

# Substation Package Exceeds Expectations While Decreasing Cost

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**T**ower Automotive, a large automobile parts manufacturer in the Chicago area, recently undertook a major assembly line changeover project. The redesign included a significant upgrade to the plant's electrical service. The primary goal was to provide a highly reliable electrical service for an industry that cannot afford down time, while at the same time not exceeding the project's budget constraints. The consultant hired for creating the specification for the electrical upgrade was very familiar with the secondary or plant service specification requirements, but not familiar with primary service equipment specification. The common practice in the Chicago area is for the local utility, Commonwealth Edison (Exelon), to provide primary service to its customers. Customers are then required to provide their secondary or plant distribution needs. In this case, the utility provided two 50 MVA, 138 kV transformers stepping down to 15 kV from the local substation, but required the customer to supply all the equipment for primary service. The consultant relied on the expertise of Cooper Power Systems' industrial representative, Rick Fagan, to assist in writing the specification for the primary requirements.

Rick sat down with a representative from Tower Automotive and their consultant and presented the conventional method of providing primary service, which would include several 15 kV outdoor, primary-fused, air-interrupter switches close-coupled to several outdoor, mineral oil-filled secondary unit substation transformers, all located around the exterior of the facility. Secondary distribution gear would then be located indoors near the various factory loads, fed via high current bus duct several feet from the external substation transformers.

This would be considered a "normal" or conventional specification. But Rick, armed with the latest product innovations from Cooper Power Systems, presented a



specification that would provide a safer, code compliant, smaller footprint and less costly alternative. The alternative included a transformer and primary switchgear combined into one enclosure. The combined package would be located indoors, close coupled with the secondary gear near the plant loads.

## Indoor Applications

To locate a liquid-filled transformer indoors the requirements of the National Electrical Code®, Article 450-23, must be met. By specifying a liquid-filled transformer



filled with Envirotemp® FR3™ fluid that is both FM Approved and UL Classified, the customer is assured the installation is Code compliant. Envirotemp FR3 fluid, developed and manufactured by Cooper Power Systems, is an insulating fluid which is derived from 100% natural seed oil and food grade additives to provide a minimum 300°C fire point fluid that exceeds the requirements of Article 450-23.

By incorporating a Factory Mutual Global® Approved listed and labeled transformer, Tower Automotive was able to install the unit indoors without the need to provide expensive fireproof vaults and

## SUBSTATION SPECIFICATION

(11) 2500 kVA Secondary Unit Substation Transformers, rated 55/65°C rise, OA/FA, Envirotemp® FR3™ fluid-filled, 12470 Delta – 480Y/277

**Features: 600 A, 15 kV Vacuum Fault Interrupter, VFI; FM Approved Listed and Labeled; 600 A, Deadfront Primary Loop Feed Termination with 600 A, 15 kV, T-OP® II Deadbreak Connector and 15 kV M.O.V.E.™ Surge Arresters; and 4-Position, 600 A, Loadbreak Sectionalizing Switch.**

automatic fire extinguishing equipment. In this case, the transformers were located in the plant in open mezzanines near the factory loads. This eliminated the need to provide long runs of high-current bus duct, which saved considerable dollars.

### Switchgear Requirements

Overcurrent protection and primary disconnect to the transformer was achieved through the use of a Vacuum Fault Interrupter, or VFI switch, located under oil inside of the transformer tank. The VFI switch is a



three-phase, gang-operated device that interrupts phase-to-ground faults up to 12 kA inside a vacuum bottle. The VFI switchgear, manufactured by Cooper for many years, has now been incorporated into the transformer tank, providing superior fault protection directly at the transformer without the need for additional space to locate external switchgear. Since

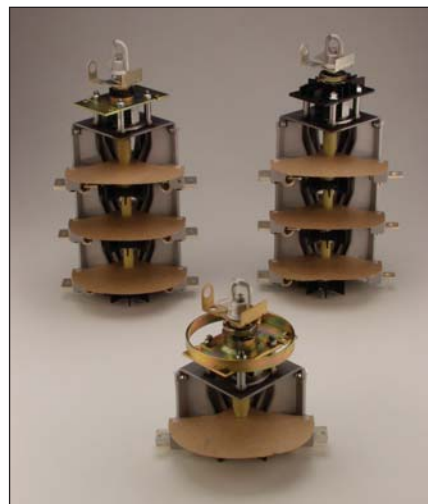
these transformers were located in a mezzanine inside the factory, space considerations were a concern. The transformer and VFI package provided the solution.

### Deadfront Termination

The concept of deadfront termination is very common for distribution three-phase and single compartmental pad-mounted transformer construction utilized by utilities for the commercial and industrial markets. But it is very uncommon for substation transformer applications where live-

front termination is the standard. Rick applied his expertise to propose a deadfront alternative that would provide safety, reduce size and ultimately lower the installation cost. The proposal included the use of six 600 A deadbreak apparatus bushings arranged for loopfeed application. The primary cables will be terminated on to 600 A, 15 kV, T-OP II deadbreak connectors. This type of

connection provides the flexibility to terminate surge arresters through the use of six 15 kV, M.O.V.E. elbow arresters. Deadfront terminations provided safety for plant maintenance personnel, while at the same time reducing the overall size of the termination enclosure by not having to deal with air clearances for livefront terminations.



### Sectionalizing

Providing loopfeed configurations at each transformer allows for flexibility in sourcing options with the addition of a four-position loadbreak sectionalizing switch. The “T-blade” switch option will allow the customer to independently feed the transformer from Source “A” or Source “B” or use one source to loop through all transformers while having each transformer energized or de-energized. Providing this type of switching flexibility integral to the transformer enclosure would otherwise only be available in a separate piece of expensive air-insulated switchgear. This alternative saved Tower Automotive thousands of dollars.

### New Math: 1 + 1 = 1

Overcurrent protection, overvoltage protection, and switching flexibility were provided all in one transformer and switchgear package, located indoors close to plant loads. The installation met or exceeded all code requirements for fire and personnel safety. Tower Automotive was given a solution wrapped in one convenient package that exceeded product reliability and safety goals, while beating their targeted budget.

THE LINE

