FLUID POWER

TUTORIAL - SYMBOLS AND STANDARDS

This tutorial provides the background information for Outcome 1 of the Edexcel standard module:

UNIT 21746P APPLIED PNEUMATICS AND HYDRAULICS

Outcome one is somewhat general and difficult to cover without studying the other outcomes at the same time. The model assignments should be attempted only when a fuller understanding of fluid power has been achieved by studying the rest of the tutorials. This tutorial is quite short in content but provides a very comprehensive study of fluid power.

Outcome 1 Investigate fluid power diagrams	• Recognise and describe appropriate fluid power symbols.
	• Review and report on a design for either pneumatic or hydraulic multi-actuator sequential operation using a minimum of four actuators.
	• Review and report on a design for either pneumatic or hydraulic rotary actuation with speed control in both directions.
	• Review and report on common faults and problems encountered on fluid power diagrams.

On completion of this tutorial you should be able to do the following.

- Explain the general purpose of fluid power.
- Explain the importance of standards.
- Find and use the appropriate standards.
- Explain the correct layout and identification of fluid power circuit diagrams.

APPLICATIONS OF PNEUMATICS AND HYDRAULICS

1. INTRODUCTION

Fluid power is widely used throughout industry and throughout the world. Here are some examples.

- Earth moving machines such as excavators. (Hydraulics)
- Winches on cranes and boats. (Hydraulics)
- Rams for extrusion presses. (Hydraulics)
- Automated production lines.(Pneumatic and Hydraulic)
- Aeroplane controls.(Hydraulic).
- Automated assembly units. (Pneumatic and Hydraulic)
- Robots. (Pneumatic and Hydraulic)
- Machine tools (Hydraulic)

Hydraulic power is usually used for precise control of large forces (e.g. rudder control on an aeroplane).
Pneumatic power is used for rapid but light forces (e.g. rapid assembly of electrical components in a witch box).

2. STANDARDS

STANDARDS ARE IMPORTANT FOR THE FOLLOWING REASONS.

- Components must be interchangeable and must perform to known standards. This includes actuators, valves and pipe fittings.

- Symbols must be interpreted the same way by any competent person so that they can follow a circuit diagram and install them correctly.

- Drawings layouts and drawing symbols must be interpreted the same way by any competent person and this involves both circuit and layout drawings.

- There are many other standards concerning things such as the composition health and safety, hydraulic fluids and filters.

There are various organisations devoted to producing standards in the field of fluid power.

The standards organisations in this field are

- BS, (British Standards).

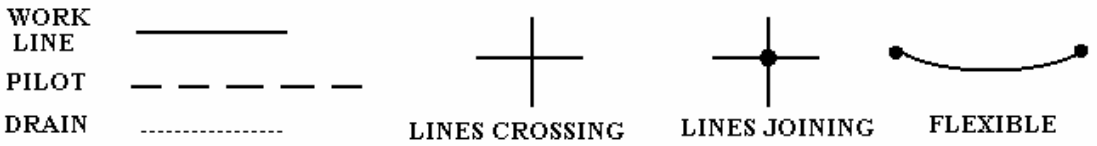
- ISO (International Standards Organisation.

- CETOP (Comite Des Transmissions Oleohydrauliques et Pneumatiques or European Hydraulic and Pneumatics Committee).

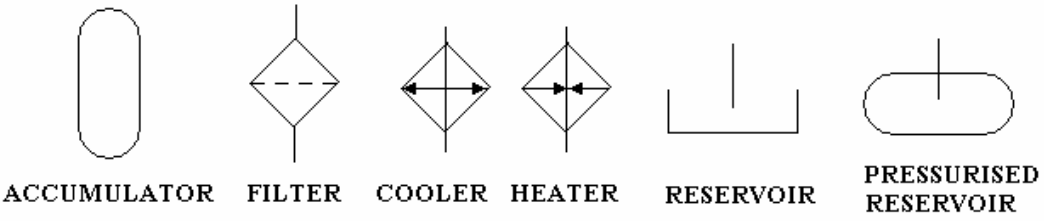
You will find a complete list of fluid power standards on the following website.
http://www.fimop.be/en/norm
http://www.iso.ch/iso/en/ISOOnline.openerpage
http://www.cetop.org/presentation.htm
Symbols may be found on the web e.g at http//www.HydraulicSupermarket.com

BASIC FLUID POWER SYMBOLS - NOT DRAWN TO SCALE

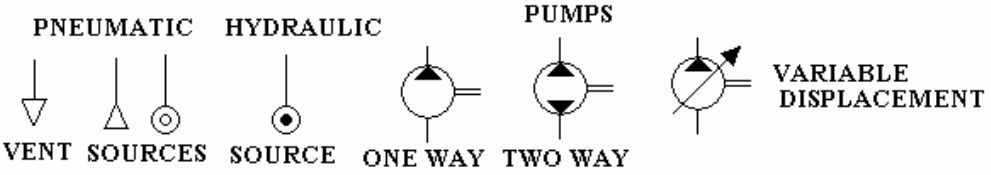
LINES



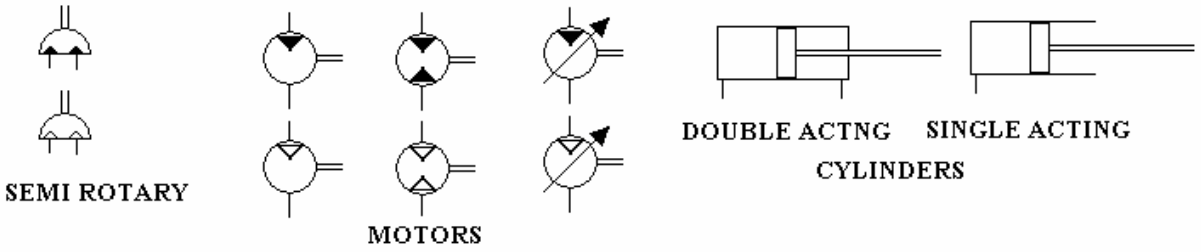
FLUID CONDITIONING/STORAGE



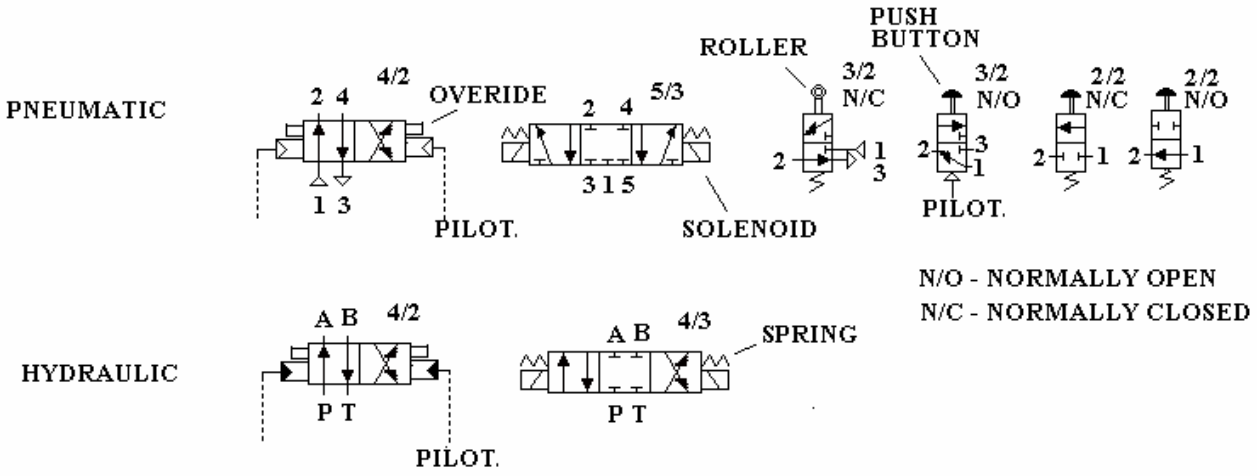
PUMPS

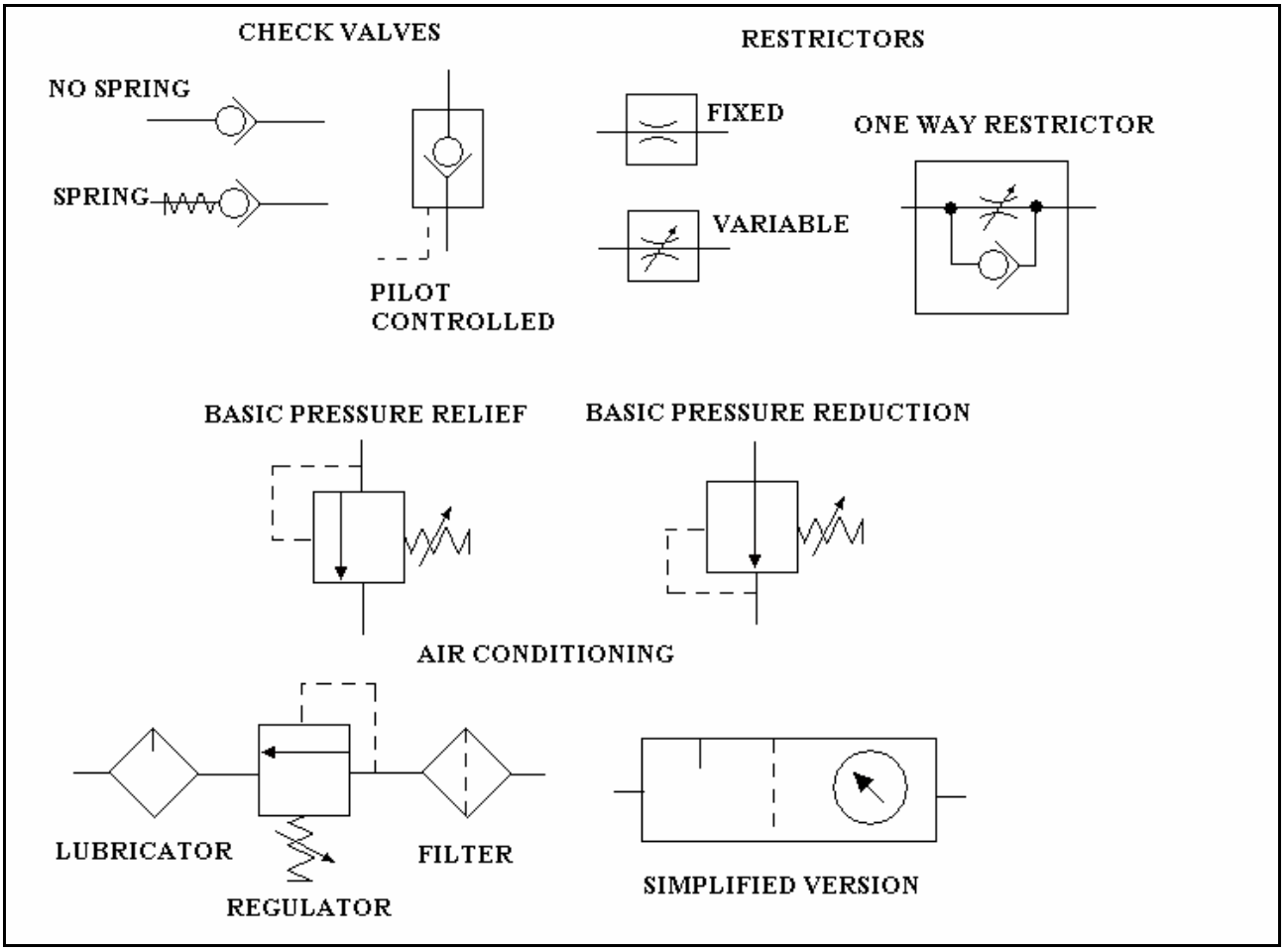


ACTUATORS



DIRECTIONAL CONTROL VALVES




CHECK VALVES
NO SPRING
SPRING
PILOT
CONTROLLED
RESTRICTORS
FIXED
VARIABLE
ONE WAY RESTRICTOR
BASIC PRESSURE RELIEF
BASIC PRESSURE REDUCTION
AIR CONDITIONING
LUBRICATOR
FILTER
REGULATOR
SIMPLIFIED VERSION

3. DRAWING CIRCUIT DIAGRAMS

The main standards for circuit drawings are as follows.

Symbols must be created to standards BS2917/ISO 1219-1. You should use these throughout your studies.

The layout of the drawing should conform to ISO 1219 – 2

The standards for connections to the hardware are covered by ISO 9461

Each component on the circuit diagram should be numbered and annotated with essential data such as pressure settings and capacity.

NUMBERING SYSTEM

The number should consist of four parts. Consider the identification tag 2 – 3V5

The first number is the installation number. If there is only one, it may be omitted.

The second number is the circuit number and again if there is only one, it may be omitted. The number 0 is used for the drawing of the power pack and accessories.

The letter identifies the type of component as follows.

P	Pump
A	Actuator
M	Prime Mover
S	Sensor
V	Valve

Z or any other appropriate letter is used for any other component.

The last number is the sequence number of the component so V5 means valve number 5.

PIPES

Pipes are identified on drawings with the following letters.

P	Pressure lines
T	Tank or return lines
L	Leakage or drainage lines

Each should be numbered starting with 1 and a different number used for pipes at different operating pressures.

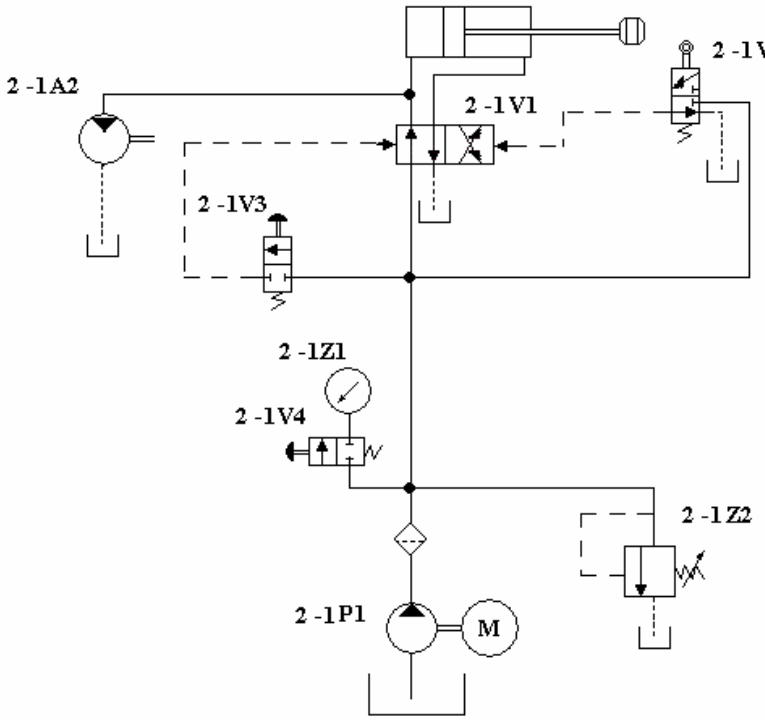
The hydraulic and pneumatic examples attached show these features.

The use of Computer Aided Design packages such as “PneSim pro”™ automatically produce drawings to the correct standards.

EXAMPLE OF A CIRCUIT DRAWING

LIST OF PARTS

ITEM	DECRIPTION	QTY	I.D.	SPECIFICATION
1	Double acting cylinder	1	A1	Rex C23-760D
2	Hydraulic motor	1	A2	VK-6-56-P3
3	4/2 DCV Pilot/Pilot	1	V1	NG-7124/3/8
4	3/2 DCV Roller/spring	1	V2	NG-7125/3/8
5	2/2 DCV Button/Spring NC	2	V3 V4	NG-7128/3/8
6	Pressure gauge	1	Z1	BD 713 0-200
7	Full Flow filter	1	Z2	FF-71309/8
8	Pump	1	P1	DWT 7 -1/2



ACTUATORS AT TOP

DCV NEXT LEVEL

ANCILLIARY EQUIPMENT

TITLE BLOCK

ACE HYDRAULICS PLC		
DRG No.	902-05-02	Signature
Drawn	A.N.Other	
Chkd	J.Doe	
Scale		
Installation	2	

WORKSHEET **INTRODUCTION TO BASIC CIRCUITS**

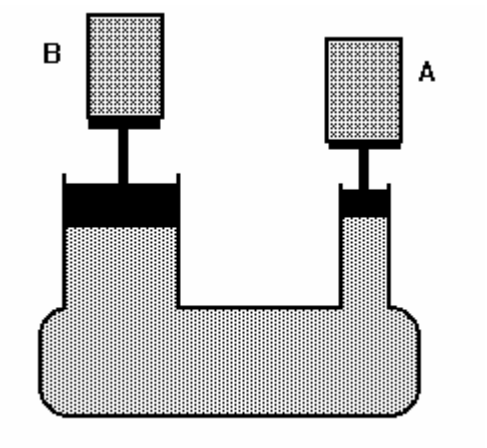
PART 1 – SIMPLE JACK

A good starting point in understanding hydraulic circuits is the simple jack similar to that used to lift cars off the ground.

Examine the diagram of a simple hydraulic jack. Piston A is pushed down by a weight and piston B is pushed up raising another weight.

1.a. Which moves the most A or B? _____

1.b. Which is the heaviest weight A or B? _____



2. The next diagram shows a simple jack. Write down what happens to NRV1 , NRV 2 and piston 2 when piston 1 is pushed in (the answer is either open or shut in each case).

NRV 1_____ NRV 2_____ Piston 2_____

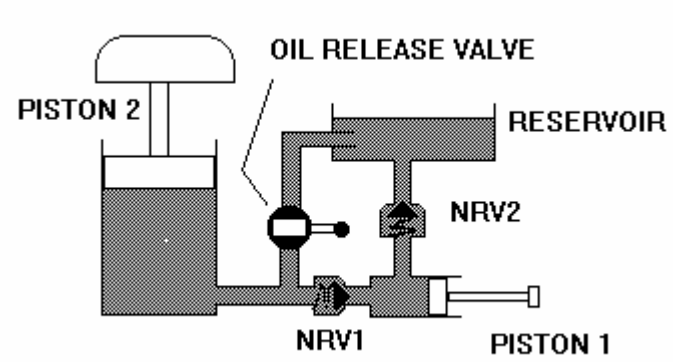
Write down what happens when piston 1 is pulled out.

NRV 1_____ NRV 2_____ Piston 2_____

What is the purpose of the oil release valve ?

_____

_____



PART 2 BASIC HYDRAULIC CIRCUIT.

Study the simple hydraulic system shown below and fill in the answers to the questions.

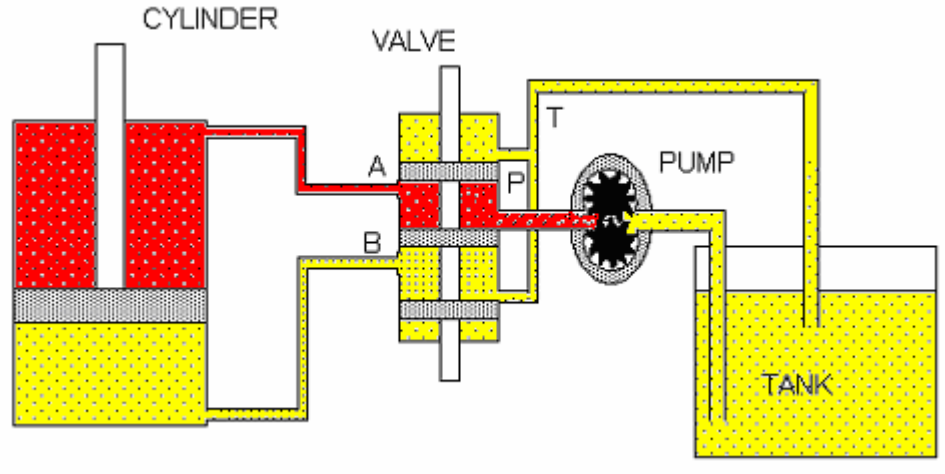


Figure 3

3. With the valve in the position shown, which way is the cylinder piston moving, UP or DOWN?

_____

4. Which way must the valve be moved in order to reverse the motion of the load cylinder, UP or down?

_____

5. What will happen to the pressure on the outlet of the pump when the load piston reaches the end of the travel? Will it INCREASE or DECREASE?

_____

6. The simple hydraulic circuit shown represents the system in figure 3. The circuit diagram should be drawn using symbols from British Standard 2917 and these are laid out below. Using solid pencil lines, draw in the pipe line connections to complete the circuit.