

**COMPARISON OF HIGH VOLTAGE CIRCUIT BREAKERS  
PERFORMANCES AT JABATAN SENGGARAAN ASET (KEDAH  
& PERLIS), TNB TRANSMISSION DIVISION**

This thesis is presented in partial fulfillment for the award of the

Bachelor of Engineering (Honors) Electrical

**FACULTY OF ELECTRICAL ENGINEERING**

**UNIVERSITI TEKNOLOGI MARA**

**MALAYSIA**



**MOHAMMAD ZULFAHMI BIN KHAIRUL ANWAR**

**2008298344**

**Faculty of Electrical Engineering**

**UNIVERSITI TEKNOLOGI MARA**

**40450 SHAH ALAM, SELANGOR DARUL EHSAN**

## **ACKNOWLEDGEMENT**

Alhamdulillah, I would like to express my sincerely gratitude and thanks to my project supervisor, Hj. Ir. Harizan Bin Che Mat Haris for his kindness, support, guidance, and suggestions during the progression of this project.

A special thanks to the staff of Jabatan Senggaraan Aset (Kedah & Perlis), Tenaga Nasional Berhad, Transmission Division, especially Substation Unit for the continuous guidance in every aspect to complete this project.

Finally, my deepest appreciation goes to my family for their moral and spiritual support. Last but not least, I would like express my gratitude and thanks to all my friends for their help and support and to all people who have been involved directly or indirectly contributes towards the progress of this thesis.

Thank you.

## **ABSTRACT**

This paper describes the comparison of high voltage circuit breakers performances at Jabatan Senggaraan Aset (Kedah & Perlis). The comparisons are between the operating mechanisms and model of circuit breakers by using a routine maintenance test. At the end of this paper, one type of the operating mechanism and model of circuit breaker will be suggested to be the best performance of CB in JSA (Kedah & Perlis).

## TABLE OF CONTENTS

<b><u>CHAPTER</u></b>	<b><u>PAGE</u></b>
APPROVAL	i
DECLARATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
TABLE OF CONTENTS	v
LIST OF FIGURES	vii
LIST OF TABLES	ix
LIST OF SYMBOLS AND ABBREVIATIONS	x
1: INTRODUCTION	1
1.1. BACKGROUND OF STUDY	1
1.2. PROBLEM STATEMENT	5
1.3. OBJECTIVE	5
1.4. SIGNIFICANT OF STUDY	5
1.5. SCOPE OF WORK	6
2: LITERATURE REVIEW	7
2.1 CIRCUIT BREAKER	7
2.2 FUNCTION OF CIRCUIT BREAKER	8
2.3 TYPES OF CIRCUIT BREAKER	8
2.4 CIRCUIT BREAKER CLASSIFICATION	10
2.4.1 CLASSIFICATION BY VOLTAGE	10
2.4.2 CLASSIFICATION BY LOCATION	10
2.4.3 CLASSIFICATION BY EXTERNAL DESIGN	11
2.4.4 CLASSIFICATION BY INTERRUPTING MEDIA	12
2.4.4.1 AIR BLAST CIRCUIT BREAKER	12
2.4.4.2 OIL MINIMUM CIRCUIT BREAKER	13
2.4.4.3 VACUUM CIRCUIT BREAKER	13
2.4.4.4 SULFURHEXAFLUORIDE (SF6)	13
2.4.5 CLASSIFICATION BY OPERATING MECHANISM	14
2.4.5.1 SPRING OPERATING MECHANISM	15
2.4.5.2 PNEUMATIC OPERATING MECHANISM	15
2.4.5.3 HYDRAULIC OPERATING MECHANISM	16
2.5 CIRCUIT BREAKER TESTING	16
2.5.1 MAINTENANCE OF CIRCUIT BREAKER	16

2.5.2	TIMING TEST	18
2.5.3	CONTACT RESISTANCE TEST	18
3:	METHODOLOGY	21
3.1	FLOW CHART OF THE PROJECT	21
3.2	DATA COLLECTION	22
3.3	DATA ANALYSIS	23
4:	RESULTS AND DISCUSSION	24
4.1	SYSTEM CONNECTIVITY	24
4.2	DATA COLLECTION	26
4.3	ANALYSIS DATA	28
4.3.1	MANUFACTURER OF CIRCUIT BREAKER USED BY JSA (KEDAH & PERLIS)	28
4.3.2	PRODUCING COUNTRIES OF THE CIRCUIT BREAKER USED BY JSA (KEDAH & PERLIS)	29
4.3.3	OPERATING MECHANISM OF CIRCUIT BREAKER	30
4.3.4	DATA AND RESULTS OF HYDRAULIC OPERATING MECHANISM CIRCUIT BREAKER (275 kV)	31
4.3.5	DATA AND RESULTS OF SPRING OPERATING MECHANISM CIRCUIT BREAKER (275 kV)	34
4.3.6	DATA AND RESULTS OF HYDRAULIC OPERATING MECHANISM CIRCUIT BREAKER (132 kV)	37
4.3.7	DATA AND RESULTS OF SPRING OPERATING MECHANISM CIRCUIT BREAKER (132 kV)	40
4.3.8	SIUTABLE CIRCUIT BREAKER TO BE USED	45
4.3.9	SPRING OPERATING MECHANISM IS BETTER THAN HYDRAULIC OPERATING MECHANISM	46
5:	CONCLUSION	48
6:	RECOMMENDATIONS FOR FUTURE STUDY	49
	REFERENCES	50
	APPENDICES	