# Applying 600V High-Accuracy Current Transformers for Revenue Metering Applications

## Technical Bulletin # 103

### 0.3 Revenue Metering Class

In order to appreciate the benefits of applying high-accuracy current transformers, one must first understand how the normal revenue metering class of 0.3 is defined under IEEEC57.13.

The 0.3 accuracy class guarantees a 0.3% error performance from nominal rated current (Inom) up to the maximum continuous current, which is Inom multiplied by the rating factor (RF). The 0.3 class also guarantees a 0.6% error performance from 10% Inom to Inom. No performance requirement is given below 10% Inom. Figure 1 shows a graphical representation of the 0.3 class with a sample actual accuracy measurement at rated burden plotted within the limits of the class. As the current drops below 10% Inom, the accuracy performance falls off exponentially.

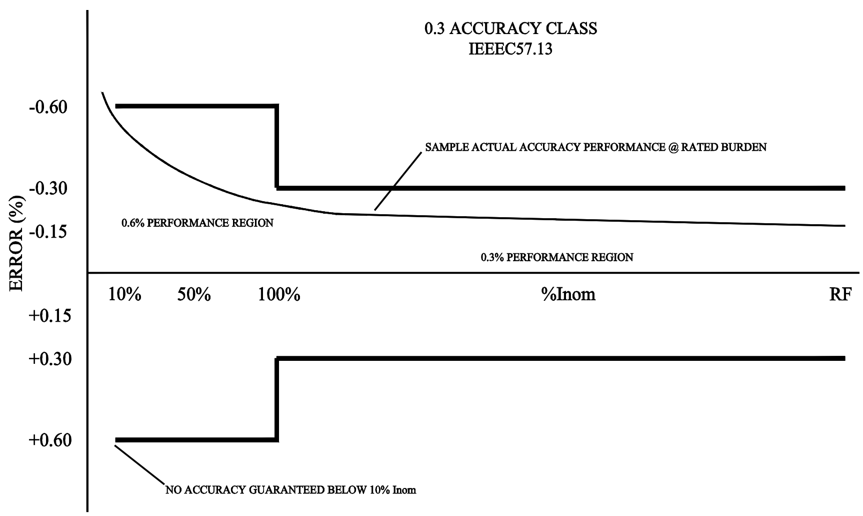


*Figure 1*

Current transformer error is almost always negative, primarily due to excitation current that is lost to excite the core. Given this, it can be assumed that CTs will always "under report" to the meter, resulting in lost revenue. Therefore, an improvement in accuracy performance over the range of operating current will result in a reduction of lost revenue.

### 0.15 High Accuracy Metering Class

The term "High Accuracy" refers to accuracy performance that is better than the normal 0.3 metering class. IEEEC57.13.6 defines the 0.15 accuracy class. The 0.15 class offers tighter accuracy performance requirements across a wider range than the 0.3 class.


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The 0.15 accuracy class guarantees 0.15% error performance from Inom to Inom x RF and 0.3% error performance from 5% Inom to Inom. Figure 2 shows a graphical representation of the 0.15 class with a sample actual accuracy measurement at rated burden plotted within the limits of the class.

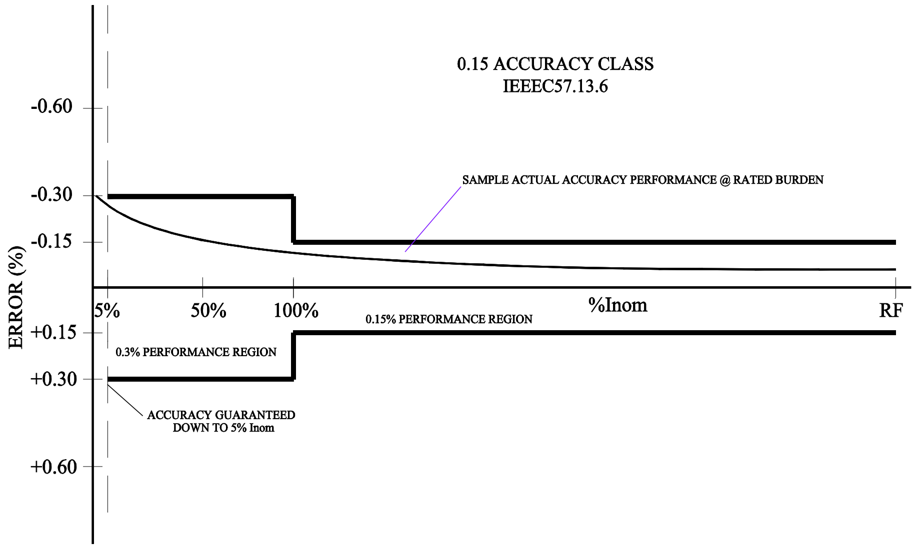


*Figure 2*

The application of high accuracy CTs will almost always improve the overall accuracy of the metering point resulting in increased revenue. The extension of 0.3% performance down to 5% Inom offered by the 0.15 accuracy class also offers the opportunity for reduction in the number of different ratios needed. This reduces the chance for CT misapplication and allows for a reduction in required inventory.

**Burden Rating**

The maximum burden ratings listed for the High Accuracy designs can sometimes be lower than that listed for the normal 0.3 class designs. These lower burden ratings reflect the lower burdens presented by modern electronic meters. The typical current element burden presented by electronic meters is on the scale of 0.1 milliohms. Therefore, the total burden presented to the CT is almost completely a function of the round-trip lead-length. Figure 3 shows the resistance of copper secondary leads used to connect the meter to the CT.

| Wire Size | Ohms/1000 ft at 68$^0$F / 20 C |
|---|---|
| 14 | 2.5250 |
| 12 | 1.580 |
| 10 | 0.9989 |
| 8 | 0.6282 |

*Figure 3*

As an example, for a CT with a rated burden of B0.1 (0.1 ohms) using #10 AWG leads, the meter could be placed to 50 feet away (100 feet of leads) without exceeding the burden rating of the CT.

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## Improving Metering Performance and Reducing Inventory

Based on the performance guarantees of the normal 0.3 accuracy class, utilities often have to utilize many different ratios within a particular style CT to accommodate the various loads encountered. It is also common for meter departments to make standard rules for picking the CT ratio based on the size transformer used to supply the load and not the actual load requirements, which may not be known exactly at the time of the service installation. Often, the end result is high inventory levels and CTs being oversized for the actual load being metered. By using High Accuracy CTs, both of these issues can be addressed.

The following is an example of the different ratio, 0.3 class CTs for pad-mount transformers (Ritz type DCDW) that a utility might use and hold in inventory:

| Ratio and RF | 0.6% Performance Range | 0.3% Performance Range |
|---|---|---|
| 300:5A, RF4.0 | 30A-300A | 300A-1200A |
| 400:4A, RF4.0 | 40A-400A | 400A-1600A |
| 600:5A, RF3.0 | 60A-600A | 600A-1800A |
| 1000:5A, RF2.0 | 100A-1000A | 1000A-2000A |
| 1200:5A, RF2.0 | 120A-1200A | 1200A-2400A |

Using the High Accuracy option of style DCDW, the unit with an 800:5A ratio and RF3.0 can replace all of the types listed above, while at the same time improving metering performance (e.g. reducing the amount of lost revenue).

| Ratio and RF | 0.3% Performance Range | 0.15% Performance Range |
|---|---|---|
| 800:5A, RF3.0 | 40A-800A | 800A-2400A |

## Comparison of Ritz High-Accuracy Designs and GE Encompass Designs

The following is a comparison between the GE Encompass type JAB-0W, 500:5A design and the Ritz High-Accuracy type DCDW 800:5A design.

| Type | 0.3% or Better Performance Range |
|---|---|
| GE JAB-0W, 500:5A | 200A-2000A |
| Ritz DCDW HA, 800:5A | 40A-2400A |

As can be seen, the Ritz design offers 0.3% or better performance down to 40A, or 5 times lower than the Encompass design.

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