NERC

NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Transmission Availability Data System

Data Reporting Instructions

Effective: January 2025

RELIABILITY | RESILIENCE | SECURITY

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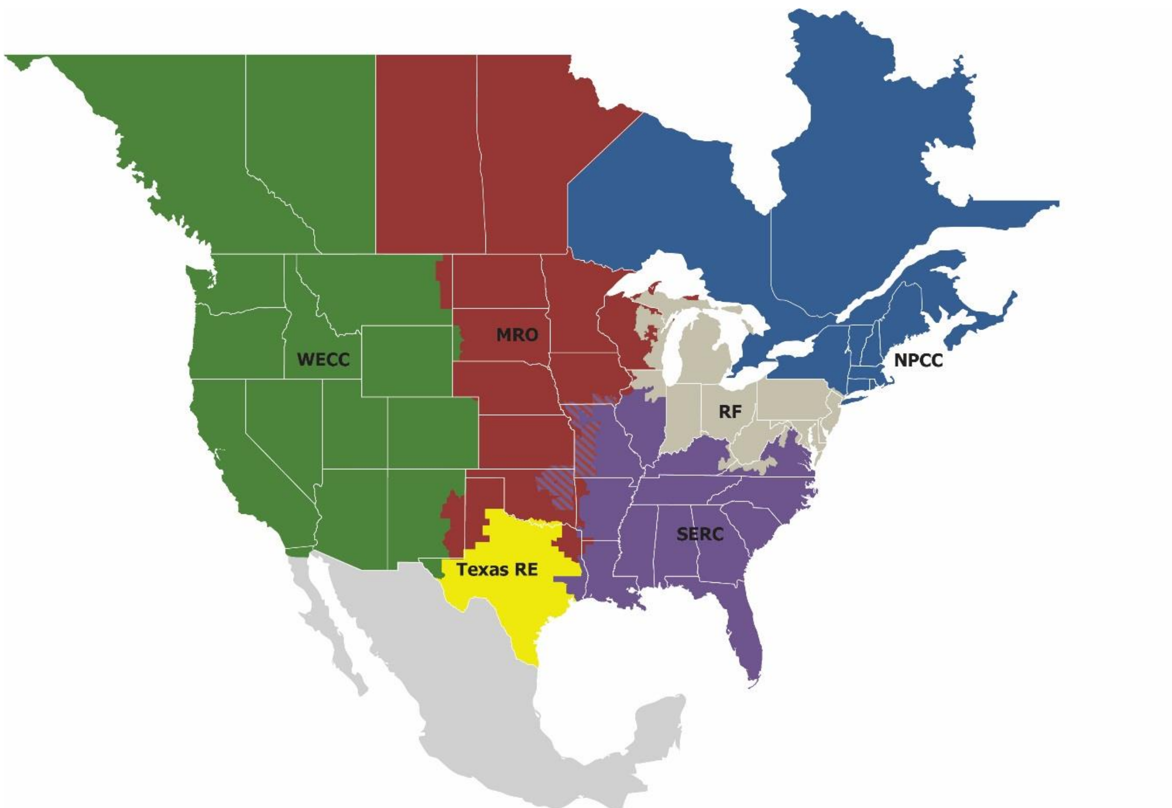
Preface

Electricity is a key component of the fabric of modern society and the Electric Reliability Organization (ERO) Enterprise serves to strengthen that fabric. The vision for the ERO Enterprise, which is comprised of NERC and the six Regional Entities, is a highly reliable, resilient, and secure North American bulk power system (BPS). Our mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

Reliability | Resilience | Security
Because nearly 400 million citizens in North America are counting on us

The North American BPS is made up of six Regional Entities as shown on the map and in the corresponding table below. The multicolored area denotes overlap as some load-serving entities participate in one Regional Entity while associated Transmission Owners/Operators participate in another.



MRO	Midwest Reliability Organization
NPCC	Northeast Power Coordinating Council
RF	ReliabilityFirst
SERC	SERC Reliability Corporation
Texas RE	Texas Reliability Entity
WECC	WECC

Introduction

Background

Transmission Availability Data Systems (TADS) Data Reporting Instructions (DRI) were developed to assist TO personnel in reporting information to NERC's TADS reporting applicaion. These instructions detail the procedures, schedule, and format to follow when reporting data.

Who Must Report

Reporting of transmission performance and inventory data is mandatory for all NERC registered TOs. TADS outage data is due 45 days after the end of each calendar quarter.

The following describe reporting requirements for different TO situations:

1. TOs that do not own any TADS Elements are not required to submit any other TADS data for the reporting calendar year even if they subsequently become owners of TADS Elements during that calendar year. However, a TO may voluntarily report data for the year that the TADS Elements are added.
2. A non-reporting TO that becomes unregistered during a calendar year is no longer subject to any TADS reporting requirements. However, if a reporting TO becomes unregistered during a reporting calendar year, it has either (i) retired all its TADS Elements or (ii) sold all its TADS Elements. In case (ii), the new TO shall assume the reporting obligation of the unregistered TO for the entire calendar year. This will ensure that all TADS Elements continue to have their data reported.

What Will Be Reported

Inventory and performance data will be collected for all Bulk Electric System (BES) Elements which fall into one of the four categories below:

1. AC Circuits (Overhead and Underground)
2. Transformers with ≥ 100 kV secondary voltage
3. AC/DC Back-to-Back Converters
4. DC Circuits (Overhead and Underground)

Table I.1 lists the type of outages which are collected by voltage class.

Table I.1: TADS Outage Collection by Voltage Class

Voltage Class	Automatic Outages		Non-automatic Outages	
	Sustained	Momentary	Planned	Operational
0-199 kV	Yes	No	No	No
200 kV and Above	Yes	Yes	No	Yes

The Outage Reporting Reference Guide located in **Figure I.1** below can be used to determine whether and Element outage is TADS-reportable.

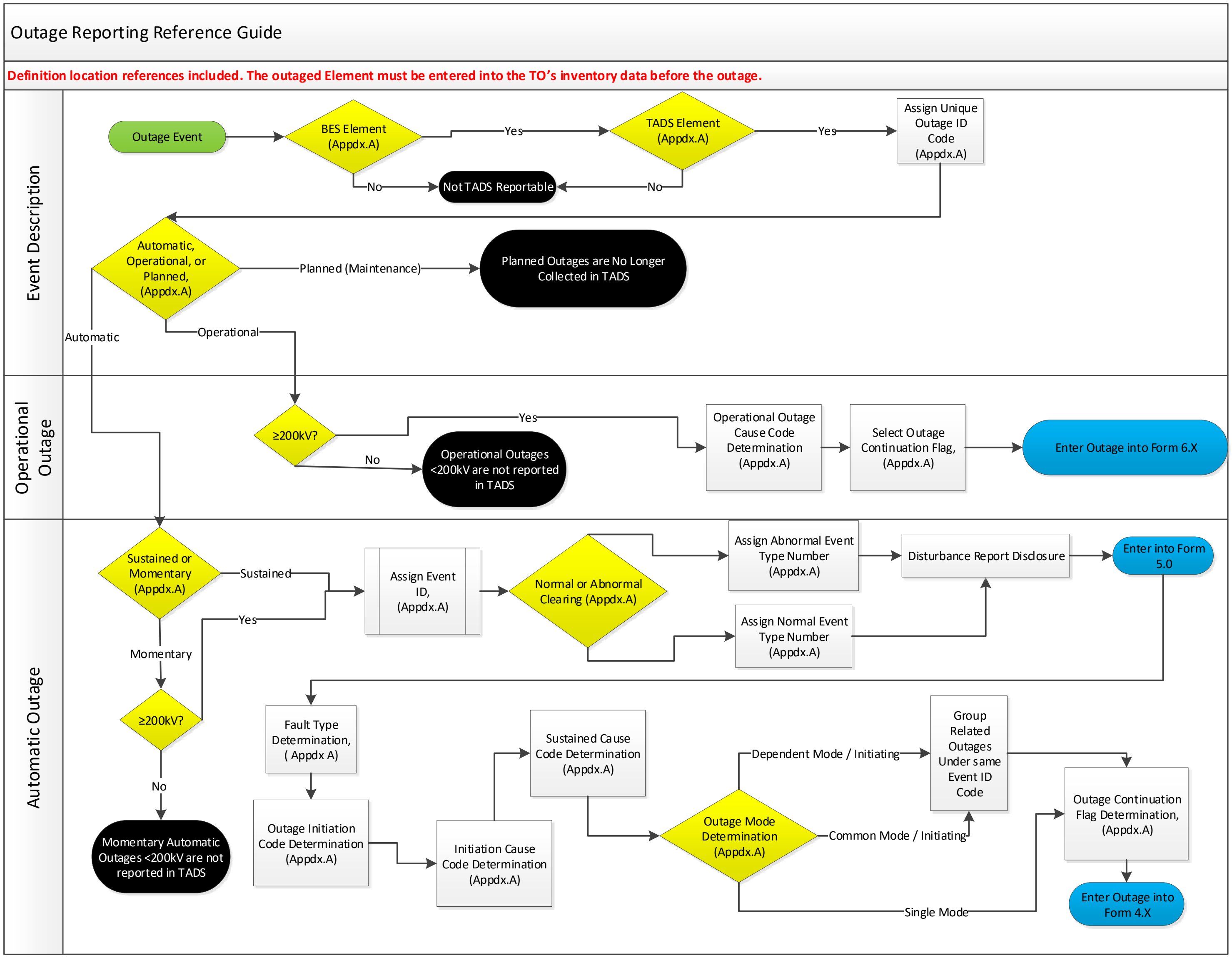


Figure I.1: Outage Reporting Reference Guide

Chapter 1: Data Transmittal and Format

OATI and webTADS

NERC contracted with Open Access Technology International, Inc. (OATI) to develop a software data system named "webTADS" to support several processes, including:

- Data entry
- Data error checking
- Data management
- Data analysis and reporting

The webTADS system allows TOs to directly enter their data or have it bulk-uploaded from XML files, which are created from the data entered into the TADS Reporting Workbook posted on the TADS website.[1] Each version of the workbook is assigned a number, and TOs should use the latest version of the workbook to ensure their data will be accepted by webTADS.

Regional Entities are the point of contact for TADS data submittals, and they prescribe and supervise the data entry process for TOs within their Region.

1. All Regions require TOs to input data directly into webTADS. Through webTADS, Regional Entities will have access to the data for TOs within their Region so that they can review that data.
2. WECC is collecting additional data beyond that required by TADS. For convenience, this data can be entered into webTADS and is considered voluntary.

[1] https://www.nerc.com/pa/RAPA/tads/Pages/default.aspx

Chapter 2: Data Collection Forms

Information collected in webTADS is organized by data forms, one for each type of data being entered. Each of the tabs in the TADS Reporting Workbook corresponds to one of these data forms. The 18 forms are listed below in **Table 2.1** and written instructions for completing each form is contained in this chapter.

When a TADS-reportable outage occurs:

1. The outaged Element should first be entered into the TO's inventory data using forms 3.1 - 3.6
2. Next an event record is created using form 5.0
3. Finally, the outage information is entered using forms 4.1 - 4.4 or 6.1 - 6.1.

Table 2.1: TADS Data Forms

Form	Title
2.1	Multiple-Owner AC and DC Circuits
2.2	Multiple-Owner AC/DC Back-to-Back Converters
3.1	AC and DC Circuit Detailed Inventory Data
3.2	Transformer Detailed Inventory Data
3.3	AC/DC Back-to-Back Converter Detailed Inventory Data
3.5	AC Multi-Circuit Structure Miles
3.6	Common Corridors (WECC TOs Only; Voluntary)
4.1	AC Circuit Detailed Automatic Outage Data
4.2	DC Circuit Detailed Automatic Outage Data
4.3	Transformer Detailed Automatic Outage Data
4.4	AC/DC Back-to-Back Converter Detailed Automatic Outage Data
5.0	ID Code and Event Type Number Data
6.1	AC Circuit Detailed Non-Automatic Outage Data
6.2	DC Circuit Detailed Non-Automatic Outage Data
6.3	Transformer Detailed Non-Automatic Outage Data
6.4	AC/DC Back-to-Back Converter Detailed Non-Automatic Outage Data

Each data form has a common layout:

1. The Section 1600 Data reporting confirmation form is required annually to identify whether a TO meets TADS reporting criteria.
2. The column letters and sometimes the row numbers for each form are used as references in the instructions. TOs may add additional rows as needed. Many columns have drop-down menus that correspond to defined choices. For example, all Cause Codes are in a drop-down menu and provide the TO the choice among the *defined* Cause Codes only.
3. To keep the form format and column letter designation the same within a form type, the unused columns are hidden from view. Therefore, column letter designations will not be in sequence when a column has been hidden.

Appendix C contains examples to assist the TO in com*pleting* Forms 3.1-3.5, which contain detailed Element inventory data. Form 3.6 is voluntary for all TOs and only applies to WECC TOs. **Appendix D** contains examples to assist the TO in completing Forms 4.1-4.4, which contain detailed Element Automatic Outage data.

Multiple-Owner Element Forms

These forms are used to ensure that only one TO takes on the TADS reporting responsibility for multiple-owner Elements for all Automatic and Non-Automatic outages. However, if a TO has less than 100% ownership interest in such Elements, each TO must enter this Element on Form 2.1 or 2.2. These multiple entries should be coordinated by the TOs involved. This list of such Elements should also include any multiple-owner Element that was in-service for at least part of the reporting period.

Each such Element and its associated multiple-owner Element Identifier (Column I below) should be listed on Form 2.x. The coordinated entries should indicate which single TO will take reporting responsibility for Forms 3, 4, 5 and 6. The single TO designated as the Reporting TO (Column G-H below) must include that Element within their detailed inventory on the appropriate Form 3.x. The same Reporting TO must enter the Element's outages on their Form 4 and 6. The calculated metrics are based on the reported inventory and outages. Selecting a single TO to become the Reporting TO for these inventory and outage forms will avoid duplication of outage and inventory reporting. The other TOs who are multiple owners must be aware that they should not report to TADS on that Element. In addition to the names of all multiple owners, their registered NERC ID (or NERC assigned pseudo ID) of the designated reporting representative is also required to be entered on Form 2.x.

If a TO owns 100% of an Element, the reporting responsibility of that Element belongs to the TO. Do not enter the Element on Forms 2.1 or 2.2. For 100% owned ac circuits, communication among the TOs who own the ac substations that bound the circuit is expected for the purpose of identifying data related to the cause of the outages which the reporting TO must supply.

Forms 2.x are submitted twice for each reporting year:

1. In December of the year prior to the reporting calendar year.
2. During Quarter 4 data reporting and the detailed inventory update.

The first Form 2.x submission in December confirms who is the reporting TO. The reporting TO should internally collect the multiple owner outage information starting on January 1. WebTADS official data entry may occur later in the year. However, the multiple owner outage information should be collected by the designated reporting TO starting January 1. The second submission reflects any additions or retirements of Elements that are covered by these forms.

Among all of the owners for a particular Element, they must agree on the Element ID to be entered in Column I. Only the TO declared to be the reporting TO on Form 2.x can use that Element ID. If one of the non-reporting TO owners also enters that Element ID for an Outage, the Outage will be rejected as an error when they complete Form 4.x or Form 6.x. Therefore, Form 2.x must be marked as complete prior to final completion of Form 4.x and Form 6.x. When Form 4.x and Form 6.x are marked complete, software error checks are performed on each outage to confirm that the declared Element ID on Form 2.x has not been used by one of the wrong multiple owners, declared on Form 2.x.

Form 2.1: Multiple-Owner AC and DC Circuits

The characteristics of each multiple-owner circuit are input on this form (one circuit per row). TOs must mutually agree on who should report outage and inventory information (on Forms 3, 4, 5 and 6) of the multiple-owner circuit information for TADS and which other owners should not report. Do not enter circuits that you do not partially own.

For Multiple-Owner AC and DC Circuits form fields. See **Table 2.2**.

Table 2.2: Multiple-Owner AC and DC Circuits Form Fields	
Column	**Form 2.1 Descriptor**
None	**Questions 1 and 2 in the top of the form ask whether there were any additions of multiple-owner circuits during the reporting year and if so, whether those changes were incorporated into the response. These questions apply to the second submittal only, and appropriate "NA" responses are provided as an answer associated with a first submittal.**
A	The type of circuit (AC or DC), input from a drop-down menu, describes the main characteristic of the Element.
B	From – Substation or Terminal Name. The alphanumeric code designating one of the Substation Names for an AC Circuit or one of the Terminal Names for a DC Circuit. If the Element has more than 3 Terminals, only list the first 3 Terminals.
C	To – Substation or Terminal Name. The alphanumeric code designating a second Substation Name for an AC Circuit or a second Terminal Name for a DC Circuit.
D	To2 – Substation or Terminal Name. The alphanumeric code designating a third Substation Name for an AC Circuit or a third Terminal Name for a DC Circuit.
E	The Voltage Class of the Element, input from a drop-down menu. The 400-599 kV Voltage Class can only be used if "AC" is selected in column A, and the 400-499 kV and 500-599 kV Voltage Classes can only be selected if "DC" is selected in column A. Other Voltages Classes (200-299 kV and 600-799 kV) can be used for either AC or DC Circuits. Data that does not conform to this requirement will be rejected and an error notice provided.
F	Underground or Overhead. This Element characteristic is input from a drop-down menu. See the definition of Overhead and Underground in **Appendix A**.
G-H	The NERC ID number and name of the TO with TADS outage reporting responsibility for the multiple-owner circuit.
I	The reporting TOs Element Identifier. This is a required data entry. The multiple owners of this Element shall also use the same Element Identifier on their Form 2.x for this Element. However, only one TO can be designated as the reporting TO for a given set of multiple-owners using the given Element ID. Only the Reporting TO should enter the Element Identifier of Multiple-Owner Elements on their Series 3 forms.
J-AD	The NERC ID numbers and name of the TOs that have an ownership interest in the Element. Up to ten owner names are provided. One of the TOs must be the TO with TADS reporting responsibility input in columns G-H. Among the multiple-owners, only the reporting TO can input the above Column I Element ID for reported outages on their Form 4.x and Form 6.x. The other multiple owners are not permitted to use the above Column I Element ID for outages reported on their Forms 4.x or Form 6.x.

Form 2.2: Multiple-Owner AC/DC Back-to-Back Converter

The characteristics of each multiple-owner AC/DC Back-to-Back Converter are input on this form (one Element per row). This form is *not* to be used for AC/DC Back-to-Back Converters owned 100% by a single TO.

Table 2.3: Multiple-Owner AC/DC Back-to-Back Converters	
Column	**Form 2.2 Descriptor**
None	**Questions 1 and 2 in the top of the form ask whether there were any additions of multiple-owner AC/DC BTB Converters during the reporting year and if so, whether those changes were incorporated into the response. These questions apply to the second submittal only, and appropriate "NA" responses are provided as an answer associated with a first submittal.**
A	Converter Station Name. The alphanumeric code designating the converters name.
B	Reporting TOs NERC ID.
C	Reporting TOs Name.
D	The reporting TOs Element Identifier. This is a required data entry. The multiple owners of this Element shall also use the same Element Identifier on their Form 2.x for this Element. However, only one TO can be designated as the reporting TO for a given set of multiple-owners using the given Element ID. Only the reporting TO should enter the Element Identifier of Multiple-Owner Elements on their Series 3 forms.
E	The AC Circuit Voltage Class, input from a drop-down menu, on one side of the converter.
F	The AC Circuit Voltage Class, input from a drop-down menu, on the other side of the converter.
G-AE	The NERC ID numbers and names of the TOs that are multiple owners of the Element. Up to four owner names are provided. One of the TOs must be the TO with TADS reporting responsibility input in column G-H.

Chapter 3: Element Inventory Data Forms

Inventory information is required for all Elements meeting the criteria laid out in the "What Will Be Reported" section of this document, regardless of whether those Elements have outages. Inventory data for each Entity is carried over from year to year and acts as a living snapshot of an Entity's system in the field. This data is updated on a quarterly basis to account for system reconfigurations, retirements, and new Elements being placed in service. When entering an outage into webTADS, the first step is to enter the outaged Element into the TADS inventory data. If the Element already exists in TADS, then the user can then proceed to complete the Event and Outage data forms.

Form 3.1: AC and DC Inventory Data

Table 3.1 records the detailed inventory details for AC and DC Circuit Elements.

Table 3.1: AC Circuit and DC Circuit Detail Inventory Form (* Indicates Mandatory Fields)		
Column	**Form 3.1 Field Name**	**Form 3.1 Descriptor**
A	Unique Element Identifier*	A TO defined unique Element Identifier. Element Identifiers cannot be reused in any future reporting period for a different Element. If there are multiple owners of the Element, those TOs must agree on the Element Identifier.
B	Voltage Class*	The Element's Voltage Class: AC Circuit= phase-to-phase DC Circuit= phase-to-return The 400-599 kV Voltage Class can only be used if "AC" is selected in column C, and the 400-499 kV and 500-599 kV Voltage Classes can only be selected if "DC" is selected in column C. Data that does not conform to this requirement will be rejected and an error notice provided.
C	Circuit Type*	ACO = Overhead AC Circuit Element ACC = Underground AC Circuit Element DCO = Overhead DC Circuit Element DCC = Underground DC Circuit Element
D-F	From Bus, To Bus, and Tertiary Bus*	Data that provides a description of the physical location of the Element terminals. Terminals are those buses on the Element, behind which exist power sources. In general, these terminals will comprise the set of locations that need to open to clear faults on the Element. Buses connected to the Element that serve only load, without power sources available behind them are not considered terminals. AC Circuit = AC Substation Names (3 max)
G	Circuit Miles*	The Circuit Mileage of the Element. For TADS purposes, a DC Circuit is assumed to have 2 poles. For example, a one mile-long, DC tower line that carries two DC poles would equate to two Circuit Miles.

Table 3.1: AC Circuit and DC Circuit Detail Inventory Form (* Indicates Mandatory Fields)		
Column	**Form 3.1 Field Name**	**Form 3.1 Descriptor**
H	Number of Terminals*	The number of terminals that the Element connects to.
I	Conductors per Phase	The number of conductors on the Element per Phase.
J	Overhead Ground Wire	The number of overhead ground wires on the Element.
K	Insulator Type	The type of insulator used on at least 80% of the Element. If multiple types are used such that at least 80% of the Element does not comprise one type, selected “Mixed”. CEP = Ceramic Post CES = Ceramic Suspension POP = Polymer Post POS = Polymer Suspension GLS = Glass Suspension MXD = Mixed OTH = Other
L	Cable Type	The type of cable used on the Element. SWD = Solid with conduit SND = Solid with no conduit OWD = Oil filled with conduit OND = Oil filled with no conduit GWD = Gas filled with conduit GND = Gas filled with no conduit.
M	Structure Materials	The type of structure materials used on at least 80% of the Element. If multiple types are used such that at least 80% of the Element does not comprise one type, selected “Mixed”. AL = Aluminum CN = concrete FG = fiberglass ST = steel WD = wood CM = composite OT = other MX = mixed.
N	Structure Types	The type of structure materials used on at least 80% of the Element. If multiple types are used such that at least 80% of the Element does not comprise one type, selected “Mixed”. DLC = Double Lattice Column HFR = H Frame KFR = K Frame LAT = Lattice Tower SPG = Single Pole Guyed

Table 3.1: AC Circuit and DC Circuit Detail Inventory Form (* Indicates Mandatory Fields)		
Column	**Form 3.1 Field Name**	**Form 3.1 Descriptor**
		SPU = Single Pole Un-guyed DOP = Double Pole SLC = Single Lattice Column YTY = Y Type OTH = Other MXD = Mixed
O	Circuits per Structure	The number of circuits per structure on the Element.
P	Terrain	The type of structure materials used on at least 80% of the Element. If multiple types are used such that at least 80% of the Element does not comprise one type, selected “Mixed”. If multiple types are applicable, pick the type the most influences outages. CO = Coastal DS = Desert MT = Mountains FR = Forest UR = Urban PR = Prairie MX = Mixed
Q	Elevation	Enter the range of elevation that the circuit traverses. 1 = less than 2000 feet 2 = 2001 to 4000 feet 3 = 4001 to 6000 feet. 4 = 6001 to 8000 feet 5 = 8001 to 10000 feet 6 = 10001 to 12000 feet 99 = elevation varies more than 2000 feet
R	Change/Reconfiguration Date*	Enter the date (mm/dd/yyyy) that the Element last changed or the initial in-service date.
S	Retirement Date*	If applicable to the Element, the date the Element became out-of-service.
T	Precursor Element Identifier*	The Unique Element Identifier that precedes the Element. This is used to maintain a parent/child relationship as Elements are modified.
U	BES Exempted Flag*	If the Element was reported in a prior reporting year and is now no longer considered within the BES, this flag should be be TRUE. Also, the retirement date should be set to the date that the Element was Exempted from the BES.

Form 3.2: Transformer Detailed Inventory Data

Table 3. records the detailed inventory details for Transformer Elements. The inventory details should be updated with the fourth quarter reporting. If entering an outage on a circuit not in the inventory detail, the identifier should be entered to allow validation of the Element.

Table 3.2: Transformer Detail Inventory Form (* Indicates Mandatory Fields)		
Column	Form 3.2 Field Name	Form 3.2 Descriptor
A	Unique Element Identifier*	A TO defined unique Element Identifier. Element Identifiers cannot be reused in any future reporting period for a different Element. If there are multiple owners of the Element, those TOs must agree on the Element Identifier.
B	Located at (AC Substation Name)*	The substation name where the transformer is located.
C	High-Side Voltage Class*	The Transformer Primary-Side's Voltage Class.
D	Low-Side Voltage Class*	The Transformer Secondary's Voltage Class
E	Phasing	The phasing of the Transformer. Single = Composed of a single 3-Phase bank transformer Single Phase of 3-Phase Bank = Composed of 3 single phase transformers
F	Three Phase Rating	The rating, in MVA, of the Transformer (all 3-phases combined).
G	Change/Reconfiguration Date*	Enter the date (mm/dd/yyyy) that the Element last changed or the initial in-service date. For transformers in general, the initial transformer in-service date would be used. If the change involves replacing the transformer with a new transformer (or transformers), then that would constitute a new Element.
H	Retirement Date*	If applicable to the Element, the date the Element became out-of-service.
I	Precursor Element Identifier*	The Unique Element Identifier that precedes the Element. This is used to maintain a parent/child relationship as Elements are modified.
J	BES Exempted Flag*	If the Element was reported in a prior reporting year and is now no longer considered within the BES, this flag should be be TRUE. Also, the retirement date should be set to the date that the Element was Exempted from the BES.

Form 3.3: AC/DC BTB Converter Inventory Data

Table 3. records the detailed inventory details for AC/DC Back-to-Back Converter Elements. The inventory details should be updated with the fourth quarter reporting. If entering an outage on a circuit not in the inventory detail, the identifier should be entered to allow validation of the Element.

Table 3.3: AC/DC Back to Back Converter Detail Inventory Form (* Indicates Mandatory Fields)		
Column	**Form 3.3 Field Name**	**Form 3.3 Descriptor**
A	Unique Element Identifier*	A TO defined unique Element Identifier. Element Identifiers cannot be reused in any future reporting period for a different Element. If there are multiple owners of the Element, those TOs must agree on the Element Identifier.
B	Converter Name*	The substation name where the AC/DC BTB Converter is located.
C	Voltage Class*	The AC/DC BTB Converter's Voltage Class.
D	Change/Reconfiguration Date*	Is when the element was placed in-service. If this is unknown, use the January 1 of the current year you are reporting. If the element is altered/reconfigured in a way that would change its rating or voltage characteristics, then that date would be entered here.
E	Retirement Date*	If applicable to the Element, the date the Element became out-of-service.
F	Precursor Element Identifier*	The Unique Element Identifier that precedes the Element. This is used to maintain a parent/child relationship as Elements are modified.
G	BES Exempted Flag*	If the Element was reported in a prior reporting year and is now no longer considered within the BES, this flag should be be TRUE. Also, the retirement date should be set to the date that the Element was Exempted from the BES.

Form 3.5: AC Multi-Circuit Structure Miles

For TOs located outside of WECC: In contrast to the detailed inventory in Forms 3.1, 3.2 and 3.3, AC Multi-Circuit Structure Miles are collected on a summary basis.

For TOs located inside of WECC: Form 3.5 is a summary form that uses Form 3.6 Common Corridors to populate the data. Please fill out Form 3.6, and this form will auto-populate.

For TOs outside of WECC: Form 3.5 should be completed and should not fill out the Form 3.6 Common Corridors form.

The bottom half contains Multi-Circuit Structure Mile data for AC Circuits only. If a line section contains two or more common structures that form one or more multi-circuit spans, the total span length can be measured. Then, the associated mileage should be reported in the Multi-Circuit Structure Mile data. If multiple circuits are connected to only one common structure, that structure should be ignored for outage and inventory mileage purposes.

All DC Circuits are assumed to have two circuits per structure; therefore, for each DC Circuit Voltage Class, the Multi-Circuit Structure Miles is one-half of the total Circuit Miles.

Table 3.5[2]: AC Multi-Circuit Structure Miles	
Column	**Form 3.5 Descriptor**
None	Questions 1 and 2 ask whether the coordination requested below for **AC Multi-Circuit Structure Miles Inventory Data** has taken place among TOs that report separate circuits on common structures.
	AC Multi-Circuit Structure Miles Inventory Data

[2] Table 3.4 excluded to better align with TADS form numbers.

Table 3.5[2]: AC Multi-Circuit Structure Miles	
Column	**Form 3.5 Descriptor**
	Appendix 8 has an example that illustrates the data requirements for columns B-K for Multi-Circuit Structure Miles. 1. Note: Multi-circuit structures that are occupied *by only one circuit* do not contribute to the tabulation of Multi-Circuit Structure Miles. 2. **Appendix D** illustrates how to make this calculation for an annual submittal. ***For common structures that carry circuits owned by different TOs, TOs are expected to coordinate with one another on their reporting of Multi-Circuit Structure Miles to ensure no double counting occurs. As an example, suppose two circuits owned by different TOs occupy common structures for 10 miles. For this section, the combined number of Multi-Circuit Structure Miles reported by the TOs should not exceed 10. We do not want each TO to report 10 miles since that would double count the miles for the Region.***
A	AC multi-circuit structure Voltage Class. Note the “Mixed Voltage” class. This class applies to multi-circuit structures that have two TADS AC Circuits of different voltages (e.g., 230 kV and 345 kV) on the same structure. A structure is not a considered a multi-circuit structure for TADS reporting unless it has two or more TADS AC Circuit Elements. Therefore, a structure with a 230 kV and a Non-BES 69 kV AC Circuit does not contribute to the tabulation of Multi-Circuit Structure Miles.
B	NOT APPLICABLE
C	The number of Multi-Circuit Structure Miles in the Voltage Class associated with AC Circuits reported by the TO at the end of the reporting year. **This includes AC Circuits that are multiple-owner circuits that are reported by the TO.** If you have no multi-circuit structures in a particular Voltage Class, a blank is the default entry in columns C, F, G, J, and K.
D-E	NOT APPLICABLE
F	The number of Multi-Circuit Structure Miles added in the Voltage Class associated with AC Circuits reported by the TO.
G	The equivalent number of Multi-Circuit Structure Miles added.
H-I	NOT APPLICABLE
J	The number of Multi-Circuit Structure Miles removed in the Voltage Class associated with AC Circuits reported by the TO.
K	The equivalent number of Multi-Circuit Structure Miles removed.
L	NOT APPLICABLE
M	This is a calculated value for the equivalent annual number of Multi-Circuit Structure Miles for the reporting year. Note that column J is not used; it is requested as a “sanity check” for column K.
N-Q	NOT APPLICABLE

Form 3.6: Common Corridors

The Common Corridor form, Form 3.6, is voluntary and only applicable to WECC entities. WECC TOs should use the established Common Corridor definitions to populate the form.

Chapter 4: Detailed Automatic Forms

Forms 4.1-4.4: Detailed Automatic Outage

These forms contain data for each Automatic Outage of an Element, both Sustained and Momentary, and do not have row numbers. Since each line represents an outage and each outage has a unique Outage ID Code, this code is used to identify each outage entry.

Since there is so much similarity between the columns, all descriptors will be provided once, using the generic term of "Element" instead of AC Circuit, Transformer, etc.

Appendix D provides many examples illustrating the completion of the various Form 4.x series.

Table 4.1: Data for Elements That Had an Automatic Outage	
Column	**Forms 4.1-4.4 Descriptor**
A	The Outage ID Code assigned to the outage. This is assigned by the TO. See **Appendix A** for the definition of Outage ID Code. For any given TO, over multiple years, webTADS requires the TO entered Form 4.x Outage ID to be used only once on an Automatic Outage (on Form 4.x).
B	The Event ID Code associated with the outage. This is assigned by the TO on Form 5.0. See **Appendix A** for the definition of Event ID Code. The Event ID Code used on Form 4.x must be pre-defined on Form 5.0.
C	A TO defined unique Element Identifier. See column A in Table 3.1 for details.
The descriptions that follow use defined terms that the TO should become familiar with. Definitions of defined terms are located in **Appendix A** and they will not be repeated here. Most data fields have drop-down menus. They each describe various facets of the outage.	
D	The Fault Type (if any) for each circuit Outage, input from a drop-down menu.
E	The Outage Initiation Code, input from a drop-down menu.
F	The Outage Start Time. This may be local time or UTC time. WebTADS will offer a choice of time zones, with UTC being the default. This applies whether the data is entered directly into webTADS or bulk-uploaded via XML files (created either from an Excel workbook or directly by the TO). WebTADS will convert all non-UTC times to UTC and store the time as UTC within webTADS. The use of UTC will allow related outages occurring on Elements reported by different Transmission Owners to be linked. For Outages occurring on Elements that cross quarters, TOs should, in the first quarter, extend the length of the Outage to the end of the first quarter. In subsequent quarters, the Outage length should be extended until the end of the reporting year. Refer to the instructions in Section 4.1, below, for outages that continue beyond the end of the reporting calendar year.
G	The Outage Time Zone. The Time Zone of the reported Outage.
H	The Outage Duration expressed as hours and minutes. Momentary Outages will enter a "0" (zero). A zero entry in column M tells the reviewer that the outage was Momentary. See instructions in Section 4.1 below for outages that continue beyond the end of the reporting year. Note that the format is a text field and requires a colon (":") be entered between the hours and minutes. Enter 860 hours and 20 min. as 860:20. *If the colon is absent, the entry will be interpreted as "hours."* If the Outage Duration exceeds the number of hours remaining in the year (based upon the Outage

Table 4.1: Data for Elements That Had an Automatic Outage	
Column	**Forms 4.1-4.4 Descriptor**
	Start Time), the data will be rejected and an error notice provided. If the previous entry of “860:20” were entered as 86020, it would be read as 86,020 hours and rejected.
I	The Initiating Cause Code, input from a drop-down menu. All Outages must supply an Initiating cause code.
J	The Sustained Cause Code, input from a drop-down menu. This only applies to Sustained Outages. For Momentary Outages, enter “NA-Momentary.”
K	The Outage Mode, input from a drop-down menu.
L	The Outage Continuation Flag described whether the outages started and ended within the reporting year or not. The flag is explained in a footnote on the data form as well as in **Appendix A** where the term is fully defined. Outages that span across quarters in the same year should not use this flag. Instead, TOs should update the outage duration during each quarter until the outage ends.

Outages That Continue Beyond the End of the Year

The data should be entered in local time. If an outage begins in a reporting calendar year and continues beyond the end of the year (December 31), the following process will be observed.

1. Two separate Outage Durations will be input.
   a. For the reporting year when the outage started, the TO inputs the Outage Start Time and calculates an Outage Duration from the Outage Start Time until the end of the reporting calendar year. The Outage Continuation Flag is input as “1.” See **Appendix A** for a complete description of this flag.
   b. For the next reporting year (Y+1), the Outage Continuation Flag is input as “2” and the same Event ID Code (defined on the prior year Form 5.0) will be entered. The Outage Start Time is equal to January 1, 00:00 Local Time of that reporting year. If the outage is concluded in the Y+1 year, the Outage Duration should be calculated from January 1, 00:00 Local Time to the outage end time. If the outage continues into another reporting year (Y+2, Y+3, etc…), the Outage Duration is entered as 8760:00, or 8784:00 for a leap year. The Outage Continuation Flag is input as “2.”

Long Duration Outages

Treat long-term outages as follows:

1. If the equipment were to return to service at some date in the future, the outage reported in each reporting year and the continuation flag would be marked as noted in the section above.
2. If the equipment is going to be retired, then the outage would be marked as complete on the day of the decision and the Element Inventory would be marked as retired on the day of the decision.
3. If the equipment returns to service for one minute or more and then is removed for long-term repairs, the outage is completed and the outage converted to a planned outage. Planned outages are not reportable to TADS.

Chapter 5: TADS Event Forms

Form 5.0: Event ID Codes

Single TADS Outages and every set of related TADS Outages are assigned to a TADS Event. An Event is a transmission incident that results in the Sustained or Momentary Outages of one or more Elements. If multiple Outages are associated to the same Event ID, they should occur within one minute of each other. The purpose of a TADS Event is to identify related Outages, if applicable. To accomplish this, TOs create their specific TADS events in TADS Form 5.0 and assign these Events to each associated TADS Outage. Specifically TOs assign their own Event ID Codes and associated Event Type Numbers. The table below describes the data collected for each TADS Event:

Table 5.1: Form 5.0 Field Descriptions	
Column	**Form 5.0 Descriptor**
A	The Event ID Code associated with one or more outages. This is assigned by the TO. See **Appendix A** for the definition of Event and Event ID Code. For a given TO the same Event ID Code cannot be defined more than once on Form 5.0. The TO cannot define the same code again on Form 5.0 in any subsequent year.
B	The Event Type No. This is a descriptor of the Event. The table on Form 5.0 shows the permitted entries, which are in a drop-down menu. • Note that if Event Type Number 11 is selected, the Outage Mode on Forms 4.1, 4.2, or 4.3 (column K) must be "Single Mode Outage." Table 2.9 and Table 2.10 show the possible Event Type Numbers. See **Appendix A** for the definitions of Normal Clearing, NCCBS, Abnormal Clearing, Delayed Fault Clearing, SPS or RAS, and Event Type Number. A consistent set of definitions is necessary to determine the Event Type Number to be entered in Column B.
C	Optional input: Provide a brief description of the Event's outage(s) for any Event ID Code. Please limit the description to 500 characters or less.
D	This field indicates whether a EOP-004 disturbance report was filed that was associated with the Event, with the choices contained in a drop-down menu (Yes, or No). TOs should speak with their Regional Entity Coordinator if they are unsure whether a particular transmission event had a disturbance report filed. For example, a TO will know which Region its facilities reside (Region ID), but the TO should also know the associated Balancing Authority (BA) identified by a BA ID. Since the posted information is available in an Excel file, a TO should first sort by its Region and BA to determine if any of its Events had a possible disturbance report associated with it. If no disturbances were reported for the TOs Region and BA, then the TO should answer "No." If some disturbances were reported, the TO should then examine the disturbance start and end dates and times on the posted information and compare them to the start and end dates and times associated with the individual outages associated with an Event ID. If this comparison shows that the TOs Event outage times are not inside any disturbance report time windows, then the TO should answer "No." On the other hand, if a disturbance time interval and an Event time interval overlap, the column with the "Event Description" may provide enough information to determine whether the TO should answer "Yes."

NERC Multiple Utility Event ID Code Creation

NERC Multiple Utility (NMU) Event ID Codes are special Event ID Codes that correlate multiple related4 Outages involving more than one TO that require more than one TO to report into the same Event ID Code. As part of the TADS program, TOs shall identify related multiple-TO Outages by using a single NMU Event ID Code. In contrast, related Outages occurring within only a single TO's territory are to be coded with the same Event ID Code created by that TO.

When a TADS Event involves related Outages impacting multiple TOs, each Outage shall use the same NMU Event ID Code. The TO on whose system the outage was iniated is responsible for creating the NMU Event ID Code. Once the NMU Event ID code is created, the responsible TO shall communicate the NMU Event ID to all involved TOs each of whom shall use that NMU Event ID for the group of Outages in the Event.

To create an NMU Event ID Code within webTADS, TOs should change the filter from their company to NERC within Form 5.0. Then, the TO creates an NMU TADS Event using the relevant interface buttons. WebTADS will automatically assign a new NMU Event ID for all involved TOs to use in their Outages for that Event.

Cascading Tolerance

If multiple Outages are associated to the same Event ID, they should occur within one minute of each other. If Outages are entered that are more than one minute apart, the Company user will receive an import warning message. An override must be requested in order for the Outages to be accepted as valid. When a Company user receives the tolerance warning message, a button labeled 'Request Override' is displayed at the bottom of the form page. When the 'Request Override' button is pressed, an email is sent to the Company user, NERC and the Regional contact. The Regional contact will then login and approve the override. This will change the read only field 'Extended Cascading Tolerance' on Form 5.0 from the default of No to Yes.

Event Type Numbers

Every TADS event is defined an Event Type Number to describe the general circumstances of the outage. A classification of the Event as Normal and Abnormal Clearing initially divides the Event Type Numbers. Then, Events with Normal Clearing are subdivided by the number of involved Elements, involvement of a bus section or common structure involvement. Abnormally Clearing Events are subdivided by the classification of breaker failure, dependability-based protection system misoperations, or security-based protection system misoperations.

Table 5.2: Event Type Number Descriptions: Events with Normal Clearing

Event Type No.	Description
05	Single bus section fault or failure resulting in one or more Automatic Outages.
06	Single internal circuit breaker fault resulting in one or more Automatic Outages.
11	Automatic Outage of a single Element not covered by Event Type Numbers 05 and 06.
13	Automatic Outage of two or more Elements within one Normal Clearing Circuit Breaker Set (NCCBS).
31	Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures. To qualify as Event Type Number 31 the Automatic Outages must be the direct result of the circuits occupying common structures.
49	Automatic Outage(s) with Normal Clearing not covered by Event Type Numbers 05 through 31 above.

All of the above Event Type Numbers, 05 to 49, are Events with Normal Clearing. For further explanations and examples regarding the determination of the proper Event Type Numbers, see Appendix A definitions for Normal Clearing, NCCBS, Abnormal Clearing, Delayed Fault Clearing, Special Protection System (SPS) or Remedial Action Scheme (RAS), and Event Type Number. These Event Type Numbers apply only when the Automatic Outages are the result of Protection Systems and controls disconnecting the Elements that are expected to be automatically disconnected for a single event. In contrast, the term Abnormal Clearing is for an Event when Normal Clearing did not occur.

Table 5.3: Event Type Number Descriptions: Events with Abnormal Clearing	
Event Type No.	**Description**
60	**Breaker Failure:** One or more Automatic Outages with Delayed Fault Clearing due to a circuit breaker being stuck, slow to open or failure to interrupt current.
61	**Dependability (failure to operate):** One or more Automatic Outages with Delayed Fault Clearing due to the failure of a composite protection scheme under either… a. failure to initiate the isolation of a faulted power system Element as designed, or within its designed operating time, or In the absence of a fault, failure to operate as intended within its designed operating time. (Item b is a very rare type of event.)
62	**Security (unintended operation):** One or more Automatic Outages caused by improper operation (e.g. overtrip) of a Protection System resulting in isolating one or more TADS Elements it is not intended to isolate, either during a fault or in the absence of a fault.
90	Automatic Outage(s) with Abnormal Clearing not covered by Event Types 60 through 62 above.

All of the above Event Type Numbers, 60 to 90, are Events with Abnormal Clearing. For further explanations and examples regarding the determination of the proper Event Type Numbers, see **Appendix A** definitions for Normal Clearing, NCCBS, Abnormal Clearing, Delayed Fault Clearing, SPS or RAS, and Event Type Number.

Non-TADS Element Outages

Please note: Event Type Number 11 (Automatic Outage of a single Element) is intended to include a single Automatic Outage resulting from one or more non-TADS Element outages. This type of Event should not be entered as Event Type Number 49 other Normal Clearing. If the Element outage results from one or more non-TADS Element outages, the Outage Initiation Code (Form 4) should be entered as “Dependent Mode”.

Event Type Number 13 versus Event Type Number 11

Event Type Number 13 is similar to Event Type Number 11 except a total of two or more Element outages occur within one NCCBS. By keeping type 13 separate from type 11, statistical granularity can be maintained in the annual report.

If two or more Automatic Outages occur (within one NCCBS) which result from one or more non-TADS Element outages, Event Type Number 13 should be entered and the Outage Initiation Code (Form 4) should be entered as “Dependent Mode” on each Automatic Outage. If two or more Automatic Outages occur outside of the Normal Clearing Circuit Breaker Set, do not enter Event Type Number 13. See the Event Analysis Guideline below.

Event Description

An optional event description may be entered on Form 5.0 in the Description column. In general for Event Type Numbers 05 to 31 (Normal Clearing), and Event Types 60 to 62 (Abnormal Clearing) a description is not needed but may be entered. However, for Event Type Number 49 (other Normal Clearing) or 90 (other Abnormal Clearing), entering a description of the Event would be helpful. Such a description, although not mandatory, would provide further clarification of these Events.

Event Analysis Guidelines

When using the revised Event Type Numbers, to reduce the amount of analysis labor required in determining the Event Type code numbers, the following systematic process contains a sample of logical questions and answers to determine the appropriate Event Type Number to be entered on Form 5.0. Several examples are included in this Instruction Manual with both the given Automatic Outage (Form 4.x) attributes and after using the Steps below, the appropriate determination of Event Type (Form 5.0). Data entries for each scenario are shown in tables along with each scenario. While not all possible situations could be covered, the examples are complete enough to illustrate Event Type determination.

The process below assumes that all Automatic Outage information required for completion of Form 4.x have already been collected and are available to the user. The user should be familiar with the TADS definitions in **Appendix A** for: Normal Clearing, NCCBS, Abnormal Clearing, Delayed Fault Clearing, SPS or RAS, Event, Event ID Code, and Event Type Number. Form 4.x data and associated event analysis are necessary for the determination of the Event Type number to be entered on Form 5.0. Event Type analysis should not begin until a complete set of Automatic Outages associated which each Event is ready for entry on Form 4.x including their associated event identification (Event ID) code.

The analysis Steps below are intended to reduce the labor resources to complete the determination of Event Type for entry on Form 5.0. The steps below will not reduce the labor needed to determine the Form 4 data to be entered for each Automatic Outage. This is a guideline and exceptions can be made as deemed necessary to determine the appropriate Event Type. It is anticipated that the overwhelming majority of Automatic Outages (2 of every 3 outages) will be a simple Normal Clearing of a single Element Automatic Outage which did not result from a bus outage or internal circuit breaker fault. For such cases, no additional resources will be necessary to determine the Event Type. Only Steps N1 and N3.1 below will be needed to determine the Event Type Number.

Event Type Number Determination

Begin at Step N1 with a set of one or more Automatic Outages entered on Form 4.x that has a unique Event ID Code. Follow the process until an Event Type Number for each Event is determined.

Step N1 - Normal Clearing determination

Did Abnormal Clearing occur? (Refer to examples below.)

- Yes – Proceed with Step A1 – Abnormal Clearing below.
- No – Proceed with Step N1 – Normal Clearing.

Example of an Event with Normal Clearing

For a given Event ID and its associated Automatic Outages, an Event which results from one or more unintended circuit breaker operations or unintended delayed clearing should be coded as Abnormal Clearing. Abnormal Clearing, per Section B definition, is the outage of a TADS Element that does not conform with Normal Clearing. For example, any unintended circuit breaker operations which occur beyond the NCCBS and results in a total of two or more Automatic Outages should be categorized as Abnormal Clearing.

Example of an Event with Normal Clearing beyond the NCCBS

SPS or RAS may normally trip additional 100 kV or above circuit breakers beyond the NCCBS. For a given Event ID and its associated Automatic Outages, an Event which results from one or more expected SPS or RAS normal operations should be coded as Normal Clearing.

Step N2 - Screen for Event Type Numbers 05 and 06

- If one or more Automatic Outages were the result of a Bus Section fault or failure, enter Event Type Number 05.

- If one or more Automatic Outages were the result of a single internal circuit breaker fault, enter Event Type Number 06.
- If not Event Type Number 05 or 06, then proceed with Step N3 below.

Step N3 – Screen for Event Type Numbers 11 and 13

- N3.1) If the Outage Mode Code was "Single Mode Outage", enter Event Type Number 11.
- N3.2) For an Event ID with a total of two or more Automatic Outages that occur within one NCCBS, enter Event Type Number 13. The Outage Mode Codes on Form 4.x should be "Dependent Mode Initiating Outage" or "Dependent Mode Outage".

If not Event Type Number 11 or 13, then proceed with Step N4 below.

Note: for a given Event ID code, each Automatic Outage on Form 4.x has one of the following Outage Mode Codes.

- Single Mode Outage
- Dependent Mode Initiating Outage
- Dependent Mode Outage
- Common Mode Outage
- Common Mode Initiating Outage

Step N4 – Screen for Event Type Number 31

- If two or more Automatic Outages of TADS adjacent AC Circuits or DC Circuits were the direct result of the Elements occupying common structures, enter Event Type Number 31.
- If not Event Type Number 31, then proceed with Step N5 below.

Step N5 – Screen for Event Type Number 49 – Other Normal Clearing

- If the Event included other Normal Clearing not covered by Event Type Number 05 to 31, enter Event Type Number 49.

Examples of an Event Type Number 49:

Event Type Number 49 includes, but is not limited to, Normal Clearing of two or more NCCBS. For example, an airplane crash causes Automatic Outages of two AC Circuits on a common right-of-way. Both circuits trip as expected with Normal Clearing. Event Type Number 49 should be used for such an event.

Event Type Number 49 also includes additional Automatic Outages with Normal Clearing that are initiated by SPS, RAS, Under Voltage Load Shedding (UVLS), Under Frequency Load Shedding (UFLS), etc.

Step A1 - Abnormal Clearing

- Did Abnormal Clearing occur? (Refer to examples in Step N1.)
  - Yes – Proceed with Step A2.
  - No – Return to Step N1.

Step A2 – Screen for Event Type Number 60; Breaker Failure

- Among the relay targets associated with this Event, did a breaker failure relay operation occur for one or more circuit breakers? Did this time-delayed relay operate as intended? If the answer to both of these questions is yes, enter Event Type Number 60. If one or more Automatic Outages experienced Delayed Clearing due to one or more circuit Breaker Failures (BF), enter Event Type Number 60. If the BF relay scheme did not operate as intended, go to Step A3 below.

  Such delayed clearing examples include, but are not limited to, a circuit breaker being stuck, or slow to open, or failure to interrupt current. Such failures usually cause a circuit BF time-delayed relay to operate. Therefore, a BF relay target also occurs.

- If not Event Type Number 60, then proceed with Step A3 below.

Step A3 – Screen for Event Type numbers 61 and 62; Dependability or Security Failures

- Dependability (failure to operate); If one or more Automatic Outages experienced delayed clearing due to a Dependability failure to operate, enter Event Type Number 61.

  A Dependability failure includes, but is not limited to, a failure of the Composite Protection System to:

  - initiate the isolation of a faulted power system Element, or
  - failure to operate within its designed operating time, or

- Failure to operate as intended for non-fault conditions within its designed operating time.
- Security (false or undesirable operations): If one or more Automatic Outages are caused by a Security failure, enter Event Type Number 62.

  A Security failure includes improper operation of a Protection System (or its controls):

  - in absence of a fault on the power system TADS Element, or
  - during a fault it is not designed to protect.

- If not Event Type Number 60, 61 or 62 then proceed with Step A4 below.

Step A4 – Screen for Event Type Number 90; Other Abnormal Clearing

- If the Event included other Abnormal Clearing not covered by Event Type Number 60, 61 or 62, enter Event Type Number 90.

Example of an Event Type Number 90

Event Type Number 90 includes, but is not limited to, additional Automatic Outages with Abnormal Clearing that are initiated by SPS, RAS, UVLS, UFLS, etc. It also includes Abnormal Clearing of multiple faults or failures that are not covered by Event Type Number 60 to 62.

For additional examples for determining the Event Type Number for Normal Clearing and Abnormal Clearing Events, see **Appendix D** – Detailed Automatic Outage Data examples.

Chapter 6: Detailed Non-Automatic Outage Data

Forms 6.1-6.4

These forms contain data for *each* Non-Automatic Operational Outage of an Element and do not have row numbers. Since each line represents an outage and each outage has a unique Outage ID Code, this code is used to identify outage entry.

Table 6.1: Data for Elements That Had a Non-Automatic Outage	
Column	**Forms 6.1-6.4 Descriptor**
A	The Outage ID Code assigned to the outage. This is assigned by the TO. See **Appendix A** for the definition of Outage ID Code. For any given TO, over multiple years, webTADS requires the TO entered Form 6.x Outage ID to be used only once on a Non-Automatic Outage (on Form 6.x).
B	A TO defined unique Element Identifier. Element Identifiers cannot be reused in any future reporting period for a different Element. If there are multiple owners of the Element, those TOs must agree on the Element Identifier.
C	Non-Automatic Outage Type. Please refer to **Appendix A** for the definition of Non-Automatic Outage Types.
The descriptions that follow use defined terms that the TO should become familiar with. They will not be repeated here. Most data fields have drop-down menus. They each describe various facets of the outage.	
D	The Outage Start Time. This may be local time or UTC time. WebTADS will offer a choice of time zones, with UTC being the default. This applies whether the data is entered directly into webTADS or bulk-uploaded via XML files (created either from an Excel workbook or directly by the TO). WebTADS will convert all non-UTC times to UTC and store the time as UTC within webTADS. The use of UTC will allow related outages occurring on Elements reported by different Transmission Owners to be linked. See instructions Section 4.1 below for outages that continue beyond the end of the reporting calendar year.
E	The Outage Time Zone. The Time Zone of the reported Outage.
F	The Outage Duration expressed as hours and minutes. Momentary Outages will enter a "0" (zero) in this field since we round to the nearest minute. A zero entry in column M tells the reviewer that the outage was Momentary. See instructions in Section 4.1 below for outages that continue beyond the end of the reporting year. Note that the format is a text field and requires a colon (":") be entered between the hours and minutes. Enter 860 hours and 20 min. as 860:20. *If the colon is absent, the entry will be interpreted as "hours."* If the Outage Duration exceeds the number of hours remaining in the year (based upon the Outage Start Time), the data will be rejected and an error notice provided. If the previous entry of "860:20" were entered as 86020, it would be read as 86, 020 hours and rejected.
G	The Operational Cause Code, input from a drop-down menu. This only applies to Operational Outages.
H	The Outage Continuation Flag described whether the outages stated and ended within the reporting year or not. The flag is explained in a footnote on the data form as well as in **Appendix A** where the term is fully defined.

Outages That Continue Beyond the End of the Year

See section in **Chapter 4**.

Appendix A: Definitions

TADS Population Definitions

Element

The following are Elements within the BES for which TADS data are to be collected:

1. AC Circuits (Overhead and Underground)
2. Transformers[3]
3. AC/DC Back-to-Back Converters
4. DC Circuits (Overhead and Underground)

A TADS reportable Element may also be referred to as a "TADS Element" in the DRI. They have the same meaning.

A non-TADS Element is one of the four types of Elements listed above that does not qualify within the BES definition.

Protection System

The NERC Glossary of Terms used in NERC Reliability Standards defines Protection System as follows:

- Protective Relays which respond to electrical quantities,
- Communications systems necessary for correct operation of protective functions,
- Voltage and current sensing devices providing inputs to protective relays,
- Station dc supply associated with protective functions (including batteries, battery chargers, and non-battery-based dc supply), and
- Control circuitry associated with protective functions through the trip coil(s) of the circuit breakers or other interrupting devices.

For coding outages as protection system equipment see the definition of the cause code failed protection system equipment.

AC Circuit

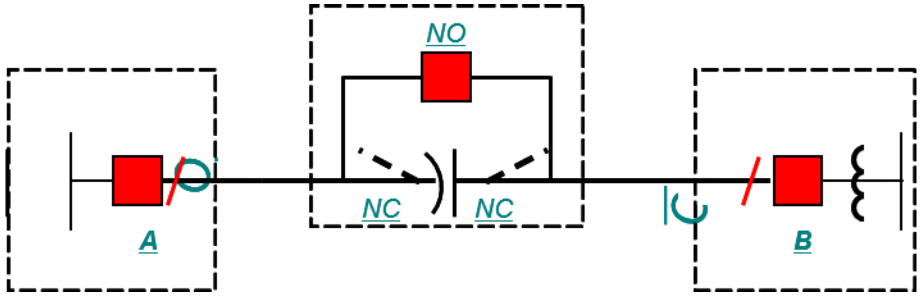
A set of AC overhead or underground three-phase conductors that are bound by AC Substations. Radial circuits which are BES Elements are to be included in AC Circuits.

The boundary of an AC Circuit extends to the transmission side of an AC Substation. A circuit breaker, Transformer, and their associated disconnect switches are not considered part of the AC Circuit, but they are defined, instead, as part of the AC Substation.

The AC Circuit includes the conductor, transmission structure, joints and dead-ends, insulators, ground wire, and other hardware. In addition, the AC Circuit includes in-line switches used to sectionalize portions of the AC Circuit as well as series compensation (capacitors and reactors) that is within the boundaries of the AC Circuit even if these 'in-line' devices are within an AC Substation. If these devices are not within the AC Circuit boundaries, they are not part of the AC Circuit but instead are part of the AC Substation.

[3] Generator step-up units are not included in TADS-reportable Transformers.

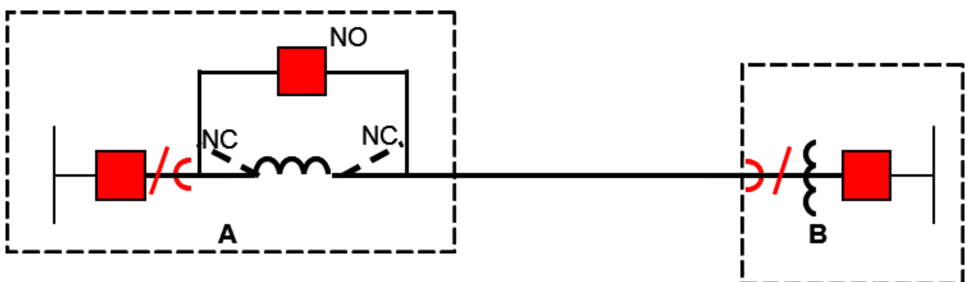
The diagrams on the next several pages explain this concept. The red arcs define the AC Circuit boundaries.[4] In **Figure A.1**, the series capacitor, bypass circuit breaker, and numerous disconnect switches are in a fenced AC Substation that is within the boundaries of the AC Circuit itself. When the series capacitor is connected and the bypass breaker is open, the capacitor and it's disconnect switches are part of the AC Circuit. When the bypass breaker is closed, the bypass breaker and it's disconnect switches (not shown) are part of the AC Circuit.



Two in-line NC switches and one series capacitor are part of the AC Circuit between AC Substations A and B. When the bypass breaker and its disconnect switches (not shown) are closed and the capacitor switches opened, the breaker and its switches are part of the AC Circuit.

Figure A.1

In **Figure A.2**, the series reactor and in-line switches are part of the AC Circuit since they are within the AC Circuit boundaries even though they are within the AC Substation boundaries. In **Figure A.3**, they are <u>not</u> part of the AC Circuit because they are not within the AC Circuit boundaries.



Two in-line NC switch and one series reactor are part of the AC Circuit between AC Substations A and B. The AC Circuit boundaries are the breaker disconnect switch in AC Substation A and the high-side disconnect switch on the Transformer in AC Substation B.

Figure A.2

[4] To simplify future diagrams, disconnect switches may not be shown.

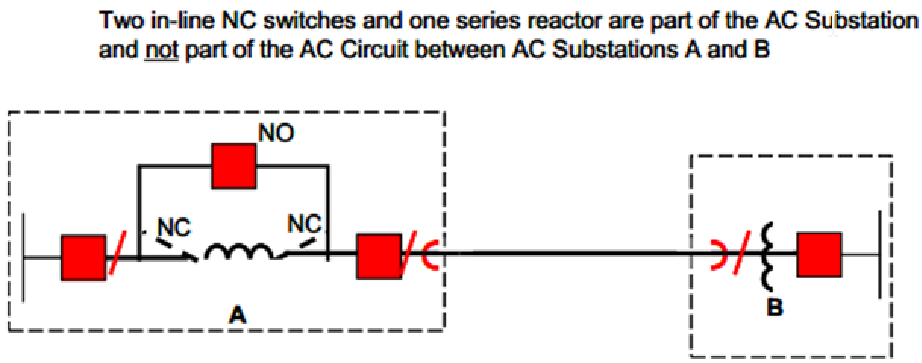


Figure A.3

Transformer
A bank comprised of three single-phase transformers or a single three-phase transformer. A Transformer is bounded by its associated switching or interrupting devices.

Terminal
Terminals are those buses on the Element, behind which exist power sources. In general, these terminals will comprise the set of locations that need to open to clear faults on the Element. Buses connected to the Element that serve only load, without power sources available behind them are not considered terminals.

AC Substation
An AC Substation includes the circuit breakers and disconnect switches, which define the boundaries of an AC Circuit, as well as other facilities such as surge arrestors, buses, Transformers, wave traps, motorized devices, grounding switches, and shunt capacitors and reactors. Series compensation (capacitors and reactors) is part of the AC Substation if it is not part of the AC Circuit. See the explanation in the definition of "AC Circuit." Protection System equipment is not part of the AC Substation.

AC/DC Terminal
A terminal that includes all AC and DC equipment needed for DC operation such as PLC (power-line carrier) filters, AC filters, reactors and capacitors, Transformers, DC valves, smoothing reactors and DC filters. On the AC side, an AC/DC Terminal is normally bound by AC breakers at the AC Substation bus where it is connected. On the DC side, it is bound by DC converters and filters. Protection System equipment is not part of the DC Terminal.

AC/DC Back-to-Back Converter
Two AC/DC Terminals in the same location with a DC bus between them. The boundaries are the AC breakers on each side.

DC Circuit
One pole of an Overhead or Underground DC line that is bound by an AC/DC Terminal on each end.

Overhead Circuit
An AC or DC Circuit that is not an Underground Circuit. A cable conductor AC or DC Circuit inside a conduit that is not below the surface is an Overhead Circuit. A circuit that is part Overhead and part Underground is to be classified based upon the majority characteristic (Overhead Circuit or Underground Circuit) using Circuit Miles.

Underground Circuit

An AC or DC Circuit that is below the surface, either below ground or below water. A circuit that is part Overhead Circuit and part Underground Circuit is to be classified based upon the majority characteristic (Overhead Circuit or Underground Circuit) using Circuit Miles.

Circuit Mile

One mile of either a set of AC three-phase conductors in an Overhead or Underground AC Circuit, or one pole of a DC Circuit. A one mile-long, AC Circuit tower line that carries two three-phase circuits (i.e., a double-circuit tower line) would equate to two Circuit Miles. A one mile-long, DC tower line that carries two DC poles would equate to two Circuit Miles. In addition, a one mile-long, common-trenched, double-AC Circuit Underground duct bank that carries two three-phase circuits would equate to two Circuit Miles.

Multi-Circuit Structure Mile

A one-mile linear distance of sequential structures carrying multiple Overhead AC or DC Circuits. (Note: this definition is *not* the same as the industry term "structure mile." A TO's Multi-Circuit Structure Miles will generally be less than its structure miles since not all structures contain multiple circuits.)

If a line section contains two or more Multi-Circuit Structures that form one or more multi-circuit spans, the total span length can be measured and the associated mileage should be reported in the 'Multi-Circuit Structure Mile' total inventory if multiple circuits are connected to only one common structure, that structure should be ignored for outage and inventory mileage purposes.

Voltage Class

For BES Elements only, the following voltages classes will be used for reporting purposes:

1. 0 – 99 kV[5]
2. 100 – 199 kV
3. 200 – 299 kV
4. 300 – 399 kV
5. 400 – 599 kV
6. 400 – 499 kV*
7. 500 – 599 kV*
8. 600 – 799 kV

For Transformers, the Voltage Class reported will be the high-side voltage, even though the cut-off voltage used in the definition is referenced to the transformer's secondary voltage. Voltages are operating voltages.

Generator Lead Lines

Generator leads are defined as the three phase connection from the primary side of the GSU to the first fault interrupting device. Regardless of length, these Elements are considered part of the Generating Equipment and are not reportable to TADs in either outages or inventory.

[5] Only Elements within the BES would be included in this Voltage Class. For consistency with the other Voltage Classes, the TADS Reporting Workbook refers to this Voltage Class as 0 – 99 kV, but the term "Less than 100 kV (BES Only)" is equivalent.

*Only DC Circuits are applied to these voltage classes.

TADS Population Outage Definitions

Automatic Outage

An outage that results from the automatic operation of a switching device, causing an Element to change from an In-Service State to a not In-Service State. Single-pole tripping followed by successful AC single-pole (phase) reclosing is not an Automatic Outage.

Momentary Outage

An Automatic Outage with an Outage Duration less than one (1) minute. If the circuit recloses and trips again within less than a minute of the initial outage, it is only considered one outage. The circuit would need to remain in service for longer than one minute between the breaker operations to be considered as two outages. Only 200kV and above Elements have reportable momentary outages.

Sustained Outage[6]

An Automatic Outage with an Outage Duration of a minute or greater.

Non-Automatic Outage

An outage that results from the manual operation (including supervisory control) of a switching device, causing an Element to change from an In-Service State to a not In-Service State. Includes outages caused by personnel during on-site maintenance, testing, inspection, construction, or commissioning activities.

Planned Outage

A Non-Automatic Outage with advance notice for the purpose of maintenance, construction, inspection, testing, or planned activities by third parties that may be deferred. Outages of TADS Elements of 30 minutes or less duration resulting from switching steps or sequences that are performed in preparation for restoration of an outage of another TADS Element are not reportable. Planned Outages are not Reportable to TADS.

Operational Outage

A Non-Automatic Outage for the purpose of avoiding an emergency (i.e., risk to human life, damage to equipment, damage to property) or to maintain the system within operational limits and that cannot be deferred. Includes Non-Automatic Outages resulting from manual switching errors.

In-Service State

An Element that is energized and connected at all its terminals to the system for at least one minute. Examples of reportable AC Circuit and Transformer Automatic Outages are illustrated below. An exclusion example is demonstrated in **Figure A.7** on page 29.

In **Figure A.4**, AC Circuit A is bound by the disconnect switches (not shown)[7] of two breakers, and Transformer A is bound by a breaker and a disconnect switch. AC Circuit B is bound by a breaker and a disconnect switch, and Transformer B is bound by a breaker and a disconnect switch. A 230 kV bus fault opens the green breakers. The TADS Transformers each report an outage. AC Circuit A reports an outage, but AC Circuit B does not. It is defined by the

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[6] The TADS definition of Sustained Outage is different from the NERC *Glossary of Term Used in Reliability Standards* definition of Sustained Outage that is presently only used in FAC-003-1. The glossary defines a Sustained Outage as: “The deenergized condition of a transmission line resulting from a fault or disturbance following an unsuccessful automatic reclosing sequence and/or unsuccessful manual reclosing procedure.” The definition is inadequate for TADS reporting for two reasons. First, it has no time limit that would distinguish a Sustained Outage from a Momentary Outage. Second, for a circuit with no automatic reclosing, the outage would not be “counted” if the TO has a successful manual reclosing under the glossary definition.

[7] For simplification, disconnect switches may not be show in some figures. When a circuit breaker or Transformer disconnect switch define an AC Circuit boundary, we may just refer to the circuit breaker and the Transformer as defining the boundary without reference to their disconnect switches.

breaker on the left and the disconnect switch on the right. Since the breaker associated with AC Circuit B did not experience an automatic operation, it was not outaged because the disconnect switch on the AC Circuit B side of Transformer B remains connected. It remains connected at all its terminals by the breaker and the disconnect switch.

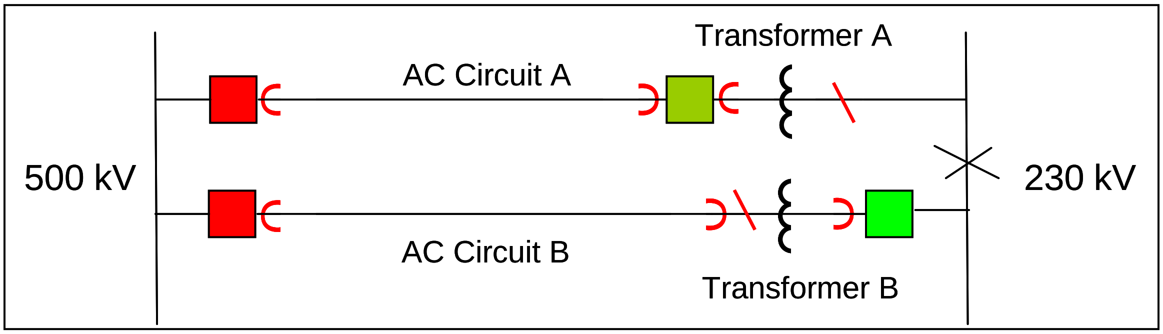

Figure A.4

In **Figure A.5**, a similar situation exists except that the Transformers are not reportable since their secondary voltages are less than 100 kV. The AC Circuit outages are reportable exactly the same as in **Figure A.4**; however, the Transformer outages are not reportable because Transformer B is not a BES Element.

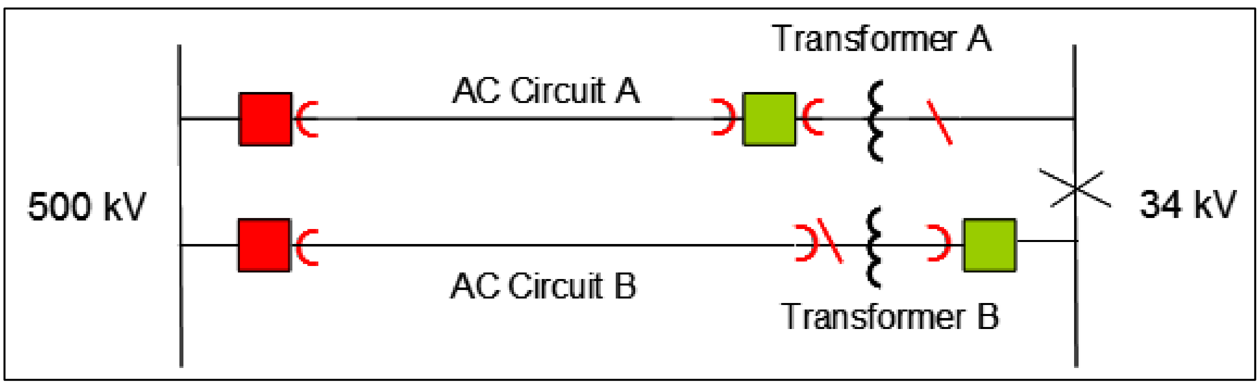

Figure A.5

In **Figure A.6**, AC Circuit 22, the only source connecting AC Substations A and B, has a fault. As a result, AC Circuits 84 and 88 are de-energized but remain connected at all their terminals. Three outages are reported: circuits 22, 84 and 88. None of them meets the In-Service State requirement of being energized *and* connected at all their terminals.

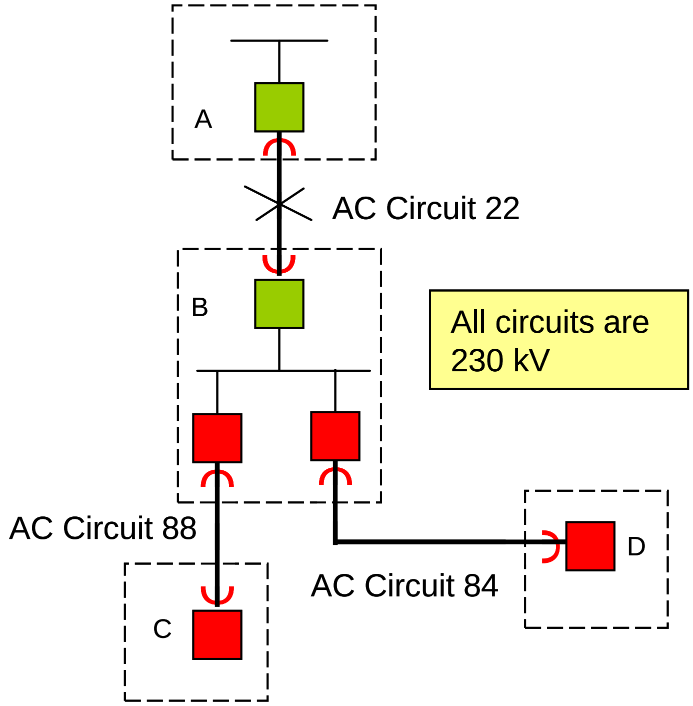

Figure A.6

Multi-Terminal AC Circuit with Tapped Transformer and Shared Breaker Exception

An exception that an Element be "connected at all its terminals" to be considered in an In-Service State is provided for a multi-terminal AC Circuit with a Transformer on one terminal that shares a breaker with the circuit.

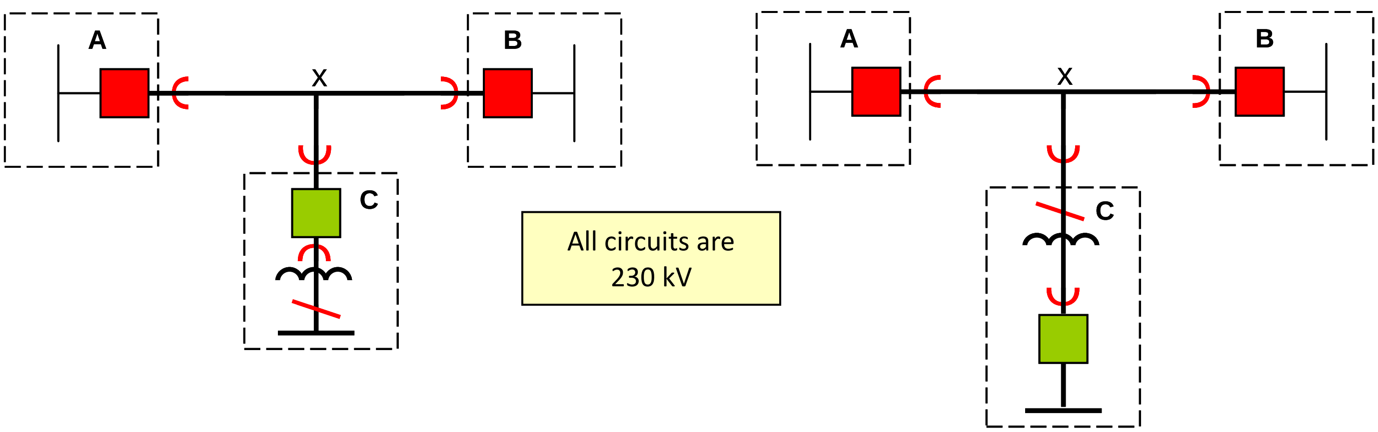

Figure A.7 **Figure A.8**

In both Figure A.7 and A.8, the AC Circuit is bounded by AC Substations "A," "B," and "C" as indicated by the red arcs. Each Transformer's boundaries are the red disconnect switch and the red arc before the breaker. Note that the Transformer in either figure may *or* may not be a reportable Element (i.e., one with a secondary voltage ≥ 100 kV).

Assume that each Transformer is out of service because of the operation of its associated breaker (indicated in green). In Figure A.7, the AC Circuit would normally be considered out of service since the breaker at AC Substation C, which is shared by the AC Circuit and the Transformer, is open. Nevertheless, as previously stated if all other portions of the AC Circuit are in service, the entire AC Circuit is considered to be in an In-Service State even if the Transformer is out of service. Because TADS does not recognize partial outage states, the multi-terminal exception, above, was developed to avoid overstating the outage contribution of a multi-terminal configuration of this type. In Figure A.78, the AC Circuit does not share the open breaker, and the AC Circuit remains connected. Thus, the exception does not apply in this case since the AC Circuit is connected at all its terminals even though the Transformer is out of service.

Substation, Terminal, or Converter Name

For Automatic Outages or Non-Automatic Outages of AC Circuits and DC Circuits, the termination name at each end of the circuit will be reported to help identify *where* the circuit is located. For AC Circuits, these are the AC Substation Names; for DC Circuits, these are the AC/DC Terminal Names. For AC/DC Back-to-Back Converters, this is the Converter Station Name.

TO Element Identifier

An alphanumeric name that the TO must enter to identify the Element which is outaged (e.g., a circuit name). This identifier must be unique and consistent from year to year.

Outage Start Time

The date (mm/dd/yyyy) and time (hhhh:mm), rounded to the minute, that the Automatic Outage or Non-Automatic Outage of an Element started. Outage Start Time may be expressed in Coordinated Universal Time (UTC) or in local time.

Outage Duration

The amount of time from the Outage Start Time to when the Element is returned to its pre outage configuration In-Service State as define above. Outage Duration is expressed as hours and minutes, rounded to the nearest minute. Momentary Outages are assigned a time of zero Outage Duration.

Outage Continuation Flag

Not all outages start and end in the same reporting year. This flag describes that characteristic for an outage.

Table A.1: Outage Continuation Flags

Flag	Interpretation
0	The Outage began and ended within the reporting year.
1	The Outage began in the reporting year but continues into the next reporting year.
2	The Outage started in a previous reporting year and continued into the current reporting year.

Outage Identification (ID) Code

A unique alphanumeric identifier assigned by the Transmission Owner to identify the reported outage of an Element.

Normal Clearing

The NERC Glossary of Terms definition of Normal Clearing is:

"A Protection System[8] operates as designed, and the fault is cleared [by the NCCBS, defined below] in the time normally expected with proper functioning of the installed Protection System" [clarification added in brackets].

For TADS purposes, Normal Clearing also includes a Protection System operating as designed for a non-fault condition where an Automatic Outage occurs as expected with proper functioning of the installed Protection System. The

[8] This definition is in the current NERC *Glossary of Terms Used in Reliability Standards*. Although the term "protection system" is not capitalized in the *Glossary*, we have capitalized it here because we believe it has the same meaning.

Normal Clearing definition applies to the opening of circuit breakers. Subsequent automatic reclosing by the Protection System is not included in the Normal Clearing period.

An example of a Normal Clearing event where the reclosing did not function properly would be if an AC Circuit is struck by lightning (with no damage to the equipment), and the Protection System clears the fault as designed (Normal Clearing). However, the Protection System automatic reclosing equipment fails to re-energize the AC Circuit. It was expected that the breakers would reclose and return the line to an In-Service State. Even though the Protection System failed to reclose properly, the above sequence of events is still an example of Normal Clearing as defined above. The Initiating Cause Code would be “Lightning”, and the Sustained Cause Code would be “AC Substation.”

Normal Clearing Circuit Breaker Set (NCCBS)

The set of circuit breakers that would open to isolate a fault on a given Element under Normal Clearing.

For each Element by design, a given set of circuit breakers trip in order to interrupt fault current (if a fault occurred on the Element). In general, this set of circuit breakers may be determined by examining an Elementary single line diagram of the circuit that includes the TADS defined Element. Please note when this given set of circuit breakers open, two or more Elements may change to a not In-Service State and therefore become reportable Automatic Outages. In such a case, these Outages are reportable as one Event, and the same Event ID should be used for each of the Outages.

For example, see the above **Figure A.78**. For purposes of this example, the 230 kV AC Circuit is tapped by a 230 kV/69 kV transformer, which has a low side 69 kV circuit breaker. However, as shown on **Figure A.78**, the transformer does not have a high side 230 kV circuit breaker. In such a case, the NCCBS for this TADS 230 kV AC Circuit includes the 69 kV circuit breaker as part of the expected Normal Clearing if a fault occurs on the TADS Element. The three circuit breakers shown on **Figure A.78** are the NCCBS including the 69 kV circuit breaker.

Abnormal Clearing

The outage of a TADS Element that does not conform with Normal Clearing in all aspects.

For a given Event ID and its associated Automatic Outages, an Automatic Outage that results from one or more unintended BES Element circuit breaker operations outside the NCCBS should be categorized as Abnormal Clearing.

Example Event ID 17A: See the above **Figure A.6**. The NCCBS for “AC Circuit 22” is circuit breaker A and circuit breaker B. During an event where an Automatic Outage of “AC Circuit 22” occurs, if 230 kV circuit breaker D also trips, the Automatic Outage of “AC Circuit 84” is the result of Abnormal Clearing. Since one of the Automatic Outages is the result of Abnormal Clearing, Event ID 17A is an Abnormal Clearing event.

Example Event ID 17B: On the contrary, during an event where an Automatic Outage of “AC Circuit 22” occurs (**Figure A.6**), if the 69 kV circuit breaker C on **Figure A.78** also trips, the 230 kV/69 kV transformer outage is not a reportable Automatic Outage. Since the only Automatic Outage is “AC Circuit 22” and it is the result of Normal Clearing, Event ID 17B is a Normal Clearing event.

Improper operation of Protection System automatic reclosing is not considered Abnormal Clearing. Reclosing is a separate function and occurs after circuit breaker clearing.

Delayed Fault Clearing is considered Abnormal Clearing. See definition below.

Delayed Fault Clearing

Fault clearing consistent with correct operation of a breaker failure Protection System and its associated breakers, or of a backup Protection System with an intentional time delay.

Example Event ID 18A: See Figure A.6. For the purpose of this example, the correct operation of the Protection System for "AC Circuit 22" normally clears both circuit breakers A and B in less than four cycles. However, if the primary Protection System fails (no primary relay targets) and the backup Protection System operates (with an intentional time delay relay target) then this Automatic Outage includes Delayed Fault Clearing. Since the Automatic Outage includes Delayed Fault Clearing, Event ID 18A is an Abnormal Clearing event.

Special Protection System (SPS) or Remedial Action Scheme (RAS)

"An automatic Protection System designed to detect abnormal or predetermined system conditions and take corrective actions other than and/or in addition to the isolation of faulted components to maintain system reliability. Such action may include changes in demand, generation (MW and Mvar), or system configuration to maintain system stability, acceptable voltage, or power flows. An SPS does not include (a) underfrequency or undervoltage load shedding or (b) fault conditions that must be isolated or (c) out-of-step relaying (not designed as an integral part of an SPS). Also called Remedial Action Scheme."

The above definition is from the NERC Glossary of Terms. As designed, a SPS or RAS may normally trip additional circuit breakers beyond the NCCBS. For a given Event ID and its associated Automatic Outages, an Event which results from one or more expected SPS or RAS normal operations should be categorized as Event Type Number 49 (Other Normal Clearing). Abnormal SPS or RAS operations should be categorized as Event Type Number 90 (Other Abnormal Clearing).

Event

An Event is a transmission incident that results in the Automatic Outage (Sustained or Momentary) of one or more Elements. These Outages typically occur within one minute of each other.

Event Identification (ID) Code

A unique alphanumeric identifier assigned by the Transmission Owner to an Event. Because outages that begin in one reporting year and end in the next reporting year must have the same Event ID Code, the code must be unique between all reporting years. For example, an Event ID Code may be W324-2008. This unique Event ID Code establishes an easy way to identify which Automatic Outages are related to one another as defined by their Outage Mode Codes (see Section D).

1. An Event associated with a Single Mode Outage will have just one Event ID Code.
2. Each outage in a related set of two or more outages (e.g., Dependent Mode, Dependent Mode Initiating, Common Mode or Common Mode Initiating) shall be given the same Event ID Code.

Event Type Number

A code that describes the type of Automatic Outage(s) that occurred.

Two tables are provided for Event Type Numbers that fall into two distinct categories.

Normal Clearing: This table applies under two conditions:

1. When a fault has occurred, and the Element is isolated under Normal Clearing.
2. When a fault has not occurred, but the Element is isolated by the proper operation of the Protection System. For example, a circuit breaker may be opened due to the detection of circuit breaker low gas pressure, causing the Protection System to operate. Alternatively, the Protection System due to high oil temperature may isolate a Transformer. Both of these events are categorized as Normal Clearing.

Abnormal Clearing: This table applies under two conditions:

1. When a fault has occurred, and the Element is isolated under Abnormal Clearing.

2. When a fault has not occurred, but the Element is isolated by the failure or unintended operation of the Protection System.

An example of Abnormal clearing would be when a low gas pressure sensor, part of the Protection System, provides an incorrect sensor reading and causes the Protection System to operate when it would not otherwise have operated. Since the sensor and its controls are part of the Protection System, its operation is abnormal (not proper). The isolation of the Element was due to the Protection System's improper operation of a protection sensor. Since an Automatic Outage was due to Abnormal Clearing, the event is categorized as Abnormal Clearing.

Another example of Abnormal Clearing is caused by an improper relay setting (either during design or by misapplication) that causes an unintended outage of one or more Elements.

Table A.2: Event Type Number Descriptions: Events with Normal Clearing[1]	
Event Type No.	**Description**
05	Single bus section fault or failure resulting in one or more Automatic Outages.
06	Single internal circuit breaker fault resulting in one or more Automatic Outages[2].
11	Automatic Outage of a single Element not covered by Event Type Numbers 05 and 06.
13	Automatic Outage of two or more Elements within one NCCBS.
31	Automatic Outages of two or more TADS adjacent AC Circuits or DC Circuits on common structures. To qualify as Event Type Number 31 the Automatic Outages must be the direct result of the circuits occupying common structures[3].
49	Automatic Outage(s) with Normal Clearing not covered by Event Type Numbers 05 through 31 above[4].

Table A.3: Event Type Number Descriptions: Events with Abnormal Clearing[5]	
Event Type No.	**Description**
60	**Breaker Failure:** One or more Automatic Outages with Delayed Fault Clearing due to a circuit breaker being stuck, slow to open or failure to interrupt current.
61	**Dependability (failure to operate):** One or more Automatic Outages with Delayed Fault Clearing due to failure of a single Protection System (primary or secondary backup) under either of these conditions: a. failure to initiate the isolation of a faulted power system Element as designed, or within its designed operating time, or b. In the absence of a fault, failure to operate as intended within its designed operating time. (Item b is a very rare type of event.)
62	**Security (unintended operation):** One or more Automatic Outages caused by improper operation (e.g. overtrip) of a Protection System resulting in isolating one or more TADS Elements it is not intended to isolate, either during a fault or in the absence of a fault.
90	Automatic Outage(s) with Abnormal Clearing not covered by Event Types 60 through 62 above[6].

Notes:

1. Event Type Numbers 05 to 49 are Events with Normal Clearing. These Event Type Numbers apply only when the Automatic Outages are the result of Protection Systems and controls disconnecting the Elements that are

expected to be automatically disconnected for a single event. Normal Clearing is defined in the NERC *Glossary of Terms Used in Reliability Standards*:

2. *"A protection system operates as designed and the fault is cleared in the time normally expected with proper functioning of the installed protection systems."*

   An internal breaker fault means a breaker failing internally. This creates a system fault, which must be cleared by protection on both sides of the breaker.

3. As stated in the TADS definition of Multi-Circuit Structure Mile:
   "… If a line section contains two or more Multi-Circuit Structures which form one or more multi-circuit spans, the total span length can be measured, and the associated mileage should be reported in the 'Multi-Circuit Structure Mile' total inventory. If multiple circuits are connected to only one common structure, that structure should be ignored for outage and inventory mileage purposes."

4. Event Type Number 49 also includes Automatic Outage(s) initiated by normal operation of a Special Protection System (SPS) or Remedial Action Scheme (RAS). SPS (a.k.a. RAS) are defined in the NERC Glossary of Terms. For convenience, this SPS definition has also been added to **Appendix A**.

5. Event Type numbers 60 to 90 are Events with Abnormal Clearing. These Event Type numbers apply when Normal Clearing (see Note 1) does not occur for any one or more Automatic Outage associated with the Event.

6. Event Type 90 also includes Automatic Outage(s) initiated by abnormal operation of a Special Protection System (SPS) or Remedial Action Scheme (RAS).

Event Type No. 11 and 13 Examples

1. For example, suppose a 500 kV AC Circuit is outaged and results in a tapped 500/230 kV Transformer outage due to Normal Clearing. This is an example of Event Type #13.
2. If the Transformer in the previous example had been a 500/69 kV Transformer, the Transformer would not be an Element and, therefore, only the AC Circuit outage would be reported in TADS. This is an example of Event Type #11.

Event Type No. 31 Examples

To qualify for an Event Type No. 31, the outages must be a direct result of the circuits occupying common structures. These characteristics will generally apply.

1. The Outage Initiation Codes are either Element-Initiated or Other-Element Initiated.
2. The Outage Mode Codes are one of the following: (a) Dependent Mode Initiating (first outage) and Dependent Mode (second outage); (b) Common Mode Initiating and Common Mode (two outages); or (c) both Common Mode (two outages).

These are examples of Events that are Event Type No. 31:

1. A tornado outaged two 230kV AC Circuits on common structures. In this example, the outages are Element-Initiated and Common Mode. This is an Event Type No. 31 because the loss of both circuits was directly related to them being on the same structures.
2. On one 230kV AC Circuit, a conductor breaks (outaging the circuit), and the conductor swings into a second 230kV AC Circuit on common structures. The first circuit outage is Element-Initiated and Dependent Mode Initiating; the second circuit outage is Other-Element Initiated and Dependent Mode. This is an Event Type No. 31 because the second circuit's outage was a result of it being on common structures with the first circuit.

These Events are not an Event Type No. 31:

1. Two 230kV AC Circuits on common structures are outaged due to a bus fault in the AC Substation where the circuits terminate. Both outages are AC Substation-Initiated and Common Mode. Because the outages are not a result of the two circuits being on common structures, it is not an Event Type No. 31. It is an Event Type No. 05.
2. Two 230kV AC Circuits are on common structures and terminate at the same bus. Lightning strikes one of the 230kV circuits, but the breaker fails to open due to a failure of a relay to operate properly. The second circuit, which is connected to the same bus, is outaged because of the failure of first circuit's breaker to open. The first outage is an Element-Initiated and Dependent Mode Initiating; the second outage is Protection System-Initiated and Dependent Mode.

   (Note: the relay is excluded as part of an AC Substation, making the Outage Initiation Code "Protection System-Initiated" and not "AC Substation-Initiated.") Because the outages are not a result of the two circuits being on common structures, it is not an Event Type No. 31. It is an Event Type No. 61.

Fault Type

The descriptor of the fault, if any, associated with each Automatic Outage of an Element. Several choices are possible for each Element outage:

1. No fault
2. Phase-to-phase fault (P-P)
3. Single phase-to-ground fault (P-G)
4. Phase-to-phase-to-ground (P-P-G), 3P, or 3P-G fault
5. Unknown fault type

The term "associated with" could be broadly interpreted to mean any fault, no matter how remote, which results in an Automatic Outage of an Element. This is not intended. Therefore, the following guide is to be used for reporting Fault Type. This guide uses the Outage Initiation Codes described in Section C below.

If an Element has an Automatic Outage and its Outage Initiation Code is:

- "Element-Initiated," report the Fault Type from one of the five above.
- "Other Element-Initiated," report "No fault" as the Fault Type for the outage since a Fault Type will be reported for the other Element that initiated the outage.
- Either "AC Substation-Initiated" or "AC/DC Terminal Initiated," report Fault Types from 2-5 above ONLY if a fault occurred on AC equipment that is within the BES. Otherwise, report "No fault" if a fault did not occur OR if a fault occurred, but it occurred on AC equipment outside of the BES (generally less than 100 kV).
- "Other Facility-Initiated," or "Protection System-Initiated," report "No fault" as the Fault Type.

The Fault Type for each Element outage may be determined from recorded relay targets or by other analysis. TOs should use the best available data to determine (1) whether a fault was associated with the outaged Element and, if so, (2) what type of fault occurred.

Relay targets are not a foolproof method to determine the Fault Type; however, they may be the best available data to determine Fault Type. Relay targets should be documented as soon as practical after a fault and the targets re-set to prepare for the next fault. If a single fault results in several Element outages, the protective relay targets associated with each Element indicate the Fault Type for that Outage. An Element whose relays did not indicate a fault should be reported as “No fault.”

Example 1
A 500 kV AC Circuit experiences a single phase-to-ground fault on the Element, outaging the Element. The AC Circuit outage also results in an outage of a 500 kV/230 kV Transformer that is connected to the 500 kV circuit. The Transformer did not experience a fault. The AC Circuit’s Outage Initiation Code would be “Element-Initiated” and its Fault Type would be “Single P-G fault.” The Transformer’s Outage Initiation Code would be “Other Element-Initiated” and its Fault Type would be “No fault.” See bullets “a.” and “b.” above.

Example 2
A 500 kV AC Circuit trips when its relays operate due to a Protection System misoperation for a single phase-to ground fault on a 500 kV/69 kV Non- BES Transformer. The AC Circuit’s “Outage Initiation Code” should be entered as “Protection System-Initiated” because it initiated on the Protection System, which misoperated. The AC Circuit outage fault type should be reported as “No fault.” It does not matter if the fault was on the 500 kV or 69 kV side of the Transformer for this example. See bullet “d.” above. Note that the Transformer outage will not be reported since it is not a TADS Element.

Outage which has more than one Fault Type

An Element outage may have occurred due to multiple reclosing and tripouts prior to lockout (Sustained Outage) of the Element. In such a case during each reclosure, different relay targets may have been initiated. The fault type may not have stayed the same during each reclosure. Many relay targets do not have a recorded time stamp. Therefore, the type of fault during each reclosure may not be known. It is recognized that the resulting list of relay targets is not a foolproof method to determine the Fault Type. However, the TO should use their best judgment on the type of fault encountered from a dynamic stability point of view.

Guidelines

The worst type of fault for dynamic stability is generally the above type 4 – “Phase-to-phase-to-ground (P-P-G), 3P or 3P-G fault”. If both Phase and Ground targets have been recorded without time stamps and are the only information available, the TO should use their best judgment whether item 4 above should be reported as the Fault Type.

A lower impact fault on dynamic stability is the above item 2 – “Phase-to-phase fault (P-P)”. The least impact fault is generally the above item 3 - “Single phase-to-ground fault (P-G)”. It is recognized that a P-G type of fault may produce the highest single-phase fault current. However, for TADS purposes the Fault Type chosen, based on TO best judgment of what occurred, should represent the worst impact on system dynamic stability. This guideline can be clarified by the following Example:

Example 4a - Assume the following actual situation occurred at the site:
A 230 kV AC circuit trips at both terminals due to a long horizontal antenna wire contacting the line. A bright arc occurs from one phase along the antenna wire to the grounded antenna mast. The bright arc disappears. Within a few seconds, the antenna wire melts and whips across two phases. After 15 seconds, a bright arc occurs from one phase to the second phase. The arc does not travel to the antenna mast. The bright arc disappears. The AC conductor is not badly damaged, and the conductor has returned to an energized condition. No one reports the above fireworks to the local utility.

Utility knowledge of the above event:
A momentary outage occurred on 230 kV AC Circuit X-Y:

Both terminals X and Y initially tripped. After 15 seconds, terminal X auto-reclosed and tripped. After 15 more seconds, terminal X auto-reclosed and held. After 5 more seconds, terminal Y auto-reclosed and held. Therefore, the circuit was returned to an in-service state in 35 seconds.

The utility did not have sequence of events or fault recorders at Substation X or Substation Y. From the utility office, a relay technician dials-in to each substation to read the relay target information at generation Substation X and system Substation Y. The recorded protective Relay Targets are: Instantaneous “Ground” current relay target at both terminals X and Y (with no timestamp on the relay targets). Terminal X also has an instantaneous “Zone 1 Phase” relay target (with no time stamp). No other information is available.

It is recognized that perfect information is not always available to the Utility. In such a case, the Fault Type reported in TADS should be type 4 – “Phase-to-phase-to-ground (P-P-G), 3P, or 3P-G fault” which would indicate the worst type of fault, generally, for system stability.

Example 4b - 10 years later, the above event occurs again. However, within that 10-year period digital relays with time stamped Relay Targets have been installed.
The protective relay targets reported are: Instantaneous “Ground” current relay target (at time equal zero) at generation Substation X and system Substation Y. [No Phase relay target at time zero.] Substation X also has an instantaneous “Zone 1 Phase” relay target (at time equal 15 seconds). [No additional “Ground” targets at time equal 15 seconds.] With the new timestamp information, the fault impact on dynamic stability can now be properly reported. Based on the timestamp information, the Fault Type reported in TADS should be type 2 – Phase-to-Phase fault (P-P). For this example, analysis showed that the initial Single Phase to Ground fault had less impact. The actual fault type was not type 4 Phase-to-phase-to-ground (P-P-G).

Relay targets are not a foolproof method to determine the Fault Type; however, they may be the best available data to determine Fault Type. In all cases, the TADS outage should use the applicable Fault Type that is determined.

Outage Initiation Codes

The Outage Initiation Codes describe *where* an Automatic Outage was initiated on the power system.

Element-Initiated Outage

An Automatic Outage of a TADS Element that is initiated on or within the TADS Element that is outaged. (Note: Only used for TADS Element.)

Other Element-Initiated Outage

An Automatic Outage of a TADS Element that is initiated by another TADS Element and not by the TADS Element that is outaged. (Note: Only used for TADS Element.)

AC Substation-Initiated Outage

An Automatic Outage of a TADS Element that is initiated on or within AC Substation facilities. (Note: By the definition of “AC Substation” in Section A, Protection System Equipment is not part of the AC Substation; it is therefore included in “Protection System-Initiated Outage.” Only used for TADS Element.)

AC/DC Terminal-Initiated Outage

An Automatic Outage of a TADS Element that is initiated on or within AC/DC Terminal facilities. (Note: By the definition of “AC/DC Terminal” in Section A, Protection System Equipment is not part of the DC Terminal; it is therefore included in “Protection System-Initiated Outage.” Only used for TADS Element.)

Protection System-Initiated Outage
An Automatic Outage of a TADS Element that is initiated on or within the Protection System. (Note: This includes Automatic Outages due to the failure of a Protection System Element initiated by protection equipment (including, but not limited to incorrect protection settings, wiring errors, miscoordination, Protection System related Human Error, etc.) causing the protection system to misoperate. Only used for TADS Element.)

Other Facility-Initiated Outage
An Automatic Outage that is initiated on or within other facilities. “Other facilities” include any facilities not includable in any other Outage Initiation Code. (Note: Only used for non-TADS Element.) Mode code is always “Dependent Mode Outage”.

Outage Initiation Code Examples

- **Example 1** - A Transformer, which is an Element, is outaged. Is its outage an Element-Initiated Outage or an AC Substation-Initiated Outage? It depends. If the outage initiated on or within the Element (e.g., an internal fault or a cracked insulator that caused a fault), the outage is Element-Initiated, even though the Transformer is in a Substation. However, if the Transformer outage was not due to the Transformer itself but due, for example, to a failed circuit breaker, it is AC Substation-Initiated.
- **Example 2** - An AC Circuit, which is an Element, has an outage that was initiated by a non-TADS Element AC Circuit. The Element outage is Other Facility-Initiated.
- **Example 3** - An AC Circuit Outage was initiated by an Element Transformer outage. The AC Circuit Outage is Other Element-Initiated.

Outage Mode Codes
The Outage Mode Code describes whether an Automatic Outage is related to other Automatic Outages.

Single Mode Outage
An Automatic Outage of a single Element that occurred independent of any other Automatic Outages (if any).

Dependent Mode Initiating Outage
An Automatic Outage of a single Element that initiates one or more subsequent Element Automatic Outages.

Dependent Mode Outage
An Automatic Outage of an Element that occurred because of an initiating outage, whether the initiating outage was an Element outage or a non-TADS Element outage. (Note: to re-emphasize, a Dependent Mode Outage must be a result of another outage.)

Common Mode Outage
One of two or more Automatic Outages with the same Initiating Cause Code and where the outages are not consequences of each other and occur nearly simultaneously (i.e., within cycles or seconds of one another).

Common Mode Initiating Outage
A Common Mode Outage that initiates one or more subsequent Automatic Outages.

Dependent Mode and Common Mode Outage Examples

- **Example 1** - A Dependent Mode Outage involves two or more outages, but one of the outages can be a non-TADS Element outage. Therefore, not all Dependent Mode Outages will have an associated Dependent Mode Initiating Outage. If the initiating outage is one of the four defined Elements, that outage will be a Dependent Mode Initiating Outage, and the resulting second Element outage will be a Dependent Mode Outage. For example, suppose a 500 kV AC Circuit is outaged because of a 500/230 kV Transformer outage. The AC Circuit outage is a Dependent Mode Outage, and the Transformer outage is a Dependent Mode Initiating Outage. However, if an outage is not initiated by an Element, it will not have an associated Dependent Mode Initiating Outage. If the Transformer in the previous example had been a 345/68 kV Transformer and the AC Circuit a 345 kV circuit, the Transformer would not be an Element and, therefore, the AC Circuit outage would not have an associated Dependent Mode Initiating Outage. The AC Circuit outage would be classified as a Dependent Mode Outage since it was the result of a non-TADS Element outage.

- **Example 2** - A Common Mode Outage involves two or more outages, but unlike a Dependent Mode Outage, all outages must be Elements. In addition, one outage must not cause the other outage(s) to occur; i.e., the outages are not consequences of each other. In addition, they must occur nearly simultaneously.
  - As an example, suppose that lightning strikes two AC Circuits in the same right of way (but not necessarily on a common structure) and both circuits are outaged nearly simultaneously. Assume no further outages occur. Both are Common Mode Outages.
  - Now assume the same scenario with a slight difference: one AC Circuit clears normally, the second AC Circuit does not, and there is a circuit breaker failure, resulting in the outage of two additional AC Circuits. The first AC Circuit outage is a Common Mode Outage. The second AC Circuit outage is a Common Mode Initiating Outage, with the two additional AC Circuit outages both being Dependent Mode Outage (if it had only been one additional outage it would also have been Dependent Mode).

Automatic Outage Cause Code Types

Initiating Cause Code

The Automatic Outage Cause Code that describes the initiating cause of the outage.

Sustained Cause Code

The Automatic Outage Cause Code that describes the cause that contributed to the longest duration of the outage. Momentary Outages do not have a Sustained Cause Code.

Initiating and Sustained Cause Code Examples

- **Example 1** - Suppose a lightning strike on an AC Circuit that should have cleared normally becomes a Sustained Outage because of breaker failure. “Lightning” is the Initiating Cause Code and “Failed AC Substation Equipment” is the Sustained Cause Code.
- **Example 2** - Wind causes galloping on a conductor resulting in a circuit lockout. Several hours pass before the circuit can be patrolled to determine whether there was any damage. After patrolling, no damage was found, and the circuit was successfully re-energized. “Weather, excluding lightning” is the Initiating Cause Code as well as the Sustained Cause Code.
- **Example 3** - A Tornado passes through and fails a wood pole structure bringing it to the ground. The line is outaged for 57 hours before it can be returned to an in-service state. Weather, excluding lightning, is the initiating cause code and Failed AC Circuit Equipment is the Sustained Cause Code.

How to interpret "contributed to the longest duration"

To illustrate the meaning of the phrase “contributed to the longest duration” in the definition above, suppose that lightning caused a conductor to break (“Failed AC Circuit Equipment”) and that the breaker for the circuit failed (“Failed AC Substation Equipment’). This example has two possible Sustained Cause Codes, and the one to select is the one that contributed to the longest duration. If the conductor was repaired before the circuit breaker, then “Failed AC Substation Equipment” is the Sustained Cause Code since the circuit breaker outage contributed to the longest duration. However, if the circuit breaker was repaired before the conductor, then "Failed AC Circuit Equipment" is the Sustained Cause Code.

Automatic Outage Cause Codes

The Automatic Outage Cause Code describes the cause with respect to location on the power system it occurred. (See Outage Initiation Code for location on the power system)

Weather, excluding lightning

Automatic Outages caused by weather such as snow, extreme temperature, rain, hail, fog, sleet/ice, wind (including galloping conductor), tornado, microburst, dust storm, and flying debris caused by wind.

Lightning

Automatic Outages caused by lightning.

Environmental

Automatic Outages caused by environmental conditions such as earth movement (including earthquake, subsidence, earth slide), flood, geomagnetic storm, or avalanche.

Contamination

Automatic Outages caused by contamination such as bird droppings, dust, corrosion, salt spray, industrial pollution, smog or ash.

Foreign Interference

Automatic Outages caused by foreign interference from such objects including an aircraft, machinery, a vehicle, a train, a boat, a balloon, a kite, a bird (including streamers), an animal, flying debris not caused by wind, and when falling conductors from another line cause a fault and result in an outage.

Foreign Interference is not due to an error by a utility employee or contractor. Categorize these as "Human Error."

Fire

Automatic Outages caused by fire or smoke.

Physical Security Incident[9]

Automatic Outages caused by intentional activity such as shot conductors or insulators, removing bolts from structures, and bombs.

Accidental acts initiated by any incorrect action traceable to employees and/or contractors for companies operating, maintaining, and/or providing assistance to the Transmission Owner should still be cause coded as "Human Error".

Cyber Security Incident

A malicious act that causes an outage on a TADS reportable Element by disrupting the operation of a cyber-system. This includes incidents such as security perimeters being compromised through electronic means.

Failed AC Substation Equipment

Automatic Outages caused by the failure of AC Substation, i.e., equipment "inside the substation fence" including Transformers and circuit breakers but not Protection System equipment as it is not part of the AC Substation. Refer to the definition of "AC Substation."

[9] This was previously known as Vandalism, Terrorism or Malicious Acts. It was changed to Physical Security Incident starting with2024 reporting year to separate outages caused by a Cyber Security Incident.

For TADS reporting when an instrument transformer failure results in a BES fault on the primary system it should be reported as failed AC substation equipment.

Failed AC/DC Terminal Equipment

Automatic Outages caused by the failure of AC/DC Terminal equipment, i.e., equipment "inside the terminal fence" including PLC (power-line carrier) filters, AC filters, reactors and capacitors, Transformers, DC valves, smoothing reactors, and DC filters but not Protection System equipment as it is not part of the DC Terminal. Refer to the definition of "AC/DC Terminal."

Failed Protection System Equipment

Automatic Outages caused by the failure of devices which are part of a Protection system as defined in the NERC Glossary of Terms. Includes any relay and/or control misoperations, *except* those that are caused by incorrect relay or control settings that do not coordinate with other protective devices. Categorize these as "Human Error".

Automatic Outages caused by the failure of a protective device which is not part of the NERC defined Protection system should be coded as Failed AC Substation Equipment and NOT Failed Protection System Equipment.

For TADS reporting when an instrument transformer has a failure on the secondary system it should be reported as failed protection system equipment.

Failed AC Circuit Equipment

Automatic Outages related to the failure of AC Circuit equipment, i.e., overhead or underground equipment "outside the substation fence." Refer to the definition of "AC Circuit."

Failed DC Circuit Equipment

Automatic Outages related to the failure DC Circuit equipment, i.e., overhead or underground equipment "outside the terminal fence." Refer to the definition of "DC Circuit." However, include the failure of a connecting DC bus within an AC/DC Back-to-Back Converter in this category.

Vegetation

Automatic Outages (both Momentary and Sustained) caused by vegetation:

1. Outages caused by vegetation growing into applicable lines by vegetation <u>inside and/or outside</u> of the transmission rights of way (ROW).
2. Outages caused by vegetation falling into applicable lines from <u>inside and/or outside</u> the ROW.
3. Outages caused by vegetation and applicable lines blowing together from <u>within</u> the ROW.

Outages that fall under the following exclusions, which apply to circumstances that are beyond the control of an applicable Transmission Owner, subject to FAC-003-5, should be reported under another Cause Code:

1. Vegetation-related outages that result from vegetation falling into lines from outside the ROW that result from natural disasters shall not be considered reportable with the Vegetation Cause Code. Examples of natural disasters that could create non-reportable Vegetation Cause Code outages include, but are not limited to, earthquakes, fires, tornados, hurricanes, landslides, wind shear, fresh gale, major storms as defined either by the applicable Transmission Owner or an applicable regulatory body, ice storms, and floods.
2. Vegetation-related outages due to human or animal activity shall not be considered reportable under the Vegetation Cause Code. Examples of human or animal activity that could cause a non-reportable Vegetation Cause Code outage include, but are not limited to, logging; animal severing tree; vehicle contact with tree; or installation, removal or digging of vegetation.

Outages that fall under the two exclusions above likely should be coded as:

- Weather, excluding lightning
- Environmental
- Foreign Interference
- Vandalism, Terrorism or Malicious Acts
- Human Error

Instances where the Initiating Cause Code is not classified as Vegetation, the Sustained Cause Code would also not be classified as Vegetation.

Vegetation outages reported under FAC-003-X would be expected to be reported with the Vegetation Cause Code in TADS.

Power System Condition

Automatic Outages caused by power system conditions such as instability, overload trip, out-of-step, abnormal voltage, abnormal frequency, or unique system configurations (e.g., an abnormal terminal configuration due to existing condition with one breaker already out of service).

Human Error

Automatic Outages caused by any incorrect action traceable to employees and/or contractors for companies operating, maintaining, and/or providing assistance to the Transmission Owner will be identified and reported in this category. In addition, any human failure or interpretation of standard industry practices and guidelines that cause an outage will be reported in this category.

Unknown

Automatic Outages caused by unknown causes should be reported in this category.

Other

Automatic Outages for which the cause is known; however, the cause is not included in the above list.

Operational Outage Cause Codes

Emergency

Use for Operational Outages that are taken for the purpose of avoiding risk to human life, damage to equipment, damage to property, or similar threatening consequences.

System Voltage Limit Mitigation

Use for Operational Outages taken to maintain the voltage on the transmission system within desired levels (i.e., voltage control).

System Operating Limit Mitigation, excluding System Voltage Limit Mitigation

Use for Operational Outages taken to keep the transmission system within System Operating Limits, except for System Voltage Limit Mitigation. The term “System Operating Limit” is defined in the NERC *Glossary of Terms Used in Reliability Standards* and is excerpted:

System Operating Limit:

The value (such as MW, MVar, Amperes, Frequency or Volts) that satisfies the most limiting of the prescribed operating criteria for a specified system configuration to ensure operation within acceptable reliability criteria. System Operating Limits are based upon certain operating criteria. These include, but are not limited to:

1. Facility Ratings (Applicable pre- and post-Contingency equipment or facility ratings)

2. Transient Stability Ratings (Applicable pre- and post-Contingency Stability Limits)

3. Voltage Stability Ratings (Applicable pre- and post-Contingency Voltage Stability)

4. System Voltage Limits (Applicable pre- and post-Contingency Voltage Limits).

Do not include actions in the last category (System Voltage Limits) since this is included in the previous "System Voltage Limitation" code.

Human Error

Use for manual switching errors and any operation that is caused by personnel during on-site maintenance, testing, inspection, construction, or commissioning activities.

- **Example 1** - An employee intends to open breaker 1 to outage circuit A. However, he operates the wrong control handle and opens breaker 3 and outages circuit B.
- **Example 2** - An employee is testing a relay and, as a result, unintentionally operates a breaker, placing the circuit into a not In-Service State. This would also include interruptions when an electrician is working in the switchhouse and accidentally shorts out a circuit and trips a breaker.

Other Operational Outage

Use for Operational Outages for reasons not included in the above list.

Appendix B: Inventory Data Calculation and Entry

The following examples demonstrate a calculation method that can be used to complete the TADS inventory spreadsheet data for detailed inventory reporting and summary Multi-Circuit Structure Mile reporting. Also, these methods are applicable in calculating Equivalent: DC Circuit Mileage, Number of DC Circuits, Number of Transformers and Number of AC/DC Back to Back Converters. Conceptually, equivalent measurements are defined as the measure multiplied by the percent of the year that the Element was able to be in an In-Service State.

The TADS Working Group acknowledges that other calculation methods can be utilized to complete the inventory spreadsheet. Every reporting Entity must determine the method that is best for their organization.

Equivalent Circuit Mileage

Conceptually, equivalent measurements are defined as the measure multiplied by the percent of the year that the Element was able to be in an In-Service State. For Circuit Mileage, this is defined as:

$$Equivalent\ Circuit\ Mileage = Element\ Circuit\ Mileage \times \frac{Days\ In\ Service + Days\ in\ Outage}{Total\ Days\ in\ Reporting\ Year}$$

For example, a 5-mile circuit commissioned on midnight March 1 with no outages would have 5.0 Circuits × (306.00 + 0.00)/365.00 ≈ 4.19 Equivalent AC Circuit Miles for the entire year. DC Circuit Elements are calculated similarly. To increase accuracy, fractional days may be used to take into account the circuit commissioning time. If taking into account the fractional days from the beginning of a reporting year, count from January 1 at 00:00:01 UTC for the beginning of the year. For the end of the year, count to December 31 at 23:59:59 UTC.

Equivalent Number of Elements

Conceptually, equivalent measurements are defined as the measure multiplied by the percent of the year that the Element was able to be in an In-Service State. For Number of Elements, this is defined as:

$$Equivalent\ Number\ of\ Elements = Element\ Number\ of\ Elements \times \frac{Days\ In\ Service + Days\ in\ Outage}{Total\ Days\ in\ Reporting\ Year}$$

For example, a circuit commissioned on midnight March 1 with no outages would have 1.0 Circuits × (306.00 + 0.00)/365.00 ≈ 0.84 Equivalent AC Circuits for the entire year. A similar calculation is performed for DC Circuit Elements.

To increase accuracy, fractional days may be used to take into account the circuit commissioning time. If you are using the fractional days from the beginning of a reporting year, the count would begin on January 1 at 00:00:01 UTC. For the end of the year, count to December 31 at 23:59:59 UTC.

Inventory Data Entry Examples

In **Figure B.1** below, System A needs to be reported in webTADS. The entire system is 345 kV, and it consists of multiple AC Circuits added and removed throughout the year. It is assumed that all of the original circuits were placed in-service on January 1, 2013. Also, a temporary substation is added and then removed in order to perform maintenance on circuit DF1 during the year. This will need to be accounted for in the detailed inventory as it changes both Element identifiers and mileages.

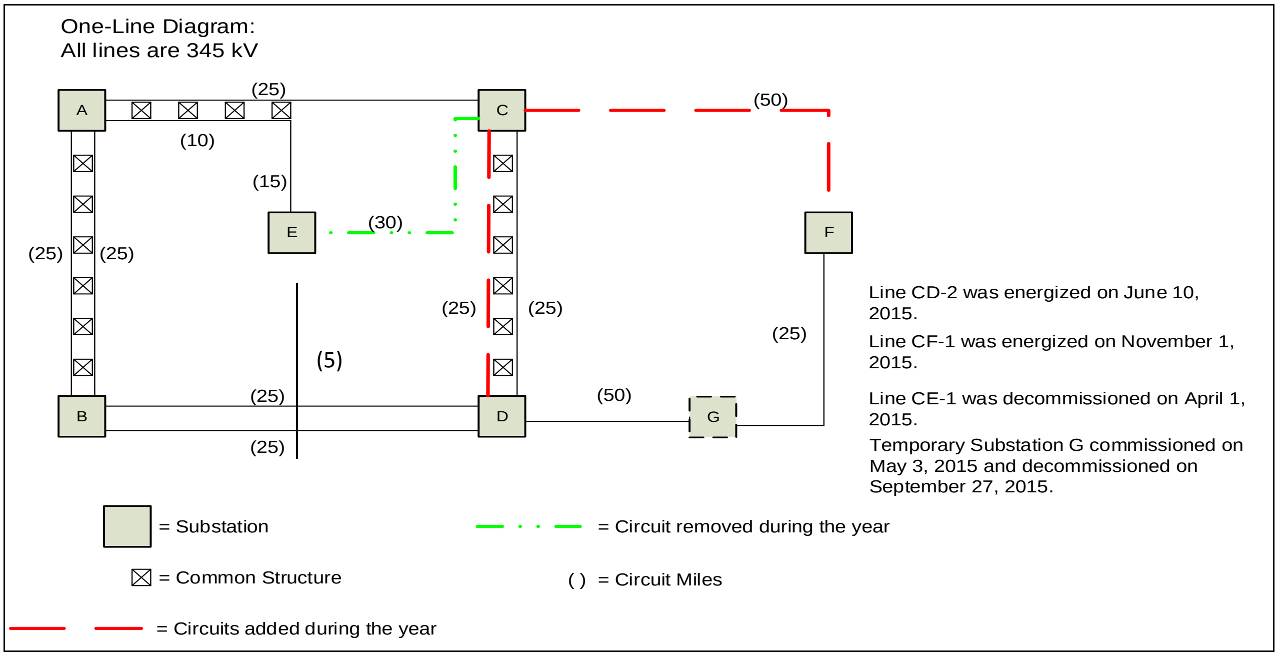

Figure B.1: System A One-line Diagram

As System A contains only AC Circuits, the inventory will be entered into TADS using Form 3.1 Table B.1 below shows the required data fields which must be provided to enter the example system into the TOs inventory data.

Table B.1: Form 3.1 Detailed AC & DC Ckt Inventory Data									
Unique Element Identifier	Voltage Class	Circuit Miles	Number of Terminals	Change / Reconfiguration Date	Retirement Date	Precursor Element	From Bus	To Bus	Tertiary Bus
AB1	300-399 kV	25	2	1/1/2013			A	B	
AB2	300-399 kV	25	2	1/1/2013			A	B	
AE1	300-399 kV	25	2	1/1/2013			A	E	
AC1	300-399 kV	25	2	1/1/2013			A	C	
BDE1	300-399 kV	30	3	1/1/2013			B	D	E
BD2	300-399 kV	25	2	1/1/2013			B	D	
CD1	300-399 kV	25	2	1/1/2013			C	D	
CE1	300-399 kV	30	2	1/1/2013			C	E	
DF1	300-399 kV	75	2	1/1/2013			D	F	

Adding and Splitting Circuits

On 5/3/2015, temporary substation G is commissioned which splits line DF1 into DG1 and FG1. This is followed by circuit CD2 going in-service on 6/10/2015.

A new entry is added to Form 3.1 to account for circuit CD2. Then the entry for circuit DF1 is modified to indicate a Retirement Date of 5/3/2015 to account for the temporary substation G. Finally, two additional entries are made to include the new circuits DG1 and FG1. The Precursor Element field is populated for the two new circuits to indicate they were the result of splitting a previous line. These changes are shown in Table B.2 below.

Table B.2: Form 3.1 Detailed AC & DC Ckt Inventory Data									
Unique Element Identifier	Voltage Class	Circuit Miles	Number of Terminals	Change / Reconfiguration Date	Retirement Date	Precursor Element	From Bus	To Bus	Tertiary Bus
CD2	300-399 kV	25	2	6/10/2015			C	D	
DF1	300-399 kV	75	2	1/1/2013	5/3/2015		D	F	
DG1	300-399 kV	50	2	5/3/2015		DF1	D	G	
FG1	300-399 kV	25	2	5/3/2015		DF1	F	G	

Deleting a Substation

On 7/19/2015, temporary substation G is removed. This results in circuits DG1 and FG1 combining back onto one continuous circuit. In order to maintain the change history, this circuit must be given a new Element Identifer and it cannont be same ID which was used before tempory substation G was commissioned. In **Table B.3** below, Form 3.1 is modified to add a Retirement Date of 7/19/2015 for circuit DG1 and FG1. The combined circuit DF1_2 is added and the Precursor Element field is populated with the previous line segments which now make up the new circuit.

Table B.3: Quarter 1 2015 Form 3.1 TADS Inventory Entry									
Unique Element Identifier	Voltage Class	Circuit Miles	Number of Terminals	Change / Reconfiguration Date	Retirement Date	Precursor Element	From Bus	To Bus	Tertiary Bus
DG1	300-399 kV	50	2	5/3/2015	7/19/2015	DF1	D	G	
FG1	300-399 kV	25	2	5/3/2015	7/19/2015	DF1	F	G	
DF1_2	300-399 kV	75	2	7/19/2015		DG1, G1	D	F	

AC Multi-Circuit Structure Miles Calculation Example - Form 3.5

As shown in **Table B.4** below, 85 would be entered into the column titled “Multi-Circuit Structure Miles (End of Year)” for System A.

Table B.4: Form 3.5 Multi-Circuit Structure Miles Calculations (Elements at the end of the year)	
Element Identification	Multi-Circuit Structure Miles
AB1 and AB2	25
AC1 and AE1	10
CD1 and CD2	25
BDE1 and BD2	25
Total Structure Miles	**85**

For System A, 25 would be entered into the column titled “No. of Multi-Circuit Structure Miles for Circuits Added”.

For System A, 14.04 would be entered into the column titled “Equivalent Annual No. of Multi-Circuit Structure Miles for Circuits Added”.

Table B.5: Multi-Circuit Structure Miles Calculations (Elements added during the year)			
Element Identification	**Multi-Circuit Structure Miles**	**Number of Days from In-Service date to the end of the reporting year**	**Equivalent Multi-Circuit Structure Miles**
CD1 and CD2	25	205	14.04
Total Equivalent Structure Miles added during the year			**14.04**

- 25 Structure Miles (205 days in service during the year/365 days in year) = 14.04

A similar calculation would be performed for Multi-Circuit Structure Miles for Circuits Removed during a reporting year.

TADS Element on a common structure with a non-BES Element

In this situation, AC Circuit CF was placed on a common structure with an existing non-BES, 69 kV circuit. For TADS, this common structure situation shall not be included in the Multi-Circuit Structure Mile calculation. For TADS, you are only to report those Multi-Circuit Structure Miles where two or more TADS Elements share a common structure. Non-BES Elements are not considered TADS Elements.

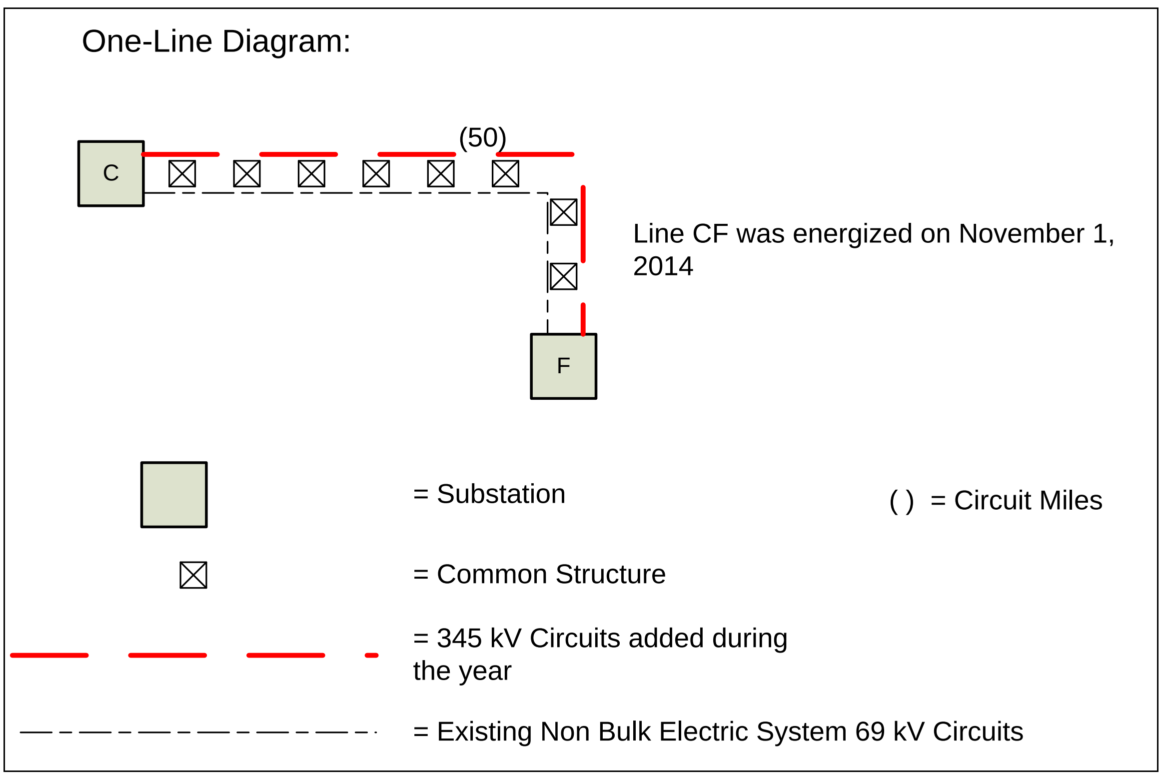

Figure B.1: Example B One-line Diagram

Appendix C: Detailed Automatic Outage Data Examples

The following examples illustrate several AC Circuit Automatic Outage scenarios accompanied by (in most cases) a Transformer Automatic Outage scenario. Data entries for Form 4.1, Form 4.2 and Form 5.0 with the appropriate data entries for the reportable outages are provided. While not all possible situations could be covered, the examples are complete enough to help with outage interpretation.

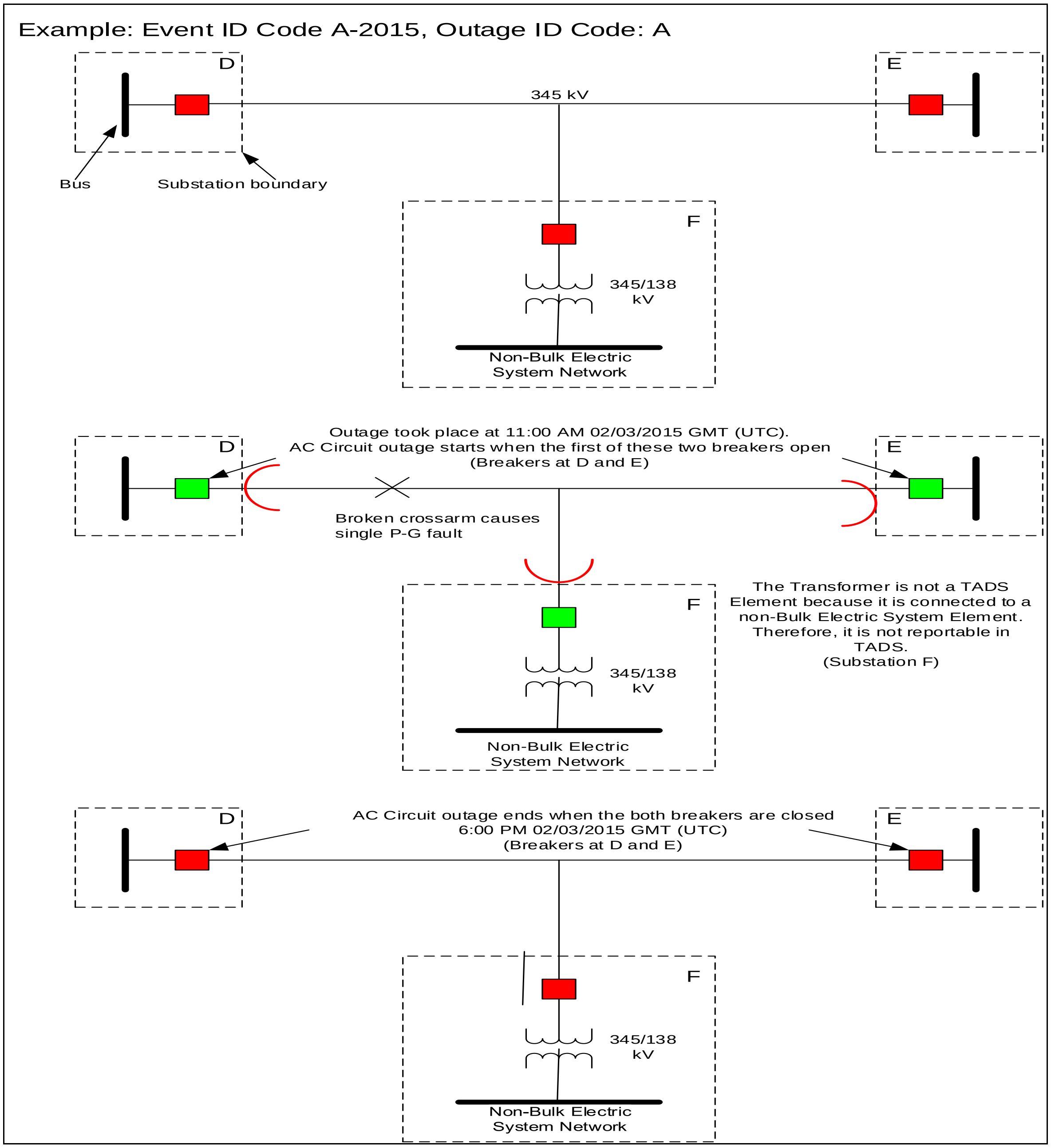

Figure C.1: Example 1 AC Circuit with Non-TADS Transformer

In Figure C.1, an AC Circuit with a non-TADS Element attached to one of the segments is shown. Since the transformer is not considered a TADS Element, outages to the transformer are not reportable.

It is important to note in this example the application of the TADS In-Service State definition. There is only one exception, the multi-terminal transformer exception, that an Element be "connected at all its terminals" to be considered in an In-Service State. This exception applies only to a multi-terminal AC Circuit with a transformer on one terminal sharing a breaker with the circuit.

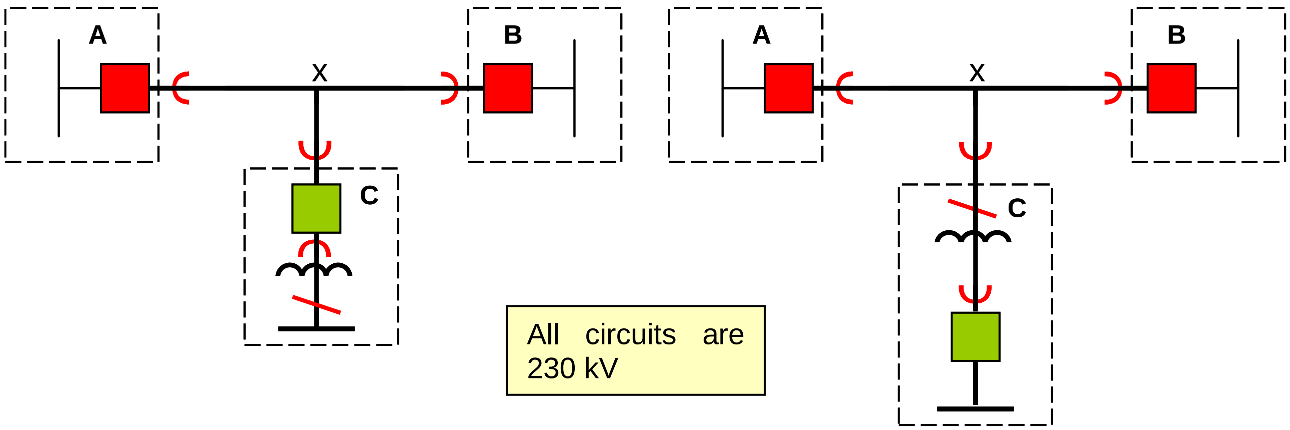

Figure C.2 **Figure C.1**

In **Figure C.2** and **Figure C.3**, the AC Circuit is bounded by AC Substations A, B, and C as indicated by the red arcs. Each transformer's boundaries are the red disconnect switch and the red arc before the breaker. Note, the transformer in either figure may *or* may not be a reportable Element.

Assume that each transformer is out of service because of the operation of its associated breaker (indicated in green). In **Figure C.2**, the AC Circuit would normally be considered out of service since the breaker at AC Substation C, which is shared by the AC Circuit and the transformer, is open. Nevertheless, if all other portions of the AC Circuit are in service, the entire AC Circuit is considered to be in an In-Service State even if the transformer is out of service. Because TADS does not recognize partial outage states, the multi-terminal exception above was developed. This avoids overstating the outage contribution of this multi-terminal configuration type. In **Figure C.23**, the open breaker is not shared by the AC Circuit, and the AC Circuit remains connected. Thus, the exception does not apply, in this case, since the AC Circuit is connected at all its terminals even though the transformer is out of service. This outage will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in **Table C.1-Table C.2**.

Table C.1: Example 1 Form 5.0 - Event ID Code Data

Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
A-2015	11		No

Table C.2: Example 1 Form 4.1 - AC Circuit Detailed Automatic Outage Data

Outage ID Code	Fault Type	Outage Initiation Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
A	Single P-G Fault	Element-Initiated	2/3/208 11:00	7:00	Failed AC Circuit Equipment	Failed AC Circuit Equipment	Single Mode	0

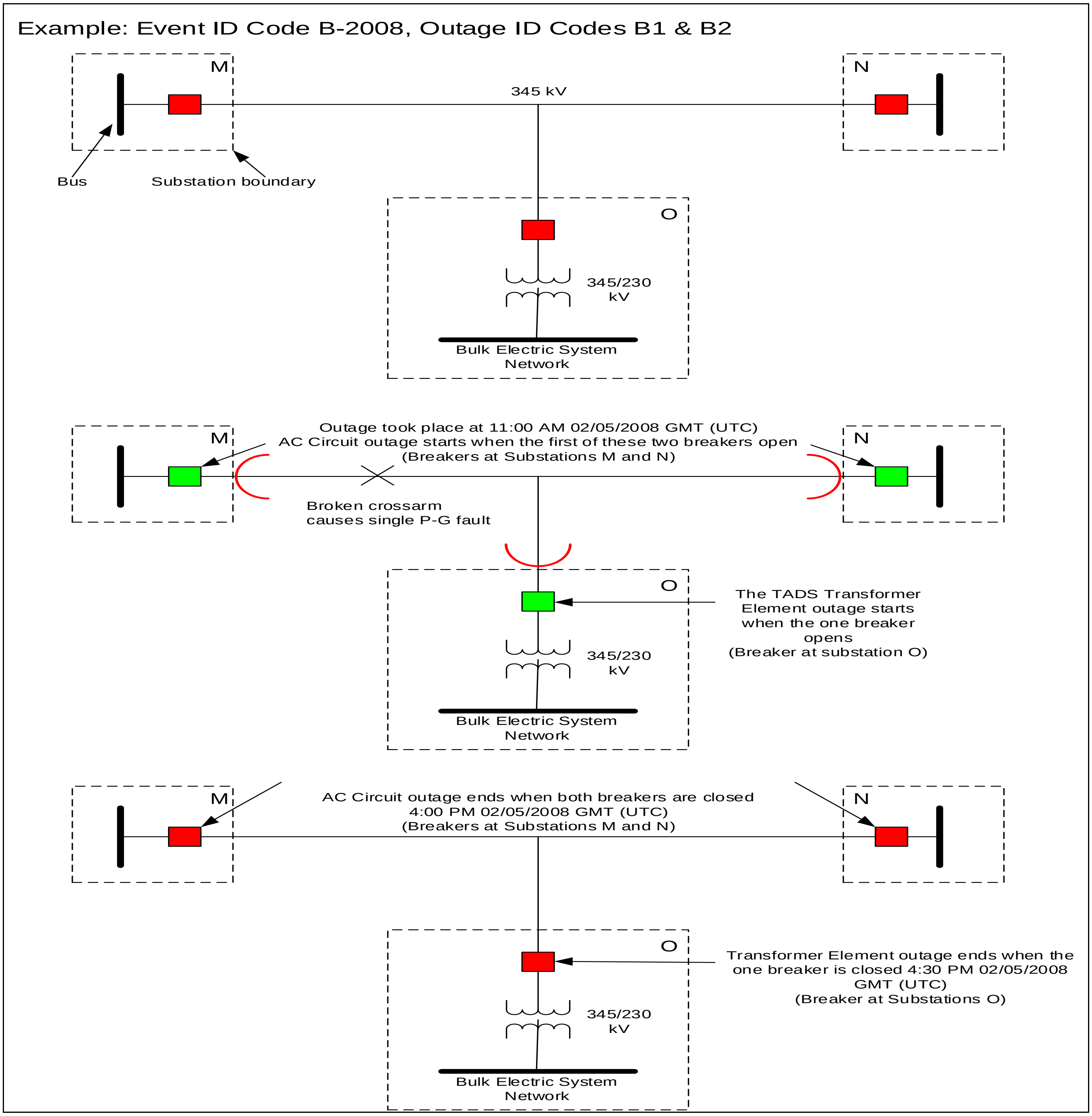

Figure C.2: Example 2 Three-terminal AC Circuit with a TADS Transformer

This is a three-terminal, AC Circuit with a TADS Transformer attached to one of the segments. Since the Transformer is a TADS Element, its outage is reportable. This outage will require the completion of Form 5.0, 4.1, and 4.3. Data entries for these forms are shown below in **Table C.3-Table C.5**.

Table C.3: Example 2 Form 5.0 - Event ID Code Data			
Event ID Code	**Event Type No.**	**Description of the Event (optional)**	**Disturbance Report Filed**
B-2008	13	Outage of 345 kV Transmission Line and 345 kV/230 kV Transformer	No

Table C.4: Example 2 Form 4.1 - AC Circuit Detailed Automatic Outage Data								
Outage ID Code	**Fault Type**	**Outage Initiation Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
B1	Single P-G Fault	Element-Initiated	2/3/2008 11:00	5:00	Failed AC Circuit Equipment	Failed AC Circuit Equipment	Dependent Mode Initiating	0

Table C.5: Example 2 Form 4.3 - Transformer Detailed Automatic Outage Data										
Outage ID Code	**Event ID Code**	**High-Side Voltage Class**	**Fault Type**	**Outage Initiating Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
B2	B-2008	300-399 kV	No fault	Other Element-Initiated	2/5/2008 11:00	5:30	Failed AC Circuit Equipment	Failed AC Circuit Equipment	Dependent Mode	0

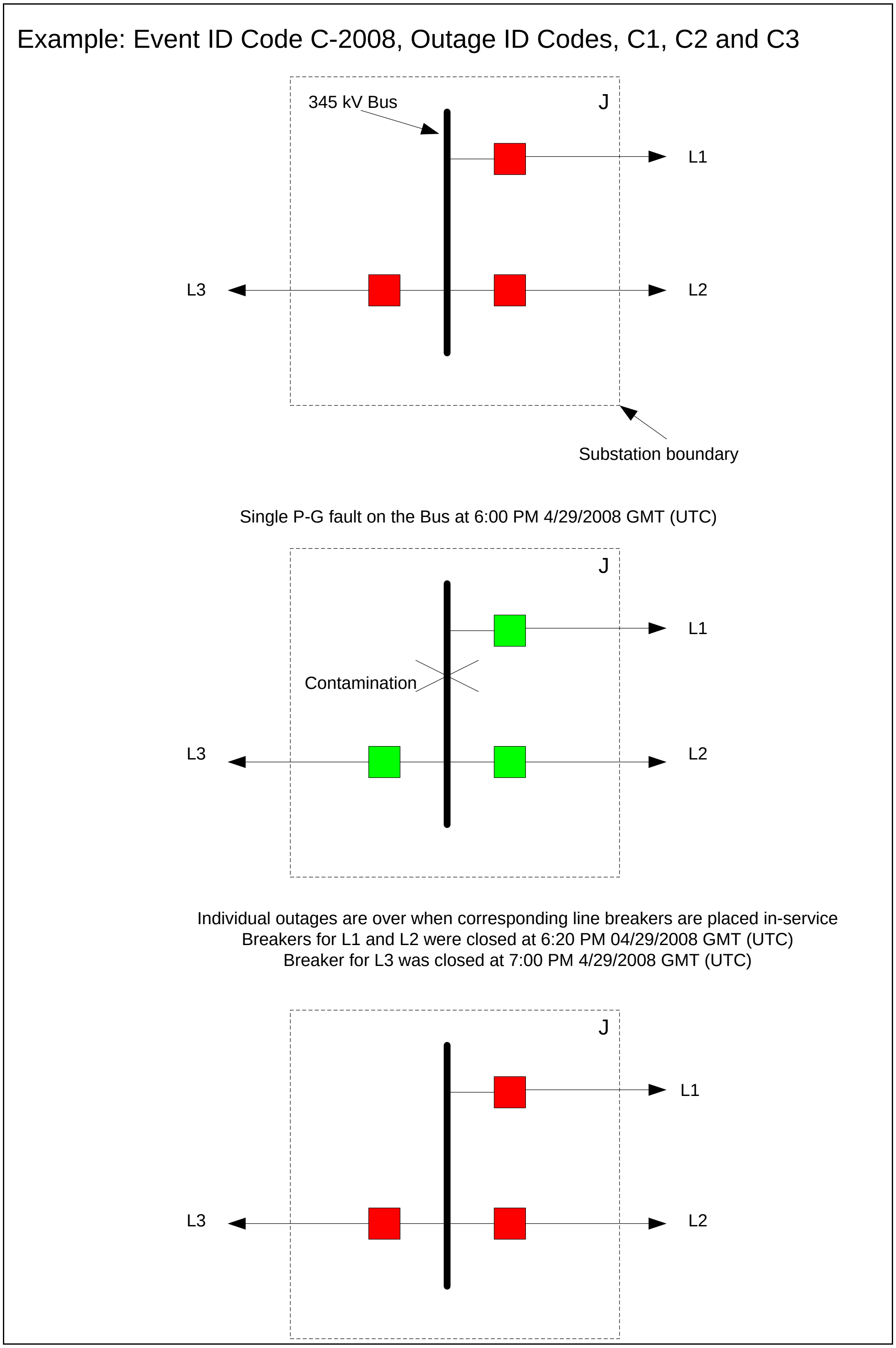

Figure C.3: Example 3: Bus Fault Interrupts TADS Elements

This is an outage of a 345 kV bus caused by contamination. No damage resulted, and all the AC Circuits connected to the bus are reportable. This outage will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in **Table C.6-Table C.7**.

Table C.6: Example 3 Form 5.0 - Event ID Code Data

Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
C-2008	05	Bus Outage	No

Table C.7: Example 3 Form 4.1 - AC Circuit Detailed Automatic Outage Data

Outage ID Code	Fault Type	Outage Initiation Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
C1	Single P-G Fault	AC Substation-Initiated	4/29/2008 18:00	0:20	Contamination	Contamination	Common Mode	0
C2	Single P-G Fault	AC Substation-Initiated	4/29/2008 18:00	0:20	Contamination	Contamination	Common Mode	0
C3	Single P-G Fault	AC Substation-Initiated	4/29/2008 18:00	1:00	Contamination	Contamination	Common Mode	0

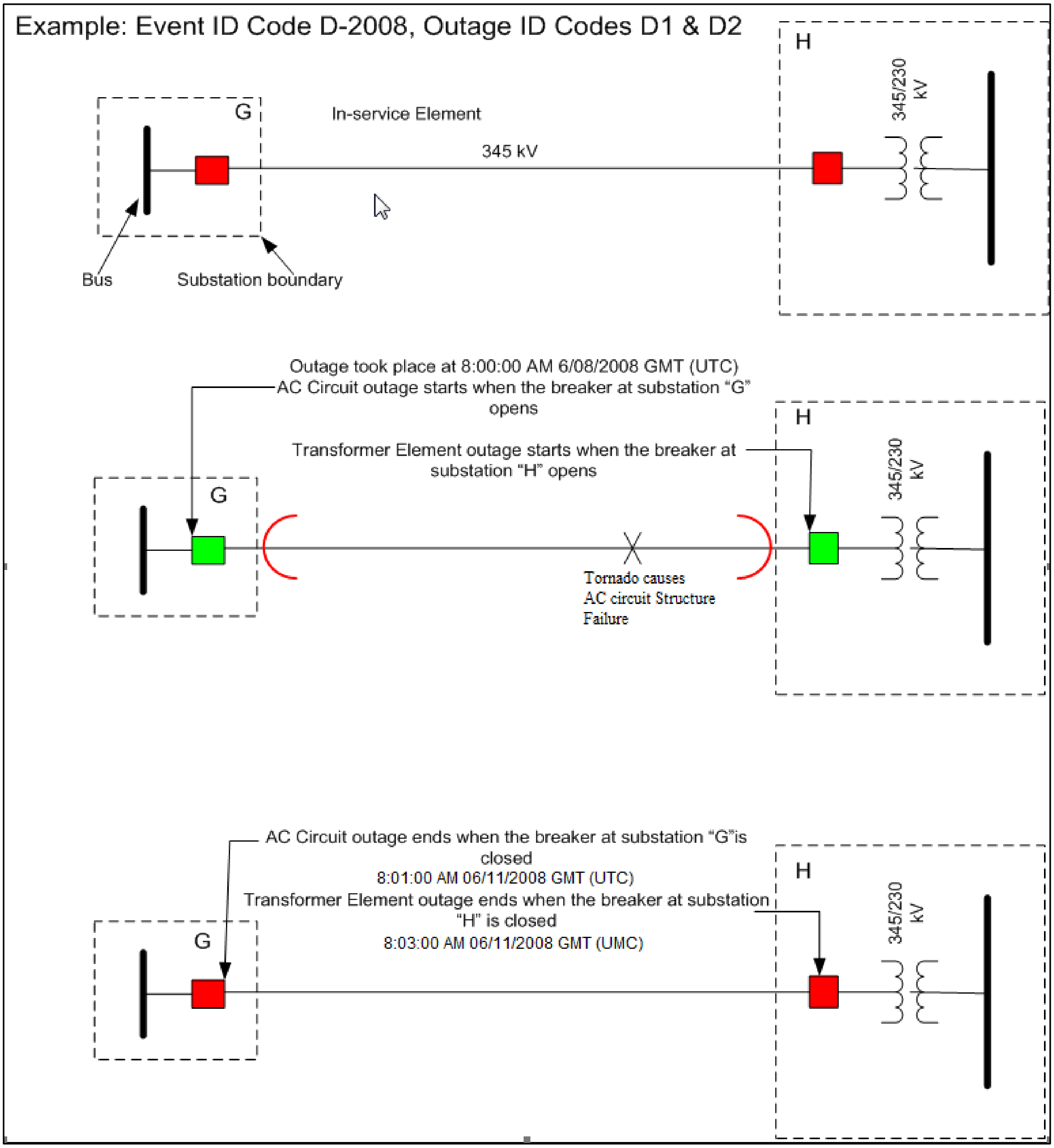

Figure C.4: Example 4 AC Circuit directly connected to a TADS Transformer

The AC Circuit structure was damaged by the tornado and required replacement. This outage will require the completion of Form 5.0, 4.1, and 4.3. Data entries for these forms are shown below in **Table C.8-Table C.10**.

Table C.8:Example 4 Form 5.0 - Event ID Code Data

Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
D-2008	13	Outage of 345 kV Transmission Line and 345 kV/230 kV Transformer	No

Table C.9: Example 4 Form 4.1 - AC Circuit Detailed Automatic Outage Data

Outage ID Code	Fault Type	Outage Initiation Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
D1	Element-Initiated	AC Substation-Initiated	6/8/2008 8:00	3:00	Weather, excluding lightning	Failed AC Circuit Equipment	Dependent Mode Initiating	0

Table C.10: Example 4 Form 4.3 - Transformer Detailed Automatic Outage Data

Outage ID Code	Event ID Code	High-Side Voltage Class	Fault Type	Outage Initiating Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
D2	D-2008	300-399 kV	No fault	Other Element-Initiated	6/8/2008 8:00	3:00	Weather, excluding lightning	Failed AC Circuit Equipment	Dependent Mode	0

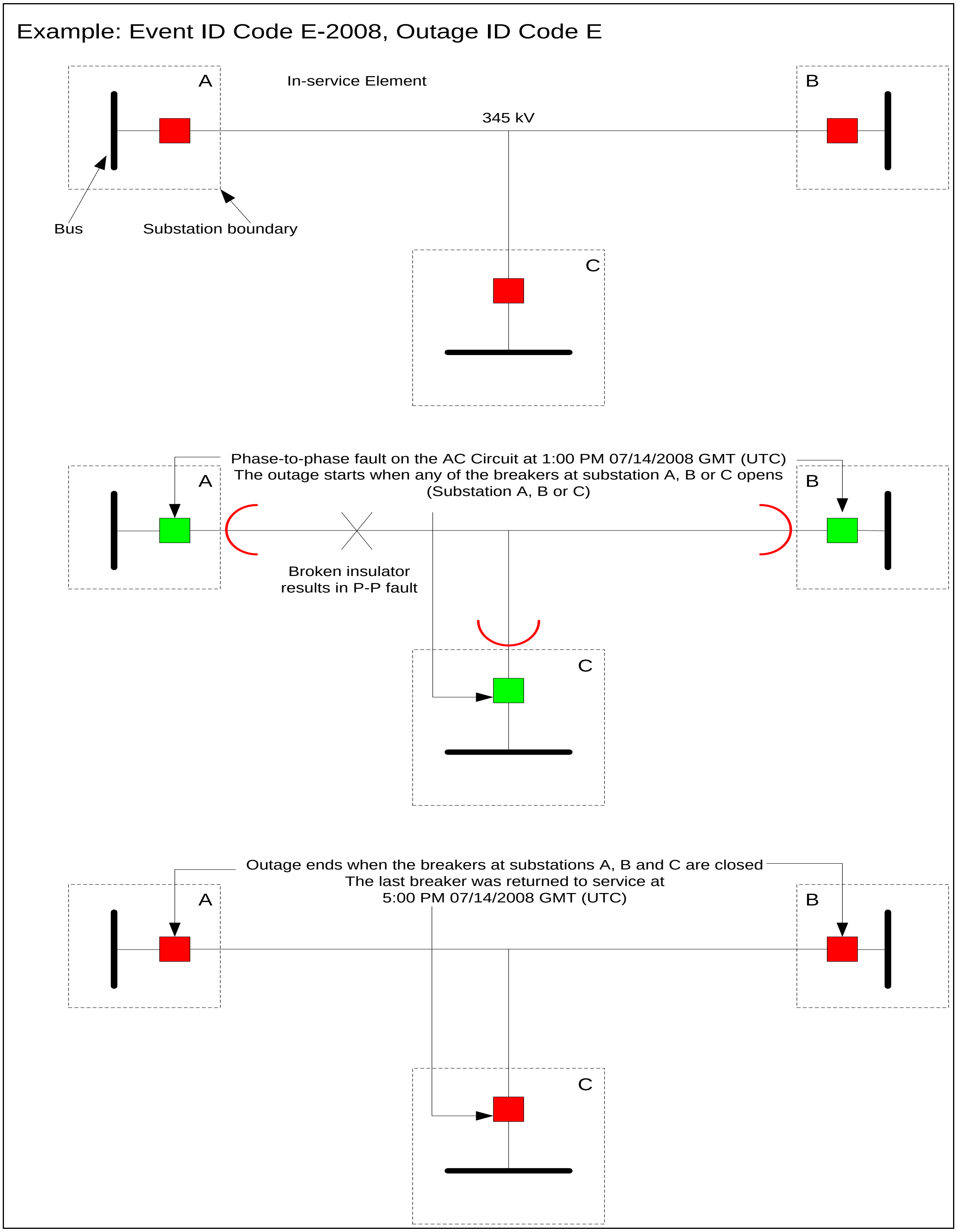

Figure C.5: Example 5 Three-terminal AC Circuit

This outage will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in **Table C.11-Table C.12**.

Table C.11: Example 5 Form 5.0 - Event ID Code Data			
Event ID Code	**Event Type No.**	**Description of the Event (optional)**	**Disturbance Report Filed**
E-2008	11		No

Table C.12: Example 5 Form 4.1 - AC Circuit Detailed Automatic Outage Data								
Outage ID Code	**Fault Type**	**Outage Initiation Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
E	P-P fault	Element-Initiated	7/14/2008 13:00	4:00	Failed AC Circuit Equipment	Failed AC Circuit Equipment	Single Mode	0

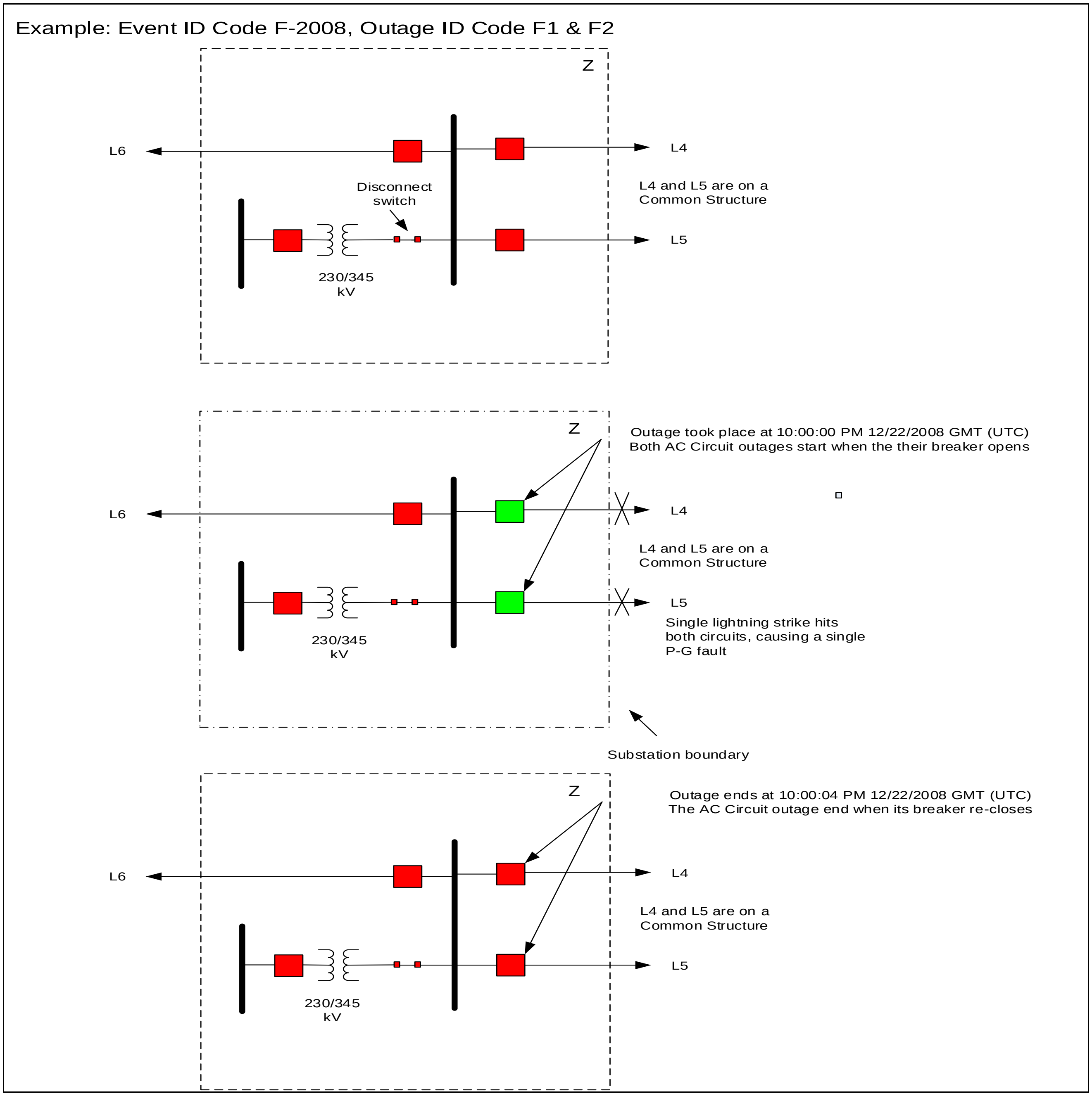

Figure C.6: Example 6: Outage of two AC Circuits with Common Cause

This outage will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in Table C.13-Table C.14.

Table C.13: Example 6 Form 5.0 - Event ID Code Data			
Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
F-2008	31		No

Table C.14: Example 6 Form 4.1 - AC Circuit Detailed Automatic Outage Data								
Outage ID Code	**Fault Type**	**Outage Initiation Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
F1	Single P-G fault	Element-Initiated	12/22/2008 13:00	0:00	Lightning	NA-Momentary	Common Mode	0
F2	Single P-G fault	Element-Initiated	12/22/2008 22:00	0:00	Lightning	NA-Momentary	Common Mode	0

***Note**: The outages would have been characterized as a Common Mode Outage even if the AC Circuits had not been on common structures.

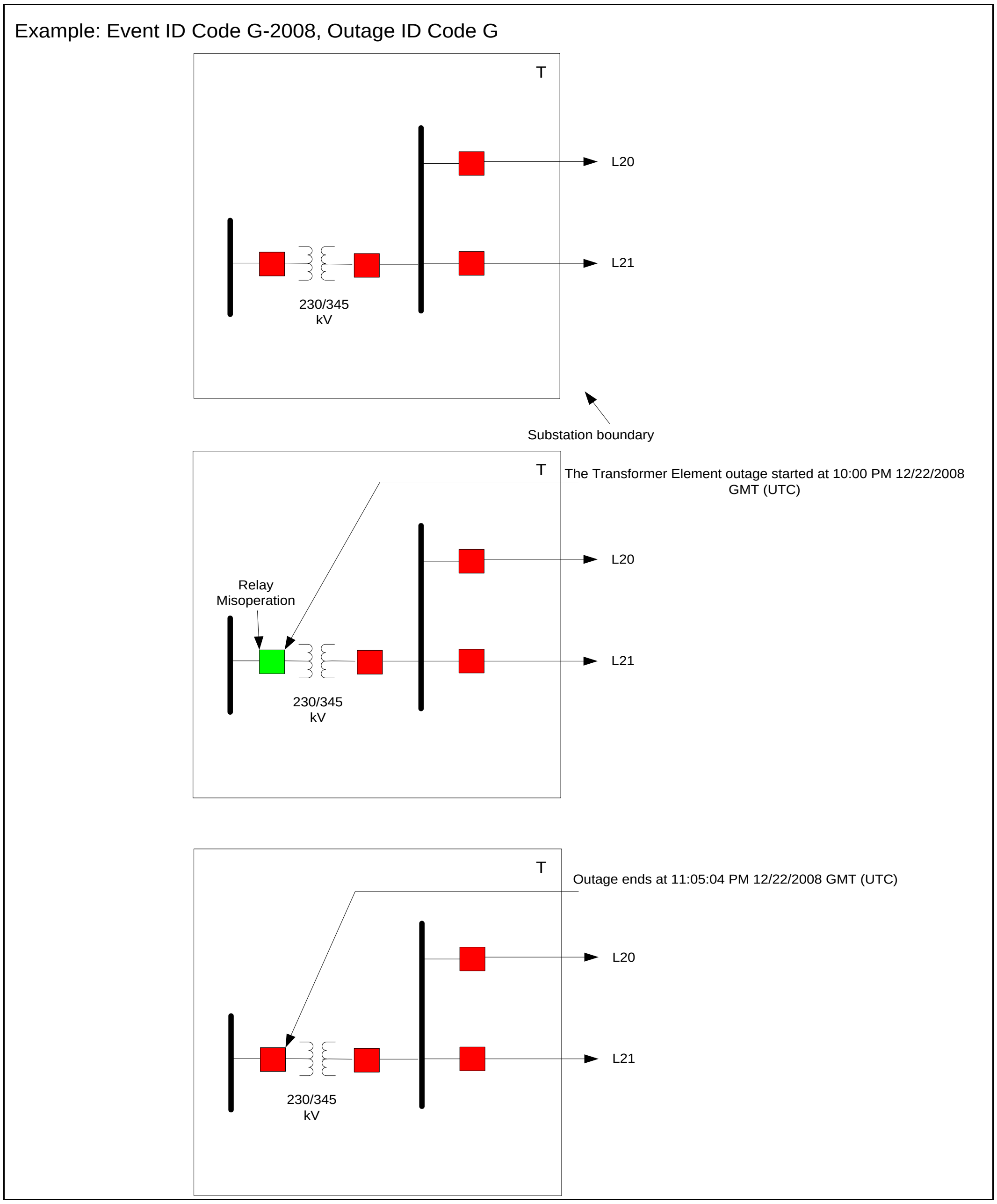

Figure C.7 Example 7: Transformer Outage with Protection System Misoperation

Only the Transformer was outaged because of the relay misoperation. This outage will require the completion of Form 5.0 and 4.3. Data entries for these forms are shown below in Table C.15-Table C.16.

Table C.15: Example 7 Form 5.0 - Event ID Code Data			
Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
G-2008	11		No

Table C.16: Example 7 Form 4.3 - Transformer Detailed Automatic Outage Data										
Outage ID Code	**Event ID Code**	**High-Side Voltage Class**	**Fault Type**	**Outage Initiating Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
G	G-2008	300-399 kV	No fault	Other Element-Initiated	12/22/2008 22:00	1:05	Failed Protection System Equipment	Failed Protection System Equipment	Single Mode	0

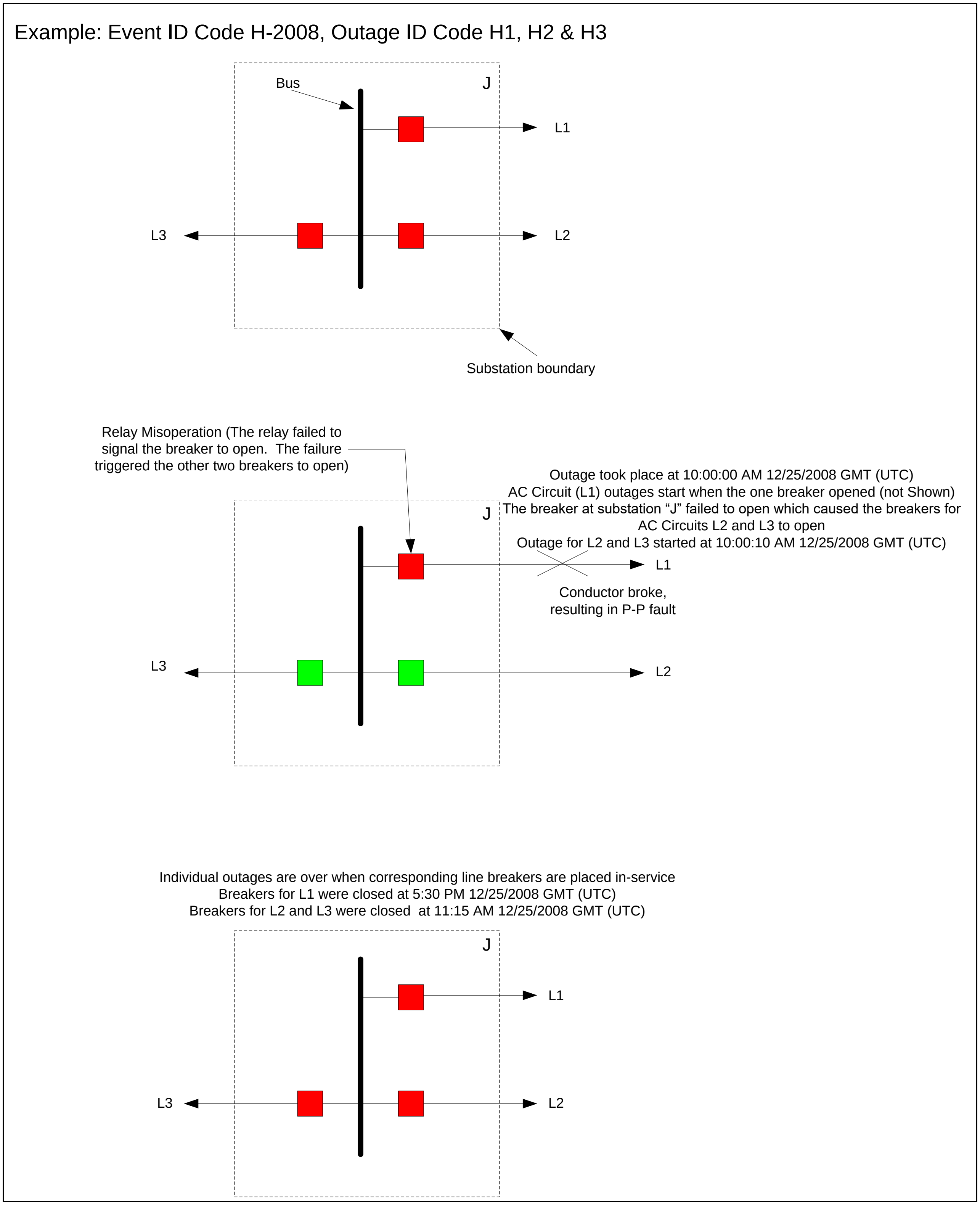

Figure C.8: Example 8: AC Circuit Outage with Breaker Failure

This outage will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in **Table C.17-Table C.18**.

Table C.17: Example 8 Form 5.0 - Event ID Code Data

Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
H-2008	60	Fault on an AC Circuit and a circuit breaker equipment failure resulting in a stuck circuit breaker	No

Table C.18: Example 8 Form 4.1 - AC Circuit Detailed Automatic Outage Data

Outage ID Code	Fault Type	Outage Initiation Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
H1	P-P fault	Element-Initiated	12/25/2008 10:00	7:30	Failed AC-Circuit Equipment	Failed AC-Circuit Equipment	Dependent Mode Initiating	0
H2	P-P fault	Other Element-Initiated	12/25/2008 10:00	1:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0
H3	P-P fault	Other Element-Initiated	12/25/2008 10:00	1:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0

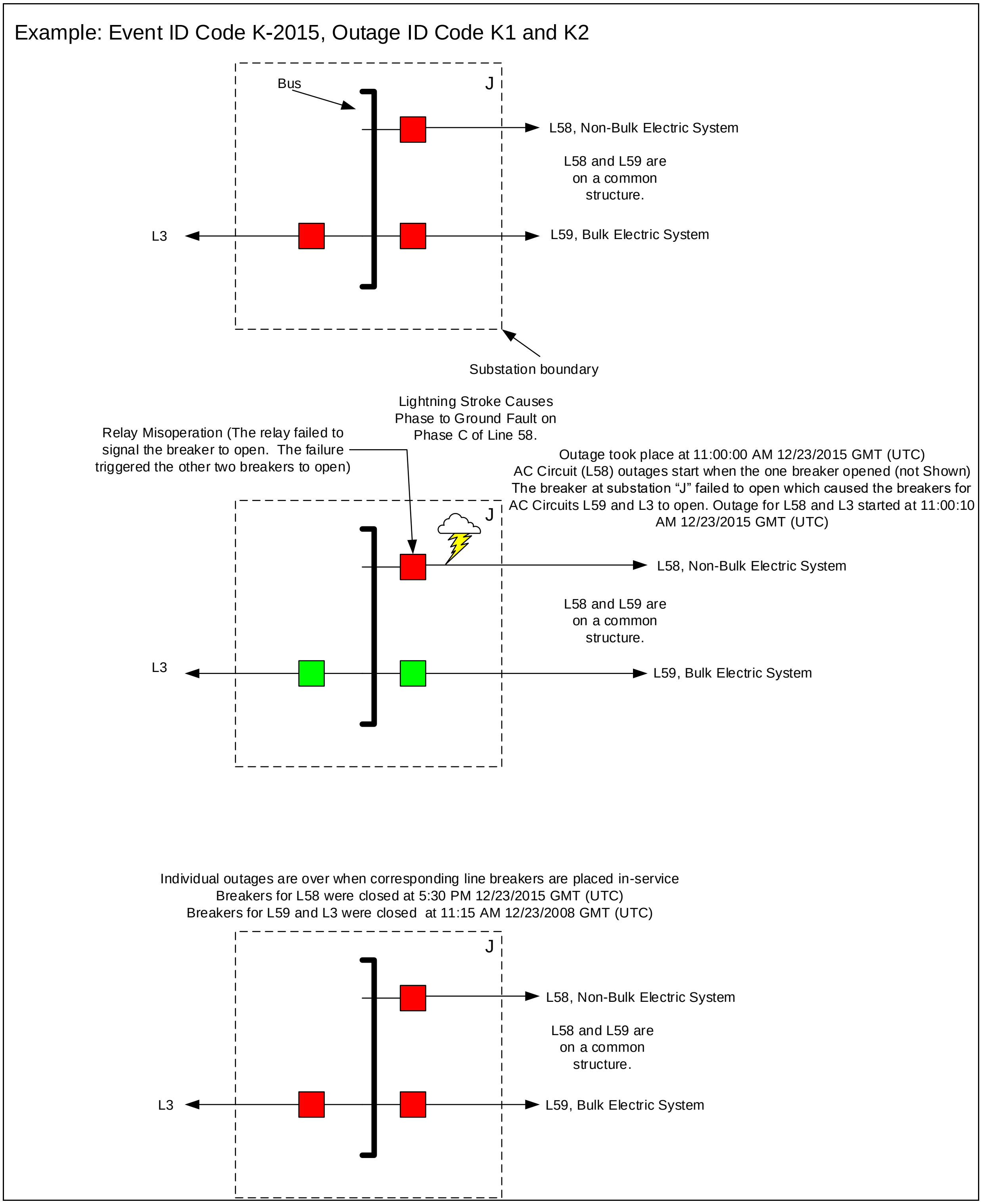

Figure C.9: Example 9: AC Multi-Circuit Structure Outage with Non-TADS Element on Structure

In Figure C.11, Example 9 shows an outage that will require the completion of Form 5.0s and 4.1. Data entries for these forms are shown below in **Table C.19-Table C.20**.

Table C.19: Example 9 Form 5.0 - Event ID Code Data			
Event ID Code	**Event Type No.**	**Description of the Event (optional)**	**Disturbance Report Filed**
K-2015	61	Single phase to ground fault, relay does not signal circuit breaker on non-BES Line.	No

Table C.20: Example 9 Form 4.1 - AC Circuit Detailed Automatic Outage Data								
Outage ID Code	**Fault Type**	**Outage Initiation Code**	**Start Time**	**Outage Duration**	**Initiating Cause Code**	**Sustained Cause Code**	**Outage Mode**	**Outage Continuation Code**
K1	No Fault	Protection System-Initiated	12/23/2015 11:00	0:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0
K2	No Fault	Protection System-Initiated	12/23/2015 11:00	0:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0

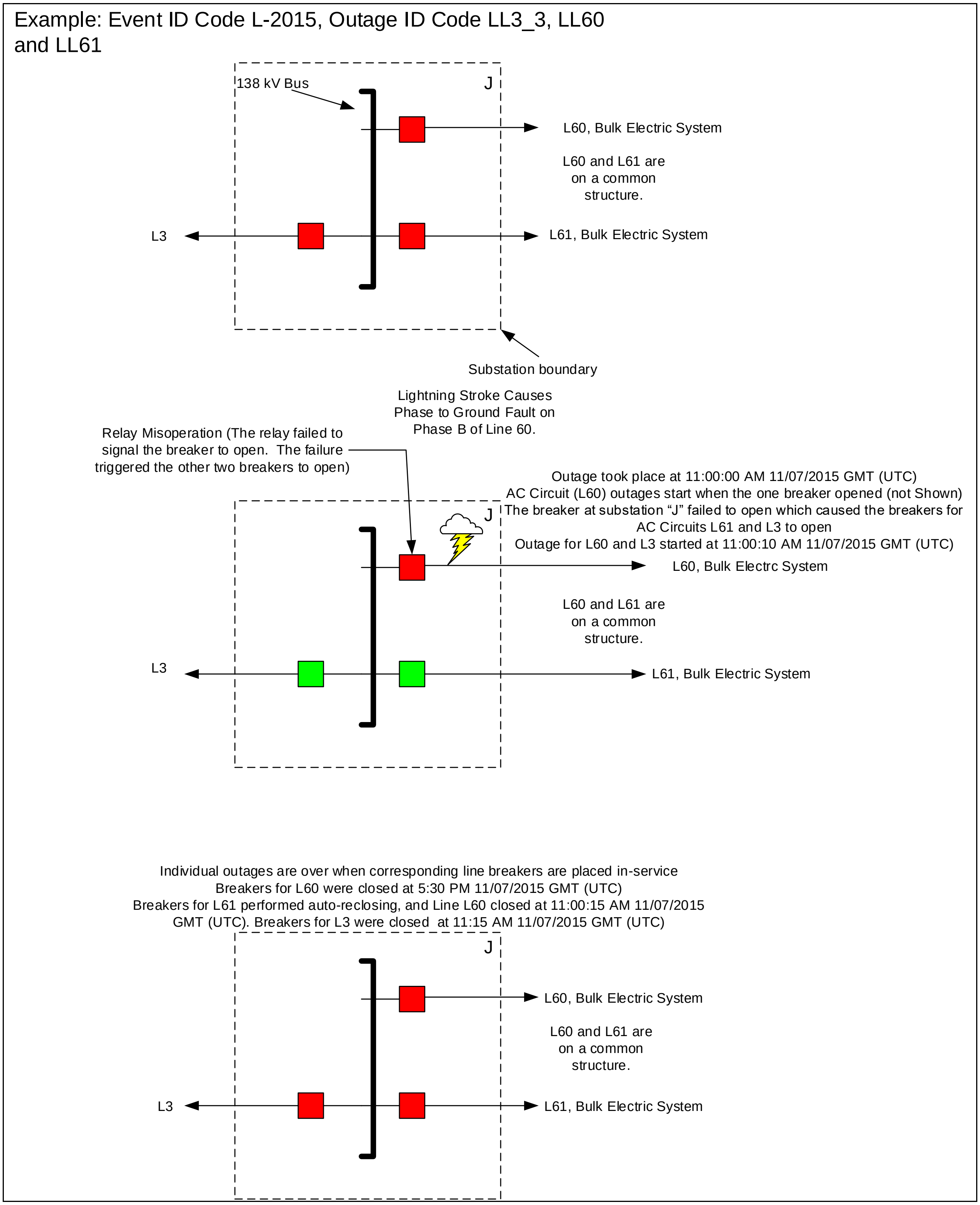

Figure C.10: Example 10: AC Multi-Circuit Structure Outage with TADS Element on Structure

The outage shown in Figure C.12, Example 10, will require the completion of Form 5.0 and 4.1. Data entries for these forms are shown below in Table C.21-Table C.22.

Table C.21: Example 10 Form 5.0 - Event ID Code Data			
Event ID Code	Event Type No.	Description of the Event (optional)	Disturbance Report Filed
L-2015	61	Single phase to ground fault, relay does not signal circuit breaker on BES Line	No

Table C.22: Example 10 Form 4.1 - AC Circuit Detailed Automatic Outage Data								
Outage ID Code	Fault Type	Outage Initiation Code	Start Time	Outage Duration	Initiating Cause Code	Sustained Cause Code	Outage Mode	Outage Continuation Code
LL60	Lightning	Single P-G fault	11/07/2015 11:00	6:30	Lightning	Failed Protection System Equipment	Dependent Mode Initiating	0
LL61	No Fault	Protection System-Initiated	11/07/2015 11:00	0:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0
LL3_3	No Fault	Protection System-Initiated	11/07/2015 11:00	0:15	Failed Protection System Equipment	Failed Protection System Equipment	Dependent Mode	0

Example 11: Animal Damage within Substation

A rat gains entry into a substation control house and chews on a control or relay cable. The relay either operates immediately or sometime in the future (or does not operate when called upon). Operation could be an unnecessary trip during a fault (on another Element) or an unnecessary trip in absence of a fault on the system. It could also result in failure of primary Element to trip for fault condition which could result in other Elements needing to trip to clear the fault.

The definition of Failed Protection System states: "*Automatic Outages caused by the failure of Protection System equipment. **Includes any relay and/or control misoperations, except those that are caused by incorrect relay or control settings that do not coordinate with other protective devices**. Categorize these as "Human Error"."*

The Automatic Outage Cause Code for this outage would be Failed Protection System.

Appendix D: Frequently Asked Questions

Inventory Related Questions

1. Are generator lead lines reportable to TADS?

Question: Are generator lead lines part of the BES? Are they reportable in TADS?

Answer: If the AC Circuit leads to a network source comprising more than 75 MW of generator capacity, the AC Circuit is considered part of the BES[10]. From the high side to the GSU to the first interrupting device or set of interrupting devices is considered to be GSU leads and not reportable to TADs regardless of the length.

See Scenario A and B for reportable and non-reportable outage examples.

Scenario A - Generator Lead Line Reporting
All the substations and transmission lines in Scenario A are 345kV. There is a 10-mile line/connection to a wind farm. This is considered a generator lead line at Utility X. For reportable outages, should the line/connection between substation B and the wind farm be reported in TADS? (Note: The wind farm trips offline due a SPS (Special Protection System) in place for faults between Substation A and Substation B.) If the Wind Farm is at a total combined capacity above 75 MW, the generator lead line is considered part of the BES and should be reported in TADS. The 10 miles line from Substation B to the wind farm is reportable; however, the leads from the GSU breakers to the GSU are not reportable. Elements highlighted in red are TADS reportable; elements in green are not TADS reportable.

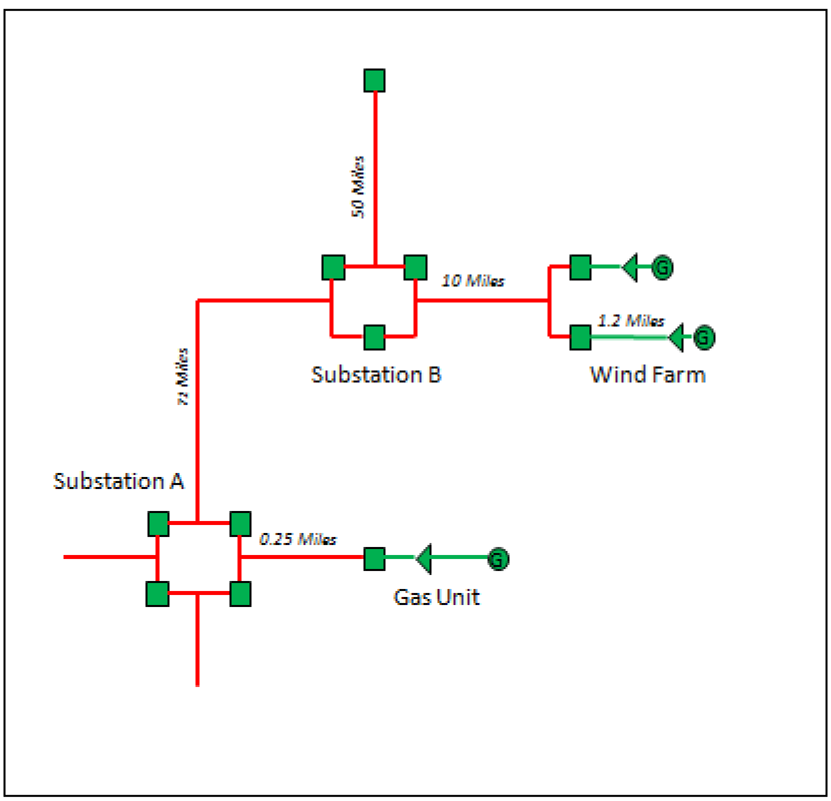

Figure D.1: Scenario A

[10] http://www.nerc.com/pa/rapa/pages/bes.aspx

Scenario B - Generator Lead Line Reporting

The gas unit plants sit adjacent to the 345kV substation. The gas units trip offline from time to time. In addition, they are taken offline for maintenance and load curtailment during the spring and fall seasons. Should Automatic and Planned outages on those lines be reported in TADS?

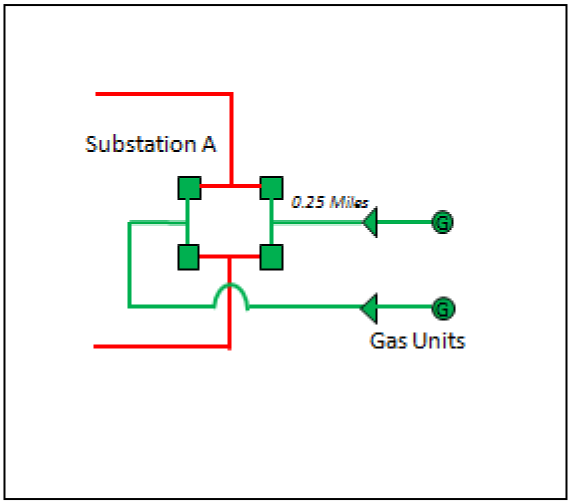

Figure D.2: Scenario B

Based on the configuration shown, no Outages would be reported to any elements if any one of the Gas Units are tripped offline with the normal clearing circuit breaker set. However, if both Gas Units are offline, this would result in a reportable outage to both 345kV lines. This is based on the definition of In-Service State that requires all terminals to be connected and energized. Elements highlighted in red are TADS reportable; elements in green are not TADS reportable.

2. DC line with only two circuits clarification

Question: In our network, we have a DC line with two sections per pole: X to Y (1000 km) and Y to Z (500 km), with several multi-terminal and two-terminal configurations.
How many DC Circuits do I report to TADS in the following scenario?

Answer: If you can control the terminals in such a way that the power flow goes from 0 to a maximal value, it should be treated as the equivalent to a circuit breaker for a DC Circuit. Then, treat the network similarly to an AC Circuit network with each DC Circuit having two poles. In this specific case, this network would be interpreted as 2 separate DC Circuits (X-Y and Y-Z).

3. FERC Order No. 785 – Generator Requirements at the Transmission Interface

Question: NERC cannot force a Generator Owner (GO) to register as a Transmission Owner (TO) to report the transmission interconnections to the power grid. How should these transmission elements be handled?

Answer: TADS is only applicable to Transmission Owners. If an Element is either partially or fully owned by an Entity with a Transmission Owner function, that Element should be reported in TADS. Only BES elements up to the GSU high side breaker(s) are reportable. GSU leads regardless of length are not reportable.

Outage Related Questions

1. ***Trees washed out during flooding, slid down hill, and contacted line. Is the cause Environmental or Vegetation?***

Question: Trees washed out during flooding, slid down hill, and contacted line. Is the Initiating Cause Code Environmental or Vegetation?

Answer: The Initiating Cause Code would be Environmental due to the flood.

2. ***Momentary, then Less than 1 Minute Operational Outage***

Question: We had a momentary outage on a transmission line (5th on that line that day) because of buzzard "pollution". 50 seconds later, the dispatchers manually opened the line (Emergency Forced) and the line remained deenergized for a week. How should report these outages? One (automatic) or two (automatic and manual)?

Answer: The outage should be reported as a single Outage due to the buzzard "Pollution". In this case, it would be one Automatic Outage. The AC Circuit must be energized and connected at all terminals for at least 1 minute to be considered back in an In-Service state. This clause avoids numerous entries of auto-reclosing Automatic Outages.

3. ***Operator closes the second end of the line back after more than one minute***

Question: A line correctly trips, and correctly recloses from one end. The other end of the line is designed to not reclose. If the operator closes the second end of the line back after more than one minute, what is the "Sustained Code"? There is no damage to the line, and the operator did not make an error. In the past, I was advised that this would be the same as the Outage Initiating Code. Is this correct?

Answer: If one or more terminals are not designed to reclose or reclosing has been disabled for any condition, then the sustained cause code would be other.

4. ***How to code an outage when a circuit is out of service for scheduled maintenance all day and was accidentally energized and closed/tripped.***

Question: We had a circuit out of service for scheduled maintenance all day and it was inadvertently energized and the breaker closed, then automatically tripped. Should be entered in TADS as a momentary outage.

Answer: For TADS, an AC Circuit must remain in an In-Service State for at least 1 minute for the Outage to be counted as a separate Outage. In this case, there would not be a second Outage because the closing/tripping occurred during an already occurring Planned Outage.

5. ***How to code an outage caused by vegetation within the right of way on a line with manual reclosing.***

Question: A tree within the right of way falls through a line without damaging it, then manual reclosing takes place ten minutes later by design. How would I code this?

Answer: The initiating cause code would be reported as Vegetation and the sustained cause code would be Other since the reclosing occurred per procedure without any issues.

Event Related Questions

1. Clarification of "Normal Clearing"

Question: Clarification of "Normal Clearing": If a breaker fails to trip from primary relaying but does successfully trip in the required time via secondary/backup relaying, is this considered normal or abnormal?

Answer: This is considered abnormal clearing according to the definitions. The outage should be coded with Event Type 61 (Dependability based).

Question: If a breaker trips due to lightning and doesn't reclose because of an issue reclosing, is this considered Normal Clearing or Abnormal Clearing?

Answer: For TADS, once the breaker correctly trips, it is Normal Clearing. Normal Clearing and Abnormal Clearing are only concerned with protection trips, intended (correct) or unintended (incorrect) clearing of an Element. It has nothing to do with reclosing functions.

2. Normal vs. Abnormal Clearing depending on normal clearing circuit breaker set.

Question: If a system is set up to clear more than one line during a fault (and this is the expected result) even though it is not normally set up this way (issue with breaker so two lines are being protected by single breaker), this would be Normal Clearing as well?

Answer: By manually changing whether the breaker is bypassed or not, the TO has indicated that it has changed its Normal Clearing Circuit Breaker Set. However, if the second AC Circuit cleared due to the primary protection failing or the backup protection overreaching, the Event would be Abnormal Clearing.

3. Catastrophic Failure of a Bus Potential Transformer

Figure D.3

Inventory Configurations with Reporting Examples

1. See Figure D.4 for the Following Questions:

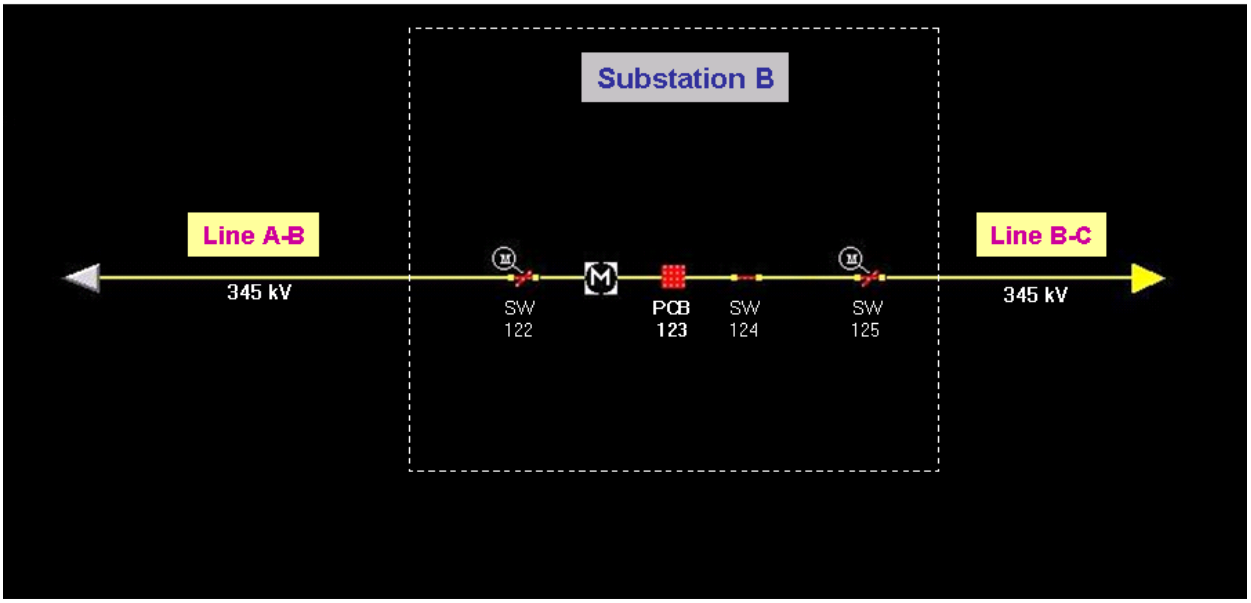

Figure D.4: At substation B, 345 kV line A-B connects to 345 kV line B-C via PCB 123.

a. What is the terminal of AC Circuit A-B at substation B?

SW122and PCB123 are considered the terminal for the AC Circuit. SW122 and PCB123 must be closed for the AC Circuit to be considered In-Service.

b. What is the terminal of AC Circuit B-C at substation B?

SW125, SW124, and PCB123 are considered the terminal for the AC Circuit. SW125, SW124, and PCB123 must be closed for the AC Circuit to be considered In-Service.

c. If PCB123 trips from low gas but both lines remain energized from their remote ends and SW 122, 124, and 125 remain closed, are AC Circuit A-B and AC Circuit B-C still in service?

No. Neither AC Circuit A-B nor AC circuit B-C are "In-Service" (see definition of "In-Service State") if PCB123 is open. Neither line is connected to its terminal at Substation B. This is a case where the two AC Circuits are sharing a common terminal. The two Outages would both be Common Mode Outages and have an Initiating Cause Code.

d. Assume that lightning strikes Line A-B and causes PCB123 to open. AC Circuit B-C remains energized from its remote end at Substation C. With PCB123 open is AC Circuit B-C still in service?

No. Because PCB123 is opened, the terminal connection is severed. AC Circuit B-C is no longer in an In-Service State (see definition of "In-Service State") and an outage is reportable to TADS.

e. If AC Circuit B-C is considered to be interrupted in question #D, what is the outage mode?

Dependent Mode. The outage to AC Circuit B-C occurred as a consequence of the 'lightning strike' outage on Line A-B therefore AC Circuit B-C has an Outage Mode Code of Dependent Mode and AC Circuit A-C has an Outage Mode Code of Dependent Mode Initiating Outage. Both AC Circuit A-B and AC Circuit B-C would have an Initiating Cause Code of Lightning.

2. For the following questions, refer to Figure D.5:

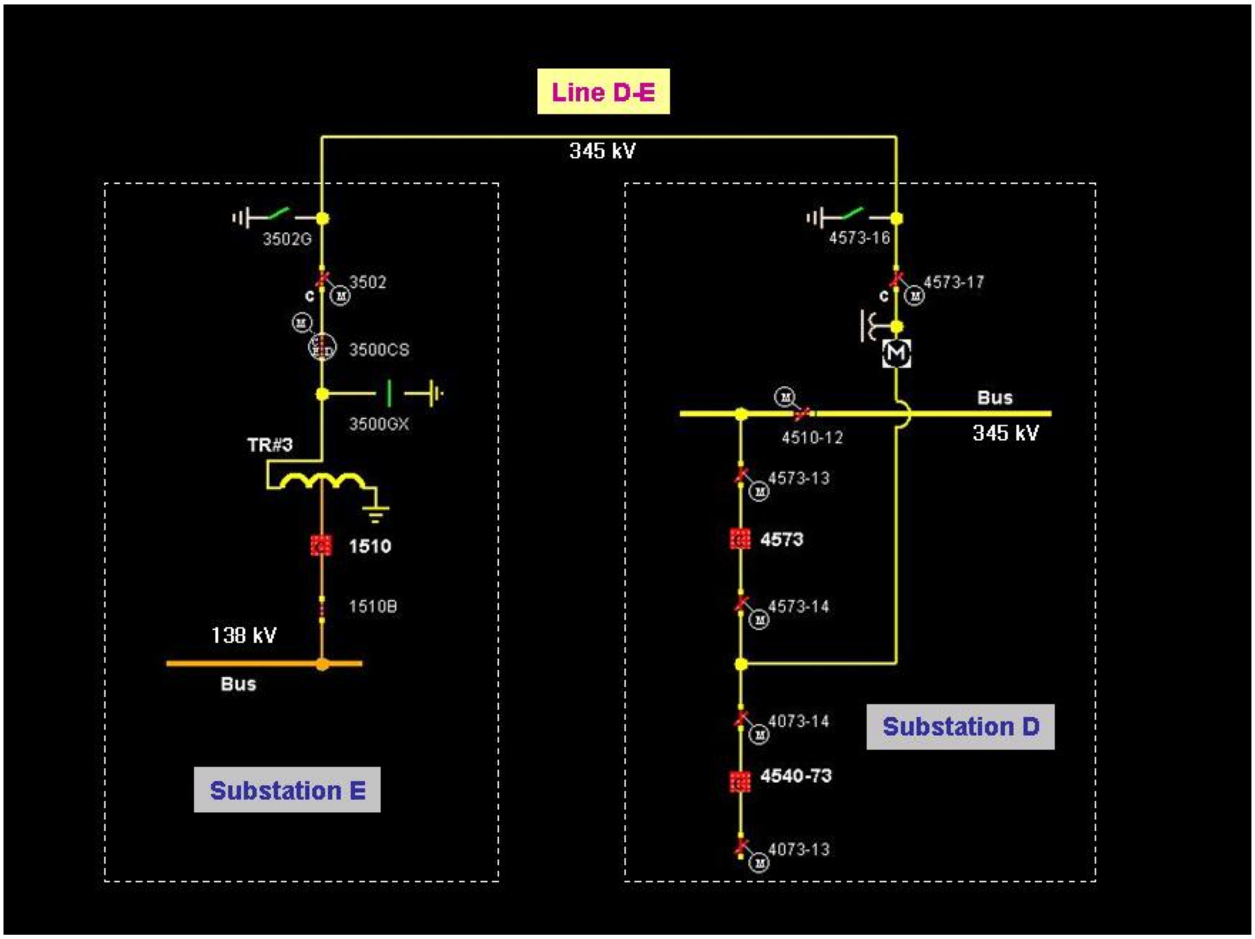

Figure D.5: AC Circuit D-E is a 345 kV radial feeder circuit that supplies a 345 kV/138 kV transformer at Substation E.

a. ***What is the terminal of AC Circuit D-E at substation E?***

The terminal of AC Circuit D-E at Substation E would be comprised of SW3502 and 3500CS. Both must be closed in order for Line D-E to be fully connected at Substation E (see definition of "In-Service State"). Data that provides a description of the physical location of the Element terminals. Terminals are those buses on the element, behind which exist power sources. In general, these terminals will comprise the set of locations that need to open to clear faults on the element. Buses connected to the Element that serve only load, without power sources available behind them are not considered terminals.

b. ***If AC Circuit D-E remains energized from Substation D, does the automatic opening of 3500CS cause a TADS reportable interruption?***

Yes. The Automatic opening of 3500CS would disconnect the terminal at Substation D of AC Circuit D-E. This would cause an Automatic Outage of AC Circuit D-E since AC Circuit D-E is no longer in an 'In-Service State'.

c. ***If AC Circuit D-E remains energized from Substation D, does the automatic opening SW3502 cause a TADS reportable interruption?***

Yes. Opening SW3502 would disconnect the terminal at Substation D of AC Circuit D-E. The AC Circuit would no longer be in an 'In-Service State' and hence is a reportable interruption.

d. If a transformer fault causes PCB1510 and 3500CS to open, is AC Circuit D-E still in service?

No, AC Circuit D-E is not in an In-Service State. Opening 3500CS would disconnect the terminal consisting of SW3502 and 3500CS. This would cause an Automatic Outage of AC Circuit D-E and hence a reportable interruption to Line D-E.

3. Please see Figure D.6 for the Following Questions:

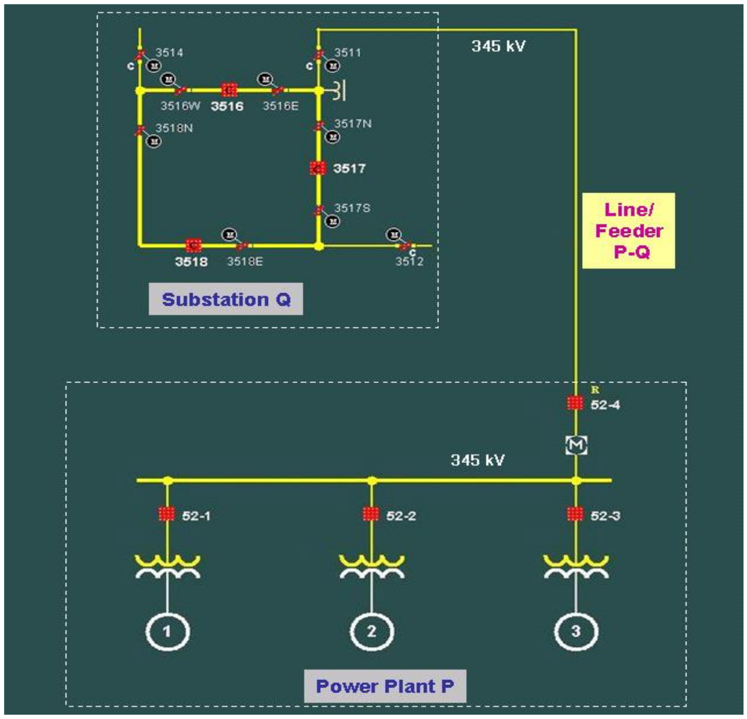

Figure D.6: Power Plant P connects to the grid at Substation Q via the generation feeder circuit P-Q.

a. Is the (generation) feeder circuit P-Q considered a line for TADS purposes?

If the feeder AC Circuit P-Q is either completely or partially owned by an Entity with a Transmission Owner function, the AC Circuit should be reported for TADS purposes. TADS only applies to the Transmission Owner function.

b. If so, what are the terminals?

The terminal at Power Plant Q is 52-4. The terminal at Substation Q is switch 3511 and 3516 (and its associated disconnects 3516W and 3516E) OR 3517 (and its associated disconnects 3517N and 3517S). For power to flow, 52-4 and 3511 must be closed. Additionally, either 3516 (and its associated disconnects 3516W and 3516E) OR 3517 (and its associated disconnects 3517N and 3517S) must be closed.

c. If the circuit remains energized and connected at Substation Q, does opening PCB 52-4 at Power Plant P cause an interruption?

Yes, the terminal at 52-4 would be disconnected. This would place the AC Circuit P-Q in a non-In-Service State.

d. Would the opening of only Breaker 3516 result in an interruption to Circuit P-Q?

No, the opening of Breaker 3516 by itself would not result in an interruption to Line P-Q (if all other Breakers and Switches remained closed). It would take an opening Breaker 3516 and Either Breaker 3517 or one of the switches (3517S or 3517N) to result in an interruption to Circuit P-Q at Substation Q.

4. ***Please see Figure D.7 for the following questions:***

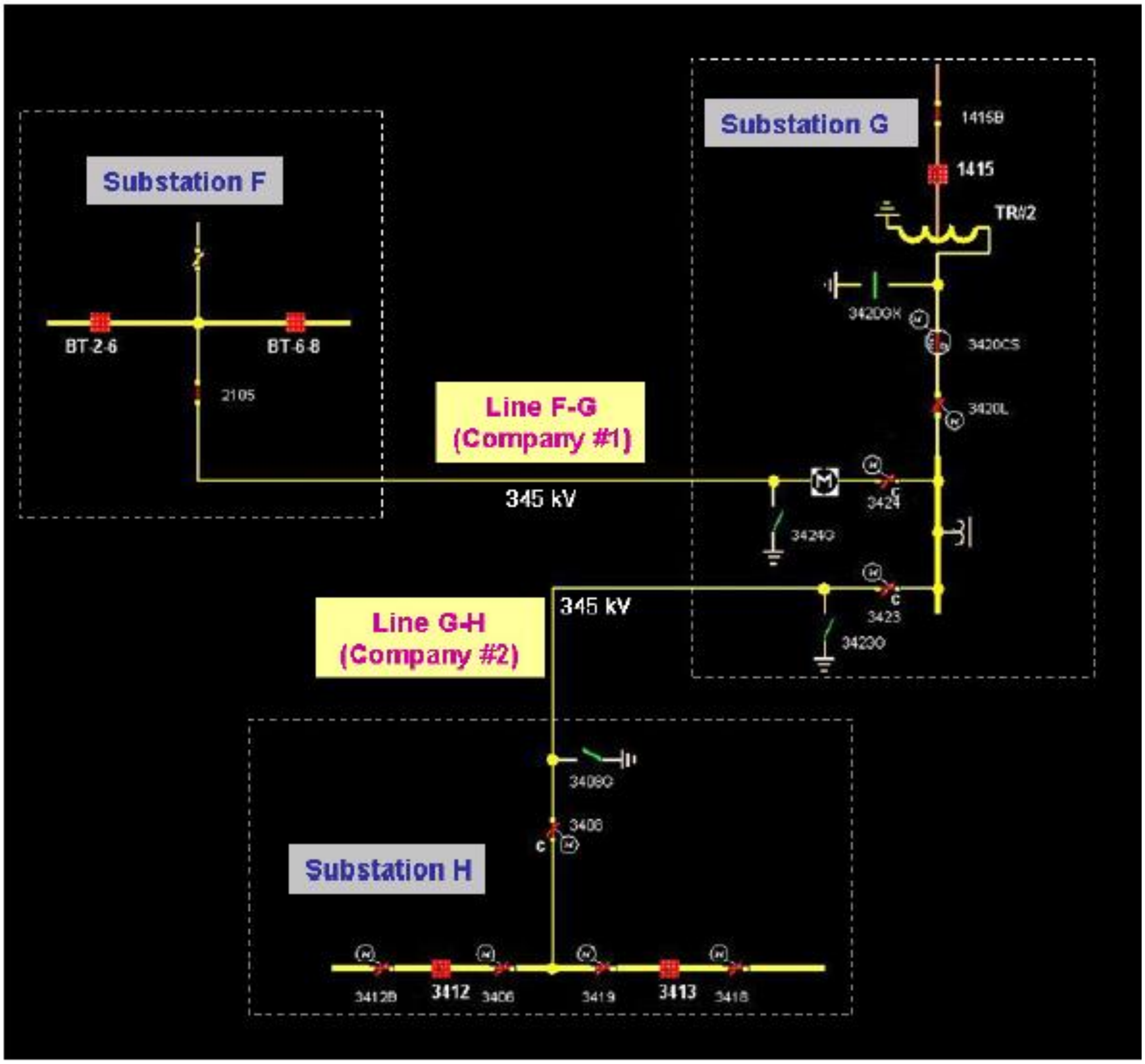

Figure D.7: Line [section] F-G is owned and operated by Company #1. Line [section] G-H is owned and operated by Company #2.

Note: There is no fault current interrupting device between line section F-G and line section G-H. When one line encounters a fault, both lines sections must trip in order to clear the fault.

a. ***Is line [section] F-G considered a separate line from line [section] G-H for TADS purposes?***

No. Since there is no fault interrupting device at Station G between line section F-G and line section G-H, it is a single AC Circuit F-H. Company 1 and Company 2 must agree which single company of the two will include AC Circuit F-H in its detailed inventory (Form 3.1) and that company will also submit all TADS interruptions on AC

Circuit F-H. Both companies will submit information for AC Circuit F-H in Form 2.1 with the agreed upon 'Reporting TO Element ID' and the agreed upon 'Reporting Transmission Owner Name'.

b. If so, what is the terminal for line [section] F-G at Substation G? SW3424?

F-G is only a line section and not an entire AC Circuit and SW3424 is not a terminal. However, AC Circuit F-H may have a terminal at Substation G if it is a true 3-terminal line. If the equipment beyond Breaker 3420CS is more than just a load and Breaker 3420CS is part of the Normal Clearing Circuit Breaker Set (NCCBS) for AC circuit F-H then AC Circuit F-H is a 3-terminal line with a terminal at Breaker 3420CS (and disconnect 3420L).

c. If so, what is the terminal for line [section] G-H at Substation G? SW3423?

G-H is only a line section and not an entire AC Circuit and SW3423 is not a terminal. However, AC Circuit F-H may have a terminal at Substation G if it is a true 3-terminal line. If the equipment beyond Breaker 3420CS is more than just a load and Breaker 3420CS is part of the Normal Clearing Circuit Breaker Set (NCCBS) for AC circuit F-H then AC Circuit F-H is a 3-terminal line with a terminal at Breaker 3420CS (and disconnect 3420L).

5. Please see Figure D.8 for the following questions:

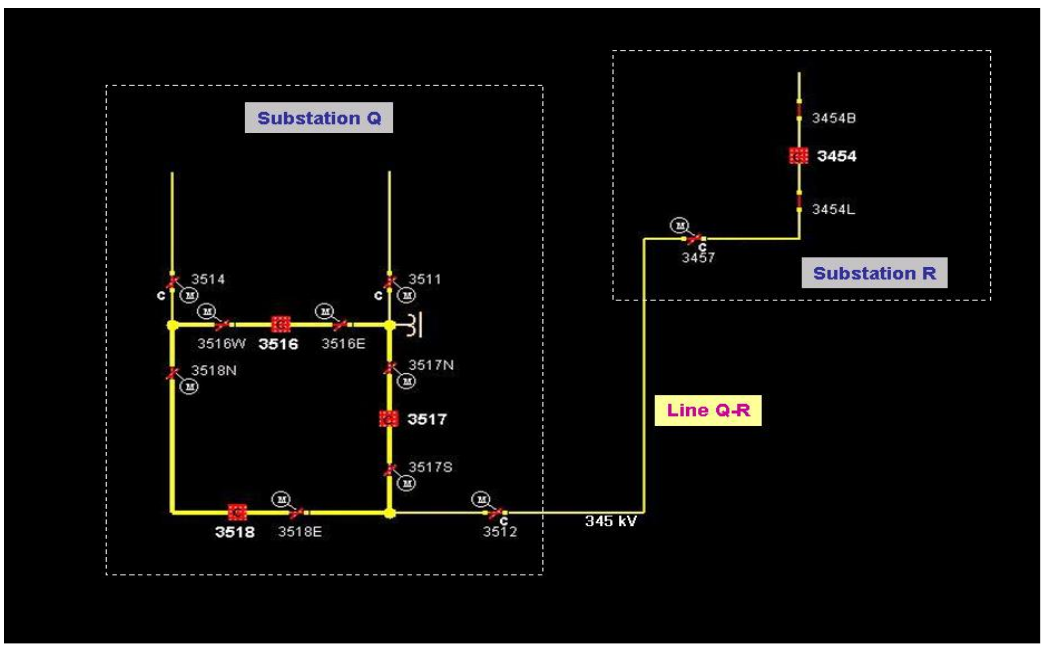

Figure D.8: AC Circuit Q-R is a 345 kV circuit between Substation Q and Substation R. The AC Circuit connects to a ring bus at Substation Q.

a. What is the terminal of AC Circuit Q-R at substation Q?

The terminal for AC Circuit Q-R at substation Q would comprise the switches/breakers: 3512, 3518E, 3518N, 3518, 3517S, 3517N and 3517. To determine whether AC Circuit Q-R meets the definition of an In-Service State, you must determine whether power can flow from Substation Q to Station R (or vice-versa). At Substation Q: First, switch 3512 must be closed. Secondly, either Breaker 3518 or its associated disconnects (3518N and 3518E) OR Breaker 3518 and its associated disconnects (3517N and 3517S) must be closed. At Substation R: 3454, 3454B, 3454L and 3457 must all be closed.

*b. **If both Breaker 3517 and Breaker 3518 are open at Substation Q but AC Circuit Q-R remains energized from Substation R and SW 3512 remains closed, is AC Circuit Q-R in an In-Service State?***

No. AC Circuit Q-R is not considered in an In-Service state because it is not connected at all its terminals (Substation Q) (even though the AC Circuit is energized). It is no longer possible for power to flow from Substation Q to Substation R.

*c. **What is the terminal of AC Circuit Q-R at Substation R?***

The terminal at substation R for Line Q-R would consist of the switches/breakers: Switch 3457 and Breaker 3454 and its associated disconnects (3454B and 3554L). All of these would need to be closed for AC Circuit Q-R to be connected at its terminal at Substation R.

*d. **Assume that all breakers and switches at Substation Q are closed and AC Circuit Q-R is energized from Substation Q. If Breaker 3454 is opened at Substation R, but SW 3457 and SW 3454L remain closed, is AC Circuit Q-R still in an In-Service State?***

No. AC Circuit Q-R is not considered in an In-Service State because it is not connected at all its terminals (Substation R) (even though the AC Circuit is energized). It is no longer possible for power to flow from Substation Q to Substation R (or vice versa).

*e. **Assume that all breakers and switches at Substation Q are closed and AC Circuit Q-R is energized from Substation Q. If SW 3454L is opened with SW 3457 closed at Substation R, is AC Circuit Q-R still in an In-Service State?***

No. AC Circuit Q-R is not considered in an In-Service State because it is not connected at all its terminals (Substation R) (even though the AC Circuit is energized). It is no longer possible for power to flow from Substation Q to Substation R (or vice versa).

6. For the following questions, refer to Figure D.9:

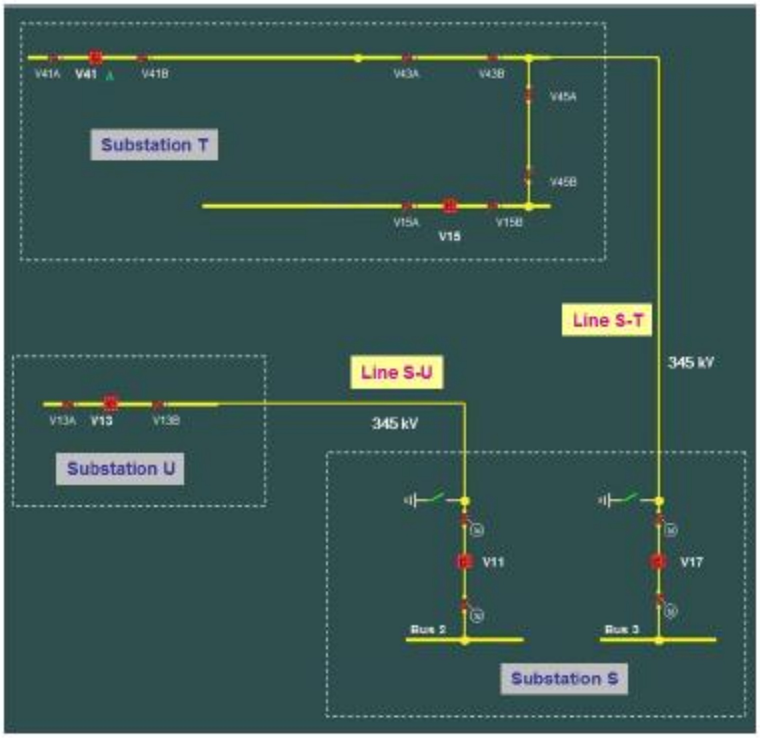

Figure D.9: AC Circuit S-T is a 345 kV circuit between Substation S and Substation T.

a. ***AC Circuit S-T trips and recloses during a storm with a P-G fault (Breakers V17, V41 and V15). Because of a failed communications circuit, the remote end of AC Circuit S-U trips and recloses at Substation U (Breaker V13). What is this the correct way to report these interruptions?***

Table D.1		
	Form 4.1 – AC Circuit S-T	**Form 4.1- AC Circuit S-U**
Fault type:	P-G fault	No fault
Outage Initiation Code	Element-Initiated	Protection System-Initiated
Initiating Cause Code	Weather, excluding lightning	Failed Protection System Equipment
Sustained Cause Code	N/A - Momentary	N/A - Momentary
Outage Mode Code	Dependent Mode Initiating	Dependent Mode

Both interruptions will use the same TADS Event ID Code with Event Type = 62.

7. ***For the following questions, refer to Figure D.10:***

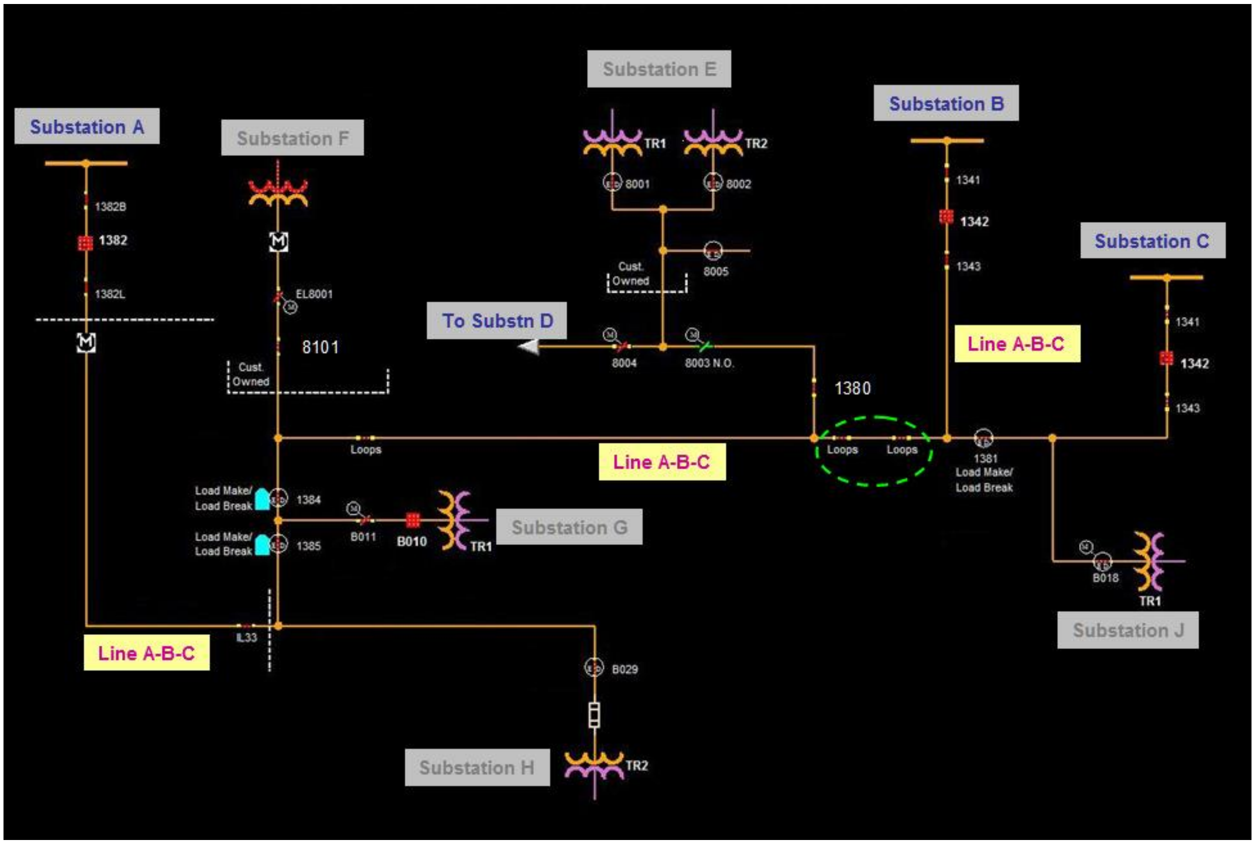

Figure D.10: Assume that AC Circuit A-B-C is a 345 kV circuit with multiple radial feeds to sub-100 kV transformers.

a. ***Assume that loops are opened as circled in green in the diagram, but the AC Circuit is fully energized and all breakers are closed. Is this AC Circuit in an In-Service State with the loops opened? (For this example, Substations A, B, and C (3 terminal line) are considered to be networked transmission stations and Substations D, E, F, G, H, and J are considered to be tapped load connection points on the AC Circuit A-B-C.)***

No. With the loops opened in the middle of AC Circuit A-B-C, the AC Circuit is no longer in an In-Service State. The intent of "connected at all of its terminals to the system" in the definition of In-Service State is that power can freely flow between all of the Element's terminals (in this case: Substation A, Substation B, and Substation C). With any of the loops (or a switch such as IL33, 1384, 1385, or 1381) open in the middle of the AC Circuit, power can no longer flow between all the terminals and the AC Circuit is no longer in an In-Service State.

b. ***If switch 8101 is opened at Substation F with all other breakers/switches closed and the line energized, is AC Circuit A-B-C in service?***

Yes, AC Circuit A-B-C is still in an In-Service State. Substation F is a tapped load connection point to the AC Circuit A-B-C and is not essential for the transmission line for power flow between Substation A, Substation B, and Substation C. Substation F and its associated tap line is not a terminal of AC Circuit A-B-C.

c. ***If inline switch 1380 near Substation E is opened with all other breakers/switches closed and the line energized, is AC Circuit A-B-C in service?***

Yes, AC Circuit A-B-C is still in an In-Service State. Substation E and Substation D are tapped load connection points to the AC Circuit A-B-C and is not essential for the transmission line for power flow between Substation A, Substation B, and Substation C. (Substation D, though not shown, is considered to be another tapped load connection point.)

8. Temporarily Jumpered AC Circuit

At a station that has numerous transmission lines:

An Automatic outage occurs on one AC Circuit (Line 1) starting on 5/17/2010. Before the AC Circuit is restored, Line 1 is temporarily jumpered (around the affected station) on 7/1/2010 to another AC Circuit (Line 2). The single 'new' (temporary) AC Circuit (Line 3 = Line 1 + Line 2) is then energized and connected to the system (although not in their 'normal' configuration) through the opposite ends (with no 'terminal' at the affected station). The circuit breakers at the affected station have been jumpered around and are out-of-service (but by definition are not part of the AC Circuit). It may remain like this for several months for example until 1/17/2011.

a. Since the AC Circuits are energized and connected to the system, they are technically "in-service". Correct? However, the outage duration definition states that it is "the amount of time the Element is fully restored to its original or normal configuration".

If the AC Circuits are to be temporarily configured in this situation with a planned restoration date, then the preferred (recommended) method is to continue reporting as 2 separate lines. The utility will need then to report 2 outages for each interruption that occurs during this time frame.

b. Should this outage be reported as approximately 1.5 months or 8 months?

1.5 Months. For the outage listed above, the utility should report one Automatic outage starting on 5/17/2010 and ending on 7/1/2010. Any Automatic (or Operational) interruptions that occur while the two lines are tied together should be reported simultaneously on **both** lines.

9. Ring Bus Fault Locations

Question: What Outage Initiation codes should be reported for the respective faults on the diagram below?

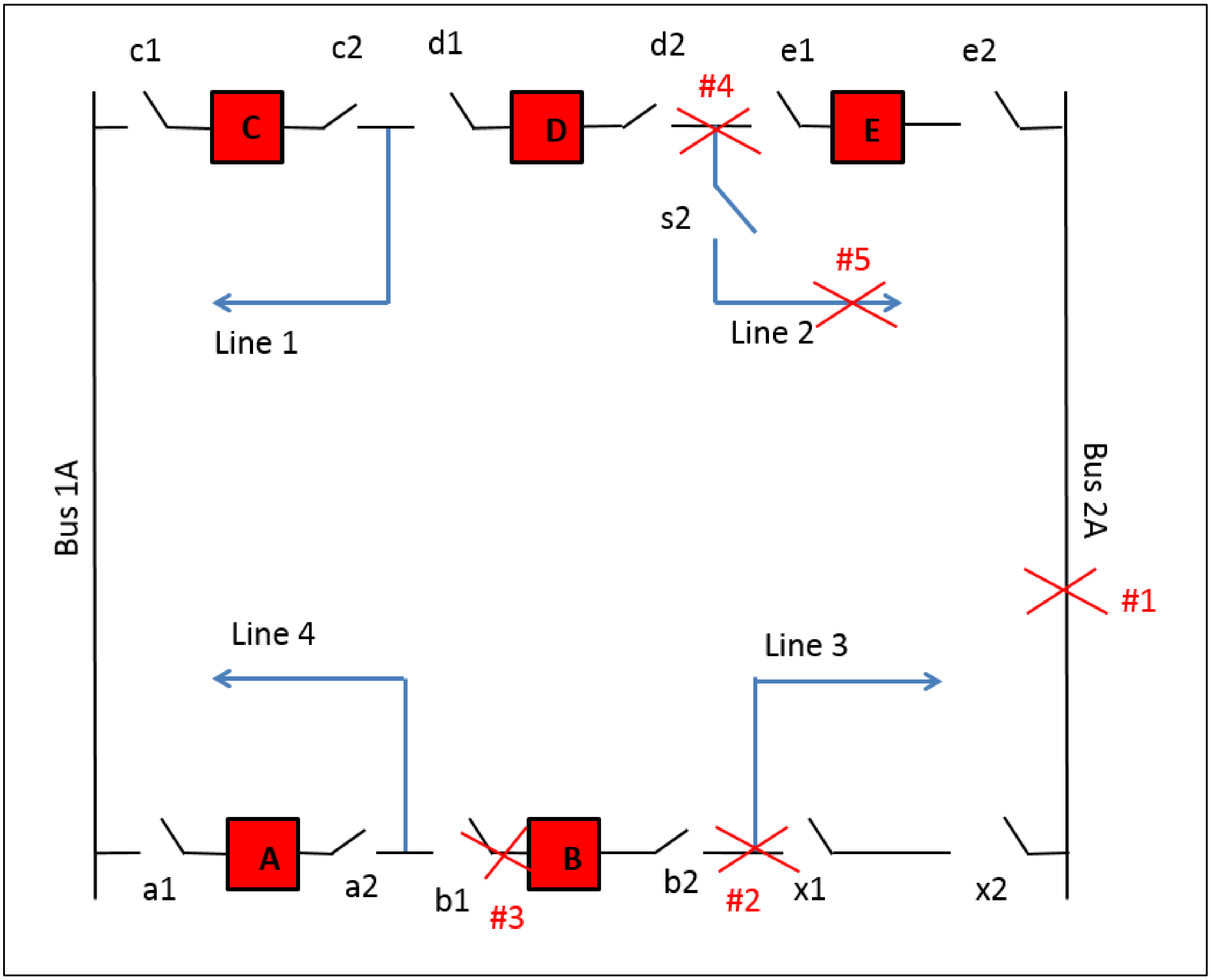

Figure D.11

Answer:

- Fault #1 on Bus 2A: Initiation Code = 'AC Substation Initiated'
- Fault #2: Initiation Code = 'Element Initiated'
- Fault #3: Initiation Code = 'AC Substation Initiated'
- Fault #4: Initiation Code = 'AC Substation Initiated'
- Fault #5: Initiation Code = 'Element Initiated'

Appendix E: Metrics

Metrics below 200 kV:

No.	Metric	Formula	Units	Definition	Acronym
	Element Outage Frequency				
2	Element Sustained Outage Frequency	Total Sustained Outages / Total Elements	# of Outages	# Sustained Outages per Element per year	SOF
	Element Outage Duration, Repair time and Up time				
4	Element Sustained Outage Duration Time	Total Sustained Outage Hours / Total Elements	# of Hours	Average # of sustained outage hours per element per year	SODT
5	Element Sustained Outage Mean Time to Repair	Total Sustained Outage Hours / Total Sustained Element Outages	# of Hours	Average # of Sustained Outage hours per outaged element	MTTR
6	Median Time to Repair Sustained Element Outage Failures	The time when 50% of the mean time to repair minutes are greater than this figure	# of Hours	Median # of Sustained Outage Hours per outaged Element	MdTTR
7	Mean Time Between Sustained Element Outages (Mean "Up Time"). Also referred to as mean time between failures	(Total Element Hours - Total Sustained Outage Hours)/ Total Sustained Element Outages	# of hours	Mean # of hours of operation an element has before failure	MTBF
	Element Availability				
8	Element Availability Percentage	[1-(Total Sustained Outage Hours / Total Element Hours)] * 100	%	Percentage of time that an element is available	APC
10	Percent of Element Automatic Outages associated with a Disturbance Report (EOP0004)	Total Automatic Outages associated with a Disturbance Report / Total Automatic Outages	%	Percentage of automatic outages associated with a disturbance report	PCDR
	Circuit Outage Frequency, per 100 Circuit Miles (Applies to AC and DC Circuits Only)				
12	Circuit Sustained Outage Frequency, Mileage Adjusted	(Total Circuit Sustained Outages * 100) / Total Circuit Miles	# of outages	# Sustained Outages per 100 circuit miles per year	SCOF100CT mi
	Frequency per 100 Multi-Circuit Structure Miles (For AC Circuits, multi circuit outages are Event Type 31 outages; for DC Circuits, they are Event Type 31 outages.)				
15	Multi-Circuit Sustained Outage Frequency, Mileage Adjusted	(Total Multi Circuit Sustained Outages * 100) / Total Multi Circuit Structure Miles	# of outages	# Sustained Outages per 100 multi-circuit miles per year	SMOCF100ST mi
	Phase II Metrics and Updated Phase I Metrics				
14	Maximum Percent of Simultaneous Element Outages	Point in time when outages due to sustained automatic outages are at their maximum	%	Point in time when outages due to sustained automatic outages are at their maximum	MSIM

Metrics 200 kV and above

No.	Metric	Formula	Units	Definition	Acronym
	Element Outage Frequency				
1	Element Total Automatic	Total Automatic Outages / Total Elements	# of Outages	# Automatic Outages per element per year	TOF
2	Element Sustained Outage Frequency	Total Sustained Outages / Total Elements	# of Outages	# Sustained Outages per Element per year	SOF
3	Element Momentary Outage Frequency	Total Momentary Outages / Total Elements	# of Outages	# Momentary Outages per Element per year	MOF
	Element Outage Duration, Repair time and Up time				
4	Element Sustained Outage Duration Time	Total Sustained Outage Hours / Total Elements	# of Hours	Average # of sustained outage hours per element per year	SODT
5	Element Sustained Outage Mean Time to Repair	Total Sustained Outage Hours / Total Sustained Element Outages	# of Hours	Average # of Sustained Outage hours per outaged	MTTR
6	Median Time to Repair Sustained Element Outage Failures	The time when 50% of the mean time to repair minutes are greater than this figure	# of Hours	Median # of Sustained Outage Hours per outaged Element	MdTTR
7	Mean Time Between Sustained Element Outages (Mean "Up Time"). Also referred to as mean time between failures	(Total Element Hours - Total Sustained Outage Hours)/ Total Sustained Element Outages	# of hours	Mean # of hours of operation an element has before failure	MTBF
	Element Availability				
8	Element Availability Percentage	[1-(Total Sustained Outage Hours / Total Element Hours)] * 100	%	Percentage of time that an element is available	APC
9	Percentage of Elements with Zero Automatic Outages	Total Elements with Zero Automatic Outages / Total Elements	%	Percentage of elements with no automatic outages	PCZO
10	Percent of Element Automatic Outages associated with Disturbance Report (EOP004)	Total Automatic Outages associated with a Disturbance Report / Total Automatic Outages	%	Percentage of automatic outages associated with a disturbance report	PCDR
	Circuit Outage Frequency, per 100 Circuit Miles (Applies to AC and DC Circuits Only)				
11	Circuit Total Outage Frequency, Mileage Adjusted	(Total Circuit Automatic Outages * 100) / Total Circuit Miles	# of outages	# Automatic Outages per 100 cirucuit miles per year	TCOF100CTmi
12	Circuit Sustained Outage Frequency, Mileage Adjusted	(Total Circuit Sustained Outages * 100) / Total Circuit Miles	# of outages	# Sustained Outages per 100 circuit miles per year	SCOF100CT mi
13	Circuit Momentary Outage Frequency, Mileage Adjusted	(Total Circuit Momentary Outages * 100) / Total Circuit Miles	# of outages	# Momentary Outages per 100 circuit miles per year	MCOF100CTmi
	Frequency per 100 Multi-Circuit Structure Miles (For AC Circuits, multi circuit outages are Event Type 31 outages; for DC Circuits, they are Event Type 31 outages.)				
14	Multi Circuit Total Outage Frequency, Mileage Adjusted	(Total Multi Circuit Automatic Outages * 100) / Total Multi Circuit Structure Miles	# of outages	# Automatic Outages per 100 multi circuit structrues miles per year	TMCOF100STmi
15	Multi Circuit Sustained Outage Frequency, Mileage Adjusted	(Total Multi Circuit Sustained Outages * 100) / Total Multi Circuit Structure Miles	# of outages	# Sustained Outages per 100 multi-circuit miles per year	SMOCF100ST mi
16	Multi Circuit Momentary Outage Frequency, Mileage Adjusted				MMCOF100STmi
	Phase II Metrics and Updated Phase I Metrics				
3	Element Operational Outage Frequency	Total Operational Outages / Total Elements	# of outages	# operational outages per element per year	OOF
10	Element Total Operational Outage Duration Time	Total Operation Outage Hours / Total Elements	# of hours	Avg # of operational outage hours per element per year	OODT
11	Mean Total Operational Outage Duration Time	Total Operational Outage Hours / Total Operational outage elements	# of hours	Avg # of operational outage hours per element per year	MOOT
12	Median Total Operational Outage Duration Time	The time when 50% of the operational outage time are greater than this figure	# of Hours	Median # of operational outage hours per Element per year	MdOOT

Appendix F: Revision History

Version	Date	Revisions
1.0	10/3/2019	Initial Release
2.0	1/29/2021	Failed Protection System cause code definition; Removed data fields not collected; Added procedure to add more than one Outage to the same Event ID that are more than one minute apart; Added procedure to handle long duration outages
3.0	1/4/2022	Under “Who Must Report”: Removed “TOs that register during a reporting calendar year are not subject to any TADS reporting requirements until the next calendar year. However, a TO may voluntarily report data for the year that it first becomes newly registered.” This is a legacy requirement that is no longer needed. Under Form 3.3, Table 3.3 should be referenced, not Table 3.2. Table 3.3 (incorrectly referenced as Table 3.2): “Update text to “Column D (Change/Reconfiguration Data) is when the element was placed in-service. If this is unknown, use January 1 of the current year you are reporting. If the element is altered/reconfigured in a way that would change its rating or voltage characteristics, then that date would be entered here.” Table 5.1: Column B- Change “P” to “K” Table 6.1: Changed wording in Column A to “…TO entered Form 4.x Outage ID to be used only once on a Non-Automatic Outage (on Form 4.x) In Table 6.1, removed Column G – Operational Outages enter “NA”. Renumbered subsequent columns.
4.0	1/2/2024	Under the TADS population outage definitions, a reference has been added that there is an exclusion example provided in Fig A.7 for In-Service Sate. The Vandalism, Terrorism, and Malicious Acts cause code has been updated to Physical Security Incident to distinguish it from Cyber Security Incident.
5.0	1/24/2025	Table A.1, Outage Continuation Flags, modified flag #2, “The Outage started in a previous reporting year and continued into the current reporting year.” Appendix A, Automatic Outage Cause Codes, clarification has been provided for using the Vegetation Cause Code for exclusions which apply to circumstances that are beyond the control of an applicable Transmission Owner, subject to FAC-003-5.
5.1	3/10/2025	Removed sections in Chapter 1 that were redundant to other superseding documents or outdated practices. Removed references to Forms 1.1 and 1.2 as they are now input by NERC as part of setup.

		Added clarification to the beginning of Chapter 3 regarding inventory reporting. Corrected and simplified Outages that Continue Beyond the End of the Year based on software implementation. Section moved to Chapter 3 and now referenced in Chapter 6.