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ENGINEERING SERVICES

[Pressure intensification in hydraulic cylinders](#)

By Brendan Casey, HydraulicSupermarket.com

A question that I'm asked regularly is "What is the best way to test the integrity of the piston seal in a double-acting hydraulic cylinder?"

There is a simple bench-test for doing this but it involves the intensification of pressure in the cylinder. While the test procedure is safe if you understand the concept of intensification in a hydraulic cylinder - it is inherently dangerous if you don't.

In this article I will explain the dangers of intensification in a double acting cylinder and in a future article I will explain the test procedure.

Cylinder force

Force produced by a hydraulic cylinder is a product of pressure and area ($F = p \times A$). In a conventional double-acting cylinder the effective area and therefore force produced by the piston and rod sides of the cylinder are unequal. It follows that if the rod side of the cylinder has half the effective area of the piston side, it will produce half the force of the piston side for the same amount of pressure.

Pressure intensification

The equation $F = p \times A$ can be transposed as $p = F/A$ that is, pressure equals force divided by area. If the rod side of the cylinder has to resist the force developed by the piston side, with only half the area, then it needs double the pressure. This means that if the piston side is pressurized to 3,000 PSI a pressure of 6,000 PSI will be required on the rod side to produce an equal force. This is why pressure intensification can occur in a double-acting cylinder. Note that pressurizing a cylinder rated at 3,000 PSI, to 6,000 PSI can have devastating consequences. [Watch this 6-minute video](#) for a better understanding of pressure intensification.

If, for any reason, the piston side of a double-acting cylinder is pressurized and at the same time fluid is prevented from escaping from the rod side, pressure will increase (intensify) in the rod side of the cylinder until the forces become balanced or the cylinder fails catastrophically. Consider the following scenario one of our newsletter readers described to me recently:

"It was minus 36 degrees here the other day and we had a cylinder at about minus 10 degrees. The boss was attempting to press out a pin. He turned on

the pump and moved the lever, and the gland end of the cylinder blew out. It was a 7.5" cylinder with a 2,500 PSI operating pressure."

The gland on this cylinder blew out as a result of pressure intensification due to a blockage between the rod side of the cylinder and tank. Possibly due the cold conditions, that is the ambient temperature had fallen below the pour point of the hydraulic fluid.

Safety is paramount

As you can see, pressure intensification in a double-acting cylinder is a dangerous phenomenon and the concept must be thoroughly understood when testing hydraulic cylinders.

ABOUT THE AUTHOR: Brendan Casey has more than 25 years experience in the maintenance, repair and overhaul of mobile and industrial hydraulic equipment. For more information on reducing the operating cost and increasing the up-time of your hydraulic equipment, visit his web site:

<http://www.HydraulicSupermarket.com>