Green Power Solutions

CPE – Constant Potential Exciter

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GPS Tech Seminar 2023

Constant Potential Exciter (CPE)

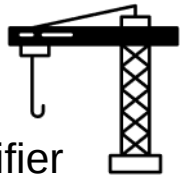
Constant Potential Exciters are high current AC/DC power converters which may use several rectifying devices in parallel in each leg of the converter.

Main Features

Static, open loop, AC line regulated, AC to DC conversion rectifiers. Line regulated models incorporate the use of a power Diode rectifier bridge to supply dependable & durable service for industrial, military and commercial applications.

Stabilized or adjustable output, direct current, closed loop, phase-controlled Thyristors, heavy industrial rectifier system.
Specifically designed for applications requiring a closely regulated DC output over a limited operating range.
Voltage range: 125V, 250V, 400V, 500V
Power: up to 2500 kW
Converter configuration: 3-Phase/Double-Way, 3-Phase/Bridge, 6-Pulse, 12-Pulse

Typical Applications



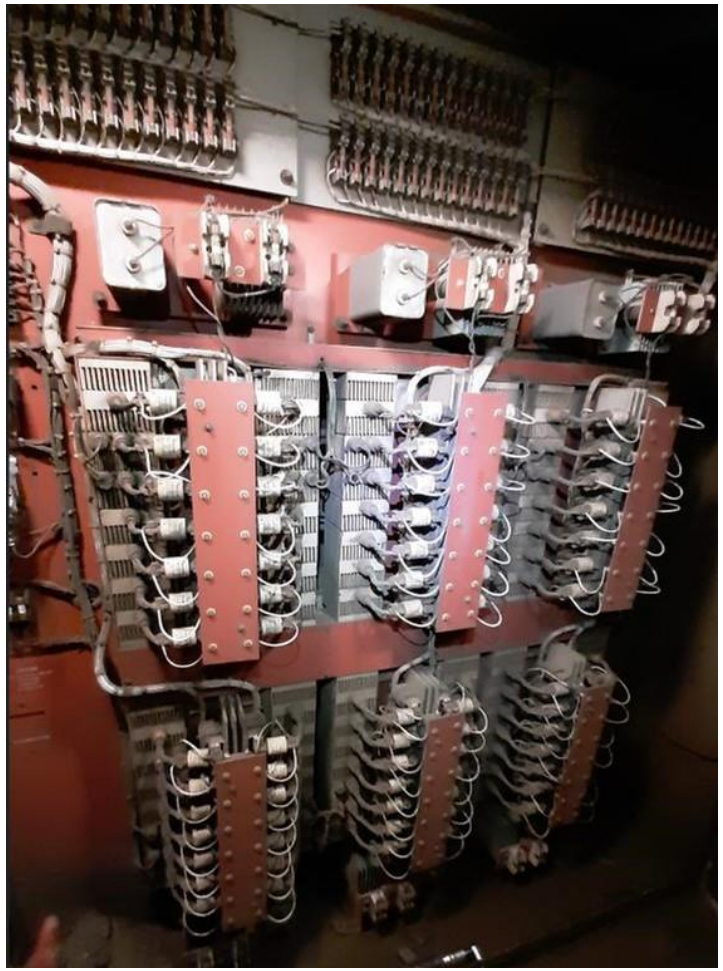
For Cranes with DC powered Rails and the rectifier ground based, equipment includes DC substations, constant potential Diode rectifiers or regulated Thyristor rectifiers. These rectifiers can feed one crane, multiple cranes, multiple crane bays or operate in paralleled with other rectifiers and/or MG sets onto a common DC bus. Options such as AC switchgear, redundant N -1 (or N - 2) semi-conductors and DC output main and feeder breakers as part of DC substation.
For Cranes with AC powered Rails, rectifiers designed for the highly demanding application of crane mounted rectifiers.

DC Motor Field Exciters / Dynamic Breaking

DigiCPE - Constant Potential Exciter

Typical CPE Power Rectifier Panels

Ternium Siderar - G.E. CPE & Distribution Panel



Cleveland-Cliffs - CPE Rectifier

AMI Thyristor Converter Control

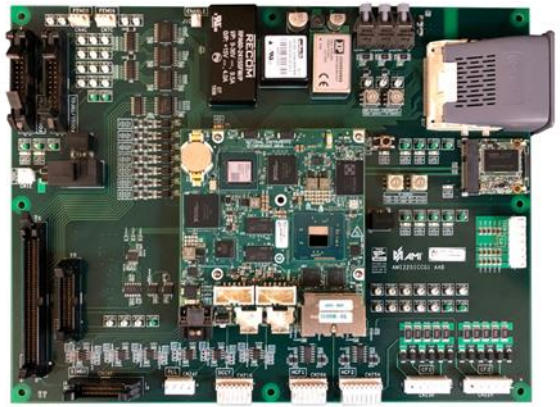
ESB – Embedded Single Board

ICC - Integrated Compact Controller

ESB Control Unit

- DigiFEX for AC Synchronous Machine
- DigiValve Thyristor Converter
- DigiSoft Start

- DC Brushless
- AC Brushless
- Collector Ring
- Quadramatic
- CPE
- LV Valve
- MV Valve
- SoftStarter



The AMI - ICC is a power electronics control processor board suitable for multiple thyristor-based rectifiers and valves.

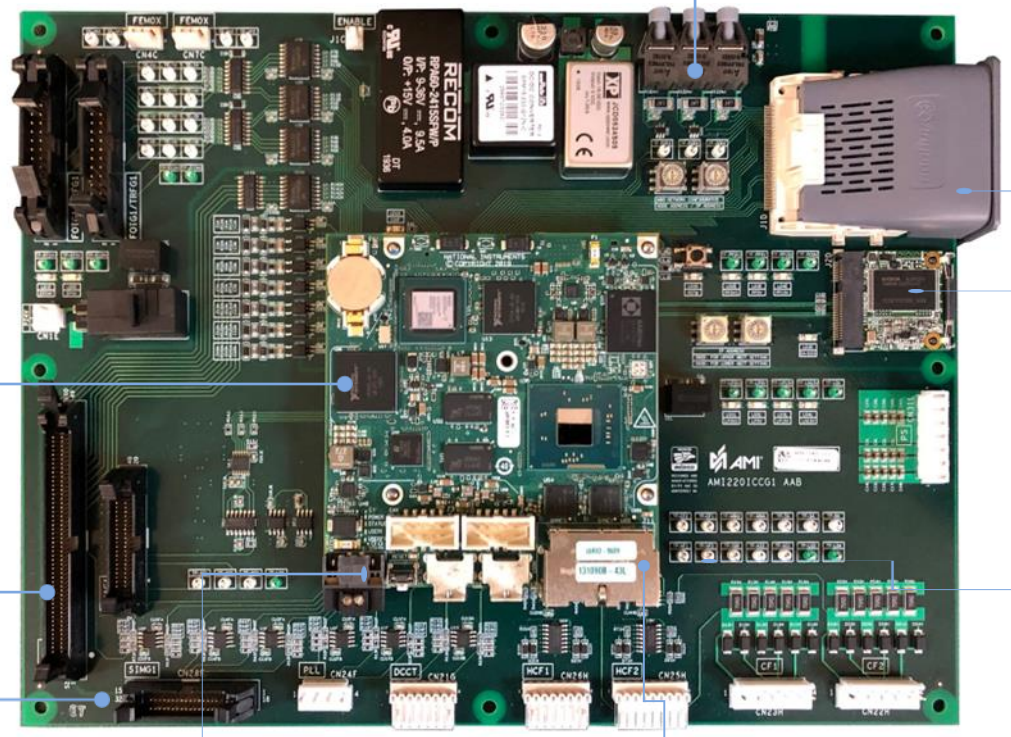
DigiFCR – Thyristor Control AMI Platform

ICC - Integrated Compact Controller

Fiber Optic Diagnostic Capability

Integrated communication protocols
(Profibus, ProfiNET, Modbus Ethernet, etc.)

- Intel Atom **Quad-Core** Processor
- Xilinx **Artix-7** FPGA
- Linux Real-Time OS (64-bit)



mSATA SSD
- Field Upgrades
- Clone Unit

AMI® Analog/Digital Interface Boards

Multiple Diag. Test-Points

USB Tipo-C
- 2.0, 3.1 Gen1, SS,
- Display Port for **SmartMonitor™**

Ethernet Ports (2)

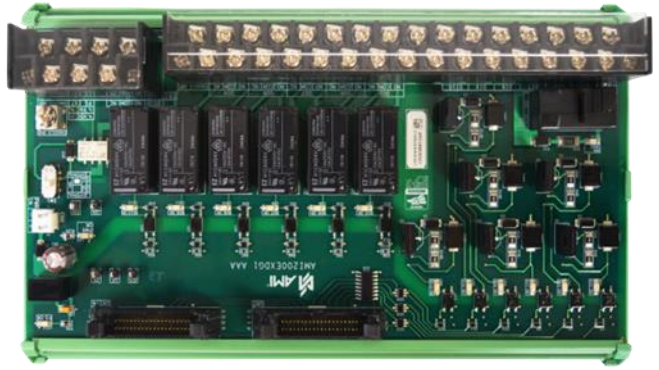
DigiFCR – Thyristor Control Platform

AMI Analog/Digital Interface Boards

SIMG1 - Drive's feedback signals

EXA

Augmented External I/O D/A



EXD

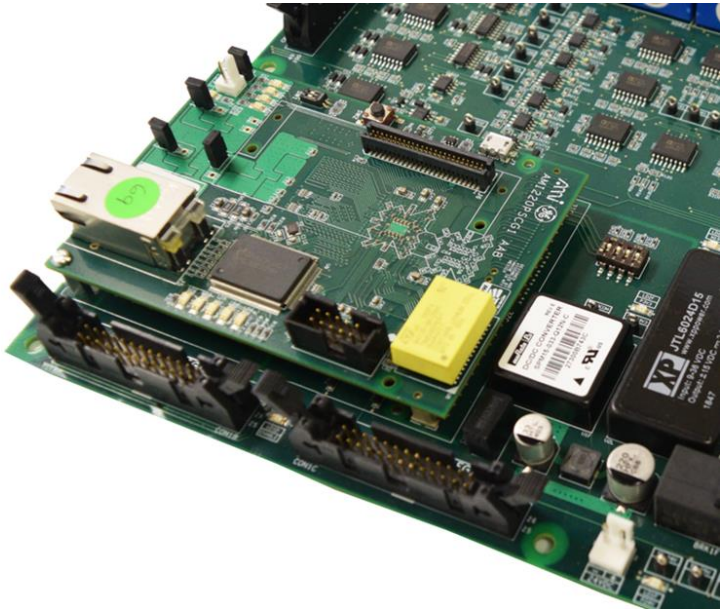
AXIO

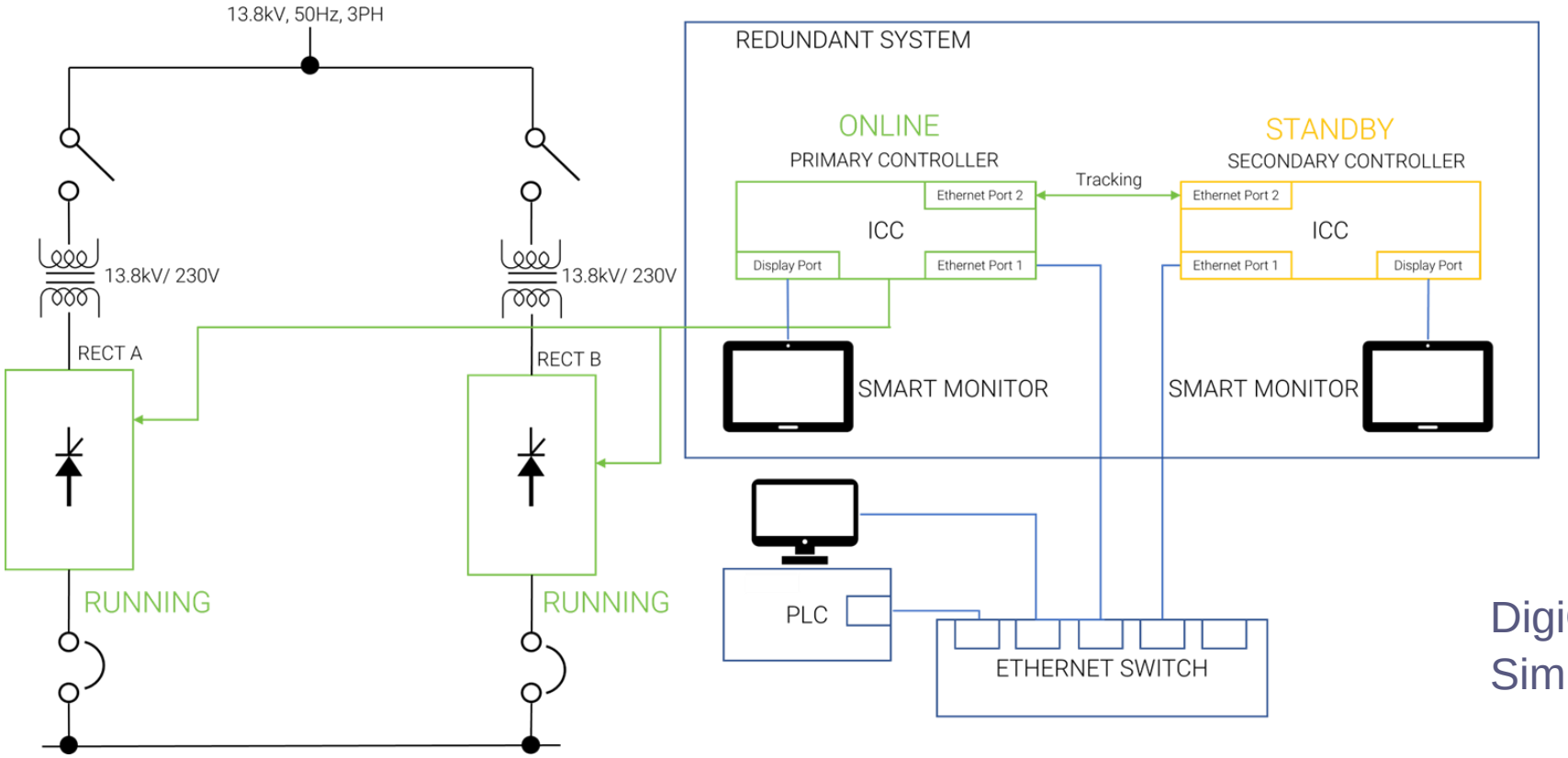
Designed to interface any DigiFCR Control Platform:

- ICC
- PXC
- TMdrive

DigiCPE - Constant Potential Exciter

ICC platform is used for Constant Potential Exciter Control.





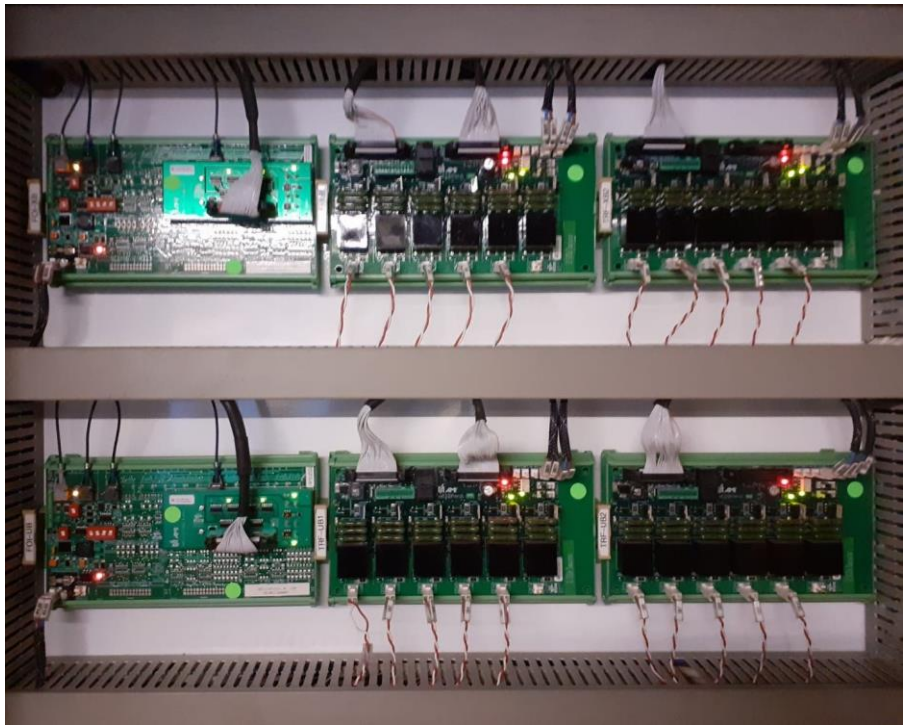
DigiCPE Double Redundance Simplified Layout

DigiCPE - Constant Potential Exciter

Control HW

Redundant Control Panel

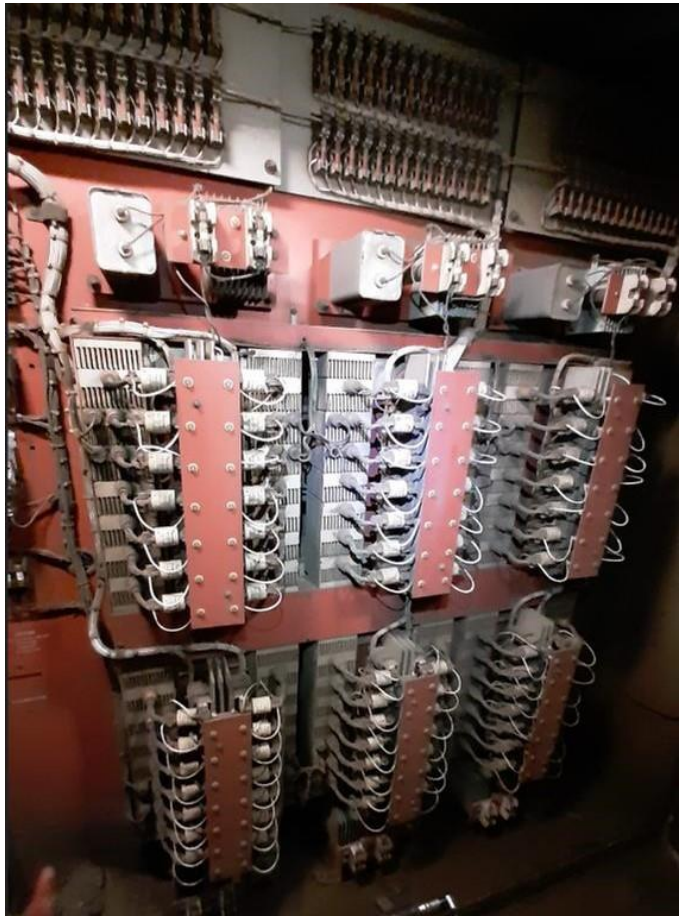
Thyristor Firing Panel



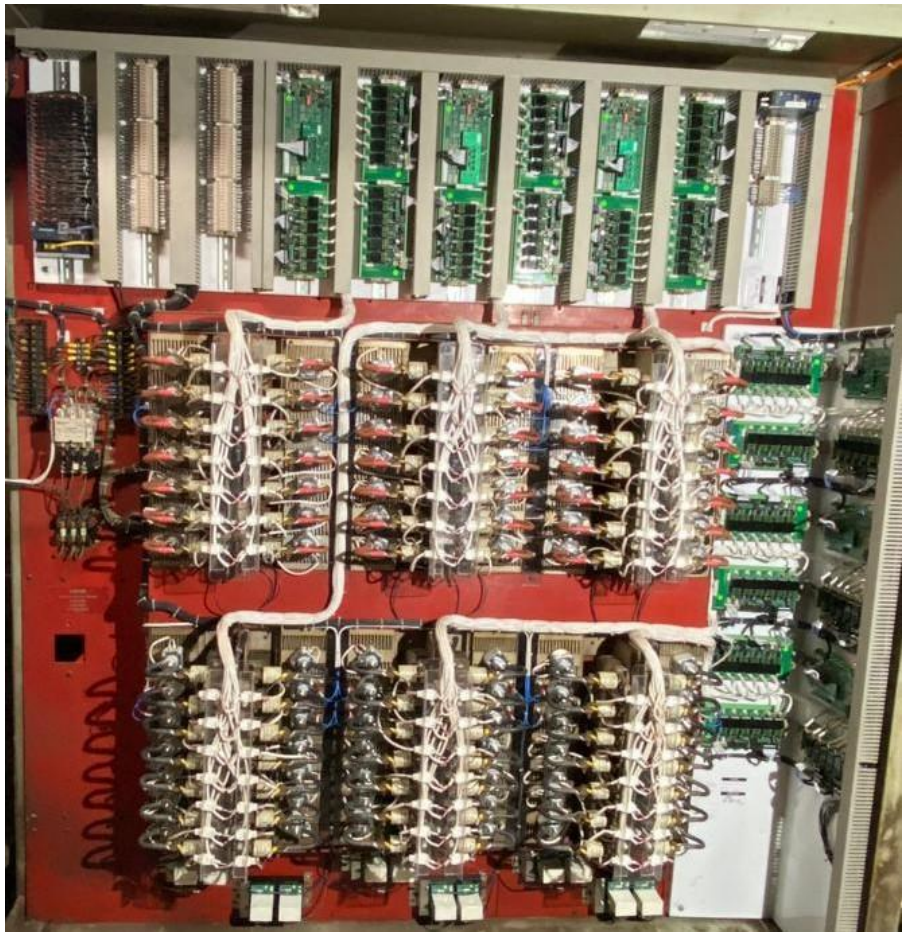
Thyristor Firing Boards

DigiCPE - Constant Potential Exciter

Power Rectifiers Revamping



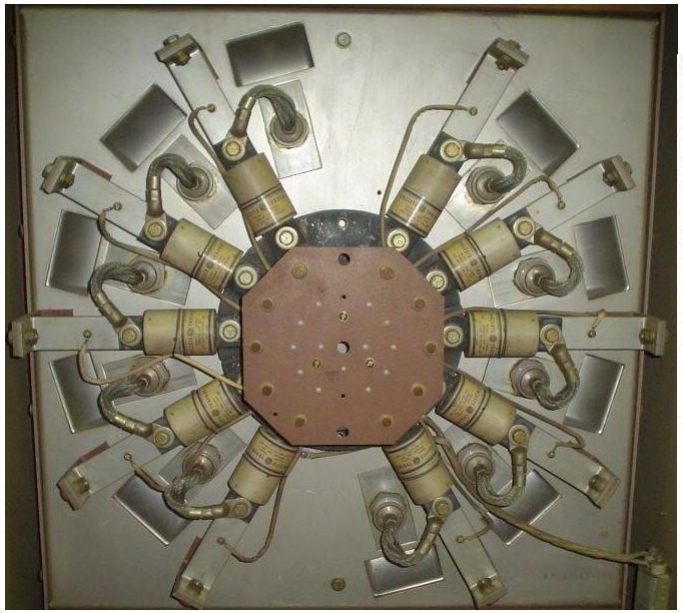
Original Stud Diode Rectifiers

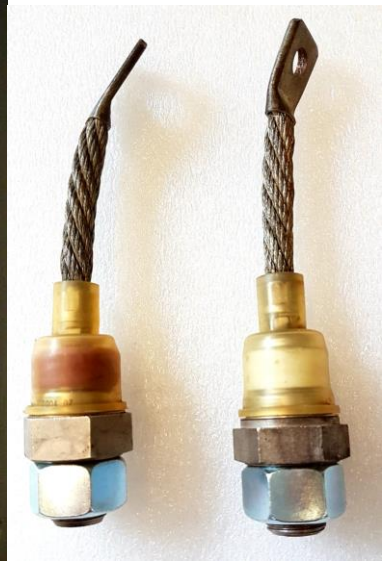


Upgraded Stud-box Thyristor Rectifiers

DigiCPE - Constant Potential Exciter

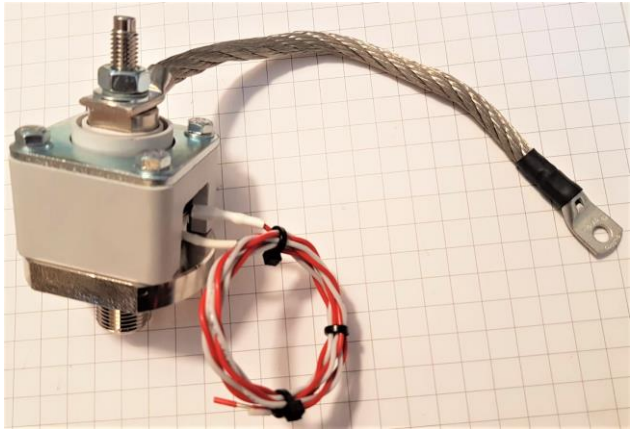
Power Rectifiers Revamping





Original Rectifier with old Stud Type Diodes (Single Arm / 10 Parallel)

- ❖ Unregulated DC Output

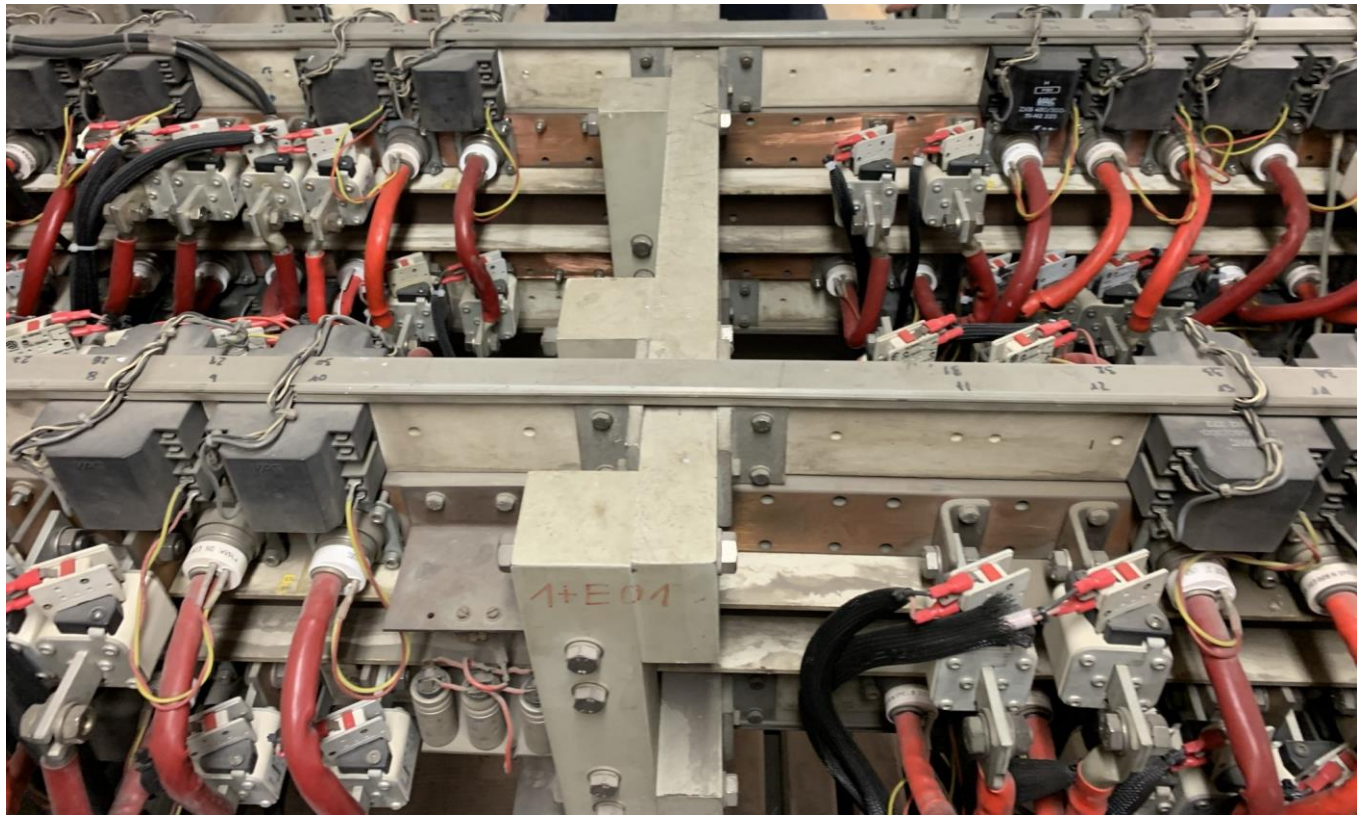


Upgraded Rectifier with GPS Stud-Box Thyristor (Hockey Puk Type)

- ❖ Regulated DC Output

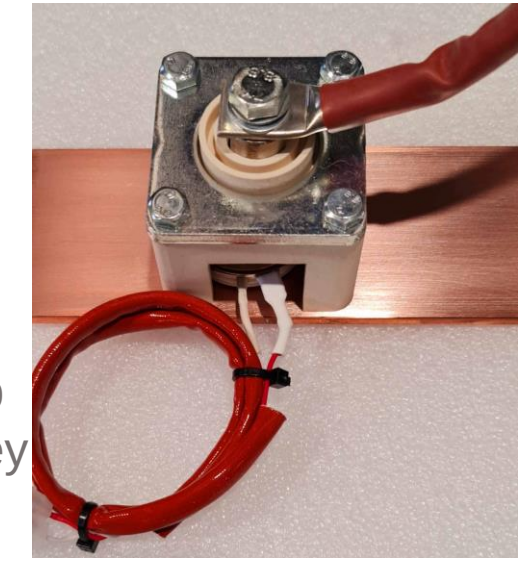
Multiparallel Rectifier Repowering

Typical Power Rectifiers



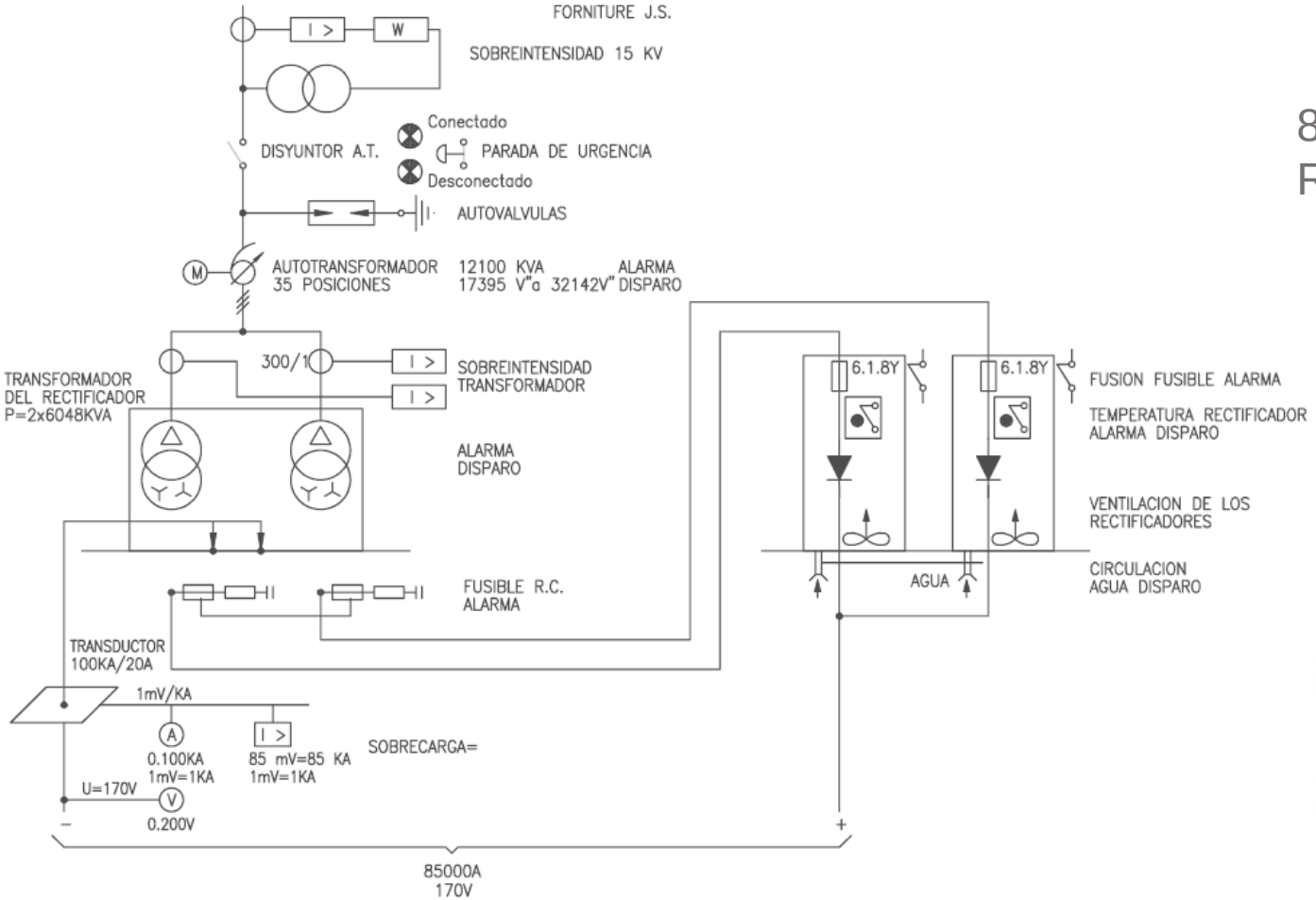
ElectroSlag Rementing Furnace
12.5 kA Bidirectional Converter
2-Phase/Double-Way/20-Paralle SCR for Arm

Old AEG
Flat-Case
Thyristor



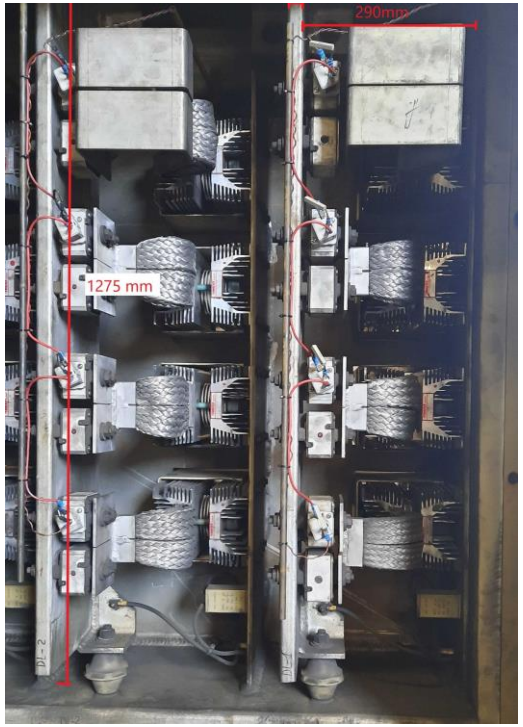
GPS Box-Clamp
Thyristor (Hockey
Puk Type)

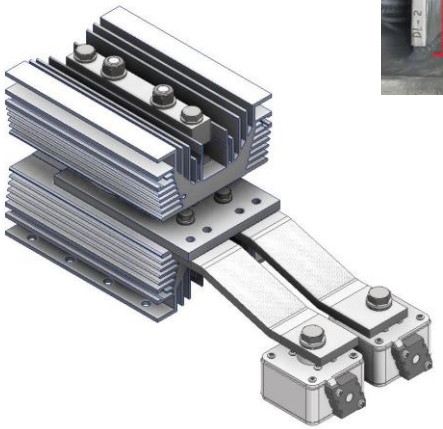
Multiparallel Rectifier Repowering



Resonac - Electric Furnace for Graphite Electrode
85 kA /175 V Rectifier 3-Phase/2xYY/12-Pulse

8-Parallel Diode Rectifier Arm





Single-Diode GPS Module for Repowering up to 95 kA

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THANK YOU!

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