



## TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

### 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
LAST REVISION DATE: September 6, 2011

This standard was reviewed and approved by key managers on September 6, 2011. Officer approval of this revision is not required.

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#### 1.0 SCOPE

- 1.1 This guide applies to the interconnection of a Utility with the Company's system via a new or existing interconnection at transmission voltages (69 kV, 138 kV, and 345 kV), in compliance with NERC Reliability Standard FAC-001-0.
- 1.2 This guide does not apply to a POI capable of bi-directional power transfer.
- 1.3 The interconnection arrangements covered in this guide are not intended to cover all possible scenarios. Interconnection scenarios that differ from the arrangements covered in this guide will be addressed on a case by case basis.
- 1.4 Company reserves the right to deviate from the requirements specified in this guide based on the circumstances specific to a given POI.
- 1.5 Interconnections will be provided in accordance with the Regulations specified herein. In the event of a conflict between this guide and the Regulations, the Regulations will control.
- 1.6 This guide is subject to revision at the sole discretion of Company. It is Utility's responsibility to request and comply with the latest revision of this guide.

#### 2.0 DEFINITIONS

- 2.1 ANSI Standards – American National Standards Institute Standards.
- 2.2 Company – Oncor Electric Delivery Company LLC or its successors and assigns.
- 2.3 Company's Facilities or Company Facilities – Company-owned electric lines, electrical equipment, protection equipment, and other facilities that function as part of Company's electric system and which must be used, installed and/or modified to deliver electrical service from Company's transmission system to the Utility's Facilities.
- 2.4 ERCOT – Electric Reliability Council of Texas.
- 2.5 ERCOT Requirements – ERCOT Nodal Protocols, ERCOT Nodal Operating Guides, ERCOT Regional Planning Group Charter and Procedures, as well as any other binding documents adopted by ERCOT relating to the interconnection and operation of Utilities in ERCOT. These documents are available on the ERCOT website at <http://www.ercot.com/>.
- 2.6 Good Utility Practice – Shall have the meaning as specified in the PUCT Substantive Rules section 25.5.
- 2.7 IEEE Standards – Institute of Electrical and Electronic Engineers Standards
- 2.8 NERC Reliability Standards – North American Electric Reliability Corporation Reliability Standards.



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- 2.9 NESC – National Electrical Safety Code, approved by the American National Standards Institute.
  - 2.10 Point of Interconnection (POI) – The point where the Company's conductors are connected to the Utility's conductors and a change of ownership occurs.
  - 2.11 PUCT – Public Utility Commission of Texas.
  - 2.12 Regulations - Laws, regulations, Tariff, and agreements applicable to the services provided under this guide.
  - 2.13 Tariff – Oncor Tariff for Transmission Service approved by the Public Utility Commission of Texas. Such Tariff is available on the Company website at <http://oncor.com/electricity/tariffs/transrates/>.
  - 2.14 Utility - Investor-owned electric utility, municipally-owned electric utility, electric cooperative, or river authority owning or operating transmission facilities in ERCOT.
  - 2.15 Utility's Facilities or Utility Facilities – Utility-owned electric lines, electrical equipment, protection equipment and other facilities that function as part of Utility's electric system and which must be used, installed and/or modified to accept electrical service from Company's Facilities.
- 3.0 NERC RELIABILITY STANDARD FAC 001 FACILITY CONNECTION REQUIREMENTS
- 3.1 Procedures for Coordinated Joint Studies

Company will perform assessments of the reliability impacts of new Points of Interconnection, or changes to existing Points of Interconnection, in accordance with the Oncor Electric Delivery Transmission Planning Procedures. Such procedures are available upon request.
  - 3.2 Procedures for Notification of New or Modified Facilities
    - 3.2.1 Utility and Company will notify ERCOT of new or modified transmission facilities as required by the ERCOT Nodal Protocols section 3.10.
    - 3.2.2 Company will provide advance notice to ERCOT of its future plans to make such changes in accordance with Company Standard 0107 NOMCR Process. At the time such changes are to be made, Company will obtain approval from ERCOT for such changes and will notify ERCOT when such changes are implemented, both in accordance with Company's Transmission Grid Management Guide T-011 System Change Process.
  - 3.3 Voltage Level and MW and MVAR Demand
    - 3.3.1 Company's transmission voltages are 69 kV, 138 kV, and 345 kV. The actual voltage for a Point of Interconnection will be determined through analyses performed by Company. Not all voltages may be available to Utility at its location.



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- 3.3.2 Utility will provide its load information in accordance with section 4.1 below.
- 3.3.3 Utility will comply with section 3.9 below with respect to MVAR demand.
- 3.4 Breaker Duty and Surge Protection
  - 3.4.1 Utility will comply with section 5.2.1 below.
  - 3.4.2 Utility's transmission voltage facilities directly connecting to the POI should meet the applicable IEEE Standards for direct lightning stroke shielding and surge arrester protection including but not necessarily limited to IEEE Standards 998 and C62.22.
- 3.5 System Protection and Coordination

Utility will comply with the provisions regarding system protection, as specified in section 7 below.
- 3.6 Metering and Telecommunications
  - 3.6.1 Metering equipment will be installed, operated, and maintained in accordance with the Tariff, applicable ERCOT Requirements, including, but not limited to, the applicable metering requirements contained in the ERCOT Nodal Operating Guides and the ERCOT Nodal Protocols.
  - 3.6.2 Telecommunications equipment will be installed as specified in the Interconnection Agreement.
- 3.7 Grounding and Safety Issues
  - 3.7.1 Utility will ground its transmission voltage equipment at the POI in accordance with applicable IEEE Standards including but not necessarily limited to IEEE Standard 80.
  - 3.7.2 Utility and Company will coordinate switching and tagging of switches at a POI in accordance with Company's switching procedures. Such procedures will be made available to Utility upon request.
- 3.8 Insulation and Insulation Coordination

Utility will meet the applicable requirements of the applicable IEEE Standards with respect to insulation, insulation coordination, and electrical clearances for its facilities at the POI, including but not necessarily limited to IEEE Standards 1313.1, 1313.2, and 1427.
- 3.9 Voltage, Reactive Power, and Power Factor Control

Utility will comply with the provisions of the Tariff and the ERCOT Requirements, as they relate to a Utility's obligations with respect to voltage, reactive power, and power factor



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control, including but not necessarily limited to the following sections of the ERCOT Nodal Operating Guides: 2.7 and the following sections of the ERCOT Nodal Protocols: 3.15.2.

#### 3.10 Power Quality Impacts

Utility will comply with the applicable provisions of the Tariff, including section 4.6.2.2, with respect to adverse impacts upon Company's system and any applicable provisions of the interconnection agreement.

#### 3.11 Equipment Ratings

Utility's equipment will be rated in accordance with applicable ANSI Standards, including but not necessarily limited to ANSI Standards C84.1 and C92.2, and in accordance with ERCOT Requirements including but not limited to section 3.7.4 of the ERCOT Nodal Operating Guides.

#### 3.12 Maintenance Coordination

Utility and Company will coordinate maintenance of transmission facilities in accordance with the ERCOT Requirements, including but not necessarily limited to section 3.1 of the ERCOT Nodal Protocols.

#### 3.13 Operational Issues (abnormal frequency and voltages)

3.13.1 Regarding abnormal voltage issues, Utility will comply with the applicable provisions of the ERCOT Requirements including but not necessarily limited to section 2.7 of the ERCOT Nodal Operating Guides.

3.13.2 ERCOT is responsible for managing frequency, and Utility will participate in the shedding of firm load to support frequency to the extent it is required to do so by the applicable requirements of the ERCOT Requirements including but not necessarily limited to sections 2.6 and 4.5 of the ERCOT Nodal Operating Guides and section 6.5.9.4 of the ERCOT Nodal Protocols.

#### 3.14 Inspection Requirements

Utility shall have the responsibility for inspecting facilities it owns to determine if such facilities have been constructed in accordance with all requirements applicable to such facilities.

#### 3.15 Communications and Procedures during normal and emergency operating conditions

Utility shall have a control center that is staffed on a 24/7 basis with personnel capable of making operating decisions and possessing the ability to effect control of its facilities at each POI.



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#### 4.0 UTILITY INFORMATION

- 4.1 Utility will provide the following information to Company and secure from Company a commitment to interconnect Utility's Facilities with Company's Facilities prior to Utility finalizing the design of Utility's Facilities.
- 4.1.1 Desired in-service date for requested POI.
  - 4.1.2 Physical location of proposed POI.
  - 4.1.3 Company's transmission line structure number for each structure on either side of the proposed POI if Utility's requested POI is to an existing transmission circuit.
  - 4.1.4 Voltage at which interconnection is being requested.
  - 4.1.5 Length and calculated positive and zero sequence impedance of the transmission line extension from the POI, if Utility plans to build a line extension.
  - 4.1.6 One line electrical diagram of proposed Utility Facilities, both initial and ultimate.
  - 4.1.7 Proposed transformer ratings including:
    - Voltages and winding connections
    - MVA (both base and maximum ratings)
    - Impedances (both positive and zero sequence at base rating)
  - 4.1.8 Initial and five year load projections (MW) including peak load power factor at the POI.
  - 4.1.9 List of all motors greater than 500 horsepower associated with the load addition and the following information for each motor listed:
    - Horsepower rating of each motor
    - Code (A, B, C, D, etc.)
    - Rated voltage
    - Minimum starting voltage
  - 4.1.10 Size, voltage, and impedance of any step down transformers
  - 4.1.11 Special service requirements
  - 4.1.12 Relay functional diagram of Utility's proposed facilities for Company's review. Relay functional will specifically include all facilities that may impact Company's system and relaying performance.
  - 4.1.13 Drawings of proposed physical facilities, including initial installation and any anticipated future additions.
  - 4.1.14 Surveyed or detailed site plan showing proposed Utility Facilities in proximity to existing Company Facilities.



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#### **5.0 CONSTRUCTION AND OWNERSHIP**

##### **5.1 Company's Facilities**

- 5.1.1 Company's Facilities will be designed, installed, owned, and operated by Company. Company will perform all maintenance work related to Company's Facilities.
- 5.1.2 A written interconnection agreement is required to establish a Point of Interconnection. Company will have no obligation to begin design, procurement of materials, construction of Company's Facilities, nor make other project specific improvements until Utility and Company have completed contractual arrangements.
- 5.1.3 Company will not begin construction of Company's Facilities within Utility's property until any required easement and/or right of way has been provided, the required environmental site assessments have been made, and the required permitting requirements have been met.
- 5.1.4 At Points of Interconnection where existing Company Facilities are not equipped with ac and/or dc service and new Company Facilities will require ac and/or dc service and Utility's Facilities are or will be equipped with ac and/or dc service, Utility will, if requested by Company, provide the necessary ac and/or dc service to Company's Facilities at no cost to Company.

##### **5.2 Utility's Facilities**

- 5.2.1 Utility will be responsible for the design, installation, ownership, operation, and protection of Utility's Facilities. Utility's protective equipment will be fully rated to interrupt available fault current (See Section 7).
- 5.2.2 Design of Utility's Facilities is subject to Company's review as to suitability for safe, compatible, and reliable operation with Company's system so as not to reduce or adversely impact the quality of electric service being provided by Company to all entities connected to its system.
- 5.2.3 Utility's Facilities will be constructed and operated in accordance with an interconnection agreement between Company and Utility and the Tariff.
- 5.2.4 Utility will submit to Company proposed modifications to Utility Facilities prior to making the modifications so that Company can determine if the proposed modifications will impact Company Facilities.
- 5.2.5 A manual or motor operated switch with visible break for the purpose of isolating Utility's Facilities from Company's Facilities will be provided by Utility. The switch location is shown in Figure 1. Such switch shall be accessible to Company personnel for operation at all times, and capable of being locked in an open position by Company and Utility. (See Section 7.1.3)
- 5.2.6 Utility will design and construct the Utility Facilities at the POI, and those Utility Facilities having an impact on Company Facilities, in accordance with the applicable provisions of the following: ERCOT Requirements, NERC Reliability



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Standards, ANSI Standards, IEEE Standards, NESC, Tariff, Good Utility Practice, and laws and regulations

#### **6.0 OPERATIONAL REQUIREMENTS**

6.1 Operating Provisions governing the interconnected operations between Company's Facilities and Utility's Facilities when Utility's Facilities will consist of multiple substation transformers connected to multiple transmission lines will be in accordance with this guide, Company procedures, and Regulations. Figure 2 is a typical representation of this type of interconnection.

6.1.1 In the event of a scheduled outage of a Utility substation transformer or a Point of Interconnection, if Company's transmission system conditions permit, Company's transmission system dispatcher will permit Utility to transfer all or a part of its load from one Utility substation transformer to a Utility substation transformer connected to another transmission line by paralleling the secondary sides of the transformers, but only if appropriate relaying is in service in Utility's substation to either limit the closed transition load transfer time or to restrict reverse power flow through the transformers in accordance with Company's guidelines. Utility shall not parallel the secondary sides of Utility substation transformers connected to different transmission lines without the approval of Company's transmission system dispatcher. Company will make reasonable efforts to support such request to transfer load. Utility's load-side bus-tie device used to transfer Utility's substation load between transformers connected to different transmission lines shall normally be operated in the open position.

6.1.2 In the event a Utility substation transformer or a Point of Interconnection is de-energized due to an unscheduled event, Utility may transfer all or a part of its load from the de-energized transformer to a Utility substation transformer connected to another transmission line without Company's transmission system dispatcher's prior approval, but only after the Utility opens a circuit breaker or switch to isolate the Utility's substation load from the de-energized transformer. In the event Utility transfers its load in accordance with this paragraph, Utility shall notify Company's transmission system dispatcher of the load transfer as soon as reasonably possible after the transfer takes place.

6.1.3 Company reserves the right to demand Utility, and Utility shall comply with such demand, to remove all or a part of Utility's load from a Point of Interconnection, including load normally served from a Point of Interconnection and load transferred to a Point of Interconnection upon Company's approval, if Company believes that conditions exist which, in accordance with Good Utility Practice, may endanger persons or property.

#### **7.0 SYSTEM PROTECTION REQUIREMENTS (See Figure 3)**

##### **7.1 General System Protection Requirements**

7.1.1 Company will determine requirements for relaying protection of Company's Facilities and will specify and implement protection and control schemes to meet such requirements. Company will work with the Utility to determine protection



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requirements of Utility's Facilities necessary to provide coordination with protection of Company's Facilities.

- 7.1.2 Utility is responsible for the installation and maintenance of at least two separate fault sensing and clearing schemes. Each scheme will have its own lockout relay.
- 7.1.3 Utility will provide equipment necessary to automatically disconnect Utility's substation transformer, and/or any other equipment beyond the transformer, from Company's Facilities in the event of a fault on Utility's Facilities detected by the primary and/or backup protection scheme. The primary clearing device will complete a disconnection within 0.133 seconds (8 cycles). The backup disconnect device will visibly isolate the faulted equipment within 5 seconds, coordinate with Company's system, and not adversely affect other entities. A motor-operated disconnect switch meets the visible backup disconnect device requirement if the HSI is a circuit breaker. A circuit switcher that incorporates a motor-operated air break switch also meets the requirement of an HSI and a visible backup disconnect device. If the HSI is a fuse, the visible backup disconnect device is not required to be motor-operated. Utility will be responsible for all risk associated with the exposure to ferroresonance, if fuses are used. To insure coordination, Company will review Utility's choice of disconnect device. (see Figure 3)
- 7.1.4 Utility will provide relay settings and relay testing documentation to Company certifying that all protection equipment has been properly adjusted and trip tested before Utility's Facilities are placed in service.
- 7.1.5 Utility's protection equipment will be maintained in service at all times that Utility's Facilities are connected to Company's Facilities.
- 7.2 POI and Utility Substation Adjacent to Existing Line (See Figure 4)
  - 7.2.1 Company will install a full tension conductor dead-end structure in the Company's transmission line if a tap point is required. Company will also own all facilities in Company's through flow transmission current path. All switches in Company's through flow path will be operated by or under the dispatch authority of Company. The Utility's line extension will contact Company Facilities at slack tension. Exact tension requirements will be determined for each installation.
  - 7.2.2 Interconnection to Transmission Line with Carrier Relaying - Although it rarely occurs, the location of a POI on Company's transmission system along with the characteristics of the Utility's transformer may result in a situation where the transmission line's power line carrier signal is shorted to ground by the Utility's transformer. If normal mitigating techniques do not resolve this problem Company may install a wave trap at the POI. To accommodate this possibility, Utility's Facilities design will provide space for the installation of such wave trap.
- 7.3 POI and Utility Substation Adjacent to Company's Substation or Switching Station. (See Figure 5)

The standard interconnection will be to tap a Company transmission circuit outside the Company's substation or switching station to establish the POI. However, if it becomes





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necessary to connect the POI directly to Company's substation or switching station bus, Utility will install the system protection equipment specified in Section 7.1. In addition, depending on the Company's bus differential protection scheme, Company may require Utility's Facilities to include Company specified current transformers for inclusion in the bus differential scheme. When Utility Facilities are included in the Company's bus differential scheme or when any control wiring is shared between the Company and Utility Facilities the Company's and Utility's station ground grids must be interconnected.

#### 7.4 POI With Utility Substation Remote From Company's Existing Line

##### 7.4.1 Case 1

Assumptions:

- Line extension does not exceed 1000 feet.  
No carrier relaying on Company's existing line.

##### 7.4.1.1 Minimum Requirements at the POI (See Figure 6)

A. Utility equipment:

- An air switch for isolation of Utility's Facilities from Company's Facilities.

B. Company equipment:

- Air switches to sectionalize Company's existing line.

##### 7.4.1.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

##### 7.4.2 Case 2

Assumptions:

- Utility's line extension exceeds 1,000 feet.
- No carrier relaying on Company's existing line.
- Company's line relaying can adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.

##### 7.4.2.1 Minimum Requirements at the POI (See Figure 7)

A. Utility equipment:

- A circuit breaker.
- An air switch for isolation of Utility's Facilities from Company's Facilities.
- Instantaneous phase and ground relays to detect faults to the end of Utility's line extension. These relays will be connected to trip the Utility's breaker with no additional delay.



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- B. Company equipment:
- Air switches to sectionalize Company's existing line.

#### 7.4.2.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

#### 7.4.3 Case 3

Assumptions:

- Utility's line extension exceeds 1,000 feet.
- No carrier relaying on Company's existing line.
- No end users with critical processes exist in the area of influence.
- Company's line relaying cannot adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.

#### 7.4.3.1 Minimum Requirements at the POI (See Figure 8)

A. Utility equipment:

- A circuit breaker.
- A motor operated air switch (MOAS) for isolation of Utility's Facilities from Company's Facilities.
- A single-phase high speed grounding switch connected on the Utility's side of the isolating MOAS.
- Instantaneous phase and ground relays to detect faults to the end of Utility's line extension. These relays will be connected to trip the Utility's breaker with no additional delay.
- Backup phase and ground relays to provide breaker failure protection. The backup protection will be connected to trip the MOAS and the high speed grounding switch.

B. Company equipment:

- Air switches to sectionalize Company's existing line.

#### 7.4.3.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

#### 7.4.4 Case 4

Assumptions:

- Line extension does not exceed 1000 feet.
- Carrier relaying on Company's existing line.
- Company's line relaying can adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.



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#### 7.4.4.1 Minimum Requirements at the POI (See Figure 9)

##### A. Utility equipment:

- An air switch for isolation of Utility's Facilities from Company's Facilities.

##### B. Company equipment:

- Air switches to sectionalize Company's existing line.
- Wave trap if required (See Section 7.2.2.)

#### 7.4.4.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

#### 7.4.5 Case 5

##### Assumptions:

- Utility's line extension exceeds 1,000 feet.
- Carrier relaying on Company's existing line.
- Company's line relaying can adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.

#### 7.4.5.1 Minimum Requirements at the POI (See Figure 10)

##### A. Utility equipment:

- A circuit breaker.
- A motor-operated air switch (MOAS) for isolation of Utility's Facilities from Company's Facilities.
- Instantaneous phase and ground relays to detect faults to the end of Utility's line extension. These relays will be connected to trip the Utility's breaker with no additional delay.
- Backup phase and ground relays to provide breaker failure protection. The backup protection will be connected to trip the MOAS.
- Carrier equipment to establish a carrier blocking terminal. The blocking terminal is installed to prevent Company's remote terminals from tripping on high speed carrier relaying when a fault occurs on Utility's line extension.

##### B. Company equipment:

- Air switches to sectionalize Company's existing line.

Note: If the POI is close to one of Company's remote terminals so as to negatively impact the use of Company's zone one relaying, Company may delay zone one and ground relaying to allow the Utility's relays at the POI time to initiate tripping.



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#### 7.4.5.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

#### 7.4.6 Case 6

Assumptions:

- Utility's line extension exceeds 1,000 feet
- Carrier relaying on Company's existing line.
- No Utilities with critical processes exist in the area of influence.
- Company's line relaying cannot adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.

#### 7.4.6.1 Minimum Requirements at the POI (See Figure 11)

A. Utility equipment:

- A circuit breaker.
- A motor-operated air switch (MOAS) for isolation of Utility's Facilities from Company's Facilities.
- A single-phase high speed grounding switch connected on the Utility's side of the isolating MOAS.
- Instantaneous phase and ground relays to detect faults to the end of Utility's line extension. These relays will be connected to trip the Utility's breaker with no additional delay.
- Backup phase and ground relays to provide breaker failure protection. The backup protection will be connected to trip the MOAS and the high speed grounding switch.
- Carrier equipment to establish a carrier blocking terminal. The blocking terminal is installed to prevent Company's remote terminals from tripping on high speed carrier relaying when a fault occurs on Utility's line extension.

B. Company equipment:

- Air switches to sectionalize Company's existing line.

Note: If the POI is close to one of Company's remote terminals so as to negatively impact the use of Company's zone one relaying, Company may delay zone one and ground relaying to allow the Utility's relays at the POI time to initiate tripping.

#### 7.4.6.2 Minimum Requirements at Utility's remote substation (See Figure 3)

Utility will install equipment in accordance with Section 7.1.

#### 7.4.7 Case 7

Assumptions:

- Utility's line extension exceeds 1,000 feet.



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- Carrier relaying on Company's existing line.
- Utilities with critical processes exist in the area of influence.
- Company's line relaying cannot adequately detect faults to the end of Utility's transmission line extension without significant degradation to the protection and without restricting loading of Company's existing line.

#### 7.4.7.1 Minimum Requirements at the POI (See Figure 12)

##### A. Utility equipment:

- A circuit breaker.
- A motor-operated air switch (MOAS) for isolation of Utility's Facilities from Company's Facilities.
- Instantaneous phase and ground relays to detect faults to the end of Utility's line extension. These relays will be connected to trip the Utility's breaker with no additional delay.
- Backup phase and ground relays to provide breaker failure protection. The backup protection will be connected to trip the MOAS and initiate transfer trip to Company's remote terminal(s).
- Carrier equipment to establish a carrier blocking terminal. The blocking terminal is installed to prevent Company's remote terminals from tripping on high speed carrier relaying when a fault occurs on Utility's line extension.
- Transfer trip transmitter and associated equipment

##### B. Company equipment:

- Air switches to sectionalize Company's existing line.
- Transfer trip equipment at the Company's remote terminal(s).

Note: If the POI is close to one of Company's remote terminals so as to negatively impact the use of Company's zone one relaying, Company may delay zone one and ground relaying to allow the Utility's relays at the POI time to initiate tripping.

#### 7.4.7.2 Minimum Requirements at Utility's remote substation (See Figure 3)

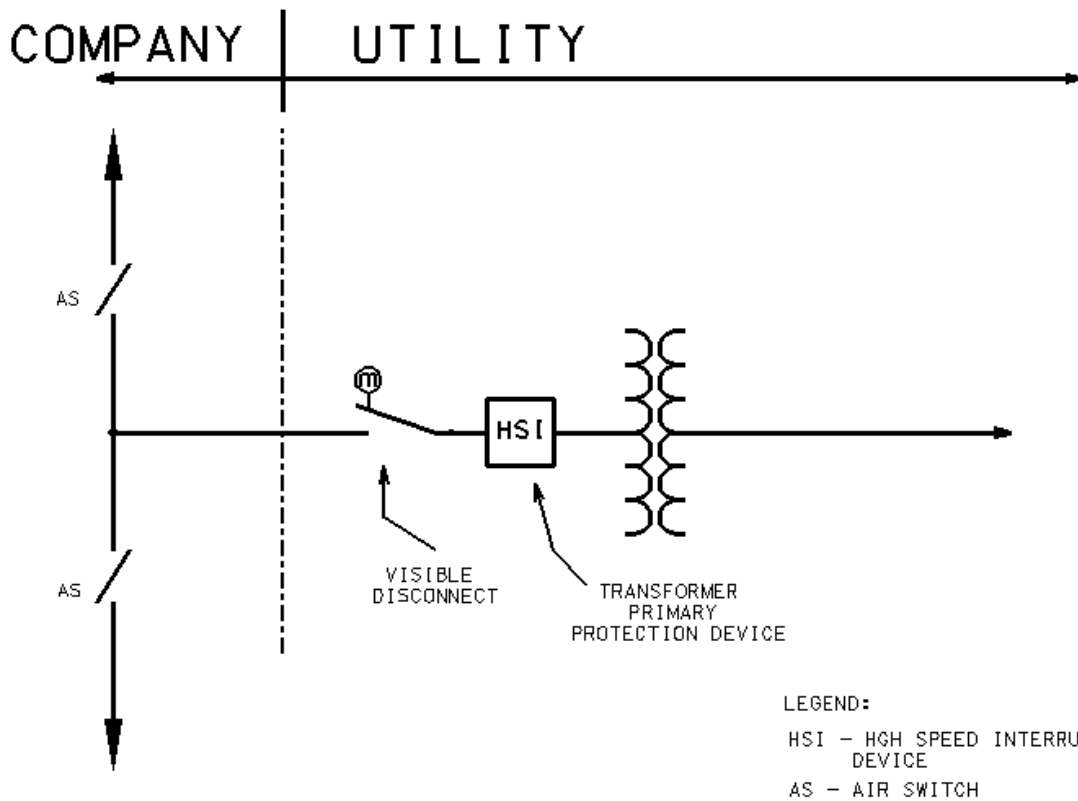
Utility will install equipment in accordance with Section 7.1.

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Figure 1

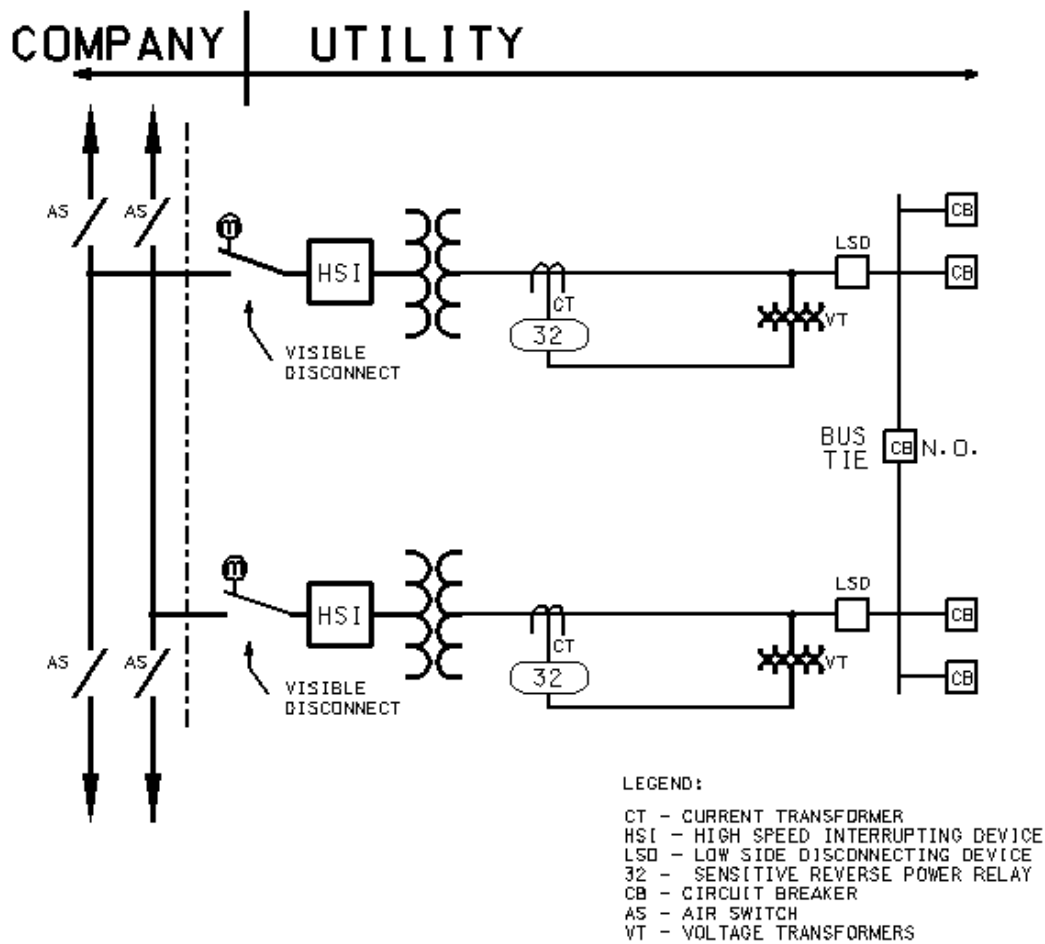


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Figure 2

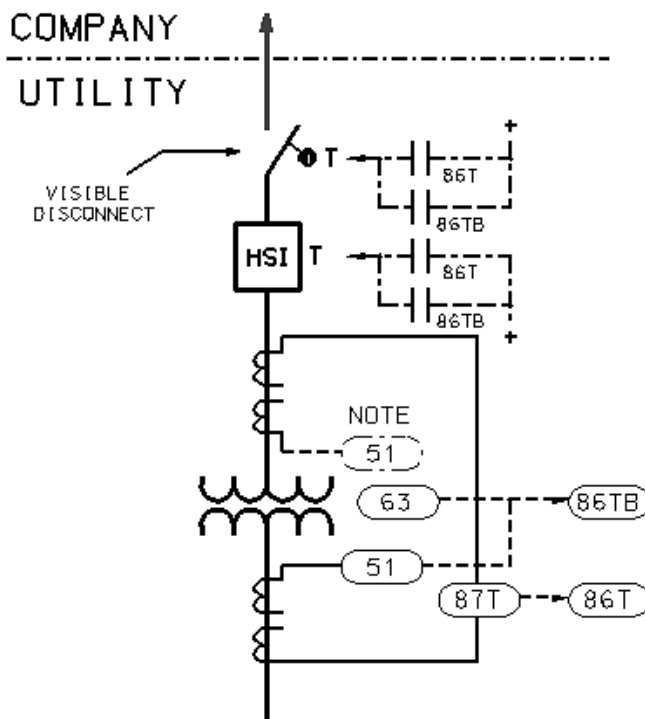


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Figure 3



NOTE:  
ALTERNATE LOCATION FOR 51 RELAY

LEDGEND:

- 87T TRANSFORMER DIFFERENTIAL RELAY
- 63 RATE OF RISE OF PRESSURE RELAY
- 51 OVER-CURRENT RELAY
- 86T LOCKOUT RELAY
- 86TB LOCKOUT RELAY
- HSI HIGH SPEED INTERRUPTING DEVICE

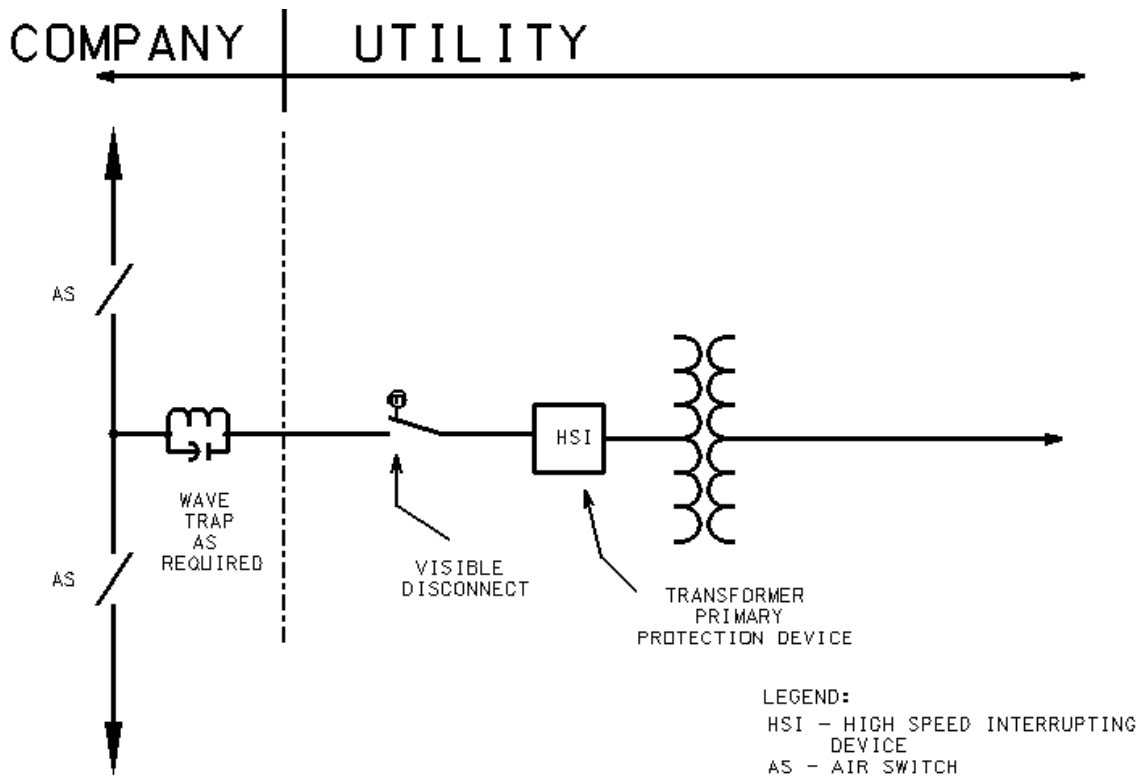


# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
LAST REVISION DATE: September 6, 2011

Figure 4

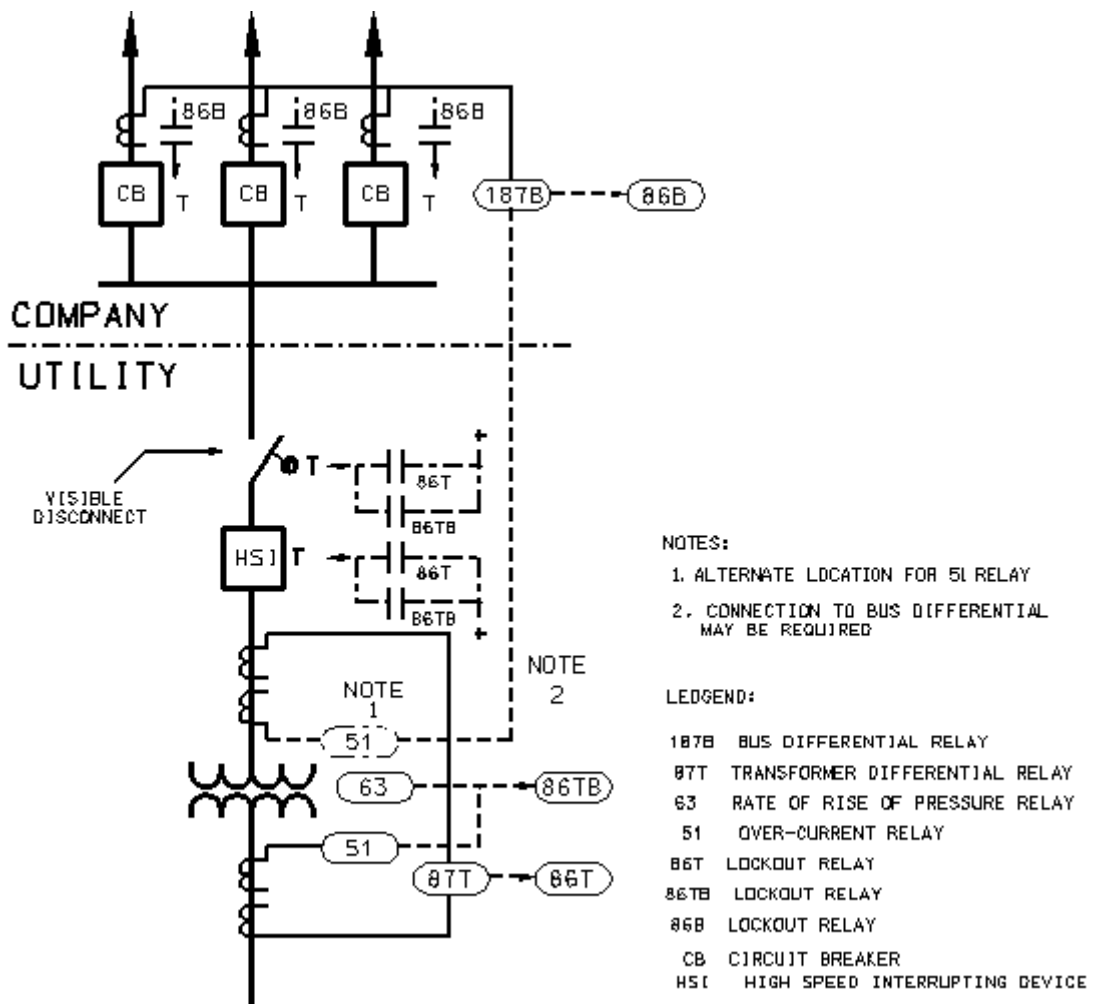


# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

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Figure 5

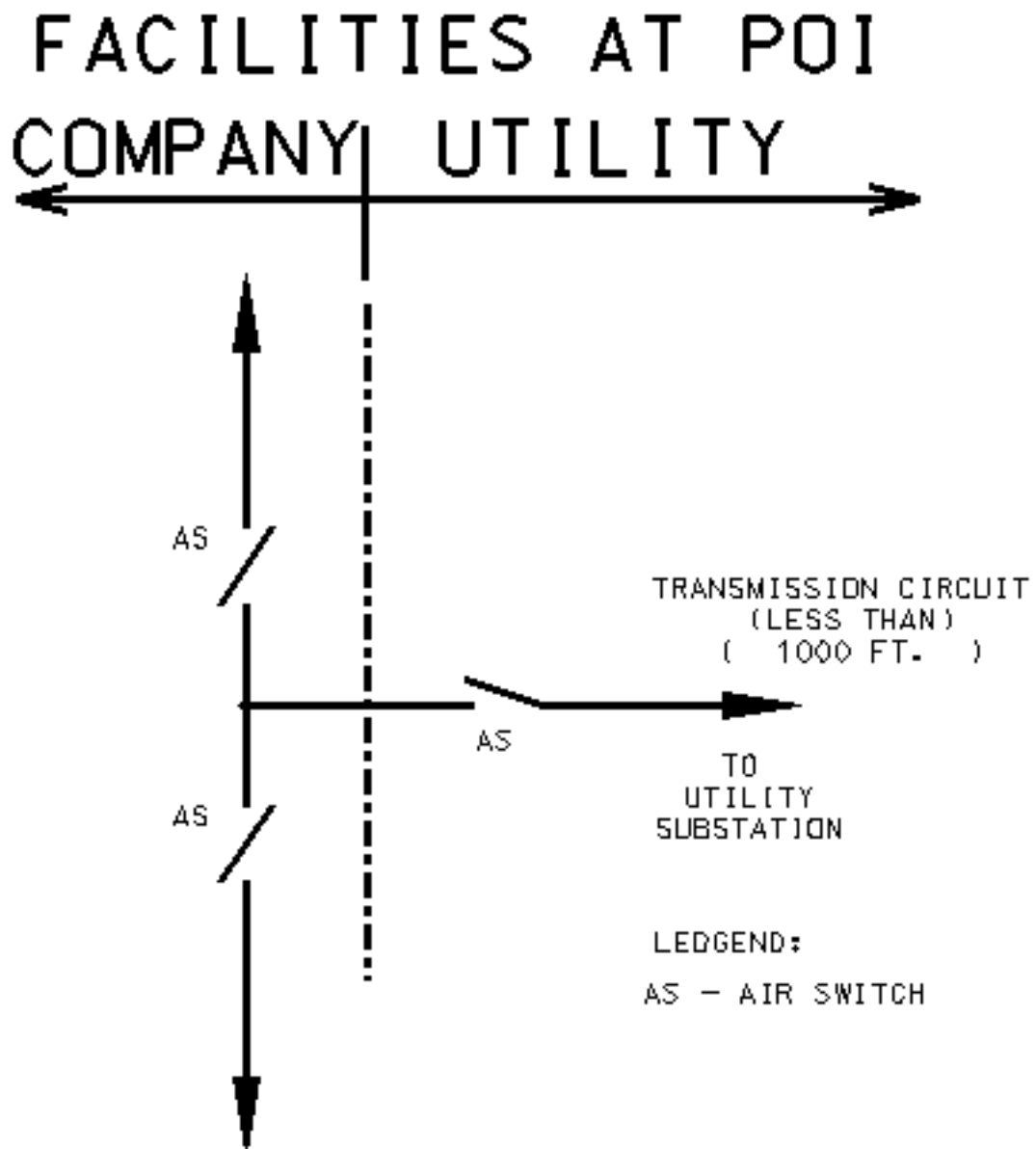


# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

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Figure 6

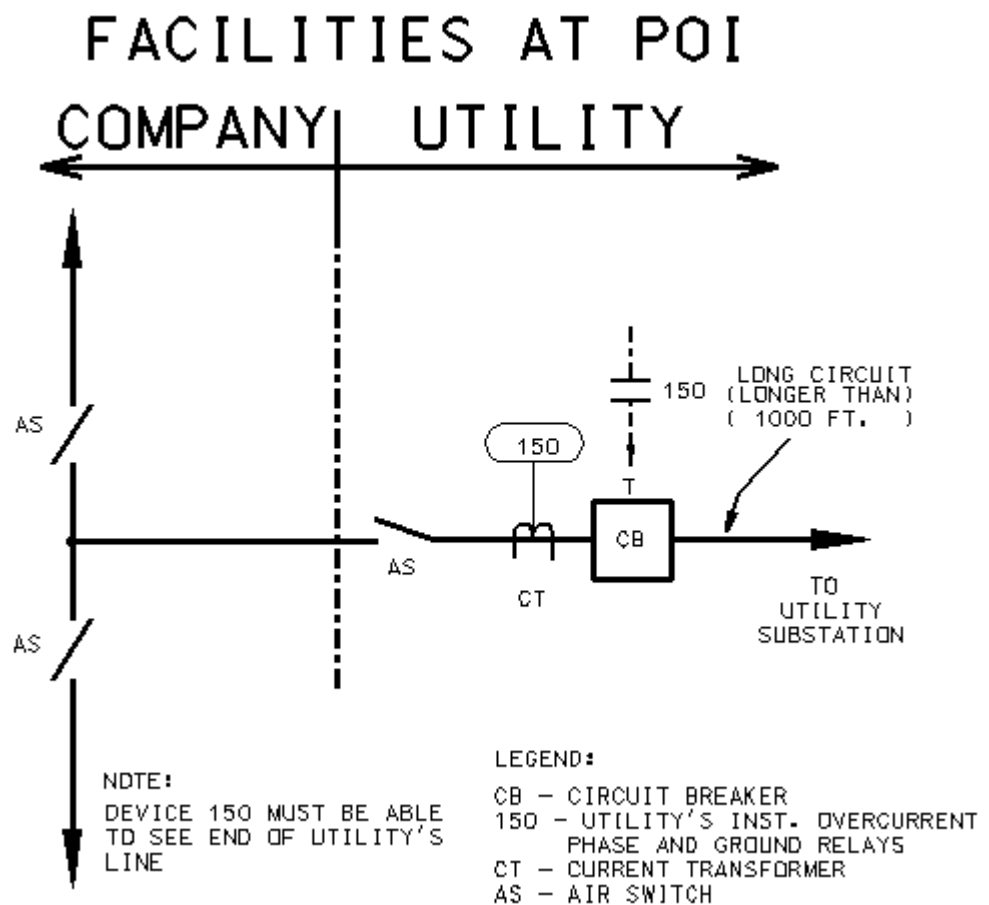


# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

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Figure 7

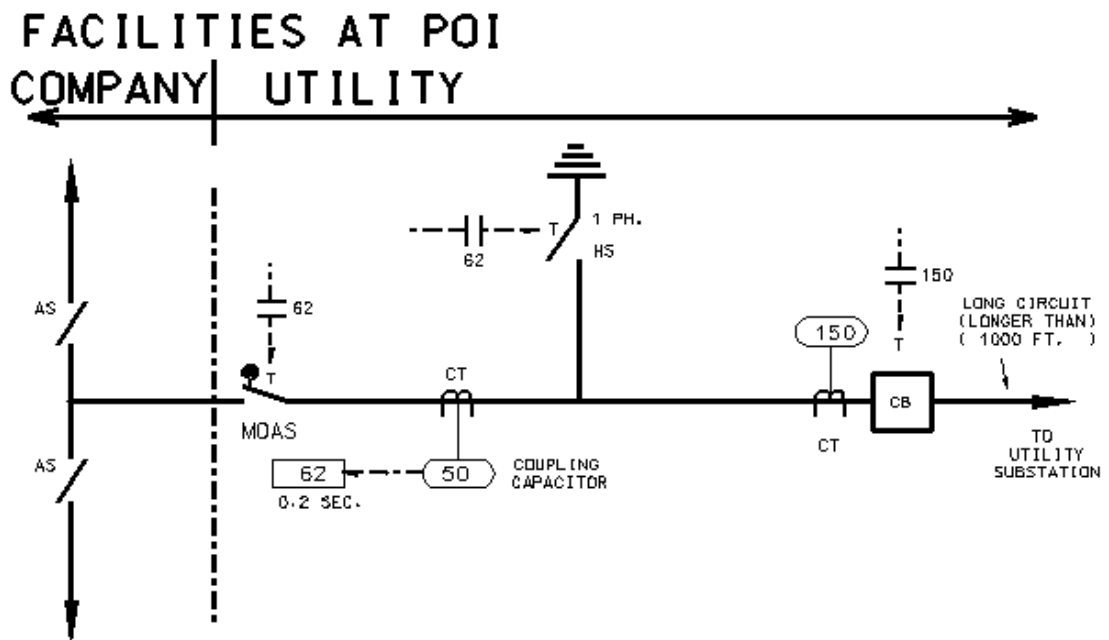


# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
LAST REVISION DATE: September 6, 2011

Figure 8



NOTE:  
DEVICE 50 AND 150 MUST BE ABLE  
TO SEE END OF UTILITY'S LINE

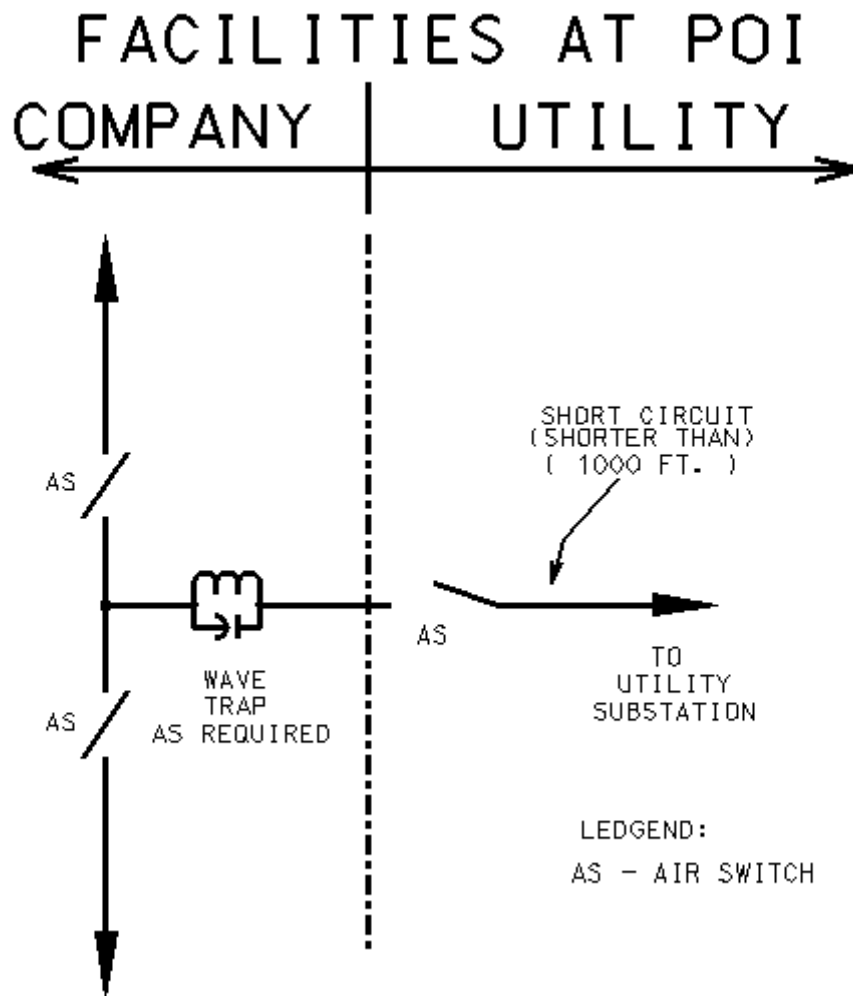
LEGEND:  
CB - CIRCUIT BREAKER  
150 - UTILITY'S INST. OVERCURRENT PHASE AND  
GROUND RELAYS  
50 - UTILITY'S BACK UP INST. OVERCURRENT PHASE AND  
GROUND RELAYS  
62 - BREAKER FAILURE BACKUP TIMER  
MDAS - MOTOR OPERATED AIR SWITCH  
HS - HIGH SPEED SINGLE PHASE GROUND SWITCH  
CT - CURRENT TRANSFORMER  
AS - AIR SWITCH

# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
LAST REVISION DATE: September 6, 2011

Figure 9

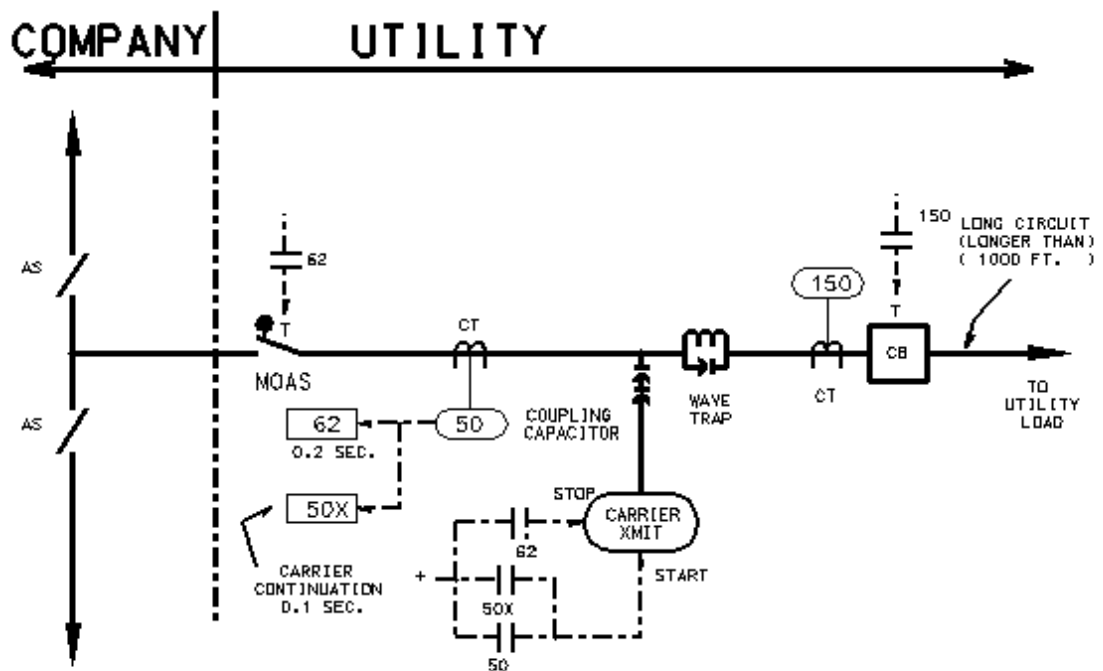


## TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

### 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
 LAST REVISION DATE: September 6, 2011

Figure 10



NOTE:  
 DEVICE 50 AND 150 MUST BE ABLE  
 TO SEE END OF UTILITY'S LINE

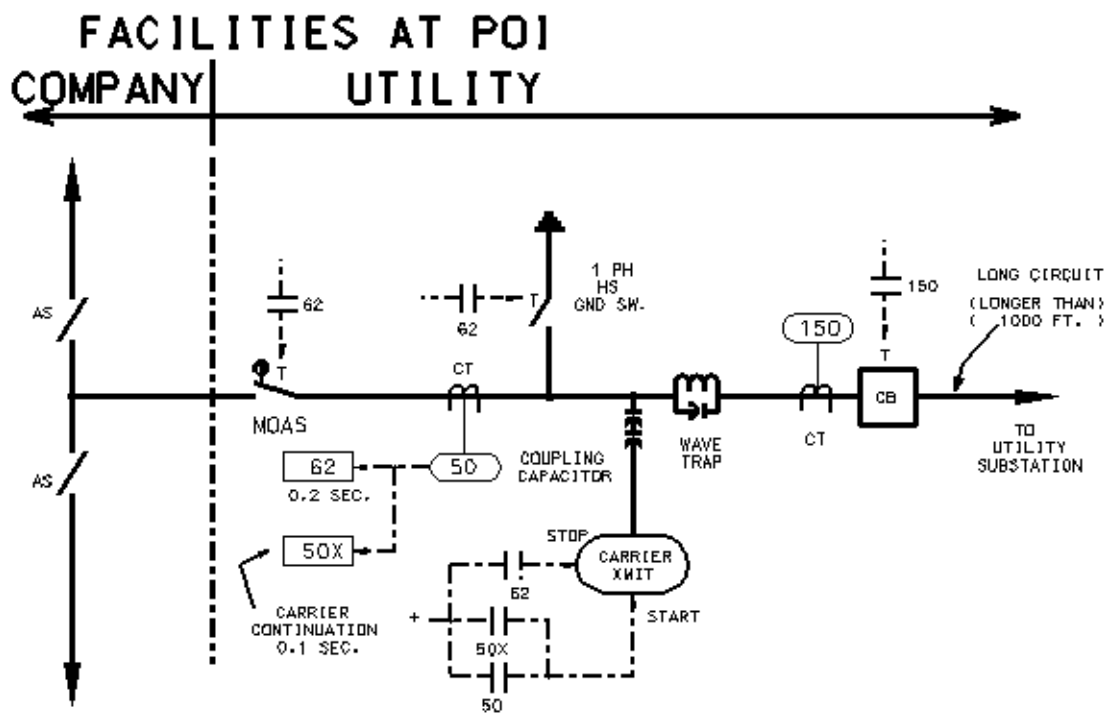
LEGEND:  
 CB - CIRCUIT BREAKER  
 150 - UTILITY'S INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50 - UTILITY'S BACK UP INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50X - APPROXIMATELY 0.1 SECOND CARRIER CONTINUATION  
 LOGIC  
 62 - BREAKER FAILURE BACKUP TIMER  
 MOAS - MOTOR OPERATED AIR SWITCH  
 CT - CURRENT TRANSFORMER  
 AS - AIR SWITCH

# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

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Figure 11



NOTE:  
 DEVICE 50 AND 150 MUST BE ABLE  
 TO SEE END OF UTILITY'S LINE

LEGEND:  
 CB - CIRCUIT BREAKER  
 150 - UTILITY'S INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50 - UTILITY'S BACK UP INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50X - APPROXIMATELY 0.1 SECOND CARRIER CONTINUATION  
 LOGIC  
 62 - BREAKER FAILURE BACKUP TIMER  
 MOAS - MOTOR OPERATED AIR SWITCH  
 CT - CURRENT TRANSFORMER  
 AS - AIR SWITCH

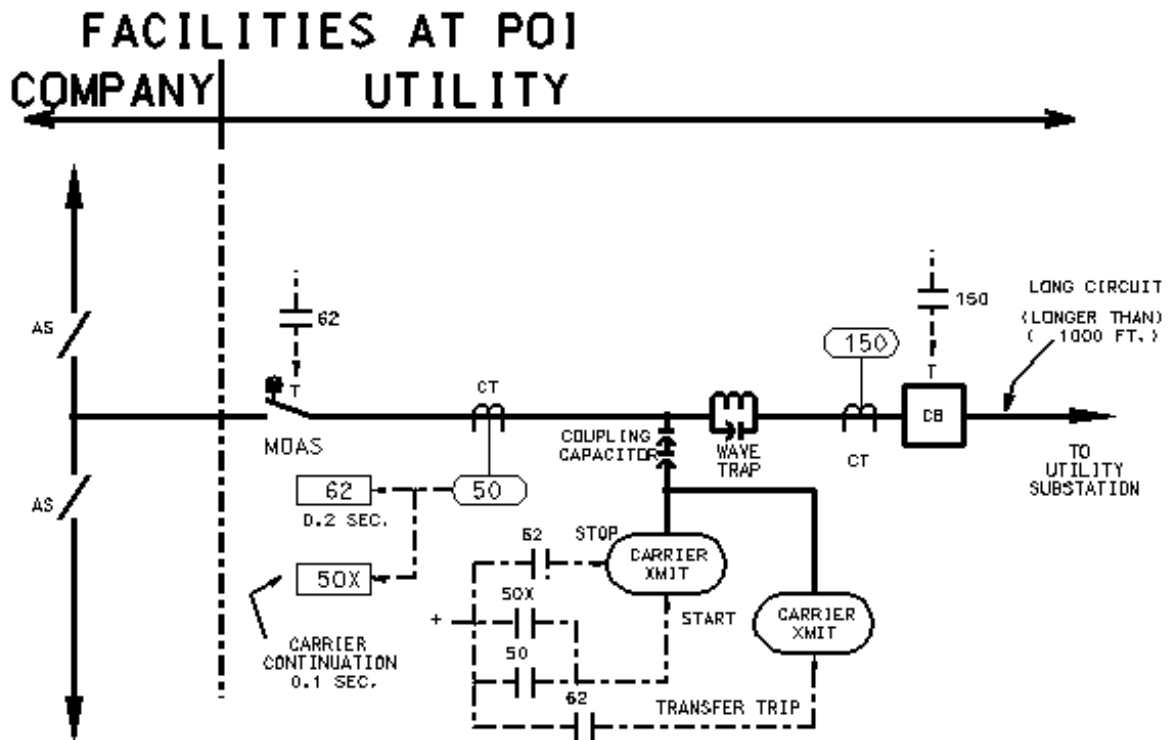


## TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

### 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
 LAST REVISION DATE: September 6, 2011

Figure 12



NOTE:  
 DEVICE 50 AND 150 MUST BE ABLE  
 TO SEE END OF UTILITY'S LINE

LEGEND:  
 CB - CIRCUIT BREAKER  
 150 - UTILITY'S INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50 - CUSTOMER'S BACK UP INST. OVERCURRENT  
 PHASE AND GROUND RELAYS  
 50X - APPROXIMATELY 0.1 SECOND CARRIER CONTINUATION  
 LOGIC  
 62 - BREAKER FAILURE BACKUP TIMER  
 MOAS - MOTOR OPERATED AIR SWITCH  
 CT - CURRENT TRANSFORMER  
 AS - AIR SWITCH



# TRANSMISSION ENGINEERING STANDARDS SUBSTATIONS

## 500-250 Guideline – Facility Connection Requirements for Radial Points of Interconnection at Transmission Voltages with Utilities

INITIAL RELEASE DATE: March 11, 1991  
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### REVISION HISTORY (most recent listed first)

Revision Date	Revision Request Number	Changes Made by	Summary of Changes	Background/Historical Information
9-6-11	S-00175	Jeff Herring	Updated guideline to reflect the transition from ERCOT Operating Guides and ERCOT Protocols to the ERCOT Nodal Operating Guides and ERCOT Nodal Protocols.	9-6-11 -- key manager approval; officer approval not required for this revision.
7-28-10	N/A	B. Dietzman	Guidelines revised to comply with NERC Standard FAC-001-0 - Facility Connection Requirements.	Initial release and officer approval - 7-28-2010.
9-11-08	F-00102	Libby Smith	Template format change – added “Oncor Proprietary Information”	
9-10-07		Libby Smith	Template format changes	
12-30-05		Rafael Garcia	Better define the differences between retail customers and non retail customers and to provide better guidance on allowable interconnections to Jeff Herring’s group who has to deal with the customers up front. The original 500-250 was split into 500-250 and 500-251.	