Nuclear Motor and Gear Services
Repair, Replacement, Testing and Decontamination

NUREG-0588 CAT-I (EO) Insulation Systems
24-Hour Emergency Service
Innovative Solutions for Plant Life Extension.
Motor, Generator, and Gearbox Repair and Replacement

Founded in 1927, and now part of Timken Power Systems, Schulz Electric is the preferred safety-related motor repair facility in the nuclear power industry, offering decontamination, engineering and repair in one building. Schulz has performed work for every nuclear utility in the United States, Canada and Mexico. This work has included supplying new large EQ safety-related motors, performing contaminated motor repair, repairing and testing MOV motors, EDG pole and stator rewinds, and repair or replacement safety-related gearboxes.

Technicians rewinding and restacking a 2000 HP, 4 kV circ water pump motor.

Core loop test shows core degradation prior to restack and rewind.

Rewind using Schulz Electric's form-wound EQ insulation system.

Motor, gearbox, MOV and EDG services
- NUREG-0588 CAT-I insulation systems
- Rewind and overhaul
- Bearing replacement
- Dynamometer full-load testing
- Shaft replacement
- Contaminated motor and gearbox repair
- Supply of new and repair of EQ motors
- Seismic qualification per IEEE-344
- Specialized testing for MOV motors (GL 89-10)
- Supply of new and repair of safety and non-safety gearboxes

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Quality Assurance and Engineering Services

Quality

Schulz Electric maintains an extensive quality program that is ISO 9001:2008 certified for non-safety related units, meets the requirements of 10CFR50 Appendix B and NQA-1-1994, as audited by NUPIC and various customers, and Z299.2, as audited by our Canadian customers.

Engineering

The Schulz project engineering department staffs both mechanical and electrical engineers as well as project management specialists.

New safety-related motors/dedication

Schulz incorporates one of the most rigorous, in-depth, motor dedication programs available to the industry.

• Full-load testing is performed on every motor dedicated.
• Testing includes elevated or reduced voltage testing and locked rotor testing when required.
• Schulz Electric provides new and repaired motors that meet all industry safety-related and environmental qualification needs (both mild and/or harsh EQ).
• New motor dedication for both mild and harsh environments with seismic qualification.

“Thank you again to Schulz Electric for another outstanding job. Your reliability and professionalism is greatly appreciated.”

Senior Buyer-Nuclear Purchasing, BWR, Northeast US.

“(1250 HP Reactor Recirc MG set. Decontamination, overhaul and re-lead, returned in 14 days.)

“I appreciate working with your professional organization and allowing us to achieve excellence in equipment reliability.”

Vibration Engineer
BWR, Mid-Atlantic US.

“Thank you for quality workmanship, schedule adherence, and meeting the commitment.”

Maintenance Director
BWR, Mid-Atlantic US.

“(Rapid, back-to-back rewinds of three 4500HP vertical condensate pump motors presenting near-term threat winding flaws. All three were completed within a one month period.)
Schulz Electric offers environmentally qualified form and random-wound insulation systems that meet requirements of 10CFR50.49. Our random-wound EQ insulation systems include inside containment, intermittent duty (MOV), and continuous duty radiation-only qualified configurations.

All of Schulz’s random-wound EQ insulation systems and our form-wound EQ insulation system feature a fully taped coil system and meet NUREG-0588 CAT-I Requirements (IEEE 323-1974).

**Medium voltage motor lead wire**

Schulz has environmentally qualified low smoke, zero halogen (LSZH), medium voltage motor lead wire when used with Schulz Electric’s form-wound EQ motor insulation system.

Results of the qualification program are documented in Schulz Electric EQ Report QR1602.

**Inside-Containment Qualification Curves**

![Diagram of Inside-Containment Qualification Curves](image)

Schulz Electric uses EPRI’s inside containment, random-wound EQ insulation system for fan applications, which exceeds current OEM qualification parameters.

**MOV Motor Services**

Schulz provides in-depth testing of both AC and DC MOV motors that includes requirements of NRC generic letter GL-89-10, such as:

- Reduced voltage testing
- Increased ambient temperature testing
- Locked rotor testing
- Speed/torque curves
- Testing at 70, 80, 90, 100 and 110% of rated voltage
- Data acquisition systems including ADAMS and ADAMS2
- Class H winding insulation

Schulz provides fast turnaround times and will repair your MOV motors meeting industry needs and requirements.
Vacuum Pressure Impregnation (VPI)

- A winding that undergoes VPI is virtually impervious to oil, moisture and chemical contaminants.
- Results in the greatest mechanical strength for windings, a cooler running motor, improves performance and reliability and extends machine life.
- Can be used for AC and DC motor stators, armatures, field coils and transformers.
- In-house systems are compliant with Schulz’s EQ insulation systems.
- Schulz has two independent VPI systems in-house, specific to the Schulz insulation system and to EPRI, respectively.
- Post-VPI windings will pass spray and immersion hi-pot testing.

Random-wound intermittent duty EQ insulation*†

- 20-year qualified life @ 50° C ambient with a 80° C rise, 0-90% RH, 1040 load cycles
- 5.1 x 10⁷ rad normal, 1.7 x 10⁸ rad accident, 2.2 x 10⁸ rad TID
- 8 OBEs to 6.67g, 1 SSE to 10g (5% damping)
- LOCA test, 425° F peak temperature, 77 PSIG pressure, PWR chemical and water spray, 100% humidity

Random-wound continuous duty radiation-only EQ insulation

- 20-year qualified life @ 50° C ambient with a 80° C rise, 0-90% RH
- 5.2 x 10⁷ rad normal, 1.7 x 10⁸ rad accident, 2.3 x 10⁸ rad TID
- 8 OBEs to 6.67g, 1 SSE to 10g (5% damping)

Form-wound continuous duty EQ insulation*

- 20-year qualified life @ 50° C ambient with a 80° C rise, 0-90% RH
- 2.0 x 10⁷ rad normal, 4.5 x 10⁷ rad accident, 6.5 x 10⁷ rad TID
- 8 OBEs to 6.67g, 1 SSE to 10g (5% damping)
- MSLB/HELB test, 395° F peak temperature, 70 PSIG pressure, 100% humidity

Inside containment random-wound continuous duty EQ insulation*†

- 40-year qualified life @ 40-50° C ambient with a 80° C rise, 10-90% RH, 2193 load cycles
- Radiation TID: 1.05 x 10⁸ rad
- LOCA/HELB test, peak temp: 419° F, 100% relative humidity, PWR chemical spray, 104 PSIG peak pressure

*One-year post accident operation.
Decontamination

Schulz Electric is licensed by the NRC to decontaminate motors to unconditional free-release status. Routine monitoring for radioactive contamination is performed throughout the entire Schulz facility.

Along with the radiation safety officer, trained radiation workers receive and survey incoming motors that are potentially contaminated.

Methods of Decontamination:
- Bead blasting
- Cryogenics
- Steam cleaning
- Non-destructive

Machine shop services

In-house machining allows for expedited turnarounds. Together with a strict quality program, our machine shop ensures that rigid specifications are maintained throughout the entire machining process.

Custom repairs
- Shaft repair and replacement
- Custom manufacturing of obsolete parts
- Rotor repair
- Stator repair

Turnaround Times

350 HP EQ Harsh Environment, 4kV Vertical Motor: Decontaminated, rewound, overhauled and tested in 9 days, 16 hours. Occurred during Christmas week, shipped on a Sunday at 10 pm.

15 HP, AC Wound Rotor Crane Motor, Needed for an Outage: Arrived at Schulz on a Friday morning. Rewound, overhauled and tested in under 72 hrs. Shipped to customer via helicopter.

1250 HP, MG Set Motor: Re-lead and overhaul. Completed in 5 consecutive days: I & A, motor repair plan, re-lead, varnish treatments, testing and painting.

(10) 40 HP and (10) 60 HP EQ Motors: All NUREG-0588 CAT-I Insulation System Rewinds. All motors included upgrades including accelerometers, bearings, extensive machining and complicated load-test. Each group of motors was completed in 8 weeks.

Engineer’s labyrinth seal drawing as provided to Schulz machinist.

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Gearbox Solutions — New, Repair, Upgrade

**Gearing solutions from a world leader**

Schulz Electric now provides a full suite of aftermarket gear products and services including: new enclosed drives; overhauled and upgraded gearboxes; OEM parts; and Onsite Technical Services (OTS). Additionally, Schulz is the only New England-based supplier to have access to the SOP’s and intellectual property of Timken Power Systems, which includes Philadelphia Gear, Western Gear, and WesTech brand gear drives.

As part of a network of regional service centers focused on total power train solutions, Schulz Electric is uniquely positioned to offer its customers inspection, overhaul and upgrade solutions for their mission critical gear drives. We use the same processes, procedures that Philadelphia Gear has pioneered since 1892, and we back it all with a best-in-industry, 3-year warranty.

**Expertise in the service center, reliability in the field**

Using state-of-the-art inspection and measurement techniques, we are equipped to answer critical operational questions from our customers. Our goal is to provide the rotating equipment decision makers with the data they need to make informed decisions.

Additionally, by performing a detailed design review of both the gearbox and its application, the service center can determine the up-rate potential of the unit, and incorporate any designed upgrades during the inspect and repair process.

**Gear aftermarket services**

Backed by more than a century of engineering and manufacturing excellence, Schulz faces the toughest gearbox repair challenges in the most demanding industries.

- ISO 9001 Certified
- Expertise in all gearing types and applications
- On-site assistance 24/7/365
- Reverse engineering and up-rating capability
- We work on any brand, any time
- Parts made to OEM specs
- Overhaul and repair of safety-related gearboxes
- Manufacture of new gearboxes

**Engineered upgrades to get more out of your equipment**

Things change over time. Yesterday’s state-of-the-art equipment is today’s high risk machine. Changes to your processes and outputs may have occurred since your equipment was installed, yet capital dollars for replacement have gotten tighter.

Call your Schulz Electric representative today to see how we can extend the life of your critical equipment. After all, our goal is the same as yours: reduce unplanned downtime.

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Capabilities Summary

Testing

- AC power: 0 to 13.2kV
- DC power: 0 to 1200V
- Dynamometers: fractional to 1500 HP, varies per RPM, both vertical and horizontal
- Surge tester: 0 to 40,000V
- High potential tester: 0 to 60,000V AC/100,000DC
- Continuous megger: 5000V/3000 gigaohms
- Low resistance to 1 microhm
- Data acquisition systems including the ADAMS, ADAMS2 and ADRE system by GE Bently-Nevada
- Core loss testing with infrared images
- Specialized testing for MOV motors

Motor and gear shop

- Motor and generator repairs to 50,000 HP
- Vacuum Pressure Impregnation (VPI)
- Authorized by UL for repair of hazardous duty motors
- Climate controlled coil winding area
- Bearing replacement
- Shaft replacement
- Contaminated motor repair
- Supply of new and repair of EQ motors
- Seismic qualification by analysis per IEEE 344
- Repair and upgrade of safety and non-safety gearboxes

Machine shop

- Large machining capabilities
- Babbitt bearing repairs
- Vertical & horizontal digital boring mills
- Dynamic balancing to 60,000 lbs.
- Welding – Tig, Mig, Arc & Gas
- Manufacture and replace shafts of AISI 4140 material for MOV motors that have had keys replaced with AISI 4140 material in high impact loading applications (IN 94-10)

The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets high-performance mechanical components, including bearings, gears, belts, chain and related mechanical power transmission products and services.

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