



Power Conditioning Mitigation

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Definition

Power Conditioning Devices

- Power conditioning devices are equipment to protect against power disturbances and to provide solutions to power quality problems.
- These devices perform functions such as the elimination of noise, stabilization of voltage, frequency and waveform.

POWER CONDITIONING TECHNOLOGY

Power Quality Problem	Power Conditioning Technology								
	UPS	Voltage Regulator	SPD	Harmonic Filters	EMI/RFI Filters	K-Rated Tx	Isolation Tx	Zig-Zag Tx	Proper Wiring & Earthing
Sustained Power Interruption									
Temporary Power Interruption									
Momentary Power Interruption									
Voltage Sags/Dips									
Voltage Swells									
Undervoltage									
Overvoltage									
Transients (Surges or Impulses)									
Harmonics									
Noise									

POWER CONDITIONING TECHNOLOGY

Power Quality Problem	Power Conditioning Technology								
	UPS	Voltage Regulator	SPD	Harmonic Filters	EMI/RFI Filters	K-Rated Tx	Isolation Tx	Zig-Zag Tx	Proper Wiring & Earthing
Voltage & Current Unbalance									
High neutral to earth voltage									
Neutral to Earth Voltage Impulse									
Voltage Fluctuations									
DC Offset									

* Voltage regulator is tap changing transformer or voltage stabilizer

Power Conditioning Equipment

- 2 categories of power conditioning equipment:
 - "power enhancers"
 - "power synthesizers"

Power Conditioning Equipment

Power Enhancers

- Power enhancers provide a way to improve building's electrical supply.
- Provide no help for loss of power during a long power outage.
- Some examples of power enhancers are:
 - Isolation Transformers
 - Noise Filters
 - Harmonic Filters
 - SPDs
 - Voltage Regulators

Power Conditioning Equipment

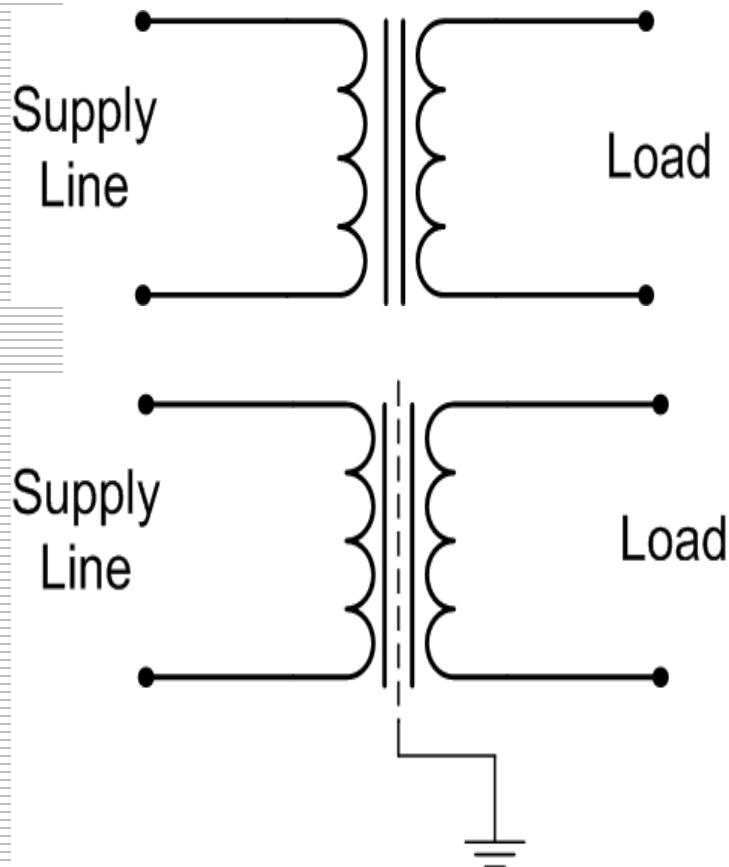
Power Synthesizers

- Power synthesizers are capable of providing auxiliary power during utility outages.
- Power Synthesizers include:
 - Motor Generator Sets
 - Standby UPS
 - On-line UPS
 - UPS with Genset

Power Conditioning Equipment

Power Enhancers

■ Double Wound Shielded Isolation Transformers

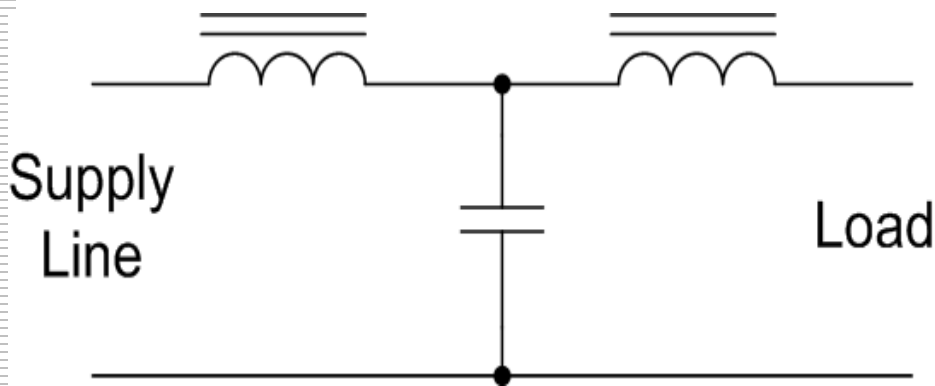


- Ability to change the input-to-output voltage level.
- To establishing the power earth reference close to the point of use.
- Reduces the problem of common-mode noise, and if equipped with electrostatic shields CM noise can be further reduce.
- For Delta/Wye connection triplen harmonic circulate in the Delta primary.

Power Conditioning Equipment

Power Enhancers

- Noise Filters



Line filters is to reduced conducted electromagnetic interference and radio frequency interference (RFI).

Low Pass filter to pass 50 Hz voltage but to block the very high frequencies or steep wavefront surges. The series inductors forms a low-impedance path for the 50 Hz supply, but a high-impedance path to the high-frequency noise. The capacitor conducts the remaining high-frequency noise to ground before its reach the load

Power Conditioning Equipment

Power Enhancers

- Harmonic Filters
 - In-Line Reactors or Chokes
 - Zigzag transformers
 - Passive filters
 - Active filters
 - Isolation transformers

Power Conditioning Equipment

Power Enhancers

- SPDs

Spark Gaps – Mainly for overhead high tension cable and HT switchgear and LV

Gas Discharge Tubes – Used for telecommunication line protections and power

Metal Oxide Varistors (MOV) – Used to clamp surge voltages to an acceptable level in the LV system.
Relatively fast response to transient (0.5 μ sec)

Silicon Avalanche Diode (SAD) – Very fast response and precise clamp voltage. Normally used as DC volt clamping device on PCB.

Power Conditioning Equipment

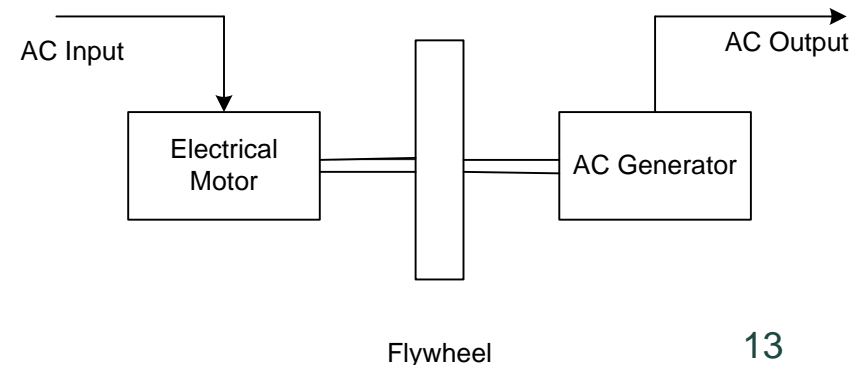
Power Enhancers

- Voltage Regulators
 - Ferroresonant Regulators – Constant Voltage Transformer (CVT)
 - Tap Changer Transformer
 - Variable Transformer Regulators
 - Buck-Boost Regulators
 - buck-decreasing the ratio
 - boost-increasing the ratio

Power Conditioning Equipment

Power Synthesizers

- Motor Generator Sets
 - Effectively isolates the load from the utility source.
 - It has a relatively higher source impedance compared to low impedance utility source.
 - Load current changes will cause voltage or frequency variation.
 - Noise and maintenance issue

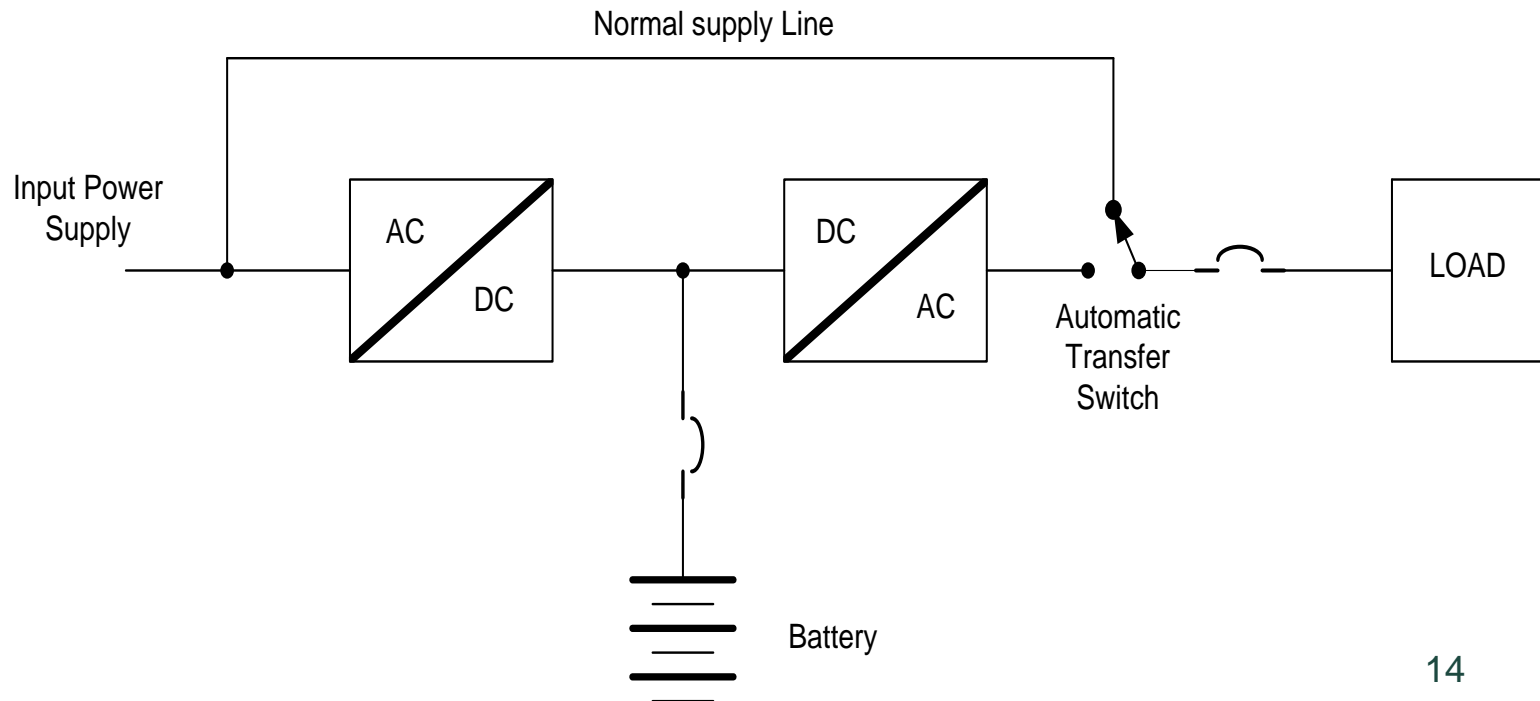


Power Conditioning Equipment

Power Synthesizers

■ Standby UPS

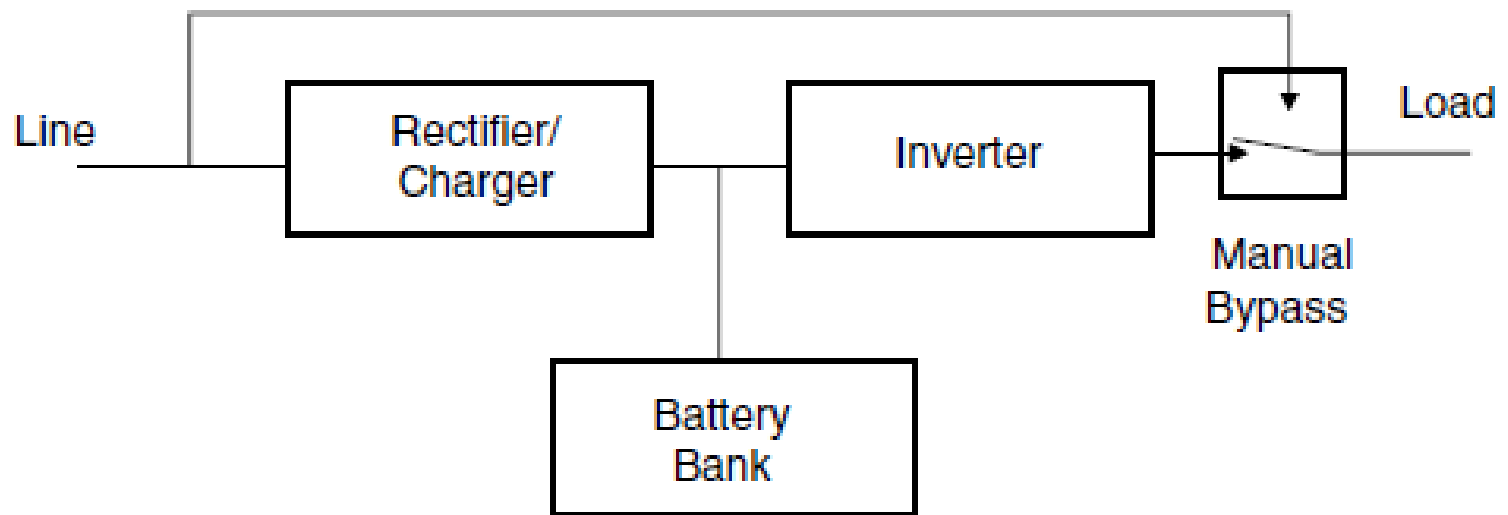
- Transfer time of 4 ms
- Not provide any transient protection or voltage regulation



Power Conditioning Equipment

Power Synthesizers

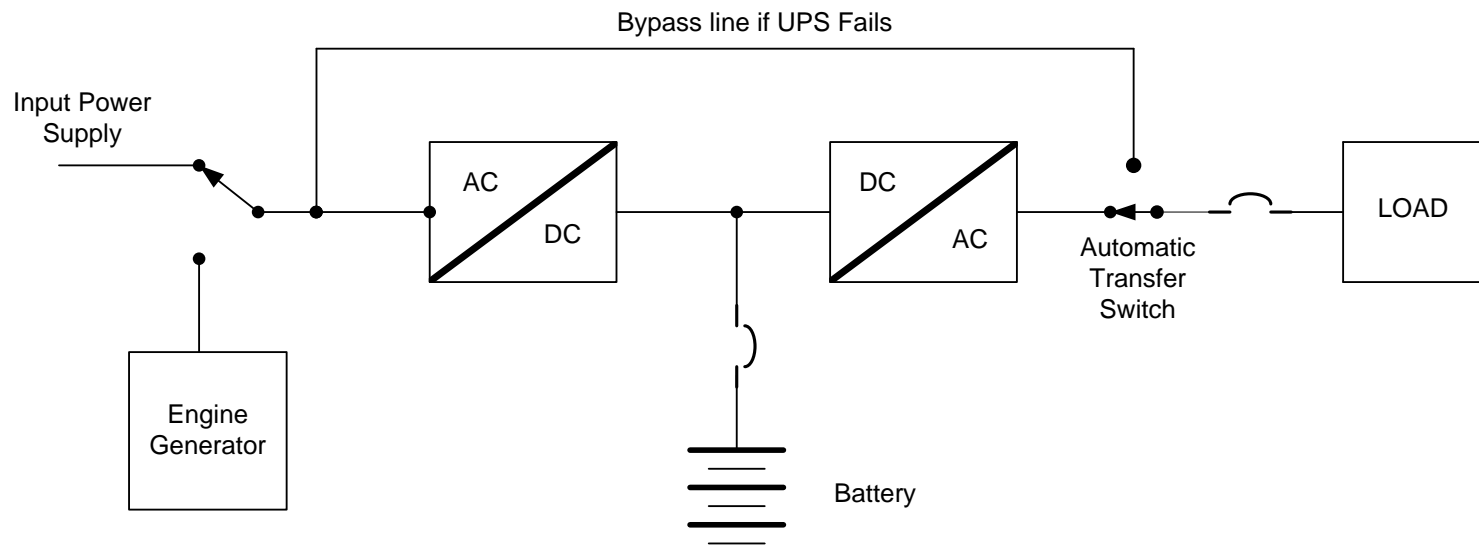
- On-line UPS



Power Conditioning Equipment

Power Synthesizers

■ UPS with Genset



CONCLUSION

- There is a wide variety of power conditioners
- No single product can solve all problems.
- Proper application of device best suited to system and compatible with load and power source is essential for solution to PQ problems.



Thank You

Bahagian Perunding Rekabentuk

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