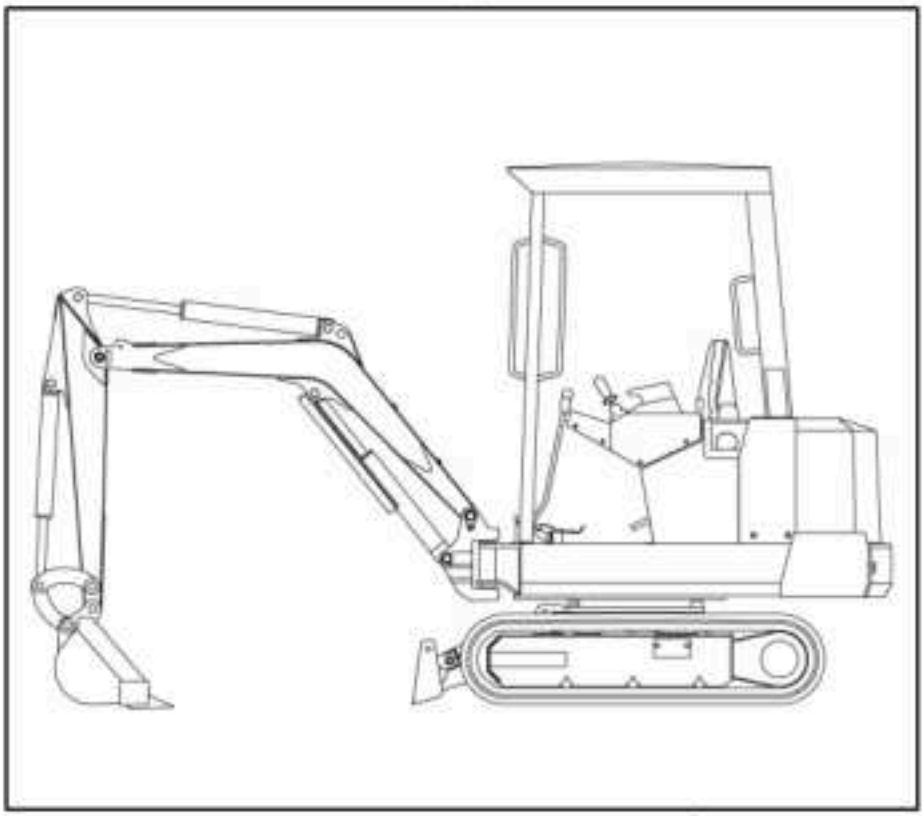
# X 220

# Excavator

# Service Manual

## (S/N 508211999 & Below)



MELROE
INGERSOLL-RAND

6720230 (5–89)

Printed in U.S.A.

bobcat

© Melroe Company 1989

MidWestTech | Bobcat X220 Excavator Service Manual | Publication 6720230_5_89 Order the manual at mid-west-tech.com >

# CONTENTS


SAFETY INSTRUCTIONS ..... i
SERIAL NUMBER LOCATIONS ..... ii
DELIVERY REPORT ..... ii
HYDRAULIC EXCAVATOR IDENTIFICATION ..... iii
PREVENTIVE MAINTENANCE ..... 1–1
HYDRAULIC SYSTEM ..... 2–1
DRIVE SYSTEM ..... 3–1
UPPER WORKS & SWING SECTION ..... 4–1
MAIN FRAME & TRACKS ..... 5–1
ELECTRICAL SYSTEM ..... 6–1
ENGINE SERVICE ..... 7–1
TECHNICAL DATA ..... 8–1







MidWestTech | Bobcat X220 Excavator Service Manual | Publication 6720230_5_89

Order the manual at mid-west-tech.com >

Remove the filter element housing **[A]**.

Remove the instrument panel and disconnect the wire harness. (See Page 6–1.)




Remove the lower mounting bolts from the hydraulic reservoir **[B]**.




Remove the upper mounting bolts from the reservoir **[C]**.




Remove the bolts from the upright frame **[D]**.






MidWestTech | Bobcat X220 Excavator Service Manual | Publication 6720230_5_89

Order the manual at mid-west-tech.com >

## TROUBLESHOOTING

The following troubleshooting chart is provided as an assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

| PROBLEM | CAUSE |
|---|---|
| Slow cranking speed. | 1, 2, 3, 4 |
| Engine will not start. | 2, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 19, 27, 28, 29 |
| Difficult to start. | 5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 25, 27, 28, 29 |
| No power from engine. | 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 27, 28, 29 |
| Engine is mis–firing. | 8, 9, 11, 12, 13, 15, 16, 17, 21, 22, 24, 25, 26, 28 |
| Too much fuel consumption. | 10,12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29 |
| Black exhaust. | 10, 12, 13, 15, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29 |
| Blue/white exhaust. | 4, 10, 15, 16, 17, 21, 23, 27, 29, 30, 50 |
| Low oil pressure. | 4, 31, 32, 33, 34, 35, 37, 39, 52 |
| Engine knocking. | 13, 15, 16, 19, 22, 24, 25, 27, 29, 31, 40, 41, 53 |
| Engine running rough. | 7, 8, 9, 10, 11, 12, 13, 17, 18, 22, 24, 25, 26, 29, 40, 53 |
| Vibration. | 12, 13, 17, 21, 22, 25, 26, 29, 40, 42, 43 |
| High oil pressure. | 4, 33, 36 |
| Overheating. | 10, 12, 13, 15, 16, 20, 21, 40, 44, 45, 46, 47, 51 |
| Too much crankcase pressure. | 22, 27, 29, 30, 40, 49 |
| Poor compression. | 10, 16, 21, 24, 25, 27, 28, 29, 30, 41, 53 |
| Start and stop. | 9, 10, 11 |

### KEY TO CORRECT THE CAUSE

1. Battery capacity low.
2. Bad electrical connections.
3. Faulty starter motor.
4. Incorrect grade of oil.
5. Low cranking speed.
6. Fuel tank empty.
7. Faulty stop control operation.
8. Plugged fuel line.
9. Plugged fuel filter.
10. Restriction in the air cleaner.
11. Air in the fuel system.
12. Faulty fuel injection pump.
13. Faulty fuel injectors.
14. Broken injection pump drive.
15. Incorrect injection pump timing.
16. Incorrect valve timing.
17. Poor compression.
18. Plugged fuel tank vent.
19. Incorrect grade of fuel.
20. Exhaust pipe restriction.
21. Cylinder head gasket leaking.
22. Overheating.
23. Cold running.
24. Incorrect tappet adjustment.
25. Sticking valves.
26. Incorrect high pressure fuel lines.
27. Worn cylinder bores.
28. Worn valves and seats.
29. Broken or worn piston rings.
30. Worn valve stems or guides.
31. Worn or damaged bearings.
32. Not enough oil in the oil pan.
33. Switch is defective.
34. Oil pump worn.
35. Relief valve is stuck open.
36. Relief valve is stuck closed.
37. Broken relief valve spring.
38. Faulty suction pipe.
39. Plugged oil filter.
40. Piston seizure.
41. Incorrect piston height.
42. Faulty engine mounting.
43. Incorrect alignment of flywheel.
44. Faulty thermostat.
45. Restriction in water jacket.
46. Loose alternator belt.
47. Plugged radiator.
48. Faulty water pump.
49. Plugged breather pipe.
50. Damaged valve stem oil deflectors.
51. Coolant level too low.
52. Plugged oil pump pipe strainer.
53. Broken valve spring.



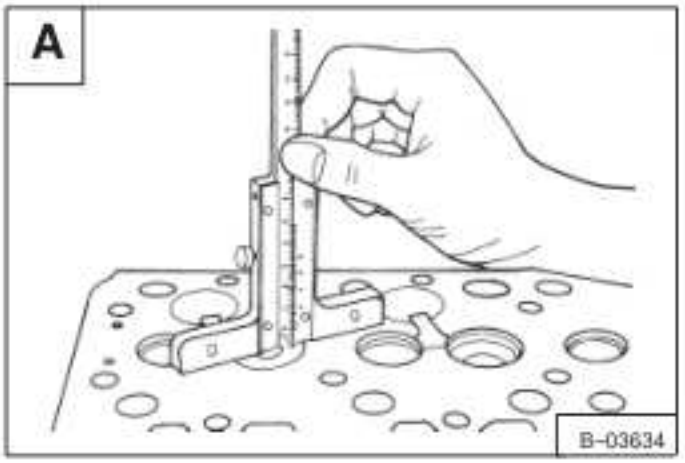
MidWestTech | Bobcat X220 Excavator Service Manual | Publication 6720230_5_89 Order the manual at mid-west-tech.com >

### Servicing the Cylinder Head and Valves (Cont'd)

Install the valve in the seat and check the depth **[A]**.

The specifications for the depth of the valve is 0.043"–0.051" (1,09–1,30 mm).

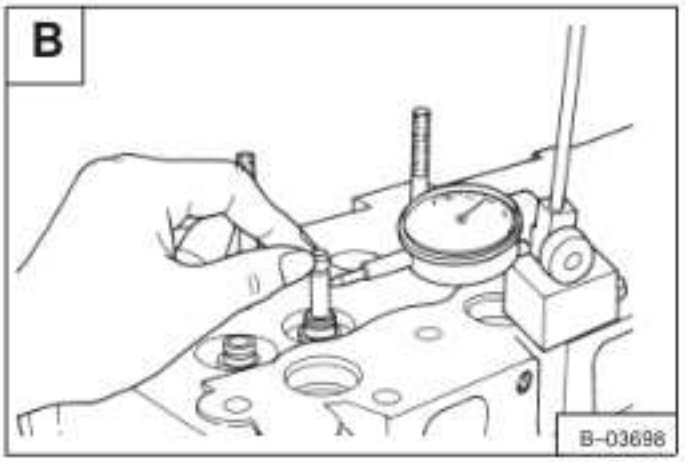
If the measurement is more than specifications, add the correct thickness of washer under the valve spring to keep the correct spring tension.




Clean the valve guide. Install the valve in the cylinder head. Install a dial indicator **[B]**.

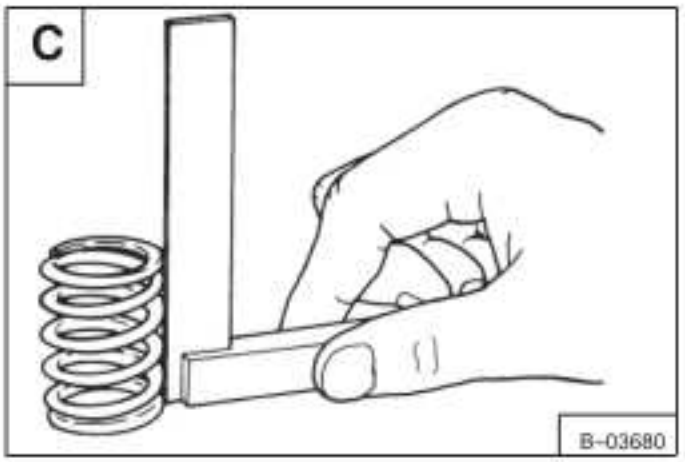
Measure the clearance of the valve guide and the valve. The measurement must be 0.0014"–0.0026" (0,04–0,07 mm).

Replace the valve guide and valves as needed. Make sure to ream the inside diameter of the new guide to the correct dimension of 0.276"–0.277" (7,01–7,04 mm)




### Checking the Valve Springs

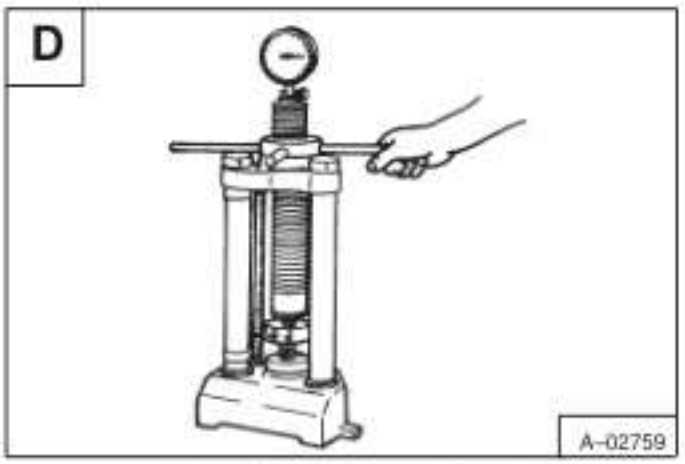
Measure the valve spring. The length of the spring must be 1.382"–1.402" (35,1–35,6 mm). Check the valve spring with a square to make sure it is straight **[C]**.




Put the valve spring in a tester **[D]**.

Push down on the spring 1.22" (31 mm), the compression load must be 16.5 lbs. (7,5 kg).

Replace the valve spring if it does not meet these specifications.





Order the manual at mid-west-tech.com >

By pulling the spool out (Section 9) on the control valve ❷ will allow the flow of oil out of the front port of the control valve ❷ to the A port of the swing motor ⓱ , turning the upper structure in the counterclockwise direction. Return flow will be from the B port of the swing motor ⓱ and back to the control valve ❷ rear port. Any internal oil leakage in the swing motor ⓱ would flow out of the T port and into the drain line which goes back to the hydraulic tank ❿ . (NOTE: If the rotation of the upper structure is blocked, the swing motor relief valves ⓲ will open at 1635 PSI (11273 kPa) for S/N 11001-11500; 1500 PSI (10342 kPa) for S/N 11501-11703 or 1150 PSI (7929 kPa) for S/N 11704-11999 which will divert the oil flow to the drain line and back to the hydraulic tank ❿ ).

Activating Section 10 (Arm) of the control valve ❷ by pushing the spool into the valve will allow the flow of oil thru the rear port of the control valve ❷ and to the restrictor adapter ㉔ and to the rod end of the arm cylinder ㉑ , forcing the piston to the base end of the cylinder (pushing the arm away from the excavator) until the piston bottoms out. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

By pulling the spool out (Section 10) on the control valve ❷ , oil will flow out of the front port of the control valve ❷ and to the base end of the arm cylinder ㉑ , forcing the piston to the rod end of the cylinder (pulling the arm towards the excavator) until the piston bottoms out. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

(NOTE: Port relief valves ❺ on Section 4 (Boom) and Section 10 (Arm) will only activated under certain conditions Example: If the arm and boom section of the control valve ❷ is in the neutral position, and the arm is in the full down position and the excavator is backed up, extreme hydraulic pressure would be placed on the arm & boom section of the control valve ❷ . Port relief valve ❺ would open once 2700 PSI (18616 kPa) is reached. This would allow the oil to flow out of the boom ⓴ and/or arm cylinder ㉑ and to the drain line).

All hydraulic oil going into the drain line from the control valve ❷ , swing motor ⓱ and swivel joint ⓮ goes to the oil filter ❼ and then into the hydraulic tank ❿ .

If the oil filter ❼ element becomes plugged, the oil filter ❼ by-pass valve ❽ will open at 25 PSI. The oil would be directed around the filter element and into the hydraulic tank ❿ .



MidWestTech | Bobcat X220 Excavator Service Manual | Publication 6720230_5_89 Order the manual at mid-west-tech.com >

Section 3 is plugged and not used on S/N 11001—11308 and on S/N 11308—11999 has been removed creating a 9 spool valve.

Activating Section 4 (Boom) of the control valve ❷ by pushing the spool into the valve will allow flow thru the rear port of the control valve ❷ and to the rod end of the boom cylinder ⓴ . This will force the piston down to the base end of the cylinder ⓴ (lowering the boom) until it bottoms out. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

By pulling the spool out (Section 4) on the control valve ❷ , oil will flow out of the front port of the control valve ❷ and to the restrictor adapter ㉔ and to the base end of the boom cylinder ⓴ (raising the boom) forcing the piston to full rod extension. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

Activating Section 5 (Bucket) of the control valve ❷ by pushing the spool into the valve will allow flow thru the rear port of the control valve ❷ to the base end of the bucket cylinder ㉒ pushing the piston to full rod extension (closing the bucket). Bottoming the piston out will open main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

By pulling the spool out (Section 5) on the control valve ❷ , oil will flow out of the front port of the control valve ❷ and to the rod end of the bucket cylinder ㉒ pushing the piston to the base end of the cylinder ㉒ (opening the bucket). Bottoming the piston out will open the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

Activating Section 6 (Boom Swing) of the control valve ❷ by pushing the spool into the valve will allow flow thru the rear port of the control valve ❷ to the restrictor adapter ㉔ and to the base end of the boom swing cylinder ⓳ forcing the piston to the rod end of the cylinder ⓳ (pivoting the boom counterclockwise) until it bottoms out. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

By pulling the spool out (Section 6) on the control valve ❷ , oil will flow out of the front port of the control valve ❷ and to the rod end of the boom swing cylinder ⓳ forcing the piston to the base end of the cylinder ⓳ (pivoting the boom clockwise) until it bottoms out. This then opens the main relief valve ❹ once 2133 PSI (14707 kPa) is reached.

Some excavators have had a swing lock valve ㉚ installed into the boom swing cylinder ⓳ hydraulic circuit. This will prevent fluid flow from the boom swing cylinder ⓳ while this circuit is in the neutral positin.

Activating Section 7 (L.H. Travel) of the control valve ❷ pushing the spool into the valve will allow the flow of oil out the rear port of the control valve ❷ , thru the swivel joint ⓮ and to the L.H. travel motor ⓯ port P1. The L.H. travel motor ⓯ will turn counterclockwise (Forward Travel). Return flow will be from the L.H. travel motor ⓯ P2 port to and thru the swivel joint ⓮ and to the front port of the control valve ❷ .

By pulling the spool out (Section 7) on the control valve ❷ will allow the flow of oil out the front port of the control valve ❷ , thru the swivel joint ⓮ and to the L.H. travel motor ⓯ port P2. The L.H. travel motor ⓯ will turn clockwise (Reverse Travel). Return flow will be from the L.H. travel motor ⓯ P1 port, an thru the swivel joint ⓮ and to the rear port of the control valve ❷ . Any internal oil leakage in the L.H. travel motor ⓯ would flow out of the T port, to and thru the swivel joint ⓮ , into the drain line which goes back to the hydraulic tank ❿ .

Activating Section 8 (Auxiliary) of the control valve ❷ by pushing the spool into the valve will allow the flow of oil out the rear port of the control valve ❷ and to the female quick coupler ㉓ and into the installed attachment. Return flow from the attachment would come thru the male coupler and return to the front port of the control valve ❷ . By pulling the spool out (Section 8) on the control valve ❷ will allow the flow of oil out the front port of the control valve ❷ and the auxiliary foot pedal will actuate an electric micro switch which switches the flow from the diverter valve ㉕ to the male quick coupler ㉓ and into the installed attachment. (NOTE: This oil flow would be increased to 9 GPM (34 L/min.). Return flow from the attachment could come thru the female quick coupler ㉓ and return to the rear port of the control valve ❷ (or the return line can be switched to the direct to tank line which allows the oil to flow directly back to the hydraulic tank ❿ ). (To change flow to direct to tank, disconnect the female coupler hose at frame manifold and install this hose onto the direct to tank bulk head fitting.)

Activating Section 9 (Swing Motor) of the control valve ❷ by pushing the spool into the valve will allow the flow thru the rear port of the control valve ❷ and to the B port of the swing motor ⓱ , turning the upper structure in the clockwise direction. Return flow will be the A port of swing motor ⓱ and back to the control valve ❷ front port.


Order the manual at mid-west-tech.com >