



A Rockwell Automation Company

## Enbridge Inc. Spearhead South Expansion - Protection Coordination

### The Client:

As a transporter of energy, Enbridge operates, in Canada and the U.S., the world's longest crude oil and liquids transportation system. Since it was incorporated in 1949, the company now owns and operates Enbridge Pipelines Inc. and has a 27% interest in Houston Based Enbridge Energy Partners, L.P. (the Partnership). The Partnership is Enbridge's primary means of expanding in the USA. The liquid pipeline systems now comprise approximately 8,000 kilometers (5,000 miles) of pipeline in Canada and approximately 5,600 kilometers (3,500 miles) of pipeline in

the USA, delivering approximately 2.2 million barrels per day in 2006. Enbridge has a growing involvement in natural gas transmission and midstream businesses, through the Alliance and Vector pipelines, New Brunswick distribution, and various other U.S. assets. As a distributor of energy, Enbridge owns and operates Canada's largest natural gas distribution company, Enbridge Gas Distribution, which provides gas to approximately 1.9 million industrial, commercial and residential customers.

### The Requirement:

Among the deliverables of the project electrical studies, Enbridge US requested protection coordination. When engineering design is done, the designers select fuse and circuit breaker sizes to meet the electrical code requirements to protect the associated equipment and to operate safely in the system in which they are installed. In larger facilities there are normally different designers working on different respective areas of the facility. A protection engineer is required to look at all of the protection equipment together to ensure that there is selective coordination between the various protection components.

A protection engineer is required to look at all the various zones within the facility and ensure selectivity within each

zone and between zones to minimize the extent of any outage caused by a disturbance, while properly protecting the equipment and providing personnel safety. A zone could be considered as a medium voltage system and there could be several low voltage zones fed from this one.

The protection equipment chosen by the designers needs to be reviewed by the protection engineer for proper application to provide adequate protection of equipment and safe operation in the system with respect to voltage and current ratings.

### The Design Solution:

The protection engineer uses sophisticated engineering software to produce time-current plots on a log-log graph to determine and adjust coordination between various protection components. This also includes the protected equipment such as transformers, motors, and cables to ensure their protection. In this project the software used was Power Tools for Windows (SKM Systems Analysis) at the client's request. The protection engineer may recommend changing some device sizes chosen by the designers (by code requirements) to better protect equipment and/or provide selectivity, while still complying with the electrical code.

Selective tripping (also called discrimination) is achieved by two general methods. One method is through time graded systems. The protective devices have operating time delays selected or set so that only the relevant device(s) will open a circuit to remove the smallest area around the fault. Another method is unit systems. The protective devices respond only

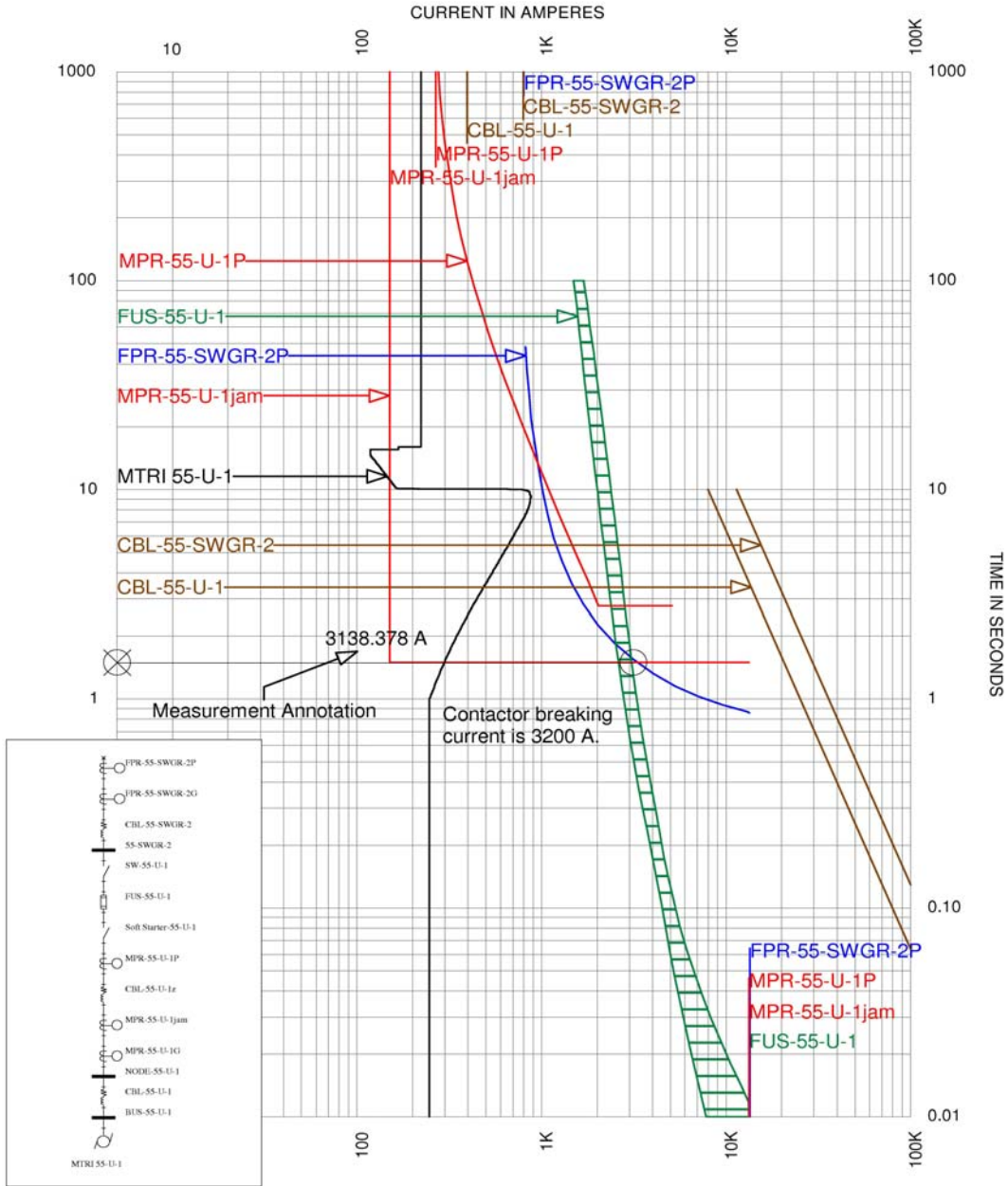
to conditions lying within a particular zone. This method can achieve very fast tripping. In some cases it is also possible to coordinate instantaneous overcurrent protection into zones by setting upstream protection to pick up above the available fault level in a zone downstream. Both methods were used for various aspects of this project.

The protection engineer will also desire to do the coordination study in conjunction with an arc flash study. By doing this the protection engineer can adjust device settings or change device selection to reduce the incident energy in the event of an arcing fault, and provide greater personnel safety. This may also reduce the level (category number) of PPE required and further enhance personnel safety by making the PPE less cumbersome to work in.



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For further information or to contact a Hinz office near you, please check our website at:

[www.hinz.com](http://www.hinz.com)