



TESCO METERING

SIZING INSTRUMENT TRANSFORMERS for Accurate Performance

TESCO's Meter School

TESCOOL

July 21-24, 2024

July 24, 2024

8:45 AM – 10:15 AM

Tim Hope

WHAT ARE INSTRUMENT TRANSFORMERS

- Specialized transformers designed to operate measurement and control devices:
 - Voltmeters
 - Ammeters
 - Watthour Meters
 - & Relays
- Transform high voltage or high current to lower values.
 - Watthour meters may handle up to 320 amps and 480 volts.
- IT's transform with a high degree of precision.
- Also used to isolate high voltage or high available fault current from both the operator and end devices.

- Nominal System Voltage
 - Basic Impulse Level
 - Environment
 - Accuracy Class
-
- | | |
|--|---|
| <ul style="list-style-type: none">• VT Considerations<ul style="list-style-type: none">• Burden• Type of Circuit & Connection• Physical mounting requirements• Fusing | <ul style="list-style-type: none">• CT Considerations<ul style="list-style-type: none">• Burden• Physical mounting requirements• Expected Load Current• Overcurrent Capability |
|--|---|

- Nominal System Voltage
 - The insulation class is based on phase to phase voltage
- Basic Impulse Level
 - IT BIL must match or exceed the System BIL.
 - Caution: More than one BIL may be available for a given Nominal System Voltage.
- Environment
 - Indoor or Outdoor installation.
 - Contaminating atmosphere.
 - High Altitude (Over 3300 feet above sea level, derate transformer insulation)

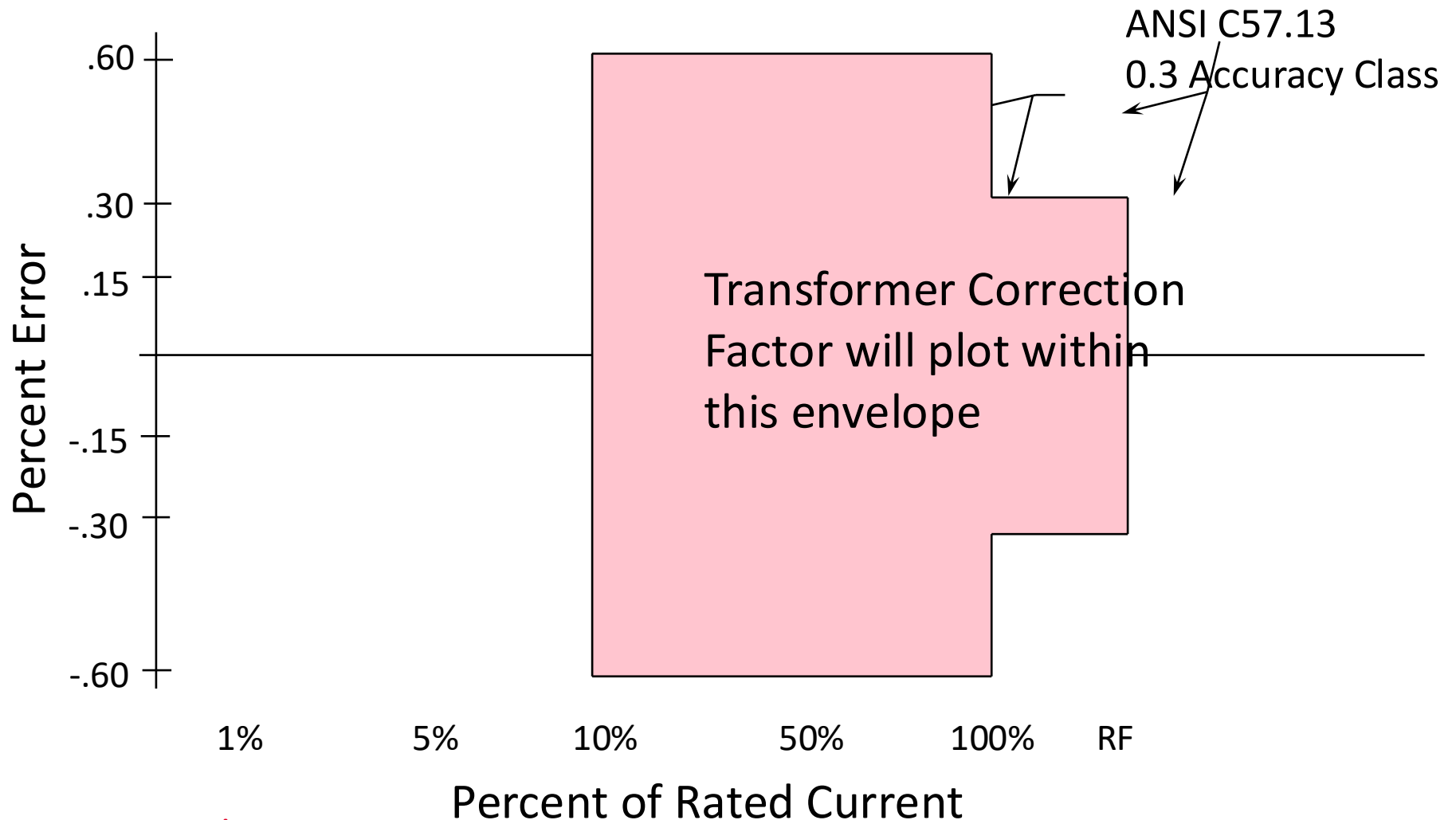
- Accuracy Classes define an envelope of ratio accuracy and phase angle accuracy for defined burdens.
- Separate accuracy envelopes are defined for Current Transformers and Voltage Transformers.
- ANSI C57.13 defines 3 levels of performance:
 - 0.3 Revenue Metering
 - 0.6 Indicating Instruments
 - 1.2 Indicating Instruments
 - Accuracy is defined for load power factors from 1.0 to 0.6 lagging.
- VT Accuracy
 - performance from 90% rated voltage to 110%.
- CT Accuracy
 - large performance envelope from 10% of rated current to rated current.
 - smaller performance envelope from rated current to rating factor.

- Maximum Expected load current should approach the Thermal Rating Factor of the CT.
- Rating Factor Example: 75:5, RF 3.0 @ 30°C
 - maximum expected primary “load” current = 225 amps, and
 - maximum expected secondary “meter” current = 15 amps,
 - assuming that ambient temperature does not exceed 30°C.

- Maximum Expected Load Current
 - Rating Factors are used to keep transformer winding temperatures below 85 degree C.
 - Rating Factors may be given for:
 - Outdoor applications 30 degrees C ambient
 - Indoor applications 55 degrees C ambient
 - Rating Factors may be adjusted for ambient temperatures other than 30 and 55 degree C.

$$\frac{(\text{New RF @ New Ambient})^2}{(\text{Stated RF at 30 C})^2} = \frac{(85 - \text{New Ambient})}{55 \text{ degrees rise}}$$

TYPICAL CT APPLICATION RANGE

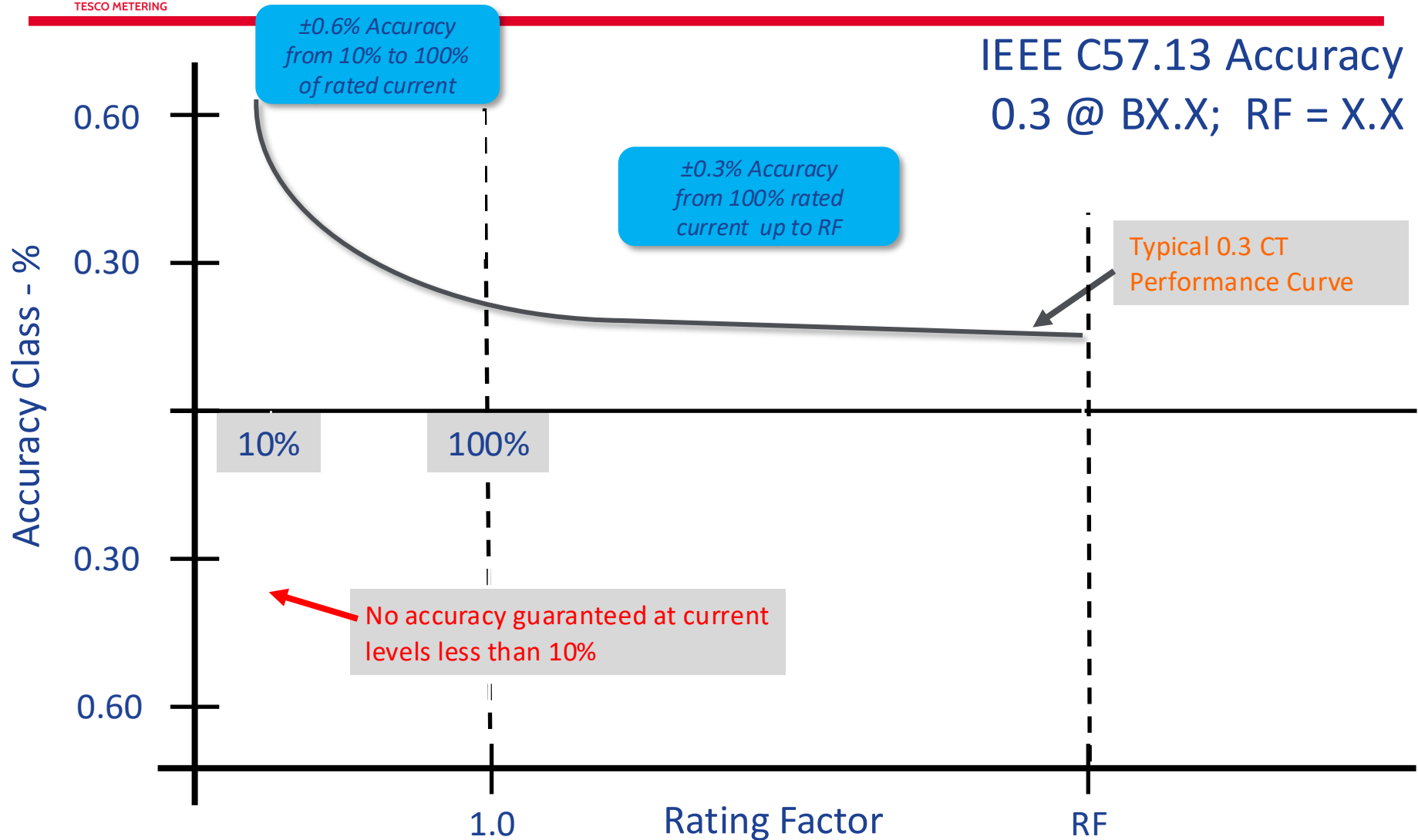




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STANDARD 0.3 ACCURACY CLASS

IEEE C57.13 Accuracy
0.3 @ BX.X; RF = X.X





TESCO METERING

IT CATALOG SHEET

JAB-0C Grecian Urn 600 Volt CT



APPLICATION

Designed for indoor service; especially designed for installation over the secondary bushings of pad-mounted transformers from 75 kVA to 3000 kVA. For mounting and application information, including use at higher voltages, and matching the current rating to the pad transformer thermal capability, please refer to the Applications Information section of catalog GEP-9186.

WEIGHT

Approximately8.25 lbs.

REFERENCE DRAWINGS

Outline: 0121C33851

INSULATION LEVEL

0.6kV; BIL 10kV full wave.

FREQUENCY

50-60 Hz

JAB-0C DATA TABLE

Current Ratio Pri : Sec	ANSI Accuracy Class @ 60 Hz					Continuous Thermal Current Rating Factor ψ		Catalog Number
	B-0.1	B-0.2	B-0.5	B-0.9	B-1.8	@30°C Amb.	@55°C Amb.	
200:5	0.3	—	—	—	—	4.0	2.9	750X136202
200:5	0.3	—	—	—	—	4.0	2.9	750X136252 ‡
300:5	0.3	0.3	—	—	—	4.0	2.9	750X136203
300:5	0.3	0.3	—	—	—	4.0	2.9	750X136253 ‡
400:5	0.3	0.3	—	—	—	4.0	2.9	750X136204
500:5	0.3	0.3	0.3	—	—	4.0	2.9	750X136205
600:5	0.3	0.3	0.3	—	—	3.0	2.2	750X136206
800:5	0.3	0.3	0.3	—	—	3.0	2.2	750X136208
1000:5	0.3	0.3	0.3	—	—	2.0	1.5	750X136210
1200:5	0.3	0.3	0.3	—	—	2.0	1.5	750X136212
1500:5	0.3	0.3	0.3	0.3	—	2.0	1.5	750X136215
2000:5	0.3	0.3	0.3	0.3	0.3	1.5	1.1	750X136220
3000:5	0.3	0.3	0.3	0.3	0.3	1.33	1.0	750X136230

Notes:

‡ A high temperature version is available for use in locations with unusually high ambient temperatures.

Example 1:

0.3 accuracy CT, 200:5, RF 4.0 (**Standard**)

200 amps (rated amps) to 800 amps (RF 4.0) = 0.3% accuracy

20 amps (10% of rated amps) to 200 amps (rated amps) = 0.6%

A commercial building is being built with a 4-wire wye main service, rated for 200 A at 12,470/7200Y. Your boss wants you to meter the building with an electronic polyphase watt-hour meter. The initial load is expected to average about 1000 kW, but may peak to 2000 kW on occasion.

Select the best CTs And PTs for the job

NSV

BIL

Type

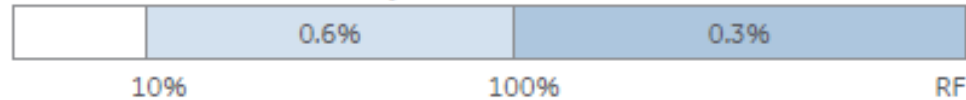
Ratio

- Expected Current = $1,000,000\text{W} / 7200\text{volt} \times 3$
 - Expected Current = $1,000,000\text{W} / (12,470\text{volt} \times 1.732)$
 - Expected Current = 46.3 amps
-
- Peak Current = $2,000,000\text{W} / 7200\text{volt} \times 3$
 - Peak Current = $2,000,000\text{W} / (12,470\text{volt} \times 1.732)$
 - Peak Current = 92.6 amps

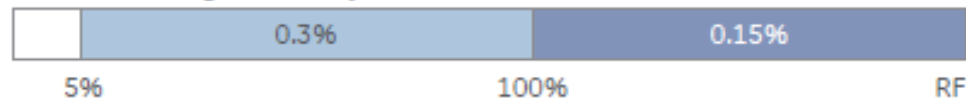
IEEE Metering Class

There are three revenue grade metering classes defined by IEEE C57.13-2008 and C57.13.6-2004. These are illustrated below, with limits shown as a percent of rated CT current:

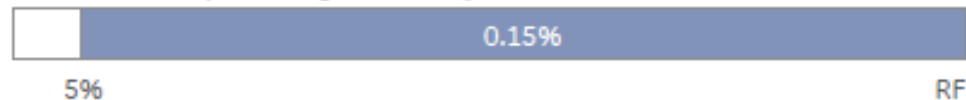
0.3 Class – Standard Accuracy



0.15 Class – High Accuracy



0.15S Class – Special High Accuracy



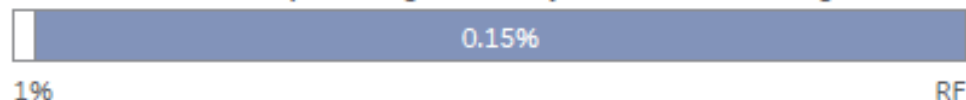
Encompass & RevenueSense Exceed IEEE Standards

Encompass and RevenueSense redefine CT performance by exceeding the operating range within their respective IEEE accuracy classes, offering utilities additional flexibility to reduce inventory, part numbers, and billing multipliers. RevenueSense also allows for a further reduction of metering losses by extending high accuracy performance down to 1% of rated current.

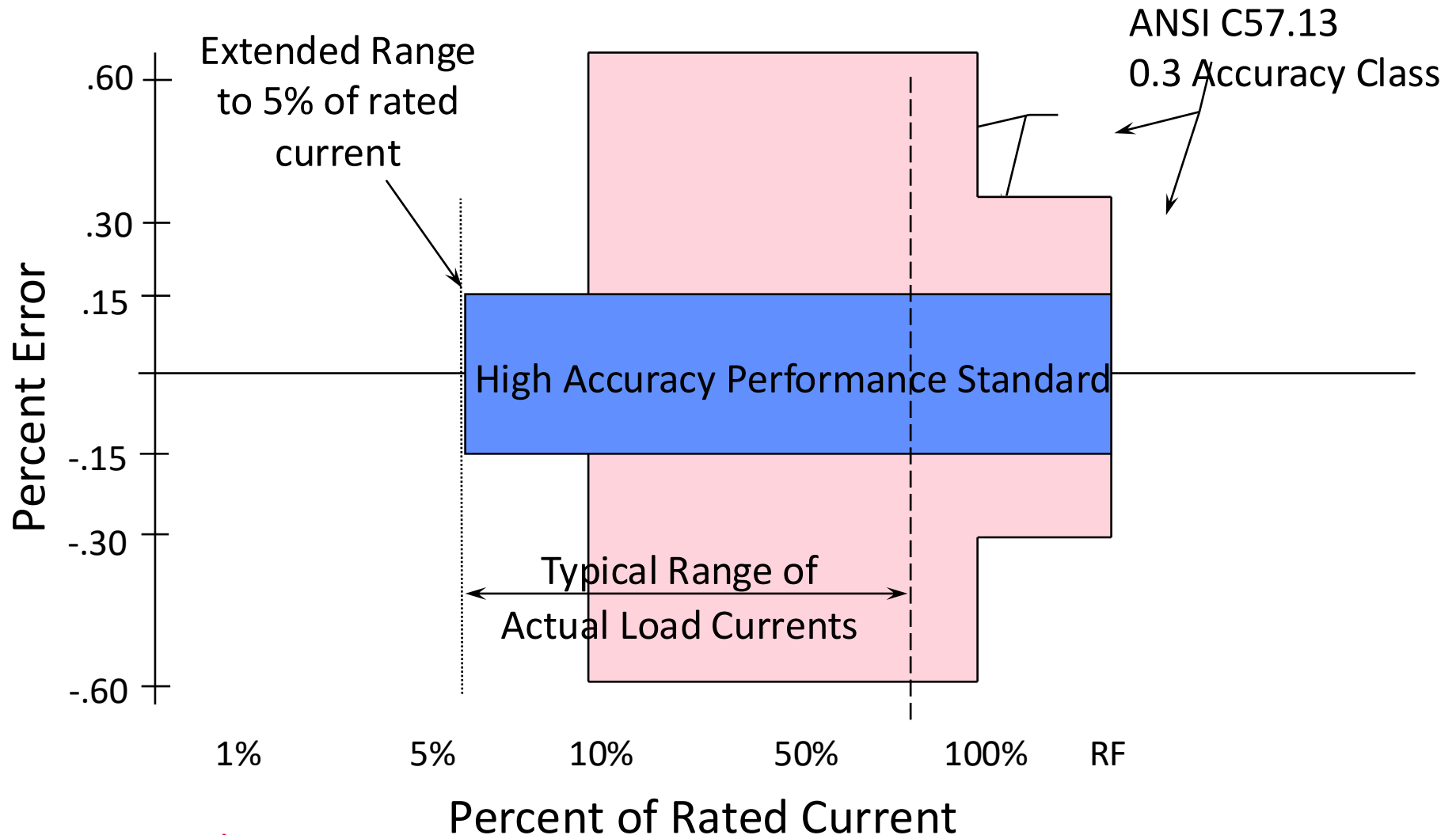
GE Encompass – Standard Accuracy with Extended Range



GE RevenueSense – Special High Accuracy with Extended Range



HIGH ACCURACY CT APPLICATION RANGE



Tim Hope
Alabama Power



This presentation can also be found under Meter Conferences and Schools on the TESCO website: tescometering.com

ISO 9001:2015 Certified Quality Company
ISO 17025:2017 Accredited Laboratory