

DECLARATION

I declare that this final year project report entitled “Study a Pneumatic Telescopic Cylinder Arm Operation for Variable Load Application” is my own work except as cited in the reference.

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ABSTRACT

Pneumatic telescopic cylinder is basically consist of cylindrical housing ,a central piston, hollow piston rod, concentric piston, piston rod, air opening in the concentric piston rod and air outlet at the exit end of the cylindrical wall. When the air enters the central piston, the piston rod and concentric piston will initiate the extension followed by other stages. During retraction, air will enter the outlet concentric piston causing concentric piston and piston to retract. When the air opening in concentric piston rod is aligned with the rod, the central piston and piston rod will also be retracted. The pneumatic telescopic cylinder is a compact apparatus which is inexpensive, easy to manufacture and simple construction. Therefore, in this project, pneumatic system is used instead of the hydraulic system. This project has been carried out in order to study the pneumatic telescopic cylinder arm operation which involves the movement of the cylinder when a variation of load is applied. The study is done by using theoretical method and experimental method. From the result gained, the movement which is the velocity of the cylinder is different according to the load applied.

ABSTRAK

Silinder teleskopik pneumatik pada dasarnya terdiri daripada tapak silinder, piston tengah, rod piston berlubang, piston berpusat, rod piston, ruang udara pada piston berpusat dan ruang keluar udara pada dinding silinder. Apabila udara memasuki piston tengah, rod piston dan piston berpusat akan memanjang. Ini akan diikuti oleh piston pada selepasnya. Semasa proses pemendekan, udara akan memasuki bukaan udara pada piston berpusat menyebabkan piston berpusat dan rod piston memendek. Apabila ruang udara berada pada paras yang sama dengan rod, piston tengah dan rod piston akan turut memendek. Silinder teleskopik pneumatik adalah alatan yang padat yang kurang mahal, mudah untuk dibuat, dan mempunyai struktur pembinaan yang mudah. Oleh sebab itu, projek ini menggunakan prinsip pneumatik dan tidak menggunakan system hidraulik. Projek ini telah dijalankan untuk mengkaji operasi silinder teleskopik pneumatic yang melibatkan pergerakan silinder apabila beban yang berlainan di letakkan. Kajian ini dijalankan dengan menggunakan kaedah teori dan kaedah eksperimen. Daripada keputusan yang dihasilkan, didapati pergerakan iaitu halaju bagi silinder adalah berlainan mengikut berat yang diletakkan.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	ACKNOWLEDGEMENT	iii
	ABSTRACT	iv
	ABSTRAK	v
	TABLE OF CONTENT	vi
	LIST OF TABLE	x
	LIST OF FIGURE	xi
	LIST OF SYMBOL	xx
	LIST OF APPENDICES	xxi

1	INTRODUCTION	
1.1	Background of project	1
1.2	Objectives	2
1.3	Scopes	2
1.4	Problem statement	3
2	LITERATURE REVIEW	
2.1	Cylinder	4
2.1.1	Double Acting Cylinder	8
2.1.1.1	Comparison between Single Acting Cylinder and Double Acting Cylinder	10
2.1.1.2	Cylinder Characteristics	10
2.1.2	Telescopic Cylinder	11
2.1.2.1	Basic Design Type	12
2.1.2.2	Comparison between Telescopic Cylinder and Rod Cylinder	14
2.1.2.3	Characteristics of Double Acting Pneumatic Cylinder	15
2.2	Pneumatic	16
2.2.1	Advantages of pneumatic	16
2.2.2	Comparison between Hydraulic and Pneumatic	18
2.2.3	History of Pneumatic	19
2.3	Basic Pneumatic System	20
2.3.1	Control Valves	21
2.3.1.1	Pneumatic Directional Control Valve	22
2.3.1.2	Pneumatic Check Valve	23
2.3.1.3	Pneumatic Flow Control Valve	24
2.3.2	Air Service Unit	25
2.3.2.1	Compressed Air Filter	25
2.3.2.2	Compressed Air Regulator	26

2.3.2.3 Compressed Air Lubricator	26
2.4 Compressor	27
2.4.1 Reciprocating Compressor	27
2.4.1.1 Piston Type	28
2.4.1.2 Diaphragm Type	29
2.4.2 Rotary Compressor	30
2.4.2.1 Sliding Vane	30
2.4.2.2 Screw	31
2.4.3 Theory Application	32
2.5 Control System	36
3 METHODOLOGY	
3.1 Design Development of Pneumatic Telescopic Cylinder	40
3.1.1 Computer Aided Design	40
3.1.1.1 AutoCAD	40
3.1.1.2 Telescopic Cylinder Model	41
3.1.2 Assembly Design	42
3.1.2.1 Housing	42
3.1.2.2 Shaft	43
3.1.2.3 Guide Bushing	44
3.1.2.4 End Cap	45
3.2 Design Manufacturing	45
3.2.1 Lathe Machine	46
3.2.2 Milling Machine	47
3.2.3 Material	48
3.3 Experiment Set Up	49
3.3.1 Variable	50
3.3.2 Equipment of the experiment	51
3.3.3 Procedure of Experiment	53

3.3.1.1	Programmable Logic Controller	54
4	RESULT AND ANALYSIS	56
4.1	Theoretical Method	56
4.1.1	Result	63
4.1.2	Result Analysis	73
4.1.3	Sample Calculation	74
4.2	Experimental Method	76
4.2.1	Result	77
4.2.2	Result Analysis	87
4.2.3	Sample Calculation	88
5	DISCUSSION	89
5.1	Theoretical Data	89
5.2	Experimental Data	94
5.3	Graphical Method	97
5.4	Comparison between Theoretical and Experimental	99
5.4.1	Percentage Error Sample Calculation	101
5.5	Limitation	102
6	CONCLUSION AND RECOMMENDATION	104
6.1	Conclusion	104
6.2	Recommendation	105
7	REFERENCE	106
8	BIBLIOGRAPHY	109
9	APPENDICES	110

LIST OF TABLES

NO	TITLE	PAGE
2.1	The Descriptions of the Double Acting Cylinder Component (source: Linear and Rotary Actuator 1999)	8
2.2	Comparison between Single Acting Cylinder and Double Acting Cylinder (Hughes 1999)	10
2.3	Comparison between Hydraulic and Pneumatic (source: Dunn D.J)	18
3.1	Material for Pneumatic Telescopic Cylinder	49
4.1	Coefficient of Friction	61
4.2	Sample calculation of Theoretical Method	74

LIST OF FIGURE

NO	TITLE	PAGE
2.1	Components of double acting cylinder (source: Linear and Rotary Actuator, 2007)	9
2.2	A double-acting model for hydraulic service with standard tie-rod construction (internet source : www.hydraulicpneumatic.com,2009)	9
2.3	A cutaway of a six-stage single-acting model (internet source:www.hydraulicpneumatic.com, 2009)	12
2.4	Basic Fluid Power Systems (source:Dunn D.J., 2009)	17
2.5	The components of the basic pneumatic system (source: Fluid Power system, 2009)	20
2.6	3/2 way air actuated valve (source: Fluid Power Pneumatic Control system,2007)	22
2.7	Single Pilot Valve with Spring Return Cylinder (source: Fluid Power Pneumatic Control system, 2007)	23

2.8	5/2 Way Valve for Double Pilot Valve (source: Fluid Power Pneumatic Control System, 2007)	23
2.9	Check Valve symbol (source: Fluid Power Pneumatic Control system, 2007)	24
2.10	Adjustable Flow Control Valve symbol (internet source: Fluid Power Pneumatic Control System,2007)	24
2.11	One-way Flow control valve (internet source: Fluid Power Pneumatic Control System,2007)	24
2.12	Air Service Unit (internet source: Fluid Power Pneumatic Control System,2007)	25
2.13	Compressed Air Regulator (internet source: Fluid Power Pneumatic Control System,2007)	26
2.14	Compressed Air Lubricator (internet source: Fluid Power Pneumatic Control System,2007)	27
2.15	Single Stage (source: Compressor and Air Preparation, 2007)	28
2.16	2 stage (source: Compressor and Air Preparation, 2007)	29
2.17	Diaphragm Compressor (source: Compressor and Air Preparation, 2007)	30

2.18	Sliding Vane (source: Compressor and Air Preparation, 2007)	31
2.19	Screw Compressor Principle (source: Compressor and Air Preparation, 2007)	32
2.20	Sizing Cylinder during Extension (Linear and Rotary Actuator, 2007)	32
2.21	Sizing Cylinder during Retraction (Linear and Rotary Actuator)	33
3.1	The Methodology Flow	39
3.2	Pneumatic telescopic Cylinder (source: Aida, R., 2009)	41
3.3	Assembly design of Telescopic Cylinder	42
3.4	Telescopic Cylinder Housing	42
3.5	Telescopic Cylinder Shaft 1	43
3.6	Telescopic Cylinder Shaft 2	43
3.7	Telescopic Cylinder Guide bushing 1	44
3.8	Telescopic Cylinder Guide bushing 1	44
3.8	Telescopic Cylinder End Cup	45

3.9	Lathe machine (internet source:www.olympiclathe.com, 2007)	46
3.10	Milling machine (internet source :www.milling-machine.info,2008)	48
3.11	Cylinder control system	50
3.12	Programmable Logic Controller	51
3.13	Pneumatic Telescopic Cylinder	51
3.14	Compressor	52
3.15	Load	52
3.16	Stopwatch	52
3.17	First Stage Cylinder Extension	53
3.18	System component of PLC	55
4.1	Force Analysis for Cylinder 1	57
4.2	Force Analysis for Cylinder 2	59
4.3	Theoretical Graph Pressure against Velocity for load = 0.1 kg	63

4.4	Theoretical Graph Pressure against Velocity for load = 0.2 kg	63
4.5	Theoretical Graph Pressure against Velocity for load = 0.3 kg	64
4.6	Theoretical Graph Pressure against Velocity for load = 0.4 kg	64
4.7	Theoretical Graph Pressure against Velocity for load = 0.5 kg	65
4.8	Theoretical Graph Pressure against Velocity for load = 0.6 kg	65
4.9	Theoretical Graph Pressure against Velocity for load = 0.7 kg	66
4.10	Theoretical Graph Pressure against Velocity for load = 0.8 kg	66
4.11	Theoretical Graph Pressure against Velocity for load = 0.9 kg	67
4.12	Theoretical Graph Pressure against Velocity for load = 1.0 kg	67
4.13	Theoretical Graph Pressure against Velocity for load = 1.1 kg	68

4.14	Theoretical Graph Pressure against Velocity for load = 1.2kg	68
4.15	Theoretical Graph Pressure against Velocity for load = 1.3 kg	69
4.16	Theoretical Graph Pressure against Velocity for load = 1.4 kg	69
4.17	Theoretical Graph Pressure against Velocity for load = 15 kg	70
4.18	Theoretical Graph Pressure against Velocity for load = 1.6 kg	70
4.19	Theoretical Graph Pressure against Velocity for load = 1.7 kg	71
4.20	Theoretical Graph Pressure against Velocity for load = 1.8 kg	71
4.21	Theoretical Graph Pressure against Velocity for load = 1.9 kg	72
4.22	Theoretical Graph Pressure against Velocity for load = 2.0 kg	72
4.23	Experimental Graph Pressure against Velocity for load = 0.1 kg	77

4.24	Experimental Graph Pressure against Velocity for load = 0.2 kg	77
4.25	Experimental Graph Pressure against Velocity for load = 0.3 kg	78
4.26	Experimental Graph Pressure against Velocity for load = 0.4 kg	78
4.27	Experimental Graph Pressure against Velocity for load = 0.5 kg	79
4.28	Experimental Graph Pressure against Velocity for load = 0.6 kg	79
4.29	Experimental Graph Pressure against Velocity for load = 0.7 kg	80
4.30	Experimental Graph Pressure against Velocity for load = 0.8 kg	80
4.31	Experimental Graph Pressure against Velocity for load = 0.9 kg	81
4.32	Experimental Graph Pressure against Velocity for load = 1.0 kg	81
4.33	Experimental Graph Pressure against Velocity for load = 1.1 kg	82

4.34	Experimental Graph Pressure against Velocity for load = 1.2kg	82
4.35	Experimental Graph Pressure against Velocity for load = 1.3 kg	83
4.36	Experimental Graph Pressure against Velocity for load = 1.4 kg	83
4.37	Experimental Graph Pressure against Velocity for load = 15 kg	102
4.38	Experimental Graph Pressure against Velocity for load = 1.6 kg	84
4.39	Experimental Graph Pressure against Velocity for load = 1.7 kg	85
4.40	Experimental Graph Pressure against Velocity for load = 1.8 kg	85
4.41	Experimental Graph Pressure against Velocity for load = 1.9 kg	86
4.42	Experimental Graph Pressure against Velocity for load = 2.0 kg	86
5.1	Graph Pressure against Velocity for Cylinder 1 for Load 0.1 kg until 2.0 kg (Theoretical)	93

5.2	Graph Pressure against Velocity for Cylinder 2 for Load 0.1 kg until 2.0 kg (Theoretical)	93
5.3	Graph Pressure against Velocity for Cylinder 1 for Load 0.1 kg until 2.0 kg (Experimental)	96
5.4	Graph Pressure against Velocity for Cylinder 2 for Load 0.1 kg until 2.0 kg (Experimental)	96
5.5	Graphical Method for Cylinder 1	97
5.6	Graphical Method for Cylinder 2	98

LIST OF SYMBOLS

Q	= flow rate (GPM)
A	= area (m^2)
F	= force (N)
P	= pressure (Pa)
Q	= compressor inlet air flow rate. (Standard m^3/min)
P_{in}	= inlet absolute pressure of air. (kPa)
P_{out}	= outlet absolute pressure of air. (kPa)
x	= Piston's position (m)
F_f	= Friction force
m	= Mass (kg)
a	= Acceleration, (m/s^2)
v_0	= Initial velocity, (m/s)
v	= Velocity, (m/s)
t	= time, (s)

LIST OF APPENDICES

NO	TITLE	PAGE
A	Open Control Step and Stop in PLC for Cylinder	110
B	Pneumatic Telescopic Cylinder Assembly Drawing	112
C	Housing for Pneumatic Telescopic Drawing	113
D	Shaft 1 for Pneumatic Telescopic Drawing	114
E	Guiding Bush 1 for Pneumatic Telescopic Cylinder Drawing	115
F	Guiding Bush 2 for Pneumatic Telescopic Cylinder Drawing	116
G	Shaft 2 for Pneumatic Telescopic Cylinder	117
H	End Cap for Pneumatic Telescopic Cylinder Drawing	118
I	Theoretical Result for Cylinder 1	119
J	Theoretical Result for Cylinder 2	123

K	Experimental Result	127
L	Percentage Error for Cylinder 1 and Cylinder 2	131
M	PLC Schematic Diagram for Cylinder	135

CHAPTER I

INTRODUCTION

Projek Sarjana Muda (PSM) is a scientific and education studies about the course taken in the faculty. This project must be prepared by final year students as a requirement for students to become a bachelor of mechanical engineering in Universiti Teknikal Malaysia Melaka (UTeM).

1.1 Background Of Project

Pneumatic is a fluid power that is widely used in the industrial application. Pneumatic through the compressed air or other gas is used to transmit power to actuating mechanisms. The pneumatic system is low cost, lightweight, unpolluted, highly safe, easy to fix or repair and soft output. Semiconductor business and auto-producing system are the examples of industry that use the pneumatic system technique frequently.

In industry actuators, pneumatic cylinder is the most common type which provides the enumerated qualities at low cost as well as suitable for clean environments. It is safer and easier to work with if compared to the conventional electric and hydraulic actuators. It also becomes an alternative in certain types of applications. A pneumatic cylinder has a lower specific weight and a higher power rate than an equivalent electromechanical actuator. In some cases, a pneumatic system has a significant weight of advantage.

In either hydraulic or pneumatic, telescopic cylinder is designed and applied to minimize the length of the stroke when in retracted position. For localized applications of considerable forces in areas that lack sufficient space, it can be found as telescoping fluid actuator. Other applications are for agricultural tools or for vehicle used in construction and maintenance work on overhead system. The telescopic cylinders were mounted on the platform and can be lifted enough to reach the uppermost parts of the structure. In summary, telescopic cylinders have their own unique performance characteristics and it is the responsibility of the user to take them into account when selecting one for their specific application.

1.2 Objective

The objective of this project is to study the pneumatic telescopic cylinder arm operation for variable load applications.

1.3 Scope

- i. Do the literature review of the previous study of pneumatic telescopic cylinder and its application.
- ii. Study the theories that are applied in the pneumatic telescopic cylinder and the variable load lifting system.
- iii. Run an experiment of the pneumatic telescopic cylinder for variable load lifting application.

1.4 Problem Statement

The application of fluid power for mechanical equipments is widely used today. Pneumatic and hydraulic are fluid power that are commonly used in industry. However, the hydraulic power is high cost. This is because the installation of hydraulic equipment generally calls for greater skills and hence costs more. Besides that, the maintenance costs for hydraulic are expensive and the application of hydraulic can causes pollution.

In certain application, the common linear actuators need a large space to operate. This is because linear actuators do not have enough space to operate where force is considered in a limited space.

The velocity of the cylinder for each stage is different according to the load applied. Therefore, a study of the pneumatic telescopic arm operation is necessary in order to determine the movement of each stage of the cylinder when variable of load is applied. Besides that, the study is also important to determine the pressure effect and the load effect on the cylinder movement. The purpose is to make sure that for certain required velocity, the pressure is sufficient to carry the load.