Hepburn and Sons LLC

Hepburn Technologies

Advanced Power Solutions for Tomorrow's Navy

TECHNICAL CHALLENGE:

Integration of next generation power components into mission-driven Shipboard Power Systems for unrivaled capability and operational availability

HEPBURN AND SONS TECHNOLOGIES & SOLUTIONS:

Insulated Bus Pipe (IBP)



Description

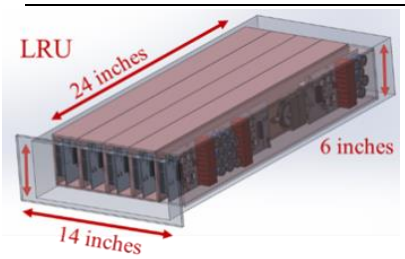
Vast Rugged and modular power distribution alternative to legacy cable that provides touch safe, high current medium voltage direct current (MVDC) and alternating current (MVAC) power transmission medium. Stäubli Electrical Connectors enable toolless assembly.

Techincal details: designed up to 3kA and 12 kV DC / 15 kV AC tested, scalable up to 8kA, 1.5x bend radius, straight lengths up to 50ft

Benefits

- ✓ Supports modular ship construction
- ✓ Enables labor cost savings and ship construction schedule savings
- ✓ Reduces lifecycle maintenance due to high fire, abrasion resistance, and boltless connections
- ✓ Coaxial variant providing kA-level of current with zero electro-magnetic signtature

Modular Solid-State Transformer (SST)

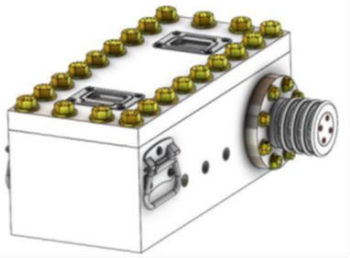


Next generation, scalable power transformer / rectifier that provides more reliable, maintainable, and compact alternative to existing solutions.

Techincal details: 5 kVAC, 1 kVDC, 75 kVA SST all in a 3.5U, single sailor-carriable box. 900 kVA in a 42U rack. Supports up to 15 kV (95 kV Basic Impulse Level) and parallelizable to 10s–100s of MW

- ✓ Maximizes reliability for seamless internal redundant power change over
- ✓ Increases operational availability
- ✓ Eases supply chain and logistics concerns due to modularity
- ✓ Reduces weight, volume, and space required for component installation and operation

MVDC Disconnect Switch

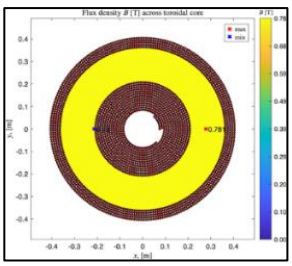


Shipboard power distribution in-line isolation, enabling shipboard power equipment maintenance for lock-out tag-out (LOTO) function. Advanced insulator using supercritical fluids to provide safe LOTO for 1kV DC up to 12 kV DC systems.

Technical details: Capacity to break up to residual 2% load current.

- ✓ Increases sailor safety in cost-optimized implementation
- ✓ Enabling efficient shipboard power system maintenance
- ✓ Minimize upstream switchgear for power density

Resonant Grounding with Advanced Magnetics



Novel magnetic materials deployed for continuous MVAC grounding with ability to withstand non-isolated rectifier ground faults. Spatially tuned magnetic permeability enables saturation and hotspot control with natural convection cooling in mechanically robust ungapped cores.

Technical details: Mitigates up to 20A of ground fault current with less than 2.5 kW loss on a 15 kV AC systems.

- ✓ Casualty-resilience, withstanding non-isolated ground faults
- ✓ COTS cabinets provide additional shock and vibration resiliency
- ✓ Design based tuning for flexible SPS installation

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Machine Learning Enhanced Metrology & System Health Monitoring

TECHNICAL CHALLENGE:

Insight and management of electrical power systems to drive operational availability and maximum warfighter readiness

HEPBURN AND SONS TECHNOLOGIES & SOLUTIONS:

Insulation Health Monitoring System

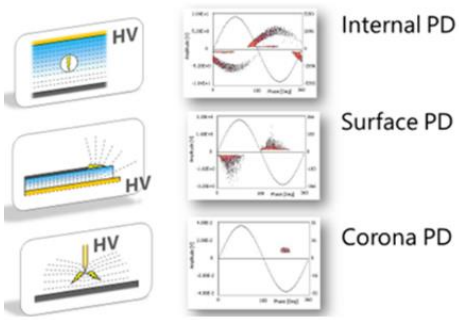
- Interprets partial discharge and non-destructive space charge measurements to infer power asset damage and health. Discerns AC, Pulse-Width Modulation (PWM), DC partial discharge signatures. Identifies critical and non-critical types of damage.

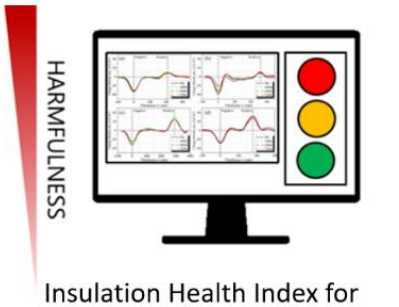
Ground Fault Localization System

- Reduces time to find and remediate power system faults by identifying feed and distance from measurement hardware, maximizing operational availability and prioritizing warfighter safety with mitigation of severe fault case scenarios. Identifies ground fault occurrence within µS. Localizes within <1 meter in milliseconds.

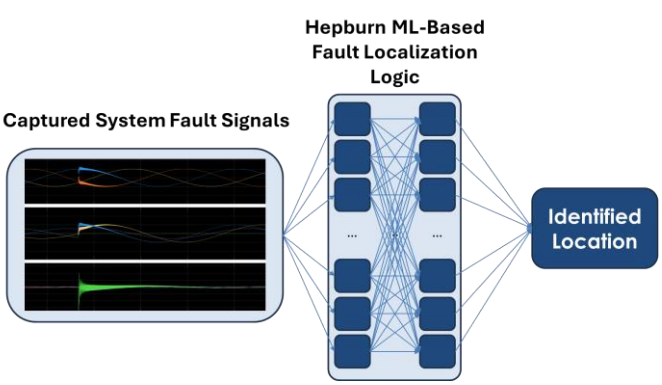
Zonal DC Protective Relay

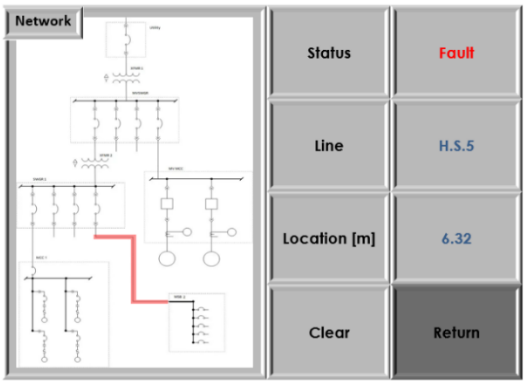
- Identifies fault location within a zonal DC system architecture, enabling rapid isolation response. Distinguishes between fault and high slew rate pulsed loads.





Insulation Health Index for Estimated Remaining Service Life





Government Partners

- DOE
- NSWC Philadelphia Division
- ONR
- PAE Maritime
- PMS 470
- Team Ships

Industry Collaborators

- Bechtel Plant Machinery Inc. (BPMI)
- American Bureau of Shipbuilding (ABS)
- Core Power Magnetics
- Curtiss-Wright
- Leonardo DRS
- Geometric Data Analytics
- GD Bath Iron Works
- GD Electric Boat
- HII-Newport News Shipbuilding
- HII-Ingalls Shipbuilding
- Northrop Grumman
- ONR ManTech



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