Glossary

Cavitation

Refer to Research on Technology to Control Air Bubble Content in Hydraulic Fluid (page 17)

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1 What Is Cavitation?

A hydraulic fluid may contain bubbles for several reasons, including mixing of the air by agitation, mixing of the air due to vibration of the hydraulic circuit or tank (sloshing), and precipitation of the air dissolved in the fluid when the fluid pressure reduces to a certain level (aeration). Particularly, when the pressure reduces to below the saturated vapor pressure due to an increase in flow rate of the fluid in the hydraulic line or machinery, the fluid may vaporize to generate bubbles. This phenomenon is called cavitation (Fig. 1).

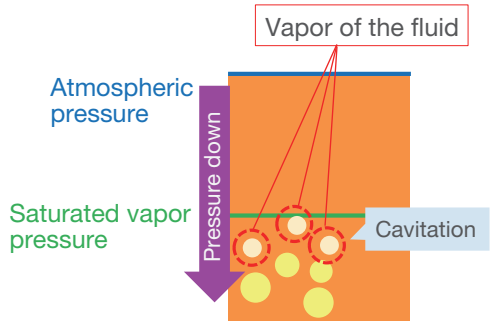

Fig. 1 How cavitation occurs

2 Problems Caused by Cavitation

Bubbles that have been generated by cavitation rapidly disappear (collapse) when the fluid pressure increases again. The collapse generates impact pressure that may damage the wall of the fluid duct and machinery components, which may cause erosion (cavitation erosion). Repeated shock waves may also lead to vibration or noise of the piping or machinery.

In addition, cavitation could be a cause of degraded products. The following introduces two examples of such products.

2.1 Hydraulic Pumps

When a hydraulic pump is run at a higher speed, the hydraulic fluid is sucked at a higher flow rate. Once the suction speed exceeds a certain level, the suction port has a local decrease in pressure, causing cavitation. When a number of bubbles are present in the fluid, the fluid accounts for less percentage of the suction volume by the same amount as the bubbles. This results in the problem of a decrease in discharge rate as shown in Fig. 2.

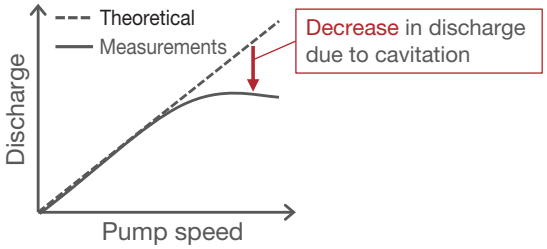

Fig. 2 Discharge characteristics

2.2 Shock Absorbers

A shock absorber as a component of an automobile (Fig. 3[(1)]) can alleviate the vibration transmitted from the surface of the road to the vehicle body. This can be achieved by a piston rod (valve) moving backwards and forwards within a cylinder filled with a hydraulic fluid. If the piston rod abruptly strokes at a higher speed, cavitation may occur to generate bubbles. When the bubbles affect the compressibility of the fluid, the intended damping characteristics may be lost as shown in Fig. 4.

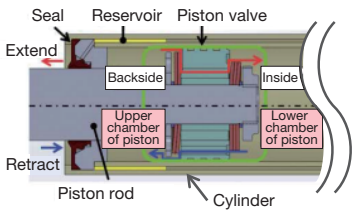

Fig. 3 Overview of shock absorber

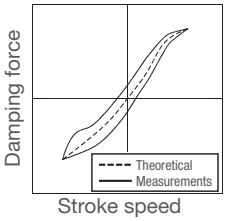

Fig. 4 Damping characteristics

References

1) SANO Yuta: Development for Analytical Technology of Shock Absorber Valve Characteristics, KYB Technical Review No. 58 (April 2019).