

Project: Barka I
Location: Barka (Sultanate fo Oman)
Contract:
Engineer: MAGC
Filename: BarkaV3

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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: 2

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: BarkaV3

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
					MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar		
'	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			Initial Voltage		Load								% Limits	
					Constant kVA		Constant Z		Constant I		Generic			
ID	kV	Sub-sys	% 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	Y0
			Adj. (m)	% Tol.									
coupling2		0,6NCUN3	6	1.0	0.0	1	75	3.621000	0.102400		5.793600	0.261120	
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	1.000	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	0.180	0.690	0.400	6.00	3.96	0	0	10.0	0	0	6.6000	Dyn	-30.000

2-Winding Transformer Grounding Input Data

Transformer	Rating			Conn.	Grounding								
	ID	MVA	Prim. kV		Sec. kV	Type	Type	kV	Amp	Ohm	Type	kV	Amp
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	1.000	11.000	0.433	D/Y						Solid			
T5	4.000	11.000	0.725	D/Y						Solid			
Transf. Panel2	0.180	0.690	0.400	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	101.01	584.83	593.49	
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	731.21	2895.61	2986.50	
coupling2	Cable	AC-001-415-H.R.Board4	AC-001-415-H.R.Board2	184.33	5.21	184.41	
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	294.93	13.29	295.23	
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

<u>Harmonic Source Information</u>						
<u>Bus ID</u>	<u>Device ID</u>	<u>Type</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Fund. Freq.</u>	<u>Mod. Freq.</u>
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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Filter Input Data

Filter Type: Single-Tuned

<u>Filter</u>		<u>Capacitor C1</u>			<u>Inductor L1</u>			<u>R</u>
ID	Connected Bus ID	kV	Max kV	kvar	XI	Q Fact.	Max I	Ohm
HF3	AC-001-415-TP1	0.415	0.000	2.4	0.0320	100.00	0.0	0.0000
HF2	AH-002-690-A1	0.690	0.000	59.4	0.3208	100.00	0.0	0.0000

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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	7.135	0	0	Existing_A2BBA	22.817	7.135	876.3	95.4	
*2	15.750	100.000	0.0	25.188	8.250	0	0	Existing_A1BBA	25.188	8.250	971.6	95.0	
..	11.000	100.026	-33.6	0	0	1.771	0.503	AC-001-011-A1	-1.771	-0.503	96.6	96.2	
..	11.000	100.026	-33.6	0	0	1.771	0.503	AC-001-011-A1	-1.771	-0.503	96.6	96.2	
...	11.000	99.710	-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	100.026	-33.6	0	0	0	0	Existing_A0BCA1	-5.783	-1.559	314.3	96.6	
								AH-002-690-A1	1.447	0.284	77.4	98.1	
								AC-001-415-A1	0.795	0.268	44.0	94.7	
								..	1.771	0.503	96.6	96.2	
								..	1.771	0.503	96.6	96.2	
AC-001-011-B1	11.000	99.710	-33.2	0	0	0	0	Existing_A0BCA2	-2.911	-0.803	159.0	96.4	
								AH-002-690-B1	1.141	0.297	62.0	96.8	
								...	1.771	0.507	97.0	96.1	
AC-001-415-A1	0.415	101.739	-6.4	0	0	0.473	0.156	AC-001-011-A1	-0.787	-0.223	1118.4	96.2	
								AC-001-415-B1	0.314	0.067	439.2	97.8	
								UPS2	0.024	0.018	41.0	80.0	
								VFD7	0.017	0.004	23.9	97.0	
								VFD013001	0.029	0.000	39.8	100.0	
AC-001-415-B1	0.415	101.739	-6.4	0	0	0.314	0.067	AC-001-415-A1	-0.314	-0.067	439.2	97.8	
								VFD20	0.017	0.004	23.9	97.0	
AC-001-415-H.R.Board2	0.415	99.836	24.1	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	99.841	24.1	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	99.841	24.1	0	0	0.062	0.040	AH-002-690- B1	-0.066	-0.043	109.7	83.9	1.875
								AC-001-415-H.R.Board4	0.004	0.003	7.3	85.0	
								UPS1	0.024	0.018	41.8	80.0	
AH-002-690- B1	0.690	103.777	-4.8	0	0	0.319	0.065	AC-001-415-TP1	0.067	0.045	64.8	82.9	
								AH-002-690-B1	-0.385	-0.110	322.9	96.2	
								VFD16	0.319	0.065	262.1	98.0	
AH-002-690-A1	0.690	100.196	-5.6	0	0	1.442	0.231	AC-001-011-A1	-1.442	-0.231	1219.8	98.7	-3.750
								VFD4	0.288	0.059	245.6	98.0	
								VFD5	0.160	0.032	136.0	98.0	
								VFD6	0.153	0.031	130.0	98.0	
								VFD8	0.128	0.026	109.1	98.0	
								VFD9	0.281	0.057	239.1	98.0	
								VFD10	0.153	0.031	130.0	98.0	
								VFD11	0.281	0.057	239.1	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	103.777	-4.8	0	0	0.752	0.153	AC-001-011-B1	-1.138	-0.262	941.4	97.4	
								AH-002-690- B1	0.385	0.110	322.9	96.2	
								VFD2	0.160	0.032	131.3	98.0	
								VFD3	0.160	0.032	131.3	98.0	
								VFD13	0.153	0.031	125.5	98.0	
								VFD14	0.281	0.057	230.9	98.0	
Existing_A0BCA1	11.000	100.187	-33.5	0	0	19.360	5.019	AC-001-011-A1	5.791	1.545	314.0	96.6	
								Existing_A1BBA	-25.151	-6.564	1361.7	96.8	
Existing_A0BCA2	11.000	99.792	-33.2	0	0	19.873	4.981	AC-001-011-B1	2.913	0.783	158.7	96.6	
								Existing_A2BBA	-22.786	-5.763	1236.2	96.9	
Existing_A1BBA	11.000	100.187	-33.5	0	0	0	0	.	-25.151	-6.564	1361.7	96.8	-3.125
								Existing_A0BCA1	25.151	6.564	1361.7	96.8	
Existing_A2BBA	11.000	99.792	-33.2	0	0	0	0	'	-22.786	-5.763	1236.2	96.9	-3.750
								Existing_A0BCA2	22.786	5.763	1236.2	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

<u>Bus</u>		<u>Voltage Distortion</u>								
<u>ID</u>	<u>kV</u>	<u>Fund.</u>	<u>RMS</u>	<u>ASUM</u>	<u>THD</u>	<u>TIF</u>	<u>TIHD</u>	<u>TSHD</u>	<u>THDG</u>	<u>THDS</u>
		<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>		<u>%</u>	<u>%</u>	<u>%</u>	<u>%</u>
	15.750	100.00	100.00	100.10	0.03	0.84	0.00	0.00	0.04	0.04
	15.750	100.00	100.00	100.09	0	1.07	0.00	0.00	0.04	0.04
	11.000	100.03	100.03	101.62	0.63	17.28	0.00	0.00	0.63	0.63
	11.000	100.03	100.03	101.62	0.63	17.28	0.00	0.00	0.63	0.63
	11.000	99.71	99.71	101.44	0.76	12.80	0.00	0.00	0.76	0.76
AC-001-011-A1	11.000	100.03	100.03	101.62	0.63	17.28	0.00	0.00	0.63	0.63
AC-001-011-B1	11.000	99.71	99.71	101.44	0.76	12.80	0.00	0.00	0.76	0.76
AC-001-415-A1	0.415	101.74	101.75	104.61	1.67	7.60	0.00	0.00	1.67	1.67
AC-001-415-B1	0.415	101.74	101.75	104.61	1.67	7.60	0.00	0.00	1.67	1.67
# * AC-001-415-H.R.Board2	0.415	99.84	100.17	121.22	8.24	188.26	0.00	0.00	8.24	8.24
# * AC-001-415-H.R.Board4	0.415	99.84	100.18	121.23	8.24	188.27	0.00	0.00	8.24	8.24
# * AC-001-415-TP1	0.415	99.84	100.18	121.23	8.24	188.27	0.00	0.00	8.24	8.24
# * AH-002-690- B1	0.690	103.78	104.08	122.60	7.67	148.16	0.00	0.00	7.67	7.67
# * AH-002-690-A1	0.690	100.20	100.38	115.74	6.09	182.70	0.00	0.00	6.09	6.09
# * AH-002-690-B1	0.690	103.78	104.08	122.60	7.67	148.16	0.00	0.00	7.67	7.67
Existing_A0BCA1	11.000	100.19	100.19	101.65	0.58	15.86	0.00	0.00	0.58	0.58
Existing_A0BCA2	11.000	99.79	99.79	101.38	0.70	11.74	0.00	0.00	0.70	0.70
Existing_A1BBA	11.000	100.19	100.19	101.65	0.58	15.86	0.00	0.00	0.58	0.58
Existing_A2BBA	11.000	99.79	99.79	101.38	0.70	11.74	0.00	0.00	0.70	0.70

* 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	876.33	876.49	904.17	1.90	10.78	9447.14	9447.14	0.00	0.00	0.00	1.90	1.90
.	Existing_A1BBA	971.59	971.63	989.86	0.88	13.02	12653.17	12653.17	0.00	0.00	0.00	0.88	0.88
..	AC-001-011-A1	96.60	96.62	101.28	1.93	84.94	8207.10	8207.10	0.00	0.00	0.00	1.93	1.93
..	AC-001-011-A1	96.60	96.62	101.28	1.93	84.94	8207.10	8207.10	0.00	0.00	0.00	1.93	1.93
...	AC-001-011-B1	96.95	96.96	100.58	1.43	64.19	6224.07	6224.07	0.00	0.00	0.00	1.43	1.43
AC-001-011-A1	Existing_A0BCA1	314.31	314.60	344.54	4.25	77.18	24280.74	24280.74	0.00	0.00	0.00	4.25	4.25
	AH-002-690-A1	77.38	78.24	102.27	14.95	240.32	18802.47	18802.47	0.00	0.00	0.00	14.95	14.95
	AC-001-415-A1	44.03	44.07	47.40	4.37	22.59	995.45	995.45	0.00	0.00	0.00	4.37	4.37
	..	96.60	96.62	101.28	1.93	84.94	8207.10	8207.10	0.00	0.00	0.00	1.93	1.93
	..	96.60	96.62	101.28	1.93	84.94	8207.10	8207.10	0.00	0.00	0.00	1.93	1.93
AC-001-011-B1	Existing_A0BCA2	158.98	160.81	202.09	15.20	113.87	18311.81	18311.81	0.00	0.00	0.00	15.20	15.20
	AH-002-690-B1	62.04	66.54	103.05	38.74	227.31	15124.67	15124.67	0.00	0.00	0.00	38.74	38.74
	...	96.95	96.96	100.58	1.43	64.19	6224.07	6224.07	0.00	0.00	0.00	1.43	1.43
AC-001-415-A1	AC-001-011-A1	1118.42	1119.49	1204.23	4.37	22.59	25288.61	25288.61	0.00	0.00	0.00	4.37	4.37
	AC-001-415-B1	439.21	444.24	564.81	15.18	100.78	44768.21	44768.21	0.00	0.00	0.00	15.18	15.18
AC-001-415-B1	AC-001-415-A1	439.21	444.24	564.81	15.18	100.78	44768.21	44768.21	0.00	0.00	0.00	15.18	15.18
AC-001-415-H.R.Board2	AC-001-415-H.R.Board4	3.87	3.88	4.58	7.04	160.24	621.85	621.85	0.00	0.00	0.00	7.04	7.04
AC-001-415-H.R.Board4	AC-001-415-H.R.Board2	3.87	3.88	4.58	7.04	160.24	621.85	621.85	0.00	0.00	0.00	7.04	7.04
	AC-001-415-TP1	7.29	7.29	7.37	0.44	10.05	73.21	73.21	0.00	0.00	0.00	0.44	0.44
AC-001-415-TP1	AH-002-690- B1	109.66	109.82	124.97	5.49	121.65	13359.62	13359.62	0.00	0.00	0.00	5.49	5.49
	AC-001-415-H.R.Board4	7.29	7.29	7.37	0.44	10.05	73.21	73.21	0.00	0.00	0.00	0.44	0.44
AH-002-690- B1	AC-001-415-TP1	64.76	64.86	73.64	5.39	119.41	7744.71	7744.71	0.00	0.00	0.00	5.39	5.39
	AH-002-690-B1	322.88	342.03	525.51	34.95	275.59	94260.38	94260.38	0.00	0.00	0.00	34.95	34.95
AH-002-690-A1	AC-001-011-A1	1219.76	1232.32	1597.37	14.39	231.50	285279.00	285279.00	0.00	0.00	0.00	14.39	14.39
AH-002-690-B1	AC-001-011-B1	941.35	1009.53	1563.47	38.74	227.31	229477.80	229477.80	0.00	0.00	0.00	38.74	38.74
	AH-002-690- B1	322.88	342.03	525.51	34.95	275.59	94260.38	94260.38	0.00	0.00	0.00	34.95	34.95
Existing_A0BCA1	AC-001-011-A1	314.00	314.29	344.42	4.28	78.08	24538.10	24538.10	0.00	0.00	0.00	4.28	4.28
	Existing_A1BBA	1361.74	1361.85	1402.69	1.26	27.74	37775.94	37775.94	0.00	0.00	0.00	1.26	1.26
Existing_A0BCA2	AC-001-011-B1	158.67	160.50	201.95	15.27	115.26	18499.35	18499.35	0.00	0.00	0.00	15.27	15.27
	Existing_A2BBA	1236.20	1236.51	1289.97	2.24	23.18	28664.72	28664.72	0.00	0.00	0.00	2.24	2.24
Existing_A1BBA	.	1361.74	1361.79	1386.55	0.86	12.62	17180.78	17180.78	0.00	0.00	0.00	0.86	0.86
	Existing_A0BCA1	1361.74	1361.85	1402.69	1.26	27.74	37775.94	37775.94	0.00	0.00	0.00	1.26	1.26
Existing_A2BBA	'	1236.20	1236.41	1274.00	1.83	10.38	12828.02	12828.02	0.00	0.00	0.00	1.83	1.83
	Existing_A0BCA2	1236.20	1236.51	1289.97	2.24	23.18	28664.72	28664.72	0.00	0.00	0.00	2.24	2.24

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV3

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Bus ID: ' .

Fund. 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	0.03	7.00	350.00	0.02	11.00	550.00	0.01	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

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	0.00	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	0.01												

Bus ID: ..

Fund. kV: 11.003

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	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

Bus ID: ..

Fund. kV: 11.003

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	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

Bus ID: ...

Fund. kV: 10.968

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	0.28	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: AC-001-011-A1

Fund. kV: 11.003

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	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

Bus ID: AC-001-011-B1

Fund. kV: 10.968

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	0.28	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: AC-001-415-A1

Fund. kV: 0.422

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	1.04	7.00	350.00	1.27	11.00	550.00	0.28	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: BarkaV3

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Bus ID: AC-001-415-A1

Fund. kV: 0.422

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: 0.422

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	1.04	7.00	350.00	1.27	11.00	550.00	0.28	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: 0.414

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	5.75	7.00	350.00	2.75	11.00	550.00	3.28	13.00	650.00	2.40	17.00	850.00	1.69	19.00	950.00	1.13
23.00	1150.00	1.77	25.00	1250.00	1.78	35.00	1750.00	0.47	37.00	1850.00	0.35	47.00	2350.00	0.00	49.00	2450.00	0.04

Bus ID: AC-001-415-H.R.Board4

Fund. kV: 0.414

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	5.75	7.00	350.00	2.75	11.00	550.00	3.28	13.00	650.00	2.40	17.00	850.00	1.69	19.00	950.00	1.13
23.00	1150.00	1.77	25.00	1250.00	1.78	35.00	1750.00	0.47	37.00	1850.00	0.35	47.00	2350.00	0.00	49.00	2450.00	0.04

Bus ID: AC-001-415-TP1

Fund. kV: 0.414

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	5.75	7.00	350.00	2.75	11.00	550.00	3.28	13.00	650.00	2.40	17.00	850.00	1.69	19.00	950.00	1.13
23.00	1150.00	1.77	25.00	1250.00	1.78	35.00	1750.00	0.47	37.00	1850.00	0.35	47.00	2350.00	0.00	49.00	2450.00	0.04

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	5.90	7.00	350.00	2.82	11.00	550.00	2.50	13.00	650.00	1.26	17.00	850.00	1.79	19.00	950.00	1.25
23.00	1150.00	1.54	25.00	1250.00	1.05	35.00	1750.00	0.02	37.00	1850.00	0.01	47.00	2350.00	0.00	49.00	2450.00	0.00

Bus ID: AH-002-690-A1

Fund. kV: 0.691

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	0.41	7.00	350.00	3.49	11.00	550.00	3.12	13.00	650.00	1.51	17.00	850.00	2.28	19.00	950.00	1.57
23.00	1150.00	1.88	25.00	1250.00	1.25												

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	5.90	7.00	350.00	2.82	11.00	550.00	2.50	13.00	650.00	1.26	17.00	850.00	1.79	19.00	950.00	1.25
23.00	1150.00	1.54	25.00	1250.00	1.05	35.00	1750.00	0.02	37.00	1850.00	0.01	47.00	2350.00	0.00	49.00	2450.00	0.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV3

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Bus Tabulation

Harmonic Voltages (% of Fundamental Voltage)

Bus ID: Bus1
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. %
-------	----------	--------	-------	----------	--------	-------	----------	--------	-------	----------	--------	-------	----------	--------	-------	----------	--------

Bus ID: Existing_A0BCA1
Fund. kV: 11.021

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	0.35	11.00	550.00	0.30	13.00	650.00	0.15	17.00	850.00	0.23	19.00	950.00	0.15
23.00	1150.00	0.15	25.00	1250.00	0.08												

Bus ID: Existing_A0BCA2
Fund. kV: 10.977

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	0.55	7.00	350.00	0.26	11.00	550.00	0.23	13.00	650.00	0.11	17.00	850.00	0.15	19.00	950.00	0.10
23.00	1150.00	0.11	25.00	1250.00	0.07	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: 11.021

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	0.35	11.00	550.00	0.30	13.00	650.00	0.15	17.00	850.00	0.23	19.00	950.00	0.15
23.00	1150.00	0.15	25.00	1250.00	0.08												

Bus ID: Existing_A2BBA
Fund. kV: 10.977

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	0.55	7.00	350.00	0.26	11.00	550.00	0.23	13.00	650.00	0.11	17.00	850.00	0.15	19.00	950.00	0.10
23.00	1150.00	0.11	25.00	1250.00	0.07	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: BarkaV3

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Study Case: HA

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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	0.03	7.00	350.00	0.02	11.00	550.00	0.01	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	0.00	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	0.01												

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	0.06	7.00	350.00	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

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	0.06	7.00	350.00	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

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	0.60	7.00	350.00	0.28	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: 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	0.06	7.00	350.00	0.38	11.00	550.00	0.33	13.00	650.00	0.16	17.00	850.00	0.25	19.00	950.00	0.16
23.00	1150.00	0.16	25.00	1250.00	0.09												

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	0.60	7.00	350.00	0.28	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: BarkaV3

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Study Case: HA

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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	6.12	7.00	350.00	2.92	11.00	550.00	2.60	13.00	650.00	1.30	17.00	850.00	1.86	19.00	950.00	1.30
23.00	1150.00	1.60	25.00	1250.00	1.09	35.00	1750.00	0.02	37.00	1850.00	0.01	47.00	2350.00	0.00	49.00	2450.00	0.00

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	0.06	7.00	350.00	0.35	11.00	550.00	0.30	13.00	650.00	0.15	17.00	850.00	0.23	19.00	950.00	0.15
23.00	1150.00	0.15	25.00	1250.00	0.08												

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	0.06	7.00	350.00	0.35	11.00	550.00	0.30	13.00	650.00	0.15	17.00	850.00	0.23	19.00	950.00	0.15
23.00	1150.00	0.15	25.00	1250.00	0.08												

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	0.55	7.00	350.00	0.26	11.00	550.00	0.23	13.00	650.00	0.11	17.00	850.00	0.15	19.00	950.00	0.10
23.00	1150.00	0.11	25.00	1250.00	0.07	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	0.06	7.00	350.00	0.35	11.00	550.00	0.30	13.00	650.00	0.15	17.00	850.00	0.23	19.00	950.00	0.15
23.00	1150.00	0.15	25.00	1250.00	0.08												

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	0.55	7.00	350.00	0.26	11.00	550.00	0.23	13.00	650.00	0.11	17.00	850.00	0.15	19.00	950.00	0.10
23.00	1150.00	0.11	25.00	1250.00	0.07	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: BarkaV3

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Study Case: HA

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Filter Overloading

Filter			Capacitor C1			Inductor L1			Capacitor C2			Inductor L2		
ID	Type	Connection	Max. kV	Opr. kV	% OverVolt	Max. Amp	Opr. Amp	% Overload	Max. kV	Opr. kV	% OverVolt	Max. Amp	Opr. Amp	% Overload
HF3	3	Wye	0.000	0.426	N/A	0.00	5.48	N/A						
HF2	3	Wye	0.000	1.786	N/A	0.00	517.86	N/A						

Filter Types: 0 = By-Pass, 1 = High-Pass (Damped), 2 = High-Pass (Undamped), 3 = Single Tuned, 4 = 3rd Order Damped, 5 = 3rd Order C-Type

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV3

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VIHD (Individual Harmonic Distortion) Report

Bus	Voltage Distortion			
	ID	kV	Fund. %	VIHD %
AC-001-415-H.R.Board2	0.415	99.84	5.75	5.00
AC-001-415-H.R.Board4	0.415	99.84	5.75	5.00
AC-001-415-TP1	0.415	99.84	5.75	5.00
AH-002-690- B1	0.690	103.78	5.90	5.00
AH-002-690-B1	0.690	103.78	5.90	5.00
AC-001-415-H.R.Board2	0.415	99.84	2.75	7.00
AC-001-415-H.R.Board4	0.415	99.84	2.75	7.00
AC-001-415-TP1	0.415	99.84	2.75	7.00
AH-002-690- B1	0.690	103.78	2.82	7.00
AH-002-690-A1	0.690	100.20	3.49	7.00
AH-002-690-B1	0.690	103.78	2.82	7.00
AC-001-415-H.R.Board2	0.415	99.84	3.28	11.00
AC-001-415-H.R.Board4	0.415	99.84	3.28	11.00
AC-001-415-TP1	0.415	99.84	3.28	11.00
AH-002-690- B1	0.690	103.78	2.50	11.00
AH-002-690-A1	0.690	100.20	3.12	11.00
AH-002-690-B1	0.690	103.78	2.50	11.00
AC-001-415-H.R.Board2	0.415	99.84	2.40	13.00
AC-001-415-H.R.Board4	0.415	99.84	2.40	13.00
AC-001-415-TP1	0.415	99.84	2.40	13.00
AH-002-690-A1	0.690	100.20	1.51	13.00
AC-001-415-H.R.Board2	0.415	99.84	1.69	17.00
AC-001-415-H.R.Board4	0.415	99.84	1.69	17.00
AC-001-415-TP1	0.415	99.84	1.69	17.00
AH-002-690- B1	0.690	103.78	1.79	17.00
AH-002-690-A1	0.690	100.20	2.28	17.00
AH-002-690-B1	0.690	103.78	1.79	17.00
AH-002-690-A1	0.690	100.20	1.57	19.00
AC-001-415-H.R.Board2	0.415	99.84	1.77	23.00
AC-001-415-H.R.Board4	0.415	99.84	1.77	23.00
AC-001-415-TP1	0.415	99.84	1.77	23.00
AH-002-690- B1	0.690	103.78	1.54	23.00
AH-002-690-A1	0.690	100.20	1.88	23.00
AH-002-690-B1	0.690	103.78	1.54	23.00
AC-001-415-H.R.Board2	0.415	99.84	1.78	25.00
AC-001-415-H.R.Board4	0.415	99.84	1.78	25.00
AC-001-415-TP1	0.415	99.84	1.78	25.00

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

Project: Barka I
Location: Barka (Sultanate fo Oman)
Contract:
Engineer: MAGC
Filename: BarkaV3

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VTHD (Total Harmonic Distortion) Report

Bus		Voltage Distortion	
ID	kV	Fund. %	VTHD %
AC-001-415-H.R.Board2	0.415	99.84	8.24
AC-001-415-H.R.Board4	0.415	99.84	8.24
AC-001-415-TP1	0.415	99.84	8.24
AH-002-690- B1	0.690	103.78	7.67
AH-002-690-A1	0.690	100.20	6.09
AH-002-690-B1	0.690	103.78	7.67

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

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV3

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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-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	5.75	383.6	5.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	2.75	183.3	7.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	3.28	218.4	11.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	2.40	160.0	13.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	1.69	112.6	17.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	1.77	118.0	23.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	1.50	Bus IHD	1.78	118.7	25.00
AC-001-415-H.R.Board2	Bus	Exceeds Limit	2.50	Bus THD	8.24	329.7	Total
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	5.75	383.6	5.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	2.75	183.3	7.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	3.28	218.4	11.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	2.40	160.0	13.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	1.69	112.6	17.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	1.77	118.0	23.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	1.50	Bus IHD	1.78	118.7	25.00
AC-001-415-H.R.Board4	Bus	Exceeds Limit	2.50	Bus THD	8.24	329.7	Total
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	5.75	383.6	5.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	2.75	183.3	7.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	3.28	218.4	11.00

Project: Barka I
 Location: Barka (Sultanate fo Oman)
 Contract:
 Engineer: MAGC
 Filename: BarkaV3

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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-TP1	Bus	Exceeds Limit	1.50	Bus IHD	2.40	160.0	13.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	1.69	112.6	17.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	1.77	118.0	23.00
AC-001-415-TP1	Bus	Exceeds Limit	1.50	Bus IHD	1.78	118.7	25.00
AC-001-415-TP1	Bus	Exceeds Limit	2.50	Bus THD	8.24	329.7	Total
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	5.90	393.1	5.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	2.82	187.8	7.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	2.50	166.8	11.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	1.79	119.7	17.00
AH-002-690- B1	Bus	Exceeds Limit	1.50	Bus IHD	1.54	102.5	23.00
AH-002-690- B1	Bus	Exceeds Limit	2.50	Bus THD	7.67	306.7	Total
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	3.49	232.8	7.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	3.12	208.2	11.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.51	100.5	13.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	2.28	151.8	17.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.57	104.7	19.00
AH-002-690-A1	Bus	Exceeds Limit	1.50	Bus IHD	1.88	125.5	23.00
AH-002-690-A1	Bus	Exceeds Limit	2.50	Bus THD	6.09	243.8	Total
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	5.90	393.1	5.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	2.82	187.8	7.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	2.50	166.8	11.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	1.79	119.7	17.00
AH-002-690-B1	Bus	Exceeds Limit	1.50	Bus IHD	1.54	102.5	23.00
AH-002-690-B1	Bus	Exceeds Limit	2.50	Bus THD	7.67	306.7	Total
HF2	Filter	Over Voltage	0.00	kV	1.79	999.0	Capacitor1 Vmax
HF2	Filter	Overcurrent	0.00	Amp	517.86	999.0	Inductor1 Amp
HF3	Filter	Over Voltage	0.00	kV	0.43	999.0	Capacitor1 Vmax
HF3	Filter	Overcurrent	0.00	Amp	5.48	999.0	Inductor1 Amp