



Task Title: Understanding Hydraulic Power Systems

OALCF Cover Sheet – Learner Copy

Learner Name: _____

Date Started: _____

Date Completed: _____

Successful Completion: Yes No

Goal Path: Employment Apprenticeship

Secondary School Post Secondary Independence

Task Description: The learner will read about hydraulic power system parts and answer questions.

Main Competency/Task Group/Level Indicator:

- Find and Use Information/Read continuous text/A1.3

Materials Required:

- Pen/pencil and paper and/or digital device

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Learner Information

Millwrights must be able to identify parts and uses of Hydraulic Power Systems. Each part plays an important role in the successful operation of a particular hydraulic cylinder.

Read "Parts of a Hydraulic Cylinder".

Parts of a Hydraulic Cylinder

Hydraulic Power Systems are used in manufacturing operations of all kinds, from simple holding and clamping operations to bending, punching and assembling. A hydraulic cylinder consists of the following parts:

Cylinder barrel

The main function of cylinder body is to hold cylinder pressure. The cylinder barrel is mostly made from a seamless tube. The cylinder barrel is ground and/or honed internally with a typical surface finish of 4 to 16 microinch. Normally hoop stress is calculated to optimize the barrel size.

Cylinder base or cap

The main function of the cap is to enclose the pressure chamber at one end. The cap is connected to the body either by welding, threading, bolts, or tie rod. Cap size is determined based on the bending stress. A static seal / o-ring is used in between cap and barrel (except welded construction).

Cylinder head

The main function of the head is to enclose the pressure chamber from the other end. The head contains an integrated rod sealing arrangement or the option to accept a seal gland. The head is connected to the body in one of the following methods: threading, bolts, or tie rod. A static seal / o-ring is used in between head and barrel.

Piston

The main function of the piston is to separate the pressure zones inside the barrel. The piston is machined with grooves to fit elastomeric or metal seals and bearing elements. These seals can be single acting or double acting. The difference in pressure between the two sides of the piston causes the cylinder to extend and retract. The piston is attached with the piston rod by means of threads, bolts, or nuts to transfer the linear motion.

Piston rod

The piston rod is typically a hard chrome-plated piece of cold-rolled steel which attaches to the piston and extends from the cylinder through the rod-end head. In double rod-end cylinders, the actuator has a rod extending from both sides of the piston and out both ends of the barrel. The piston rod connects the hydraulic actuator to the machine component doing the work. This connection can be in the form of a machine thread or a mounting attachment.

Seal gland

The cylinder head is fitted with seals to prevent the pressurized oil from leaking past the interface between the rod and the head. This area is called the seal gland. The advantage of a seal gland is easy removal and seal replacement. The seal gland contains a primary seal, a secondary seal / buffer seal, bearing elements, wiper / scraper and static seal. In some cases, especially in small hydraulic cylinders, the rod gland and the bearing elements are made from a single integral machined part.

Seals

The seals are considered / designed as per the cylinder working pressure, cylinder speed, operating temperature, working medium and application. Piston seals are dynamic seals, and they can be single acting or double acting. Generally speaking, Elastomer seals made from nitrile rubber, Polyurethane or other materials, are best in lower temperature environments, while seals made of Fluorocarbon Viton are better for higher temperatures. Metallic seals are also available and commonly use cast iron for the seal material. Rod seals are dynamic seals and generally are single acting. The compounds of rod seals are nitrile rubber, Polyurethane, or Fluorocarbon Viton. Wipers / scrapers are used to eliminate contaminants such as moisture, dirt, and dust, which can cause extensive damage to cylinder walls, rods, seals and other components. The common compound for wipers is polyurethane. Metallic scrapers are used for sub-zero temperature applications, and applications where foreign materials can deposit on the rod. The bearing elements / wear bands are used to eliminate metal to metal contact. The wear bands are designed as per the side load requirements. The primary compounds for wear bands are filled PTFE, woven fabric reinforced polyester resin and bronze.

Work Sheet

Task 1: List the parts of a hydraulic cylinder.

Answer:

Task 2: List ways in which the cylinder cap can be connected to the cylinder base.

Answer:

Task 3: Describe how the cylinder head may be connected to the body.

Answer:

Task 4: List ways in which the piston rod may connect the hydraulic actuator to the machine component.

Answer:

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Task 5: When are metallic scrapers used in seals?

Answer:
