PGDTF GIC Model User Guide

February 15, 2018

Version 1.2

Prepared By:

ERCOT Planning Geomagnetic Disturbance Task Force

Table of Contents

[1. GIC System Model Data Checks 3](#_Toc503793887)

[2. Auto Transformers 4](#_Toc503793888)

[3. Switched Shunts 6](#_Toc503793889)

[4. Transformer Winding Errors Fix 6](#_Toc503793890)

# GIC System Model Data Checks

1. Latitude and longitude, flag if not:
   1. # of digits –> 4 significant digits (after decimal)
   2. 25 < latitude < 38
   3. -108 < longitude < -94
2. Substation grounding resistance, flag if not:
   1. Rg < 15
   2. Rg = 99 for ungrounded substations
3. Earth Model, flag if not: BR1, CP2, IP1, or IP4
4. For transformer data, flag if not:
   1. R (ohms/phase) < 5
   2. Winding 1 Resistance > Winding 2 Resistance
   3. GICBD (I/J/K) = 0
   4. K Factor = 0
   5. GRDR (I/J/K) = 0
   6. T Model = 0
   7. Vector group specified
5. For shunt data, flag if not:
   1. R (ohms/phase) = 0
   2. RG (ohms) = 0
6. For branch data, flat if not:
   1. RBRN (ohms/phase) < 4
   2. INDVQ (V) = 0
   3. Branch mileage < 160 km (found in branch GIC output)

# Auto Transformers

Example 1:



**NOTE:** For the GIC model, resistance values represent common, series, and tertiary resistance values, not high, low, and tertiary winding values for autotransformers (per section 7.2.4 in PSS/E v34.3.1 POM) while vector group is defined by winding 1, winding 2, winding 3 designations.

Thus if,

RH1H0= 0.5 Ω, RX1X0= 0.2 Ω (C = 0.2 Ω, S =0.3 Ω), RY1Y2 = 0.07 Ω, and

Winding 1 = 345 kV Wye, Winding 2 = 138 kV Wye, Winding 3 = 13.8 kV Delta and the transformer is an autotransformer

Then,

WRI = 0.3 Ω, WRJ = 0.2 Ω, WRK = 0.07 Ω and VECGRP = YNa0d1

Example 2:



**NOTE:** For the GIC model, resistance values represent common, series, and tertiary resistance values, not high, low, and tertiary winding values for autotransformers (per section 7.2.4 in PSS/E v34.3.1 POM) while vector group is defined by winding 1, winding 2 designations.

Thus if,

RH1H0= 0.25 Ω, RX1X0= 0.10 Ω (C = 0.10 Ω, S =0.15 Ω), and

Winding 1 = 69 kV Wye, Winding 2 = 138 kV Wye, and the transformer is an autotransformer

Then,

WRI = 0.15 Ω, WRJ = 0.10 Ω and VECGRP = YNa0

# Switched Shunts

For the situation where several switched shunts are modeled by one switched shunt in the SSWG case with multiple steps, the owner should either submit the resistance value as a parallel of all resistance as if they were all on at the same time or submit idvs to separate the switched shunt in the case and submit the resistance values separately for each resulting switched shunt. If an additional bus is added, add this bus to the substation tab on the submitted template.

# Transformer Winding Errors Fix

If you are experiencing transformer winding mismatch errors use the following approach to fix them.

**Two Winding Transformers**

|  |  |  |  |
| --- | --- | --- | --- |
| Two Winding Transformer Template | | | |
| Bus | I | J | K |
| Voltage Level | High | Low | - |
| Auto | Series Winding Resistance | Common Winding Resistance | - |

|  |  |  |
| --- | --- | --- |
| Two Winding Transformer Working Case | | |
| Voltage Level | High | Low |
| Winding Number | W1 | W2 |

\*\*\* When you update the working case, make sure to update the nominal kV value as necessary.

**Three Winding Transformers**

|  |  |  |  |
| --- | --- | --- | --- |
| Three Winding Transformer Template | | | |
| Bus | I | J | K |
| Winding Number | W1 | W2 | W3 |

\*\*\* Make sure the series winding resistance matches the column with the high voltage side and the common winding resistance matches the column with the low side voltage.