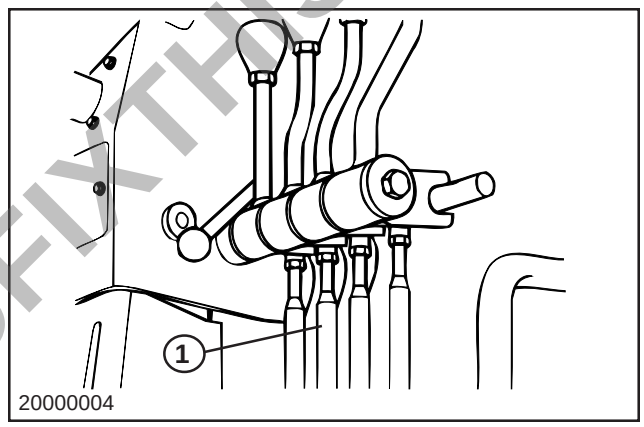
3. Turn clevis, 1, counterclockwise to lengthen link rod, 2, and clockwise to shorten link rod.

NOTE: Maintain a minimum of three threads between the link rods and clevis yokes.

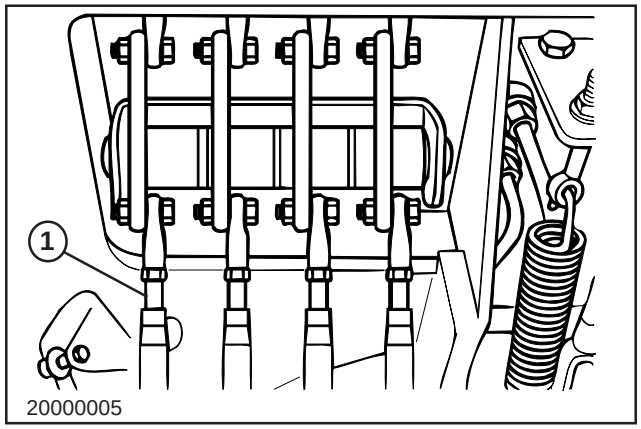


To move the lever forward:

a. Shorten upper vertical link, 1.



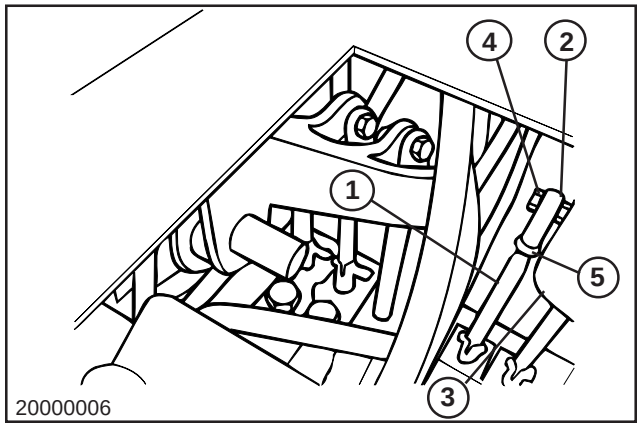
b. Shorten horizontal link, 1.



c. Lengthen lower vertical link, 1.

4. Attach clevis yoke, 2, to bracket, 3, with bolt, 4, and lock nut.

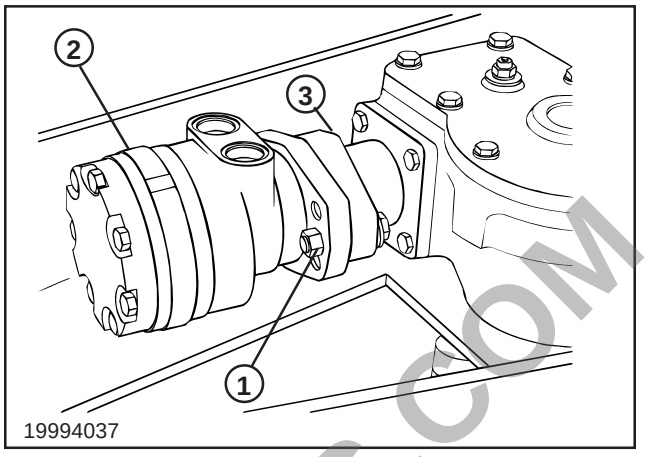
5. Tighten jam nut, 5, clockwise against clevis yoke.



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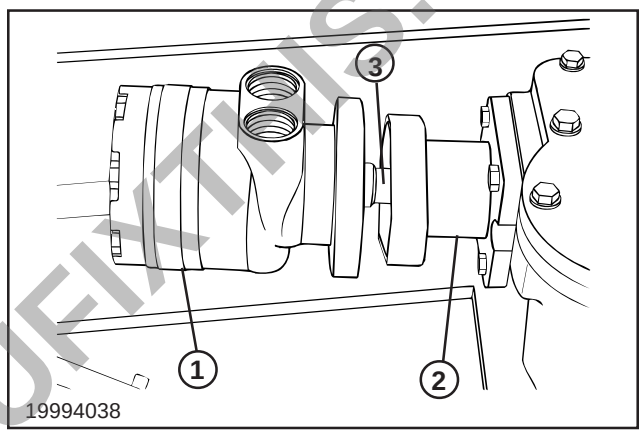
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3. Remove two bolts and nuts, 1, attaching motor, 2, to shaft on adapter, 3.



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4. Slide motor, 1, straight out from adapter, 2, until shaft clears coupler, 3.



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Installation

1. Connect a hoist to the two cap screws, 5, on the top surface of the ROPS/FOPS unit, 3.

CAUTION: Use a hoist of sufficient lifting capacity for the weight of the ROPS/FOPS unit.

CAUTION: Be sure sufficient clearance exists above the machine to allow installation.

2. Carefully lift the ROPS/FOPS unit, 3, and set it down on the machine platform, 4, being sure to align the eight mounting holes.

3. Secure the ROPS/FOPS unit with eight bolts, 1, and washers, 2.

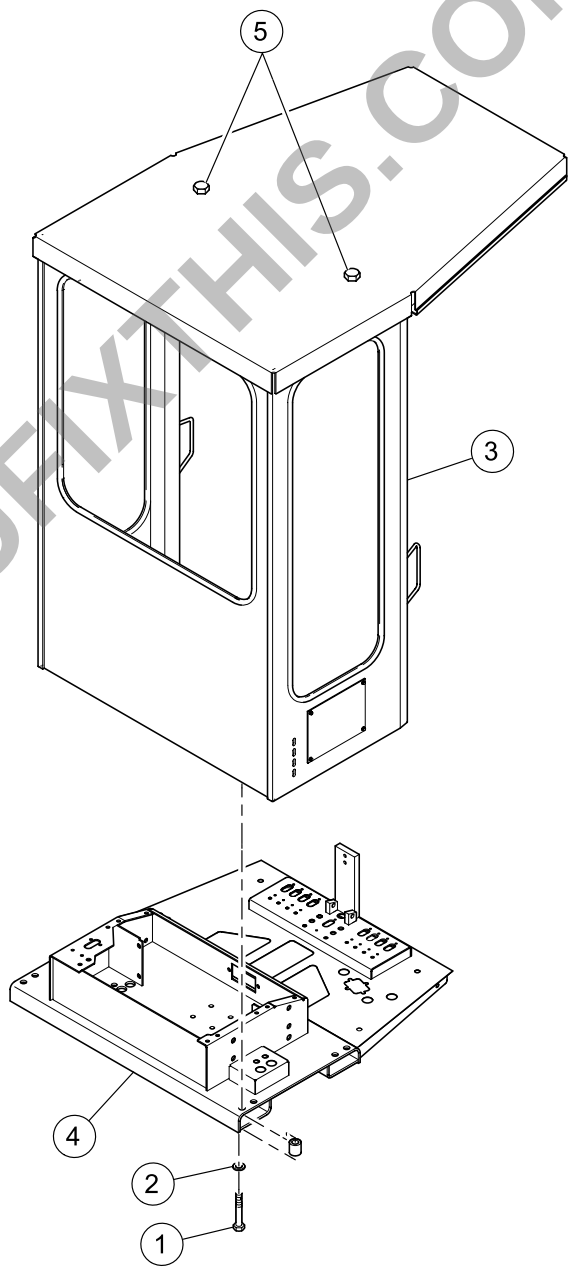
4. Torque the bolts to 198 Nm (146 lb-ft).

5. Connect all wires and cables to the ROPS/FOPS unit.

6. Connect all ground straps attached to the ROPS/FOPS unit.

7. Install mirrors if, applicable.

8. Install floodlights, if applicable.



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10. Attach rod, 13, to lever assembly, 16, with clevis pin, 15, and cotter pin, 14.

11. Fasten jam nut, 12, on rod, 13.

12. Screw link, 11, onto rod, 13.

13. Install lever, 9, with washers, 10, into link, 11, and secure with clevis pin, 8, and cotter pin, 7.

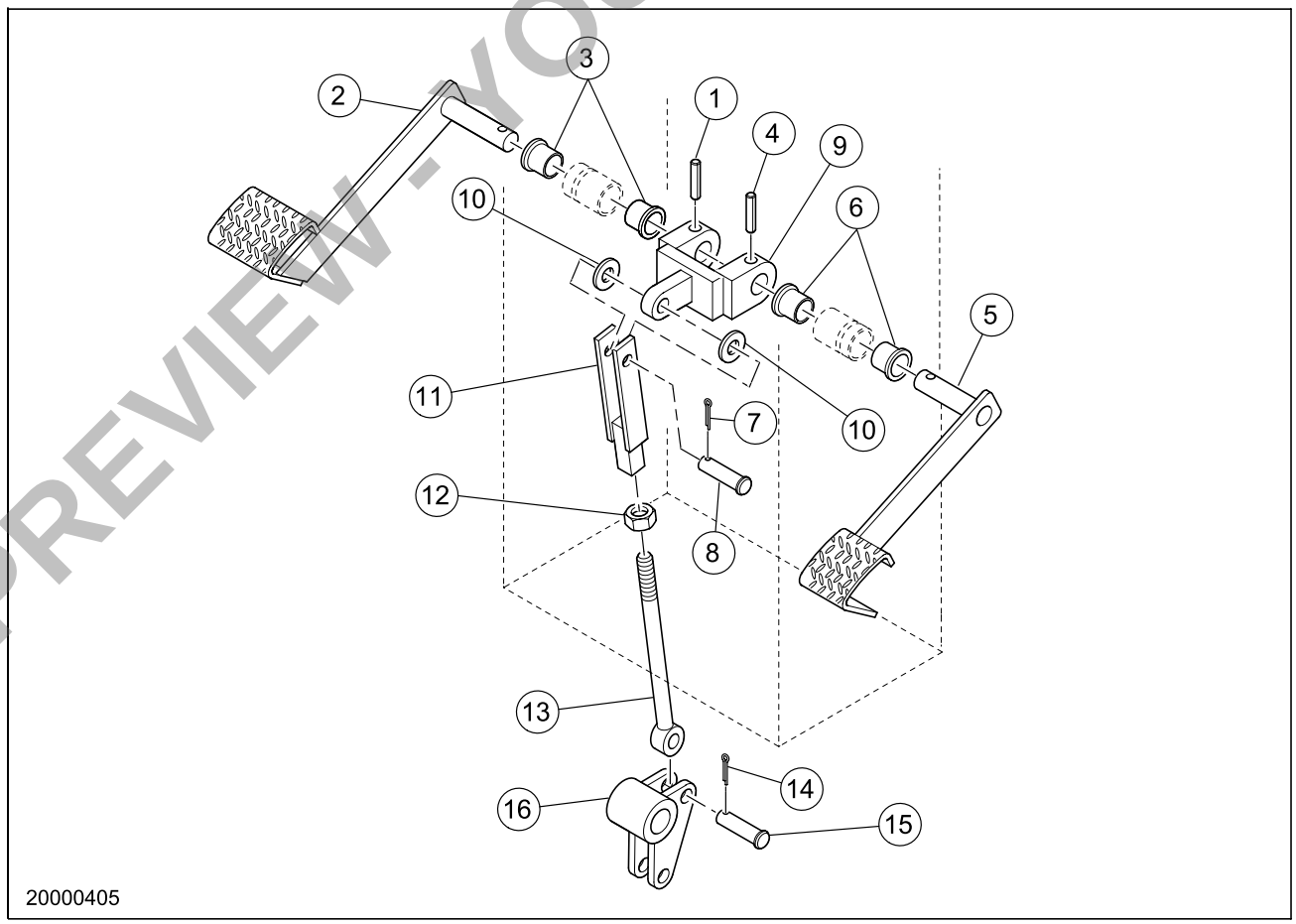
14. Install bearings, 3, into housing, and insert left pedal, 2, through bearings, into lever, 9.

15. Secure right pedal, 2, to lever, 9, with roll pin, 1.

16. Install bearings, 6, into housing, and insert right pedal, 5, through bearings, into lever, 9.

17. Secure right pedal, 5, to lever, 9, with roll pin, 4.

18. Connect control lever shaft to control lever and secure assembly with jam nut. Repeat procedure on all right hand and left hand control levers.



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