NO.	DATE	BY	DESCRIPTION	CHEK'D	APP'D	CERT'D
A	10/2013	DAR	FIRST ISSUE	SA	OB	AYK

REVISIONS

DESIGNED
BY:- **SA**
DATE:- 10/2013

CHECKED
BY:- **OB**
DATE:- 10/2013

OPRG. DEPT
BY
DATE:-

ENG'G. DEPT.
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Saudi Electricity Company
Eastern Region Branch

الشركة السعودية للكهرباء
فرع المنطقة الشرقية

RELAY SETTING CALCULATION

AS BUILT BY | DATE

DOCUMENT TITLE	INDEX	PLANT	DOCUMENT NO.	SHEET NO.	REV.
RELAY SETTING CALCULATION QATIF 115/13.8 KV SUBSTATION NO. 2	A	DA441	EE-221424	01 OF 54	A
QATIF SAUDI ARABIA	JOB ORDER NO. 1-113045.01		DWG.CON. SHT. EE-221387		

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1.1 115KV BUSBAR DIFFERENTIAL PROTECTION (WITH BUILT IN BF) RELAY SETTING (REB 500)

Circuit Ref :	Bus 1A,1B,2A,2B and check zone	**Relay Designation**	87B+50BF	**Relay Type**	REB500	**Make**	ABB	**Doc. Ref**
Aux. Voltage	125 V DC	**CT Ratio**	2000/1	**PT Ratio**	_			
Nominal Current	1A	**Rated Voltage**		**Freq**	60HZ			

CT Data

CT Ratio : Primary	3000	A	Adopted tap
: Secondary	1	A	2000 A
Class	TPS		
CT Knee Point Voltage (V_{kp})	1666.6	V	
Magnetising current I_M at V_{kp}	30	mA	
CT Secondary resistance R_{CT}	3.13	Ohms	

Ik min	Op char. L1,L2.L3	1000 A
k	Op char. L1,L2.L3	0.8
Diff. current Alarm c	Op char. L1,L2.L3	10 % I kmin
Delay	Op char. L1,L2.L3	5 S
Ik min	Op char. L0	300 A
k	Op char. L0	0.8
Diff. current Alarm c	Op char. L0	10 % I kmin
Delay	Op char. L0	10 s

Breaker Failure Protection

BFP Active	Active
Setting (per CT)	1.2 In
Timer 1 Active	Active
Ttimer 2 Active	Active
Timer 1	100 ms
Ttimer 2	150 ms
Inter trip pulse Duration	200 ms
Logic type	1

2.1 115/13.8KV Power Transformer Differential Protection

Circuit Ref :	T601, T602 & T603	**Relay Designation**	87T / T601 87T / T602 87T / T603	**Relay Type**	RET670	**Make**	ABB	**Doc. Ref**	
Aux. Voltage	125 V DC	**CT Ratio**	500/1A	**Relay order #**	RET670 *1.2-B40X00-D02-D04P01-01-C-B-K-B-B-B3-DAXE				
Nominal Current	1A	**Rated Voltage**	–	**Freq**	60HZ				

Calculation for Transformer Differential Protection 87T settings :

	HV		MV		Remarks
Voltage Ratio	115	/	13.8	kV	
Connection	D	/	y		
Vector group		Dyn1			
Rating ONAN	50	/	50	MVA	
Rating ONAF	67	/	67	MVA	

OLTC Type			
OLTC range	115 (+10 to -16) x 1.25%kV		
Highest tap 1	129.38 kV		
Nominal tap 11	115 kV		Nominal tap
Lowest tap 27	92 kV		

Rated Current @ 67 MVA at Highest tap= MVA*1000/SQRT(3) x KV

299 A

Rated Current @ 67 MVA at Nominal tap= MVA*1000/SQRT(3) x KV

336 A

Rated Current @ 67 MVA at Lowest tap = MVA*1000/SQRT(3) x KV

420 A

% Impedance on 50MVA Base	**HV-MV**	**HV-TV**	**MV-TV**	
Positive Sequence Impedance, Tap 1	23.60%	-	-	
Positive Sequence Impedance, Tap 11	22.00%	-	-	Nominal tap
Positive Sequence Impedance, Tap 27	22.30%	-	-	

Transformer **HV** side CT ratio	3000	/	1	A	MRCT
Adopted tap	500	/	1	A	
Rated HV Side. current @67MVA	336 A				

Transformer **MV** side CT ratio 4000 / 1 A DRCT

Adopted tap 4000 / 1 A

Rated Sec. current @ 67MVA 2803.1 A

Maximum current error due to OLTC (26 taps x 1.25%) = 32.5 %

Setting Parameter for Differential protection DIFP

Parameter	Range	Unit	Setting	Description
RatedVoltageW1	--	KV	115	HV rating voltage
RatedVoltageW2	--	KV	13.8	MV rating voltage
RatedVoltageW3	--	KV	-	TV rating voltage
RatedCurrentW1	--	A	336	HV rating current
RatedCurrentW2	--	A	2803	MV rating current
RatedCurrentW3	--	A	-	TV rating current
ConnectTypetW1	--	-	DELTA (D)	HV side connection type
ConnectTypetW2	--	-	wye (y)	MV side connection type
ConnectTypetW3	--	-	-	TV side connection type
ClockNumberW1	--	deg	1 [30 deg lag]	clock number
ZSCurrSubW1	On/Off	-	On	Operation Zero Seq Current Subtraction Off/On for HV
ZSCurrSubW2	On/Off	-	On	Operation Zero Seq Current Subtraction Off/On for LV
TconfigForW1	On/Off	-	Off	
TconfigForW2	On/Off	-	Off	
LocationOLTC1	Winding1 (W1) / Winding2 (W2)	-	Winding1 (W1)	Tap Changer location
LowTapPosOLTC1	--	-	1	the lowest Tap position
RatedTapOLTC1	--	-	11	the nominal Tap position
HighTapPsOLTC1	--	-	27	the highest Tap position
TapLowVoltTC1	--	-	5	
StepSizeOLTC1	--	%	1.25%	max. resolution of Tap
Idmin	10 - 60	% of Ir	30%	Maximum Sensitivity
Idure	100 - 5000	% of Ir	575%	Unrestrained limit
I2/I1 ratio	5 -100	%	15%	Second to first harmonic ratio
I5/I1 ratio	5-100	%	25%	Fifth to first harmonic ratio
Other Parameters	--	-	-	not relevant for this application use default value

2.2 115/13.8KV Transformer LV Restircted Earth Fault Protection Relay Setting

Circuit Ref :	T601 , T602 & T603	**Relay Designation**	87REF	**Relay Type**	MCAG 14	**Make**	Areva	
Aux. Voltage	125 V DC	**CT Ratio**	4000	**ORDERING NO**		SS DB 0220A		
Nominal Current	1	**Freq**	60HZ					

CT Data

CT Ratio : Primary	4000	A
: Secondary	1	A
Class	TPS	
CT Knee Point Voltage (V_{kp})	500	V
Magnetising current I_M at V_{kp}	30	mA
CT Secondary resistance R_{CT}	14	Ohms
Max Through fault current		
Max Through fault current	25	k A

Relay setting calculations

As per MCAG relay catalogue,

$V_s' \geq I_f (R_s + R_p)$

$V_{sA} = VA/I_r + I_r R_{sr}$

$I_s = I_r + nI_e$

where,

V_s'	=	Minimum required stability voltage
I_f	=	Maximum sec. through fault current
R_s	=	CT secondary winding resistance
R_p	=	maximum loop lead resistance between CTs and relay
V_{sA}	=	Actual voltage setting
VA	=	relay burden
I_r	=	Relay setting current
R_{sr}	=	Resistance of Stabilising series resistor
I_s	=	Effective fault setting expressed in secondary current

I_e = Magnetising current of CT

n = number of CT groups forming the protected zone.

To determine stability voltage for through fault V_s'

Voltage across the relay at I_{FS} (V_S)

CT Resistance (R_{CT})	=	14	Ohms
Lead Loop Resistance (R_L)	=	0.875	Ohms
Maximum through fault current reflected in CT secondary If	=	25x1000x1/4000 =	6.3
$V_S' = I_{FS} * (R_{CT} + R_L)$	=	6.25 X (14+0.875)	
		92.96875	Volts
Setting voltage		93	V
Setting of the Pickup for the relay, Ir		0.1	A
Rated burden of the relay at relay setting		1	VA

To determine series stabilising resistance R_{sr}

Stabilising Resistance Rsr = (Vs' - VA/Ir)/Ir (Required)	830.00	ohms
Selected value of stabilising Resistors	**1000.00**	ohms
Actual Voltage Setting VsA = VA/Ir + Ir*Rsr	93.00	V
the required resistance to the rated value ratio	**83.00%**	**Rsr selection is suitable since its not less than 65%**

Minimum Fault sensitivity

The offered CT Im		30 mA
Ip	T * (Ir + nIm + IM)	
Ir		0.10 A
Im at Vs'		$\frac{\text{Im at } U_{al} \times Vs_A}{U_{al}}$
		30 x 93 / 500
		0.006 A
Total Im for 4 CTs		4 x 0.0056
nIm		0.023 A
IM at Vs		$0.52*(\text{sqrt}(2)*Vi / C)^{1/b}$
C		900
b		0.25
		0.52 x (SQRT(2) x 93/ 900)^4
		0.00024 A
Ip		T * (Ir + nIm + IM)
		4000 x (0.1 + 0.023 + 0.00024)
		493.0 A

The Sensitivity of the bus bar Protection is 12.32% of CT rating

PHASE FAULT

2.3	**Applicable for**		-	**115KV POWER TRANSFORMER HV Side NON DIRECTIONAL O/C Relay (AREVA-P142)**		
	Relay ordering number		=	P142316D6M044OJ		
	System voltage:	HV	=	115.0 KV		
		LV	=	13.8 KV		
	CT Ratio		=	500 /1 A		
	Load		=	67 MVA		
	Load Current		=	67*1000/(115*sqrt(3))		336
	Tripping co-ordination		=	13.8kV Bus Tie O/C Protection		
	Overload Factor		=	1.20		
	Relay Pick up Setting	**Pick up**	=	**1.2*336/500**		0.80640 A
		Pick up current Chosen	=	**0.81 In**		
	Fault Current on HV Side		=	8830*13.8/115	(ETAP Fault File-Annexure B)	1059.60 A
	OPERATING TIME OF 13.8KV BUS TIE O/C RELAY FOR FAULT AT 13.8KV BUS		=	0.73S	@ 8830A	
	Required operating time for HV side Directional O/C relay		=	0.726 + 0.35		1.08S
	Multiple of fault current w.r.t pickup current		=	1059.6/(0.81*500)		2.61630
	Relay operating time at TMS = 1		=	0.14 / (2.6162962962963^0.02 - 1)	=	7.21 S
	Required TMS		=	1.076 / 7.20854982736079	=	**0.15**
		TMS Chosen	=	**0.150**		
	Operating time @ 1.052kA		=	0.15*0.14/(2.6162962962963^0.02-1)	=	1.081282474
	Highset setting		=	1.25 times of Maximum through fault current		
	Maximum through fault current		=	1059.00A		
			=	1.25*1059.6/500		**2.649**
		HS Chosen	=	**2.65In**		

Settings for 67MVA Powertransformer HV side Non Directional O/C Relay - 50/51 HV (AREVA P142)						
IDMTL Curve	=	**Standard Inverse(IEC)**				
Relay Pick up Setting	=	**0.81 In**	-	***Setting Range***	=	***0.08 to 4xIn in step of 0.01In***
TMS	=	**0.150**	-	***Setting Range***	=	***0.025 to 1.2 in step of 0.025***
HS pick up setting	=	**2.65In**	-	***Setting Range***	=	***0.08 to 32In in step of 0.01In***
High Set time delay	=	**0.050**	-	***Setting Range***	=	***0.00 to 100s in step of 0.01s***

PHASE FAULT

2.4	**Applicable for**		-	**380KV AUTOTRANSFORMER MV Side DIRECTIONAL O/C Relay (AREVA-P142)**		
	Relay ordering number		=	P142316D6M04FOJ		
	System voltage:		=	13.8 KV		
	CT Ratio		=	4000 /1 A		
	Load		=	67 MVA		
	Load Current		=	67*1000/(13.8*sqrt (3))		**2803.00 A**
	Grading of Transformer LV Directional relay is such that it should operate before Bus Tie O/C relay for Transformer fault					
	Recommended Pick up setting		=	50%	of load current	
	Relay Pick up Setting	**Pick up**	=	**0.5*2803/4000**		0.35038 A
		Pick up current Chosen	=	**0.36**		
	Maximum 3 phase fault current		=	8830 A	(ETAP Fault File-Annexure B)	8830.00 A
	Bus Tie operating time for this fault current		=	0.719S		
	Required Transformer LV side directional O/C relay operating time		=	0.35 s		
	Multiple of fault current w.r.t pickup current		=	8830/(0.36*4000)		
			=	6.130		
	Relay operating time at TMS = 1		=	0.14 / (6.13^0.02 - 1)	=	3.79 S
	Required TMS		=	0.35 / 3.79	=	0.09 S
		TMS Chosen	=	**0.100**		
	Operating time @ 8.83 kA		=	0.1*0.14/(6.13^0.02-1)	=	0.379
	Settings for 67MVA Autotransformer MV side Directional O/C Relay - 67 MV (AREVA P142)					
	IDMTL Curve	=	**Standard Inverse(IEC)**			
	Relay Pick up Setting	=	**0.36 In**	-	***Setting Range***	= ***0.08 to 4xIn in step of 0.01In***
	TMS	=	**0.100**	-	***Setting Range***	= ***0.025 to 1.2 in step of 0.025***

EARTH FAULT

2.5	**Applicable for**		-	**115/13.8KV TRANSFORMER HV Side DIRECTIONAL E/F Relay (AREVA-P142)**			
	Relay ordering number		=	P142316D6M054OJ			
	System voltage:	HV	=	115.0 KV			
		LV	=	13.8 KV			
	CT Ratio		=	500 /1 A			
	Load		=	67 MVA			
	Load Current		=	67*1000/(115*sqrt(3))			336
	Tripping co-ordination		=	None			
	Required Sensitivity		=	15%	(of CT Rating)		
	Relay Pick up Setting	**Pick up**	=	**0.15 In**			0.15 In
		Pick up current Chosen	=	**0.15 In**			
	Maximum unbalance secondary current		=	5	Times of Setting (assumed)		
	Required operating time		=	0.50S			0.50S
	Relay operating time at TMS = 1		=	0.14 / (5^0.02 - 1)		=	4.28 S
	Required TMS		=	0.5 / 4.27972007094537		=	**0.117**
		TMS Chosen	=	**0.125**			
	Operating time		=	0.125*0.14/(5^0.02-1)	=		0.534965009
	Highest setting		=	1.25 times of maximum unbalance secondary current			
			=	1.25*5*0.15*500/500			**0.9375**
			=	**0.94In**			

Settings for 67MVA Powertransformer HV side Non Directional E/F Relay - 50N/51N (AREVA P142)

IDMTL Curve	=	**Standard Inverse(IEC)**				
Relay Pick up Setting	=	**0.15 In**	-	***Setting Range***	=	***0.08 to 4xIn in step of 0.01In***
TMS	=	**0.125**	-	***Setting Range***	=	***0.025 to 1.2 in step of 0.025***
HS pick up setting	=	**0.94In**	-	***Setting Range***	=	***0.08 to 32In in step of 0.01In***
High Set time delay	=	**0.000**	-	***Setting Range***	=	***0.00 to 100s in step of 0.01s***

EARTH FAULT

2.6	**Applicable for**		-	**67 MVA POWER TRANSFORMER MV Side DIRECTIONAL E/F Relay (AREVA-P142)**		
	Relay ordering number		=	P142316D6M044OJ		
	System voltage:	HV	=	115.0 KV		
		MV	=	13.8 KV		
	CT Ratio		=	4000 /1 A		
	Load		=	67 MVA		
	Load Current		=	67*1000/(13.8*sqrt(3))		2803
	Tripping co-ordination		=	Annexure-B		
	Grading of Transformer LV DEF relay is such that it should operate before Bus Tie E/F relay for transformer fault					
	Relay Pick up Setting	**Pick up**	=	**0.15 In**		0.15 A
		Pick up current Chosen	=	**0.15 In**		
	Maximum Through fault current		=	9090 A	(ETAP Fault File-Annexure B)	
	13.8kv Bus Tie O/C Relay operating time for this fault current		=	0.703		0.703S
	Required operating time		=	0.35 s		
	Multiple of fault current w.r.t pickup current		=	9090/(0.15*4000)		15.15000
				15.150		
	Relay operating time at TMS = 1		=	0.14 / (15.15^0.02 - 1)	=	2.51 S
	Required TMS		=	0.35 / 2.50605677006555	=	**0.14**
		TMS Chosen	=	**0.150**		
	Operating time @ 9.09kA		=	0.15*0.14/(19.49^0.02-1) =		0.375908516

Settings for 67MVA Powertransformer MV side Directional E/F Relay - 67 MVN (AREVA P142)

IDMTL Curve	=	**Standard Inverse(IEC)**				
Relay Pick up Setting	=	**0.15 In**	-	***Setting Range***	=	***0.08 to 4xIn in step of 0.01In***
TMS	=	**0.150**	-	***Setting Range***	=	***0.025 to 1.2 in step of 0.025***

EARTH FAULT

2.7	**Substation**	-	**QATIF 115/13.8KV SUBSTATION NO. 2**			
	Applicable for	-	**67MVA TRANSFOMER MV GROUND O/C Relay (AREVA-P142)**			
	Relay ordering number	=	P142316D6M044OJ			
	System voltage:	=	13.8 KV			
	CT Ratio	=	4000 /1A			
	Load	=	67 MVA			
	Load Current	=	67*1000/(13.8*sqrt(3))	=	2803.08 A	
	Required sensitivity	=	40.00% **OF CT RATING**			
	Relay Pick up Setting	=	0.4*1	=	0.4000 In	
	Pick up Chosen	=	**0.400 In**	**Pick up Current Chosen =**	**0.400 A**	
	Required Co-ordination	=	13.8kV Bus Tie E/F Relay			
	Fault current for co-ordination	=	9090 A (ETAP Fault File - Annexure B)			
	Bus Tie E/F Relay operating time for this fault current	=	0.14 x0.25/(11.363^0.02-1)		0.70799784	
	Required Operating time	=	0.35+0.707			
		=	1.058S			
	Multiple of fault current w.r.t pick-up current	=	9090/(0.4*4000)			
		=	5.58			
	Operating time at TMS=1	=	0.14/(5.581^0.02-1)			
		=	4.00S			
	Required TMS	=	1.05799783966979 /4	=	**0.265**	
	TMS Chosen		0.275S			
	Operating Time @8.93kA	=	0.275*0.14/(5.581^0.02-1)	=	**1.100**	

Settings for 67MVA TRANSFORMER MV GROUND O/C Relay - 51G (AREVA P142)

IDMTL Curve	=	**Standard Inverse(IEC)**			
Relay Pick up Setting	=	**0.40 A**	-	***Setting Range***	= ***0.08 to 4xIn in step of 0.01In***
TMS	=	**0.275**	-	***Setting Range***	= ***0.025 to 1.2 in step of 0.025***

3.1 115KV BUS COUPLER OVERCURRENT RELAY SETTING

PHASE FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**			
Applicable for	-	**115KV BUS COUPLER FEEDER OVERCURRENT RELAY**			
Relay Type	=	P142			
Relay Ordering No.	=	P142316D6M044OJ			
System voltage:	=	115.0 KV			
CT Ratio	=	2000 /1 A			
Load Current	=	808.00 A	(ASSUMED)		
Over load factor	=	1			
Tripping co-ordination curve	=	Annexure-B			
Load Current	=	808 A			
Relay Pick up Setting	=	1 X 808/2000		=	0.40400 A
Pick up current Chosen	=	**0.41**			
Maximum fault current at 115kV Bus	=	24600 A	(ETAP Fault File - Annexure B)		
Required op. time for this fault current is	=	0.50 Sec			
Multiple of fault current w.r.t pick-up current	=	24600/(0.41x2000)			
	=	30	Since 30>20		
Operating time at TMS =1	=	0.14 /(20^0.02-1)		=	2.2674 S
Required TMS	=	0.5 /2.26736		=	0.221
TMS Chosen	=	**0.225**			
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)			
	=	0.14 * 0.225/ (20^0.02 - 1)		=	0.5102 s

Settings for 115kV Bus Coupler O/C Relay - 50/51 (AREVA P142)							
IDMTL Curve	**=**	**Standard Inverse(IEC)**					
Plug Setting	**=**	**0.41**	**-**	***Setting Range***	**=**	***0.08 to 4xIn in step of 0.01In***	
TMS	**=**	**0.225**	**-**	***Setting Range***	**=**	***0.025 to 1.2 in step of 0.025***	

3.2 115KV BUS COUPLER E/F OVERCURRENT RELAY SETTING

EARTH FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**			
Applicable for	-	**115KV BUS COUPLER E/F OVERCURRENT RELAY**			
Relay Type	=	P142			
Relay Ordering No.	=	P142316D6M044OJ			
System voltage:	=	115.0 KV			
CT Ratio	=	2000 /1 A			
Tripping co-ordination curve	=	Annexure-B			
Relay Pick up Setting	=	20% of CT RATING	=	0.2In	
Pick up current Chosen	=	**0.2**			
Maximum 1 Ph earth fault current att 115kV Bus	=	19500 A	(ETAP Fault File - Annexure B)		
Required operating time at 19500 A	=	0.4000S			
Multiple of fault current w.r.t pick-up current	=	19500/(0.2x2000)			
	=	48.75	Since 48.75 > 20		
Operating time at TMS =1	=	0.14 /(20^0.02-1)	=	2.2674 S	
Required TMS	=	0.4 /2.26736	=	0.176	
TMS Chosen	=	**0.175**			
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)			
	=	0.14 * 0.175/ (20^0.02 - 1)	=	0.3968 s	

Settings for 115kV Bus Coupler O/C Relay - 50/51 (AREVA P142)							
IDMTL Curve	**=**	**Standard Inverse(IEC)**					
Plug Setting	**=**	**0.2**	**-**	***Setting Range***	**=**	***0.08 to 4xIn in step of 0.01In***	
TMS	**=**	**0.175**	**-**	***Setting Range***	**=**	***0.025 to 1.2 in step of 0.025***	

4.1 115KV BUS SECTION OVERCURRENT RELAY SETTING

PHASE FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for	-	**115KV BUS SECTION FEEDER OVERCURRENT RELAY**		
Relay Type	=	P142		
Relay Ordering No.	=	P142316D6M044OJ		
System voltage:	=	115.0 KV		
CT Ratio	=	2000 /1 A		
Tripping co-ordination curve	=	Annexure-B		
Load Current	=	808 A	(assumed)	
Overload Factor	=	1.0 KV		
Relay Pick up Setting	=	1 X 808/2000	=	0.40400 A
Pick up current Chosen	=	**0.41**		
Max. 3 ph. fault current	=	24600 A	(ETAP Fault File - Annexure B)	
BUS COUPLER operating time for this fault current	=	0.51 Sec		
Required op. time for B/S relay is	=	0.51+0.35		**0.86016**
Multiple of fault current w.r.t pick-up current	=	24600/(0.41x2000)		
	=	30	Since 30 > 20	
Operating time at TMS =1	=	0.14 /(20^0.02-1)	=	2.2674 S
Required TMS	=	0.86016 /2.26736	=	0.379
TMS Chosen	=	**0.400**		
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
	=	0.14 * 0.4/ (20^0.02 - 1)	=	0.8593 s

Settings for 115kV Bus Section O/C Relay - 50/51 (AREVA P142)						
IDMTL Curve	**=**	**Standard Inverse(IEC)**				
Plug Setting	**=**	**0.41**	**-**	***Setting Range***	**=**	***0.08 to 4xIn in step of 0.01In***
TMS	**=**	**0.400**	**-**	***Setting Range***	**=**	***0.025 to 1.2 in step of 0.025***

4.2 115KV BUS SECTION E/F OVERCURRENT RELAY SETTING

EARTH FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for	-	**115KV BUS SECTION E/F OVERCURRENT RELAY**		
Relay Type	=	P142		
Relay Ordering No.	=	P142316D6M0440J		
System voltage:	=	115.0 KV		
CT Ratio	=	2000 /1 A		
Tripping co-ordination curve	=	Annexure-B		
Relay Pick up Setting	=	25% of CT RATING	=	0.25In
Pick up current Chosen	=	**0.25**		
Maximum 1 phase earth fault current at 115 kV Bus	=	19500 A	(ETAP Fault File - Annexure B)	
BUS COUPLER operating time for this fault current	=	0.3968S		
Required Operating time	=	0.396+0.35		**0.747**
Multiple of fault current w.r.t pick-up current	=	19500/(0.25x2000)		
	=	39	Since 39 > 20	
Operating time at TMS =1	=	0.14 /(20^0.02-1)	=	2.2674 S
Required TMS	=	0.74679 /2.26736	=	0.329
TMS Chosen	=	**0.350**		
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
	=	0.14 * 0.35/ (20^0.02 - 1)	=	0.7936 s

Settings for 115kV Bus Section O/C Relay - 50/51 (AREVA P142)							
IDMTL Curve	**=**	**Standard Inverse(IEC)**					
Plug Setting	**=**	**0.25**	**-**	***Setting Range***	**=**	***0.08 to 4xIn in step of 0.01In***	
TMS	**=**	**0.350**	**-**	***Setting Range***	**=**	***0.025 to 1.2 in step of 0.025***	

6.1 13.8KV STATION SERVICE TRANSFORMER FEEDER OVERCURRENT RELAY SETTING

PHASE FAULT

Substation		-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for		-	**13.8KV STATION SERVICE TRANSFORMER T301 & T302 FEEDER OVERCURRENT RELAY**		
Relay Type		=	REF615		
Relay Ordering No.		=			
System voltage:	HV	=	13.8 KV		
	LV	=	0.38 KV		
CT Ratio		=	400 /1 A		
Load (Transformer Rating)		=	0.5 MVA		
Load Current		=	21.00 A	MVA/R3*KV=500/(1.732*13.8-TRFR primary)	
Over load factor		=	1.2		
Tripping co-ordination curve		=	Annexure-B		
Load Current		=	21 A		
Relay Pick up Setting		=	1.2*21/400	=	0.06300 A
	Pick up current Chosen	=	**0.07**		
Max. 3 ph. fault current at the transformer LV		=	14860 A	(ETAP Fault File - Annexure B)	
Fault current seen by relay transformer HV		=	(14860*0.38/13.8)		
		=	409 A		
			409 A		
Required O/C relay Operating time for this fault current		=	0.35 Sec		
Multiple of fault current w.r.t pick-up current		=	409/(0.07x400)		
		=	14.607		
Operating time at TMS =1		=	0.14 /(14.607^0.02-1)	=	2.5411 S
Required TMS		=	0.35 /2.5411	=	0.138
	TMS Chosen	=	**0.150**		
Operating time at selected TMS		=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
		=	0.14 * 0.15/ (14.607^0.02 - 1)	=	0.3812 s
Highset setting		=	1.25 times of Maximum through fault current		
Maximum through fault current		=	409.000 A		
		=	1.25 * 409/ 400	=	1.28
	HS Chosen	=	**1.28 In**		
	Time delay	=	**0.05 s**		

Settings for Station Service Transformer HV side O/C Relay - 50/51 (REF615)

IDMTL Curve	=	**Standard Inverse(IEC)**					
Plug Setting	=	**0.07**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.150**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***
HS pick-up setting	=	**1.280 In**	-	***Setting Range***	=	***0.10 to 40xIn in step of 0.01In***
Highset time delay	=	**0.05**	-	***Setting Range***	=	***0.04 to 200s in step of 0.01s***

6.2 13.8KV STATION SERVICE TRANSFORMER FEEDER E/F OVERCURRENT RELAY SETTING

EARTH FAULT

Substation		-	**QATIF 115/13.8KV SUBSTATION NO.2**			
Applicable for		-	**13.8KV STATION SERVICE TRANSFORMER T301 & T302 FEEDER E/F OVERCURRENT RELAY**			
Relay Type		=	REF615			
Relay Ordering No.		=				
System voltage:	HV	=	13.8 KV			
CT Ratio		=	400 /1 A			
Load (Transformer Rating)		=	0.5 MVA			
Load Current		=	21.00 A			
Over load factor		=	1.2			
Load Current		=	21 A			
Recommended Pick up Setting		=	2% of CT rating			
Relay Pick up Setting		=	0.02 x 1	=		0.02000 A
	Pick up current Chosen	=	**0.05**			
Max. through fault current		=	5 X HV FULL LOAD CURRENT			
		=	5 X 21			105.00 A
Required Operating time		=	0.35 Sec	Assumed		
Multiple of fault current w.r.t pick-up current		=	105/(0.05x400)			
		=	5.25			
Operating time at TMS =1		=	0.14 /(5.25^0.02-1)	=		4.1518 S
Required TMS		=	0.35 /4.15176	=		0.084
	TMS Chosen	=	**0.100**			
Operating time at selected TMS		=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)			
		=	0.14 * 0.1/ (5.25^0.02 - 1)	=		0.4152 s

Settings for Station Service Transformer HV side E/F O/C Relay - 50N/51N (REF615)

IDMTL Curve	=	**Standard Inverse(IEC)**				
Plug Setting	=	**0.05**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.100**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***

7.1 13.8KV OUTGOING FEEDER OVERCURRENT RELAY SETTING

PHASE FAULT

Substation		-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for		-	**13.8KV OUTGOING FEEDER OVERCURRENT RELAY**		
Relay Type		=	REF615		
Relay Ordering No.		=			
System voltage:	HV	=	13.8 KV		
CT Ratio		=	600 /1 A		
Load		=	5.0 MVA	ASSUMED	
Load Current		=	209.00 A		
Over load factor		=	1.2		
Tripping co-ordination curve		=	Annexure-B		
Load Current		=	209 A		
Relay Pick up Setting		=	1.2*209/600	=	0.41800 A
	Pick up current Chosen	=	**0.42**		
Max. 3 ph. fault current at remote end bus		=	7870 A	(ETAP Fault File - Annexure B)	
Required O/C relay Operating time for this fault current		=	0.35 Sec	Assuming remote end relay operates instantaneously	
Multiple of fault current w.r.t pick-up current		=	7870/(0.42x600)		
		=	31.23	Since 31.032 > 20	
Operating time at TMS =1		=	0.14 /(20^0.02-1)	=	2.2674 S
Required TMS		=	0.35 /2.26736	=	0.154
	TMS Chosen	=	**0.160**		
Operating time at selected TMS		=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
		=	0.14 * 0.16/ (20^0.02 - 1)	=	0.3628 s
Highset setting		=	1.25 times of Maximum through fault current		
Maximum through fault current		=	7870.000 A		
		=	1.25 * 7870/ 600	=	16.4
	HS Chosen	=	**16.40 In**		
	Time delay	=	**0.05 s**		

Settings for OUTGOING FEEDER O/C Relay - 50/51 (REF615)						
IDMTL Curve	=	**Standard Inverse(IEC)**				
Plug Setting	=	**0.42**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.160**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***
HS pick-up setting	=	**16.400 In**	-	***Setting Range***	=	***0.10 to 40xIn in step of 0.01In***
Highset time delay	=	**0.05**	-	***Setting Range***	=	***0.04 to 200s in step of 0.01s***

7.2 13.8KV OUTGOING FEEDER E/F OVERCURRENT RELAY SETTING

EARTH FAULT

Substation		-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for		-	**13.8KV OUTGOING FEEDER E/F OVERCURRENT RELAY**		
Relay Type		=	REF615		
Relay Ordering No.		=			
System voltage:	HV	=	13.8 KV		
CT Ratio		=	600 /1 A		
Load		=	5.0 MVA	ASSUMED	
Load Current		=	209.00 A		
Over load factor		=	1.2		
Load Current		=	209 A		
Recommended Pick up Setting		=	10% of CT rating		
Relay Pick up Setting		=	0.1 x 1	=	0.10000 A
	Pick up current Chosen	=	**0.1**		
Max. through fault current		=	6290 A		
Required Operating time		=	0.35 Sec	Assumed	
Multiple of fault current w.r.t pick-up current		=	6290/(0.1x600)		**104.83**
		=	20	SINCE 104.83 > 20	
Operating time at TMS =1		=	0.14 /(20^0.02-1)	=	2.2674 S
Required TMS		=	0.35 /2.26736	=	0.154
	TMS Chosen	=	**0.150**		
Operating time at selected TMS		=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
		=	0.14 * 0.15/ (20^0.02 - 1)	=	0.3401 s
HIGHSET SETTING		=	1.2 TIMES OF MAXIMUM REMOTE END FAULT CURRENT		
MAXIMUM REMOTE END FAULT CURRENT		=	6290.0 A		
		=	1.25*6290/600		13.1042 s
	HS CHOSEN	=	**13.11In**		

Settings for Outgoing Feeder E/F O/C Relay - 50N/51N (REF615)

IDMTL Curve	=	**Standard Inverse(IEC)**				
Plug Setting	=	**0.1**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.150**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***
HIGHEST SETTING	=	**13.11In**		***Setting Range***	=	***1 to 40xIn in step of 0.01***
HIGHEST TIME DELAY	=	**0.02s**		***Setting Range***	=	***0.02 to 200s in step of 0.01s***

8.1 13.8KV BUS SECTION OVERCURRENT RELAY SETTING

PHASE FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for	-	**13.8KV BUS SECTION FEEDER OVERCURRENT RELAY**		
Relay Type	=	REF615		
Relay Ordering No.	=			
System voltage:	=	13.8 KV		
CT Ratio	=	4000 /1 A		
Load Current	=	2803.00 A trfr FLC	MVA/R3*KV=67000/(1.732*13.8)	
Over load factor	=	1.1		
Tripping co-ordination curve	=	Annexure-B		
Load Current	=	2803 A		
Relay Pick up Setting	=	1.2 X 2803/4000	=	0.84090 A
Pick up current Chosen	=	**0.85**		
Max. 3 ph. fault current	=	8830 A	(ETAP Fault File - Annexure B)	
fault current for coordination	=	13.8KV OUTGOING FEEDER O/C FAULT CURRENT		
	=			
IDMT optg time of 13.8kV OUTGOING Feeder O/C relay for this fault current	=	0.36 Sec		
Required op. time for B/S relay is	=	0.36+0.35		**0.72**
Multiple of fault current w.r.t pick-up current	=	8830/(0.85x4000)		
	=	2.597		
Operating time at TMS =1	=	0.14 /(2.597^0.02-1)	=	7.2650 S
Required TMS	=	0.7228 /7.265	=	0.099
TMS Chosen	=	**0.100**		
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)		
	=	0.14 * 0.1/ (2.597^0.02 - 1)	=	0.7192 s

Settings for 13.8kV Bus Section O/C Relay - 50/51 (REF615)						
IDMTL Curve	=	**Standard Inverse(IEC)**				
Plug Setting	=	**0.85**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.100**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***

8.2 13.8KV BUS SECTION E/F OVERCURRENT RELAY SETTING

EARTH FAULT

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**			
Applicable for	-	**13.8KV BUS SECTION A304 E/F OVERCURRENT RELAY**			
Relay Type	=	REF615			
Relay Ordering No.	=				
System voltage:	=	13.8 KV			
CT Ratio	=	4000 /1 A			
Load Current	=	2803.00 A			
Over load factor	=	1.1			
Tripping Coordination	=	13.8kV OUTGOING Feeder O/C E/F Protection.			
Tripping co-ordination curve	=	Annexure-B			
Load Current	=	2803 A			
Relay Pick up Setting	=	20 % of CT Sec. rating	=	0.20000 A	
Pick up current Chosen	=	**0.2**			
Max. through fault current	=	9090 A	(ETAP Fault File - Annexure B)		
IDMT optg time of OUTGOING Feeder E/F O/C relay for this fault current	=	0.3400S			
Required Operating time	=	0.34+0.35		**0.69**	
Multiple of fault current w.r.t pick-up current	=	9090/(0.2x4000)			
	=	11.363			
Operating time at TMS =1	=	0.14 /(11.363^0.02-1)	=	2.8108 S	
Required TMS	=	0.69 /2.8108	=	0.245	
TMS Chosen	=	**0.250**			
Operating time at selected TMS	=	0.14 * TMS / (multiples of optg. Current $^{0.02}$ -1)			
	=	0.14 *0.25/ (11.363^0.02 - 1)	=	0.7027 s	

Settings for Bus Section E/F O/C Relay - 50N/51N (REF615)						
IDMTL Curve	=	**Standard Inverse(IEC)**				
Plug Setting	=	**0.2**	-	***Setting Range***	=	***0.05 to 5*In in step of 0.01***
TMS	=	**0.250**	-	***Setting Range***	=	***0.05 to 15 in step of 0.05***

9 13.8KV CAPACITOR BANK RELAY SETTING

9.1 CAPACITOR BANK NEUTRAL UN-BALANCE SETTING

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**
Applicable for	-	**13.8kV CAPACITOR BANK**
Relay Type	=	AREVA - MICOM P142
Relay Ordering Data	=	P142316D6M0440J
System voltage:	=	13.8 KV
CT Ratio	=	50 /5 A

ALARM STAGE CURRENT SETTING	=	**2.0 A**
ALARM STAGE TIME SETTING	=	**5 Sec**
TRIP STAGE CURRENT SETTING	=	**4.14 A**
TRIP STAGE TIME SETTING	=	**1.0 Sec**

Settings range for 13.8kV capacitor bank neutral un-balance current relay 46-1 & 46-2(Areva - MICOM P142)

SETTING FOR STAGE-1

STARTING CURRENT	=	**2.00 A**
OPERATING TIME	=	**5.00 s**

SETTING FOR STAGE-2

STARTING CURRENT	=	**4.14 A**
OPERATING TIME	=	**1.00S**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.2 13.8kV Capacitor bank inst PH O/C protection (50PA, 50PB & 50PC)

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for	-	**13.8kV CAPACITOR BANK**	
Relay Type	=	ABB - RXIG22	
Relay Ordering Data		RK 411 008 DG	
System voltage:	=	13.8 KV	
CT Ratio	=	1200-600-400/1A	
Adopted Tap		600 /1 A	
Maximum peak inrush current	=	2.03kA	
Maximum peak outrush current	=	2.55kA	
Relay setting	=	1.2 X outrush Current / (SQRT(2) X CTR)	
		=1.2 x 2.55X 1000 /(sqrt(2) x600)	
	=	3.61 A	
Relay setting	=	4.50 A	
Note : Since the relay operating current increases to +600% for 360HZ this setting will not operate the relay during Inrush condition.			
Back-Back switching is not consider since this detail is not available			

Settings range for 13.8kV capacitor bank instantaneous PH O/C - ABB - RXIG22 (50PA,50PB&50PC)

RELAY SETTING = 4.50 A

9 13.8KV CAPACITOR BANK RELAY SETTING

9.3 13.8kV Capacitor bank INST E/F protection-RXIG22 (50PN)

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for	-	**13.8kV CAPACITOR BANK**	
Relay Type	=	ABB - RXIG22	
Relay Ordering Data		RK 411 008 DG	
System voltage:	=	13.8 KV	
CT Ratio	=	1200-600-400/1A	
Adopted Tap		600 /1 A	
Maximum peak inrush current		2030A @ 358 HZ	
Maximum peak outrush current		2550A @ 358 HZ	
RELAY SETTING	=	2.25A	
Note : Since the relay operating current increases to +600% for 360HZ this setting will not operate the relay during Inrush condition.			
Back-Back switching is not consider since this detail is not available			

Settings range for 13.8kV capacitor bank instantaneous E/F Protection(50PN) - ABB - RXIG22

RELAY SETTING	=	**2.25A**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.4 13.8kV Capacitor bank IDMT PH O/C protection

Substation		-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for		-	**13.8kV CAPACITOR BANK**	
Relay Type		=	AREVA - P142	
Relay Ordering Data			P142316D6M0440J	
System voltage:		=	13.8 KV	
CT Ratio		=	1200-600-400/1A	
Adopted Tap			600 /1 A	
Capacitor rating		=	7.0 MVar	
Capacitor current		=	= 7x10^3/(sqrt(3) x 13.8)	293.00 A
	Relay setting	=	(1.35Xcapacitor current/CT ratio)	
		=	(1.35X293/600)	**0.66 In**
Relay IDMTL curve		=	VERY INVERSE	
Fault current considered		=	5000A Assumed	
Operating time required		=	0.5 s Assumed	
Fault current in multiples of relay setting		=	(5000/(0.66X600)	12.63 times
Relay operating time at TMS 1 for 13.66 times the fault current		=	(13.5/12.63-1)	1.16 S
Required relay operating time		=	0.50 s Assumed	
Required TMS setting		=	(0.5/1.16)	0.44
TMS SETTING		=	**0.45**	

Settings range for 13.8kV capacitor bank IDMT PH O/C Protection(51P) - AREVA - P142

IDMTL Curve	**=**	**Very Inverse(IEC)**				
Plug Setting	**=**	**0.66 In**	**-**	**Setting Range**	**=**	**0.08 to 4A in step 0.01A**
TMS	**=**	**0.45**	**-**	**Setting Range**	**=**	**0.025 to 1.2 in step 0.005**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.5 13.8kV Capacitor bank IDMT E/F protection

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**		
Applicable for	-	**13.8kV CAPACITOR BANK**		
Relay Type	=	AREVA - P142		
Relay Ordering Data		P142316D6M0440J		
System voltage:	=	13.8 KV		
CT Ratio	=	1200-600-400/1A		
Adopted Tap		600 /1 A		
Capacitor rating	=	7000.0 KVar		
Capacitor current	=	7000/(sqrt(3) x 13.8)		293.00 A
Relay setting	=	50% of CT current		
	=	**0.5**		
Relay IDMTL curve	=	Normal Inverse		
Fault current considered	=	5000 A	Assumed	
Operating time required	=	0.25 s	Assumed	
Fault current in multiples of relay setting	=	(5000/(0.5X600)		16.67 times
	=			
Relay operating time at TMS 1 for 15.63 times the	=	(0.14/16.67^0.02-1)		2.42 S
Required relay operating time	=	0.25 s		
Required TMS setting	=	(0.25/2.42)		0.10
TMS SETTING	=	**0.10**		

Settings range for 13.8kV capacitor bank IDMT E/F Protection(51N) -AREVA - P142

IDMTL Curve	**=**	**Normal Inverse(IEC)**				
Plug Setting	**=**	**0.50In**	**-**	**Setting Range**	**=**	**0.08 to 4A in step 0.01A**
TMS	**=**	**0.10**	**-**	**Setting Range**	**=**	**0.025 to 1.2 in step 0.005**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.6 13.8kV Capacitor bank O/V protection 59-1

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for	-	**13.8kV CAPACITOR BANK**	
Relay Type	=	AREVA P142	
Relay Ordering Data		P14231AD6M0**0BJ	
PT Ratio	=	13.8KV/SQRT(3)/115V/SQRT(3))	
Overvoltage setting- Alarm	=	105% of nominal voltage	
	=	(1.05*66.39)	**70.0 V**
Time settings	=	**5.00S**	
Overvoltage setting- Trip	=	110% of nominal voltage	
	=	(1.1x66.39)	**73.0 V**
Time settings	=	**3.00 S**	

Settings range for 13.8kV capacitor bank O/V Protection(59-1) -AREVA P142

starting voltage U>	**=**	**70 V**
Time seting tU>	**=**	**5.00 S**
starting voltage U>>	**=**	**73 V**
Time seting tU>>	**=**	**3.00 S**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.7 13.8kV Capacitor bank O/V protection 59-2

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for	-	**13.8kV CAPACITOR BANK**	
Relay Type	=	AREVA P142	
Relay Ordering Data		P14231AD6M0**0BJ	
PT Ratio	=	13.8KV/SQRT(3)/115V/SQRT(3))	
Overvoltage setting- Alarm	=	105% of nominal voltage	
	=	(1.05*66.39)	**70.0 V**
Time settings	=	**5.00S**	
Overvoltage setting- Trip	=	110% of nominal voltage	
	=	(1.1x66.39)	**73.0 V**
Time settings	=	**3.00 S**	

Settings range for 13.8kV capacitor bank O/V Protection(59-2) -AREVA P142

starting voltage U>	**=**	**70 V**
Time seting tU>	**=**	**5.00 S**
starting voltage U>>	**=**	**73 V**
Time seting tU>>	**=**	**3.00 S**

9 13.8KV CAPACITOR BANK RELAY SETTING

9.8 13.8kV Capacitor bank U/V protection

Substation	-	**QATIF 115/13.8KV SUBSTATION NO.2**	
Applicable for	-	**13.8kV CAPACITOR BANK**	
Relay Type	=	AREVA P142	
Relay Ordering Data		P14231AD6M0**0BJ	
PT Ratio	=	13.8KV/SQRT(3)/115V/SQRT(3))	
Under voltage setting	=	85% of nominal voltage	
	=	(0.85*66.4)	56.4 V
Time settings	=	5.00S	
Under voltage setting	=	70% of nominal voltage	
	=	(0.7*66.4)	46.5 V
Time settings	=	3.00S	

Settings range for 13.8kV capacitor bank U/V Protection(27) -AREVA P922

Starting voltage 27-1	**=**	**56.44 V**
Time seting t 27-1	**=**	**5.00 S**
Starting voltage 27-2	**=**	**46.48 V**
Time seting 27-2	**=**	**3.00 S**

10.1 13.8 KV BB Differential Protection (High Impedence) Relay Setting

Circuit Ref :	13.8KV BUS B1, B2 & B3	**Relay Designation**	87B1-A, 87B1-B, 87B1-C, 87B2-A, 87B2-B, 87B2-C, 87B3-A, 87B3-B, 87B3-C	**Relay Type**	MCAG 14	**Make**	Areva	
Aux. Voltage	125 V DC	**CT Ratio**	4000/1A	**ORDERING NO**				
Nominal Current	1	**Freq**	60HZ					

CT Data

CT Ratio : Primary	4000	A
: Secondary	1	A
Class	TPS	
CT Knee Point Voltage (V_{kp})	500	V
Magnetising current I_M at V_{kp}	30	mA
CT Secondary resistance R_{CT}	14	Ohms
Max Through fault current		
Max Through fault current	25	k A

Relay setting calculations

As per MCAG relay catalogue,

$V_s' \geq I_f (R_s + R_p)$

$V_{sA} = VA/I_r + I_r R_{sr}$

$I_s = I_r + nI_e$

where,

V_s'	=	Minimum required stability voltage
I_f	=	Maximum sec. through fault current
R_s	=	CT secondary winding resistance
R_p	=	maximum loop lead resistance between CTs and relay
V_{sA}	=	Actual voltage setting
VA	=	relay burden
I_r	=	Relay setting current
R_{sr}	=	Resistance of Stabilising series resistor
I_s	=	Effective fault setting expressed in secondary current

I_e = Magnetising current of CT

n = number of CT groups forming the protected zone.

To determine stability voltage for through fault V_s'

Voltage across the relay at I_{FS} (V_S)

CT Resistance (R_{CT})	=	14	Ohms
Lead Loop Resistance (R_L)	=	1.05	Ohms
Maximum through fault current reflected in CT secondary If	=	25x1000x1/4000 =	6.25
$V_S' = I_{FS} * (R_{CT} + R_L)$	=	6.25 X (14+1.05)	
		94.0625	Volts
Setting voltage		95	V
Setting of the Pickup for the relay, Ir		0.2	A
Rated burden of the realy at relay setting		1	VA

To determine series stabilising resistance R_{sr}

Stabilising Resistance Rsr = (Vs' - VA/Ir)/Ir (Required)	450.00	ohms
Selected value of stabilising Resistors	**450.00**	ohms
Actual Voltage Setting VsA = VA/Ir + Ir*Rsr	95.00	V
the required resistance to the rated value ratio	**100.00%**	**Rsr selection is suitable since its not less than 65%**

Minimum Fault sensitivity

The offered CT Im		30 mA
Ip	T * (Ir + nIm + IM)	
Ir		0.20 A
Im at Vs'		$\frac{\text{Im at } U_{al} \text{ x } Vs_A}{U_{al}}$
		30 x 95 / 500
		0.00570 A
Total Im for 17 CTs		17 x 0.0057
nIm		0.097 A
IM at Vs		$0.52*(\text{sqrt}(2)*Vi / C)^{1/b}$
C		540
b		0.25
		0.52 x (SQRT(2) x 95/ 540)^4
		0.00199 A
Ip		T * (Ir + nIm + IM)
		4000 x (0.2 + 0.0969 + 0.00199)
		1195.6 A

The Sensitivity of the bus bar Protection is 29.89% of CT rating

10.2 13.8 KV BB Differential Protection (High Impedence) CT Supervision Relay

Circuit Ref :	BUS 1B, 2B & 3B	**Relay Designation**	95B1-A, 95B1-B, 95B1-C, 95B2-A, 95B2-B, 95B2-C, 95B3-A, 95B3-B, 95B3-C	**Relay Type**	MVTP11	**Make**	Areva

Source fault level	=	25000	A
Type of protection	=	CT Secondary Supervision	
Type of relay	=	MVTP	
Tr. T601 Ful load current	=	2803	A
Sensitivity required	=	10% of load current	
Sensitivity required	=	280.3	A
CT Ratio	=	4000/1A	
CT secondary resistance R_s	=	14	Ohms
Lead resistance (6 sq mm cable) R_p	=	1.05	Ohms
	=		
Voltage developed across the relay			
Current reflected in CT secondary	=	280.3/(4000/1)	A
	=	0.0701	A
V	=	Current x (R_s + R_p + R_{sr})	
V	=	0.07(14+1.05 + 450)	V
	=	32.588	V
	=	33	V
Selected voltage tap in the relay	**=**	**2**	V
Time setting	**=**	**3**	**s**

11.1 115KV BCU SYNCHROCHECK FUNCTION SETTING

Circuit Ref :	A601, A602, A603, A604, A605, A606, A607, A608, A609, A611, A614, A617	**Relay Designation**	BCU	**Relay Type**	REC 670	**Make**	ABB	**Doc. Ref**	
Aux. Voltage	125V	**CT Ratio**	–	**PT Ratio**	**115kV/sqrt3 : 115/sqrt3 -115x 115/sqrt3 - 115V**				
Nominal Current	–	**Rated Voltage**	Ur=110V AC	**Freq**	60HZ				

Synchro Check Relay - REC670 for 115 KV

Substation		QATIF 115/13.8KV SUBSTATION NO.2	
System voltage:		115 KV	
PT sec. Voltage: U1	L-N (line)	115/R3 =	66.4 V
PT sec. Voltage: U2	L-N (Bus)	115/R3 =	66.4 V
System Frequency		60 Hz	
Relay Details		REC670	
SETTINGS			
Base Voltage in kV (UBase)		115.0 kV	
Voltage Difference limit		15 %UBase	
Phase shift for Auto & Manual		20.00 deg	
Frequency diff for Auto & Manual		0.200 HZ	
Breaker closing Time		0.080 s	
Bus voltage high limit		80 %UBase	
Line voltage high limit		80 %UBase	
Time delay output for Synch Auto		0.100 s	
Time delay output for Synch Auto		0.100 s	

12.1 115/13.8KV POWER TRANSFORMER AVR SETTING

Input data

Rating of Power transformer	=	**67 MVA ONAF**	
Voltage ratio of Power transformer	=	115/13.8 KV	
Vector group	=	Dyn1	
% Impedance (HV-LV)	=	22.0%	@50MVA
Tap range	=	+12.5% to -20%	
Type of relay	=	MR - TAPCON260	

Relay settings

Mode of operation	
Local / Remote	REMOTE
Auto / Manual	Auto
Desired voltage level	115
Bandwidth	0.750%
Delay timer 1	30s
Delay timer 2	5s
Under voltage blocking U<	90%
Over voltage detection U>	110%
Over current blocking I>	77%

Measuring transformer

Voltage transformer	13.8 KV
Current transformer	4000/1A
Phase angle between current path and voltage path	90 Deg

LDC

Ur	0
Ux	0

Z compensation

Voltage raise	0
Limitation	0

Parallel control

Master / follower	Master / follower

CT Parameter

Ratio:	4000-3000-2500-2000-1500-1000/1A
Adopted tap:	4000/1A
Class:	CL 0.5
Burden:	30VA

TR. parameter

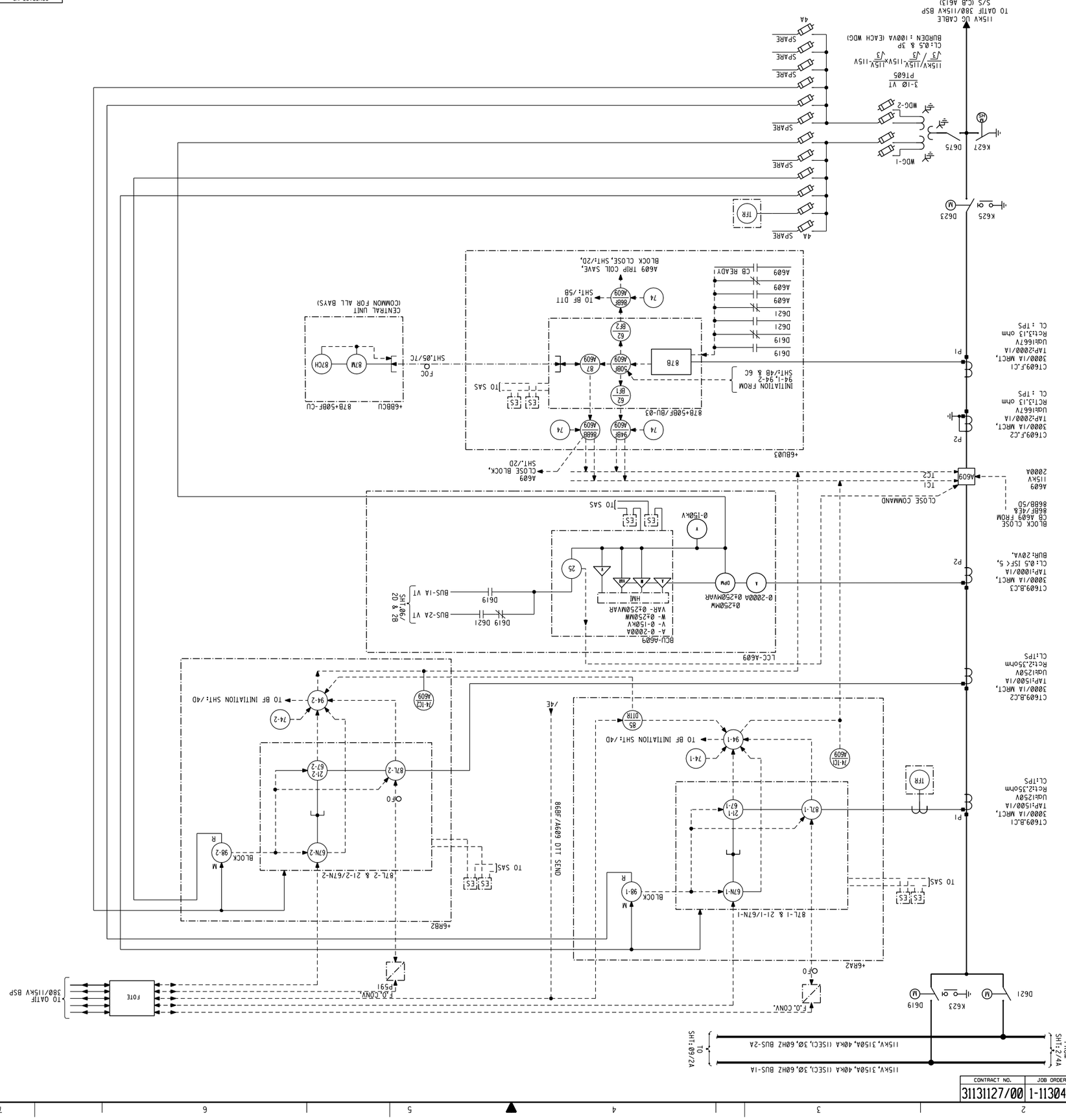
Tr Rating:	67 MVA ONAF
Tr % impedance:	22% @ 50MVA
Voltage rating	115/13.8KV
Vector Group	Dyn1
Tap range	+12.5% to -20%

VT parameter

Ratio:	13800/115V

ANNEXURE-A

(Relay and metering one line diagram)



CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	01 of 15	0

NO-A (2012/01)

DMS | VECTOR

NG-A00

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87L-1 21-1 67N-1	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-1Ø 21-1/ 67N-1/	RED 670	ABB
87L-2 21-2 67-2 67N-2	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-2Ø 21-2/ 67N-2/	P546	ALSTOM
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-09	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74-1 74-2 74/94BF 74/86BB 74/86BF	SPER1CI	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-1C1 74-1C2	MVAX31	ALSTOM
85OTTR	DIRECT TRANSFER TRIP RECEIVING RELAY	85OTTR	AR	ABB
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-1 94-2 94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-1 98-2 98-L 98-BUS	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A609	REC670	ABB

ABBREVATIONS;

— o —	FIBRE OPTIC CABLE (FOC)
M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
ES	ETHERNET SWITCH
SAS	SUBSTATION AUTOMATION SYSTEM
FOTE	FIBER OPTIC TERMINAL EQUIPMENT
6RA1	QATIF 115KV UG LINE-1 SET-1 FRONT PANEL
6RB1	QATIF 115KV UG LINE-1 SET-2 FRONT PANEL
6BBU	115KV BUSBAR PROTN PANEL FOR CENTRAL UNIT
6BU1	115KV BUSBAR BAY UNIT PANEL FOR (A609)
LCC-A603	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-22138J
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	P1S- 11EN46
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	--
	-
	-

RELAYING AND METERING ONE LINE DIAGRAM

LINE-1 115KV UG TO QA1F BSP S/S (A609)

QA1F 115/13.8KV SUBSTATION NO. 2

SAUDI ARABIA

REV.	DATE	BY	DESCRIPTION
0	03.2013	DAR	ISSUED FOR CONSTRUCTION
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN
A	05.2012	DAR	FIRST ISSUE

DRAWING COMPLETION CERTIFICATE (DCC):

DRAWN BY G.MUSTAFA	CHECKED BY OSAMA/ZAHID	SCALE:	N.T.S
DATE STARTED 08.05.2012	DATE COMPLETED		
OPRG. DEPT.	ENG. DEPT.		

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED

BY DATE

CONTRACTOR'S CONSULTANT:

DAR ENGINEERING
ENGINEERS & DESIGNERS
P.O.BOX 10103
DAMMAM-31493

AS-BUILT BY DATE

DMS | VECTOR

NG-A (2012/01)

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	02 of 15	0

DATIF — SAUDI ARABIA

RELAYING AND METERING ONE LINE DIAGRAM

115kV U/G LINE TO DATIF BSP S/S (CB A609) (A611)

DATIF 115/13.8kV SUBSTATION NO. 2

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED	CERTIFIED BY _____ DATE _____

OPRG. DEPT. _____ ENG. DEPT. _____

DATE STARTED 08.05.2012. DATE COMPLETED _____

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S

National Grid SA — الشركة الوطنية لنقل الكهرباء

DRAWING COMPLETION CERTIFICATE (DCC):

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

CONSULTANTS:
DAR ENGINEERING
ENGINEERS & DESIGNERS
P.O.BOX 10100
DAMMAM-31493

AS-BUILT BY _____ DATE _____

ABBREVATIONS:

	FIBRE OPTIC CABLE (FOC)
M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
SAS	SUBSTATION AUTOMATION SYSTEM
ES	ETHERNET SWITCH
FOTE	FIBER OPTIC TERMINAL EQUIPMENT
6RA1	DATIF 115kV UG LINE-1 SET-1 FROTN.PANEL
6RB1	DATIF 115kV UG LINE-1 SET-2 FROTN.PANEL
6BUI	115kV BUSBAR BAY UNIT PANEL FOR CENTRAL UNIT
6BUCU	115kV BUSBAR FROTN.PANEL FOR CENTRAL UNIT
LCC-A603	LOCAL CONTROL PANEL FOR (A609)
CICT	CURRENT ISOLATING CT TFR

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87L-1 21-1 67N-1	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-1& 21-1/ 67N-1/	RED 670	ABB
87L-2 21-2 67-2 67N-2	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-2& 21-2/ 67N-2/	P546	ALSTOM
50BF 62-BF1 62-BF2 87BB	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-09	REB500	ABB
74	SUPERVISION RELAY FOR TRP RELAY	74-1 74-2 74/94BF 74/86BB	SPER1CI	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-1C1 74-1C2	MVAX31	ALSTOM
85DTTR	DIRECT TRANSFER TRIP RECEIVING RELAY	85DTTR	AR	ABB
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-1 94-2 94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-1 98-2 98-L 98-BUS	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A609	REC670	ABB

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-22138?
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	P1S- 11EN46
MAIN SWITCHING ONE LINE DIAGRAM	EA- 22147?
	-
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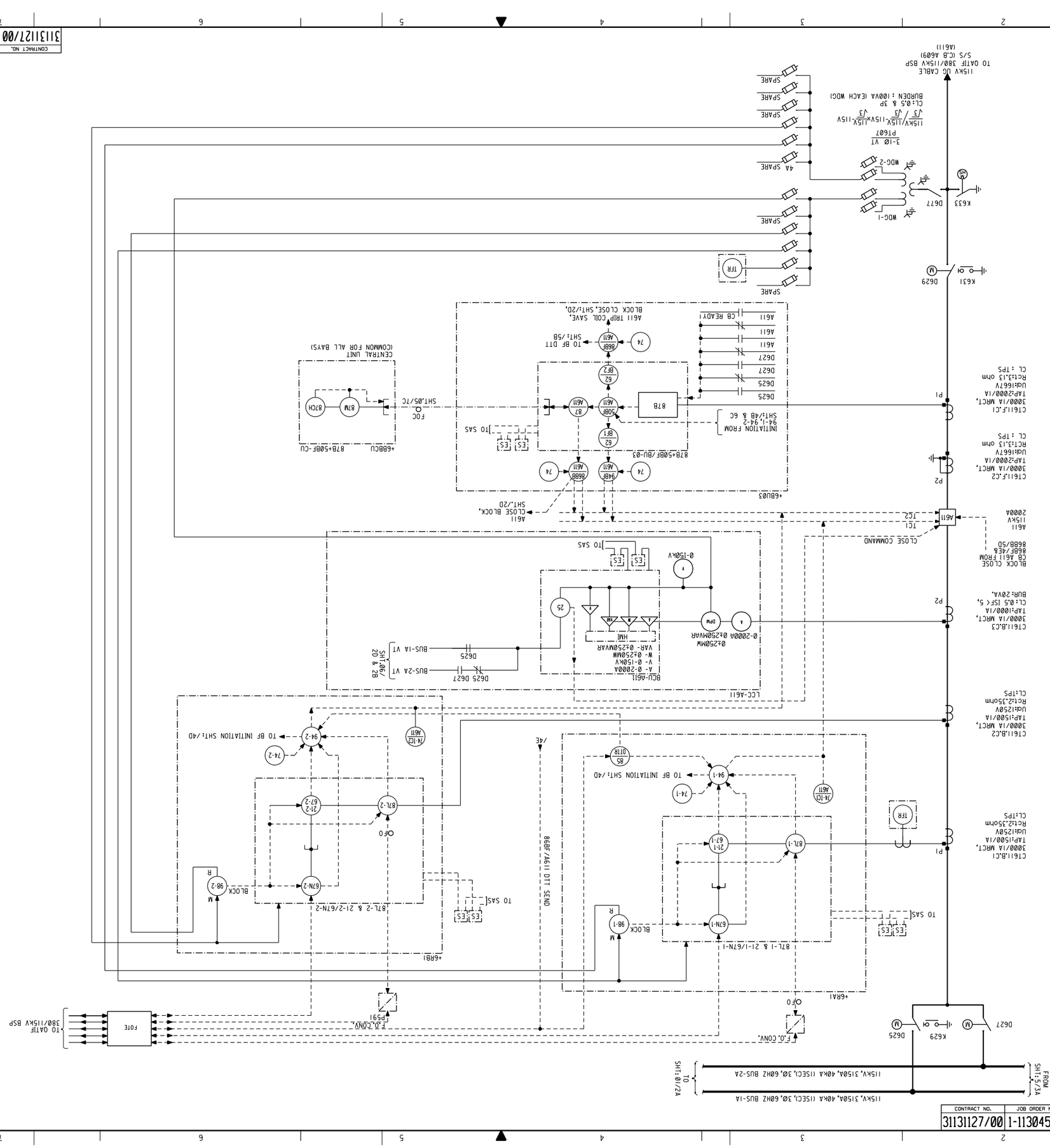
	-

NOTES

1. DRAWING NOTE



CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	03 of 15	0

FROM SHT: 1/2A

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-1C

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-2C

TO SHT: 4/2A

D620 (M) K620 D618 (M)

F.O. CONV. FO +6RA3

FOTE — TO QATIF 380/115kV BSP

F.O. CONV. P591 FO +6RB3

87L-1 & 21-1/67N-1: 67N-1, BLOCK, 98-1 (M, R), ES ES TO SAS

87L-2 & 21-2/67N-2: 67N-2, BLOCK, 98-2 (M, R), ES ES TO SAS

86BF/A606 DTT SEND → /4E

CT606.B.C1
3000/1A MRCT,
TAP:1500/1A
Uak:1250V
Rct:2.35ohm
CL:TPS

P1 — TFR — 74-1C1 A606 — 87L-1 — 21-1 67-1 — 74-1 — 94-1 → TO BF INITIATION SHT: /4D — 85 DTTR

87L-2 — 21-2 67-2 — 74-2 — 94-2 → TO BF INITIATION SHT: /4D — 74-1C2 A606

CT606.B.C2
3000/1A MRCT,
TAP:1500/1A
Uak:1250V
Rct:2.35ohm
CL:TPS

LCC-A606

BCU-A606
A- 0-2000A
V- 0-150kV
W- 0±250MW
VAR- 0±250MVAR
HMI

D618 D620 — BUS-2C VT
D618 — BUS-1C VT
SHT.08/ 2D & 2E

0±250MW
0-2000A 0±250MVAR
A — DPM — W — VAR — V — A — 25

0-150kV — ES ES TO SAS

CT606.B.C3
3000/1A MRCT,
TAP:1000/1A
CL: 0.5 ISF< 5,
BUR: 20VA.

P2

BLOCK CLOSE CB A606 FROM 86BF/4E& 86BB/5D

CLOSE COMMAND

A606 115kV 2000A — TC1 TC2

A606 CLOSE BLOCK, SHT./2D

CT606.F.C2
3000/1A MRCT,
TAP:2000/1A
Uak:1667V
RCT:3.13 ohm
CL : TPS

P2

CT606.F.C1
3000/1A MRCT,
TAP:2000/1A
Uak:1667V
Rct:3.13 ohm
CL : TPS

P1

+6BU08

74 — 94BF A606 — 86BB A606 — 74

87B+50BF/BU-08: 62 BF1 — 50BF A606 — 87 A606 — 62 BF2

INITIATION FROM 94-1, 94-2 SHT:/4B &6C

87B

D618 D618 D620 D620 A606 A606 A606 — CB READY!

74 — 86BF A606 → TO BF DTT SHT: /5B

A606 TRIP COIL SAVE, BLOCK CLOSE, SHT:/2D,

ES ES TO SAS

+6BBCU 87B+50BF-CU

FOC SHT.05/7C

87M — 87CH

CENTRAL UNIT (COMMON FOR ALL BAYS)

K622 D622 (M) — TFR — SPARE SPARE

K624 D674 (MS) — WDG-1 WDG-2 — SPARE SPARE SPARE SPARE SPARE

3-1Ø VT
PT604
115kV/√3 / 115V/√3 : 115V × 115V/√3 : 115V
CL: 0.5 & 3P
BURDEN : 100VA (EACH WDG)

115KV U/G CABLES TO QATIF 380/115kV BSP S/S (CB A608) (A606)

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87L-1 21-1 67-1 67N-1	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-1& 21-1/ 67N-1/	RED 670	ABB
87L-2 21-2 67-2 67N-2	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-2& 21-2/ 67N-2/	P546	ALSTOM
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-09	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74-1 74-2 74/94BF 74/86BF 74/86BB	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	ALSTOM
85DTTR	DIRECT TRANSFER TRIP RECEIVING RELAY	85DTTR	AR	ABB
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-1 94-2 94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-1 98-2 98-C 98-BUS	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A606	REC670	ABB

ABBREVIATIONS:

-o-	FIBRE OPTIC CABLE (FOC)
M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
SAS	SUBSTATION AUTOMATION SYSTEM
ES	ETHERNET SWITCH
FOTE	FIBER OPTIC TERMINAL EQUIPMENT
6RA2	QATIF 115KV UG LINE-2 SET-1 PROTN.PANEL
6RB2	QATIF 115KV UG LINE-2 SET-2 PROTN.PANEL
6BBCU	115KV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BU08	115KV BUSBAR BAY UNIT PANEL FOR (A606)
LCC-A606	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	-
	--
	-

CONTRACTOR'S CONSULTANT:
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ENGINEERS & DESIGNERS
P.O.BOX 13103
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الدار الدولية للمهندسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHK'D.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء — نقل الكهرباء National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S

DATE STARTED 08.05.2012. DATE COMPLETED _____

OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED — CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
LINE-1 115kV UG TO QATIF BSP S/S (A606)
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	03 of 15	0

NG-A (2012/01)

DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	04 of 15	0

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-1C

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-2C

FROM SHT: 03/3A

TO SHT: 5/4A

D626 K626 D624

F.O. CONV.

FO

+6RA4

87L-1 & 21-1/67N-1

67N-1

BLOCK 98-1 M R

ES ES TO SAS

87L-1

21-1 67-1

74-1

94-1 → TO BF INITIATION SHT: /4D

B5 DTTR

74-1C1 A608

86BF/A608 DTT SEND

/4E

F.O. CONV. P591

FOTE → TO QATIF 380/115kV BSP

+6RB4

FO

87L-2 & 21-2/67N-2

67N-2

BLOCK 98-2 M R

ES ES TO SAS

87L-2

21-2 67-2

74-2

94-2 → TO BF INITIATION SHT: /4D

74-1C2 A608

CT608.B.C1
3000/1A MRCT,
TAP:1500/1A
Uak:1250V
Rct:2.35ohm
CL:TPS

P1

TFR

CT608.B.C2
3000/1A MRCT,
TAP:1500/1A
Uak:1250V
Rct:2.35ohm
CL:TPS

CT608.B.C3
3000/1A MRCT,
TAP:1000/1A
CL: 0.5 ISF< 5,
BUR: 20VA.

P2

LCC-A608

BCU-A608
A- 0-2000A
V- 0-150kV
W- 0±250MW
VAR- 0±250MVAR
HMI

0±250MW
0-2000A 0±250MVAR

A DPM

V 0-150kV

25

ES ES TO SAS

D624 D626 BUS-2C VT

D624 BUS-1C VT

SHT.08/ 2D & 2E

BLOCK CLOSE CB A608 FROM 86BF/4E& 86BB/5D

CLOSE COMMAND

A608 115kV 2000A

TC1

TC2

A608 CLOSE BLOCK, SHT./2D

CT608.F.C2
3000/1A MRCT,
TAP:2000/1A
Uak:1667V
RCT:3.13 ohm
CL : TPS

CT608.F.C1
3000/1A MRCT,
TAP:2000/1A
Uak:1667V
Rct:3.13 ohm
CL : TPS

+6BU09

87B+50BF/BU-09

INITIATION FROM 94-1, 94-2 SHT:/4B &6C

87B

74 94BF A608 86BB A608 74

62 BF1

50BF A608

87 A608

62 BF2

74 86BF A608 → TO BF DTT SHT: /5B

ES ES TO SAS

D624
D624
D626
D626
A608
A608
A608 CB READY

A608 TRIP COIL SAVE, BLOCK CLOSE, SHT:/2D,

FOC SHT.05/7C

+6BBCU 87B+50BF-CU

87M 87CH

CENTRAL UNIT (COMMON FOR ALL BAYS)

K628 D628

SPARE

TFR

SPARE

K630 D674

WDG-1

WDG-2

SPARE

SPARE

SPARE

SPARE

3-1Ø VT
PT606

115kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V

CL: 0.5 & 3P
BURDEN : 100VA (EACH WDG)

115KV U/G CABLES TO QATIF 380/115kV BSP S/S (CB A606) (A608)

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87L-1 21-1 67-1 67N-1	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-1& 21-1/ 67N-1/	RED 670	ABB
87L-2 21-2 67-2 67N-2	LINE DIFFERENTIAL PROTN. LINE DISTANCE PROTN. DIRECTIONAL O/C PROTN. DIRECTIONAL E/F PROTN.	87L-2& 21-2/ 67N-2/	P546	ALSTOM
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-09	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74-1 74-2 74/94BF 74/86BF 74/86BB	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	ALSTOM
85DTTR	DIRECT TRANSFER TRIP RECEIVING RELAY	85DTTR	AR	ABB
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-1 94-2 94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-1 98-2 98-C 98-BUS	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A606	REC670	ABB

ABBREVIATIONS:

-O-	FIBRE OPTIC CABLE (FOC)
M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
SAS	SUBSTATION AUTOMATION SYSTEM
ES	ETHERNET SWITCH
FOTE	FIBER OPTIC TERMINAL EQUIPMENT
6RA2	QATIF 115KV UG LINE-2 SET-1 PROTN.PANEL
6RB2	QATIF 115KV UG LINE-2 SET-2 PROTN.PANEL
6BBCU	115KV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BU09	115KV BUSBAR BAY UNIT PANEL FOR (A608)
LCC-A606	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
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	-

CONTRACTOR'S CONSULTANT:
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الدار الدولية للمهندسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHK'D.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء
نقل الكهرباء National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S

DATE STARTED 08.05.2012. DATE COMPLETED _____

OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY _____ DATE _____

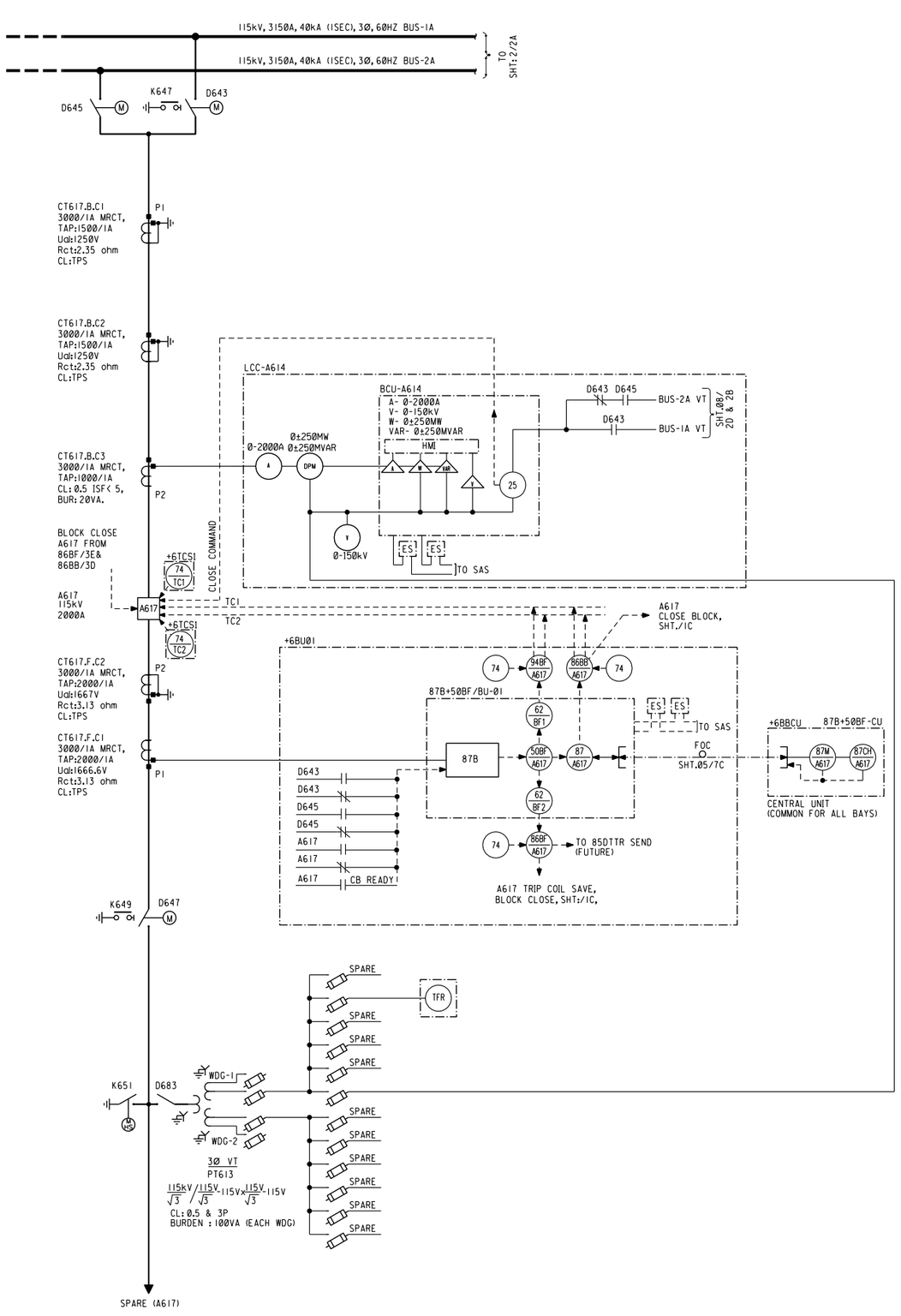
RELAYING AND METERING ONE LINE DIAGRAM
115kV U/G LINE TO QATIF BSP S/S (CB-A606) (A608)
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

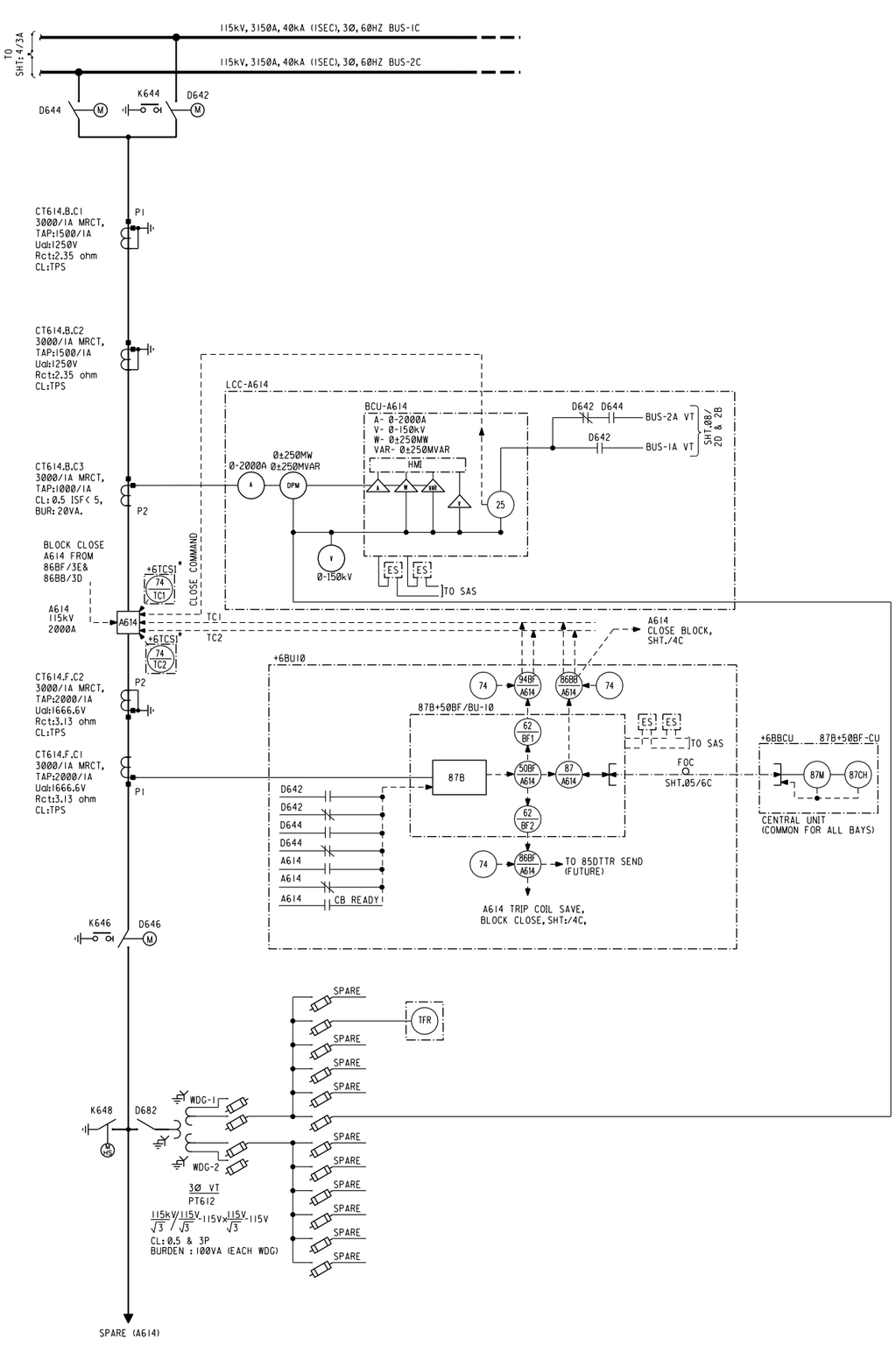
CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	04 of 15	0

NG-A (2012/01)

DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	05 of 15	0





NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B +50BF /BU-09	REB500	ABB
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B +50BF /BU-10	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74/94BF 74/86BF 74/86BB	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	ALSTOM
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-L 98-BUS	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A617	REC670	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A6014	REC670	ABB

ABBREVATIONS:

FOC	FIBRE OPTIC CABLE (FOC)
M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
BCP	BAY CONTROL PANEL
ES	ETHERNET SWITCH
SAS	SUBSTATION AUTOMATION SYSTEM
6BBCU	115KV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BU1	115KV BUSBAR BAY UNIT PANEL FOR (A617)
6BU10	115KV BUSBAR BAY UNIT PANEL FOR (A614)
+6TCS1	115KV TRIP CIRCUIT SUPERVISION PANEL
LCC-A617	LOCAL CONTROL PANEL
LCC-A614	LOCAL CONTROL PANEL

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
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	-

CONTRACTOR'S CONSULTANT:
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مهندسون ومستشارون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

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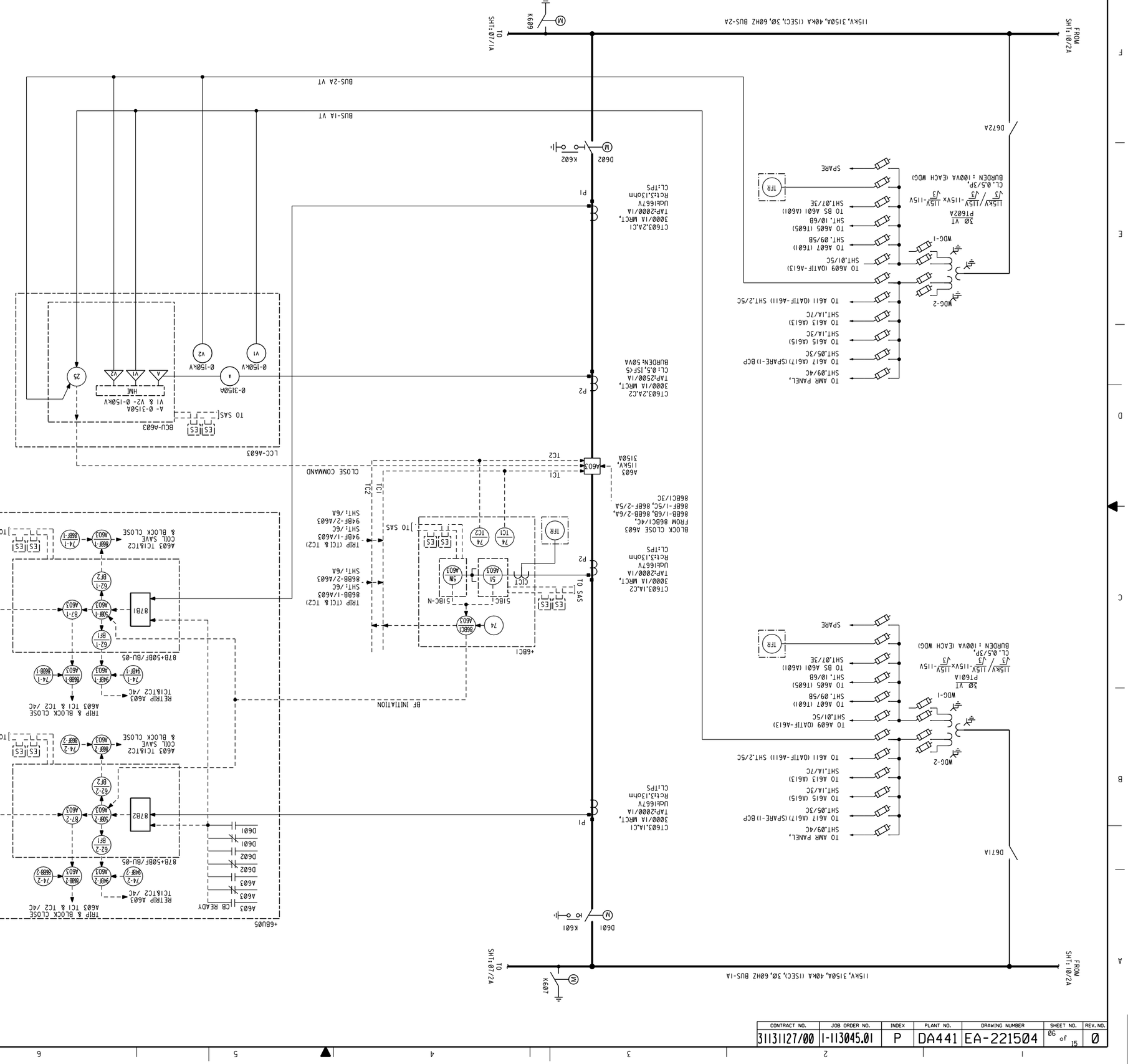
DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012. DATE COMPLETED _____
OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED
CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
115kV SPARE LINE-1 (A617) & LINE-2 (A614)
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	05 of 15	0

NG-A (2012/01)
DMS VECTOR NGA00



CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
3113112700	I-113045.01	P	DA441	EA-221504	06 of 15	0

NO-A (2012/01)

DMS | VECTOR

NGA00

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
50BF	BREAKER FAILURE PROTN.	87B+ 50BF/ BU-03	RED500	ABB
62-BF1	BF STAGE-1 TIMER			
62-BF2	BF STAGE-2 TIMER			
87B1 &2	BUSBAR DIFFERENTIAL PROTN.			
51BC-N	NON DIRECTIONAL O/C & E/F PROTN.	51N	P142	ALSTOM
74	SUPERVISION RELAY FOR TRP RELAY	74/94BF 74/86BB 74/86BC1	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	ALSTOM
86BB-1 86BB-2	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF-1	BREAKER FAILURE PROTN TRIP	86BF	LOR/HR	ES
86BF-2	LOCKOUT RELAY			
86BC1	BUSCOUPLER-1 PROTN TRP LOCKOUT RELAY	86BC1	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF -CU	RED500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
98	VT FUSE SUPERVISION RELAY	98-1A 98-2A	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A603	REC670	ABB

ABBRVATIONS:

M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
BCP	BAY CONTROL PANEL
FO	FIBRE OPTIC CABLE (FOC)
ES	ETHERNET SWITCH
BPP	BAY PROTECTION PANEL
SAS	SUBSTATION AUTOMATION SYSTEM
IED-EC	INTELLIGENT ELECTRONIC DEVICE FOR EMERGENCY CONTROL
IED-C	INTELLIGENT ELECTRONIC DEVICE FOR CONTROL
6BUS	115kV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BUCU	115kV BUSBAR BAY UNIT PANEL FOR (A603)
+6BC1	115kV BUS COUPLER 1A/2A PROTN.PANEL
LCC-A603	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING NO.	DRAWING TITLE
EE-22138J	DRAWING CONTROL SHEET
P1S- 11EN146	SCOPE OF WORK & TECHNICAL SPECIFICATIONS
EA- 221470	MAIN SWITCHING ONE LINE DIAGRAM
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-	

CONTRACTORS CONSULTANT:

DAR ENGINEERING
ENGINEERS & DESIGNERS
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AS-BUILT BY ____ DATE ____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012 DATE COMPLETED ____
OPRG. DEPT. ____ ENG. DEPT. ____

CERTIFIED THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED
BY ____ DATE ____

RELAYING AND METERING ONE LINE DIAGRAM
115kV BUS COUPLER-1 (A603)
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	07 of 15	0

FROM SHT: 06/4F

115kV, 3150A, 40kA (1SEC), BUS-2A

D604

115kV, 3150A, 40kA (1SEC), BUS-2B

TO SHT: 08/1F

FROM SHT: 06/4A

115kV, 3150A, 40kA (1SEC), BUS-1A

D603 K603

CT601.1A.C1
3000/1A MRCT,
TAP:2000/1A
Ual:1667V
Rct:3.13ohm
CL:TPS

P1

CT601.1A.C2
3000/1A MRCT,
TAP:2500/1A
CL: 0.5, ISF<5
BURDEN: 50VA

P2

115kV, 3150A, 40kA (1SEC), BUS-1B

BF INITIATION

+6BS1

74 86BS A601

ES ES

5IBS 5IBS-N

CICT

51 A601 5N A601

TFR

74 TC1 74 TC2

ES ES TO SAS

TRIP (TC1 & TC2)
86BB-1/A601
SHT: /6C
86BB-2/A601
SHT: /6A

TRIP (TC1 & TC2)
94BF-1/A601
SHT: /4C
94BF-2/A601
SHT: /4A

TC1 TC2

BLOCK CLOSE A601
FROM 86BS/4C,
86BB-1/6B, 86BB-2/6A,
86BF-1/5C, 86BF-2/5A
86BS/2D

A601
115kV,
3150A

CLOSE COMMAND

CT601.1C.C2
3000/1A MRCT,
TAP:2000/1A
Ual:1667V
Rct:3.13ohm
CL:TPS

P2

CT-2B
3000/1A MRCT,
TAP:2500/1A
CL: 0.5, ISF<5
BURDEN: 50VA

P1

P2

115kV, 3150A, 40kA (1SEC), BUS-1B

CT601.1C.C1
3000/1A MRCT,
TAP:2000/1A
Ual:1667V
Rct:3.13ohm
CL:TPS

P1

D606 K604

D605 K605

115kV, 3150A, 40kA (1SEC), BUS-2C

TO SHT: 08/1F

115kV, 3150A, 40kA (1SEC), BUS-1C

TO SHT: 08/1A

+6BU06

A601 CB READY
A601
A601
D603
D603
D605
D605
D604
D604
D606
D606

TRIP A601 TC1 & TC2 /4C
BLOCK CLOSE /2D

RETRIP A601
TC1&TC2 /4C

74-2 94BF-2 94BF-2 A601 86BB-2 A601 74-2 86BB-2

87B+50BF/BU-06

62-2 BF1

87B2

50BF-2 A601 87-2 A601

62-2 BF2

95 B-2

A601 TC1&TC2
COIL SAVE
& BLOCK CLOSE

86BF-2 A601 74-2 86BF-2 ES ES TO SAS

TRIP A601 TC1 & TC2 /4C
BLOCK CLOSE /2D

RETRIP A601
TC1&TC2 /4C

74-1 94BF-1 94BF-1 A601 86BB-1 A601 74-1 86BB-1

87B+50BF/BU-06

62-1 BF1

87B1

50BF-1 A601 87-1 A601

62-1 BF2

95 B-1

A601 TC1&TC2
COIL SAVE
& BLOCK CLOSE

86BF-1 A601 74-1 86BF-1 ES ES TO SAS

+6BBCU 87B+50BF-CU

FOC /7C

87M 87CH

CENTRAL UNIT
(COMMON FOR ALL BAYS)

LCC-A601

ES ES TO SAS

BCU-A601

A1 & A2 - 0-3150A
HMI

0-3150A A1 A1

0-3150A A2 A2

25

SHT: 06/2A BUS-IA VT

SHT: 08/2B BUS-IC VT

A601 A602 A603

+6BBCU

A614 A612 A610 A608 A606 A604

87B CU
BUSBAR PROTN.
CENTRAL UNIT

A617 A615 A613 A611 A609 A607 A605

ES ES TO SAS

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EOP	TYPE	MAKE
50BF 62-BF1 62-BF2 87B1 &2	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF /BU-01	REB500	ABB
51BS 51BS-N	NON DIRECTIONAL O/C & E/F PROTN.	51 5IN	P142	ALSTOM
74	SUPERVISION RELAY FOR TRIP RELAY	74/94BF 74/86BF 74/86BB 74/86BS	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	ALSTOM
86BB-1 86BB-2	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF-1 86BF-2	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
86BS	BUS SECTION PROTN TRIP LOCKOUT RELAY	86BS	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK ZONE	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
95	CURRENT SUPERVISION RELAY	95B-1 95B-2	-----	-----
98	VT FUSE SUPERVISION RELAY	98-1A 98-1C	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A601	REC670	ABB

ABBREVIATIONS;

M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
	FIBRE OPTIC CABLE (FOC)
BCP	BAY CONTROL PANEL
BPP	BAY PROTECTION PANEL
ES	ETHERNET SWITCH
SAS	SUBSTATION AUTOMATION SYSTEM
IED-EC	INTELLIGENT ELECTRONIC DEVICE FOR EMERGENCY CONTROL
IED-C	INTELLIGENT ELECTRONIC DEVICE FOR CONTROL
6BBCU	115KV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BU6	115KV BUSBAR BAY UNIT PANEL FOR (A601)
6BS1	115KV BUS SECTION 1B PROTN. PANEL
BCP-A601	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
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	-

CONTRACTOR'S CONSULTANT:
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ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
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A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

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DATE STARTED 08.05.2012. DATE COMPLETED _____

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CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
115kV BUS SECTION (A601)
QATIF 115/13.8kV SUBSTATION NO. 2

QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	07 of 15	0

NG-A (2012/01)

DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	08 of 15	0

FROM SHT:07/2F

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-IC

TO SHT:11/1A

K606

D608 K610

D671C

CT602.1C.C1
3000/1A MRCT,
TAP:2000/1A
Udi:1667V
Rct:3.13ohm
CL:TPS

P1

CT602.1C.C2
3000/1A MRCT,
TAP:2000/1A
Udi:1667V
Rct:3.13ohm
CL:TPS

P2

TO AMR PANEL, SH: 9/4C

TO SPARE-2 (A614) BCP
SHT.05/6C

TO A612 (A612)
SHT.2A/7C

TO A610 (A610)
SHT.2A/3C

TO A608 (OATIF-A608).
SHT.04/5C

WDG-2

WDG-1

TO A606 (OATIF-A606)
SHT.03/5C

TO A604, SHT.11/5C

TO A601 (A601) BS
SHT.07/3F

3Ø VT
PT601C

115kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V
CL: 0.5/3P,
BURDEN : 100VA (EACH WDG)

TFR

SPARE

SPARE

+6BC2

74 86BC1 A603

ES ES TO SAS

51BC 51 A603 51BC-N 51N A603

CICT

74 TC1 74 TC2

ES ES TO SAS

TFR

BLOCK CLOSE A602
FROM 86BC2/4C,
86BB-1/6B, 86BB-2/6A,
86BF-1/5C, 86BF-2/5A
86BC2/3C

TRIP (TC1& TC2)
86BB-1/A602
SHT: /6C
86BB-2/A602
SHT: /6A

TRIP (TC1& TC2)
94BF-1/A602
SHT: /6C
94BF-2/A602
SHT: /6A

TC1 TC2

A602
115kV,
3150A

A602

TC1

TC2

CLOSE COMMAND

BF INITIATION

+6BU07

A602 CB READY
A602
A602
D610
D610
D608
D608

TRIP & BLOCK CLOSE
A602 TC1 & TC2 /4C

RETRIP A602
TC1&TC2 /4C

74-2 94BF-2 A602 86BB-2 A602 74-2 86BB-2

87B+50BF/BU-07

62-2 BF1

87B2

50BF-2 A602 87-2 A602

62-2 BF2

A602 TC1&TC2
COIL SAVE
& BLOCK CLOSE

86BF-2 A602 74-2 86BF-2 ES ES TO SAS

FOC
SHT.05/7C

+6BBCU 87B+50BF-CU

87M 87CH

CENTRAL UNIT
(COMMON FOR ALL BAYS)

TRIP & BLOCK CLOSE
A602 TC1 & TC2 /4C

RETRIP A602
TC1&TC2 /4C

74-1 94BF-1 A602 86BB-1 A602 74-1 86BB-1

87B+50BF/BU-07

62-1 BF1

87B1

50BF-1 A602 87-1 A602

62-1 BF2

A602 TC1&TC2
COIL SAVE
& BLOCK CLOSE

86BF-1 A602 74-1 86BF-1 ES ES TO SAS

FOC
SHT.05/7C

LCC-A602

ES ES TO SAS

BCU-A602

A- 0-3150A
V1 & V2- 0-150kV
HMI

0-3150A A

0-150kV V1

0-150kV V2

A V1 V2 25

CT602.2C.C2
3000/1A MRCT,
TAP:2500/1A
CL: 0.5, ISF<5
BURDEN: 50VA

P2

TO AMR PANEL, SH: 9/4C

TO SPARE-2 (A614) BCP
SHT.05/6C

TO A612 (A612)
SHT.2A/7C

TO A610 (A610)
SHT.2A/3C

TO A608 (OATIF-A608).
SHT.04/5C

WDG-2

WDG-1

TO A606 (OATIF-A606)
SHT.03/5C

TO A604, SHT.11/5C

TO A601 (A601) BS
SHT.07/3F

3Ø VT
PT602C

115kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V
CL: 0.5/3P,
BURDEN : 100VA (EACH WDG)

TFR

SPARE

SPARE

CT602.2C.C1
3000/1A MRCT,
TAP:2000/1A
Udi:1667V
Rct:3.13ohm
CL:TPS

P1

D610 K612

D672C

BUS-1C VT

BUS-2C VT

FROM SHT:07/1F

115kV, 3150A, 40kA (ISEC), 3Ø, 60HZ BUS-2C

TO SHT:11/1A

K608

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EOP	TYPE	MAKE
50BF 62-BF1 62-BF2 87B1 &2	BREAKER FAILURE PROTN. BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN. RELAY	87B+ 50BF/ BU-02	REB500	ABB
51BC 51BC-N	NON DIRECTIONAL O/C & E/F PROTN.	51 51N	P142	ALSTOM
74	SUPERVISION RELAY FOR TRIP RELAY	74/94BF 74/86BF 74/86BB 74/86BC2	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1 74-TC2	MVAX31	AREVA
86BB-1 86BB-2	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF-1 86BF-2	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
86BC2	BUSCOUPLER-2 PROTN TRIP LOCKOUT RELAY	86BC2	LOR/HR	ES
87M 87CH	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK ZONE	87B+ 50BF -CU	REB500	ABB
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
98	VT FUSE SUPERVISION RELAY	98-1C 98-2C	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-A602	REC670	ABB

ABBREVIATIONS:

M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
FOC	FIBRE OPTIC CABLE (FOC)
BCP	BAY CONTROL PANEL
BPP	BAY PROTECTION PANEL
ES	ETHERNET SWITCH
SAS	SUBSTATION AUTOMATION SYSTEM
FOTE	FIBER OPTIC TERMINAL EQUIPMENTS
IED-EC	INTELLIGENT ELECTRONIC DEVICE FOR EMERGENCY CONTROL
IED-C	INTELLIGENT ELECTRONIC DEVICE FOR CONTROL
6BBCU	115KV BUSBAR PROTN.PANEL FOR CENTRAL UNIT
6BU07	115KV BUSBAR BAY UNIT PANEL FOR (A602)
+6BC2	115KV BUS COUPLER IC/2C PROTN. PANEL
LCC-A602	LOCAL CONTROL PANEL
CICT	CURRENT ISOLATING CT TFR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	-
	--
	-

CONTRACTOR'S CONSULTANT:
DAR ENGINEERING
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P.O.BOX 13103
DAMMAM-31493

الدار الدولية للهندسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء
National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S

DATE STARTED 08.05.2012. DATE COMPLETED _____

OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
115kV BUS COUPLER-2 (A602)
QATIF 115/13.8kV SUBSTATION NO. 2

QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	08 of 15	0

NG-A (2012/01)

DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	09 of 15	0

115kV, 3150A, 40kA (1SEC), 3Ø 60HZ, BUS-1A
115kV, 3150A, 40kA (1SEC), 3Ø 60HZ, BUS-2A
FROM SHT: 01/4A
TO SHT: 01/1A
K617 D613 D615
+6T1A1
+6T1B1
TO SAS
CICT
87T
87REF
TFR
CB A301 TRIP TC1 /2F
CB A301 BLOCK CLOSE
ABTS INITIATION
TO INITIATE BF (A607)
SHT. /5B
CB A607 TRIP TC1 /3B
CB A607 BLOCK CLOSE /2B
+T601 MK
+LCC-A607
BCU - A607
A- 0-600A
V- 0-150kV
W- 0±80MW
VAR- 0±80MVAR
HMI
0-150kV
0±80MVAR
0±80MW
0-600A
DPM
D613 D615 BUS-2A VT
D613 BUS-1A VT
SHT.06/ 2C & 2D
COMMON ALARM PANEL
ALARM
CT607.B.C1
3000/1A MRCT,
TAP:500/1A
Ual:417V,Rct:0.78ohm
CL:TPS
CT607.B.C2
3000/1A MRCT,
TAP:500/1A
Ual:417V,Rct:0.78ohm
CL:TPS
CT607.B.C3
3000/1A MRCT,
TAP:500/1A,
CL :0.5 ISF< 5
BUR:10VA
P1
P2
+6T1A1
+6T1B1
86-1/T1, 86-3/T1
SHT. /4A
86-2/T1, 86-4/T1
SHT. /5C & 6C
BLOCK CLOSE
86-1, 86-3 /4A,
86-2 /5C,
86-4 /6C,
86BF /5C,
86BB /5B
A607
115kV,
2000A
CLOSE COMMAND
TC-1
TC-2
CT607.F.C2
3000/1A MRCT,
TAP:2000/1A,
Ual:1666.6V,Rct:3.13ohm
CL:TPS
CT607.F.C1
3000/1A MRCT,
TAP:2000/1A,
Ual:1666.6V,Rct:3.13ohm
CL:TPS
+6BU04
CB A607 BLOCK CLOSE /2B,
CB A301 TC-1/2 TRIP & BLOCK CLOSE /2F
ABTS INITIATION
87B+50BF/BU-04
INITIATION FROM
86T-1, 86T-3,
86T-2 &86T-4
SHT:/4A & 5D
87B
62 BF1
62 BF2
CB READY
A607 TRIP COIL SAVE,
ABTS INITIATION &
BLOCK CLOSE SHT:/2B
TRIP & BLOCK CLOSE A301, SHT./2F
+6BBCU 87B+50BF-CU
FOC
SHT.05/7C
87M
87CH
CENTRAL UNIT
(COMMON FOR ALL BAYS)
SPARE
D673 WDG-1
WDG-2
K619 D617
K621
GIS BUSDUCT
SF6/AIR BUSHING
3-1Ø, 108kV
SURGE
ARRESTER
3-1Ø PT'S
PT603
115kV/115V/√3 / 115V/√3 x 115V/√3 - 115V
CL: 0.5 & 3P
BURDEN : 100VA (EACH WDG)
BCT.1
600/1A MRCT
TAP-600/1A,
CL: 0.5, ISF<5
BUR:30VA
BCT.2
AS PER
MANUFACTURER
DATA
+LCP-T601
TRANSFORMER T601
50/67 MVA, ONAN/ONAF
115/13.8kV, 60Hz, 3X%Ø,
Z-22% / (50MVA BASE)
OLTC -20% TO +12.5%
Dyn1
BCT.7
4000/1A MRCT,
TAP:4000/1A,
Ual:500V,Rct:14ohm
CL:TPS
BCT.6
4000/1A
TAP:4000/1A
Ual:500,Rct:14ohm
CL: TPS
BCT.3
4000/1A MRCT
TAP-4000/1A, BUR:30VA
CL: 0.5, ISF<5
ONLY ON 'Y' PHASE
BCT.4
AS PER
MANUFACTURER
DATA
BCT.5
4000/1A MRCT
TAP:4000/1A,
BUR:30VA
CL: 0.2, ISF<5
PT301
3-1Ø PT'S
13.8kV/115/√3 / 115V/√3 x 115V/√3 - 115V
CL:0.2/3P,
BURDEN: 18VA
6R-1Cx630 SQ.MM,
15kV CU/XLPE CABLE
K301
T011-T013 C1
4000/1A
Ual:500V,Rct:14ohm
CL: TPS
T011-T013 C2.
4000-3600/1A,DRCT
TAP:4000/1A,
Ual:500V,Rct:14ohm
CL: TPS
A301
3600A
86T-2 /5C,
86T-4 /6C
86T-1 /4A,
86T-3 /4A
86BF, SHT. /4C,
86BB, SHT. /5C,
86BI, SHT.12/5C
T021-T023 C2
4000/1A
UaL:500V,Rct:14ohm
CL: TPS
T021-T023 C1.
4000-3600/1A, DRCT
TAP:4000/1A,
UaL:500V,Rct:14ohm
CL: TPS
T601
87TB1
TRAFO. T601
DIFF. /87B
TO SHT:12/3B
+6AMR1
+6DCU1
PQM1
RM1
A301 SWGR
BCU-A301
A- 0-4000A
V- 0-18kV
W- 0+80MW
VAR- 0+80MVAR
MWh
MVarh
0-18kV
DPDM
CB A607 TRIP TC2 /2B
CB A607 BLOCK CLOSE /2B
CB A301 TRIP TC2 /2F
CB A301 BLOCK CLOSE
BLOCK ABTS
CB A607 TRIP TC2 /2B
CB A607 BLOCK CLOSE /2B
CB A301 TRIP TC2 /2F
CB A301 BLOCK CLOSE
ABTS INITIATION
TO INITIATION
BF (A607)
SHT: /4B
50/51-1
50/51-2
50N/51N
51G
50/50N/51N
67
67N
BLOCK
98
/4D
96-2
63 QP-2
+RTCC1
DV-HV
(0-150kV)
DV-LV
(0-18kV)
TP
AVR
V
TP- 1-26 POS.
V- 0-15kV
TO SAS
SHT:12/6A
TFR
CICT

NOTES

1. DRAWING NOTE

LEGEND

RELAY	DESCRIPTION	TYPE	MAKE
26-2	OIL TEMPERATURE HIGH (TRIP)	LOR/SR	ES
49-2/HV	WINDING TEMPERATURE HIGH-HV (TRIP)	LOR/SR	ES
49-2/LV	WINDING TEMPERATURE HIGH-LV (TRIP)	LOR/SR	ES
63PRD-1T	PRESSURE RELIEF DEVICE MAIN TANK (TRIP)	LOR/SR	ES
63PRD-2T	PRESSURE RELIEF DEVICE TAP CHANGER (TRIP)	LOR/SR	ES
63QP-2	OLTC PROTECTIVE RELAY (TRIP)	LOR/SR	ES
96-2	BUCHHOLZ RELAY - MAIN TANK (TRIP)	LOR/SR	ES

DESCRIPTION

26-1	OIL TEMPERATURE HIGH (ALARM)
49-1/HV	WINDING TEMPERATURE HIGH-HV (ALARM)
49-1/LV	WINDING TEMPERATURE HIGH-LV (ALARM)
63PRD-1	PRESSURE RELIEF DEVICE MAIN TANK (ALARM)
63PRD-2	PRESSURE RELIEF DEVICE TAP CHANGER (ALARM)
63QP-1	OLTC PROTECTIVE RELAY (ALARM)
71QL-1	OIL LEVEL LOW - MAIN TANK (ALARM)
71QL-2	OIL LEVEL LOW - OLTC (ALARM)
96-1	BUCHHOLZ RELAY - MAIN TANK (ALARM)
96DA	GAS DETECTOR RELAY (ALARM)
COLF	TRANSFORMER COOLER TROUBLE (ALARM)

ABBREVIATIONS

ABTS	AUTOMATIC BUS TRANSFER SCHEME
ACCS	AUTOMATIC CAPACITOR CONTROL SYSTEM
AVR	AUTOMATIC VOLTAGE REGUALTOR
BPP	BUS PROTECTION PANEL
DA	DIGITAL AMMETER
DCU	DATA COLLECTION UNIT
DPM	DIGITAL POWER METER CONVERTING MW, MVAR
DRCT	DUAL RATIO CURRENT TRANSFORMER
DV	DIGITAL VOLTMETER
HMI	HUMAN MACHINE INTERFACE
M	MEASURING VOLTAGE
MRCT	MULTIRATIO CURRENT TRANSFORMER
POM	POWER QUALITY METER
R	REFERENCE VOLTAGE
RM	REVENUE METER
SA	SURGE ARRESTOR
TC-1	TRIP CIRCUIT-1
TC-2	TRIP CIRCUIT-2
BCP	BAY CONTROL PANEL
ES	ETHERNET SWITCH
-.O.-	FIBRE OPTIC CABLE (FOC)

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87REF /LV	RESTRICTED EARTH FAULT PROTN.	87REF /LV	MCAG14	ALSTOM
87T	TRAFO. DIFF. PROTN.	87T	RET670	ABB
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTECTION BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-07	REB500	ABB
50/51-1 50N/ 51N	HV SIDE NON DIR. O/C & E/F PROTN.-1	50/51-1 50N/ 51N	PI42	ALSTOM
50/51-2 50N/ 51N	HV SIDE NON DIR. O/C & E/F PROTN.-2	50/51-2 50N/ 51N	PI42	ALSTOM
51G	LV NEUTRAL O/C PROTN.	51G	PI42	ALSTOM
67/ 67N	LV SIDE DIRECTIONAL O/C & E/F PROTN.	67/ 67N	PI42	ALSTOM
87M/ A607 87CH/ A607	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF/ CU	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74/86T-1 74/86T-2 74/86T-3 74/86T-4 74/94BF 74/86BF 74/86BB	SPERIC	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74/TC1 74/TC2	MVAX31	AREVA
86T	PROTECTION TRIP LOCKOUT RELAY	86T-1, 86T-2, 86T-3, 86T-4	LOR/HR	ES
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-T 98-B	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A607	REC670	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A301	REF615	ABB
TP, V, AVR	TAP POSITION INDICATOR VOLTAGE MEASUREMENT AUTOMATIC VOLTAGE REGULATOR	90	TAPCON 260	MR
POM1	POWER QUALITY METER	AMR	-----	-----
RM1	REVENUE METER	AMR	-----	-----
25	CONTROL & SYN.CHECK FUNCTION	25	KAVS100	ALSTOM

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	-
	--
	-

+6T1A1& +6T1A2	115/13.8KV TRANSFORMER T601 SET-1 PROTN. PANEL
+6T1B1	115/13.8KV TRANSFORMER T601 SET-2 PROTN. PANEL
RTCC1	115/13.8KV TRANSFORMER T601 RTCC PANEL
6BBCU	115KV BUSBAR PROTN. PANEL FOR CENTRAL UNIT
6BU04	115KV BUSBAR BAY UNIT PANEL FOR (A607)
6AMR1	115/13.8KV AMR PANEL
6DCU1	115/13.8KV DCU PANEL
LCC-A607	LOCAL CONTROL PANEL
SAS	SUBSTATION AUTOMATION SYSTEM
CICT	CURRENT ISOLATING CT TFR

CONTRACTOR'S CONSULTANT:
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DAMMAM-31493
الدار الدولية للمحدسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء
نقل الكهرباء National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012. DATE COMPLETED _____
OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED
CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
QATIF TRANSFORMER T601 (A607)
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	09 of 15	0

NG-A (2012/01)
DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	10 of 15	0

115kV,3150A, 40kA (ISEC), 3Ø 60HZ, BUS-1A
115kV,3150A, 40kA (ISEC), 3Ø 60HZ, BUS-2A
FROM SHT:09/2A
TO SHT:06/1A,1F
K611 D607 D609
P1
CT605.B.C1 3000/1A MRCT, TAP:500/1A Ual:417V,Rct:0.78ohm CL:TPS
CT605.B.C2 3000/1A MRCT, TAP:500/1A Ual:417V,Rct:0.78ohm CL:TPS
CT605.B.C3 3000/1A MRCT, TAP:500/1A, CL :0.5 ISF< 5 BUR:10VA
P2
BLOCK CLOSE 86-1, 86-3 /4A, 86-2 /5C, 86-4 /6C, 86BF /5C, 86BB /5B
A605 115kV, 2000A
CLOSE COMMAND TC-1 TC-2
+6T2A1 74 TC1
+6T2B1 74 TC2
86-1/T1, 86-3/T1 SHT. /4A
86-2/T1, 86-4/T1 SHT. /5C & 6C
CT605.F.C2 3000/1A MRCT, TAP:2000/1A, Ual:1667V,Rct:3.13ohm CL:TPS
CT605.F.C1 3000/1A MRCT, TAP:2000/1A, Ual:1666.6V,Rct:3.13ohm CL:TPS
K613 D611
K615 D671 WDG-1 WDG-2
GIS BUSDUCT
SF6/AIR BUSHING
3-1Ø, 108kV SURGE ARRESTER
3-1Ø PT'S PT601 115kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V
CL: 0.5 & 3P BURDEN : 100VA (EACH WDG)
SPARE
BCT.1 600/1A MRCT TAP-600/1A, CL: 0.5, ISF<5 BUR:30VA
BCT.2 AS PER MANUFACTURER DATA
+LCP-T602 (49-WG/W)
TRANSFORMER T602 50/67 MVA, ONAN/ONAF 115/13.8kV, 60Hz, 3%Ø, Z=22% / (50MVA BASE) OLTC -20% TO +12.5% Dyn1
BCT.7 4000/1A MRCT, TAP:4000/1A, Ual:500V,Rct:14ohm CL:TPS
BCT.6 4000/1A TAP:4000/1A Ual:500,Rct:14ohm CL: TPS
BCT.3 4000/1A MRCT TAP-4000/1A, BUR:30VA CL: 0.5, ISF<5 ONLY ON 'Y' PHASE
BCT.4 AS PER MANUFACTURER DATA
+LCP-T602 (49-WG/V)
BCT.5 4000/1A MRCT TAP:4000/1A, BUR:30VA CL: 0.2, ISF<5
PT302 3-1Ø PT'S 13.8kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V CL:0.2/3P, BURDEN: 18VA
6R-1Cx630 SQ.MM, 15kV CU/XLPE CABLE
K302
T011-T013 C1 4000/1A, Ual:500V,Rct:14ohm CL: TPS
T011-T013 C2. 4000-3600/1A TAP:4000/1A, DRCT Ual:500V,Rct:14ohm CL: TPS
+6T2B1 74 TC2 +6T2A1 74 TC1 A302, 3600A TC2 TC1
86T-2 /5C, 86T-4 /6C
86T-1 /4A, 86T-3 /4A
86BF, SHT. /4C, 86BB, SHT. /5C, 86B1, SHT.10/5C
T021-T023 C2 4000/1A Ual:500V,Rct:14.0ohm CL: TPS
T021-T023 C1. 4000-3600/1A, DRCT TAP:4000/1A, Ual:500V,Rct:14.0ohm CL: TPS
T602 87T2
TRAFO. T602 TO SHT.12/4D
TFR
COMMON ALARM PANEL
ALARM
+6T2A1 74 86T-1
CB A302 TRIP TC1 /2F
CB A302 BLOCK CLOSE
ABTS INITIATION
TO INITIATE BF (A605) SHT. /5B
CB A605 TRIP TC1 /3B
CB A605 BLOCK CLOSE /2B
TO SAS
CICT
87T
87REF
+6T2B1 74 86T-3
49-2/LV 49-2/HV 26-2 63PRD-1T
/6D
96-2 63QP-2 63PRD-2T
+T601 MK
63 QP-1 63 PRD-2 63 PRD-2 49-1 LV 49-2 HV
26-1 COLF 71 QL-2 71 QL-1 96DA 96-1
+LCC-A605
0-150kV V
0-600A A DPM
0±80MVAR 0±80MW
BCU - A607
A- 0-600A
V- 0-150kV
W- 0±80MW
VAR- 0±80MVAR
HMI
25
D605 D609 BUS-2A VT
D605 BUS-1A VT
SHT:06/2E & 2F
+6BU04
74 94BF A605 86BB A605 74
87B+50BF/BU-04
62 BF1 50BF A605 87 A605 62 BF2
87B
INITITATION FROM 86T-1, 86T-3, 86T-2 &86T-4 SHT:/4A & 5D
D605 D605 D609 D609 A605 A605 A605 CB READY
74 86BF A605
A605 TRIP COIL SAVE, ABTS INITIATION & BLOCK CLOSE SHT:/2B
TRIP & BLOCK CLOSE A302, SHT./2F
CB A605 BLOCK CLOSE /2B, CB A302 TC-1/2 TRIP & BLOCK CLOSE /2F ABTS INITIATION
TO SAS
FOC SHT.05/7C
+6BBCU 87B+50BF-CU
87M A605 87CH A605
CENTRAL UNIT (COMMON FOR ALL BAYS)
+6T2B1
CB A605 TRIP TC2 /2B
CB A605 BLOCK CLOSE /2B
CB A302 TRIP TC2 /2F
CB A302 BLOCK CLOSE
BLOCK ABTS
CB A605 TRIP TC2 /2B
CB A605 BLOCK CLOSE /2B
CB A302 TRIP TC2 /2F
CB A302 BLOCK CLOSE
ABTS INITIATION
/4D
96-2 63 QP-2
5I
50/51-1 50/51-2
50N/51N 50N/51N
74 86T-2
86T-2
TO INITIATION BF (A605) SHT: /4B
86T-4 74 86T-4
67 67N
BLOCK 98
51G
50/50N/51IN
TO SAS
CICT
TFR
+6AMR1 RM2
+6DCU1
+RTCC2
DV-HV (0-150kV)
DV-LV (0-18kV)
90 TP AVR V HMI
R 98 M
TP- 1-26 POS. V- 0-15kV
A302 SWGR
A- 0-4000A V- 0-18kV W- 0+80MW VAR- 0+80MVAR MWh MVarh DPDM
0-18kV V
BCU-A302
A- 0-4000A V- 0-18kV W- 0±80MW VAR- 0±80MVAR HMI
25 R 98 B M
R 98 T M
SHT: 12/7A

NOTES

1. DRAWING NOTE

LEGEND

RELAY	DESCRIPTION	TYPE	MAKE
26-2	OIL TEMPERATURE HIGH (TRIP)	LOR/SR	ES
49-2/HV	WINDING TEMPERATURE HIGH-HV (TRIP)	LOR/SR	ES
49-2/LV	WINDING TEMPERATURE HIGH-LV (TRIP)	LOR/SR	ES
63PRD-1T	PRESSURE RELIEF DEVICE MAIN TANK (TRIP)	LOR/SR	ES
63PRD-2T	PRESSURE RELIEF DEVICE TAP CHANGER (TRIP)	LOR/SR	ES
63QP-2	OLTC PROTECTIVE RELAY (TRIP)	LOR/SR	ES
96-2	BUCHHOLZ RELAY - MAIN TANK (TRIP)	LOR/SR	ES

DESCRIPTION

26-1	OIL TEMPERATURE HIGH (ALARM)
49-1/HV	WINDING TEMPERATURE HIGH-HV (ALARM)
49-1/LV	WINDING TEMPERATURE HIGH-LV (ALARM)
63PRD-1	PRESSURE RELIEF DEVICE MAIN TANK (ALARM)
63PRD-2	PRESSURE RELIEF DEVICE TAP CHANGER (ALARM)
63QP-1	OLTC PROTECTIVE RELAY (ALARM)
71QL-1	OIL LEVEL LOW - MAIN TANK (ALARM)
71QL-2	OIL LEVEL LOW - OLTC (ALARM)
96-1	BUCHHOLZ RELAY - MAIN TANK (ALARM)
96DA	GAS DETECTOR RELAY (ALARM)
COLF	TRANSFORMER COOLER TROUBLE (ALARM)

ABBREVIATIONS

ABTS	AUTOMATIC BUS TRANSFER SCHEME
ACCS	AUTOMATIC CAPACITOR CONTROL SYSTEM
AVR	AUTOMATIC VOLTAGE REGUALTOR
BPP	BUS PROTECTION PANEL
DA	DIGITAL AMMETER
DCU	DATA COLLECTION UNIT
DPM	DIGITAL POWER METER CONVERTING MW, MVAR
DRCT	DUAL RATIO CURRENT TRANSFORMER
DV	DIGITAL VOLTMETER
HMI	HUMAN MACHINE INTERFACE
M	MEASURING VOLTAGE
MRCT	MULTIRATIO CURRENT TRANSFORMER
PQM	POWER QUALITY METER
R	REFERENCE VOLTAGE
RM	REVENUE METER
SA	SURGE ARRESTOR
TC-1	TRIP CIRCUIT-1
TC-2	TRIP CIRCUIT-2
BCP	BAY CONTROL PANEL
ES	ETHERNET SWITCH
.O.	FIBRE OPTIC CABLE (FOC)

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87REF /LV	RESTRICTED EARTH FAULT PROTN.	87REF /LV	MCAG14	ALSTOM
87T	TRAFO. DIFF. PROTN.	87T	RET670	ABB
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTECTION BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF / BU-07	REB500	ABB
50/51-1 50N/ 51N	HV SIDE NON DIR. O/C & E/F PROTN.-1	50/51-1 50N/ 51N	PI42	ALSTOM
50/51-2 50N/ 51N	HV SIDE NON DIR. O/C & E/F PROTN.-2	50/51-2 50N/ 51N	PI42	ALSTOM
51G	LV NEUTRAL O/C PROTN.	51G	PI42	ALSTOM
67/ 67N	LV SIDE DIRECTIONAL O/C & E/F PROTN.	67/ 67N	PI42	ALSTOM
87M/ A605 87CH/ A605	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF / CU	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74/86T-1 74/86T-2 74/86T-3 74/86T-4 74/94BF 74/86BF 74/86BB	SPERIC	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74/TC1 74/TC2	MVAX31	ALSTOM
86T	PROTECTION TRIP LOCKOUT RELAY	86T-1, 86T-2, 86T-3, 86T-4	LOR/HR	ES
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
95	PROTN. TRIP RELAY (SELF RESET)	95-B	-----	-----
98	VT FUSE FAILURE SUPERVISION RELAY	98-T 98-B 98	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A605	REC670	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A302	REF615	ABB
TP, V, AVR	TAP POSITION INDICATOR VOLTAGE MEASUREMENT AUTOMATIC VOLTAGE REGULATOR	90	TAPCON 260	MR
RM2	REVENUE METER	AMR	-----	-----
25	CONTROL & SYN.CHECK FUNCTION	25	KAVS100	ALSTOM

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
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	-
	--
	-

+6T1A1& +6T1A2	115/13.8KV TRANSFORMER T601 SET-1 PROTN. PANEL
+6T1B1	115/13.8KV TRANSFORMER T601 SET-2 PROTN. PANEL
RTCC1	115/13.8KV TRANSFORMER T601 RTCC PANEL
6BBCU	115KV BUSBAR PROTN. PANEL FOR CENTRAL UNIT
6BU04	115KV BUSBAR BAY UNIT PANEL FOR (A607)
6AMR1	115/13.8KV AMR PANEL
6DCU1	115/13.8KV DCU PANEL
LCC-A605	LOCAL CONTROL PANEL
SAS	SUBSTATION AUTOMATION SYSTEM
CICT	CURRENT ISOLATING CT TFR

CONTRACTOR'S CONSULTANT:
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مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

نقل الكهرباء
الشركة الوطنية لنقل الكهرباء
National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012. DATE COMPLETED _____
OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED
CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
QATIF TRANSFORMER T602 (A605)
QATIF 115/13.8kV SUBSTATION NO. 2

QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	10 of 15	0

NG-A (2012/01) NGA00

DMS VECTOR

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	11 of 15	0

115kV, 3150A, 40kA (1SEC), 3Ø 60HZ, BUS-1C
115kV, 3150A, 40kA (1SEC), 3Ø 60HZ, BUS-2C
FROM SHT: 08/4A,4F
TO SHT: 03/2A
K614 D612 D614
+6T3A1
+6T3B1
CB A303 TRIP TC1 /2F
CB A303 BLOCK CLOSE
ABTS INITIATION
TO INITIATE BF (A604) SHT. /5B
CB A604 TRIP TC1 /3B
CB A604 BLOCK CLOSE /2B
TO SAS
CICT
87T
87REF
TFR
+T603_MK
+LCC-A604
CT604.B.C1
3000/1A MRCT,
TAP:500/1A
Uak:417V,Rct:0.78ohm
CL:TPS
CT604.B.C2
3000/1A MRCT,
TAP:500/1A
Uak:417V,Rct:0.78ohm
CL:TPS
CT604.B.C3
3000/1A MRCT,
TAP:500/1A,
CL : 0.5 ISF< 5
BUR:10VA
COMMON ALARM PANEL
ALARM
0-150kV
0-600A
0±80MVAR
0±80MW
BCU - A604
A- 0-600A
V- 0-150kV
W- 0±80MW
VAR- 0±80MVAR
HMI
D613 D615
BUS-2A VT
D613
BUS-1A VT
SHT.06/2C &2D
BLOCK CLOSE 86-1, 86-3 /4A, 86-2 /5C, 86-4 /6C, 86BF /5C, 86BB /5B
A604 115kV, 2000A
CLOSE COMMAND
TC-1
TC-2
86-1/T1, 86-3/T1 SHT. /4A
86-2/T1, 86-4/T1 SHT. /5C & 6C
CT604.F.C2
3000/1A MRCT,
TAP:2000/1A,
Uak:1667V,Rct:3.13ohm
CL:TPS
CT604.F.C1
3000/1A MRCT,
TAP:2000/1A,
Uak:1666.6V,Rct:3.13ohm
CL:TPS
+6BU08
CB A604 BLOCK CLOSE /2B,
CB A303 TC-1/2 TRIP & BLOCK CLOSE /2F
ABTS INITIATION
INITITATION FROM 86T-1, 86T-3, 86T-2 &86T-4 SHT:/4A & 5D
87B+50BF/BU-08
87B
D612
D612
D614
D614
A604
A604
A604
CB READY
A604 TRIP COIL SAVE, ABTS INITIATION & BLOCK CLOSE SHT:/2B
TRIP & BLOCK CLOSE A303, SHT./2F
FOC SHT.05/7C
+6BBCU 87B+50BF-CU
CENTRAL UNIT (COMMON FOR ALL BAYS)
SPARE
K616 D616
K618
D672 WDG-1
WDG-2
GIS BUSDUCT
SF6/AIR BUSHING
3-1Ø, 108kV SURGE ARRESTER
3-1Ø PT'S
PT602
115kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V
CL:0.5 & 3P
BURDEN : 100VA (EACH WDG)
+6T3B1
CB A604 TRIP TC2 /2B
CB A604 BLOCK CLOSE /2B
CB A303 TRIP TC2 /2F
CB A303 BLOCK CLOSE
BLOCK ABTS
CB A604 TRIP TC2 /2B
CB A604 BLOCK CLOSE /2B
CB A303 TRIP TC2 /2F
CB A303 BLOCK CLOSE
ABTS INITIATION
/4D
51
50/51-1
50/51-2
50N/51N
50/50N/51N
TO SAS
74 86T-2
86T-2
TO INITIATION BF (A604) SHT: /4B
86T-4
74 86T-4
51G
67
67N
BLOCK
98
96-2
63 QP-2
+6AMR1
+6DCU1
RM3
BCT.1
600/1A MRCT
TAP-600/1A,
CL: 0.5, ISF<5
BUR:30VA
BCT.2
AS PER MANUFACTURER DATA
+LCP-T603
TRANSFORMER T603
50/67 MVA, ONAN/ONAF
115/13.8kV, 60Hz, 3%%Ø,
Z=22% / (50MVA BASE)
OLTC -20% TO +12.5%
Dyn1
BCT.7
4000/1A MRCT,
TAP:4000/1A,
Ual:500V,Rct:14ohm
CL:TPS
BCT.6
4000/1A
TAP:4000/1A
Ual:500,Rct:14ohm
CL: TPS
BCT.3
4000/1A MRCT
TAP-4000/1A, BUR:30VA
CL: 0.5, ISF<5
ONLY ON 'Y' PHASE
BCT.4
AS PER MANUFACTURER DATA
+LCP-T603
BCT.5
4000/1A MRCT
TAP:4000/1A,
BUR:30VA
CL: 0.2, ISF<5
+RTCC3
DV-HV (0-150kV)
DV-LV (0-18kV)
90
TP
AVR
HMI
V
TP- 1-26 POS.
V- 0-15kV
TO SAS
PT303
3-1Ø PT'S
13.8kV/√3 / 115V/√3 - 115V x 115V/√3 - 115V
CL:0.2/3P,
BURDEN: 1ØVA
6R-1Cx630 SQ.MM, 15kV CU/XLPE CABLE
K303
WDG-2
WDG-1
T011-T013 C1
4000/1A
Ual:500V,Rct:14.0ohm
CL:TPS
T011-T013 C2.
4000-3600/1A,DRCT
TAP:4000/1A,
Ual:500V,Rct:14.0ohm
CL:TPS
+6T3B1 +6T3A1
A303
3600A
TC2
TC1
86T-2 /5C, 86T-4 /6C
86T-1 /4A, 86T-3 /4A
86BF, SHT. /4C, 86BB, SHT. /5C, 86B1, SHT.12/5C
T021-T023 C2
4000/1A
UaL:500V,Rct:14ohm
CL:TPS
T021-T023 C1.
4000-3600/1A, DRCT
TAP:4000/1A,
UaL:500V,Rct:14ohm
CL:TPS
T603
87B3
TRAFO. T603 TO SHT.13/5D
A303_SWGR
BCU-A303
A- 0-4000A
V- 0-18kV
W- 0±80MW
VAR- 0±80MVAR
MWh
MVarh
0-18kV
DPDM
SHT: 13/3C

NOTES

1. DRAWING NOTE

LEGEND

RELAY	DESCRIPTION	TYPE	MAKE
26-2	OIL TEMPERATURE HIGH (TRIP)	LOR/SR	ES
49-2/HV	WINDING TEMPERATURE HIGH-HV (TRIP)	LOR/SR	ES
49-2/LV	WINDING TEMPERATURE HIGH-LV (TRIP)	LOR/SR	ES
63PRD-1T	PRESSURE RELIEF DEVICE MAIN TANK (TRIP)	LOR/SR	ES
63PRD-2T	PRESSURE RELIEF DEVICE TAP CHANGER (TRIP)	LOR/SR	ES
630P-2	OLTC PROTECTIVE RELAY (TRIP)	LOR/SR	ES
96-2	BUCHHOLZ RELAY - MAIN TANK (TRIP)	LOR/SR	ES

LEGEND

DESCRIPTION

26-1	OIL TEMPERATURE HIGH (ALARM)
49-1/HV	WINDING TEMPERATURE HIGH-HV (ALARM)
49-1/LV	WINDING TEMPERATURE HIGH-LV (ALARM)
63PRD-1	PRESSURE RELIEF DEVICE MAIN TANK (ALARM)
63PRD-2	PRESSURE RELIEF DEVICE TAP CHANGER (ALARM)
630P-1	OLTC PROTECTIVE RELAY (ALARM)
71QL-1	OIL LEVEL LOW - MAIN TANK (ALARM)
71QL-2	OIL LEVEL LOW - OLTC (ALARM)
96-1	BUCHHOLZ RELAY - MAIN TANK (ALARM)
96DA	GAS DETECTOR RELAY (ALARM)
COLF	TRANSFORMER COOLER TROUBLE (ALARM)

ABBREVIATIONS

ABTS	AUTOMATIC BUS TRANSFER SCHEME
ACCS	AUTOMATIC CAPACITOR CONTROL SYSTEM
AVR	AUTOMATIC VOLTAGE REGUALTOR
BPP	BUS PROTECTION PANEL
DA	DIGITAL AMMETER
DCU	DATA COLLECTION UNIT
DPM	DIGITAL POWER METER CONVERTING MW, MVAR
DRCT	DUAL RATIO CURRENT TRANSFORMER
DV	DIGITAL VOLTMETER
HMI	HUMAN MACHINE INTERFACE
M	MEASURING VOLTAGE
MRCT	MULTIRATIO CURRENT TRANSFORMER
R	REFERENCE VOLTAGE
RM	REVENUE METER
SA	SURGE ARRESTOR
TC-1	TRIP CIRCUIT-1
TC-2	TRIP CIRCUIT-2
BCP	BAY CONTROL PANEL
ES	ETHERNET SWITCH
	FIBRE OPTIC CABLE (FOC)

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
87REF /LV	RESTRICTED EARTH FAULT PROTN.	87REF /LV	MCAG14	ALSTOM
87T	TRAFO. DIFF. PROTN.	87T	RET670	ABB
50BF 62-BF1 62-BF2 87B	BREAKER FAILURE PROTECTION BF STAGE-1 TIMER BF STAGE-2 TIMER BUSBAR DIFFERENTIAL PROTN.	87B+ 50BF/ BU-07	REB500	ABB
50/51-1	HV SIDE NON DIR. O/C & E/F PROTN.-1	50/51-1 50N/ 51N	PI42	ALSTOM
50/51-2 50N/ 51N	HV SIDE NON DIR. O/C & E/F PROTN.-2	50/51-2 50N/ 51N	PI42	ALSTOM
51G	LV NEUTRAL O/C PROTN.	51G	PI42	ALSTOM
67/ 67N	LV SIDE DIRECTIONAL O/C & E/F PROTN.	67/ 67N	PI42	ALSTOM
87M/ A605 87CH/ A605	BUSBAR PROTN. MAIN BUSBAR PROTN. CHECK	87B+ 50BF/ CU	REB500	ABB
74	SUPERVISION RELAY FOR TRIP RELAY	74/86T-1 74/86T-2 74/86T-3 74/86T-4 74/94BF 74/86BF 74/86BB	SPERIC	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74/TC1 74/TC2	MVAX31	ALSTOM
86T	PROTECTION TRIP LOCKOUT RELAY	86T-1, 86T-2, 86T-3, 86T-4	LOR/HR	ES
86BB	BUSBAR PROTN TRIP LOCKOUT RELAY	86BB	LOR/HR	ES
86BF	BREAKER FAILURE PROTN TRIP LOCKOUT RELAY	86BF	LOR/HR	ES
94	PROTN. TRIP RELAY (SELF RESET)	94-BF	LOR/SR	ES
95	PROTN. TRIP RELAY (SELF RESET)	95-B	-----	-----
98	VT FUSE FAILURE SUPERVISION RELAY	98-T 98B 98	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A605	REC670	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU - A303	REF615	ABB
TP, V, AVR	TAP POSITION INDICATOR VOLTAGE MEASUREMENT AUTOMATIC VOLTAGE REGULATOR	90	TAPCON 260	MR
RM3	REVENUE METER	AMR	-----	-----
25	CONTROL & SYN.CHECK FUNCTION	25	KAVS100	ALSTOM

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	-
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	-

+6T1A1& +6T1A2	115/13.8KV TRANSFORMER T601 SET-1 PROTN. PANEL
+6T1B1	115/13.8KV TRANSFORMER T601 SET-2 PROTN. PANEL
RTCC1	115/13.8KV TRANSFORMER T601 RTCC PANEL
6BBCU	115KV BUSBAR PROTN. PANEL FOR CENTRAL UNIT
6BU08	115KV BUSBAR BAY UNIT PANEL FOR (A607)
6AMR1	115/13.8KV AMR PANEL
6DCU1	115/13.8KV DCU PANEL
LCC-A604	LOCAL CONTROL PANEL
SAS	SUBSTATION AUTOMATION SYSTEM
CICT	CURRENT ISOLATING CT TFR

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DAMMAM-31493
المستشار المقاول
الدار الهندسية للهندسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

نقل الكهرباء
الشركة الوطنية لنقل الكهرباء
National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012. DATE COMPLETED _____
OPR'G. DEPT. _____ ENG. DEPT. _____

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CERTIFIED BY _____ DATE _____

RELAYING AND METERING ONE LINE DIAGRAM
QATIF TRANSFORMER T603 (A604)
QATIF 115/13.8kV SUBSTATION NO. 2

QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	11 of 15	0

NG-A (2012/01)
NGA00
DMS VECTOR

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	12 of 15	0

13.8kV, 3600A, 25kA (1s), 60Hz, 3PH, 3WIRE BUS-1

FROM T601 SHT.9/2F

T601 87B1

TO A301 SWGR SHT.9/7F

TO A302 SWGR SHT.10/5F

TO SAS

+ABTS

CU+59+27

98-B1 59-B1 27-B1

98-B2 59-B2 27-B2

TO 38B343 SHT.10/2B

BUS-1 MEAS (V)

BUS-1 REF (V)

BUS-2 REF. (V)

BUS-2 MEAS. (V)

ACCS

TFR

TO BUS-2 SHT. 13/2D

TO ./1E

+6DCU1 +6AMR1 RM4

WDG-2 10A WDG-1

PT304 $\frac{13.8kV}{\sqrt{3}}/\frac{115V}{\sqrt{3}}$ -115V x $\frac{115V}{\sqrt{3}}$ -115V

CL:0.2/3P, (BOTH WINDINGS) BURDEN: 18VA

PT305 $\frac{13.8kV}{\sqrt{3}}/\frac{115V}{\sqrt{3}}$ -115V x $\frac{115V}{\sqrt{3}}$ -115V

CL:0.2/3P, (BOTH WINDINGS) BURDEN: 18VA

K304 K305

/1D /1F

B311 B312 B313 1250A B314 630A B315 630A B316 630A B317 630A B318 630A B319 630A B320 630A B321 630A B322 630A B323 630A B324 630A B325 630A

FOR DETAIL SEE SHT.12

PROTECTION & METERING TYPICAL TO B316

B316 SWGR PANEL (O/G)

BCU+50/51P&N

A- 0-600A V- 0-18kV W- 0±10MW VAR- 0±10MVAR Mwh,Mvarh HMI 50 51 50N 51N 79 DPDM

T031-T033.C1 600-400/1A TAP:600/1A Ual:480V Rct:2.1 ohm CL: TPS

T031-T033.C2 600-400/1A TAP:600/1A CL: 0.5 ISF<5 BUR:10VA

T041-T043.C1 4000/1A TAP:4000/1A Ual:500V Rct:14.0 ohm CL: TPS

CLOSE COMMAND ES TO SAS

TC2 TC1 FROM 86B1 /6E

B325 SWGR PANEL (STN TRAFO.)

T051-T053.C1 600-400/1A TAP:400/1A Ual:320V Rct:1.4 ohm CL: TPS

T051-T053.C2 100-50/1A TAP:50/1A CL: 0.2 ISF<5 BUR:10VA

T041-T043.C1 4000/1A TAP:4000/1A Ual:500V Rct:14.0 ohm CL: TPS

T061-T063.C1 4000/1A TAP: 4000/1A Ual:500V Rct:14.0 ohm CL: TPS

A304 SWGR PANEL (BUS TIE-1)

BCU

A- 0-4000A, V- 0-18kV HMI

25 A304 98 B-2 98 B-1 SM/SN A304 50/51 A304 VB1 0-18kV

A 0-4000A

T061-T063.C2 4000/1A TAP:4000/1A CL: 0.5 ISF<5 BUR: 10VA

A304 3600A (NC)

14-TC1 A304 86 A304 74-86 A304 FROM 86B1, 86B2, ABTS

CICT

REMOVABLE BUSBAR LINK 3600A

T071-T073.C1 4000/1A TAP:4000/1A Ual:500V Rct:14.0 ohm CL: TPS

T071-T073.C2 4000-3600/1A DRCT TAP:4000/1A Ual:1400V Rct:14.0 ohm CL: TPS

K321 K322 K323 K324 K325 K326 K327 K328 K329 K330 K331 K332 K333 K334 K335

FUTURE

7MVar CAPACITOR BANK

STATION SERVICE TRAFO (T301)

95 B1 87 B1 95 BX1 86 B1 74 86-B1

TRIP & CLOSE BLOCK ALL BUS-1 CBs & BUS TIE A304

13.8KV METERING PANEL (BUS-1)

+6DCU1 +6AMR1 RM5

FROM T602 SHT.10/2F

T602 87B2

13.8kV, 3600A, 25kA (1s), 60Hz, 3PH, 3W BUS-2

/7B /7A BUS-2 VOLTAGE

TO SHT.13/1D

TO SHT.13/1E

B331 SWGR PANEL (STN TRAFO.)

B332 SWGR PANEL (O/G)

BCU+50/51P&N

A- 0-600A V- 0-18kV W- 0±10MW VAR- 0±10MVAR Mwh,Mvarh HMI 50 51 50N 51N 79 DPDM

T051-T053.C1 600-400/1A TAP:400/1A Ual:320V Rct:1.4 ohm CL: TPS

T031-T033.C1 600-400/1A TAP: 600/1A Ual:480V Rct:2.1 ohm CL: TPS

T051-T053.C2 100-50/1A TAP:50/1A CL: 0.2 ISF<5 BUR:10VA

T031-T033.C2 600-400/1A TAP:600/1A CL: 0.5 ISF<5 BUR:10VA

T041-T043.C1 4000/1A TAP:4000/1A Ual:500V Rct:14.0 ohm CL: TPS

CLOSE COMMAND ES TO SAS

TC2 TC1 FROM 86B2

B331 630A B332 630A

PROTECTION & METERING TYPICAL TO B332

FOR DETAIL SEE SHT.12

B333 630A B334 630A B335 630A B336 630A B337 630A B338 630A B339 630A B340 630A B341 630A B342 630A B343 1250A B344 630A

K341 K342 K343 K344 K345 K346 K347 K348 K349 K350 K351 K352 K353 K354

STATION SERVICE TRAFO (T302)

7MVar CAPACITOR BANK

87 B2 95 B2 74 86-B2 86 B2 95 BX2

TRIP & CLOSE BLOCK ALL BUS-2 CBs &BUS TIE A304 & A305

13.8KV METERING PANEL (BUS-2)

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
50/51P&N	PROTECTION RELAY	BCU+50/51P&N	REF615	ABB
CU +59+27	AUTOMATIC BUS TRANSFER CONTROL UNIT WITH BUILT IN UNDER VOLTAGE RELAY &OVER VOLTAGE RELAY	CU +59+27	REC670	ABB
CU-ACCS	AUTOMATIC CAPACITOR CONTROL UNIT	CU ACCS	REC670	ABB
RM	REVENUE METER FOR STN. FEEDER	RM4 RM5	-----	-----
25	SYNCHROCHECK RELAY	25	KAVS100	ALSTOM
74	SUPERVISION RELAY FOR TRIP RELAY	74-86/A304 74-86/B1 74-86/B2	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1/A304 74-TC2/A304	MVAX31	ALSTOM
74/DC	DC SUPPLY SUPERVISION RELAY	74/DC	MVAX12	ALSTOM
86	PROTECTION TRIP LOCKOUT RELAY	86-A304 86-B1 86-B2	LOR/HR	ES
87	13.8kV BUS DIFFERNTIAL. PROTN.	87-B1 87-B2	MCAG14	ALSTOM
95	CT SUPERVISION RELAY	95-B1 95-B2	MVTP11	ALSTOM
98	VT FUSE FAILURE SUPERVISION RELAY	98-B1 98-B2	RXBA4	ABB

DEVICE FUNCTION NUMBERS

25	SYNCHRO CHECK RELAY
59	SYSTEM OVER VOLTAGE RELAY
79	AUTO-RECLOSING RELAY
86	LOCKOUT RELAY
87B	BUSBAR DIFFERENTIAL RELAY
94	TRIPPING RELAY, SELF RESET
95B	C.T CIRCUIT SUPERVISION RELAY
95BX	C.T SECONDARY SHORTING LOCKOUT RELAY
98	FUSE FAILURE RELAY

ABBREVIATIONS

ABTS	AUTOMATIC BUS TRANSFER SCHEME
ACCS	AUTOMATIC CAPACITOR CONTROL SYSTEM
BCU	BUS CONTROL UNIT
DA	DIGITAL AMMETER
DV	DIGITAL VOLTMETER
HMI	HUMAN MACHINE INTERFACE
M	MEASURING VOLTAGE
DPDM	MULTI FUNCTION METER WITH 3Ø DISPLAY OF CURRENT, VOLTAGE, PF RECORING & MAXIMUM DEMAND RECORDING
R	REFERENCE VOLTAGE
RM	REVENUE METER
TC-1	TRIP CIRCUIT-1
TC-2	TRIP CIRCUIT-2
ES	ETHERNET SWITCH

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	-
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	-

CONTRACTOR'S CONSULTANT:

DAR ENGINEERING
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الدار الدولية للهندسة
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الدمام ٣١٤٩٣

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B	11-2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	08-05-12	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

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DATE STARTED 08.05.2012. DATE COMPLETED _____

OPR'G. DEPT. _____ ENG. DEPT. _____

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RELAYING AND METERING ONE LINE DIAGRAM
13.8kV SYSTEM
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	12 of 15	0

NG-A (2012/01)

DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	13 of 15	0

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
50/51P&N	PROTECTION RELAY	BCU+50/51P&N	REF615	ABB
CU +59+27	AUTOMATIC BUS TRANSFER CONTROL UNIT WITH BUILT IN UNDER VOLTAGE RELAY &OVER VOLTAGE RELAY	CU +59+27	REC670	ABB
CU-ACCS	AUTOMATIC CAPACITOR CONTROL UNIT	-----	REC670	ABB
25	SYNCHRO CHECK RELAY	25	KAVS100	ALSTOM
74	SUPERVISION RELAY FOR TRIP RELAY	74-86/A305 74-86/B3	SPERIC1	ABB
74/TC	TRIP CIRCUIT SUPERVISION RELAY	74-TC1/A305 74-TC2/A305	MVAX 31	ALSTOM
74/DC	DC SUPPLY SUPERVISION RELAY	74/DC	MVAX12	ALSTOM
86	PROTECTION TRIP LOCKOUT RELAY	86-A305 86-B3	LOR/HR	ELECTRO SW
87	13.8kV BUS DIFFERNTIAL. PROTN.	87-B3	MCAG14	ALSTOM
95	CT SUPERVISION RELAY	95-B3	MVTP11	ALSTOM
98	VT FUSE FAILURE SUPERVISION RELAY	98-B2 98-B3	RXBA4	ABB

ABBREVIATIONS :

ABTS	AUTOMATIC BUS TRANSFER SCHEME
ACCS	AUTOMATIC CAPACITOR CONTROL SYSTEM
BCU	BUS CONTROL UNIT
DA	DIGITAL AMMETER
DV	DIGITAL VOLTMETER
HMI	HUMAN MACHINE INTERFACE
DPDM	MULTIFUNCTION METER WITH 3Ø DISPLAY OF CURRENT, VOLTAGE, PF RECORING & MAXIMUM DEMAND RECORDING
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
TFR	TRANSIENT FAULT RECORDER
CICT	CURRENT ISOLATING CT

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
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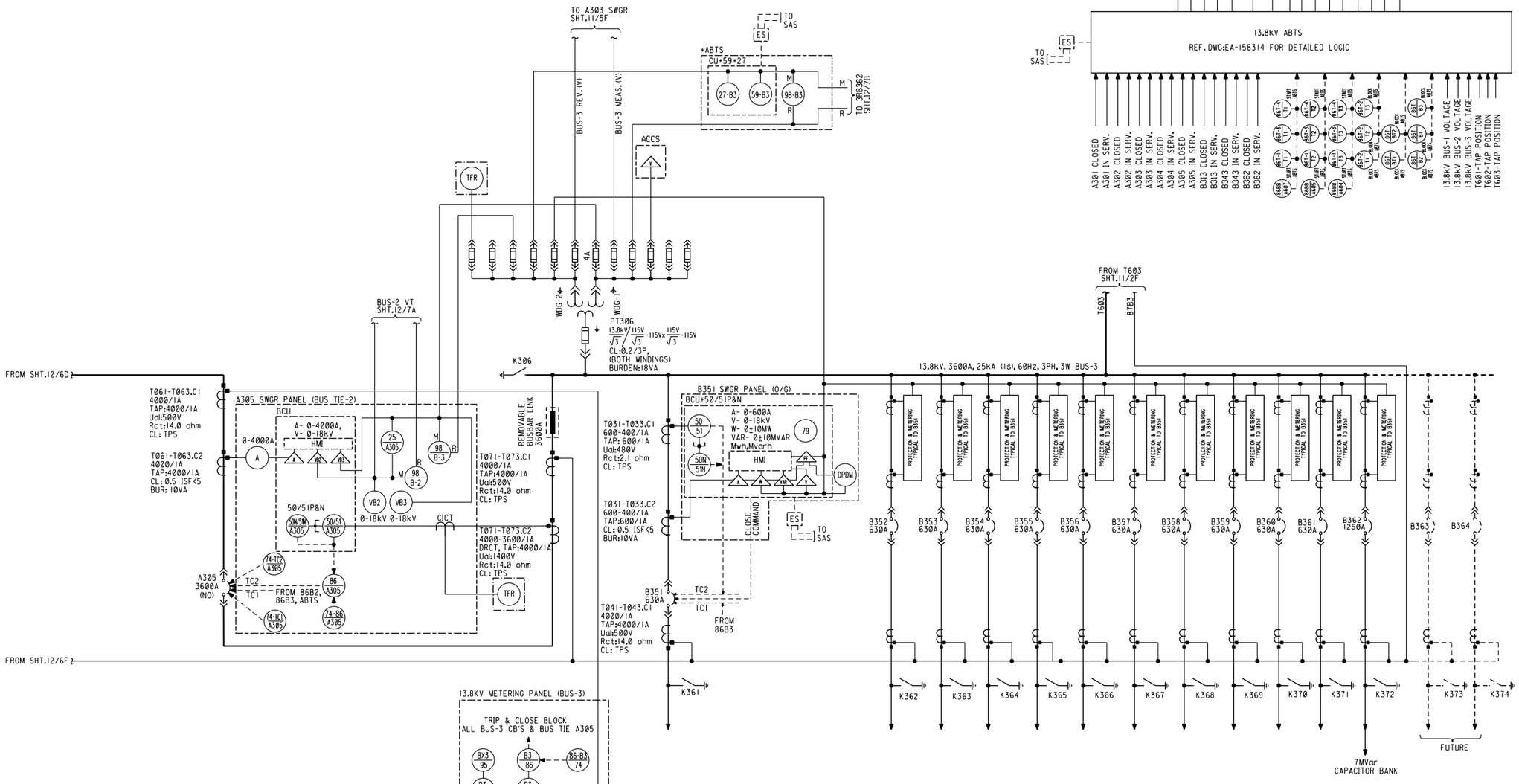

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RELAYING AND METERING ONE LINE DIAGRAM
13.8kV SYSTEM
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF SAUDI ARABIA

NG-A (2012/01)
DMS VECTOR NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	I-113045.01	P	DA441	EA-221504	14 of 15	0

13.8kV BUS-1 | 13.8kV BUS-1 — NC — A304 — 13.8kV BUS-2 | 13.8kV BUS-2 | 13.8kV BUS-2 — NO — A305 — 13.8kV BUS-3 | 13.8kV BUS-3

T081-83.C1
1200-600-400/1A
TAP: 600/1A
Ua: 320V
Rct: 2.1 ohm
CL: TPS

T081-83.C2
1200-600-400/1A
MRCT, BUR: 10VA
TAP: 600/1A
CL: 0.5 ISF<5

B313 SWGR PANEL | BCU-B313 | A- 0-600A, V- 0-18kV, VAR- 0±10MVAR, HMI | DPDM | +3RB313 | TO SAS | ES | BUS-1 PT SHT.12/4A | 59-1 | 59-2 | 27 | BLOCK | 98 | M | R | ALARM | 94 | 74/94 | CLOSE COMMAND | B313 1250A | TC-1 | TC-2

B343 SWGR PANEL | BCU-B343 | A- 0-600A, V- 0-18kV, VAR- 0±10MVAR, HMI | DPDM | +3RB343 | TO SAS | ES | BUS-2 PT SHT.12/6A | 59-1 | 59-2 | 27 | BLOCK | 98 | M | R | ALARM | 94 | 74/94 | CLOSE COMMAND | B343 1250A | TC-1 | TC-2

B362 SWGR PANEL | BCU-B362 | A- 0-600A, V- 0-18kV, VAR- 0±10MVAR, HMI | DPDM | +3RB362 | TO SAS | ES | BUS-3 PT SHT.12/4C | 59-1 | 59-2 | 27 | BLOCK | 98 | M | R | ALARM | 94 | 74/94 | CLOSE COMMAND | B362 1250A | TC-1 | TC-2

T041-43.C1
4000/1A
TAP: 4000/1A
Ua: 500V
Rct: 14.0 ohm
CL: TPS

TO BUS BAR DIFFERENTIAL PROTECTION (REFER SHEET 12 OF 15)

K323 | K353 | K372

3xICx630mm² 15kV, XLPE CABLE

FILTER REACTOR 15KV 420AMPS 60HZ, 2.0mH

3-1Ø SA 18KV

7MVAR CAPACITOR FILTER BANK

HF301 | HF302 | HF303

+3RA313 | +3RA343 | +3RA362

74-86 | 86 | ALARM | IED | 46-1 | 46-2 | 50PA | 50PB | 50/51 | 50PC | 50PN | 50N/5IN | TO SAS

ACCS

B313 OPEN | B313 CLOSE | B313 CLOSE BLOCK | B343 OPEN | B343 CLOSE | B343 CLOSE BLOCK | B362 OPEN | B362 CLOSE | B362 CLOSE BLOCK

A301 CLOSED | A301 IN SERV. | A607 CLOSED | A302 CLOSED | A302 IN SERV. | A605 CLOSED | A303 CLOSED | A303 IN SERV. | A604 CLOSED | A304 CLOSED | A304 IN SERV. | A305 CLOSED | A305 IN SERV. | B313 CLOSED | B313 IN SERV. | B343 CLOSED | B343 IN SERV. | B362 CLOSED | B362 IN SERV. | 13.8kV BUS-1 VOLTAGE | 13.8kV BUS-2 VOLTAGE | 13.8kV BUS-3 VOLTAGE | T601- MVAR | T602- MVAR | T603- MVAR | T601- PF | T602- PF | T603- PF | 86 (A303) | 27 (A303) | 59 (A303) | 86 (A304) | 86 (A605) | 86 (A607) | 86 (A301) | 86 (A302) | ACCS ON | ACCS OFF | ACCS TEST | ACCS AUTO | ACCS MANUAL | ACCS LOCAL | ACCS REMOTE

NOTES

1. DRAWING NOTE

LEGEND

FUNCTION	DESCRIPTION	EQP	TYPE	MAKE
59-1	OVER VOLTAGE RELAY STAGE-1	59-1	P142	ALSTOM
59-2	OVER VOLTAGE RELAY STAGE-2	59-2	P142	ALSTOM
27 2/27	UNDER VOLTAGE RELAY TIMER FOR UNDER VOLTAGE RELAY	27 2/27	P142	ALSTOM
50PA 50PB 50PC 50PN	NON DIRECTIONAL O/C PROTN. FOR PHASE-A NON DIRECTIONAL O/C PROTN. FOR PHASE-B NON DIRECTIONAL O/C PROTN. FOR PHASE-C NON DIRECTIONAL E/F PROTN.	50PA 50PB 50PC 50PN	RXIG22	ABB
50/51 50N/5IN	NON DIRECTIONAL O/C & E/F PROTN.	50/51 50N/5IN	P142	ALSTOM
46-1 & 46-2	NEUTRAL UNBALANCE OVERCURRENT RELAY	46-1 & 46-2	P142	ALSTOM
74	SUPERVISION RELAY FOR TRIP RELAY	74/94 74/86	SPERICI	ABB
86	PROTN. TRIP LOCKOUT RELAY	86	LOR/HR	ES
94	PROTN. TRIP RELAY	94	LOR/SR	ES
98	VT FUSE FAILURE SUPERVISION RELAY	98-FFR	RXBA4	ABB
BCU	BAY CONTROL UNIT WITH CURRENT, VOLTAGE, WATT, VAR MEASUREMENTS	BCU-B313 BCU-B343 BCU-B363	REF615	ABB

ABBREVATIONS:

M	MEASURING VOLTAGE
R	REFERENCE VOLTAGE
TC1	TRIP CIRCUIT-1
TC2	TRIP CIRCUIT-2
HMI	HUMAN MACHINE INTERFACE
ES	ETHERNET SWITCH
SAS	SUBSTATION AUTOMATION SYSTEM
3RA313	CAPACITOR BANK-1 SET-1 PROTN. PANEL
3RB313	CAPACITOR BANK-1 SET-2 PROTN. PANEL
3RA343	CAPACITOR BANK-2 SET-1 PROTN. PANEL
3RB343	CAPACITOR BANK-2 SET-2 PROTN. PANEL
3RA362	CAPACITOR BANK-3 SET-1 PROTN. PANEL
3RB362	CAPACITOR BANK-3 SET-2 PROTN. PANEL
DPDM	MULTIFUNCTION METER WITH 3Ø DISPLAY OF CURRENT, VOLTAGE, PF RECORING & MAXIMUM DEMAND RECORDING

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
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	-

CONTRACTOR'S CONSULTANT:
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RELAYING AND METERING ONE LINE DIAGRAM
13.8kV CAPACITOR BANK
QATIF 115/13.8kV SUBSTATION NO. 2
QATIF — SAUDI ARABIA

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
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NG-A (2012/01)
DMS | VECTOR
NGA00

CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	15 of 15	0

115KV U/G CABLES TO QATIF 380/115kV BSP S/S (C.B A613) A609.

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT609	B	CT609.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT609.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT609.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT609.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT609.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV U/G CABLES TO TARUT 115/13.8kV S/S (C.B A609) A613.

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT613	B	CT613.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT613.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT613.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT613.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT613.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV U/G CABLES TO POINT A (A615)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT615	B	CT615.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT615.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT615.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT615.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT615.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV U/G CABLES TO TARUT 115/13.8KV S/S, (CB-A606) (A610)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT610	B	CT610.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT610.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT610.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT610.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT610.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV U/G CABLES TO POINT A (A612)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT612	B	CT612.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT612.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT612.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT612.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT612.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV U/G CABLES TO QATIF 380/115kV BSP S/S (CB, A608) A606

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT606	B	CT606.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT606.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT606.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT606.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT606.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1667V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV FEEDER - SPARE A617

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT617	B	CT617.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT617.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT617.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT617.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT617.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV FEEDER - SPARE A614

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT614	B	CT614.B.C1	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-1 PROTN.
		CT614.B.C2	3000-2500-2000-1500-1250-1000-500/1A	1500/1A	TPS	1250V	-	40mA	2.35 Ohm	26.67	6.65	4.7	2	LINE SET-2 PROTN.
		CT614.B.C3	3000-2500-2000-1500-1250-1000-500/1A	1000/1A	0.5, ISF<5	-	20VA	-	-	-	-	-	2	LINE METERING
	F	CT614.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT614.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV TO TRAFO, T601 (A607)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT607	B	CT607.B.C1	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF DIFFERENTIAL PROTN.
		CT607.B.C2	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF NON DIR.O/C & E/F PROTN.
		CT607.B.C3	3000-2500-2000-1500-1250-1000-500/1A	500/1A	0.5, ISF<5	-	10VA	-	-	-	-	-	2	TRF METERING
	F	CT607.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT607.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV TO TRAFO, T602 (A605)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT605	B	CT605.B.C1	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF DIFFERENTIAL PROTN.
		CT605.B.C2	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF NON DIR.O/C & E/F PROTN.
		CT605.B.C3	3000-2500-2000-1500-1250-1000-500/1A	500/1A	0.5, ISF<5	-	10VA	-	-	-	-	-	2	TRF METERING
	F	CT605.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT605.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

115KV TO TRAFO, T603 (A604)

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	KSSC	K	Rb	TRF	APPLICATION
CT604	B	CT604.B.C1	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF DIFFERENTIAL PROTN.
		CT604.B.C2	3000-2500-2000-1500-1250-1000-500/1A	500/1A	TPS	417V	-	120mA	0.78 Ohm	80	2.23	1.56	2	TRF NON DIR.O/C & E/F PROTN.
		CT604.B.C3	3000-2500-2000-1500-1250-1000-500/1A	500/1A	0.5, ISF<5	-	10VA	-	-	-	-	-	2	TRF METERING
	F	CT604.F.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	BUSBAR PROTECTION
		CT604.F.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	-	30mA	3.13 Ohm	20	8.87	6.26	2	SPARE

TRANSFORMER BUSHING CTs -T601, T602 & T603

LOCATION	CT REF	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) at Tap	BURDEN @ ADOPTED TAP	Ial@ ADOPTED TAP	Rct Ohms Tap	KSSC	K	Rb	TRF	APPLICATION
T601, T602 T603	HVBCT1	600-400-200-100/1A	600/1A	0.5, ISF<5	-	30 VA	-	-	-	-	-	2	HV METERING (3Ph.)
	BCT-2	AS PER MANUFACTURER DATA											HV WTI
	LVBCT1	4000-3000-2500-2000-1500-1000/1A	4000/1A	0.5, ISF<5		30 VA	-	-	-	-	-	2	AVR (BØ ONLY)
	BCT-4	AS PER MANUFACTURER DATA											LV WTI
	LVBCT2	4000-3000-2500-2000-1500-1000/1A	4000/1A	0.2, ISF<5	-	30 VA	-	-	-	-	-	2	LV METERING (3Ph.)
	NBCT1	4000/1A	4000/1A	TPS	500	-	30	14.0	6.25	1.9	28	1.2	87 REF (LV)
	NBCT2	4000-3000-2500-2000-1500-1000/1A	4000/1A	TPS	500	-	30	14.0	6.25	1.9	28	2	51G LV

115KV BUS SECTION A601

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	Ial@ ADOPTED TAP	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
CT601	1A	CT601.1A.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT601.1A.C2	3000-2500-2000-1500-1250-1000-500/1A	2500/1A	0.5, ISF<5	-	-	-	50VA	-	-	-	2	BS METERING
	1B	CT601.1B.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT601.1B.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BS NON DIR OC & E/F PROTN.
CT2B	2B	CT2B.C1	3000-2500-2000-1500-1250-1000-500/1A	2500/1A	0.5, ISF<5	-	-	-	50VA	-	-	-	2	BS METERING

115KV BUS COUPLER (BC-2) A602

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	Ial@ ADOPTED TAP	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
CT602	1C	CT602.1C.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT602.1C.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BS NON DIR OC & E/F PROTN.
	2C	CT602.2C.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT602.2C.C2	3000-2500-2000-1500-1250-1000-500/1A	2500/1A	0.5, ISF<5		-	-	50VA	-	-	-	2	BC METERING

115KV BUS COUPLER (BC-1) A603

LOCATION		CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual@ ADOPTED TAP	Rct @ ADOPTED TAP (75c)	Ial@ ADOPTED TAP	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
CT603	1A	CT603.1A.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT603.1A.C2	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BS NON DIR OC & E/F PROTN.
	2A	CT603.2A.C1	3000-2500-2000-1500-1250-1000-500/1A	2000/1A	TPS	1666.6V	3.13 Ohm	30 mA	-	20	8.87	6.26	2	BUSBAR PROTECTION
		CT603.2A.C2	3000-2500-2000-1500-1250-1000-500/1A	2500/1A	0.5, ISF<5		-	-	50VA	-	-	-	2	BC METERING

13.8kV INCOMER A301

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T011-T013	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87B1, 87B2 & 87B3
	CORE-2	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	67/67N
T021-T023	CORE-1	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87T
	CORE-2	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87REF

13.8kV INCOMER A302

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T011-T013	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87B1, 87B2 & 87B3
	CORE-2	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	67/67N
T021-T023	CORE-1	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87T
	CORE-2	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87REF

13.8kV INCOMER A303

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T011-T013	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87B1, 87B2 & 87B3
	CORE-2	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	67/67N
T021-T023	CORE-1	4000-3600/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87T
	CORE-2	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	87REF

13.8kV OUTGOING FEEDERS

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T031-T033	CORE-1	600-400/1A	600/1A	TPS	480	2.1	26.67	-	41.67	1.83	4.2	1.2	O/C PROTN. 50/51 &50N/51N
	CORE-2	600-400/1A	600/1A	0.5, ISF<5	-	-	-	10VA	-	-	-	1.2	METERING
T041-T043	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	BB PROTN. 87B1, 87B2&87B3

13.8kV OUTGOING CAPACITOR BANK (B313, B343 & B362)

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T081-83	CORE-1	1200-600-400/1A	600/1A	TPS	320	2.1	40	-	41.67	1.22	4.2	1.2	O/C PROTN. 50/51 &50N/51N
	CORE-2	1200-600-400/1A	600/1A	0.5, ISF<5	-	-	-	10VA	-	-	-	1.2	METERING
T041-T043	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	BB PROTN. 87B1, 87B2&87B3

13.8kV FEEDER FOR STATION SERVICE TRAFO. (T301 & T302)

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T051-T053	CORE-1	600-400/1A	400/1A	TPS	320	1.4	40	-	62.5	1.22	2.8	1.2	O/C PROTN. 50/51 &50N/51N
	CORE-2	100-50/1A	50/1A	0.2, ISF<5	-	-	-	10VA	-	-	-	1.2	METERING
T041-T043	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	BB PROTN. 87B1, 87B2&87B3

13.8kV BUS-TIE/RISER/MET

LOCATION	CT CORE NO	CT RATIO	ADOPTED TAP	ACC. CLASS @ TAP	Ual(V) @ ADOPTED TAP	Rct @ ADOPTED TAP (Ohm)	Ial @ Ualn mA	BURDEN @ ADOPTED TAP	KSSC	K	Rb	TRF	APPLICATION
T061-T063	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	B/B PROTN. 87B1, 87B2, 87B3
	CORE-2	4000/1A	4000/1A	0.5, ISF<5	-	-	-	10VA	-	-	-	1.2	METERING
T071-T073	CORE-1	4000/1A	4000/1A	TPS	500	14.0	30	-	6.25	1.9	28	1.2	B/B PROTN. 87B1, 87B2, 87B3
	CORE-2	4000-3600/1A	4000/1A	TPS	1400	14.0	30	-	6.25	5.33	28	1.2	O/C PROTN. 50/51+50N/51N

NOTES

1. DRAWING NOTE

LEGEND

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
SCOPE OF WORK & TECHNICAL SPECIFICATIONS	PTS- 11EN146
MAIN SWITCHING ONE LINE DIAGRAM	EA- 221470
	-
	--
	-

CONTRACTOR'S CONSULTANT:
DAR ENGINEERING
ENGINEERS & DESIGNERS
P.O.BOX 13103
DAMMAM-31493

الدار الدولية للهندسة
مهندسون ومصممون
ص.ب ١٣١٠٣
الدمام ٣١٤٩٣

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03.2013	DAR	ISSUED FOR CONSTRUCTION	M.Z.K	O.B	A.Y.K
B	11.2012	DAR	ISSUED FOR DETAIL DESIGN	M.Z.K	O.B	A.Y.K
A	05.2012	DAR	FIRST ISSUE	M.Z.K	O.B	A.Y.K

DRAWING COMPLETION CERTIFICATE (DCC):

الشركة الوطنية لنقل الكهرباء
نقل الكهرباء National Grid SA

DRAWN BY G.MUSTAFA CHECKED BY OSAMA/ZAHID SCALE: N.T.S
DATE STARTED 08.05.2012. DATE COMPLETED _____
OPR'G. DEPT. _____ ENG. DEPT. _____

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED
BY _____ DATE _____

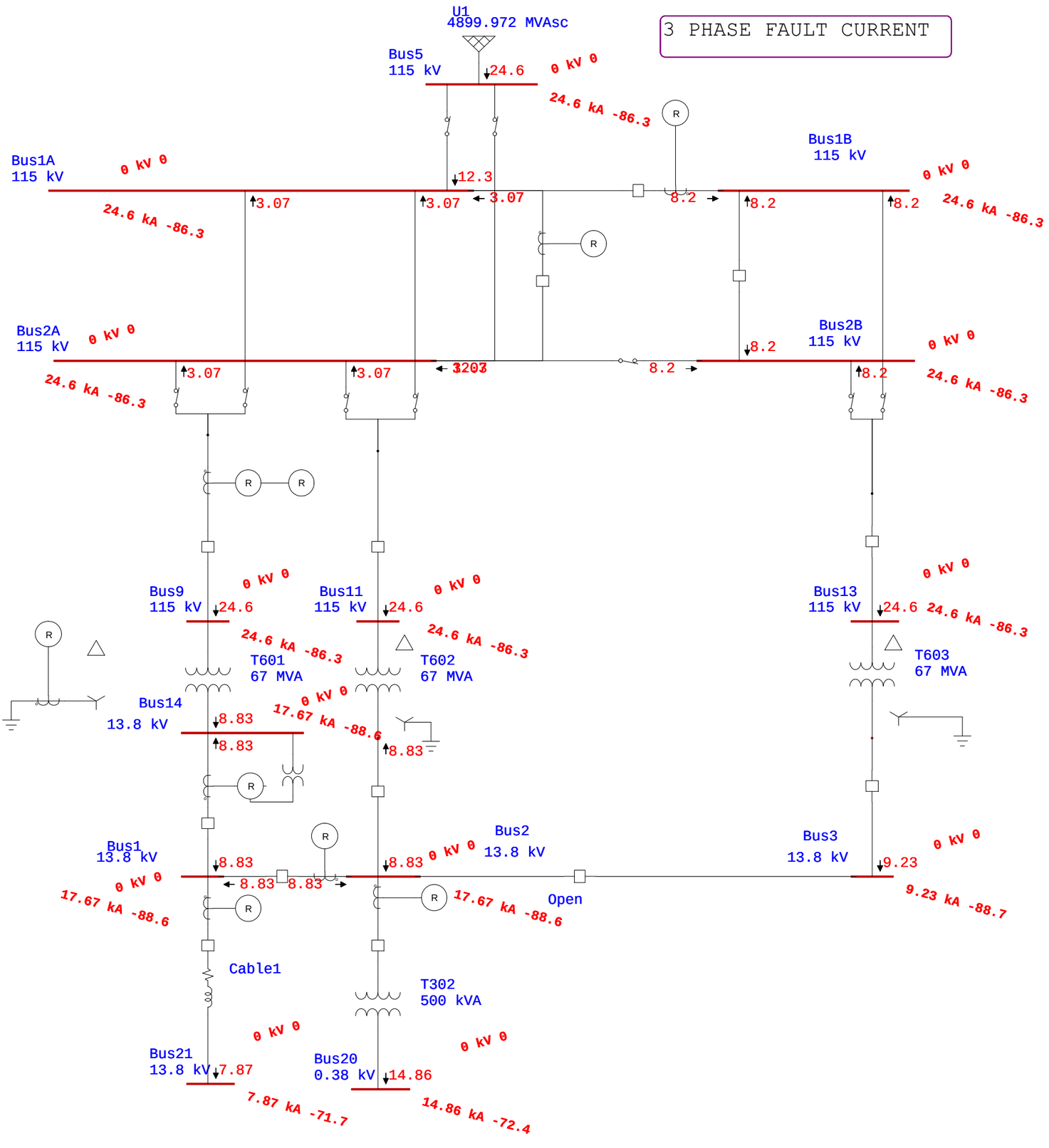
RELAYING AND METERING ONE LINE DIAGRAM
CT RATING DETAIL
DATIF 115/13.8kV SUBSTATION NO. 2
DATIF SAUDI ARABIA

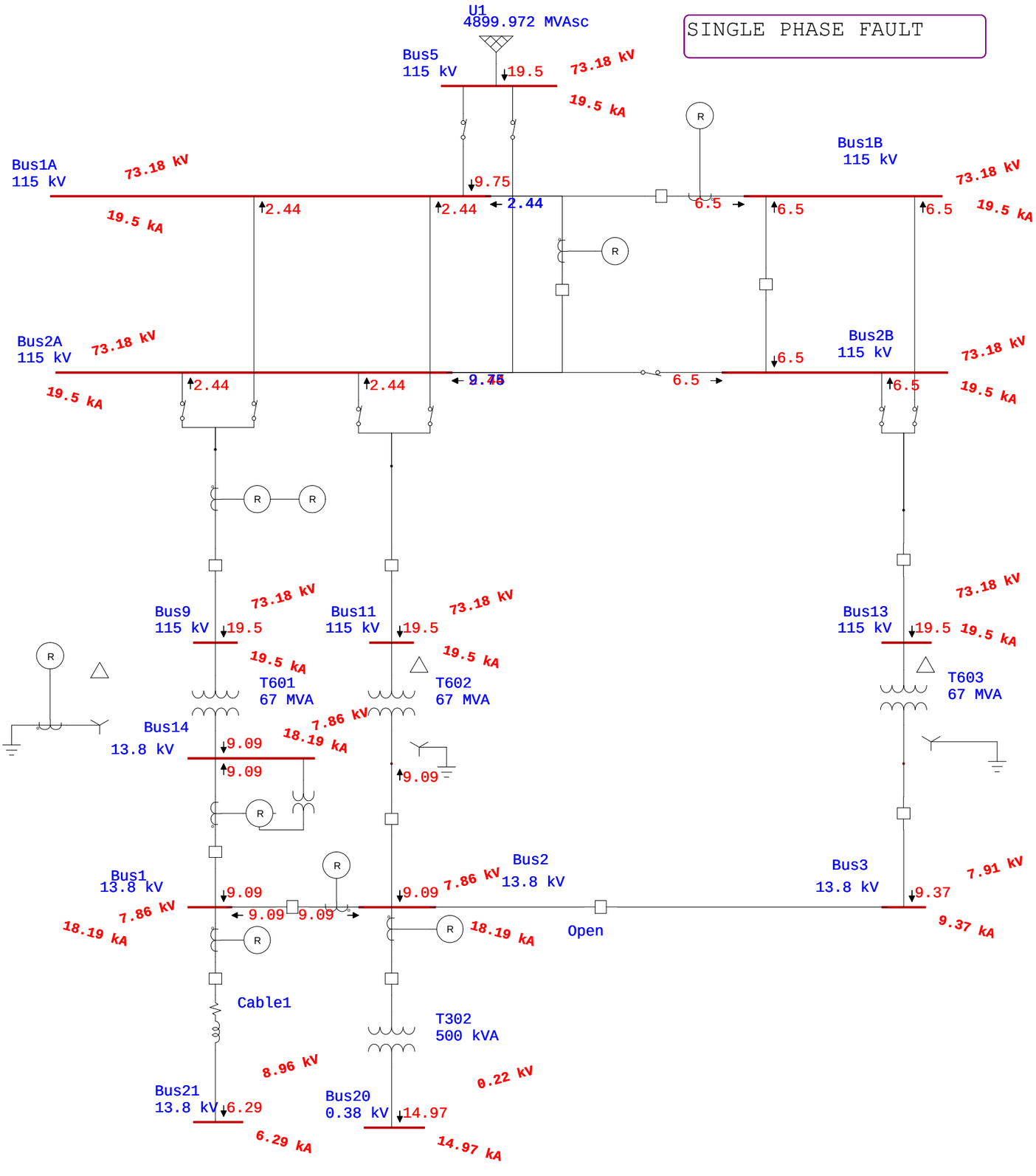
CONTRACT NO.	JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
31131127/00	1-113045.01	P	DA441	EA-221504	15 of 15	0

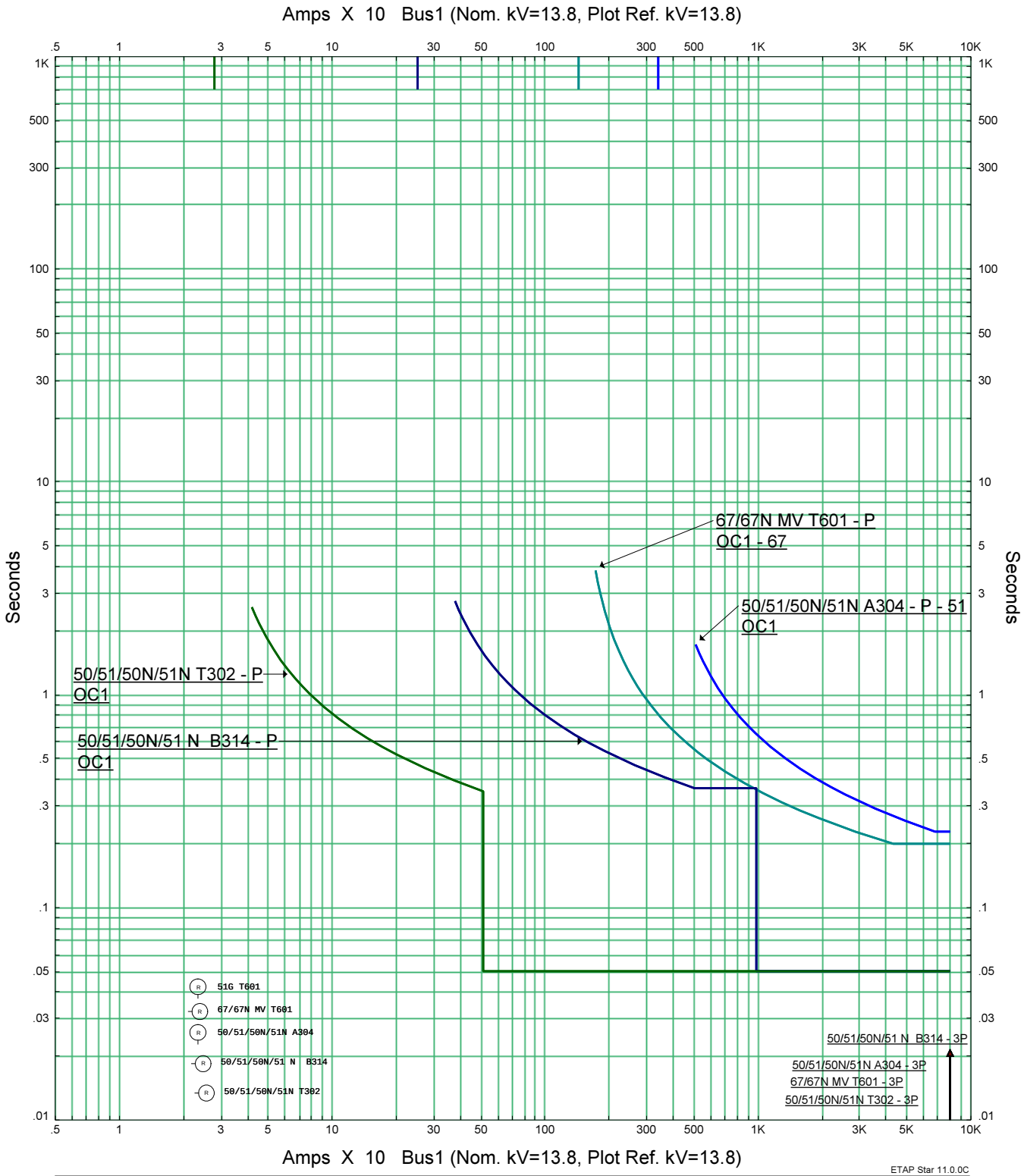
NG-A (2012/01)
DMS VECTOR NGA00

ANNEXURE-B

(ETAP result and co-ordination graph)


3 PHASE FAULT CURRENT
U1
4899.972 MVAsc
Bus5
115 kV
24.6
0 kV 0
24.6 kA -86.3
Bus1A
115 kV
0 kV 0
12.3
3.07
3.07
3.07
24.6 kA -86.3
Bus1B
115 kV
0 kV 0
8.2
8.2
8.2
24.6 kA -86.3
Bus2A
115 kV
0 kV 0
3.07
3.07
3.07
24.6 kA -86.3
Bus2B
115 kV
0 kV 0
8.2
8.2
8.2
24.6 kA -86.3
Bus9
115 kV
24.6
0 kV 0
24.6 kA -86.3
T601
67 MVA
Bus11
115 kV
24.6
0 kV 0
24.6 kA -86.3
T602
67 MVA
Bus13
115 kV
24.6
0 kV 0
24.6 kA -86.3
T603
67 MVA
Bus14
13.8 kV
8.83
0 kV 0
17.67 kA -88.6
8.83
8.83
Bus1
13.8 kV
8.83
0 kV 0
17.67 kA -88.6
8.83
8.83
Bus2
13.8 kV
8.83
0 kV 0
17.67 kA -88.6
Open
Bus3
13.8 kV
9.23
0 kV 0
9.23 kA -88.7
Cable1
T302
500 kVA
Bus21
13.8 kV
7.87
0 kV 0
7.87 kA -71.7
Bus20
0.38 kV
14.86
0 kV 0
14.86 kA -72.4


U1
4899.972 MVAsc
SINGLE PHASE FAULT
Bus5
115 kV
19.5
73.18 kV
19.5 kA
Bus1A
115 kV
73.18 kV
19.5 kA
9.75
2.44
2.44
2.44
6.5
Bus1B
115 kV
6.5
6.5
73.18 kV
19.5 kA
Bus2A
115 kV
73.18 kV
19.5 kA
2.44
2.44
9.75
6.5
Bus2B
115 kV
6.5
6.5
73.18 kV
19.5 kA
R
Bus9
115 kV
19.5
73.18 kV
19.5 kA
Bus11
115 kV
19.5
73.18 kV
19.5 kA
Bus13
115 kV
19.5
19.5 kA
73.18 kV
T601
67 MVA
T602
67 MVA
T603
67 MVA
Bus14
13.8 kV
9.09
7.86 kV
18.19 kA
9.09
9.09
Bus1
13.8 kV
9.09
7.86 kV
18.19 kA
9.09
9.09
9.09
7.86 kV
Bus2
13.8 kV
18.19 kA
Open
Bus3
13.8 kV
9.37
7.91 kV
9.37 kA
Cable1
T302
500 kVA
8.96 kV
0.22 kV
Bus21
13.8 kV
6.29
6.29 kA
Bus20
0.38 kV
14.97
14.97 kA

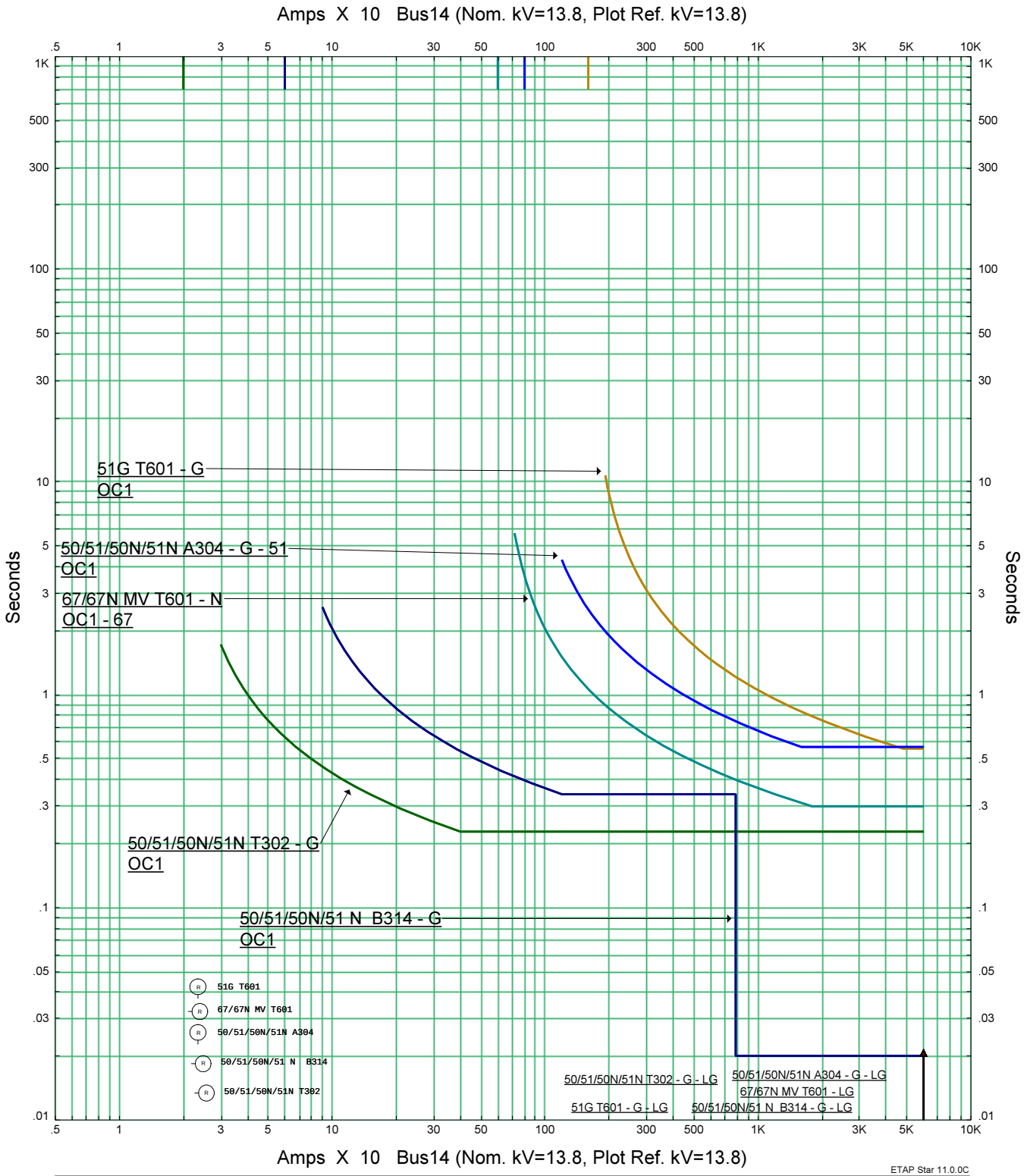


ETAP Star 11.0.0C

13.8KV PHASE FAULT CURVE

Project:
Location:
Contract:
Engineer:
Filename: E:\DG298\RELAY SETTINGS\REV.0\QATIF 2 SS\QATIF 2 SS.OTI

Date: 10-23-2013
SN: DAR-ENGING
Rev: Base
Fault: Phase

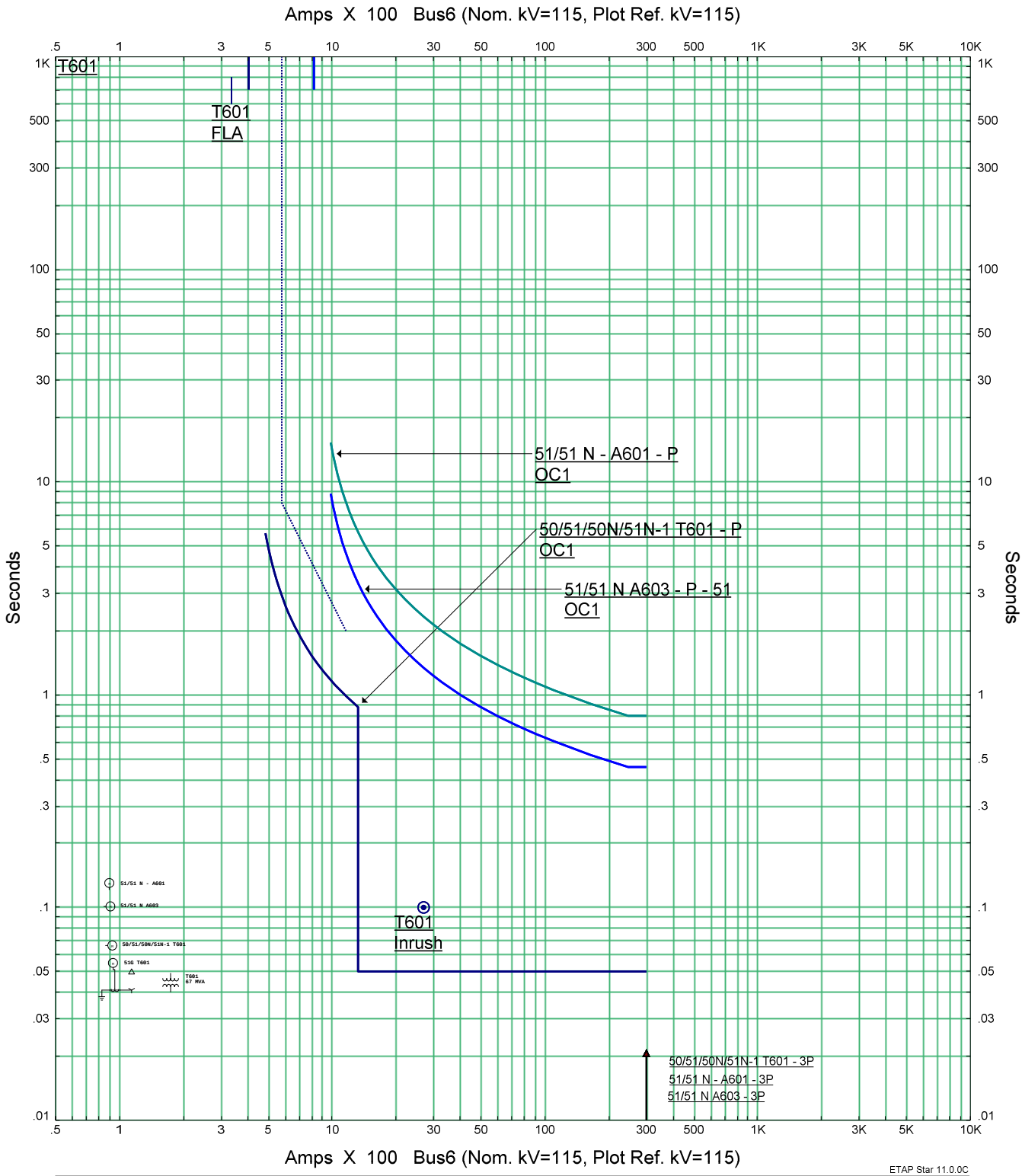


ETAP Star 11.0.0C

13.8KV EARTH FAULT CURVE

Project:
Location:
Contract:
Engineer:
Filename: E:\DG298\RELAY SETTINGS\REV.0\QATIF 2 SS\QATIF 2 SS.OTI

Date: 10-23-2013
SN: DAR-ENGING
Rev: Base
Fault: Ground

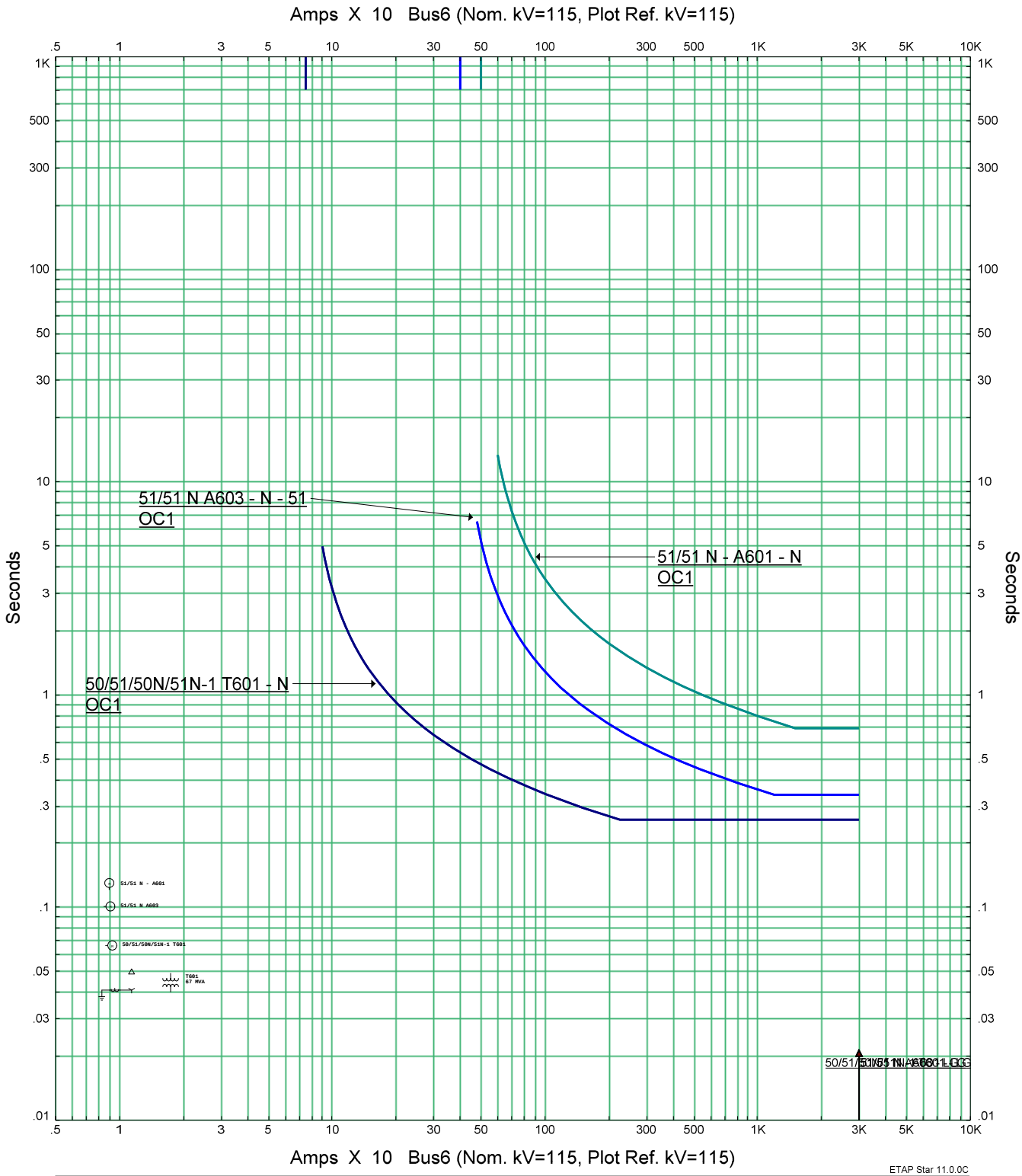


ETAP Star 11.0.0C

115KV PHASE FAULT CURVE

Project:
Location:
Contract:
Engineer:
Filename: E:\DG298\RELAY SETTINGS\REV.0\QATIF 2 SS\QATIF 2 SS.OTI

Date: 10-23-2013
SN: DAR-ENGING
Rev: Base
Fault: Phase



ETAP Star 11.0.0C

115KV EARTH FAULT CURVE

Project:
Location:
Contract:
Engineer:
Filename: E:\DG298\RELAY SETTINGS\REV.0\QATIF 2 SS\QATIF 2 SS.OTI

Date: 10-23-2013
SN: DAR-ENGING
Rev: Base
Fault: Ground

Electrical Transient Analyzer Program

Short-Circuit Analysis

ANSI Standard
3-Phase, LG, LL, & LLG Fault Currents
30-Cycle Network

	Swing	V-Control	Load	Total
Number of Buses:	1	0	18	19

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	4	0	0	1	0	19	24

	Synchronous Generator	Power Grid	Synchronous Motor	Induction Machines	Lumped Load	Total
Number of Machines:	0	1	0	0	0	1

System Frequency:	60.00 Hz
Unit System:	English
Project Filename:	QATIF 2 SS
Output Filename:	E:\DG298\RELAY SETTINGS\REV.0\QATIF 2 SS\Untitled.SA2

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable Resistance:	Yes	Individual	

Bus Input Data

Bus					Initial Voltage	
ID	Type	Nom. kV	Base kV	Sub-sys	%Mag.	Ang.
Bus1	Load	13.800	13.800	1	100.00	-30.00
Bus1A	Load	115.000	115.000	1	100.00	0.00
Bus1B	Load	115.000	115.000	1	100.00	0.00
Bus2	Load	13.800	13.800	1	100.00	-30.00
Bus2A	Load	115.000	115.000	1	100.00	0.00
Bus2B	Load	115.000	115.000	1	100.00	0.00
Bus3	Load	13.800	13.800	1	100.00	-30.00
Bus5	SWNG	115.000	115.000	1	100.00	0.00
Bus6	Load	115.000	115.000	1	100.00	0.00
Bus7	Load	115.000	115.000	1	100.00	0.00
Bus8	Load	115.000	115.000	1	100.00	0.00
Bus9	Load	115.000	115.000	1	100.00	0.00
Bus11	Load	115.000	115.000	1	100.00	0.00
Bus13	Load	115.000	115.000	1	100.00	0.00
Bus14	Load	13.800	13.800	1	100.00	-30.00
Bus15	Load	13.800	13.800	1	100.00	-30.00
Bus16	Load	13.800	13.800	1	100.00	-30.00
Bus20	Load	0.380	0.380	1	100.00	0.00
Bus21	Load	13.800	13.800	1	100.00	-30.00

19 Buses Total

All voltages reported by ETAP are in % of bus Nominal kV.
Base kV values of buses are calculated and used internally by ETAP.

Line/Cable Input Data

Line/Cable							Ohms or Siemens per 1000 ft per Conductor (Cable) or per Phase (Line)					
			Length									
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R1	X1	Y1	R0	X0	Y0
Cable1	15NCUS3	400	16404.2	0.0	1	75	0.0187508	0.0310896		0.0298124	0.0789676	

Line / Cable resistances are listed at the specified temperatures.

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
T302	0.500	13.800	0.380	5.00	3.09	0	0	0	0	0	5.0000	Dyn	-30.000
T601	67.000	115.000	13.800	29.00	50.40	0	0	0	0	0	29.0000	Dyn	30.000
T602	67.000	115.000	13.800	29.00	50.40	0	0	0	0	0	29.0000	Dyn	30.000
T603	67.000	115.000	13.800	29.00	50.40	0	0	0	0	0	29.0000	Dyn	30.000

2-Winding Transformer Grounding Input Data

				Grounding								
Transformer	Rating			Conn.	Primary				Secondary			
ID	MVA	Prim. kV	Sec. kV	Type	Type	kV	Amp	Ohm	Type	kV	Amp	Ohm
T302	0.500	13.800	0.380	D/Y					Solid			
T601	67.000	115.000	13.800	D/Y					Solid			
T602	67.000	115.000	13.800	D/Y					Solid			
T603	67.000	115.000	13.800	D/Y					Solid			

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R	X	Z	Y
T302	2W XFMR	Bus2	Bus20	307.90	951.42	1000.00	
T601	2W XFMR	Bus9	Bus14	0.86	43.28	43.28	
T602	2W XFMR	Bus11	Bus15	0.86	43.28	43.28	
T603	2W XFMR	Bus13	Bus16	0.86	43.28	43.28	
Cable1	Cable	Bus1	Bus21	16.15	26.78	31.27	
A301	Tie Breakr	Bus14	Bus1				
A302	Tie Breakr	Bus15	Bus2				
A303	Tie Breakr	Bus16	Bus3				
A304	Tie Breakr	Bus2	Bus1				
A601	Tie Breakr	Bus1B	Bus1A				
A602	Tie Breakr	Bus1B	Bus2B				
A603	Tie Breakr	Bus1A	Bus2A				
A604	Tie Breakr	Bus8	Bus13				
A605	Tie Breakr	Bus7	Bus11				
A607	Tie Breakr	Bus6	Bus9				
SW1	Tie Switch	Bus5	Bus1A				
SW2	Tie Switch	Bus5	Bus2A				
SW3	Tie Switch	Bus2B	Bus2A				
SW4	Tie Switch	Bus2A	Bus6				
SW5	Tie Switch	Bus1A	Bus6				
SW6	Tie Switch	Bus2A	Bus7				
SW7	Tie Switch	Bus1A	Bus7				
SW8	Tie Switch	Bus2B	Bus8				
SW9	Tie Switch	Bus1B	Bus8				

Power Grid Input Data

Power Grid	Connected Bus	Rating		% Positive Seq. Impedance 100 MVA Base			Grounding	% Zero Seq. Impedance 100 MVA Base		
ID	ID	MVASC	kV	X/R	R	X	Type	X/R	R0	X0
U1	Bus5	4899.972	115.000	15.60	0.13055	2.03665	Wye - Solid	8.30	0.436016	3.61893

Total Power Grids (= 1) 4899.972 MVA

SHORT- CIRCUIT REPORT

Fault at bus: **Bus1**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus1	Total	0.00	17.667	0.00	98.66	98.45	18.189	18.189	5.60E-001	2.37E+001	4.29E-001	2.16E+001
Bus21	Bus1	0.00	0.000	0.00	98.66	98.45	0.000	0.000				
Bus20	Bus2	0.00	0.000	56.96	100.00	56.84	0.000	0.000				
Bus11	Bus15	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001
Bus9	Bus14	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001

\# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus1A**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus1A	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus1B**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus1B	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus2**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus2	Total	0.00	17.667	0.00	98.66	98.45	18.189	18.189	5.60E-001	2.37E+001	4.29E-001	2.16E+001
Bus20	Bus2	0.00	0.000	56.96	100.00	56.84	0.000	0.000				
Bus21	Bus1	0.00	0.000	0.00	98.66	98.45	0.000	0.000				
Bus9	Bus14	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001
Bus11	Bus15	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus2A**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus2A	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus2B**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus2B	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus3**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus3	Total	0.00	9.231	0.00	99.30	99.19	9.371	9.371	9.89E-001	4.53E+001	8.59E-001	4.33E+001
Bus13	Bus16	95.50	9.231	97.78	100.00	97.67	9.371	9.371 *	9.89E-001	4.53E+001	8.59E-001	4.33E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus5**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus5	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus9**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus9	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus11**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus11	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus13**

Prefault voltage = 115.000 kV = 100.00 % of nominal bus kV (115.000 kV)
= 100.00 % of base kV (115.000 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus13	Total	0.00	24.600	0.00	110.22	113.46	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000
Bus16	Bus13	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus15	Bus11	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
Bus14	Bus9	0.00	0.000	65.51	63.64	100.00	0.000	0.000				
U1	Bus5	100.00	24.600	100.00	100.00	100.00	19.500	19.500	1.31E-001	2.04E+000	4.36E-001	3.62E+000

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus14**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus14	Total	0.00	17.667	0.00	98.66	98.45	18.189	18.189	5.60E-001	2.37E+001	4.29E-001	2.16E+001
Bus9	Bus14	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001
Bus21	Bus1	0.00	0.000	0.00	98.66	98.45	0.000	0.000				
Bus20	Bus2	0.00	0.000	56.96	100.00	56.84	0.000	0.000				
Bus11	Bus15	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus15**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus15	Total	0.00	17.667	0.00	98.66	98.45	18.189	18.189	5.60E-001	2.37E+001	4.29E-001	2.16E+001
Bus11	Bus15	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001
Bus20	Bus2	0.00	0.000	56.96	100.00	56.84	0.000	0.000				
Bus21	Bus1	0.00	0.000	0.00	98.66	98.45	0.000	0.000				
Bus9	Bus14	91.39	8.834	95.71	100.00	95.49	9.095	9.095 *	1.12E+000	4.73E+001	8.59E-001	4.33E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus16**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus16	Total	0.00	9.231	0.00	99.30	99.19	9.371	9.371	9.89E-001	4.53E+001	8.59E-001	4.33E+001
Bus13	Bus16	95.50	9.231	97.78	100.00	97.67	9.371	9.371 *	9.89E-001	4.53E+001	8.59E-001	4.33E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus20**

Prefault voltage = 0.380 kV = 100.00 % of nominal bus kV (0.380 kV)
= 100.00 % of base kV (0.380 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus20	Total	0.00	14.856	0.00	99.44	99.82	14.967	14.967	3.08E+002	9.75E+002	3.08E+002	9.51E+002
Bus2	Bus20	97.78	14.856	99.07	98.69	100.00	14.967	14.967 *	3.08E+002	9.75E+002	3.08E+002	9.51E+002

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Fault at bus: **Bus21**

Prefault voltage = 13.800 kV = 100.00 % of nominal bus kV (13.800 kV)
= 100.00 % of base kV (13.800 kV)

Contribution		3-Phase Fault		Line-To-Ground Fault					Positive & Zero Sequence Impedances Looking into "From Bus"			
From Bus ID	To Bus ID	% V From Bus	kA Symm. rms	% Voltage at From Bus Va	Vb	Vc	kA Symm. rms Ia	3I0	% Impedance on 100 MVA base R1	X1	R0	X0
Bus21	Total	0.00	7.872	0.00	112.51	110.39	6.287	6.287	1.67E+001	5.05E+001	2.61E+001	8.97E+001
Bus1	Bus21	58.84	7.872	67.47	99.30	99.72	6.287	6.287	1.67E+001	5.05E+001	2.61E+001	8.97E+001

# Indicates fault current contribution is from three-winding transformers

* Indicates a zero sequence fault current contribution (3I0) from a grounded Delta- Y transformer

Short-Circuit Summary Report

30 Cycle - 3-Phase, LG, LL, & LLG Fault Currents

Prefault Voltage = 100 % of the Bus Nominal Voltage

Bus		3-Phase Fault			Line-to-Ground Fault			Line-to-Line Fault			*Line-to-Line-to-Ground		
ID	kV	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.	Real	Imag.	Mag.
Bus1	13.80	0.418	-17.662	17.667	0.408	-18.185	18.189	15.296	0.362	15.300	15.097	9.731	17.962
Bus1A	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus1B	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus2	13.80	0.418	-17.662	17.667	0.408	-18.185	18.189	15.296	0.362	15.300	15.097	9.731	17.962
Bus2A	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus2B	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus3	13.80	0.201	-9.229	9.231	0.199	-9.369	9.371	7.992	0.174	7.994	7.895	4.932	9.308
Bus5	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus9	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus11	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus13	115.00	1.574	-24.550	24.600	1.760	-19.420	19.500	21.261	1.363	21.304	-22.128	6.663	23.110
Bus14	13.80	0.418	-17.662	17.667	0.408	-18.185	18.189	15.296	0.362	15.300	15.097	9.731	17.962
Bus15	13.80	0.418	-17.662	17.667	0.408	-18.185	18.189	15.296	0.362	15.300	15.097	9.731	17.962
Bus16	13.80	0.201	-9.229	9.231	0.199	-9.369	9.371	7.992	0.174	7.994	7.895	4.932	9.308
Bus20	0.38	4.481	-14.164	14.856	4.545	-14.260	14.967	12.266	3.880	12.866	-14.572	3.298	14.940
Bus21	13.80	2.475	-7.472	7.872	1.875	-6.001	6.287	6.471	2.143	6.817	5.720	4.649	7.371

All fault currents are symmetrical momentary (30 Cycle network) values in rms kA

* LLG fault current is the larger of the two faulted line currents

Short-Circuit Summary Report

Bus		Positive Sequence Imp. (ohm)			Negative Sequence Imp. (ohm)			Zero Sequence Imp. (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus1	13.800	0.01066	0.45085	0.45098	0.01066	0.45085	0.45098	0.00818	0.41207	0.41215
Bus1A	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus1B	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus2	13.800	0.01066	0.45085	0.45098	0.01066	0.45085	0.45098	0.00818	0.41207	0.41215
Bus2A	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus2B	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus3	13.800	0.01884	0.86292	0.86312	0.01884	0.86292	0.86312	0.01635	0.82413	0.82429
Bus5	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus9	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus11	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus13	115.000	0.17266	2.69347	2.69899	0.17266	2.69347	2.69899	0.57663	4.78603	4.82065
Bus14	13.800	0.01066	0.45085	0.45098	0.01066	0.45085	0.45098	0.00818	0.41207	0.41215
Bus15	13.800	0.01066	0.45085	0.45098	0.01066	0.45085	0.45098	0.00818	0.41207	0.41215
Bus16	13.800	0.01884	0.86292	0.86312	0.01884	0.86292	0.86312	0.01635	0.82413	0.82429
Bus20	0.380	0.00445	0.01408	0.01477	0.00445	0.01408	0.01477	0.00445	0.01374	0.01444
Bus21	13.800	0.31825	0.96085	1.01219	0.31825	0.96085	1.01219	0.49722	1.70746	1.77839

ANNEXURE-C

(Relay ordering details)

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221655	02 of 04	0

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115/13.8KV TRANSFORMER T601 SET-1 PROTECTION PANEL -6T1A1 CONSISTING OF THE FOLLOWING :	1	VSH 200	ABB	
U03.5001	74/DC-1	DC SUPERVISION RELAY WITH THE FOLOWING CONTACTS : 1 NO + 3 NC DC VOLTAGE : 110/125 V DC OPERATION INDICATOR : SELF RESET	1	MVAX 12	AREVA	MVAX12 RICB0757A
U03.5002	74/TC-1//A607	TRIP CIRCUIT-1 SUPERVISION RELAY-A607 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31S1DE0754A
C	R1 R2,R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U08.5001	87T	TRANSFORMER DIFFERENTIAL PROTECTION RELAY RATED CURRENT : 1A AUX. SUPPLY : 90-250V DC RATED FREQUENCY : 50/60HZ	1	RET670 VER.1.2	ABB	RET670*1.2-B40X00-D02-D04 P01-01-C-B-K-B-B-B3-DAXE
U15.113	74/86T-1	SUPERVISION RELAY FOR TRIP RELAY DC VOLTAGE : 40-265V DC CONTACTS : 2 C/O	1	SPERIC1	ABB	RS 485 002-AA
U15.5001	87REF	RESTRICTED EARTH FAULT RELAY FOR HV WINDING RATED CURRENT : 1A CONTACTS : 2 NO RATED FREQUENCY : 60HZ SETTING VOLTAGE : 5-40 % OF IN STAB.RESISTOR : 1000 OHMS OPERATION INDICATOR : HAND RESET	1	MCAG 14	AREVA	MCAG14 SS DB 0220A
U20.5001	86T-1	HAND RESET LOCKOUT TRIP RELAY FOR SET-1 PROT. WITH THE FOLLOWING: RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F	1	LOR H/R	ELECTRO SWITCH	7810 F
U33.5001 U33.5002 U33.5003	TS-1 TS-2 TS-3	FLEXI TEST SWITCH WITH 8C-2P FOR 87T CT ISOLATION FLEXI TEST SWITCH WITH 8C-2P FOR 87T CT ISOLATION FLEXI TEST SWITCH WITH 10C FOR 87REF CT ISOLATION	1	FT-19R	ABB	FR2G 083 083 073
U36.5001 U36.5002 U36.5003	TS-4 TS-5 TS-6	FLEXI TEST SWITCH WITH 8C-2P FOR 87REF CT ISOLATION FLEXI TEST SWITCH WITH 2P-2T-6P FOR TRIP ISOLATION FLEXI TEST SWITCH WITH 10P FOR TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 819 001
	B1.1	NON LINEAR RESISTOR FOR (87REF)	1	METROSIL	AREVA	
	SR1	STABILISING RESISTOR FOR MCAG14 RELAY	1		AREVA	
U39.5001	F1	6A MCB FOR DC AUX SUPPLY	1	STOTZ	ABB	S282-UC-K6
U39.5002	CO1,CO2	POWER SOCKET DUPLEX TYPE. 127 & 220V AC	1	US M45 & US MS45	LEGRAND	74140 & 74180
U39.5003	TJ	TELEPHONE JACK	1	EDF 410	EDISSON ELECTRIC	EDF 410
	LK1-LK3	NEUTRAL ISOLATION LINK	3	RS20	AREVA	
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	SW	TOGGLE SWITCH FOR SPACE HEATER	1	MCBH-10 M2SS1-10B	ABB	1SFA 611 685 R1101 1SFA 611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK3110	RITTAL	SK3110
	SH	SPACE HEATER-150W, 120V, 60HZ	1	1FZEK7580104	COMPOTECH	
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	T-4 SP-20W	ANHORN INT'L GROUP LTD.	
	1X1S,2X1S,3X1S,4X1S	TERMINAL BLOCK FOR CT CKT (6WAYS BLOCK)	4	EB27	GE	0790462
	1X3	TERMINAL BLOCK FOR AUX. DC CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X3.1	TERMINAL BLOCK FOR AUX. AC CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X41	TERMINAL BLOCK FOR TRIP CIRCUIT-1	15	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X43	TERMINAL BLOCK FOR INTIATION CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X45	TERMINAL BLOCK FOR CLOSING CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X46	TERMINAL BLOCK FOR SPARE CONTACTS	50	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1X6	TERMINAL BLOCK FOR ALARM CIRCUIT	10	M6/8_RS	ENTRELEC	115.685.12
	1XB2	TERMINAL BLOCK FOR TFR CIRCUIT	5	M6/8_RS	ENTRELEC	115.685.12
	1XSH	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	1XTJ	TERMINAL BLOCK FOR TEL. JACK	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	CICT-A,B,C,N	CURRENT ISOLATION CURRENT TRANSFORMER	4	CICT	AMETEK	

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221504
AC ELEMENTARY DIAGRAM	EA-221755
DC ELEMENTARY DIAGRAM	EA-221655

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	05/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	ARK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-06-16 DATE COMPLETED --
OPR'G. DEPT. PSN ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS -6T1A1
115/13.8kV TRANSFORMER T601 SET-1 PROTECTION PANEL
DATIF 115/13.8kV SUBSTATION * 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221655	02 of 04	0

SEC-A 12004/10

DMS VECTOR SECABB

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221655	02 of 04	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221655	04 of 04	Ø

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115/13.8KV TRANSFORMER T801 SET-1 PROTECTION PANEL =6T1A2 CONSISTING OF THE FOLLOWING :	1	VSH 200	ABB	
U14.113	74/86T-3	LOR COIL SUPERVISION RELAY RATED VOLTAGE : 48-265V DC CONTACTS : 2C/O	1	SPER1C1	ABB	RS 495 002-AA
U18.5001 U18.5002 U14.5001 U14.5002 U18.5001 U18.5002 U22.5001	63-T 63-OLTC 49W-HV 49W-LV 63PR-T 26-T 63PR-OLTC	SELF RESET TRIP RELAYS FOR INTERFACING MECHANICAL PROTECTION TRIP SIGNALS FROM TRANSFORMER AND TAP CHANGER VOLTAGE SUPPLY : 125V DC CONTACTS : 6NO + 6NC FLAG : SELF RESET OPERATING COIL TYPE : F RESETING COIL TYPE : D	7	LOR S/R	ELECTRO SWITCH	7863FD
U22.5002	86T-3	HAND RESET LOCKOUT TRIP RELAY FOR MECH. PROT. WITH THE FOLLOWING: RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F HAND RESET : D	1	LOR H/R	ELECTRO SWITCH	7810 F
U33.5001 U33.5002 U33.5003	TS-7 TS-8 TS-9	FLEXI TEST SWITCH WITH 10P FOR TRIP ISOLATION FLEXI TEST SWTICH WITH 10P FOR TRIP ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR 86T-3 TRIP ISOLATION	1	FT-19R	ABB	FR20 001 001 819
U36.5002	TS-10	FLEXI TEST SWTICH WITH 10P FOR TRIP ISOLATION	1	FT-19R	ABB	FR20 001 020 000
U39.5001	CO1.CO2	POWER SOCKET DUPLEX , 127 & 250V AC	1	US M45 & US MS45	LEGRAND	74140&74180
U39.5002	TJ	TELEPHONE JACK.4WIRE.1GANG	1	EDF 410	EDISON ELECTRIC	EDF 410
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202 P-K20	ABB	S202 P-K20
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202 P-K20	ABB	S202 P-K20
	SW	SWITCH FOR SPACE HEATER	1	MCBH-10 M2SS1-10B	ABB ABB	1SF A611 605 R1101 1SF A611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK3110	RITTAL	SK3110
	SH	SPACE HEATER-150W.127V AC, 60HZ	1	1FZEK000002	COMPOTECH	
	DS	DOOR SWITCH FOR FLUORESCENT LAMP.2NC	1	LS30P	ABB	1SBV010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	SP-20W	ANHORN	T-4 SP-20W
	2X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	2X4	TERMINAL BLOCK FOR AUX. DC CKT	10	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	2X3.1	TERMINAL BLOCK FOR AUX. AC CKT	10	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	2X6	TERMINAL BLOCK FOR COMMON ALARM PANEL	15	M6/8_HS	ENTRELEC	115.685.12
	2X82	TERMINAL BLOCK FOR TFR PANEL	5	M6/8_RS	ENTRELEC	115.685.12
	2X46	TERMINAL BLOCK FOR SPARE WIRED	15	M6/8_RS	ENTRELEC	115.685.12
	2X5H	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	2XTJ	TERMINAL BLOCK FOR TEL. JACK	4	M10/10_RS	ENTRELEC	1SNA 115-320-R2700

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221504
AC ELEMENTARY DIAGRAM	EA-221755
DC ELEMENTARY DIAGRAM	EA-221855

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
Ø	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	06/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	ARK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY LK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-06-16 DATE COMPLETED -
OPR'G. DEPT. PSN ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS =6T1A2
115/13.8kV TRANSFORMER T801 SET-1 PROTECTION PANEL
DATIF 115/13.8kV SUBSTATION # 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221655	04 of 04	Ø

SEC-A (2004/10)
DMS VECTOR SEC400

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221655	04 of 04	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221656	02 of 02	Ø

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115/13.8KV TRANSFORMER T601 SET-2 PROTECTION PANEL -6T1B1 CONSISTING OF THE FOLLOWING :	1	VSW 200	ABB	
U14.113 U14.313	74/86T-2 74/86T-4	LOR COIL SUPERVISION RELAY RATED VOLTAGE : 48- 265V DC CONTACTS : 2C/O	2	SPERIC1	ABB	RS 485 002-AA
U14.101	98/67/67N	FUSE FAILURE SUPERVISION RELAY FOR HV SIDE OF TRANSFORMER VT RATED VOLTAGE : 110V AC (L-L) FREQUENCY : 50/60HZ CONTACTS : 3NO	1	RXBA4	ABB	RK 420 004-AA
U02.5001	67/67N	NUMERICAL DIRECTIONAL O/C PROTECTION FOR LV SIDE RATED CURRENT : 1A AUX. SUPPLY : 90-250V DC RATED FREQUENCY : 50/60HZ	1	P142	AREVA	P142 3160SM044OJ
U02.5002 U06.5001	50/51/50N/51N-1 50/51/50N/51N-2	NUMERICAL O/C & E/F PROTECTION RATED CURRENT : 1A AUX. SUPPLY : 90-250V DC RATED FREQUENCY : 50/60HZ	2	P142	AREVA	P142 3160SM044OJ
U06.5002	51G	NUMERICAL NEUTRAL O/C PROTECTION RATED CURRENT : 1A AUX. SUPPLY : 90-250V DC RATED FREQUENCY : 50/60HZ	1	P142	AREVA	P142 3160SM044OJ
U18.5001 U18.5002	86T-2 86T-4	HAND RESET LOCKOUT RELAY FOR TRANSFORMER SET-2 PROT. WITH THE FOLLOWING: RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F	2	LOR H/R	ELECTRO SWITCH	7810 F
U14.5001	74/DC-2	DC SUPPLY SUPERVISION RELAY WITH REVERSE FLAG RATED DC SUPPLY VOLTAGE : 110-125V DC NO. OF CONTACTS : 1NO + 3NC OPERATION INDICATOR : SELF RESET	1	MVAX12	AREVA	MVAX12R1CB0757A
U14.5002	74/TC-2//A687	TRIP CIRCUIT-2 SUPERVISION RELAY-A687 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31S1DE0754A
C	R1 R2,R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U26.5001 U26.5001 U26.5002	TS-1 TS-2 TS-3	FLEXI TEST SWITCH WITH 8C+2P FOR 67/67N CT ISOLATION FLEXI TEST SWITCH WITH 10P FOR 67/67N VT ISOLATION FLEXI TEST SWITCH WITH 10P FOR 98/67/67N VT ISOL.	1	FT-19R	ABB	FR2G 083 001 001
U29.5001 U29.5002 U29.5003	TS-4 TS-5 TS-6	FLEXI TEST SWITCH WITH 8C+2P FOR 50/51/50N/51N-1 CT ISOLATION FLEXI TEST SWITCH WITH 8C+2P FOR 50/51/50N/51N-2 CT ISOLATION FLEXI TEST SWITCH WITH 8C+2P FOR 51G CT ISOLATION	1	FT-19R	ABB	FR2G 083 083 083
U32.5001 U32.5002	TS-7 TS-8	FLEXI TEST SWITCH WITH 2P+2T+6P FOR 86T-2 TRIP ISOL. FLEXI TEST SWITCH WITH 2P+2T+6P FOR 86T-4 TRIP ISOL.	1	FT-19R	ABB	FR2G 819 819 000

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
U39.5001	F1	6A MCB FOR INCOMING DC AUX. SUPPLY	1	STOZ	ABB	S282-UC-K6
U39.5002	CO1,CO2	POWER SOCKET DUPLEX , 127 & 220V AC	1	US M45& US MS45	LEGRAND	74140 & 74180
U39.5003	TJ	TELEPHONE JACK,4WIRE,IDAND	1	EDF 410	EDISON ELECTR	EDF 410
	LK1-LK3	NEUTRAL ISOLATION LINK	3	RS20	AREVA	
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202 P-K20	ABB	S202 P-K20
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202 P-K20	ABB	S202 P-K20
	SW	SWITCH FOR SPACE HEATER	1	MC8H-10 M2SS1-10B	ABB ABB	1SFA 611 605 R1101 1SFA 611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK3110	RITTAL	SK3110
	SH	SPACE HEATER-150W, 127V AC, 60HZ	1	1FZEK006002	COMPTECH	
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	SP-20W	ANHORN	T-4 SP-20W
	1X1S - 3X1S	TERMINAL BLOCK FOR CT CKT (6 WAYS IN A GROUP)	3	EB27	DE	EB2780GSC
	X2	TERMINAL BLOCK FOR VT CKT	15	DTTA6/P/P	PHONIX	
	X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X3.1	TERMINAL BLOCK FOR AUX. AC CKT	10	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X6	TERMINAL BLOCK FOR COMMON ALARM PANEL.	15	M6/8_RS	ENTRELEC	115.685.12
	X42	TERMINAL BLOCK FOR TC-2	15	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X43	TERMINAL BLOCK FOR BFI	5	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X45	TERMINAL BLOCK FOR CLOSE BLOCK	12	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X5H	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	XTJ	TERMINAL BLOCK FOR TEL. JACK	4	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X46	TERMINAL BLOCK FOR SPARE CONTACTS	40	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	X82	TERMINAL BLOCK FOR DFR	5	M10/10_RS	ENTRELEC	1SNA 115-320-R2700
	CICT-N	CURRENT ISOLATION CURRENT TRANSFORMER	4	CICT	AMETEK	

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-221756
DC ELEMENTARY DIAGRAM	EA-221856

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
Ø	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	08/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	ARK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-06-16 DATE COMPLETED -
OPR'G. DEPT. PSN ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS -6T1B1
115/13.8kV TRANSFORMER T601 SET-2 PROTECTION PANEL
DATIF 115/13.8kV SUBSTATION # 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221656	02 of 02	Ø

SEC-A 12004/10

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221656	02 of 02	B

DMS VECTOR SEC408

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221651	02 of 02	Ø

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115KV BUS COUPLER-1 PROTECTION PANEL -GBC1 CONSISTING OF THE FOLLOWING :	1	VSH 200	ABB	
U03.5001	51BC	THREE PHASE NUMERICAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS 8 LOGIC INPUT & 15 RELAY OUTPUT IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485 RATED CURRENT : 1A VN : 100-120V AC FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31606M0440J
U03.5002	51BC-N	THREE PHASE NUMERICAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS 8 LOGIC INPUT & 15 RELAY OUTPUT IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485 RATED CURRENT : 1A VN : 100-120V AC FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31606M0440J
U17.5001	86BC-1	HAND RESET LOCKOUT TRIP RELAY FOR BUS COUPLER 1A/2A PROT. WITH THE FOLLOWING: RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F HAND RESET : D	1	LOR H/R	ELECTRO SWITCH	7810 F
U21.5001	74/DC	DC SUPERVISION RELAY WITH THE FOLOWING CONTACTS : 1 NO + 3 NC DC VOLTAGE : 110/125 V DC OPERATION INDICATOR : SELF RESET	1	MVAX 12	AREVA	MVAX12 R1CB0757A
U21.5002	74/TC-1//A603	TRIP CIRCUIT-1 SUPERVISION RELAY-A603 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31S1DE0754A
C	1R1 1R2,1R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U21.5003	74/TC-2//A603	TRIP CIRCUIT-2 SUPERVISION RELAY-A603 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31S1DE0754A
C	2R1 2R2,2R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U25.101	74/86BC-1	SUPERVISION RELAY FOR TRIP RELAY DC VOLTAGE : 48-265V DC CONTACTS : 2 C/O	1	SPER1C1	ABB	RS 485 002-AA
U33.5001 U33.5002 U33.5003	TS-1 TS-2 TS-3	FLEXI TEST SWITCH WITH 8C+2P FOR 51BC CT ISOLATION FLEXI TEST SWITCH WITH 8C+2P FOR 51BC-N CT ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR TRIP CKT & TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 083 819
U39.5001	F1	6A MCB FOR DC AUX SUPPLY	1	STOTZ	ABB	S282-UC-K6
U39.5002	CO1,CO2	POWER SOCKET DUPLEX TYPE, 127 & 220V AC	1	US M45 & US M545	LEGRAND	74140 & 74180
U39.5003	TJ	TELEPHONE JACK	1	EDF418	EDISON ELECTRA	EDF 410
	LK1	NEUTRAL ISOLATION LINK	1	RS 20	AREVA	
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	SW	TOGGLE SWITCH FOR SPACE HEATER	1	MCBH-10, M2SS1-10B	ABB	1SFA 611 605 R110 1SFA 611 200 R100G
	TH	THERMOSTAT FOR SPACE HEATER	1	SL3H0	RITTAL	SK3110
	SH	SPACE HEATER-150W, 120V, 60HZ	1	1FZEK7580104	COMPOTECH	
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV 010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	SP-20W	ANHORN	T-4 SP-20W
	1X1S	TERMINAL BLOCK FOR CT CKT (6WAYS BLOCK)	1	EB27	GE	0790462
	X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X3.1	TERMINAL BLOCK FOR AUX. AC CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X41	TERMINAL BLOCK FOR TRIP CIRCUIT-1	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X42	TERMINAL BLOCK FOR TRIP CIRCUIT-2	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X43	TERMINAL BLOCK FOR INTIATION CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X45	TERMINAL BLOCK FOR CLOSING CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X02	TERMINAL BLOCK FOR CLOSING CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X46	TERMINAL BLOCK FOR SPARE CONTACTS	35	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X6	TERMINAL BLOCK FOR COMMON ALARM	15	M6/8_RS	ENTRELEC	115.685.12
	XSH	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	XTJ	TERMINAL BLOCK FOR TEL. JACK	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	CICT-A CICT-B CICT-C CICT-N	CURRENT ISOLATION CURRENT TRANSFORMER	4	CICT	AMETEK	

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221307
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-221751
DC ELEMENTARY DIAGRAM	EA-221951

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
Ø	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	07/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	AK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE

DATE STARTED 2012-07-04 DATE COMPLETED -

OPR'G. DEPT. PSN END. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERT[F]ED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS =GBC1
115kV BUS COUPLER-1 PROTECTION PANEL
DATIF 115/13.8KV SUBSTATION # 2
DATIF SAUDI ARABIA

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221651	02 of 02	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221651	02 of 02	Ø

SEC-A 12024/101

DMS VECTOR SEC400

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221650	01 of 02	0

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115KV BUS SECTION-1 PROTECTION PANEL =6BS1 CONSISTING OF THE FOLLOWING :	1	VSH 200	ABB	
U03.5001	51BS	THREE PHASE NUMERICAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS 8 LOGIC INPUT & 15 RELAY OUTPUT IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485 RATED CURRENT : 1A Vn : 100-120V AC FREQUENCY : 60HZ AUX.DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31GD6M0440J
U03.5002	51BS-N	THREE PHASE NUMERICAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS 8 LOGIC INPUT & 15 RELAY OUTPUT IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485 RATED CURRENT : 1A Vn : 100-120V AC FREQUENCY : 60HZ AUX.DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31GD6M0440J
U17.5001	86BS-1	HAND RESET LOCKOUT TRIP RELAY FOR BUS SECTION 1A/1B PROT. WITH THE FOLLOWING: RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F HAND RESET : D	1	LOR H/R	ELECTRO SWITCH	7810 F
U21.5001	74/DC	DC SUPERVISION RELAY WITH THE FOLOWING CONTACTS : 1 NO + 3 NC DC VOLTAGE : 110/125 V DC OPERATION INDICATOR : SELF RESET	1	MVAX 12	AREVA	MVAX12 RICB0757A
U21.5002	74/TC-1//A601	TRIP CIRCUIT-1 SUPERVISION RELAY-A601 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31SIDE0754A
C	1R1 1R2,1R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U21.5003	74/TC-2//A601	TRIP CIRCUIT-2 SUPERVISION RELAY-A601 AUXILIARY VOLTAGE : 110 /125V DC NO. OF CONTACTS : 1NO + 2NC OPERATION INDICATOR : HAND RESET	1	MVAX31	AREVA	MVAX31SIDE0754A
C	2R1 2R2,2R3	1.5K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY 4.0K OHMS EXTERNAL RESISTOR FOR TRIP CKT. SUPERVISION RELAY	1 2		AREVA	
U25.101	74/86BS-1	SUPERVISION RELAY FOR TRIP RELAY DC VOLTAGE : 40-265V DC CONTACTS : 2 C/O	1	SPERICI	ABB	RS 485 002-AA
U33.5001 U33.5002 U33.5003	TS-1 TS-2 TS-3	FLEXI TEST SWITCH WITH 8C+2P FOR 51BS CT ISOLATION FLEXI TEST SWITCH WITH 8C+2P FOR 51BS-N CT ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR TRIP CKT & TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 083 819
U39.5001	F1	6A MCB FOR DC AUX SUPPLY	1	282UC-K6	ABB	GHS282282 0164 R0377
U39.5002	CO1,CO2	POWER SOCKET DUPLEX TYPE,127 & 220V AC	1	US M45 & US MS45	LEGRAND	74140 & 74180
U39.5003	TJ	TELEPHONE JACK	1	EDF410	EDISON	EDF410
	LK1	NEUTRAL ISOLATION LINK	1	RS 20	AREVA	
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 021 R0487
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 001 R0487
	SW	TOGGLE SWITCH FOR SPACE HEATER	1	MCBH-10, M2SS1-10B	ABB	1SFA 611 605 R110 1SFA 611 200 R1005
	TH	THERMOSTAT FOR SPACE HEATER	1	SK3110	RITTAL	SK3110
	SH	SPACE HEATER-127V AC	1	IFZEK75B0104	COMPOTECH	EB27/B065C
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS32P13B02	ABB	1SBV010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	SP-20W	ANHORN	SP-20W
	IXIS	TERMINAL BLOCK FOR CT CKT (6WAYS BLOCK)	1	EB27	GE	EB27 B065C
	X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X3.1	TERMINAL BLOCK FOR AUX. AC CKT	18	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X41	TERMINAL BLOCK FOR TRIP CIRCUIT-1	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X42	TERMINAL BLOCK FOR TRIP CIRCUIT-2	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X43	TERMINAL BLOCK FOR INTIATION CKT	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X45	TERMINAL BLOCK FOR CLOSING CKT	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X46	TERMINAL BLOCK FOR SPARE CONTACTS	35	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X82	TERMINAL BLOCK FOR SPARE CONTACTS	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	X6	TERMINAL BLOCK FOR COMMON ALARM	15	M6/8.RS	ENTRELEC	115.685.12
	XSH	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	XTJ	TERMINAL BLOCK FOR TEL. JACK	5	M10/10.RS	ENTRELEC	1SNA 115 320 R2700
	CICT-A CICT-B CICT-C CICT-N	CURRENT ISOLATION CURRENT TRANSFORMER	4	CICT	AMETEK	

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-223758
DC ELEMENTARY DIAGRAM	EA-221650

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
A	07/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	AK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-07-04 DATE COMPLETED -
DR'G. DEPT. PSN ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS =6BS1
115kV BUS SECTION-1 PROTECTION PANEL
QATIF 115/13.8KV SUBSTATION # 2
QATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221650	02 of 02	0

SEC-A 12004/101
DMS VECTOR SEC400

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221650	02 of 02	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221680	02 of 02	Ø

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		13.8KV CAPACITOR BANK-1 SET-1 PROTECTION PANEL «3RA1 CONSISTING OF THE FOLLOWING»	1	VSH 200	ABB	
U08.5001	51P/N	THREE PHASE NUMERICAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS RATED CURRENT : 1A FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC INPUT MODULE : 8 OUTPUT MODULE : 15 PROTOCOL/COMM : IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485	1	P142	AREVA	P142 316D6M0440J
U08.5002	46-1/46-2	NUMERICAL NEUTRAL OVER CURRENT RELAY WITH INVERSE TIME CHARACTERISTICS & INSTANTANEOUS RATED CURRENT : 1A FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC INPUT MODULE : 8 OUTPUT MODULE : 15 PROTOCOL/COMM : IEC61850 OVER ETHERNET AND COURIER VIA REAR K-BUS/RS485	1	P142	AREVA	P142 316D6M0440J
U21.101 U21.301 U21.113 U21.313	50PA 50PB 50PC 50PN	INSTANTANEOUS PHASE AND GROUND FAULT OVER CURRENT RELAY RATED CURRENT : 1-3A FREQUENCY : 60HZ AUX. DC SUPPLY : 110V DC SCALE RANGE : 1 - 3A	4	RXIG22	ABB	RK 411 008-DG
U21.125	74/86	TRIP RELAY COIL SUPERVISION RELAY CONTACTS : 2 C/O RATED VOLTAGE : 48-265 V DC	1	SPER1C1	ABB	RS 485 002-AA
U03.5001	74/DC-1	DC SUPPLY SUPERVISION RELAY AUX. VOLTAGE : 110-125V DC CONTACTS : 1NO + 3NC OPERATION INDICATOR-SELF RESET	1	MVAX12	AREVA	MVAX12R1CB0757A
U17.5001	86	HIGH SPEED SERIES 24 HAND RESET LOCKOUT RELAY WITH THE FOLLOWING SPECIFICATIONS RATED VOLTAGE : 125V DC NO. OF DECKS : 10 NO. OF CONTACTS : 20 NO + 20NC OPERATING COIL TYPE : F	1	LOR H/R	ES	7810F
U30.5001 U30.5002 U30.5003	TS-1 TS-2 TS-3	FLEXIBLE TEST SWITCH 8C+2P FOR 50PA,B,C,N CT ISOLATION FLEXIBLE TEST SWITCH 10C FOR 50/51/50N/51NK46-1,46-2 CT ISOL. FLEXIBLE TEST SWITCH 10P FOR 51 & 51N TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 073 001
U30.5004 U30.5005 U30.5006	TS-4 TS-5 TS-6	FLEXIBLE TEST SWITCH 4P+2T+4P FOR 86 TRIP ISOLATION FLEXIBLE TEST SWITCH 10P FOR TRIP ISOLATION FLEXIBLE TEST SWITCH 10P FOR TRIP ISOLATION	1	FT-19R	ABB	FR2G 819 001 001
U39.5001	F1	6A MCB FOR INCOMING DC AUX. SUPPLY	1	S282UC-K6	ABB	S282UC-K6
U39.5002	CO1/CO2	POWER SOCKET DUPLEX TYPE 127V AC & 220V AC	1	US M45 & US M545	LEGRAND	74140 & 74160
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 001 R0487
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 001 R0487
	SW	SWITCH FOR SPACE HEATER	1	MCBH-10, M2SS1-10B	ABB	1SFA 611 605 R1110 1SFA 611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK 3110	RITTAL	SK3110
	SH	SPACE HEATER-150W, 127V, 60HZ	1	1FZEK006002	COMPOTECH	1FZEK006002
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV 810213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	SP-20W	ANHORN	T-4 SP-20W
U39.5003	TJ1	TELEPHONE JACK	1	EDF 410	EDISSON ELECTRIC	EDF 410
	1X1S-2X1S	TERMINAL BLOCK FOR CT CIRCUITS (6 WAY IN A GROUP)	2	EB27	GE	EB27B06SC
	X3	TERMINAL BLOCK FOR DC AUX.POWER CIRCUITS	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X3.1	TERMINAL BLOCK FOR AC AUX.POWER CIRCUITS	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X41	TERMINAL BLOCK FOR TRIP CKT-1	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X42	TERMINAL BLOCK FOR TRIP CKT-2	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X43	TERMINAL BLOCK FOR CONTROL CIRCUITS	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X82	TERMINAL BLOCK FOR TFR CIRCUITS	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X45	TERMINAL BLOCK FOR CLOSE BLOCK CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X46	TERMINAL BLOCK FOR SPARE CKT	17	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X6	TERMINAL BLOCK FOR ANNUNCIATION CKT	10	M6/8_RS	ENTRELEC	115 685.12
	XTJ	TERMINAL BLOCKS FOR TELEPHONE JACK	8	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	XSH	TERMINAL BLOCKS FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	LK1, LK2	NEUTRAL ISOLATION FUSE FOR CT GROUNDING	2	RS 20	AREVA	

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-221780
DC ELEMENTARY DIAGRAM	EA-221888

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
Ø	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	06/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	AK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-06-16 DATE COMPLETED -
DPR'G. DEPT. PSS ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED

CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS :3RA1
13.8kV CAPACITOR BANK-1 SET-1 PROTECTION PANEL
DATIF 115/13.8kV SUBSTATION # 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221680	02 of 02	Ø

SEC-A 12004/10
DMS VECTOR SECADD

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221680	02 of 02	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221681	02 of 02	0

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		13.8KV CAPACITOR BANK-1 SET-2 PROTECTION PANEL -3RB1 CONSISTING OF THE FOLLOWING:	1	VSH.200	ABB	
U03.5001	59-1	OVER VOLTAGE RELAY RATED CURRENT : 1A FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31AD6M0**0BJ
U03.5002	59-2	OVER VOLTAGE RELAY RATED CURRENT : 1A FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31AD6M0**0BJ
U03.5002	27-1/27-2	UNDER VOLTAGE RELAY RATED CURRENT : 1A FREQUENCY : 60HZ AUX. DC SUPPLY : 110-250V DC	1	P142	AREVA	P142 31AD6M0**0BJ
U21.101	98/27	VT FUSE FAILURE RELAY RATED VOLTAGE : 110V AC L-L CONTACTS : 3NO RATED FREQUENCY : 50-60 HZ	1	RXBA4	ABB	RK 428 004-AA
U21.113	74/94	TRIP RELAY COIL SUPERVISION RELAY CONTACTS : 2 C/O RATED VOLTAGE : 40-265 V DC	1	SPER1C1	ABB	RS 485 002-AA
U25.5001	74/DC-2	DC SUPPLY SUPERVISION RELAY AUX. VOLTAGE : 110-125V DC CONTACTS : 1ND + 3NC OPERATION INDICATOR-SELF RESET	1	MVAX12	AREVA	MVAX12R1CB0757A
U17.5001	94	SELF RESET TRIP RELAY WITH THE FOLLOWING SPECIFICATION: RATED VOLTAGE : 125V DC NO. OF DECKS : 8 NO. OF CONTACTS : 16 NO + 16 NC OPERATING COIL TYPE : F RESET COIL TYPE : D	1	LOR S/R	ES	7868FD
U33.5001 U33.5002 U33.5003	TS-1 TS-2 TS-3	FLEXIBLE TEST SWITCH 10P FOR VT ISOLATION FLEXIBLE TEST SWITCH 2P-2T-6P FOR TRIP ISOLATION FLEXIBLE TEST SWITCH 10P FOR TRIP ISOLATION	1	FT-19R	ABB	FR2G 001 819 001
U33.5001 U33.5002 U33.5003	TS-4 TS-5 TS-6	FLEXIBLE TEST SWITCH 10P FOR VT ISOLATION OF 59-1 FLEXIBLE TEST SWITCH 10P FOR VT ISOLATION OF 59-2 FLEXIBLE TEST SWITCH 10P FOR VT ISOLATION OF 27/27-2	1	FT-19R	ABB	FR2G 001 001 001
U39.5001	F1	6A MCB FOR INCOMING DC AUX. SUPPLY	1	S282UC-K6	ABB	S282-VC-K6
U39.5002	CO1/CO2	POWER SOCKET DUPLEX TYPE 127V AC & 220V AC	1	UG MK3 & UG MS45	LEGRAND	74140 & 74180
U39.5003	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 001 R0487
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	2CDS 282 001 R0487
	SW	SWITCH FOR SPACE HEATER	1	MCBH-10. M2SS1-10B	ABB	1SFA 611 605 R110 1SFA 611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK 3110	RITTAL	SK3110
	SH	SPACE HEATER-150W. 127V. 60HZ	1	1FZEK006002	COMPOTECH	1FZEK006002
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV 010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	EB27	SINAR	EB27/B06SC
	TJI	TELEPHONE JACK	1	EDF410	EDISON ELECTRIC	EDF 410
	X3	TERMINAL BLOCK FOR DC AUX.POWER CIRCUITS	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X3.1	TERMINAL BLOCK FOR AC AUX.POWER CIRCUITS	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X41	TERMINAL BLOCK FOR TRIP CKT-1	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X42	TERMINAL BLOCK FOR TRIP CKT-2	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X46	TERMINAL BLOCK FOR SPARE CKT	17	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	X2	TERMINAL BLOCKS FOR VT INPUT	15	OTTA 6T/PP	PHOENIX	790462
	X6	TERMINAL BLOCKS FOR COMMON ALARM	20	M6/8_RS	ENTRELEC	115-685-12
	XTJ	TERMINAL BLOCKS FOR TELEPHONE JACK	8	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	XSH	TERMINAL BLOCKS FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115 320 R2700

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221367
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-221781
DC ELEMENTARY DIAGRAM	EA-221881

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APP'D.
0	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	06/2012	ABB	ISSUED FOR BASE DESIGN	MDS	SS	AK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-06-16 DATE COMPLETED _____
DPR'G. DEPT. PSS ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS -3RB1
13.8kV CAPACITOR BANK-1 SET-2 PROTECTION PANEL
DATIF 115/13.8kV SUBSTATION # 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221681	02 of 02	0

SEC-A 12004/101

DMS VECTOR SEC400

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221681	02 of 02	B

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221667	02 of 02	0

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
		115KV BUSBAR WITH BREAKER FAILURE PROTECTION BAY UNIT PANEL =6BU01 FOR CB A619/A617 CONSISTING OF THE FOLLOWING :	1	MNS	ABB	
U02.5001	74/DC/A619	DC SUPERVISION RELAY WITH THE FOLOWING CONTACTS : 1 NO + 3 NC DC VOLTAGE : 110/125 V DC OPERATION INDICATOR : SELF RESET	1	MVAX 12	AREVA	MVAX12 R1CB0757A
U02.101 U02.107 U02.113	74/94BF/A619 74/86BB/A619 74/86BF/A619	SUPERVISION RELAY FOR BB PROTECTION LOCKOUT TRIP RELAY COIL WITH FOLLOWING SPECIFICATIONS AUX. VOLTAGE : 40-265V DC CONTACTS : 2C/O	3	SPER1C1	ABB	RS 485 002-AA
U06.5001	87B+50BF/BU-19	BAY UNIT FOR NUMERICAL BUSBAR PROTECTION FOR CB A619 WITH FOLLOWING: - HIGH TROUGH - FAULT STABILITY EVEN IN CASE OF CT SATURATION - END FAULT PROTECTION - NEUTRAL CURRENT CRITERION INSTANTANEOUS VALUES FOR FAULT RECORDING - DISTURBANCE FREE AND FAST DATA TRANSFER TO AND FROM THE CENTRAL UNIT BY FIBER OPTIC LINKS - PHASE SEGRAGATED MEASUREMENT - REDUCE CT PERFORMANCE REQUIREMENTS - BUILT IN HUMAN MACHINE INTERFACE - USER-FRIENDLY PC-BASED HUMAN MACHINE INTERFACE PROGRAM - COMMN. FACILITIES FOR S/S MONITORING & CONTROL SYSTEM - COMPREHENSIVE SELF SUPERVISION - FULLY NUMERICAL SIGNAL PROCESSING RATED CURRENT : 1A AUX. VOLTAGE : 125V DC RATED FREQUENCY : 60HZ	1	500 BU 03	ABB	REB 500-BU03 VER 7.5
U06.5002	94BF/A619	SELF RESET TRIP RELAY WITH THE FOLLOWING SPECIFICATION: RATED VOLTAGE : 125V DC NO. OF DECKS : 8 NO. OF CONTACTS : 16 NO + 16NC OPERATING COIL TYPE : F RESET COIL TYPE : D	1	LOR S/R	ELECTRO SWITCH	7868 FD
U13.5001 U13.5002	86BF/A619 86BB/A619	BB PROTECTION TRIP LOCKOUT RELAY WITH THE FOLLOWING SPECIFICATIONS: AUX. VOLTAGE : 110-125V DC TYPE OF COIL : F NO. OF DECKS : 10 CONTACTS : 20NO+20NC RESET : HAND	2	LOR H/R	ELECTRO SWITCH	7810F
U17.5001 U17.5002 U17.5003	TS-1 TS-2 TS-3	FLEXI TEST SWITCH WITH 8C+2P FOR 87B+50BF/BU-19 CT ISOLATION FLEXI TEST SWITCH WITH 10P FOR 87B+50BF/BU-19 TRIP ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR 94BF TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 001 819
U17.5004 U17.5005	TS-4 TS-5	FLEXI TEST SWITCH WITH 10P FOR 86BF TRIP ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR 86BB TRIP ISOLATION	1	FT-19R	ABB	FR2G 001 819 000
U41.5001	F1/A619	6A MCB FOR DC AUX SUPPLY FOR A619 BAY UNIT	1	STOTZ	ABB	S282-UC-K6
U41.5002	F1/A617	6A MCB FOR DC AUX SUPPLY FOR A617 BAY UNIT	1	STOTZ	ABB	S282-UC-K6
U41.5003	CO1,CO2	POWER SOCKET DUPLEX TYPE, 127 & 220V AC	1	US M45&US M545	LEGRAND	74140 & 74180
U41.5004	TJ	TELEPHONE JACK	1	EDF 410	EDISON ELECTRIC	EDF 410
		FOR CB A804/A805/A806 CONSISTING OF THE FOLLOWING :				
	C1	2 POLE 20AMP MCB RATED 127V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	C2	2 POLE 20AMP MCB RATED 220V FOR INCOMING AC AUX. SUPPLY	1	S202P-K20	ABB	S202P-K20
	SW	ON/OFF SWITCH FOR SPACE HEATER	1	MCBH-10 M2SS1-10B	ABB ABB	1SFA 611 605 R1101 1SFA 611 200 R1006
	TH	THERMOSTAT FOR SPACE HEATER	1	SK3110	RITTAL	SK3110
	SH	SPACE HEATER-150W, 127V, 60HZ	1	1FZEK006002	COMPOTECH	
	DS	DOOR SWITCH FOR CUBICLE ILLUMINATION LAMP WITH 2NC CONTACTS	1	LS30P	ABB	1SBV010213R1202
	IL	FLUORESCENT LAMP, 127V AC	1	T-4 SP-20W	ANHORN INT'L GROUP LTD.	
	LK1-LK2	NEUTRAL ISOLATION LINK	2	RS20	AREVA	
	X3.1	TERMINAL BLOCK FOR AUX. AC CKT	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X1S	TERMINAL BLOCK FOR CT CKT (6WAYS BLOCK)	1	EB27	GE	0790462
	19X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10_RS	ENTRELEC	
	19X41	TERMINAL BLOCK FOR TRIP CIRCUIT-1	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X42	TERMINAL BLOCK FOR TRIP CIRCUIT-2	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X43	TERMINAL BLOCK FOR INTIATION CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X45	TERMINAL BLOCK FOR CLOSING CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X46	TERMINAL BLOCK FOR SPARE CONTACTS	50	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X48	TERMINAL BLOCK FOR GIS-LCP CONNECTION	25	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X49	TERMINAL BLOCK FOR PSE CONNECTION	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	19X6	TERMINAL BLOCK FOR COMMON ALARM	5	M6/8_RS	ENTRELEC	115.685.12
	XSH	TERMINAL BLOCK FOR SPACE HEATER	2	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	XTJ	TERMINAL BLOCK FOR TEL. JACK	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700

LOCATION REF.	ITEM DESIGNATION	D E S C R I P T I O N	QTY.	TYPE	MAKE	ORDERING INFORMATION
U02.5002	74/DC/A617	DC SUPERVISION RELAY WITH THE FOLOWING CONTACTS : 1 NO + 3 NC DC VOLTAGE : 110/125 V DC OPERATION INDICATOR : SELF RESET	1	MVAX 12	AREVA	MVAX12 R1CB0757A
U02.137 U02.143 U02.149	74/94BF/A617 74/86BB/A617 74/86BF/A617	SUPERVISION RELAY FOR BB PROTECTION LOCKOUT TRIP RELAY COIL WITH FOLLOWING SPECIFICATIONS AUX. VOLTAGE : 40-265V DC CONTACTS : 2C/O	3	SPER1C1	ABB	RS 485 002-AA
U24.5001	87B+50BF/BU-17	BAY UNIT FOR NUMERICAL BUSBAR PROTECTION FOR CB A617 WITH FOLLOWING: - HIGH TROUGH - FAULT STABILITY EVEN IN CASE OF CT SATURATION - END FAULT PROTECTION - NEUTRAL CURRENT CRITERION INSTANTANEOUS VALUES FOR FAULT RECORDING - DISTURBANCE FREE AND FAST DATA TRANSFER TO AND FROM THE CENTRAL UNIT BY FIBER OPTIC LINKS - PHASE SEGRAGATED MEASUREMENT - REDUCE CT PERFORMANCE REQUIREMENTS - BUILT IN HUMAN MACHINE INTERFACE - USER-FRIENDLY PC-BASED HUMAN MACHINE INTERFACE PROGRAM - COMMN. FACILITIES FOR S/S MONITORING & CONTROL SYSTEM - COMPREHENSIVE SELF SUPERVISION - FULLY NUMERICAL SIGNAL PROCESSING RATED CURRENT : 1A AUX. VOLTAGE : 125V DC RATED FREQUENCY : 60HZ	1	500 BU 03	ABB	REB 500-BU03 VER 7.5
U24.5002	94BF/A617	SELF RESET TRIP RELAY WITH THE FOLLOWING SPECIFICATION: RATED VOLTAGE : 125V DC NO. OF DECKS : 8 NO. OF CONTACTS : 16 NO + 16NC OPERATING COIL TYPE : F RESET COIL TYPE : D	1	LOR S/R	ELECTRO SWITCH	7868 FD
U31.5001 U30.5002	86BF/A617 86BB/A617	BB PROTECTION TRIP LOCKOUT RELAY WITH THE FOLLOWING SPECIFICATIONS: AUX. VOLTAGE : 110-125V DC TYPE OF COIL : F NO. OF DECKS : 10 CONTACTS : 20NO+20NC RESET : HAND	2	LOR H/R	ELECTRO SWITCH	7810F
U35.5001 U35.5002 U35.5003	TS-7 TS-8 TS-9	FLEXI TEST SWITCH WITH 8C+2P FOR 87B+50BF/BU-17 CT ISOLATION FLEXI TEST SWITCH WITH 10P FOR 87B+50BF/BU-17 TRIP ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR 94BF TRIP ISOLATION	1	FT-19R	ABB	FR2G 083 001 819
U35.5004 U35.5005	TS-10 TS-11	FLEXI TEST SWITCH WITH 10P FOR 86BF TRIP ISOLATION FLEXI TEST SWITCH WITH 2P+2T+6P FOR 86BB TRIP ISOLATION	1	FT-19R	ABB	FR2G 001 819 000
	17X1S	TERMINAL BLOCK FOR CT CKT (6WAYS BLOCK)	1	EB27	GE	0790462
	17X3	TERMINAL BLOCK FOR AUX. DC CKT	5	M10/10_RS	ENTRELEC	
	17X41	TERMINAL BLOCK FOR TRIP CIRCUIT-1	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X42	TERMINAL BLOCK FOR TRIP CIRCUIT-2	10	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X43	TERMINAL BLOCK FOR INTIATION CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X45	TERMINAL BLOCK FOR CLOSING CKT	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X46	TERMINAL BLOCK FOR SPARE CONTACTS	50	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X48	TERMINAL BLOCK FOR GIS-LCP CONNECTION	25	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X49	TERMINAL BLOCK FOR PSE CONNECTION	5	M10/10_RS	ENTRELEC	1SNA 115 320 R2700
	17X6	TERMINAL BLOCK FOR COMMON ALARM	5	M6/8_RS	ENTRELEC	115.685.12
	X02	TERMINAL BLOCKS FOR FAULT RECORDER CIRCUITS	20	M6/8_RS	ENTRELEC	115 685.12

NOTES

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NO.
DRAWING CONTROL SHEET	EE-221387
RELAYING AND METERING ONE LINE DIAGRAM	EA-221584
AC ELEMENTARY DIAGRAM	EA-221767
DC ELEMENTARY DIAGRAM	EA-221867

AS-BUILT BY _____ DATE _____

REV. NO.	DATE	BY	DESCRIPTION	CHKD.	CERT.	APPD.
0	03-2013	ABB	ISSUED FOR CONSTRUCTION	MDS	SS	AK
B	11-2012	ABB	ISSUED FOR DETAIL DESIGN	MDS	SS	AK
A	08/2012	ABB	ISSUED FOR DETAILED DESIGN	MDS	SS	AK

الشركة السعودية للكهرباء
Saudi Electricity Company

DRAWN BY UK CHECKED BY MDS SCALE: NONE
DATE STARTED 2012-08-16 DATE COMPLETED -
ORIG. DEPT. PSN ENG. DEPT. AUT

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIAL UNTIL CERTIFIED AND DATED. CERTIFIED BY -- DATE --

GENERAL ARRANGEMENT AND LIST OF APPARATUS =6BU01
115KV B/B WITH BUILT IN BF PROT.BU PANEL FOR CB A619 & A617
DATIF 115/13.8kV SUBSTATION # 2
DATIF SAUDI ARABIA

JOB ORDER NO.	INDEX	PLANT NO.	DRAWING NUMBER	SHEET NO.	REV. NO.
1-113045.01	P	DA441	EA-221667	02 of 02	0

SEC-A (2004/10)
DMS VECTOR SECA00

MANUFACTURER/VENDOR NAME		
ABB Automation Co. Ltd.		
DRAWING NUMBER	SHEET NO.	REV. NO.
S-13610 EA-221667	02 of 02	B

ANNEXURE-D

(Transformer Data & Fault Level Data)

7.0 DATA SCHEDULE

POWER TRANSFORMERS,
RATED 2 MVA UP TO 100 MVA
(QATIF- EA-221577)

SEC Enquiry No. _____ **Date:**

SEC Purchase Order No. **Date:**
or Contract No. _____

SEC PTS No./Project Title with J.O. No. Refer to Main SOW/TS

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
	Power Transformer Model No./Type No.	*	1ZTR121500	
	Type of System Grounding(Solidly grounded, resistance grounded, other)			
	HV	Effectively Grounded	N/A	
	LV	Effectively Grounded	Solidly grounded	
	TV (if applicable)		N/A	
	Common Neutral (Auto Transformer)		N/A	
3.0	**Applicable Industry Standards**	*	IEC 60076	
4.0	**DESIGN AND CONSTRUCTION REQUIREMENTS**			55 (max. ambient)
4.1	**Design Ambient Temperature (ºC)**	*	35 (yearly average)	
	Number of Windings	Two	Two	
	Type of Cooling	ON AN /ON AF	ONAN/ONAF	
	Vector Group Designation	Dyn1	Dyn1	

A'- SEC SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'.
(*) -DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

ABB Elektrik Sanayi A.Ş.
Date:01/08/2012

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED 2 MVA UP TO 100 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'		'B'	'C'
4.2.1	**Natural Cooling Rating**				
	HV/LV/TV (MVA)	50 50 -		50/50/N/A	//
	1st Stage Forced Cooling				
	HV/LV/TV (MVA)	67 / 67/ -		67/67/N/A	//
	2nd Stage Forced Cooling				
	HV/LV/TV (MVA)	- / - / -		N/A/N/A/N/A	//
	Rated Voltage Transformation Ratio				
	HV/LV/TV (kV)	115 / 13.8/ -		115/13.8/N/A	//
	Temperature Rise Based on Ambient Temperature Conditions Specified in 01-TMSS-01				
	Winding °C		*	50 rise	
	Oil °C		*	45 rise	
	Winding maximum (hot spot) Temperature (°C)		*	63 rise	
	Design X/R ratio			≤50.4	
	HV		*	N/A	
	LV		*	N/A	
	TV		*	N/A	
	Impedance Voltage natural cooling power base and reference temp. of 75°C (%) (Manufacturer shall indicate the value with applicable tolerance)				
	1. At Principal Tap (Guaranteed values)				
	HV - LV	22% 50MVA Base		22% (50 MVA Base)	
	HV-TV (if applicable)		*	N/A	
	LV-TV (if applicable)		*	N/A	
	2. At Extreme Plus Tap			23.6% (at 50 MVA Base)	
	HV - LV		*		
	HV-TV (if applicable)		*	N/A	
	LV-TV (if applicable)		*	N/A	

ABB Elektrik Sanayi A.Ş.

Date:01/08/2012

7.0 DATA SCHEDULE

POWER TRANSFORMERS, RATED 2 MVA UP TO 100 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2.1 (continued)				
	3. At Extreme Minus Tap			
	HV - LV	*	22.3% (at 50 MVA Base)	
	HV-TV (if applicable)	*	N/A	
	LV-TV (if applicable)	*	N/A	
	Zero-sequence impedance on natural cooling power base and reference temp. of 75°C (%)(Manufacturer shall indicate the value with applicable tolerance)			
	1. At Principal Tap			
	HV - LV	*	Approx. 22.2 (at 50 MVA base)	
	HV-TV (if applicable)	*	N/A	
	LV-TV (if applicable)	*	N/A	
	2. At Extreme Plus Tap			
	HV - LV	*	Approx. 23.5 (at 50 MVA base)	
	HV-TV (if applicable)	*	N/A	
	LV-TV (if applicable)	*	N/A	
	3. At Extreme Minus Tap			
	HV - LV	*	Approx. 22.2 (at 50 MVA base)	
	HV-TV (if applicable)	*	N/A	
	LV-TV (if applicable)	*	N/A	
	Highest Design Operating Voltage for the tappings			
	continuous operation (%)	105	105	
	emergency operation (%)	110	110	
	Maximum Design Flux Density			
	at rated voltage (Tesla)	*	1.6	
	at 110% rated voltage (Tesla)	*	1.76	
	Saturation Voltage (%U_N)	*	≥121%	
	Current density at rated output			
	Primary winding (Amp/mm^2)	*	4.5	
	Secondary winding (Amp/mm^2)	*	4.5	
	Tertiary winding (Amp/mm^2)	*	N/A	
	No-load current when excited from LV side as % of full load current			

ABB Elektrik Sanayi A.Ş.
Date:01/08/2012

7.0 DATA SCHEDULE

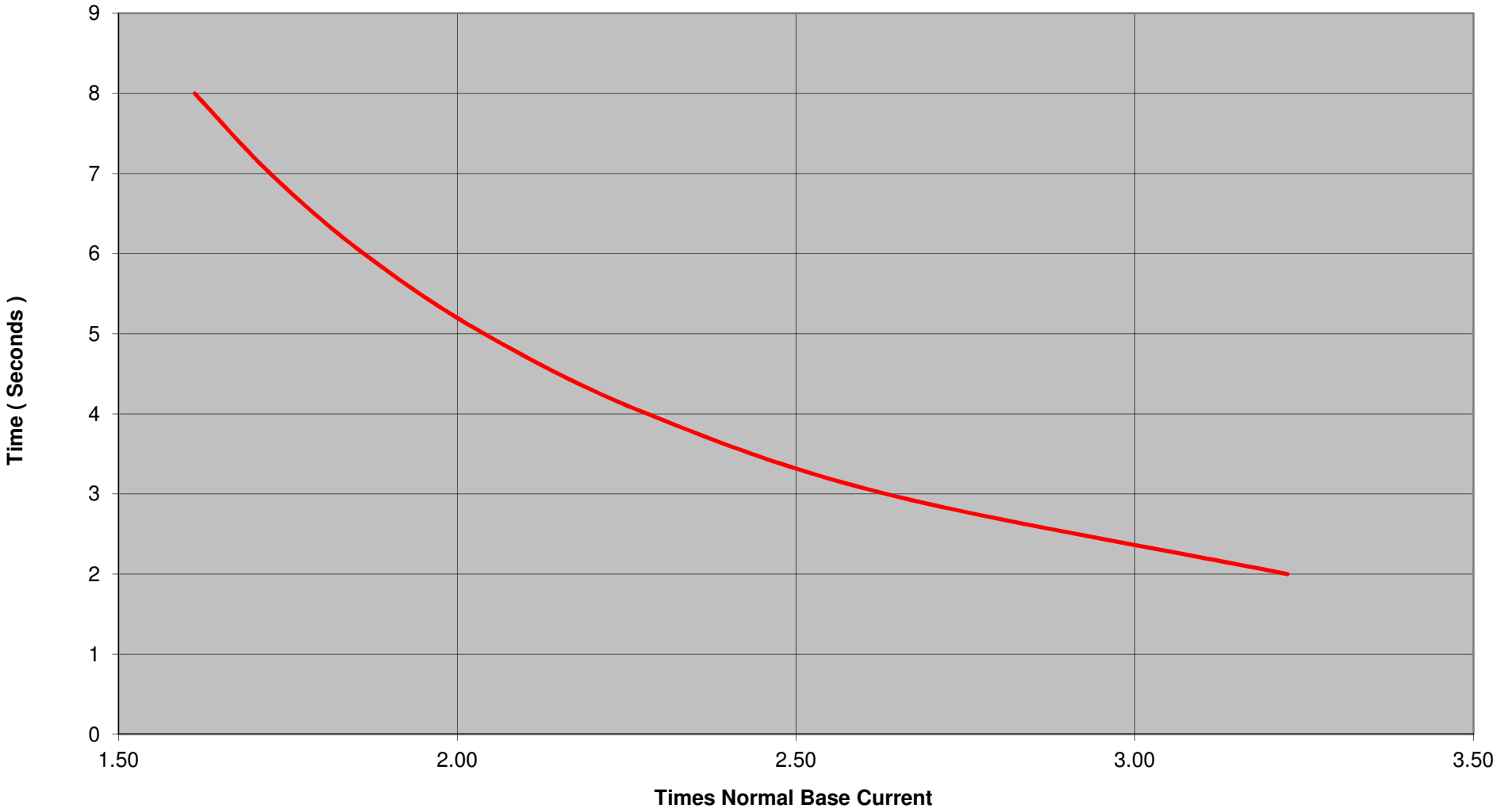
POWER TRANSFORMERS, RATED 2 MVA UP TO 100 MVA

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2.1 (continued)				
	100% voltage (Guaranteed value)	*	≤0.10 (Tol=30%)	
	105% voltage	*	≤0.15 (Tol=30%)	
	110% voltage	*	≤0.20 (Tol=30%)	
	No-load current harmonics at 100% and 110% rated voltage (%)		at 100% /110%	
	2nd Harmonics	*	-	
	3rd Harmonics	*	approx.19.9/24.2	
	4th Harmonics	*	-	
	5th Harmonics	*	approx. 13.8/39.9	
	6th Harmonics	*	-	
	7th Harmonics	*	approx.8/23.7	
	8th Harmonics	*	-	
	9th Hamonics	*	-	
	Basic Impulse Withstand Voltage (BIL)			
	HV winding (kV_{peak})	*	550	
	LV winding (kV_{peak})	*	95	
	HV neutral end (kV_{peak})	*	N/A	
	LV neutral end (kV_{peak})	*	95	
	Common neutral for auto transformer winding (kV_{peak})	*	N/A	
	Tertiary winding (kV_{peak})	*	N/A	
	Tertiary neutral end (kV_{peak}) (if applicable)	*	N/A	
	Switching Impulse Withstand Voltage (BSL) if applicable (kV_{peak})	*	N/A	
	Separate Source Power Frequency Withstand Voltage			
	HV winding (kV_{rms})	*	230	
	LV winding (kV_{rms})	*	38	
	HV neutral end (kV_{rms})	*	N/A	
	LV neutral end (kV_{rms})	*	38	
	Common neutral for auto transformer winding (kV_{rms})	*	N/A	
	Tertiary Winding (kVrms)	*	N/A	

ABB Elektrik Sanayi A.Ş.

Date:01/08/2012

1ZTR121500
DAMAGE CURVE



CERT. | APP'D | CHK'D | DESCRIPTION | NO.
3 | 2 | 1
REVISIONS

DEPT.: E&DD
PREP. BY: MAG / FPE / MS
DATE: 02 / 08 / 2011

APPROVED
BY: AAS / AAZ
DATE: 02 / 08 / 2011

CERTIFIED
BY: AON
DATE: 02 / 08 / 2011

THIS DOCUMENT IS NOT TO BE USED FOR CONSTRUCTION OR FOR ORDERING MATERIALS UNTIL CERTIFIED AND DATED

SECTION IV - DESIGN CRITERIA

The CONTRACTOR shall adopt the design criteria indicated below and in Appendix-XIV, as a minimum for this PROJECT:

4.01 ENVIRONMENTAL CONDITIONS

All equipment/materials devices and their specified ratings furnished under this PROJECT shall be suitable for operation as outlined in TES-P-119.02 and 01-TMSS-01.

For additional environmental conditions requirements for communication equipments, refer to Appendix - VI.

4.02 ELECTRICAL CHARACTERISTICS

A. General

1. COMPANY's 115kV system is effectively grounded. The entire electrical system including grounding shall be designed for the short circuit current rating of the corresponding system voltage circuit breakers. The system design parameters shall be in accordance with the requirements outlined in COMPANY Standard TES-P-119.02 and hereunder:

   a. The short circuit rating of 115kV system is 40kA for 1 sec. (Sym.) for Qatif 115/13.8 kV Substation No. 2.

   b. The short circuit rating of the 13.8kV switchgear shall be 25kA for 1 sec. (Sym.).

2. Ultimate System Short Circuit Level

   The expected ultimate short circuit levels at 115kV & 13.8kV voltage levels are given below. These values are given for guidance/information only and shall not be considered as the basis for short circuit force calculation, grounding calculations, CT sizing, etc. except for specific purpose indicated in this PTS.

	Substation		3-Phase Fault			1-Phase-to-Ground Fault		
	Location	kV	I_{Sym} (kA)	X/R	I_{Asym} (kA)	I_{Sym} (kA)	X/R	I_{Asym} (kA)
Min	Qatif S/S	115	16.9	22.1	21.7	14.3	10.2	15.4
	Qatif S/S (1)	13.8	16.8	48.7	23.2	17.4	51.2	24.4
	Qatif S/S (2)	13.8	8.9	52.7	12.5	9.1	54.0	12.9
Max	Qatif S/S	115	24.6	15.6	29.1	19.5	8.3	20.4
	Qatif S/S (1)	13.8	18.2	46.8	25.0	18.7	49.8	26.1
	Qatif S/S (2)	13.8	9.5	51.5	13.3	9.7	53.5	13.6

The fault levels are based on the following assumptions & notes:

ANNEXURE-E

(Other Relevant Data)

7.0 DATA SCHEDULE

PAD-MOUNTED STATION SERVICE TRANSFORMER UP TO 2.0 MVA.

SEC Enquiry No. _____ Date: _____

SEC Purchase Order No. or Contract No. _____ Date: _____

SEC PTS No /Project Title with J.O. No. _____

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
3.0	APPLICABLE CODES AND STANDARDS			
	Applicable Industry Standards	*	IEC-60076	
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	General.			
	Model Designation	*	E05/1G/3C/2U, Rev.0	
	Estimated transformer life to operate under sevice conditons (year)	*	Appsoximately 20 Yeass	
	Type of system grounding (solidly grounded, resistance grounding, other)	SOLIDLY GROUNDED	Solidly Gsounded	
4.2	Performance Characteristics and Ratings:			
	Rated power (kVA)	500 (MIN.)	500 KVA	
	Vector group designation (Dyn11 or Dyn5)	Dyn 11	Dyn11	
	Primary voltage (V) (13800, 33000 or 34000)	13800	13800	
	Secondary voltage (V) (400/231, 380/220 or 231/133)	380/220	380/220	

'A'- SEC SPECIFIED DATA/PARAMETER.
'B'- BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS.
'C'- REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'
(*)- DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'.

7.0 DATA SCHEDULE

PAD-MOUNTED STATION SERVICE TRANSFORMER UP TO 2.0 MVA.

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2 Continued	Basic impulse withstand voltage (BIL)			
	HV winding (kVpeak)	*	95	
	LV winding (kVpeak)	*	6	
	Power frequency withstand voltage			
	HV winding (kVrms)	*	38	
	LV winding (kVrms)	*	3	
	Guaranteed no-load losses at rated voltage. (kW)	*	0.75	
	Guaranteed load losses at rated voltage & 75 °C (kW)	*	5.2	
	Guaranteed impedance voltage at rated voltage & 75°C (%)	5	5%	
	Guaranteed excitation current at rated voltage excited from secondary side (A)	*	4.72 A (Refers to L.V. Side)	
	Efficiency (%) (100% Load at Unity P.F.)		98.77%	
	Voltage regulation at normal tap and 0.8 p.f (%) (100% Load at 0.8 p.f.)	*	3.91%	
	Guaranteed top oil temperature - rise at highest total load losses (K) above the maximum ambient temperature	50°c	50°C	
	Guaranteed average windings temperature-rise at highest total load losses (K) above the maximum ambient temperature	55°c	55°C	
	Hot spot temperature-rise (K)	*	68°C	
	Short circuit withstand level (KA)/sec	*	@ HV = 0.42 kA/2 Seconds @ LV= 15.20 kA/2 Seconds	

7.0 DATA SCHEDULE

PAD-MOUNTED STATION SERVICE TRANSFORMER UP TO 2.0 MVA.

REFERENCE SECTION NO	DESCRIPTION	'A'	'B'	'C'
4.2 Continued	Maximum design flux density @ 100% of rated voltage (Tesla)	*	1.62	
	Noise level (dBA)	*	As per NEMA TR-1	
4.3	Construction			
	Tank:			
	Material	*	Mild Steel	
	Tank (rigid/non-rigid)	*	Non-Rigid	
	Tank (sealed /conservator)	*	Sealed	
	Thickness of tank (mm)	*	3 mm (Minimum)	
	Normal operating pressure of tank (kpa)	*	—	
	Maximum pressure withstand without permanent deformation of tank & radiator for 24 hours (kpa)	*	50	
	Minimum pressure (vacuum) withstand without permanent deformation of rigid body tank for 30 minutes (kpa)	*	—	
ST	Winding: Material	CU	Copper	
	Core: Material	*	M5, Silicon Steel	
4.4	Off-Load Tap Changer:			
	Applied standard	*	IEC-60214	
	Number of steps	5	5	
	Step voltage (%)	2.5	2.5	
	Voltage tapping range (%)	±5	±5	
	Operating method	MANUAL	Off-circuit, Manual	
	Tap position of maximum primary voltage	*	Postion-1	
4.5	Bushings and Terminations:			
	Opposite side wall mounted	YES	YES (Refer, as per the attached G.A. dwg.)	

From: Lepeniotis, Panos [mailto:Panos.Lepeniotis@cooperindustries.com]
Sent: Tuesday, April 09, 2013 4:21 PM
To: Maged Abdel Aziz
Cc: Hamed Mohamed Hamed; Divakaran Kannoth Kandy; Mohammed Al-Owaid; Margalia, Mary
Subject: RE: Input Data request - Capacitor bank- Qatif S/S #2 - SA-3004

Dear Sir,

All information related to the transient currents is included in the analysis submitted to you on September 4th, approved by NG on Nov. 13th 2013.
Nevertheless, I am glad to provide the below data in red:

1. 13.8kv Capacitor bank inrush current – Ipeak=2.03kA(Table 1)
2. 13.8kv Capacitor bank Outrush current – Ipeak=2.55kA(Table 2)

Thank you.
Best Regards,

Panos Lepeniotis

Sales Engineer - Int'l Sales Office
Tel +30 210 964 6332

From: Maged Abdel Aziz [mailto:maged@abc.sa.com]
Sent: Tuesday, April 09, 2013 3:34 PM
To: Margalia, Mary; Lepeniotis, Panos
Cc: Hamed Mohamed Hamed; Divakaran Kannoth Kandy; Mohammed Al-Owaid
Subject: Input Data request - Capacitor bank- Qatif S/S #2

Dear Mrs. Mary

Regarding the subject mentioned, Please send us the data mentioned below as requested by our Consultant:

1. 13.8kv Capacitor bank inrush current
2. 13.8kv Capacitor bank Outrush current

Your extended support and help will be much appreciated.

Thank you & Best Regards,

Mr. Maged A. Aziz
Project Manager
Tel.: +966-3 8584218, 8142018, 8592842 – Ext. 114
Fax: +966-3 8584218, 8142018, 8592842 – Ext. 110
Mobile: +966-551944736
Email: maged@abc.sa.com
Eng_maged63@yahoo.com

ANNEXURE-F

(Relay Configuration Files in PDF Format)