Study of Grounding and UPS system at

Minnesota Correctional Facility Moose Lake 1001 Lakeshore Drive Moose Lake, MN 55767

EEA Project No. 6214
RECS Project No. 78ML0041

February 24, 2014

ERICKSEN ELLISON and Associates Inc.

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CERTIFICATIONS

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Signature

23427
License Number

Todd Peterson, PE
Print Name

February 24, 2014
Date

I. STUDY OVERVIEW

A. The facility at MCF Moose Lake has noticed some problems in their electrical system that indicate possible grounding problems in the electrical distribution system at the facility. This study is intended to review the grounding system of each building at the facility and determine if it meets current electrical code (NEC 2011) as well as safety issues and proper operation of the electrical system

B. The facility at MCF Moose Lake wants a review of their Uninterruptable Power Supply (UPS) system and recommendations for replacement of equipment, possible consolidation of equipment, improvements in reliability of the UPS system.

II. CODE REFERENCES GROUNDING SYSTEM

A. The following codes have been reviewed associated with the requirements for building electrical system.

1. National Electrical Code (NEC) 2011, especially article 250 Grounding and Bonding.

B. NEC 250-50 states that all grounding electrodes described in 250-52(A)(1) through (a)(7) that are present at each building or structure served shall be bonded together to form a grounding electrode system.

C. NEC 250-252(A) Grounding electrodes are:

(1) Metal underground water pipe
(2) Metal frame of the building or structure
(3) Concrete-encased electrode
(4) Ground Ring
(5) Rod or pipe electrodes
(6) Other listed electrodes
(7) Plate electrodes.

D. Grounding electrode conductor size is determined by table 250-66.

E. NEC 250-92 states that all raceways, cable trays, cablebus framework, auxiliary gutters service cable armor, all enclosures containing service conductors shall be bonded together.

F. NEC 250-104(A) states that the metal water piping system installed or attached to a building or structure shall be bonded to the service equipment enclosure. Note this is not the same as using the piping as the grounding electrode but rather to make sure all piping is at the same potential as the electrical ground system.

III. GROUNDING SYSTEM OBSERVATIONS

A. Service 1 (Building 50) This service voltage is 480 volts with a 1200 amp switchboard fed from a 1000 KVA dry-type transformer. There were also two other step down transformers in the main service room. This room has a new copper ground bus bar and multiple connections to it from the recent radio project. However, we could only see one small copper ground wire connected to a small water pipe in the adjacent room. This grounding system does not appear to meet current code grounding requirements.

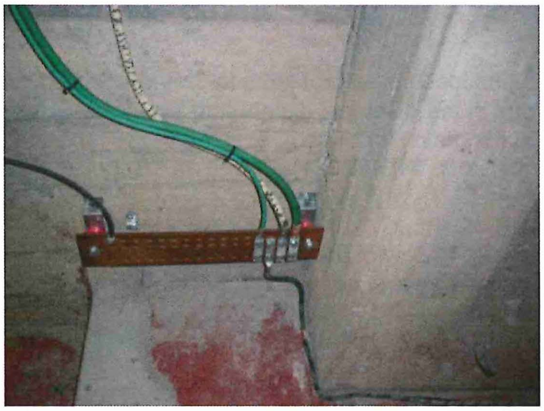

Photo 1: Bldg. 50 ground bus

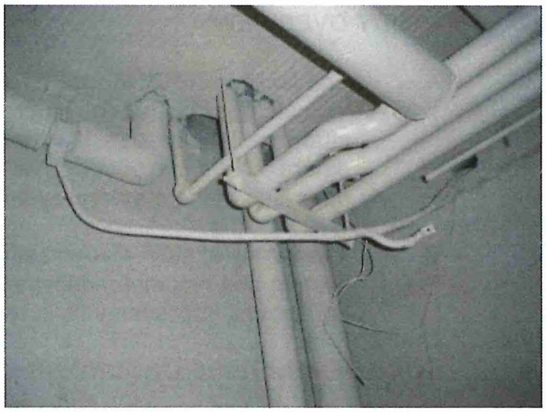

Photo 2: Bldg. 50 ground wire tied to water pipe

B. Service 2 (Fire Pump) .This service feds the fire pump through its controller directly off a transformer. Ground wires can be seen between the controller and the pump but no visible connection to ground can be seen. This grounding system does not appear to meet current code grounding requirements.

C. Service 3 (Building 60). This service voltage is 208 volts with a 1200 amp switchboard fed from a 300 KVA dry-type transformer. There were also one other step down transformer in the main service room. This room has a copper ground wires tied together at the ceiling. However, we could only see one small copper ground wire connected to a small water pipe in the corridor outside the room. This grounding system does not appear to meet current code grounding requirements.

Photo 3: Bldg. 60 ground wires tied together

Photo 4: Bldg. 60 ground wire tied to water pipe

D. Service 4 (Unit 3) This service voltage is 208 volts with a 800 amp switchboard fed from a 225 KVA dry-type transformer. There were no other step down transformers in the main service room. This room has a copper ground wires tied together on the wall. However, we could only see one small copper ground wire connected to a small water pipe in the corridor outside the room. There was also a ground wire run to the water service where it comes out of the floor. This grounding system does not appear to meet current code grounding requirements.

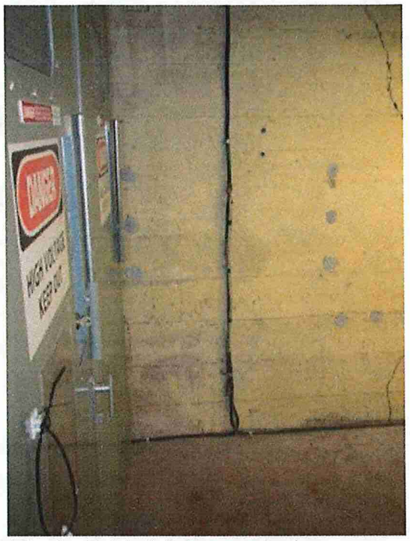

Photo 5: Unit 3 Ground wire

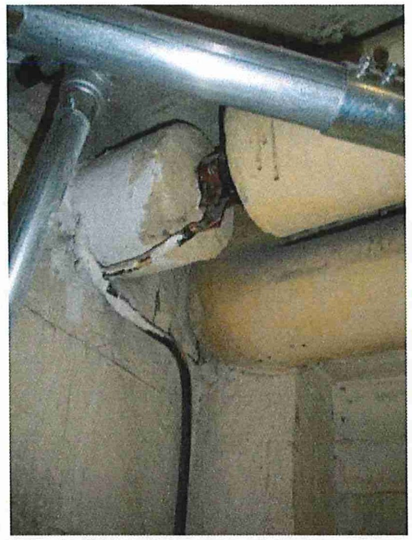

Photo 6: Unit 3 ground tied to pipe

Photo 7: Unit 3 water service

E. Service 5 (Unit 4) This service voltage is 208 volts with a 800 amp switchboard fed from a 225 KVA dry-type transformer. There were no other step down transformers in the main service room. This room has a copper ground wires tied together on the wall. However, we could only see one small copper ground wire connected to a small water pipe in the corridor outside the room. There was also a ground wire run to the water service where it comes out of the floor. This grounding system does not appear to meet current code grounding requirements.

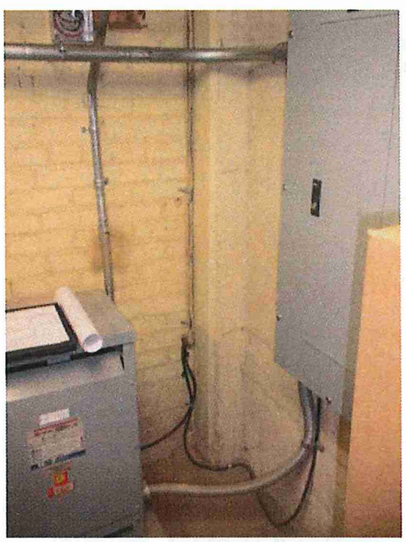

Photo 8: Unit 4 Ground wires

Photo 9: Unit 4 ground tied to pipe

Photo 10: Unit 4 water service

F. Service 6A (Unit 8) This service voltage is 208 volts with a 600 amp switchboard fed from a 112.5 KVA dry-type transformer. There were no other step down transformers in the main service room. This room has a copper ground wires tied together on the wall. There is a ground wire run to the water service where it comes out of the floor. This grounding system may meet current code grounding requirements.

Photo 11: Unit 8 Ground wires

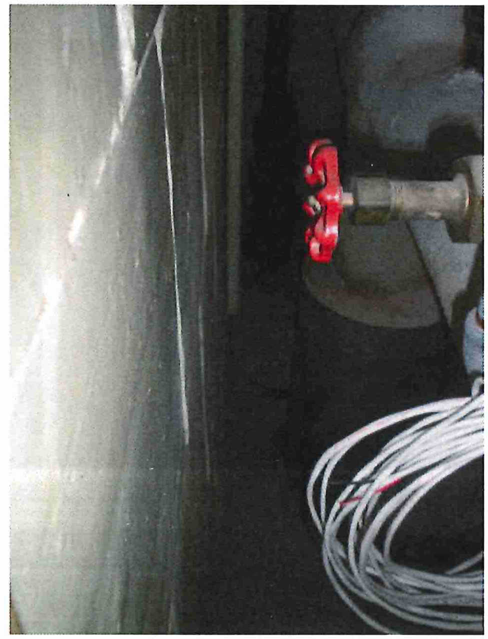

Photo 12: Unit 8 Ground tied to water service

G. Service 6B (Unit 10) This service voltage is 208 volts with a 600 amp switchboard and a 400 amp tap fed from a dry-type transformer (no size indicated). There were two other step down transformers in the main service room. This room has a copper ground wires tied together on the wall. There is a ground wire run to the water service where it comes out of the floor. This grounding system may meet current code grounding requirements.

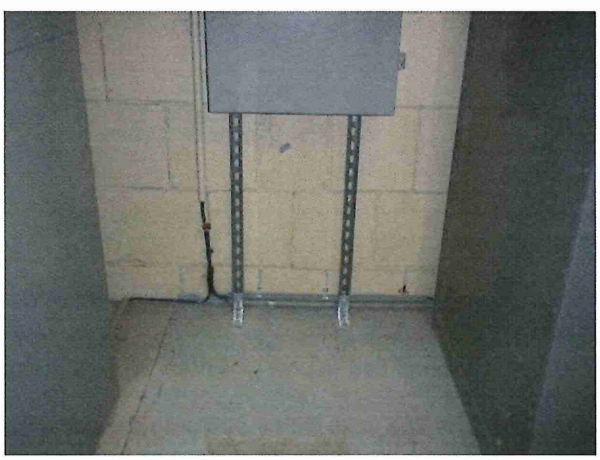

Photo 13: Unit 10 Ground wire

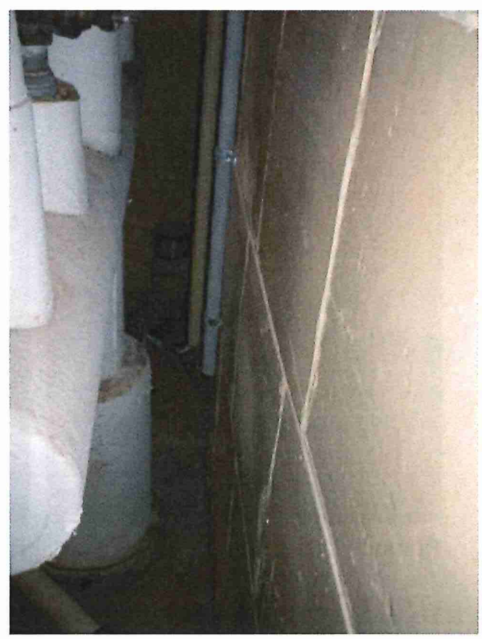

Photo 14: Unit 10 Ground tied to water service

H. Service 7 (Gym) This service voltage is 208 volts with a 500 amp panelboard fed from a 112.5 KVA dry-type transformer. There were no other step down transformers in the main service room. This room has a copper ground wires tied together on the wall and connected to a water pipe. This grounding system does not appear to meet current code grounding requirements.

Photo 15: Gym Grounds tied together at water pipe

I. Service 8 (Industry) This service voltage is 480 volts with a 2000 amp switchboard fed from a pad mounted oil filled transformer. There were one other step down transformer in the main service room. This building is of newer construction and ground wires were not visible. We would expect there to be ground rods at the transformer pad and this would meet current codes.

J. Service 9 (Power Plant) This electrical room has three transformers feeding different switchboards. Ground wires are tied to a wall mounted ground bus which is tied to the water service. This building may meet current codes.


Photo 16: Power Plant Ground bus


Photo 17: Power Plant Water service connection

IV. GROUNDING SYSTEM RECOMMENDATIONS

A. Since it appears that several of the services at MCF Moose Lake do not meet current codes, and there are inconsistencies between the different services, we recommend that grounding be redone at each service so that all services are consistent and done to meet current codes.

B. As NEC 250-252(A) requires that all present types of grounding electrodes be connected, we feel that each service should be connected to:

- Underground metal water pipe
- Building structural steel
- New ground rods installed below the concrete floor (one per service).

The other electrodes listed do not appear to be present so they are not required. A new copper ground bus should be provided on the wall of each electrical service room (unless one already exists) and all grounding electrodes should be tied to this bus along with raceways and enclosures.

C. As NEC 250-104(A) requires interior metal water piping system to be bonded to the service, we recommend that each present system including domestic cold water, domestic hot water, and fire protection piping all be bonded to the new ground bus in each electrical room.

D. We recommend that all service grounds in the interconnected building (not including Industry and Power Plant) be interconnected with a new properly sized copper grounding conductor

V. UPS SYSTEMS OBSERVATIONS

A. Currently there are multiple UPS's located in several rooms in the Administration Building. There are UPS's of many different sizes. Some loads which are dual corded have one UPS connected to each cord for redundancy. All UPS's are located within the rooms where they serve loads. The UPS's are of different manufacture and age.

B. The following UPS's were observed at the facility:

Master Control

- (1) 10 KVA UPS online feeding panelboard by security equipment rack
- (1) 12 KVA old UPS unit is off for a backup
- Remote batteries located in basement below stairs.
- UPS's fed from EFLP-50 1H1 across the hall from Master Control.

T Control Room

- No UPS at this time, but one could be necessary in the future.

Phone Room (Basement)

- (1) 1000 VA in rack
- (1) 750 VA in rack
- (1) 700 VA in rack
- (1) 680 VA for phone switch
- (4) 1500 VA for radio equipment
- (1) 2000 VA for inmate phone system
- (1) 600 VA for DVR
- No distribution, all loads are plugged directly into UPS's
- All equipment fed from EFLP50-BH1

Computer Room (Third floor)

- (3) 1000 VA in racks
- (1) 3000 VA in racks
- (1) 6000 VA in racks

- (1) 750 VA on floor
- (1) 700 VA on floor
- (1) 2000 VA on floor
- (2) 3000 VA in racks – Dual corded equipment one is redundant
- (4) 1000 VA on floor – Dual corded equipment one is redundant
- No distribution, all loads are plugged into UPS's
- All equipment fed from panel LP50-3H1A on third floor, panel is full with little room for expansion

C All UPS's are in the rooms there they serve loads so they are contribution to the heat gain of the space. All heat generated needs to be removed by cooling system. It is also noted that rooms do not have adequately sized backup cooling systems, if the main unit fails, the backup cannot keep up with properly cooling the room.

VI. UPS RECOMMENDATIONS

A. There are different schools of thought when it comes to UPS design. Having many smaller units as is the case does give you some protection against a major failure taking down all the equipment. The 'all eggs in one basket' approach. However, this approach is more expensive as each unit must be maintained separately and is more costly to keep and maintain. There is no diversity to take advantage of, each UPS must be sized for its load and if redundancy is important the there must be double the UPS capacity. We recommend consolidating UPS into one central location and having one large unit rather than many smaller ones.

B. Having the UPS's in each room takes up valuable space and adds additional heat gain to the space. We recommend providing for a central UPS location outside of the existing equipment rooms.

C. Having redundancy in electrical power is desirable in many types of facilities and correctional facilities certainly have a need for this redundancy. The question is how much redundancy is necessary, and how much redundancy can be afforded. We will break down or recommendations into phases that can be implemented separately, or not at all if not needed.

D. Phase 1 – a single UPS for all the sensitive equipment. Provide a single UPS unit in its own dedicated space would be a real benefit for this facility. We investigate a space in the basement, one side of the plan room is open and could be setup as a UPS room. We recommend installing a UPS that is modular and expandable. For example, from the above loads we calculate that there is just over 42 KW of UPS capacity currently in the facility. So a UPS with 100 KW of capacity made up of 10 KW modules could be specified. In the beginning, six modules could be provided with one module being a redundancy module would give the facility 50 KW of UPS capacity in an N + 1 configuration. This means that if any one of the six modules were to fail, they would still have the full 50 KW of capacity. Modules are hot swappable so the failed module could be replaced without taking down the UPS system. In these UPS's battery modules are also hot swappable and modular so the amount of required run time can be included and battery replacement can be done with the system on-line. If future loads grow the system can have additional modules added to increase UPS's capacity up to 100 KW while maintaining the N + 1 protection. This helps eliminate the 'all eggs in one basket' approach because the new UPS is more robust and maintainable than the current individual UPS's. With locating the UPS in its own room, we would provide a UPS panelboard in the room and connect the loads to the panel. There is currently an existing panelboard in Master Control and the Phone Room that could be reused and would need to be connected to the new UPS. New Panelboards in the Computer Room and possible T Control would be installed. The UPS room would need cooling for the UPS unit itself but removal of the UPS's from the other rooms will free up cooling capacity in those rooms. Cooling and humidity requirements for UPS rooms are typically not as stringent as for computer rooms. Two DX cooling units (one for redundancy since UPS can never be shut down) are being considered. However, other options such as dry coolers or units with an economizer could be considered to take advantage of free cooling when temperature is below 40 degrees could be considered for energy savings.

MCF Moose Lake indicated they feel the UPS in Master Control will need to be replaced soon as they are having trouble getting replacement parts. We can split this phase into two parts, 1A and 1B. Phase 1A would involve installing the 100 KW rack with only two modules for 10 KW capacity with n+1 redundancy. We would provide the distribution panelboard and only connect to the panel in Master Control. This would allow for removal of the existing Master Control UPS. Phase 1B would the involve installing the remaining 40 KW worth of UPS modules, connecting the telephone room panel and installing a new panel in the Computer Room. Cooling could be addressed with one unit being installed in Phase 1A and the redundant unit installed in Phase 1B.

E. Phase 2 – add a second UPS for redundancy. A second UPS same as installed in Phase 1 could be installed, also in the basement but possibly in a separate room if desired to provide more reliability. New panelboards would be installed in each room and dual corded equipment would have one cord connected to each system. Data Centers typically color code their systems such as Red and Blue and each piece of equipment has a connection to the Red system and one to the Blue system. Each UPS is still modular and hot swappable for easy maintenance as well.

E. Phase 3 – Provide separate electrical feeder to one or both UPS's. Again to increase reliability it would be possible to connect the above UPS's each to a separate service in the building or to bring in a new feeder from the Power Plant to feed one of the UPS's. Again if the UPS's are feed off separate services than a problem or disruption to one service, say a transformer failure would not cause all UPS input power to be lost. There is space for additional circuit breakers in the Power Plant switchgear and this would allow for a new breaker and feeder to feed one of the UPS's directly off this switchgear reducing the possibility of an electrical problem elsewhere in the Administration Building from affecting the important electronics equipment. It is noted that the existing generator control system would need to be modified for this option. The facility has noted some troubles in making modifications as well as obtaining spare parts for their current generator control system It should be considered that this system be upgraded either before or during this phase.

F. Battery run times estimated to be 10 minutes at full load should be sufficient, however, the UPS being considered has modular battery units that are hot swappable like the UPS modules and additional run time could be added at any time. We are pricing and additional 10 minutes as an alternate.

G. Computer Room and Phone Room additional cooling. Master Control has been programmed to be upgrade which would improve and provide redundant cooling in the space. It should also be considered to provide a backup cooling unit in the Computer Room and Phone Room to provide adequate cooling in the event of a failure or planned maintenance of the current cooling units in these spaces.

VII. COST OPTION SUMMARY

All estimates are figured on 2014 dollars and include a 5% inflation factor to the midpoint of construction. It should be noted that if these projects are not begun on 2014 that additional inflation should be added to the numbers based on the number of years past 2014 the work is budgeted.

Grounding Cost Estimate	
Building grounding	$ 51,215
Ground Ring	$ 28,200
Subtotal	$ 79,415
General Conditions	$ 9,530
Overhead and profit	$ 3,558
Construction Escalation	$ 4,625
Total Construction Cost	$ 97,127
Design fees	$ 10,000
Total Project Cost	**$ 107,127**

UPS Estimate	Phase 1A	Phase 1B	Phase 2	Phase 3
Construction estimate	$ 93,059	$ 59,906	$ 192,016	$ 721,828
Subtotal	$93,059	$ 59,906	$ 192,016	$ 721,828
General Conditions	$11,167	$ 7,189	$ 23,042	$ 86,619
Overhead and profit	$4,169	$ 2,684	$ 8,602	$ 32,338
Construction Escalation	$5,420	$ 3,489	$ 11,183	$ 42,039
Total Construction Cost	$113,815	$ 73,268	$ 234,843	$ 882,825
Design fees	$10,000	$ 6,000	$ 16,000	$ 30,000
Total Project Cost	**$123,815**	**$ 79,268**	**$ 250,843**	**$ 912,825**
Cost estimate based on 10 min batteries To increase battery run time to 20 min add:	$ 2,000	$ 6,000	$ 6,000	

Prices are modular to increase from 20 minutes to 30 minutes would be the same amount again.

Cost to add a panel and feeder to T Control would be an additional $ 25,000.

Additional Estimates	Computer Room AC	Generator Controls Upgrade
Construction estimate	$ 25,850	$ 200,000
Subtotal	$ 25,850	$ 200,000
General Conditions	$ 3,102	$ 24,000
Overhead and profit	$ 1,158	$ 8,960
Construction Escalation	$ 1,506	$ 11,648
Total Construction Cost	$ 31,616	$ 244,608
Design fees	$ 7,000	$ 12,000
Total Project Cost	**$ 38,616**	**$ 256,608**

VIII. MEETING MINUTES

All minutes are included in this report as attachments.

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MEMORANDUM

DATE:	December 10, 2013		
PROJECT:	MCF Moose Lake Grounding and UPS Study	EEA PROJECT #	6214
MEMO BY:	Todd Peterson, PE	RECS PROJECT #	78ML0014
SUBJECT:	Summary from site survey		
MEMO TO:	Greg Anderson, Keith Beal – MCF ML; Peter Hargreaves – RECS, Bill Montgomery – DOC-CO		

Greg Anderson and Todd Peterson met onsite to review the project scope of work and conduct a site survey. The following is a summary of our results:

Grounding:

Scope of work is to review grounding at each building electrical service to determine if grounding meets current electrical code as well as determine and safety issues.

We looked at all 8 electrical services off the east and west loops, the fire pump service, and the facility incoming electrical service at the Power Plant. In general we found the condition of the grounding at each service to be questionable and very confusing. EEA documented with photographs and will review this information, review the current version of the National Electrical Code (NEC) and make determination on the existing condition of grounding as well as make recommendations for solutions to address any shortcomings

Greg noted that MCF Moose Lake has asked the local electrical inspector for an opinion of their grounding but he would not give an opinion, so an engineer is being brought in to review and make a recommendation.

During recent fire alarm system upgrade, MCF Moose Lake had difficulties getting communications between two fire alarm panels with their power connected to different services. This was a problem until a grounding jumper wire was installed between each panel which quieted down substantial electrical noise on the cable shields.

UPS:

Scope of work is to review existing Uninterruptable Power Supplies (UPS) at the facility and determine what is the best option for UPS going forward that will give the most reliable power and cheapest and easiest maintenance and service abilities.

Noted no UPS at T Control, UPS power would be nice at this location

Noted one UPS in Master Control with batteries downstairs. UPS feeds one panel that Greg would like to relocated to the basement. All power comes from emergency panel across the sallyport from Master Control.

Noted 10 UPS's in the phone room, basically one UPS for each rack or piece of equipment. All power comes from an emergency panel in the phone room.

Noted 12 UPS's in the Computer room, most of the equipment is dual corded and each cord is connected to a separate UPS. Basically there are two redundant UPS for each load. Power comes from a normal power panel down the corridor and is mixed in with loads from the entire third floor.

EEA

Noted there is only one cooling unit for this room, there is the old unit for backup but it is too small to be of much good.

Discussed that a good option would be to have a central UPS system that is expandable and redundant to provide a good source of UPS power to all loads noted above. Reviewed a room below Master Control that would be a good location for a central UPS. Also noted in would be good to have redundant power from the Power Plant Service to feed the UPS's. This might take some rework of the main electrical gear.

SCHEDULE:

EEA will have a draft report including recommendations by January 20, 2014

We will schedule a meeting to review the draft report

EEA to issue final report after this meeting, about mid-February

MISC:

Greg gave EEA a copy of scanned drawings from the 1995 electrical upgrade plus a drawing of the electrical loop and Power Plant switchgear.

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* * * End of Memo * * *

EEA

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and Associates Inc.

CONSULTING ENGINEERS
MEMORANDUM

305 SECOND STREET NW ■ SUITE 105 ■ NEW BRIGHTON, MN 55112-3279 TEL 651-632-2300 FAX 651-632-2397

DATE:	February 6, 2014		
PROJECT:	MCF Moose Lake Grounding and UPS Study	EEA PROJECT #	6214
MEMO BY:	Todd Peterson, PE	RECS PROJECT #	78ML0014
SUBJECT:	Study draft review meeting		
MEMO TO:	Greg Anderson, Keith Beal – MCF ML; Peter Hargreaves – RECS, Bill Montgomery – DOC-CO		

Keith Beal, Greg Anderson and Todd Peterson met onsite with Peter Hargreaves and Bill Montgomery via telephone to review the draft report sent out by EEA on January 21. The following is a summary of our results:

Grounding:

Upon review of each facility service and review, EEA has determined existing grounding does not meet current code. It cannot be determined that each service has a good grounding electrode conductor and the connections to water piping are inadequate. Also it makes good engineering sense to EEA that all these services in the interconnected buildings have their grounds interconnected so that each building ground is at the same potential.

Drawings by EEA show a proposed grounding system at each service where there is a grounding electrode conductor to water service where it comes out of the ground, a grounding electrode is provide at each service, and if applicable, building steel is connected. Also we recommended bonding each building water piping system: hot, cold, and fire protection as well as a ground bus in the building telecommunications room(s).

EEA will complete cost estimate in the final report.

UPS:

Currently there are 26 UPS's between Master Control, Phones Room and Computer Room. EEA is recommending a single central UPS that is modular, expandable and has N+1 redundant modules. This could be put in a central room below Master Control which will free up both space and cooling capacity in the equipment rooms. UPS room needs to be cooled as well but not as tightly as equipment rooms.

Current UPS capacity is approximately 42 KVA, EEA is proposing a unit that can ultimately provide up to 100 KVA in 10 KVA increments (see attached cut sheet).

EEA presented a phased approach, a kind of good, better, best scenario for providing redundant power to the critical loads in these three rooms.

- Phase 1 would provide a single UPS (100 KVA frame with 50 KVA modules installed) in a room below Master Control. This UPS will feed panels in each room, and the panels will feed the equipment. Master Control and Phone Room already have the panels in place, one would need to be installed in the Computer Room.
- Phase 2 would be to add a second UPS, same size as the first one, possibly in a separate room in the basement. Most of the critical equipment is dual corded (equipment has two redundant power supplies each with its own cord and plug). Each piece of equipment is connected with one plug to each UPS. In this approach, failure of one UPS does not take down the entire critical load system.

- Phase 3 would feed the second UPS on a new separate feeder from the Power Plant. IN this approach, a failure of the distribution system feeding one UPS would not take down both UPS's.

MCF Moose Lake noted they are really concerned about the UPS in Master Control and may need to address this very soon. EA suggested splitting Phase 1 onto two parts. Phase 1A would be the 10 KVA UPS frame with only 10 KVA modules and would feed Master Control only. Phase 1B would be the remaining 40 KVA modules and feeding Phone Room and Computer Room. All agreed this would be a good idea.

The UPS selected by EEA has battery modules that are also modular and expandable. Discussed how much battery run time the facility needs. MCF ML noted they have full generator backup for their facility, and the utility substation near the facility also has full generator backup. Their power is reliable. It was felt that 10 minutes of battery which is standard would be sufficient, but EEA will also get prices for 20 minutes of battery as well.

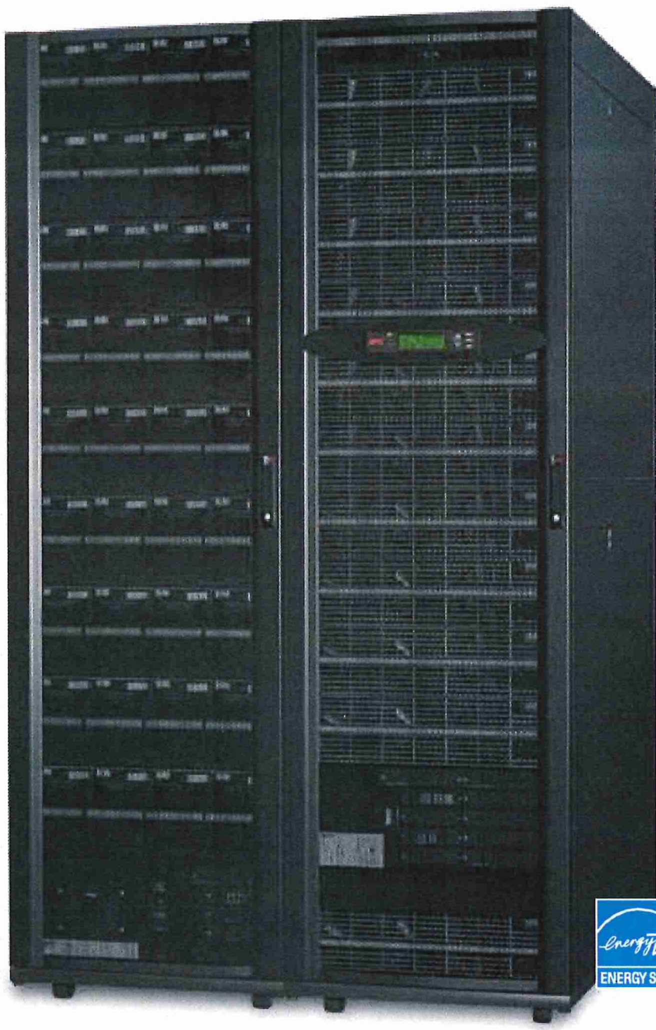
EEA will complete cost estimates in final report.

* * * End of Memo * * *

Symmetra PX 100 kW

Scalable from 10 kW to 100 kW

Modular, scalable, high-efficiency power protection for data centers



High-performance, right-sized, 3-phase power protection with high efficiency and availability for small and medium data centers or high-density zones

- Fault-tolerant (N+1) design for the highest level of availability
- High-efficiency power modules (95% efficiency)
- Hot-swappable power and battery modules for safe expansion
- ENERGY STAR® qualified
- Space-saving, high-density design
- Modular batteries with integrated monitoring
- Hot-swappable modules for fast mean time to repair
- Rack-based for agility and aesthetics
- Lowest total cost of ownership

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Features and benefits

The APC™ Symmetra™ PX 100 kW is a world-class, high-efficiency, ENERGY STAR qualified power protection system designed to cost-effectively provide redundancy and high levels of availability in a two-rack footprint. The hot scalable Symmetra PX 100 provides up to 100 kW (10 – 90 kW N+1) of modular power protection for 208 V deployments, and hot-swappable battery modules reduce mean time to repair (MTTR). The Symmetra PX 100 UPS can be paired with APC power distribution solutions that accept 600 V, 480 V, or 208 V input and distribute 208 V output, making it a flexible solution for data centers with any input voltage.

Seamlessly integrating into today's state-of-the-art data center designs, the Symmetra PX 100 kW is a cost-effective power protection system for your data center. Made up of hot-swappable power modules, battery modules, a static bypass, and intelligent management modules, this architecture can scale power and runtime in increments of 10 kW up to 100 kW as demand grows, or when higher levels of availability are required in your data center. Self-diagnostic capabilities enhance the manageability of the Symmetra PX 100 kW and increase overall data center reliability.

The Symmetra PX family serves as the core power train that drives APC InfraStruxure™ systems for small, medium and large data centers. Standardized, factory-assembled modules mitigate the risk of human error during installation or routine maintenance procedures, and the Symmetra PX 100 kW fits seamlessly onto the data center floor or in the back room. If a module requires replacement, a mean time to repair of less than 10 minutes enhances availability. In two standard APC NetShelter™ SX racks, the Symmetra PX 100 kW delivers the high availability, extreme agility, and low total cost of ownership you have come to expect from the Symmetra PX family.

Symmetra PX 100 kW features

Availability
Hot-scalable 10 kW power modules

Redundant intelligence module

Hot-swappable power, battery and intelligence modules

Hot-swappable static bypass switch

Self-diagnosing, field-replaceable modules

Toolless module replacement

Scalability
Adaptable 10 to 100 kW power capacity

N+0 or N+1 redundancy

Extended battery runtime available

Manageability
Embedded network management

Remote access over HTTP, HTTPS, Telnet, SSH, SNMP

Local access at PowerView™ display interface

Configurable alarm notifications

StruxureWare™ Data Center Expert compatible

Total Cost of Ownership (TCO)
Unity power factor corrected

Up to 95% efficient

Integrated monitoring of battery modules

Flexibility
Compatible with modular, configurable and iBusway™ for data center power distribution solutions

Integrates into existing power distribution solutions if they match the UPS requirements

Typical Applications
Small/medium data centers

High-density zones of large data centers

Symmetra PX 100 features

1 High-Density Footprint
With 100 kW of power protection and runtime supplied in the compact footprint of two standard APC NetShelter SX racks, your load is protected by a mere 14 square feet of UPS equipment, allowing you to reclaim floor space for your IT equipment.

2 Main Intelligence Module and Redundant Intelligence Module
Backup for the hot-swappable main intelligence module guarantees the maximum possible availability for your system.

3 Hot-Swappable 10 kW High-Efficiency Power Module
High-efficiency power modules reduce power and cooling costs, saving you money while delivering the optimal power protection your data center deserves.

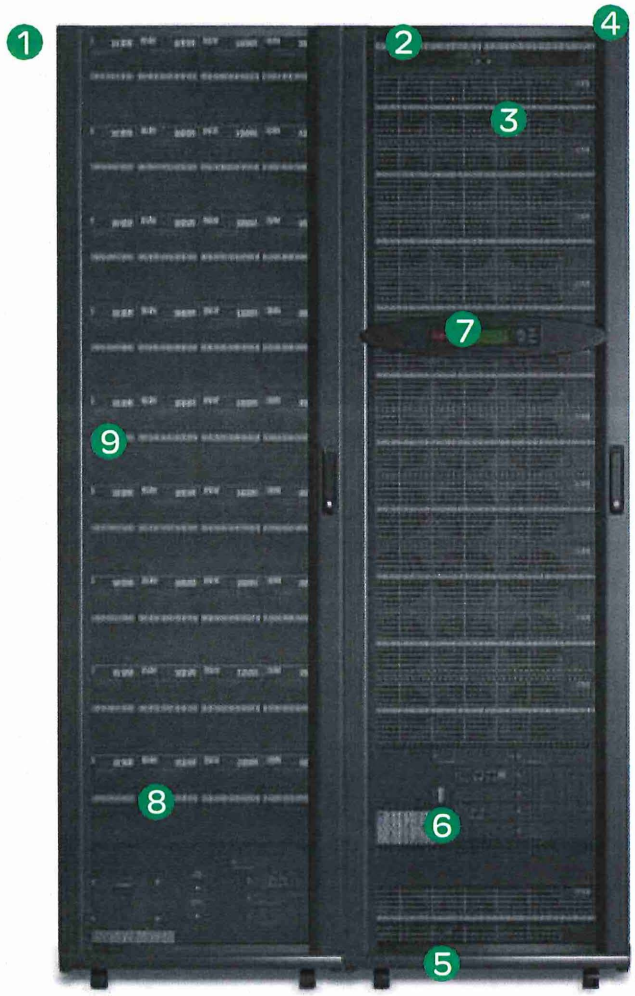
4 Dual-Mains Input
Dual-mains input allows for top or bottom feed connection to two separate power inputs for increased availability.

5 Built-In Static Bypass Switch
The hot-swappable static bypass switch transfers the load to utility power without interruption in case of heavy overload or faulty conditions, and ensures that even in 125% overload conditions, the data center remains operational.

6 Embedded Network Management Card
Provides UPS status and event notification to simplify UPS and PDU management. Two SmartSlot™ positions support dry contact, environmental monitoring, and building management system (Modbus/Jbus) cards.

7 LCD Display Interface
Offers a clear text-based overview of alarms, status data, and system configuration options in a central location.

8 Hot-Swappable Battery Module
Connected in parallel for increased availability, these hot-swappable battery modules feature advanced battery monitoring and temperature-compensated battery charging that extends battery life. Hot swappability lowers the cost of replacement and mean time to repair (MTTR). Up to four battery frames can be installed for longer run times.



9 Advanced Battery Management
With advanced monitoring capabilities, Symmetra PX 100 kW UPS detects failing battery units before they become a problem — no add-on battery management system necessary. Each battery unit in the battery module records its battery performance and monitors its temperature, reporting this data to the UPS. The Symmetra PX 100 also continually calculates the battery charge percentage and discharge characteristics. During utility power failure or battery self-test, the UPS performs battery diagnostics on each battery unit and generates an alarm if significant performance deviations are detected.

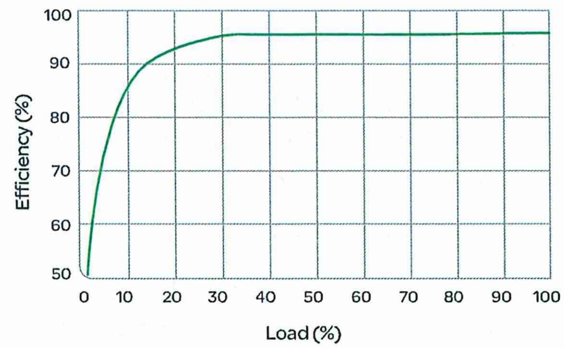
Symmetra PX 100 features (continued)

Best-In-Class Energy Efficiency

APC by Schneider Electric™ is proud to be the first company whose UPSs earned the ENERGY STAR — and our tradition of high-efficiency performance continues with the Symmetra PX 100 kW. Symmetra PX 100 kW is the most efficient modular UPS in its class with up to 95% efficiency, reducing your operating costs and carbon footprint, making it the eco-conscious core of a modern data center.

The ENERGY STAR program is aimed at reducing pollutants caused by the inefficient use of energy, while also making it easy for consumers to identify and purchase the most energy-efficient products. The ENERGY STAR program distinguishes UPS systems whose efficiency ratings are in the top 25% of the market. Qualified UPSs perform with excellence at 25, 50, 75, and 100% load levels, as verified by an independent certification body. By requiring consistent measurement methodology and the publication of test results, the ENERGY STAR program empowers consumers to make informed UPS comparisons.

Energy use/efficiency
APC Symmetra PX 100 kW 208 V, SY100K100F



Curve fit to measured efficiency data. All measurements taken in normal operating mode, at typical environmental conditions, with nominal electrical input and balanced resistive load. (PF = 1.0) output

The Symmetra PX 100 kW efficiency curve is nearly flat down to 25% load, saving power and cooling costs and significantly reducing your overall TCO.

Modular Batteries

Hot-swappable batteries can be added or replaced at any time without interrupting the load or transferring to bypass.

- Any-time replacement means significantly reduced MTTR.
- Patented rear connectors enable toolless connection and disconnection.

Parallel strings increase availability.

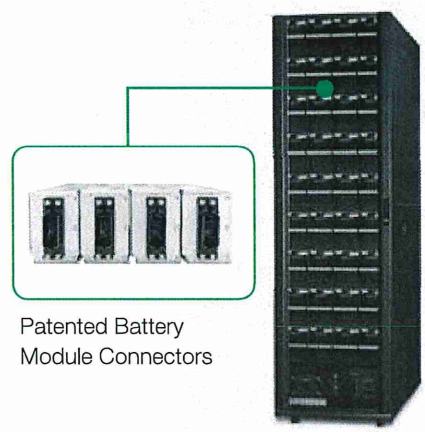
- One row of modules makes one string. All battery modules support the load, so no individual battery is a single point of failure.

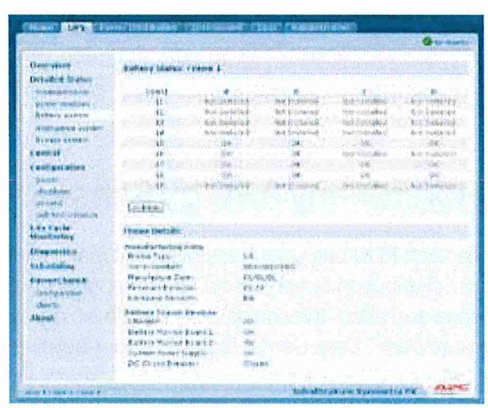
Now, even batteries look great in the data center.

- No messy looking cables — battery connections are made inside the battery unit case.
- All DC connections are pre-configured and insulated — no cable installation or contact with DC terminals required.
- Fully integrated system housed in a standard IT rack form factor.

Batteries are monitored at the individual module level.

- Each individual module monitors current, voltage, and temperature and reports the information to the UPS.
- No time wasted–the online battery chart helps you quickly identify and replace faulty modules. See battery data that interests you, and receive (configurable) alarm notifications.





Power distribution options

Choose the power distribution solution that meets your data center's unique needs.

100 kVA Modular PDU

The 100 kVA Modular PDU is designed exclusively for use with Symmetra PX 100 kW, which monitors and publishes PDU status. The 100 kVA Modular PDU enhances the Symmetra PX 100 UPS with these features:

- 600 V, 480 V, or 208 V input, and 208 V output
- Distribution and MBP in a single 600 mm rack
- High-efficiency NEMA-rated TP-1 isolation transformers
- Toolless addition of new circuits — factory assembled and tested power distribution modules (PDMs) snap into place
- PDMs include self-diagnostic capabilities, branch current monitoring, and breaker position monitoring
- Fully-rated subfeed

Symmetra PX 100 with 100 kVA Modular PDU

InfraStruxure PDU

The APC InfraStruxure PDU is a panelboard PDU with a twist — breakers and cord sets that match your site requirements are installed at the factory, bringing agility, availability, and speed of deployment to your data center.

150 kVA InfraStruxure PDU:

- 480 V input, 208 V output
- 600 mm footprint
- Complete the solution with the 300 mm maintenance bypass panel

Custom 100 kVA InfraStruxure PDU:

- 600 V, 480 V, or 208 V input, and 208 V output
- 600 mm footprint

150 kVA Infrastructure PDU

Monitor any APC by Schneider Electric PDU

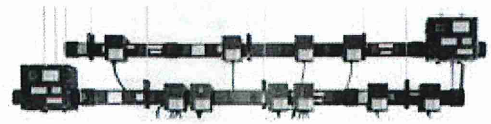
While each PDU has unique features that make it ideally suited to your data center, all APC power distribution options allow you to monitor your power savings, configure your system settings and alarm thresholds, and customize alarm notifications remotely using a Web browser, StruxureWare™ Data Center Expert, or your building management system.

Power distribution options (continued)

iBusway for Data Center Solution

Install the iBusway for Data center solution to provide reliable, efficient, adaptable power distribution above your IT racks:

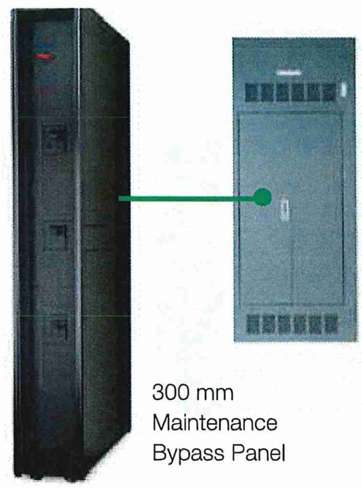
- Up to 240 V input, 240 V output
- Zero IT floor footprint
- Up to 20 openings every 10 feet
- Totally enclosed Busway Straight housing is UL listed



iBusway for Data Center Solution

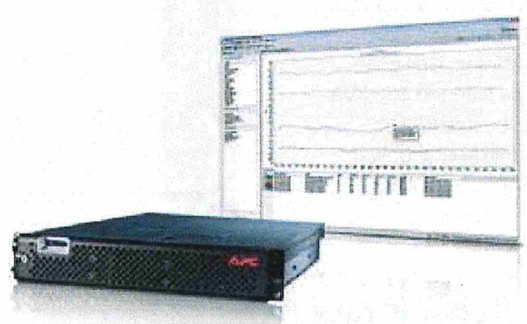
Connect Symmetra PX 100 to Your Existing Power Distribution Architecture

When you replace your aging legacy UPS with the high-efficiency ENERGY STAR qualified Symmetra PX 100, you can save money in two ways — through efficiency incentives or rebates potentially supported in your region, and by using your existing power distribution architecture to supply power to the load. Add the 300 mm maintenance bypass panel to transfer power to utility during maintenance procedures.



StruxureWare for Data Centers Software Suite

In the data center environment, our Symmetra PX 100 UPS is fully managed through StruxureWare for Data Centers, an integrated suite of Data Center Infrastructure Management (DCIM) applications. It enables businesses to prosper by managing their data centers across multiple domains, providing actionable intelligence for an ideal balance of high availability and peak efficiency throughout the entire data center life cycle. StruxureWare is a key element of Schneider Electric EcoStruxure™— an integrated hardware and software system architecture for intelligent energy management. EcoStruxure provides efficient, modular, high-availability power protection that your business-critical applications require.



A Comprehensive Portfolio of Services

Schneider Electric Critical Power & Cooling Services (CPCS) provides the expertise, services, and support you need for your building, industry, power, or data center infrastructure. Our world-class life cycle services offer a smart way to install and maintain your critical applications, ensuring your systems are always running at peak performance.

Options

Extended Runtime (XR) Frames

To increase the number of minutes your load can remain on battery, add optional battery extended runtime frames. A maximum of four battery frames can be connected to the Symmetra PX 100.

Symmetra PX 100 Bottom Feed Side Car

The 300 mm bottom feed side car, which supports raised-floor applications, enables bottom feed installation of utility power to the UPS.

300 mm Maintenance Bypass Panel

The 300 mm maintenance bypass panel isolates the UPS from the critical load during service procedures. Designed for use with the 150 kVA InfraStruxure PDU or your third-party power distribution solution.

Remote Power Panel Options for PDU Subfeed

For unique power distribution demands, or to expand the power distribution capabilities of the 100 kVA Modular PDU or 150 kVA InfraStruxure PDU, use the subfeed to power a modular or configurable remote power panel.

28.8 kVA Configurable Rack Distribution Panel

144 kVA Modular RPP

72 kVA Modular RDP

Management Cards

Two SmartSlot™ positions can be used to expand the monitoring capabilities of the UPS with these APC management cards:

- **Dry Contact I/O SmartSlot Card:** Monitor the conditions of the UPS and its environment using external devices such as sensors.

- **Building Management System (Modbus/Jbus) Card:** Enable a building management system to monitor the UPS.

Seismic Kits

Seismic Kit for 600 mm Symmetra PX Battery Cabinets

Seismic Kit for 300 mm Symmetra PX 100, Symmetra PX 250/500, and Modular PDU Frames

Seismic Kit for 600 mm Symmetra PX 100 and Symmetra PX 250/500 Frames

Technical specifications

UPS Rating kVA/KW (PF=1)	Symmetra PX 100 without PDU
Mains Input (Normal operation)	
Grid system	3 phases + Neutral + Ground
Voltage range (full load)	177 – 239 V
Frequency Range	40 – 70 Hz
Power factor (PF)	>0.98% @ >25% load
I thd (full load)	<5%
Nominal input current	297 A
Maximum input current (Nominal Vin, 10% charging batteries)	327 A
Input current limit	360 A
Protection	Backfeed contactor
Bypass Input (Bypass operation)	
Grid system	3 phases + Neutral + Ground
V nominal	208 V
V range	+/-10%
Frequency (nominal)	50/60 Hz
Frequency (range)	+/-0.1Hz, +/-3Hz, +/-10Hz (user selectable)
Nominal input current	278 A @ 208 V
Maximum overload input current	347 A
Output	
Power rating	100 kW
Output power factor	PF=1
Grid system	3 phases + Neutral + Ground
V nominal	208 V L-L
Nominal output current	278 A
Frequency regulation	50/60 Hz bypass synchronized, 50/60 Hz +/-0.1% free running
Sync. slew rate	Programmable to 0.25, 0.5, 1, 2, 4, 6Hz/sec.
Overload (normal and battery operation)	150% for 30 seconds
V thd	<2% @ 100% Resistive load, <6.5% @ 100% SMPS load
Load PF	from 0.5 leading to 0.5 lagging without any derating
Efficiency	
Normal operation	up to 95%
Mechanical	
Maximum dimensions (HxWxD)	79.1 x 47.2 x 42.1 in. (2011 x 1200 x 1070 mm)
Maximum Weight	4054 lb. (1808 kg)
Maximum shipping weight	4434 lb. (2021 kg)
UPS Maximum Capacity	
10 kW power modules	10
Battery modules	1 module = 1 row
Regulatory compliance	
UL1778 second edition, FCC Part 15, CE, EN/IEC62040-3,OSHPD	