

APPLICATION NOTE

2020

CUSTOM AUTOMATED PARTIAL DISCHARGE & DIELECTRIC TEST SYSTEM

Brief Description:

Emerging Technologies, LLC was called upon to design and build a custom Automated Partial Discharge & Dielectric Test System for testing multiple customer product at one time. The system was required to accommodate hundreds of variations of product for testing.

The system requirements document was developed (derived from the customer RFQ) followed by system design, fabrication, software development, construction, FAT (factory acceptance test), and SAT (site acceptance test).

A new LabVIEW test application was developed to perform the steps defined by the system requirements document. Safety management, integration with plant systems, optical I/O subsystem isolation was employed. Final test results are stored for later recall if needed.

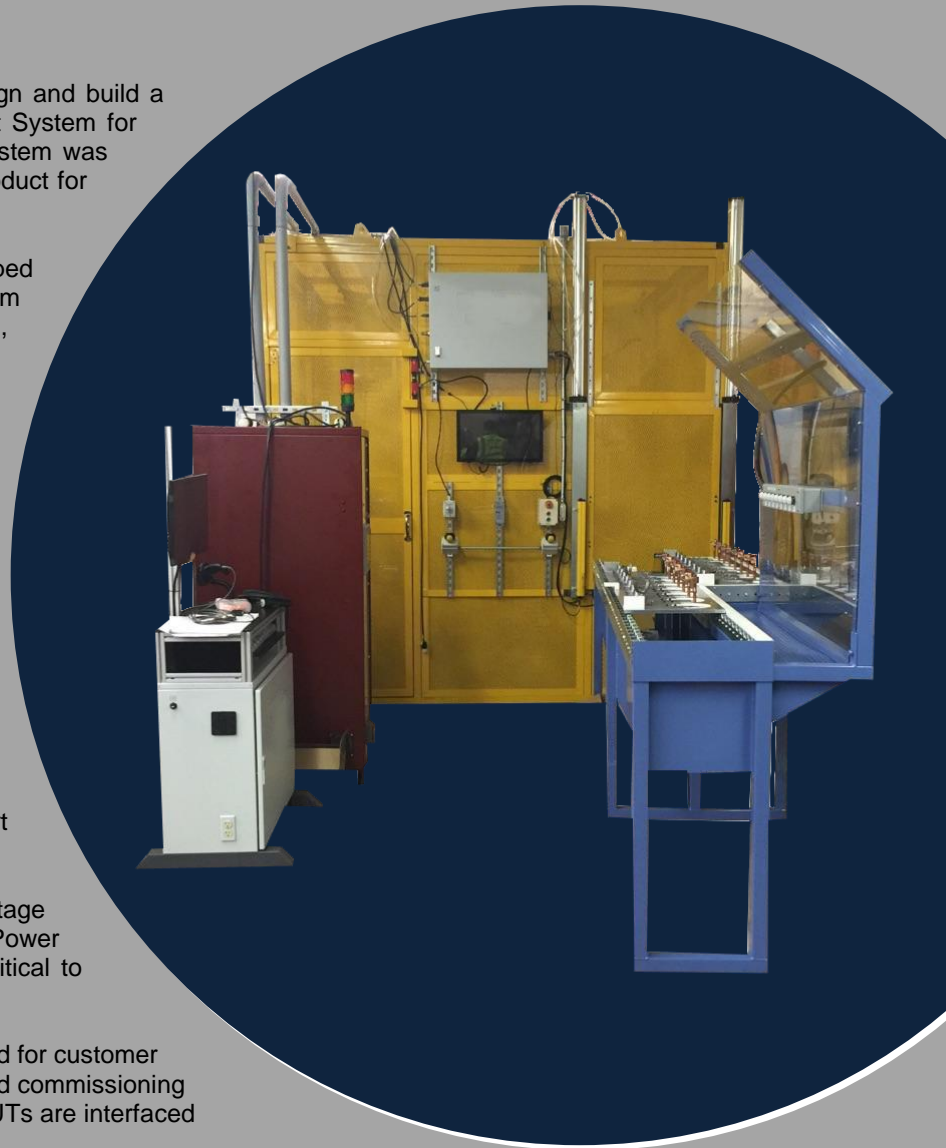
Product fixturing provided a significant challenge for the system. Hundreds of variation of DUT along with the requirement for a common fixture and interchangeable nest platform were required. Additionally, multiple clamping variations were required to correctly hold product for testing. Automated clamping, by the system, based on DUT part number selection was required.

Low level partial discharge testing along with high voltage dielectric testing in a common fixture was required. Power filtering, grounding, and Faraday cage design were critical to the success of this application.

The standard ET system design package was developed for customer approval and to support the ET system build effort. Field commissioning and operator training were supplied by ET. Up to 24 DUTs are interfaced via special software and fixture per test cycle.

Customer Benefit:

The customer is able to perform specialized product testing in an operator safe environment. The system was installed in a special purpose built test cage for operator safety as well as electrical noise control. The customer is able to perform sensitive testing in the typically noisy plant manufacturing environment. Accuracy and repeatability as well as throughput was increased over existing plant systems in use at the time of the installation of this new equipment.



Multi-Position DUT Fixture:



A universal eight position DUT fixture was developed. The fixture was required to allow for top and side compression of various DUTs to be tested. Additionally, the fixture interfaced with removal convertible DUT nests. The nests are manually positioned into the test bay by the operator and then pulled in automatically once activated by the operator using the two hand control to initiate testing.

APPLICATION NOTE

2020

Convertible DUT Nest:



Removable convertible nests are used to allow for loading and unloading while testing. Additionally, each nest has swappable DUT interface rings to support a variety of DUT configurations. Multiple nests are interchangeable to provide a universal platform between like systems in the plant.

Continuous Prep Shuttle:



A shuttle preparation and transfer unit allows the user the facilities to prepare additional DUT nests while a nest is in the system cage for testing. The design supports one nest testing, a second nest under preparation, and a third nest parked waiting for test or unload.

Isolated Operator Workstation:



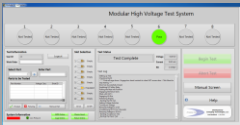
A separate isolated operator work station was developed to allow operator as well as plant infrastructure protection from the high voltage test equipment. Additionally, a redundant operator station is installed at the test cage for operator convenience.

Partial Discharge Testing:



Partial discharge testing required a low system noise floor for successful testing. The system was deployed with power on noise floor below one pico-coulomb. Significant effort was invested in clean power and grounding for the system.

Software:



The functional test system required the development of custom functional test software based on the customer

provided test specifications for the different variations of product tested. The test application was developed using National Instruments LabVIEW. Included are features for custom configuration, test sequencing, and results storage.

Faraday Cage:



A Custom Faraday was required for partial discharge testing. The cage was designed using Solidworks modeling, and fabricated based on the model, then set up and previewed at Emerging Technologies prior to installation at the customer's manufacturing facility during the planned outage. Special attention was given to the final coatings which included powder coat as well as traditional paint coatings. An automated DUT door, sliding door, as well as a standard pedestrian door were included. All doors are equipped with redundant safety switches and individual grounding straps. Special low impedance grounding was required and applied to this installation.

Field Installation:

Field installation was performed during a pre-planned outage. Included in the installation process was; test cage erection, fixture and shuttle installation, test equipment installation, and finally system commissioning. Electrical, Mechanical, and Facilities modification, and installations were required. The field installation was implemented using a team of resources including Emerging Technologies staff, Customer staff, and third party installation contractors.

Summary:

Multiple systems were required to meet product flow. Half of the systems were deployed using a mirrored footprint to save space on the plant floor. Automation and continuous system operation has positioned the plant for a significant increase in throughput via use of the new systems.

ET Responsibilities:

- Functional Specification Generation
- ✓ Design / Engineering
- ✓ Fabrication
- ✓ Programming – Software
- ✓ Programming – Firmware
- ✓ Circuit & PCB Design
- ✓ On-Site Commissioning
- ✓ Post Commissioning Support
- Other

Technologies:

- Embedded Computers
- ✓ Microcontrollers
- ✓ Visual Software
- ✓ Control Software
- ✓ Data Acquisition
- Computer Based Control
- ✓ Communications – serial
- System Integration
- Other

Special Features:

- ✓ Bar code scanner input capability
- ✓ SD card results storage & config capability
- ✓ Compact size and portability
- ✓ No PC required for operation
- ✓ Automatic Sequencing
- ✓ Loop on sequence step failure
- ✓ Data Collection mode to gather & store additional data
- ✓ Manual step mode