HINZ
A Rockwell Automation Company

Enbridge Inc.

Spearhead South Expansion - Load Flow and Short Circuit Analysis

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 load flow and short circuit analysis. Preliminary studies are required as a design tool to determine parameters for selecting equipment. Once the facility design has been completed, final studies are required to confirm the adequacy of the design.

Although designers do basic volt drop calculations using simple methods such as a spreadsheet with formulas, more complex calculations are required involving the interactions of the facility as a whole to determine that there are no voltage drops violating electrical code requirements. Load flow analysis is also required to ensure that equipment power ratings are not exceeded. There are various operating scenarios for a facility such as peak load, normal load, and maintenance or shutdown load. These all must be looked at in addition to the design load required by the electrical code.

Short circuit analysis is required to determine the withstand rating of all equipment and the interrupting rating of protection devices. The worst case (highest) available short circuit current is required. Short circuit analysis is also required to provide fault levels for protection coordination and the short circuit model is also required for arc flash analysis.

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:

Equipment and facility design parameters and utility system parameters are collected and used to create a model of the facility. First, design parameters are used based on material specifications used for purchasing, to provide a model to be used to prove an acceptable design. Once actual purchased material fabrication parameters and/or material test data is obtained and layouts are better defined, the model is updated and studies are re-run to prove the actual facility that will be constructed will be acceptable. In this project Power Tools for Windows (SKM Systems Analysis) was used at the client's request.

Multiple load flow studies are done to provide the operating conditions for various operating scenarios that the facility is likely to see. Design load is used to ensure that the facility will meet code requirements. This scenario is rarely the actual operating scenario, even at peak load so minimal compliance can be achieved by such devices as transformer taps and fan ratings. Recommended tap settings are determined by the normal load flow scenario. The maintenance or shutdown load scenario is done to ensure that there will not be high voltage problems caused by transformer tap settings.

Short circuit analysis is also done for preliminary and final design parameters. Power systems change over time and usually get stronger (higher short circuit availability) so sufficient capacity for growth needs to be provided in the preliminary design. Final short circuit studies are done for protection coordination, and the final model is used for arc flash analysis to provide actual operating conditions to ensure safety and reliability of the facility.

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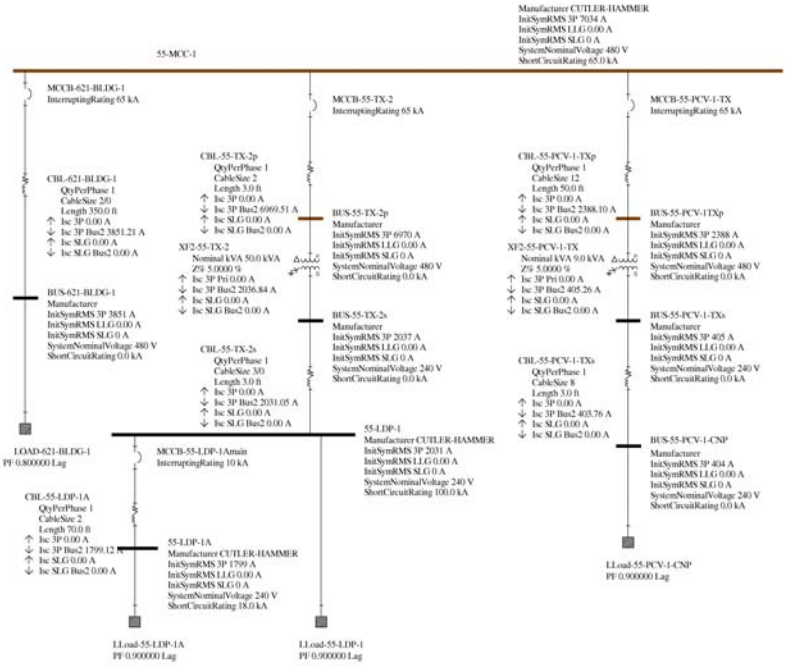

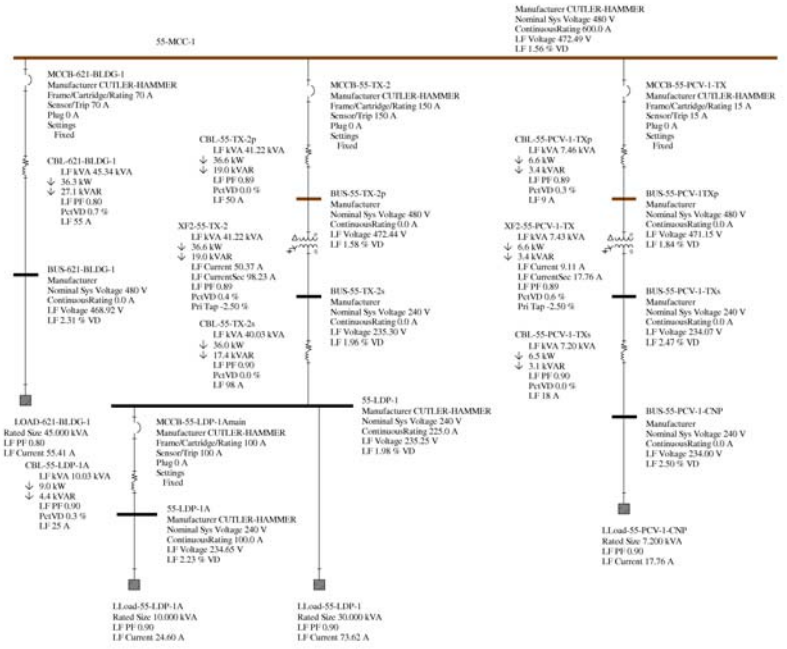

Representative Sample Only

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