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Intro to Self Contained Metering,Transformer Rated Metering, and Testing

TESCOOL
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TOPICS

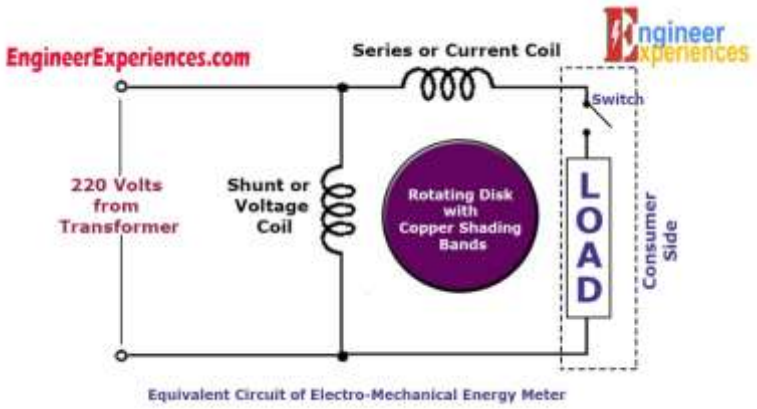
- What is a meter?
- Electro-mechanical versus Solid State
- Forms and Services
- Self Contained Metering
- Transformer Rated Metering

METERS 101 – WHAT IS A METER?

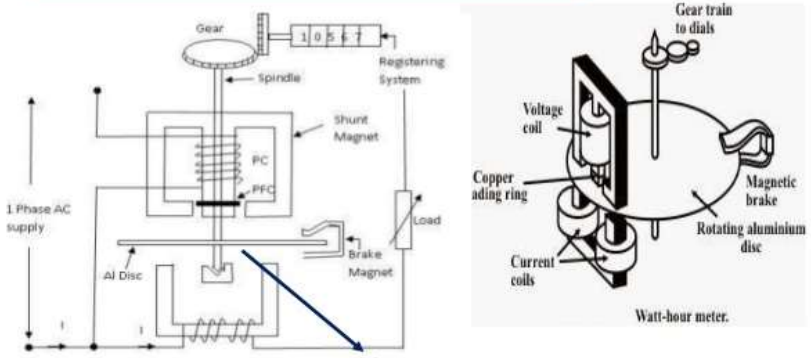
Energy Revenue Billing Meter

- Measures Watt-hours (Wh)
- Used to quantify the amount of energy that was provided to the customer for billing purposes
- NIST Traceability – Verification of Accuracy

METERS 101 – ELECTRO-MECHANICAL



Electromechanical energy meter continue...



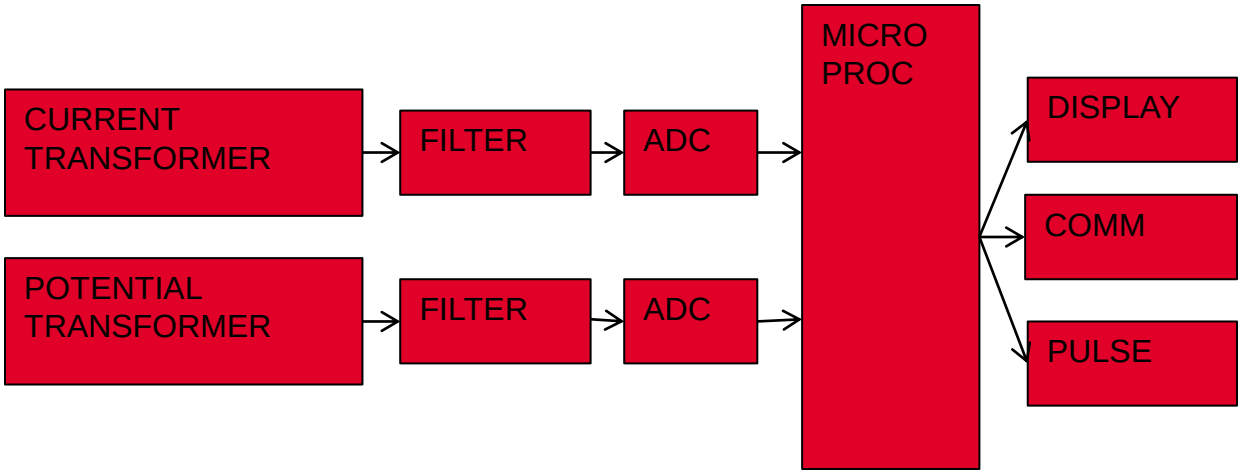
Disk to rotate

Overview of Functionality

- The electromechanical induction meter operates through electromagnetic induction
- A non-magnetic, but electrically conductive, metal disc which is made to rotate at a speed proportional to the power passing through the meter
- The disc is acted upon by two sets of induction coils, which form, in effect, a two phase linear induction motor.
- One coil is connected in such a way that it produces a magnetic flux in proportion to the voltage
- The other coil produces a magnetic flux in proportion to the current.
- The field of the voltage coil is delayed by 90 degrees, due to the coil's inductive nature, and calibrated using a lag coil
- This produces eddy currents in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and instantaneous voltage
- A permanent magnet acts as an eddy current brake, exerting an opposing force proportional to the speed of rotation of the disc
- The equilibrium between these two opposing forces results in the disc rotating at a speed proportional to the power or rate of energy usage
- The disc drives a register mechanism which counts revolutions, much like the odometer in a car, in order to render a measurement of the total energy used.
- The amount of energy represented by one revolution of the disc is denoted by the symbol Kh which is given in units of watt-hours per revolution.
- A Kh of 7.2 is typical. In this example, each full rotation of the disk is equivalent to 7.2Wh of energy.

Overview of Functionality

- Potential and Current is scaled down and conditioned with transformers and filters
- ADC's (analog to digital converters) digitize the signals
- A micro-processor or DSP executes the calculations
- Resulting data is displayed, sent externally via the communication circuits, and used for the calibrated pulse output



METERS 101 – A-BASE, K-BASE, S-BASE

K-base

A-base

S-base

SELF-CONTAINED VS. TRANSFORMER-RATED

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1S
14S
39S
17S
2S
3S
12S
35S
4S
25S
10S
76S
46S
45S
66S
11S
32S
5S
26S
6S
16S
9S
15S
56S
24S
13S

SELF-CONTAINED VS. TRANSFORMER-RATED

SELF-CONTAINED

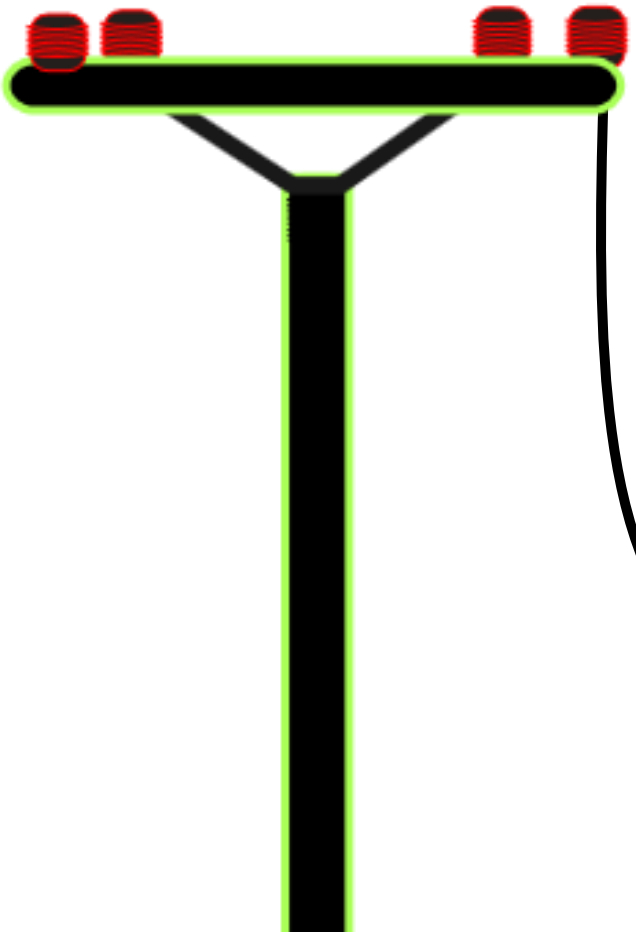
1S
14S
2S
12S
25S
16S
17S
13S
15S
32S

TRANSFORMER RATED

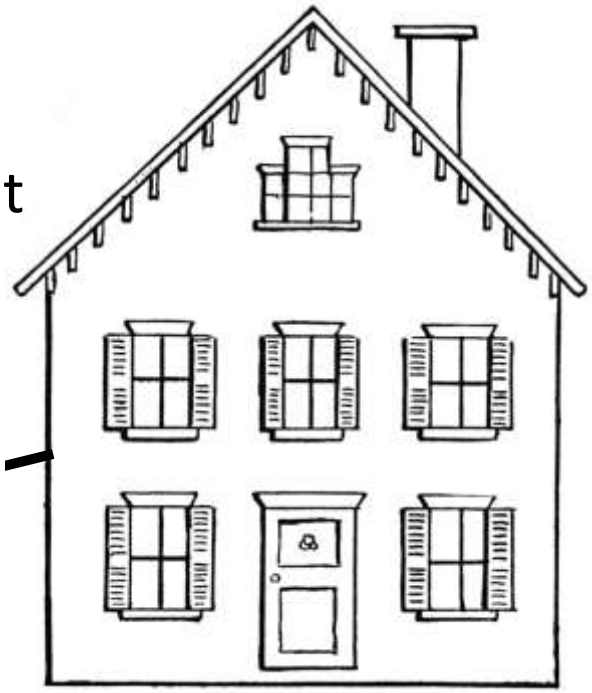
39S
36S
7S
3S
29S
76S
5S
35S
4S
46S
8S
26S
11S
66S
45S
6S
9S
10S
56S
24S

Self-Contained vs. Transformer-Rated

Primarily Residential
(1S, 2S, 12S)

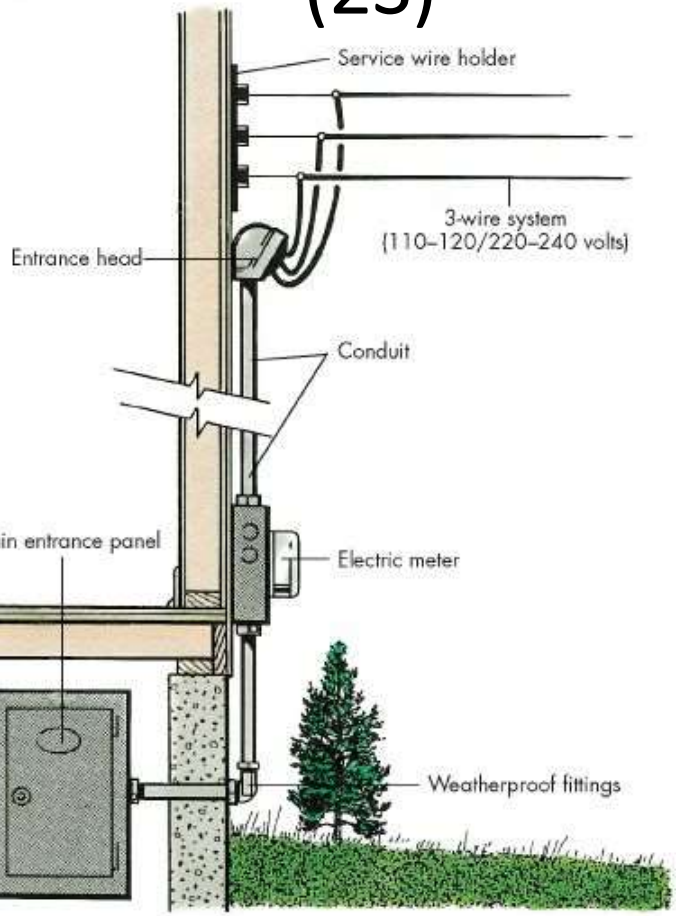


Relatively Low Current
Example: 100A



Self-Contained Metering

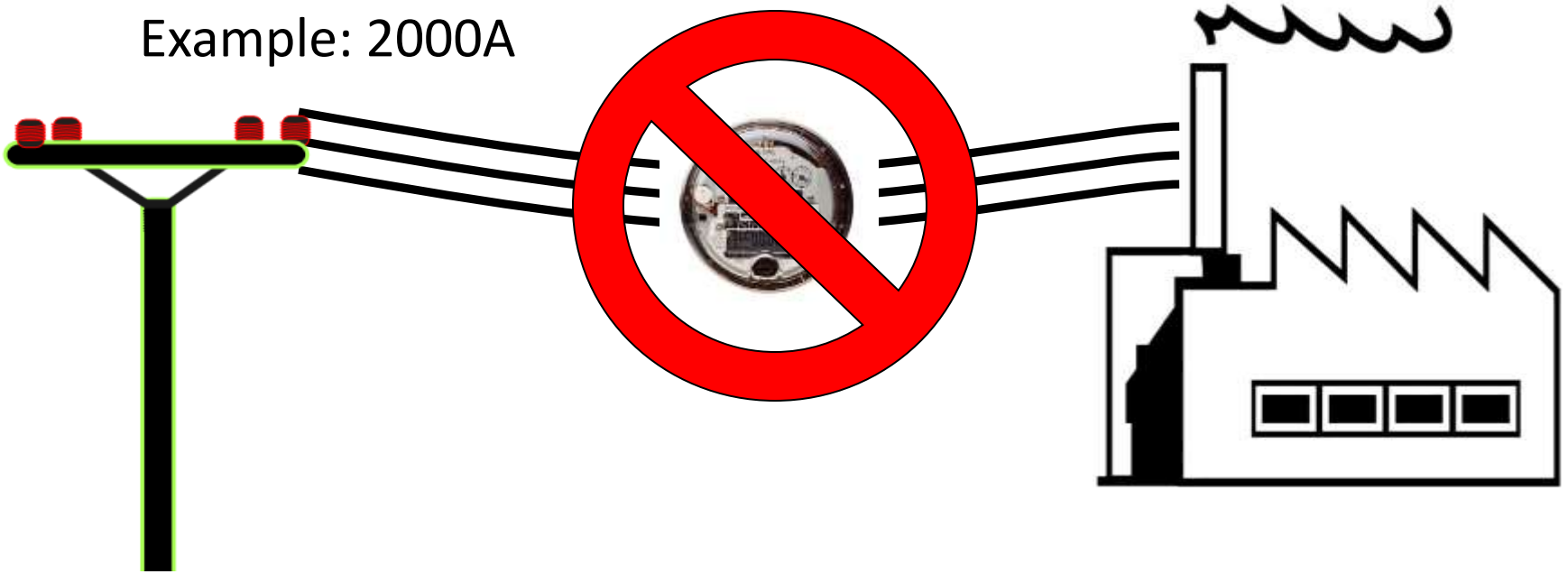
Primarily Residential (2S)



Self-Contained vs. Transformer-Rated

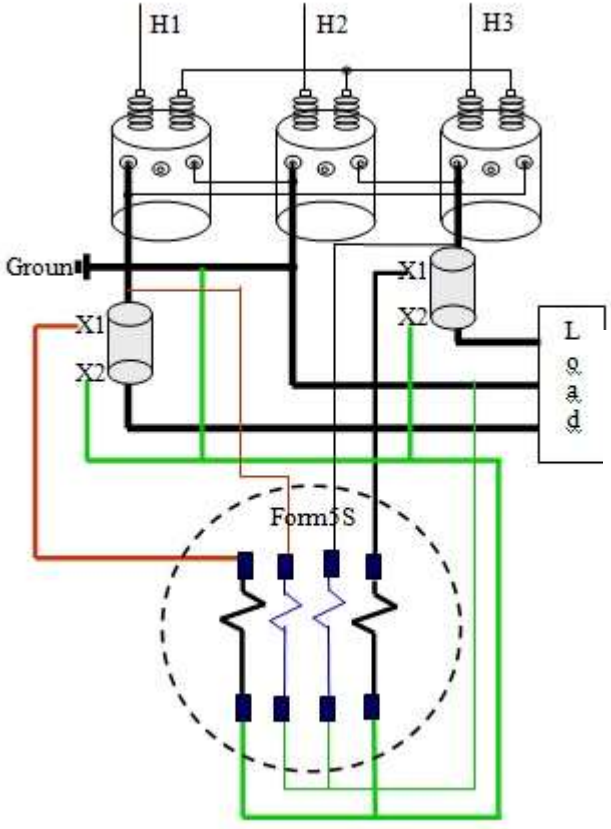
Primarily Commercial/Industrial
(9S)

Relatively High Current
Example: 2000A



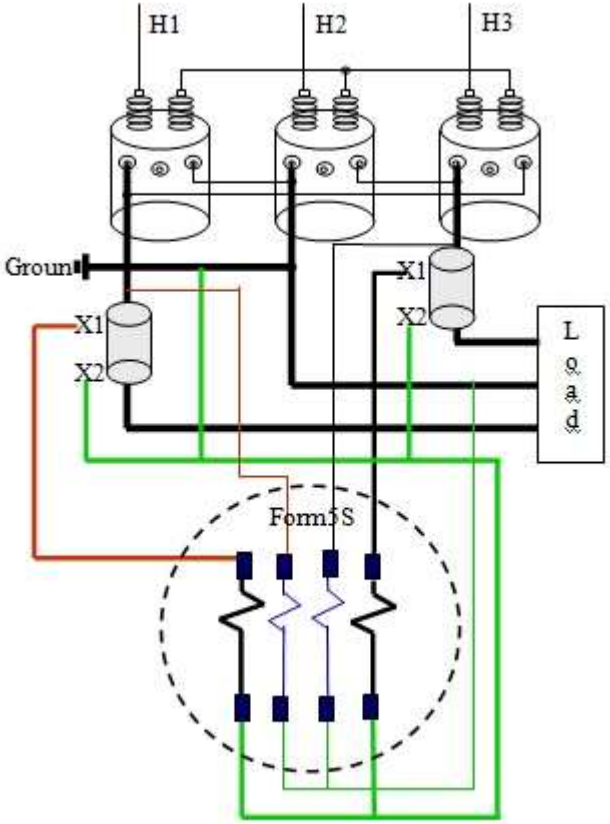
TRANSFORMER-RATED METERING

Primarily Commercial/Industrial (9S)



TRANSFORMER-RATED METERING

Typical Components of an Installation

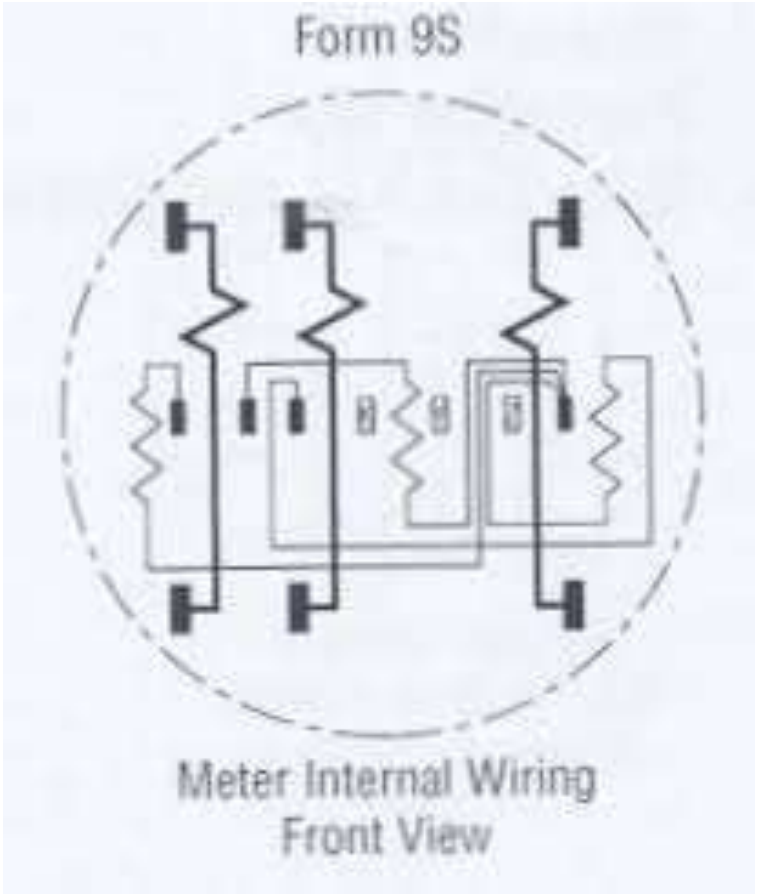


TRANSFORMER-RATED METERING

Meter

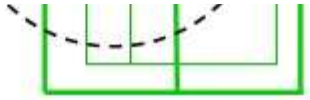
TRANSFORMER-RATED METERING

Meter



TRANSFORMER-RATED METERING

Enclosure, Socket, Test Switch



Transformer-Rated Metering

Enclosure, Socket, Test Switch

Enclosure

- Painted Steel or Aluminum
  - One or Two Piece Lid
- Many, Many Configurations

Transformer-Rated Metering

Enclosure, Socket, Test Switch

Socket

- Configured for Specific Form

TRANSFORMER-RATED METERING

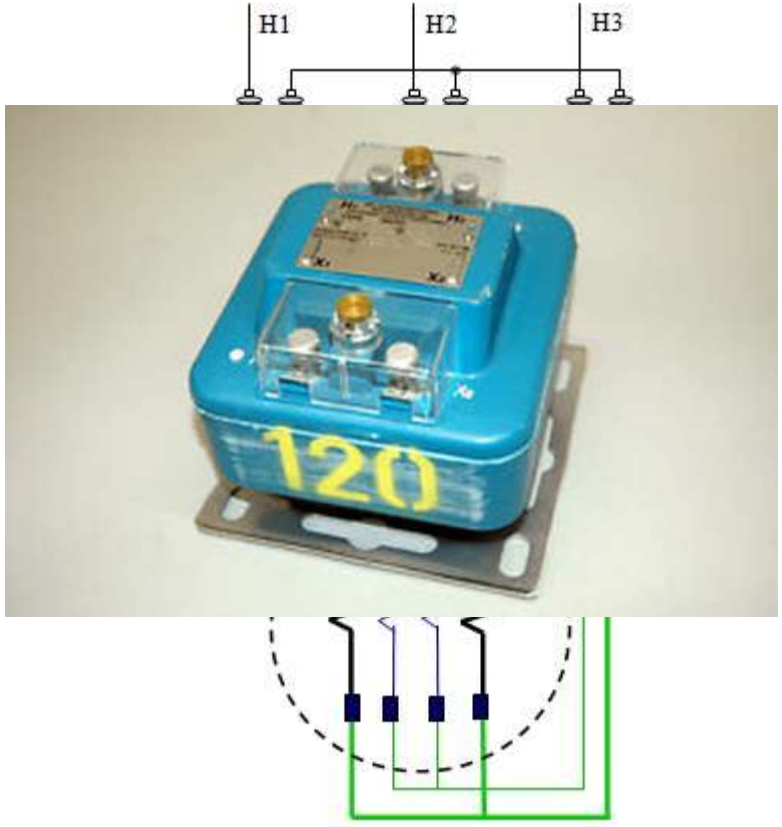
Enclosure, Socket, Test Switch

Test Switch

- Upmost Safety
- Shuts the CT
- Isolates the Meter from the Service During Testing

TRANSFORMER-RATED METERING

PT/VT –Voltage Transformer



TRANSFORMER-RATED METERING

PT/VT –Voltage Transformer

PT/VT

- Scales Down the Voltage
  - 4:1
  - 480V:120V

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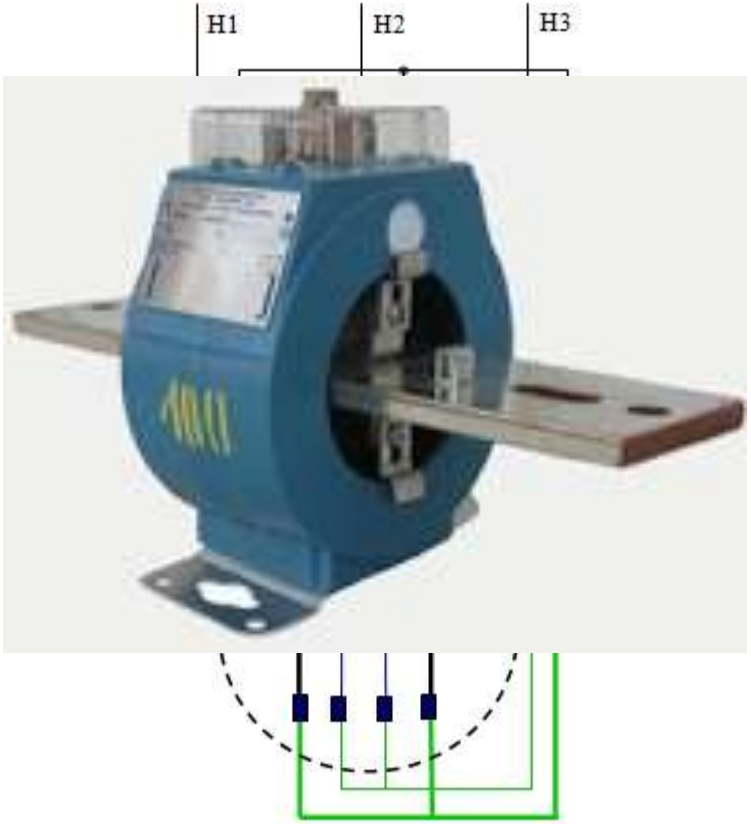
TRANSFORMER-RATED METERING

CT – Current Transformer



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TRANSFORMER-RATED METERING

CT – Current Transformer

CT

- Scales Down the Current
  - 400:5
  - 800A:10A

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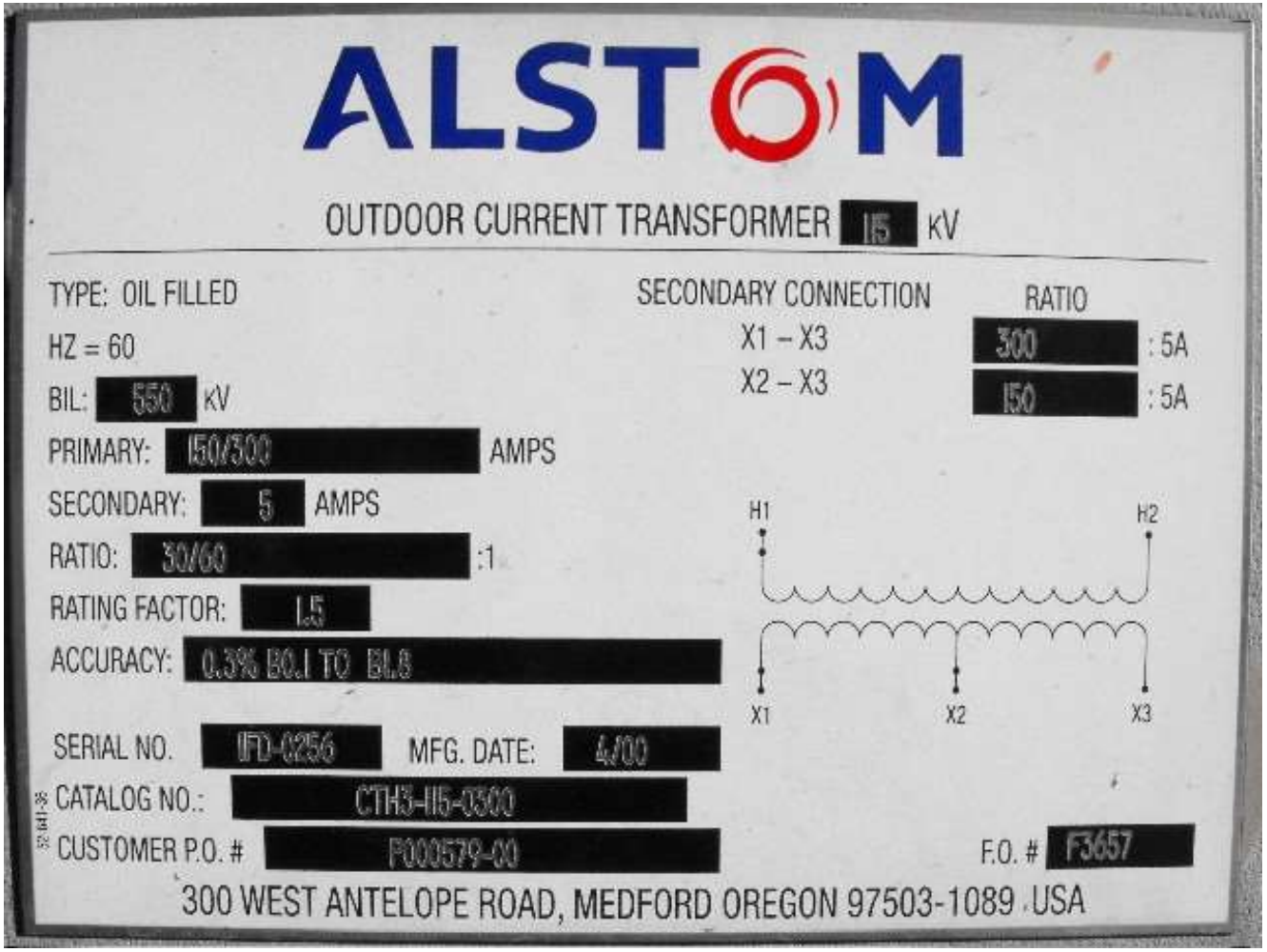
FACEPLATE SPECIFICATIONS



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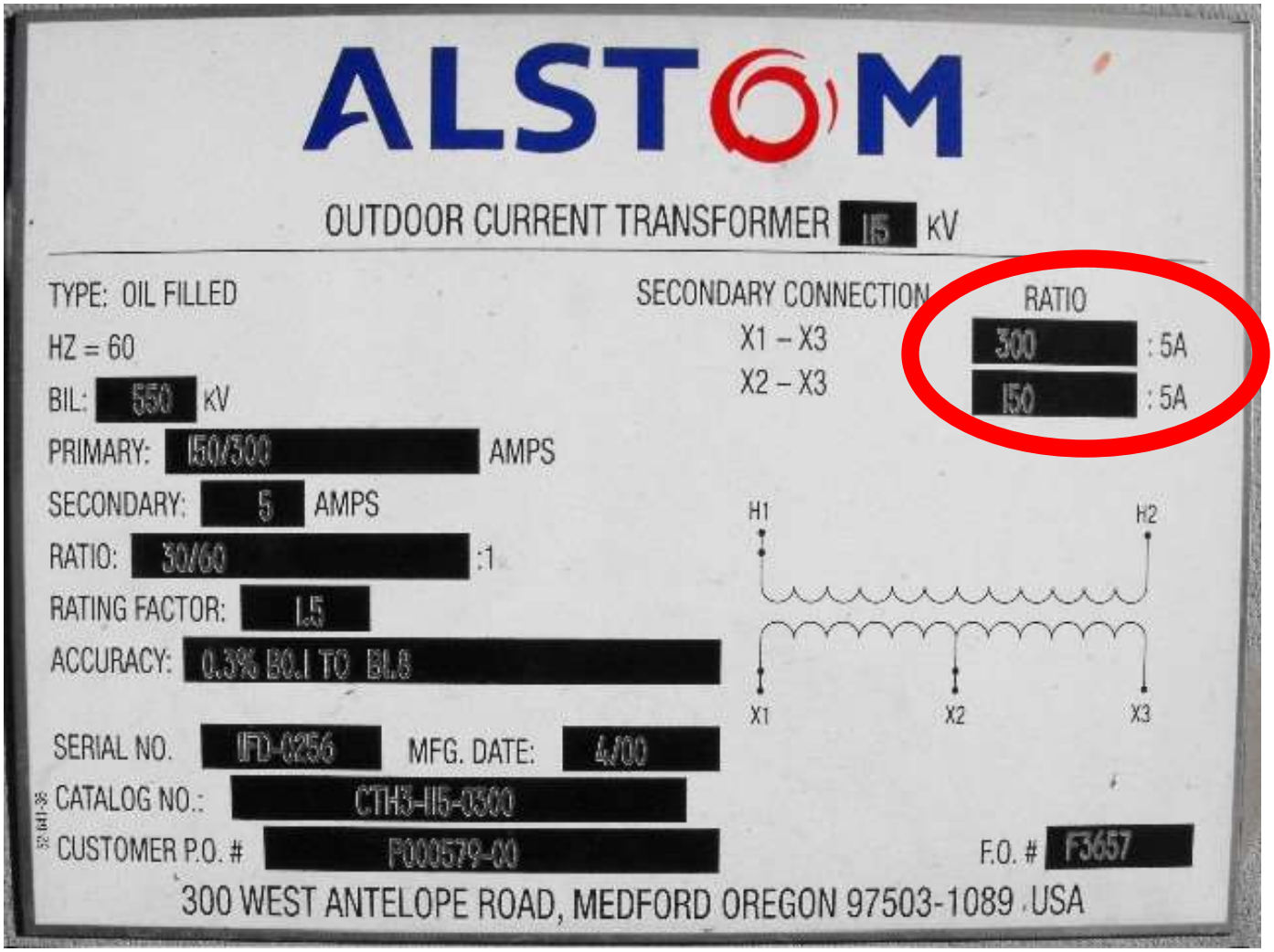
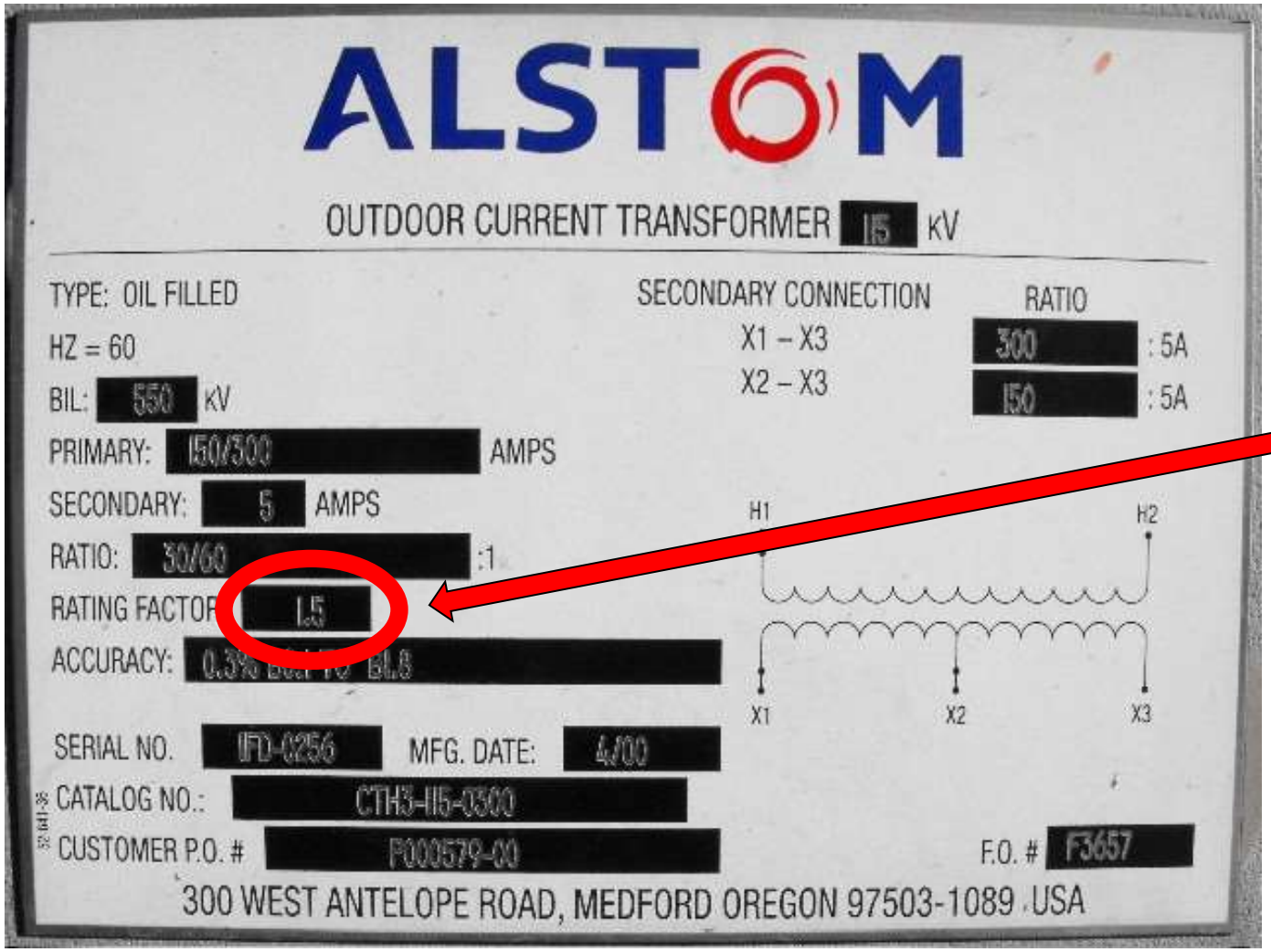


Ratio

FACEPLATE SPECIFICATIONS



Thermal factor

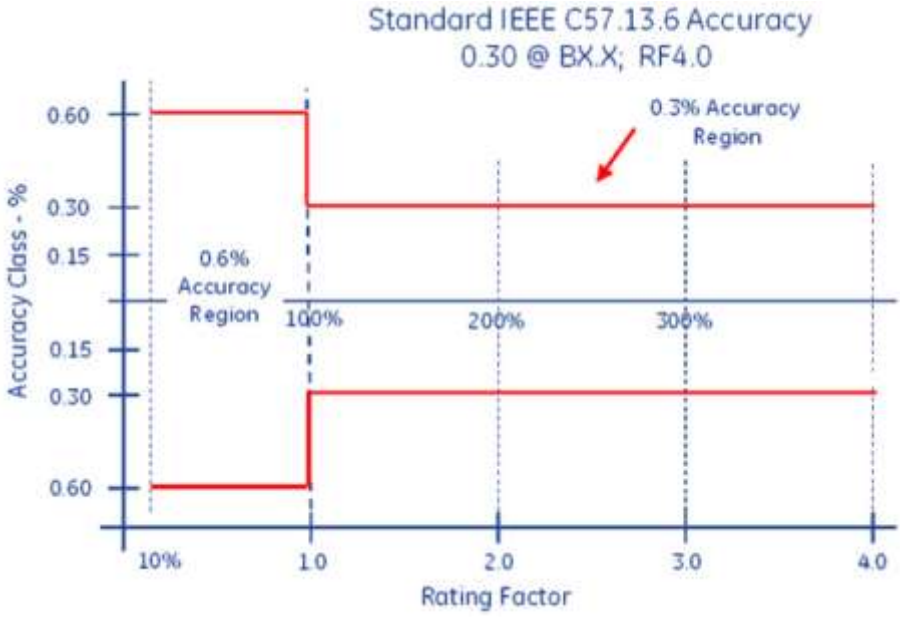
CT's – Functions and Terminology

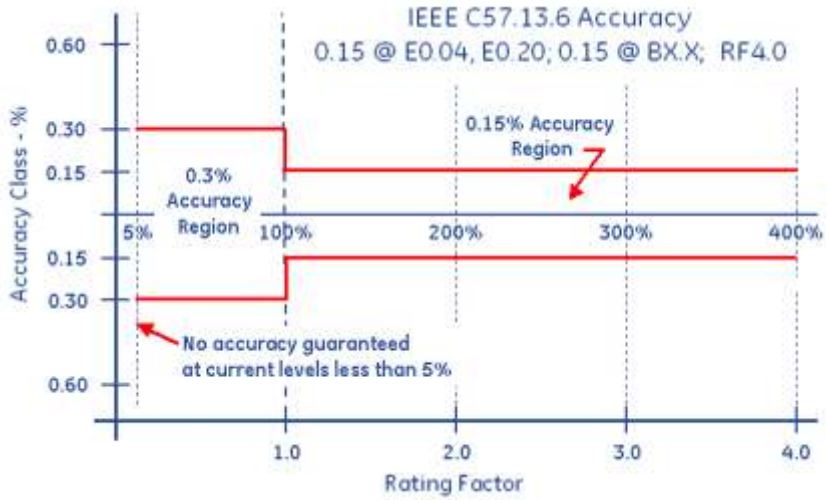
Thermal Rating factor

A value representing the amount by which the primary current can be increased without exceeding the allowable temperature rise. For instance, a RF of 4.0 at 30° ambient on a 400:5 ratio CT would allow for a primary current up to 1600A.

Accuracy Classifications

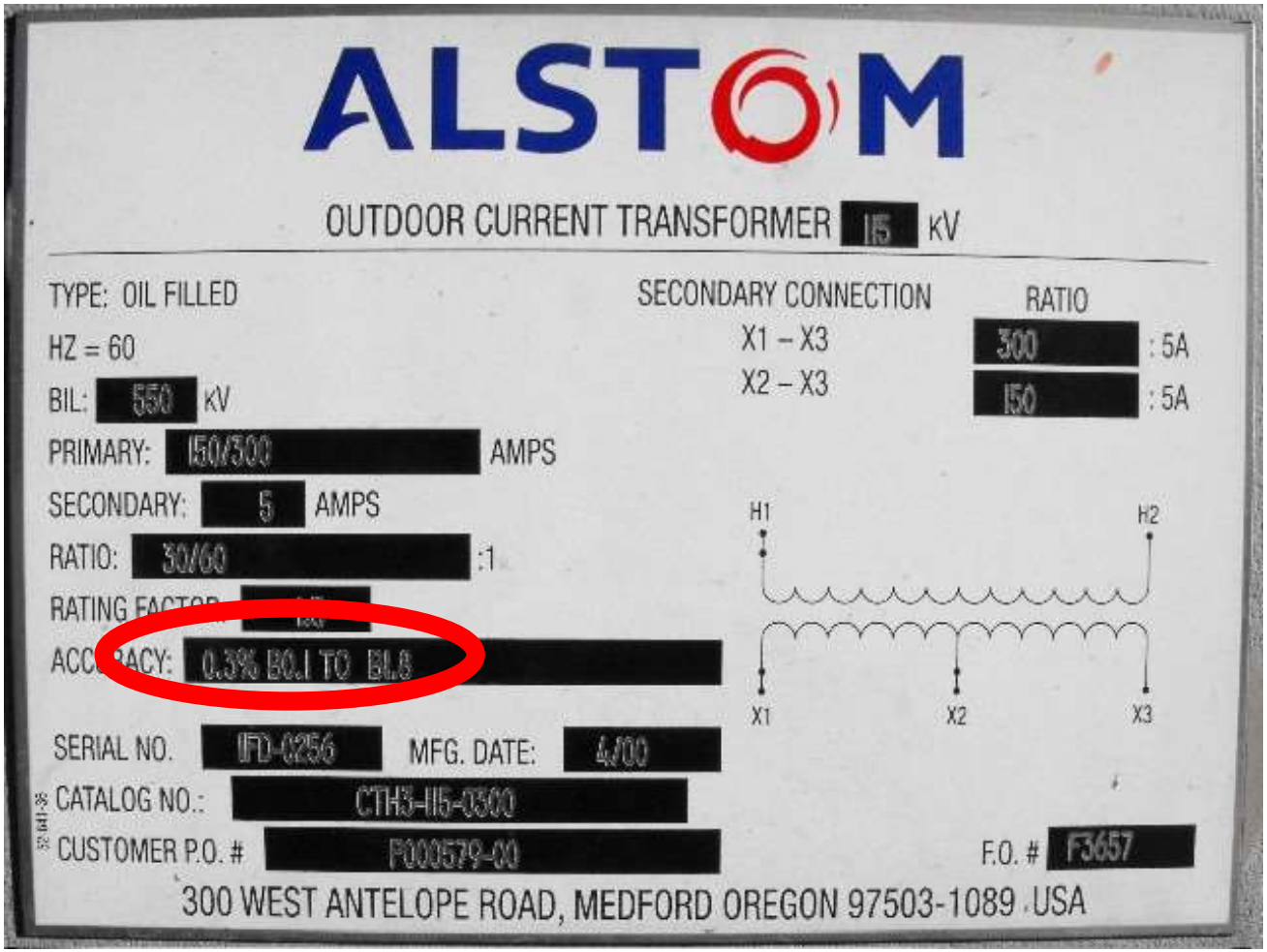
All CT's fall within an accuracy class.
IEEE Standards have defined accuracy classes.





FACEPLATE SPECIFICATIONS

Burden Rating



BURDEN RATING

.3@B0.1,B0.2

The burden range, present in the secondary circuit, that the manufacturer will guarantee their CT's will still accurately function, in regards to the ratio specification.

Questions and Discussion

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