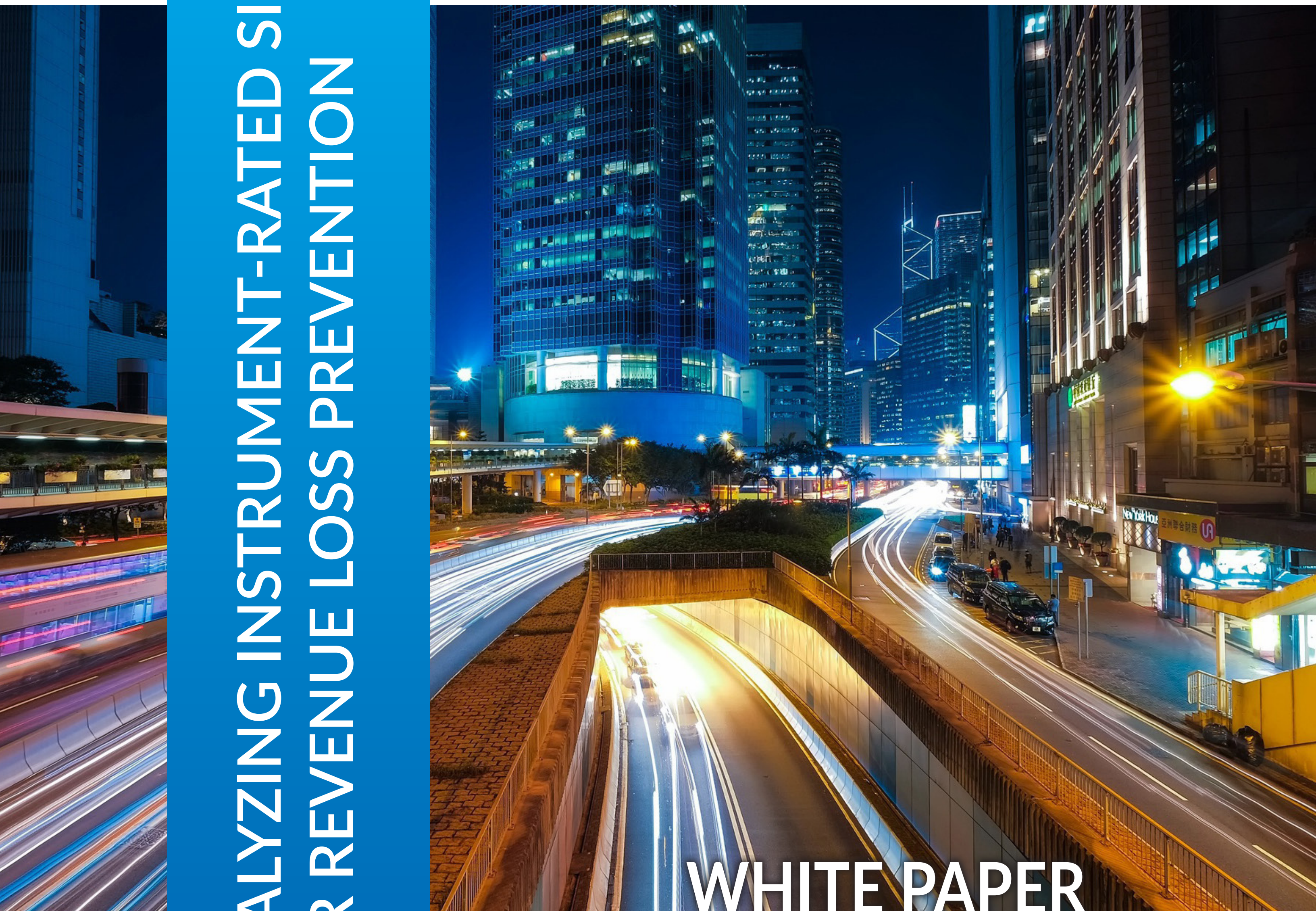
PROBEWELL

ANALYZING INSTRUMENT-RATED SITES FOR REVENUE LOSS PREVENTION



WHITE PAPER

Analyzing Instrument-Rated Sites for Revenue Loss Prevention

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How to Identify Sources of Revenue Loss and Fix Them Quickly and Effectively

Preventing revenues losses has become a priority for electric utilities, which are facing an increase in energy demand while dealing with aging infrastructure and erratic climate conditions that can result in equipment reliability issues. Under constant pressure from their commercial and industrial clients—where most of their net benefits are concentrated—they have to maintain peak performance in order to avoid surcharge billing and ensure full customer satisfaction.

For every month that a problem remains unresolved, undetected issues in the commercial and industrial sectors can result in several thousands of dollars in revenue loss. The side effects can also be significant for electric utilities: a tarnished reputation, loss in customer confidence, not to mention potential lawsuits, a public relations crisis, and resources required to repair the damages.

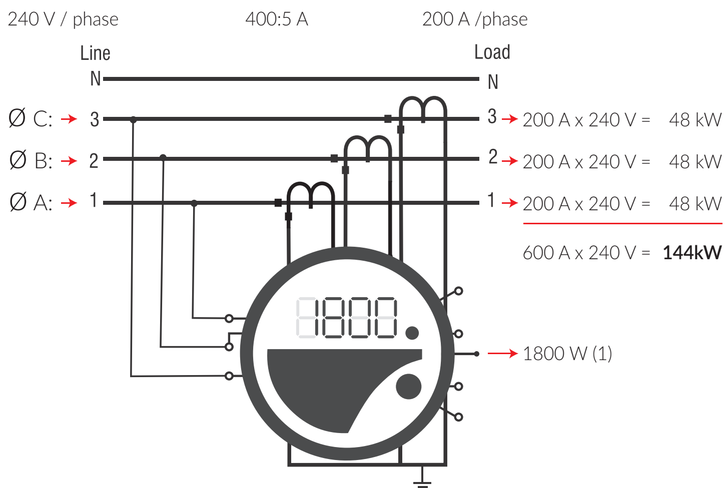
Luckily, electricity providers now have access to several technologies and emerging methodologies to better monitor the power quality of electrical installations and assess billing while minimizing the time and money invested in the solution.

This article aims to illustrate the problems and negative consequences that can occur when instrument-rated sites are not regularly inspected, as well as the revenue loss that risks impacting utilities that are not diligent with their routine inspection.

It also highlights the tests required to enable utilities to quickly identify sources of revenue loss and effectively repair them while optimizing equipment performance, maximizing crew productivity and thereby increasing return on investment (ROI).

Benchmark Installation

According to the EIA (Energy Information Administration), the average monthly bill for the industrial sector in the U.S. for 2020 is about $5,370.93*, although the actual amount will vary depending on the size of the business, the climate conditions and the electricity cost in different U.S. locations. The graph below represents an installation at its optimum performance, which we will use as a reference throughout this article.

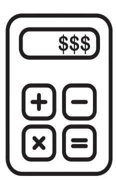


Calculating Energy Costs

Energy calculation is straightforward. The unit of electrical energy is the kilowatt-hour (kWh), found by multiplying the power use (in kilowatts, kW) by the number of hours during which the power is consumed. Multiply that value by the cost per kWh to obtain the total energy cost.

Total energy cost = (power in watts/1,000) × hours operating × cost per kWh

In our benchmark example, the calculation is as follows:



Power consumption: 144 kW
Energy price: $0.1289/kWh**
Usage time: Per day***

Period	Energy consumed	Cost
Per hour:	144 kWh	**$18.56**
Per day:	1,152 kWh	**$148.49**
Per week:	5,760 kWh	**$742.46**
Per month:	25,045.7 kWh	**$3,228.39**
Per year:	300,548.6 kWh	**$38,740.71**

* Data from the U.S. EIA forms EIA-861- schedules 4 A-D, EIA-861S and EIA-861U

** Source: U.S. EIA: Average Price of Electricity to Ultimate Customers by End-Use Sector, June 2022 ($0.1289 Cents per Kilowatthour).

*** A standard 8-hour day and 5-days week was used in these calculations. It is meant to average energy consumption so results are not artificially inflated in an effort to account for the fact that commercial and industrial companies have different peaks of consumption within a day. To know the weekly cost for a company that runs 24/7, use the following formula: (cost per day x 3) x 7 days.

Defects Leading to Revenue Loss and Their Consequences

What are the true costs of revenue loss?

Utilities unknowingly lose thousands of dollars every month due to technical and non-technical reasons in the course of normal business operations.

Specifically, revenue loss occurs when an electric utility makes less than expected from its operations due to defective installations, whether it's faulty equipment due to weathering, human error or tampering, such as illegal hookups. Revenue loss is an unfortunate prospect for any business that operates over an extended period of time.

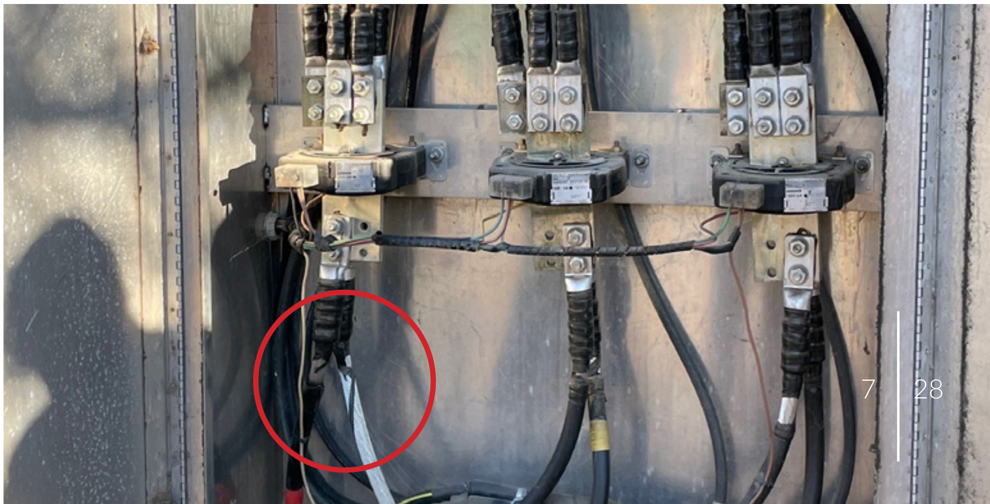
Without routine inspections, it can be difficult to detect tampering, such as when a meter is bypassed to prevent the energy from being registered.

Energy theft reduces grid stability and reliability, potentially generating more problems for the utility further down the line, as some issues may lead to premature deterioration of the infrastructure, thus increasing equipment maintenance costs. Not to mention the increased risk of fire or electrocution due to improperly installed bypasses.

Unfortunately, lost revenue has a direct impact on customers, as utility losses result in higher rates for all and undermine consumer confidence.

Therefore, it is crucial for utility workers to perform routine maintenance to flag malfunctions leading to revenue loss. Otherwise, the company may be forced to either rause its rates or downsize its operations by taking measures such as laying off employees or, in the worst case, closing down.

In the following pages, we will list potential issues to look for by detailing some of the many ways utility revenues are impacted and break down their cost over time.



MAIN SOURCES OF REVENUE LOSS:

Loose Connections

Wires are under constant cycles of heating and cooling, expansion and contraction, which can loosen connections over time. When connections are loose or corroded, the resistance measured in impedance increases. Since impedance and current are directly related, the current will also increase. Having abnormally high impedance could affect the meter and prevent it from properly doing its job measuring power for billing. High impedance on the system can also damage the site itself, including the transformer or any equipment connected to the service, such as three-phase motors.

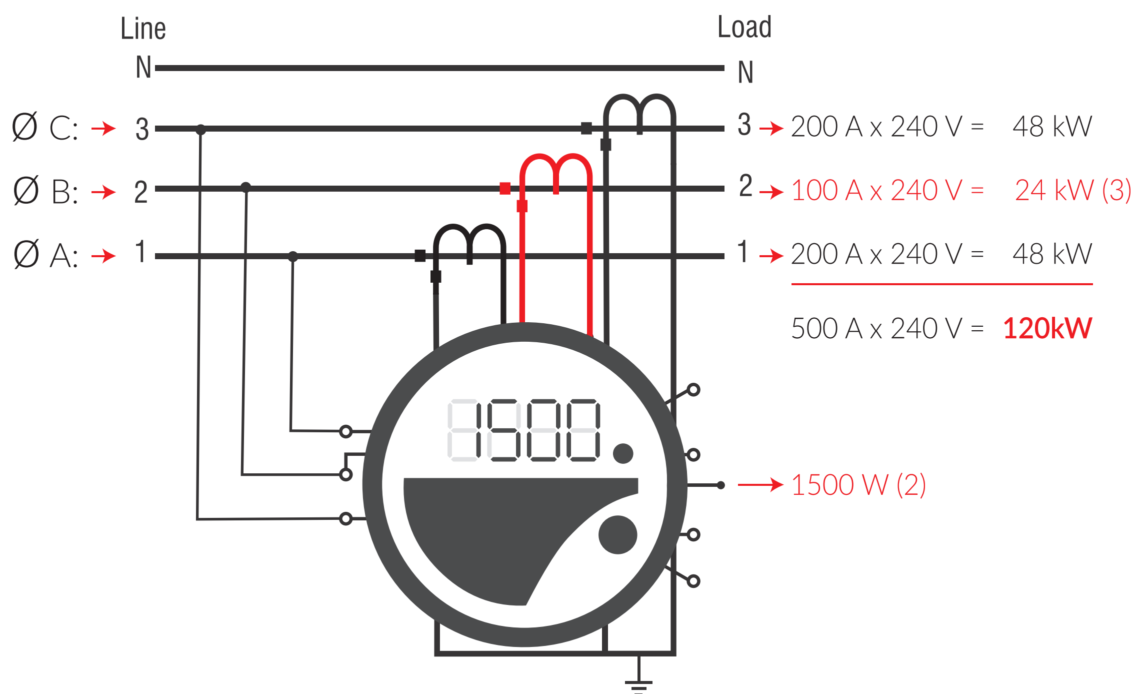
An admittance check can detect if there is higher-than-normal impedance by conducting a transformer analysis. Also, a power quality test can detect if the current on the loose connection is higher or lower than normal.

To illustrate the possible revenue loss, let's consider an industrial facility with three-phase inputs; each phase has a current transformer rated at 400:5 (400 amps going into the building, and 5 amps going into the meter). The installation has a maximum of 1,200 amps going into the building. If connections going to one or more transformers were not torqued properly or have loosened up over time, this could cause arcing between the connection point of the cable and the bus bar inside the transformer. Consequently, the impedance increases, resulting in a revenue loss for the utility because its meter is not getting the correct information.

Scenario: Loose Connection on Phase B

In a different example, if one transformer has a loose connection and each transformer normally draws 200 amps X 3 phases for a total of 600 amps at 240 Volts, the building current should be 144 kW. Then, the meter would normally read 600 Watts per phase, for a total of 1,800 Watts with a multiplier of 80 (ratio between the primary current and secondary current). However, if one of the phases is not getting the proper current, instead of having 1,800 Watts total, it could only have 1,740 Watts total – 600 Watts on phase A, 540 Watts on phase B, and 600 Watts on phase C. A reduction of 60 Watts, in this case multiplied by 80, gives a total of 1.6 kW. At an average cost of 12 cents per kWh, this leads to a revenue loss of $0.62 per hour.

Loose Connection on Phase B



Lost Revenue Calculation per Hour

1-Benchmark installation:	1,800 W
2-Defective installation:	1,740 W
Difference:	60 W
Ratio 400:5	X 80*
3-Lost	4.8 kW
Avrg cost	X $0.1289 / kWh**
Total lost per hour:	$0.62

* Ratio between the primary current and secondary current.

** Source: U.S. EIA: Average Price of Electricity to Ultimate Customers by End-Use Sector, June 2022 ($0.1289 Cents per Kilowatthour).

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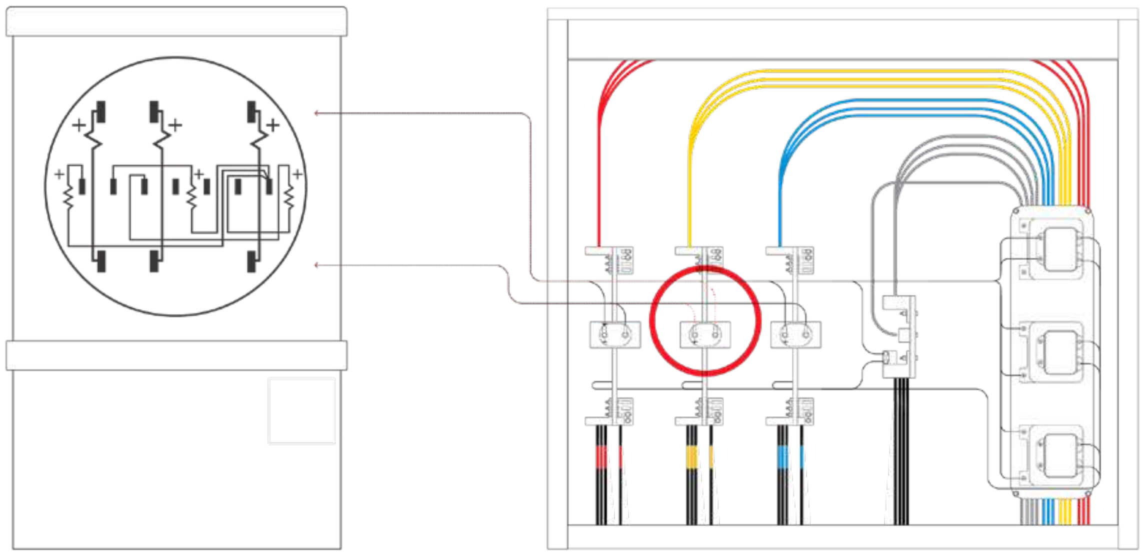
Lost Revenue Over Time

Power consumption:	139.2 kW
Energy price:	$0.1289/kWh**
Usage time per day:	per day***

Period	Actual cost	Energy registered	Invoiced	Revenue lost
Per hour:	**$18.56**	139.2 kWh	$17.94	**$0.62**
Per day:	**$148.49**	1,113.6 kWh	$143.54	**$4.95**
Per week:	**$742.46**	5,568 kWh	$717.72	**$24.74**
Per month:	**$3,228.39**	24,210.86 kWh	$3,120.78	**$107.61**
Per year:	**$38,740.71**	290,530 kWh	$37,449.35	**$1,291.36**

Incorrectly Installed Current Transformer (CT)



Wiring current transformers incorrectly can lead to situations with reversed polarity, i.e. reading the current as if the customer is generating electricity instead of consuming it. So when there are one or more inverted phases, the current is not correctly recorded by the meter, which has a huge impact on billing.

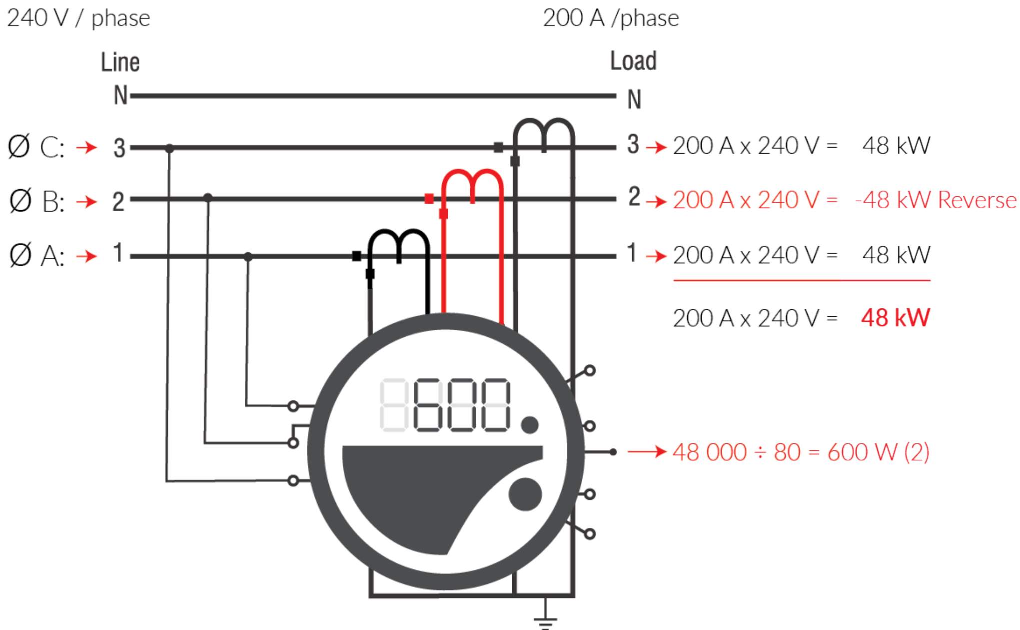
In a three-phase installation, having just one CT wired backward or inverted would result in the loss of up to two thirds of revenue at that location, assuming the transformers are properly balanced.

In this situation, the meter would read negative power on the reversed phase with the inverted transformer, which would roughly cancel out positive power recorded on an adjacent phase.

For these industrial three-phase sites, the loss can become exponential, if, in addition to an inverted phase, there is also a ratio mismatch on one or more phases. In that enent, revenue losses could be multiplied by a factor ranging from 20 to 100.

Technicians can find this problem by conducting a power quality test, which shows the polarity of the vectors in a graph and the power factor in a table. Vectors are used to detect whether the polarity is correct or reversed.

Reverse Connection on Phase B



Lost Revenue Calculation per Hour

1-Benchmark installation:	1,800 W
2-Defective installation:	600 W
Difference:	1,200 W
Ratio 400:5	X 80*
3-Lost	96 kW
Avrg cost	X $0.1289 / kWh**
Total lost per hour:	$12.37

* Ratio between the primary current and secondary current.

** Source: U.S. EIA: Average Price of Electricity to Ultimate Customers by End-Use Sector, June 2022 ($0.1289 Cents per Kilowatthour).

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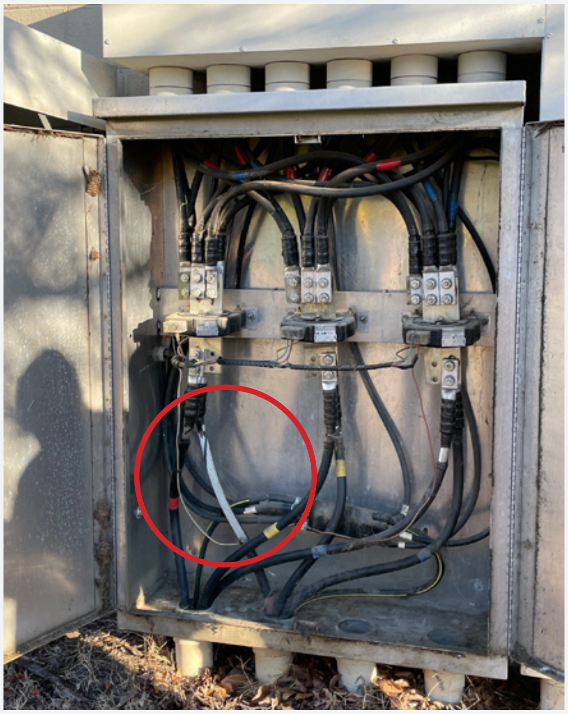
Lost Revenue Over Time

Power consumption:	139.2 kW
Energy price:	$0.1289/kWh**
Usage time per day:	Per day***

Period	Actual cost	Energy registered	Invoiced	Revenue lost
Per hour:	**$18.56**	48 kWh	$6.19	**$12.37**
Per day:	**$148.49**	1,152 kWh	$49.50	**$98.99**
Per week:	**$742.46**	5,760 kWh	$247.49	**$494.97**
Per month:	**$3,228.39**	25,045.7 kWh	$1,076.13	**$2,152.26**
Per year:	**$38,740.71**	300,548.6 kWh	$12,913.57	**$25,827.14**

Shorted Current Transformer (CT)



When there is a shorted winding inside the current transformer, no current information will be collected at the meter for that phase. Since no current is recorded, no power consumption is charged to the customer for that phase. This is recorded as a revenue loss by the meter.

A short circuit in a CT does not necessarily cause damage to the meter at the installation, but it does affect billing. If just one CT is shorted on a phase at the location, the meter will net a one-third revenue loss.

By performing a power quality test, technicians can identify whether or not there is current in the CT that is shorted. When no current is detected, the ratio test indicates an infinite value because it only reads noise for the secondary current. An admittance test can also be performed if the installation has no current. Once again, the test will show an astronomical figure because admittance and impedance are opposite.

Degrading Current Transformer (CT)

Too much impedance inside the transformer can cause a CT to degrade, causing the transformer to overload. When there is too much current passing through it, the transformer can break down and even open, which can be very dangerous. Introducing a lot of current through an open transformer makes the voltage rise exponentially. Consequently, the meter gives an erroneous reading, causing the customer to be either over- or under-billed depending on the situation.

A burden test can detect if there is a deviation in the readings. This way, technicians can see if the transformer is capable of handling the maximum current, or if it drops faster than it should.

Open Current Transformer (CT)

An open transformer might be the most dangerous of all possible failures. When the current is passing through the CT, the output can get out of control with a certain amount of current passing through and infinite resistance in an open CT. Thus, the voltage accumulates at the meter in excess of 6,000 Volts, causing a potential hazard for the technicians and the installation.

Arc flashes can happen when removing the meter even if the proper procedure is applied. Checking the current clamps at the meter base and looking at the secondary current can help prevent an open CT.

As previously mentioned, having current passing through an open CT can create extremely high voltage directly at the meter, which can damage equipment and harm technicians. Consequently, huge revenue losses can occur because the transformer does not register any current.

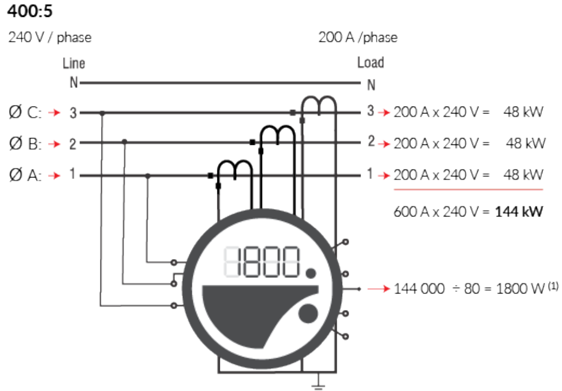
Wrong Ratio

A wrong ratio failure can happen when the transformer's nameplate shows an incorrect ratio.

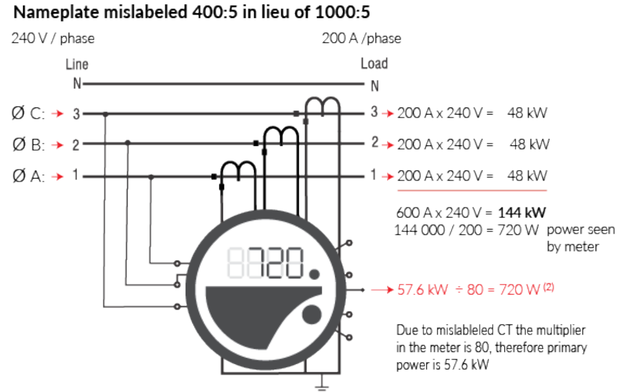
For example, if an installed transformer with a nameplate indicating 400:5 is actually a 1000:5 ratio, when the technician is installing the transformer, everything will appear to be working properly, but the information will not be sending correctly to the meter. Instead of a ratio of 80, it should be 200. Consequently, the customer will be undercharged. If this example was reversed, the electric company would be overcharging. Both of these examples create a lack of confidence between the utility and the customer.

To overcome this misidentification, a **ratio test** is necessary to detect the transformer's actual ratio. With this ratio test, the technician checks the input and the output current that passes through the transformer to verify if the ratio is correct on the CT nameplate.

400:5



Nameplate mislabeled 400:5 in lieu of 1000:5



To illustrate the possible revenue loss, let's consider a transformer identified with a 400:5 ratio (200 amps in, 2.5 amps out), but which, in reality, has a 1000:5 ratio. Thus, the 200 amps current that enters the transformer is subjected to a ratio of 200 rather than 80. By taking the same voltage, 240 Volts, the meter that should have read 1,800 ((200 / 80 = 2.5) × 240 × 3), reads 720 ((200 / 200 = 1) × 240 × 3) instead, which is a huge difference.

Lost Revenue Calculation Over Time Due to a Wrong Ratio

60%
REVENUE LOSS

Proper labelling	400:5
1-Expected secondary power:	1,800 W
Ratio 400:5	X 80*
Real consumption	144 kW
Avrg cost	X $0.1289/kWh**
Energy registered	1,152 kWh
Total A	**$18.56**

1,000:5 mislabeled as 400:5	
2-Actual secondary power:	720 W
Programmed ratio 400:5	X 80*
Displayed consumption	57.6 kW
Avrg cost	X $0.1289/kWh**
Energy registered	460.8 kWh
Total B	**$7.42**

Lost revenu result		
Total A (Proper labeling)		$18.56
Total B (Mislabeled)		$7.42
Total lost	**per hour:**	**$11.14**
	Per day:* **	**$89.10**
	Per week*:**	**$445.48**
	Per month:	**$1,937.04**
	Per year:	**$23,244.43**

* Ratio between the primary current and secondary current.

** Source: U.S. EIA: Average Price of Electricity to Ultimate Customers by End-Use Sector, June 2022 ($0.1289 Cents per Kilowatthour).

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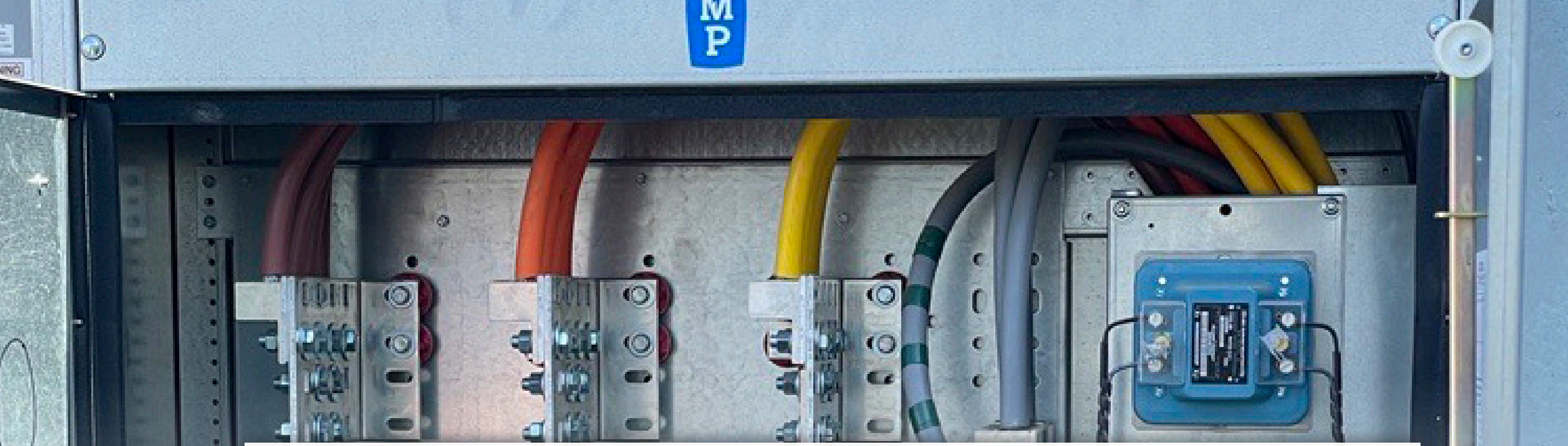
Testing to Identify Risk Factors Leading to Loss of Revenue



Inspection Method to Mitigate Revenue Loss

Factors Leading to Loss of Revenue	Inspection Method →	Safety and visual inspection	Power Quality	Primary / Secondary	Secondary Burden	Admittance
Incorrectly installed current transformer	→	✓	✓	✓		✓
Shorted CT secondary	→	✓	✓	✓	✓	✓
Degrading CT secondary	→	✓	✓		✓	✓
Open CT secondary	→	✓	✓	✓	✓	✓
CT nameplate error *	→	✓		✓	✓	
High burden	→	✓			✓	✓
CT Magnetization	→	✓	✓		✓	✓
Sag/Swells	→		✓			
Harmonic distortion	→		✓			
Outage	→	✓	✓			
Spikes and transient voltage	→		✓			
Undervoltage/overvoltage	→		✓	✓		
Voltage/current imbalance	→		✓			
Voltage/current fluctuations	→		✓			
Poor power quality	→		✓			
Power theft	→	✓	✓			

* Nameplate error could be the wrong ratio, the wrong accuracy class and/or the wrong maximum burden.

Power Quality Test:

The power quality test checks the secondary current and voltage. Furthermore, it confirms phase orientation and detects harmonics that may affect power consumption.

What is the Power Quality Test?

It is the degree to which the verification of the voltage, frequency, current and waveform of a power source conforms to established specifications.

Good power quality can be defined as a steady supply of electrical energy that stays within the prescribed range. In general, it is useful to consider power quality as the compatibility of what comes in and what is measured by an electrical meter. Routine power quality inspections can detect problems that manifest as voltage, current, or frequency deviations that may result in failure or malfunction of utility or end-user electrical equipment.

Mitigating power quality risks is critical in our modern society. Industrial and commercial equipment and infrastructure demand uninterrupted, uncorrupted electric energy from utilities. Power failures are expensive and can significantly impact the an organization's bottom line.

How is it tested?

A common test method is to use a voltmeter to measure the secondary voltage going to the meter, together with an ammeter, to then measure the secondary current. But this method requires testing each phase individually.

Newer-generation testers can automatically perform all measurements and even measure all three phases simultaneously.

Wafeform

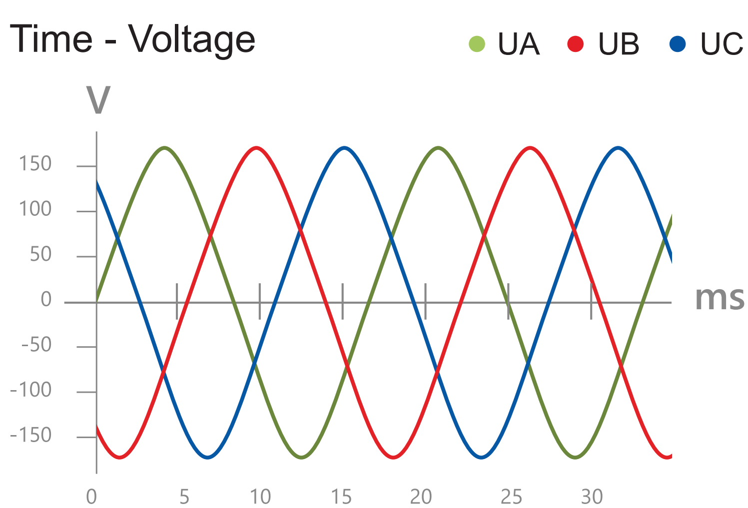


Figure A: Current and voltage amplitude are usually displayed in a sinewave format

Vector Diagram (Phasors)

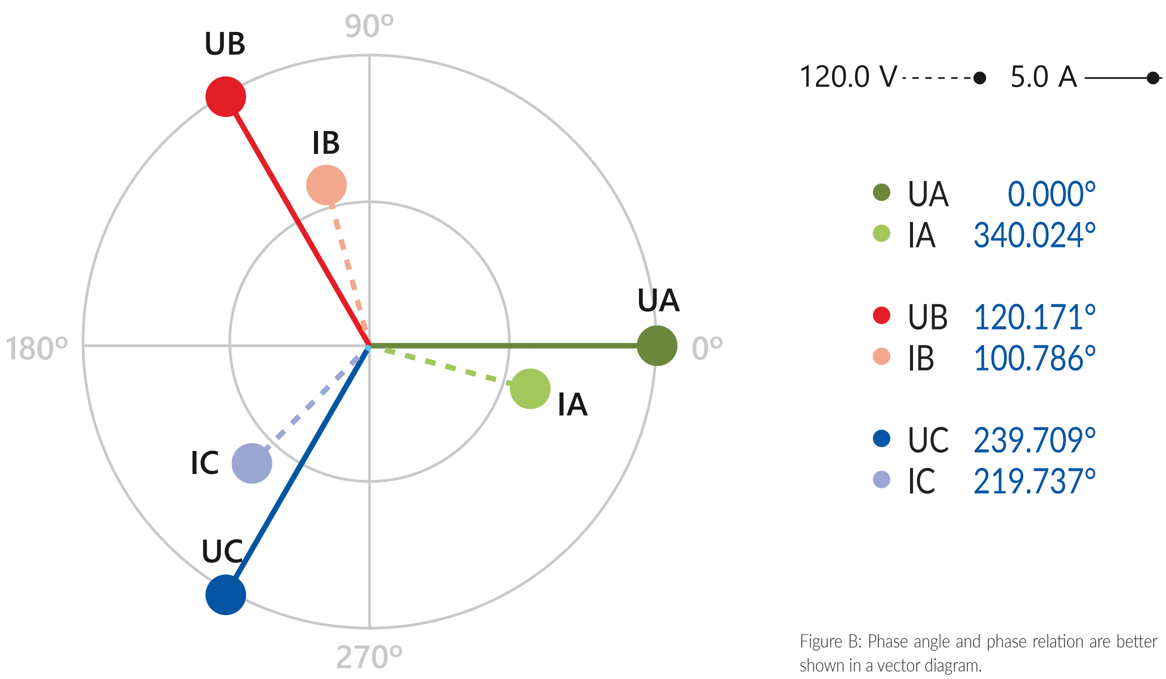


Figure B: Phase angle and phase relation are better shown in a vector diagram.

Interpreting the results

For a 3-phase installation in a Wye configuration, the phase angles are 0, 120 and 240 degrees (Figure B). For a 3-phase installation in a Delta configuration, the phase angles are 0, 90 (or 270) and 180.

In an ideal installation, current and voltage have the same phase and the power factor is perfect. In most installations, the current precedes or lags the voltage by a few degrees. This is due to motors such as air conditioning units, pumps, etc.

For example, if the current and voltage of a phase are 120 degrees apart, then the wiring of the CT or PT going to the meter base test switch is in the wrong position. If the current vector of a phase is 180 degrees from the voltage, check the polarity of that CT.

Non-optimized power is affected by harmonics, imbalances and low power factor, which lead to higher electricity bills, overload and premature deterioration of the electrical infrastructure, resulting in higher equipment maintenance costs.

Harmonics

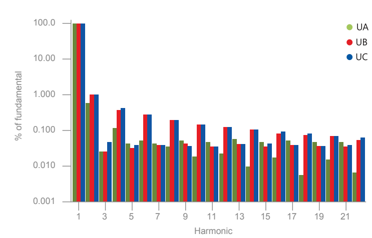


Figure C: Harmonics is normally shown in a bar graph in relation to the fundamental harmonic.

Types of anomalies

- Sag/Swells ✓
- Harmonic distortion ✓
- Outages ✓
- Spikes and transient voltage ✓
- Undervoltage/overvoltage ✓
- Voltage/current imbalance ✓
- Voltage/current fluctuations ✓
- Poor power factor ✓

Primary/Secondary Analysis (CT/PT Ratio):

The ratios and phase between the transformer's primary and secondary windings can be verified by conducting a comparison analysis of the installation. Using the probes, the tester will read the current and voltage, then conduct an analysis to identify the ratios and phase between the transformer's primary and secondary windings.

What is a Primary/Secondary Analysis?

Ratio is described as the relation between the primary input to secondary output at full load. For example, a CT with a ratio of 300:5 will produce 5 amps of secondary current when 300 amps flow through the primary.

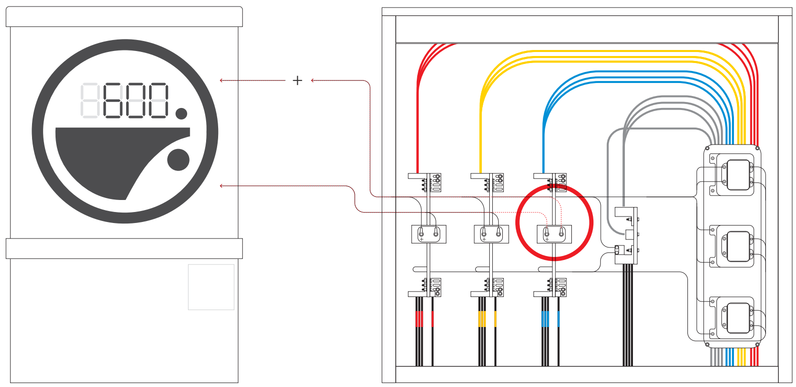
The current transformer's primary winding usually consists of only one or very few turns. This primary winding can be either a single flat turn, a coil of heavy-duty wire wrapped around the core or just a conductor or bus bar placed through the center.

How is it tested?

A current ratio test can be performed by injecting a primary current and measuring the current output, or by injecting a secondary voltage and measuring the induced primary voltage.

The ratio test is conducted to prove that the transformer's nameplate of the transformer is as specified, and to verify the ratio is correct at different taps of a multi-tap transformer.

Testing a transformer's potential ratio is done by applying a suitable voltage to the primary side while the secondary side is measured to calculate the Primary/secondary ratio.



DANGER: Use caution when conducting a ratio test and DO NOT apply a voltage high enough to cause the transformer to saturate. Applying a saturation voltage will result in inaccurate readings.

Interpreting the results

In the example below, a 3-phase 9S instrument-rated installation in a Wye configuration, the CTs are rated for primary current at 400 A with a secondary current of 5 A, at a maximum burden of 1 ohm and an accuracy class of 1.2. the nameplate will show 400:5 1.2 B 1. With a PT primary voltage of 277 V and secondary voltage of 115 V for a ratio of 2.4:1 with an accuracy of 2%.

The results shows that the ratio is correct on all phases, but the delta angle is offset by 180 degrees on phase C. The CT polarity is reversed on that CT. The results for the voltage are as per the nameplate and installed properly, showing a ratio close to 2.4:1.

In other words, these results show that phase C of the CT is inverted, causing the meter to read the current in reverse on phase C, resulting in a loss of up to two-thirds of the revenue at that location (similar to our example on page 10–11).

Socket	**Form:**	**9S**	**Wiring:**	**WYE**	
CT			**PT**		
Ratio:		400.00 A : 5.00 A	Ratio:		2,4:1 V
Max burden:		1.00 Ohm			
Accuracy:		1.20%	Accuracy:		2.00%

Measurements	**Primary**	**Secondary**	**Ratio**	**Ratio error**	**Delta angle**
CT Unit	A	A		%	°
A	202.5	2.535	399.41	-0.001	0.2
B	212.1	2.621	404.62	0.012	0.35
C	81.2	1.015	400.00	0.000	-180.2
PT Unit	V	V		%	°
A	277.1	115.8	2.39	-0.003	0.001
B	277.2	115.2	2.41	0.003	-0.001
C	276.9	115.1	2.41	-0.002	-0.002

Types of anomalies

- Incorrectly installed current transformer ✓
- Shorted CT secondary ✓
- Degrading CT secondary
- Open CT secondary ✓
- CT namenplate error * ✓
- High burden
- CT magnetization
- Power theft

*Nameplate error could be the wrong Ratio, the wrong accuracy class and/or the wrong maximum burden.

CT Secondary Burden:

By applying resistance in series with the CT, it is possible to analyze the maximum burden in which the CT can still operate efficiently. Testing the secondary burden will ensure that the transformer is in good condition.

What is Burden?

Burden can be described as the total impedance in ohms on the secondary output loop. The total burden is a combination of impedance in the secondary circuit offered by:

- Watt-hour meter coils
- Relay current coils
- Contact resistance
- Terminal blocks
- Wire resistance
- Test switches used

Each current transformer has a secondary burden when it is connected in a metering circuit. Each current transformer should provide the secondary output current according to its accuracy class.

How to calculate CT burden?

Depending on their accuracy class, current transformers are divided into two groups: Metering and Protection (Relay). A CT can have burden ratings for both groups.

Metering CTs are typically specified as 0.3 B 0.5

0.3 ....The accuracy class.

B 0.5 ...The maximum burden in ohms that the CT can withstand while remaining accurate.

For a CT with a secondary current of 5 A the VA burden rating can be calculated as:

$$VA = Voltage * Current = (Current)^{2} * Burden = (5)^{2} * 0.5 = 12.5\ VA$$

How is it tested?

Burden is measured by injecting a resistive load onto the secondary current loop of the CT at its terminals toward the load side by isolating the CT secondary and watching the current drop across the injection points, and at every point of the circuit to ground.

Measuring the current drop at the source combined with ohm's law will give us the burden impedance. Analyzing the current drop patterns throughout the circuit confirms the wiring is correct. Current transformer burdens are typically expressed in VA.

The burden test is performed to verify that the CT can supply a known current into a known burden while maintaining its stated accuracy. A burden test is typically performed at the full-rated secondary current value (i.e., 5A or 1A).

Interpreting the results

If a current transformer is incorrectly sized for the secondary burden loop, it may decrease the CT's secondary current. It is well worth testing the burden to verify that it is supplying current to a circuit that is not exceeding its burden rating.

* Nameplate error could be the wrong ratio, the wrong accuracy class and/or the wrong maximum burden.

Types of anomalies

Incorrectly installed current transformer	
Shorted CT secondary	✓
Degrading CT secondary	✓
Open CT secondary	✓
CT nameplate error*	✓
High burden	✓
CT magnetization	✓
Power theft	

Admittance Test:

Injecting an audio frequency into the transformer's secondary will determine the CT's conductivity. It also establishes a baseline where any degradation over time can be measured.

What is admittance?

Admittance is a measurement in millisiemens (mS) of how easily a circuit or device allows current to flow through it. Admittance (Y) is the reciprocal (opposite) of impedance (Z). Conductivity and resistance are similarly related.

Admittance is defined as

$$Y = \frac{1}{Z}$$

where

Y is the admittance, measured in siemens and **Z** is the impedance, measured in ohms.

Benchmark method

By performing an admittance test with each new CT installation, this sets a benchmark that reflects the CT's optimal performance. Comparing subsequent test results with the installation benchmark will show any significant deviation from the initial values while in service, ensuring continued CT integrity at minimal cost.

If no initial test has been performed, it is still possible to evaluate admittance by comparing the results of the CT admittance test with other CTs of the same type and value. When testing an installation with multiple CTs of the same type and value, any CT with significantly different results suggests a problem with that CT.

How is it tested?

This test is conducted by injecting an audio signal into the CT secondary, then measuring the audio frequency's induced current and voltage to determine the admittance value.

Analog filtering and programmable gain are used to get the best dynamic range by removing the 60 Hz from the secondary current, for the DSP to compute the admittance at the audio frequency injected. While CT burden needs secondary current to achieve its purpose, admittance needs low to no current (max. 0.5 A) on the secondary side. If the current is higher than 0.5 A, the test will not be conducted.

Interpreting the results

An admittance test can easily detect defects in a CT, such as internally shorted turns and other common issues which can cause metering errors that might otherwise go unnoticed for years.

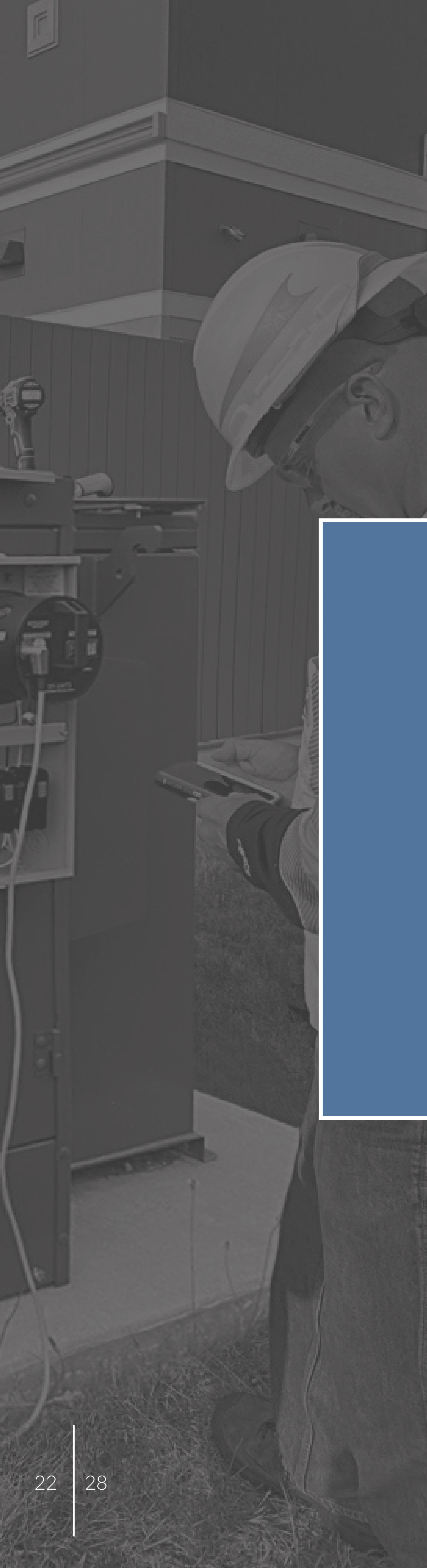
High millisiemens reading: It is likely that the CT has an internal short.

Low millisiemens reading: May be due to increased impedance caused by an open or damage circuit (i.e. corrosion, loose connections ,worn out or dirty jaws).

*Nameplate error could be the wrong ratio, the wrong accuracy class and/or the wrong maximum burden.

Types of anomalies

Incorrectly installed current transformer	✓
Shorted CT secondary	✓
Degrading CT secondary	✓
Open CT secondary	✓
CT nameplate error *	
High burden	✓
CT magnetization	✓
Power theft	



Minimizing Revenue Loss

When considering revenue loss, managers are often reluctant to add more inspections to the schedule because they are traditionally considered more time consuming, tedious and as the old saying goes "If it ain't broke, don't fix it." But how do you know for sure that it's working properly if you don't test it?

Aging infrastructure, erratic weather, human error, and even tampering jeopardize utility revenues. Management cannot ignore these risks and must balance facility efficiency and team productivity.

Few have the means to implement unlimited maintenance, increase the frequency of site inspections and add to their team's workload.

It is not only crucial to create a schedule for conducting site inspections, but also to plan periodic re-inspections as the installation can change over time.

Several options and testing devices for verifying the installation are available on the market. To optimize time and resources, we assert that testing the whole installation from the meter base instead of the test switches is a more efficient approach. Here's why:

1. Conducting the inspection directly from the meter socket further reduces the risk of misconnections and handling errors, such as crossing wires, mismatching phases, or reversing polarities.
2. Because the field technician is dealing with fewer connections, this adds an additional layer of safety.
3. Moreover, since the tester is installed in the meter socket, it sees exactly what the meter sees and tests the entire system from this perspective, which enhances the precision of the data collected.

However, since this testing option requires removing the meter from its base during the inspection, some utilities could be concerned with the revenue loss associated with the test's duration. To address this concern, it is important to note that this method does not exceed the 20 minutes at most (from meter out to meter in).

To illustrate this point, the electricity cost of removing an industrial meter (for a three-phase motor) is $57.60 at maximum power, using a 2,000 Amps base meter at 240 V with the US industrial average rate of $0.12/kWh.*

*In fact, this would be a worst-case scenario, since a base meter is never used at 100%. Therefore, the savings related to this testing method are more important than the unbilled electricity cost due to the removal of the meter.

Things to take into consideration when choosing test equipment:

Safety

Reducing hazards exposure for technicians.

Total time on site

Testing both the installation and the meter.

Test duration

A meter should be out of service for the shortest time possible. Every minute counts, especially during peak hours.

Ease-of-use

Equipment requiring multiple probes and connections can be tedious for the technician and could increase human error, time onsite, and time a meter is out of service.

Learning curve

Training on equipment, connections, and software should be short.

Latest technologies

State-of-the-art technologies can offer intuitive and comprehensive products.

Conclusion

The primary objective of **revenue loss prevention** is to foster a fair-trade exchange between utilities and their customers. Balancing the cost of operational savings against value-added services will help protect this business relationship.

It is crucial to service customers' equipment regularly to ensure optimal and consistent performance.

The point being that routine inspections can prevent financial damage and also boost customer confidence. By investing wisely in preventive maintenance, management teams will discover ways to enhance customer satisfaction while keeping revenue loss risks at a minimum.

Additionally, labor plays an important role. Reducing the time required to perform maintenance is valuable because it leads directly to improved service without increasing costs.

To grow and prosper, a service-based business must keep customers happy over time. Customer experience is measured by both the quality of the utility service that customers have to rely on, and customer service. In sum, customer satisfaction is priceless. By strengthening the customer relationship with value-added services, utilities are not only preventing revenue loss, but also protecting the intangible asset that is customer satisfaction.

In short, it is possible to create added value for customers while improving productivity and performance. The key is to use the savings from revenue loss prevention to fund operational investments such as routine site inspections, which will ultimately pay for themselves by keeping installations at peak performance, thereby preventing revenue loss.

Question?

Do you have any questions or comments about this white paper?

Contact us to learn more about our solutions.

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Probewell is actively developing technologies to support the unique challenges of the utility industry.

Probewell continuously develops advanced technologies in parallel with the utility industry's ever-changing requirements, because we believe it is mutually beneficial to establish a dynamic and durable relationship with our business partners.

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