Coaxial Ground Fault Detection

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NFPA
Article 830
Network-Powered Broadband Communication Systems

UL - Coaxial Fault Protectors for Network-Power Broadband Communication Systems - DUAA

New Product Category

- Scope of investigation has been established
- UL Category file is Subject 2389
- Product evaluations are in the NBK office
- Six week program
- 35 complete systems required

Listing Guide Card “DUAA”

- Limits category to Coaxial Fault Protectors
- Listed systems are to be installed in accordance with Article 830
- Product to be installed by Trained Craftsmen only
- Direct Buried Cable Only

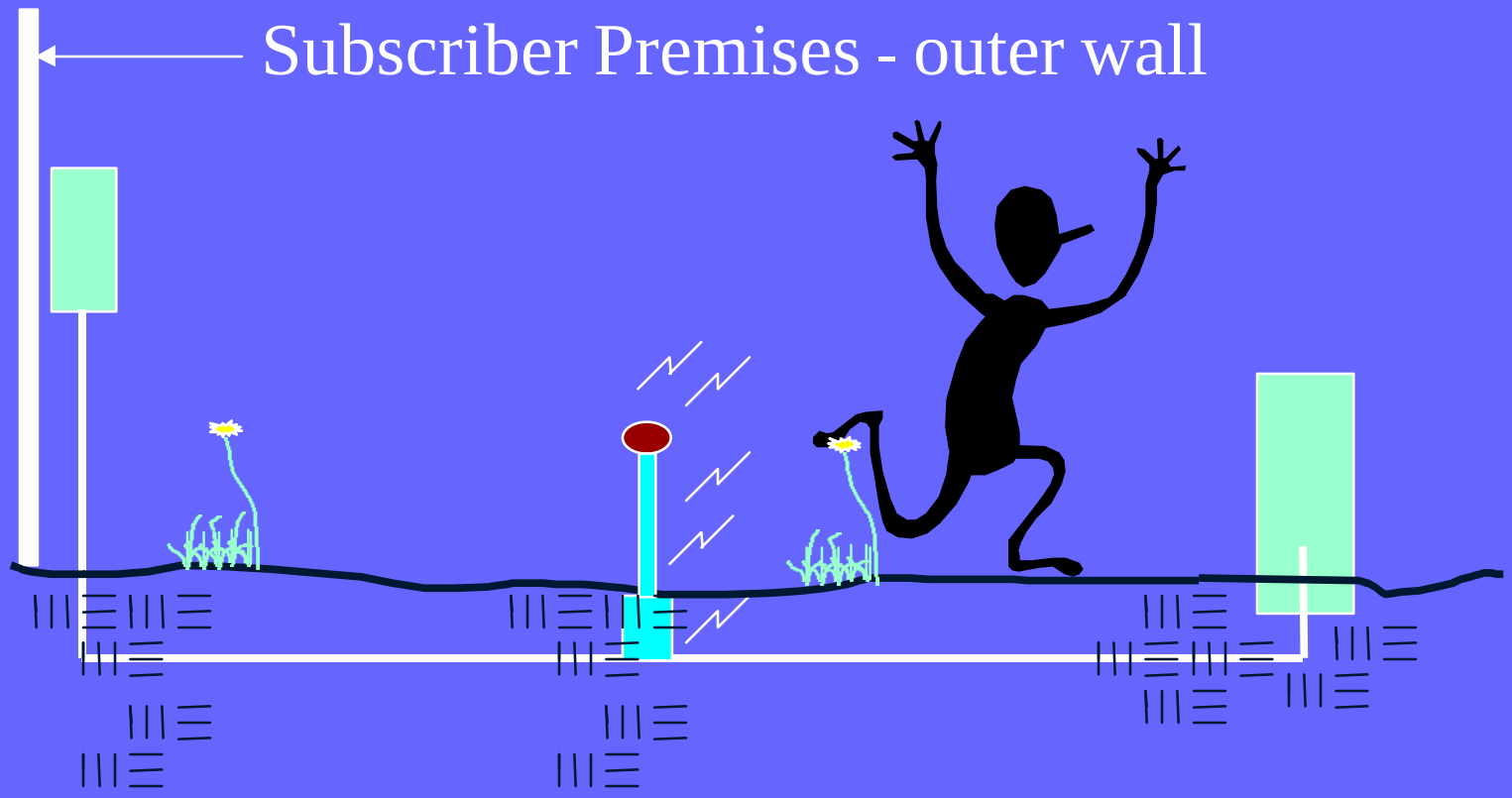
Guide Card "DUAA" Continued

- The systems listed in the category are intended to:
  - Monitor Customer feeder cable
  - Detect a short to ground
  - Detect leakage current to ground
  - Detect an open condition
  - Disconnect Network power in the event of a fault

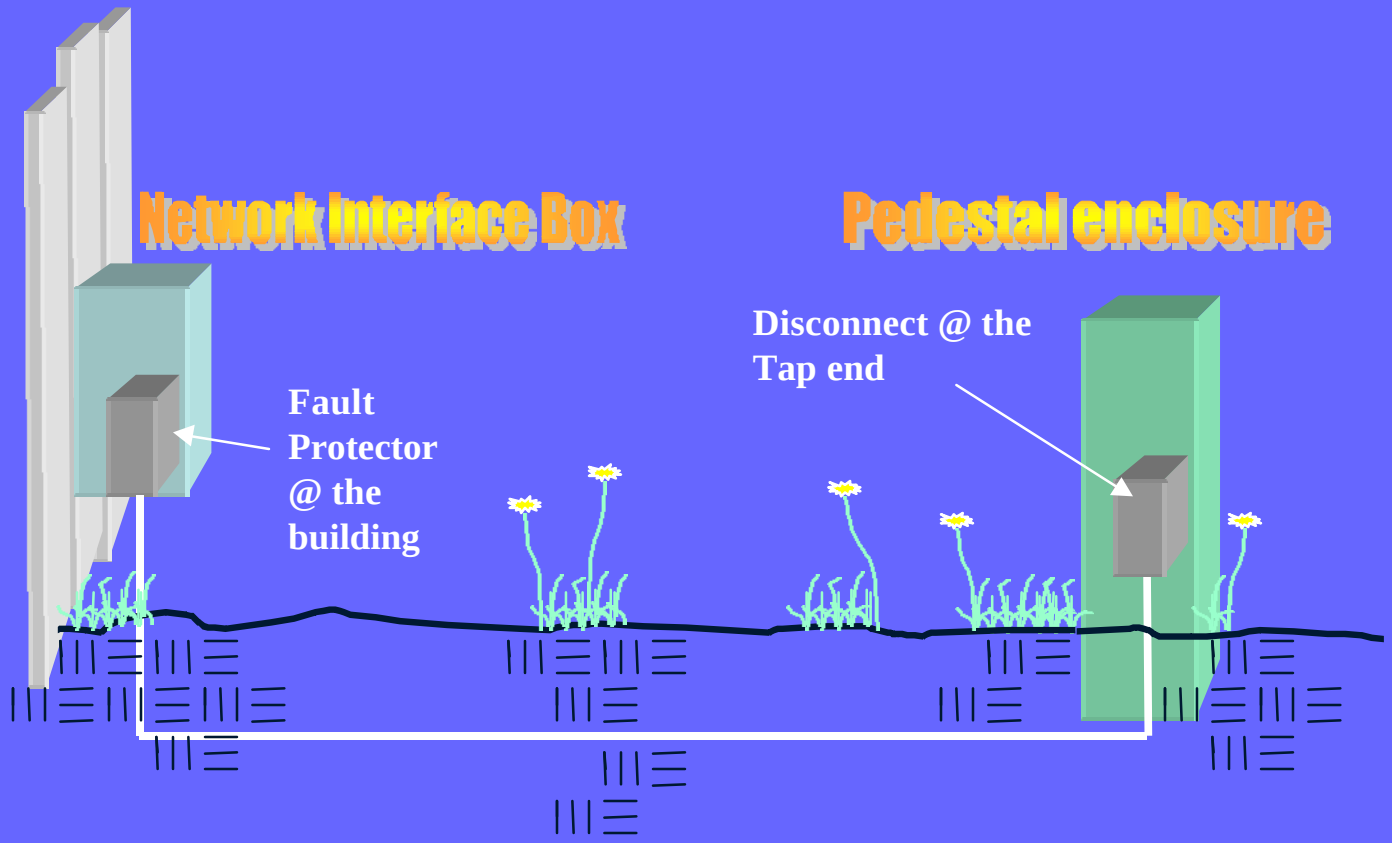
Guide Card - Final comments

- The Guide card address the manner in which protector and cable are installed
  - The disconnect components are located at the Tap-end or network side of the cable feed
  - The component located at the customer end is to be placed in a compatible NID or SIU

How does a fault occur



The System

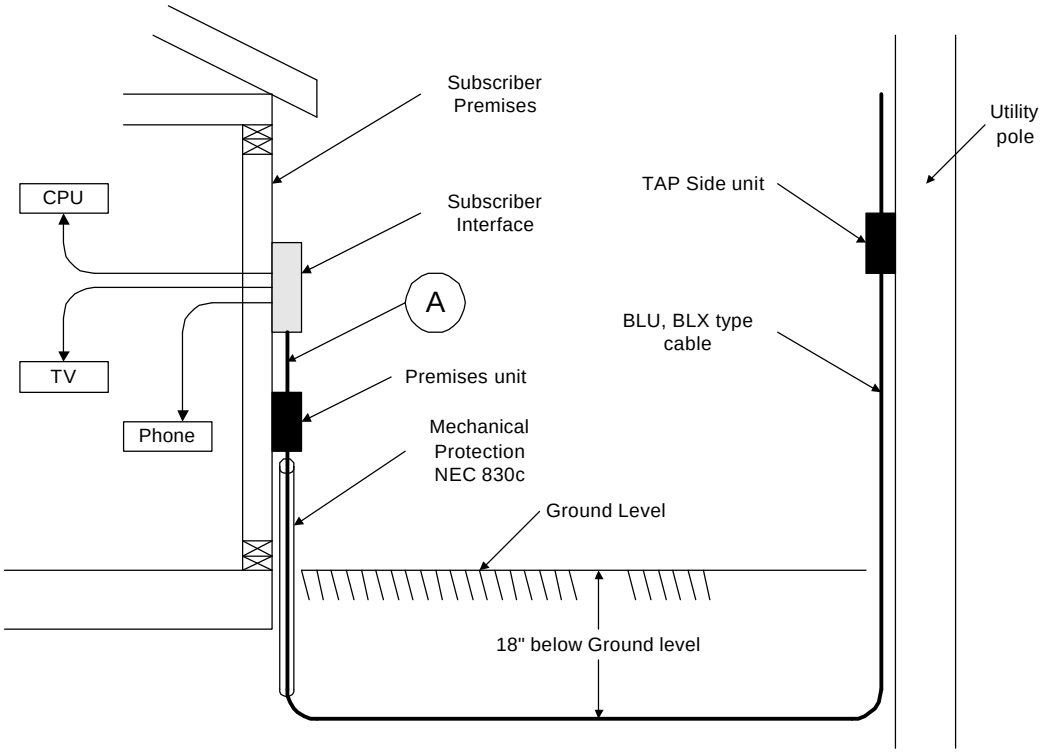

Network Interface Box
Pedestal enclosure
Disconnect @ the Tap end
Fault Protector @ the building

Article 830 Power Limitations Table 830-4

Power Source	Low	Medium
V max.	100	150
VA max.	250	250
I max.	1000/Vmax	1000/Vmax
Max Power Rating	100	100

More on the Installation

Figure A



L:\Devoss\Drop Check for Multimedia drops

Table 830-4 Read the Fine Print Notes:

- V_{max}, I_{max} & VA_{max} are determined with the current-limiting impedance in the circuit
- Note: The Installer needs to observe the following in order to achieve the above

Table 830-4 V_{max}

- Maximum system voltage regardless of load
- Maximum system voltage with rated input
- Maximum system voltage as measured at any point in the circuit

Table 830-4 I_{max}

- Maximum system current under any Non-capacitive load
- Maximum current including short-circuit conditions
- Over-current protection is by-passed
- Limits apply after 1 minute of any condition

Table 830-4 - Additional Limitations (I_{max})

- Maximum Over-current protection equals 100/Vmax or 100/90=1.11 amperes
- In Note 2 of table 830-4 Over-current protection is not required where (when)
  - The current limiting device provides equivalent current limitations
  - The current limiting device does not reset until power or the load is reset.

Network-Powered Broadband Cable

- Cable intended for outdoor use shall be listed as suitable for the application (830-5)
- The cable listed for outdoor underground use is Type BMU or BLU
- Type BLX cable is listed for outdoor use but not for underground use

Direct-Buried Cable (830-11)

- Broadband communication cable shall be a min. 12 in. from light & power Ckts.
- The cable shall be buried 18 in. minimum. Refer to table 830-11
- Direct buried cable emerging from the ground is to be in rigid metal conduit
- Rigid conduit is to be used to a point 8ft. above finished grade

The Exception

A low power network-powered broadband communications circuit that is equipped with a listed fault protection device appropriate to the network-powered broadband cable used, and located on the network side of the network-powered broadband communications cable being protected.

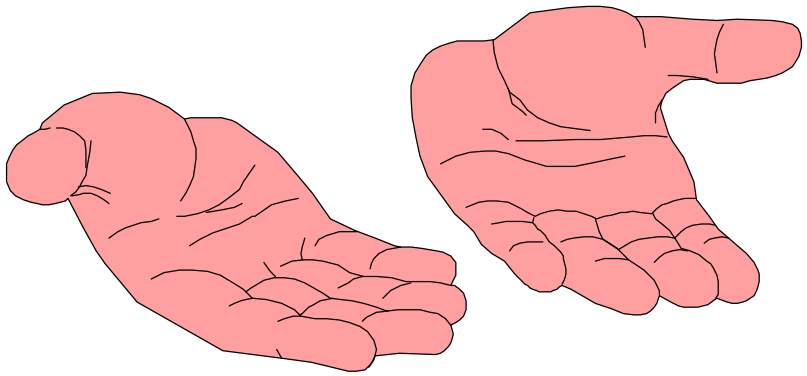
High points to the Exception

- Addresses only Low Power broadband communication circuits
- Equipped with a Listed fault protection Device
- Protection device shall be located on the network side
- Used with Listed communication underground cable

Study of Involuntary reaction to electrical current

- Study was conducted in 1971 by
- Dr. Kouwenhoven of John Hopkins University
- Professor Dalziel of the University of California at Berkeley
- John Stevens of Underwriters Labs.

Acceptable Limits & leakage Current



- Palm of Hand
- Fingers
- Arms
- Women
- Men

How much current is too much?

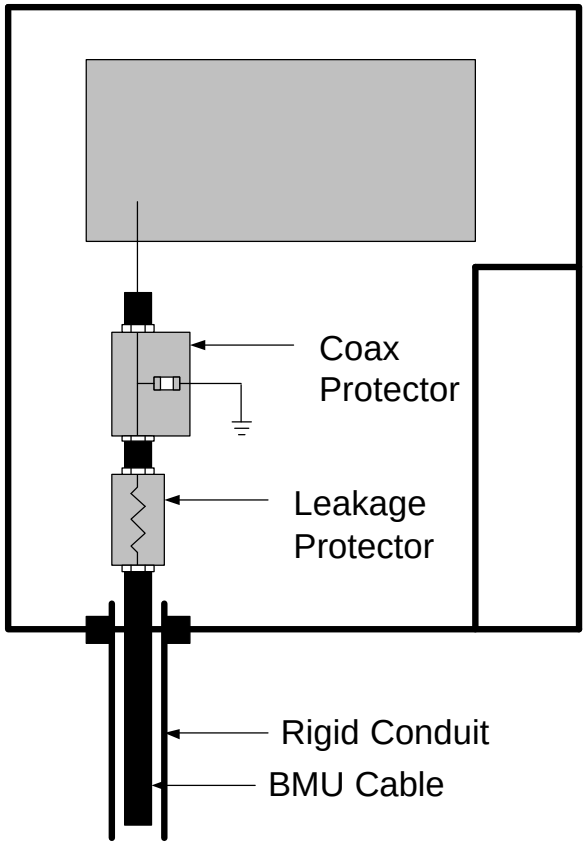
- 5 milliamperes is considered a safe level for “Let-go”
- 0.5 milliamperes is considered the maximum current level to avoid involuntary reaction
- 0.2 milliamperes is considered the level for detection

The Formula - Time Vs Current

- Max Time to operate = $(20/I)^{1.43}$
- I = numerical value of ma

- Seconds = $(20/5)^{1.43} = 7.26$
- Seconds = $(20/10)^{1.43} = 2.69$

Installation at the NID



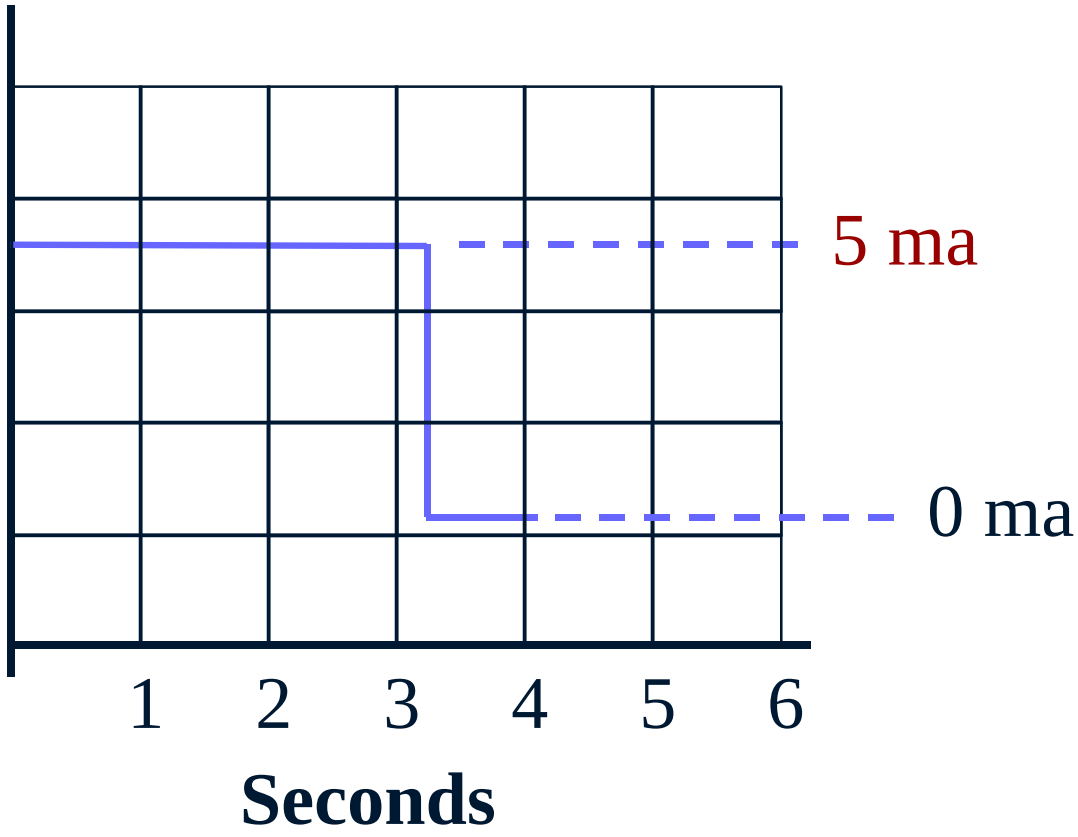
UL Test Program

- Normal Operation
- Fire Hazard
- Shock Hazard
- Component & Circuit Failure Analysis

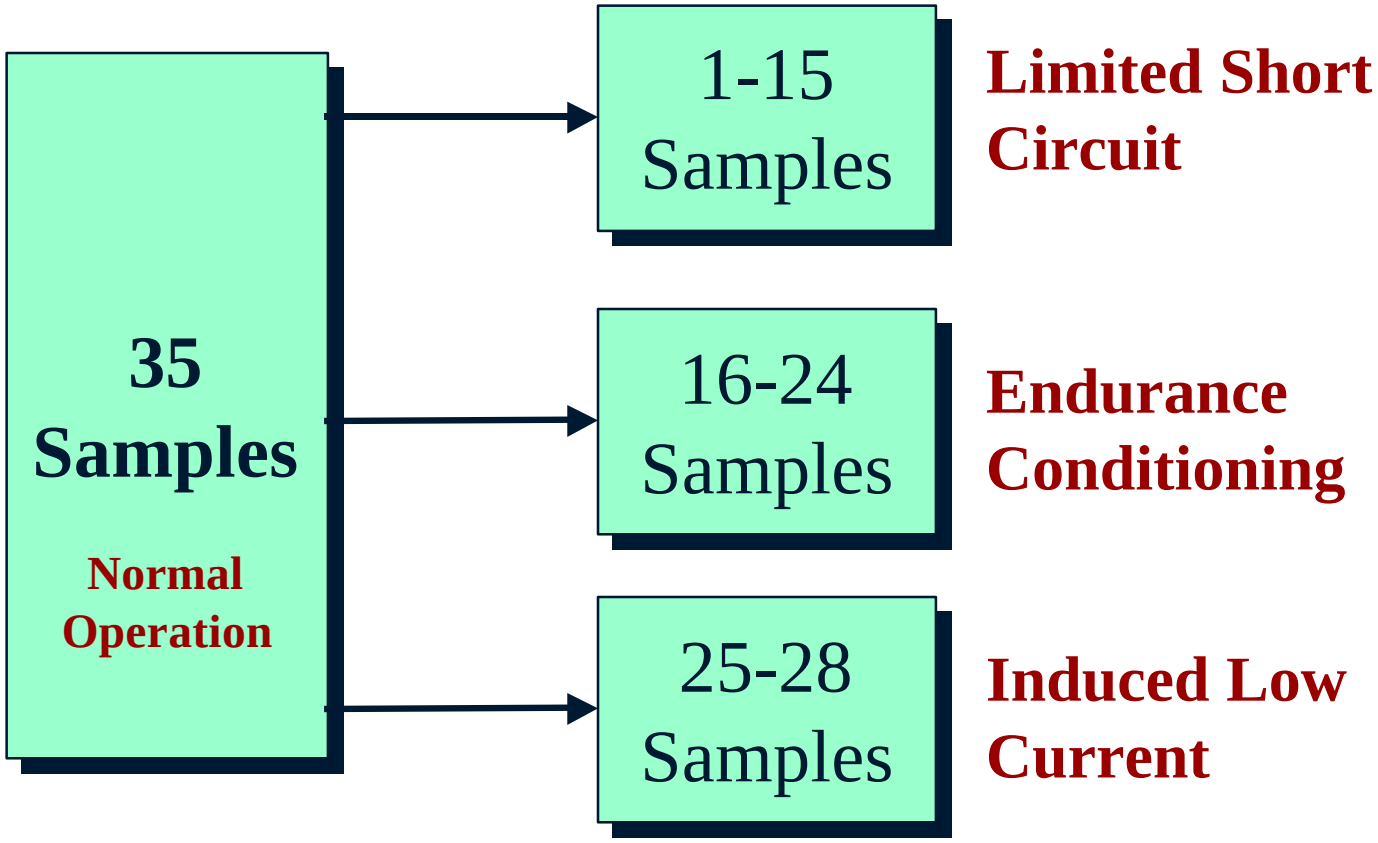
UL - Normal Operation

- Ability to detect leakage current at or within the rating of the product
- The Unit shall operate for the leakage current limits considered maximum limits by UL.
- The unit shall operate at or within time limits specified by UL

Scope reading

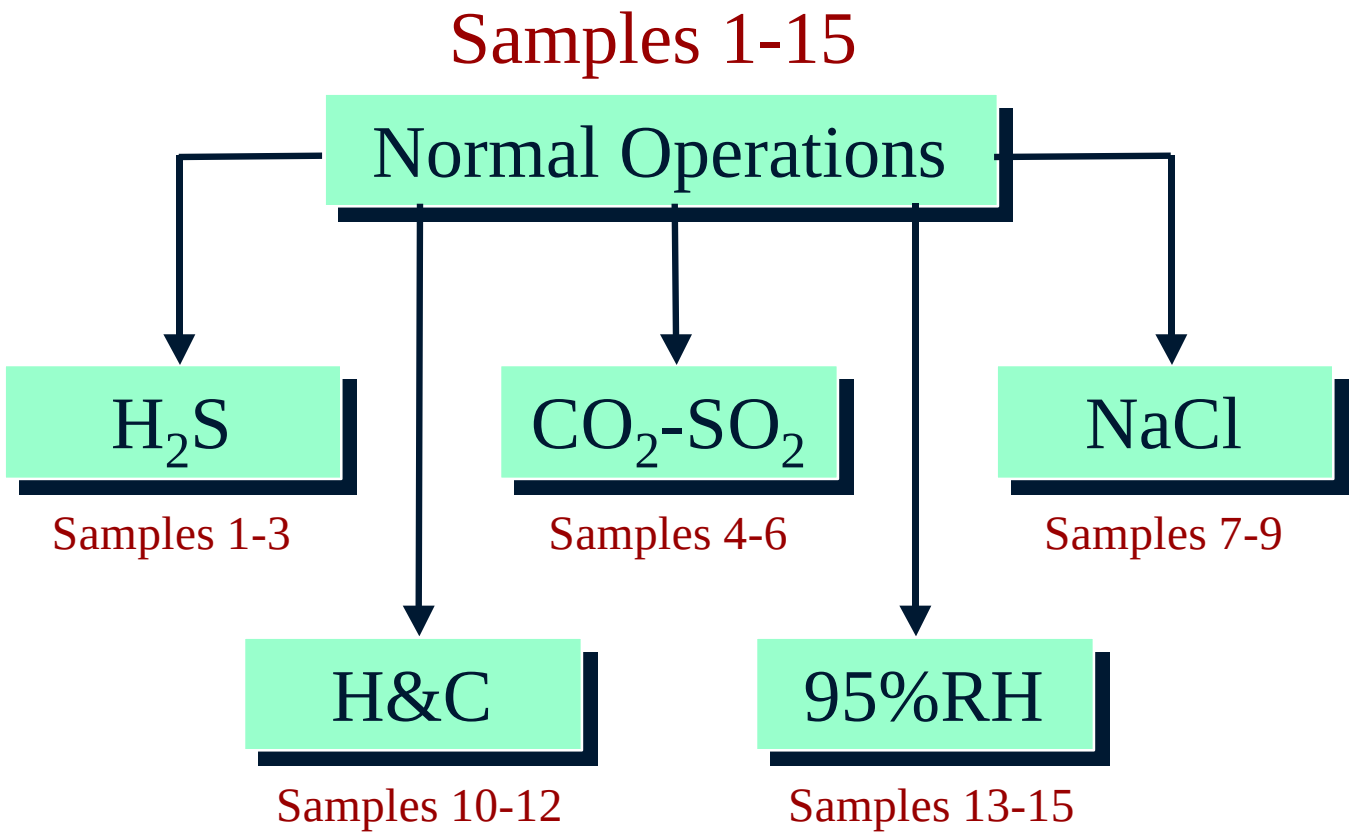


UL Test Program - Power & Surge Fault

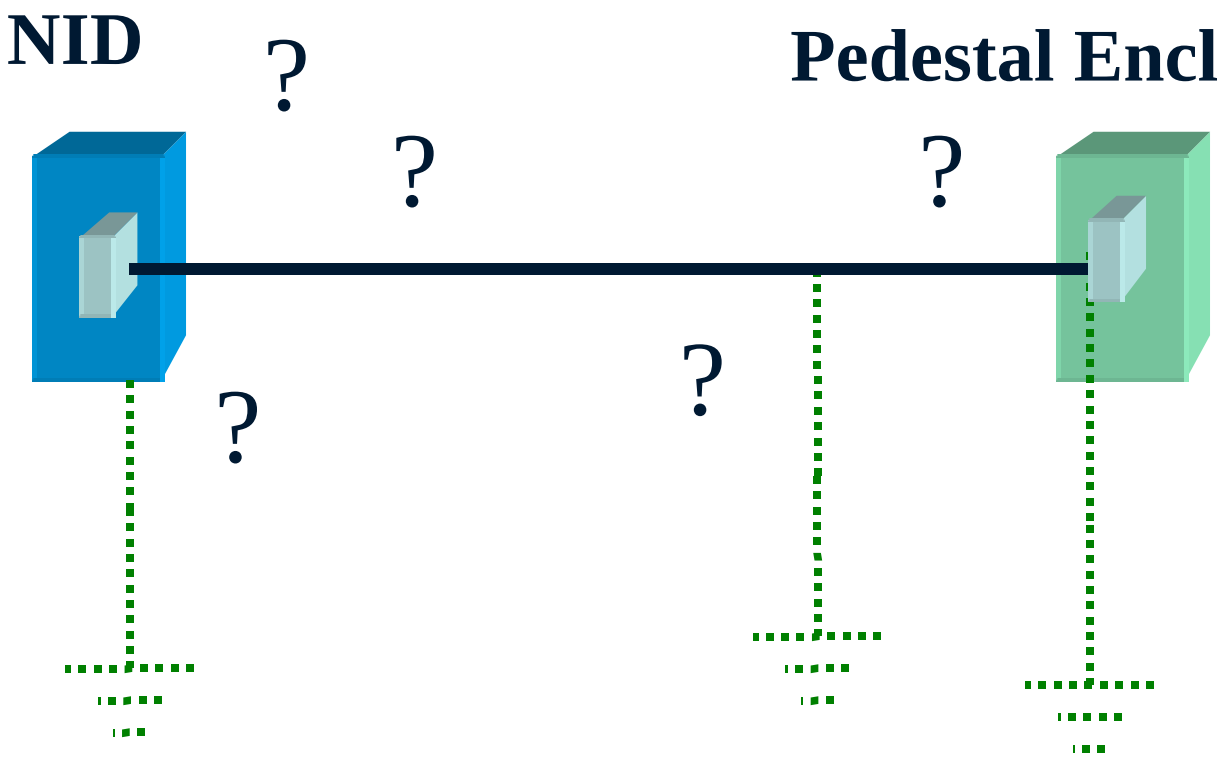


Limited short Circuit test

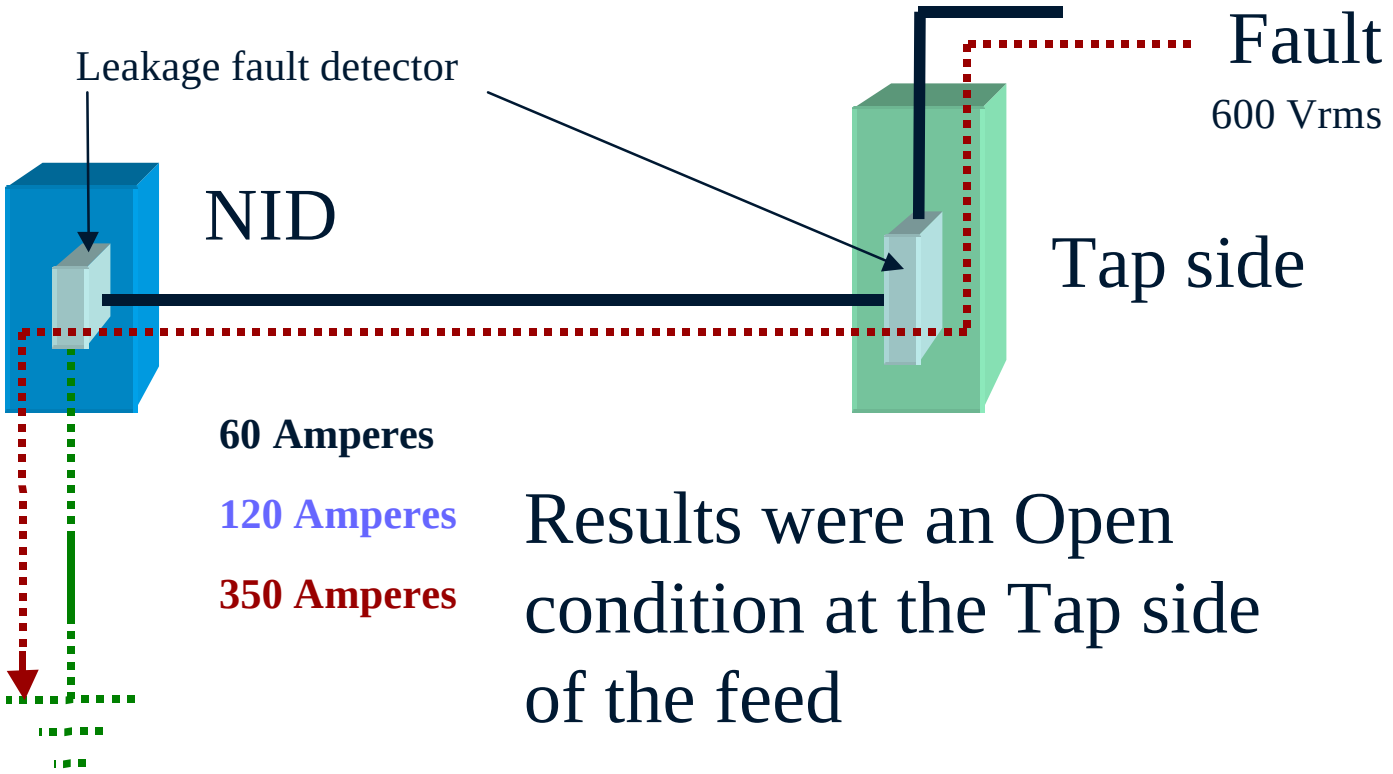
Pre-conditioning



Leakage current paths

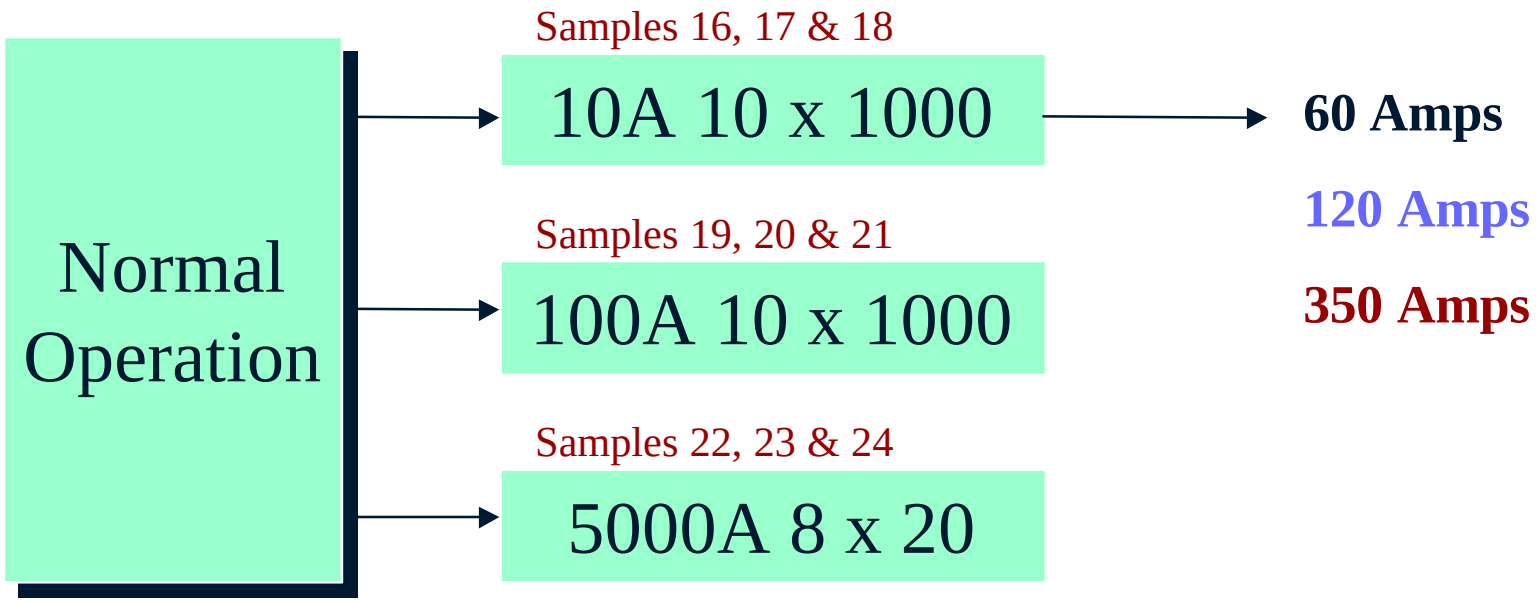


Test Currents - LSC



Results were an Open condition at the Tap side of the feed

Endurance Conditioning



Results were an Open condition at the Tap side of the feed

Normal operation during Ambient extremes

Sample No.	Ambient	Disconnect	Leakage
30	-35C	1 sec.	3 sec.
31	66C	0.9 sec.	4 sec.
32	95% RH	1.2 sec	4 sec.

$$\text{Seconds} = (20/5)^{1.43} = 7.26$$

Other Test

- Variable Ambient exposure (3)
- Abnormal Operation (1)
- Endurance cycling (1)
- Jarring (1)
- Dielectric Withstand (1)
- Water Spray (1)

Article 830 Bonding to Ground

- Do we always have reliable Bonds to ground ?
- The Multimedia system with power is not designed with a grounded neutral !
- How do we control access to parts that can carry operating current ?

The Product Leakage Current Protectors

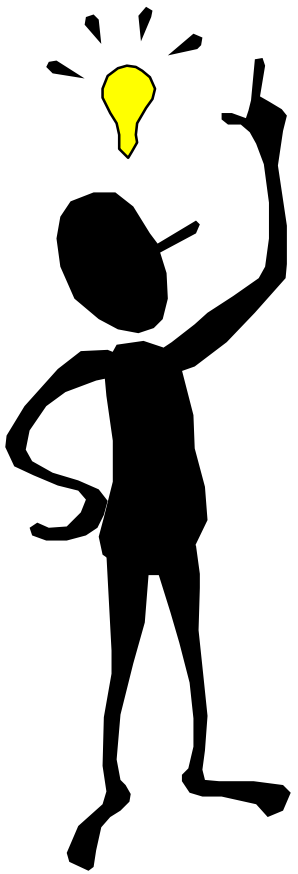
- Intended for use only in Network Powered Broadband Communication Systems
- The Installation Manual shall describe and require the installation conditions outlined in Article 830
- The product is to be installed, maintained and repaired by trained craftsmen only

The First Listing

- The first product report has been reviewed by UL's Electrical Council and Research Depts.
- In addition to Listing, Reex testing once a year is required
- The Product shall be rated when limited use is determined

Any suggestions

- Installation concerns
- Testing concerns
- Listing format
- Reex concerns
- Compatibility



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