Expedited System Impact Study for Generation Interconnection Request

GEN-2001-033

SPP Tariff Studies

(#GEN-2001-033)

February 2005

Executive Summary

<OMITTED TEXT>Customer has requested a re-evaluation of a previous System Impact Study performed by Shaw PTI. The re-evaluation investigates changing the wind turbine generators from Vestas V80 type turbines to Mitsubishi MWT-1000a type turbines.

The purpose of this re-evaluation is to determine if the change in equipment will constitute a material change in the interconnection request. The study will compare the operating characteristics of the two turbines to see if they are sufficiently similar.

The Customer has proposed the addition of 180MW of wind-powered generation at the site. The unit will be interconnected to the Southwestern Public Service (SWPS) circuit K50, a 230kV circuit between Chaves and Oasis in eastern New Mexico. The requested in-service date is November 15, 2005.

The previous study assumed 100 each 1.8MW Vestas V80 turbines. This revised evaluation assumes 180 each 1.0MW Mitsubishi MWT-1000a turbines. There are also significant differences between the collector system layouts for each turbine type.

Transient stability analysis indicates that for more probable disturbances with normal fault clearing times, system stability is maintained. With the occurrence of a less probable, extreme fault condition near the San Juan Mesa 230kV bus, in which fault clearing is delayed due to stuck breaker conditions, both turbine types will experience tripping due to low voltage conditions. Also, the Mitsubishi wind turbines appear to trip for fewer low voltage conditions than Vestas V80 wind turbines. This would not be the case if the Vestas turbines were outfitted with the AGO4 low voltage package.

Close, three-phase faults near the interconnection point of the wind farm cause the Mitsubishi wind turbines to trip for low-voltage. This is expected due to the operating characteristics of induction machines. The comparison to the Vestas machines in the same scenario is very similar. It appears that the change to the Mitsubishi machines would not constitute a material change for this interconnection request.

1. Introduction

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The Customer has proposed the addition of 180MW of wind-powered generation at the site. The unit will be interconnected to the Southwestern Public Service (SWPS) circuit K50, a 230kV circuit between Chaves and Oasis in eastern New Mexico. The requested in-service date is November 15, 2005.

2. Transient Stability Analysis

Transient Stability analysis was performed to verify dynamic system response to disturbances on the system using a 2009 summer peak model. The customer provided a stability model of the Mitsubishi MWT-1000a for the Shaw PTI PSSE version 29 stability package. The Mitsubishi MWT-1000a differs from the Vestas V80 in several ways.

The Mitsubishi machine has a smaller nominal electrical output, but it has a slightly larger inertia and much lower transient reactance than the Vestas V80. This causes the Mitsubishi machine to exhibit a somewhat stronger reactance to grid voltage dips than a comparable Vestas V80 machine. However, in order to counteract the Vestas' undesirable characteristics, Vestas has give the V80 a much better low voltage ride through rating allowing it to remain interconnected during those low voltage conditions on the grid. In simpler terms, the Mitsubishi voltage decline will be slower than Vestas, but Vestas will remain connected at a much lower voltage than Mitsubishi.

The previous Vestas study was performed by Shaw PTI using the collector system layout provided by the customer. Shaw PTI then used that data to construct an equivalent generator model using six aggregate generators as a proxy for the individual turbines. This study was performed by SPP staff using a new collector system layout designed to accommodate the additional turbines needed to reach the 180MW capacity of the plant. This new collector system layout resulted in 20 aggregate generators acting as a proxy for the individual turbines.

The collector layout for the Mitsubishi turbines is very different from that used for the Vestas study. The current layout calls for 8 collector circuits connected to two230/34.5kV transformers. A 230kV line will then extend northwest approximately 3.3 miles to the K50 circuit on the SWPS system near the Roosevelt and Chaves county line. Detailed collection system impedance and length data was provided by the customer. The customer also indicated that the collection system would be an underground cable construction. However, no cable charging data was supplied with the system impedance information. Therefore, no charging was included with the collection system. In actuality, this may result in an underestimation of the voltage rise along the collector circuit.

The customer proposed the construction of a total of 72 MVar of capacitor banks at certain positions in the collection system. From the analysis performed, no additional capacitance or reactive support is required for stability purposes. Once the collection system design is finalized for construction, these capacitor values may need to be revisited so that the customer facility satisfies the relevant interconnection power factor requirements.

The machine data for the remaining system was obtained from the current SPP dynamics data files modified to include a previously constructed Mitsubishi MWT-1000a wind farm in the local area. The Caprock Wind Ranch located on the SWPS circuit between Clovis and Tucumcari is an 80MW nameplate capacity facility.

Selected fault scenarios were applied with clearing times specified in accordance with SWPS information. Single phase and three phase fault conditions were tested at the interconnection point and machines in the SWPS control area were monitored for stability. A list of the faults applied is in Table 4 below.

Table 4 Selected Faults

Fault #	Fault Description
FLT_1_1PH	Single phase fault on the Tolk-Eddy 345kv line (midpoint).
FLT_1_3PH	Three phase fault (same as above)
FLT_2_1PH	Single phase fault on the Tolk-Roosevelt 230kV line (midpoint).
FLT_2_3PH	Three phase fault (same as above)
FLT_3_1PH	Single phase fault on the Oasis – San Juan Mesa 230kV line at Oasis.
FLT_3_3PH	Three phase fault (same as above)
FLT_4_1PH	Single phase fault on the Chaves – San Juan Mesa 230kV line at Chaves.
FLT_4_3PH	Three phase fault (same as above)
FLT_5_1PH	Single phase fault on the Tolk – Tuco 230kV line at Tuco.
FLT_5_3PH	Three phase fault (same as above)
FLT_6_1PH	Single phase fault on the Oasis – Norris 115kV line at Norris.
FLT_6_3PH	Three phase fault (same as above)

The faults above were applied in two scenarios: A basecase without the Customer plant and a case with the Customer plant online at 180MW.

Transient stability analysis indicates that for more probable disturbances with normal fault clearing times, system stability is maintained. With the occurrence of a less probable, extreme fault condition near the San Juan Mesa 230kV bus, in which fault clearing is delayed due to stuck breaker conditions, both turbine types will experience tripping due to low voltage conditions. Also, the Mitsubishi wind turbines appear to trip for fewer low voltage conditions than Vestas V80 wind turbines. This would not be the case if the Vestas turbines were outfitted with the AGO4 low voltage package.

The table in the appendix documents each fault and the behavior of each aggregate generator. The table will show whether the generator tripped and at what time during the simulation that it was tripped. Also listed in the table is the maximum voltage and minimum voltage experienced at each wind turbine generator. This information will be useful to determine which faults were most severe and how the collector system layout affects the voltage profile. Minimum voltages below 0.85 pu were highlighted in red. These voltages are low enough such that a trip timer would be initiated. If the wind turbine did not trip, then the voltage recovered fast enough such that the turbine was not tripped. However, slightly delayed clearing of the fault could cause this generator to be tripped. Significantly delayed clearing of any of the faults simulated would most likely result in tripping of the wind farm.

6. Conclusion

This System Impact Study re-evaluation was requested by Customer to assess whether a change from Vestas V80 wind turbines to Mitsubishi MWT-1000a wind turbines would constitute a material modification to the interconnection request. <u>The interconnection requirements for the addition of 180MW of new generation are the same for the Mitsubishi MWT-1000a wind turbines as they were for the Vestas V80 wind turbine</u>.

The customer proposed the construction of a total of 72 MVar of capacitor banks at certain positions in the collection system. From the analysis performed, no additional capacitance or reactive support is required for stability purposes. Once the collection system design is finalized for construction, these capacitor values may need to be revisited so that the customer facility satisfies the relevant interconnection power factor requirements.

The analysis evaluated the MWT-1000a and compared the impact of introducing the new generation on the power system, during normal operation and contingency conditions, using the previously performed Shaw PTI study utilizing the Vestas V80 machines.

Appendix

Trip Matrix
San Juan Mesa Wind Farm
MHI MWT -1000a
180MW nameplate

Generator #	90900	90901	90902	90903	90904	90905	90906	90907	90908	90909
Generator Location	Circuit 1 turbine 15	Circuit 1 turbine 26	Circuit 2 turbine 15	Circuit 2 turbine 24	Circuit 3 turbine 6	Circuit 3 turbine 15	Circuit 3 turbine 19	Circuit 4 turbine 3	Circuit 4 turbine 22	Circuit 4 turbine 19
Initial Voltage (34.5kV PU)	1.0111	1.034	1.0119	1.0265	1.0068	1.0191	1.0226	1.0076	1.0098	1.0229
FLT_1_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.01109	Vmax = 1.03399	Vmax = 1.01196	Vmax = 1.02646	Vmax = 1.00681	Vmax = 1.01916	Vmax = 1.02263	Vmax = 1.00769	Vmax = 1.0098	Vmax = 1.02292
	Vmin = 0.8989	Vmin = 0.92494	Vmin = 0.89993	Vmin = 0.91639	Vmin = 0.8939	Vmin = 0.90801	Vmin = 0.91193	Vmin = 0.89491	Vmin = 0.89732	Vmin = 0.91229
FLT_1_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.011	Vmax = 1.034	Vmax = 1.012	Vmax = 1.026	Vmax = 1.007	Vmax = 1.019	Vmax = 1.023	Vmax = 1.008	Vmax = 1.01	Vmax = 1.023
	Vmin = 0.7769	Vmin = 0.8032	Vmin = 0.7784	Vmin = 0.7951	Vmin = 0.7693	Vmin = 0.7847	Vmin = 0.7887	Vmin = 0.7709	Vmin = 0.7733	Vmin = 0.7893
FLT_2_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.011	Vmax = 1.034	Vmax = 1.012	Vmax = 1.026	Vmax = 1.007	Vmax = 1.019	Vmax = 1.023	Vmax = 1.008	Vmax = 1.01	Vmax = 1.023
	Vmin = 0.9299	Vmin = 0.9544	Vmin = 0.931	Vmin = 0.9465	Vmin = 0.9245	Vmin = 0.9381	Vmin = 0.9418	Vmin = 0.9256	Vmin = 0.9279	Vmin = 0.9422
FLT_2_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.011	Vmax = 1.034	Vmax = 1.012	Vmax = 1.026	Vmax = 1.007	Vmax = 1.019	Vmax = 1.023	Vmax = 1.008	Vmax = 1.01	Vmax = 1.023
	Vmin = 0.647	Vmin = 0.675	Vmin = 0.6489	Vmin = 0.6666	Vmin = 0.6378	Vmin = 0.6547	Vmin = 0.659	Vmin = 0.6397	Vmin = 0.6423	Vmin = 0.6597
FLT_3_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.029	Vmax = 1.051	Vmax = 1.03	Vmax = 1.044	Vmax = 1.025	Vmax = 1.037	Vmax = 1.04	Vmax = 1.026	Vmax = 1.028	Vmax = 1.041
	Vmin = 0.8246	Vmin = 0.8518	Vmin = 0.8259	Vmin = 0.8431	Vmin = 0.818	Vmin = 0.8334	Vmin = 0.8375	Vmin = 0.8194	Vmin = 0.8219	Vmin = 0.838
FLT_3_3PH	Tripped @ 0.779s	Tripped @ 0.778s	Tripped @ 0.779s	Tripped @ 0.783s	Tripped @ 0.775s	Tripped @ 0.779s	Tripped @ 0.783s	Tripped @ 0.779s	Tripped @ 0.779s	Tripped @ 0.783s
	Vmax = 1.011	Vmax = 1.034	Vmax = 1.012	Vmax = 1.026	Vmax = 1.007	Vmax = 1.019	Vmax = 1.023	Vmax = 1.008	Vmax = 1.01	Vmax = 1.023
	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0
FLT_4_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.033	Vmax = 1.055	Vmax = 1.034	Vmax = 1.048	Vmax = 1.029	Vmax = 1.041	Vmax = 1.044	Vmax = 1.029	Vmax = 1.031	Vmax = 1.044
	Vmin = 0.8157	Vmin = 0.8451	Vmin = 0.8171	Vmin = 0.8356	Vmin = 0.809	Vmin = 0.8254	Vmin = 0.8298	Vmin = 0.8104	Vmin = 0.813	Vmin = 0.8303
FLT_4_3PH	Tripped @ 1.221s	Not tripped	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s
	Vmax = 1.011	Vmax = 1.146	Vmax = 1.012	Vmax = 1.026	Vmax = 1.007	Vmax = 1.019	Vmax = 1.023	Vmax = 1.008	Vmax = 1.01	Vmax = 1.023
	Vmin = 0	Vmin = 0.4466	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0
FLT_5_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.013	Vmax = 1.036	Vmax = 1.014	Vmax = 1.028	Vmax = 1.009	Vmax = 1.021	Vmax = 1.025	Vmax = 1.01	Vmax = 1.012	Vmax = 1.025
	Vmin = 0.9857	Vmin = 1.009	Vmin = 0.9867	Vmin = 1.002	Vmin = 0.9811	Vmin = 0.994	Vmin = 0.9976	Vmin = 0.982	Vmin = 0.9842	Vmin = 0.9979
FLT_5_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.023	Vmax = 1.045	Vmax = 1.024	Vmax = 1.037	Vmax = 1.019	Vmax = 1.031	Vmax = 1.034	Vmax = 1.02	Vmax = 1.022	Vmax = 1.034
	Vmin = 0.8971	Vmin = 0.9228	Vmin = 0.8983	Vmin = 0.9146	Vmin = 0.8911	Vmin = 0.9055	Vmin = 0.9094	Vmin = 0.8923	Vmin = 0.8947	Vmin = 0.9099
FLT_6_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.013	Vmax = 1.035	Vmax = 1.014	Vmax = 1.028	Vmax = 1.008	Vmax = 1.021	Vmax = 1.024	Vmax = 1.009	Vmax = 1.011	Vmax = 1.024
	Vmin = 0.9431	Vmin = 0.9677	Vmin = 0.9441	Vmin = 0.9597	Vmin = 0.9379	Vmin = 0.9514	Vmin = 0.9551	Vmin = 0.939	Vmin = 0.9412	Vmin = 0.9555
FLT_6_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.015	Vmax = 1.038	Vmax = 1.016	Vmax = 1.031	Vmax = 1.011	Vmax = 1.023	Vmax = 1.027	Vmax = 1.012	Vmax = 1.014	Vmax = 1.027
	Vmin = 0.7523	Vmin = 0.781	Vmin = 0.7539	Vmin = 0.772	Vmin = 0.7447	Vmin = 0.7612	Vmin = 0.7655	Vmin = 0.7463	Vmin = 0.7489	Vmin = 0.7661

Generator #	90910	90911	90912	90913	90914	90915	90917	90918	90919	90920
Generator Location	Circuit 5 turbine 15	Circuit 5 turbine 29	Circuit 6 turbine 3	Circuit 6 turbine 9	Circuit 6 turbine 25	Circuit 6 turbine 20	Circuit 7 turbine 13	Circuit 7 turbine 25	Circuit 8 turbine 4	Circuit 8 turbine 10
Initial Voltage (34.5kV PU)	1.0115	1.0367	1.0072	1.0087	1.011	1.0216	1.0193	1.0215	1.0231	1.0282
FLT_1_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.01157	Vmax = 1.03668	Vmax = 1.00726	Vmax = 1.00877	Vmax = 1.01102	Vmax = 1.02163	Vmax = 1.01932	Vmax = 1.02154	Vmax = 1.02316	Vmax = 1.02826
	Vmin = 0.89952	Vmin = 0.92811	Vmin = 0.89364	Vmin = 0.89546	Vmin = 0.89801	Vmin = 0.91052	Vmin = 0.90777	Vmin = 0.91034	Vmin = 0.91228	Vmin = 0.91829
FLT_1_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.012	Vmax = 1.037	Vmax = 1.007	Vmax = 1.009	Vmax = 1.011	Vmax = 1.022	Vmax = 1.019	Vmax = 1.022	Vmax = 1.023	Vmax = 1.028
	Vmin = 0.7778	Vmin = 0.8074	Vmin = 0.772	Vmin = 0.7763	Vmin = 0.7783	Vmin = 0.7981	Vmin = 0.7928	Vmin = 0.7968	Vmin = 0.7991	Vmin = 0.8076
FLT_2_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.012	Vmax = 1.037	Vmax = 1.007	Vmax = 1.009	Vmax = 1.011	Vmax = 1.022	Vmax = 1.019	Vmax = 1.022	Vmax = 1.023	Vmax = 1.028
	Vmin = 0.9305	Vmin = 0.9577	Vmin = 0.9256	Vmin = 0.928	Vmin = 0.9302	Vmin = 0.9439	Vmin = 0.9407	Vmin = 0.9435	Vmin = 0.9454	Vmin = 0.9516
FLT_2_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.012	Vmax = 1.037	Vmax = 1.007	Vmax = 1.009	Vmax = 1.011	Vmax = 1.022	Vmax = 1.019	Vmax = 1.022	Vmax = 1.023	Vmax = 1.028
	Vmin = 0.6481	Vmin = 0.6799	Vmin = 0.6415	Vmin = 0.6471	Vmin = 0.6491	Vmin = 0.6733	Vmin = 0.6666	Vmin = 0.6714	Vmin = 0.6741	Vmin = 0.6843
FLT_3_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.029	Vmax = 1.054	Vmax = 1.025	Vmax = 1.027	Vmax = 1.029	Vmax = 1.04	Vmax = 1.037	Vmax = 1.039	Vmax = 1.041	Vmax = 1.046
	Vmin = 0.8254	Vmin = 0.8556	Vmin = 0.8192	Vmin = 0.8224	Vmin = 0.8247	Vmin = 0.8415	Vmin = 0.8373	Vmin = 0.8407	Vmin = 0.8429	Vmin = 0.8505
FLT_3_3PH	Tripped @ 0.779s	Tripped @ 0.788s	Tripped @ 0.775s	Tripped @ 0.779s	Tripped @ 0.779s	Tripped @ 0.788s	Tripped @ 0.783s	Tripped @ 0.783s	Tripped @ 0.788s	Tripped @ 0.788s
	Vmax = 1.012	Vmax = 1.037	Vmax = 1.007	Vmax = 1.009	Vmax = 1.011	Vmax = 1.022	Vmax = 1.019	Vmax = 1.022	Vmax = 1.023	Vmax = 1.028
	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0
FLT_4_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.033	Vmax = 1.058	Vmax = 1.029	Vmax = 1.031	Vmax = 1.033	Vmax = 1.043	Vmax = 1.041	Vmax = 1.043	Vmax = 1.045	Vmax = 1.05
	Vmin = 0.8166	Vmin = 0.8491	Vmin = 0.8097	Vmin = 0.8128	Vmin = 0.8154	Vmin = 0.8327	Vmin = 0.8285	Vmin = 0.832	Vmin = 0.8344	Vmin = 0.8423
FLT_4_3PH	Tripped @ 1.221s	Not tripped	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s	Tripped @ 1.221s
	Vmax = 1.012	Vmax = 1.148	Vmax = 1.007	Vmax = 1.009	Vmax = 1.011	Vmax = 1.022	Vmax = 1.019	Vmax = 1.022	Vmax = 1.023	Vmax = 1.028
	Vmin = 0	Vmin = 0.4525	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0	Vmin = 0
FLT_5_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.014	Vmax = 1.038	Vmax = 1.01	Vmax = 1.011	Vmax = 1.013	Vmax = 1.024	Vmax = 1.021	Vmax = 1.024	Vmax = 1.025	Vmax = 1.03
	Vmin = 0.9863	Vmin = 1.012	Vmin = 0.9817	Vmin = 0.9835	Vmin = 0.9858	Vmin = 0.9974	Vmin = 0.9948	Vmin = 0.9972	Vmin = 0.9989	Vmin = 1.004
FLT_5_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.023	Vmax = 1.047	Vmax = 1.02	Vmax = 1.021	Vmax = 1.023	Vmax = 1.034	Vmax = 1.031	Vmax = 1.033	Vmax = 1.035	Vmax = 1.04
	Vmin = 0.8978	Vmin = 0.9263	Vmin = 0.8924	Vmin = 0.8951	Vmin = 0.8974	Vmin = 0.9126	Vmin = 0.9089	Vmin = 0.912	Vmin = 0.914	Vmin = 0.9208
FLT_6_1PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.013	Vmax = 1.038	Vmax = 1.009	Vmax = 1.01	Vmax = 1.013	Vmax = 1.023	Vmax = 1.021	Vmax = 1.023	Vmax = 1.025	Vmax = 1.03
	Vmin = 0.9437	Vmin = 0.9708	Vmin = 0.9388	Vmin = 0.941	Vmin = 0.9433	Vmin = 0.9563	Vmin = 0.9533	Vmin = 0.956	Vmin = 0.9578	Vmin = 0.9639
FLT_6_3PH	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped	Not tripped
	Vmax = 1.016	Vmax = 1.041	Vmax = 1.012	Vmax = 1.013	Vmax = 1.015	Vmax = 1.026	Vmax = 1.024	Vmax = 1.026	Vmax = 1.027	Vmax = 1.032
	Vmin = 0.7533	Vmin = 0.7853	Vmin = 0.7466	Vmin = 0.7506	Vmin = 0.7529	Vmin = 0.7724	Vmin = 0.7674	Vmin = 0.7713	Vmin = 0.7737	Vmin = 0.7823