

POWER ELECTRONICS PROJECTS

- ECIL in International Mega Science Projects
- **ULTRA STABLE POWER CONVERTERS** for FAIR, Germany
(28A – 535A DC , 15V – 250V DC, 100 ppm, 1Q, 2Q, 4Q)
- **HIGH VOLTAGE DC POWER SUPPLIES** for ITER
(100 KV for RFX, Italy & 100 KV, 27KV ITER India)
- Critical Systems for **Energy Extraction of Super Conducting Magnets** for CERN

ULTRA STABLE POWER CONVERTER FOR FAIR, Germany

Application

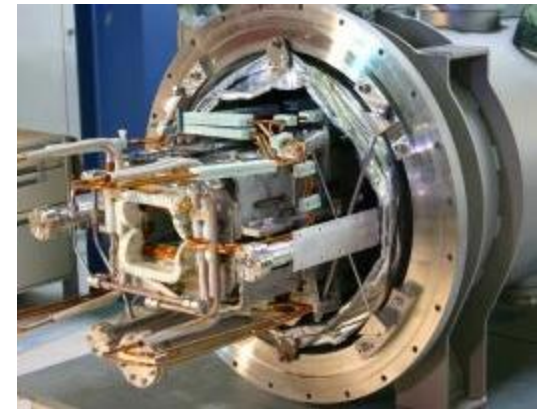
Programmable DC power for magnets used to transport, steer or focus ion beams in accelerators.

Customer

Facility for Antiproton and Ion Research, Germany

Salient features

Output current:	28A - 535A DC
Output voltage:	15V - 250V DC
Stability of current :	100 ppm
Quadrants of operation:	Four
Input:	3ph, 400V, 50Hz
Technology:	IGBT based SMPS,
Effective fsw :	20kHz



Typical super conducting magnet

630 nos of power converters of various ratings

Salient features of Power Converters

- IGBT based switched mode supplies
- Multiple Quadrant operations (1, 2, 4 Quadrants)
- Stability (20 to 100ppm)
- Current rating (up to 620A)
- Power rating (up to 150 kW)
- Flat top voltage ranging from 3V to 210V
- Ramp up voltage ranging from 4.8V to 260V
- Drives normal and super conducting Magnets up to 55 H
- Meeting IEC standards

- Prototype power converter for FAIR programme : Designed and built 535A, 200V(flat top) 4Q converter for proof-of-concept.



Salient features:

Maximum Power : 134kW
Maximum Current: 535A
Ramp rate : 54A/S
Total Deviation : 100ppm
Flat top Voltage : 200V
Ramp up Voltage : 250V
Quadrants of operation : 1-4
Type of cooling : Water cooled
Switching frequency of IGBT : 10 kHz
Load voltage : 100%

HIGH VOLTAGE POWER SUPPLIES FOR ITER (Neutral beam supply)

Application

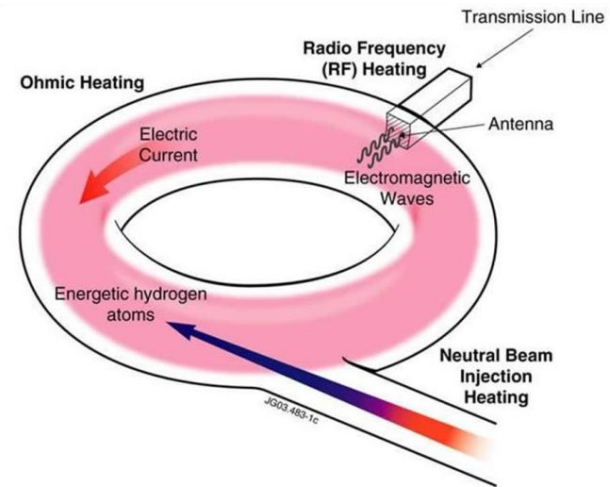
Adjustable high power dc supply for anode and grid of an RF generator. RF power is used to accelerate hydrogen ions. These ion beams are neutralized and impinged on plasma to raise its temperature

Customer: ITER (international thermonuclear experimental reactor at RFX), and II

Salient features

Max. output power:	5.0 MW
Output voltage:	Up 100 kV
Output current:	75A
Accuracy of voltage:	1%
Output capacitance:	$\leq 10\text{nF}$
Input:	3ph, 22 kV, 50Hz

Technology: **Filter less**. PSM (Power Step Modulation),
150 nos of dc power supplies cascaded through IGBTs.



High Voltage Regulated DC Power Supplies for ITER

- Based on Pulse Step Modulation technology with 12 pulse rectification.
- FPGA based Controllers provided to monitor & Control the DC Output Voltage
- Tie-up with IPR/ITER India for Technology Transfer
- ECIL is supplying the following High Voltage DC Power Supplies:
 - 27 KV, 200A mps- ICHVPS for ITER, India
 - 96KV, 75 Amps - SPAGPS for RFX Padova, Italy
 - 96KV, 75Amps - DNBPS for ITER, India
 - 100 KV, 25 Amps – RHVDCPS to ADS, BARC

High Voltage Power Supplies for ITER

Sub-Systems of HVPS are

- High voltage Transformers
- Switched Power Supply modules
- High Voltage Rack
- Switchgears for protection and Control
- Control Cubicles with electronics
- HV Cables
- Cooling system
- Load Bank
- Instrumentation

27kv –HVPS for ITER



Typical SPM



Cabinet with SPMs



Control Cabinet

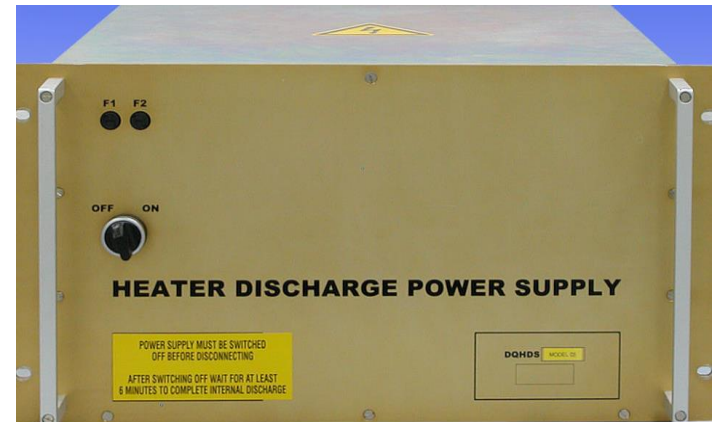


Cast resin transformers

Large Hadron Collider (LHC-CERN)



Breaker Control Modules



Quench Heater Power Supply

**Critical Systems in
Energy Extraction of Super Conducting Magnets**