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APPENDICES

APPENDIX A
KNOWLEDGE REPRESENTATION

Winding Temp Alarm Stage 1	Winding Temp Alarm Stage 2	Minor Trouble	Major Trouble	KTxA Lockout Operated
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Annunciator

KTxA Relay Lockout Operated	KTxA Diff. Relay Operated	KTxA High Side OC Relay Operated	KTxA Low Side OC/OCG Relay Operated	KTxA Tertiary OCG Relay Operated	87KS1-51G Converter Fail	87KS1-51G OC Supply Fail
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Protective Relay Operated

Tx. Press. Relief Dev. Trip	Div. Sw. Press. Relief Trip	Buchholtz Trip	Fault Press Relay Trip	LTC Press Relay or Oil Flow Relay Trip
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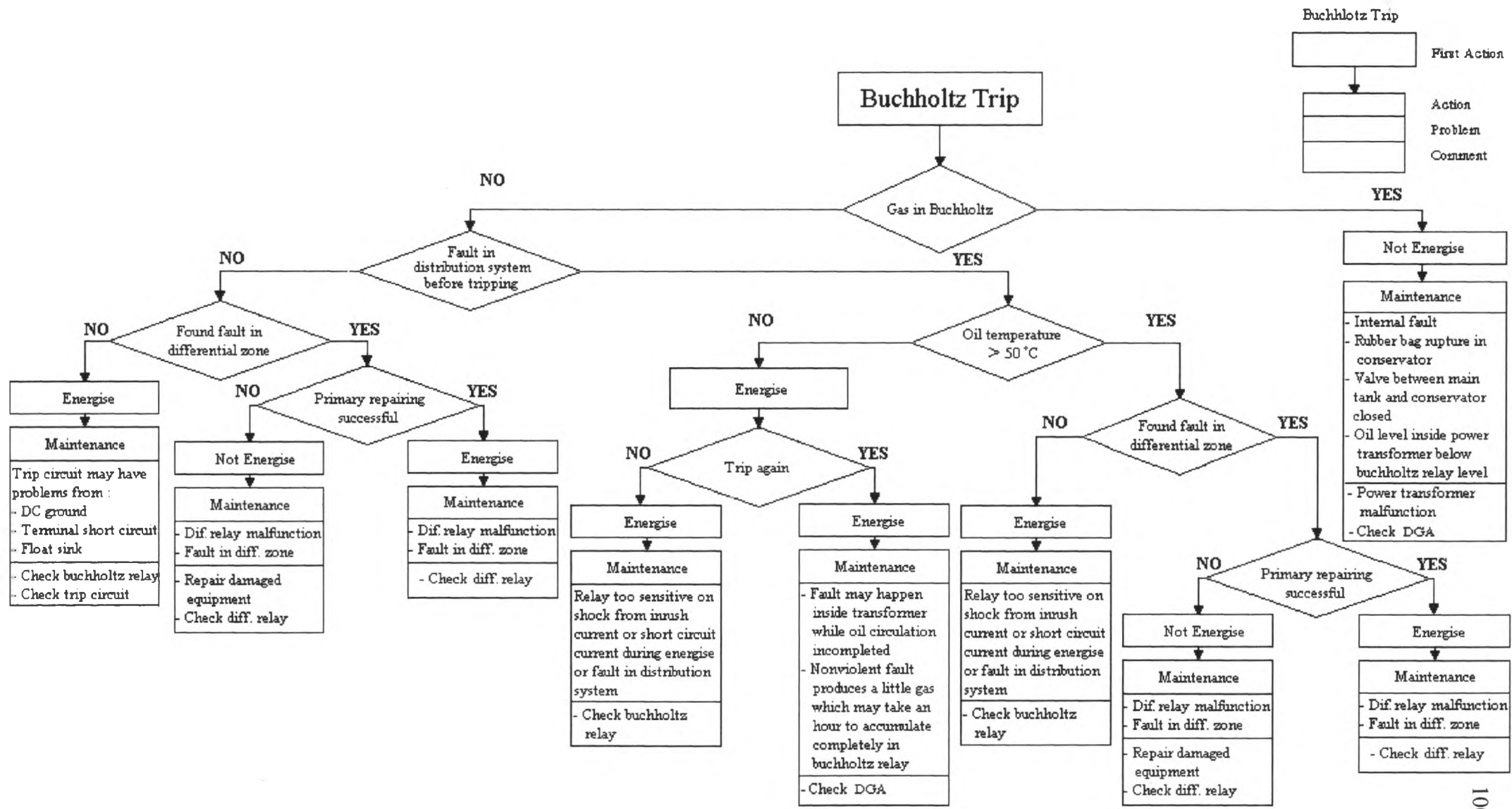
Self Protective Relay Trip

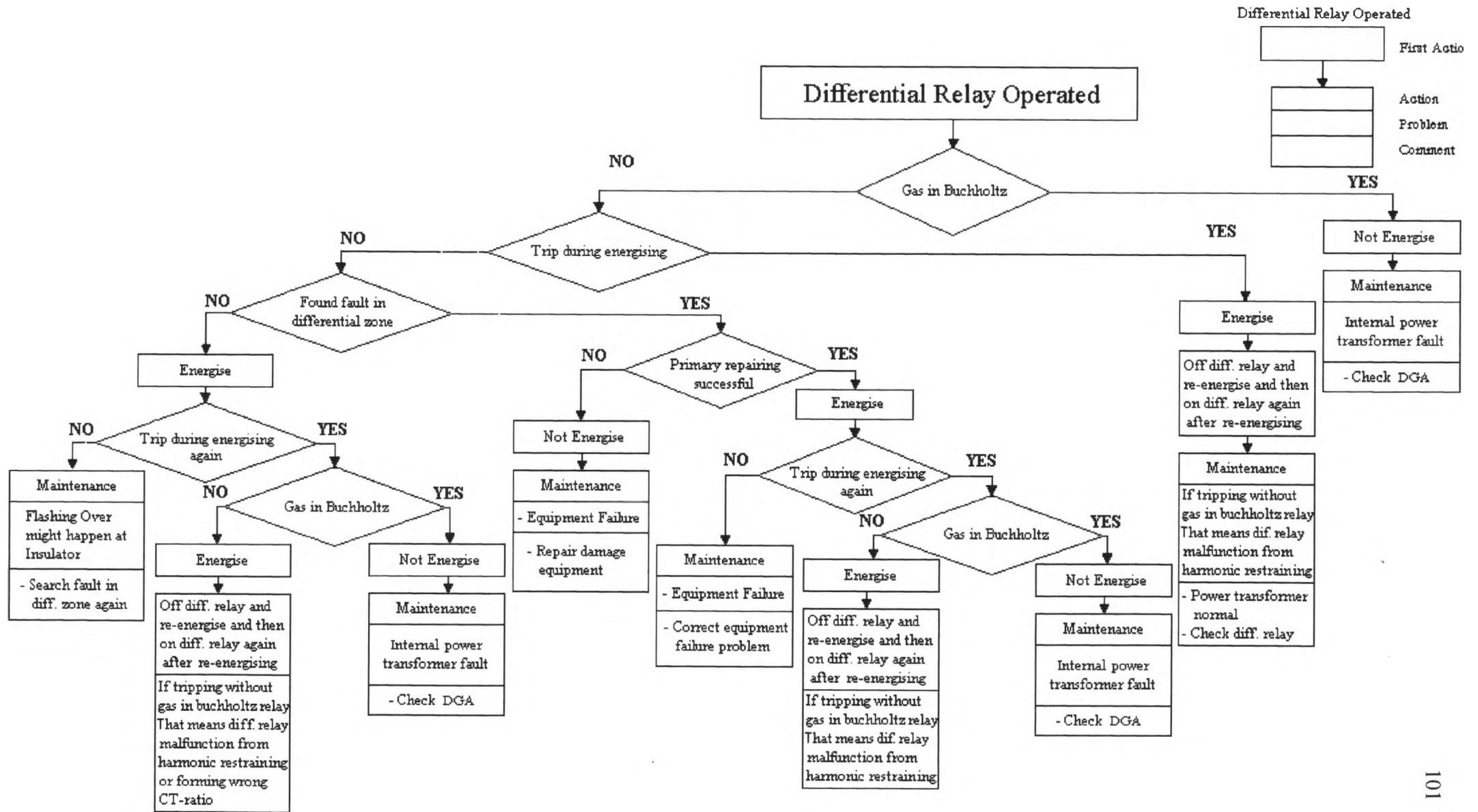
Oil temp	Buchholtz Alarm	AC. Supply Failure	DC. Supply Failure	AC. Control Failure	FAN Therm Relay Stg.1	FAN Therm Relay Stg.2	Fan Bkr. Stg.1	Fan Bkr. Stg.2	DC. Trip Circuit Failure
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Major trouble

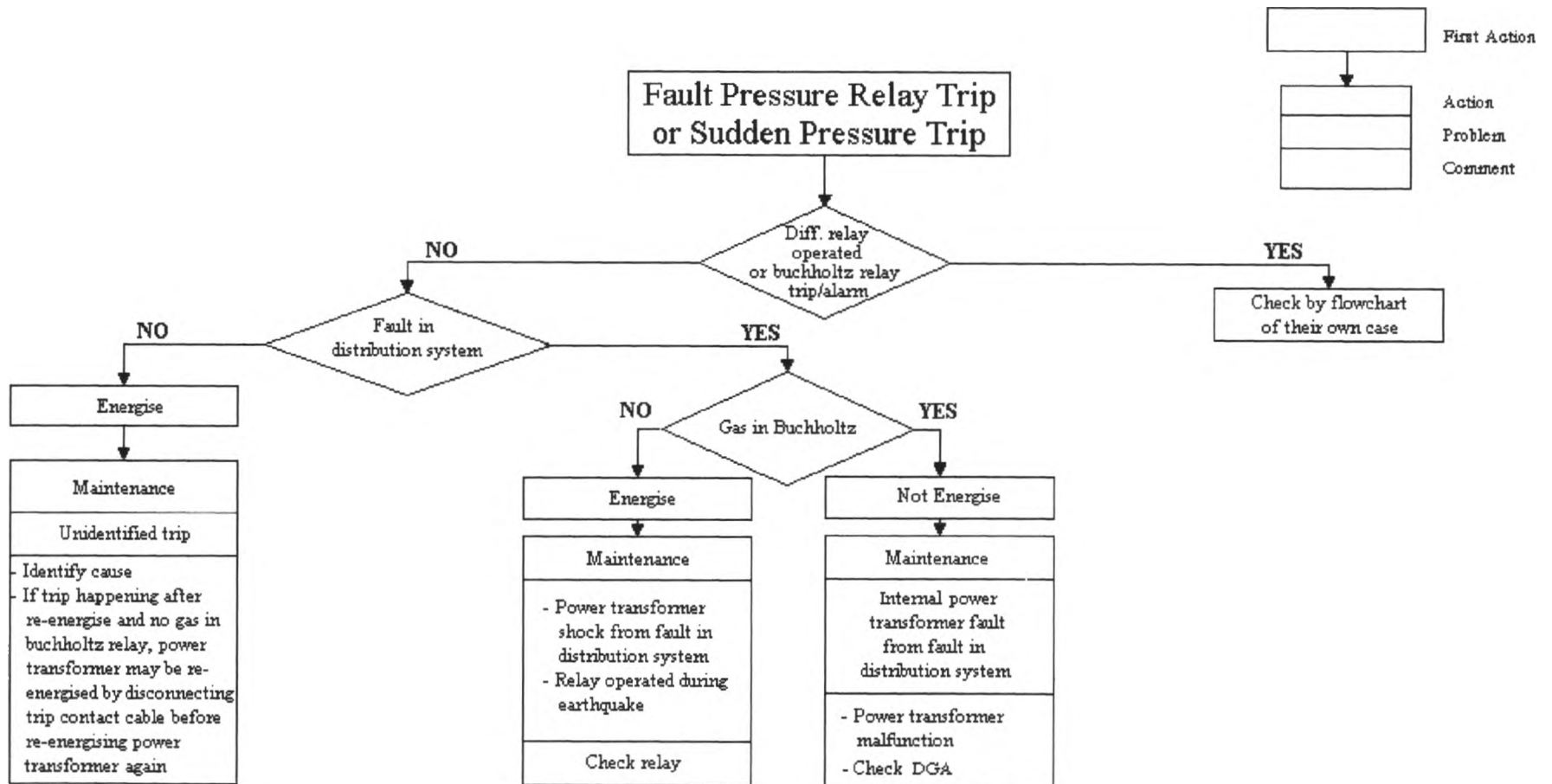
Tx. Oil Level	Div. Sw. Oil Level	Rubber Bag Rupture	AC. Regulating Failure	DC. Control Failure	LTC Overcurrent During Tap Change	Tap Change Delay	Tap Diff	LTC Drive Motor Bkr.	Hot Line Oil Filter Trouble
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Minor Trouble

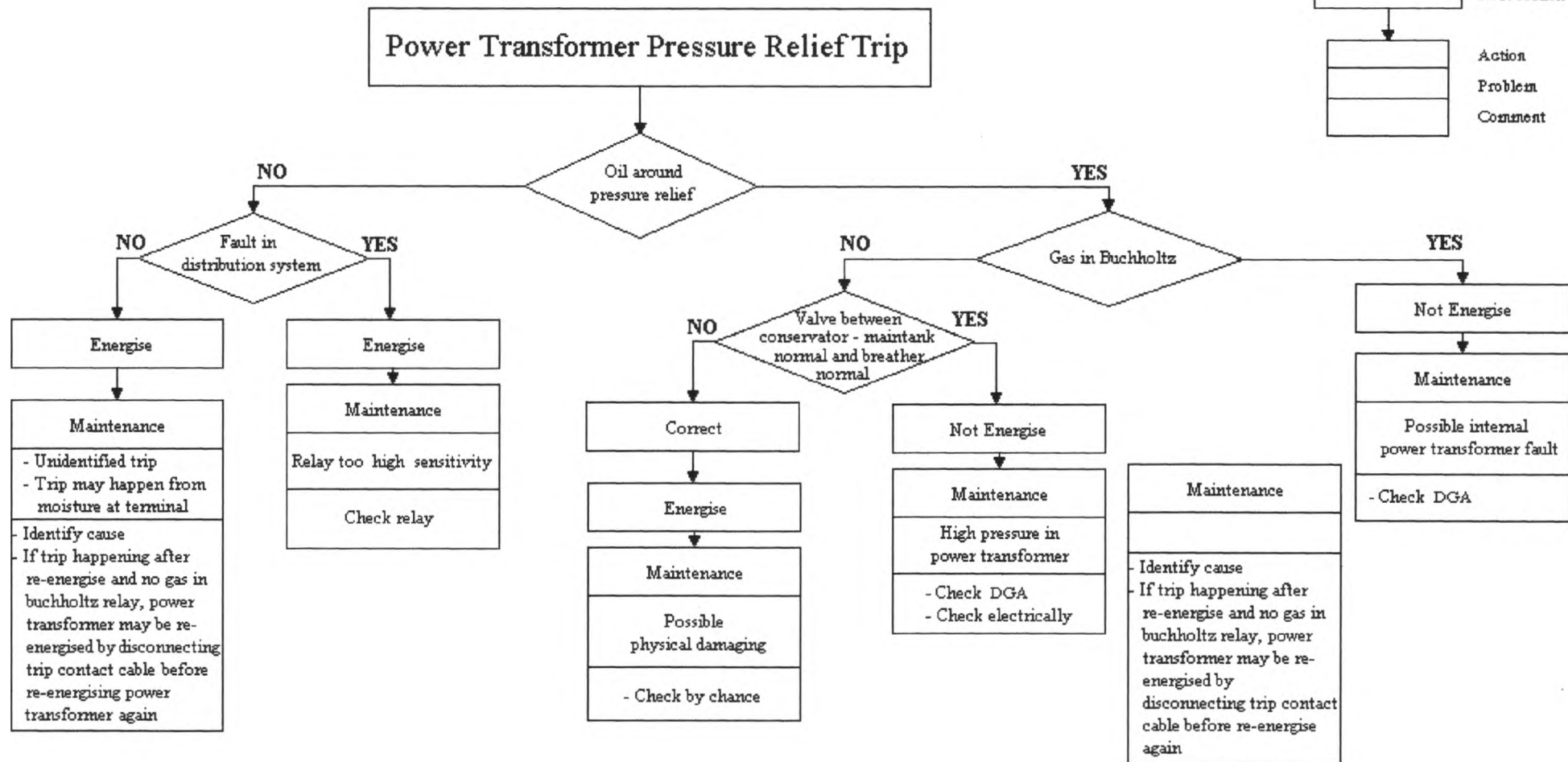
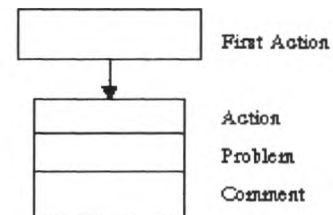


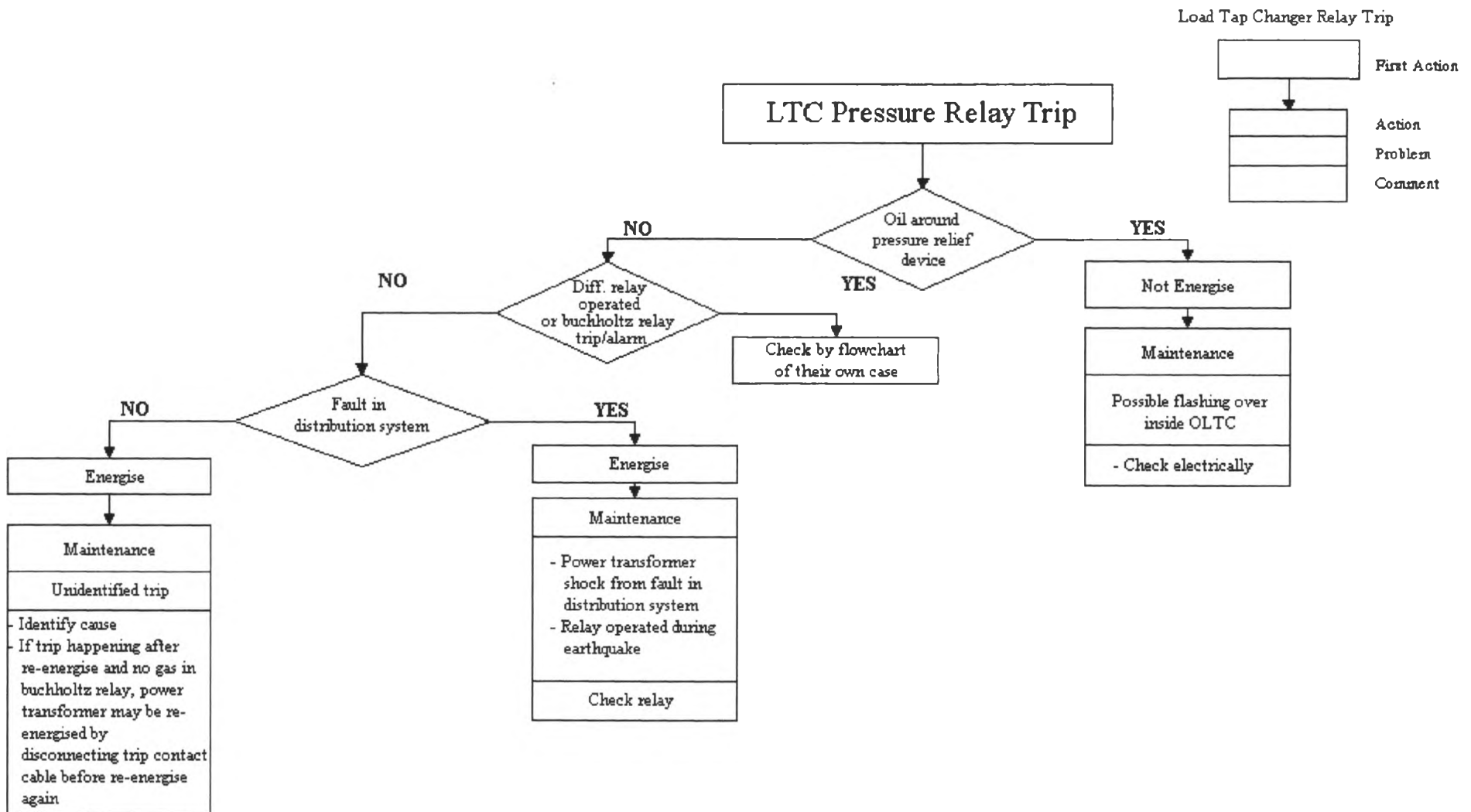


Fault Pressure Relay Trip or Sudden Pressure Trip



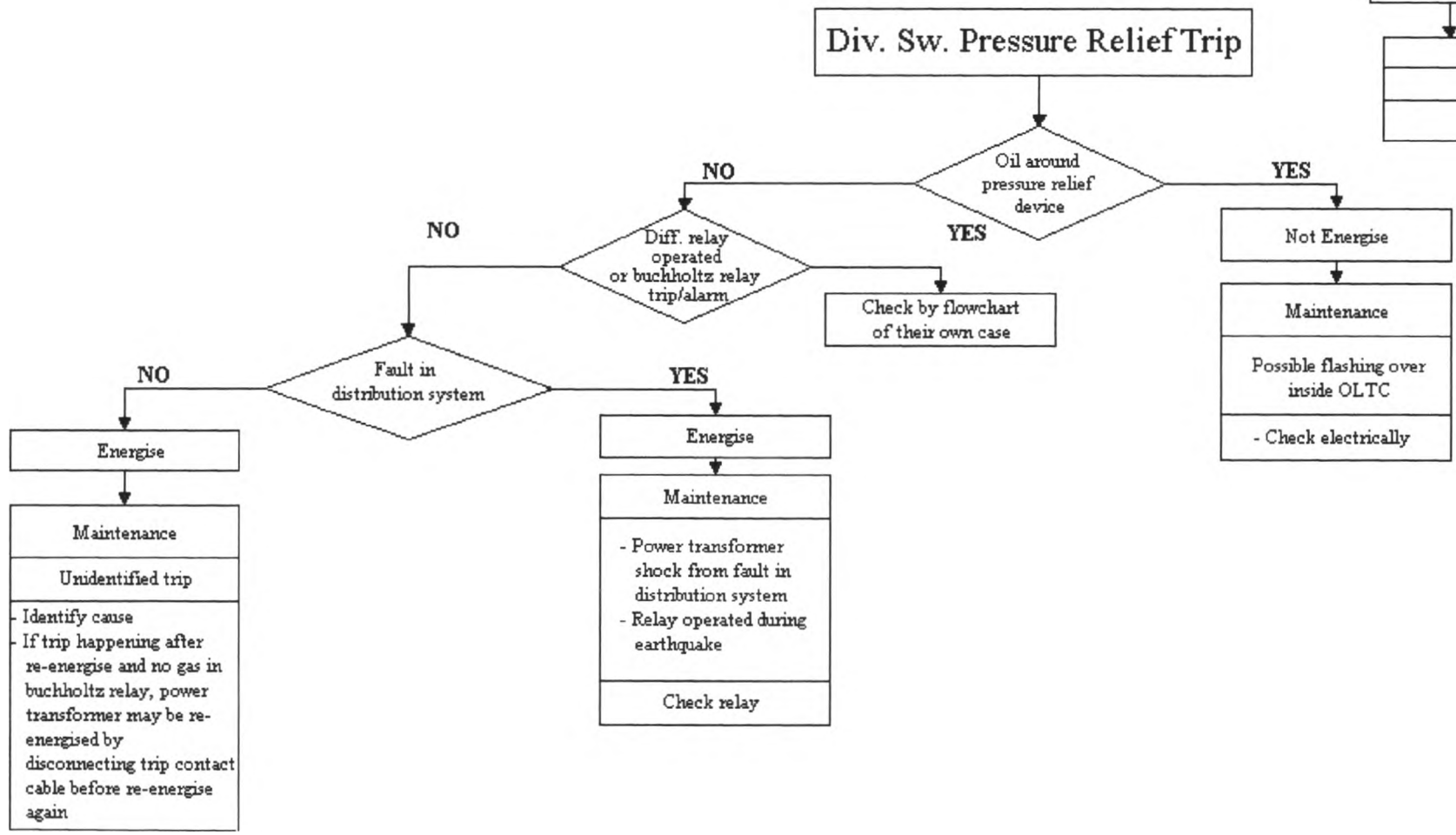
Power Transformer Pressure Relief Trip

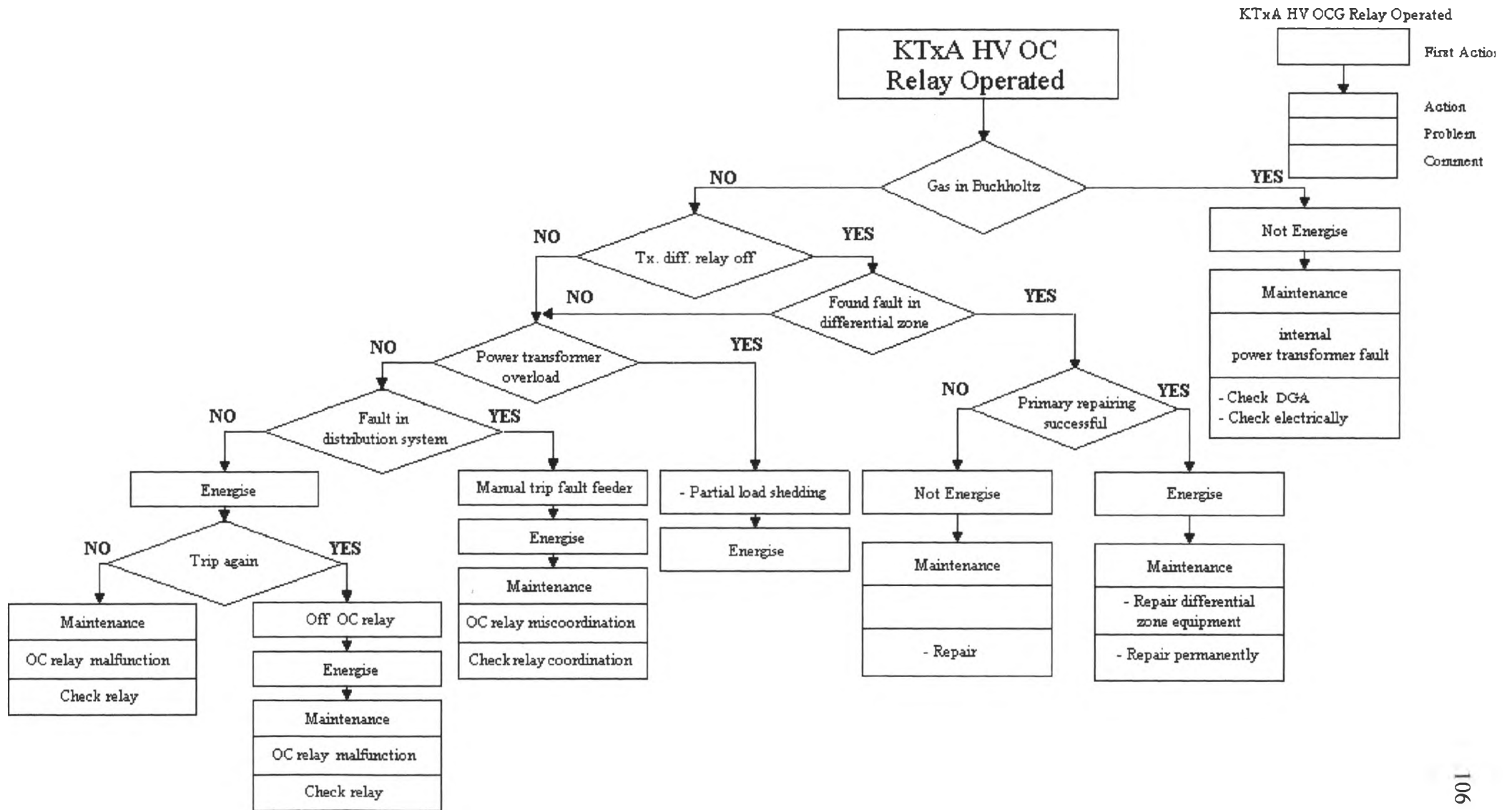


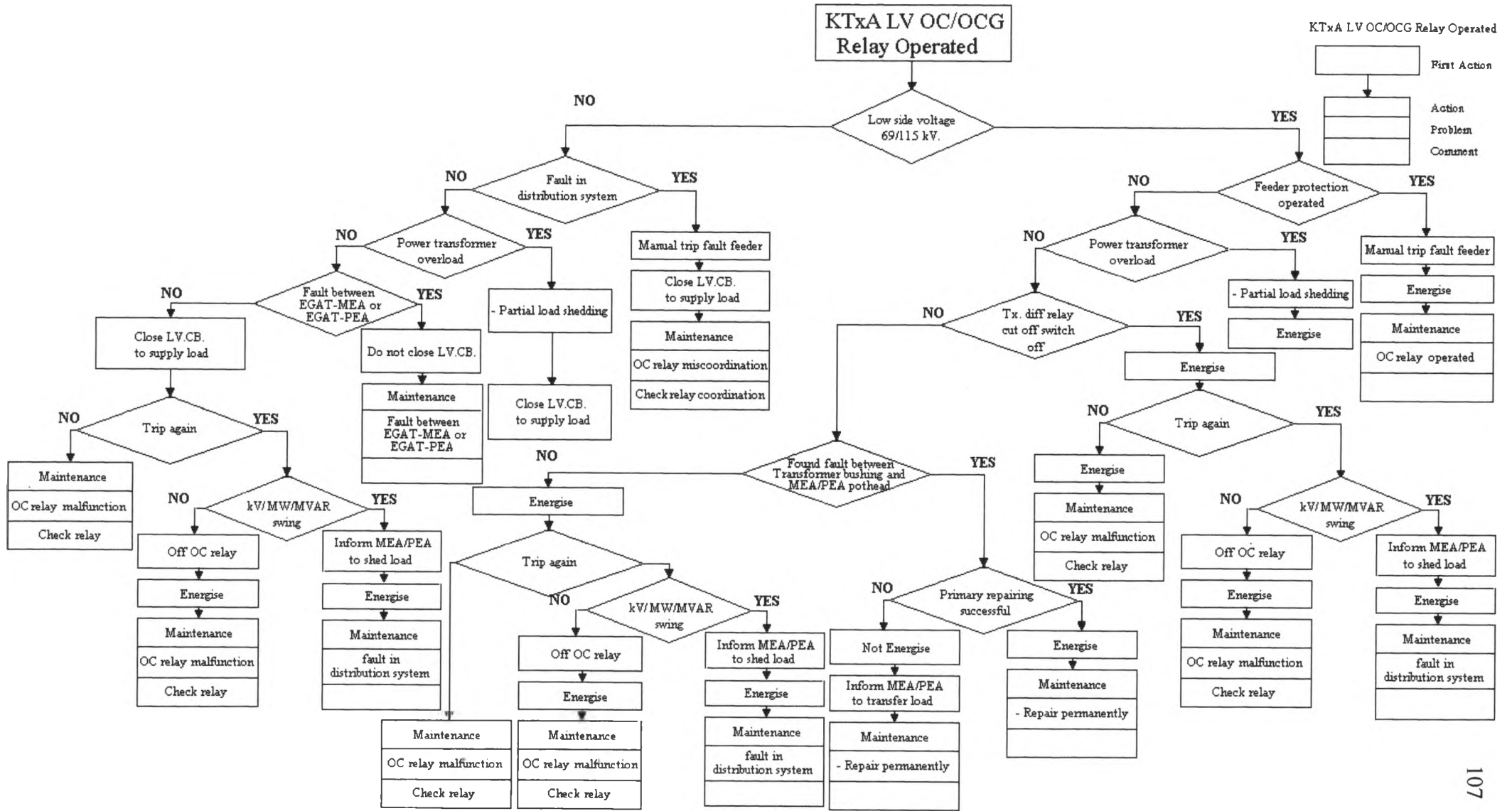


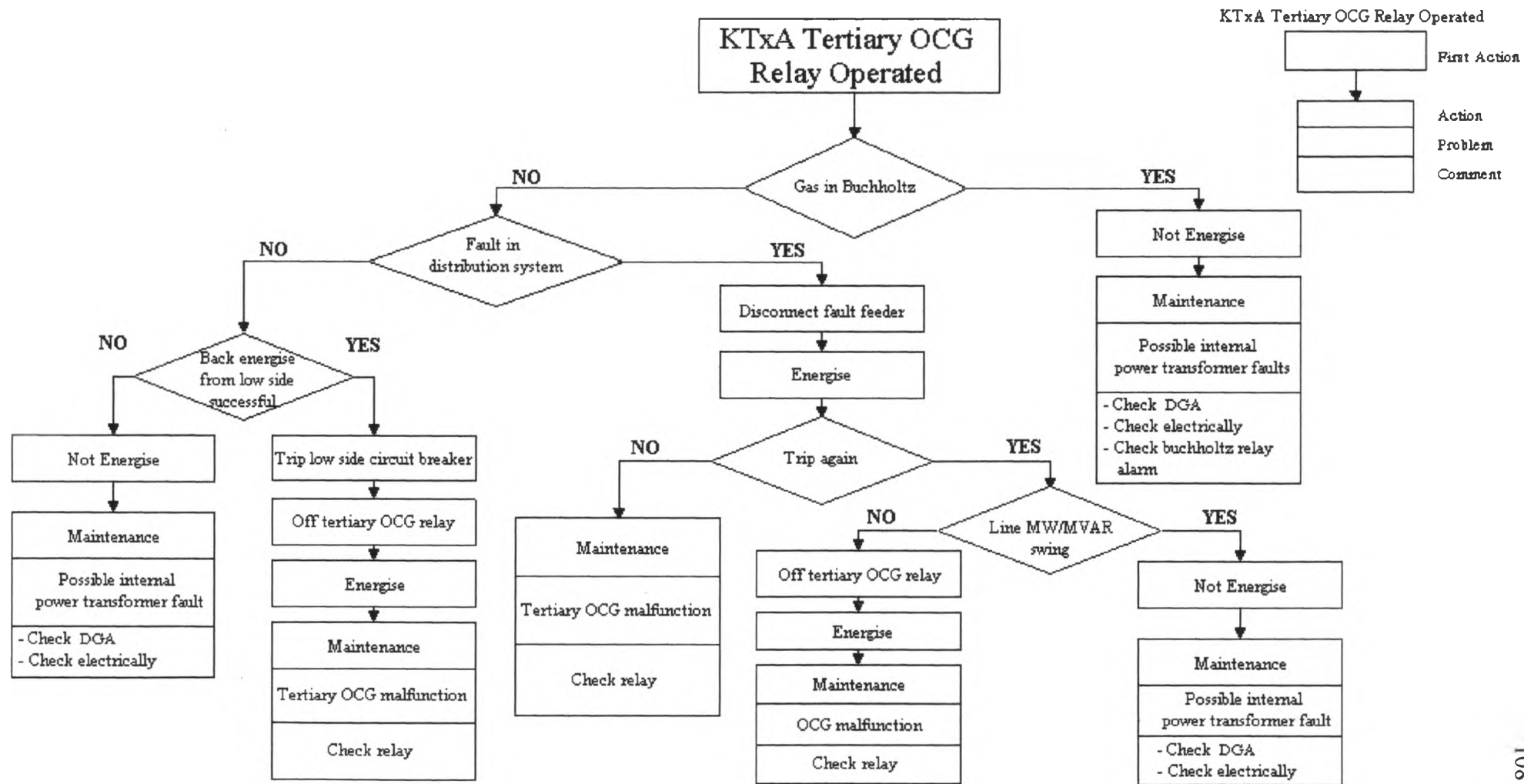
Div. Sw. Pressure Relief Trip

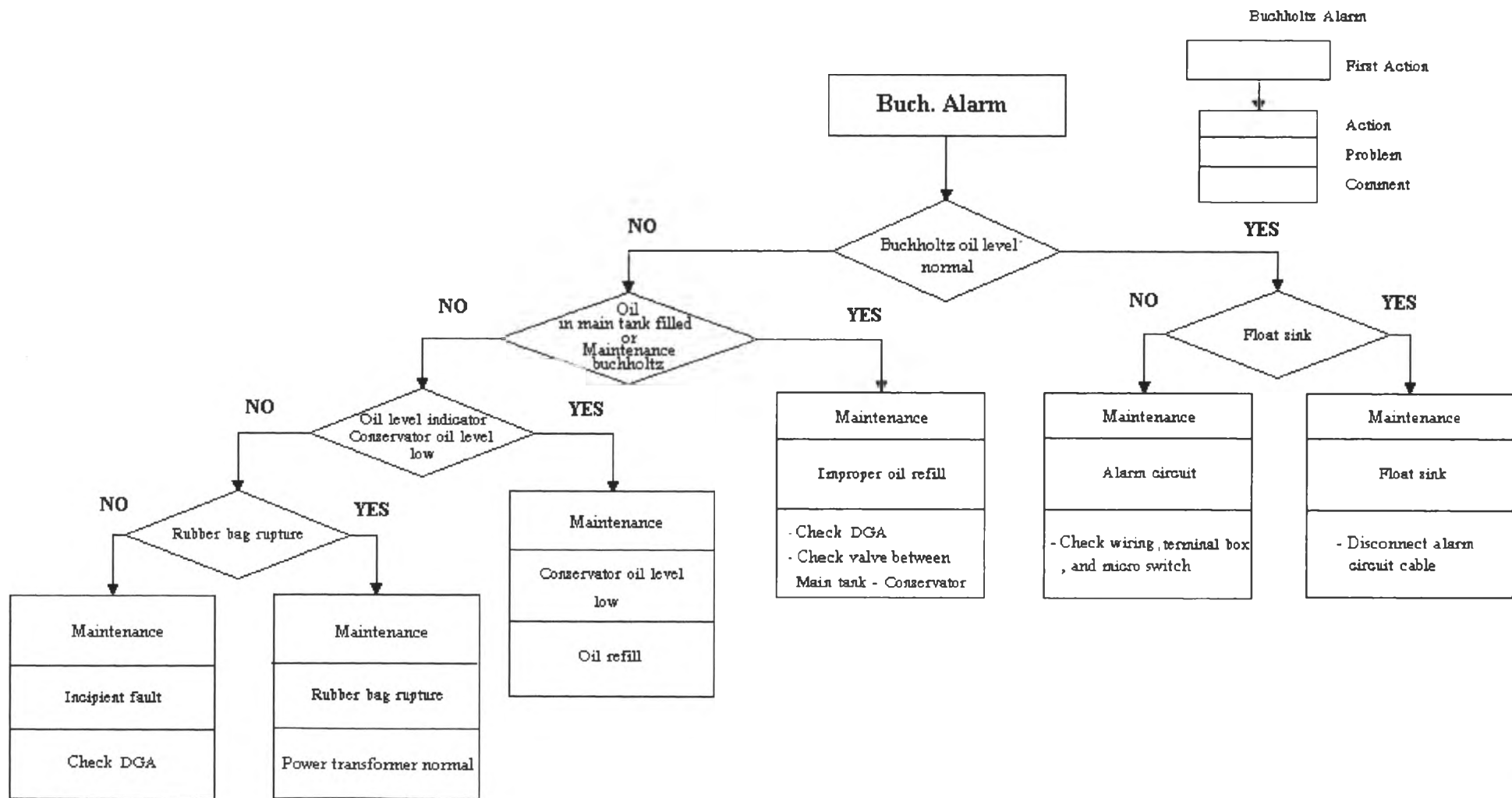
	First Action
	Action
	Problem
	Comment

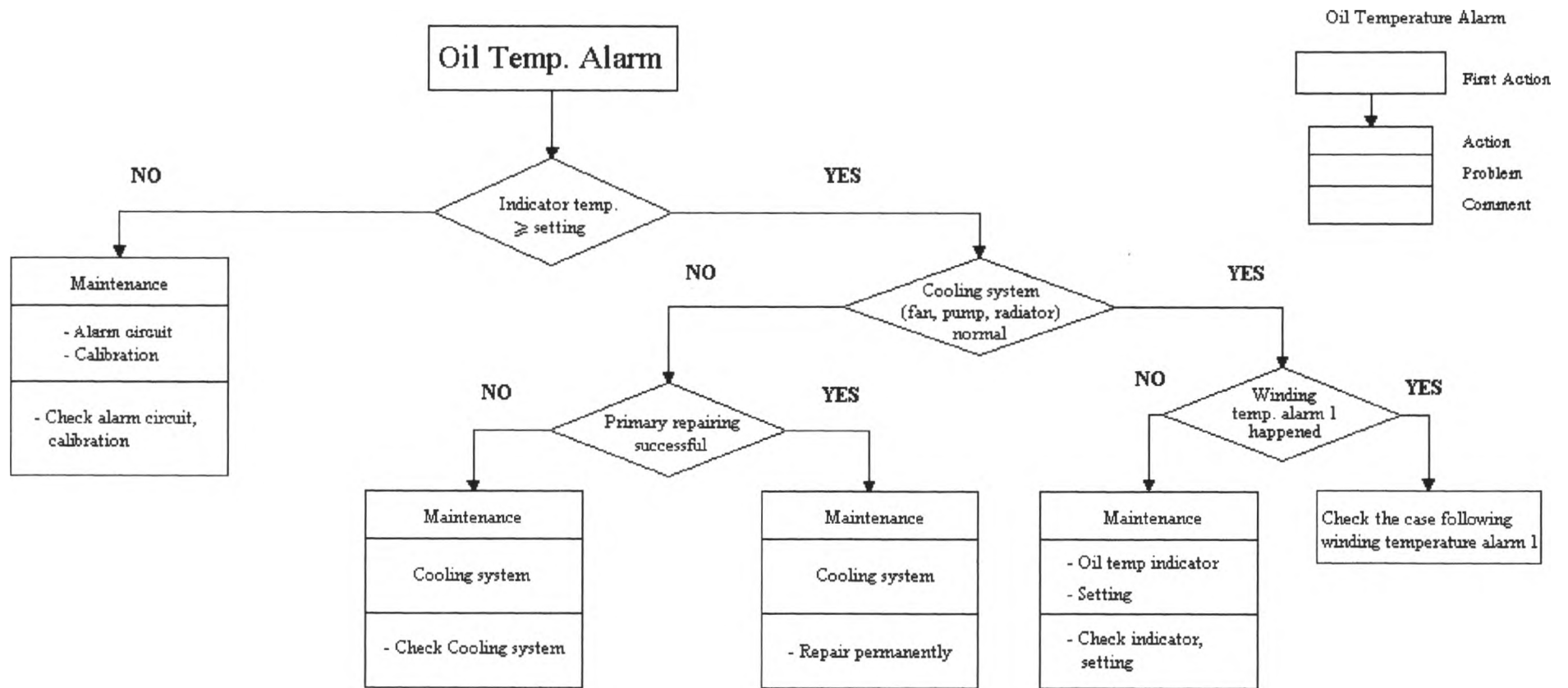




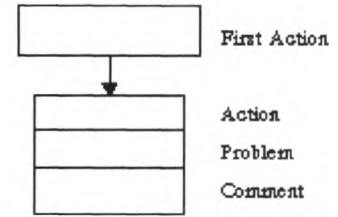
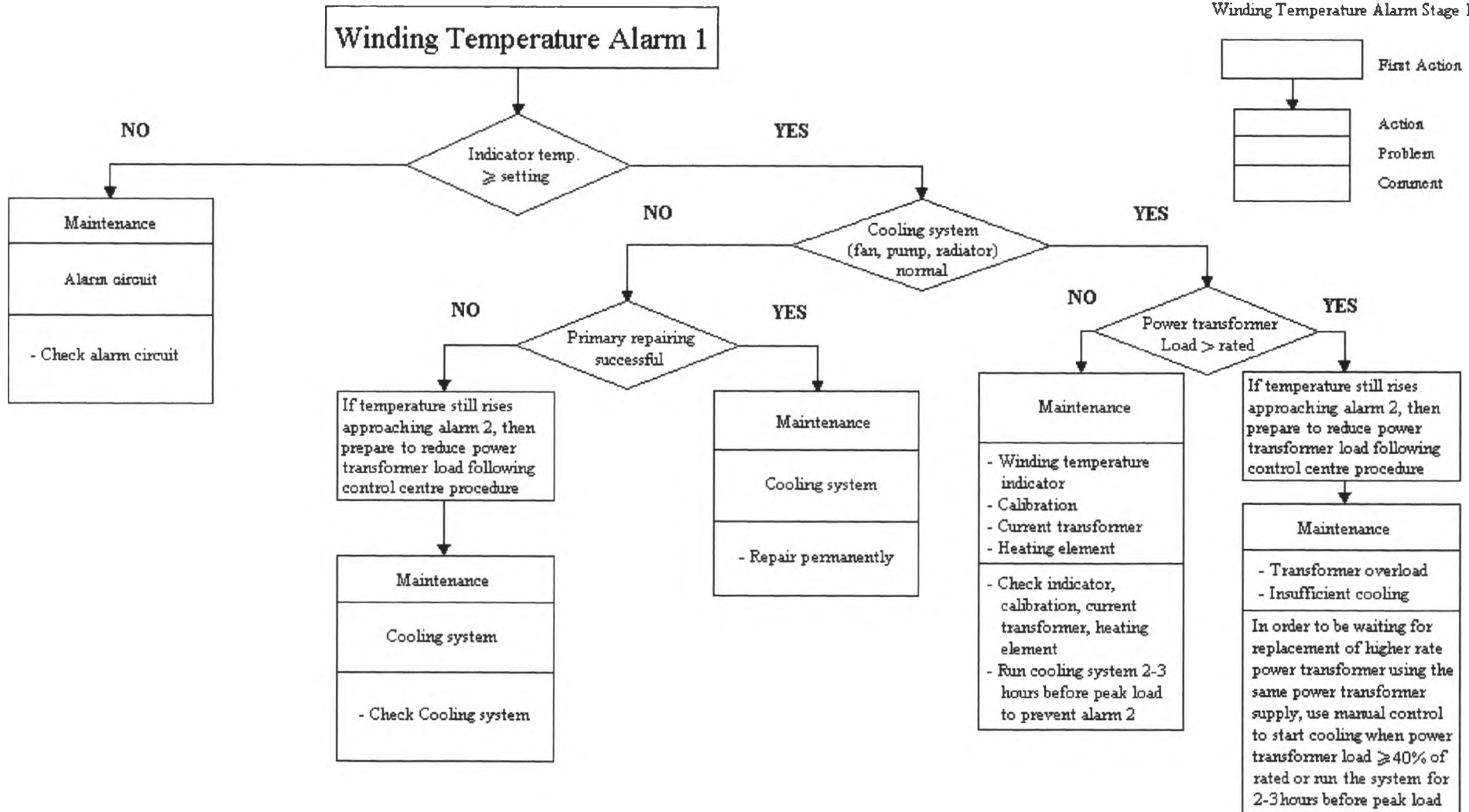




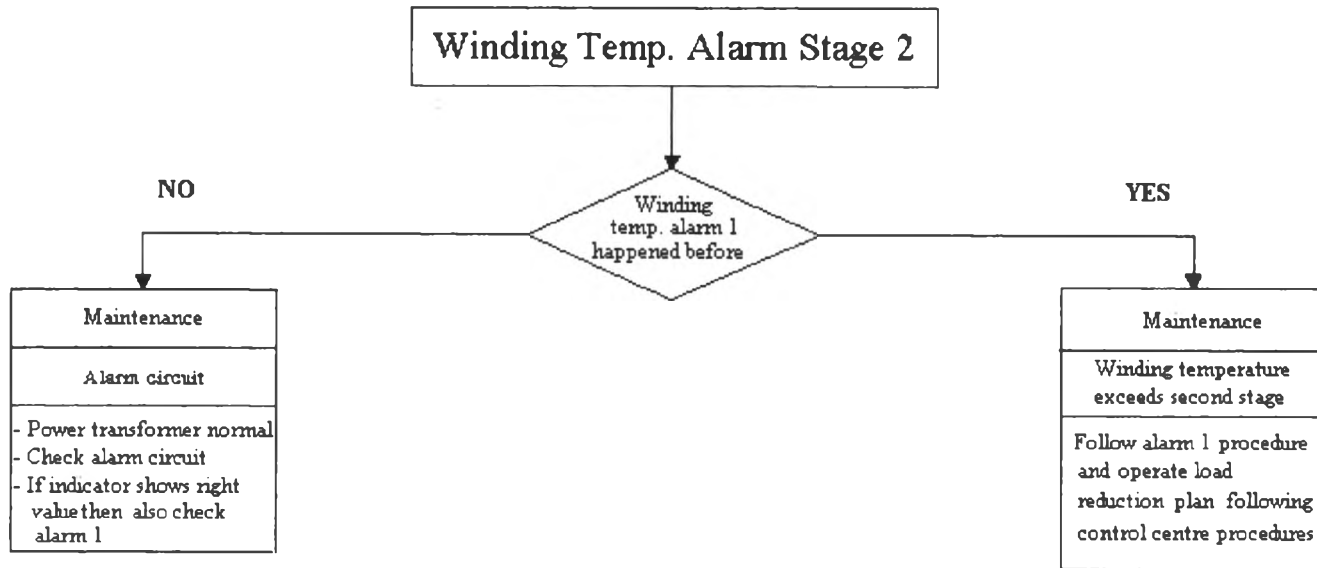
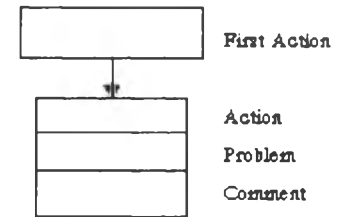




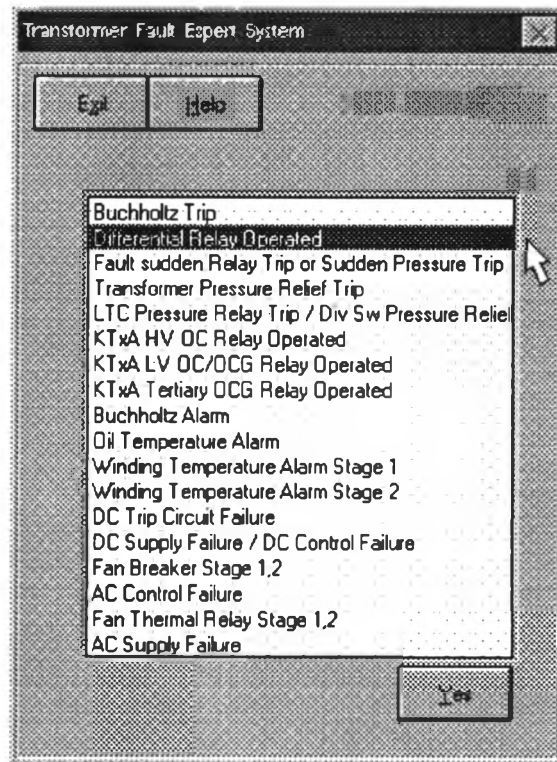
Winding Temperature Alarm Stage 1



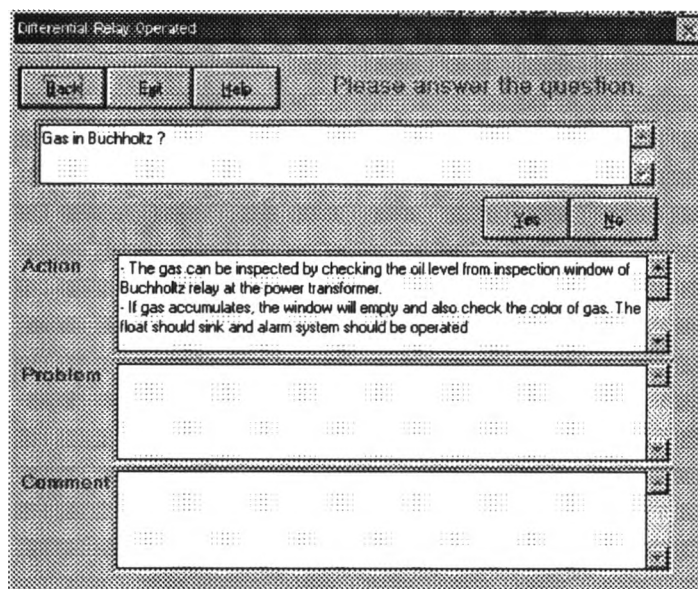
Winding Temperature Alarm Stage 2



APPENDIX B
RESULTS OF EXPERT SYSTEM



When the differential relay operated, the related case will be selected from the list on main screen.



After selecting differential relay operated, the expert system needs to know about gas in inspection window of Buchholtz relay.

Differential Relay Operated

Back Exit Help

Not Energise

Action: Maintenance by DGA checking.

Problem: Internal power transformer fault.

Comment: Check DGA.

If there is any gas accumulated in Buchholtz relay, the recommendation screen will appear respectively after answering by clicking 'yes' button.

Differential Relay Operated

Back Exit Help Please answer this question

Trip during energising?

Yes No

Action

Problem

Comment

But if there is no gas accumulated in Buchholtz relay, the next question about trip during power transformer energising from the expert system will be launched.

Differential Relay Operated

Back Exp Help

Off diff.relay and re-energise and then on diff.relay again.

Energise

Action: Maintenance by checking diff. relay.

Problem: If tripping without gas in buchholtz relay. That mean dif.relay malfunction from harmonic restrain.

Comment: Power transformer normal.
Check diff.relay.

If trip during energising, the summary screen will appear respectively after answering by clicking 'yes' button.

Differential Relay Operated

Back Exp Help Please answer the question

Found fault in differential zone ?

Yes No

Action: Check related equipment in differential zone from CT high side to CT low side, insulator of CT, PT, power transformer bushing, and arrester may be flashed over. Check operation of pressure relief of arrester. Check dead animals around the flashing over areas such as bird, snake, cat.

Problem:

Comment:

But if there is no trip during energising, the next question from expert system will be appeared for additional information.

Differential Relay Operated

Back Exit Help Please answer the question.

Primary repairing successful?

Yes No

Action: Checking normal operation of the repaired equipment.

Problem

Comment

If there was any fault happened in differential zone before differential relay operated, the next question from the expert system will be shown for gathering additional information about the repairing of damaged equipment from fault.

Differential Relay Operated

Back Exit Help Please answer the question.

Trip during energising again?

Energise Yes No

Action

Problem

Comment

If primary repairing on damaged equipment was successful, the system will be recommended from the expert system to be re-energised and followed the result of energising.

Differential Relay Operated

Back Exit Help

Action: Maintenance by repairing damaged equipment in differential zone.

Problem:

Comment: Correct equipment failure problem.

If power transformer condition is normal after re-energising, the equipment damaged from fault in differential zone is needed to be repaired permanently.

Differential Relay Operated

Back Exit Help Please answer the question

Gas in Buchholz ?

Yes No

Action: - The gas can be inspected by checking the oil level from inspection window of Buchholz relay at the power transformer.
- If gas accumulates, the window will empty and also check the color of gas. The float should sink and alarm system should be operated

Problem:

Comment:

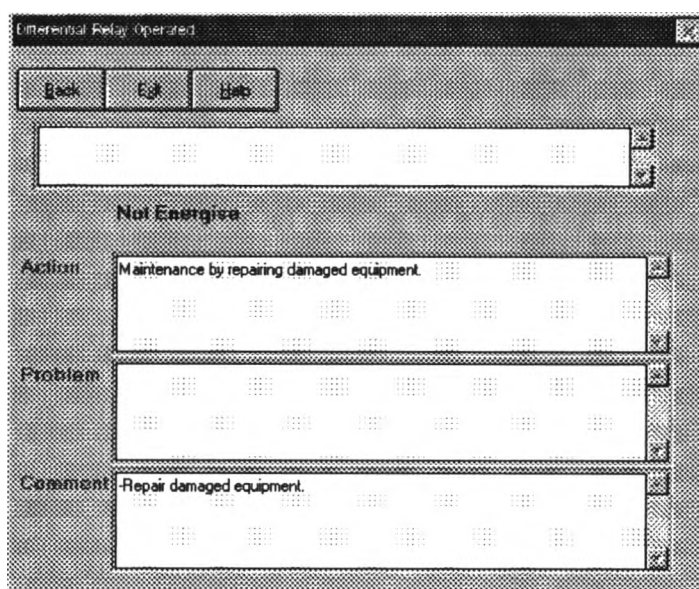
But if the power transformer was still tripped again, the gas in Buchholz relay is needed to be checked.

The screenshot shows a window titled "Differential Relay Operated" with three buttons: "Back", "Exit", and "Help". Below the buttons is a large empty text area. The status "Not Energise" is displayed. The "Action" field contains "Maintenance by DGA checking.", the "Problem" field contains "Internal power transformer fault.", and the "Comment" field contains "Check DGA."

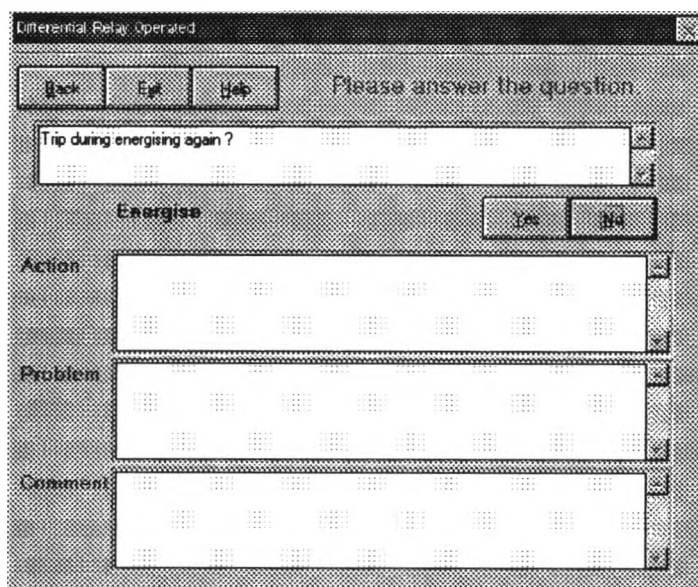
If there is any gas accumulated in Buchholtz relay, the summary screen will appear respectively after answering by clicking 'yes' button.

The screenshot shows a window titled "Differential Relay Operated" with three buttons: "Back", "Exit", and "Help". Below the buttons is a large empty text area. The status "Energise" is displayed. The "Action" field contains "Off diff.relay and re-energise and then on diff.relay again.", the "Problem" field contains "If tripping without gas in buchholtz relay. That means diff.relay malfunctions from harmonic restrain.", and the "Comment" field is empty.

But if there is no gas accumulated in Buchholtz relay, the summary screen will appear respectively after answering by clicking 'no' button.



But if primary repairing on damaged equipment was still unfinished, the power transformer needed to be disconnected manually from the system until the primary repairing will be successful.



After there is no fault found in differential zone, the power transformer will be recommended from the expert system to be re-energised and followed the result of energising.

Differential Relay Operated

Back Edit Help Please answer the question

Gas in Buchholz?

Yes No

Action:

- The gas can be inspected by checking the oil level from inspection window of Buchholz relay at the power transformer.
- If gas accumulates, the window will empty and also check the color of gas. The float should sink and alarm system should be operated

Problem:

Comment:

If the power transformer was still tripped again, the gas in Buchholz relay is needed to be checked.

Differential Relay Operated

Back Edit Help

Not Energise

Action: Maintenance by DGA checking

Problem: Internal power transformer fault

Comment: Check DGA

If there is any gas accumulated in Buchholz relay, the summary screen will appear respectively after answering by clicking 'yes' button.

Differential Relay Operated

Back Eg Help

Energise

Action: Off diff. relay and re-energise and then on diff. relay again.

Problem: If tripping without gas in buchholtz relay. That means diff. relay malfunctions from harmonic restrain.

Comment:

But if there is no gas accumulated in Buchholtz relay, the summary screen will appear respectively after answering by clicking 'no' button.

Differential Relay Operated

Back Eg Help

Energise

Action: Maintenance by checking power transformer condition.

Problem:

Comment: Search fault in diff. zone again.

But if power transformer condition is normal after re-energising, the fault in differential zone is needed to be searched again.

APPENDIX C

POWER TRANSFORMERS IN CENTRAL REGION

DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KT2A	BN	ทตล1-ส	7128827901	103826	ABB		200/200/60	230/72.5/11		YNd1	60/75
					ABB	UCGRT 650/600 IS	45/7-305017-h32		06/10/36		
KT3A	BN	ทตล1-ส	7128827902	103827	ABB		200/200/60	230/72.5/11		YNd1	60/75
					ABB	UCGRT 650/600 IS	45/7-30-5017-H32		15/10/38		
KT4A	BN	ทตล1-ส	7128700201		SALVIGIANO			230/115/22			
									15/07/36		
KT6A	BN	ทตล1-ส	7128700303	565273	MITSUBISHI	1970	66.66	230/115/22			
					MITSUBISHI	MRDI 400-110R			15/07/36		
KT7A	BN	ทตล1-ส		AG69095T121	FUJI	1983	200	230/69/11			
					MR	3ARSD2302/S621	45/6-30-0166-E001(K)		29/05/28		
KT8A	BN	ทตล1-ส	7128825501	AG69095T221	FUJI	1984	120/160/200 MVA	230/69/11KV	13.25/11.72/15.86	YyOd1	65°C
					TRAFO-UNION	3*ARSD2302/621		E001(K)	22/12/34		
KW1A	BN	ทตล1-ส	7141101202	40391001	MITSUBISHI	1969	500 KVA	11KV/416V	3.2		
								485-B	21/11/34		
KW2A	BN	ทตล1-ส	7141101201	40391002	MITSUBISHI	1969	500 KVA	11KV/416V	3.3		
								465-B	21/11/07		
KT2A	NB	ทตล1-ส	7128822401	AX69026T3	FUJI	1986	120/160/200 MVA	230/72.5/11KV	7.90/7.05/9.52	YyOd1	65°C
					TRAFO UNION	3*ARSD2302/621S-6		F001(FU)	01/02/30		
KT3A	NE	ทตล1-ส	7126826001	9047066	TAKAOKA	1990	200	230/72.5/11			
						M1 601 150B	45/3-30-5070-6908(SB)		11/02/39		
KT6A	NB	ทตล1-ส	7128823101	8946782	TAKAOKA	1989	200 MVA	230/72.5/11 KV	14.1	YyOd1	65/80°C
				184740	MR	3XMI601	1989	45/2-30-5007-EGAT-G05(M)	07/03/36		
KW1A	NE	ทตล1-ส	7141112501	3B34707	SIRIWAT	1980	160 KVA	11KV/416V	3.66	Dy11	
									19/12/23		



DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KW2A	NB	ทตล1-ส.	71411	3834706	SIRIWIWAT	40TF	1980	160 KVA	11KV/416V	3.86	Dv11
									27/01/24		
KW3A	NB	ทตล1-ส.	71411	23273	SIRIWIWAT	32TF	1972	250 KVA	11KV/400V	3.5	Dv11
									20/04/26		
KW4A	NB	ทตล1-ส.	71411	3B33000	SIRIWIWAT	34TF	1960	250 KVA	11KV/400V	3.71	
									7/34		
KT1A	RS	ทตล1-ส.	7126823201	8946783	TAKAOKA	STRODL/BTRODL.CL2C	1989	120/160/200 MVA	230/72.5/11	13.0/12.0/20.2	Yv0d1 65°C
				164741	MR	3XM1601-150B	1989	G05(M)(2-2)		26/01/33	
KT2A	RS	ทตล1-ส.	7126823203	8946785	TAKAOKA	STRODL/BTRODL.CL2C	1989	120/160/200 MVA	230/72.5/11	13.0/12.0/20.2	Yv0d1 65°C
				184743	MR	3XM1601-150B	1989	G05(M)(2-2)		18/02/39	
KT3A	RS	ทตล1-ส.	7126611101	AG69096T131	FUJI	CORE	1964	120/160/200 MVA	230/115/11	7.39/6.76/9.24	Yv0d1 65°C
				AG69096T131	TRAFO UNION	3XARSD3252/S621-62	1984	E001(K)		20/12/33	
KT4A	RS	ทตล1-ส.	7126822601	AG69006T1	FUJI	CORE	1967	120/160/200 MVA	230/72.5/11	7.66/7.05/9.60	Yv0d1 65°C
					TRAFO UNION	3XARSD1021		8604		14/12/31	
KT6A	RS	ทตล1-ส.	7126824101	19100006	TOSHIBA	CORE	1991	200 KVA	230/115/22 KV	12.02/11.86/12.60	Yv0d1 65°C
				186224 A.B.C	MR	3XM1600-	1990	45/3-30-5079-EGAT-ATP-01&02(M)		18/04/36	
KT6A	RS	ทตล1-ส.	7126826301	96400	TEUMONT-SCHNEIDER		1993	200 MVA	220/115/22		
				188906	MR	3XM1601	1993	45/5-30-5076-H22(J)		4/02/39	
KW1A	RS	ทตล1-ส.	7141110001	2B4682001	OSAKA		1977	500 KVA	11KV/416V		
									BC1A(10)	13/03/23	
KW2A	RS	ทตล1-ส.	7141119001	3B41966	SIRIWIWAT		1983	500 KVA	11KV/416V		
									BC1A(10)	20/03/29	
KT1A	SB	ทตล1-ส.	712682204	AX69026T4	FUJI	CORE	1986	120/160/200 MVA	230/72.5/11	7.67/	Yv0d1 65°C
				AX69026T4		3*ARSD2302/621S-6	1986	F001(FU)		01/08/29	

DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KT2A	SF	ทณน1-ส.	7128822701	AG69005T?	FUT	1967	120/160/200 MVA	230/72.5/11	7.86/7.05/9.60	YvOd1	65 C
					TRAFO UNION	1987		8604	08/04/31		
					3*ARSD1021						
KT3A	SB	ทณน1-ส.	7128801101	7200167	ASEA	1980	120/160/200 MVA	230/115/11	11.6/16.8/16.3	YvOd1	65 C
				2271071	ASEA	1980		7913-A	10/03/31		
					UCBRT 560/1200						
KT4A	SB	ทณน1-ส.	7128826602	103712	ABB	1993	200 /200/60	230/72.5/11		YvOd1	65 C
				8061434		1993		45/6-30-5074-H22(A)	14/08/37		
					UCGRT 6600/600IS						
KT5A	SB	ทณน1-ส.	7128826601	103711	ABB	1993	200/200/60	230/72.5/11		YvOd1	65 C
				8016433		1992		45/6-30-5074-H22(A)	24/07/37		
					UCGRT 650/600IS						
KT6A	SB	ทณน1-ส.	7128824901	5BK012901	DAIHEN	1990	200	230/115/22 KV	11.7/11.5/13.2	Yd0,Yd1	65 C
				186075		1990		45/3-30-5073-6907(BWN)	21/06/35		
					3XMI 1200						
KW1A	SB	ทณน1-ส.	71_____	60633-002	VOLTA-WERKE	1980	28 MVA	69000/10.500 V		Dy11	
KW2A	SB	ทณน1-ส.	71_____	60633-001	VOLTA-WORKE	1980	28 MVA	69000/10.500 V		Dy11	
KT1A	SNO	ทณน1-ส.	7128900102	408032	TRAFO-UNION	1994	300	230/121/22			
					TRAFO UNION			45/6-30-5060 H20	24/12/38		
KW1A	SNO	ทณน1-ส.	71-----	220131361	THAI MAXWELL	1992	250 KVA	2KV-400Y/230	5.62	Dyn1	65 C
									23/06/35		
KT1A	STB	ทณน1-ส.	7128824001	9047125	TAKAOKA	1991	200	230/72.5/22			
					MR			45/3-30-5079-ATP01-02(M)	24/02/36		
					MI 600 150C						
KT2A	STB	ทณน1-ส.	7128824002	9047126	TAKAOKA	1991	200	230/72.5/22			
					MR			45/3-30-5079-ATP01-02(M)	24/02/36		
					MI 600 150C						
KT3A	STB	ทณน1-ส.	7128825101	9047372	TAKAOKA	1991	200	230/72.5/22			
					MR			45/3-305070-6906(SB)	26/03/39		
					MI 600 150C						

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DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KT1A	BK	ท๑๑2-๑.	7128826101	7653301	ABB	TBA 54	1992	120/160/200	230/72.5/11	14.1/12.1/10.0	Yy0,d1 60°C
					MR	UCGRT 650/600 1S		9101		26/04/36	
KT2A	BK	ท๑๑2-๑.	7128826102	7653302	ABB	TBA 54	1992	120/160/200	230/72.5/11	14.1/12.1/10.0	Yy0,d1 60°C
						UCGRT 650/600 1S		9101		26/04/36	
KT3A	BK	ท๑๑2-๑.	7128823402	8946787	TAKAOKA	STRODL/BTRODL	1992	120/160/200	230/69/11	15.3/13.2/10.4	Yy0,d1 65°C
					MR	MI 601-150B		G 05(M)		28/04/36	
KT4A	BK	ท๑๑2-๑.	7128619001	84900043	TOSHIBA		1984	120/160/200	230/69/11	7.76	Yy0,d1 65°C
					TOSHIBA	3 X FK-M100J/C		D010(MS)		30/04/36	
KW1A	BK	ท๑๑2-๑.		8834866	AEG		1966	0.5	11/0.4	5.94	D/5
KW2A	BK	ท๑๑2-๑.		8834866	AEG		1966	0.5	11/0.4	5.94	D/5
KW3A	BK	ท๑๑2-๑.		191123294	THAI MAXWELL	DT 64424		0.5	11/0.4		Dy.n1 55°C
KW4A	BK	ท๑๑2-๑.		191123295	THAI MAXWELL	DT 64424		0.5	11/0.4		Dy.n1 55°C
KT1A	BPL	ท๑๑2-๑.	7128800302	7312504701	MITSUBISHI	SUB-MRF	1975	120/160/200 MVA	230/69/11		Yy0d1 55°C
					MITSUBISHI	MRF11600P-80L/150T		A001		15/01/20	
KT2A	BPL	ท๑๑2-๑.	7128800604	5251366	TRAFU-UNION	MLFN8263	1980	120/160/200 MVA	230/115/11KV	12.3/12.6/8.86	Yy0d1 55°C
					TRAFU UNION	3*ARSD150/1521/5-1		C001(TU)		07/03/25	
KT3A	BPL	ท๑๑2-๑.	7128823601	AV69020T2	FUJ	CORE	1990	120/160/200 MVA	230/115/11KV	12.45/11.55/15.46	Yy0d1 65°C
					MR	MI 601-150B		6613(1-2)		11/04/34	
KT4A	BPL	ท๑๑2-๑.	7126824401	91900005	TOSHIBA		1990	120/160/200 MVA	230/69/22KV	9.67/9.35/9.04	Yy0d1 65°C
					MR	T1200C-110/C		ATP-01&02(M)		21/04/34	

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DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KT6A	BPL	ท๑๑2-๑	7128826401	96401	JEUMONT-SCHNEIDER	1993	120/160/200	230/115/11	13.49/11.40/11.06	Yy0,d1	65 C
					MR		45/5-30-6076-H22(1)		280139		
KT6A	BPL	ท๑๑2-๑	7128824501	6946849	TAKAOKA	1989	120/160/200	230/72.5/11	15.2/13.0/10.0	Yy0,d1	65 C
					MR	1989	G05(M)		5/05/36		
KW1A	BPL	ท๑๑2-๑	7141101301	23146	SIRIWIWAT	19	250 KVA	11KV/416V			
							AO12(3)		16/01/20		
KW2A	BPL	ท๑๑2-๑	7141102001	24219	SIRIWIWAT	19	600 KVA	11KV/416V			
							AO12(3)		15/01/20		
KT1A	LPR	ท๑๑2-๑	7128800301	7412607701	mitsubishi	1972	120/160/200 MVA	230/69/11KV	9.27/8.43/6.13	Yy0d1	55 C
					mitsubishi		MRF1600P-80L/160T	A001	13/03/19		
KT2A	LPR	ท๑๑2-๑	7128801001	5251401	TRAFO-UNION	1980	120/160/200 MVA	230/69/11KV	9.37/10.01/6.41	Yy0d1	55 C
					TRAFO UNION		3*ARSD110/2400/6-1	C001(TU)	16/10/25		
KT3A	LPR	ท๑๑2-๑	7126824301	91900007	TOSHIBA	1991	120/160/200 MVA	230/69/22KV	14.36/13.27/12.24	Yy0d1	65 C
					MR		TI2000-110/C	ATP01&02(M)	11/12/34		
KT4A	LPR	ท๑๑2-๑	7126800501	AE69036T1	FUJI	1979	120/160/200	230/69/11		Yy0,1	
					MR		3 X DSF1	B001T	07/11/36		
KW1A	LPR	ท๑๑2-๑	7141101401	23144	SIRIWIWAT	1972	150 KVA	11KV/416V			
							A-012(2)		17/03/19		
KW2A	LPR	ท๑๑2-๑	7141112001	3B32966	SIRIWIWAT	1980	150 KVA	11KV/416V			
							C-109(2)		18/10/25		
KT1A-A	NCO	ท๑๑2-๑	7129800301	94427	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.09/47.22/40.17	Yy0d1	65 C
					MR		TI1001-220/C-10193	EHVS3-T(J)(1A-1)	07/10/33		
KT1A-B	NCO	ท๑๑2-๑	7129800302	94426	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.12/47.33/40.27	Yy0d1	65 C
					MR		TI1001-220/C-10193	EHVS3-T(J)(1A-1)	07/10/33		

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DEVICE NO	SUB SECTION	EGAT_SN	TX_SN	MFGTX	TYPETX	YEARTX	MVATX	KVTX	IMPEDANCE	VECTOR	TEMP
			OLTC_SN	MFGOLTC	TYPEOLTC	YEAROLTC	CONTRACT		1st ENERGIZED		
KT1A-C	NCO	ทณร2-ส.	7129800303	94429	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.09/47.33/40.37	Yy0d1	65°C
					MR	TI1001-220/C-10193		EHVS3-T(J)(1A-1)	07/10/33		
KT2A-A	NCO	ทณร2-ส.	7129800401	94440	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.09/47.17/40.24	Yy0d1	65°C
					MR	TI1001-220/C-10193		EHVS3-T(J)(ADD)	05/11/34		
KT2A-B	NCO	ทณร2-ส.	7129800402	94441	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.13/47.39/40.41	Yy0d1	66°C
					MR	TI1001-220/C-10193		EHVS3-T(J)(ADD)	05/11/34		
KT2A-C	NCO	ทณร2-ส.	7129800403	94442	JEUMONT-SCHNEIDER	1990	120/160/200 MVA	525/242/22KV	14.12/47/48/40.46	Yy0d1	65°C
					MR	TI1001-220/C-10193		EHVS3-T(J)(ADD)	05/11/34		
KT4A	NCO	ทณร2-ส.	7126825201	91900022	TOSHIBA	1991	120/160/200 MVA	230/115/22 KV	12.38/12.20/12.91	Yy0d1	65/80°C
					MR	MI600-110/C-12211W	1990	45/2-30-6001-8813(9001)	30/04/35		
KT5A	NCO	ทณร2-ส.	7126826201	96395	JEUMONT-SCHNEIDER	1993	120/160/200	230/121/22	12.7/12.09/13.66	Yy0.d1	65°C
			168907		MR	3XMI601	1993	45/5-30-5076-H22(J)			
KW1A	NCO	ทณร2-ส.	71411		SIRIWIWAT	19--	500 KVA	24KV/400V			
								K-MB1	07/07/27		
KW1B	NCO	ทณร2-ส.	71411		SIRIWIWAT	19--	500 KVA	24KV/400V			
								K-MB1	07/07/27		
KW2A	NCO	ทณร2-ส.	7142120501	191123296	MAI-MAXELL	19--	500 KVA	24KV/400V			
								EHVS3	07/10/35		

APPENDIX D
CAUSES OF ABNORMAL EVENTS

Table D.1 Causes of Abnormal Events

Main Causes of Events	Specific Description
Adverse Weather	Thunder Storm Strong Wind and Rain Rainy Lightning Stroke Wind Heavy Cloud Fog
Adverse Environment	Fire Tree Fall on Transmission Line Vine Growth on Structure Tree Growth Under Transmission Flood Pollution and Contamination Foreign Object on Transmission Line Foreign Object in Switchyard
Abnormal System Condition	Power Plant Trip Power Swing Overload Underfrequency Relay Operated Undervoltage Relay Operated Faults in EGAT System Faults in Energy De Laos System Faults in Malaysia's System Cascading Outage of Transmission Line
Defective Equipment	Structure Failure Failure of Transmission Line Equipment Broken Conductor of Transmission Line Substation Equipment Failure Protection Equipment Malfunction Equipment Explosion Equipment Malfunction Insulator Flashover Lack of Transmission Line Clearance
Human Element	Human Error from EGAT Personnel Human Deed Construction Division Human Error from Transmission System Maintenance Division Human Error from Substation Maintenance Division
Animal Topic	Animals with Wings Snakes and Lizards Vermis or Other Animals

Main Causes of Events	Specific Description
Customer Distribution Fault	MEA Distribution Fault PEA Distribution Fault Direct Customer Distribution Fault Faults Happened for MEA Operating purposes Faults Happened for PEA Operating purposes Faults Happened for Direct Customer Operating purposes
Maintenance and System Improvement	Transmission Line Equipment Maintenance Substation Equipment Maintenance Purposes for Works in Substation Change Transformer Tap New Equipment Installation Switching Purpose De-energising Due to Lack of Generation Operation on System Improvement Equipment Testing
Unclassified	Unclassified Causes Happened during Normal Weather Temporary Fault
Deferrable Outage	Mainly Related to Generation System Mainly Related to Transmission System

APPENDIX E
FAULT EVENTS IN CENTRAL REGION

RI.TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
96/01/17	BPL-KT1A	21:58	00/18	277.00	00/08	36.93	BPL(80332,322,69212,222)	SELF(LTC-PR)	SUC/-	MEA /CLEAR	INSULATOR EXPLODED SUPPORT OF BPT 6922A 3PHASE OF MEA	
96/01/17	BPL-KT6A	21:58	00/51	0.00	--/--	0.00	BPL(80122,132,69112,132)	G/C B,C	SUC/-	MEA /CLEAR	INSULATOR EXPLODED SUPPORT OF BPT 6922A 3PHASE OF MEA	
96/01/20	NB-KT6A	17:03	00/56	0.00	--/--	0.00	NB(8072,69612)	CCG B/U	SUC/-	MEA /CLEAR	#A MEA CONDUCTOR DAMAGE AT TAKE OFF STRUCTURE	
96/01/20	BK-KT2A	23:57	00/12	0.00	--/--	0.00	BK(80069,69212,69222)	TX. LOCK OUT	SUC/-	UNKNOWN /CLEAR		
96/01/21	BK-KT2A	21:37	04/39	0.00	--/--	0.00	BK(80069,69212,69222)	SELF(LTC-PR)	SUC/-	INSULATOR FLASH OVER /CLEAR	PRESSURE RELIEF DEVICE CABLE LEAK GROUND AT JUNCTION BOX	
96/01/27	SA1-KT5A	00:07	00/20	19.90	00/20	6.63	SA1(70012,2212)	TX. DIFF A,B,C	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT UNDER BRK. SA1 2212	
96/02/05	SA2-KT5A	19:39	00/19	36.00	00/19	11.40	SA2(70062,2212)	TX. DIFF B,C	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT DS. SA2#2215	
96/02/11	SR2-KT4A	18:53	01/45	0.00	--/--	0.00	SR2(80132,232,432,532,701812)	TX. DIFF C	SUC/-	OTHER /CLEAR	CABLE QZ5C #C LOOSE	
96/03/02	BP2-KT5A	08:58	00/38	0.00	--/--	0.00	BP2(80112,80132)		SUC/-	HUMAN ERROR (EGAT) /RAIN	TSM DEPT. MOVE CONTROL BOARD AT BP2 80112	
96/03/23	SR2-KT1A	13:59	00/58	0.00	--/--	0.00	SR2(700422,2212)	TX. DIFF. C	SUC/-	PEA /CLEAR	BREAKER FEEDER#1 OF P2A EXPLODED	
96/03/28	AT2-KT1A	04:16	00/34	0.00	--/--	0.00	AT2(800212,800222,70032)	TX.DIFF B,C	SUC/-	LIGHTNING /RAIN	LIGHTNING ARRESTER #B AT HS. EXPLODED	
96/03/28	AT2-KT1A	04:50	05/22	0.00	--/--	0.00	AT2(800212,800222,70032)	TX.DIFF B,C	SUC/-	LIGHTNING /RAIN	LIGHTNING ARRESTER #B AT HS. EXPLODED	
96/04/14	TL1-KT6A	05:47	00/31	21.60	00/31	11.16	TL1(70012,2212)	TX. DIFF A	SUC/-	PEA /RAIN	FAULT IN PEA	
96/04/23	BY1-KT2A	15:39	00/14	0.00	--/--	0.00	BY1(7012)		SUC/-	EQUIPMENT FAILURE /CLEAR	LOCK OUT RELAY BAD CONTACT	



RI, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DOR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSEING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
96/04/23	RY1-KT2A	15:52	03/40	0.00	--/--	0.00	RY1(7012)		SUC/-	EQUIPMENT FAILURE /CLEAR	LOCK OUT RELAY BAD CONTACT	
96/04/25	B8G-KT2A	15:56	00/41	17.25	01/14	21.23	B8G(7052)	TX. DIFF A	SUC/-	UNKNOWN /RAIN		
96/05/05	BP1-KT1A.KT2A	10:06	00/12	17.40	00/12	3.48	BP1(7082,2212)	TX. DIFF	SUC/-	ANIMALS /CLEAR	POWER FUSE #B.#C OF KW1A EXPLODED (CHAMELEON DIE)	
96/05/12	B8G-KT2A	16:50	00/11	15.00	00/11	2.75	B8G(7052,2222)	TX. DIFF A	SUC/-	UNKNOWN /CLEAR		
96/05/12	SN3-KT1A	19:00	00/08	13.50	00/21	4.73	SN3(7032,2212)	TX. DIFF B	SUC/-	PEA /CLOUDY	FAULT IN PEA (F#1 TRIP AND RECLOSING)	
96/05/12	SN3-KT1A	19:08	00/13	0.00	--/--	0.00	SN3(7032,2212)	TX. DIFF B	SUC/-	PEA /CLOUDY	FAULT IN PEA (F#1 TRIP AND RECLOSING)	
96/05/13	SN3-KT1A	14:50	00/02	29.50	00/03	1.48	SN3(7032,2212)	KT1A DIFF	SUC/-	EQUIPMENT FAILURE /CLEAR	DIFFERENTIAL RELAY CONTACT STUCK	
96/05/15	B8G-KT2A	07:15	00/10	15.00	00/10	2.50	B8G(7052,2222)	TX. DIFF A	SUC/-	ANIMALS /CLEAR	BIRD NEST AT BUSHING HS. #A	
96/05/17	PRB-KT1A	14:25	00/07	13.00	00/07	1.52	PRB(7032,2212)	TX. DIFF AUX.	SUC/-	UNKNOWN /CLEAR		
96/05/29	KKC-KT1A.2A	19:12	00/36	0.76	00/36	0.46	KKC(7012,2212,1212)	DIFF RELAY	SUC/-	UNKNOWN /CLEAR	SUCHBOLY RELAY SHOW	
96/06/04	LPR-KT1A	13:34	00/32	240.00	00/14	56.00	LPR(8012,8032)	TX. DIFF C	SUC/-	LIGHTNING /RAIN	CHG. BROKEN AND FALL ON TRANSMISSION LINE	
96/06/04	LPR-KT2A	13:34	00/41	140.00	00/19	44.33	LPR(8022,8042)	O/C C	SUC/-	LIGHTNING /RAIN	CHG. BROKEN AND FALL ON TRANSMISSION LINE	
96/06/04	LPR-KT3A	13:34	00/54	0.00	--/--	0.00	LPR(8052,8072)	TX.(HV) O/C C	SUC/-	LIGHTNING /RAIN	CHG. BROKEN AND FALL ON TRANSMISSION LINE	
96/06/06	LPR-KT1A	20:07	--/--	0.00	--/--	0.00	LPR(8012,8032,6912,6922)	SELF(PRI)	MEK/-	MBA /CLEAR	FAULT IN MBA	



R1, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
96/06/19	CA-KT1A	19:08	01/41	5.40	00/42	3.78	CA(7032,2212)	TX. DIFF A,B	SUC/-	EQUIPMENT FAILURE /RAIN	POWER FUSE 2216F #A EXPLODED	
96/06/20	NCS-KT3A	03:56	03/15	29.30	00/16	7.81	NCS(7062,2222)	TX. DIFF A,B,C	SUC/-	ANIMALS /CLEAR	DEAD RAT AT NCS 2212	
96/06/25	LB1-KT2A	18:56	00/13	13.30	00/13	2.88	LB1(7022,2222)	TX. DIFF A,B	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT TX. KW2A	
96/06/29	AT2-KT1A	19:58	03/34	0.00	--/--	0.00	AT2(80212,80822,70032)	TX. DIFF A,B	SUC/-	LIGHTNING /CLEAR	LIGHTNING ARRESTOR HS. #A FLASH OVER	
96/06/30	SA2-KT2A	07:19	00/09	7.00	00/09	1.05	SA2(70072,2222)	DIFF A,B,C	SUC/-	INSULATOR FLASH OVER /CLEAR	BUSHING #A OF BRK. FLASH OVER	
96/07/04	RY1-KT2A	19:23	00/23	26.50	00/23	10.16	RY1(7012,2222)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /CLEAR	DS. RY1 7015 ARCING	
96/07/13	LB2-KT2A	19:02	00/10	11.00	00/10	1.83	LB2(70092,2222)	TX. DIFF A,B	SUC/-	ANIMALS /CLOUDY	DEAD BIRDS AT STRUCTURE 22KV.	
96/07/15	RY1-KT1A	01:05	00/10	21.00	00/10	3.50	RY1(7032,2212)	TX. DIFF. A,B,C	SUC/-	ANIMALS /CLEAR	DEAD CAT AT METERING 22KV	
96/07/29	BPL-KT3A	11:55	00/43	30.00	00/46	23.00	BPL(80732,70222,70232)	OCG	SUC/-	MEA /CLEAR	FAULT IN MEA (MEA LOAD LOSS 30MW 46MIN)	
96/07/29	BPL-KT5A	11:55	00/44	0.00	--/--	0.00	BPL(80712,80722,70322,70332)	OCG	SUC/-	MEA /CLEAR	FAULT IN MEA (MEA LOAD LOSS 30MW 45MIN)	
96/07/29	BPL-KT2A	11:55	00/46	0.00	--/--	0.00	BPL(70112,70122)	OCG	SUC/-	MEA /CLEAR	FAULT IN MEA (MEA LOAD LOSS 30MW 46MIN)	
96/08/11	NCS-KT3A	10:51	00/03	0.00	--/--	0.00	NCS(7062)	TX. DIFF A	SUC/-	UNKNOWN /CLEAR		
96/08/11	NCS-KT3A	10:54	00/11	0.00	--/--	0.00	NCS(7062)	TX. DIFF A	SUC/-	UNKNOWN /CLEAR		
96/08/12	CB3-KT1A	18:30	00/11	6.70	00/11	1.23	CB3(7042,2212)	TX. DIFF B,C	SUC/-	UNKNOWN /RAIN		

81, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
96/08/12	SB3-KT1A	20:36	00/56	24.60	00/56	22.95	SB3(7022,2212)		SUC/-	UNKNOWN /CLEAR		
96/03/15	RS-KT6A	09:23	00/20	0.00	--/--	0.00	RS(80232,80222,70032,70012)	LOCK OUT	SUC/-	UNKNOWN /CLEAR		
96/08/20	BBG-KT2A	20:10	00/10	20.40	00/10	3.40	BBG(7052,2222)	TX: DIFF A,B	SUC/-	ANIMALS /RAIN	DEAD BIRD AT DS. 2223	
96/08/22	SA1-KT6A	02:31	00/24	19.50	00/32	10.40	SA1(70102,2222)	87K6,7 A,B,C	SUC/-	UNKNOWN /CLEAR		
96/08/22	SA1-KT7A	02:31	00/24	23.50	00/35	13.71	SA1(70102,2232)	51K	SUC/-	UNKNOWN /CLEAR		
96/09/26	DBN-KT1A	19:05	00/17	21.50	00/19	6.81	DBN(7032,2212)	TX: DIFF B	SUC/-	ANIMALS /CLOUDY	DEAD BIRD AT METERING 22KV	
96/08/28	SB-KT4A	16:03	00/24	274.00	00/24	109.60	SB(80732,80722,6912,6922,6932)	69KV O/C A,B,C	SUC/-	MEA /CLEAR	DISCON. MEA 6033A ARC. INSULATOR SUPPORT 6033A #A,C	BROKEN (87B MEA OFF)
96/08/28	SB-KT5A	16:03	00/24	0.00	--/--	0.00	SB(80712,80722,6952,6942,6962)	69KV O/C	SUC/-	MEA /CLEAR	DISCON. MEA 6033A ARC. INSULATOR SUPPORT 6033A #A,C	BROKEN (87B MEA OFF)
96/09/09	RS-KT1A	14:05	00/17	0.00	--/--	0.00	RS(80812,80822,69412,69422)	O/C C (LS)	SUC/-	MEA /CLEAR	BROKEN COND. PASS TWO KRT 6914C AND LIGHTNING ARRESTER	LINE KRT 691B #A,#B EXPLODED
96/09/09	RS-KT2A	14:05	00/16	0.00	--/--	0.00	RS(80712,80722,69512,69522)	O/C & OCG C	SUC/-	MEA /CLEAR	BROKEN COND. PASS TWO KRT 6914C AND LIGHTNING ARRESTER	LINE KRT 691B #A,#B EXPLODED
96/09/09	RS-KT4A	14:05	04/22	428.00	04/23	1876.07	RS(80912,69632)	TX: DIFF A,C	SUC/-	MEA /CLEAR	BROKEN COND. PASS TWO KRT 6914C AND LIGHTNING ARRESTER	LINE KRT 691B #A,#B EXPLODED
96/09/12	RS-KT4A	13:03	02/20	0.00	--/--	0.00	RS(80912,69623)	TX: DIFF C	SUC/-	EQUIPMENT FAILURE /CLEAR	ARC. AT TERMINAL CT. (LS) #B	
96/09/28	BP1-KT1A,KT2A	18:28	02/42	0.00	--/--	0.00	BP1(7082,2212)	TX: DIFF	SUC/-	EQUIPMENT FAILURE /RAIN	SURGE ABSORBING CAPACITOR #B EXPLODED	
96/10/05	AT1-KT2A	05:41	06/52	0.00	--/--	0.00	AT1(9082,6972)		SUC/-	INSULATOR FLASH OVER /RAIN	INSULATOR FLASH OVER #B AT T156	



RI, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-BRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
96/10/19	BP2-KT3A	13:20	00/15	30.00	00/16	3.00	BP2(70212,2212)	TX. DIFF A.B	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT METERING 22KV	
96/10/19	LPR-KT2A	22:31	00/39	0.00	--/--	0.00	LPR(9342,8322,5942)	TX. DIFF	PEW/-	MEA /CLEAR	FAULT IN MEA	
96/10/26	SA1-KT6A,KT7A	06:02	00/41	45.10	00/41	30.32	SA1(70102,2222,2232)	5L T7-A(O/C HS.#A)	SUC/-	PEA /RAIN	SA1 2232 #B EXPLODED AND #A. #C ARC. (FAULT IN PEA AND	GROUND WIRE OF P9 BROKEN)
96/10/29	AP-KT4A,KT5A	21:50	00/24	12.49	00/24	5.90	AP(70412,70432,2232,2222)	BUCHHOLTZ (KT4A)	SUC/-	PEA /CLEAR	FAULT IN PEA (CAR ATTACHED TOWER OF PEA)	
96/11/05	KKC-KT1A,KT2A	03:10	00/25	0.40	04/20	1.73	KKC(7012,2212,1212)	BUCHHOLTZ & DIFF RELAY	SUC/-	EQUIPMENT FAILURE /CLEAR	ARC. DISCHARGE KT2A	
96/11/11	SA1-KT6A,KT7A	10:24	00/42	79.40	00/42	55.58	SA1(70102,2222,2232)	SELP(LTC-SP)	SUC/-	OTHER /CLEAR	LTC PRESSURE RELAY	
96/11/22	NB-KT5A	01:20	00/17	0.00	--/--	0.00	NB(69122,1222)	TX. DIFF A.B	SUC/-	ANIMALS /CLEAR	SNAKE UNDER LINE 11KV.	
96/11/23	SA1-KT5A	13:16	00/10	30.00	00/11	5.50	SA1(70112,2212)	TX. DIFF B.C	SUC/-	UNKNOWN /CLEAR		
96/12/17	RS-KT3A	12:26	00/06	0.00	--/--	0.00	RS(80432,70112,70122)		SUC/-	HUMAN ERROR (EGAT) /CLEAR	SRP. WORKING.	
96/12/23	B11-KT2A	19:30	00/19	9.60	00/19	1.60	B11(7022,2222)	TX. DIFF	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT BR. B11 2222	
97/01/15	SC-KT2A	10:39	00/10	22.10	00/11	4.05	SC(7032/2212)		SUC/-	HUMAN ERROR (EGAT) /CLEAR	TX. MAINTENANCE-1 OVERHAUL KT1A	
97/01/15	SC-KT2A	11:09	01/43	12.50	00/17	3.54	SC(7032/2212)	TX. DIFF	SUC/-	HUMAN ERROR (EGAT) /CLEAR	TX. MAINTENANCE-1 OVERHAUL KT1A	
97/01/17	BPL-KT2A	15:43	00/13	0.00	--/--	0.00	BPL(80512,80532,70112,70122)	OCG	SUC/-	MEA /CLEAR	TREE ATTACHED LINE 791A OF MEA (MEA LOAD LOSE 160MW)	(MEA BRK.TC BROKEN)
97/01/17	BPL-KT3A	15:43	00/15	0.00	--/--	0.00	BPL(80722,80732,70222,70232)	OCG	SUC/-	MEA /CLEAR	TREE ATTACHED LINE 791A OF MEA (MEA LOAD LOSE 160MW)	(MEA BRK.TC BROKEN)



R1, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS BR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
97/01/17	BPL-KT5A	15:48	00/15	0.00	--/--	0.00	BPL(80722,80712,70332,70322)	OCG	SUC/-	MEA /CLEAR	TREE ATTACHED LINE 791A OF MEA (MEA LOAD LOSE 150MW)	MEA BKR. TC BROKEN
97/01/17	BPL-KT2A	16:04	00/13	0.00	--/--	0.00	BPL(80512,80532,70112,70122)	OCG	SUC/-	MEA /CLEAR	TREE ATTACHED LINE 791A OF MEA(MEA LOAD LOSE 160MW)	
97/01/17	BPL-KT3A	16:04	00/13	0.00	--/--	0.00	BPL(80732,70222)	OCG	SUC/-	MEA /CLEAR	TREE ATTACHED LINE 791A OF MEA(MEA LOAD LOSE 160MW)	
97/01/13	SP-KT1A	05:29	00/23	16.00	00/33	3.80	SP(7042,2212)	TX. DIFF	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT METERING	
97/01/21	BPK-KT5B	11:27	00/33	0.00	--/--	0.00	BPK(800912)	800932 BF LOCK OUT	SUC/-	UNKNOWN /CLEAR		
97/02/04	SC-KT2A	09:59	00/01	11.50	00/01	0.19	SC(7032,2212)		MBL/-	HUMAN ERROR (EGAT) /CLEAR	WORKER SCREW PANEL 86K OPERATE	
97/02/07	SM-KT1A,KT2A	18:51	00/10	10.00	00/15	2.50	SM(7042,2212)	TX. DIFF B	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT DS. SM 2214	
97/02/12	LPR-KT4A	18:25	00/14	0.00	--/--	0.00	LPR(8042,8062,6962)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /RAIN	POTHEAD C-BANK#6 ARC.	
97/02/14	LBI-KT2A	23:49	00/46	9.00	00/15	2.25	LBI(7022,2222)	TX. DIFF A,B	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT BKR. LBI 2222	
97/02/17	SB-KT3A	10:29	00/21	100.00	00/02	3.33	SB(80632,80622,70532,70632,70732)	TX. DIFF A,C	SUC/-	HUMAN DEED (NON EGAT) /CLEAR	CONTRACTOR CUT LINE CONTROL CABLE CT. L/S KT3A BROKEN	
97/02/17	SB-KT3A	11:02	02/23	55.00	01/01	55.92	SB(80632,80622,70532)	TX. DIFF C	SUC/-	HUMAN DEED (NON EGAT) /CLEAR	CONTRACTOR CUT LINE CONTROL CABLE CT. L/S KT3A BROKEN	
97/02/17	SB-KT3A	13:25	00/12	45.00	00/34	25.50	SB(80632)	TX. DIFF C	SUC/-	HUMAN DEED (NON EGAT) /CLEAR	CONTRACTOR CUT LINE CONTROL CABLE CT. L/S KT3A BROKEN	
97/02/18	DBN-KT2A	18:52	00/29	13.00	00/18	3.90	DBN(7022,2222)	TX. DIFF B,C	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT TX. KT2A	
97/02/27	LPR-KT2A	13:44	00/03	0.00	--/--	0.00	LPR(8022,8042,6932,6942)	KT2A LOCKOUT	SUC/-	HUMAN ERROR (EGAT) /CLEAR	SRC1 HUMAN ERROR	



21.TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DOR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
97/03/06	A72-KT4A	04:34	02/03	4.20	00/31	2.17	A72(70122,2222)	TX. DIFF C	SUC/-	ANIMALS /CLOUDY	BIRD KEPT STRAW TO THE STRUCTURE BAY KT4A	
97/03/17	BP1-KT1A.KT2A	05:22	00/50	19.20	00/16	5.12	BP1(7082,2212)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /CLEAR	ARC. CT. QW1A #8	
97/03/23	A72-KT3A	17:15	00/31	0.00	--/--	0.00	A72(800612)	TX. DIFF	HEB/-	UNKNOWN /CLEAR		
97/03/26	LB1-KT1A	05:01	00/32	4.30	00/19	1.36	LB1(7012,2212)	TX. DIFF	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT BKR. LB1 2212	
97/03/26	SB3-KT1A	17:04	03/03	79.29	03/03	241.63	SB3(7012,2212)	TX. DIFF B.C	SUC/-	EQUIPMENT FAILURE /CLEAR	ARC. AT DS. 2213 #C	
97/03/27	TM-KT2A	22:53	00/57	8.40	00/24	3.36	TM(7022,2222)	TX. DIFF A	SUC/-	EQUIPMENT FAILURE /CLEAR	TX. FAILED	
97/03/27	TM-KT2A	23:50	00/34	0.00	--/--	0.00	TM(7022,2222)	TX. DIFF A	SUC/-	EQUIPMENT FAILURE /CLEAR	TX. FAILED	
97/04/02	CBD-KT2A	09:43	00/29	11.00	00/05	0.92	CBD(7032,2222)	TX. DIFF C	SUC/-	ANIMALS /CLEAR	DEAD BIRD AT BKR. 2222 #C	
97/04/08	RB1-KT1A	18:31	00/12	7.70	00/27	3.47	RB1(7032,2212)		PEW/-	PEA /CLEAR	FAULT 22KV PEA	
97/04/19	LPR-KT1A	09:25	00/12	0.00	--/--	0.00	LPR(8032,3012,6912,6922)	SEL7 (PR)	HEX/-	MEA /CLEAR	MEA LPT 691B #A BROKEN (MEA LOAD LOSE 194MW/3MIN)	
97/04/21	LPR-KT4A	10:20	01/12	348.00	01/14	429.20	LPR(8042,3062)	SEL7 (PR)	SUC/-	UNKNOWN /CLEAR		
97/04/21	LPR-KT3A	10:20	00/15	0.00	--/--	0.00	LPR(8052,3072,6952,6962,6962A)	O/C B.C	SUC/-	OVERLOAD /CLEAR		
97/04/23	A72-KT1A	17:57	02/50	0.00	--/--	0.00	A72(30212,30222,70032)	TX. DIFF A	SUC/-	EQUIPMENT FAILURE /CLEAR	LIGHTNING ARRESTER#C EXPLODED	
97/04/23	CC-KT2A	14:36	00/16	21.40	00/17	6.06	CC(7062,2222)	TX. DIFF C	SUC/-	EQUIPMENT FAILURE /CLOUDY	ARC. AT DS. 2224	

RI, TX. TRIP 96/01/01 - 97/06/22

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
97/04/29	SB-KT4A.KT5A	07:00	00/28	0.00	--/--	0.00	SB(80712,722,732,6912,52,22,32,42,52)	G/C C	SUC/-	MBA RAIN	FAULT IN MBA(MBA LOAD LOSS 175MW/9MIN)	
97/05/10	RY1-KT2A	09:56	05/55	9.00	00/44	6.60	RY1(7012,2222)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /CLEAR	ARC. DS.2224 #C	
97/05/15	BPK-KT1B.KT2B	05:11	00/29	0.00	--/--	0.00	BPK(800322,800332)	BUS DIFF	SUC/-	UNKNOWN /CLOUDY		
97/05/16	BPK-KT1B.KT2B	03:13	00/55	0.00	--/--	0.00	BPK(800322,800332)	BUS DIFF	SUC/-	BROKEN CONDUCTOR /CLEAR	CONDUCTOR #A DISCONNECT FROM T.CLAMP	
97/05/16	SB3-KT1A	15:52	02/12	20.34	02/14	45.43	SB3(7032,2212)	TX. DIFF A,B,C	SUC/-	EQUIPMENT FAILURE /RAIN	ARC. AT POT HEAD KT1A	
97/06/11	KB-KT2A	02:41	06/44	15.50	00/27	6.98	KB(7052,2222)	TX.DIFF A,B,C	SUC/-	ANIMALS /CLEAR	CAT CLIMB BKR.2222,BUSING BKR.#B BROKEN	
97/06/15	PA1-KT1A	06:11	00/32	22.50	00/32	12.00	PA1(7032,2212)	G/C A,C(HV)	SUC/-	OVERLOAD /CLOUDY	PEA TRANSFER LOAD FROM PA2	
97/06/22	BPK-KT4A	06:25	12/57	22.80	00/35	13.30	BPK(800822,800832,2222,2232,2242)	KT4A LOCKOUT RELAY	SUC/-	HUMAN ERROR (ZGAT) /CLEAR	OPERATOR ERROR	

No. of events = 93
 Total Outage Duration (HR/MN) = 114/44
 Total Load Loss (MW-HRS) = 3298.8
 Cause of fault & Load Loss concern transmission system maintenance department (TSMD)
 No. of event = 0 Load Loss(MW-HRS) = 0.00



R1, TX. TRIP 95/01/01 - 95/12/31

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-BRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/01/08	KKC-KT1A,KT2A	13:54	00/32	1.40	00/32	0.75	KKC(7012)	TX. DIFF.A.B	NBX/-	PEA /CLEAR	PEA FAULT	
95/01/19	PRB-KT1A	19:30	--/--	9.90	--/--	0.00	PRB(7032,2212)	TX. LOCK-OUT	SUC/-	OTHER /CLEAR	LTC. PRESSURE RELIEF FAIL	
95/01/20	SA2-KT1A	18:34	00/10	39.60	00/10	6.60	SA2(7062,2212)	TX. DIFF A.B.C	SUC/-	ANIMALS /CLEAR	DS-2215 FLASH #A.B	
95/01/21	PRB-KT1A	15:31	--/--	0.00	--/--	0.00	PRB(7032,2212)	TX. DIFF B	SUC/-	UNKNOWN /CLEAR		
95/01/22	KKC-KT1A,KT2A	20:45	00/29	1.30	00/29	0.48	KKC(7012,2212)	TX. DIFF B.C	SUC/-	OTHER /CLEAR	FUSE #B 22KV PEA BROKEN	
95/02/01	DBW-KT1A	19:20	00/15	16.20	00/15	4.05	DBW(7032,2212)	TX. DIST A.B	SUC/-	ANIMALS /CLEAR	BIRDS UNDER 22KV METERING STRUCTURE	
95/02/14	AT2-KT4A	08:52	00/13	2.60	00/13	0.56	AT2(70122,2222)	TX.DIFF A.B	SUC/-	UNKNOWN /CLEAR		
95/02/18	AP-KT1A	11:50	00/21	0.00	--/--	0.00	AP(80632,70122,70132)	BREAKER FAILURE	SUC/-	UNKNOWN /CLEAR		
95/02/24	SC-KT3A	18:42	00/28	15.60	00/10	2.60	SC(7082,2222)	TX. DIFF A,B,C	SUC/-	ANIMALS /CLEAR		
95/03/05	TL3-KT1A	15:41	00/19	0.00	--/--	0.00	TL3(700712,700722)	OVER LOAD	SUC/-	HUMAN DEED (NON EGAT) /CLEAR		
95/03/05	TL3-KT3A	15:41	00/20	0.00	--/--	0.00	TL3(700512,700532)	OVER LOAD	SUC/-	HUMAN DEED (NON EGAT) /CLEAR		
95/03/22	EB-KT1A	17:40	--/--	0.00	00/43	0.00	EB(7022,2212)	OC B	SUC/-	OTHER /CLEAR	PEA FAULT AT BUSHING OF STATION SERVICE	
95/03/29	SB-KT2A	06:05	07/38	0.00	--/--	0.00	SB(80322,90332,69622, 69612)	TX. DIFF A.C	SUC/-	INSULATOR CONTAMINATION /RAIN	INSULATOR SUPPORT SB 80321 #A FLASH OVER HOT LINE WASHING	DUE TO (EGAT)
95/03/29	BN-KT3A	03:24	04/47	0.00	--/--	0.00	BN(80412,80422,6952)	SELF B) BUCHHOLTZ	- /-	MBA /RAIN	LINE #8 MBA FAULT (MBA)	

R1, TX. TRIP 95/01/01 - 95/12/31

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MM)	MW	LOAD LOSS HR/MM	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/03/29	BN-KT2A	03:25	01/00	0.00	--/--	0.00	BN(80512,80522,6942)	SELP (A) BUCHHOLTZ	- /-	NEA /RAIN	LINE #8 NEA FAULT (NEA)	
95/03/29	SP-KT1A	03:54	07/36	11.00	07/36	33.60	SP(7042,2212)	TX. DIFF	MEZ/-	PEA /CLEAR	LN OF PEA #A	
95/03/29	BP1-KT1A.KT2A	19:03	00/14	27.00	00/14	6.30	BP1(7082,2212)	TX. DIFF	SUC/-	ANIMALS /RAIN		
95/04/01	SA2-KT1A	07:57	00/07	37.20	00/07	4.34	SA2(70062,2212)	TX. DIFF A,B	SUC/-	ANIMALS /CLEAR		
95/04/17	KHL-KT2A	19:06	00/42	3.80	00/42	2.66	KHL(7022,2212,2222)	TX. DIFF A,C	SUC/-	ANIMALS /CLEAR		
95/04/21	SB-KT4A	16:40	00/30	55.00	00/21	19.25	SB(80722,80732,6912,6922,6932)	DIFF RELAY	SUC/-	EQUIPMENT FAILURE /CLEAR	CT #C OF C-BANK#3 EXPLODED (EG AT)	
95/04/27	SN1-KT1A	21:50	00/40	36.00	00/40	24.00	SN1(7052,2212)	TX. DIFF C	SUC/-	EQUIPMENT FAILURE /CLEAR	INSULATOR DS. 2216 BROKEN 3 PH ASE	
95/04/27	SN1-KT1A	22:39	01/01	14.00	01/01	14.23	SN1(7052,2212)	TX. DIFF C	SUC/-	EQUIPMENT FAILURE /CLEAR		
95/04/30	SA1-KT7A	12:02	01/47	16.30	01/47	29.07	SA1(70102,2232)	TX. DIFF A,C	SUC/-	OTHER /CLEAR		
95/05/01	SA2-KT1A	01:37	00/21	21.60	00/21	7.56	SA2(2212)	TX. DIFF	SUC/-	ANIMALS /CLEAR		
95/05/08	SA1-KT6A.KT7A	07:12	01/35	31.15	01/35	49.32	SA1(70102,2222,2232)	TX. DIFF	SUC/-	PEA /CLEAR		
95/05/10	SC-KT3A	13:47	00/09	15.60	00/27	7.02	SC(2222)	TX. DIFF B,C	SUC/-	ANIMALS /RAIN		
95/05/17	SH1-KT1A	19:20	00/23	11.20	00/23	4.29	SH1(7052/1212)	OC A,B,C	SUC/-	ANIMALS /CLEAR		
95/05/18	AT1-KT2A	19:23	04/17	0.00	--/--	0.00	AT1(8082,6972)	BUCHHOLTZ C	SUC/-	UNKNOWN /CLEAR		



21,XX. TRIP 95/01/01 - 95/12/31

YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DOR(BR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSEING PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/05/20	SP-KT2A	19:19	00/08	29.00	--/--	0.00	SP(2222)	TX. DIFF	SUC/-	ANIMALS /CLEAR		
95/05/21	NCO-KT4A	14:15	02/43	0.00	--/--	0.00	NCO(800212,7032)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /CLEAR	PT 22KV #A EXPLODED (EGAT)	
95/05/27	SH1-KT1A	07:06	01/36	7.50	01/36	12.00	SH1(7052,1212)	OC A,B,C	SUC/-	UNKNOWN /RAIN		
95/05/27	LPR-KT1A	14:15	10/29	0.00	--/--	0.00	LPR(8012,3032)	SBLP(LTC-SP)	SUC/-	EQUIPMENT FAILURE /CLOUDY	FLASH OVER DS MEA 37B MEA NOT TRIP (MBC2) MEA CHECKED 37B	ITS OK
95/05/29	SM-KT1A	20:50	00/39	16.20	00/39	10.53	SM(7042)	OC C (H.S)	SUC/-	PEA /CLOUDY	PEA FEEDER 1,2 #A,B FAULT (TEST RELAY OK)	
95/05/29	SN1-KT1A	21:14	00/35	39.00	00/35	22.75	SN1(7052,2212)	TX. DIFF A,C	SUC/-	INSULATOR CONTAMINATION /RAIN	FLASHOVER AT BUSHING (L.S) ON KT1A	
95/05/30	RY1-KT2A	08:25	00/17	15.00	00/17	4.53	RY1(700612,2212)	TX. DIFF	SUC/-	EQUIPMENT FAILURE /RAIN	CVT #C 22KV SIDE EXPLODED	
95/06/05	BEG-KT2A	19:26	00/13	19.50	00/16	5.20	BEG(7052,2222)	OC C(HS)	SUC/-	OVERLOAD /CLEAR		
95/06/10	LPR-KT1A.KT2A	15:00	00/42	0.00	--/--	0.00	LPR(8012,3032,8022,3042)	OC (HS)	SUC/-	HUMAN DEED (NON EGAT) /CLEAR	CRANE TRUCK LIFTED BOOM ATTACHED TO CONDUCTOR	21/21N MEA NOT TRIP(G-MHO)MEA CHECK 21/21N FAILED (MEA)
95/06/12	SB-KT4A	00:49	03/11	0.00	--/--	0.00	SB(80722,80732,6912)		- /-	EQUIPMENT FAILURE /CLEAR	MALFUNCTION OF MICRO SWITCH FROM OXIDE AND HUMIDITY AT	TERMINAL
95/06/12	BSP-KT4A	08:53	01/00	0.00	--/--	0.00	BSP(80832)	O/C B	SUC/-	ANIMALS /CLEAR	BIRD DIED NEAR C-UNIT OF HARMONIC FILTER#7	
95/06/16	SA2-KT1A	17:27	02/12	36.00	00/09	5.40	SA2(70062,2212)	TX. DIFF A,C	SUC/-	ANIMALS /CLEAR	TWO BIRDS CAUSED TO FLASH OVER AT #2213 DISCONNECTING SWITCH	
95/07/29	LB2-KT2A	19:57	00/14	10.30	00/14	2.52	LB2(70092,2222)	TX. DIFF	SUC/-	ANIMALS /CLEAR	TWO BIRDS NEAR LB2 2224 DS.	
95/07/30	KKC-KT2A	11:01	00/36	1.00	00/29	0.48	KKC(7012,2212,1212)	TX. DIFF AUX.	SUC/-	EGAT /CLEAR	PRESSURE RELIEF OF KT2A OPERATED	

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YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/08/01	BN-KT3A	07:32	02/46	0.00	--/--	0.00	BN(80422,80412)	SBLF(LTC-PR)	SUC/-	EQUIPMENT FAILURE /CLEAR	INSULATION OF CONTROL CABLE FOR PRESSURE RELIEF	DETERIORATE
95/08/09	BBG-KT1A	19:00	00/17	29.40	00/17	8.33	BBG(7032,2212)	TX. DIFF	SUC/-	ANIMALS /CLEAR		
95/08/12	XBL-KT1A,KT2A	05:11	00/34	4.20	00/34	2.38	XBL(7022,2212,2222)	O/C A,C	SUC/-	UNKNOWN /RAIN		
95/08/14	XBL-KT2A	13:26	00/25	2.00	00/25	0.83	XBL(7022,2212)	O/C A,B,C	SUC/-	UNKNOWN /CLEAR		
95/08/14	XBL-KT3A	13:26	00/26	2.00	00/25	0.83	XBL(7022,2222)	O/C A,B,C	SUC/-	UNKNOWN /CLEAR		
95/08/17	TL3-KT3A	11:57	01/49	0.00	--/--	0.00	TL3(80732,80712,700522)	TX. DIFF B	SUC/-	HUMAN ERROR (SGAT) /CLEAR		
95/08/28	BN-SYC KT1A	12:03	00/43	0.00	--/--	0.00	BN(69422)	LOW FREQ.	SUC/-	UNKNOWN /CLEAR		
95/08/28	BN-SYC KT1A	12:49	01/02	0.00	--/--	0.00	BN(69422)	DIFF RELAY	SUC/-	UNKNOWN /CLEAR		
95/09/11	SC-KT3A	19:38	00/15	15.00	00/15	3.75	SC(7082,2222)	TX. DIFF A,B	SUC/-	ANIMALS /RAIN	BIRD NEAR 22KV METERING UNDER 2225 DS.	
95/09/11	AT1-KT9A	19:40	--/--	0.00	--/--	0.00	AT1	O/C A,B,C	SUC/-	PEA /RAIN	FAULT AT POT HEAD OF P2A CAUSE TO DAMAGING OF KT9A	AND KT6A
95/09/12	AY2-KT1A	06:26	00/06	8.20	00/06	0.82	AY2(6942)	O/C A,B	SUC/-	PEA /CLOUDY	NO BREAKER AT L/S	
95/09/17	AT1-KT2A	11:26	--/--	0.00	--/--	0.00	AT1(8082)	OCG B/U	SUC/-	UNKNOWN /CLEAR		
95/09/19	AT1-KT2A	13:25	--/--	0.00	--/--	0.00	AT1(8082)	BUCHHOLZ #B	SUC/-	UNKNOWN /RAIN		
95/09/19	BN-KT3A	13:20	00/54	0.00	--/--	0.00	BN(80412,80422,69122)	BUCHHOLZ	SUC/-	MEA /RAIN	FAULT IN MEA	



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YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/09/19	BN-KT1A	13:35	--/--	0.00	--/--	0.00	BN(69422)	O/C	SUC/-	UNKNOWN /RAIN	LOW SIDE BREAKER ALREADY TRIPPED FOR S/C	
95/09/20	BN-KT1A	13:56	00/01	0.00	--/--	0.00	BN(69422)	TX. DIFF	SUC/-	UNKNOWN /CLEAR		
95/09/22	SM-KT1A,KT2A	18:25	00/25	11.00	00/25	4.58	SM(7042,2212)	TX. DIFF B	SUC/-	UNKNOWN /RAIN		
95/09/25	BI1-KT2A	17:25	00/20	11.60	00/20	3.87	BI1(7022,2222)	TX. DIFF B	SUC/-	PEA /THUNDER STORM	#2 FEEDER OF PEA TRIPED AND RECLOSED	
95/09/26	BI1-KT2A	03:49	00/10	6.80	00/10	1.13	BI1(7022,2222)	TX. DIFF B	SUC/-	PEA /CLEAR	O/C CANNOT TRIP BECAUSE DC CABLE OF L/S O/C DAMAGED	FROM MOUSE
95/09/26	BI1-KT2A	04:27	00/06	2.00	00/06	0.20	BI1(7022,2222)	TX. DIFF B	SUC/-	PEA /CLEAR	O/C CANNOT TRIP BECAUSE DC CABLE OF L/S O/C DAMAGED	FROM MOUSE
95/09/27	LPR-KT2A	05:11	00/31	0.00	--/--	0.00	LPR(8042,8022)	TX. DIFF	SUC/-	MEA /CLEAR		
95/09/28	BN-KT1A-SYNC	08:14	22/46	45.00	00/45	33.75	BN(69422)	EXCITE BKR.	SUC/-	OTHER /CLEAR		
95/09/29	BN-KT1A-SYNC	07:01	22/59	0.00	--/--	0.00	BN(69422)	EXCITE BKR.	SUC/-	OTHER /CLEAR		
95/09/30	BN-KT1A-SYNC	06:01	22/59	0.00	--/--	0.00	BN(69422)	EXCITE BKR.	SUC/-	OTHER /CLEAR		
95/10/01	BN-KT1A-SYNC	05:01	22/59	0.00	--/--	0.00	BN(69422)	EXCITE BKR.	SUC/-	OTHER /CLEAR		
95/10/02	BN-KT1A-SYNC	04:01	20/05	0.00	--/--	0.00	BN(69422)	EXCITE BKR.	SUC/-	OTHER /CLEAR		
95/10/02	BY2-KT2A	13:20	--/--	0.00	--/--	0.00	BY2(700612,2212)	LTC. PRESS	SUC/-	OTHER /CLEAR	LTC FAULT	
95/10/03	BN-KT2A	12:46	00/52	0.00	--/--	0.00	BN(80512,80522,69222)	TX. DIFF B.C	SUC/-	BROKEN CONDUCTOR /CLEAR	11KV POWER CABLE EXPOLDE	

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YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DUR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/10/06	ES-KT1A	02:24	00/29	3.00	--/--	0.00	ES(80812,69512)	O/C B	SUC/-	MEA /CLEAR	KRT 6912C MEA BKR. 1NO	TRUCK CRASHED 691A KRT FEEDER
95/10/06	ES-KT2A	02:24	00/33	3.90	--/--	0.00	ES(80712,69412)	LS. O/C + GCG	SUC/-	MEA /CLEAR	KRT 6912C MEA BKR. 1NO	TRUCK CRASHED 691A KRT FEEDER
95/10/06	ES-KT4A	02:24	00/38	0.00	--/--	0.00	ES(80932,69632)	HS. O/C B	SUC/-	MEA /CLEAR	KRT 6912C MEA BKR. 1NO	TRUCK CRASHED 691A KRT FEEDER
95/10/07	AT1-KT1A	13:14	00/20	0.00	--/--	0.00	AT1(9062,5932)	TX. DIFF A.C	SUC/-	ANIMALS /CLEAR	CAUSE TO ARCING AT #A.#C TERTIARY	
95/10/09	BN-KT1A-SYNC	10:36	16/24	0.00	--/--	0.00	BN(69422)	TX. LOCKOUT	SUC/-	UNKNOWN /CLEAR		
95/10/10	BN-KT1A-SYNC	03:01	10/08	0.00	--/--	0.00	BN(69422)	TX. LOCKOUT	SUC/-	UNKNOWN /CLEAR		
95/10/10	BN-KT1A-SYNC	13:09	00/03	0.00	--/--	0.00	BN(69422)	TX. LOCKOUT	SUC/-	UNKNOWN /CLEAR		
95/10/16	SM-KT1A,KT2A	02:00	00/47	3.40	00/47	2.66	SM(7042,2212)	TX. DIFF B	MEY/-	EGAT /RAIN	FAULT IN PEA F1,F2 (37K SUB)	
95/10/17	BN-KT2A	16:32	03/33	0.00	--/--	0.00	BN(80622,30612,69222)	TX. DIFF A.B	SUC/-	EQUIPMENT FAILURE /RAIN	POST TYPE INSULATOR EXPOLDE ON 69KV SIDE AT TAKE OFF	STRUCTURE
95/10/18	CA-KT1A	10:05	00/02	14.70	00/02	3.49	CA(7032,2212)	BUCHHOLTZ	SUC/-	HUMAN ERROR (EGAT) /CLEAR	CONSTRUCTION DEPT. WORKING AT CONTROL BOARD. HUMAN ERROR	
95/10/18	CA-KT1A	10:07	00/00	0.00	00/00	0.00	CA(7032,2212)	BUCHHOLTZ	SUC/-	EQUIPMENT FAILURE /CLEAR	BREAKER FAIL TO CLOSED	
95/10/18	CA-KT1A	10:07	00/00	0.00	00/00	0.00	CA(7032,2212)	BUCHHOLTZ	SUC/-	EQUIPMENT FAILURE /CLEAR	BREAKER FAIL TO CLOSED	
95/10/18	CA-KT1A	10:08	00/38	0.00	00/38	0.00	CA(7032,2212)	BUCHHOLTZ	SUC/-	EQUIPMENT FAILURE /CLEAR	BREAKER FAIL TO CLOSED	
95/10/26	LB2-KT2A	13:18	00/18	12.50	00/18	3.75	LB2(70092,2222)	TX. DIFF A.B	SUC/-	ANIMALS /CLEAR	BIRD NEAR DS.	



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YY/MM/DD	OUTAGE NAME	TIME	OUTAGE DOR(HR/MN)	MW	LOAD LOSS HR/MN	MW-HRS	SWITCHING NO.	RELAY TYPE	RELAY/RECLOSE PERFORMANCE	CAUSE OF FAULT /WEATHER	FAULT DETAIL	REMARK
95/11/02	B12-KT1A	03:55	00/31	0.00	--/--	0.00	B12(80312.322,700712.722)	O/C B.H.S.	MEX/-	PEA /CLEAR	RELAY UNDER SETTING	
95/11/02	B12-KT2A	03:55	00/29	0.00	--/--	0.00	B12(80412.422,700612.622)	O/C B.H.S.	MEX/-	PEA /CLEAR	RELAY UNDER SETTING	
95/11/02	B11-KT2A	09:55	00/10	13.60	00/10	2.27	B11(2222)	O/C B	SUC/-	UNKNOWN /CLEAR		
95/11/02	SP-KT2A	19:04	00/11	24.00	00/11	4.49	SP(7062.2222)	TX. DIFF	SUC/-	ANIMALS /CLEAR	DEAD BIRDS AT DS. 2223	
95/11/10	RY1-KT1A	05:35	00/40	25.00	00/40	16.67	RY1(7032.2212)	TX. DIFF A,B,C	SUC/-	ANIMALS /RAIN	DEAD BIRDS AT 22KV METERING	
95/11/14	BPL-KT1A	12:19	00/13	0.00	--/--	0.00	BPL(80332.322,69222.212)	TX. DIFF A	SUC/-	EQUIPMENT FAILURE /CLEAR	C-BANK#2 #A BROKEN ARCCING TO GROUND WAY AT #A FAIL	
95/11/19	BL-KT1A	14:32	00/03	13.00	00/03	0.65	BL(7032,2212)	TX. DIFF,O/C H.S.	PER/-	HUMAN ERROR (EGAT) /CLEAR	RELAY DEPT. DRILLED BOARD TO INSTALL BKR. FAIL CAUSE TO	TRIP
95/12/10	CA-KT1A	14:00	00/20	28.00	00/57	26.60	CA(7002,2212)	TX. DIFF A	MRL/-	ANIMALS /CLEAR	FOUND ANT IN RELAY	
95/12/10	CA-KT1A	17:46	00/19	28.00	00/19	3.87	CA(7002,2212)	TX. DIFF A	MRL/-	ANIMALS /CLEAR	FOUND ANT IN RELAY	
95/12/19	AT1-KT1A	19:04	00/10	0.00	--/--	0.00	AT1(8062,6932)	TX. DIFF A,C	SUC/-	ANIMALS /CLEAR	INSULATOR FLASH OVER AT 11KV OF KT1A DURING #A AND #C	(DEAD BIRD)
95/12/31	NCS-KT4A	19:37	00/29	3.60	00/29	1.74	NCS(7072,2232)	O/C A (HS.)	SUC/-	PEA /CLEAR	FAULT IN PEA (RELAY PEA NOT WORK)	

No. of events = 84
 Total Outage Duration (HR/MN) = 211/32
 Total Load Loss (MW-HRS) = 458.68
 Cause of fault & Load Loss concern transmission system maintenance department (TSMO)
 No. of event = 0 Load Loss(MW-HRS) = 0.00

APPENDIX F

POWER TRANSFORMER CONSIDERATION

POWER TRANSFORMER CONSIDERATION



Recommendation for Power Transformers

- 1 Connect gas cylinder with automatic regulator if transformer is to be stored for long duration in order to maintain positive pressure.
- 2 Fill the oil in the power transformer at the earliest opportunity at site and follow storage instruction. It must be commissioned as soon as possible.
- 3 Open the equalizing valve between transformer tank and OLTC diverter compartment, whenever provided, at the time of filling the oil in the tank and close the same during operation.
- 4 Clean the oil conservator thoroughly before erecting.
- 5 Check the pointers of all gauges for their free movement before erection.
- 6 Inspect the painting and do retouching if necessary.
- 7 If inspection covers are opened or any gasket joint is tightened, tighten the bolts evenly with the proper sequence to avoid uneven pressure.
- 8 Clean the Buchholz relay and check the operation of alarm and trip contacts.
- 9 Check the oil level in oil cup and ensure that the air passages are free in the breather, If oil is less, make up the oil level.
- 10 Check the oil in transformer and OLTC for dielectric strength and moisture content, and take suitable action for restoring the quality of oil.
- 11 Attend to leakage's on the bushing immediately.
- 12 Check the diaphragm of the relief vent. If cracked or broken, replace it.
- 13 Remove the air from vent plug of the diverter switch before energizing the power transformer.
- 14 Check the gear box oil level in the tapchanger. If less, top up with specified oil.
- 15 Check the OTI and WTI pockets and replenish the oil, if required.

- 16 Check the oil level in the diverter switch and if found less, top up with fresh oil.
- 17 Examine the diverter and selector contacts of tapchanger and if found burnt or worn out, replace the same.
- 18 Check and thoroughly investigate the transformer whenever any alarm or protection is operated.
- 19 Examine the bushings for dirt deposits and cats and clean them periodically.
- 20 Check the protection circuits periodically.
- 21 Check all bearings and operating mechanism of the tapchanger and lubricate them as per schedule.
- 22 Keep the valve connected between conservator of the tapchanger and its diverter compartment open, during transformer operation.
- 23 Check the silicagel charge. If it is found pink, regenerate or replace it with blue silicagel charge.

Exception for Power Transformer

- 1 Do not use low capacity lifting jacks on transformer for jacking.
- 2 Do not allow winding temperature and oil temperature to exceed 75 °C during dryout of transformer, and filter machine temperature beyond 85 °C.
- 3 Do not re-energize the transformer, unless the Buchholz gas is analyzed.
- 4 Do not re-energize the transformer without conducting all precommissioning checks.
- 5 Do not energize the transformer, unless the off-circuit tap switch handle is in locked position.
- 6 Do not leave off-circuit tap switch handle unlocked.
- 7 Do not leave tertiary terminals unprotected outside the tank. The manufacturer's recommendation should be referred in this regard.
- 8 Do not leave marshaling box doors open. They must be locked.
- 9 Do not leave any connection loose.

- 10 Do not meddle with the protection circuits.
- 11 Do not leave maximum temperature indicating pointer behind the other pointer in oil temperature and winding temperature.
- 12 Do not change the settings of winding temperature and oil temperature alarm and trip frequently. The setting should be done as per the site conditions.
- 13 Do not allow oil level in the bushings to fall; they must immediately be topped up.
- 14 Do not allow conservator oil level to fall below one-fourth level.
- 15 Do not parallel transformers which do not fulfill the required condition.
- 16 Do not switch off the heater in marshaling box except in summer.
- 17 Do not leave secondary terminals on an unloaded current transformer open.
- 18 Do not allow water pressure more than oil pressure in differential pressure gauge in OFWF cooled transformer.
- 19 Do not switch on water pump unless oil pump is switched on.
- 20 Do not leave ladder unlocked, when the transformer is energized.
- 21 Do not allow unauthorized entry near the transformer.
- 22 Do not overload the transformer other than the specified limits mentioned in national/international standards.
- 23 Do not allow inferior oil to continue in transformer.
- 24 Do not handle the off-circuit tap switch when transformer is energized.

Recommendation for Power Transformer Bushing

- 1 Check the packing externally for possible transit damage before unpacking.
- 2 Do unpacking with care to avoid any direct blow on bushing or porcelain insulator.
- 3 Store the bushing in a shed or covered with tarpaulin to protect it from moisture and rains. If removed from the crate, keep it indoors with lower end protective intact.

- 4 Handle the bushing with manila rope slings without any undue force on porcelain insulator.
- 5 Clean the porcelain insulator thoroughly.
- 6 Remove the wax tape protection on the oil end of the bushing (at the time of erection) and clean the surface with hot transformer oil.
- 7 Check the oil level and IR value of the bushing in vertical position only, taking care that the bushing is cleaned and no rope or sling etc., is touching the terminal and ground.
- 8 Check the breakdown value (BDV) of oil taken from drain plug or siphoning from the bottom-most portion of bushing. This should not be less than the recommended value.
- 9 Check the IR value and tan δ value (if possible) with bushing in position on transformer with jumper connection removed. Record these readings for reference and guidance for future measurement.
- 10 Check BDV of oil and IR value of each bushing periodically during maintenance shut down. These values should be comparable with the values recorded at the time of commissioning.
- 11 Ensure to allow the air to escape from central tube to the atmosphere while filling the transformer tank.
- 12 Maintain the log book records of periodical checks up to date.

Exception for Power Transformer Bushing

- 1 Do not unpack the bushing from the crate unless required to be mounted on the transformer.
- 2 Do not remove the waxed tape protection/metal protective hood from the oil end portion unless bushing is required for use.
- 3 Do not store the bushing outdoors without any protective covering.
- 4 Do not measure the IR value and tan δ and without thoroughly cleaning the porcelain and oil end portion.

- 5 Do not store the bushing without oil in porcelain.
- 6 Do not keep the top cap cover open for any longer time than required as it contaminates the oil.
- 7 Do not tighten the nuts and bolts in excess to stop any leakage, this could damage the cemented joints on porcelain.

Power Transformer Maintenance

From the consideration described previously, power Transformers normally needs to be checked and maintained occasionally following work procedure, check sheet, and maintenance schedule for periodical maintenance, commissioning, evaluation, and after faults and abnormal events happened following on standard of work for power transformer as shown in table F.1 as follows :

Table F.1 List of Standard of Work for Power Transformer Maintenance in EGAT

STD-1-001 Rev. No. Oct/91	Standard of Work for Transformer Maintenance
STD-1-002 Rev. No. Mar/86	Standard of Work for On Load Tap Changer Type DR, DRT
STD-1-003 Rev. No. Apr/86	Standard of Work for On Load Tap Changer MR Type V
STD-1-004 Rev. No. Apr/86	Standard of Work for On Load Tap Changer MR Type M, MS
STD-1-005 Rev. No. June/86	Standard of Work for On Load Tap Changer MR Type D
STD-1-006 Rev. No. June/86	Standard of Work for On Load Tap Changer MIT Type M
STD-1-007 Rev. No. June/86	Standard of Work for On Load Tap Changer ASEA Type UZB Standard of Work for On Load Tap Changer ASEA Type UZC
STD-1-008 Rev. No. June/86	Standard of Work for On Load Tap Changer FUJI Type SF3
STD-1-009 Rev. No. June/86	Standard of Work for On Load Tap Changer FUJI Type DSF
STD-1-010 Rev. No. June/86	Standard of Work for On Load Tap Changer ASEA Type UCB
STD-1-011 Rev. No. June/86	Standard of Work for On Load Tap Changer MIT Type MRR
STD-1-012 Rev. No. Oct/87	Standard of Work for On Load Tap Changer MIT Type URS
STD-1-013 Rev. No. Oct/86	Standard of Work for On Load Tap Changer MIT Type MRD
STD-1-014 Rev. No. Dec/86	Standard of Work for On Load Tap Changer FUJI Type VLN
STD-1-015 Rev. No. Oct/87	Standard of Work for On Load Tap Changer FKT-M
STD-1-016 Rev. No. Dec/86	Standard of Work for On Load Tap Changer TRAFU-UNION
STD-1-017 Rev. No. Dec/86	Standard of Work for On Load Tap Changer ASKA-UCK

The timing of inspection period can be described as follows :

- **Daily Checking** : Checking on power transformer will be done by operators on the 09:00am, 11:00am, 02:00pm, 04:00pm, 06:00pm, 07:00pm, 08:00pm, and 09:00pm of each day.

The values of ambient temperature, oil temperature, winding temperature will be recorded and compared to load current of the power transformer which can identify the abnormal temperature from the difference between the daily data and historical data.

The oil level values of main tank and On Load Tap Changer will be recorded on 04:00pm for indicating the needs of oil and rates of change of oil level. The number of operation counters of On Load Tap Changer, hot line oil filter, and surge arrester and its leak current will also be recorded at this time to acknowledge their operation.

The leak current is another important data which can indicate the hazard events which can malfunction the operation of power transformers.

- **Every 6 Months Checking** : The additional activities which need to be done together with basic maintenance are the checking on leaking, rust, abnormal sound, smell, color, light, and vibration of power transformer, including the foundation and positions of ground connector, animal prevention net, condition of bushings and their oil level, dehydrating breather, temperature and current of power transformer.

The operating functions of On Load Tap Changer and its position indicator are needed to be tested and checked. Cooling system and oil pressure of hotline oil filter are also needed to be tested and cleaned.

- **Annual Checking** : The annual checking is the additional activities of 6 months checking. Oil of main tank are needed to be tested for conductivity of insulation condition and checked for the accumulating danger gases. Oil gauge, oil temperature gauge, and winding temperature equipment are also needed to be checked.

- **Every 6 Years Checking** : The 6-year checking is the additional activity of the annual checking which is electrical testing on power transformer that needs to be de-energised from the system.

Fixed-time preventive maintenance schedule of the power transformers can be described as shown in table F.2 as follows :

Table F.2 Fixed-Time Preventive Maintenance of Power Transformers

Topics	Period of Checking
<p>Power Transformer</p> <ul style="list-style-type: none"> - Periodic checking by maintenance department - Main tank oil testing - Check oil and winding temperature - DGA checking for rated power over 100 MVA - DGA checking for rated power less than 100 MVA - OLTC oil testing - OLTC overhauling and self protection checking by maintenance department - Electrical checking 	<p>on the 6th, 12th, 36th, 72nd month</p> <p>once a year</p> <p>once a year</p> <p>every 6 months</p> <p>once a year</p> <p>once a year</p> <p>every 5 years or 50,000 operations (Following typical instruction manual)</p> <p>every 6 years</p>
<p>Protective Relay</p>	<p>Every week</p>

The consideration for determining the improvement of substation equipment for EGAT is :

- Equipment evaluation results cannot be accepted.
- Repairing costs for renovating equipment into complete condition take too high expenses.

- Spare equipment is difficult to find or rarely to be provided that might affect the power system usage and customer demands from taking too much time for waiting.
- The risk of equipment from uses in inappropriate environment or system.
- The establishment of new technology equipment and principles that can substitute consuming equipment, and be able to improve system efficiency.

BIOGRAPHY

Mr.Chairat Yeamsawad was born on 22nd June 1971 at Phayatai District, Bangkok Province, graduated from Department of Electrical Engineering Faculty of Engineering at Kasetsart University in 1994 and studied in Master Degree of Engineering Management at Chulalongkorn University since 1996 as a scholarship student of Electricity Generating Authority of Thailand.

He had worked in computer business at PT Information Co,Ltd. as a system engineer during 1991-1994 for three years. At present, he has worked in Transmission System Maintenance Department of Electricity Generating Authority of Thailand as an electrical engineer since 1994.