



Maintaining Constant Pressure on a Compaction Roller During Road Grading

Tony Jasumback, Project Leader

The Missoula Technology and Development Center has developed a hydraulic circuit for a motorized grader that will provide a constant, preset pressure on a compaction roller attached to the grader, regardless of the severity of the road's vertical curves. The roller was mounted on the grader's

tool bar. Hydraulic pressure was used to provide part of the compaction force rather than relying solely on the weight of the roller. Two John Deere 770B motorized graders with modified hydraulic systems are in operational use on the Nez Perce National Forest (Figure 1).

Surface compaction of a freshly graded road may substantially reduce erosion and resulting stream sedimentation during wet weather. The roller allows the road surface to be compacted at the same time it is being graded. However, when the roller passes through a negative curve or when



Figure 1—The modified compaction roller attached to the grader's toolbar maintains a constant pressure despite dips and rises in the road's surface.



the grader wheels drop into a hole, the hydraulic system has to relieve pressure or the grader wheels would lose traction and spin. When the grader passes over a positive curve or over an obstacle, the roller could be suspended above the ground. Both conditions would be unacceptable. The hydraulic system can maintain a preset pressure on the roller, regardless of the severity of the vertical curves the grader passes over.

Motorized graders generally have an open-center or closed-center hydraulic system. In the open-center hydraulic system, the

hydraulic pump maintains a constant flow at minimal pressure. The flow must be restricted to build pressure. In a closed-center system, the pump maintains pressure with minimum flow (to make up for internal losses) until there is a demand for more flow (when a valve is opened, for instance). The closed-center system appears to be the most commonly used.

Figure 2 shows the schematic for the closed-center hydraulic system. It consists of a pilot-operated pressure reducing and relieving valve, a pressure gauge and a

solenoid-operated on-off valve. The pressure reducing and relieving valve reduces the hydraulic system pressure to that desired by the operator, anywhere between 50 and 1500 psig. The valve's pilot section senses the preset pressure and adjusts the valve to maintain it. If the pressure reaches about 175 psig above the set value (for instance, when the wheels drop into a hole), the valve will shift to relieve pressure. If the pressure starts to decrease (for instance, when the wheels pass over a rock), the pilot section opens the valve to increase system pressure. The valve constantly moves back and

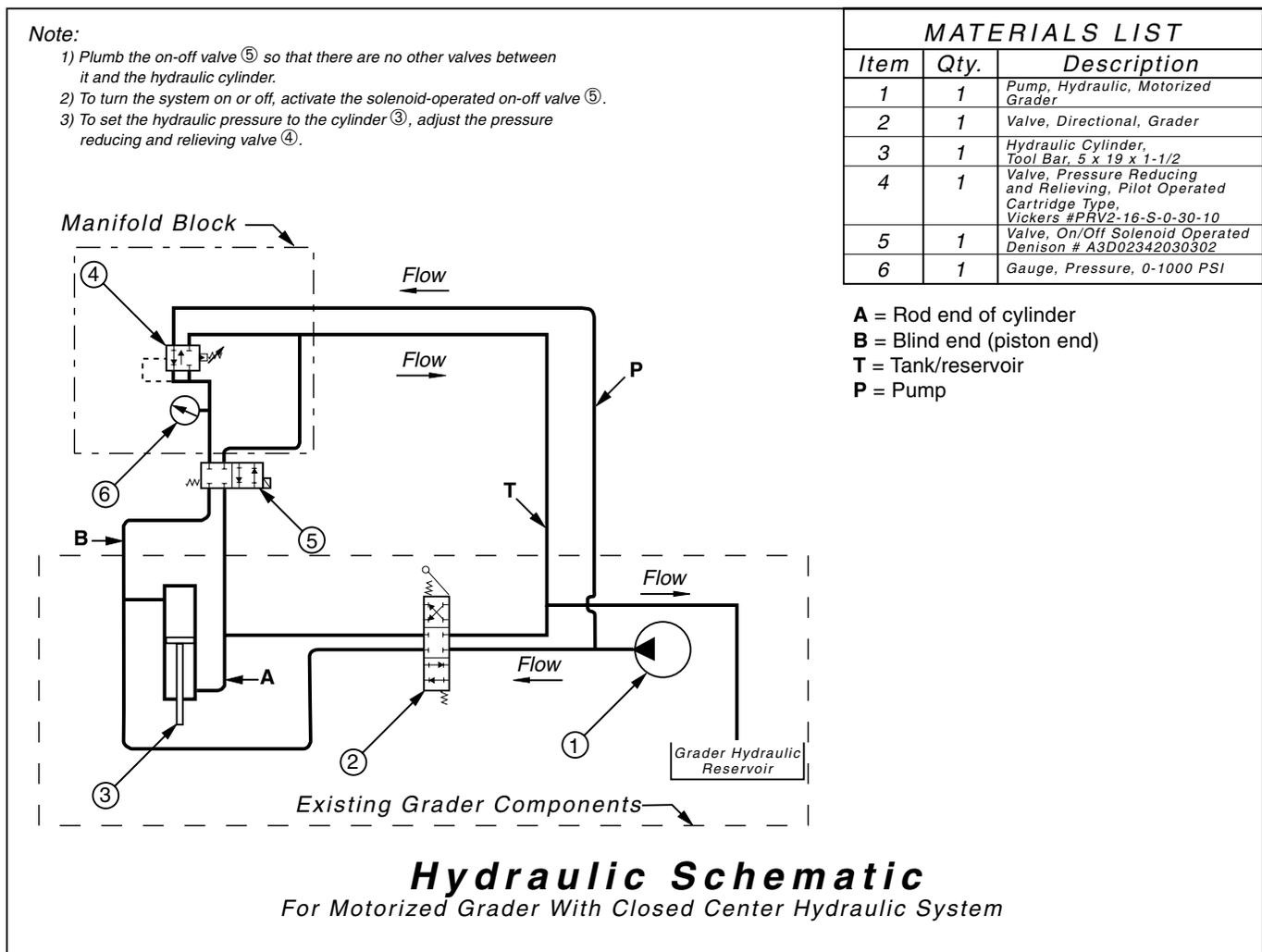


Figure 2—Hydraulic schematic for a motorized grader with a closed-center hydraulic system.

forth, maintaining the set pressure. The grader's hydraulic reservoir provides make-up oil for the roller cylinder's rod end. The operator uses the pressure gauge to set the pressure on the roller cylinder. A solenoid valve turns the system on or off.

Figure 3 shows the schematic for the open-center system. The open and closed systems are the same, except for the addition of an accumulator and a check valve in the open system. These components keep enough pressurized oil available to operate the pressure reducing and relieving valve and the roller hydraulic

cylinder. In the open-center system, the grader pump is always operating at minimum pressure and high flow. To increase pressure, the flow must be restricted or blocked. This happens when any of the grader controls are operated. Otherwise, the grader system's operating pressure is too low to maintain the set pressure to the roller cylinder. The supply hose for the accumulator and check valve should be plumbed in as close to the grader hydraulic pump as possible—and ahead of any grader control valves—to ensure that the accumulator is sufficiently pressurized at all times.

The components for the modification (including hoses and fittings) cost about \$600 (1997 dollars) for the closed-center system and about \$900 for the open-center system.

The two modified graders generally run with the pressure to the roller cylinder set at 50 to 400 psig. This seems to be adequate for the current road conditions. Higher pressures are possible. At pressures of around 1000 to 1200 psig, the roller will lift the grader, causing the wheels to lose traction and spin. For information on the system's operational use, contact

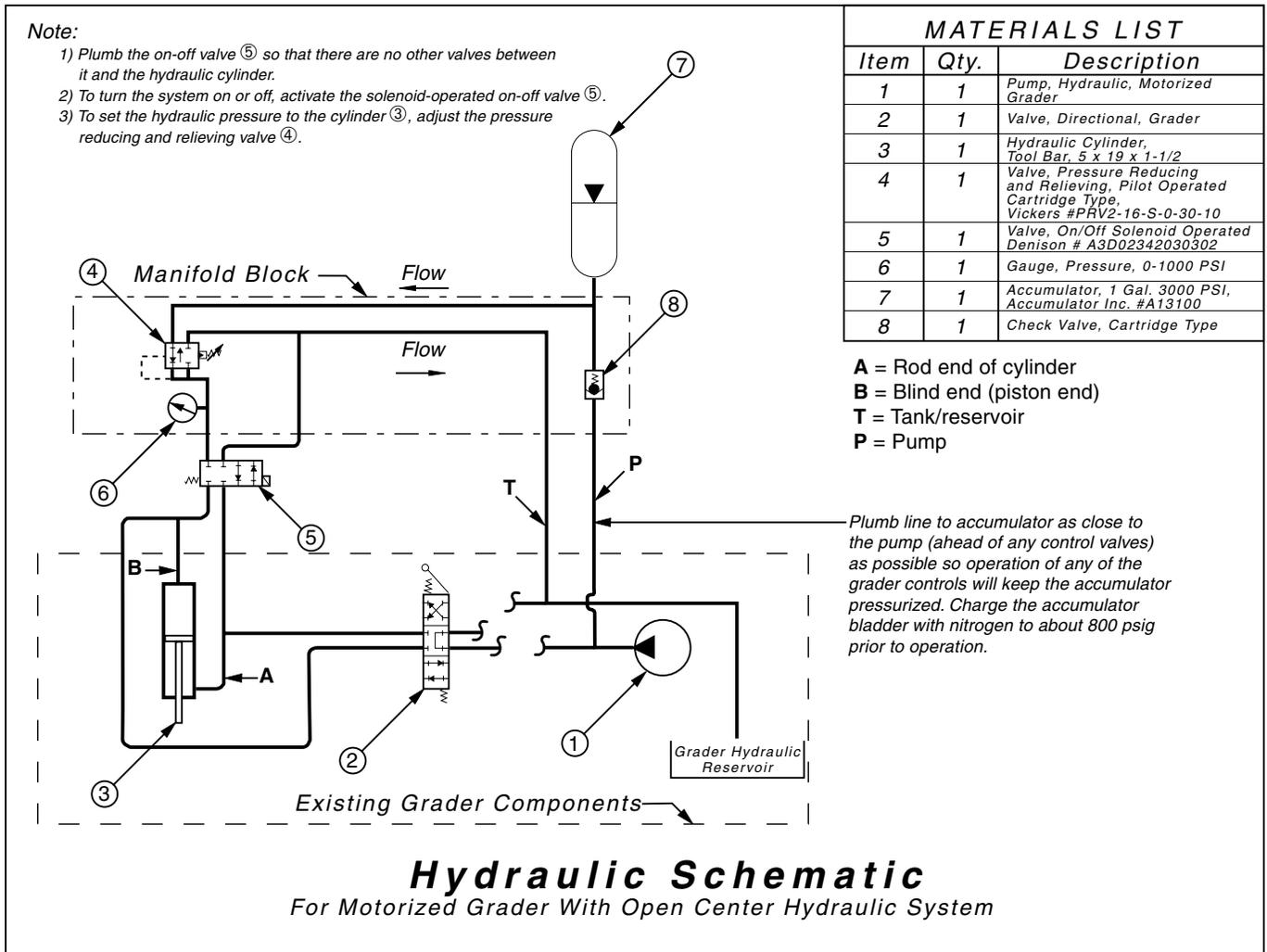


Figure 3—Hydraulic schematic for a motorized grader with an open-center hydraulic system.

John Crotinger, Nez Perce National Forest, (208) 983-1950 or DG: j.crotinger:r01f17a or IBM: jcroting/r1,nezperce. For information on this project, contact Tony

Jasumback, Missoula Technology and Development Center, (406) 329-3922 or DG: t.jasumback:r01a or IBM: tjasumback/wo,mtdc.

About the Author—

Tony Jasumback is a mechanical engineer at the Missoula Technology and Development Center.



The Forest Service, United States Department of Agriculture, has developed this information for the guidance of its employees, its contractors, and its cooperating Federal and State agencies, and is not responsible for the interpretation or use of this information by anyone except its own employees. The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader, and does not constitute an endorsement by the Department of

any product or service to the exclusion of others that may be suitable. The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means of communication of program information

(braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice or TDD). To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, D.C. 20250, or call 1-800-245-6340 (voice) or (202) 720-1127 (TDD). USDA is an equal employment opportunity employer.