IEEE Power and Engineering Society (PES) Wire-Line Subcommittee Standards Update

PEG CONFERENCE

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IEEE WLS Update- Overview

- Committee structure
- Scope
- Recent publications
- Key changes to requirements
- Real-world implementation challenges

WLS Membership at last publishing:

Percy E. Pool, *Co-Chair and Technical Editor*

Larry S. Young, *Co-Chair and Secretary*

Steven Blume	Ernest Duckworth	Del Khomarlou
Joe Boyles	John Fuller	Richard Knight
Timothy Conser	Ernest Gallo	Randall Mears
Bhimesh Dahal	Dave Hartmann	Mark Tirio
Jean de Seve	Dan Jendek	Thomas Vo

Wire-Line Subcommittee - Hierarchy

- Dielectrics and Electrical Insulation Society
- Industrial Electronics Society
- Industry Applications Society
- Power Electronics Society
- Power & Energy Society

Wire-Line Subcommittee - Hierarchy

Power & Energy Society

- Power System Communications Committee (PSCC)

Wire-Line Subcommittee - Hierarchy

Power System Communications Committee (PSCC)

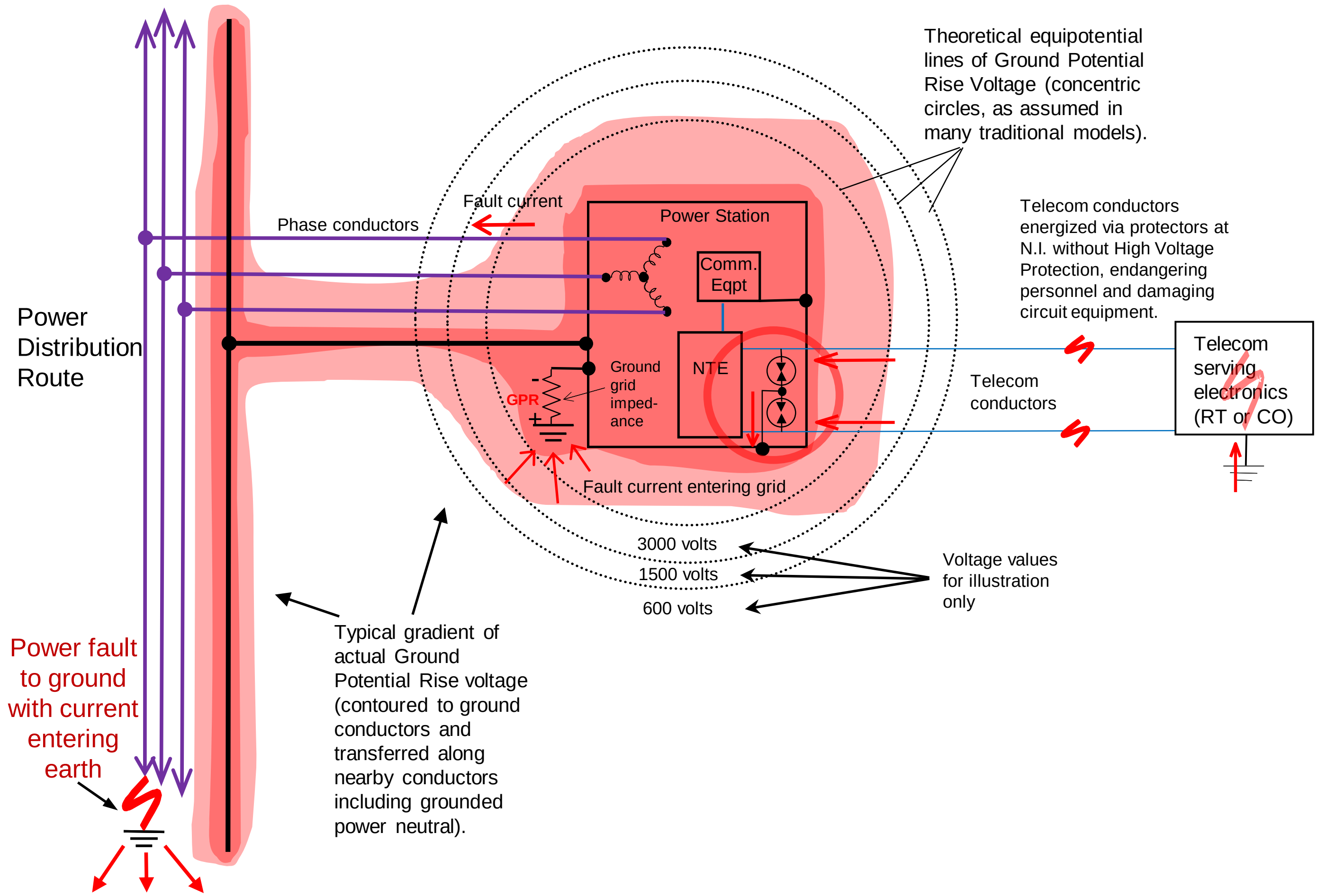
- Power Line Carrier
- Radio and Other Free Space Communications
- Fiber Optic Communications
- Methods of Measurements
- Protection of Communications Circuits and Equipment
- Personnel safety through coordinated application
- Utilization of Communications
- Communications Protocols used in Utilities
- **Wire Line Communications including both telephone lines and cables**

Wire-Line Subcommittee - Hierarchy

Power System Communications Committee (PSCC)

- **Wire Line Communications including both telephone lines and cables (a.k.a. Wire-Line Subcommittee)**

Wire-Line Subcommittee - Purpose



Wire-Line Subcommittee – Scope

Wire-Line Subcommittee (SC-6) Scope and Mission:

Establish methods and suggest practices for the protection and use of all forms of single or multipurpose wire line communication systems which serve electric power systems or which are otherwise subjected to the influence of the power system or lightning. (Communications systems may be defined in this instance as the media, whether owned or leased, for the transmittal of any form of intelligence.)

Develop and maintain related Standards, Recommendations and Guides.

Coordinate with other technical committees, groups, societies and associations as required.

Wire-Line Subcommittee Documents

Std.	Year	Title
367	2012	Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault
487	2015	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations - General Considerations
487.1	2014	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Through the Use of On-Grid Isolation Equipment.
487.2	2013	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Through the Use of Optical Fiber Systems.
487.3	2014	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Through the Use of Hybrid Facilities
487.4	2013	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Through the Use of Neutralizing Transformers
487.5	2013	Standard for the Electrical Protection of Communication Facilities Serving Electric Supply Locations Through the Use of Isolation Transformers

Wire-Line Subcommittee Documents (Continued)

Std.	Year	Title
776	2008	Recommended Practice for Inductive Coordination of Electric Supply and Communication Lines
789	2013	Standard Performance Requirements for Communications and Control Cables for Application in High-Voltage Environments.
820	2010	Standard Telephone Loop Performance Characteristics
1137	1991	Guide for the Implementation of Inductive Coordination Mitigation Techniques and Application
1692	2011	Guide for the Protection of Communication Installations from Lightning Effects

Std. 367-2012 Scope:

This standard provides guidance for the calculation of power station ground potential rise (GPR) and longitudinal induction (LI) voltages as well as guidance for their appropriate reduction from worst-case values for use in metallic telecommunication protection design. Information is also included for the determination of the following:

- The fault current and earth return current. (The probability, waveform, and duration of these currents and the impedance to remote earthing points used in these GPR and LI calculations as well as the effective X/P ratio are discussed).
- The zone of influence (ZOI) of the power station GPR.
- The calculation of the inducing currents, the mutual impedance between power and metallic telecommunication facilities, and shield factors.
- The channel time requirements for metallic telecommunication facilities where non-interruptible channels are required for protective relaying.

Std. 487-2015 Scope:

This standard presents general consideration for special high-voltage protection systems intended to protect telecommunication facilities serving electric supply locations. This standard contains material common to all of the 487-family including basic theory and fundamental electrical protection concepts and designs.

NOTE: This Standard was one document (487 only) prior to 2013

Std. 487 Considerations

Clause 9.6 ***Specific protection configurations***

Specific protection configurations are described in detail in other standards in the IEEE 487 family of standards:

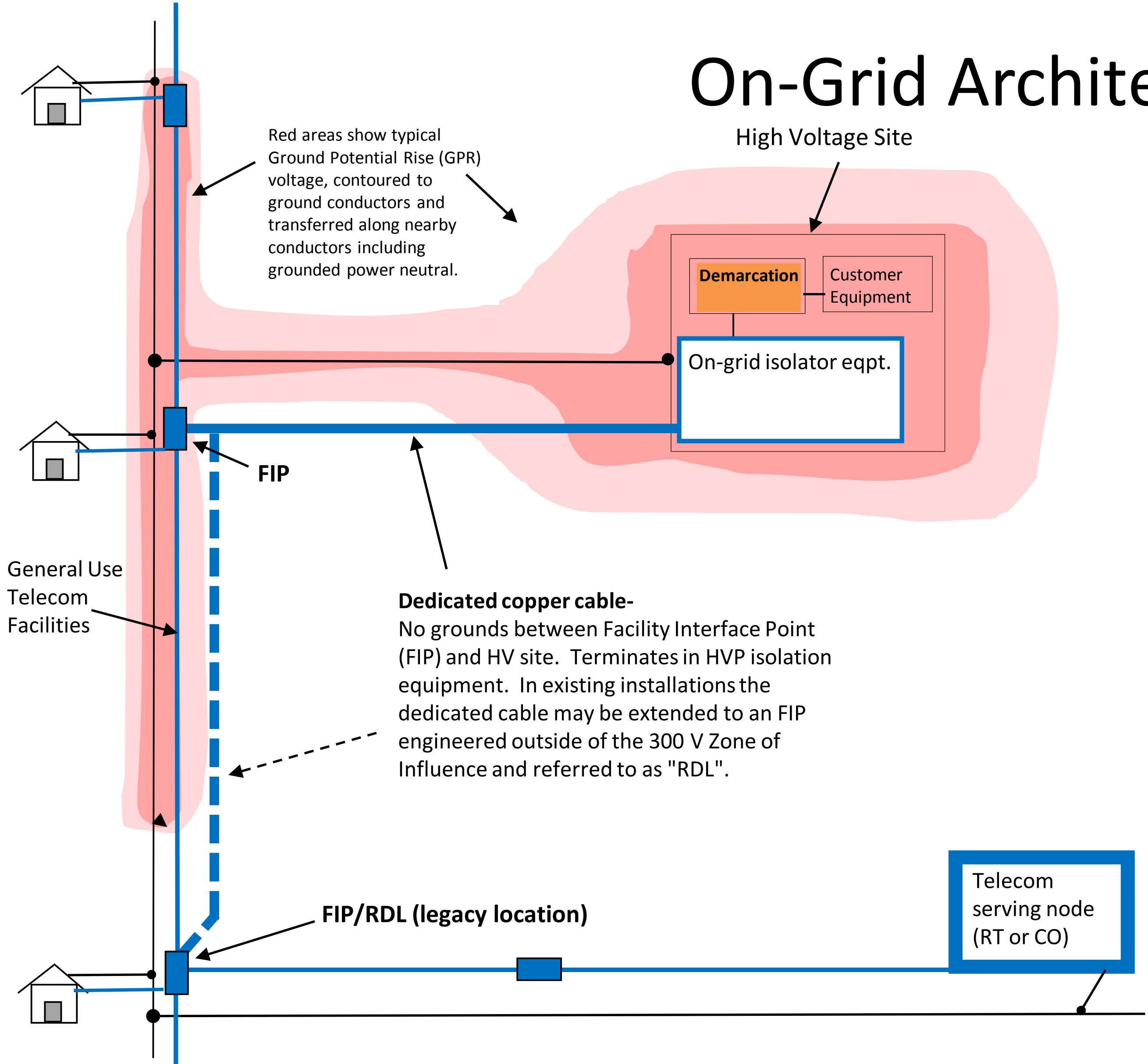
- *For protection configurations employing modular high-dielectric and modular optic isolators, refer to IEEE Std 487.1.*
- *For protection configurations employing hard-wire isolation transformers, refer to IEEE Std 487.5.*
- *For protection configurations consisting of both metallic cables and fiber cables, i.e., hybrid facilities (using metallic wire-line components in part of the telecommunications circuit and optical fiber systems in the remainder of the telecommunications circuit), refer to IEEE Std 487.3.*
- *For protection configurations consisting entirely of optical fiber cables, refer to IEEE Std 487.2.*

Std. 487.**1**-2014 Scope:

This standard presents engineering design procedures for the electrical protection of metallic wire-line communication facilities serving electric supply locations through the use of on-grid isolation equipment. Other telecommunication alternatives such as radio and microwave systems are excluded from this document.

NOTE: Applicable to modern isolation equipment such as Positron Teleline and SNC Lyte Lynx C-Line.

On-Grid Architecture



Std. 487.1 Considerations

- “RDL” vs. “FIP”
- “Remote Drainage Location” designated grounding point for drainage devices (Clause 6.4.2, *Remote drainage protection*)
- Facility Interface Point- New Definition appears in Std. 487.3 Clause 3.1 Definitions:

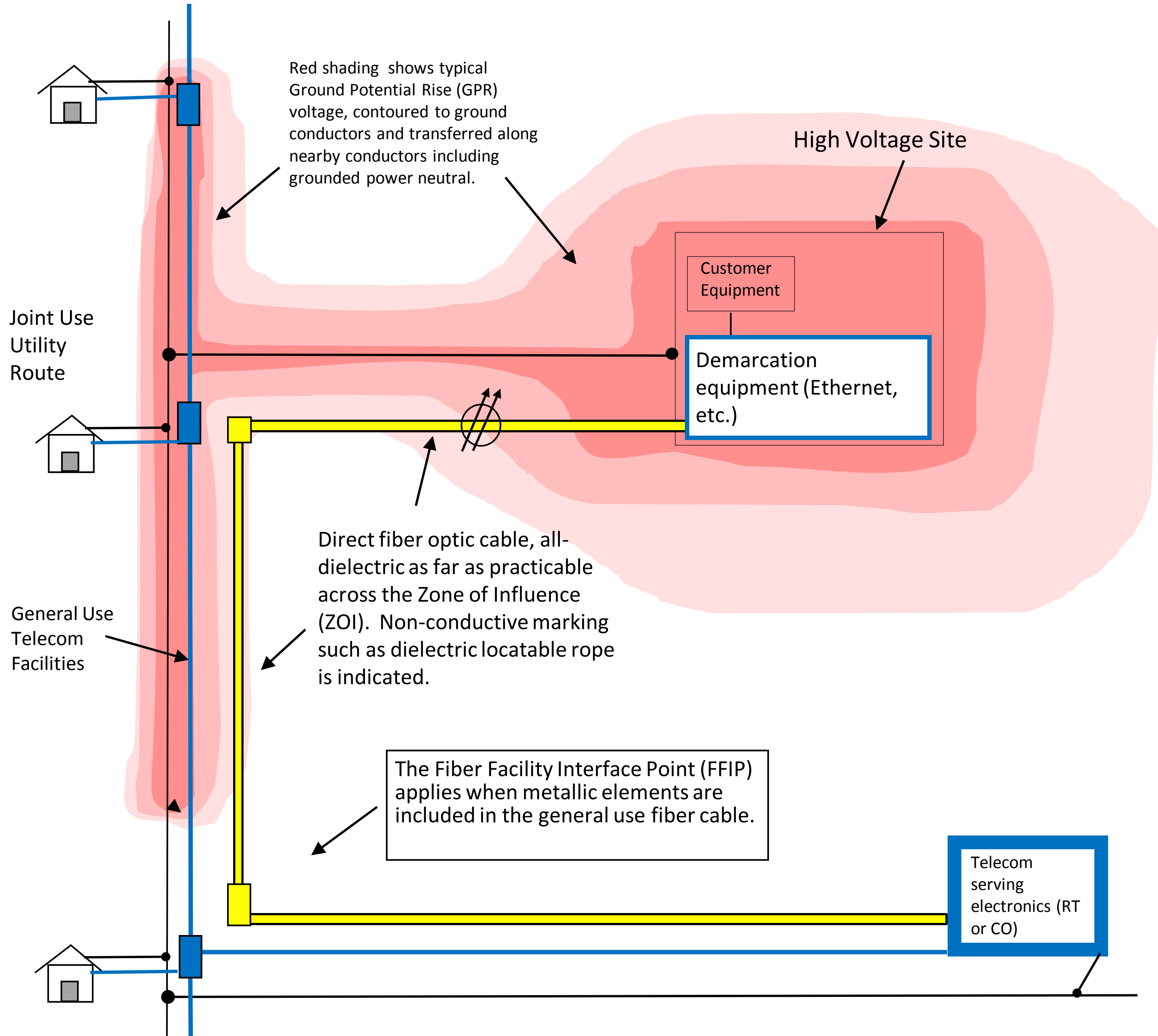
Facility Interface Point (FIP)- *The splice point for general use cable to dedicated cable. The FIP may be located anywhere in the circuit.*

Std. 487.**2**-2013 Scope:

This standard presents engineering design procedures for the electrical protection of communication facilities serving electric supply locations through the use of optical fiber systems for the entire access facility. Other telecommunication alternatives such as radio and microwave systems are excluded from this document.

NOTE: This standard, together with 487.3-2014, replaces Std. 1590-2009 in its entirety.

Direct Fiber Architecture



Std. 487.**3**-2014 Scope:

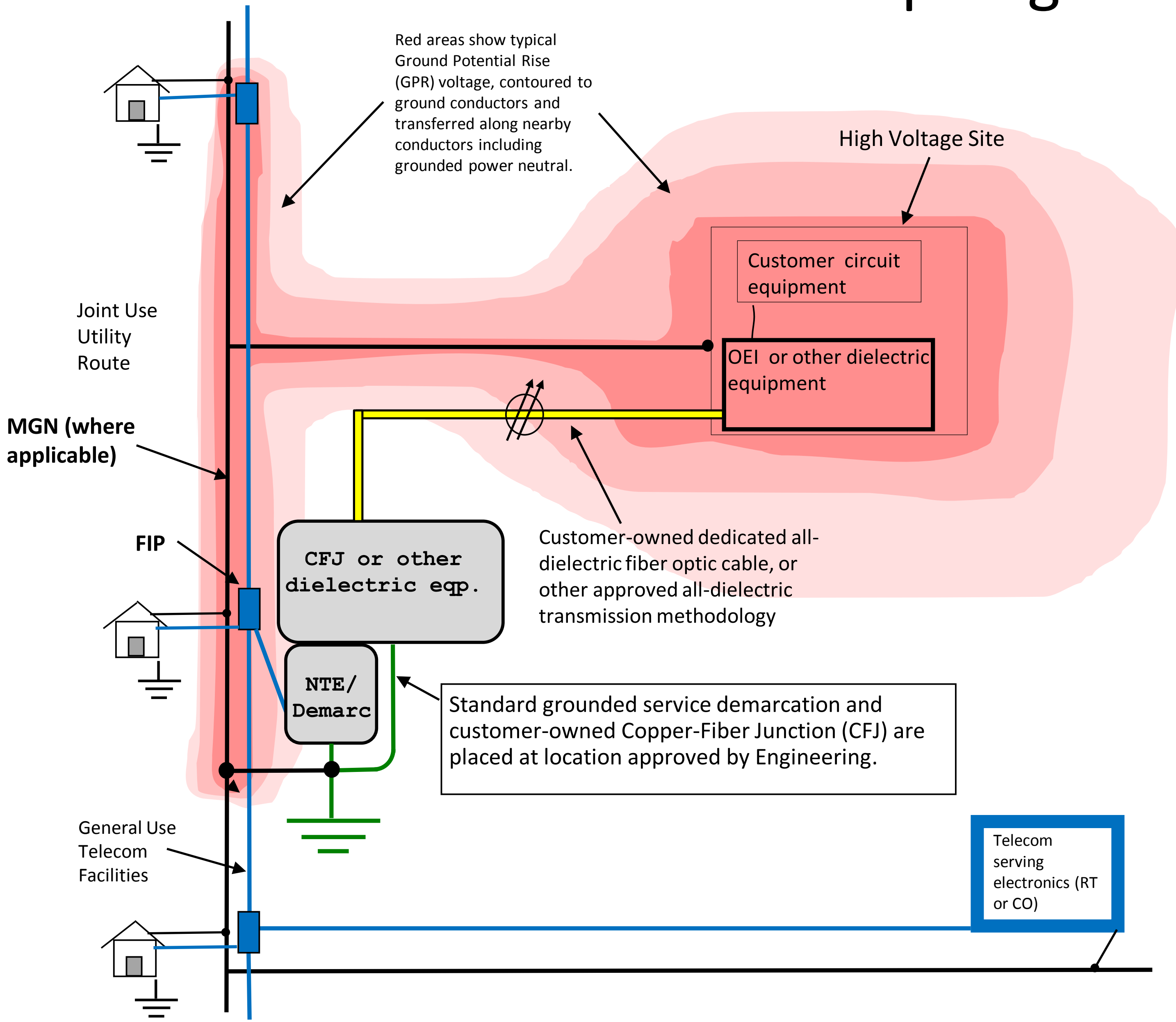
This standard presents engineering design procedures for the electrical protection of communication facilities serving electric supply locations through the use of metallic wire-line components in part of the communication circuit and optical fiber systems in the remainder of the communication circuit. Other telecommunication alternatives such as radio and microwave systems are excluded from this document.

NOTE: This standard, together with 487.2-2013, replaces Std. 1590-2009 in its entirety.

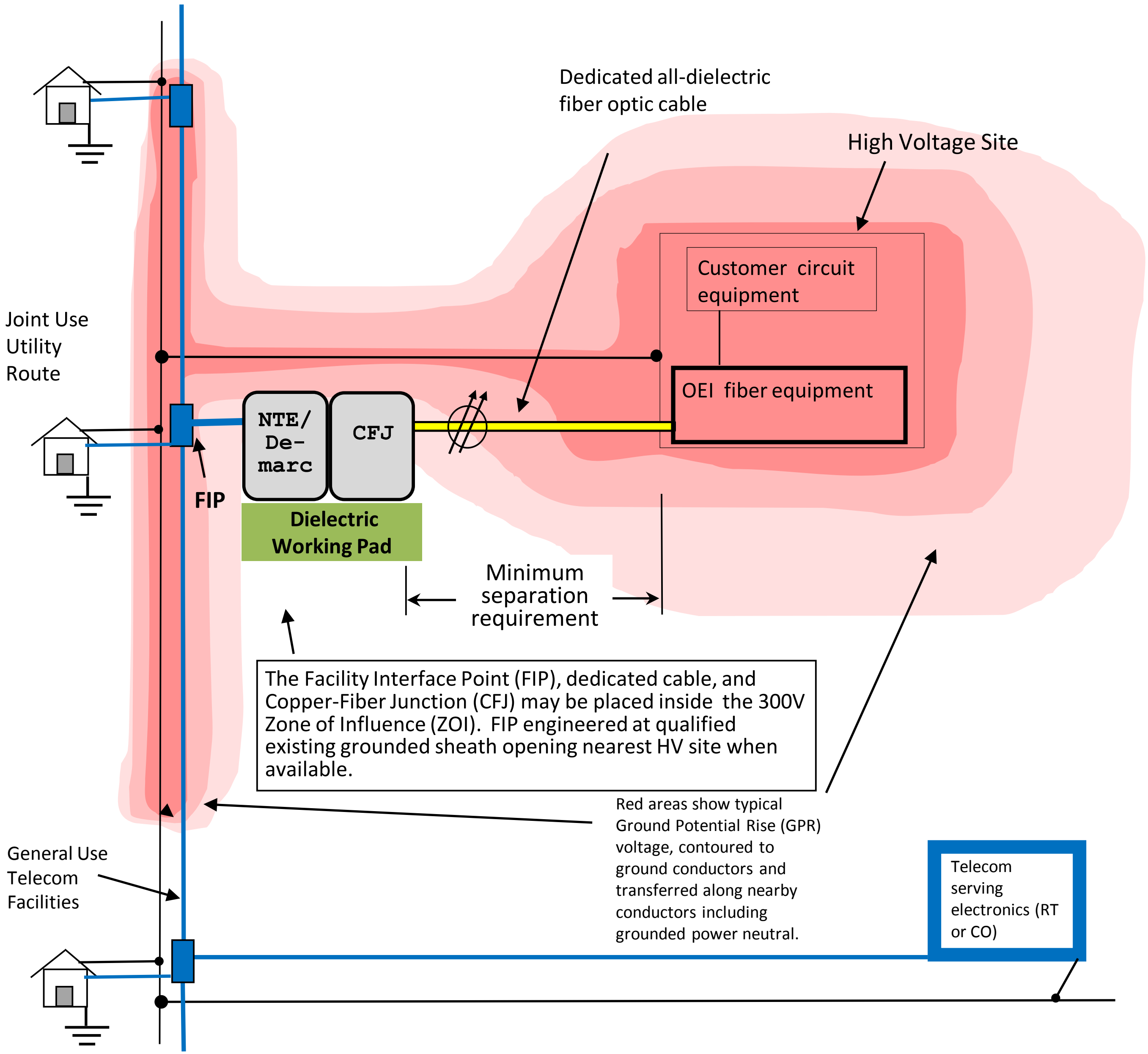
Std. 487.3 Considerations

- Grounded CFJ topologies (legacy)
- Ungrounded CFJ topologies

Grounded CFJ Topologies



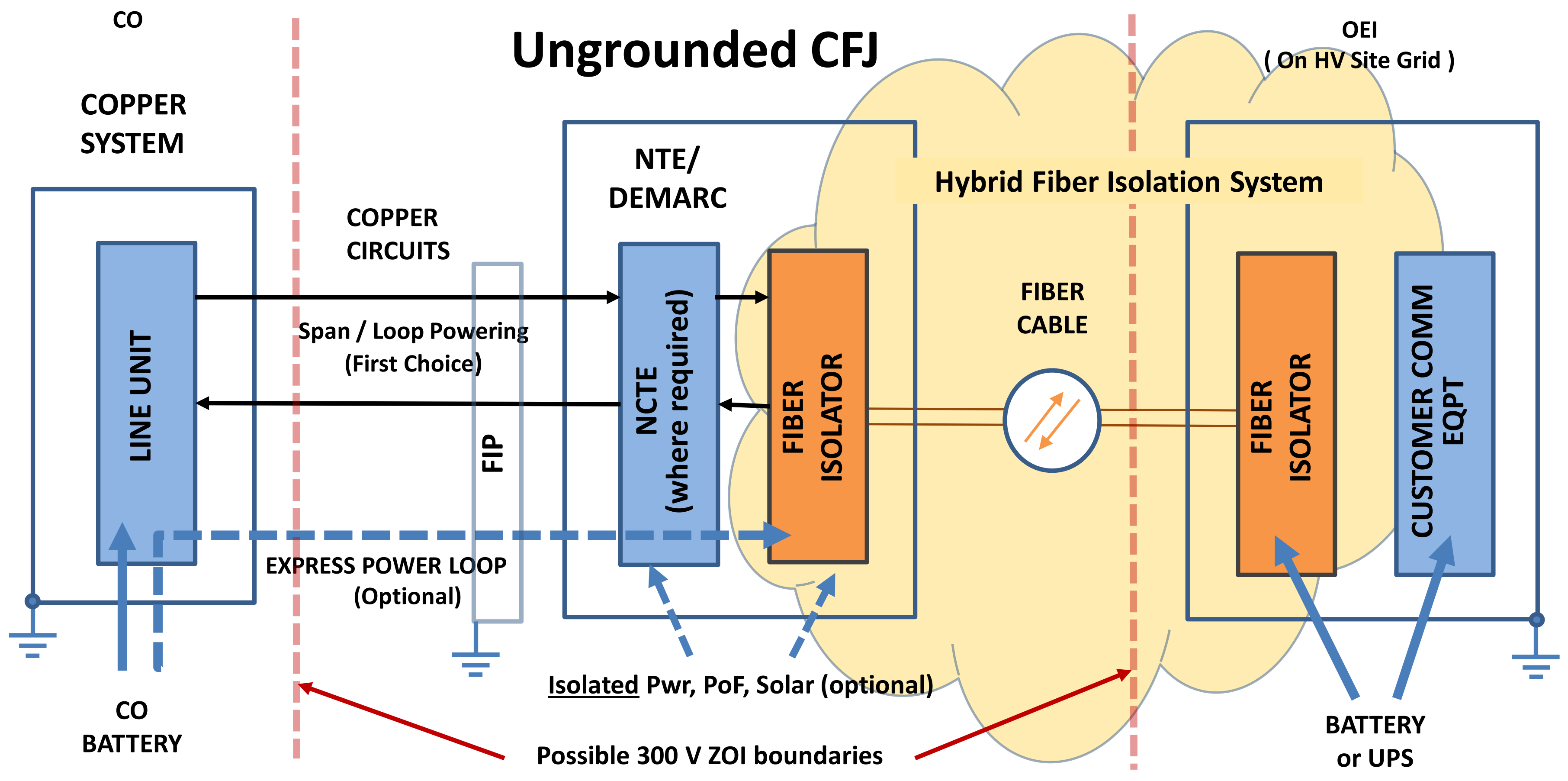
Ungrounded CFJ Topologies



Std. 487.3 Considerations

- CFJ Powering challenges
  - No station-referenced power
  - Solar power
  - Isolation transformers
  - Express Power

IEEE Std. 487.3-2014
CFJ Powering Options



Std. 487.**4**-2013 Scope:

This standard presents engineering design procedures for the electrical protection of communication facilities serving electric supply locations through the use of neutralizing transformers. Other telecommunication alternatives such as radio and microwave systems are excluded from this document..

NOTE: This content has seen no substantive changes from the legacy 487 version (editorial items only).

Std. 487.**5**-2013 Scope:

This standard presents engineering design procedures for the electrical protection of communication facilities serving electric supply locations through the use of isolation transformers. Other telecommunication alternatives such as radio and microwave systems are excluded from this document.

NOTE: Discrete isolation transformers only (contrasted with 487.1). No substantive changes from the legacy 487 version (editorial items only).

Std. 776-2013 Scope:

This recommended practice addresses the inductive environment that exists in the vicinity of electric power and wire-line telecommunications systems and the interfering effect that may be produced thereby; guidance is offered for the control or modification of the environment and the susceptibility of the affected systems in order to maintain an acceptable level of interference. To aid the user of this recommended practice in calculating induction between power and telecommunication lines, the concept of an interface is developed. This recommended practice permits either party, without need to involve the other, to verify the induction at the interface by use of a probe wire. This recommended practice does not apply to railway signal circuits.

NOTE: No substantive changes from previous versions.

Std. 789-2013 Scope:

This standard applies to wires and cables, used principally for power system communications and control purposes, which are located within electric supply locations or are installed within the zone of influence (ZOI) of the power station ground potential rise (GPR), or which may be buried adjacent to electric power transmission and distribution lines. This standard covers the appropriate design requirements, electrical and mechanical parameters, the testing requirements, and the handling procedures for cables that are to be installed and operated in high voltage environments where they may be subjected to high voltages either by conduction, or induction coupling, or both. Coaxial and fiber optic cables, except for those used in Ethernet applications, are specifically excluded from this standard.

NOTE: Minor content and editorial changes from previous versions.

Std. 789 Considerations

- Prescribed communications cable parameters include 20 kV core-to-shield dielectric strength.
- Expense associated with ANAW and CMAW cables (double sheath)
- From 487.1 Clause 5.1: ***…In the case of leased (rented) telecommunications facilities, the use of a high dielectric dedicated cable from the electric supply location to a point outside the influence of the electric supply location ground grid shall also be considered and agreed upon if the dielectric value of a general-use type cable is determined to be inadequate.***

Selected OSP Communications Cable Properties

Recommended for HVP service / Not recommended for HVP service	AWG	Manuf.	Part/ Product Number	Core-shield Dielecric Strength (kV, as stated by mfr.)	Cond-cond Dielecric Strength (kV, as stated by mfr.)	Outer Jacket Dielectric Strength (kV, <1.29" O.D. cables)			Construction/ Sheath
						ASTM D-149 Min.	Industry Range per Polymer Encycl. Reference	Minimum per stated Manufactr. Material Properties	
BURIED CABLES									
ANAW	22	Gen. Cabl	6987572	10	3.6	34.3	21 - 47	23.5	Filled ASP/ Polyethylene
ANAW	22	Sup. Essx	22-062-83	10	3.6	34.3	21 - 47	N/A*	Filled ASP/ Polyethylene
ANMW	24	Gen. Cabl	6987705	10	3	34.3	21 - 47	23.5	Filled ASP/ Polyethylene
ANMW	24	Sup. Essx	22-097-83	10	3	34.3	21 - 47	N/A*	Filled ASP/ Polyethylene
CMAW	22	Sup. Essx	21-062-48 (Custom Ordered)	20	5	34.3	21-24	N/A*	Filled ASP/ Polyethylene
CMAW	22	Gen. Cabl	Custom Manufactured	20*	5*	34.3	21-24	23.5	Filled ASP/ Polyethylene
AERIAL CABLES									
BHAH	22	Gen. Cabl	7503543	15	5	34.3	21 - 47	23.5	PASP/ Polyethylene
BHAH	22	Sup. Essx	20-062-05	20	4	34.3	21 - 47	N/A*	PASP/ Polyethylene
BKMH	24	Gen. Cabl	7503659	15	4	34.3	21 - 47	23.5	PASP/ Polyethylene
BKMH	24	Sup. Essx	20-097-05	20	3	34.3	21 - 47	N/A*	PASP/ Polyethylene
BURIED DROPS									
BW AF 2-pair	22	Sup. Essx	25-062-86	15	5	N/A	6.3-10	N/A*	Filled corrugated 6 mil aluminum/ PVC
BW AF 5-pair	22	Sup. Essx	25-154-86	15	5	N/A	6.3-10	N/A*	Filled corrugated 6 mil aluminum/ PVC
BW GDJ 2-pair	19	Sup. Essx	25-020-79	20	7	N/A	>6.3	N/A*	Filled polyeth inner jkt, flooded corrg. armor/ PVC
BW GDJ 5-pair	22	Sup. Essx	25-553-79	20	5	N/A	>6.3	N/A*	Filled polyeth inner jkt, flooded corrg. armor/ PVC

* - Manufacturers assert compliance to Telcordia GR-421-CORE or GR-3163-CORE . Outer jacket thickness depends upon cable size.

Std. 820-2005 (R2010) Scope:

This standard covers the general parameters and characteristics associated with telephone loops from the subscriber signaling and analog voice frequency interface to the local Class 5 switch interface. It includes only those business and residential lines in the North American public switched network where no special performance requirements are involved. This standard provides common denominators for subscriber line performance, independent of facility types, construction processes or equipment, and circuit provisioning methods.

IEEE 1137-1991 (R2008) Scope:

This Guide offers users assistance in controlling or modifying the inductive environment and the susceptibility of affected wire-line telecommunications facilities in order to operate within acceptable levels of steady-state or surge induced voltage of the environmental interface (probe wire) defined by IEEE Std 776. The methodology, application, and evaluation of results for mitigative techniques or devices in general are addressed for all Specific Type A and Specific Type B coordination methods also defined by IEEE Std 776.

IEEE 1692-2011 Scope:

This Guide presents engineering design guidelines for the prevention of lightning damage to communications equipment within structures.

NOTE: This document contains significant content regarding protection at sites with tower installations.

Document Maintenance:

IEEE-SA requires that SC / WG review their documents every 10 years and determine if they need to be:

- Revised
- Reaffirmed
- Withdrawn

NOTE: Documents may be opened at any time for a maintenance review.

Near-term Action Items:

- Pursue reaffirmation of 776 (Inductive Coordination).
- Initiate revision of 1137 (Inductive Coordination Techniques) to include Corrigendum 1.
- Pursue reaffirmation of 820 (Telephone Loop Performance Requirements)

NOTE: Documents may be opened at any time for a maintenance review.

Protection Engineers Group

PEG Conference

QUESTIONS, COMMENTS?...

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