

1C.1—Power Quality Introduction

ENGINEERING
Standards and Technical Support Department

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1 Scope

This document presents PacifiCorp's views regarding the importance of power quality and voltage regulation, and introduces PacifiCorp's power quality standards.

2 Quality of Delivered Power

An important part of PacifiCorp's mission is to provide and maintain a high quality of electric service to its customers. The quality of the power delivered to a customer is an important part of that service quality. These power quality standards address:

1. Regulation of the delivered voltage
2. Quality of the delivered power determined by the *cleanness* of the sinusoidal voltage and current waveforms at the point of delivery

3 Importance of Voltage Regulation and Power Quality

PacifiCorp views good voltage regulation and power quality as essential to the efficient and reliable operation of their customers' sensitive electronic loads. Power disturbances such as transients and harmonics can destroy or shorten the life of sensitive equipment resulting in expensive downtime and lost revenue. Some types of equipment and their use in a customer's facility can adversely affect the current and voltage on the distribution system so that sensitive equipment connected to the same circuit or equipment of a nearby customer does not function as it was designed. Sensitive utility equipment is vulnerable as well. For example, a dip in voltage caused by a customer starting a motor can cause an adjacent piece of microprocessor-controlled equipment to misoperate or shut down.

4 The Need for Standards and Guidelines

These power quality standards establish operational characteristics, tolerances, and limits which, when met, will allow facilities containing power sensitive and power disturbing loads to operate on PacifiCorp's distribution system with a minimum of interference to utility equipment or customer loads. PacifiCorp's customers, outside contractors and consultants, and its own engineering and operations personnel can use these standards to properly design, install, maintain, and operate facilities containing power disturbing loads or sensitive equipment requiring a high degree of power quality. They will know what voltage range is required to operate equipment effectively. The standards are important in determining the degree of power quality of any electrical distribution system, whether utility feeder or facility circuit.

5 The Power Quality Standards

Specifically, these standards provide information and specifications on voltage level, regulation, and quality that PacifiCorp intends to maintain and deliver to its customers. Standard 1C.4.1,

Harmonic Distortion, sets limits on current distortion caused by equipment or loads that will be allowed by customers connected to PacifiCorp’s distribution system. The limits place some restraint on customers whose operation of equipment adversely affects the operation of another customer’s equipment. The standards are listed and briefly described in Table 1.

Table 1 – Power Quality Standards and Their Descriptions

Power Quality Standards	Descriptions
Voltage levels and ranges (1C.2)	Normal voltage levels, overvoltage, undervoltage
Voltage balance (1C.3)	Phase–phase variation in voltages; affects system operation efficiency
Harmonic distortion (1C.4)	Voltage and current waveform distortion
Voltage fluctuation and flicker (1C.5)	Sags and dips
Voltage disturbances (1C.6)	Swells or rises, impulses or transients, high-frequency conducted noise
Stray voltage (1C.7)	Inducted voltage, step and touch potential
Voltage frequency (1C.8)	Variation in power frequency
Finding and solving power quality problems (1C.9)	Corrective measures

Close adherence to these standards by the electrical community will provide an acceptable level of power quality for both the power provider and the power user.

Achieving this acceptable level of power quality can be obtained through a cooperative effort among the power users, equipment manufacturers, and PacifiCorp; the result will be longer service life for equipment and lower cost for electric service. For example, in using this *neighborhood* approach to quality power, the voltage harmonics on a circuit can be kept at a level that can be accepted by all. This will result in a near sinusoidal waveform on the circuit, which will allow all connected load equipment to operate properly. Prevention is much better than finding a cure. In achieving a suitable level of power quality, the costs of implementing a solution using state-of-art engineering technology must of course be weighed against practical application and desired results.

6 Document Development and Technical Resources

This document and the standards listed in Table 1 were developed by the Power Quality (PQ) standards team. The team was given the charge to develop and document standards for power quality to be used by PacifiCorp. The PQ team consists of the following:

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7 Issuing Department

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8 Approvals and Authorization

The persons listed below approved this document. Their signed management approval records are on file in Standards Services. Publication and use of this document is authorized by the director of Standards and Technical Support. The signature of the manager of Standards Services below indicates that all required approvals and authorization have been received.

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