St. Joseph's Hospital

CHP Electrical Design

Presented by:

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THE POWER TO CHANGE
FEBRUARY 10-14 ▲ SHERATON DENVER DOWNTOWN ▲ DENVER, CO

ST. JOSEPH'S
Hospital Health Center

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Agenda

- Project Background
- Design Features
- Equipment Layout Challenges
- Existing Equipment modifications
- Utility Interconnection
- Overall Single Line

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Project Background

- In 2008, St. Joseph's Hospital Health Center broke ground a monumental $220 million expansion.
- Demands on the local grid was projected to "max out" the capacity of the existing electricity infrastructure.
- Keeping with the hospital's intent on sustainable development and energy conservation, cogeneration (or CHP), generating both electricity and thermal energy from a single fuel source, would fit their needs.

Client	• St. Joseph's Hospital Health Center
Schedule	• Project Start: August 2012 Operational: October 2014
Project Cost	• $15 Million
Servicing	• 431-bed Hospital
Environmental Benefits	• Reduces carbon emissions by 12,000 tons per year • Like taking 1,929 cars off the road

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Project Background

- The adoption of CHP allows the hospital to generate its own power and steam, reduce demand on the grid, improve reliability, lower costs, and reduce greenhouse gas emissions.
- Meeting the hospital's goals, CHP allows St. Joseph's to generate their own power – improving reliability; reducing greenhouse gas emissions by 11,676 tons/year; and reducing the annual utility budget

Design Features

- Major Equipment
  - Solar Mercury 50 Gas Turbine rated at 4.6 MW, 13.2kV @ 0.8 p.f.
  - Rentech 45,000 lb/hr Heat Recovery Steam Generator
  - PCS (Plant Control System) with LMS (Load Management System)
  - New 15kV Switchgear, 480V Switchgear, MCCs
  - BSG (Black Start Generator, 480V, 750kW, 0.85 p.f.
  - Gas Compressor 350 hp, 480V

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Design Features

- SJH has the capability of islanding and running off grid
- SJH utility breakers can synch back to the grid after islanded operation
- SJH has Automatic Loadshedding capabilities by utilizing the LMS.
- The LMS consists of two panels i.e. Main and Slave panel.
- SJH can be started under complete black start condition i.e. when the utility and the GTG is completely down.

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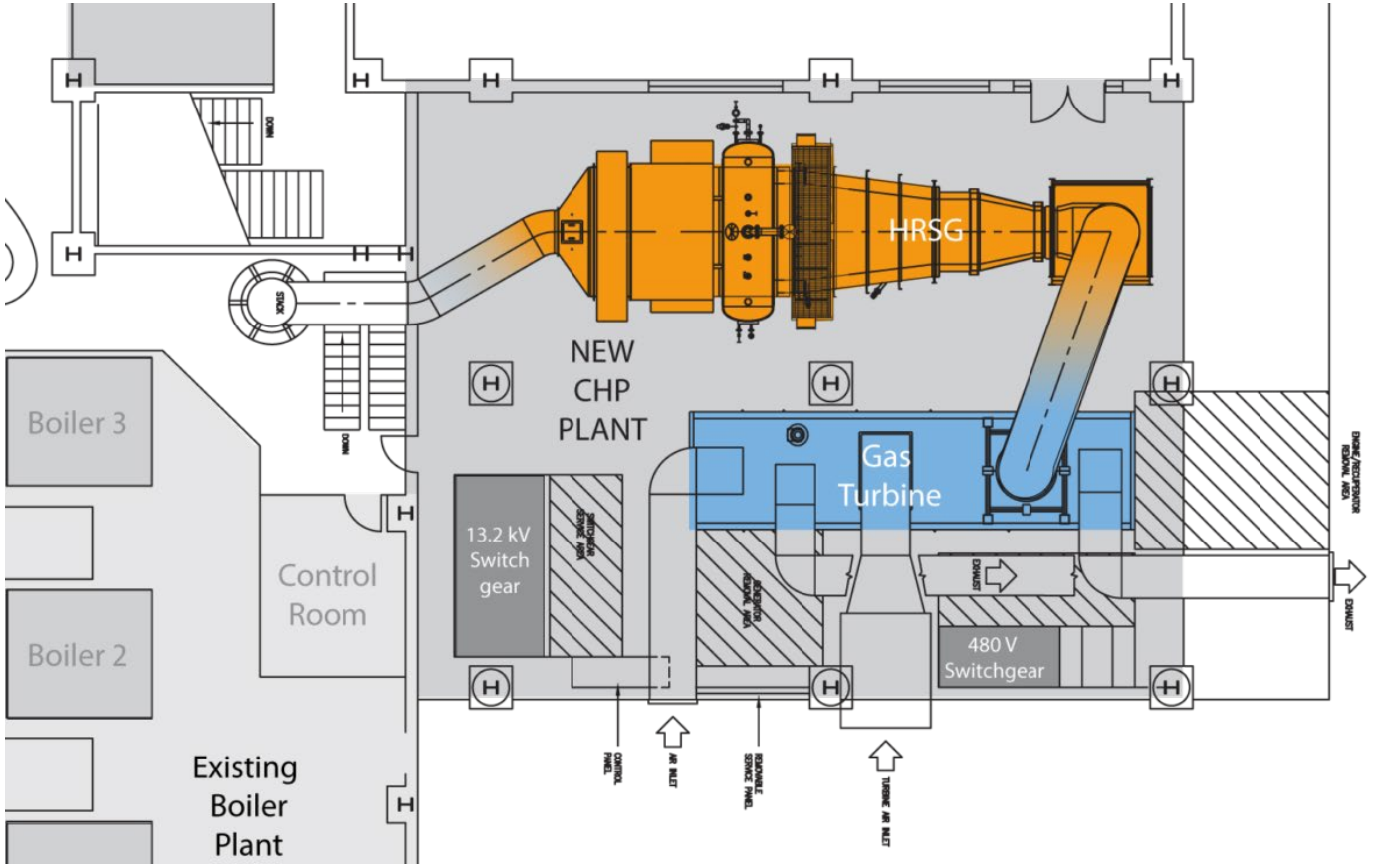
Equipment Layout Challenges

- With limited open space on campus, finding an open site to accommodate the footprint of the plant was problematic.
- The project team “looked upwards” to find a volume of space tucked beneath on of the wings of patient rooms over existing loading docks, to house the plant.



Equipment Layout Challenges

- Finding available space for the plant was a major hurdle in getting the project off the ground
- No availability of open ground on hospital's highly developed city block
- The team discovered unused "volume of space" adjacent to existing boiler plant, sandwiched between hospital's loading dock and patient rooms above

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Existing Equipment Modifications

- R540 and R590 breakers protection was redone to satisfy National Grid
- R540 and R590 new PTs added for Synchronization purposes for Line and BUS side
- New protective relays i.e. SEL 751 and SEL 351 were added for better application of IEEE 1547 and ESB 756 document by National Grid
- New Basler BE1-11f relay was added to two incoming utilities to measure proper import and not let any export of kW

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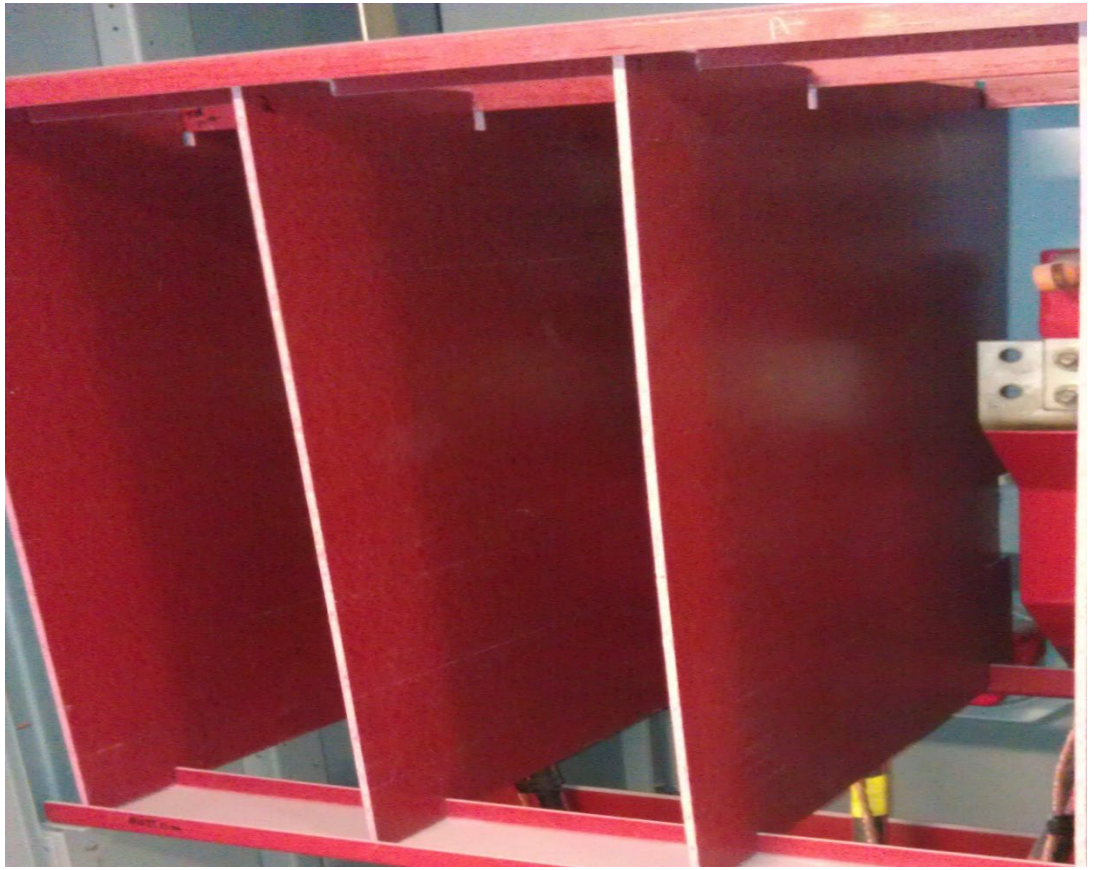
Utility Interconnection Challenges

- The utility required DTT Direct Transfer Trip, but the requirement was replaced by adding Basler Relays for better accuracy and not to allow the export of Power to the Grid
- Lighting arrestors and Glastic Barriers were added as per utility requirement and was very challenging to install but the switchgear Vendor did a great job



Utility Interconnection Challenges Cont'd

- All the synch checks were done in Delta V of the Voltage difference for the Line and Bus side.
- Close transitioning between the Main Tie Main was done in 30 cycles and the scheme resided in the protective relays.
- Directional current 67 and 67G was added and coordinated with the upstream utility owned device.
- Extra test switches were added for all protective relay I/Os. Those were a lot of test switches.

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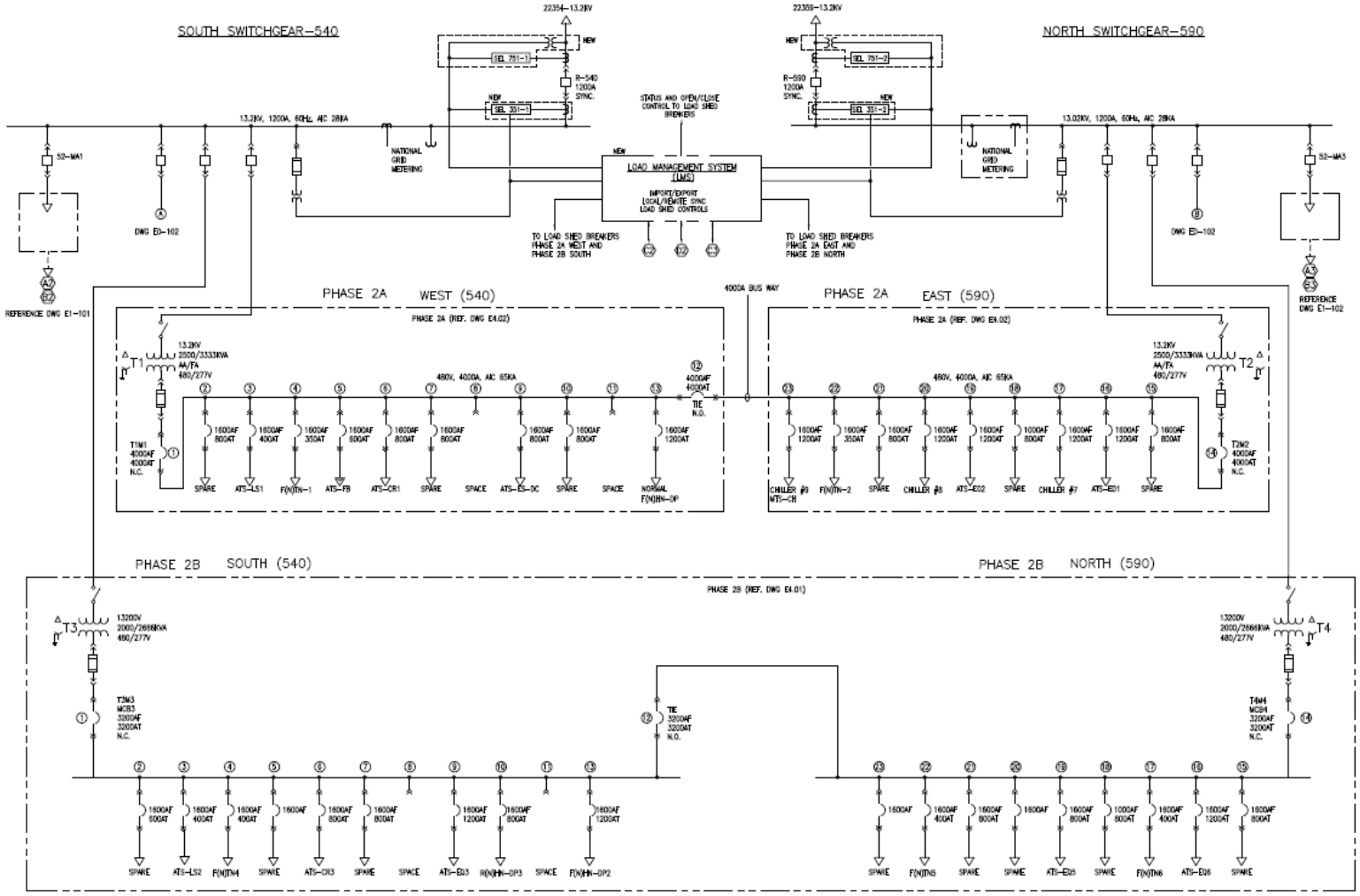
Overall Single Line



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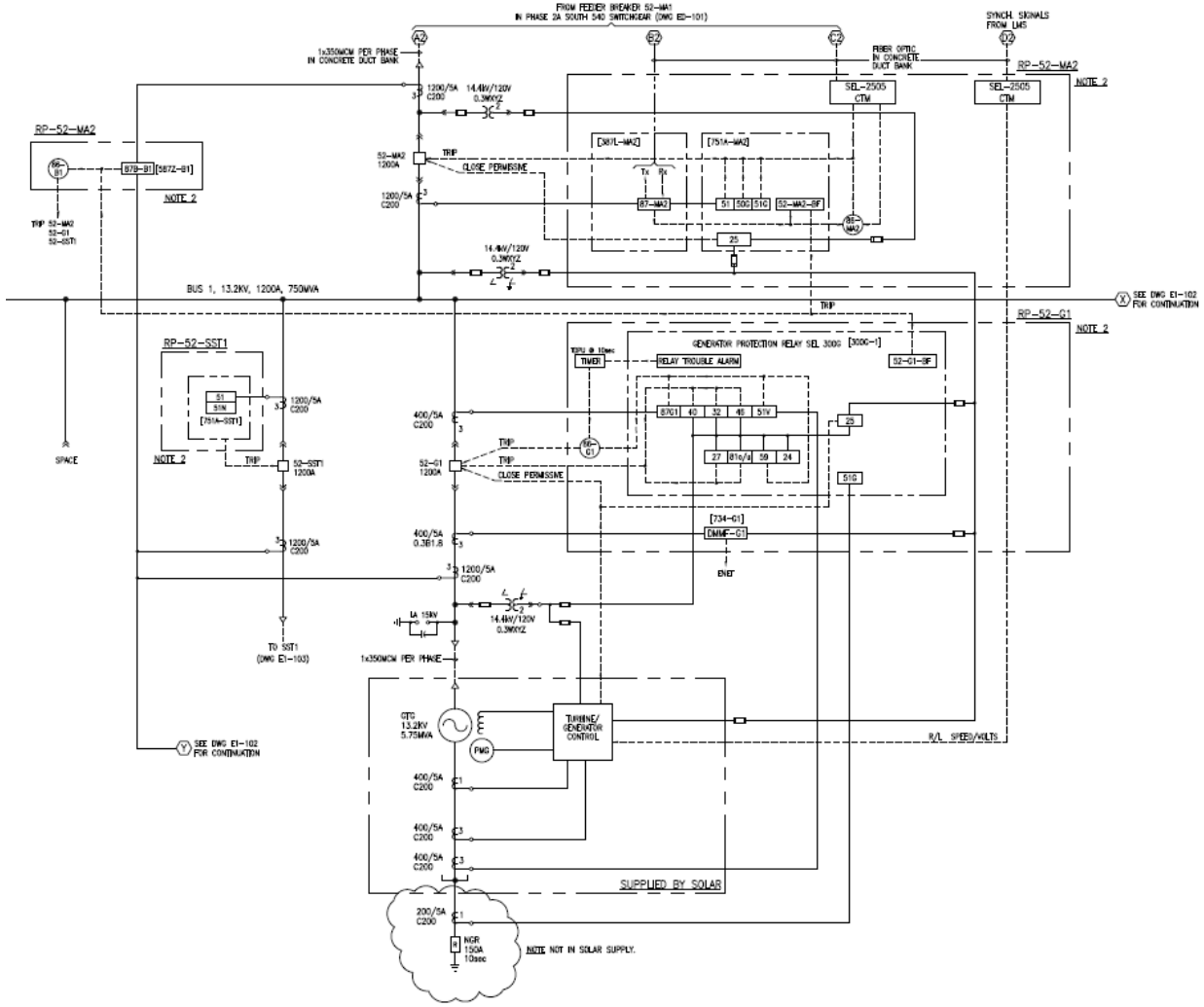

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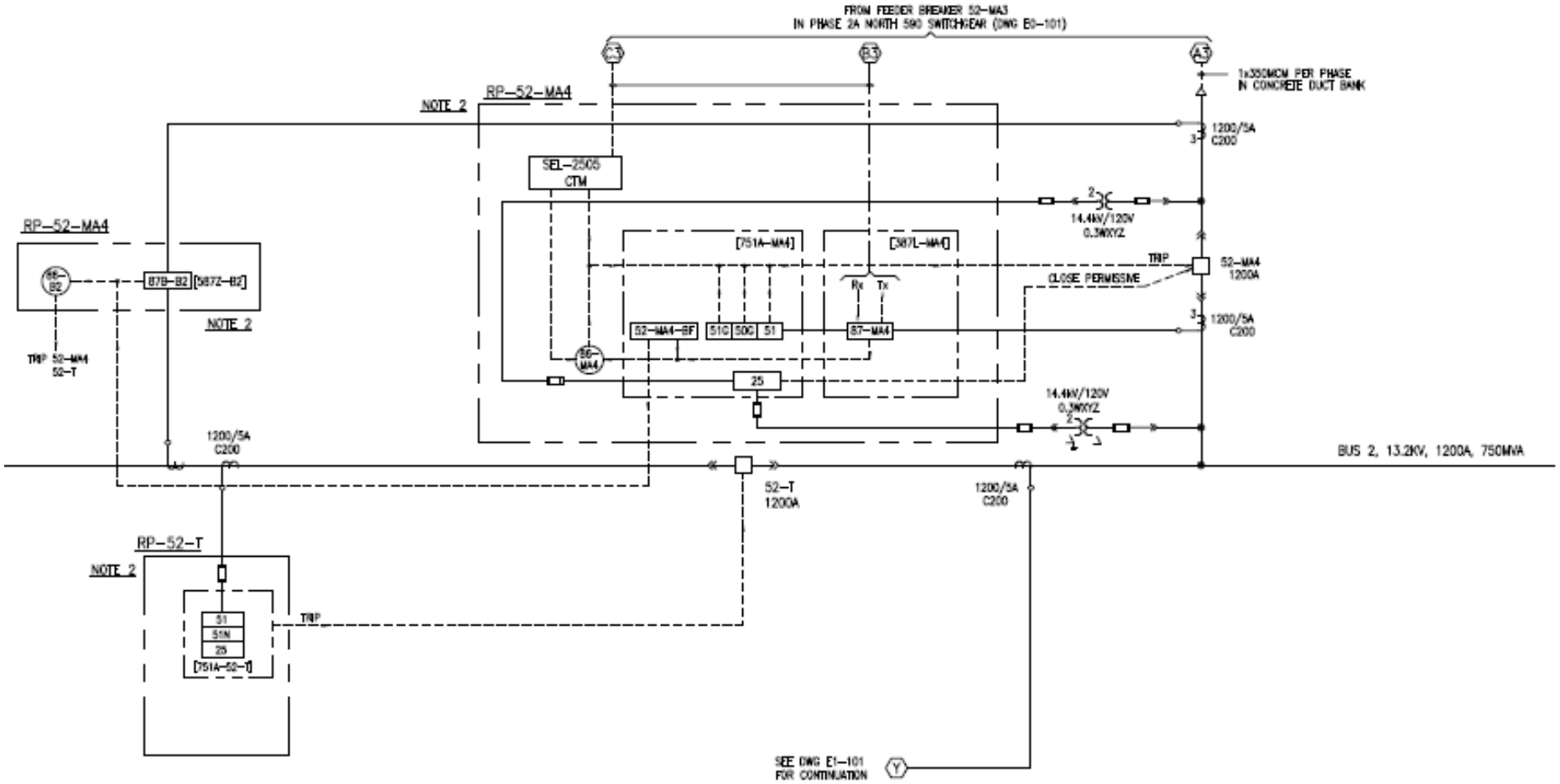

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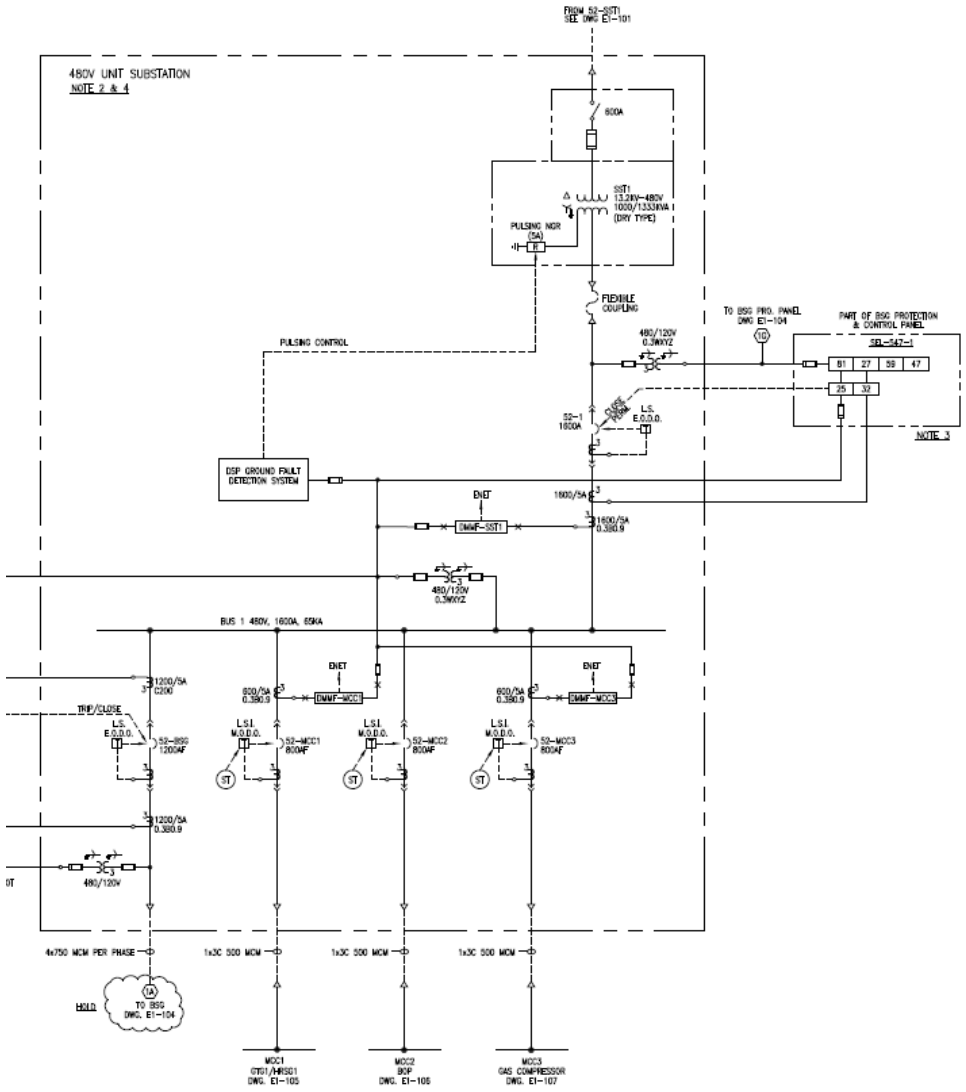

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Thank You.

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