



HIGH VOLTAGE POWER SUPPLIES BASED ON PULSE STEP MODULATION TOPOLOGY

OVERVIEW

Pulse step modulation (PSM) based high voltage power supplies are inherently fast and have low stored energy. They are extremely popular with

- Accelerators/Transmitters using RF energy. High Power RF Tubes need High Voltage for Bias.
- Accelerators using Electrostatic Extraction and Acceleration directly use High Voltage. (e.g., Ion Source for Neutral Beam Injectors, Electron beam)

These applications require voltage range extending from 30 - 100kV. Output power upto 10MW. The Source should be a Constant Voltage Source, stable in long term. Should have Low Ripple and Low Stored Energy. Should have a very fast Turn-OFF Time (micro second order) for low fault energy dump. Should have programmable rise time ~few tens of micro seconds to milli seconds. Should support power modulation 1kHz and beyond.

PRESENT STATUS OF THE PRODUCT

In-house technology available with IPR for PSM based High Voltage Power Supply (HVPS) is proven for above applications and been in the field from past few decades. The supplied HVPSs are successfully commissioned and operational with actual loads at various installations including European facility.

SALIENT FEATURES OF PSM BASED HVPS

- Voltage upto 100kV accurate within 1%, programmable rise/fall (micro to milli seconds), can be customized for specific voltage or voltage range
- Output Power upto 10MW (Pulse, modulating & Continuous Duty), can be customized for specific power and duty
- Low Ripple (< 1%), Fast Turn-OFF Time (μ S order) and low dump Energy (< 20J)
- Overshoot within 2%, settling time in few msec
- Fast DSP & FPGA based Controller and Fiber Optic Interface
- High redundancy and repeated Breakdown withstand capacity
- EM compatibility as per IEC standard
- Remote Monitoring, Operation and Control

- Completely Indoor versions with Cast resin transformers
- Single- or two-tier configuration

CONSTITUTING COMPONENTS OF HVPS

Major components include multi-secondary transformers, Switch Power Supply (chopper) modules, Electronic controller. These components are available as Industry solutions, manufactured & tested as per the relevant IEC standards. Critical components tested for EM compatibility, Environment, shock and vibration.

INFRASTRUCTURE REQUIRED

- AC Input feeder at 11kV or 22kV
- Protected/controlled clear space of 10m x 10m x 5m for installation/integration works, suitable for Power electronics system.
- Access to demineralised water, typical flow of 100lpm at 6bar
- Access to EM test facility, Environment, shock and vibration test facility.
- Access to relevant IS/IEC standards.
- Inhouse circuit simulation software/tools and CAD tools

APPLICATION

High Power RF Amplifiers, Gyrotrons, Klystrons, electron beam, extractor/accelerator of Ion sources.

SPECIFIC REQUIREMENTS TO BE FULFILLED BY PROPONENT

- The proponent should have valid ISO 9001 QMS certification.
- The proponent should have manufactured (at own facility) and successfully executed Power supply/power converter systems/drives of at least 1MW in the last three years.
- The proponent should have demonstrated compliances for IEC standards (or equivalent) on the devices manufactured and supplied by them.
- The proponent should have conducted EM test, Environment, shock and vibration test as per IEC standard (or equivalent) on the devices manufactured and supplied by them.

GLIMPSES OF HVPS INSTALLATIONS



7.2 MW, 96kV HVPS operational at SPIDER facility, ITALY



2.5 MW, 100kV HVPS operational at LEHIPA facility, BARC



3 MW, 27/18kV HVPS operational at ITER-India, IPR



6MW, 55kV HVPS operational at ITER-India, IPR