BP PPS: Installed and Working Well

Can produce complicated waveforms – e.g. can reproduce recorded BT waveform from Legacy BT supply.

BP PPS: Higher Voltage, More Current than BT Supply

BP demands more power than BT

- Single turn current = 720 kA
- Single turn voltage up to 250 V
- GE bridge operation is most demanding
- Limit voltage to 250 V to limit risk of arc at potential gap
- BT transformer ratio 10:1
- GBTs for high bandwidth (as in BT PPS)

Seven-level PWM

- Four amplifiers, each driving ten turns
- Each amplifier produces 2500 V at 19 kA
- Three 900 V modules in series
- Each module has a turn-by-turn design for isolation
- 2700 V – module needs better isolation than BP PPS modules

Conclusions

- Switching losses reduced – heat sharing
- MOSFET shorting bars
- Gate transformer isolates MOSFET from control (450 V)
- Lower cost than relay system

IGBT Temp Sensors: Simple Stress Monitor

- IGBT lifetime limited by Jt per pulse
- An external temperature sensor
- Sensors monitor baseplate temperatures
- Baseline (Jt) reveals duty cycle
- Great confidence despite complicated waveforms, high power output

MST Reversed-Field Pinch

- Plasma current: 600 kA
- Discharge duration: 40 ms
- Best confinement time: 10 ms
- Typical m = 1.05 m^3
- Highest m = 1.2 kT

Seven-level PWM

- Slowly varying demand: Left H-bridge does most of the PWM switching
- Each transition = 1 V – low noise, ripple

Seven-level PWM

- Rotates switching duties among Left, Center, Right Bridges
- Each transition = 1 V – low noise, ripple

Advantages of Seven-Level PWM

- IGBT Switching frequency is about 1/3
- Output frequency unchanged
- Output ripple reduced
- Switching losses reduced – can increase current up to 150% (slowly-varying demand)

Seven-level PWM gives lower losses, less ripple, less noise