

Project: Barka I
Location: Barka (Sultanate fo Oman)
Contract:
Engineer: MAGC
Filename: BarkaV2

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Electrical Transient Analyzer Program

Harmonic Load Flow

Loading Category (1): Design

Generation Category (1): Design

Load Diversity Factor: None

	<u>Swing</u>	<u>V-Control</u>	<u>Load</u>	<u>Total</u>
Number of Buses:	17	0	17	34

	<u>XEMR2</u>	<u>XEMR3</u>	<u>Reactor</u>	<u>Line/Cable</u>	<u>Impedance</u>	<u>Tie PD</u>	<u>Total</u>
Number of Branches:	6	0	0	3	0	8	17

	<u>Current</u>	<u>Voltage</u>
Number of Harm. Sources:	16	0

Number of Filters: 0

Method of Solution: Newton-Raphson

Maximum No. of Iteration: 99

Precision of Solution: 0.0001000000

System Frequency: 50.00 Hz

Unit System: Metric

Project Filename: BarkaV2

Output Filename: C:\Users\Pedro Rodriguez\Desktop\Proyecto PFC\Proyecto Abengoa\Barka\Barka V1\Untitled.HA1

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Adjustments

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

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

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Bus Input Data

Bus	Initial Voltage		Load												% Limits	
	ID	kV	Sub-sys	% Mag.	Ang.	Constant kVA		Constant Z		Constant I		Generic		VTHD	VIHD	
'		15.750	2	100.0	0.0									2.50	1.50	
.		15.750	1	100.0	0.0									2.50	1.50	
..		11.000	1	100.0	-30.0	1.771	1.004	0.000	-0.500					2.50	1.50	
...		11.000	1	100.0	-30.0	1.771	1.004	0.000	-0.500					2.50	1.50	
...		11.000	2	100.0	-30.0	1.771	1.004	0.000	-0.500					2.50	1.50	
AC-001-011-A1		11.000	1	100.0	-30.0									2.50	1.50	
AC-001-011-B1		11.000	2	100.0	-30.0									2.50	1.50	
AC-001-415-A1		0.415	1	100.0	0.0	0.173	0.098	0.245	0.052					2.50	1.50	
AC-001-415-B1		0.415	1	100.0	0.0	0.093	0.044	0.197	0.018					2.50	1.50	
AC-001-415-H.R.Board2		0.415	2	100.0	30.0			0.002	0.001					2.50	1.50	
AC-001-415-H.R.Board4		0.415	2	100.0	30.0			0.002	0.001					2.50	1.50	
AC-001-415-TP1		0.415	2	100.0	30.0	0.024	0.018	0.038	0.025					2.50	1.50	
AH-002-690- B1		0.690	2	100.0	0.0									2.50	1.50	
AH-002-690-A1		0.690	1	100.0	0.0									2.50	1.50	
AH-002-690-B1		0.690	2	100.0	0.0									2.50	1.50	
Bus1		0.690	15	100.0	0.0	0.312	0.257							2.50	1.50	
Existing_A0BCA1		11.000	1	100.0	-30.0			19.287	5.000					2.50	1.50	
Existing_A0BCA2		11.000	2	100.0	-30.0			19.956	5.001					2.50	1.50	
Existing_A1BBA		11.000	1	100.0	-30.0									2.50	1.50	
Existing_A2BBA		11.000	2	100.0	-30.0									2.50	1.50	
2nd Pass-1~		0.690	6	100.0	0.0	0.150	0.196							0.00	0.00	
2nd Pass-2~		0.690	14	100.0	0.0	0.150	0.196							0.00	0.00	
2nd Pass-3~		0.690	13	100.0	0.0	0.150	0.196							0.00	0.00	
Backwash-1~		0.690	4	100.0	0.0	0.282	0.248							0.00	0.00	
Booster-1~		0.690	5	100.0	0.0	0.156	0.081							0.00	0.00	
Booster-2~		0.690	11	100.0	0.0	0.156	0.081							0.00	0.00	
Booster-3~		0.690	12	100.0	0.0	0.156	0.081							0.00	0.00	
Chem. Cleaning1~		0.690	7	100.0	0.0	0.125	0.075							0.00	0.00	
Intake-1~		0.690	8	100.0	0.0	0.275	0.056							0.00	0.00	
Intake-2~		0.690	9	100.0	0.0	0.275	0.056							0.00	0.00	
Intake-3~		0.690	10	100.0	0.0	0.275	0.056							0.00	0.00	
Lime Milk Dosing P.1~		0.415	18	100.0	0.0	0.016	0.006							0.00	0.00	
Lime Milk Dosing P.2~		0.415	17	100.0	0.0	0.016	0.006							0.00	0.00	

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Bus				Load										
ID	kV	Sub-sys	Initial Voltage		Constant kVA		Constant Z		Constant I		Generic		% Limits	
			% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	VTHD	VIHD
UF CIP P.1~	0.415	16	100.0	0.0	0.029	0.007							0.00	0.00
Total Number of Buses: 34					8.128	4.771	39.727	8.599	0.000	0.000	0.000	0.000		

Generation Bus				Voltage		Generation			Mvar Limits	
ID	kV	Type	Sub-sys	% Mag.	Angle	MW	Mvar	% PF	Max	Min
'	15.750	Swing	2	100.0	0.0					
.	15.750	Swing	1	100.0	0.0					
Bus1	0.690	Swing	15	100.0	0.0					
2nd Pass-1~	0.690	Swing	6	100.0	0.0					
2nd Pass-2~	0.690	Swing	14	100.0	0.0					
2nd Pass-3~	0.690	Swing	13	100.0	0.0					
Backwash-1~	0.690	Swing	4	100.0	0.0					
Booster-1~	0.690	Swing	5	100.0	0.0					
Booster-2~	0.690	Swing	11	100.0	0.0					
Booster-3~	0.690	Swing	12	100.0	0.0					
Chem. Cleaning1~	0.690	Swing	7	100.0	0.0					
Intake-1~	0.690	Swing	8	100.0	0.0					
Intake-2~	0.690	Swing	9	100.0	0.0					
Intake-3~	0.690	Swing	10	100.0	0.0					
Lime Milk Dosing P.1~	0.415	Swing	18	100.0	0.0					
Lime Milk Dosing P.2~	0.415	Swing	17	100.0	0.0					
UF CIP P.1~	0.415	Swing	16	100.0	0.0					
						0.000	0.000			

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Cable Input Data

Cable	Ohms or Mhos / 1000 m per Conductor											
	ID	Library	Size	Length		#/Phase	T (°C)	R1	X1	Y1	R0	X0
coupling2	0,6NCUN3	6	Adj. (m)	% Tol.	1							
Incomer1	11NCUS1	240	550.0	0.0	2	75	0.093470	0.109000	0.0001734	0.148617	0.276860	
Incomer2	11NCUS1	240	550.0	0.0	2	75	0.093470	0.109000	0.0001734	0.148617	0.276860	

Cable resistances are listed at the specified temperatures

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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
Existing_A1BBT	55.000	15.750	11.600	12.00	45.00	0	0	10.0	0	0	13.2000	Dyn	30.000
Existing_A2BBT	55.000	15.750	11.600	12.00	45.00	0	0	10.0	0	0	13.2000	Dyn	30.000
T1	4.000	11.000	0.725	9.00	11.41	0	0	10.0	0	0	9.9000	Dyn	-30.000
T2	0.800	11.000	0.433	6.00	5.79	0	0	10.0	0	0	6.6000	Dyn	-30.000
T5	4.000	11.000	0.725	9.00	11.41	0	0	10.0	0	0	9.9000	Dyn	-30.000
Transf. Panel2	0.100	0.690	0.433	6.00	3.96	0	0	10.0	0	0	6.6000	Dyn	-30.000

2-Winding Transformer Grounding Input Data

Transformer	Rating			Grounding									
	ID	MVA	Prim. kV	Sec. kV	Conn.	Primary				Secondary			
				Type	Type	kV	Amp	Ohm	Type	kV	Amp	Ohm	
Existing_A1BBT	55.000	15.750	11.600	D/Y					Resistor		800.0	8.37158	
Existing_A2BBT	55.000	15.750	11.600	D/Y					Resistor		800.0	8.37158	
T1	4.000	11.000	0.725	D/Y					Solid				
T2	0.800	11.000	0.433	D/Y					Solid				
T5	4.000	11.000	0.725	D/Y					Solid				
Transf. Panel2	0.100	0.690	0.433	D/Y					Solid				

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Branch Connections

CKT/Branch		Connected Bus ID		% Positive Sequence Impedance (100 MVA Base)			
ID	Type	From Bus	To Bus	R	X	Z	Y
Existing_A1BBT	2W XFMR	.	Existing_A1BBA	0.53	23.99	24.00	
Existing_A2BBT	2W XFMR	'	Existing_A2BBA	0.53	23.99	24.00	
T1	2W XFMR	AC-001-011-A1	AH-002-690-A1	19.43	221.71	222.56	
T2	2W XFMR	AC-001-011-A1	AC-001-415-A1	126.26	731.04	741.86	
T5	2W XFMR	AC-001-011-B1	AH-002-690-B1	19.43	221.71	222.56	
Transf. Panel2	2W XFMR	AH-002-690- B1	AC-001-415-TP1	1316.18	5212.09	5375.71	
coupling2	Cable	AC-001-415-H.R.Board4	AC-001-415-H.R.Board2	157.31	4.45	157.37	
Incomer1	Cable	Existing_A0BCA1	AC-001-011-A1	1.91	2.23	2.93	0.0256660
Incomer2	Cable	Existing_A0BCA2	AC-001-011-B1	1.91	2.23	2.93	0.0256660
4P-1250A2	Tie PD	AH-002-690-B1	AH-002-690- B1				
AC-011-A1	Tie PD	AC-001-011-A1	..				
AC-011-A2	Tie PD	AC-001-011-A1	..				
AC-011-B3	Tie PD	AC-001-011-B1	...				
AC-415-C1	Tie PD	AC-001-415-A1	AC-001-415-B1				
CB B2	Tie PD	Existing_A2BBA	Existing_A0BCA2				
CB C1 (A)	Tie PD	Existing_A1BBA	Existing_A0BCA1				
CB-415-HRB-33	Tie PD	AC-001-415-TP1	AC-001-415-H.R.Board4				

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Branch Connections
Zero Sequence Impedance

CKT/Branch		Connected Bus ID		% Impedance, Zero Seq., 100 MVAb			
ID	Type	From Bus	To Bus	R0	X0	Z0	Y0
Existing_A1BBT	2W Xfmr	.	Existing_A1BBA				
Existing_A2BBT	2W Xfmr	'	Existing_A2BBA				
T1	2W Xfmr	AC-001-011-A1	AH-002-690-A1				
T2	2W Xfmr	AC-001-011-A1	AC-001-415-A1				
T5	2W Xfmr	AC-001-011-B1	AH-002-690-B1				
Transf. Panel2	2W Xfmr	AH-002-690- B1	AC-001-415-TP1				
coupling2	Cable	AC-001-415-H.R.Board4	AC-001-415-H.R.Board2	251.69	11.34	251.94	
Incomer1	Cable	Existing_A0BCA1	AC-001-011-A1	3.04	5.66	6.42	
Incomer2	Cable	Existing_A0BCA2	AC-001-011-B1	3.04	5.66	6.42	
4P-1250A2	Tie PD	AH-002-690-B1	AH-002-690- B1				
AC-011-A1	Tie PD	AC-001-011-A1	..				
AC-011-A2	Tie PD	AC-001-011-A1	..				
AC-011-B3	Tie PD	AC-001-011-B1	...				
AC-415-C1	Tie PD	AC-001-415-A1	AC-001-415-B1				
CB B2	Tie PD	Existing_A2BBA	Existing_A0BCA2				
CB C1 (A)	Tie PD	Existing_A1BBA	Existing_A0BCA1				
CB-415-HRB-33	Tie PD	AC-001-415-TP1	AC-001-415-H.R.Board4				

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Machine Input Data

Machine		Connected Bus	Rating (Base)			% Negative Seq. Imp.			Grounding			% Zero Seq. Imp.		
ID	Type	ID	MVA	kV	RPM	X/R	R2	X2	Conn.	Type	Amp	X/R	R0	X0
U1	Grid	.	6080.000	15.750		10.00	9.950	99.50	Wye	Solid		10.00	156.775	1567.75
U2	Grid	'	6080.000	15.750		10.00	9.950	99.50	Wye	Solid		10.00	156.775	1567.75
2nd Pass-1	IndM	2nd Pass-1~	0.529	0.690	1500	18.70	1.069	20.00	Wye	Open				
2nd Pass-2	IndM	2nd Pass-2~	0.529	0.690	1500	18.70	1.069	20.00	Wye	Open				
2nd Pass-3	IndM	2nd Pass-3~	0.529	0.690	1500	18.70	1.069	20.00	Wye	Open				
Ant.Storage Tank1	IndM	AC-001-415-A1	0.001	0.415	1500	0.67	41.614	27.83	Wye	Open				
Antiscal. tank agitator2	IndM	AC-001-415-B1	0.001	0.415	1500	0.67	41.614	27.83	Wye	Open				
AntiscalantUnloadingP.1	IndM	AC-001-415-A1	0.003	0.415	1500	1.34	20.807	27.83	Wye	Open				
Backwash-1	IndM	Backwash-1~	0.461	0.690	1000	16.99	1.177	20.00	Wye	Open				
Backwash-3	IndM	Bus1	0.456	0.690	1000	16.99	1.177	20.00	Wye	Open				
Booster-1	IndM	Booster-1~	0.177	0.690	3000	11.05	1.811	20.00	Wye	Open				
Booster-2	IndM	Booster-2~	0.177	0.690	3000	11.05	1.811	20.00	Wye	Open				
Booster-3	IndM	Booster-3~	0.177	0.690	3000	11.05	1.811	20.00	Wye	Open				
Caustic Soda Heater 1	IndM	AC-001-415-A1	0.003	0.415	1500	1.34	20.807	27.83	Wye	Open				
Caustic Soda Heater 2	IndM	AC-001-415-B1	0.003	0.415	1500	1.34	20.807	27.83	Wye	Open				
CausticSoda unloading P.1	IndM	AC-001-415-A1	0.005	0.415	1500	1.56	17.818	27.83	Wye	Open				
Chem. Cleaning1	IndM	Chem. Cleaning1~	0.159	0.690	1500	14.96	1.337	20.00	Wye	Open				
Compressor 1	IndM	AC-001-415-A1	0.064	0.415	1500	6.66	3.004	20.00	Wye	Open				
Crane Lime	IndM	AC-001-415-B1	0.008	0.415	1500	2.18	12.771	27.83	Wye	Open				
Crane nave	IndM	AC-001-415-A1	0.015	0.415	1500	3.05	9.132	27.83	Wye	Open				
Crane storage	IndM	AC-001-415-B1	0.013	0.415	1500	2.85	9.750	27.83	Wye	Open				
Crane SWI	IndM	AC-001-415-A1	0.010	0.415	1500	2.47	11.254	27.83	Wye	Open				
Drain Pump1	IndM	AC-001-415-A1	0.006	0.415	1500	2.02	13.802	27.83	Wye	Open				
Drainage Pump 1	IndM	AC-001-415-A1	0.017	0.415	1500	3.49	7.968	27.83	Wye	Open				
Fe.Chl. unloading pump1	IndM	AC-001-415-A1	0.003	0.415	1500	1.34	20.807	27.83	Wye	Open				
FPS Pump 1	IndM	AC-001-415-B1	0.087	0.415	3000	7.81	2.561	20.00	Wye	Open				
HPP-1	IndM	..	2.253	11.000	3000	32.55	0.473	15.38	Wye	Open				
HPP1 Motorized C.Valve	IndM	AC-001-415-A1	0.000	0.415	1500	0.45	61.724	27.83	Wye	Open				
HPP-2	IndM	..	2.253	11.000	3000	32.55	0.473	15.38	Wye	Open				
HPP2 Motorized C.Valve	IndM	AC-001-415-B1	0.000	0.415	1500	0.45	61.724	27.83	Wye	Open				
HPP-3	IndM	...	2.253	11.000	3000	32.55	0.473	15.38	Wye	Open				
HPP3 Motorized C.Valve	IndM	AC-001-415-B1	0.000	0.415	1500	0.45	61.724	27.83	Wye	Open				
Intake-1	IndM	Intake-1~	0.692	0.690	1500	22.99	0.870	20.00	Wye	Open				
Intake-2	IndM	Intake-2~	0.692	0.690	1500	22.99	0.870	20.00	Wye	Open				
Intake-3	IndM	Intake-3~	0.692	0.690	1500	22.99	0.870	20.00	Wye	Open				
Lime Milk Dosing P.1	IndM	Lime Milk Dosing P.1~	0.037	0.415	1500	4.94	5.635	27.83	Wye	Open				
Lime Milk Dosing P.2	IndM	Lime Milk Dosing P.2~	0.037	0.415	1500	4.94	5.635	27.83	Wye	Open				

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Machine		Connected Bus	Rating (Base)			% Negative Seq. Imp.			Grounding			% Zero Seq. Imp.		
ID	Type	ID	MVA	kV	RPM	X/R	R2	X2	Conn.	Type	Amp	X/R	R0	X0
Lime milk drainage pump3	IndM	AC-001-415-A1	0.006	0.415	1500	2.02	13.802	27.83	Wye	Open				
Lime sludge pump2	IndM	AC-001-415-B1	0.002	0.415	1500	0.95	29.426	27.83	Wye	Open				
Lime sludge pump3	IndM	AC-001-415-A1	0.002	0.415	1500	0.95	29.426	27.83	Wye	Open				
Neutralization Pump1	IndM	AC-001-415-A1	0.046	0.415	1500	5.49	5.074	27.83	Wye	Open				
Pressure Group P.1	IndM	AC-001-415-A1	0.008	0.415	1500	2.12	13.160	27.83	Wye	Open				
Reagent Drainage P.1	IndM	AC-001-415-A1	0.003	0.415	1500	1.34	20.807	27.83	Wye	Open				
Self Cleaning Filter 1	IndM	AC-001-415-A1	0.000	0.415	1500	0.40	69.009	27.83	Wye	Open				
Self Cleaning Filter2	IndM	AC-001-415-A1	0.000	0.415	1500	0.40	69.009	27.83	Wye	Open				
Skid 19(A)	IndM	AC-001-415-A1	0.000	0.240	1500	0.21	131.595	27.83	Wye	Solid		0.21	131.595	27.83
Skid 20-1	IndM	AC-001-415-A1	0.000	0.240	1500	0.44	62.996	27.83	Wye	Solid		0.44	62.996	27.83
Skid 20-2(A)	IndM	AC-001-415-A1	0.000	0.240	1500	0.44	62.996	27.83	Wye	Solid		0.44	62.996	27.83
Skid 21-1(A)	IndM	AC-001-415-A1	0.000	0.240	1500	0.44	62.996	27.83	Wye	Solid		0.44	62.996	27.83
Skid 21-2(A)	IndM	AC-001-415-A1	0.000	0.240	1500	0.44	62.996	27.83	Wye	Solid		0.44	62.996	27.83
Skid 22(A)	IndM	AC-001-415-A1	0.001	0.240	1500	0.62	44.545	27.83	Wye	Solid		0.62	44.545	27.83
Skid 23-1(A)	IndM	AC-001-415-A1	0.001	0.240	1500	0.64	43.645	27.83	Wye	Solid		0.64	43.645	27.83
Skid 23-2	IndM	AC-001-415-A1	0.000	0.240	1500	0.20	138.018	27.83	Wye	Solid		0.20	138.018	27.83
Skid 24-1(A)	IndM	AC-001-415-A1	0.000	0.240	1500	0.21	131.595	27.83	Wye	Solid		0.21	131.595	27.83
Skid 24-2(A)	IndM	AC-001-415-A1	0.001	0.240	1500	0.67	41.614	27.83	Wye	Solid		0.67	41.614	27.83
Skid 25(A)	IndM	AC-001-415-A1	0.011	0.415	1500	2.55	10.911	27.83	Wye	Open				
Sod. Hypo.e unloading P.	IndM	AC-001-415-A1	0.004	0.415	1500	1.56	17.818	27.83	Wye	Open				
Sod.Metab.Agitator1	IndM	AC-001-415-A1	0.001	0.415	1500	0.67	41.614	27.83	Wye	Open				
Sod.Metab.Agitator(2)	IndM	AC-001-415-B1	0.001	0.415	1500	0.67	41.614	27.83	Wye	Open				
Sulf.Ac.unloading P1	IndM	AC-001-415-A1	0.004	0.415	1500	1.56	17.818	27.83	Wye	Open				
UF CIP P.1	IndM	UF CIP P.1~	0.034	0.415	1500	4.94	5.635	27.83	Wye	Open				

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Harmonic Source from Library

Harmonic Source Information						
Bus ID	Device ID	Type	Manufacturer	Model	Fund. Freq.	Mod. Freq.
AC-001-415-TP1	UPS1	Current	Typical-IEEE	12 Pulse1	0.00	0.00
AH-002-690-A1	VFD6	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD10	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-B1	VFD13	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD4	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690- B1	VFD16	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD5	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-B1	VFD2	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-B1	VFD3	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD8	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD9	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-A1	VFD11	Current	ABB	ACS600 6P	0.00	0.00
AH-002-690-B1	VFD14	Current	ABB	ACS600 6P	0.00	0.00
AC-001-415-A1	VFD7	Current	ABB	ACS600 6P	0.00	0.00
AC-001-415-B1	VFD20	Current	ABB	ACS600 6P	0.00	0.00
AC-001-415-A1	VFD013001	Current	ABB	ACS600 6P	0.00	0.00

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Fundamental Load Flow Report

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	%Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
*1	15.750	100.000	0.0	22.817	7.139	0	0	Existing_A2BBA	22.817	7.139	876.4	95.4	
*2	15.750	100.000	0.0	25.177	8.323	0	0	Existing_A1BBA	25.177	8.323	972.0	94.9	
..	11.000	100.006	-33.6	0	0	1.771	0.504	AC-001-011-A1	-1.771	-0.504	96.6	96.2	
..	11.000	100.006	-33.6	0	0	1.771	0.504	AC-001-011-A1	-1.771	-0.504	96.6	96.2	
...	11.000	99.709	-33.2	0	0	1.771	0.507	AC-001-011-B1	-1.771	-0.507	97.0	96.1	
AC-001-011-A1	11.000	100.006	-33.6	0	0	0	0	Existing_A0BCA1	-5.779	-1.633	315.2	96.2	
								AH-002-690-A1	1.447	0.347	78.1	97.2	
								AC-001-415-A1	0.790	0.279	44.0	94.3	
								..	1.771	0.504	96.6	96.2	
								..	1.771	0.504	96.6	96.2	
AC-001-011-B1	11.000	99.709	-33.2	0	0	0	0	Existing_A0BCA2	-2.912	-0.808	159.1	96.4	
								AH-002-690-B1	1.141	0.302	62.1	96.7	
								...	1.771	0.507	97.0	96.1	
AC-001-415-A1	0.415	101.019	-7.1	0	0	0.469	0.155	AC-001-011-A1	-0.781	-0.222	1117.5	96.2	
								AC-001-415-B1	0.311	0.067	438.4	97.8	
								UPS2	0.024	0.018	41.3	80.0	
								VFD7	0.017	0.004	24.0	97.0	
								VFD013001	0.029	0.000	40.1	100.0	
AC-001-415-B1	0.415	101.019	-7.1	0	0	0.311	0.067	AC-001-415-A1	-0.311	-0.067	438.4	97.8	
								VFD20	0.017	0.004	24.0	97.0	
AC-001-415-H.R.Board2	0.415	100.133	23.3	0	0	0.002	0.001	AC-001-415-H.R.Board4	-0.002	-0.001	3.9	85.0	
AC-001-415-H.R.Board4	0.415	100.138	23.3	0	0	0.002	0.001	AC-001-415-H.R.Board2	0.002	0.001	3.9	85.0	
								AC-001-415-TP1	-0.004	-0.003	7.3	85.0	
AC-001-415-TP1	0.415	100.138	23.3	0	0	0.062	0.043	AH-002-690- B1	-0.066	-0.045	111.6	82.5	-3.750
								AC-001-415-H.R.Board4	0.004	0.003	7.3	85.0	
								UPS1	0.024	0.018	41.7	80.0	
AH-002-690- B1	0.690	103.763	-4.8	0	0	0.319	0.065	AC-001-415-TP1	0.067	0.050	67.4	80.5	
								AH-002-690-B1	-0.386	-0.114	324.6	95.9	
								VFD16	0.319	0.065	262.2	98.0	
AH-002-690-A1	0.690	100.018	-5.6	0	0	1.442	0.293	AC-001-011-A1	-1.442	-0.293	1231.2	98.0	-3.750
								VFD4	0.288	0.059	246.0	98.0	
								VFD5	0.160	0.032	136.3	98.0	
								VFD6	0.153	0.031	130.2	98.0	
								VFD8	0.128	0.026	109.3	98.0	
								VFD9	0.281	0.057	239.6	98.0	
								VFD10	0.153	0.031	130.2	98.0	
								VFD11	0.281	0.057	239.6	98.0	

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Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	%Mag.	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
AH-002-690-B1	0.690	103.763	-4.8	0	0	0.752	0.153	AC-001-011-B1	-1.138	-0.267	942.9	97.4	
								AH-002-690- B1	0.386	0.114	324.6	95.9	
								VFD2	0.160	0.032	131.4	98.0	
								VFD3	0.160	0.032	131.4	98.0	
								VFD13	0.153	0.031	125.5	98.0	
								VFD14	0.281	0.057	230.9	98.0	
Existing_A0BCA1	11.000	100.169	-33.5	0	0	19.353	5.017	AC-001-011-A1	5.787	1.619	314.9	96.3	
								Existing_A1BBA	-25.139	-6.636	1362.4	96.7	
Existing_A0BCA2	11.000	99.790	-33.2	0	0	19.872	4.980	AC-001-011-B1	2.914	0.787	158.8	96.5	
								Existing_A2BBA	-22.786	-5.768	1236.3	96.9	
Existing_A1BBA	11.000	100.169	-33.5	0	0	0	0	.	-25.139	-6.636	1362.4	96.7	-3.125
								Existing_A0BCA1	25.139	6.636	1362.4	96.7	
Existing_A2BBA	11.000	99.790	-33.2	0	0	0	0	'	-22.786	-5.768	1236.3	96.9	-3.750
								Existing_A0BCA2	22.786	5.768	1236.3	96.9	
* VFD2	0.690	100.000	0.0	0.156	0.081	0	0	Booster-2~	0.156	0.081	147.3	88.9	
* VFD3	0.690	100.000	0.0	0.156	0.081	0	0	Booster-3~	0.156	0.081	147.3	88.9	
* VFD4	0.690	100.000	0.0	0.282	0.248	0	0	Backwash-1~	0.282	0.248	314.6	75.1	
* VFD5	0.690	100.000	0.0	0.156	0.081	0	0	Booster-1~	0.156	0.081	147.3	88.9	
* VFD6	0.690	100.000	0.0	0.150	0.196	0	0	2nd Pass-1~	0.150	0.196	206.4	60.6	
* VFD7	0.415	100.000	0.0	0.016	0.006	0	0	Lime Milk Dosing P.1~	0.016	0.006	24.6	93.0	
* VFD8	0.690	100.000	0.0	0.125	0.075	0	0	Chem. Cleaning1~	0.125	0.075	122.3	85.8	
* VFD9	0.690	100.000	0.0	0.275	0.056	0	0	Intake-1~	0.275	0.056	234.9	98.0	
* VFD10	0.690	100.000	0.0	0.150	0.196	0	0	2nd Pass-2~	0.150	0.196	206.4	60.6	
* VFD11	0.690	100.000	0.0	0.275	0.056	0	0	Intake-2~	0.275	0.056	234.9	98.0	
* VFD13	0.690	100.000	0.0	0.150	0.196	0	0	2nd Pass-3~	0.150	0.196	206.4	60.6	
* VFD14	0.690	100.000	0.0	0.275	0.056	0	0	Intake-3~	0.275	0.056	234.9	98.0	
* VFD16	0.690	100.000	0.0	0.312	0.257	0	0	Bus1	0.312	0.257	338.6	77.2	
* VFD20	0.415	100.000	0.0	0.016	0.006	0	0	Lime Milk Dosing P.2~	0.016	0.006	24.6	93.0	
* VFD013001	0.415	100.000	0.0	0.029	0.007	0	0	UF CIP P.1~	0.029	0.007	41.8	97.0	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

Indicates a bus with a load mismatch of more than 0.1 MVA

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System Harmonics Bus Information

Bus		Voltage Distortion								
ID	kV	Fund.	RMS	ASUM	THD	TIF	TIHD	TSHD	THDG	THDS
		%	%	%	%		%	%	%	%
	15.750	100.00	100.00	100.11	0.03	0.90	0.00	0.00	0.05	0.05
	15.750	100.00	100.00	100.16	0.07	1.26	0.00	0.00	0.07	0.07
	11.000	100.01	100.01	102.82	1.23	20.75	0.00	0.00	1.23	1.23
	11.000	100.01	100.01	102.82	1.23	20.75	0.00	0.00	1.23	1.23
	11.000	99.71	99.71	101.60	0.83	13.84	0.00	0.00	0.83	0.83
AC-001-011-A1	11.000	100.01	100.01	102.82	1.23	20.75	0.00	0.00	1.23	1.23
AC-001-011-B1	11.000	99.71	99.71	101.60	0.83	13.84	0.00	0.00	0.83	0.83
# * AC-001-415-A1	0.415	101.02	101.07	105.93	3.27	8.50	0.00	0.00	3.27	3.27
# * AC-001-415-B1	0.415	101.02	101.07	105.93	3.27	8.50	0.00	0.00	3.27	3.27
# * AC-001-415-H.R.Board2	0.415	100.13	100.61	128.40	9.76	305.26	0.00	0.00	9.76	9.76
# * AC-001-415-H.R.Board4	0.415	100.14	100.61	128.41	9.76	305.27	0.00	0.00	9.76	9.76
# * AC-001-415-TP1	0.415	100.14	100.61	128.41	9.76	305.27	0.00	0.00	9.76	9.76
# * AH-002-690- B1	0.690	103.76	104.13	124.35	8.39	160.16	0.00	0.00	8.39	8.39
# * AH-002-690-A1	0.690	100.02	100.71	127.41	11.75	216.60	0.00	0.00	11.75	11.75
# * AH-002-690-B1	0.690	103.76	104.13	124.35	8.39	160.16	0.00	0.00	8.39	8.39
Existing_A0BCA1	11.000	100.17	100.18	102.75	1.13	19.05	0.00	0.00	1.13	1.13
Existing_A0BCA2	11.000	99.79	99.79	101.53	0.76	12.70	0.00	0.00	0.76	0.76
Existing_A1BBA	11.000	100.17	100.18	102.75	1.13	19.05	0.00	0.00	1.13	1.13
Existing_A2BBA	11.000	99.79	99.79	101.53	0.76	12.70	0.00	0.00	0.76	0.76

* Indicates THD (Total Harmonic Distortion) Exceeds the Limit.
 # Indicates IHD (Individual Harmonic Distortion) Exceeds the Limit.

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System Harmonics Branch Information

Bus		Current Distortion											
From Bus ID	To Bus ID	Fund. Amp	RMS Amp	ASUM Amp	THD %	TIF	IT Amp	ITB Amp	ITR Amp	TIHD %	TSHD %	THDG %	THDS %
'	Existing_A2BBA	876.39	876.58	906.85	2.08	11.68	10242.13	10242.13	0.00	0.00	0.00	2.08	2.08
.	Existing_A1BBA	972.04	972.41	1017.00	2.77	16.00	15559.37	15559.37	0.00	0.00	0.00	2.77	2.77
..	AC-001-011-A1	96.62	96.65	102.45	2.33	101.34	9794.04	9794.04	0.00	0.00	0.00	2.33	2.33
..	AC-001-011-A1	96.62	96.65	102.45	2.33	101.34	9794.04	9794.04	0.00	0.00	0.00	2.33	2.33
...	AC-001-011-B1	96.95	96.96	100.91	1.55	69.36	6725.58	6725.58	0.00	0.00	0.00	1.55	1.55
AC-001-011-A1	Existing_A0BCA1	315.18	317.59	384.41	12.38	92.98	29527.58	29527.58	0.00	0.00	0.00	12.38	12.38
	AH-002-690-A1	78.10	86.38	140.67	47.24	264.50	22847.57	22847.57	0.00	0.00	0.00	47.24	47.24
	AC-001-415-A1	43.99	44.07	48.26	6.13	22.08	972.89	972.89	0.00	0.00	0.00	6.13	6.13
	..	96.62	96.65	102.45	2.33	101.34	9794.04	9794.04	0.00	0.00	0.00	2.33	2.33
	..	96.62	96.65	102.45	2.33	101.34	9794.04	9794.04	0.00	0.00	0.00	2.33	2.33
AC-001-011-B1	Existing_A0BCA2	159.09	161.28	206.24	16.66	122.96	19832.05	19832.05	0.00	0.00	0.00	16.66	16.66
	AH-002-690-B1	62.15	67.51	107.01	42.42	242.79	16390.03	16390.03	0.00	0.00	0.00	42.42	42.42
	...	96.95	96.96	100.91	1.55	69.36	6725.58	6725.58	0.00	0.00	0.00	1.55	1.55
AC-001-415-A1	AC-001-011-A1	1117.46	1119.55	1226.05	6.13	22.08	24715.38	24715.38	0.00	0.00	0.00	6.13	6.13
	AC-001-415-B1	438.39	448.04	594.95	21.09	97.46	43663.93	43663.93	0.00	0.00	0.00	21.09	21.09
AC-001-415-B1	AC-001-415-A1	438.39	448.04	594.95	21.09	97.46	43663.93	43663.93	0.00	0.00	0.00	21.09	21.09
AC-001-415-H.R.Board2	AC-001-415-H.R.Board4	3.88	3.90	4.82	8.33	259.86	1012.45	1012.45	0.00	0.00	0.00	8.33	8.33
AC-001-415-H.R.Board4	AC-001-415-H.R.Board2	3.88	3.90	4.82	8.33	259.86	1012.45	1012.45	0.00	0.00	0.00	8.33	8.33
	AC-001-415-TP1	7.31	7.31	7.42	0.52	16.30	119.11	119.11	0.00	0.00	0.00	0.52	0.52
AC-001-415-TP1	AH-002-690- B1	111.62	111.75	124.79	4.75	84.54	9447.14	9447.14	0.00	0.00	0.00	4.75	4.75
	AC-001-415-H.R.Board4	7.31	7.31	7.42	0.52	16.30	119.11	119.11	0.00	0.00	0.00	0.52	0.52
AH-002-690- B1	AC-001-415-TP1	67.42	67.50	75.68	4.94	87.82	5928.41	5928.41	0.00	0.00	0.00	4.94	4.94
	AH-002-690-B1	324.55	346.11	541.04	37.05	285.28	98738.88	98738.88	0.00	0.00	0.00	37.05	37.05
AH-002-690-A1	AC-001-011-A1	1231.18	1352.48	2180.43	45.47	256.31	346652.80	346652.80	0.00	0.00	0.00	45.47	45.47
AH-002-690-B1	AC-001-011-B1	942.92	1024.25	1623.67	42.42	242.79	248676.30	248676.30	0.00	0.00	0.00	42.42	42.42
	AH-002-690- B1	324.55	346.11	541.04	37.05	285.28	98738.88	98738.88	0.00	0.00	0.00	37.05	37.05
Existing_A0BCA1	AC-001-011-A1	314.85	317.27	384.36	12.42	94.03	29832.86	29832.86	0.00	0.00	0.00	12.42	12.42
	Existing_A1BBA	1362.37	1363.10	1448.14	3.27	33.46	45613.54	45613.54	0.00	0.00	0.00	3.27	3.27
Existing_A0BCA2	AC-001-011-B1	158.77	160.98	206.11	16.73	124.46	20034.65	20034.65	0.00	0.00	0.00	16.73	16.73
	Existing_A2BBA	1236.29	1236.66	1295.07	2.46	25.08	31021.31	31021.31	0.00	0.00	0.00	2.46	2.46
Existing_A1BBA	.	1362.37	1362.86	1423.41	2.68	15.50	21126.54	21126.54	0.00	0.00	0.00	2.68	2.68
	Existing_A0BCA1	1362.37	1363.10	1448.14	3.27	33.46	45613.54	45613.54	0.00	0.00	0.00	3.27	3.27
Existing_A2BBA	'	1236.29	1236.54	1277.65	2.00	11.25	13907.35	13907.35	0.00	0.00	0.00	2.00	2.00
	Existing_A0BCA2	1236.29	1236.66	1295.07	2.46	25.08	31021.31	31021.31	0.00	0.00	0.00	2.46	2.46

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
Bus ID: ' 																	
Fund. kV: 15.750																	
5.00	250.00	0.04	7.00	350.00	0.02	11.00	550.00	0.02	13.00	650.00	0.01	17.00	850.00	0.01	19.00	950.00	0.01
23.00	1150.00	0.01	25.00	1250.00	0.00	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00
Bus ID: .																	
Fund. kV: 15.750																	
5.00	250.00	0.06	7.00	350.00	0.03	11.00	550.00	0.02	13.00	650.00	0.01	17.00	850.00	0.02	19.00	950.00	0.01
23.00	1150.00	0.01	25.00	1250.00	0.01												
Bus ID: ..																	
Fund. kV: 11.001																	
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												
Bus ID: ..																	
Fund. kV: 11.001																	
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												
Bus ID: ...																	
Fund. kV: 10.968																	
5.00	250.00	0.66	7.00	350.00	0.31	11.00	550.00	0.27	13.00	650.00	0.13	17.00	850.00	0.18	19.00	950.00	0.12
23.00	1150.00	0.13	25.00	1250.00	0.09	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00
Bus ID: AC-001-011-A1																	
Fund. kV: 11.001																	
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												
Bus ID: AC-001-011-B1																	
Fund. kV: 10.968																	
5.00	250.00	0.66	7.00	350.00	0.31	11.00	550.00	0.27	13.00	650.00	0.13	17.00	850.00	0.18	19.00	950.00	0.12
23.00	1150.00	0.13	25.00	1250.00	0.09	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00
Bus ID: AC-001-415-A1																	
Fund. kV: 0.419																	
5.00	250.00	2.89	7.00	350.00	1.50	11.00	550.00	0.25	13.00	650.00	0.07	17.00	850.00	0.06	19.00	950.00	0.04

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Bus ID: AC-001-415-A1
Fund. kV: 0.419

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
23.00	1150.00	0.04	25.00	1250.00	0.02												

Bus ID: AC-001-415-B1
Fund. kV: 0.419

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	2.89	7.00	350.00	1.50	11.00	550.00	0.25	13.00	650.00	0.07	17.00	850.00	0.06	19.00	950.00	0.04
23.00	1150.00	0.04	25.00	1250.00	0.02												

Bus ID: AC-001-415-H.R.Board2
Fund. kV: 0.416

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.55	7.00	350.00	3.00	11.00	550.00	3.99	13.00	650.00	2.94	17.00	850.00	1.39	19.00	950.00	0.90
23.00	1150.00	2.18	25.00	1250.00	2.19	35.00	1750.00	1.43	37.00	1850.00	1.36	47.00	2350.00	1.17	49.00	2450.00	1.14

Bus ID: AC-001-415-H.R.Board4
Fund. kV: 0.416

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.55	7.00	350.00	3.00	11.00	550.00	3.99	13.00	650.00	2.94	17.00	850.00	1.39	19.00	950.00	0.90
23.00	1150.00	2.18	25.00	1250.00	2.19	35.00	1750.00	1.43	37.00	1850.00	1.36	47.00	2350.00	1.17	49.00	2450.00	1.14

Bus ID: AC-001-415-TP1
Fund. kV: 0.416

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.55	7.00	350.00	3.00	11.00	550.00	3.99	13.00	650.00	2.94	17.00	850.00	1.39	19.00	950.00	0.90
23.00	1150.00	2.18	25.00	1250.00	2.19	35.00	1750.00	1.43	37.00	1850.00	1.36	47.00	2350.00	1.17	49.00	2450.00	1.14

Bus ID: AH-002-690- B1
Fund. kV: 0.716

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.47	7.00	350.00	3.09	11.00	550.00	2.73	13.00	650.00	1.35	17.00	850.00	1.94	19.00	950.00	1.35
23.00	1150.00	1.66	25.00	1250.00	1.13	35.00	1750.00	0.03	37.00	1850.00	0.03	47.00	2350.00	0.02	49.00	2450.00	0.02

Bus ID: AH-002-690-A1
Fund. kV: 0.690

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	9.14	7.00	350.00	4.33	11.00	550.00	3.79	13.00	650.00	1.82	17.00	850.00	2.72	19.00	950.00	1.87
23.00	1150.00	2.23	25.00	1250.00	1.47												

Bus ID: AH-002-690-B1
Fund. kV: 0.716

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.47	7.00	350.00	3.09	11.00	550.00	2.73	13.00	650.00	1.35	17.00	850.00	1.94	19.00	950.00	1.35
23.00	1150.00	1.66	25.00	1250.00	1.13	35.00	1750.00	0.03	37.00	1850.00	0.03	47.00	2350.00	0.02	49.00	2450.00	0.02

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
Bus ID: Bus1																	
Fund. kV: 0.690																	
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												
Bus ID: Existing_A0BCA1																	
Fund. kV: 11.019																	
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												
Bus ID: Existing_A0BCA2																	
Fund. kV: 10.977																	
5.00	250.00	0.60	7.00	350.00	0.29	11.00	550.00	0.25	13.00	650.00	0.12	17.00	850.00	0.17	19.00	950.00	0.11
23.00	1150.00	0.12	25.00	1250.00	0.08	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00
Bus ID: Existing_A1BBA																	
Fund. kV: 11.019																	
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												
Bus ID: Existing_A2BBA																	
Fund. kV: 10.977																	
5.00	250.00	0.60	7.00	350.00	0.29	11.00	550.00	0.25	13.00	650.00	0.12	17.00	850.00	0.17	19.00	950.00	0.11
23.00	1150.00	0.12	25.00	1250.00	0.08	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Bus Tabulation

Harmonic Voltages (% of Nominal Voltage)

Bus ID: ' .

Nom. kV: 15.750

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.04	7.00	350.00	0.02	11.00	550.00	0.02	13.00	650.00	0.01	17.00	850.00	0.01	19.00	950.00	0.01
23.00	1150.00	0.01	25.00	1250.00	0.00	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Bus ID: . .

Nom. kV: 15.750

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.06	7.00	350.00	0.03	11.00	550.00	0.02	13.00	650.00	0.01	17.00	850.00	0.02	19.00	950.00	0.01
23.00	1150.00	0.01	25.00	1250.00	0.01												

Bus ID: . . .

Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												

Bus ID: . . .

Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												

Bus ID: . . .

Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.66	7.00	350.00	0.31	11.00	550.00	0.27	13.00	650.00	0.13	17.00	850.00	0.18	19.00	950.00	0.12
23.00	1150.00	0.13	25.00	1250.00	0.09	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Bus ID: AC-001-011-A1

Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.97	7.00	350.00	0.45	11.00	550.00	0.40	13.00	650.00	0.20	17.00	850.00	0.30	19.00	950.00	0.20
23.00	1150.00	0.19	25.00	1250.00	0.11												

Bus ID: AC-001-011-B1

Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.66	7.00	350.00	0.31	11.00	550.00	0.27	13.00	650.00	0.13	17.00	850.00	0.18	19.00	950.00	0.12
23.00	1150.00	0.13	25.00	1250.00	0.09	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Bus Tabulation

Harmonic Voltages (% of Nominal Voltage)

Bus ID: AH-002-690-B1
Nom. kV: 0.690

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	6.72	7.00	350.00	3.20	11.00	550.00	2.84	13.00	650.00	1.40	17.00	850.00	2.02	19.00	950.00	1.40
23.00	1150.00	1.72	25.00	1250.00	1.18	35.00	1750.00	0.03	37.00	1850.00	0.03	47.00	2350.00	0.02	49.00	2450.00	0.02

Bus ID: Bus1
Nom. kV: 0.690

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												

Bus ID: Existing_A0BCA1
Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												

Bus ID: Existing_A0BCA2
Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.60	7.00	350.00	0.29	11.00	550.00	0.25	13.00	650.00	0.12	17.00	850.00	0.17	19.00	950.00	0.11
23.00	1150.00	0.12	25.00	1250.00	0.08	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Bus ID: Existing_A1BBA
Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.89	7.00	350.00	0.41	11.00	550.00	0.37	13.00	650.00	0.18	17.00	850.00	0.27	19.00	950.00	0.18
23.00	1150.00	0.17	25.00	1250.00	0.10												

Bus ID: Existing_A2BBA
Nom. kV: 11.000

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
5.00	250.00	0.60	7.00	350.00	0.29	11.00	550.00	0.25	13.00	650.00	0.12	17.00	850.00	0.17	19.00	950.00	0.11
23.00	1150.00	0.12	25.00	1250.00	0.08	35.00	1750.00	0.00	37.00	1850.00	0.00	47.00	2350.00	0.00	49.00	2450.00	0.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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VIHD (Individual Harmonic Distortion) Report

Bus	ID	kV	Voltage Distortion		
			Fund. %	VIHD %	Order
AC-001-415-A1	AC-001-415-A1	0.415	101.02	2.89	5.00
AC-001-415-B1	AC-001-415-B1	0.415	101.02	2.89	5.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	6.55	5.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	6.55	5.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	6.55	5.00
AH-002-690- B1	AH-002-690- B1	0.690	103.76	6.47	5.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	9.14	5.00
AH-002-690-B1	AH-002-690-B1	0.690	103.76	6.47	5.00
AC-001-415-A1	AC-001-415-A1	0.415	101.02	1.50	7.00
AC-001-415-B1	AC-001-415-B1	0.415	101.02	1.50	7.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	3.00	7.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	3.00	7.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	3.00	7.00
AH-002-690- B1	AH-002-690- B1	0.690	103.76	3.09	7.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	4.33	7.00
AH-002-690-B1	AH-002-690-B1	0.690	103.76	3.09	7.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	3.99	11.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	3.99	11.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	3.99	11.00
AH-002-690- B1	AH-002-690- B1	0.690	103.76	2.73	11.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	3.79	11.00
AH-002-690-B1	AH-002-690-B1	0.690	103.76	2.73	11.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	2.94	13.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	2.94	13.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	2.94	13.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	1.82	13.00
AH-002-690- B1	AH-002-690- B1	0.690	103.76	1.94	17.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	2.72	17.00
AH-002-690-B1	AH-002-690-B1	0.690	103.76	1.94	17.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	1.87	19.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	2.18	23.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	2.18	23.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	2.18	23.00
AH-002-690- B1	AH-002-690- B1	0.690	103.76	1.66	23.00
AH-002-690-A1	AH-002-690-A1	0.690	100.02	2.23	23.00
AH-002-690-B1	AH-002-690-B1	0.690	103.76	1.66	23.00
AC-001-415-H.R.Board2	AC-001-415-H.R.Board2	0.415	100.13	2.19	25.00
AC-001-415-H.R.Board4	AC-001-415-H.R.Board4	0.415	100.14	2.19	25.00
AC-001-415-TP1	AC-001-415-TP1	0.415	100.14	2.19	25.00

Indicates buses with IHD (Individual Harmonic Distortion) exceeding the limit

Project: Barka I
Location: Barka (Sultanate fo Oman)
Contract:
Engineer: MAGC
Filename: BarkaV2

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VTHD (Total Harmonic Distortion) Report

Bus	Fund.	Voltage Distortion	
		VTBD	
ID	kV	%	%
AC-001-415-A1	0.415	101.02	3.27
AC-001-415-B1	0.415	101.02	3.27
AC-001-415-H.R.Board2	0.415	100.13	9.76
AC-001-415-H.R.Board4	0.415	100.14	9.76
AC-001-415-TP1	0.415	100.14	9.76
AH-002-690- B1	0.690	103.76	8.39
AH-002-690-A1	0.690	100.02	11.75
AH-002-690-B1	0.690	103.76	8.39

Indicates buses with THD (Total Harmonic Distortion) exceeding the limit

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Alert Summary Report

% Alert Settings

<u>Bus</u>	<u>Critical</u>	<u>Marginal</u>
Individual Bus VTHD / VIHD values are used.		
<u>Transformer</u>		
Total I	100.0	95.0
<u>Filter</u>		
Capacitor kV	100.0	95.0
Inductor Amp	100.0	95.0
<u>Capacitor</u>		
Max kV	100.0	95.0
<u>Cable</u>		
Ampacity	100.0	95.0

Critical Report

<u>Device ID</u>	<u>Type</u>	<u>Condition</u>	<u>Rating/Limit</u>	<u>Unit</u>	<u>Operating</u>	<u>% Operating</u>	<u>Harmonic</u>
AC-001-415-A1	Bus	Exceeds Limit	1.50	Bus IHD	2.89	192.4	5.00
AC-001-415-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.50	100.1	7.00
AC-001-415-A1	Bus	Exceeds Limit	2.50	Bus THD	3.27	130.6	Total
AC-001-415-B1	Bus	Exceeds Limit	1.50	Bus IHD	2.89	192.4	5.00
AC-001-415-B1	Bus	Exceeds Limit	1.50	Bus IHD	1.50	100.1	7.00
AC-001-415-B1	Bus	Exceeds Limit	2.50	Bus THD	3.27	130.6	Total
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	6.55	436.6	5.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	3.00	200.3	7.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	3.99	265.7	11.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	2.94	195.9	13.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	2.18	145.1	23.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	2.19	145.8	25.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	2.50	Bus THD	9.76	390.4	Total
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	6.55	436.6	5.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	3.00	200.3	7.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	3.99	265.7	11.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	2.94	195.9	13.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	2.18	145.1	23.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	2.19	145.8	25.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV2

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Critical Report

<u>Device ID</u>	<u>Type</u>	<u>Condition</u>	<u>Rating/Limit</u>	<u>Unit</u>	<u>Operating</u>	<u>% Operating</u>	<u>Harmonic</u>
AC-001-415-HR.Board4	Bus	Exceeds Limit	2.50	Bus THD	9.76	390.4	Total
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	6.55	436.6	5.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	3.00	200.3	7.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	3.99	265.7	11.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	2.94	195.9	13.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	2.18	145.1	23.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	2.19	145.8	25.00
AC-001-415-TP1	Bus	Exceeds Limit	2.50	Bus THD	9.76	390.4	Total
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	6.47	431.5	5.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	3.09	205.7	7.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	2.73	182.3	11.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	1.94	129.6	17.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	1.66	110.6	23.00
AH-002-690- B1	Bus	Exceeds Limit	2.50	Bus THD	8.39	335.5	Total
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	9.14	609.3	5.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	4.33	289.0	7.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	3.79	253.0	11.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.82	121.5	13.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	2.72	181.6	17.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.87	124.6	19.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	2.23	148.4	23.00
AH-002-690-A1	Bus	Exceeds Limit	2.50	Bus THD	11.75	470.1	Total
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	6.47	431.5	5.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	3.09	205.7	7.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	2.73	182.3	11.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	1.94	129.6	17.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	1.66	110.6	23.00
AH-002-690-B1	Bus	Exceeds Limit	2.50	Bus THD	8.39	335.5	Total