

ScopeMeter® test tool supports critical petrochemical production

Technology at Work

Most facilities never *want* to experience unplanned downtime, but there are some who literally *can't*.

In the case of the Petrochemical Corporation of Singapore (PCS), production must run 24/7, 365 days a year without fail — no other option. A major power trip or shutdown would halt production for up to four days, at an estimated cost of US \$2 million a day.

To prevent shut downs, Mr. Tan Khai Meng, PCS electrical maintenance engineer, relies on a combination of multi-feature precision test tools, good test methodology, regular measurement, and training.

Locktight processing

Singapore's roots to economic success trace back to the 1960's and 70's, when oil refineries formed the backbone of the country's budding independence. The landscape may be a bit different now, but those same industries continue to make substantial contributions.

Almost all Singapore oil industry activities take place in a high security cluster of off-shore islands, generally called Jurong Island.



Mr. Tan and Mr. Awyong make measurements of the speed drives using the Fluke 192 ScopeMeter.

PCS is one of the key tenants on the island. It supplies high quality ethylene, propylene, acetylene and butadiene as well as basic utilities such as water, steam and compressed air — all mission critical components for downstream processing.

Any downtime in the complex would ripple immediately over a wide circumference of companies and customers within the value-chain. And as Tan explains, "even if I solved the main problem,

there could be secondary problems. These could be associated with restarting of all the machines, discarding all the half produced products, and any other damages that could result from a lack of power over a period of time."

To prevent this from happening, the facility performs large scale "shut-down maintenance" every four to five years, monitors key equipment, and responds to any aberrations immediately.

Units under test

The plants are equipped with numerous 6-pulse rectifier circuits to convert ac supply into dc voltage for charging the batteries, as well as supplying the Uninterruptible Power Supply (UPS). These chargers and UPS are deployed in pairs for redundancy (see Figure 1).

Stable dc voltage is crucial for continuous operation of plant equipment. dc voltage is also used to power the switchgear that's activated during an equipment fault.

Technicians constantly monitor these dc voltages and record the readings on the panel meters. When the dc voltage readings fluctuate, the team needs an oscilloscope to check the waveforms of the voltage across the capacitor, the voltage across the anodes and cathodes of the rectifiers (> 500 V), and the gate control waveforms (10 V peak to peak). The gate control signals and voltage across the rectifiers do not share the same electrical ground.

In the past, the team had to move the following test instruments on a trolley to the work sites:

- Bench oscilloscope
- Isolation transformer (to provide ground isolation for safety purpose)
- Camera hood for the bench oscilloscope and a conventional camera

Now they use a Fluke 192 ScopeMeter® test tool with true isolation between channels and between channels to ground. The electrical maintenance department also has a Fluke-41 Power Harmonic Analyzer and is evaluating a Fluke 434 Power Quality Analyzer.

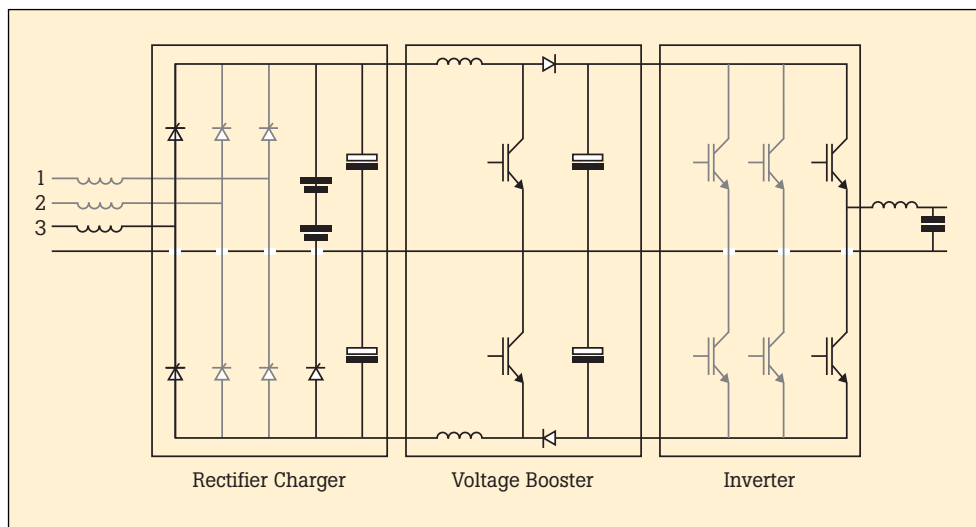


Figure 1. Example of a medium power configuration.
Source: MGE UPS system "Using IGBT in UPS" white paper, June 1998.

Incident report

In one incident, a monitor alarm notified Tan's team of low voltage on the 440 V dc supply. One of the parallel chargers was not supplying current. Production could continue as long as the second charger held, so his team isolated the faulty unit from the circuit and began tests to determine the cause of failure.

Their first round of tests showed no output current from the faulty charger and a high ripple on the output voltage (see Figure 2). Further checking traced the ripple to two open-circuited thyristors on the rectifier circuit.

Tan's team replaced the faulty thyristors and tested again; the ripple voltage on the charger dropped from 4 V to .5 V (see Figure 3). So, they re-energized the charger unit and put it back into parallel operation.

Continuous monitoring showed no further drops, indicating that the problem was faulty components on the thyristor, not a system issue such as excessive current. With that in mind, Tan purchased additional thyristors as backup parts.

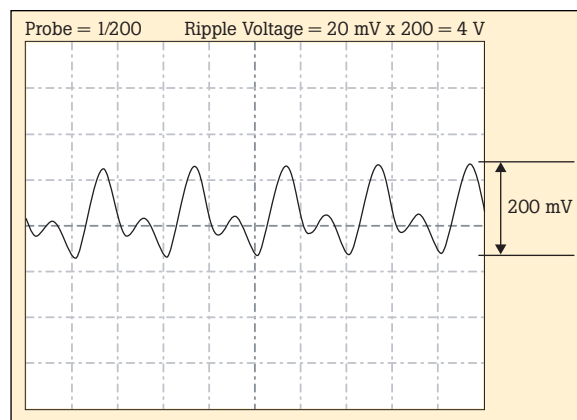


Figure 2. Waveform of ripple voltage before replacing the thyristor.

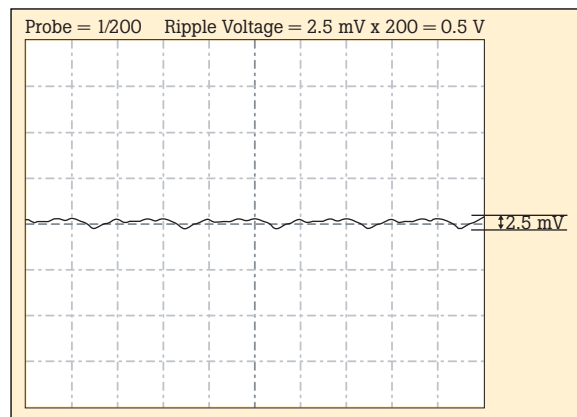


Figure 3. Waveform of ripple voltage after replacing the thyristor.

Analysis

To help evaluate their readings, Tan's team uses the abilities of the ScopeMeter to document, save, and download known-good waveforms and faulty waveforms. This site-specific reference library can be stored on the ScopeMeter as an online resource or printed out as a hard-copy reference document.

To build a reference library, start by identifying appropriate test points on a known good unit (KGU), such as the repaired charger. Run the KGU through its paces, capturing the waveform from each node. Annotate each waveform as required. When a system failure occurs, capture waveforms from the faulty system and compare them against the stored KGU waveforms.

In this particular instance, knowing what waveforms a faulty thyristor causes could speed up the test and replacement process.

Training and evolution

Tan strongly believes that Fluke instruments achieve better return on investments, given their reliability and emphasis on safety. He also appreciates the availability of consistent, extensive training materials and product update information.

"What's important to us is the service that Fluke provides," said Tan. "Fluke has good training material and technical support bundled with the equipment so we don't have to make special investments for further training." The materials have helped his team build their skills and make more effective use of their Fluke tools.



Mr. Awyong Kit Hoong, Mr. Chew Kai Leong and Mr. Tan Khai Meng (from left to right).

Fluke. *Keeping your world up and running.*

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