Harmonic Mitigation - Holistic approach

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ENCON ENGINEERS

International Copper Association India
Copper Alliance

ASIA POWER QUALITY INITIATIVE

Why Power Quality?

Looking from the bottom of the Power System Pyramid

- Brownfield or Greenfield project
  - Slash down Capital investment cost
  - Minimize equipment foot print
  - Achieve ultimate in Energy Conservation; the least SEC in terms of kWh/ unit of production
  - Get the best possible Quality of Product, and enhance volume and consistency in production
  - Slash down reworks and rejections in QC.
  - Achieve 3P; Power, Productivity & Profitability

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- Achieve immunity from electrical flash/blast

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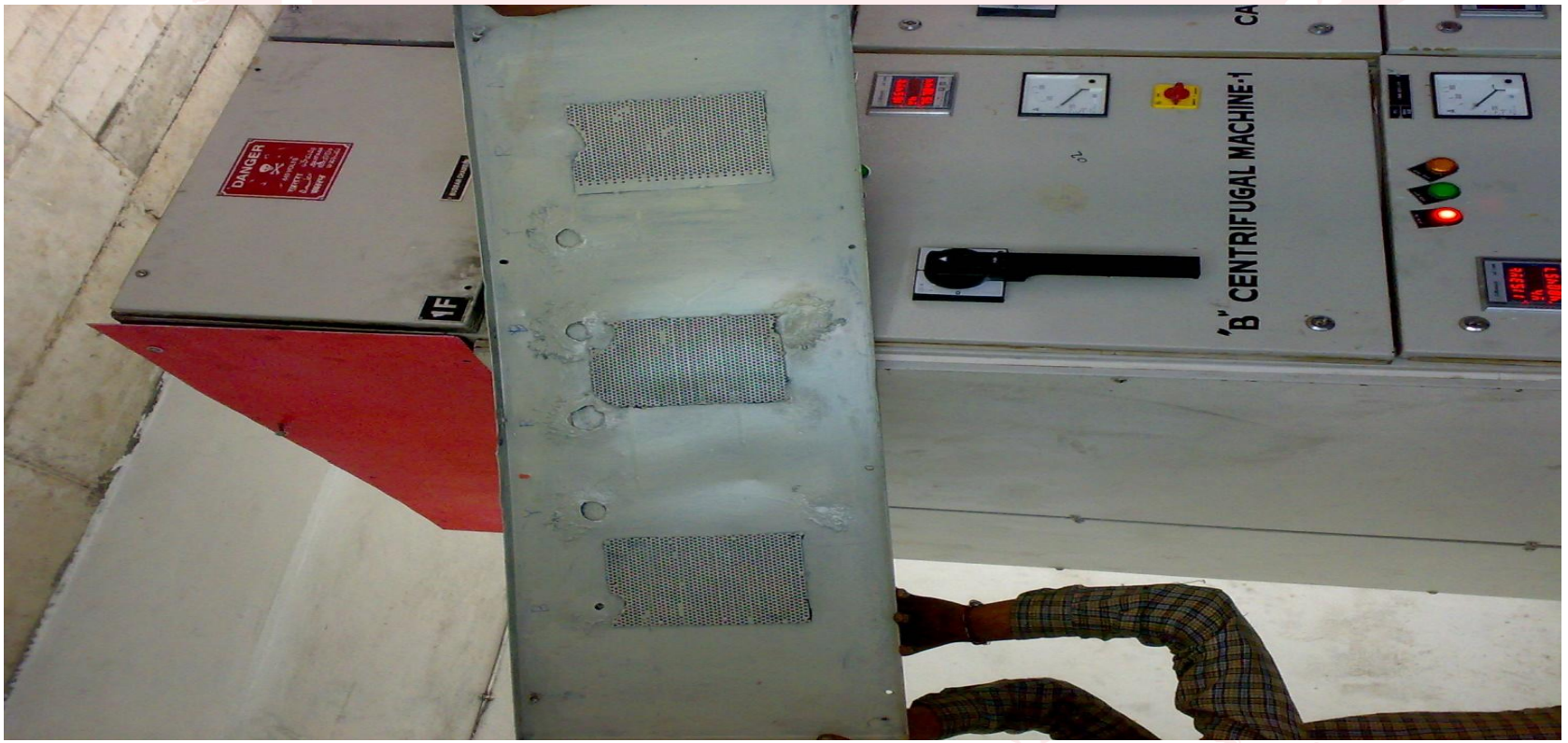

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Looking from the bottom of the Power System Pyramid

- Troubleshoot– Bizarre failures 33/.16kv EAF

Why Power Quality?

Looking from the bottom of the Power System Pyramid

- Troubleshoot – Bizarre failures, 33/1-1kv IF

Why Power Quality?

Looking from the bottom of the Power System Pyramid

- Troubleshoot– repetitive failures or issues
  - Reduce high Temp; TRF, alternator, switchgear
  - AVR fluctuation, synchronization rejection, exciter diode failures.
  - Governor fluctuation raising turbine nozzle chest pressure, limiting generation capacity
  - Damage to turbine/bearing/lining and gearbox
  - Power plant tripping leading to blackout

PQ Harmonic Solutions

Pros and Cons of available technologies

- Detuned HF
  - Standard product without specific design need. Can't control harmonics.
  - Provide Reactive power compensation
  - It blasts, if harmonics are significant

PQ Harmonic Solutions

Pros and Cons of available technologies

- Active harmonic filter and/or STATCON
  - Standard product and assuming at its best, it can provide only harmonic but not PQ Solution
  - Based on power system conditions, it magnify THDv, and complicate Harmonic Problem
  - With high harmonic loads it goes off the track, magnify even THDi causing issues/ failures.
  - It does not relieve equipment derating. Active HF fail frequently, if harmonics are high enough.

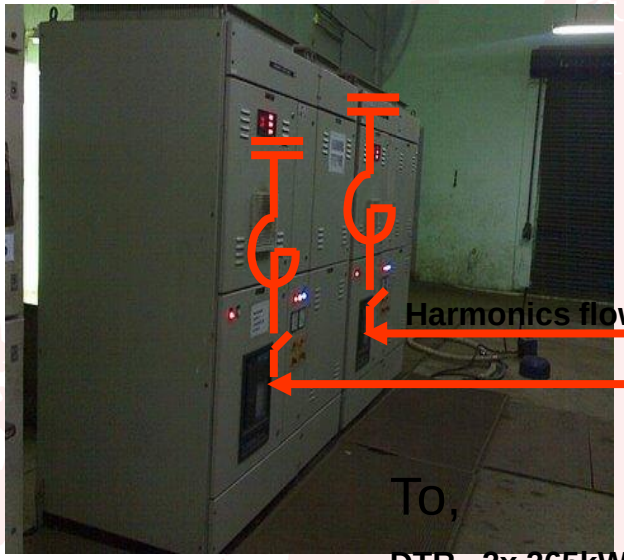
PQ Harmonic Solutions

Pros and Cons of available technologies

- Tuned harmonic filter – fixed, variable, SVC
  - Custom built product that needs significant design effort.
  - Provide Power Quality, and Harmonic solutions as well as Reactive power compensation
  - Either Fixed or Variable HF meets almost all types of load requirement
  - Only few exceptionally large loads like EAF, of say >50mw ratings, requires SVC.

Typical Tuned Harmonic Filter

2x "Encon Ih Filter" – 5th Tuned



4000kva, 11/ 0.575-0.575kV, Dd0yn5

Harmonics flow

To,

DTR –2x 265kW, 275 vdc

Mill –1x 500kW, 550 vdc

DTR –2x 265kW, 275 vdc

To,

ETR –2x 265kW

Mill –1x 500kW

Mill –2x 500kW, 550 vdc