Electrical Network Analysis

Data Center Client Id: 003191
****
****

AUGUST 5, 2016

CONFIDENTIAL AND PROPRIETARY

EXCLUSIVELY PREPARED FOR [Redacted]

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Report Created by 3DFS, LLC

August – 2016

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COMPANY INFORMATION

3DFS Software-Defined Power

3DFS Software-Defined Power ("3DFS") is a North Carolina Limited Liability Company headquartered in a 10,000 square foot multi-use office and manufacturing campus located in Pittsboro, North Carolina, a half an hour's drive to the Research Triangle Park. The main interconnected building contains offices dedicated to energy technology research and development, business development, and a sustainable contract high-tech printed circuit board and electronic systems assembly services business. This complex is the hub of an organization that leverages international resources for guidance and expertise in solving some of the world's most challenging energy problems.

The company has developed a new category of energy technology with new technological capabilities centering on sub-cycle measurement and correction of electricity. It is a sophisticated instrument that intertwines ultra-rapid computing with innovative material science and power electronics to optimize and balance electrical energy flow in real time in any electrical environment. It ensures that electricity is distributed with perfect stability and consumed with ideal efficiency.

3DFS is currently working with different companies to embed Software-Defined Power into products to give technological advantages and to install it into electrical networks and grids to protect and monitor the assets. We provide full turnkey design through manufacturing for any embedded technology or customized solution for use in mission-critical facilities.

FORWARD & SITE DESCRIPTION

Forward

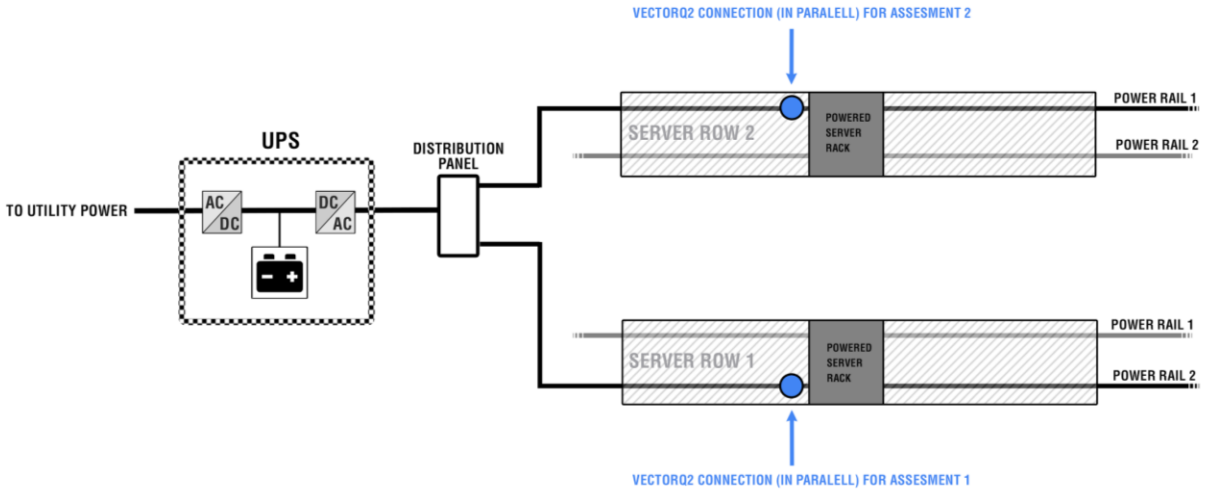
The purpose of the [REDACTED] Site Assessment is to demonstrate the instant improvement to the electrical network in a data center environment with the implementation of dynamic electrical correction using 3DFS Software-Defined Power. Sustained and reliable improvements translate into CAPEX and OPEX savings, increased electrical network stability, and optimum electrical efficiency. In addition, installing Software-Defined Power will significantly reduce the carbon footprint related to electrical efficiency.

Background and Site Description

[Redacted]

INSTRUMENTATION & INSTALLATION

The instrumentation for the two assessments utilized the VectorQ2a power controller connected in parallel as depicted below. For each assessment, the installation was correcting the electricity for one entire server rack. For this report, both of the server racks are represented independently in order to demonstrate the simplicity of installation and the reliability of the improvements.



Each installation was completed in about 20 minutes without disrupting the power to the server racks. The VectorQ2a displayed the live data results on the 3DFS dashboard on a connected computer screen for immediate results and monitoring of the operation.

[IMAGE REDACTED]

[IMAGE REDACTED]

SERVER RACK CONTENTS

Each Server Rack contained varied… [REDACTED]. The Setups are pictured below.

[IMAGE REDACTED]

[IMAGE REDACTED]

3DFS DASHBOARD

This is the dashboard used to track results and monitor live electrical data acquired during VectorQ2a demonstrations.

On the top left is the three phase Voltage and Current graphs with the white line as Phase 1, blue line as Phase 2, and orange line as Phase 3. These three colors and corresponding phases are the same throughout the entire interface.

At the bottom left is the Current harmonics bar graph for each phase. It shows the first 11 harmonics in logarithmic scale. The yellow bar depicts the average of the three phases.

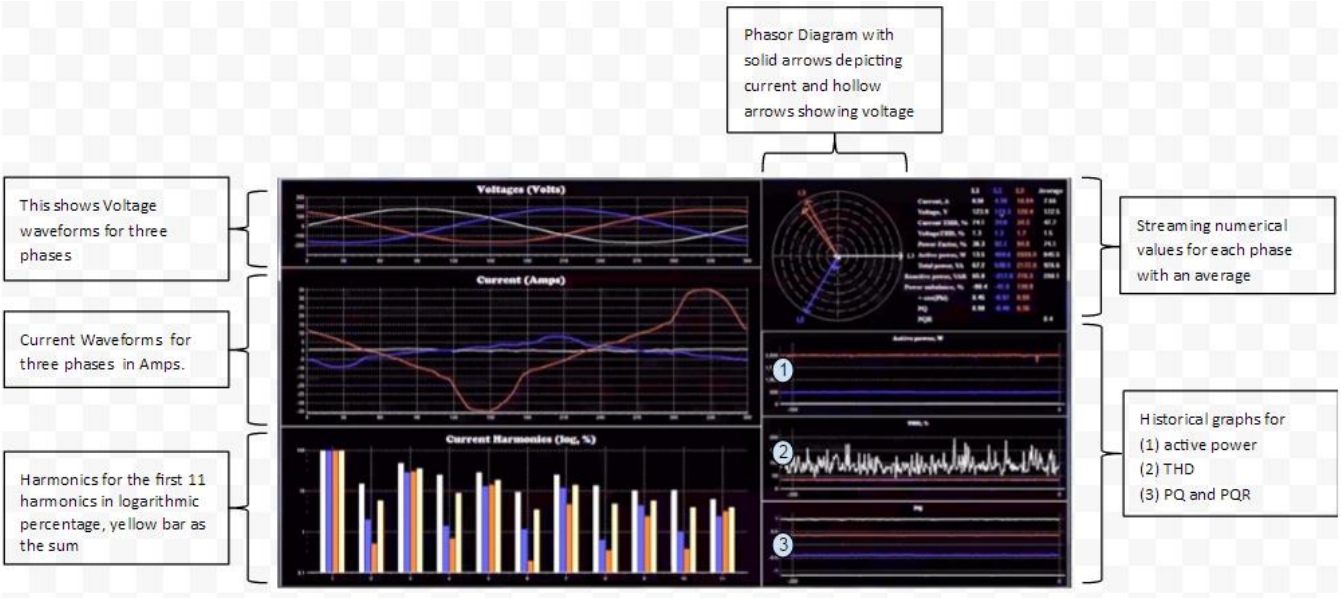
On the top right is a phasor diagram depicting real time Voltage and Current measurement for each phase.

To the Right is a table that shows streaming numerical data for each phase with an average.

The table contains the traditional power quality values in addition to PQ which is Power Quality and is calculated by dividing reactive power by total power.

Also, PQR or Power Quality Rating which is calculated as a percentage combining efficiencies related to power factor, total harmonic distortion, and phase load balance.

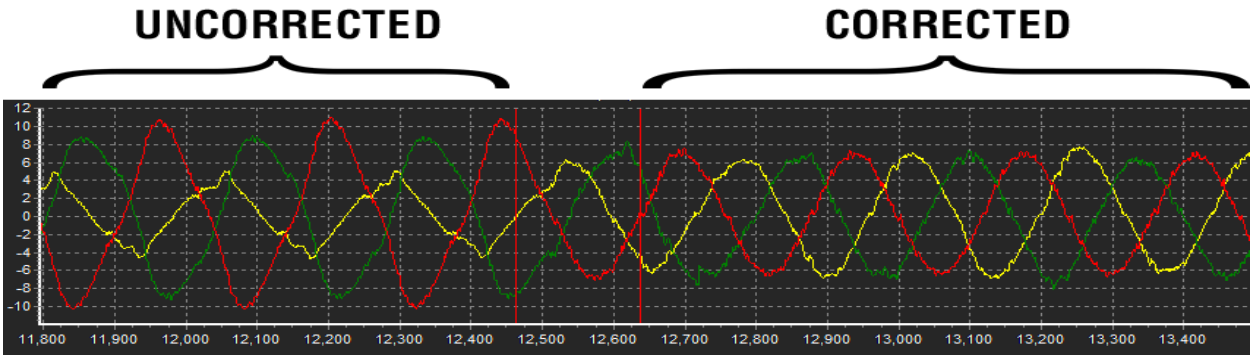
At the bottom right are charts that track each phase over time. The first chart tracks power in Watts. The second chart is percentage of Current THD, and the third chart shows Power Quality by phase with PQR as the Green Line.



FIELD MEASUREMENTS AND RESULTS

The field measurements were acquired with the VectorQ2*a* Power Controller. The digital data acquisition methodology provides sub-cycle power quality data in real time for the Voltage and Current on each phase and also performs correction on the waveforms bringing the entire electrical energy flow into ideal balance.

During both of the Assessments, upon installation, a series of real time tests were performed by the VectorQ2a in order for the system to understand the elasticity of the electrical network and how correction would affect the network. All live data for this assessment was recorded while the system engaged in a series of cycling the correction on and off. The results of that assessment, when the correction was turned on and when it was off is presented in the graphs and charts included in this report.



The charts and graphs in this report reflect the exact data acquired during each assessment and the improvement in the power quality is a direct effect of the Software-Defined Power Correction.

POWER QUALITY RATING

Power Quality Rating (PQR) is a metric which represents the overall efficiency of the electrical network from the point of installation afterward. The number is a multiplicative parameter that combines the 3 most common and harmful disturbances that reduce electrical network efficiency by individually degrading the power quality which leads to higher costs, more frequent power disturbances, and an increase the wear and tear to the assets.

$$PQR = \frac{\cos \varphi}{\sqrt{1 + (THD_{LOAD})^2} \times \sqrt{1 + (THD_V)^2}}$$

The PQR calculated on each phase and then averaged together for a single number percentage that quickly indicates the efficiency of the electrical energy flow from the point of installation afterward.

The PQR integrates power factor, Total Harmonic Distortion, and phase imbalance to get the final number which means the PQR can only achieve a 100% if there is unity power factor, ideal harmonics and perfectly balanced phases. For example, if an electrical network has near unity power factor with high harmonics and decent phase balancing the PQR would not be able to achieve 100%. The PQR is a dynamic metric that changes in response to the real time electrical network demand.

3DFS Software-Defined Power
Analysis of Existing Electrical Power

[REDACTED]

August 5, 2016

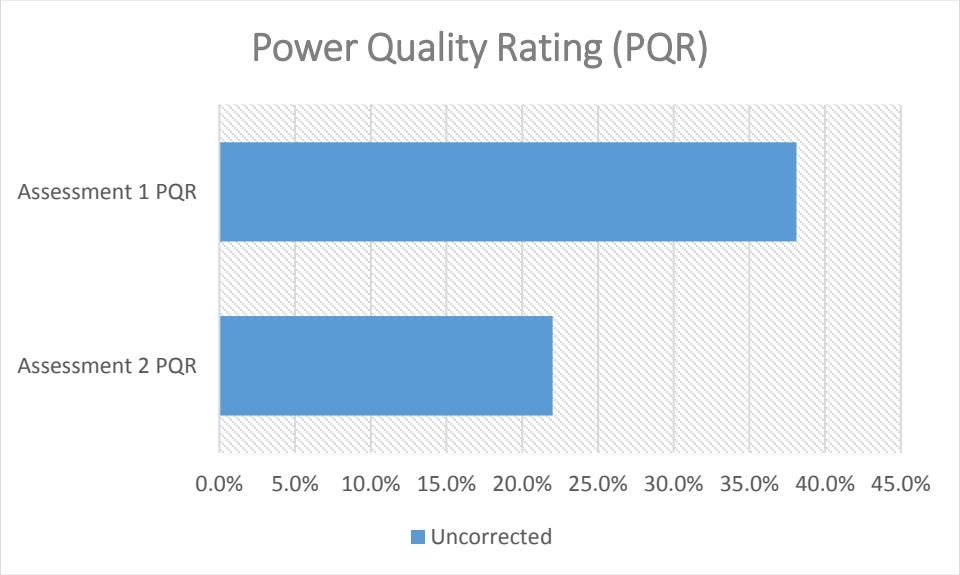
EXISTING POWER QUALITY RATING

The Power Quality Rating (PQR) is a real time metric that represents the efficiency of the electrical network after the point of installation. The existing PQR is determined without the correction turned on as a baseline. The VectorQ2a operates in parallel to the network, so the PQR is not affected by the VectorQ2a installation as would be the same as if the VectorQ2a were not installed.

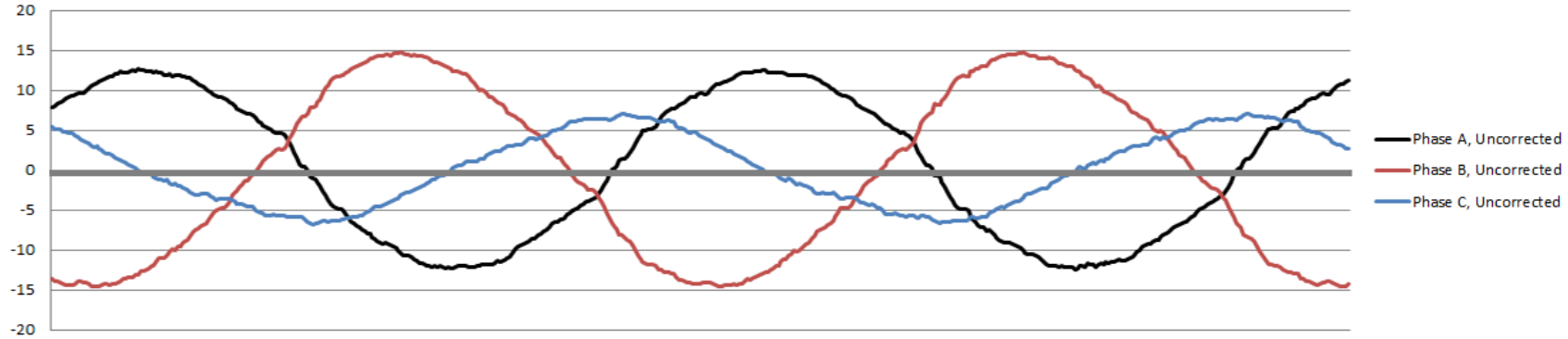
For each of these assessments, the PQR listed is for the entire server rack being assessed.

The existing PQR for the server rack in Assessment 1: **38.1%.**

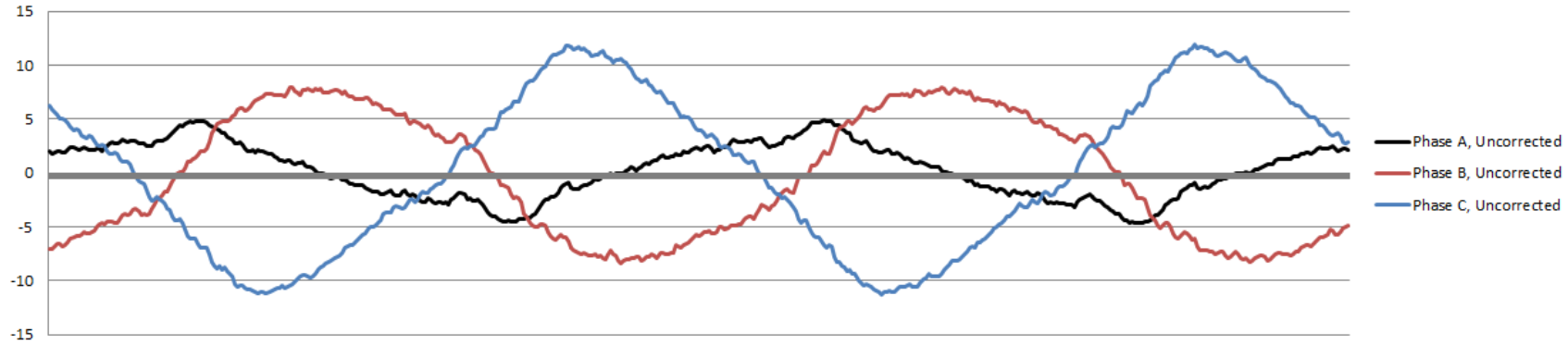
The existing PQR for the server rack in Assessment 2: **22.0%**



Assessment 1 : Current Curves



Assessment 2 : Current Curves

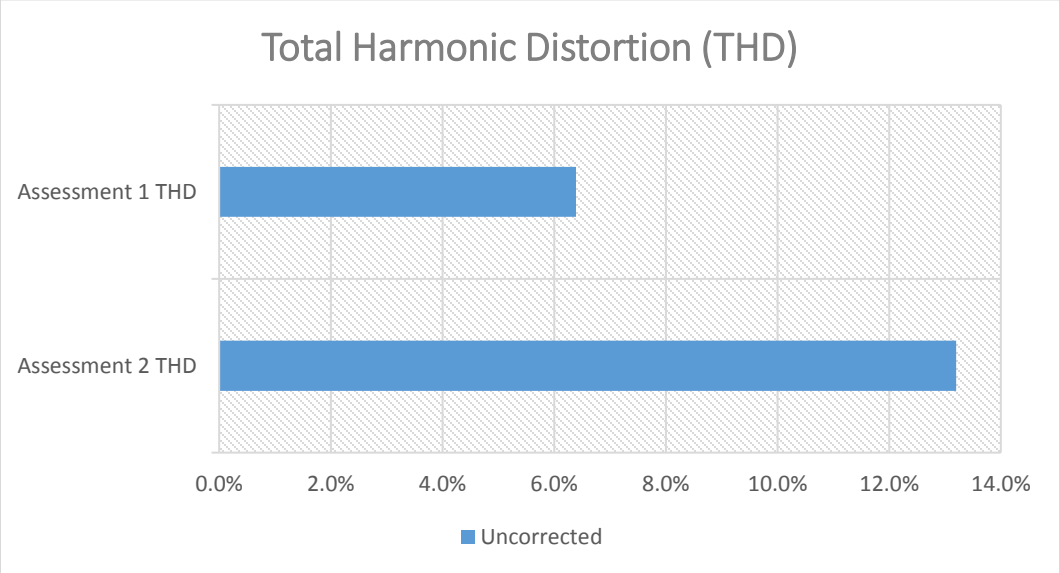


EXISTING TOTAL HARMONIC DISTORTION

The Total Harmonic Distortion graph (THD) below shows the average THD that is in the server rack during the time of the assessment.

The average THD% in the server rack during Assessment 1: **6.4%**

The average THD% in the server rack during Assessment 2: **13.2%**

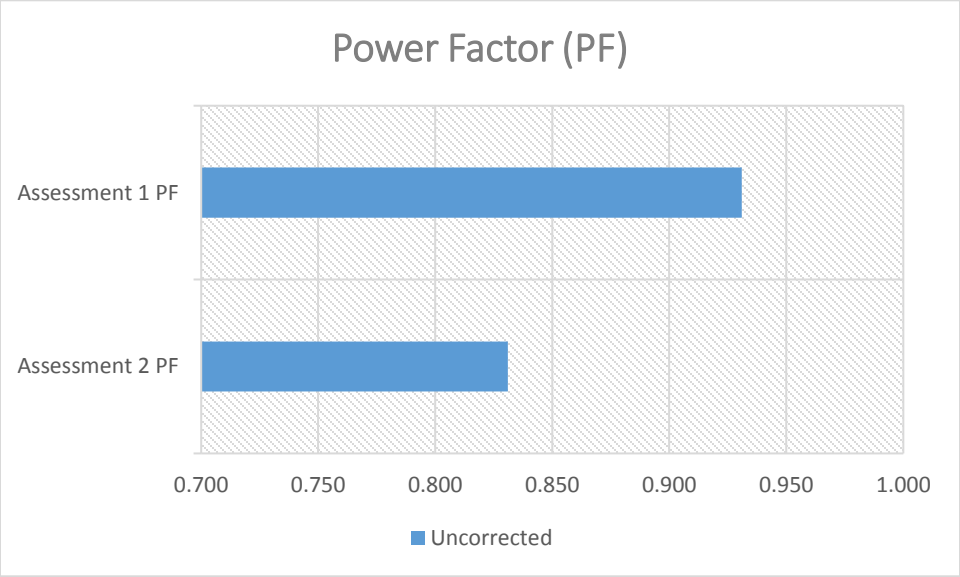


EXISTING POWER FACTOR

The power factor (PF) graph below shows the average PF that is in the server rack during the time of the assessment.

The average PF in the server rack during Assessment 1: **0.931**

The average PF in the server rack during Assessment 2: **0.831**



EXISTING PHASE BALANCE

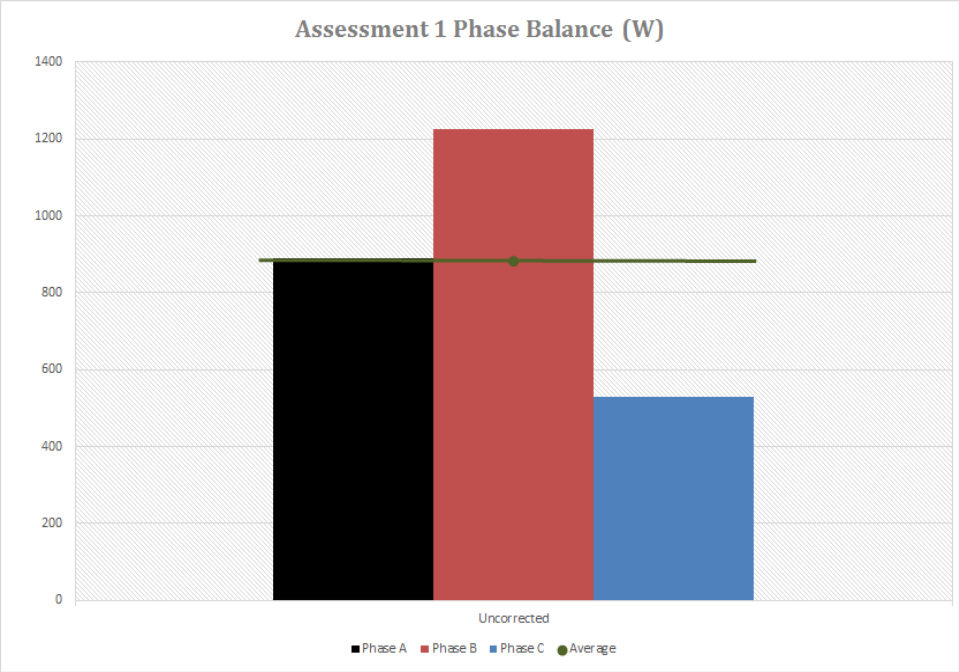
The graph below shows the power consumption in Watts on each incoming phase of the data rack. The green line through the individual phases represents the ideal average for the three phases where the power is drawn equally on the three phases.

Phase Balance in Server Rack on Assessment 1:

Phase A on average is **-1.00%** out of balance from ideal.

Phase B on average is **-39.06%** out of balance from ideal.

Phase C on average is **40.06%** out of balance from ideal.



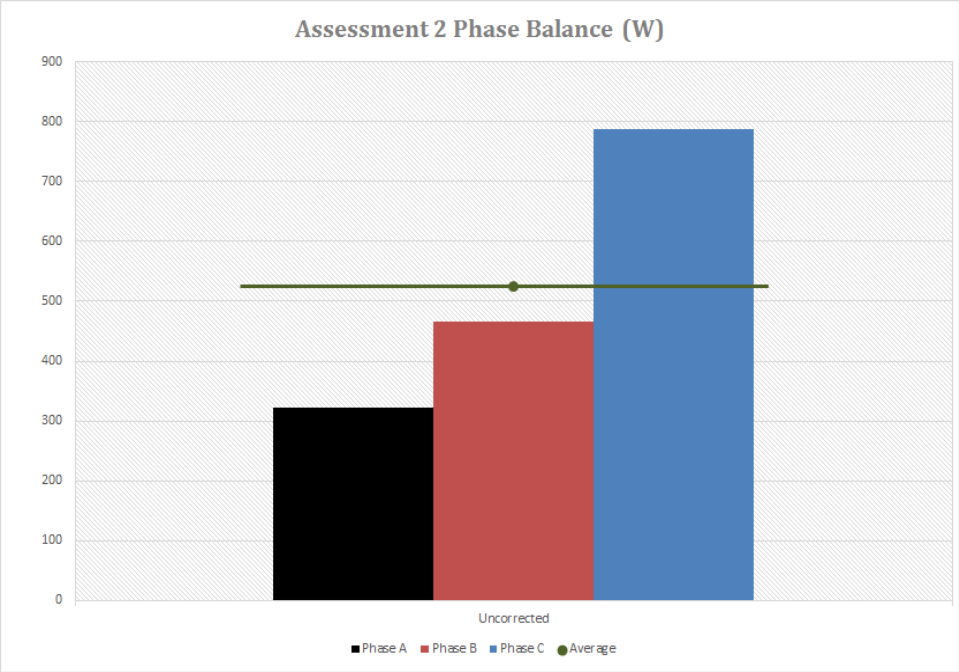
	Power Consumption, W	% Imbalance vs. Ideal
Phase A	889.3	-1.00%
Phase B	1224.4	-39.06%
Phase C	527.8	40.06%
Average	880.5	

Phase Balance in Server Rack on Assessment 2:

Phase A on average is **38.65%** out of balance from ideal.

Phase B on average is **11.20%** out of balance from ideal.

Phase C on average is **-49.85%** out of balance from ideal.



	Power Consumption, W	% Imbalance vs. Ideal
Phase A	**322.5**	**38.65%**
Phase B	**466.8**	**11.20%**
Phase C	**787.7**	**-49.85%**
Average	**525.7**	

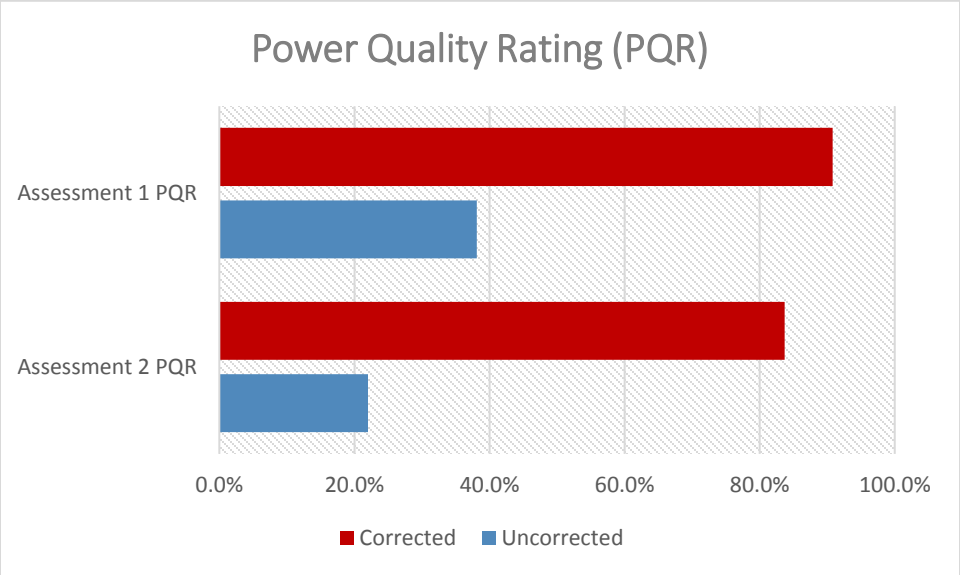
3DFS Software-Defined Power Analysis of Correction Results

[REDACTED]

August 5, 2016

CORRECTED POWER QUALITY RATING

With the VectorQ2a performing correction, the PQR for each of the assessments improved substantially. The improvement represents improved electrical efficiency for the server rack, or in other words more work with less power and less conversion to heat or vibrations.



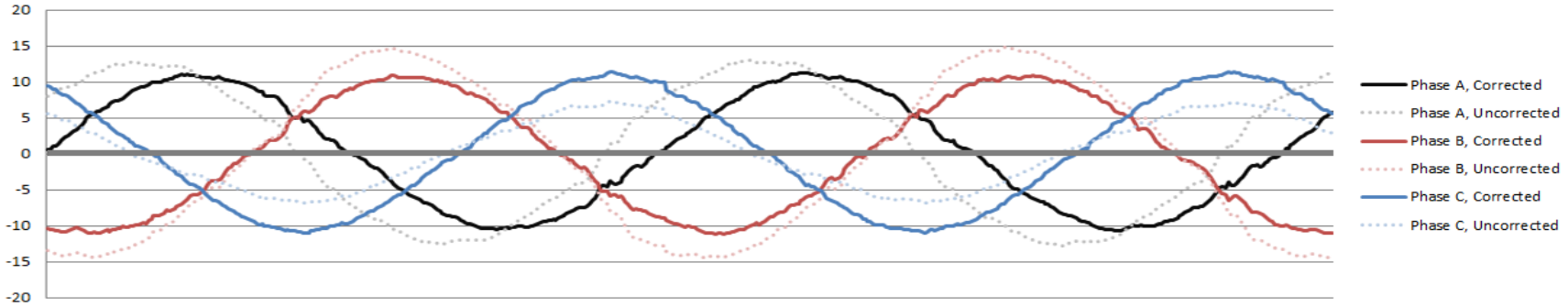
The PQR for server rack in Assessment 1 improved by **238%** when Correction was turned on.

	Uncorrected	With 3DFS Correction
Power Quality Rating Of Server Rack 1	**38.1%**	**90.8%**

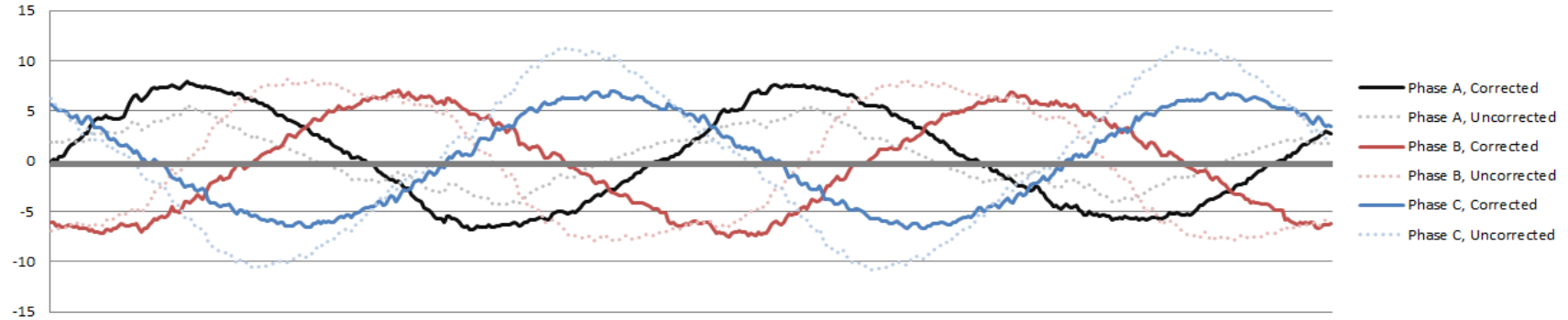
The PQR for server rack in Assessment 2 improved by **380%** when Correction was turned on.

	Uncorrected	With 3DFS Correction
Power Quality Rating Of Server Rack 2	**22.0%**	**83.7%**

Assessment 1 : Current Curves

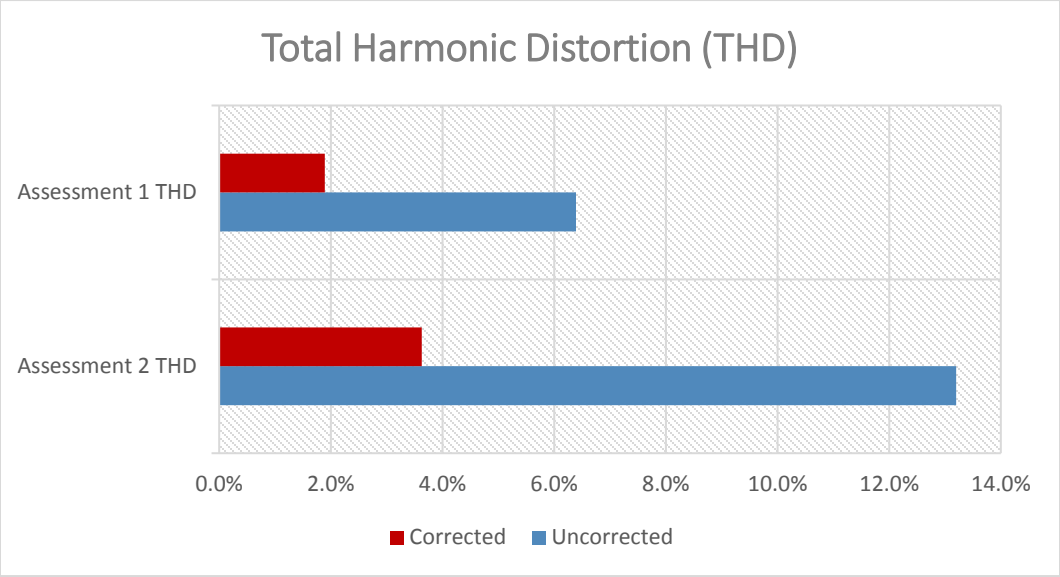


Assessment 2 : Current Curves



CORRECTED THD

With the VectorQ2a performing Correction, the average THD for each of the assessments was significantly reduced contributing significantly to the improvement in the PQR.



For each of these assessments, the THD reduction is for the entire server rack.

The THD in server rack in Assessment 1 was reduced by **338%** when correction was turned on.

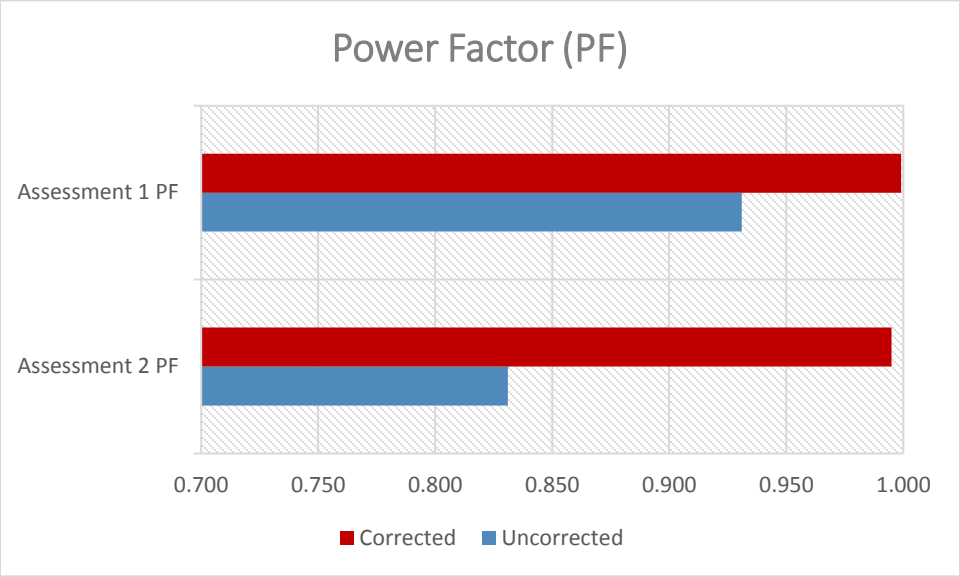
	Uncorrected	With 3DFS Correction
Average Total Harmonic Distortion in Server Rack 1	**6.4%**	**1.9%**

The THD in server rack in Assessment 2 was reduced by **364%** when correction was turned on.

	Uncorrected	With 3DFS Correction
Average Total Harmonic Distortion in Server Rack 2	**13.2%**	**3.6%**

CORRECTED POWER FACTOR

With the VectorQ2a performing Correction, the average power factor for each of the assessments was significantly reduced contributing significantly to the improvement in the PQR.



For each of these assessments, the PF improvement is for the entire server rack.

The PF in server rack in Assessment 1 was improved by **7%** when correction was turned on.

	Uncorrected	With 3DFS Correction
Average Power Factor in Server Rack 1	**0.931**	**0.999**

The PF in server rack in Assessment 2 was improved by **20%** when correction was turned on.

	Uncorrected	With 3DFS Correction
Average Power Factor in Server Rack 2	**0.831**	**0.995**

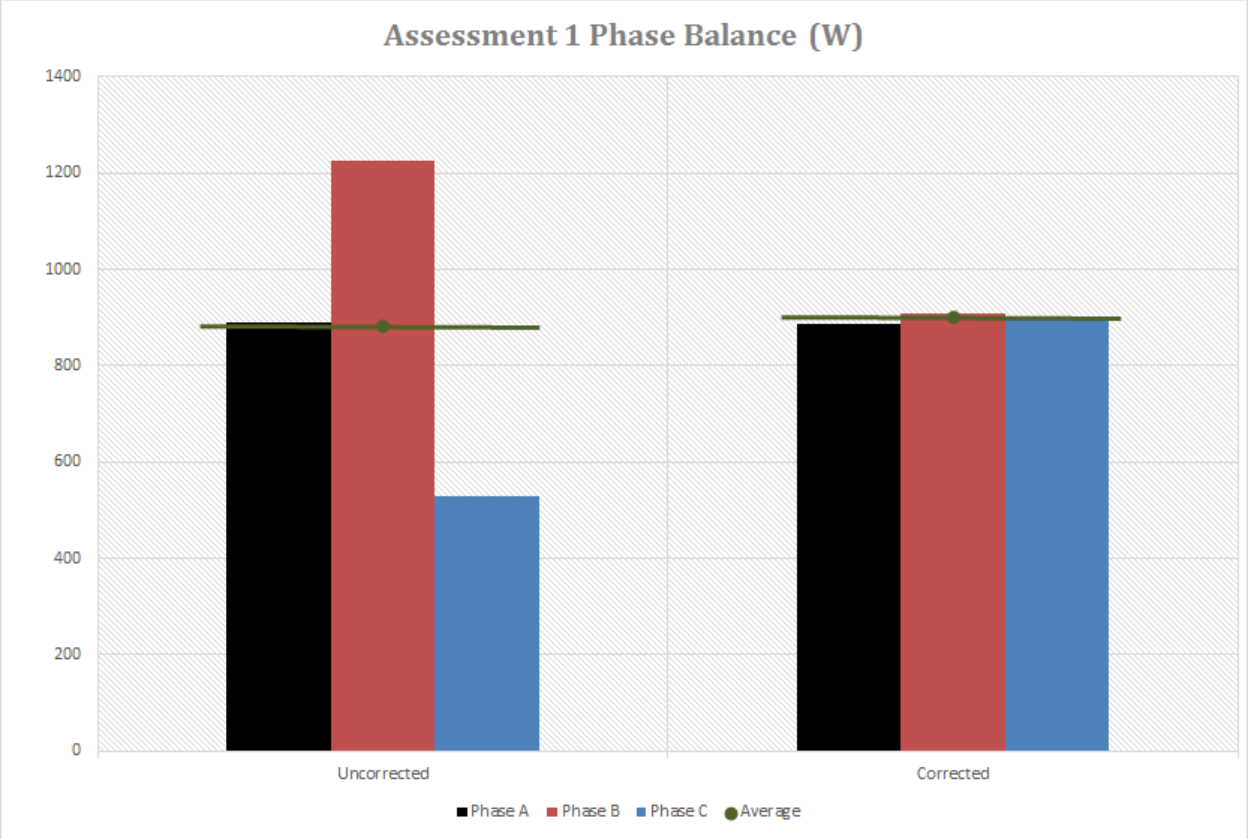
CORRECTED PHASE BALANCE

Phase Balance in Server Rack with Correction on Assessment 1:

Phase A on average is **1.35%** out of balance from ideal.

Phase B on average is **-0.93%** out of balance from ideal.

Phase C on average is **-0.42%** out of balance from ideal.



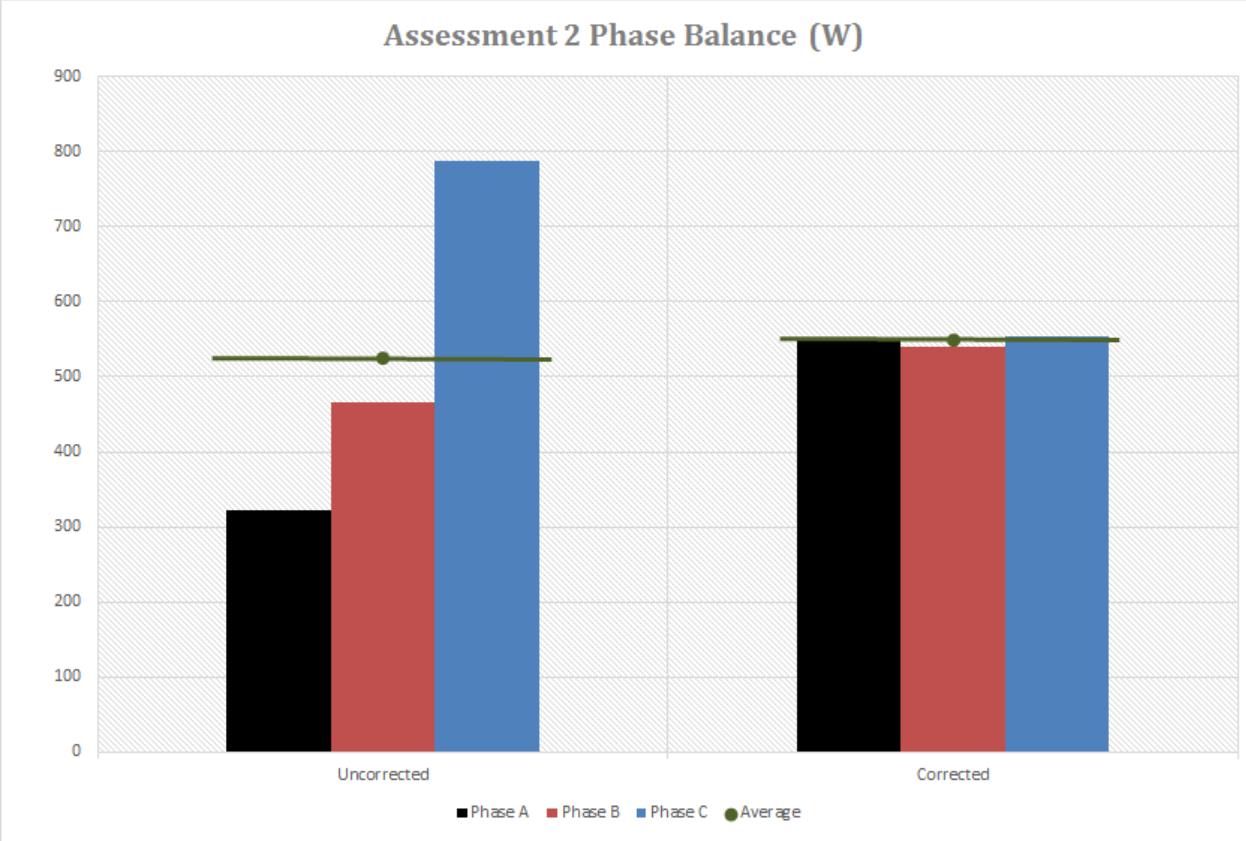
	Without 3DFS Correction		With 3DFS Correction	
	Power Consumption, W	% Imbalance vs. Ideal	Power Consumption, W	% Imbalance vs. Ideal
Phase A	889.3	-1.00%	887.3	1.35%
Phase B	1224.4	-39.06%	907.9	-0.93%
Phase C	527.8	40.06%	903.2	-0.42%
Average	880.5		899.5	

Phase Balance in Server Rack with Correction on Assessment 2:

Phase A on average is **-0.64%** out of balance from ideal.

Phase B on average is **1.52%** out of balance from ideal.

Phase C on average is **-0.88%** out of balance from ideal.



	Without 3DFS Correction		With 3DFS Correction	
	Power Consumption, W	% Imbalance vs. Ideal	Power Consumption, W	% Imbalance vs. Ideal
Phase A	322.5	38.65%	552.5	-0.64%
Phase B	466.8	11.20%	540.6	1.52%
Phase C	787.7	-49.85%	553.7	-0.88%
Average	525.7		548.9	

CONCLUSION

The [REDACTED] site in [REDACTED] is easily among the top tier data centers for engineering and management. The power network and the IT assets are designed to maximize efficiencies and the environment was pristine. **The assessment for each server rack demonstrates that even in an electrical environment that has been designed with the utmost care and consideration, the electricity being distributed and consumed throughout the power network still needs to be dynamically corrected for optimal electrical efficiency, maximum network stability, and ideal power quality.**

The assessments were performed over a short amount of time in order to demonstrate the dynamic improvement in the electrical network quality of service. The installation of 3DFS Software-Defined Power will provide [REDACTED] with the instant benefits discussed in this report and over the long term the sustained benefits will be noticed that will reduce the long term costs and increase the flexibility of the data center.

Long Term Expected Benefits upon Installation

The Multiphase inverters in UPS devices within the data center will be fully and dynamically balanced. This balance will increase the capacity of the UPS by fully utilizing all phases at all times which increases the overall run time of the UPSs as well. With optimum phase utilization, the UPS will also operate at a lower temperature.

The THD throughout the network will be dynamically corrected preventing electrical energy from converting to thermal energy in the wires and components. Preventing this conversion to heat reduces the environmental temperature within the data center which also reduces the quantity and length of time of the HVAC cycles.

To the extent that any Ground Current is present, it will be dynamically reduced to near zero. This will enhance the transmission rate of the routers by reducing the error rate in the package transfers of the routers.

There is a tremendous amount of stress on the power network when transitioning from power sources (i.e. grid power to batteries to generators) with one major influencing factor being the internal impedance of the network during each of these transition stages. That impedance mismatch causes power supplies to heat up while off grid power and leaves them vulnerable to failure upon the transition back to grid power. With Software-Defined Power, the internal impedance of the network is dynamically matched to the power source which maintains the optimum electrical energy flow during the transition.

[Attachment]

Overview

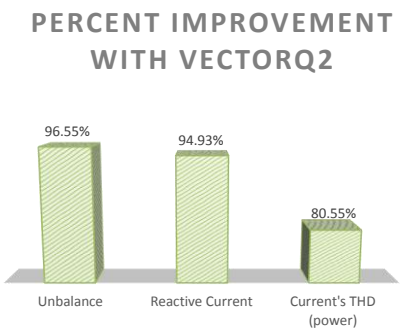
VectorQ2 ID: AGR7564893

3DFS, LLC.
1911 NC Hwy 902 West
Pittsboro, NC 27312

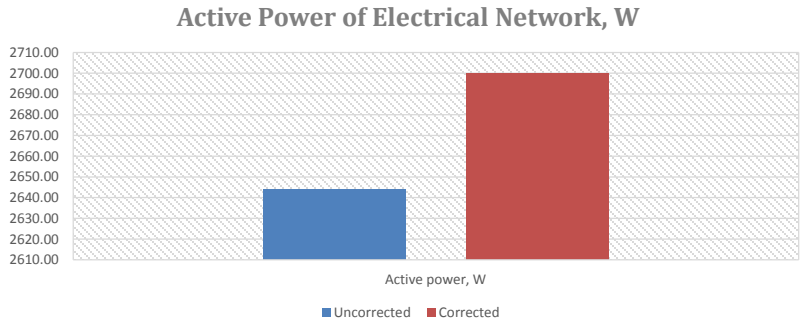
Testing Performed at:
[REDACTED]
[REDACTED]
on 8/5/2016 Assessment 1 of 2

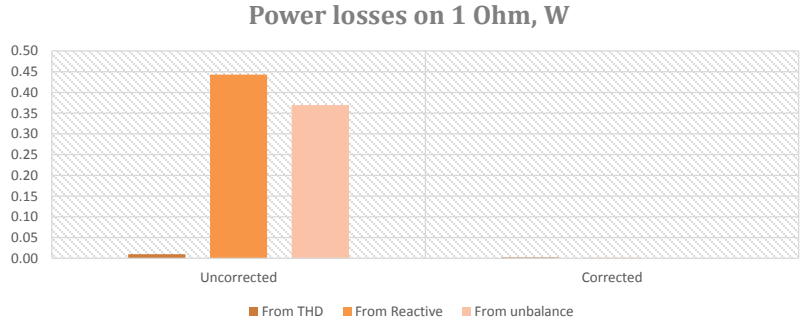
Number of Phases: 3
Median V. per Phase: 119.52

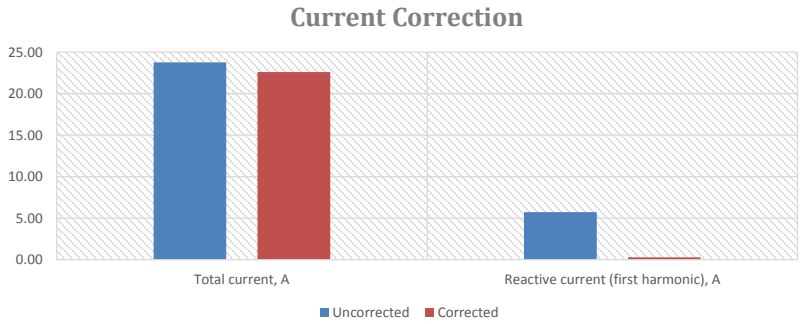
		Uncorrected	*Corrected*
Current Correction	**Total current, A**	23.78	22.60
	Reactive current (first harmonic), A	5.72	0.29
	Relative THD, %	6.39	1.89
Power losses on 0.01 Ohm, W	**From THD**	0.01	0.00
	From Reactive	0.44	0.00
	From unbalance	0.37	0.00
VQ2 Connection	**Apparent power, VA**	2839.6	2701.4
	Power Factor	0.931	0.999
	PF for phase with most distorted current	0.823	0.999
	Average RMS Voltage, V	119.53	119.52
Electrical Network	**Active power, W**	2643.98	2700.15

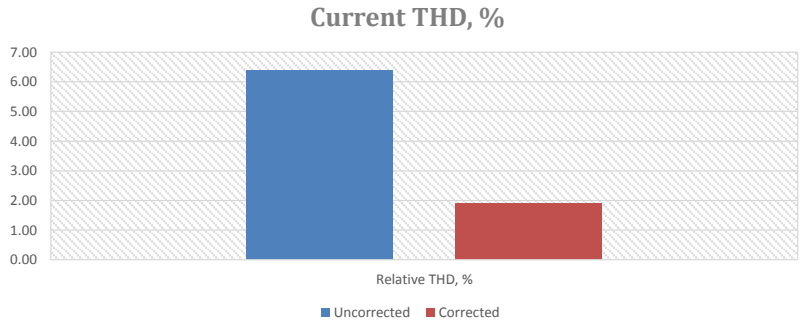


Cable resistance, Ohm	**0.01**
Saved power on 1.00 Ohm, W	**0.76367**
VQ2 Consumption, W	**38.72**
VQ2 Efficiency	**96.86%**









Overview

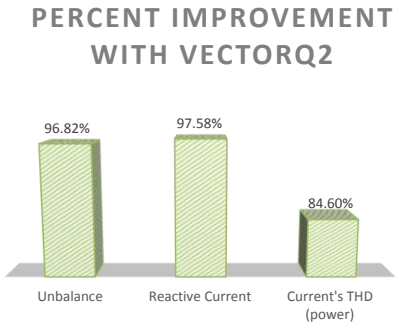
VectorQ2 ID: AGR7564893

3DFS, LLC.
1911 NC Hwy 902 West
Pittsboro, NC 27312

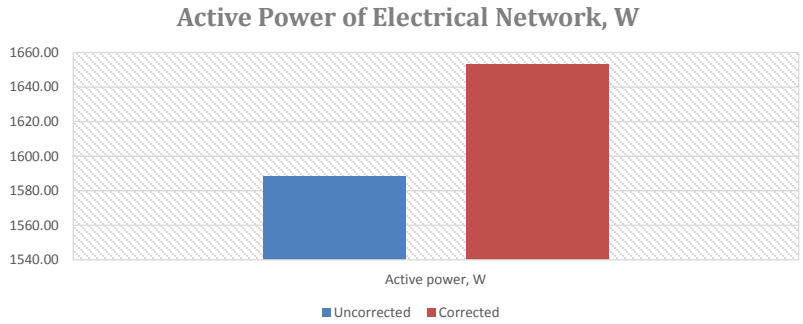
Testing Performed at:
[REDACTED]
[REDACTED]
on 8/5/2016 Assessment 2 of 2

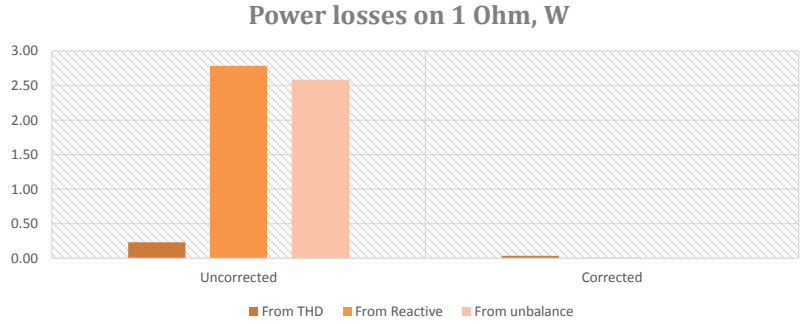
Number of Phases: 3
Median V. per Phase: 119.58

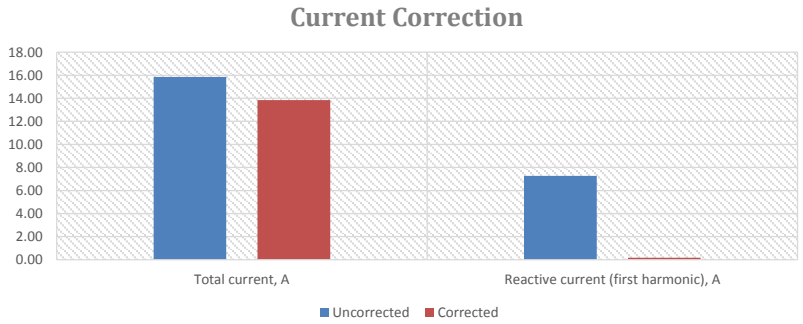
		Uncorrected	*Corrected*
Current Correction	**Total current, A**	15.86	13.84
	Reactive current (first harmonic), A	7.27	0.18
	Relative THD, %	13.20	3.63
Power losses on 0.10 Ohm, W	**From THD**	0.23	0.04
	From Reactive	2.78	0.01
	From unbalance	2.59	0.01
VQ2 Connection	**Apparent power, VA**	1897.6	1654.8
	Power Factor	0.831	0.995
	PF for phase with most distorted current	0.633	0.995
	Average RMS Voltage, V	119.59	119.56
Electrical Network	**Active power, W**	1588.58	1653.16

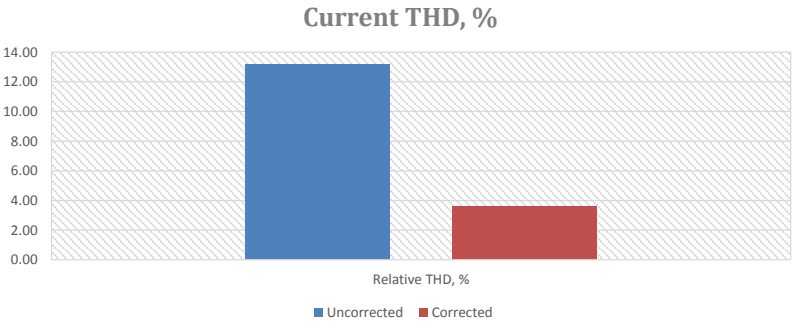


Cable resistance, Ohm	**0.10**
Saved power on 1.00 Ohm, W	**5.224832**
VQ2 Consumption, W	**31.86**
VQ2 Efficiency	**97.22%**









Uncorrected Load Figure 1.1

Power

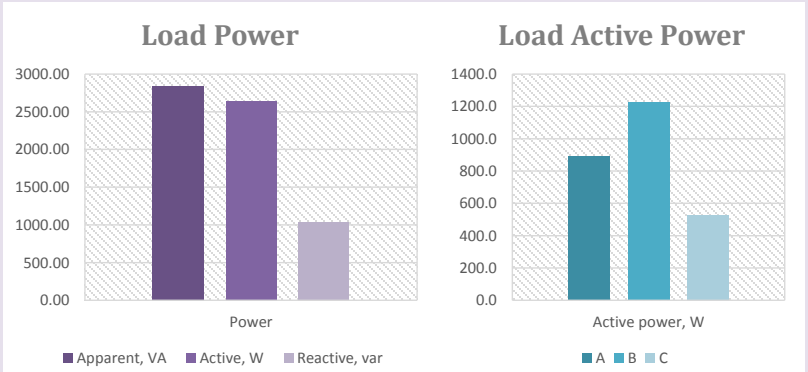
	Power factor				Apparent power, VA				Active power, W				Reactive* power, var			
	A	B	C	Total	A	B	C	Sum	A	B	C	Sum	A	B	C	Sum
Avg	0.823	0.998	0.995	0.931	1080.3	1227.4	530.2	2837.9	889.3	1224.4	527.8	2641.5	613.2	85.5	51.1	1037.3
Max	0.824	0.998	0.995	0.931	1088.6	1235.2	531.0	2853.9	895.9	1232.3	528.6	2655.8	618.5	86.2	52.1	1044.8
Min	0.823	0.998	0.995	0.931	1076.3	1223.7	529.1	2831.1	886.0	1220.7	526.6	2635.4	611.0	84.5	50.7	1034.3

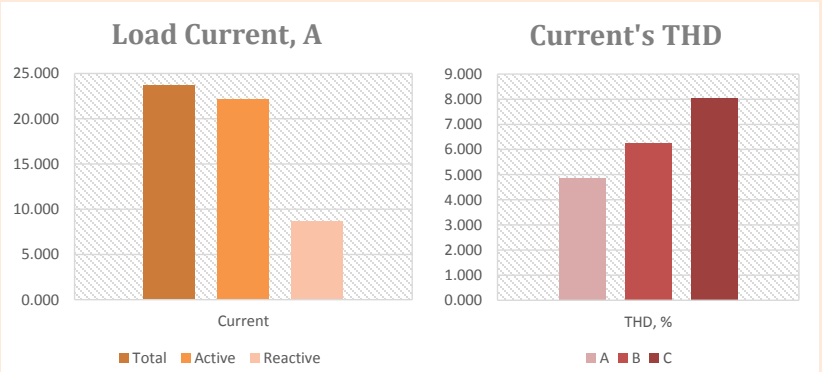
* - Reactive power was calculated with expression: $Q = SQR(S^2-P^2)$. Thus: Q - reactive, S - apparent, P - active.

Current

	Total current, A				Active current, A				Reactive current *, A				THD, %			
	A	B	C	Sum	A	B	C	Sum	A	B	C	Sum	A	B	C	Average
Avg	9.04	10.30	4.42	23.76	7.45	10.27	4.40	22.12	5.13	0.72	0.43	8.69	4.842	6.266	8.051	6.386
Max	9.12	10.36	4.43	23.89	7.50	10.33	4.41	22.23	5.18	0.72	0.43	8.75	4.872	6.297	8.115	6.413
Min	9.01	10.27	4.41	23.70	7.42	10.24	4.39	22.06	5.12	0.71	0.42	8.66	4.809	6.211	7.955	6.348

* - Reactive current was calculated with expression: $I_r = SQR(I_S^2-I_a^2)$. Thus: I_r - reactive current, I_S - total current, I_a - active current.





Uncorrected Load Figure 1.2

Power

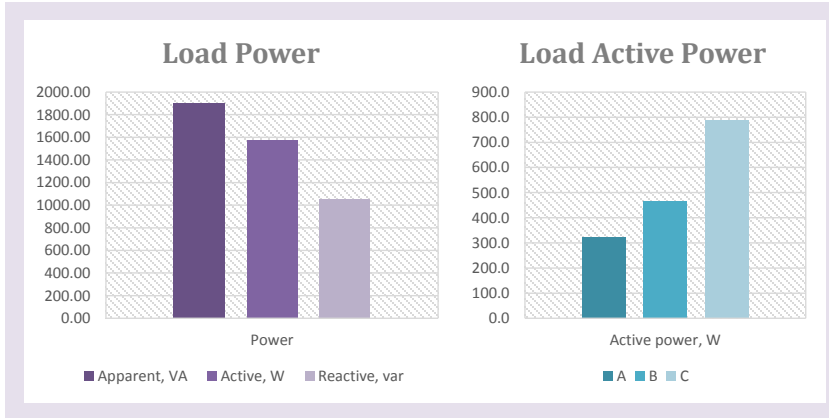
	Power factor				Apparent power, VA				Active power, W				Reactive* power, var			
	A	B	C	Total	A	B	C	Sum	A	B	C	Sum	A	B	C	Sum
Avg	0.947	0.632	0.961	0.831	340.5	738.0	819.3	1897.8	322.5	466.8	787.7	1577.0	109.3	571.7	225.3	1055.9
Max	0.948	0.635	0.962	0.832	344.7	739.7	821.7	1906.0	326.6	469.6	790.1	1586.3	110.2	573.0	228.6	1059.0
Min	0.946	0.628	0.960	0.829	338.6	731.6	815.3	1885.9	320.4	459.5	782.6	1563.5	107.8	569.2	222.3	1053.1

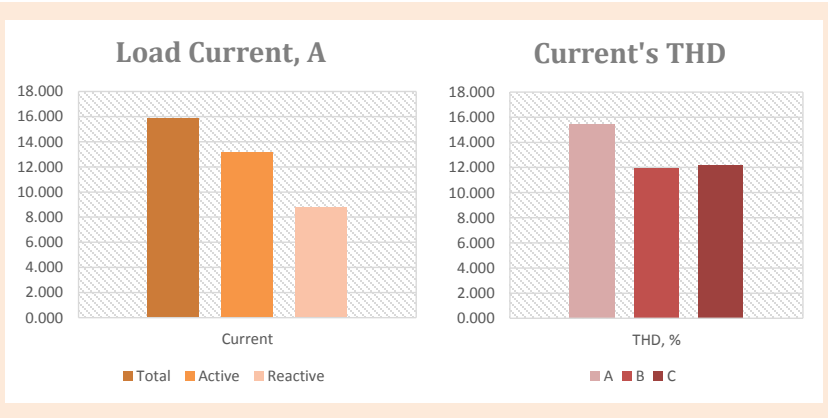
* - Reactive power was calculated with expression: $Q = SQR(S^2-P^2)$. Thus: Q - reactive, S - apparent, P - active.

Current

	Total current, A				Active current, A				Reactive current *, A				THD, %			
	A	B	C	Sum	A	B	C	Sum	A	B	C	Sum	A	B	C	Average
Avg	2.85	6.19	6.83	15.86	2.70	3.91	6.57	13.18	0.91	4.79	1.88	8.83	15.431	11.909	12.219	13.186
Max	2.88	6.20	6.85	15.93	2.73	3.94	6.59	13.25	0.92	4.80	1.91	8.86	15.782	12.012	12.281	13.323
Min	2.83	6.13	6.80	15.76	2.68	3.85	6.52	13.06	0.90	4.77	1.85	8.81	15.123	11.709	12.129	13.053

* - Reactive current was calculated with expression: $I_r = SQR(I_S^2-I_a^2)$. Thus: I_r - reactive current, I_S - total current, I_a - active current.





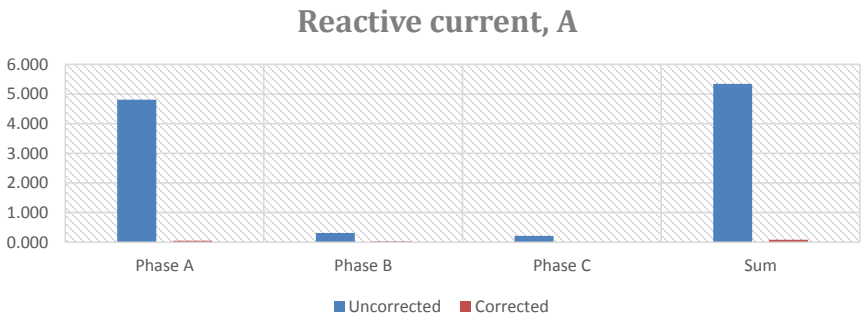
Summary - Current Figure 2.1

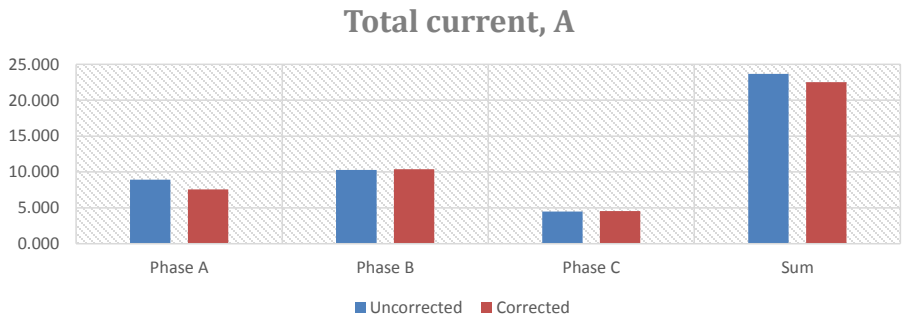
Current

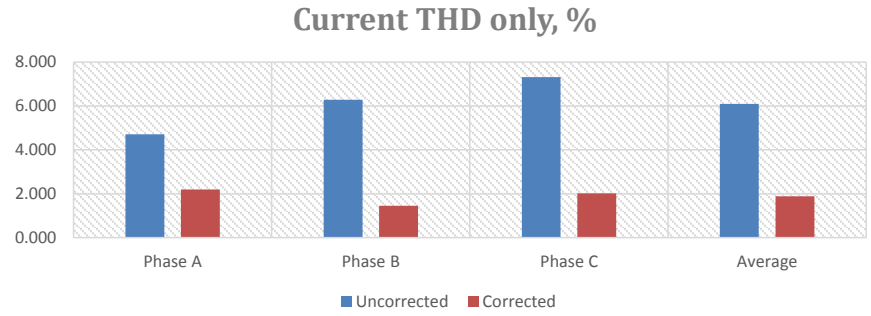
	Phase A				Phase B				Phase C				Sum			
	Reactive current, A		Total current, A		Reactive current, A		Total current, A		Reactive current, A		Total current, A		Reactive current, A		Total current, A	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	4.812	0.053	8.928	7.557	0.311	0.025	10.271	10.382	0.217	0.006	4.477	4.568	5.340	0.084	23.675	22.507
Max	4.833	0.099	8.956	7.581	0.331	0.058	10.299	10.414	0.225	0.014	4.487	4.578	5.388	0.172	23.743	22.574
Min	4.768	0.022	8.888	7.520	0.291	0.009	10.236	10.342	0.204	0.000	4.464	4.555	5.264	0.031	23.588	22.416

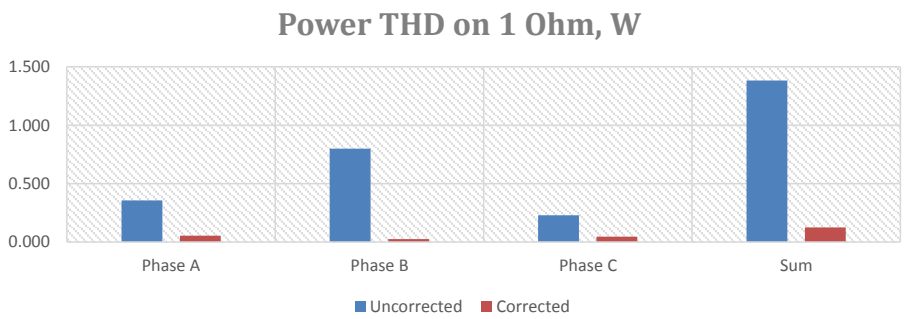
Total Harmonic Distortion (THD) in Current

	Phase A				Phase B				Phase C				Average		Sum	
	Relative THD, %		Power THD, W		Relative THD, %		Power THD, W		Relative THD, %		Power THD, W		Relative THD, %		Power THD, W	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	4.707	2.191	0.355	0.053	6.282	1.451	0.799	0.024	7.313	2.021	0.228	0.047	6.101	1.887	1.383	0.124
Max	4.762	2.372	0.361	0.062	6.309	1.526	0.805	0.027	7.367	2.100	0.232	0.050	6.146	1.999	1.398	0.139
Min	4.668	2.014	0.350	0.045	6.256	1.354	0.796	0.021	7.274	1.953	0.225	0.043	6.066	1.774	1.371	0.109









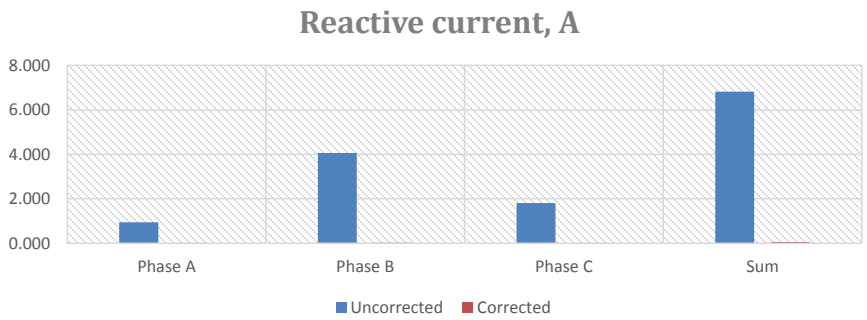
Summary - Current Figure 2.2

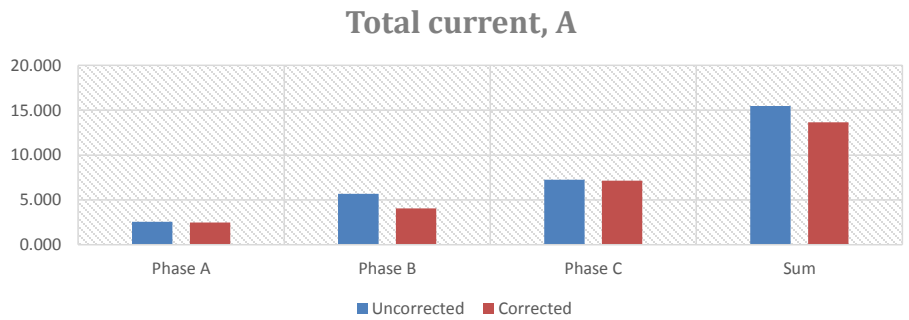
Current

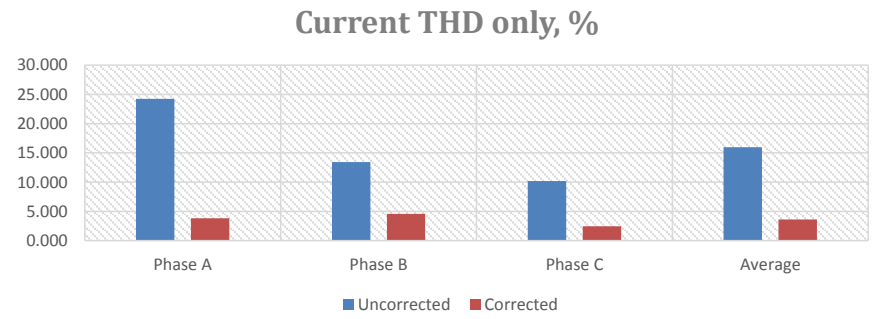
	Phase A				Phase B				Phase C				Sum			
	Reactive current, A		Total current, A		Reactive current, A		Total current, A		Reactive current, A		Total current, A		Reactive current, A		Total current, A	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	0.948	0.015	2.545	2.486	4.058	0.031	5.677	4.042	1.813	0.015	7.251	7.129	6.819	0.061	15.473	13.657
Max	0.979	0.036	2.563	2.502	4.086	0.048	5.701	4.091	1.838	0.030	7.266	7.145	6.903	0.114	15.530	13.737
Min	0.930	0.002	2.515	2.455	4.029	0.005	5.630	4.009	1.788	0.002	7.216	7.088	6.746	0.010	15.360	13.552

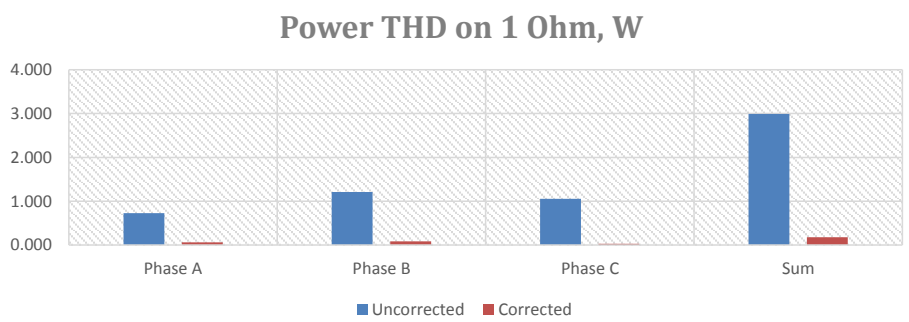
Total Harmonic Distortion (THD) in Current

	Phase A				Phase B				Phase C				Average		Sum	
	Relative THD, %		Power THD, W		Relative THD, %		Power THD, W		Relative THD, %		Power THD, W		Relative THD, %		Power THD, W	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	24.218	3.838	0.729	0.064	13.444	4.571	1.211	0.086	10.182	2.467	1.054	0.026	15.948	3.625	2.994	0.175
Max	24.953	4.305	0.766	0.079	13.656	4.944	1.256	0.100	10.263	2.624	1.076	0.029	16.291	3.958	3.098	0.209
Min	23.610	3.506	0.685	0.054	13.241	4.308	1.182	0.075	10.130	2.261	1.040	0.022	15.660	3.358	2.906	0.151









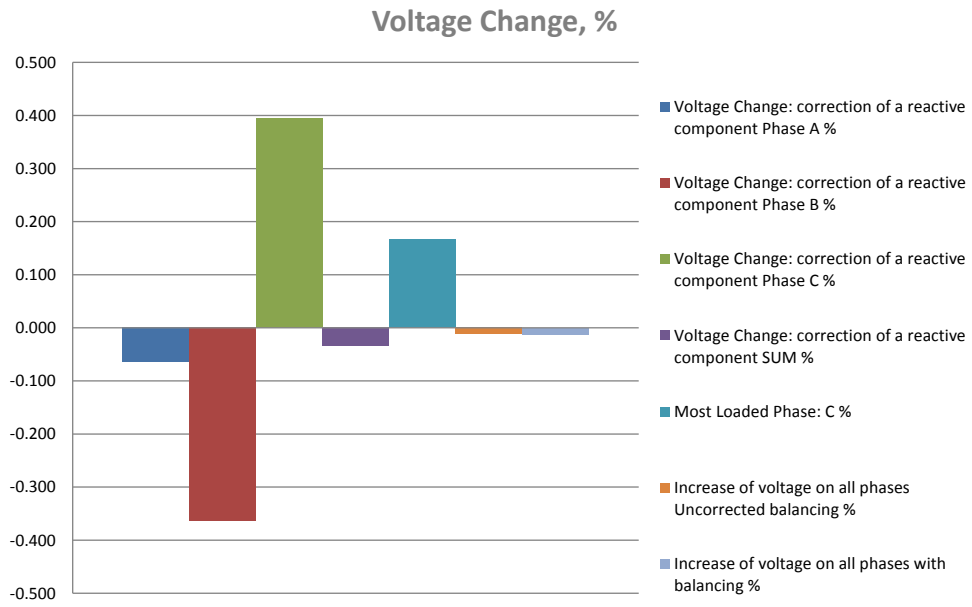
Summary of Voltage Figure 3.1

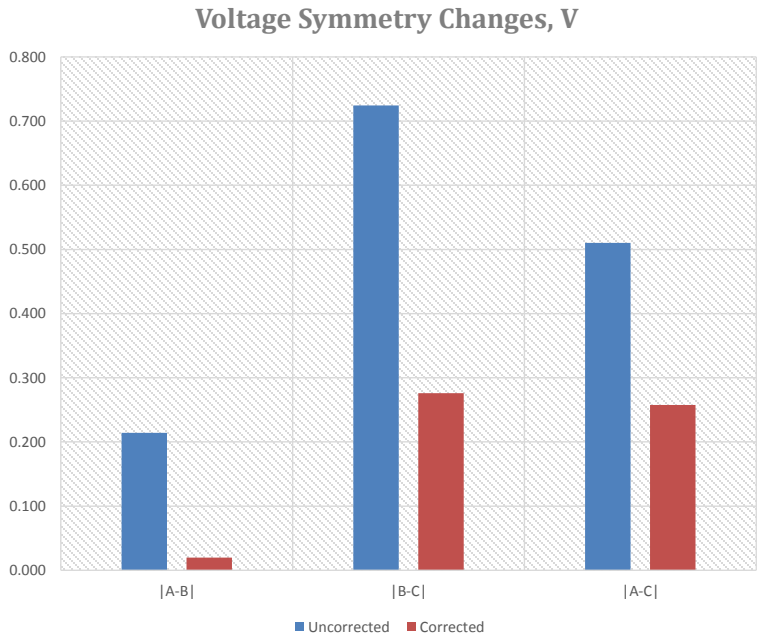
Voltage

	Voltage Change: correction of a reactive component								Most Loaded Phase:		Increase of voltage on all phases					
	Phase A		Phase B		Phase C		SUM		C		Uncorrected balancing		with balancing		Difference	
	V	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*
Avg	-0.078	-0.065	-0.434	-0.364	0.474	0.395	-0.038	-0.034	0.199	0.167	-0.013	-0.011	-0.016	-0.013	0.003	0.002
Max	-0.066	-0.055	-0.422	-0.354	0.485	0.405	-0.002	-0.004	0.212	0.178	0.485	0.405	0.212	0.178	0.273	0.227
Min	-0.084	-0.070	-0.445	-0.374	0.457	0.381	-0.072	-0.063	0.182	0.153	-0.445	-0.374	-0.266	-0.222	-0.179	-0.151

Voltage Symmetry Changes in Phases

	Uncorrected Voltage (rms), V						VQ2 Correction Voltage (rms), V						Voltage THD			
													Phase Most Corrected: A			Difference
	Phase A	Phase B	Phase C	|A-B|	|B-C|	|A-C|	Phase A	Phase B	Phase C	|A-B|	|B-C|	|A-C|	*Uncorrected*	*Corrected*	*Ratio*	%
Avg	119.433	119.219	119.943	0.214	0.724	0.510	119.436	119.418	119.694	0.020	0.276	0.258	0.584	0.587	0.996	-0.003
Max	119.441	119.236	119.954	0.235	0.737	0.526	119.451	119.433	119.710	0.041	0.286	0.284	0.634	0.630	1.002	0.004
Min	119.425	119.206	119.934	0.193	0.716	0.493	119.425	119.404	119.677	0.004	0.270	0.236	0.564	0.559	0.985	0.005





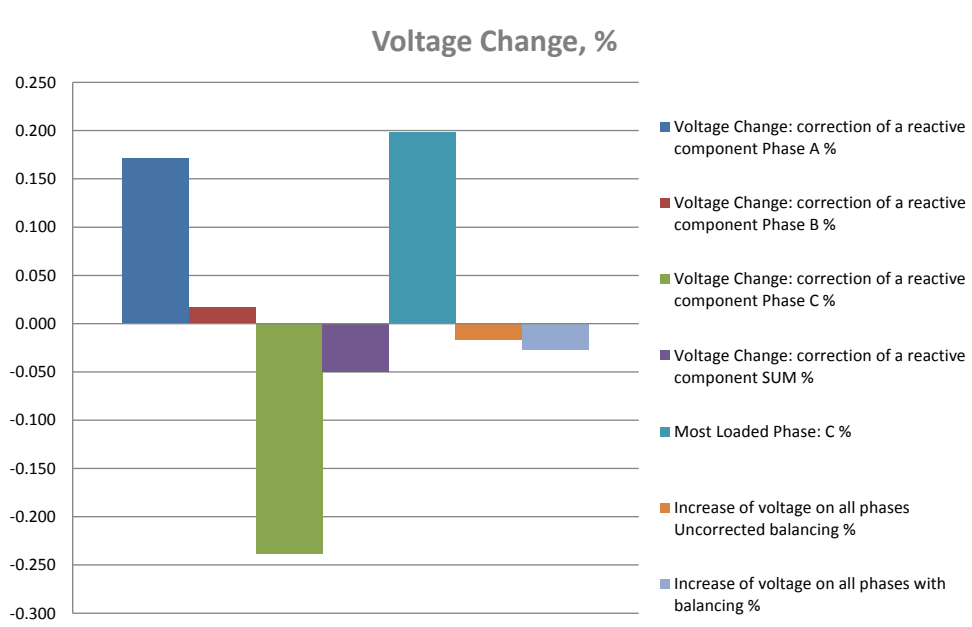
Summary of Voltage Figure 3.2

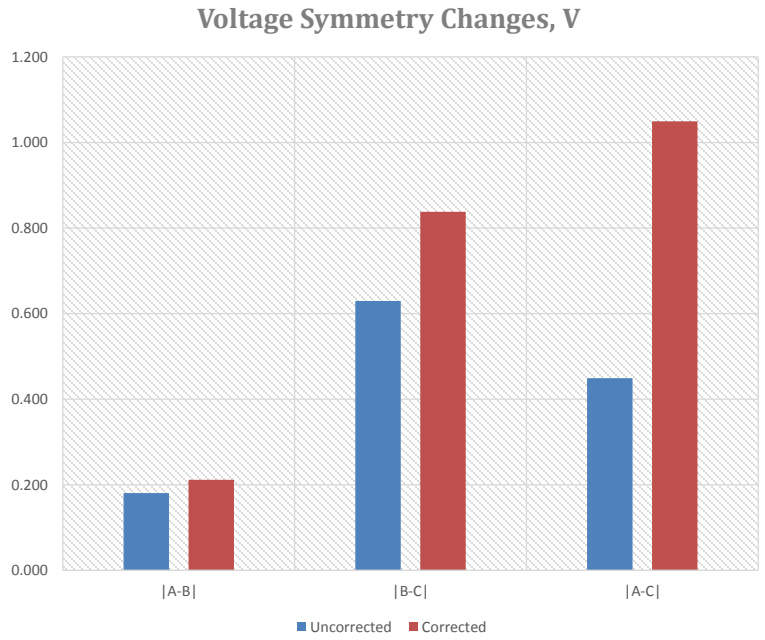
Voltage

	Voltage Change: correction of a reactive component								Most Loaded Phase:		Increase of voltage on all phases					
	Phase A		Phase B		Phase C		SUM		C		Uncorrected balancing		with balancing		Difference	
	V	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*	*V*	*%*
Avg	0.205	0.172	0.020	0.017	-0.286	-0.238	-0.060	-0.049	0.237	0.198	-0.020	-0.016	-0.032	-0.027	0.012	0.011
Max	0.214	0.179	0.030	0.025	-0.273	-0.227	-0.029	-0.023	0.254	0.212	0.214	0.179	0.254	0.212	-0.040	-0.033
Min	0.198	0.165	0.001	0.001	-0.298	-0.249	-0.100	-0.082	0.230	0.192	-0.298	-0.249	-0.374	-0.313	0.076	0.064

Voltage Symmetry Changes in Phases

	Uncorrected Voltage (rms), V						VQ2 Correction Voltage (rms), V						Voltage THD			
													Phase Most Corrected: A			Difference
	Phase A	Phase B	Phase C	|A-B|	|B-C|	|A-C|	Phase A	Phase B	Phase C	|A-B|	|B-C|	|A-C|	*Uncorrected*	*Corrected*	*Ratio*	%
Avg	119.501	119.321	119.950	0.180	0.630	0.449	119.138	119.350	120.188	0.212	0.838	1.050	0.483	0.488	0.990	-0.005
Max	119.506	119.333	119.967	0.196	0.636	0.464	119.156	119.358	120.204	0.241	0.849	1.068	0.505	0.509	0.959	-0.005
Min	119.490	119.303	119.932	0.164	0.623	0.436	119.117	119.339	120.176	0.197	0.826	1.038	0.462	0.469	0.984	-0.007



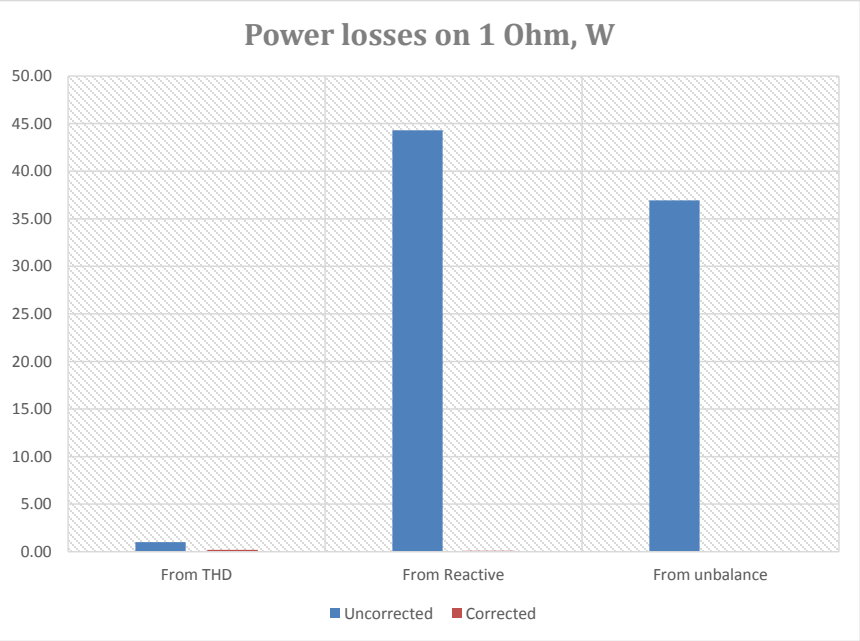


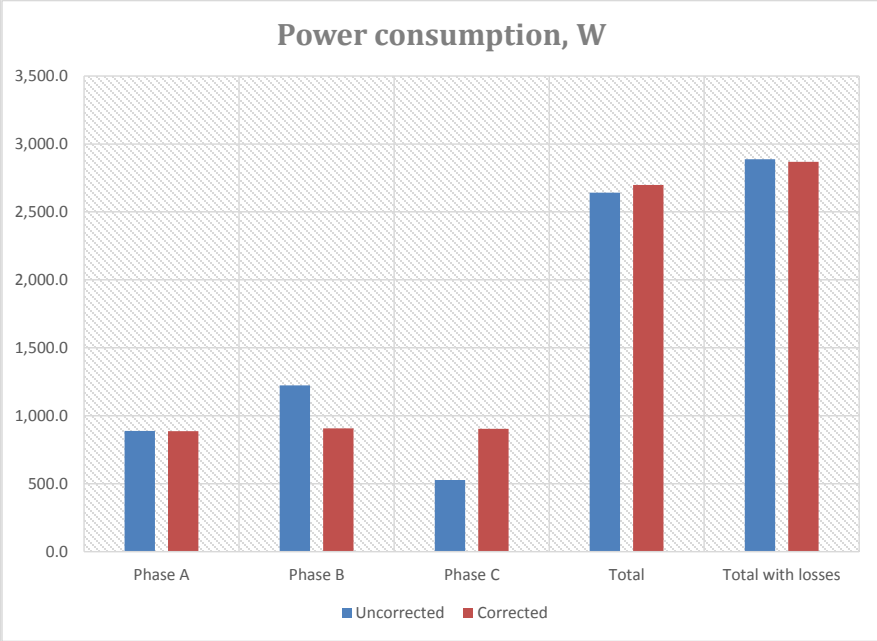
Summary of Power Figure 4.1

Power losses (1 Ohm), W

	Uncorrected			Corrected			Difference		
	From THD	From Reactive	From unbalance	From THD	From Reactive	From unbalance	From THD	From Reactive	From unbalance
Avg	1.00	44.30	36.94	0.20	0.09	0.06	0.81	44.20	36.89
Max	*1.02*	*45.23*	*37.94*	*0.21*	*0.12*	*0.07*	0.81	45.12	37.88
Min	*0.99*	*43.49*	*36.27*	*0.18*	*0.07*	*0.05*	0.81	43.42	36.22

	Power consumption, W			Power Factor	
	Uncorrected	Corrected	Diff.	Uncorrected	Corrected
Phase A	889.3	887.3	2.0	0.823	0.999
Phase B	1,224.4	907.9	316.5	0.998	0.999
Phase C	527.8	903.2	-375.5	0.995	0.999
Total	**2,641.5**	**2,698.5**	**-56.9**		
Total with losses	2,888.1	2,868.7	**19.4**		



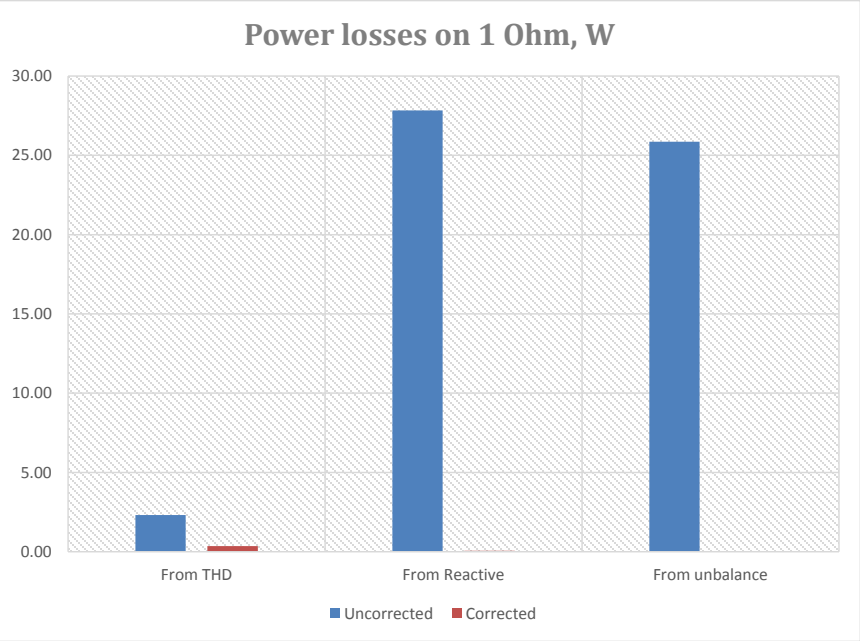


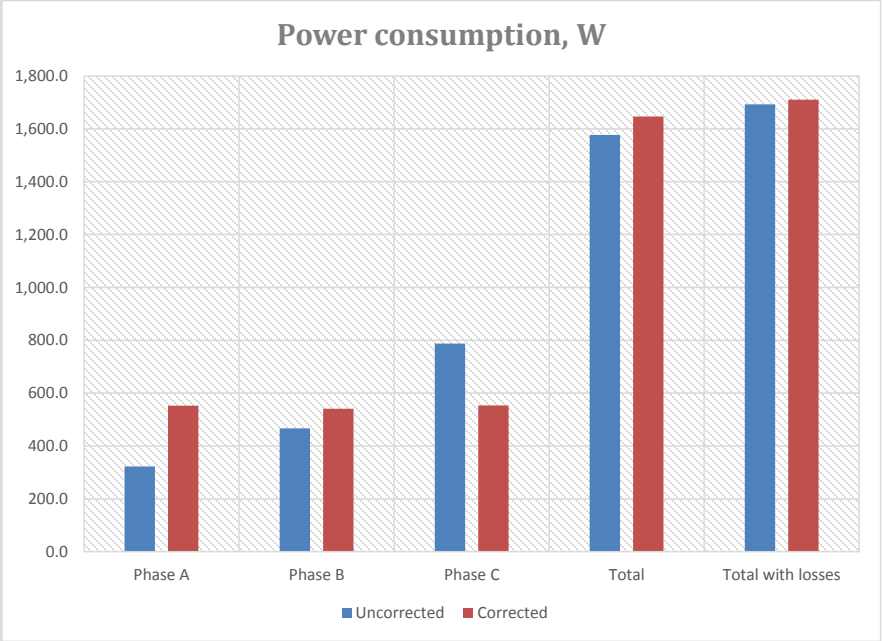
Summary of Power Figure 4.2

Power losses (1 Ohm), W

	Uncorrected			Corrected			Difference		
	From THD	From Reactive	From unbalance	From THD	From Reactive	From unbalance	From THD	From Reactive	From unbalance
Avg	2.32	27.83	25.85	0.36	0.05	0.05	1.96	27.78	25.80
Max	*2.43*	*28.15*	*26.38*	*0.39*	*0.07*	*0.06*	2.04	28.09	26.31
Min	*2.25*	*27.18*	*25.18*	*0.32*	*0.04*	*0.04*	1.92	27.15	25.14

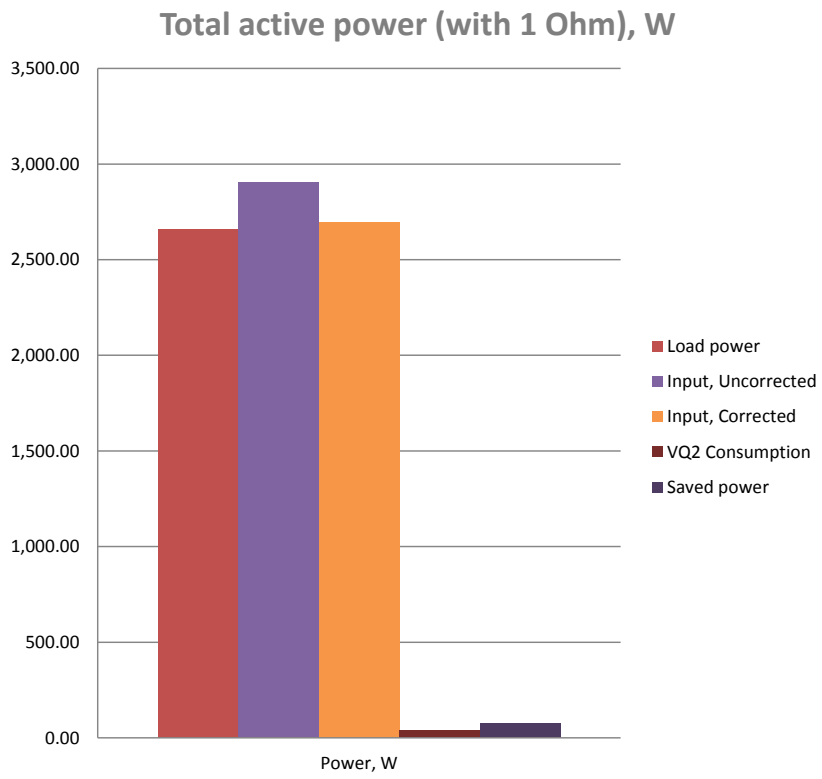
	Power consumption, W			Power Factor	
	Uncorrected	Corrected	Diff.	Uncorrected	Corrected
Phase A	322.5	552.5	-230.0	0.947	0.993
Phase B	466.8	540.6	-73.8	0.633	0.995
Phase C	787.7	553.7	234.0	0.961	0.997
Total	**1,577.0**	**1,646.8**	**-69.8**		
Total with losses	1,692.9	1,710.5	**-17.6**		

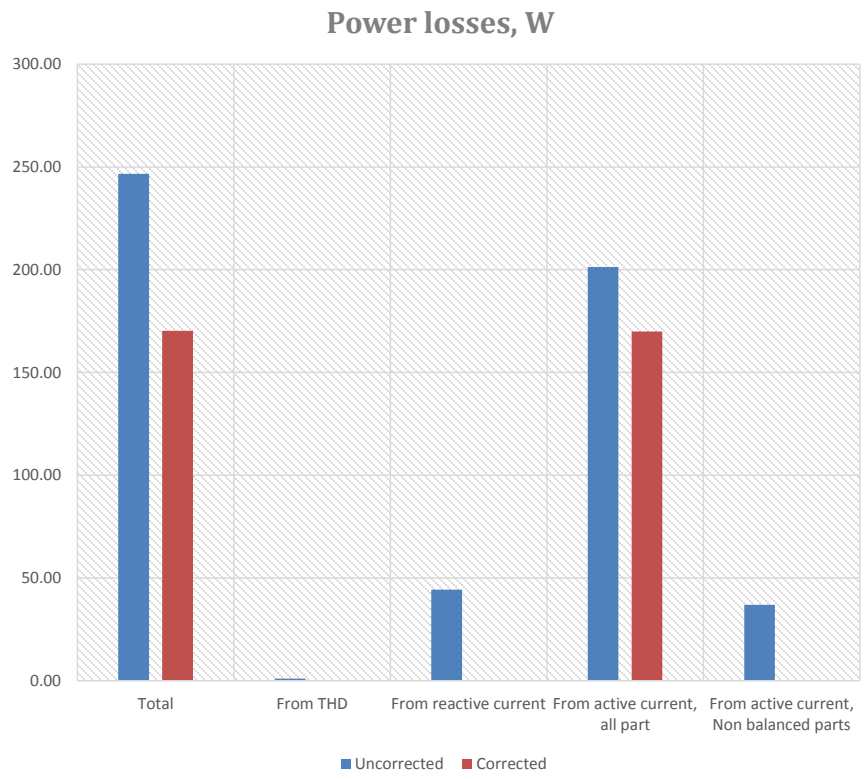




Summary of Correction Figure 5.1

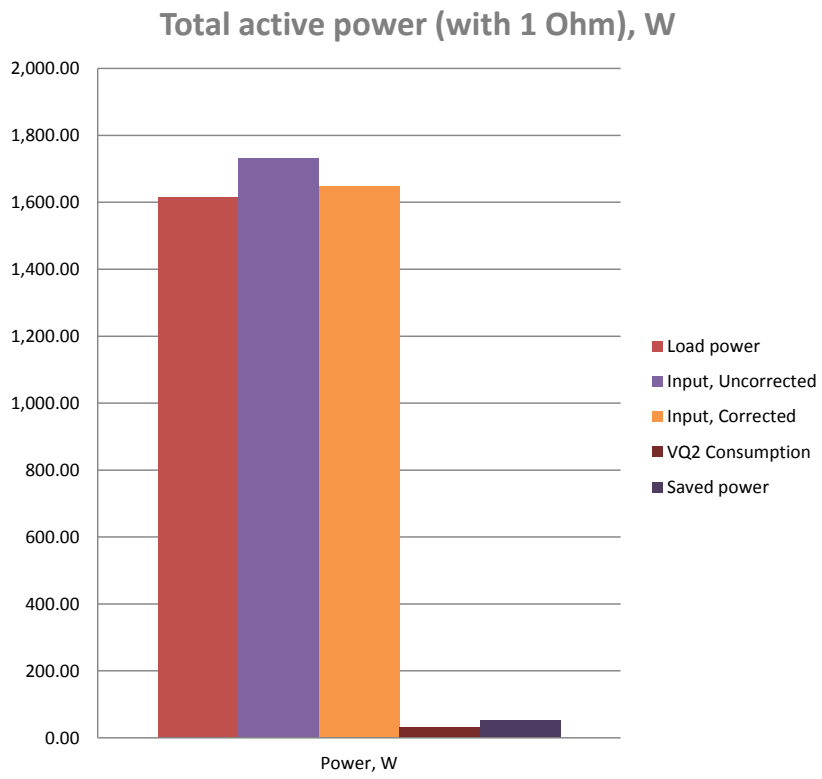
	Consumption Uncorrected (summary, on all phases)						Consumption With Correction (summary, on all phases)						Saved power (W)	VQ2 Consumption (W)
	Active power, W	Power losses (1 Ohm), W					Active power, W	Power losses (1 Ohm), W						
		Total	From THD	From reactive current	From active current			Total	From THD	From reactive current	From active current			
					All parts	Non balanced parts					All parts	Non balanced parts		
Avg	2,659.73	246.62	1.00	44.30	201.32	36.94	2,698.45	170.25	0.20	0.09	169.97	0.06	76.37	38.72
Max	2,671.55	249.98	1.02	45.23	203.74	37.94	2,711.56	171.91	0.21	0.12	171.65	0.07	78.07	40.27
Min	2,652.40	244.63	0.99	43.49	199.93	36.27	2,690.52	169.27	0.18	0.07	168.98	0.05	75.36	36.81

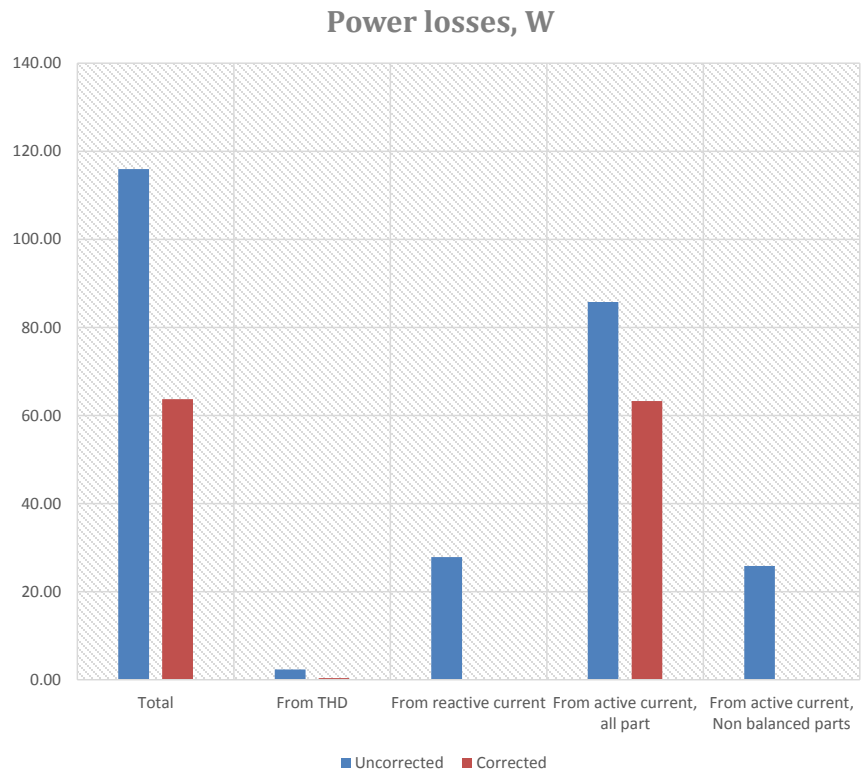




Summary of Correction Figure 5.2

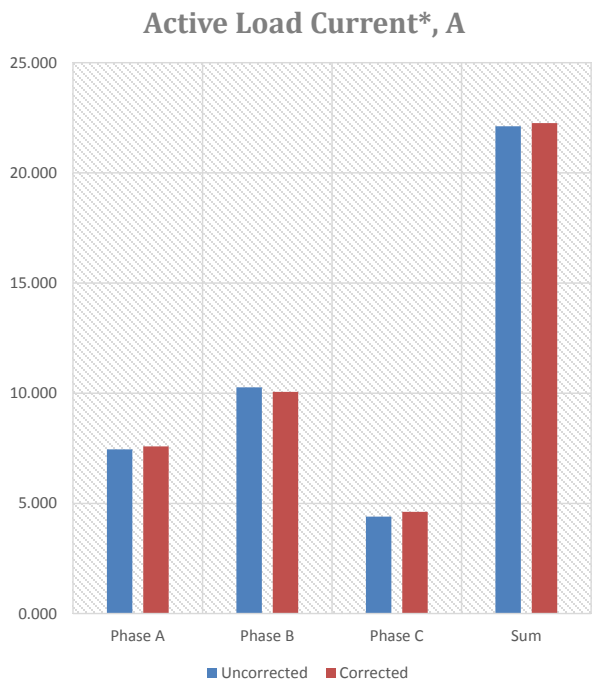
	Consumption Uncorrected (summary, on all phases)						Consumption With Correction (summary, on all phases)						Saved power (W)	VQ2 Consumption (W)
	Active power, W	Power losses (1 Ohm), W					Active power, W	Power losses (1 Ohm), W						
		Total	From THD	From reactive current	From active current			Total	From THD	From reactive current	From active current			
					All parts	Non balanced parts					All parts	Non balanced parts		
Avg	1,614.93	115.95	2.32	27.83	85.80	25.85	1,646.79	63.70	0.36	0.05	63.29	0.05	52.25	31.86
Max	1,629.41	117.44	2.43	28.15	87.15	26.38	1,660.67	64.73	0.39	0.07	64.34	0.06	52.83	33.28
Min	1,607.59	114.42	2.25	27.18	84.53	25.18	1,638.28	63.04	0.32	0.04	62.62	0.04	51.38	30.47

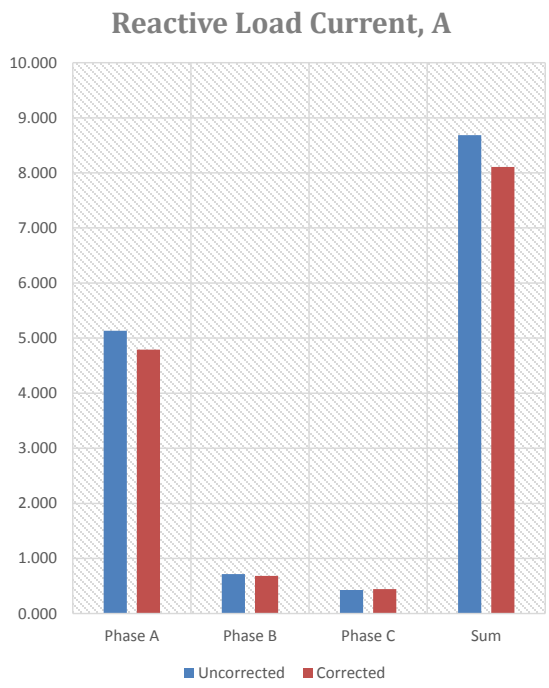


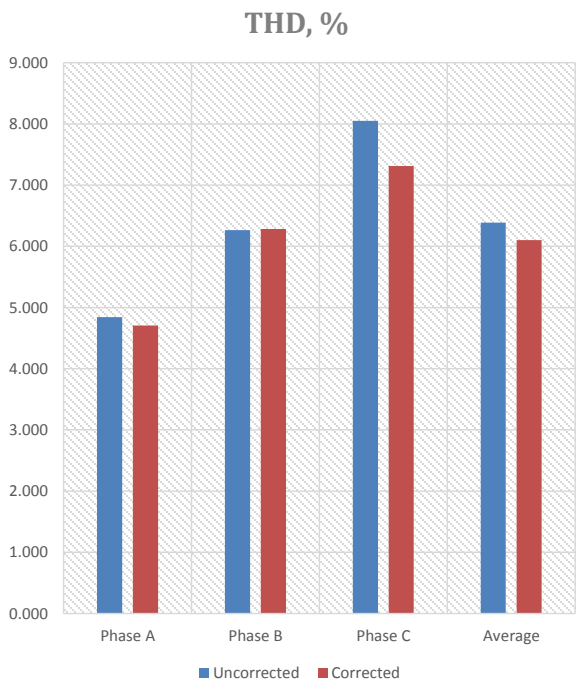


Load Current Figure 6.1

	Phase A						Phase B						Phase C						Sum				Average	
	Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	**7.45**	**7.58**	**5.13**	**4.79**	**4.84**	**4.71**	**10.27**	**10.06**	**0.72**	**0.68**	**6.27**	**6.28**	**4.40**	**4.62**	**0.43**	**0.44**	**8.05**	**7.31**	**22.12**	**22.26**	**8.69**	**8.11**	**6.39**	**6.10**
Max	7.50	7.63	5.18	4.82	4.87	4.76	10.33	10.12	0.72	0.69	6.30	6.31	4.41	4.63	0.43	0.45	8.12	7.37	22.23	22.36	8.75	8.15	6.41	6.14
Min	7.42	7.55	5.12	4.77	4.81	4.67	10.24	10.03	0.71	0.68	6.21	6.26	4.39	4.61	0.42	0.44	7.95	7.27	22.06	22.20	8.66	8.08	6.35	6.08

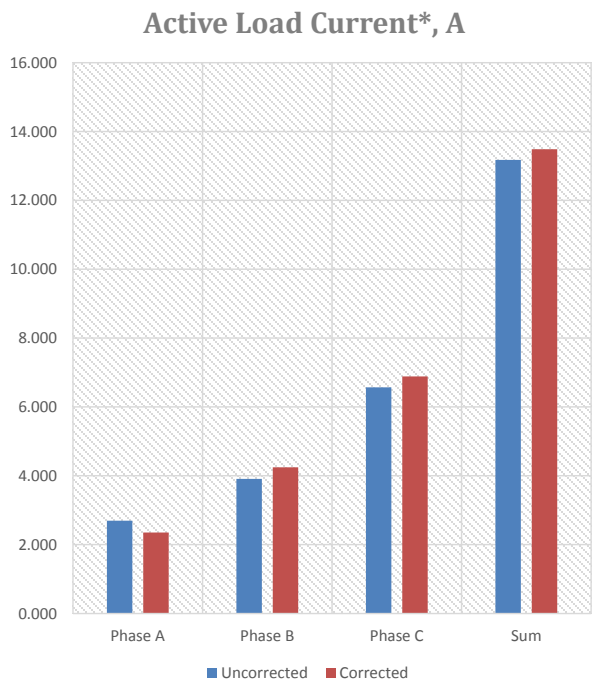


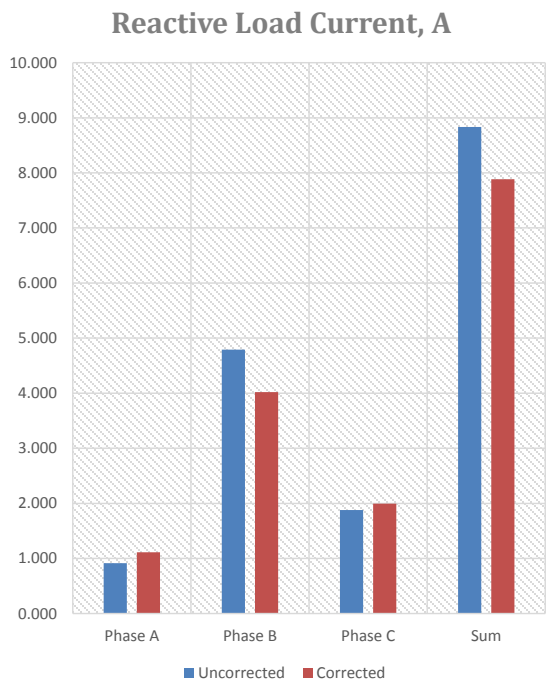


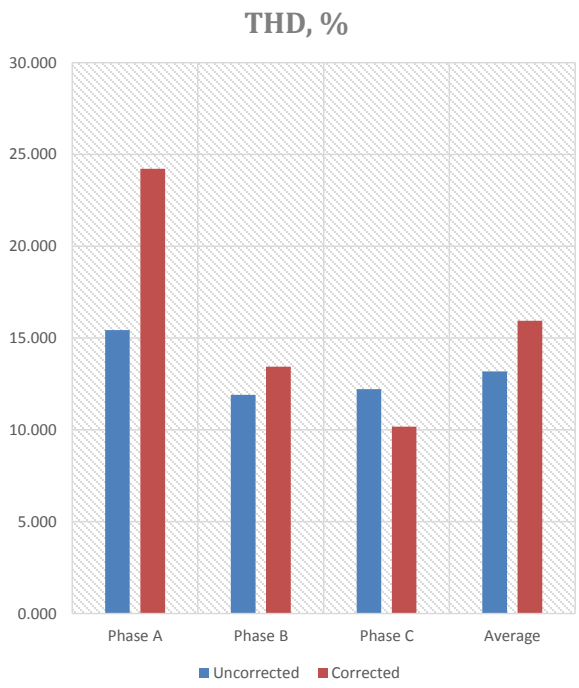


Load Current Figure 6.2

	Phase A						Phase B						Phase C						Sum				Average	
	Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %		Active RMS, A		Reactive RMS, A		THD, %	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	**2.70**	**2.35**	**0.91**	**1.11**	**15.43**	**24.22**	**3.91**	**4.25**	**4.79**	**4.02**	**11.91**	**13.44**	**6.57**	**6.89**	**1.88**	**2.00**	**12.22**	**10.18**	**13.18**	**13.49**	**8.83**	**7.88**	**13.19**	**15.95**
Max	2.73	2.38	0.92	1.14	15.78	24.95	3.94	4.27	4.80	4.04	12.01	13.66	6.59	6.95	1.91	2.05	12.28	10.26	13.25	13.61	8.86	7.91	13.32	16.26
Min	2.68	2.31	0.90	1.10	15.12	23.61	3.85	4.22	4.77	3.99	11.71	13.24	6.52	6.84	1.85	1.98	12.13	10.13	13.06	13.42	8.81	7.86	13.05	15.70

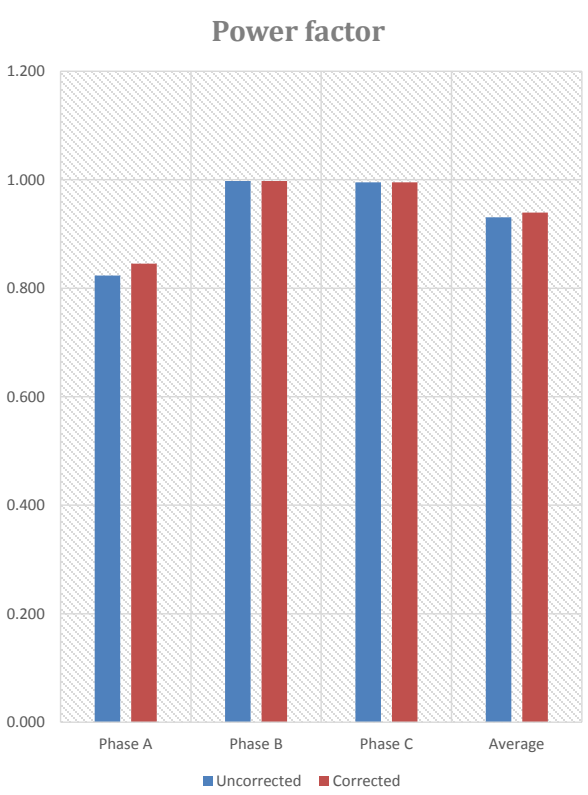


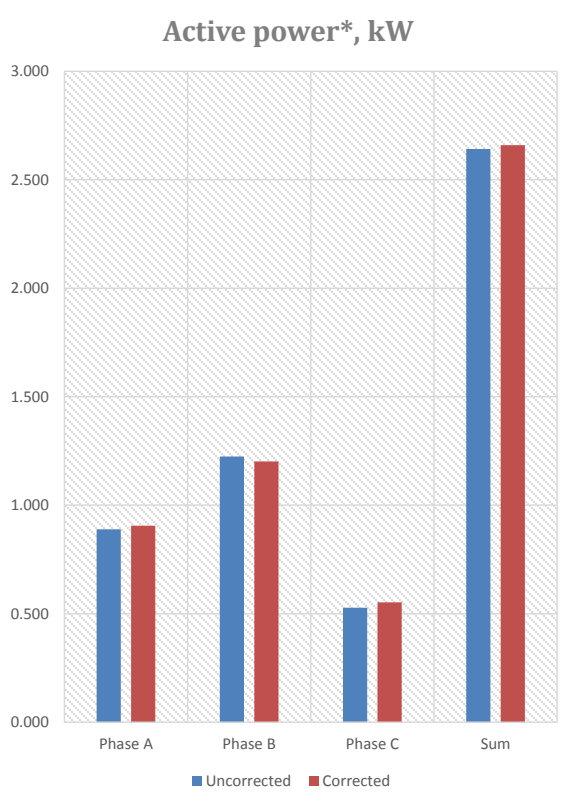


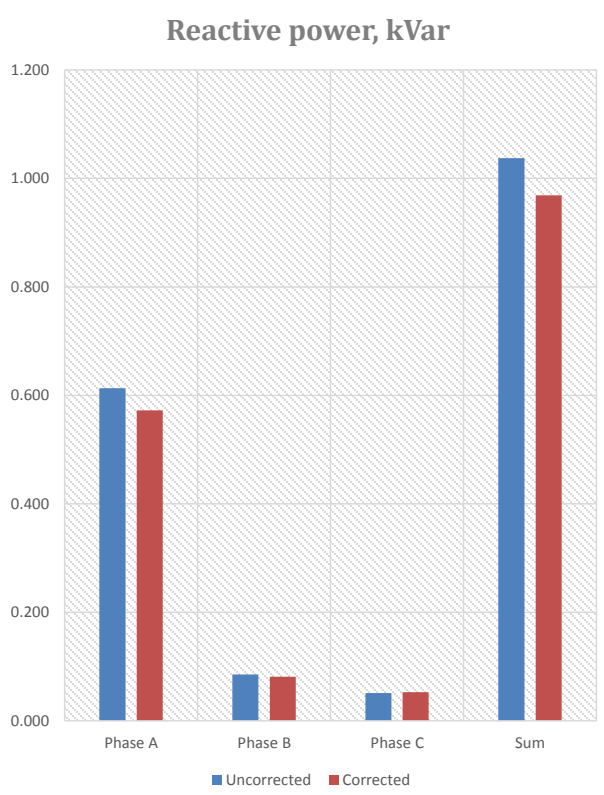


Load Power Figure 7.1

	Phase A						Phase B						Phase C						Average		Sum			
	Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	**0.823**	**0.845**	**0.889**	**0.906**	**0.613**	**0.572**	**0.998**	**0.998**	**1.224**	**1.202**	**0.086**	**0.081**	**0.995**	**0.995**	**0.528**	**0.552**	**0.051**	**0.053**	**0.931**	**0.940**	**2.642**	**2.660**	**1.037**	**0.969**
Max	0.824	0.846	0.896	0.912	0.619	0.576	0.998	0.998	1.232	1.208	0.086	0.082	0.995	0.996	0.529	0.554	0.052	0.053	0.931	0.940	2.656	2.672	1.045	0.974
Min	0.823	0.845	0.886	0.902	0.611	0.570	0.998	0.998	1.221	1.198	0.085	0.081	0.995	0.995	0.527	0.552	0.051	0.052	0.931	0.939	2.635	2.652	1.034	0.965

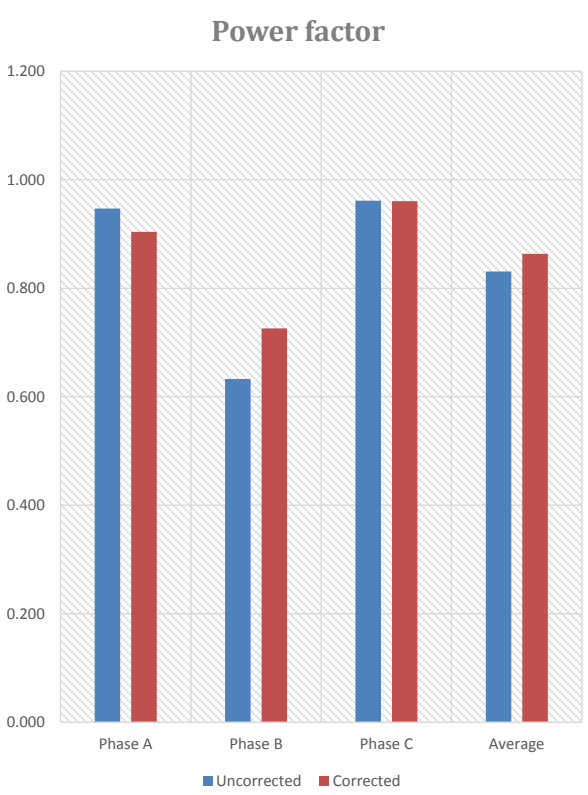


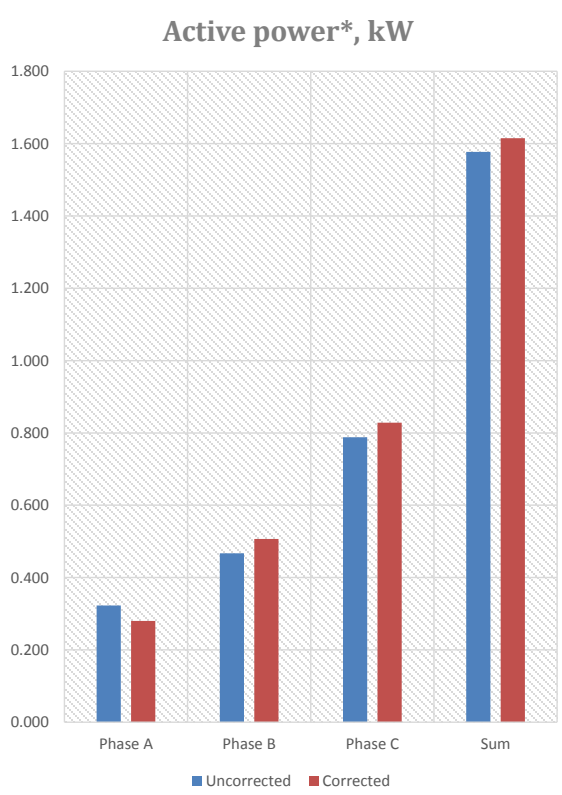


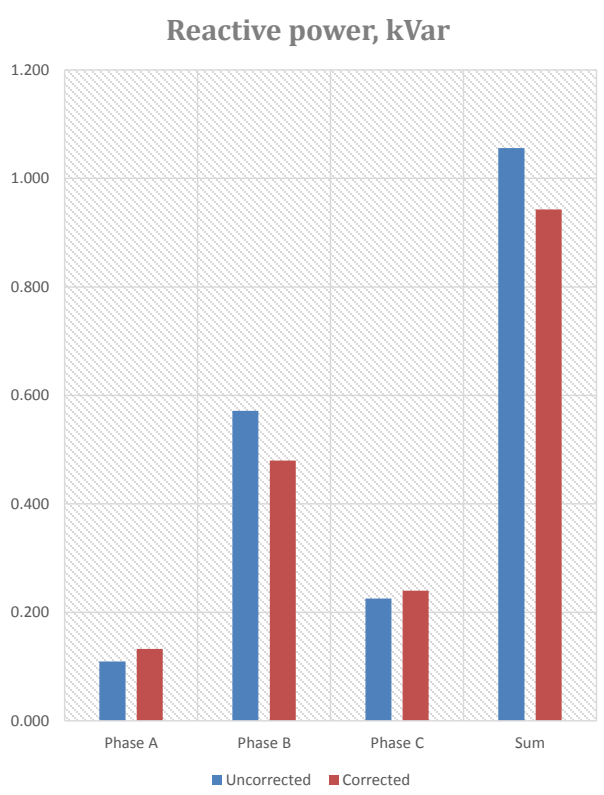


Load Power Figure 7.2

	Phase A						Phase B						Phase C						Average		Sum			
	Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar		Power factor		Active, kW		Reactive, kVar	
	Uncorrected	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*	*Uncorrected*	*Corrected*
Avg	**0.947**	**0.904**	**0.322**	**0.280**	**0.109**	**0.132**	**0.632**	**0.726**	**0.467**	**0.507**	**0.572**	**0.480**	**0.961**	**0.960**	**0.788**	**0.828**	**0.225**	**0.240**	**0.831**	**0.864**	**1.577**	**1.615**	**1.056**	**0.943**
Max	0.948	0.908	0.327	0.284	0.110	0.136	0.635	0.730	0.470	0.510	0.573	0.483	0.962	0.961	0.790	0.835	0.229	0.247	0.832	0.865	1.586	1.629	1.059	0.946
Min	0.946	0.897	0.320	0.276	0.108	0.131	0.628	0.722	0.459	0.503	0.569	0.476	0.960	0.959	0.783	0.822	0.222	0.238	0.829	0.862	1.563	1.608	1.053	0.940

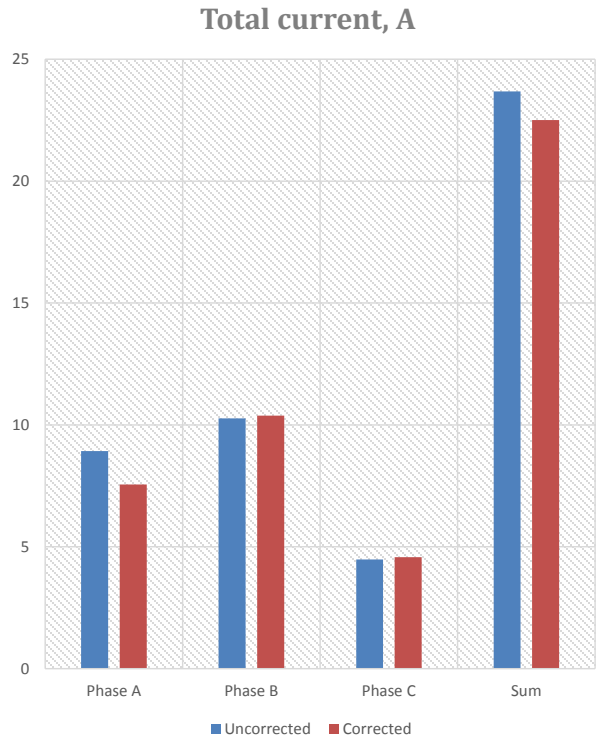


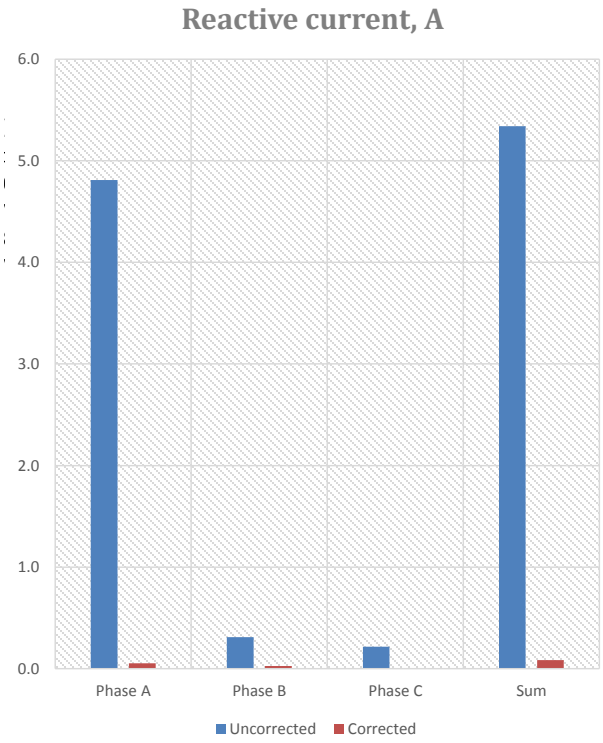


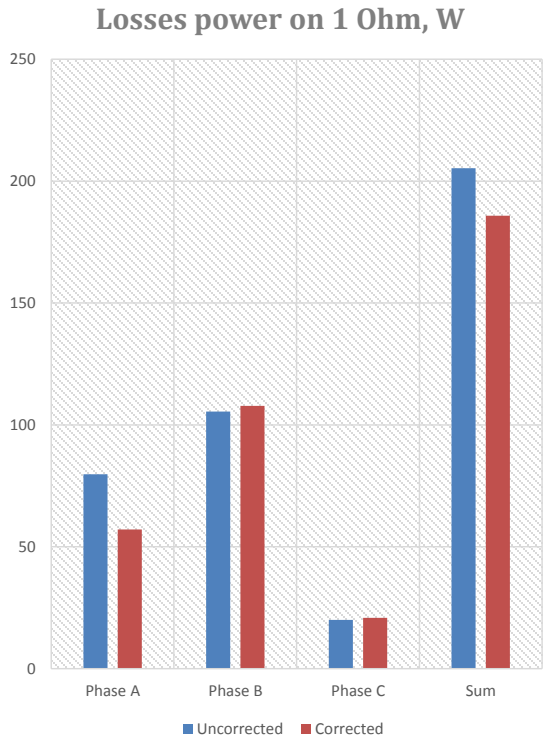


Reactive Current Correction Figure 8.1

	Phase A						Phase B						Phase C						Sum					
	Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
Avg	4.8	0.1	8.9	7.6	79.7	57.1	0.3	0.0	10.3	10.4	105.5	107.8	0.2	0.0	4.5	4.6	20.0	20.9	5.3	0.1	23.7	22.5	205.2	185.8
Max	4.8	0.1	9.0	7.6	80.2	57.5	0.3	0.1	10.3	10.4	106.1	108.5	0.2	0.0	4.5	4.6	20.1	21.0	5.4	0.1	23.7	22.6	206.2	186.7
Min	4.8	0.0	8.9	7.5	79.0	56.5	0.3	0.0	10.2	10.3	104.8	107.0	0.2	0.0	4.5	4.6	19.9	20.7	5.3	0.1	23.6	22.4	203.9	184.6

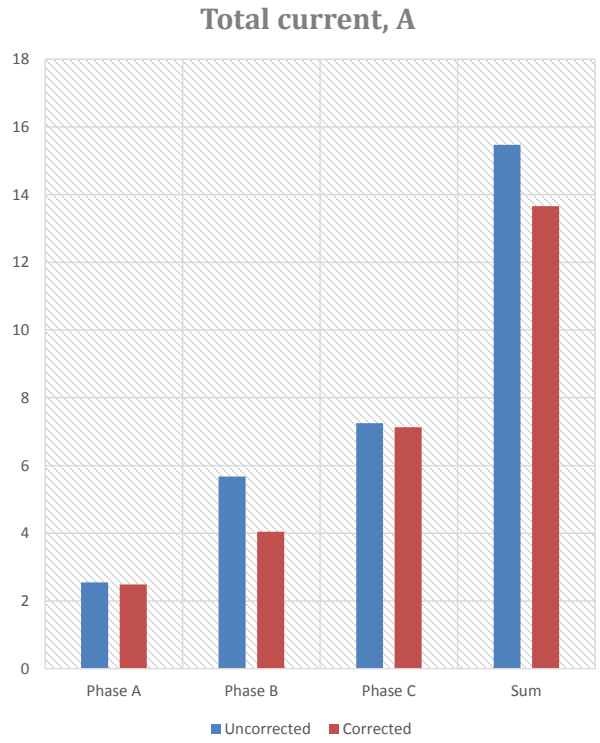


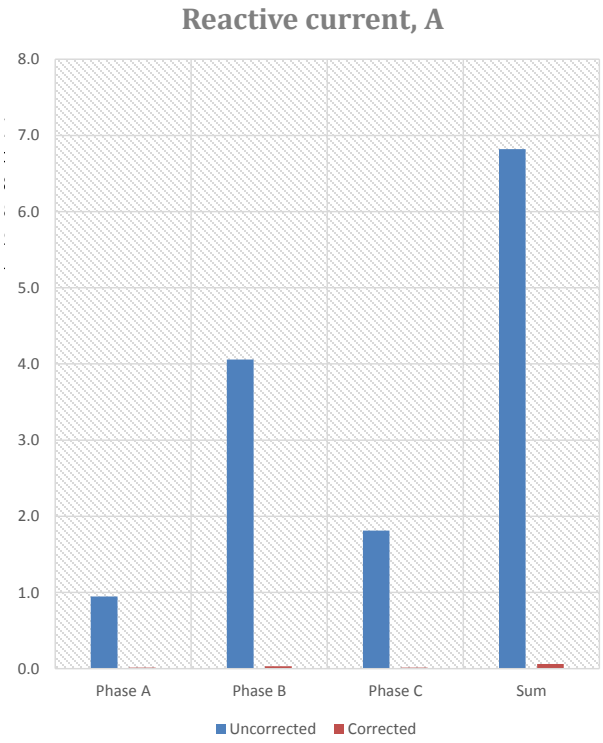


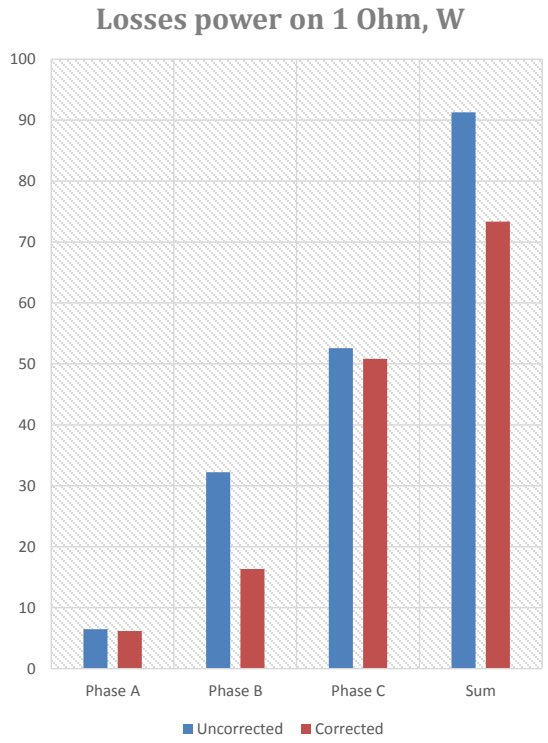


Reactive Current Correction Figure 8.2

	Phase A						Phase B						Phase C						Sum					
	Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*		Reactive current, A (rms)		Total current, A (rms)		Power (1 Ohm), W*	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
Avg	0.9	0.0	2.5	2.5	6.5	6.2	4.1	0.0	5.7	4.0	32.2	16.3	1.8	0.0	7.3	7.1	52.6	50.8	6.8	0.1	15.5	13.7	91.3	73.3
Max	1.0	0.0	2.6	2.5	6.6	6.3	4.1	0.0	5.7	4.1	32.5	16.7	1.8	0.0	7.3	7.1	52.8	51.0	6.8	0.1	15.5	13.7	91.7	73.9
Min	0.9	0.0	2.5	2.5	6.3	6.0	4.0	0.0	5.6	4.0	31.7	16.1	1.8	0.0	7.2	7.1	52.1	50.2	6.8	0.0	15.4	13.6	90.3	72.6

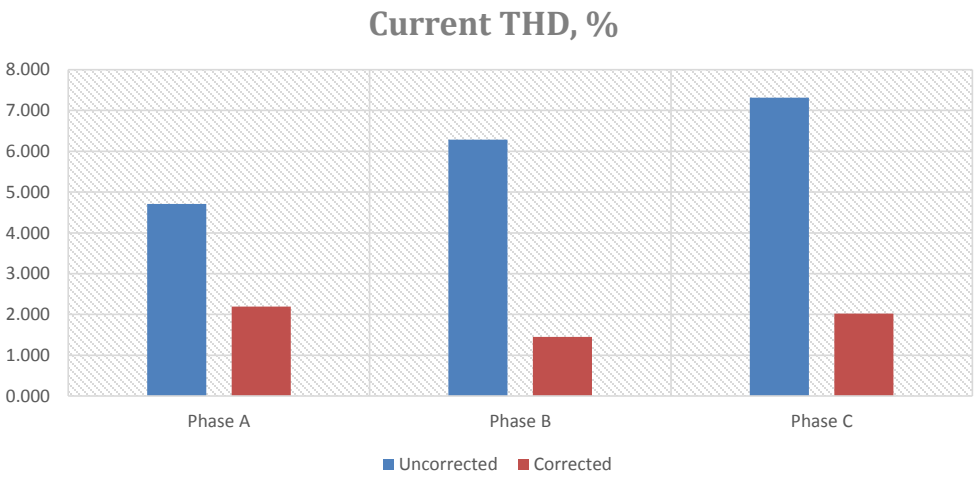


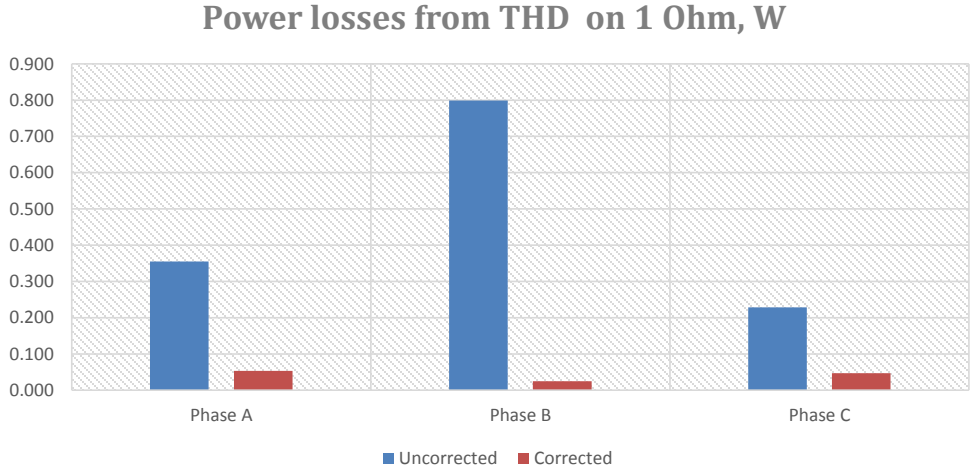




Current THD Figure 9.1a

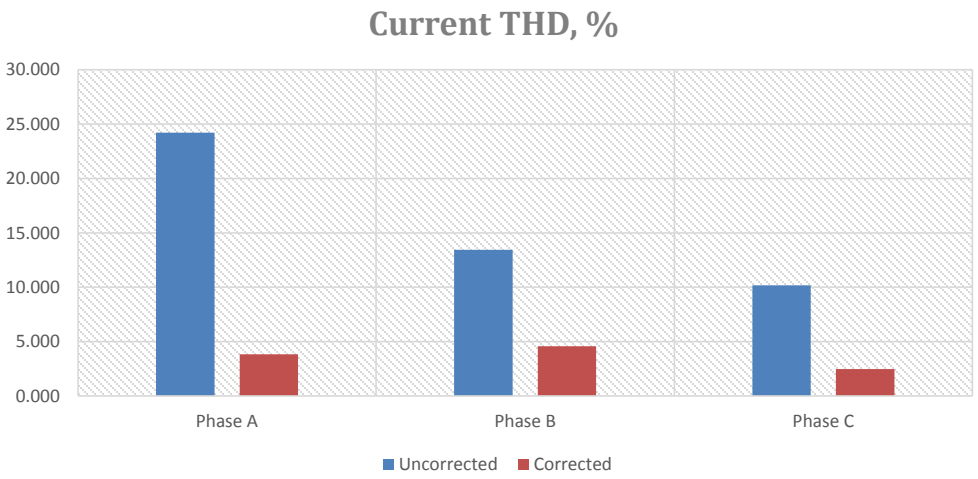
	Phase A				Phase B				Phase C				Average		Sum	
	THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
Avg	4.707	2.191	0.355	0.053	6.282	1.451	0.799	0.024	7.313	2.021	0.228	0.047	6.101	1.887	1.383	0.124
Max	4.762	2.372	0.361	0.062	6.309	1.526	0.805	0.027	7.367	2.100	0.232	0.050	6.143	1.981	1.393	0.136
Min	4.668	2.014	0.350	0.045	6.256	1.354	0.796	0.021	7.274	1.953	0.225	0.043	6.079	1.808	1.376	0.113

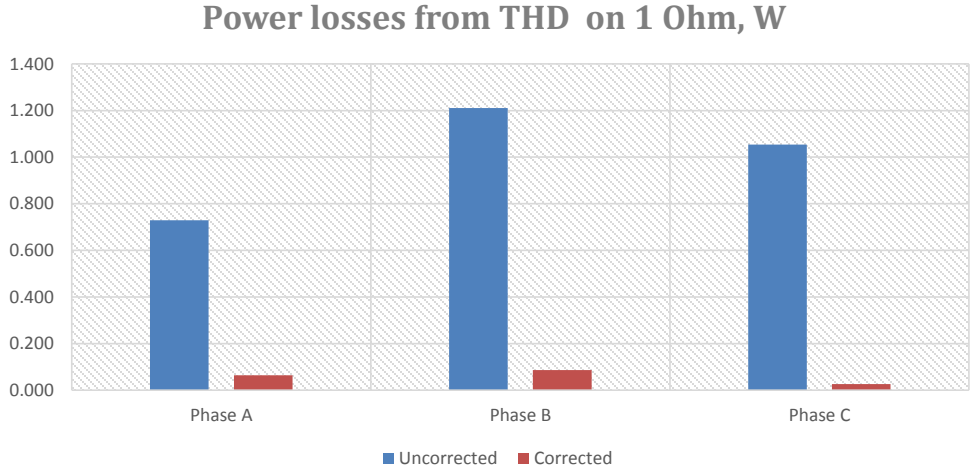




Current THD Figure 9.2a

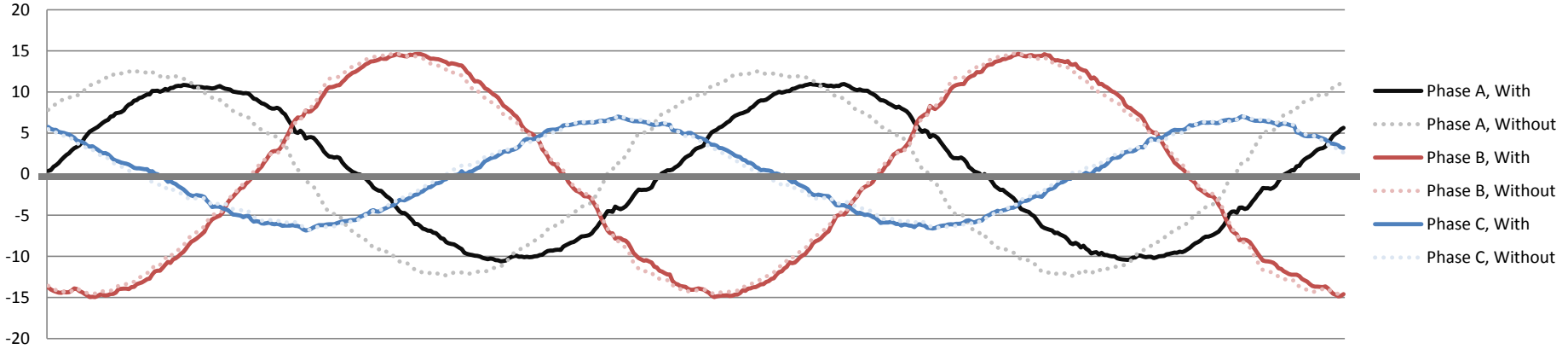
	Phase A				Phase B				Phase C				Average		Sum	
	THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*		THD, %		Power THD(1 Ohm), W*	
	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected	Uncorrected	Corrected
Avg	24.218	3.838	0.729	0.064	13.444	4.571	1.211	0.086	10.182	2.467	1.054	0.026	15.948	3.625	2.994	0.175
Max	24.953	4.305	0.766	0.079	13.656	4.944	1.256	0.100	10.263	2.624	1.076	0.029	16.258	3.903	3.058	0.202
Min	23.610	3.506	0.685	0.054	13.241	4.308	1.182	0.075	10.130	2.261	1.040	0.022	15.701	3.384	2.929	0.156



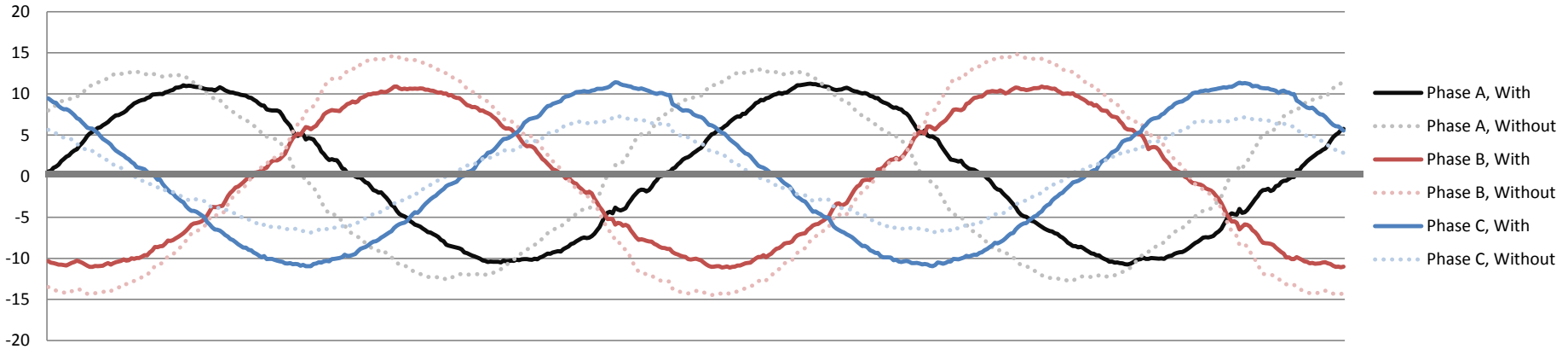


Current THD Figure 9.1b

Current curves: correction without load balancing

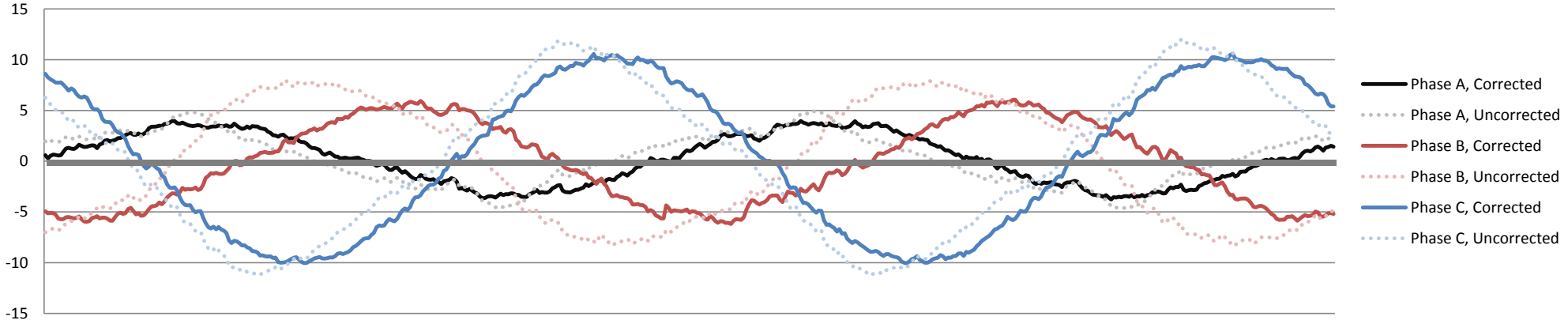


Current curves: correction with load balancing

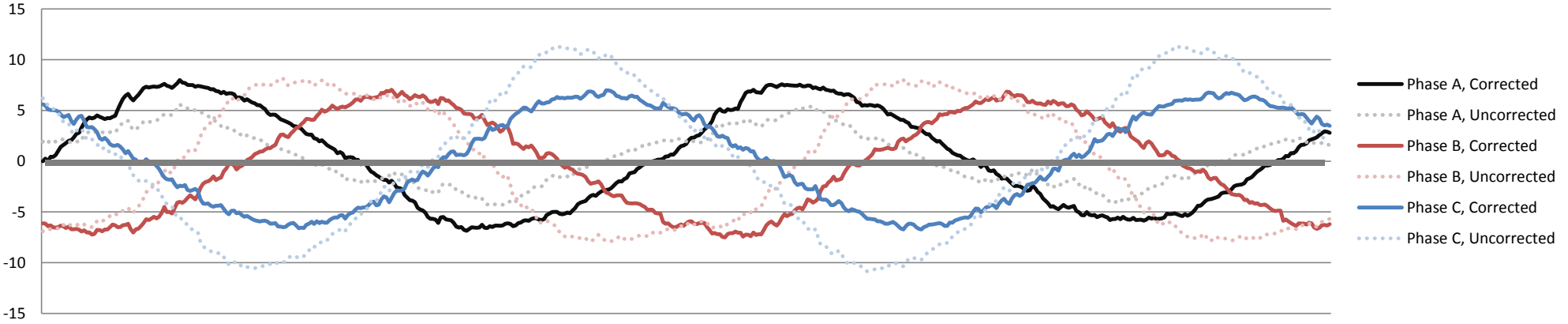


Current THD Figure 9.2b

Current curves: correction without load balancing

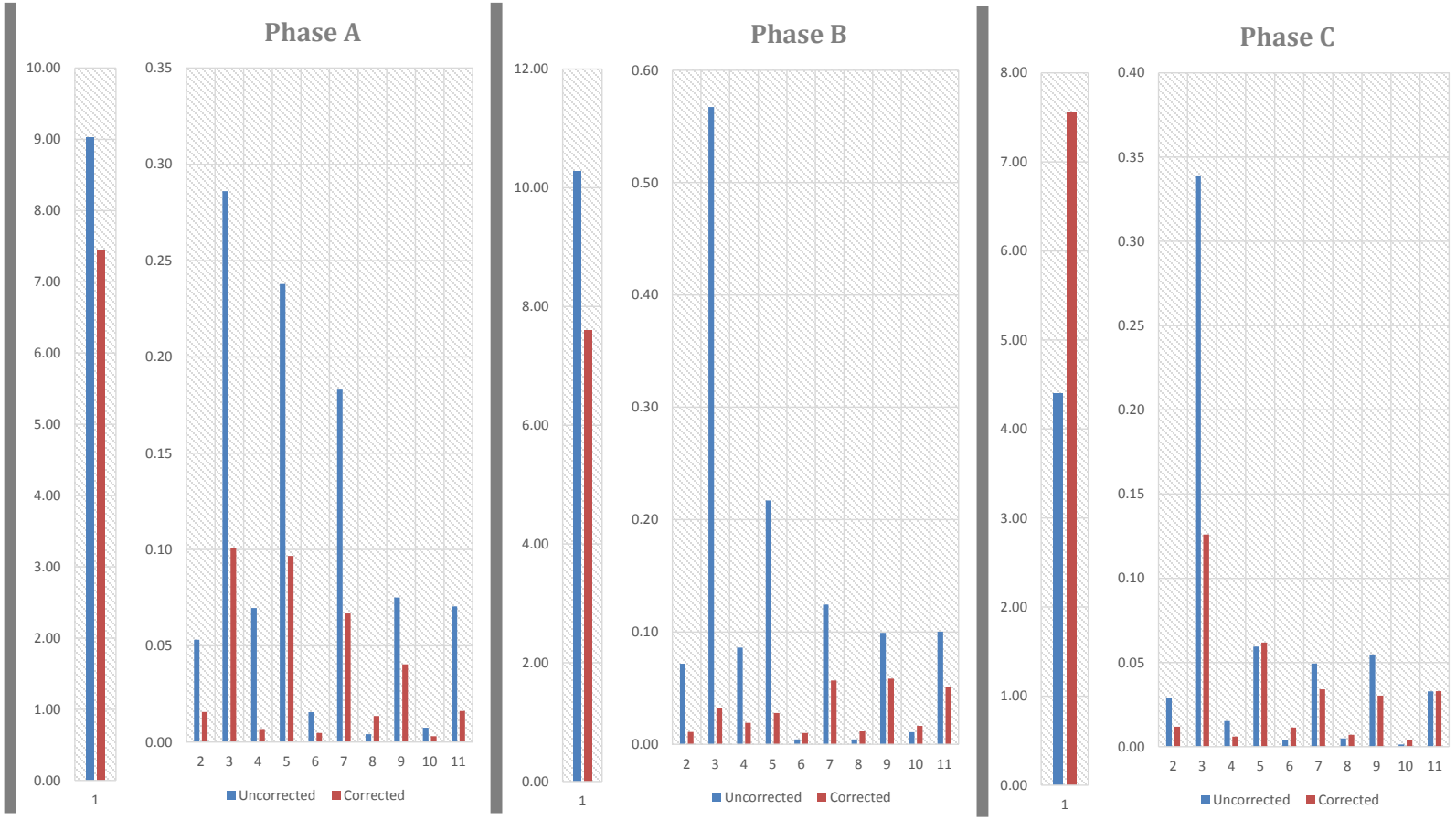


Current curves: correction with load balancing



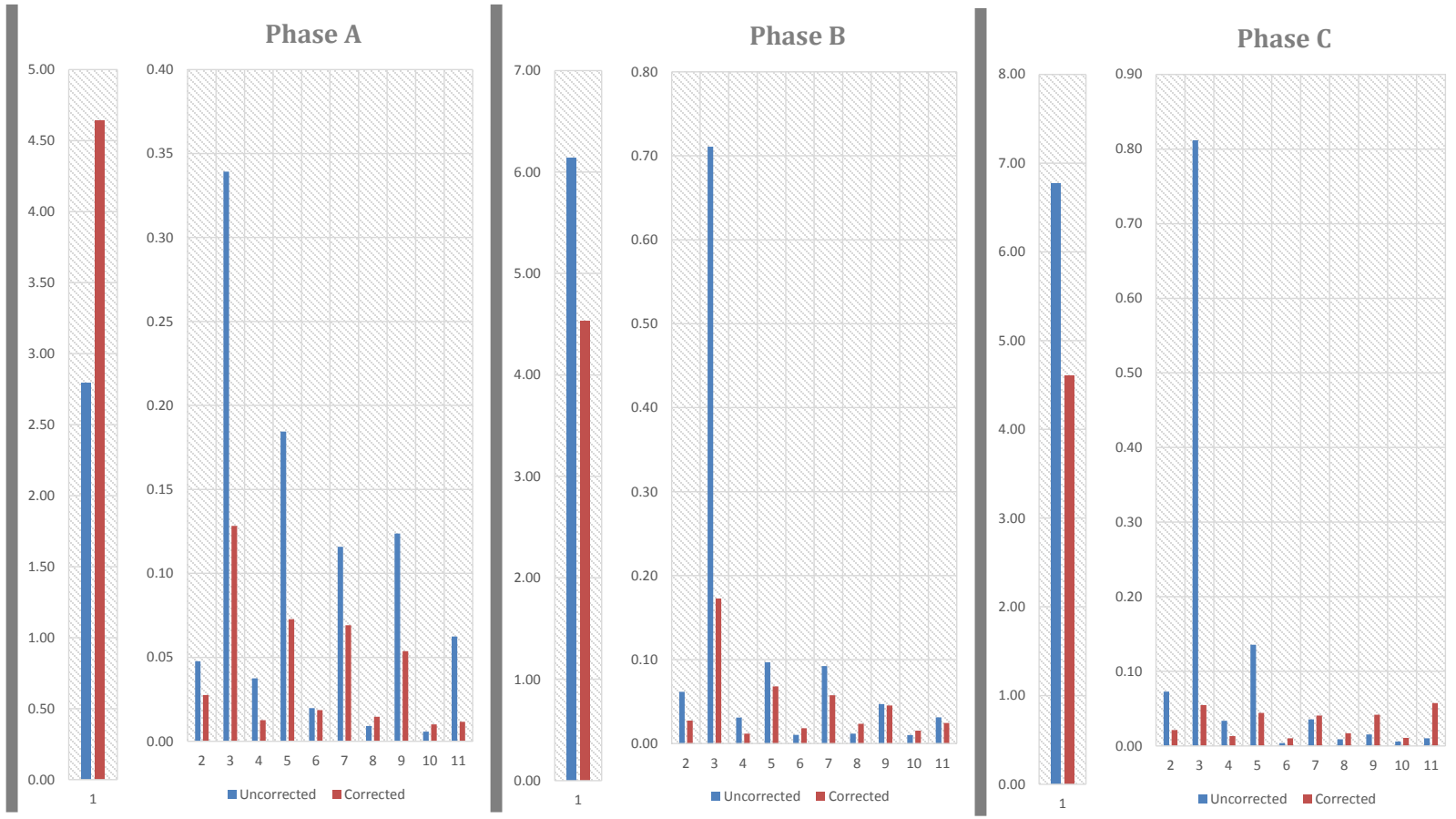
Current Harmonics Figure 10.1

		Phase A Current in Amp, rms-value											Phase B Current in Amp, rms-value											Phase C Current in Amp, rms-value										
		Harmonics number											Harmonics number											Harmonics number										
		1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11
Avg	Uncorrected	9.03	0.05	0.29	0.07	0.24	0.02	0.18	0.00	0.08	0.01	0.07	10.27	0.07	0.57	0.09	0.22	0.00	0.12	0.00	0.10	0.01	0.10	4.40	0.03	0.34	0.02	0.06	0.00	0.05	0.00	0.05	0.00	0.03
	Corrected	7.43	0.02	0.10	0.01	0.10	0.00	0.07	0.01	0.04	0.00	0.02	7.60	0.01	0.03	0.02	0.03	0.01	0.06	0.01	0.06	0.02	0.05	7.55	0.01	0.13	0.01	0.06	0.01	0.03	0.01	0.03	0.00	0.03



Current Harmonics Figure 10.2

Avg		Phase A Current in Amp, rms-value											Phase B Current in Amp, rms-value											Phase C Current in Amp, rms-value										
		Harmonics number											Harmonics number											Harmonics number										
		1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11	1	2	3	4	5	6	7	8	9	10	11
	Uncorrected	2.80	0.05	0.34	0.04	0.18	0.02	0.12	0.01	0.12	0.01	0.06	6.13	0.06	0.71	0.03	0.10	0.01	0.09	0.01	0.05	0.01	0.03	6.78	0.07	0.81	0.03	0.14	0.00	0.04	0.01	0.02	0.01	0.01
	Corrected	4.64	0.03	0.13	0.01	0.07	0.02	0.07	0.01	0.05	0.01	0.01	4.53	0.03	0.17	0.01	0.07	0.02	0.06	0.02	0.05	0.02	0.02	4.61	0.02	0.05	0.01	0.04	0.01	0.04	0.02	0.04	0.01	0.06



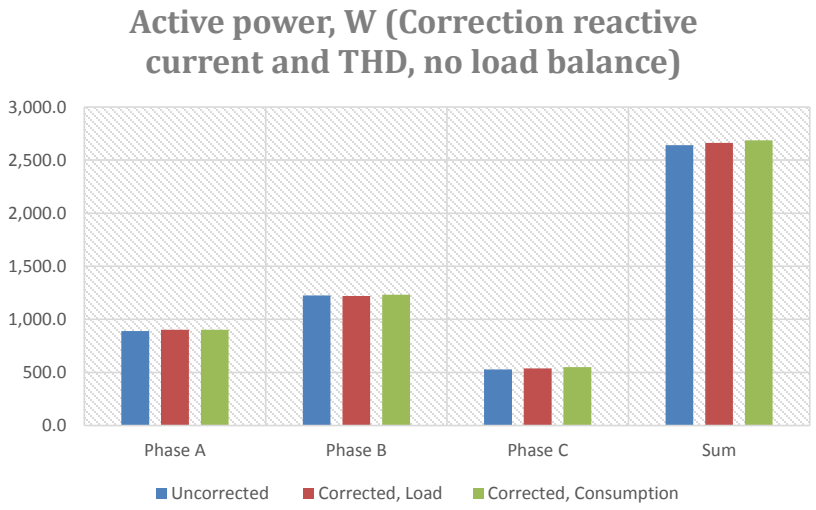
Active Power Figure 11.1

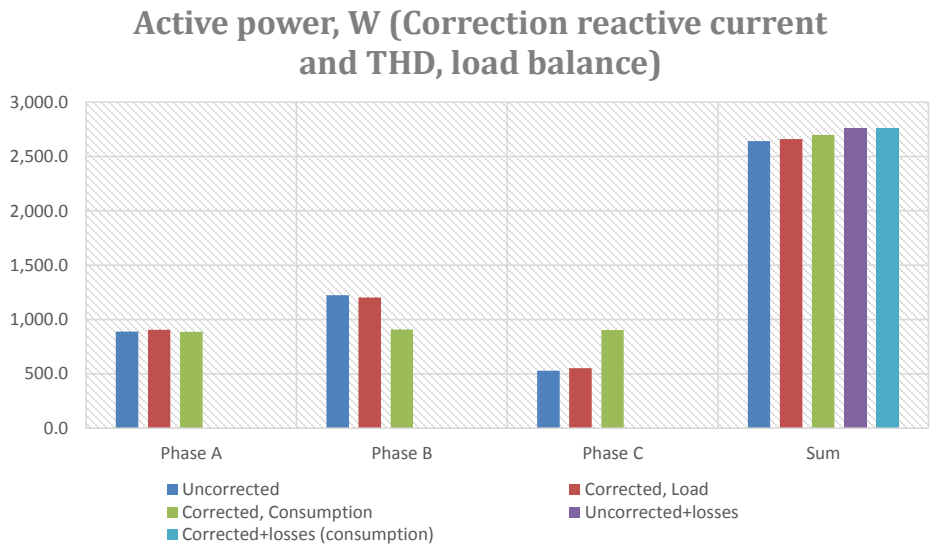
Active power for correction Uncorrected load balancing, W

	Phase A			Phase B			Phase C			Sum		
	Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected	
		Load	Consumption		Load	Consumption		Load	Consumption		Load	Consumption
Avg	889.3	902.6	902.1	1,224.4	1,219.8	1,233.2	527.8	538.9	550.1	2,641.5	2,661.3	2,685.3
Max	895.9	905.2	904.8	1,232.3	1,223.1	1,237.0	528.6	540.1	551.3	2,655.8	2,666.4	2,691.0
Min	886.0	899.1	897.5	1,220.7	1,215.5	1,228.4	526.6	537.4	548.4	2,635.4	2,654.4	2,678.1

Active power for correction Corrected load balancing, W

	Phase A			Phase B			Phase C			Sum		
	Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected	
		Load	Consumption		Load	Consumption		Load	Consumption		Load	Consumption
Avg	889.3	905.7	887.3	1,224.4	1,201.6	907.9	527.8	552.5	903.2	2,641.5	2,659.7	2,698.5
Max	895.9	911.5	891.5	1,232.3	1,208.0	912.1	528.6	554.0	907.9	2,655.8	2,671.6	2,711.6
Min	886.0	902.2	884.4	1,220.7	1,197.9	905.4	526.6	551.6	900.3	2,635.4	2,652.4	2,690.5





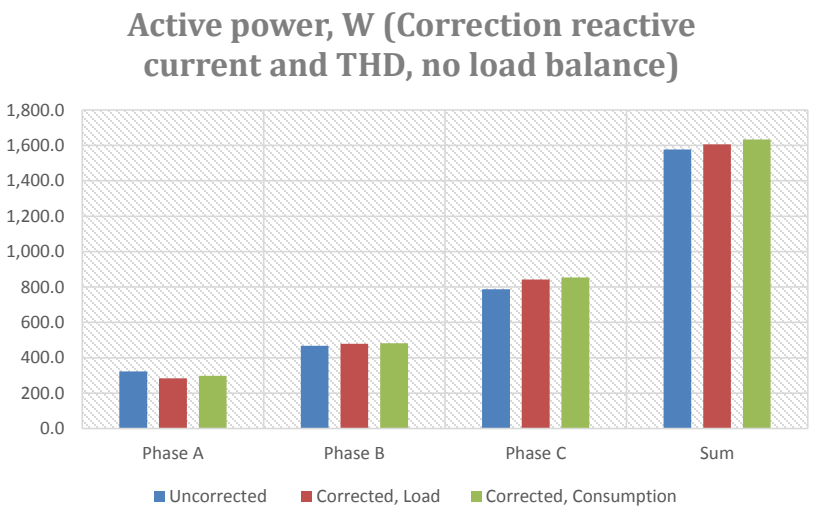
Active Power Figure 11.2

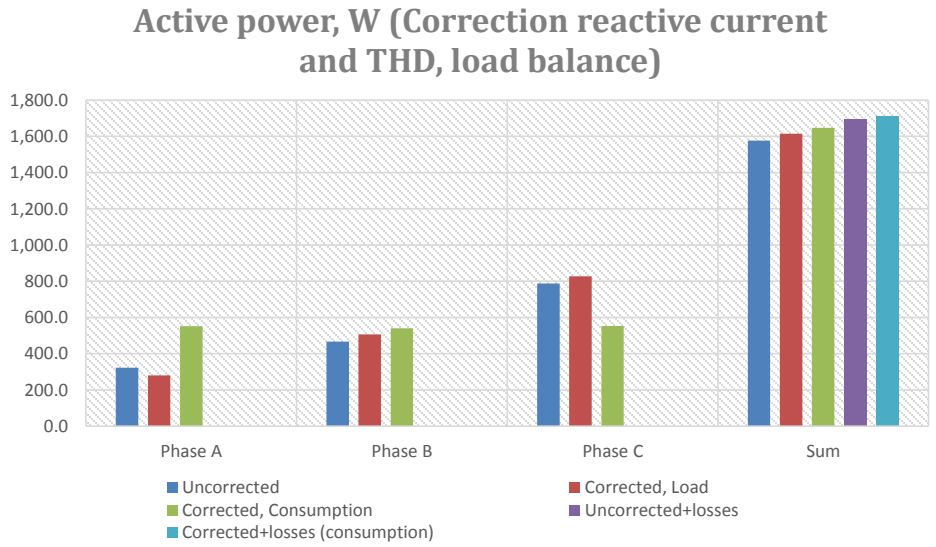
Active power for correction Uncorrected load balancing, W

	Phase A			Phase B			Phase C			Sum		
	Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected	
		Load	Consumption		Load	Consumption		Load	Consumption		Load	Consumption
Avg	322.5	284.1	297.6	466.8	479.4	482.4	787.7	842.7	853.1	1,577.0	1,606.2	1,633.1
Max	326.6	286.0	299.5	469.6	484.9	488.2	790.1	844.4	855.0	1,586.3	1,611.4	1,639.4
Min	320.4	281.0	293.8	459.5	474.5	478.4	782.6	837.5	848.1	1,563.5	1,597.6	1,625.3

Active power for correction Corrected load balancing, W

	Phase A			Phase B			Phase C			Sum		
	Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected		Uncorrected	Corrected	
		Load	Consumption		Load	Consumption		Load	Consumption		Load	Consumption
Avg	322.5	280.0	552.5	466.8	506.9	540.6	787.7	828.0	553.7	1,577.0	1,614.9	1,646.8
Max	326.6	284.1	557.6	469.6	509.9	545.4	790.1	835.5	559.1	1,586.3	1,629.4	1,660.7
Min	320.4	275.7	546.5	459.5	503.4	537.0	782.6	822.2	549.6	1,563.5	1,607.6	1,638.3





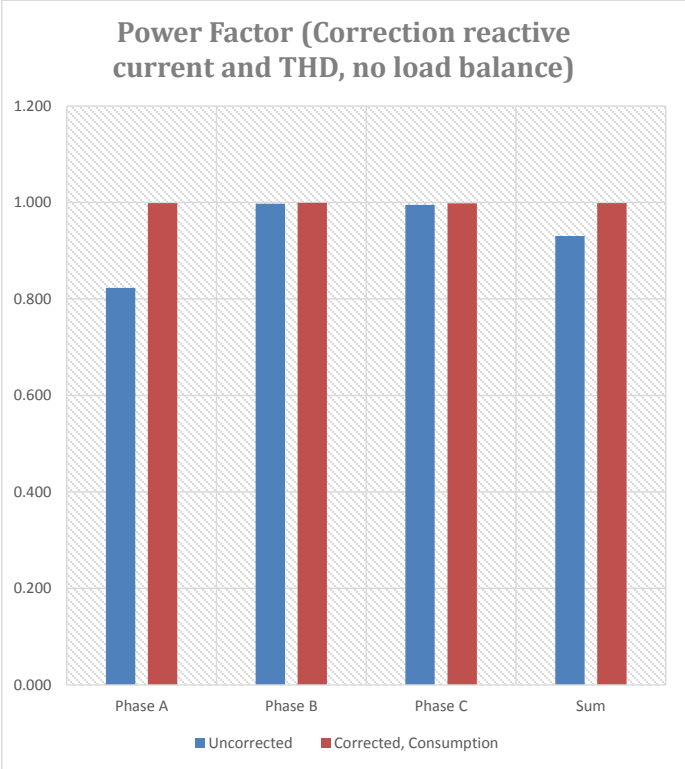
Power Factor Figure 12.1

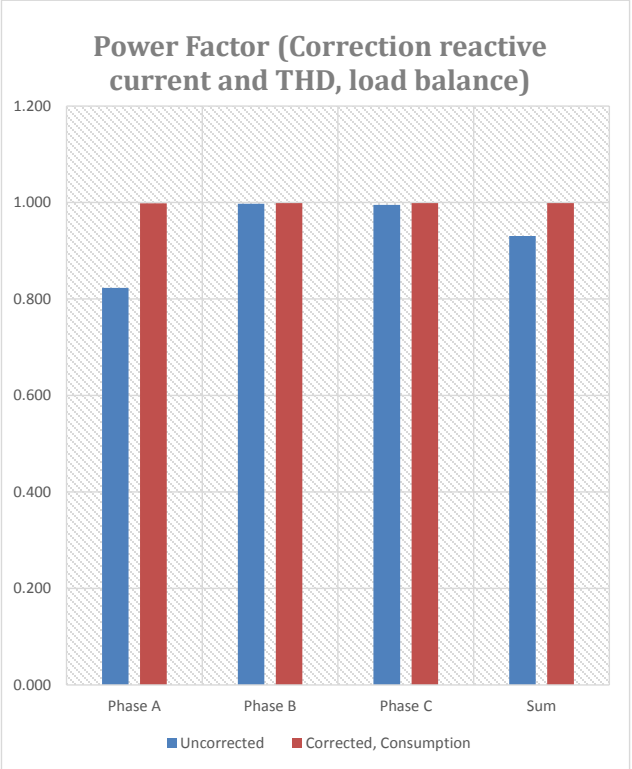
Power factor for correction Uncorrected load balancing, W

	Phase A		Phase B		Phase C		Sum	
	Uncorrected	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected
Avg	0.8232	0.9987	0.9976	0.9994	0.9952	0.9983	0.9307	0.9989
Max	0.8240	0.9987	0.9976	0.9995	0.9953	0.9983	0.9310	0.9990
Min	0.8226	0.9986	0.9975	0.9994	0.9950	0.9982	0.9305	0.9989

Power factor for correction Corrected load balancing, W

	Phase A		Phase B		Phase C		Sum	
	Uncorrected	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected
Avg	0.8232	0.9986	0.9976	0.9991	0.9952	0.9990	0.9307	0.9989
Max	0.8240	0.9987	0.9976	0.9991	0.9953	0.9991	0.9310	0.9989
Min	0.8226	0.9985	0.9975	0.9990	0.9950	0.9990	0.9305	0.9989





Power Factor Figure 12.2

Power factor for correction Uncorrected load balancing, W

	Phase A		Phase B		Phase C		Sum	
	Uncorrected	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected
Avg	0.9469	0.9833	0.6327	0.9932	0.9613	0.9988	0.8309	0.9943
Max	0.9480	0.9853	0.6350	0.9937	0.9620	0.9989	0.8321	0.9948
Min	0.9456	0.9818	0.6285	0.9928	0.9597	0.9988	0.8291	0.9940

Power factor for correction Corrected load balancing, W

	Phase A		Phase B		Phase C		Sum	
	Uncorrected	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected	**Uncorrected**	Corrected
Avg	0.9469	0.9931	0.6327	0.9953	0.9613	0.9970	0.8309	0.9951
Max	0.9480	0.9939	0.6350	0.9957	0.9620	0.9972	0.8321	0.9955
Min	0.9456	0.9926	0.6285	0.9950	0.9597	0.9968	0.8291	0.9949