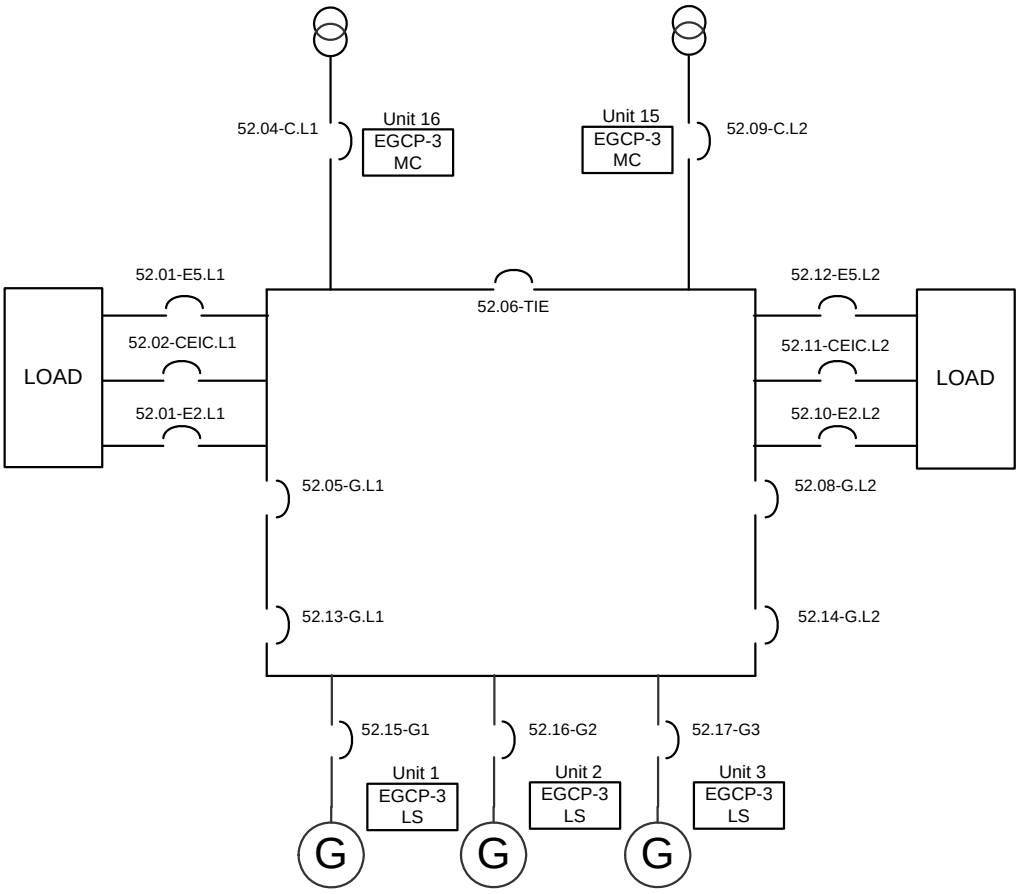
EGCP-3 Beta Site

São Paulo, Brazil

Woodward's latest power generation control products, the **EGCP-3 LS** and **EGCP-3 MC**, have successfully completed beta site testing by Sotreq in São Paulo, Brazil. This site was selected for its complexity and the ability to test most of the functionality of the EGCP-3. This site featured two utility feeds as well as three 2.5 MW Caterpillar gen sets used for stand-by and prime power. A one-line diagram of the system is illustrated below. The 52.06-TIE is a normally closed breaker that allows a single utility feed, 52.04-C.L1 or 52.09-C.L2 to supply the entire load of the customer.



System Configuration

- Handles simple to complex sites requiring load sharing
- Zero Power Transfer
- Baseload Control
- Import/Export Control
- Loss of Mains Protection

Several applications were tested at the site including:

- Zero Power Transfer, Closed Transition ATS
- Baseload Control
- Import/Export Control
- Loss of Mains Protection Control

Zero Power Transfer (ZPT)

The customer required the EGCP-3 to initiate a closed transition ATS. Two constraints were placed on this ATS—that the transition occur in 40 seconds (fast transfer time), and that zero power transfer be guaranteed. Since zero power transfer was more important to the operators, the EGCP-3 MC's TEST ATS functionality was used to perform the ZPT. Test ATS closed transition in the MC guarantees a ZPT at the mains breaker. Under normal operation, the ZPT occurs at the fast transfer time, but fault conditions can change this operation. If a fault occurs on one of the gen sets during synchronization or start-up, that gen set may not be available for closed transition. If this situation occurs, ZPT will not be met and the generators will not be able to maintain the load at the site. By using TEST ATS functionality, the MC waits for ZPT and then opens the mains breaker even if the fast transfer time has expired. So, if a fault occurs on a gen set, and the MC is not able to reach ZPT, the remaining two gen sets will remain paralleled with the utility.

This functionality was tested on both mains feeds individually. The MC initiated an all start to the LS units, which proceeded to start and synchronize their gen sets to the bus. Once synchronization occurred, the MC sent a load command to the LS units to increase load at a rate dictated by the fast transfer time. When ZPT was reached, the mains breaker was opened and the LS units shared the load in the bank. Isolated operation gave the application engineers the opportunity to test the load control and PF (power factor) control of the LS units in loadshare. The site load was changed and the loadshare and PF gains were adjusted for optimum performance.

When the MC was told to return to mains operation, it synchronized the LS units to the mains and then issued a mains close. The LS units were then unloaded at a rate dictated by the fast transfer time. When minimum gen set load was reached, a stop all command was sent to the LS units, and the gen sets opened their breakers and went into cool down and then shutdown.

Overall the ZPT action performed exactly according to specifications and the customer was very happy with the performance of the EGCP-3.

Three EGCP-3 LS units were used to control the three Caterpillar gen sets

Baseload Control

Baseload control was performed against internal load while in parallel with the utility. The MC adjusted the gen set load from 20 to 80%. During this time, the load control PID in the LS units was adjusted for optimum performance. PF control was then initiated and adjustments were made to the MC to control the PF at the mains at 0.9 LAG. Load changes were made and the PIDs were adjusted for optimum performance.

Although this was not a function that would be performed at the site during everyday operation, it gave the applications engineers a chance to test this functionality outside of the Woodward Engine Room. This verified the performance of the LS and MC units' load and PF controllers, and the customer was pleased with the load control.

The two EGCP-3 MCs were installed in the main switchgear cabinets

Import/Export Control

Occasionally the electrical grid around the site can become unstable during weather disturbances or power brown-outs. With the possibility of a loss of power to the site, the operators wanted the ability to maintain an uninterrupted supply of power using import/export control. This allows the site to continually supply power to its internal load even if the utility suddenly fails and the mains breaker opens.

The MC was configured for import/export control at several kW and PF levels. The MC initiated the start-up and paralleling of the LS units' gen sets. When parallel, the MC sent load and PF commands to the LS units, which then adjusted their speed and voltage biases to control their gen sets at specified load levels. Control was responsive to load changes and met the desires of the operators and application engineers.

Configuring one of the EGCP-3 LS units via the front panel

Loss of Mains Protection Control

Stand-by operation was tested at the site with loss of mains protection and control. When a loss of mains occurred on the system, the mains breaker was opened immediately and the MC issued a start all to the LS units. The gen sets were started and synchronized to the bus and controlled the load in isolated operation. Upon mains return, or the clearing of a loss of mains alarm, the LS units were synchronized to the mains, the mains breaker was closed, and the MC initiated a stop all command to the LS units which then unloaded and shutdown their gen sets.

Several loss of mains alarms were applied to both mains feeds, and only the MC that was in control at the time was able to start any LS units. Overall the control performed well and was accepted by the operators and application engineers on site.

Showing off the EGCP-3

Conclusions

The EGCP-3 beta site was a huge success. Because of the size of the generators, the control was verified to work with a wide range of gen sets. From small 50 kW units (Woodward Engine Lab) to large 2.5 MW units (Brazil beta site), the EGCP-3 control performed exceptionally well. LS control of the engine generator sets was confirmed and MC control of two mains feeds was confirmed with only the MC in control performing supervisory control action. ATS, Baseload, Import/Export Control, and Loss of Mains Action and Control were verified. Communication between the EGCP-3s and the plant PLC was performed via Modbus and was successful for two baud rates. Application engineers and operators of the customer, Woodward Brazil, Sotreq, and Siemens verified the control functionality and were impressed with the performance. With the success of the beta site, the EGCP-3 LS and MC will be released with a great track record in its infancy.

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