



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**BSME/BEME Y4S2**

**EMG 2418 : PNEUMATICS AND ELECTRO-HYDRAULICS**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: 16 May 2016**

**Instructions to Candidates**

You should have the following for this examination

-Answer Booklet, examination pass and student ID

-scientific calculator

-Drawing instruments

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

**Do not write on the question paper.**

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**Question ONE**

- (a) Outline the **THREE** operations properties unique to pneumatic systems,  
(4 marks)
- (b) Explain briefly the **FOUR** operational characteristics of pneumatics system brought about by the compressibility property of air.  
(6 marks)
- (c) A load of mass 500 kg is to be lifted to a distance of 600 mm and the available air pressure at point of use is 7 bar. If the load is to be moved the full distance in 3 seconds and the cylinder is to make four complete cycles per minute and allowing for 40% losses in the cylinder and using Table 1 calculate:  
(i) the diameter of the air cylinder required'  
(ii) the actual air consumption per minute by the cylinder,  
(10 marks)

Table1: Standard Air Cylinders

Bore (mm)	80	100	125	140	160
Rod Diameter (mm)	22	26	30	30	36
Stroke (mm)	Up to 750	up to 750	25-1000	30-1000	35-1200

**Question TWO**

- (a) (i) Explain briefly the principle of operation of a proximity sensor,  
(iii) Illustrate the graphical representation of the following proximity sensors:  
(I) Magnetic  
(II) capacitive  
(4 marks)
- (b) With the aid of a diagram briefly describe an OR function and the equivalent electrical circuit diagram that can be used in an electro-hydraulic system.  
(7 marks)
- (c) Illustrate a typical electrical circuit diagram for electro-hydraulic system clearly indicating the following designation:  
(I) Transformer  
(II) Rectifier  
(III) Switches  
(IV) Magnetic coils  
(9 marks)

**Question THREE**

- (a) State any TWO installation requirements for each of the following pneumatics component:  
(i) filter  
(ii) System  
(iii) piping

(b) Draw a maintenance schedule that outlines TWO tasks each carried out on pneumatics systems during the following period:

(6 marks)

- (i) weekly
- (ii) Half -yearly
- (iii) Annual

(6 marks)

(c) For each of the following failure symptoms in compressed air system, state the TWO most likely causes and their remedies:

- (i) Air escape from vent hole of the regulator
- (ii) Oil not supplied to air in the lubricator

(8 marks)

#### Question FOUR

(a) (i) State the THREE advantages and TWO disadvantage of in a pneumatic system in relation to other fluid in power transmission.

(ii) Explain the circumstance under which a lubricator is used in a compressed air system

(6 marks)

(b) Explain with the aid of a graphical diagram the unidirectional speed control in a single-acting cylinder used pneumatic system,

(6 marks)

(c) It is required to lubricate a cylinder of internal diameter of 40 mm and having a stroke of 50 mm and working at gauge pressure of 4 bar. Using Table 2 and assuming an homogeneous mixture throughout the cylinder spread, calculate:

- (i) the maximum length of 8mm copper tube that should be used between the lubricator and the cylinder,
- (ii) Rate of consumption and consumed per minute, if the cylinder in c(i) stroke 3 times in minute with each stroke lasting 0.75

(8 marks)

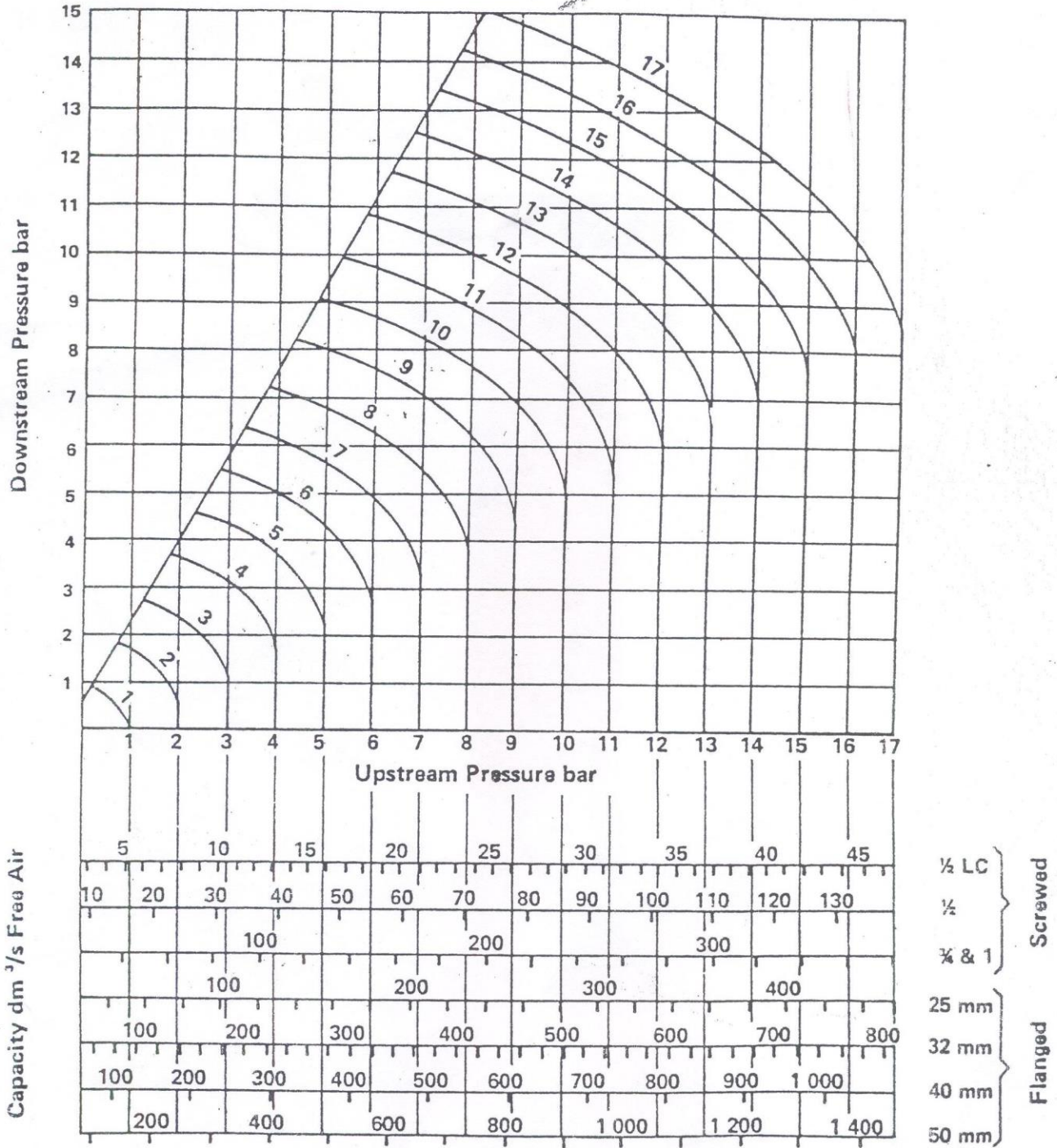
Table 2 Metric SI units for some standard tube dimensions

Nominal Bore mm	Med Weight Min ID mm	Heavy Weight Min ID mm	ID			Light Gauge		
						OD mm	mm	at 30°C
6	5.8	4.5	3	0.6	1.72	4	2.77	12
8	8.6	7.5	4	0.6	2.72	5	3.55	13
10	12.1	11.0	6	0.8	4.32	6	4.24	13
15	15.8	14.6	8	0.8	6.32	8	5.74	14
20	21.3	20.1	10	0.8	8.32	10	7.24	14
25	26.9	25.3	12	1.0	9.90	12	9.24	11
32	35.6	34.0	16	1.0	13.9	16	12.74	10
40	41.5	39.9				18	14.7	9
50	52.5	50.8				22	18.1	9
65	68.1	66.4				28	23.14	9
80	80.0	78.4						
100	104.0	102.0						
125	129.0	128.0						
150	154.0	153.0						

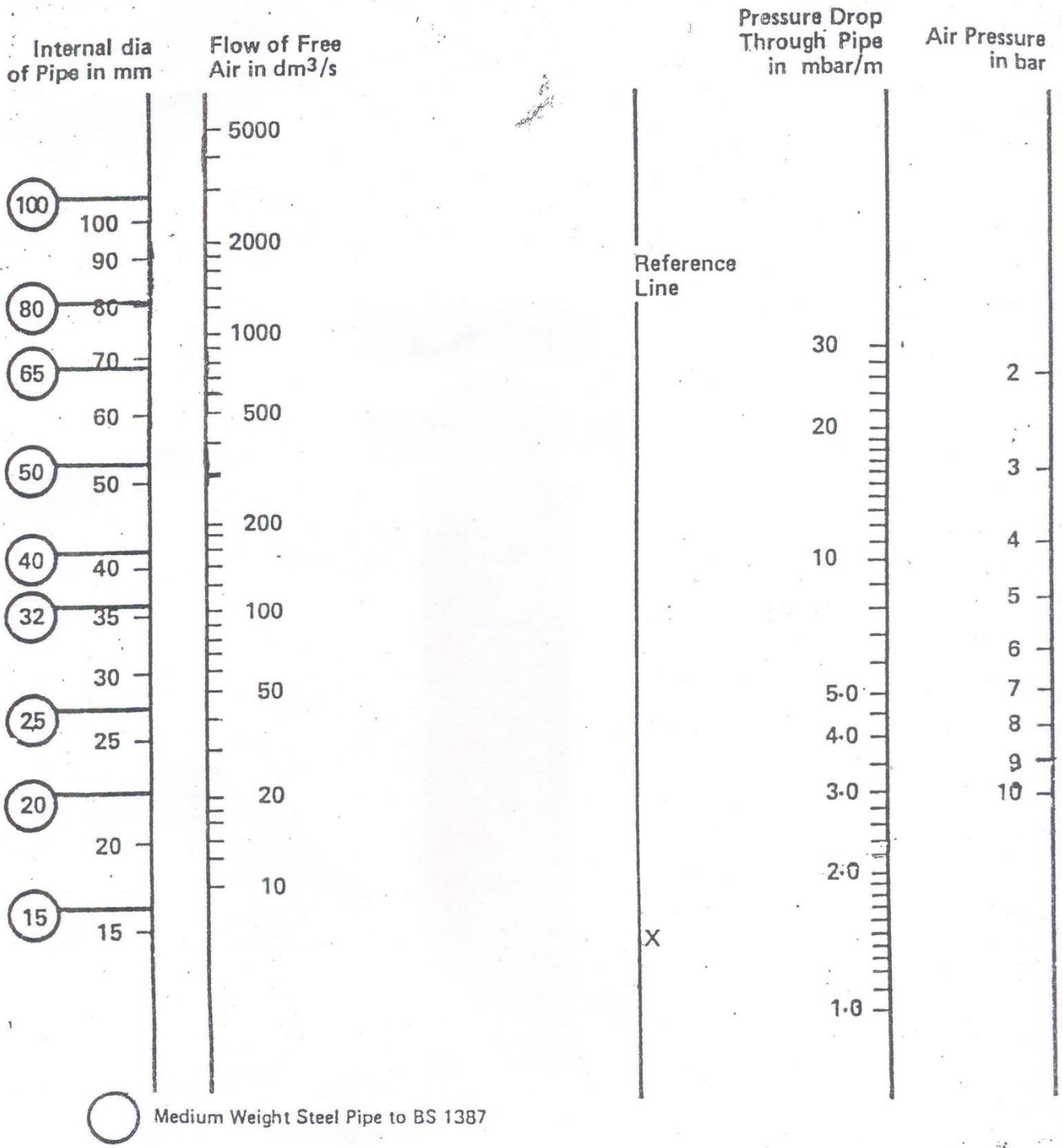
### Question FIVE

- (a) (i) Outline the TWO features that describes the operation of electro-hydraulic system,  
(ii) State the THREE advantages of electrical or electronics controls in hydraulic.  
(7 marks)
- (b) With the aid of a schematic diagram describe the TWO principal sub-assemblies in an electro-hydraulic system,  
(7 marks)
- (c) (i) Illustrate a control loop system of a hydraulic bending cylinder,  
(ii) Use a standard system to designate the control elements in the control loop in c (i). (7 marks)

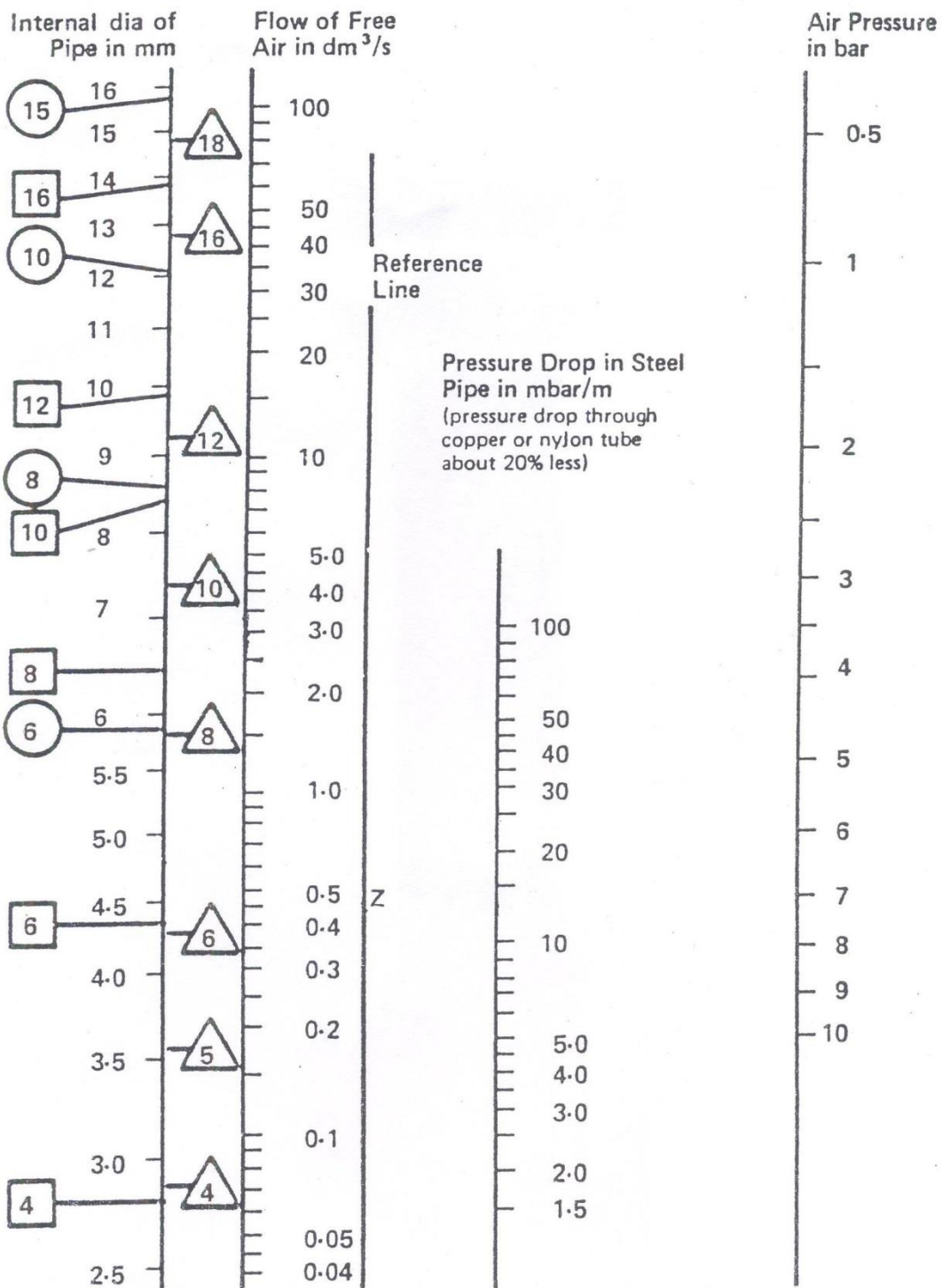
Table 1 Metric SI Units Pressure Reducing Valve Sizing and Capacities



**Table 2 Metric SI Units Pressure Drop in Steel Pipes (15 mm to 100 mm)**



**Table 3 Metric SI Units Pressure Drop in Pipes and Tubes (2.5 mm to 15 mm)**



○ Medium Weight Steel Tube BS 1387

□ Copper Tube to BS 2871 Pt II Table 4 (medium)

△ Nylon Tube CETOP RP54P