

QUALIFICATIONS SUMMARY

Electrical Reliability Services — DC Power Services



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1.0 Introduction

Vertiv's Electrical Reliability Services is the nation's leading independent electrical testing, maintenance, and engineering service company. For over 40 years we have been helping facility, maintenance, and engineering managers mitigate risks, reduce costs and achieve performance goals with services that increase reliability, reduce operating expenses, and ensure safety and regulatory compliance. We employ more than 450 engineers, including a national team of InterNational Electrical Testing Association (NETA) — certified technicians and support personnel to provide electrical power system services. As a single-source solution provider, with a network of more than 40 North American locations, we deliver the customized services you require where and when you need them.

At the core of Vertiv's Electrical Reliability Services are our Centers of Excellence. The DC Power Services group is one of six strategically integrated service areas that also include protection and controls, engineering, electrical testing and maintenance, commissioning, and compliance.

These centers are comprised of professional engineers, field engineers and repair technicians, compliance engineers, training specialists and others who provide leadership, best practices, expertise, support and training. Through these centers, we are driving superior service performance by exceeding customer expectations around quality, service and responsiveness.

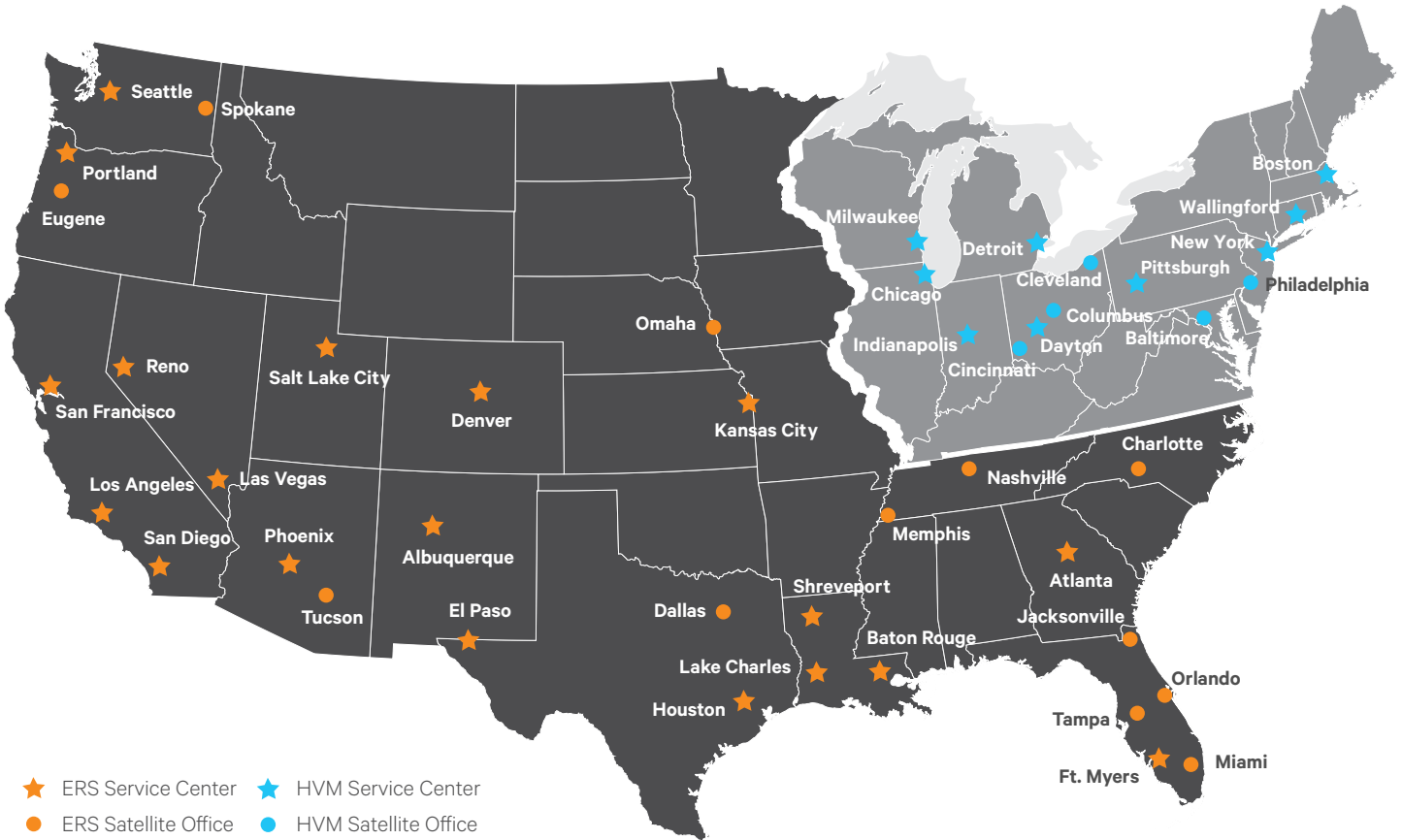
Our DC Power Services group is uniquely qualified to support your operation's standby, emergency and uninterrupted power needs. We have the technical training specific to utilities, industrial manufacturers, and commercial facilities with the field experience to ensure the maximum reliability of your DC power battery systems and UPS equipment. We maintain a nationwide service team of highly qualified, DC power specialists and technicians certified by NETA. They have the expertise to coordinate a comprehensive DC power and UPS system maintenance program with your total power maintenance plan. As a NETA Accredited Company, we provide unbiased testing services that ensure your compliance with regulatory requirements from the Institute of Electrical and Electronics Engineers (IEEE), the North American Electric Reliability Corporation (NERC) and NETA.

Our focus is on your DC power and UPS systems, your last lines of defense and the most vulnerable set of components in your power system.

- Industrial Uninterruptable Power Supply (UPS)
- Battery Strings
- Battery Chargers
- Inverters
- Battery Monitors
- Battery Racks
- Connectors

2.0 Nationwide Service Network

In the United States, we support you through a network of two service organizations including Vertiv's Electrical Reliability Services and High Voltage Maintenance Corp.



Electrical Reliability Services

Our strategically located service centers provide access to local resources with direct service capability. From these service centers, we can dispatch 24-hour emergency response teams anywhere within the western, mid-western and southern United States. (See Appendix I for our Directory of Locations.)

High Voltage Maintenance

High Voltage Maintenance (HVM) is our sister company, which provides the same quality, service excellence, and experience. With a network of 14 locations, HVM offers 24x7 service coverage for the Midwest and New England regions.

3.0 Credentials

Vertiv, Electrical Reliability Services and High Voltage Maintenance are industry leaders committed to delivering the highest quality of electrical power system testing and maintenance services.

InterNational Electrical Testing Association (NETA) Accredited Company

As founding NETA-member companies, Electrical Reliability Services and High Voltage Maintenance are dedicated to upholding industry leading standards for power system installation, maintenance and acceptance testing to ensure the highest level of reliability and safety.

Through NETA, our organizational qualifications are vetted by a third-party, two-fold application process accrediting our operational practices and certifying the knowledge and experience of our individual technician. This provides customers assurance of the highest quality service. As a NETA Accredited Company you can depend on us to deliver independent, third-party testing analysis, maintenance, replacement and upgrade services, acceptance testing and reporting across your total electrical power chain.

We actively participate in numerous national organizations to assist in the development of standards important to our industry. With more than 50 years of experience in electrical testing, maintenance, and engineering, we are a trusted partner in promoting safety and reliability management. Our managers, field technicians, and engineers are active in creating and continually improving industry standards. Below are some of the organizations in which our team is involved:



InterNational Electrical Testing Association (NETA)

NETA is an organization that serves the electrical testing industry by offering accreditation of third-party electrical testing firms, certifying electrical testing technicians, and producing American National Standards. We are a founding member of NETA and are dedicated to helping set world standards in electrical maintenance and acceptance testing.

Key personnel serve on the NETA Standards Review Council, NETA Safety Committee, NETA Continuing Technical Development Committee, and the NETA Exam Committee. We also participate on NETA's new member evaluation team and as ballot pool members. We are leaders in staffing NETA-certified technicians and currently employ 138 Level 3 and 4 technicians. Many projects require a Level 3 or 4 to be on site. You can pull from our large team of experts to ensure your project is done in a timely manner.



National Fire Protection Association (NFPA)

NFPA is a nonprofit organization devoted to eliminating death, injury, and property and economic loss due to fire, electrical, and related hazards. The association publishes many key standards for the electrical industry: (1) Originally developed at OSHA's request, NFPA created the 70E standard to help companies and employees avoid workplace injuries and fatalities due to shock, electrocution, arc flash, and arc blast, and assists in complying with OSHA 1910 Subpart S and OSHA 1926 Subpart K. (2) The National Electrical Code (NEC) covers safe installation of electrical wiring and installation. (3) NFPA 70B details preventive maintenance. (4) NFPA 790 details standards of competency of third-party Field Evaluation Bodies. (5) NFPA 791 details recommended practice and procedures for unlabeled electrical equipment evaluation.

We play an important role in helping write the 790 and 791 standards. We also have NFPA 70E certified trainers who are highly qualified to promote electrical expertise in workplace environments. Our certified trainers are recognized by their education, years of experience, training, and ability to pass a very challenging certification test. NFPA 70E certification is difficult to achieve, and trainers are required to recertify every three years.



Institute of Electrical and Electronics Engineers (IEEE)

IEEE provides the world's largest forum for sharing the latest in technological developments in the electric power industry; for creating standards that guide the development and construction of equipment and systems; and for educating members of the industry and the general public.

Key personnel play a critical role in developing standards as committee chair members.



Leadership in Energy and Environmental Design (LEED)

LEED is a green building rating system that provides the framework that project teams can follow to create healthy, highly efficient, and cost-saving green buildings.

To ensure your project meets the necessary requirements, our commissioning team consists of LEED Accredited Professionals (AP) who are trained and experienced in the LEED rating system.



International Accreditation Services (IAS)

IAS ensures Field Evaluation Bodies (FEB) are qualified to evaluate unlisted electrical equipment in the field. FEB certification is based on Accreditation Criteria for Field Evaluation of Unlisted Electrical Equipment (AC354), ISO/IEC 17020 and NFPA standards. This accreditation provides objective evidence that an organization operates at the highest level of ethical, legal, and technical standards.

As the first certified FEB company, we provide a full service offering for field testing and conformity assessments complying with stringent requirements of IAS certification, NFPA 790 and 791 standards. These requirements ensure impartial evaluations are conducted within a strict structure for prepping, testing, evaluating, documenting, and reporting on unlisted equipment.



International Association of Electrical Inspectors (IAEI)

IAEI offers an unbiased focus to interpreting the National Electrical Code and the Canadian Electrical Code. It promotes safe inspections, installations, and products to the electrical industry.

Our conformity engineers actively participate at the local, regional, and national levels.



Building Commissioning Association (BCxA)

BCxA is an international nonprofit organization that serves as the recognized authority and resource on commissioning. Its mission is to guide the building commissioning industry by advancing best practices and education, and promoting the benefits of building commissioning to achieve buildings that work.

Our certified commissioning engineers help elevate the industry's technical level by participating in the development of guidelines and standards for BCxA.



American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

ASHRAE is a global society advancing human well-being through sustainable technology for the built environment. The society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability within the industry.

Many of our field engineers actively promote ASHRAE guidelines to support the technical advances within the industry.



National Institute for the Uniform Licensing of Power Engineers (NIULPE)

NIULPE is a third-party certification organization mandated to establish and maintain international standards of education and competency for the power and energy-related trades and professions. This organization assists federal, state and municipal licensing agencies in maintaining the international standards within legislated programs.

Key personnel have held leadership positions including serving as NIULPE president. Through our active participation, we help guide the standards for power and energy education.



Building Owners and Managers Association International (BOMA)

BOMA International is a primary source of information on building management and operations, development, leasing, building operating costs, energy consumption patterns, local and national building codes, legislation, occupancy statistics, technological developments and other industry trends.

Key personnel have participated in active leadership roles to help BOMA achieve their strategic objectives while volunteering their time to develop policy positions on issues that impact our industry.

4.0 Personnel Qualifications

Vertiv, Electrical Reliability Services, and High Voltage Maintenance hire and maintains the top technical talent in the industry. From professional engineers to specialized field service technicians, our team is experienced in all aspects of electrical power chain management.

Industry Leaders in Staffing NETA-Certified Technicians and DC Power Specialists

With over 138 NETA-certified technicians and our team of 29 DC power specialists, we have the technical availability, knowledge, and expertise to deliver the service quality you need. We can efficiently and reliably meet your most demanding timelines, coordinate with shutdowns, and respond to emergencies.

Each member of our national team of DC power specialists has more than five years of electrical power field experience and are credentialed in two levels of DC power and UPS system training. We have extensive off-shore and on-shore systems experience, are certified in Helicopter Underwater Escape Training (HUET), and have Transportation Worker Identification Credentials (TWIC). This expertise in battery and UPS maintenance, replacement, and upgrades ensures we provide the highest quality services for any type of facility.

Our DC power technicians are knowledgeable on all major battery and UPS makes and models, making us capable of managing the lifecycle of varied and complex DC power and UPS configurations while ensuring compliance. We design customized maintenance plans aligned with NERC and IEEE requirements, and efficiently troubleshoot hard-to-diagnose problems to minimize downtime and ensure optimized system performance and protection.

Longevity

With one of the lowest employee turnover rates in the industry, numerous employees with more than 30 years of longevity, and long-term consistent performance, the quality and strength of our employees is evident. Our field technicians are known for their professionalism on and off the job site, which is exemplified by their work ethic, timeliness and preparedness. They show up ready to work with the right equipment, the required safety training, and years of experience. We know our people are our business, and we are committed to building sustaining capability through knowledge management, training, leadership development, advancement, and performance measurement. Resumes for all personnel are available upon request.

500+ HIGHLY SKILLED PERSONNEL	
Professional Engineers	32
NETA Level 1 & 2 Technicians	143
NETA Level 3 & 4 Technicians	138
Commissioning Engineers	6
Power System & Protection Engineers	26
Industrial DC Specialists	29
Compliance Engineers	9
Calibration & Repair Technicians	2
Training Specialists	3
Others	131

5.0 Safety, Organization and Communication

Safety Policy Statement

“Vertiv is committed to providing a safe and environmentally sound workplace. Excellence in safety is vital to the well-being of our customers, our employees and their families. It is essential to all aspects of our business.

Safety is a Vertiv core value. This means we do all things with safety in mind – every job, every day, no exceptions. We strive to achieve an injury free workplace by relentlessly reducing workplace risks in an effort to reach zero accidents. Vertiv is committed to providing the tools, training, and equipment to enable our employees to work safely.”

— Rob Johnson, Chief Executive Officer

Safety Training

Vertiv strictly adheres to industry safety and compliance regulations to ensure the safety of our personnel and yours. Every technician is trained to Occupational Safety and Health Administration (OSHA) standards for personal and environmental safety, including training in more than 60 Environmental, Safety and Health (ESH) topics and procedures. As part of our Safety Audit Program, each technician participates in a safety audit twice a year. The audit is performed by a manager or independent auditor who conducts a comprehensive check at a customer site. The auditor confirms the technician is following all safety standards, using all personal protective equipment (PPE) correctly, and that the technician fully comprehends our safety policies and procedures.

All Vertiv field employees receive more than 30 hours of in-depth safety training before working in the field and are certified in CPR, AED and first aid. This training includes eight hours of OSHA 1910 and NFPA 70E electrical safety training, and the OSHA 10-hour course for construction. Additionally, supervisors are required to complete the OSHA 30-hour course and all employees receive topic-specific monthly refresher training.

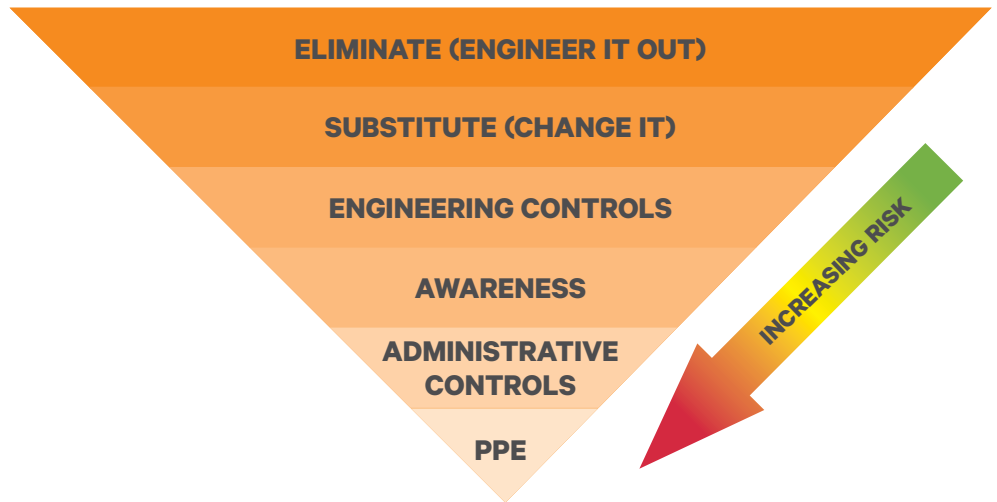
Electrical Safety Work Practices

To ensure the safety of everyone involved on a project, we designed an electrical safety program that directs activity appropriate to the risks associated with all electrical hazards. Our program takes into consideration the condition and maintenance of electrical equipment and systems and focuses on teaching awareness and self-discipline while instilling safety principles and controls. Below are some key steps followed to ensure anyone who may be exposed to an electrical hazard is safe:

- A job safety planning and job briefing meeting is held to discuss all hazards associated with the project. Participants include our testing team, subcontractors, and the customer to ensure all parties’ safety concerns are identified and addressed.
 - A risk assessment is conducted to address exposure to electrical hazards. This procedure identifies hazards, assesses risks, and implements risk controls according to a hierarchy of methods: (1) elimination, (2) substitution, (3) engineering controls, (4) awareness, (5) administrative controls and (6) PPE.
- The results of this meeting define the agreed upon safety procedures that all parties will follow for the duration of the project. Topics covered include lockout/tagout, personal protective devices, grounding procedures, etc.
- Additional job briefing meetings are conducted and documented to assess site-specific safety issues prior to commencing any activity and when conditions change, and are held daily as a minimum.
- Field work is audited to verify that the requirements contained in the procedures of the electrical safety program are being followed.

Risk Assessment

Controlling exposures to hazards is the fundamental method of protecting our employees. We adhere to a hierarchy of controls that demonstrates how we implement effective control solutions to ensure a safer environment.



Prepared for Safety

We provide the following PPE to every technician to safeguard them from potential hazards on the job:

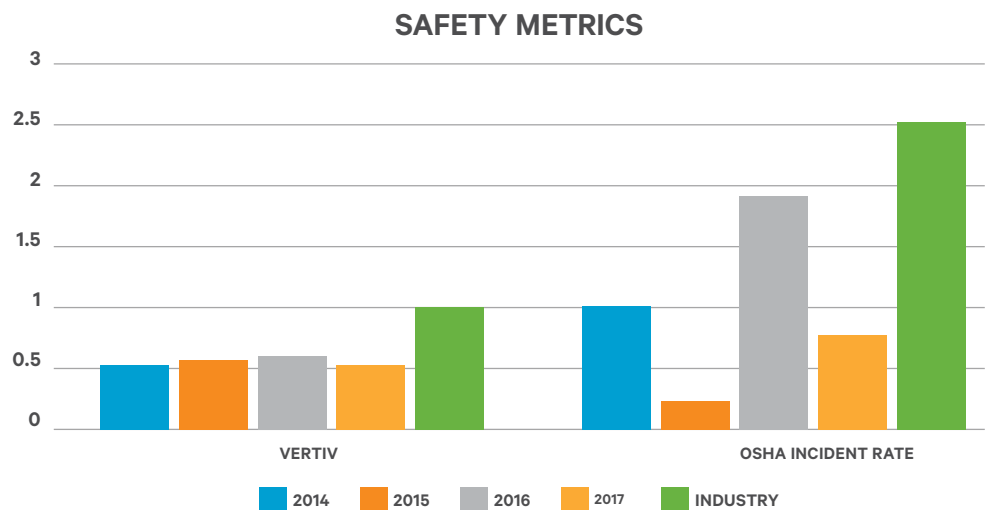
- 12 cal/cm2 arc-rated shirts and pants
- Balaclava
- Safety glasses
- Rubber-insulated blankets
- 40 cal/cm2 arc flash PPE
- Arc-rated face shield
- Hearing protection
- Class 0 and Class 2 rubber-insulated gloves
- Insulated tools

Incident Investigation

When an unforeseen incident arises, a cross-functional team of experts conduct a thorough incident investigation. Once a root cause has been established, corrective actions are taken immediately to correct all factors that contributed to the incident. To minimize or eliminate serious consequences in the future, the details of the investigation are shared throughout the organization. Based on the findings, a new or updated procedure will be put in place or a new tool will be created.

Safety Metrics

Excellence in safety is vital to the well-being of our customers and our employees; it is at the forefront of everything we do. Our dedication is why we maintain one of the best safety ratings in the industry and are well below the industry averages.



Safety Awards

We set safety expectations high and reward those that meet or exceed them. Below are some of our internal awards:

Quarterly Safety Excellence Award: Presented to highlight technicians who have submitted beneficial safety improvement ideas or have brought a safety concern to the forefront to be examined.

Perpetual Safety Award: This is the most prestigious award given to our technicians. These are presented to those that have an outstanding safety record.

6.0 Quality Assurance

Vertiv™ Quality Policy

Vertiv is committed to providing quality services and software that meet or exceed all aspects of customer expectations. We will accomplish this through a foundation of globally consistent and coordinated teamwork based on the following principles:

- Fostering a culture of world-class quality through the application of consistent and capable processes.
- Driving continuous improvement by empowering and encouraging proactive contributions and quality ownership from every employee.
- Continuously measuring and monitoring all service delivery and business processes to ensure a positive customer experience.

Vertiv senior management is committed to this policy and will provide the leadership, resources, and training to support these principles.

Quality Assurance Manual

We maintain a documented quality assurance program. The major elements include: quality policy, organization structure and responsibilities, quality practices, human resources, quality assurance audits and customer surveys. Maintaining quality assurance is the responsibility of all employees with oversight by each department manager and corporate management personnel. We have successfully passed the quality audits of many government agencies and obtained quality supplier recognition by private industry.

Service Capability Model

The Service Capability Model is an assessment tool used to evaluate performance in a multitude of business areas to drive continuous improvement. This model is used for problem solving and ensures quality and standardization, allowing for consistent service delivery everywhere you operate. Holding ourselves to high standards is crucial for meeting and exceeding your service requirements and value criteria.

Customer Satisfaction Program

Understanding your perceptions and expectations are very valuable as they guide us in driving continuous improvement throughout our organization. Customers are surveyed across four broad categories including pre-sale, purchasing experience, order and delivery, and service experience. Tracking our net promoter score is vital to us as it gauges our customers' satisfaction. Our most current score is 68.88 (50 and above represent an excellent rating).

Another assessment we pay close attention to is our customer satisfaction performance in ten key areas. On a scale from 0 to 10, the majority of customers continuously rate us at a 9 or higher for our technicians' knowledge and service. The overall results are shared throughout the organization and analyzed to see where we may improve the customer service experience.

Customer Resolution Center

To ensure a positive customer experience, we make ourselves available whenever you need us by offering 24x7 support. A live person will answer your call and assist you immediately because we are committed to solving your critical system issues. Our goal is to provide the resources you need, at the time you need them.

Test Equipment Calibration Program

Field test equipment and secondary standard laboratory equipment are calibrated every 12 months by our calibration laboratory. All test equipment calibrations are traceable in an unbroken chain to the National Institute of Standards and Technology (NIST). All calibrations are accomplished within strict guidelines utilizing recognized calibration procedures, techniques, and quality assurance standards.

The calibration laboratory maintains all the data and is among the few fully equipped, non-utility power industry calibration and metrology laboratories. Our capabilities cover a wide range of measurement parameters:

- High voltage, AC and DC up to 100,000 volts
- High current up to 10,000 amps AC, 1,500 amps DC
- Instrument and meter calibration, analog and digital: amps, volts, ohms to 100 part per million, and phase angle
- Time and frequency: picosecond to megahertz
- Temperature: direct, simulated and low infrared
- Pressure: hydraulic and gaseous to 10,000 pounds per square inch (PSI)
- Dimensional: distance and weight

The laboratory has been approved and audited for nuclear power plant work and complies with MIL standards.

7.0 DC Power Center of Excellence

Vertiv's Electrical Reliability Services drives innovation, best practices, and industry-leading solutions through our specialized **Centers of Excellence**. These Centers of Excellence bring together dedicated experts, proven processes, and investment in the right technologies to deliver smart, powerful solutions that drive world-class customer satisfaction.

Our Centers of Excellence are comprised of cross-functional teams who work together to meet your specific power challenges in all stages of your facility's lifecycle.

DC Power Services Are Critical to Total Power System Management

The members of our DC Power Center of Excellence have over five years of field experience servicing customers across the utility, industrial, and commercial industries, ensuring the reliable operation of standby, emergency, and uninterrupted power needs.

We drive performance through:

Leadership

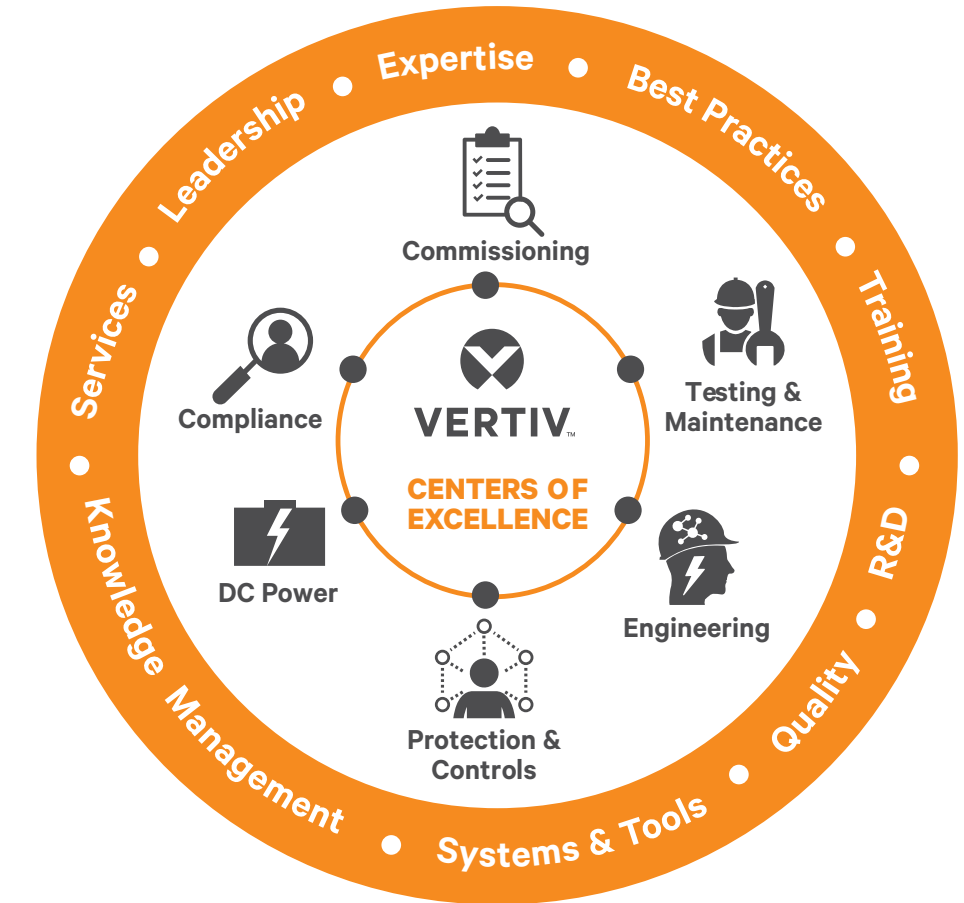
Provide oversight and governance to ensure alignment with customer and marketplace requirements.

Operations and Management

Manage costs, risks, and resources to ensure safe and timely project execution that meets objectives and budgets. Maintain capabilities and scale to effectively support single and multi-site projects.

Processes and Practices

Maintain predictable, repeatable, and consistent operational performance through standardized processes and methodologies. Utilize advanced tools and technologies, invest in research and development, and focus on continuous improvement to create best practices.



Service

Deliver project, maintenance, and performance optimization services throughout the lifecycle of a facility to ensure business critical infrastructure operates reliably, safely and efficiently.

Expertise

Hire and maintain top technical talent in the industry. Build sustaining capability through knowledge management, training, leadership development, and performance measurement.

8.0 Technical Resources

Intelligent Data Acquisition Forms

Vertiv utilizes PowerDb, the industry's leading data acquisition tool, to systematically collect test data across many types of electrical assets including DC power system components. Through built-in form intelligence, we are able to quickly identify test data that may be suspect or does not meet NETA guidelines or other industry specifications.

Our proprietary customized forms offer:

- A searchable database of test results for auditing purposes
- Reliability in storing and organizing data by organization, plant, system or device
- Historical data or trend data comparing similar devices nationwide
- Auto-deficiency statements generated from a knowledge-based library
- Testing data and recommendations for next test interval
- A standardized report format due to forms being similar in appearance, performance and features
- Integration with industry tools and applications enabling direct input from RTS for relays and Doble Pro-Test
- Built-in safety reminders applicable to each unique testing scenario

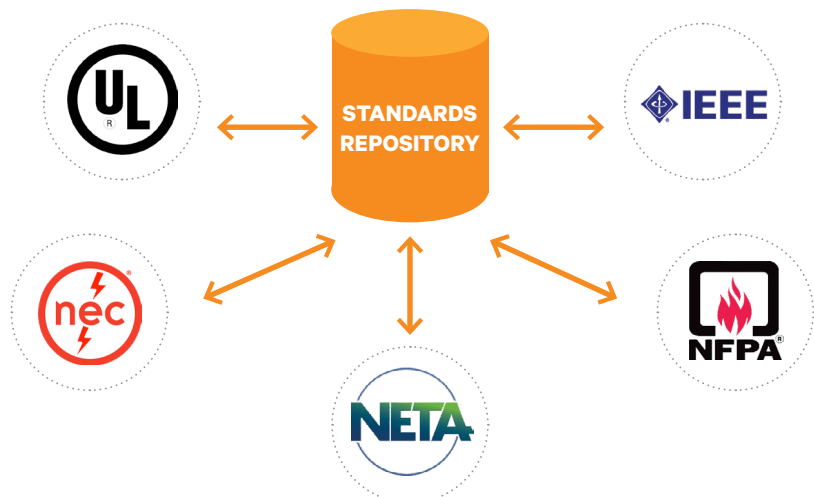
Real-Time Data Application

To improve efficiency and accuracy, we utilize the latest technology that increases the speed in which we share project information. Our data collectors use smart tablets that allow them to easily mark-up drawings and send them to the support engineer for review. Sending the data in real time allows for 24x7 engineering support.

The support engineer can quickly review the drawing, make any revisions, and send it back to the data collector before they return to work the following day. The data collector can review the progress with the customer as often as required. Before the job is finalized, they can review final drawings to ensure all data has been collected and all questions have been answered before they leave the site, eliminating unplanned follow-up visits.

Electronic Technical Library

We maintain an electronic library of international standards accessible 24x7. This information includes reference materials and standards from organizations such as IEEE, ANSI, UL, NETA and NFPA. It also includes general reference materials and specialized text on electrical theory, engineering and compliance.



9.0 Equipment

Vertiv owns more than \$15 million in state-of-the-art equipment and diagnostic software and tools to facilitate the highest level of electrical power system testing and maintenance.

Our DC Power Services group maintains an inventory of the most advanced equipment required to provide the safest and most efficient DC power services and to ensure we always have the right equipment for the job. Below are examples of our equipment:

- IR camera or heat gun
- Fluke 87 digital multimeter (DMM) w/clamp-on amp probe
- Load bank
- Battery capacity test (BCT) system
- Battery string
- Single-phase (4 to 16 kW) UPS units
- Three-phase (10 to 500 kW) UPS units
- Cellcorder
- IR scanner
- Digital voltmeter (DVM)
- Battery lift
- Mobile DC Power Services Unit (temporary DC power trailer)

10.0 Test Reports

Information management and communication within a service program is often the weakest and most detrimental facet of a client-vendor interface. Data storage and retrieval must be friendly and useable. Not only do our test reports adhere to NETA standards, we make sure they are easy to read and are consistent.

Each of our test reports include: (1) a summary of the project, (2) a description of the equipment tested, (3) a description of tests, (4) the test data, and (5) analysis and recommendations. In addition, our reports meet the following requirements:

1. Identification of the testing organization
2. Humidity, temperature, and other conditions that may affect the results of the tests/calibrations
3. Date of inspections, tests, maintenance, and/or calibrations
4. Identification of the testing technician
5. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded
6. Indication of expected results when calibrations are to be performed
7. Indication of “as-found” and “as-left” results, as applicable
8. Sufficient spaces to allow all results and comments to be noted

When our work is complete, you will receive a comprehensive engineering report as specified in the maintenance testing contract. These detailed reports are reviewed by a dedicated group and contain infrastructure data and clear recommendations for improving safety and reliability. These reports help with compliance as they meet the NFPA 70E and NERC requirements for documentation.

11.0 Services and Capabilities

The reliability of your total power system is only as strong as its weakest link. The DC power and UPS systems are your last lines of defense if there is a power fluctuation or failure, and battery failures remain a major cause of unplanned downtime.

Every facility's DC power and UPS systems go through a natural lifecycle with the highest efficiency and performance right at startup. Once online, however, the DC power batteries and UPS batteries begin to gradually deteriorate due to the dynamic and sometimes harsh environment of the facility, the inherently limited life of batteries, and normal wear and tear on the equipment.

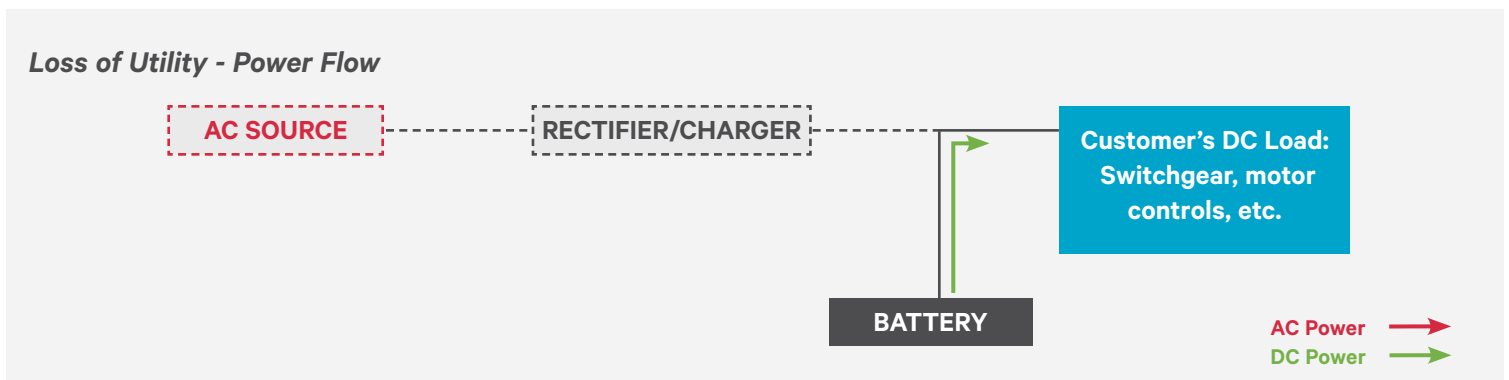
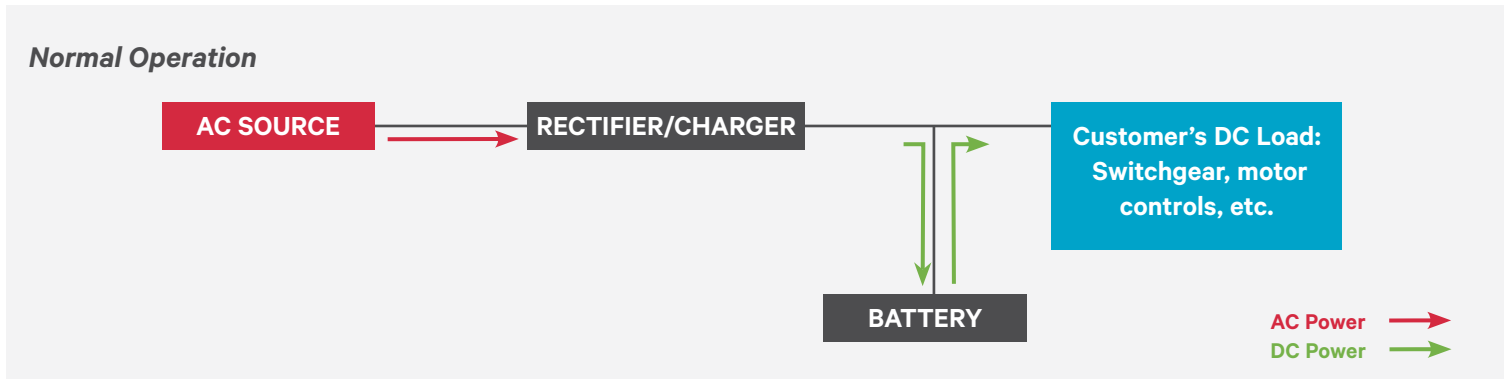
Contrast this with the lifecycle of optimized DC power and UPS systems where Vertiv helps maintain the health of your integrated equipment. Throughout the life of your DC power and UPS systems, you will see continual improvement in performance that is made possible through battery analysis, preventive maintenance strategies, life-extension services, and engineering studies. With optimized DC power and UPS systems, unplanned outages are virtually eliminated and replaced by more efficient turnarounds, improving your facility's performance today, tomorrow and beyond.

As an independent third-party company, our recommendations are unbiased and based on principles of value engineering. We understand that the health and performance of your assets is vital to your success, and we have firsthand experience proving that electrical testing and maintenance has a dramatic impact on improving the cost of maintaining a reliable electrical power system.

Wherever you are in your system's lifecycle, healthy assets are the way to a healthier bottom line. As your partner, we can provide the most comprehensive solutions for your DC power and UPS systems and also coordinate service according to your total electrical system management plan.

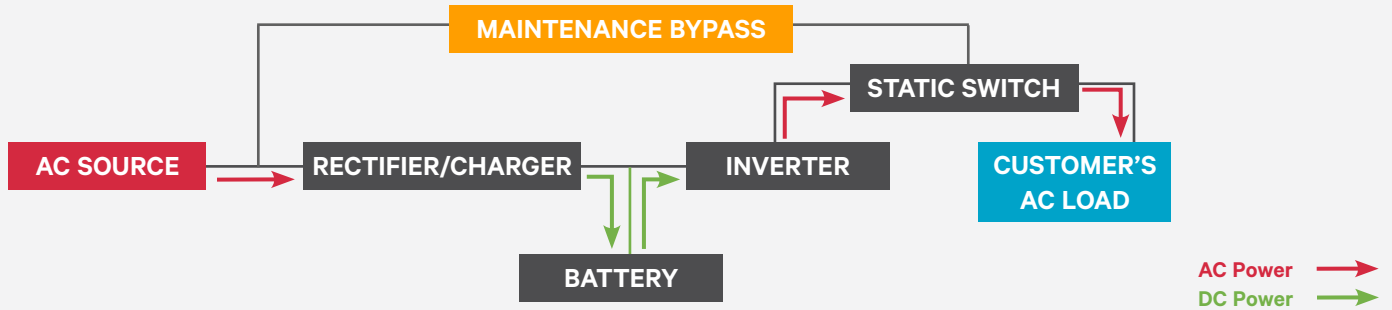
Examples of DC Power and UPS Systems We Service

DC Power System

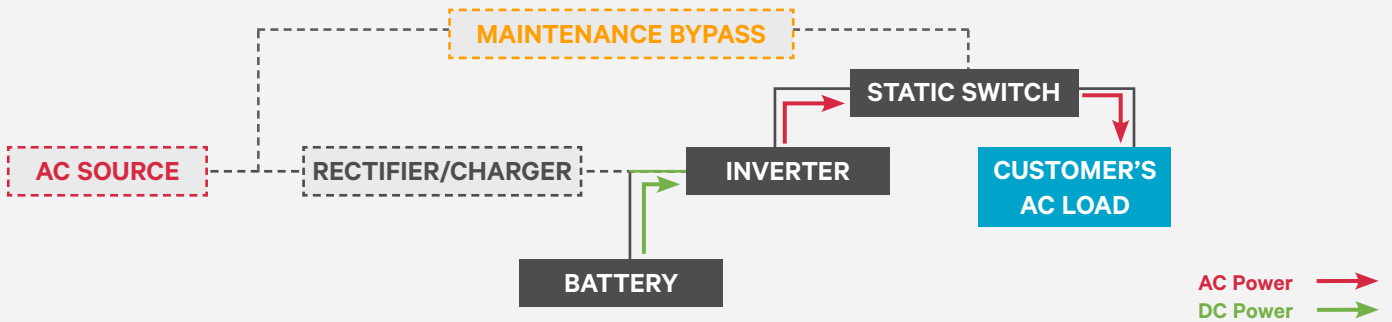


Industrial UPS System

Normal Operation



Loss of Utility Power



11.1 Design Engineering and Installation

Designing the right DC power and/or UPS system and choosing the right batteries and equipment are critical to providing optimal support for your facility. Engaging our design engineers when you are considering expanding your DC power and/or needs will ensure you have the right configuration to maximize system reliability. We will leverage our strong relationships with battery and UPS manufacturers and draw on our expertise with multiple brands to install and commission the best system for your facility's budget, space and growing power needs.

Our design engineering and installation services include:

- System planning and design
- System evaluation
- Application engineering
- Battery and UPS installation
- Acceptance testing
- Startup and commissioning

11.2 Preventive Maintenance Services

A comprehensive preventive maintenance program for your batteries is one of the most important investments you can make to ensure the reliability of your power system and prevent costly downtime. To develop the right maintenance strategy for your DC power system, our DC power specialists consider environmental conditions, operating frequency, and the criticality of the equipment and operations your system supports. An effective program includes regular inspections, thorough and well-documented testing, and proactive replacement planning to ensure your batteries are capable of supporting your critical operations when needed.

Inspections

To meet your specific needs and ensure compliance with IEEE and NERC requirements, Vertiv's Electrical Reliability Services conducts monthly, quarterly, and annual preventive maintenance inspections for all battery types, including valve-regulated lead-acid (VRLA or sealed), vented lead-acid (VLA or flooded), nickel cadmium (NiCad), and lithium-ion (Li-ion). Our DC battery specialists will recommend the ideal maintenance frequency for your system based on your battery type, environment, and the number of strings in your facility. Each inspection is designed to assess cell and string state of health, and to identify weak or failing batteries that need to be replaced.

Maintenance Testing

Proper battery maintenance not only prevents unexpected failures, but can also extend battery service life to reduce the frequency or increase the interval between replacements required. Our battery maintenance services validate the condition of the battery and include resistance testing on battery strings and individual cells, recording of float voltage measurements and gravity readings, and adjustment to connections and fluid levels as needed.

Battery Charger Maintenance

As part of a complete battery solution, our technicians maintain your batteries, as well as the equipment that keeps your batteries working as intended. Our battery charger maintenance service includes regular equipment inspections to ensure your batteries maintain the appropriate level of charge at all times. We examine interconnection cables, cell connectors, and other conductors for wear, contamination, corrosion and discoloration. Our battery specialists will also inspect racks for corrosion, cleanliness, and structural integrity.

Predictive Maintenance

A predictive maintenance approach combines regular maintenance with capacity testing and monitoring, which is the best strategy for eliminating the risk of battery failure.

Capacity Testing

Capacity testing is the most effective method available for determining a battery's ability to provide a reliable power source and to support the required load for a specific period of time. Our trained battery specialists perform all capacity tests per IEEE standards and manufacturer specifications. Tests include load testing with individual cell monitoring to check battery bank capacity. Test results identify when battery reserve is low, so you know when to replace a battery.

11.3 Battery Replacement Services

A proactive battery replacement program ensures that batteries are replaced before end-of-life. The rate of deterioration is difficult to predict and depends on many factors. An effective program should be coordinated with routine maintenance testing and monitoring that informs the replacement planning process.

Individual Cell Change-Outs

Battery failures are a leading cause of unplanned downtime. A single cell can compromise the entire battery string. Routine maintenance can identify weak cells to target for replacement. Our DC power specialists can perform both ongoing maintenance and replacement services. Our battery experts will identify problem areas and determine which cells can be replaced to restore the integrity of the battery bank and extend its service life. Whether you are replacing like-for-like batteries or switching to a new battery type, our DC power specialists will recommend the best replacement plan and perform all installation services to ensure ongoing reliability.

End-to-End Battery Replacement

As your DC power system ages, it will require upgrades and battery string replacement to maintain system integrity. Battery capacity may also need to expand to support your growing load requirements over time. Our DC power team can help you design a replacement program and deliver an end-to-end replacement solution including expert installation of new cells, startup and commissioning, and proper recycling of spent batteries. We are experts in meeting your special requirements, such as after-hours replacements and servicing difficult-to-access battery systems. Our technicians work on all major brands, and can leverage Vertiv's extensive battery purchasing power to offer affordable, effective battery replacements.

Startup and Commissioning

New battery installations require startup and commissioning to ensure your DC power system has been correctly configured and will perform as designed. Our team will conduct testing to verify the DC power system's ability to support critical loads and its integration with the total power system. All testing is conducted in accordance with manufacturer, NETA, and IEEE testing specifications.

Battery Removal and Recycling

As part of your battery replacement service, you can trust our team to properly remove and recycle your old batteries in accordance with all government and industry regulations. This includes the management of any regulatory paperwork.

11.4 Battery Monitoring

Using the Albér® monitoring system and qualified battery monitoring specialists to assess your battery strings around the clock increases mean time between failures (MTBF) by more than double when compared to preventive maintenance alone.

Our 24x7 remote monitoring services help you detect and diagnose problems that may otherwise go undetected such as leaking water, failing batteries, and more. Our services also include emergency service for rapid incident response, as well as monthly trending and reporting for better battery management.

11.5 Mobile DC Power Services Unit

When facilities can't afford to compromise critical power, a mobile power solution that is safe and secure is ideal for performing DC system maintenance and capacity testing. With our Mobile DC Power Services Unit, our DC power specialists can confidently perform all required battery inspections, tests, and replacement services without risk of power dips or load drops.

Our mobile unit includes the following equipment:

- State-of-the-art power and ancillary safety equipment
- DC battery strings and a universal charger
- Albér test set, load bank, sensor lead cables and monitor
- Power transfer cable system
- AC and DC circuit protection
- Voltage selectors support multiple power requirement ranges
- Diesel generator

11.6 UPS Maintenance

A comprehensive UPS preventive maintenance program includes routine inspections and testing. Our DC power specialists will test your UPS systems' safety and control functions and connections to ensure proper operation. This includes a visual and mechanical inspection, thermographic scan, electrical and mechanical interlock systems tests, alarm history review, insulation resistance tests, electronics calibration, and verification of alarm circuits and indicators.

11.7 Inverter Maintenance

The inverter is critical to maintaining clean, continuous power. Our DC power specialists ensure proper functionality by checking input/output voltage and currents, system alignment, and DC bus voltage and ripple on the system battery.

12.0 Project Experience

Utility

CUSTOMER	UTILITY TYPE	TYPE OF WORK	DESCRIPTION
Tennessee Valley Authority (TVA)	<ul style="list-style-type: none"> • Generation and Transmission 	<ul style="list-style-type: none"> • Battery and UPS Quarterly and Annual Maintenance • 10-YR Preventive Maintenance • Battery and UPS Replacement 	TVA is a government agency supplying 9 million people with power in the southeastern U.S. With multiple facilities across seven states, the DC power system is critical to supporting and protecting its switchgear and turbines. We provide end-to-end DC power services in multiple facilities, including quarterly, annual and 10-year preventive maintenance services on their battery and UPS systems.
Agrilectric Power Partners	<ul style="list-style-type: none"> • Generation 	<ul style="list-style-type: none"> • Annual Battery and UPS Preventive Maintenance • Capacity Testing • Battery Replacement 	Agrilectric Power Partners is a generation plant producing power from rice by-product. The DC power system and UPS support switchgear and instrument controls, providing relay protection. We provide annual UPS and battery preventive maintenance services, along with battery replacement services.
Calpine Central — Oneta Energy Center	<ul style="list-style-type: none"> • Generation 	<ul style="list-style-type: none"> • Battery Testing • Battery Charger Replacement • Industrial UPS Upgrade 	Oneta Energy Center is a natural gas power plant, distributing power in Oklahoma. Its DC power systems support the switchgear and turbines. We provided annual battery maintenance testing, battery charger replacement, and UPS upgrade services.
Southwestern Electrical Power (SWEPCO)	<ul style="list-style-type: none"> • Generation and Transmission 	<ul style="list-style-type: none"> • Battery Maintenance • Battery Capacity Testing 	SWEPCO is a power generator serving customers in Arkansas, Louisiana, and East Texas. Its DC power systems support the switchgear, distribution controls, and turbines. We provided battery maintenance and capacity testing services.

QUALIFICATIONS SUMMARY

Oil and Gas

CUSTOMER	OIL AND GAS TYPE	TYPE OF WORK	DESCRIPTION
Air Liquide	<ul style="list-style-type: none"> Petrochemical Chemical Medical Mfr. 	<ul style="list-style-type: none"> Industrial UPS Preventive Maintenance Inverter Preventive Maintenance Battery Replacement Battery Preventive Maintenance Battery Charger Preventive Maintenance Capacity Testing Fan Replacement UPS Rental 	Air Liquide is a multinational supplier of industrial gases and services to medical, chemical, and electronics manufacturers. They operate nine chemical manufacturing facilities in Louisiana, each reliant on DC power and UPS systems that support the switchgear and distribution control system. We are the preferred service provider for AC and DC power system maintenance, testing, replacements and upgrades.
Alon USA	<ul style="list-style-type: none"> Refinery 	<ul style="list-style-type: none"> Industrial UPS Preventive Maintenance Industrial UPS Repair Battery Replacement Battery Preventive Maintenance Battery Charger Preventive Maintenance 	Alon USA operates a light crude oil refinery in Krotz Springs, Louisiana. Its DC power system supports the switchgear and digital controls system. We provide coordinated AC and DC power system maintenance and monthly battery tests to ensure reliability.
Criterion Catalysts & Technologies	<ul style="list-style-type: none"> Refinery 	<ul style="list-style-type: none"> Annual Battery and UPS Preventive Maintenance Battery Testing 	Criterion Catalysts is an international company that manufactures catalysts, processing technologies, and provides catalyst services. In its manufacturing facilities, the battery and UPS systems support the switchgear, 24x7 manufacturing processes and distribution control system. We provide annual battery and UPS preventive maintenance services.
Flint Hills Resources	<ul style="list-style-type: none"> Petrochemical 	<ul style="list-style-type: none"> Industrial UPS Preventive Maintenance Annual Battery Preventive Maintenance Battery replacements 	Flint Hills Resources operates three refineries with a crude oil capacity of 600,000 barrels per day. Its DC power systems support critical switchgear, IT and instrument operations. We provide quarterly and annual preventive maintenance and replacement services on the battery systems and 10-year preventive maintenance services on their UPS systems.
LACC (Lotte-Axiall)	<ul style="list-style-type: none"> Refinery 	<ul style="list-style-type: none"> Battery and UPS Acceptance Testing 	LACC, a joint venture between Lotte Chemical and Axiall, opened a new refinery in Lake Charles, Louisiana. The DC power systems support the switchgear and operating controls. We provided battery and UPS acceptance testing.

Industrial Manufacturing

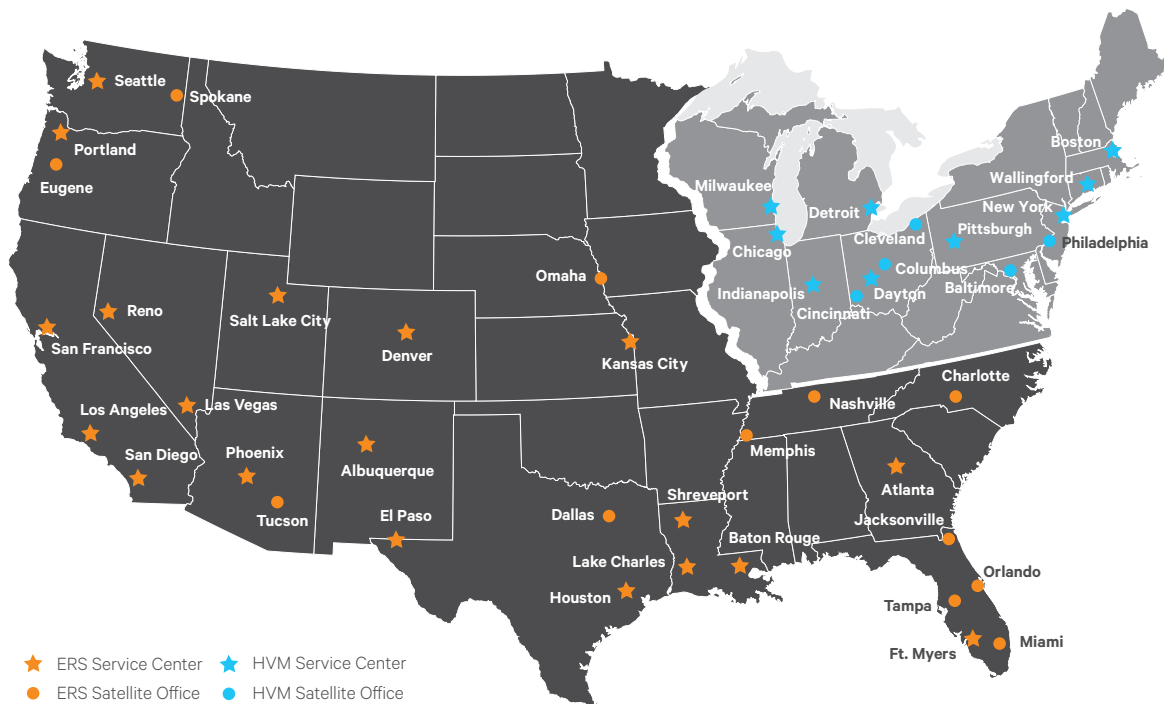
CUSTOMER	IND. MFR. TYPE	TYPE OF WORK	DESCRIPTION
Fisher – Rosemount Systems	<ul style="list-style-type: none"> Technology Mfr. 	<ul style="list-style-type: none"> DC Power System Commissioning DC Power System Acceptance Testing UPS Upgrade 	Fisher-Rosemount, contractor to Sasol, a steel manufacturer, is responsible for a network of remote instrument enclosure (RIE) buildings in Lake Charles, Louisiana. These facilities rely on DC power systems for switchgear and emergency back up power. We preformed DC power system commissioning and acceptance testing services, along with UPS upgrades.
The Proctor & Gamble Company (P&G)	<ul style="list-style-type: none"> Consumer Goods Mfr. 	<ul style="list-style-type: none"> Annual battery and UPS Preventive Maintenance Battery Testing Battery Replacement 	P&G operates more than 35 North American manufacturing plants in production 24x7. The DC power systems ensure switchgear operation and production reliability. We support multiple facilities with annual battery and UPS preventive maintenance services.
Nucor Steel	<ul style="list-style-type: none"> Metal Mfr. 	<ul style="list-style-type: none"> Quarterly and Annual Battery and UPS Maintenance Battery Testing 	Nucor Steel recently reopened a manufacturing facility in Louisiana. The battery and UPS systems are critical to supporting the switchgear and 24x7 processing equipment. We preformed the AC acceptance testing and also provided coordinated AC and DC power system preventive maintenance services, quarterly and annually, resulting in considerable savings for the company.
Microchip Technology	<ul style="list-style-type: none"> Microchip Mfr. 	<ul style="list-style-type: none"> Annual Preventive Maintenance Charger Replacement UPS Replacement 	Microchip Technology is a manufacturer of microcontroller, mixed-signal, analog and Flash-IP integrated circuits. The DC power systems, in the Gresham, Oregon-based, wafer fabrication facility support multiple redundant power chains to ensure uninterrupted operation. We performed annual preventive maintenance services including battery testing and charger and UPS replacement services.
WestRock	<ul style="list-style-type: none"> Paper and Packaging Mfr. 	<ul style="list-style-type: none"> Industrial UPS Preventive Maintenance UPS Rental Battery Testing Battery Replacement 	WestRock is one of the largest paper and packaging companies in the U.S. with facilities across the country. Its DC power systems support switchgear, safety equipment, and distribution controls. Our reputation for electrical maintenance and testing services lead to a DC power systems project, including UPS maintenance and battery replacement services at the Jacksonville, Florida and Hodge, Louisiana facilities.

QUALIFICATIONS SUMMARY

Commercial Complex

CUSTOMER	COM. TYPE	TYPE OF WORK	DESCRIPTION
Bellagio Resort and Casino	<ul style="list-style-type: none"> Hotel, Resort, Casino 	<ul style="list-style-type: none"> Bi-Annual and Annual Battery and UPS Preventive Maintenance Battery Replacement 	Bellagio is a resort, 3,950 - room luxury hotel, and casino in Las Vegas, Nevada. The DC power configuration is comprised of 24 UPS and battery systems supporting the switchgear, data center, and telecommunication applications. We provided semi-annual and annual preventive maintenance and battery replacement services.
University of Texas	<ul style="list-style-type: none"> University 	<ul style="list-style-type: none"> Annual UPS Preventive Maintenance Battery Replacement 	The University of Texas is comprised of over 15 buildings and parking garages, covering 1,438 acres. Five UPS systems support the emergency lighting for the campus. We provided annual preventive maintenance and battery replacement services to ensure the operation and safety of faculty and students.
University of New Mexico	<ul style="list-style-type: none"> University 	<ul style="list-style-type: none"> Industrial UPS Preventive Maintenance Battery Tests Battery Replacement 	University of New Mexico's main campus is located on 600 acres in Albuquerque, New Mexico. Its DC power systems support the switchgear of four substations and a fifth DC power system supports emergency backup power. For more than 15 years, we have provided annual preventive maintenance services. We initially identified multiple outdated batteries, provided battery replacements, and now provide routine battery and UPS maintenance services.
RXR Realty - Helmsley Building	<ul style="list-style-type: none"> Mixed Real Estate 	<ul style="list-style-type: none"> Battery Assessment Battery Testing 	RXR Realty is a large property management company in New York responsible for the Helmsley, a 35-story, residential landmark building. Its DC power system supports medium-voltage switchgear and emergency, backup, and standby power. We provided battery assessment and testing services.
Apple	<ul style="list-style-type: none"> Data Center 	<ul style="list-style-type: none"> Annual Battery and UPS Preventive Maintenance 	Apple's newly constructed, Reno, Nevada data center took several months to complete. One month after the data center opened, a DC power system, originally installed at the beginning of construction, was due for preventive maintenance services. We responded to an RFQ and won the project based on our reputation and competitive pricing.

Appendix I — Directory of Locations



Directory of Locations

In the United States, we support our customers through a network of two service organizations including Vertiv Electrical Reliability Services and High Voltage Maintenance Corp. These strategically located service centers and satellite offices provide cross regional support with access to local resources and direct service capability.

Vertiv's Electrical Reliability Service Centers

Arizona

Phoenix Area Service Center
221 East Willis Rd., Suite 3
Chandler, AZ 85286
PH: (480) 966-4568
FAX: (480) 966-4569

Tucson Area Satellite Office
PH: (520) 572-6235

California

Los Angeles Area Service Center
10606 Bloomfield Avenue
Santa Fe Springs, California 90670
PH: (562) 236-9555
FAX: (562) 777-8914

San Diego Area Service Center
5909 Sea Lion Place, Suite C
Carlsbad, California 92010
PH: (858) 695-9551
FAX: (858) 695-0861

San Francisco Area Service Center
6900 Koll Center Parkway, Suite 415
Pleasanton, California 94566
PH: (925) 485-3400
FAX: (925) 485-3436

Colorado

Denver Area Service Center
7100 Broadway, Suite 7E
Denver, Colorado 80221
PH: (303) 427-8809
FAX: (303) 427-4080

Florida

Ft. Myers Area Service Center
11000 Metro Parkway, Suite 30
Ft. Myers, Florida 33966
PH: (239) 693-7100
FAX: (239) 693-7772

Jacksonville Area Satellite Office
PH: (904) 495-8975

Miami Area Satellite Office
PH: (305) 669-0048

Orlando Area Satellite Office
PH: (239) 707-3521

Tampa Area Satellite Office
PH: (813) 225-3426

Georgia

Atlanta Area Service Center
2275 Northwest Parkway SE
Suite 180
Marietta, Georgia 30067
PH: (770) 541-6600
FAX: (770) 541-6501

QUALIFICATIONS SUMMARY

Whether it's an emergency or an ongoing project, you need a service partner who can respond where and when you need them. With strategically located service centers across the U.S., you'll receive local response with nationwide capability.

Louisiana

Baton Rouge Area Service Center
3535 Emerson Parkway, Suite A
Gonzales, Louisiana 70737
PH: (225) 647-0732
FAX: (225) 647-0740

Lake Charles Area Service Center
245 Hood Road
Sulphur, Louisiana 70665
PH: (337) 583-2411
FAX: (337) 583-2410

Shreveport Area Service Center
9636 St. Vincent's Avenue, Unit A
Shreveport, Louisiana 71106
PH: (318) 869-4244
FAX: (614) 410-8594

Missouri

Kansas City Area Service Center
400 NW Capital Drive
Lee's Summit, Missouri 64086
PH: (816) 525-7156
FAX: (816) 524-3274

Nebraska

Omaha Area Satellite Office
PH: (531) 215-5630

Nevada

Las Vegas Area Service Center
6351 Hinson Street, Suite A
Las Vegas, Nevada 89118
PH: (702) 597-0020
FAX: (702) 597-0095

Reno Area Service Center
1380 Greg Street, Suite 216
Sparks, Nevada 89431
PH: (775) 746-4466
FAX: (775) 746-4469

New Mexico

Albuquerque Area Service Center
8500 Washington Street NE, Suite A-6
Albuquerque, New Mexico 87113
PH: (505) 822-0237
FAX: (505) 822-0217

North Carolina

Charlotte Area Satellite Office
PH: (704) 516-8345

Ohio

Corporate Headquarters
610 Executive Campus Drive
Westerville, Ohio 43082
PH: (877) 468-6384
FAX: (614) 410-8420

Vertiv Academy
530 Westar Blvd.
Westerville, Ohio, 43082
PH: (614) 841-5400

Oregon

Portland Area Service Center
4099 SE International Way
Suite 201
Milwaukie, Oregon 97222
PH: (503) 653-6781
FAX: (503) 659-9733

Eugene Area Satellite Office
PH: (541) 747-9782

Tennessee

Memphis Area Satellite Office
PH: (318) 294-6009

Nashville Area Satellite Office
PH: (404) 977-3390

Texas

Dallas Area Satellite Office
PH: (214) 218-2794

El Paso Area Service Center
1057 Doniphan Park Circle
Suite A
El Paso, Texas 79922
PH: (915) 587-9440
FAX: (915) 587-9010

Houston Area Service Center
1426 Sens Road, #5
La Porte, Texas 77571
PH: (281) 241-2800
FAX: (281) 241-2801

Utah

Salt Lake City Area Service Center
9736 South Sandy Parkway
500 West
Sandy, Utah 84070
PH: (801) 561-0987
FAX: (801) 561-0873

Washington

Seattle Area Service Center
2222 West Valley Highway N
Suite 160
Auburn, Washington 98001
PH: (253) 736-6010
FAX: (253) 736-6015

Spokane Area Satellite Office
PH: (509) 370-6209

High Voltage Maintenance Service Centers

Connecticut

Connecticut Area Service Center
29 Diana Court
Cheshire, CT 06410
PH: (203) 949-2650
FAX: (203) 949-2646

Illinois

Chicago Area Service Center
941 Busse Road
Elk Grove Village, IL 60007
PH: (847) 640-0005
FAX: (847) 640-0004

Indiana

Indianapolis Area Service Center
1052 Greenwood Springs Blvd.
Suite E
Greenwood, IN 46143
PH: (317) 322-2055
FAX: (317) 322-2056

Maryland

Baltimore Area Satellite Office
PH: (410) 309-5970
FAX: (410) 309-0220

Massachusetts

Boston Area Service Center
24 Walpole Park South, Suite 3
Walpole, MA 02081
PH: (508) 668-9205
FAX: (508) 668-2142

Michigan

Detroit Area Service Center
24371 Catherine Industrial Drive
Suite 207
Novi, Michigan 48375
PH: (248) 305-5596
FAX: (248) 305-5579

New York

New York Area Service Center
1250 Broadway, Suite 2300
New York, NY 10001
PH: (718) 239-0359

Ohio

Cincinnati/Kentucky Satellite Office
PH: (859) 371-5355
FAX: (859) 371-5399

Columbus Area Satellite Office
PH: (614) 807-3408

Cleveland Area Satellite Office
PH: (440) 951-2706

Dayton Area Service Center
5100 Energy Drive
Dayton, OH 45414
PH: (937) 278-0811
FAX: (937) 278-7791

Pennsylvania

Pittsburgh Area Service Center
355 Vista Park Drive
Pittsburgh, PA 15205
PH: (412) 747-0550
FAX: (412) 747-0554

Philadelphia Area Sattelite Office
PH: (800) 619-0032

Wisconsin

Milwaukee Area Service Center
300 S. Calhoun Road
New Berlin, Wisconsin 53151
PH: (262) 784-3660
FAX: (262) 784-5124



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