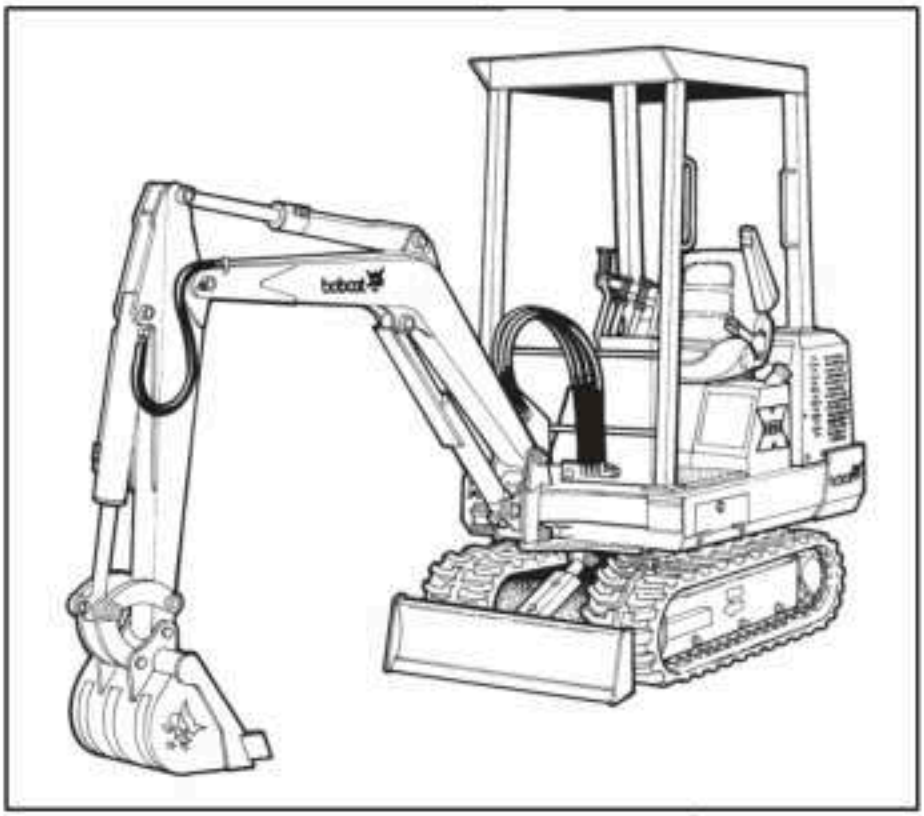
X 220

Excavator

Service Manual

(S/N 508212001 & Above)



MELROE
INGERSOLL-RAND

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DUKES HYDRAULIC CONTROL VALVE (Cont'd)

Main Relief Valve Adjustment

Install a 5000 PSI (34,475 kPa) gauge on the pump section 2 (Item 1) **[A]**.

NOTE: Pump section 1 is closest to the engine.

Start the engine and warm the hydraulic fluid to normal operating temperature.

Engage the boom circuit until the boom is completely extended. Continuing to engage the boom circuit will cause the main relief valve to go over relief.

Record the pressure.

The correct pressure for the relief valve is 2400 PSI (16545 kPa).

If main relief valve adjustment is required, loosen the locknut (Item 1) **[B]**.

Turn the adjusting screw (Item 2) **[B]** clockwise to increase pressure, counterclockwise to decrease pressure.

When the correct pressure of 2400 PSI (16545 kPa) is reached, torque the locknut against the relief valve cartridge to 10 ft.–lbs. (13.6 Nm).

NOTE: The adjusting screw must be held in place while torquing the locknut to avoid changing the relief setting.

Remove the 5000 PSI (34,475 kPa) gauge from section 2.

Install the gauge on the pump section 1 (Item 2) **[A]**.

Engage the bucket circuit until the bucket is completely extended.

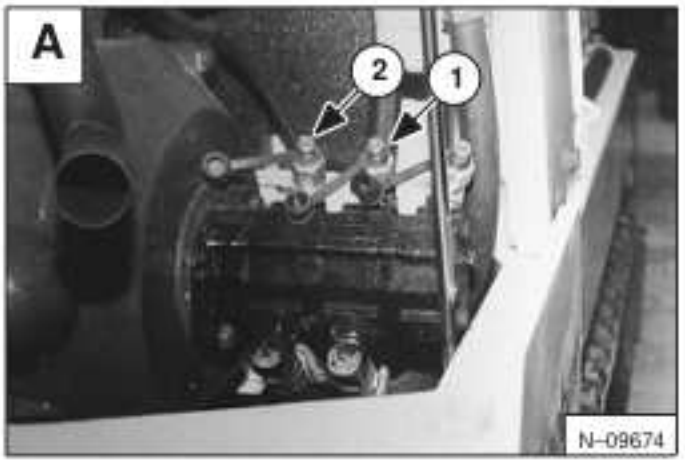
NOTE: Valve removed for photo clarity.

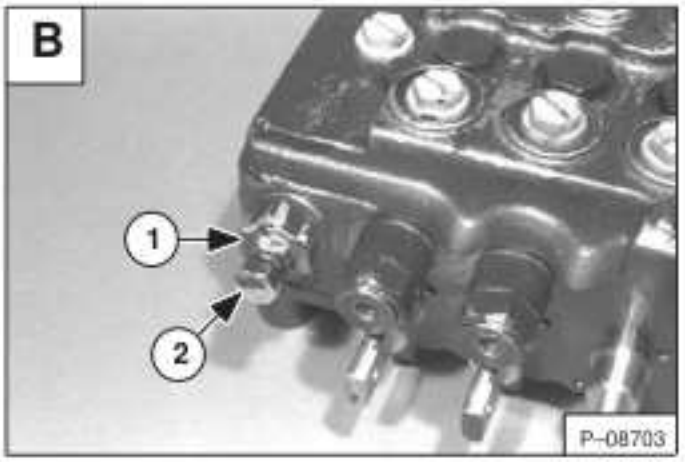
Continue to engage the bucket circuit until the main relief valve goes over relief.

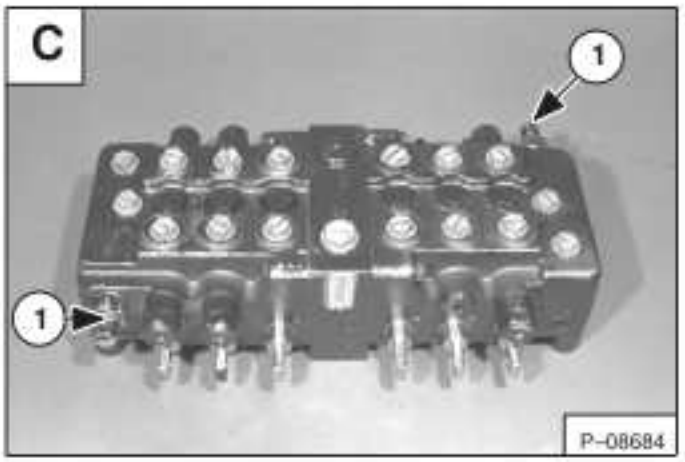
If adjustment of the main relief valve (Item 1) **[C]** is required, loosen the locknut (Item 1) **[B]**.

Turn the adjusting screw (Item 2) **[B]** clockwise to increase pressure, counterclockwise to decrease pressure.

When the correct pressure of 2400 PSI (16545 kPa) is reached, torque the locknut against the relief valve cartridge to 10 ft.–lbs. (13.6 Nm).







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BLADE CYLINDER

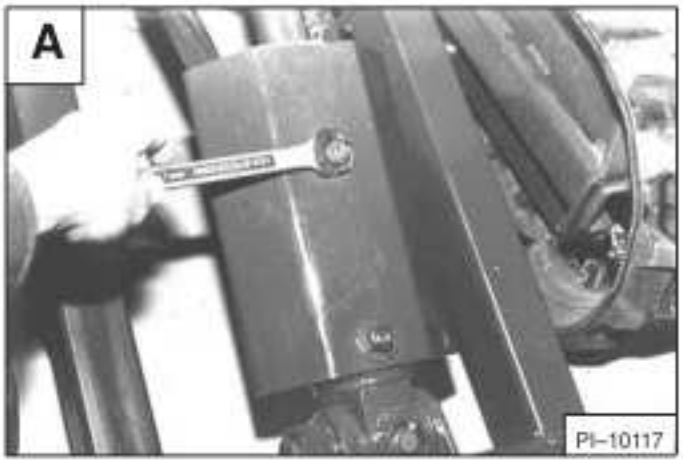
Removal And Installation

NOTE: Refer to the Pages 2–51 – 2–59 for servicing the Cylinder.

Lower the blade to the floor. Stop the engine.

Move the blade control to release the hydraulic pressure.

Remove the four nuts from the blade cylinder shield **[A]**.



Remove the blade cylinder shields **[B]**.



IMPORTANT

When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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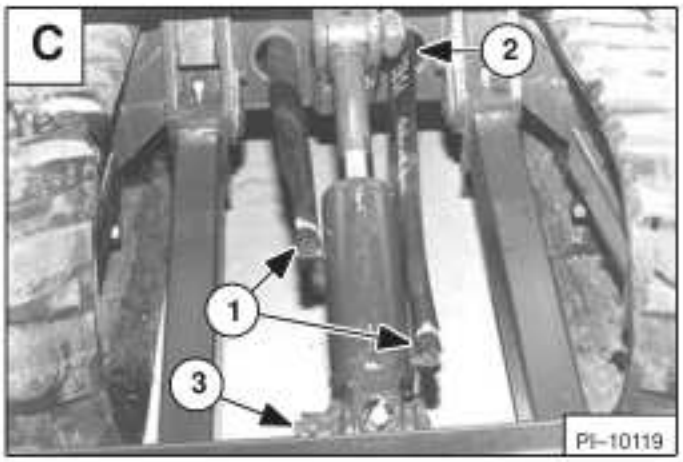
Remove the blade cylinder hoses (Item 1) **[C]**.

Remove the rod end bolt (Item 2) **[C]** and pin.

Remove the base end bolt (Item 3) **[C]** and pin.

Installation: Tighten the nut to allow no endplay of the bolt (Items 2 & 3) **[C]**.

Remove the blade cylinder.



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Servicing The Connecting Rods And Pistons (Cont'd)

Measure the piston pin (Item 1) **[A]** and the connecting rod bushing (Item 2) **[A]**.

The specifications are 0.788–0.789 inches (20,03–20,04 mm).

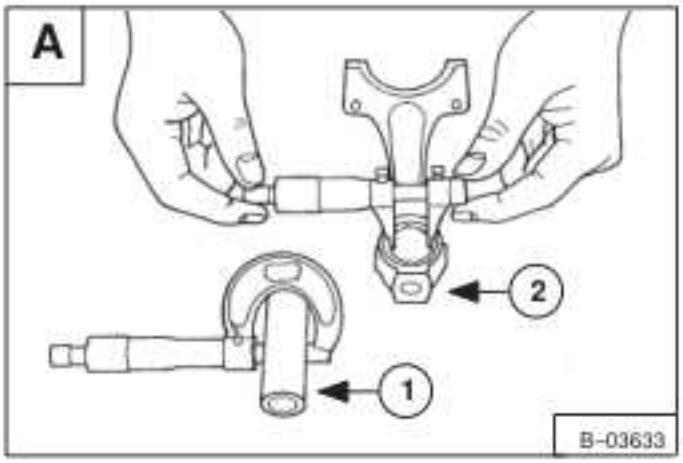
Clearance between piston pin and bushing is 0.0006–0.0015 inch (0,015–0,04 mm). The wear limit is 0.006 inch (0,15 mm).

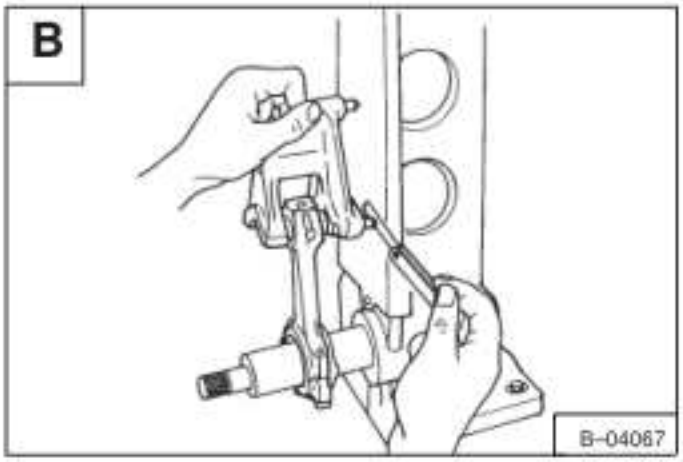
NOTE: Replacement bushing specifications are 0.0006–0.0026 inches (0,015–0,066 mm).

Install the connecting rod on the tool for checking connecting rod alignment **[B]**.

Check the clearance in the piston pin area. The specification is 0.0008 inch (0,020 mm). The wear limit is 0.002 inch (0,05 mm).

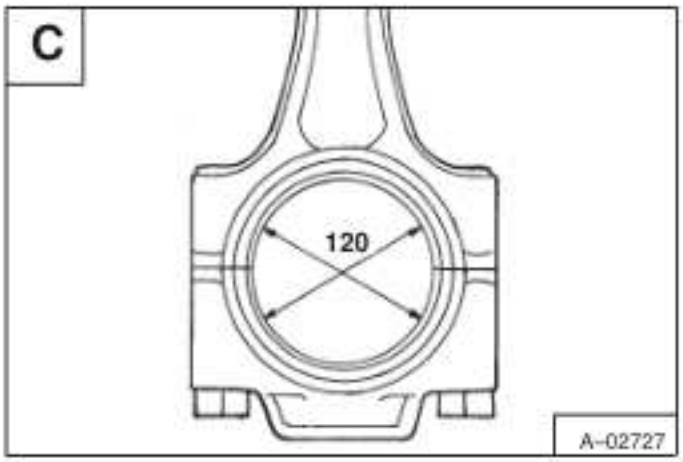
NOTE: Be sure the bushing diameter of the connecting rod is within specifications.





Check the connecting rod bearings **[C]**.

The specifications are 1.457–1.459 inches (37,00–37,06 mm). The wear limit is 0.008 inch (0,20mm).

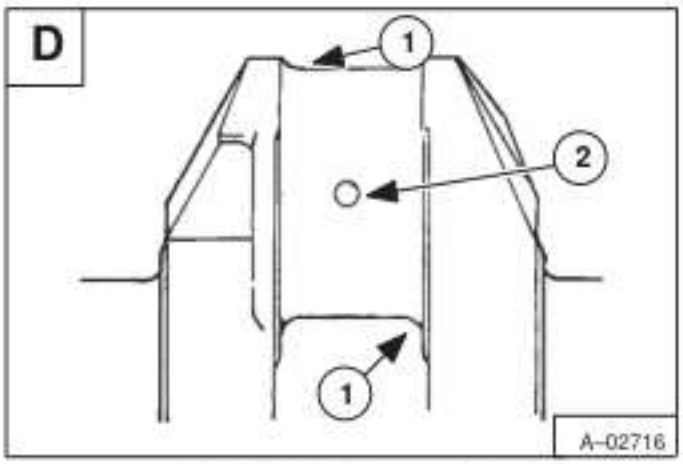


Check the connecting rod journals **[D]**.

The specifications are 1.455–1.456 inches (36,96–36,98 mm). The wear limit is 0.008 inch (0,20 mm).

If the connecting rod journals are not within specifications, grind the journals as follows **[D]**:

1. Crankshaft corner radius must be 0.138 inch R ± 0.008 inch (3,5 mmR ± 0,20 mm).
2. The oil hole must be chamfered to 0.039–0.059 inches R (0,99–1,5 mmR).



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flow from the attachment will be to the female quick coupler ⑥ and back to the front port of the control valve ⑦ .

Activating Section 2 of the 3 spool valve ⑦ (Blade) by pushing the spool into the valve, will allow the flow of oil out of the front port of the control valve ⑦ , to and thru the swivel joint ⑱ and to the base end of the cylinder ㉒ . This would force the piston to full rod extension (lowering the blade). By pulling the spool out on the control valve, will allow the flow of oil out of the rear port of the control valve ⑦ , to and thru the swivel joint ⑱ and to the rod end of the cylinder ㉒ . This would force the piston to the base end of the cylinder ㉒ (lifting the blade). Bottoming the piston out on any of the 3 spool valve ⑦ controlled cylinders will open the main relief valve ⑧ once 2300 PSI (15858 kPa) is reached.

Activating Section 3 of the 3 spool valve ⑦ (Boom Swing) by pushing the spool into the valve, will allow the flow of oil out of the front port of the control valve ⑦ , to and thru the lock valve ⑤ and to the base end of the cylinder ④ . This will force the piston to full rod extension (pivoting the boom counterclockwise). By pulling the spool out on the control valve ⑦ will allow the flow of oil out of the rear port of the control valve ⑦ , to and thru the lock valve ⑤ and to the rod end of the cylinder ④ . This will force the piston to the base end of the cylinder ④ (pivoting the boom clockwise). The swing lock valve ⑤ will prevent fluid flow from the boom swing cylinder ④ while this circuit is in the neutral position.

The return flow of oil to and thru the oil cooler ⑫ is from the 6 spool valve ⑨ T1 port and this drain line combines with the additional case drain lines, flows to and thru the oil filter ⑫ then to either the hydraulic pump ㉓ or to the hydraulic tank ⑯ . If the oil filter ⑫ element becomes plugged. The oil filter by-pass valve ⑭ will open at 25 PSI (172 kPa) and allow the oil to by-pass the filter and protect it from damage.

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fluid flow from the travel motors (17) & (19) while the machine is in neutral.By pulling out on the spool, will allow the flow of oil out the bottom port of the control valve (9) , to and thru the swivel joint (18) . The flow is then tee'd to the shuttle valve (24) which directs flow to the R.H. travel motor (17) to unlock the brakes. Oil also flows thru the holding valve (13) and into the R.H. travel motor (17) port A. This travel motor (17) will turn counterclockwise (reverse travel). Return flow will be from the R.H. travel motor (17) B port, to and thru the holding valve (13) and the swivel joint (18) and back to the top port of the control valve (9) . Any internal oil leakage in the R.H. travel motor (17) would flow out of the T port, to and thru the swivel joint (14) , into the drain line which goes back to the hydraulic tank (16) .

Activating Section 4 of the 6 spool control valve (9) (L.H. Travel) by pushing the spool into the valve, will allow the flow of oil out of the top port of the control valve (9) , to and thru the swivel joint (18) . The flow is then tee'd to the shuttle valve (24) and to the holding valves (13) . Oil flows into the shuttle valve (24) which directs flow to the L.H. travel motor (19) to unlock the brakes. Oil also flows thru the holding valve (13) and into the L.H. travel motor (19) port A. This travel motor (19) will turn counterclockwise (forward travel). Return flow will be from the L.H. travel motor (19) B port, to and thru the holding valves (13) and the swivel joint (18) and back to the bottom port of the control valve (9) .

By pulling out on the spool, will allow the flow of oil out the bottom port of the control valve (9) , to and thru the swivel joint (18) . The flow is then tee'd to the shuttle valve (24) and to the holding valves (13) . Oil flow into the shuttle valve (24) which directs flow to the L.H. travel motor (19) to unlock the brakes. Oil also flows thru the holding valve (13) and into the L.H. travel motor (19) port B. This travel motor (19) will turn clockwise (reverse travel). Return flow will be from the L.H. travel motor (19) A port, to and thru the holding valves (13) and the swivel joint (18) and back to the top port of the control valve (9) . Any internal oil leakage in the L.H. travel motor (19) would flow out of the T port, to and thru the swivel joint (18) , into the drain line which goes back to the hydraulic tank (16) .

Activating Section 5 of the 6 spool control valve (9) (swing motor) by pushing the spool into the valve, will allow the flow of oil out of the top port of the control valve (9) and to the A port of the swing motor (20) , turning the upper structure in the clockwise direction. Return flow will be from the B port of the swing motor (20) and to the top port of the control valve (9) . By pulling out on the spool will allow the flow of oil out the bottom port of the control valve (9) and to the B port of the swing motor (20) , turning the upper structure in the counterclockwise direction. Return flow will be from the A port of the swing motor (20) and to the top port of the control valve (9) . Any internal oil leakage from the swing motor (20) would flow out of the T port and into the drain line which goes back to the hydraulic tank (16) . If the upper structure is unable to rotate, the swing motor relief valves (21) will open once 1150-1275 PSI (7928-8790 kPa) is reached.

Activating Section 6 of the 6 spool control valve (9) (Boom) by pushing the spool into the valve, will allow the flow of oil out of the top port of the control valve (9) and to the base end of the cylinder (2) . This will force the piston to full rod extension (this would raise the boom). By pulling out on the spool will allow the flow of oil out of the bottom port of the control valve (9) thru the check valve orifice (28) and to the rod end of the cylinder (2) . This will force the piston to the base end of the cylinder (this will lower the boom). (NOTE: Port relief valves (30) on Section 1 and Section 6 will activate only under certain conditiones, Example: If the arm and boom section of the control valve is in the neutral position, with the arm in the full down position and the excavator is backed up. Extreme hydraulic pressure would be placed on the arm and boom section the control valves. The port relief valve (30) will open once 2850 PSI (19648 kPa) is reached. This would allow the oil to flow out of the boom (2) , and/or arm cylinder (3), and to the drain line).

Activating Section 1 of the 3 spool control valve (7) (Auxiliary) by pushing the spool into the valve, will allow the flow of oil out of the front port of the control valve (7) (NOTE: Additional oil flow is also obtained from the power beyond port PB1 of the 6 spool valve (9) , thru the power beyond hose routing (27) and to the 3 spool control valve (7)) and to the female quick coupler (5) and into the installed attachment. Return flow from the attachment will be to the male quick coupler (5) and back to the rear port of the control valve (7) . By pulling the spool out on the control valve (7) , oil will flow out of the rear port of the control valve (7) and to the male quick coupler (5) and into the installed attachment. Return

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