WOODWARD

Application Note 51121
(Revision B, 1/2001)

Original Instructions

Load Pulse Unit

- Control frequency transients caused by changing load conditions
- Assist an application with meeting severe specifications that require frequency transients be held to a minimum
- Apply to single engine/generator systems or multi-engine/generator systems

Limits Frequency Deviation

Load Pulse Unit Limits Frequency Deviation

Applications

This advanced control can help you with meeting severe specifications for frequency transients caused by load changes on engine/generator systems. Independent tests show that Woodward's Load Pulse Unit helps keep frequency transients within extremely tight specifications under a wide range of changing load conditions. Now a prime mover speed system can sense, and quickly respond to, these transients, and give your system improved performance.

Problem Description

In order to meet a customer's requirement to severely limit frequency excursions, personnel of Atlas Polar, a highly diversified manufacturing and distribution company in Toronto, Canada, and Woodward engineers worked together to retrofit diesel/generators with Woodward control systems.

The retrofitted units supply backup power to Uninterrupted Power Supplies (UPS) for a computer system located at a Canadian bank's main office. The computer system provides data processing and data storage for automatic-teller banking systems.

A UPS is highly sensitive to frequency transients—an especially important consideration when backup power is required. Typically, the system providing the UPS with backup power uses a fast-acting relay to protect the computer from reverse polarity damage. Often the fast-acting relay will interpret a frequency excursion as a reverse polarity situation and shut down the backup power system. This results in UPS-stored power being the sole source of computer power, and makes the computer vulnerable to a shutdown, which could result if UPS-stored power is exhausted before backup power is restored.

Load Pulse Unit Developed

Woodward's Load Pulse Unit (included in each retrofit package) is an electronic device designed to work with an engine/generator control system. It can be used either in a system consisting of only one generator or in a system having several generators.

Whenever a load change is sensed by the Load Pulse Unit, a signal is sent to the electronic control regulating prime mover speed. The signal then influences the electronic control before the load change can affect the system's speed loop. The ability to "anticipate" the effect of the load change allows the entire control system to meet fighter-than-normal transient response specifications and keep offshoots to a minimum.

The Load Pulse Unit receives its power from three current transformers (CTs). The unit is designed for optimum performance when using CTs having a current output of five amps at full generator load. However, the unit will function accurately if the CT full-load amperage is between three and seven amps.

An easily accessible potentiometer allows the operator to adjust pulse amplitude to meet operational needs.

The Load Pulse Unit is not phase-sensitive and it may be skid-mounted.

Problem Solved

Equipment Used

In testing the ability of various types of equipment to respond to load changes, Atlas Polar personnel used a Waukesha L5792 DSIU engine/generator (capable of producing 1000 kW at 1200 rpm). The test was conducted using a 1000 kW resistive load bank.

The engine with its original control equipment was tested first. The control equipment then was fine tuned and the system retested. Finally, the actuator was replaced with new, but comparable, equipment and again the system was tested. In all cases, even when original control equipment was fine tuned, the system did not meet a very strict maximum frequency deviation specification of ±0.5 Hz during load swings. All frequency excursions exceeded specifications, and because of this, the system was not able to meet the strict needs of the application.

Chart A typifies transients encountered during original equipment tests. The chart illustrates frequency transients when load is subtracted from and is added to the system.

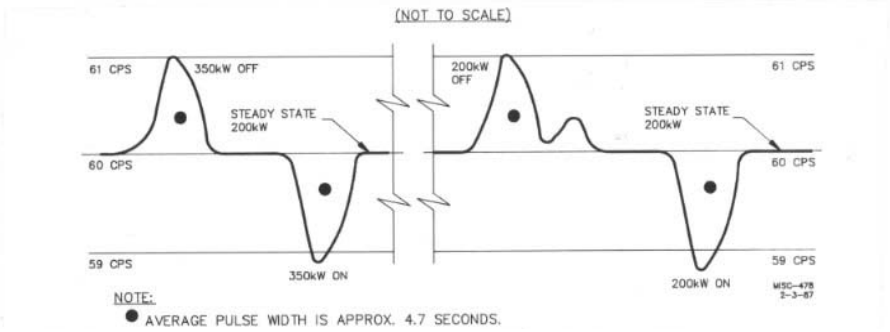

Chart A. Typical Frequency Responses Encountered with Original Equipment

Comparative Testing Performed

Atlas Polar personnel replaced the engine's original equipment with a Woodward EGB-2P reverse-acting actuator, a Woodward 2301 A Load Sharing and Speed Control, a Woodward Load Pulse Unit, and a Woodward Precise Frequency Control. Then the Woodward control system was subjected to tests similar to those performed on the original control equipment.

With Woodward controls, the engine/generator was able to continuously maintain very stable operation, and frequency excursions were consistently much less than the ±0.5 Hz specification. (*) See Chart B.

After lab testing the Woodward system, Atlas Polar personnel installed it on a Canadian bank's engine/generator set, which is a Waukesha engine/gen set capable of producing 1100 kW. They then conducted a test to confirm that the equipment would duplicate its operation under actual operating conditions.

The system performed as effectively in the field as it did in the laboratory, and frequency deviations remained far less than the ±0.5 Hz permitted by specification. *

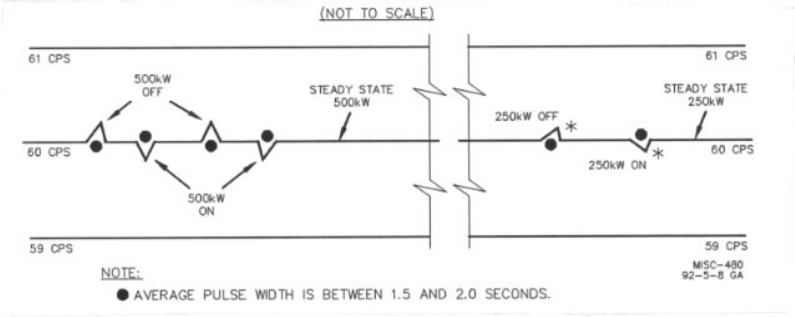

Chart B. Typical Frequency Responses Encountered During Laboratory Tests with Woodward Equipment

Additional Applications

Atlas Polar engineers, in their efforts to design special systems to meet unique needs, have identified several Load Pulse Unit applications. Applications can include Mitsubishi, Waukesha, and Volvo engines/generators to name a few. The unit may be used in the steel industry (critical control of ladle pour), the mining industry (mining cage hoists), and in critical pump applications.

The Load Pulse's ability to provide quick, precise response to load change is advantageous to almost any generating system that powers a process extremely sensitive to frequency spikes.

For more information on the Load Pulse Unit, contact Woodward.

*Copies of test data are available for inspection at Woodward in Fort Collins, Colorado, USA.

We appreciate your comments about the content of our publications.

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