**WECC Data Preparation Manual**

for Interconnection-wide Cases

System Review Work Group

Technical Studies Subcommittee

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# Introduction

The WECC Data Preparation Manual (DPM) is intended to provide data requirements and reporting procedures necessary to support creation of interconnection-wide cases. Interconnection-wide cases are used for seasonal Operating Transfer Capability (OTC) studies, WECC path rating studies, and regional- and local-area studies.

Planning Coordinators are responsible for making available models for their planning area reflecting the data provided to them to WECC. Following the data requirement and reporting procedures, by Planning Coordinators, outlined in the DPM will ensure the creation of interconnection-wide cases to meet the needs as coordinated through SRWG. Planning Coordinators may delegate their data submission activities to a Data Representative; however, the Planning Coordinators remain responsible for complying with any NERC standards. WECC staff is responsible for collecting, archiving, and making available solved interconnection-wide cases for use by WECC members and others.

**Navigating the electronic version of the DPM:**

Internal document hyperlinks: Throughout this DPM, there are many references to *internal* supporting information. These internal hyperlinks are configured such that when you see a reference that begins with “See” or “Refer to” followed by text enclosed with double quotes, simply mouse over that text and you will be given the option of following the link to the supporting section of this document.

# NERC Reliability Standards

The DPM is intended to help in the implementation of and support for the following NERC Reliability Standard:

* MOD-032: Data for Power System Modeling and Analysis.

# Definitions

**Area**: An Area is a subset of the Western Interconnection System Model composed of generators and connected contiguous elements to assist in the coordinated development of a WECC interconnection-wide case. The defined Areas are listed in “.”

**Area Coordinator**: The [Area Coordinator](https://www.wecc.org/_layouts/15/WopiFrame.aspx?sourcedoc=/Reliability/AC%20list.xlsx&action=default&DefaultItemOpen=1) is an entity to whom the applicable entities have delegated data collection and coordination activity for a defined Area.

**Balancing Coordinator**: [Balancing](https://www.wecc.biz/_layouts/15/WopiFrame.aspx?sourcedoc=/Reliability/AC%20list.xlsx&action=default&DefaultItemOpen=1) Coordinator is an entity whom submits interchange schedules between Areas in coordination with adjacent Balancing Coordinators.

**BCCS**: [Base Case Coordination System](https://bccs.wecc.biz/MODWeb/login.aspx?ReturnUrl=%2fMODWeb%2f) is a web-accessible, centralized database that automates base case building in PSLF and PSS®E formats. It also provides a central location for maintaining base case information. Refer to the [BCCS Data Submitter's Guide](https://www.wecc.biz/_layouts/15/WopiFrame.aspx?sourcedoc=/Reliability/WECC%20BCCS%20Data%20Submitter%27s%20Guide_6-30-14_FinalDraft.docx&action=default&DefaultItemOpen=1) for a detailed guide to using the BCCS.

**Data Representative:** An entity delegated by responsible functional entities to aid in the data submission activities of Planning Coordinators. An example of a data representative may be a sub-regional transmission planning entity comprising of multiple Planning Coordinators. This term is included for convenience in reference only.

**Generation Netting:** The representation of a generator(s) through the modeling a load element with the real and reactive power requirements set to the net of generation and load. Alternatively, Generation Netting may be the representation of a generator(s) using a load element with a negative Real Power demand setting. Generation Netting may be used only in Dynamic simulations by including the Generator element in the Netting section of the Positive Sequence Load Flow (PSLF) ‘dyd’ file for a given WECC Base Case.

**Interconnection-wide Case(s):** Models representing the entire Western Interconnection which may include WECC Base Cases or models in data formats specific to the need for which they are developed, i.e. short circuit analysis.

**Master Dynamics File (MDF):** File in PSLF ‘dyd’ format containing dynamic data for use in the compilation of all WECC Base Cases.

**Planned Facilities:** Plannedfacilities that have not yet met their in-service date at the time data is submitted for inclusion in a base case. See the “General Data Requirements and Reporting Procedures” section.

**PSLF:** GE’s Positive Sequence Load Flow software tool for electrical transmission analysis.

**PSS®E:** Siemens PTI’s Power System Simulator for Engineering software tool for electrical transmission analysis.

**Sub-Area Coordinator**: A Sub-Area Coordinator is an entity that represents a subset of the data collection and coordination activity within an Area. The sub area data is submitted to an Area Coordinator.

**WECC Base Cases:** A set of solved and solvable steady-state and dynamic data representing a specific operating scenario of the Western Interconnection compiled by WECC staff in cooperation with WECC members.

**WECC staff:** Employees of WECC who participate in the coordination of steady-state and dynamic data for use in creating WECC interconnection-wide cases.

# General Data Requirements and Reporting Procedures

The data requirements and reporting procedures included in the Data Preparation manual are intended to provide an outline to Planning Coordinators to support their compliance with MOD-032-1, R1 and R4. The data requirements and reporting procedures jointly developed by each Planning Coordinator can address and incorporate desires, concerns, and issues of the entities within its Planning Coordinator Area and therefore are not included in the Data Preparation Manual. Data types requested in the Data Preparation Manual are not inclusive of all the data types required in MOD-032 R1.1.

## Data Requirements

Data format and content requirements required to be provided by Planning Coordinators for the development of Interconnection-wide cases is broken into three data types: steady state, dynamics, and short circuit. Sections V, VI, and VII address each data type respectively. An additional data requirements section is provided to address the modeling of contingencies and remedial action schemes.

In consideration of including Planned Facilities in submitted data, the following guidelines should be followed:

* the facilities are expected be in-service on the scheduled base case posting date;
* the facilities are expected to be in-service in the month and year represented in the case; or
* the facilities are required to support proposed generation facilities that are modeled in-service in the case.
* Data requirements not included in MOD-032-1, Attachment 1 are identified within the Data Preparation Manual by use of “#” prior to the requirements description.

All data must be the best available data. Dynamic data resulting from equipment testing should be provided if it is available. If test data is not available then design data should be provided. If design data is not available then generic Dynamic data should be provided. In-service equipment should be supported by test data while far-term planned equipment may only have generic Dynamic data available.

## Reporting Procedures

The schedule and process for Planning Coordinators to submit data to WECC is outlined in the following documents:

* Annual Study Program Scope of Work – describes schedule, intent, and process for creation of WECC base cases
* Base Case Coordination System Data Submitter’s Guide – provides detailed instructions on the creation and use of necessary files for submitting data to WECC

Planning Coordinators, through their jointly developed data requirements and reporting procedures, may determine whether the functional entities within their Planning Coordinator Area should utilize the Base Case Coordination System (BCCS) but is not required. The development of Interconnection-wide cases only requires Planning Coordinators to be included in the process. Including additional functional entities is determined by each Planning Coordinator.

Data submittals to WECC may only be done in BCCS project file (prj) format in the version that is currently approved by WECC for production use. Submitted files must also follow the file structures defined in the [BCCS Data Submitter's Guide](https://www.wecc.biz/_layouts/15/WopiFrame.aspx?sourcedoc=/Reliability/WECC%20BCCS%20Data%20Submitter%27s%20Guide_6-30-14_FinalDraft.docx&action=default&DefaultItemOpen=1). WECC will compile the data received into a solved and solvable case that initializes correctly with the latest Dynamic data updates included in the Master Dynamics File. The base case along with the updated Dynamic data file and all associated materials (case details associated with each Area) are posted on the WECC website for review and comment. WECC will send an email to its members announcing the posting and requesting a second review.

WECC will again incorporate the submitted changes from the second review into the case and post the approved case along with the approved updated Dynamic data file and associated materials to the WECC website. WECC will send an email to WECC members announcing the posting of the approved case.

Flexibility in due dates can be granted by WECC staff due to BCCS technical difficulties. Contact WECC via the email prior to due dates if technical difficulties occur so alternate submittal methods can be arranged.

# Steady-State Data Requirements

To establish consistent system models to be used in the system analysis of the reliability of the interconnected transmission system; Planning Coordinators shall provide steady-state data to WECC according to the requirements listed herein. To provide consistency in data submittals and help avoid potential solution problems, the guidelines below shall be followed to the maximum extent possible. However, WECC recognizes deviations from the guidelines may occasionally be needed. For these situations, submitters are requested to provide the SRWG and MVWG with the rationale for exceptions. The Interconnection-wide requirements shall include the following steady-state data requirements:

* With the exception of collector-based generation such as wind and solar all Bulk Electric System elements, as presently defined by NERC, within the Western Interconnection shall be represented in WECC Base Cases without equivalencing.
* Non-Bulk Electric System elements may also be included in WECC Base Cases and must follow the same data submittal requirements as those for Bulk Electric System elements. Any equivalencing of non-Bulk Electric System elements shall be modeled to yield almost identical performance of a full representation in both static and dynamic analysis.
* Non-Bulk Electric System elements shall be included if it has been determined that they have significant interaction with Bulk Electric System elements. Non-Bulk Electric System elements that may have a significant interaction with Bulk Electric System elements may exhibit one or more of the following characteristics:
  + Facilities that are operated at or above 50 kV
  + Facilities that are operated in parallel with BES elements
  + Facilities with connected individual generation resources >=10 MVA or aggregate generation resources >=20MVA
  + Facilities with connected reactive resources >=10 MVAR
* Non-Bulk Electric Local Networks and radial systems that feed only load or parallel/looped systems that are normally operated in a radial configuration would generally be excluded from modeling.
* Steady-state power flow data submitted as described in the data request letter shall represent the existing Bulk Electric System elements plus planned transmission and generation facilities as deemed appropriate by the Planning Coordinator.
* Paths defined in the [WECC Path Rating Catalog](https://www.wecc.org/library/WECC%20Documents/Forms/AllItems.aspx?RootFolder=/library/WECC%20Documents/Reports) shall be modeled to include all elements consistent with the path definition.
* All data submittals shall conform to and meet the data requirements of the latest WECC approved version of the BCCS.
* Data fields that are strings shall not contain commas, single quotes, or double quotes.
* Key element identifiers (e.g., number, name, base voltage, ID) that indicate an element representing the same equipment shall be consistent between base cases.
  + Devices with alpha characters shall consistently use either uppercase or lowercase IDs.
  + Bus names with alpha characters shall consistently be either uppercase or lowercase.
* Uniqueness shall not depend on names and IDs being case sensitive.
* The required data is listed below in the tables of data requirements. Data fields listed in this DPM are all required and any description for the field shall be followed.
* Bus naming guideline: Although the criterion for bus names is that ‘Bus names shall be unique within the same Base Voltage class,’ it is intended that, ideally, bus names should be the same for all equipment located in the same vicinity. For example, two substations that are in different areas could both be named “Midway.” Names could be set to “MIDWAY” at one location, and to “MDWAY” at the other. The SRWG strongly suggests that naming of new buses added to the model adhere to the ideal guideline. It recommends, but it is not mandatory, to eliminate spaces in bus names and substitute underscore characters instead. It is the responsibility of the party adding bus information to assure there is no name duplication.

## AC and DC Buses (MOD-032, Attachment 1)

General Requirements:

1. Buses usually represent all of the equipment in a substation that is at the same voltage level and is connected together. If desired, multiple bus sections can be represented by separate buses connected by AC Transmission Line models that can be opened or closed as needed. Buses may also represent a node on a transmission line such as a tapping point or change in ownership.
2. Location of the bus will be identified by the combination of Area, Zone, and/or Owner fields. Optionally, the latitude and longitude fields can be submitted using decimal degrees with data entered not to exceed five decimal places.

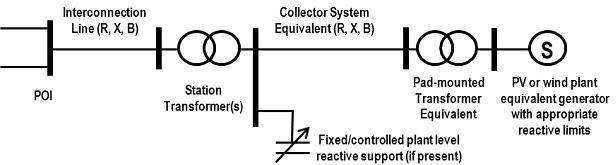
Table 1: Data Requirements (Buses)

| **Field** | **Description** | **Requirements** |
| --- | --- | --- |
| #Number | Bus number | 1. Refer to “” for designated ranges of Bus numbers. 2. WECC staff shall provide DC Bus numbers. |
| #Name | Bus name   * Alphanumeric string containing 1 to 12 characters * At least one non-numeric character | 1. Bus names shall be unique within the same Base Voltage class. |
| Base Voltage | Nominal voltage class of Bus (kV) |  |
| #Bus Type | AC Bus type {0,1,2,-2}   * 0 = swing bus (voltage magnitude and phase fixed) * 1 = load bus (unconstrained voltage angle and magnitude) * 2 = generator bus (voltage control [terminal or remote] within generator limits) * 2 = generator bus with unlimited reactive power limits   Other bus types may be used to indicate OFF status.  Bus type -4 and smaller is the accepted convention for deleted buses.  DC Bus type {1,2}   * 1 = for a rectifier * 2 = for an inverter |  |
| DC System Number | DC system number  (not required for AC Bus) | 1. WECC staff shall assign a DC system number for each DC system prior to model submission. |
| Scheduled Voltage | Scheduled voltage (pu)   * 5 decimals * Default: 1.00000 | 1. If the Bus is regulated by a generator or other device, the scheduled voltage shall be specified in per unit with respect to the Base Voltage of the Bus. 2. If the Bus is not regulated, the scheduled voltage is optional and for information purposes only. |
| Area | Area in which Bus is located | 1. Refer to “” for designated Area. |
| Zone | Zone in which Bus is located | 1. Refer to “” for designated ranges of Zones used by Area. |
| Owner | Owner Number | 1. Owner Number shall be the Transmission Owner, Generator Owner, or reporting entity, by written agreement. 2. WECC staff shall assign Owner Number to required entities. |
| #Planning Coordinator | Planning Coordinator Area in which Bus is located | 1. Refer to “Appendix 2 – Area, Zone, and Bus Number Assignments” for designated Planning Coordinator Areas. |

## Generation (MOD-032, Attachment 1)

General Requirements:

1. Modeling of generators shall comply with the following:
   1. If the individual generator unit capacity is 10 MVA or larger, and is connected to the WECC transmission system at 60 kV or higher, then steady-state data and dynamics data shall be submitted for each generator.
   2. If the aggregated generator unit capacity is 20 MVA or larger, and is connected to the WECC transmission system at 60 kV or higher, and is not a collector–based generation facility, then steady-state data and dynamics data shall be submitted for each generator. (Wind and solar farms are an example of a collector-based generation facility.)
   3. If the aggregated generation capacity is 20 MVA or larger, and is connected to the WECC transmission system at 60 kV or higher, and is a collector–based generation facility, then steady-state data and dynamics data shall be submitted for the aggregated generation capacity as a single-unit generator model. (Wind and solar farms are an example of a collector-based generation facility.)
   4. All other generating facilities shall either be netted with bus load and steady-state data shall be submitted accordingly.
2. Steady-state and dynamic generator data shall be.
3. Synchronous motors 10 MVA and larger shall be modeled as individual machines, using a generator model with negative Real Power output and constant Q.
4. The netting of small generating units with single capacity greater than or equal to 10 MVA or aggregate capacity greater than or equal to 20 MVA may not be modeled as a negative load. Generators modeled as negative load shall have an assigned load ID of ‘NT’ and have their ‘non-conforming load FLAG’ set appropriately.
5. Induction motors shall be modeled as a load with the intent of using an induction motor model (MOTORW).
6. Synchronous condensers shall be modeled individually using a generator model.
7. Generator step-up transformers shall be modeled explicitly; therefore, they shall not be modeled using the internal generator step-up transformer feature of a generator model. All related parameters shall be set to the default values. See “Data Requirements (Transformers).”
8. Station service loads (ID = ‘SS’) shall be represented explicitly as separate loads on the generator bus. See “Data Requirements (Loads).”
9. Wind and photovoltaic projects shall be represented through an equivalent generator(s), equivalent low-voltage to intermediate-voltage transformer, equivalent collector system, and substation transformer between the collector system and the transmission bus. See the [WECC Wind Power Plant Power Flow Modeling Guide](https://www.wecc.biz/Reliability/WECC%20PV%20Plant%20Power%20Flow%20Modeling%20Guidelines%20-%20August%202010.pdf) and [PV Plant Power Flow Modeling Guide](https://www.wecc.org/Reliability/WECC%20PV%20Plant%20Power%20Flow%20Modeling%20Guide.pdf).



1. Large industrial sites may include imbedded generation. Industrial generators 10 MVA and larger shall be represented in power flow instead of netting with the total load. If a generator is connected to the low side of the bulk-power-delivery transformer, then the transformer must be represented in the power flow and the generator and load must be connected to the low-voltage side of the transformer.
2. Generator maximum Real Power Pmax in power flow must be consistent with the turbine capabilities defined in the [Master Dynamics File](https://www.wecc.org/Reliability/NDA/Base%20Cases/MDF.zip).

Table 2: Data Requirements (Generation)

| **Field** | **Description** | **Requirements** | **Measure** |
| --- | --- | --- | --- |
| #Bus Numbers | Number of the Bus to which the generator is attached.   * See “Data Requirements (Buses)” |  |  |
| #Unit ID | Two -character Generator identifier |  |  |
| Status | Generator status   * 1 = in-service * 0 = out-of-service | 1. Out-of-service units shall have status set to zero. 2. Retired units shall be deleted rather than having status set to zero. |  |
| Pgen | Real Power output (gross MW) | 1. Pgen shall be at or within the unit Pmax and Pmin parameters for units that are in-service. | If Status = 1: Pmin ≤ Pgen ≤ Pmax |
| Qgen | Reactive power output (MVAr) |  |  |
| Pmax | Maximum Real Power output (MW) | 1. Pmax shall reflect the maximum Real Power output of the unit, also known as ‘gross’ capability. 2. Pmax shall not be greater than the maximum capability of the unit represented by the governor model. | Pmax ≤ Governor Max |
| Pmin | Minimum Real Power output (MW) | 1. Pmin shall reflect the minimum Real Power output of the unit. 2. Pmin shall be less than or equal to Pmax. | Pmin ≤ Pmax |
| Qmax | Maximum reactive power output (MVAr) | 1. Qmax shall reflect the appropriate maximum reactive power output of the unit. |  |
| Qmin | Minimum reactive power output (MVAr) | 1. Qmin shall reflect the appropriate minimum reactive power output of the unit. 2. Qmin shall be less than or equal to Qmax. | Qmin ≤ Qmax |
| #Q Alloc Factor | Reactive power regulating assignment factor   * 0.0 – 1.0 * > 0.0 for AVR control * 0.0 for constant PF control or gen ST=0 |  |  |
| #Q Table Flag | Reactive capability curve flag   * 0 = do not use capability curve * 1 = use capability curve if it exists | 1. Q-Table data used for internal studies shall be included in WECC Base Case submittals. |  |
| #Base load Flag | Base load flag   * 0 = non-base load unit (responds to low frequency with additional mechanical power) * 1 = base load unit (cannot respond to low frequency with additional mechanical power) * 2 = base load unit (cannot respond to low and high frequency with mechanical power) |  |  |
| Turbine Type | * 0 = unknown * 1 = non-reheat steam * 2 = reheat steam * 3 = steam cross-compound * 4 = steam in combined cycle (separate shaft) * 5 = hydro * 6 = diesel non turbo charged * 7 = diesel turbo charged * 11 = industrial GT (single shaft) * 12 = aero derivative GT * 13 = single shaft combined cycle * 14 = Synchronous condenser (no turbine) * 21 = type 1 wind turbine * 22 = type 2 wind turbine * 23 = type 3 wind turbine * 24 = type 4 wind turbine * 31 = photovoltaic * 40 = DC tie (generators representing DC ties) |  |  |
| Reg Bus | Bus with voltage controlled by this Generator | 1. Regulation of a remote Bus that does not represent actual system operation shall be avoided. |  |
| Vsched | Generator scheduled voltage (pu) |  |  |
| #Area | Area in which generator is located | 1. Refer to “” for designated Area. |  |
| #Zone | Zone in which generator is located | 1. Refer to “” for designated ranges of Zones used by Area |  |
| Base MVA | Generator base (MVA) | 1. Unit Base MVA shall be equal to the MVA Base parameter of the unit’s Dynamic machine model. | Base MVA = Machine Base |
| #Owner | Owner Number   * Up to 8 owners allowed | 1. Owner Number shall be the Generator Owner. 2. WECC staff shall assign Owner Number to required entities. |  |
| #Planning Coordinator | Planning Coordinator Area in which Generator is located | 1. Refer to “Appendix 2 – Area, Zone, and Bus Number Assignments” for designated Planning Coordinator Areas. |  |
| G tap | Tap ratio of generator step up transformer | 1. G tap shall be set to 1. | G tap = 1 |
| R TR | Resistance of generator step up transformer | 1. R TR shall be set to 0. | R TR = 0 |
| XTR | Reactance of generator step up transformer | 1. X TR shall be set to 0. | X TR = 0 |
| R Sub-transient | Sub-transient resistance of generator |  |  |
| X Sub-transient | Sub-transient reactance of generator | 1. X Sub-transient shall be equal to the sub-transient reactance represented in the unit Dynamic machine model. | X Sub-transient = Xdpp (or Ldpp) |

## AC Transmission Lines (MOD-032, Attachment 1)

General Requirements:

1. Series-connected reactive devices modeled in AC Transmission Lines shall be explicitly modeled.
2. When bus ties are necessary, the impedance should be R = 0.0 pu and X = 0.00029 pu, or less. No value of charging (G or B) is allowed on lines having less than the jumper threshold impedance. Do not make a closed loop (ring-bus representation) with ties that are less than the threshold impedance. In addition, do not use bus ties to connect different areas.
3. Normal and emergency thermal rating fields for summer, winter, spring, and fall shall be submitted and stored in the BCCS in rating profiles. Refer to the [BCCS Data Submitter's Guide](https://www.wecc.biz/_layouts/15/WopiFrame.aspx?sourcedoc=/Reliability/WECC%20BCCS%20Data%20Submitter%27s%20Guide_6-30-14_FinalDraft.docx&action=default&DefaultItemOpen=1) for formatting and structure requirements for these files.
4. Line connected transformers shall not be modeled using the internal line connected transformer feature of a transmission line model; all related parameters shall be set to the default values. See “Data Requirements (Transformers).”
5. Data for AC lines will consider the length of the line when calculating line parameters. For example, long lines will be modeled with impedances adjusted to account for the uniform distribution of the series impedance and shunt admittance along the length of the line.
6. PSS®E base case data includes three facility ratings for transmission lines. Ratings 1 and 2 are used for seasonal normal and emergency ratings in the season of the case. Rating 3 is used for various other purposes. WECC staff will load the appropriate seasonal ratings into ratings 1 and 2 when creating PSS®E cases in the BCCS.

Table 3: Data Requirements (AC Transmission)

| **Field** | **Description** | **Requirements** | **Measure** |
| --- | --- | --- | --- |
| #FROM Bus Number | Number of the bus to which the FROM end of the transmission line section is attached.   * See “Data Requirements (Buses)” |  |  |
| #TO Bus Number | Number of the bus to which the TO end of the transmission line section is attached.   * See “Data Requirements (Buses)” |  |  |
| #Circuit ID | Circuit identifier   * Two-character circuit identifier | 1. AC Transmission Line modeling equivalent circuits shall have Circuit ID set to ‘99’ or ‘EQ.’ |  |
| #Section Number | Section number (1-9 in ascending order beginning at FROM end) | 1. AC Transmission Line with multiple sections shall number the sections consecutively starting with ‘1.’ |  |
| Status | Branch status   * 0 = out-of-service * 1 = in-service * 2 = bypass | 1. AC Transmission Line shall have the anticipated status of the line in the case. |  |
| R | Branch section positive sequence resistance | 1. Resistance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Transmission Owner. |  |
| X | Branch section positive sequence reactance | 1. Reactance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Transmission Owner. |  |
| B | Branch section positive sequence susceptance | 1. Susceptance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Transmission Owner. |  |
| Rating MVA 1 | Summer Normal Branch Rating (MVA) | 1. Line rating required | Rating MVA 1 > 0 |
| Rating MVA 2 | Summer Emergency Branch Rating (MVA) | 1. Line rating required | Rating MVA 2 > 0 |
| Rating MVA 3 | Winter Normal Branch Rating (MVA) |  |  |
| Rating MVA 4 | Winter Emergency Branch Rating (MVA) |  |  |
| Rating MVA 5 | Fall Normal Branch Rating (MVA) |  |  |
| Rating MVA 6 | Fall Emergency Branch Rating (MVA) |  |  |
| Rating MVA 7 | Spring Normal Branch Rating (MVA) |  |  |
| Rating MVA 8 | Spring Emergency Branch Rating (MVA) |  |  |
| #From  Loss Assign. | Loss factor (0.0 - 1.0) used to assign losses   * 1.0 = 100% loss assigned to FROM end of AC Transmission Line * 0.0 = 100% loss assigned to “TO” end of AC Transmission Line |  |  |
| #Area | AC Transmission Line Area location | 1. Refer to “” for designated Area |  |
| #Zone | Transmission Line Zone location | 1. Refer to “” for designated ranges of Zones used by Area |  |
| #Ohms | Ohmic data flag   * 0 = impedances in pu * 1 = impedances in ohms |  |  |
| #Owner | Owner Number (1 through 8) | 1. Owner Number shall be the Transmission Owner of transmission facility and Generator Owner of generation facility. 2. WECC staff shall assign Owner Number to required entities. |  |

## Transformers (MOD-032, Attachment 1)

General Requirements

1. Transformers with no Tap Changing Under Load (TCUL) or phase-shifting capability shall have the Tap Control Type field set to ‘1’ and shall not have TCUL or phase-shifting data included in the model. Conversion from the latest approved version of PSLF to other widely used programs may create model discrepancies with partial TCUL or phase-shifting data.
2. Transformer data can be entered on either the transformer base (transformer winding MVA base and winding voltage base) or the system model base (100 MVA and system nominal voltage base). Impedance values and tap position values shall use a consistent unit base value for a given transformer.
3. Normal and Emergency thermal rating fields for summer, winter, spring, and fall shall be submitted and stored in the BCCS in rating profiles all Transformer models. See Appendix 3 for formatting and structure requirements for these files.
4. PSS®E cases use ratings 1 and 2 for seasonal normal and emergency ratings in the season of the case. If directed by the Area Coordinator, WECC staff will load the appropriate seasonal ratings into ratings 1 and 2 when creating PSS®E cases in the BCCS.

Table 4: Data Requirements (Transformers)

| **Field** | **Description** | **Requirements** | **Measure** |
| --- | --- | --- | --- |
| #FROM Bus Number | Number of the bus to which the FROM end of the transformer is attached.   * See “Data Requirements (Buses)” |  |  |
| #TO Bus Number | Number of the bus to which the “TO” end of the transformer is attached.   * See “Data Requirements (Buses)” |  |  |
| #Circuit ID | Circuit identifier   * Two-character circuit identifier | 1. Transformer modeling equivalent circuits shall have Circuit ID set to ‘99’ or ‘EQ.’ |  |
| Status | Transformer Status   * 0 = out-of-service * 1 = in-service * 2 = secondary open * 3 = tertiary open * 4 = primary open | 1. Transformers shall have the anticipated status of the transformer in the case. |  |
| Tap Control Type | Transformer type code   * 1 or 11 = Fixed * 2 or 12 = TCUL * 4 or 14 = Phase-Shifting |  |  |
| Regulated Bus Number | Number of Bus with voltage regulated or “TO” bus number for phase-regulated transformer | 1. Regulation of a remote bus that does not represent actual system operation shall be avoided. |  |
| #Impedance Table Number | Impedance correction table number |  |  |
| #Tert Bus Number | Tertiary winding Bus number   * See “Data Requirements (Buses)” |  |  |
| #3wpt Bus Number | Internal ‘3-winding point’ Bus number   * See “Data Requirements (Buses)” |  |  |
| #Area | Area in which Transformer is located | 1. Refer to “” for designated Area. |  |
| #Zone | Zone in which Transformer is located | 1. Refer to “” for designated ranges of Zones used by Area. |  |
| #FROM-TO Base MVA | Transformer MVA base (prim. to sec. for 3-wndg) |  |  |
| #FROM-Tert Base MVA | MVA base - prim. to tertiary for 3-wndg |  |  |
| #TO-Tert Base MVA | MVA base - tertiary. to sec. for 3-wndg |  |  |
| R FROM-TO | Resistance primary to secondary |  |  |
| X FROM-TO | Reactance primary to secondary |  |  |
| R FROM-Tert | Resistance primary to tertiary |  |  |
| X FROM-Tert | Reactance primary to tertiary |  |  |
| R TO-Tert | Resistance secondary to tertiary |  |  |
| X TO-Tert | Reactance secondary to tertiary |  |  |
| FROM Winding Nom Volt | Primary winding nominal voltage (kV) |  |  |
| TO Winding Nom Volt | Secondary winding nominal voltage (kV) |  |  |
| Tert Winding Nom Volt | Tertiary winding nominal voltage (kV) |  |  |
| FROM Fixed Tap | Primary winding fixed tap position (pu) |  |  |
| TO Fixed Tap | Secondary winding fixed tap position (pu) |  |  |
| Tert Fixed Tap | Tertiary winding fixed tap position (pu) |  |  |
| Variable V Tap or Variable Angle | TCUL tap position (primary winding) or phase angle position | 1. Variable V Tap or Variable Angle shall be at or within Max VAr Tap and Min VAr Tap for Transformers that are in-service. | Min VAr Tap ≤ V Tap ≤ Max VAr Tap |
| Step Size | TCUL (pu) or phase-shift (angle in deg) step | 1. Step Size shall reflect the capability of the transformer. |  |
| FROM Angle | Primary winding phase angle (deg) |  |  |
| TO Angle | Secondary winding phase angle (deg) |  |  |
| Tertiary Angle | Tertiary winding phase angle (deg) |  |  |
| G-Core Loss | Magnetizing conductance (pu) |  |  |
| B Magnetizing | Magnetizing susceptance (pu) |  |  |
| Rating 1 | **Summer Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr) | 1. Transformer rating required. | Rating MVA 1 > 0 |
| Rating 2 | **Summer Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr) | 1. Transformer rating required. | Rating MVA 2 > 0 |
| Rating 3 | **Winter Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr) |  |  |
| Rating 4 | **Winter Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr) |  |  |
| Rating 5 | **Fall Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr) |  |  |
| Rating 6 | **Fall Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr) |  |  |
| Rating 7 | **Spring Normal** Branch Rating (MVA) (primary winding for  3-winding xfmr) |  |  |
| Rating 8 | **Spring Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr) |  |  |
| TO Winding Rating MVA 1 | Ratings – secondary winding for 3-winding xfmr |  |  |
| TO Winding Rating MVA 2 | Ratings – secondary winding for 3-winding xfmr |  |  |
| TO Winding Rating MVA 3 | Ratings – secondary winding for 3-winding xfmr |  |  |
| Tert Wind. Rating MVA 1 | Ratings – tertiary winding for 3-winding xfmr |  |  |
| Tert Wind. Rating MVA 2 | Ratings – tertiary winding for 3-winding xfmr |  |  |
| Tert Wind. Rating MVA 3 | Ratings – tertiary winding for 3-winding xfmr |  |  |
| #FROM Loss Assign | Loss assignment factor (primary winding for 3-winding xfmr) (pu) |  |  |
| #TO Loss Assign | Loss assignment factor - secondary winding for 3-winding xfmr (pu) |  |  |
| #Tert Loss Assign | Loss assignment factor – tertiary winding for 3-winding xfmr (pu) |  |  |
| Max Var. Tap | Maximum TCUL ratio (pu or deg) | 1. Max Var. Tap shall be greater than Min Var. Tap. |  |
| Min Var. Tap | Minimum TCUL ratio (pu or deg) |  |  |
| Max Cont V or MW | Maximum voltage (power) at controlled bus (pu or MW) | 1. Max Cont V shall be greater than Min Cont V. |  |
| Min Cont V or MW | Minimum voltage (power) at controlled bus (pu or MW) |  |  |
| #Ohms | Ohmic data flag   * 0 = impedances in pu * 1 = impedances in ohms |  |  |
| #Owner | Owner Number (1 through 8) | 1. Owner Number shall be the Transmission Owner for transmission facility and Generator Owner for generator facility. 2. WECC staff shall assign Owner Number to required entities. |  |

## Fixed Shunt Reactive Elements (MOD-032, Attachment 1)

General Requirements

1. Represent fixed shunt elements that are directly connected to a bus as bus shunts.
2. Represent fixed shunt elements that directly connect to and switch with a transmission line as line shunts.
3. Fixed shunt reactive devices inside wind and solar projects must be modeled explicitly in power flow.

Table 5: Data Requirements (Fixed Shunts)

| **Field** | **Description** | **Requirement** |
| --- | --- | --- |
| #FROM Bus Number | Number of the Bus to which the FROM end of the transmission line on which the shunt is connected for line shunts or number of the Bus at which shunt is connected for bus shunts.   * See “Data Requirements (Buses)” |  |
| #TO Bus Number | Number of the Bus to which the TO end of the transmission line on which the shunt is connected for line shunts or 0 for bus shunts.   * See “Data Requirements (Buses)” |  |
| #Shunt ID | Shunt identifier   * Two-character shunt identifier | 1. Line shunt connected to the FROM end of the transmission line shall have Shunt ID starting with ‘F.’ 2. Line shunt connected to the TO end of the transmission line shall have Shunt ID starting with ‘T.’ |
| #Circuit ID | AC Transmission Line circuit identifier for line shunts or blank for bus shunts   * Two-character circuit identifier |  |
| #Section Number | Number of AC Transmission Line section to which shunt is connected if line shunt or ‘0’ if bus shunt |  |
| Shunt Status | Shunt status   * 0 = out-of-service * 1 = in-service | 1. Fixed shunts shall have the anticipated status of the shunt in the case. |
| #Area | Area in which fixed shunt is located | 1. Refer to “” for designated Area. |
| #Zone | Zone in which fixed shunt is located | 1. Refer to “” for designated ranges of Zones used by Area. |
| G | Actual shunt conductance (pu) |  |
| B | Actual shunt susceptance (pu) |  |
| #Owner | Owner Number (1 – 4) | 1. Owner Number shall be the Transmission Owner or Generator Owner. 2. WECC staff shall assign Owner Number to required entities. |

## Controlled Shunt Reactive Devices (MOD-032, Attachment 1)

General Requirements

1. Controlled shunt reactive device models should be used to represent the following devices explicitly in power flow:

* Mechanically switched shunt capacitors and reactors;
* [Static VAR Compensators;](https://www.wecc.biz/pcc/Pages/tss.aspx)
* [STATCOMs; and/or](https://www.wecc.biz/pcc/Pages/tss.aspx)
* [Thyristor-switched shunt capacitors and reactors](https://www.wecc.biz/pcc/Pages/tss.aspx).

1. Controlled shunt reactive devices inside wind and solar projects must be modeled explicitly in power flow.

Table 6: Data Requirements (Controlled Shunts)

| **Field** | **Description** | **Requirement** |
| --- | --- | --- |
| #Bus Number | Number of Bus at which device is connected   * See “Data Requirements (Buses)” |  |
| #SVD ID | SVD identifier   * Two-character identifier |  |
| SVD Status | SVD status   * 0 = out-of-service * 1 = in-service | 1. Controlled shunts shall have the anticipated status of the shunt in the case. |
| SVD Control Type | Device type   * 0 = Fixed * 1 = Discrete * 2 = Continuous * 3 = All or Nothing * 4 = Discrete control using Voltage Dead Band * 5=WECC SVC * 6=WECC STATCOM * 7=WECC TSC/TSR |  |
| Regulated Bus | Number of Bus regulated by this shunt   * See “Data Requirements (Buses)” | 1. Regulation of a remote Bus that does not represent actual system operation shall be avoided. |
| #Area | Area in which Controlled Shunt is located | 1. Refer to “Appendix 2 – Area, Zone, and Bus Number Assignments” for designated Area. |
| #Zone | Zone in which Controlled Shunt is located | 1. Refer to “Appendix 2 – Area, Zone, and Bus Number Assignments” for designated ranges of Zones used by Area. |
| G Actual | Actual shunt conductance (pu) |  |
| B Actual | Actual shunt susceptance (pu) |  |
| B Min | Minimum susceptance of continuous element (pu) |  |
| B Max | Maximum susceptance of continuous element (pu) |  |
| Voltage Dead Band | Voltage control bandwidth divided by two (pu) (types 3 and 4) | 1. Voltage Dead Band shall prevent regulated voltage from exceeding the Voltage Dead Band with a single Controlled Shunt step. 2. The minimum dead band shall be 0.02. |
| B Step | Susceptance of each switched element in nth stage (pu) (types 1-4, 7) | 1. Step size shall reflect the capability of the controlled shunt. |
| No. of Steps | Number of equal admittance steps in nth switched stage (types 1-4, 7) | 1. Number of steps shall reflect the capability of the controlled shunt. |
| B Min | Minimum total susceptance for device (pu) |  |
| B Max | Maximum total susceptance for device (pu)  Maximum current for type 6 (pu) |  |
| XC | Compensating (slope) reactance (pu) (types 5, 6, 7) |  |
| B Min SH | Minimum B for switching shunts (pu) (types 5, 6, 7) |  |
| B Max SH | Maximum B for switching shunts (pu) (types 5, 6, 7) |  |
| STSB | Slow reset control on/off status (pu) (types 5, 6, 7) |  |
| B Min SB | Minimum B for slow reset (pu) (pu) (types 5, 7) |  |
| B Max SB | Maximum B for slow reset (pu) (pu) (types 5, 7) |  |
| VRFMIN | Minimum Voltage reference for slow reset (pu) (types 5, 6, 7)  Minimum Voltage reference for types 3 and 4 if Voltage Dead Band <= 0 |  |
| VRFMAX | Maximum Voltage reference for slow reset (pu) (types 5, 6, 7)  Maximum Voltage reference for types 3 and 4 if Voltage Dead Band <= 0 |  |
| dVdB | System dV/dB for slow reset (pu) (types 5, 6, and 7) |  |
| Ni | Number of steps in shunt |  |
| #Owner | Owner Number (1 through 4) | 1. Owner Number shall be the Transmission Owner or Generator Owner. 2. WECC staff shall assign Owner Number to required entities. |

## Loads (MOD-032, Attachment 1)

General Requirements

1. Real and reactive power for each load shall be provided.
2. Motors 10 MVA or larger shall be modeled as machines (see “General Requirements**)**.”
3. Station service at modeled generation facilities with station service load greater than or equal to 1 MW shall be modeled explicitly. As noted in the table below, load modeling generator station service shall have Load ID set to ‘SS.’
4. A Long ID shall be provided for each load in accordance with the WECC MVWG Load Long ID Instructions [(LID\_Instructions),](https://www.wecc.org/Reliability/LID_Instructions_2012-4-10.pdf) either within the case data provided, or in a separate spreadsheet file. See Dynamic section 6B Load Characteristics. There is a separate Long ID for Station Service or generator Auxiliary loads.
5. Industrial loads and embedded generation shall be modeled on the low side of the transformer, as shown in the figure below.



Table 7: Data Requirements (Loads)

| **Field** | **Description** | **Requirement** |
| --- | --- | --- |
| Bus  Number | Number of Bus at which load is connected   * See “Data Requirements (Buses)” |  |
| Load ID | Two-character identifier | 1. Load modeling generator station service shall have Load ID set to ‘SS.’ 2. Loads at the same Bus shall have unique Load ID. |
| Load Status | * 0 = load out-of-service * 1 = load in-service | 1. Load shall have the anticipated status of the load in the case. |
| Non-Conforming Flag | * 0 = load will change with scaling * 1 = load does not change with scaling | 1. Non-conforming Flag shall be set to ‘1’ for loads which should not be changed in load scaling operations of power flow software. |
| Area | Load Area in which located | 1. Refer to “” for designated Area. |
| Zone | Load Zone in which located | 1. Refer to “” for designated ranges of Zones used by Area. |
| Planning Coordinator | Planning Coordinator Area in which Load is located | 1. Refer to “Appendix 2 – Area, Zone, and Bus Number Assignments” for designated Planning Coordinator Areas. |
| Const MVA P | Constant MVA Real Power load |  |
| Const MVA Q | Constant MVA reactive power load |  |
| Const CUR P | Constant current Real Power load | 1. Const CUR P shall not be used. |
| Const CUR Q | Constant current reactive power load | 1. Const CUR Q shall not be used. |
| Const Y P | Constant admittance Real Power load | 1. Const Y P shall not be used. |
| Const Y Q | Constant admittance reactive power load | 1. Const Y Q shall not be used. |
| #Owner | Owner Number | 1. Owner Number shall be the Transmission Owner, Generator Owner, or Distribution Service Provider. 2. WECC staff shall assign Owner Number to required entities. |
| #Long ID | Climate zone and substation type identification | 1. Seven-character identifiers of the climate zone and load type – the first three characters represent the climate zone, underscore, and three characters representing the substation/feeder type. Details are included in the [LID\_Instructions](https://www.wecc.biz/Reliability/LID_Instructions_2012-4-10.pdf) and [Composite Load Model Implementation](https://www.wecc.biz/Reliability/Composite%20Load%20Model%20Phase%201%20Implementation%20Update%202012-8-30.pdf" \l "search=composite%20load%20model) documents. |

## DC Transmission Lines (MOD-032, Attachment 1)

General Requirements

1. Include (at a minimum) the following DC Transmission Line (overhead and underground) requirements: line parameters, Normal and Emergency Ratings, control parameters, rectifier data, and inverter data.
2. Megawatt set-point of converter data shall be equal to or less than the DC Transmission Line Rating.

Table 8: Data Requirements (DC Transmission)

| **Field** | **Description** | **Requirement** | **Measure** |
| --- | --- | --- | --- |
| ifrom | DC ‘FROM’ bus number |  |  |
| ito | DC ‘TO’ bus number |  |  |
| ck[2] | DC line identifier |  |  |
| projid | Project Identifier |  |  |
| st | DC line status |  |  |
| dcsys | DC system number |  |  |
| area | Area number |  |  |
| zone | Zone number |  |  |
| r | DC line resistance |  | ohms |
| l | DC line inductance |  | henries |
| c | DC line capacitance |  | microfarad |
| rate[8] | DC current ratings |  | amps |
| aloss | DC line loss assignment factor |  | per unit |
|  |  |  |  |
| nown[8] | Owner Number |  |  |

## Area Interchange Schedules

General Requirements

1. Area Interchange schedules shall be coordinated between Areas to meet the objectives of the data request letter.
2. The sum of net Area Interchange Schedules shall be equal to zero.
3. WECC staff shall set the Real Power Net Interchange Tolerance equal to 1.0 MW for each Area.

Data Requirements (Area Interchange)

1. Zones – Zone Names and Zone Numbers shall be maintained in the BCCS. Zone assignments to the Planning Coordinators (see “Appendix 2 – Area, Zone, and Bus Number Assignments.”)
2. WECC staff shall identify paths (as listed in the [WECC Path Rating Catalog](https://www.wecc.org/Reliability/NDA/Path2014.pdf)) in the BCCS under the Interface Data section. The Interface Number shall match the WECC path number. Rating 1 shall be used for the Path Transfer Limit for prevailing flow direction and Rating 2 shall be used for the secondary flow direction Path Transfer Limit.
3. WECC path element information shall be maintained in the BCCS. Area Coordinators shall provide updates to WECC staff as changes are made or as facilities are placed in-service.
4. Facility owners of DC buses, lines, and converters that are part of any area tie line shall provide the steady-state data to be maintained in the BCCS.
5. Transformer Impedance Correction Table – Impedance correction parameters to be used for TCUL transformers and phase-shifting transformers shall be maintained in the BCCS.
6. Owner Data – A list of Owner Numbers, names, and four-character abbreviations shall be maintained in the BCCS.
7. Transaction Data – There must be a transaction for any connection between Areas. Staff manages this data in the BCCS on a case-by-case basis.

# Dynamic Data Requirements

To provide consistency in data submittals and help avoid potential solution problems, the guidelines below shall be followed to the maximum extent possible. However, WECC recognizes deviations from the guidelines may occasionally be needed. For these situations, submitters are requested to provide the SRWG and MVWG with the rationale for exceptions. In all cases, dynamic data must be consistent with steady-state data provided for each WECC Base Case. The Planning Coordinators are responsible for providing data for facilities in the format specified.

Dynamic data is submitted as soon as any new data becomes available. Dynamic data may become available outside the scheduled case building process as a result of individual entity equipment testing programs such as the generator testing program.

Dynamic data for new generators and updates for existing generators are submitted via the [WECC Generating Unit Model Validation Policy](https://www.wecc.biz/Reliability/WECC%20Generating%20Unit%20Model%20Validation%20Policy.pdf). The [WECC Generating Unit Model Validation Policy](https://www.wecc.biz/Reliability/WECC%20Generating%20Unit%20Model%20Validation%20Policy.pdf) includes the roles and responsibilities of the Generator Owner, the Transmission Planner, and WECC.

Approved dynamic models conform to the [WECC Dynamic Modeling Procedure](https://www.wecc.org/Reliability/WECC%20Dynamic%20Modeling%20Procedure.pdf). All dynamic models contained in the MDF shall be those approved by MVWG. If the model you want to use is not on the approved list, you must go through MVWG and follow the WECC Dynamic Modeling Procedure.

The following approach to dynamic data shall apply Interconnection-wide:

* Generators and other dynamic devices shall be represented with approved dynamic data as recommended by the MVWG to represent the designated dynamic equipment modeled in WECC Base Cases. The approved models can be found within the [Approved Dynamic Model Library](https://www.wecc.org/Reliability/WECC%20Approved%20Dynamic%20Model%20Library.pdf)
  + When new models have been added to or obsolete models have been removed from the Approved Dynamic Model Library, TSS and SRWG will determine an appropriate implementation schedule and scope for submitting the necessary data required by the newly approved models.
* Estimated or typical manufacturer’s dynamic data based on facilities of similar design and characteristics may be used to represent planned generators and other dynamic devices if specific design data cannot be obtained. MVWG maintains the [Typical Machine Data](https://www.wecc.org/Reliability/Typical%20Machine%20Data%202014-6-18.pdf) document. Specific dynamic design data shall be submitted according to the [WECC Steady-State and Dynamic Data Criterion](https://www.wecc.org/Reliability/MOD-11%20and%2013-WECC-CRT-1.pdf)
* Where there is a difference between the requirements of this document and the [WECC Generating Unit Model Validation Policy](https://www.wecc.org/Reliability/WECC%20Generator%20Unit%20Model%20Validation%20Guideline.pdf), the WECC Generating Unit Model Validation Policy shall preside.
* Typical dynamics studies are up to 60 seconds from the initiating event. All models, on the Approved Dynamic Model Library list, that can respond within that time frame shall be submitted.

## Generation Requirements

1. Dynamic data for generators, synchronous condensers, excitation systems, voltage regulators, turbine governor systems, power system stabilizers, and other associated generation equipment shall be derived from test results obtained by adhering to the WECC Generating Unit Model Validation Policy for each unit represented in WECC Base Cases according to thresholds as specified in Section V. This includes, as appropriate to the model, items such as inertia constant, damping coefficient, saturation parameters, and direct and quadrature axis reactances and time constants.
2. Generator Owners shall submit power plant data in accordance to the size thresholds as described in the Section V.
3. Netting of planned generators represented in WECC Base Cases shall conform to the threshold requirements of the Section V.
4. The MWCAP parameter in the dynamic turbine-governor model shall be greater than or equal to the Pmax parameter of the generator steady-state model to avoid governor initialization problems.
5. Power System Stabilizer (PSS) Dynamic data shall be submitted for all generators that have active PSS. See the [WECC Policy Statement on Power System Stabilizers](https://www.wecc.org/Reliability/Policy%20Statement%20on%20Power%20System%20Stabilizers.pdf) document.
6. Existing generators shall follow the [WECC Generating Unit Model Validation Policy](https://www.wecc.org/Reliability/WECC%20Generator%20Unit%20Model%20Validation%20Guideline.pdf).

## Load Characteristics

The goal of this section is to model effects of voltage and frequency on load as accurately as possible.

1. Keep dynamic load data consistent with reported steady-state data supplied.
2. Modeling voltage and frequency characteristics explicitly for each individual load, if possible. However, use default zone or area records for buses not explicitly defined.
3. For loads less than 5 MW, Planning Coordinators will work with WECC staff to establish a default load representation record for each area to represent loads not modeled with the CMPLDW model. This is to avoid the load representation defaulting to constant power (PSLF default). If actual dynamic load characteristics are not available, load should be modeled as constant current P, and constant impedance Q. Bus specific exceptions to the default load representation must be submitted to WECC staff for inclusion in the MDF.

## Underfrequency Load Shedding (UFLS)

1. Include Underfrequency Load Shedding records for all loads that have underfrequency relays on the interconnected system.
2. Ensure the pickup frequency of each stage is lower than that of the previous stage. UFLS must comply with WECC-coordinated off-nominal requirements as specified in the [WECC Off-Nominal Frequency Load Shedding Plan](https://www.wecc.org/Reliability/Off-Nominal%20Frequency%20Load%20Shedding%20Plan.pdf) document.
3. Include pertinent load data in the MDF. All Underfrequency Load-Shedding data in the MDF must match bus, load, and/or branch identifiers in the operating cases. For this data category, the MDF data is not a master database because it does not apply to planning cases. If data is to be included in the planning cases, the data is to be submitted with the case development and identified as planning data.
4. UFLS models provided for each base case must correspond to UFLS information provided to WECC Underfrequency Load-Shedding Review Group in accordance with [WECC Underfrequency Load Shedding Criterion](https://www.wecc.biz/Reliability/MOD-11%20and%2013-WECC-CRT-1.pdf).

## Undervoltage Load Shedding (UVLS)

1. Include undervoltage load-shedding records for all loads that have undervoltage relays on the interconnected system.
2. Coordinate the pick-up and time-delay setting for each stage with the previous stage.
3. Include pertinent load data in the MDF. All undervoltage load-shedding data in the MDF must match bus, load, and/or branch identifiers in the operating cases. For this data category, the MDF data is not a master database because it does not apply to planning cases. If data is to be included in the planning cases, the data is to be submitted with the case development and identified as planning data.

**#Relays**

Include relay models as approved for use by the SRWG per the time line and scope it establishes for primary relays. Data submitters are also strongly encouraged to submit all relevant backup relay modeling data.

## Back-to-Back DC Ties

Netting is allowed for back-to-back DC ties. Represent back-to-back DC ties as generation in the power flow, but netted in dynamic data. The record should include an ID designation of ‘DC’ on the generator record.

## DC Lines, SVC, and D-VAR systems

1. Device specific dynamic data for dynamic devices shall be modeled, including but not limited to static VAR compensators and controllers, high-voltage direct-current systems, flexible AC transmission systems, and automatically switched shunt and series capacitors or reactors.
2. Model, to the maximum extent possible, DC lines and SVC systems to accurately reflect actual system performance.
3. Coordinate DC bus numbering with WECC staff prior to model submission.

# Short Circuit Data

MOD-032-1 requires that short circuit data should be shared openly between applicable NERC functional entities. This data should be provided upon request by applicable NERC functional entities in the data owners preferred software format. WECC does not currently create interconnection-wide cases for the use of short circuit analysis.

# #Contingency and Remedial Action Scheme Data

NERC and FERC are suggesting that contingency and Remedial Action Scheme (RAS) data should be shared openly between applicable NERC functional entities.

The following approach should be taken when providing contingency and RAS data:

* All models should be provided upon request by applicable NERC functional entities in the providers preferred format until the [WECC common format](https://www.wecc.biz/pcc/Pages/tss.aspx) is available in the providers preferred software.
* Provide all contingencies used for internal TPL studies.
* RAS models should be provided if the affected elements are modeled in the case.

**Disclaimer**

WECC receives data used in its analyses from a wide variety of sources. WECC strives to source its data from reliable entities and undertakes reasonable efforts to validate the accuracy of the data used. WECC believes the data contained herein and used in its analyses is accurate and reliable. However, WECC disclaims any and all representations, guarantees, warranties, and liability for the information contained herein and any use thereof. Persons who use and rely on the information contained herein do so at their own risk.

# Appendix 1 – Late Data Procedure

The objective of the Late Data Procedure is to preserve the original schedule for the development of base cases in accordance with each year's Data Bank Compilation Schedule, and the Case Description sheet in the data request letter for each case. The Late Data Procedure describes Planning Coordinator and staff data submittal responsibilities as well as actions to be taken for actual delays or anticipated delays in the submittal of data or for the submittal of unusable data. This procedure does not take effect until one of the following occurs:

* A data submittal date has been missed; or
* There is sufficient reason to believe that a submittal date will be missed; or
* It is determined that the submitted data is not usable.

Success of the case development program depends on timely and accurate data submittal, review, and support of the development of each base case. A Planning Coordinator not meeting a scheduled response date listed in the Data Bank Compilation Schedule with a usable response could result in a delay in the case development schedule if left uncorrected.

Examples of unusable data:

* Data from two neighboring Planning Coordinators with inter-area schedules that do not match; and
* Data with such significant problems that it cannot be used for the comment phase development process which; therefore, delays the progress of the case development.

Any unusable data received by the WECC staff must be corrected by the Planning Coordinator so as to not further impair the schedule or it will be rectified in accordance with this Late Data Procedure, as will any late data or anticipated late data.

## Planning Coordinator and Staff Responsibilities

It is the responsibility of Planning Coordinators to submit timely and accurate data in accordance with the Data Bank Compilation Schedule and the Case Description sheet in the data request letter. A schedule can be impaired either by data being submitted after the scheduled due date or by the submission of unusable data, even if it is submitted on time.

If, in the judgment of WECC staff, it appears that the schedule will be impaired due to lack of usable data response by the Planning Coordinator, it will be the responsibility of WECC staff to provide the data for the case in question.

## Actions to Take

There are two actions specified by this procedure in the event the WECC staff has to exercise its late data responsibilities for a delinquent entity. The first is the action of assuming the responsibility for submitting the data and the second is the notification of such action. If the staff takes over the responsibility for the submittal of data for the delinquent entity, the data to be submitted should always be the *best data available* in the judgment of the person submitting the data. The data should be submitted in such a way that the original schedule is maintained or not further impaired.

At the time the WECC Staff takes over data submittal responsibility for a Planning Coordinator:

1. The WECC staff will notify the Planning Coordinator and copy the notification of the action taken to:
   1. PCC and TSS representatives of the Planning Coordinator; and
   2. SRWG.
2. When the case involved is an operating case for OTC studies, the staff will send a notification letter to:
   1. The Operating Committee (OC) and the Operating Transfer Capability Policy Group Study Group (OTCPGSG).

The notification will consist of the nature and extent and reasons of the action taken. Those who consistently abuse the base-case development process by submitting late or unusable data may be significantly compromising the reliability of the Western Interconnection transmission system, which is a NERC compliance issue.

## Backfitting of Late Data

The Late Data Procedure allows for the WECC staff to take over data submittal responsibilities for a Planning Coordinator in the event that entity is unable to submit usable data in accordance with the defined schedule. If the Planning Coordinator 's data should subsequently become available, the data shall be submitted to the WECC staff to partially or fully replace that which was previously submitted. However, the staff may refuse to accept this backfit data if, in its judgment, the backfit data is no better than the data already in the case or if there would be unacceptable impairment of the schedule by accepting the backfit data.

# Appendix 2 – Area, Zone and Bus Number Assignments

## Southwest Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 10 – 18 | |  |  |  |
| Zone Number Range | | 100 – 199, 1000 – 1999 | |  |  |  |
| Bus Number Range | | 10,000 – 19,999  100,000 – 199,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 10 | 100-109  1000 - 1099 | | New Mexico | | PNM | 10,000 – 10,999  100,000 – 109,999 |
|  | 120-139  1200 - 1399 | | New Mexico | | TSGT | 12,000 – 12,999  120,000 – 129,999 |
|  |  | |  | | LAC, NAPI, TNP | 13,000 – 13,999  130,000 – 139,999 |
| 11 | 110 – 119  1100 - 1199 | | El Paso | | EPE | 11,000 – 11,999  110,000 – 119,999 |
| 14 | 140-149  1400 - 1499 | | Arizona | | APS | 14,000 – 14,999  84,000 – 85,999  140,000 – 149,999 |
|  | 150-159  1500-1599 | |  | | SRP, APA | 15,000 – 15,999  150,000 – 159,999 |
|  | 160-169  1600 - 1699 | |  | | TEP, UES | 16,000 – 16,999  160,000 – 169,999 |
|  | 170-179  1700 - 1799 | |  | | AEPC, Others | 17,000 – 17,999  170,000 – 179,999 |
|  | 190 – 199  1900 - 1999 | |  | | WALC | 19,000 – 19,999  190,000 – 199,999 |
| 18 | 180 – 188  1800 - 1889 | | Nevada | | NEVP | 18,000 – 18,899  180,000 – 188,999 |
|  | 189  1899 | |  | | VEA | 18,900 – 18,999  189,000 – 189,999 |

## Southern California Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 20 – 29 | |  |  |  |
| Zone Number Range | | 200 – 299  2000 – 2999 | |  |  |  |
| Bus Number Range | | 20,000 – 29,999 94,000 – 95,999  200,000 – 299,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 20 | 200 – 209  2000 - 2099 | | Mexico – CFE | | CFE | 20,000 – 20,999  200,000 – 209,999 |
| 21 | 210 – 219  2100 – 2199 | | Imperial, CA | | IID | 21,000 – 21,999  210,000 – 219,999 |
| 22 | 220 – 239  2200 – 2399 | | San Diego | | SDGE | 22,000 – 22,999  220,000 – 229,999 |
|  |  | |  | | Others | 23,000 – 23,999  230,000 – 239,999 |
| 24 | 240 – 259  2400 – 2599 | | So Calif | | SCE | 24,000 – 24,999  240,000 – 249,999 |
|  | 940 – 959  9400 – 9599 | |  | |  | 94,000 – 95,999  29,000 – 29,999  290,000 – 299,999 |
|  |  | |  | | CDWR, MWD, Others | 25,000 – 25,999  250,000 – 259,999 |
| 26 | 260 – 299  2600 – 2999 | | LADWP | | LDWP | 26,000 – 26,999  260,000 – 269,999 |
|  |  | |  | | BURB, GLEN | 27,000 – 27,999  270,000 – 279,999 |
|  |  | |  | | Others | 28,000 – 28,999  280,000 – 289,999 |

## Northern California Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 30 – 39 | |  |  |  |
| Zone Number Range | | 300 – 399  3000 – 3999 | |  |  |  |
| Bus Number Range | | 30,000 – 39,999  300,000 – 399,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 30 | 300 – 399  3000 – 3999 | | PG and E | | PG&E | 30,000 – 36,999  300,000 – 369,999 |
|  |  | |  | | SMUD | 37,000 – 37,499  370,000 – 374,999 |
|  |  | | WAPA | | SNR | 37,500 – 37,899  375,000 – 378,999 |
|  |  | |  | | REU | 37,900 – 37,999  379,000 – 379,999 |
|  |  | |  | | NCPA | 38,000 – 38,199  380,000 – 381,999 |
|  |  | |  | | MID | 38,200 – 38,399  382,000 – 383,999 |
|  |  | |  | | TID | 38,400 – 38,599  384,000 – 385,999 |
|  |  | |  | | CDWR | 38,600 – 38,899  386,000 – 388,999 |
|  |  | |  | | Others | 38,900 – 39,999  389,000 – 399,999 |

## Northwest Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 40 – 49 | |  |  |  |
| Zone Number Range | | 400 – 499  4000 – 4999 | |  |  |  |
| Bus Number Range | | 40,000 – 49,999 90,000 – 90,999  400,000 – 499,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 40 | 400 – 499  4000 – 4999 | | Northwest | | BPA, other Federal, WPPSS, Detailed Federal hydro | 40,000 – 41,999  44,000 – 44,499  400,000 – 419,999  440,000 – 444,999 |
|  |  | |  | | PSE | 42,000 – 42,999  420,000 – 429,999 |
|  |  | |  | | PGE | 43,000 – 43,999  430,000 – 439,999 |
|  |  | |  | | Not used | 44,000 – 44,499  440,000 – 444,999 |
|  |  | |  | | PACW | 44,500 – 45,599  445,000 – 455,999 |
|  |  | |  | | SNPD | 45,600 – 45,999  456,000 – 459,999 |
|  |  | |  | | GCPD | 46,000 – 46,199  460,000 – 461,999 |
|  |  | |  | | EWEB | 46,200 – 46,399  462,000 – 463,999 |
|  |  | |  | | SCL | 46,400 – 46,599  464,000 – 465,999 |
|  |  | |  | | TPWR | 46,600 – 46,799  46,900 – 46,999  466,000 – 467,999  469,000 – 469,999 |
|  |  | |  | | CHPD | 46,800 – 46,899  468,000 – 468,999 |
|  |  | |  | | Others – Public | 47,000 – 47,499  470,000 – 474,999 |
|  |  | |  | | Others – Private or IOU | 47,500 – 47,999  475,000 – 479,999 |
|  |  | |  | | AVA | 48,000 – 49,999  480,000 – 499,999 |

## Canadian Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 50 – 59 | |  |  |  |
| Zone Number Range | | 500 – 599  5000 – 5999 | |  |  |  |
| Bus Number Range | | 50,000 – 59,999 80,000 – 81,999  500,000 – 599,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 50 | 500 – 519  5000 – 5199 | | BC Hydro | | BCHA | 50,000 – 51,999  500,000 – 519,999  80,000 – 81,999 |
| 52 | 520 – 539  520 – 5399 | | Fortis BC | | FBC | 52,000 – 53,999  520,000 – 539,999 |
| 54 | 540 – 599  5400 – 5999 | | Alberta | | AESO | 54,000 – 59,999  540,000 – 599,999 |

## Central Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 60 – 69 | |  |  |  |
| Zone Number Range | | 600 – 699  6000 – 6999 | |  |  |  |
| Bus Number Range | | 60,000 – 69,999  600,000 – 699,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 60 | 600 – 619  6000 – 6199 | | Idaho | | IPC | 60,000 – 60,999  600,000 – 609,999 |
|  |  | |  | | BPA, Others | 61,000 – 61,999  610,000 – 619,999 |
| 62 | 620 – 629  6200 – 6299 | | Montana | | NWMT | 62,000 – 62,999  620,000 – 629,999 |
| 63 | 630 – 639  6300 – 6399 | | WAPA UGP | | WAUW | 63,000 – 63,999  630,000 – 639,999 |
| 64 | 640 – 649  6400 – 6499 | | Sierra | | SPP | 64,000 – 64,999  640,000 – 649,999 |
| 65 | 650 – 699  6500 - 6999 | | Pace | | PACE-UT, WY, ID | 65,000 – 69,999  650,000 – 699,999 |

## Eastern Region

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Area Number Range | | 70 – 79 | |  |  |  |
| Zone Number Range | | 700 – 799 | |  |  |  |
| Bus Number Range | | 70,000 – 79,999  700,000 – 799,999 | |  |  | **Member System Bus Range** |
| **Area No.** | **Zone Range** | | **Area Name** | | **Member System** |
| 70 | 700 – 729  7000 – 7299 | | PSColorado | | PSC | 70,000 – 70,999  700,000 – 709,999 |
|  |  | |  | | WPE | 71,000 – 71,999  710,000 – 719,999 |
|  |  | |  | | TSGT | 72,000 – 72,999  720,000 – 729,999 |
| 73 | 730 – 799  7300 – 7999 | | WAPA R.M. | | WALM | 73,000 – 73,999  730,000 – 739,999 |
|  |  | |  | | BHPL | 74,000 – 74,999  740,000 – 749,999 |
|  |  | |  | | PRPA | 75,000 – 75,999  750,000 – 759,999 |
|  |  | |  | | BEPC | 76,000 – 76,999  760,000 – 769,999 |
|  |  | |  | | WAUC | 79,000 – 79,999  790,000 – 799,999 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Area Number Range | Not Applicable |  |  |  |
| Zone Number Range | Not Applicable |  |  |  |
| Bus Number Range | 97,000 – 99,999  897,000 – 899,999  997,000 – 999,999 |  |  | **Dummy Buses** |
| Bus Number Range | 1-9,999  90,000 – 91,999 (Temporary) |  |  | **Internal Use Buses** |

**Revision History**

|  |  |  |
| --- | --- | --- |
| **Version Date** | **Editor(s)** | **Revision Description** |
| June 26, 2012 | Mark Mallard Gordon Comegys Doug Tucker | * Added Turbine Type field for Generators * Expanded bus number ranges for Areas * Added dynamic data submittal requirement to include all devices that could respond within 60 seconds if an approved model exists |
| October 12, 2012 | Doug Tucker Gordon Comegys Don Streebel | * Added language for sub-100-kV elements * Fixed minor changes in text |
| July 18, 2014 | Jonathan Young  Doug Tucker | * Accommodate BES Definition * Reword UVLS sections * Added Short Circuit Data info * Added Contingency and Remedial Action Scheme Data * Bus number ranges slightly changed * Few member Acronyms changed * Fixed minor changes in text |
| BCCS Version | Jonathan Young | * Incorporated BCCS methodologies |
| December 12, 2014 (SRWG Approval) | Jonathan Young  J. Ramey | * Added four digit zone number ranges * WECC Technical Writer edits and formatting |
| January 21, 2015 | Jonathan Young  John Gross | * Incorporated MOD-032-1 implementation plan concepts |