


Oil & Gas Automation


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INNOVATIVE APPROACHES TO EXPLORATION AND PRODUCTION

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of Unico, Inc.



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Technically Speaking



Using Harmonic Filters to Satisfy Utility Power Quality Regulations

by Christopher Schmidt *regional sales manager / western U.S. & Mexico*

Electronic variable-speed drives have contributed greatly to the increased energy efficiency and productivity of many applications in the oil and gas industry. Unfortunately, the increased use of variable-speed drives has also contributed to the electrical pollution of utility power grids. Objectionable levels of electrical pollution caused by variable-speed drive harmonic currents have caused many utilities to enact regulations restricting the amount of harmonic distortion a customer is allowed to inject into the power grid.

Conventional variable-speed drives will not generally satisfy these tougher harmonic regulations without some additional equipment, such as a harmonic filter. The consequences of not satisfying utility requirements can be severe, as illustrated by the example regulations from the Powder River Energy Corporation (PRECorp) below. To help us understand the cause of the utility's concern, the *unfiltered* charts below show the power quality of a typical variable-speed drive without an input filter or reactor.

Fortunately, disruptive harmonic currents can be lowered to levels that satisfy utility regulations, as illustrated in the *filtered* charts below. Unico offers filters that reduce total harmonic distortion to less than 12% or 8%.

For more information on harmonic filters or for assistance in complying with utility regulations, please [contact us](#).

Electric Service Regulations—Harmonic Distortion Limitation

Source: Powder River Energy Corporation

Application of Rules

a) Applicable Standards

In addressing harmonics problems, PRECorp and the Customer shall implement, to the extent reasonably practicable, and in conformance with prudent operation, the practices outlined in IEEE Standard 519-1992, or any successor IEEE standard, to the extent not inconsistent with law, including state and federal statutes, orders, regulations, and applicable municipal regulations.

b) Investigation and Corrective Action

PRECorp shall investigate and determine the cause of the excessive harmonics. If PRECorp determines that the Customer has created excessive harmonics that cause or are reasonably likely to cause another Customer to receive unsafe, unreliable, or inadequate electric service, PRECorp shall provide written notice to the Customer creating the excessive harmonics. The notice shall state that PRECorp has determined that the Customer has created an excessive harmonics condition and that PRECorp has explained the source and consequences of the harmonic problem. The notice shall give the Customer two (2) options to cure the problem:

1) The Customer may elect to cure the problem on its side of the meter, at its cost, but the remedy must occur within six (6) calendar weeks, which will be specified in the notice. If the cost of the project exceeds \$10,000, PRECorp and the Customer may establish a mutually acceptable time period to correct the problem.

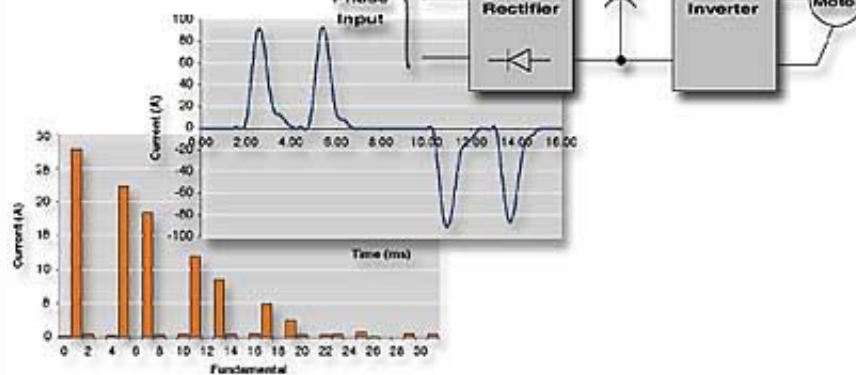
2) If the Customer does not cure the problem after being notified, and within the allotted time, PRECorp will cure the problem on its distribution system and assess all charges, including overheads, to the Customer. For facilities installed by PRECorp for purposes of correcting a customer's harmonic distortion, that customer shall be responsible for a monthly maintenance fee.

e) Election Not to Connect

PRECorp may, at its sole discretion, elect not to connect a nonfiltered variable-speed drive service.

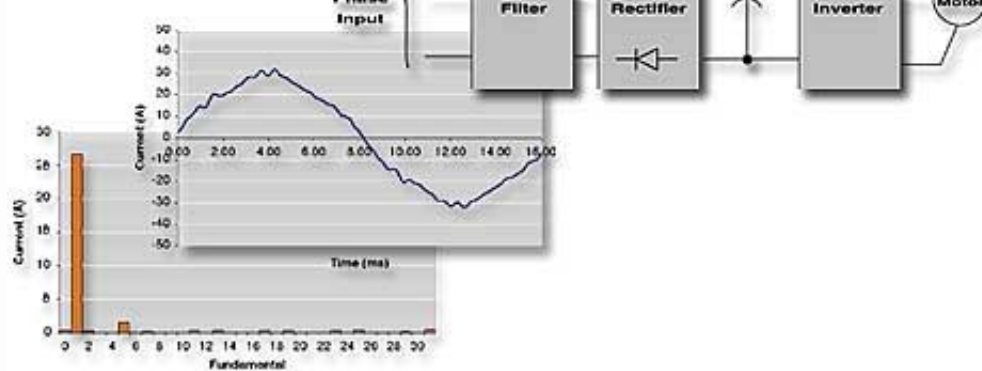
Unfiltered

Typical 20 hp unfiltered drive in a CBM pumping application



Filtered

Typical 20 hp drive with harmonic filter in a CBM pumping application



Product Watch

Software Option Allows Use of Palm Pilots for Archiving Well Parameters

Unico's newly released *Drive Archiver*[™] software for Palm Pilots and other handheld computers makes managing wells a breeze. With *Drive Archiver*[™], well operators can quickly and easily capture drive settings and crucial operational information while doing their rounds in the field, then communicate that information to field managers back for analysis back at the office.



The Drive Archiver[™] Data view shows all parameters and their values. The Events History screen lists all drive faults, warnings, and events along with the date and time they occurred.


Drive Archiver[™] interrogates the drive over a serial connection and records the values of each setup parameter. Users can create any number of archives and categorize them according to well location or other meaningful criteria. Each archive is time and date stamped. Archived setup values can easily be restored to the drive in the event of a problem, or they can be transferred to another drive to speed the commissioning process.

Drive Archiver[™] becomes a powerful tool for monitoring well operation when used in conjunction with the event-logging capabilities of some

pump-control programs. In addition to faults and warnings, many applications log an event whenever a pump starts, stops, goes to standby, or whenever there is bridle separation, belt slippage, or a host of other application-specific conditions. This information is continually recorded along with the date and time each event occurred. *Drive Archiver*[™] reads and stores the event history, which can then be transferred to a personal computer for study. It's a handy way to eliminate the guesswork about what happened during the middle of

the night.

Drive Archiver[™] operates on any handheld running Palm OS 3.5 or later. It works only with drives running Unico's proprietary Embedded System Protocol (ESP), which includes our 2000 series and our 1000 series when used with the 40 MHz controller. Synchronization with a PC requires version 4.0 or later of the HotSync Manager for Windows.

 [Contact us](#) to learn more about *Drive Archiver*[™].

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Feature Focus

1110 Series Drives Eliminate the Single-Phase Barrier

Many well locations are served only by single-phase power, making it problematic to operate ordinary three-phase pumping equipment. One option is to have the power utility install a three-phase line, but this can be prohibitively expensive. Installation costs can amount to tens of thousands of dollars per mile.



Another alternative is to use a traditional rotary mechanical phase converter. Rotary converters, however, are bulky, inefficient, and costly to maintain. Their most serious flaw, however, is that their imbalanced output leads to premature motor failures.

Imbalanced phase currents directly affect motor life. According to the Institute of Electrical Engineers, a mere 5% imbalance leads to overheating sufficient to reduce overall motor life by 25%. A 10% imbalance reduces motor life another 25%. Traditional phase converters commonly see imbalances in the range of 25% to 30%. Although special equipment can be used to balance rotary converters at a specific load, motors seldom run at constant load due to changing downhole conditions. Hence, the motor is nearly always running with imbalanced current.

Unico's 1110 series provides a superior solid-state solution that overcomes these limitations. The 1110 combines motor control and phase conversion in a single unit that operates standard, off-the-shelf three-

phase AC motors up to 100 hp from existing single-phase power lines. Unlike other phase converters, the output of the 1110 is perfectly balanced at all loads and speeds. It is also compact, energy efficient, and provides dedicated variable-speed control for progressing cavity, electric submersible, and sucker-rod pumping applications—something no ordinary phase converter can do.

📄 [Contact us](#) to learn more about how the 1110 can be your key to greater productivity.

	Rotary Phase Converter	1110 Phase-Converting AC Drive
Motor Life	Imbalanced phase currents cause overheating that cuts motor life	Phase currents are precisely balanced regardless of load and speed
Inrush Currents	High inrush currents (600% to 800% of motor rated) from starting motor across the line	Eliminates inrush currents (115% of motor rated)
Mechanical Stress	Starting across the line places mechanical stress on pumping system	Soft starting and stopping extends equipment life
Energy Usage	Constant on/off cycling wastes energy	Reduces operating costs by always delivering just the right amount of power to meet changing load requirements
Efficiency	Typically 70% to 80%	96% efficient
Pump Control	None	Complete control of speed and torque. Integral, sophisticated pump-control software for flow or pressure control
Starting Torque	Low starting torque	Full motor torque throughout entire speed range
Physical	Units are bulky and often require special mounting and installation	Drives are compact and weigh a fraction of comparable rotary converters. Can be wall mounted. Unique heat sink design reduces enclosure size
Protection	None	Extensive safeguards protect both motor and load
Noise	Noisy	Quiet
Maintenance	Requires continual refueling and maintenance	Maintenance-free


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What's Coming Up

In Future Issues...

Look for the following articles in upcoming issues of *Oil & Gas Automation Solutions*:

- A new benchmark for artificial lift energy efficiency
- Determining rod-pump fillage without a load cell
- Rod force limiting eliminates rod parts on deep wells
- Rotaflex maximum pumping capacity increased 33% using novel speed control
- Integral dynamic braking option included in new 1105 series drives

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