



NYISO FAULT CURRENT ASSESSMENT

2010

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1. INTRODUCTION

The following report highlights the significant results of the fault current screening analysis completed for the 2010 period. The purpose of this analysis is to document significant changes in fault current levels statewide, identify selected critical substations with potentially overdutied circuit breakers, refer these substations to the respective owners, and recommend remedial actions.

2. SUMMARY OF RECOMMENDATIONS

The following recommendations are presented based on the analysis and results documented in this report:

Astoria East: When Astoria 4 and 5 dual yard steam units are operating on the East bus together with all other Astoria East units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied. When all three Astoria dual yard steam units are operating on the East bus with all other Astoria East units running, all 138 kV circuit breakers at Astoria East, except the BT tie-bus breaker, are overdutied.

Corona: In addition to the overdutied breakers at Astoria East, all 138 kV circuit breakers at Corona, except 5S and BT tie-bus breakers, are also overdutied when all three Astoria dual yard steam units are operating on the East bus together with all other Astoria East units running.

Astoria West: When all three Astoria dual yard steam units are operating on the West bus with all other Astoria West units running, Astoria 3 generator lead breakers G1N and G2N are overdutied.

The NYISO recommends the continued application of the Interim Operating Protocol for Astoria East and West Stations Fault Current Mitigation approved by the Operating Committee on May 6, 2010 to prevent overduty conditions at Astoria East and West, and Corona 138 kV stations.

3. **SYSTEM REPRESENTATION AND BASE STUDY ASSUMPTIONS**

I. **System Representation**

The NYISO 2010 Statewide Short Circuit representation, dated April 1, 2010, was used as the model for this study. This representation includes all system changes through the summer capability period ending October 31, 2010. The starting point for this representation was the NYISO 2009 Statewide Short Circuit representation, with updates from the NYCA transmission owners.

The adjacent control area data including Ontario, PJM, and ISO-NE used in the April 1, 2010 representation is also updated.

Significant changes in the 2010 NYISO Statewide Short Circuit Representation from 2009 include:

- New Empire Generating (Besicorp) Facility
- Blenheim - Gilboa Plant GSU Transformer Update
- New Ithaca Transmission Project (Clarks Corners)
- Retirement of Poletti 1
- Watercure 345/230 kV transformer Out-of-Service

II. **Base Study Assumptions**

The short circuit levels for the initial screening analysis were calculated using the ASPEN OneLiner® program and the “NYISO Guideline for Fault Current Assessment”. The short circuit levels presented have been determined for all facilities scheduled in service during 2010.

4. DISCUSSION AND RESULTS

I. Fault Current Calculation

As stated above, the baseline fault levels were calculated consistent with the methodology in the “NYISO Guideline for Fault Current Assessment”.

Consistent with generally accepted practices for short circuit studies, the Guideline requires that transmission lines and transformers be modeled in their normal operating condition, with all generating units modeled as in-service. This configuration, regardless of whether or not the system can actually be operated in such a manner, provides an adequate design margin of safety and reliability by yielding the worst case and most conservative fault levels.

II. Circuit Breaker Rating

The lowest circuit breaker ratings shown for each of the selected substations were obtained from the New York transmission and generation owners. The ratings shown are the nameplate symmetrical rating, the de-rated symmetrical value as determined by the owner, or the approximate symmetrical value converted from a total current basis.

Circuit breakers rated on a total current basis were converted to an approximate symmetrical current rating by using the nominal voltage of the substation.

Advanced circuit breaker rating techniques – such as asymmetrical current analyses, de-rating for reclosing and de-rating for age - were not considered by the NYISO for this screening analysis, although each owner should consider these when performing their own analysis.

National Grid’s circuit breaker ratings that are applied to the symmetrical bus fault analysis are currently under review. If breaker duties are found to exceed the ratings, the facility owner(s) will work with the NYISO to develop mitigation plans.

III. Analysis

A. Bus Fault Summary

The first step in the procedure for identifying potentially overdutied circuit breakers is to generate a bus fault summary. The bus fault summary yielded the three-line-to-ground (3LG), double-line-to-ground (2LG), and single-

line-to-ground (SLG) fault values at each selected substation. The results of the bus fault summary are compared to the lowest rated breaker within the substations, and if any of the bus faults exceeded the lowest rated breaker, an individual breaker analysis (IBA) was performed to determine if any circuit breakers were actually overdutied.

The complete results of the bus fault summary for the 120 stations that the NYISO studied are shown in Attachment 1. Of the 120 stations, five were identified as having a bus fault in excess of the lowest circuit breaker rating, and required a more detailed analysis as outlined in the next section.

B. Detailed Analysis of Stations Identified in the Bus Fault Summary

The next step in the procedure for identifying potentially overdutied circuit breakers was to refer the results of the screening study to the facility owners for confirmation, and perform an individual breaker analysis (IBA) at each of the substations in question to determine if any of the circuit breakers were indeed overdutied.

Of the five stations with bus fault levels greater than their lowest breaker rating, the results of the IBA showed none with any overdutied circuit breakers. It is noted that three Astoria steam units have dual yard switching capability, the above results based on these units are configured with Astoria 3 and 5 dual yard steam units on the Astoria West bus, and Astoria 4 dual yard steam unit on the Astoria East bus and all other Astoria units running.

In the event these units are configured with Astoria 4 and 5 dual yard steam units on the East bus and all other Astoria units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied.

In the event Astoria West station is configured with all three Astoria dual yard steam units on the West bus and all other Astoria units running, Astoria unit 3 generator lead breakers, G1N and G2N are overdutied.

In the event Astoria East station is configured with all three Astoria dual yard steam units on the East bus and all other Astoria units running, all 138 kV circuit breakers at Corona, except 5S and BT tie breakers, are overdutied and all 138 kV circuit breakers at Astoria East, except the BT tie-bus breaker, are also overdutied.

The Interim Operating Protocol for Astoria East and West Stations Fault Current Mitigation approved by the Operating Committee on May 6, 2010 prevents overduty conditions at Astoria East, Astoria West, and Corona 138

kV stations.

5. CONCLUSIONS AND RECOMMENDATIONS

The 2010 Fault Current Assessment has identified the following significant changes in fault current statewide:

- Reynolds Road and Alps 345 kV substations due to Empire Generating (Besicorp) Plant in-service
- Gilboa and New Scotland 345 kV substations due to Gilboa GSU transformer update
- Farragut, E.15th Street, Rainey and West 49th Street 345 kV substations due to Poletti 1 retirement
- Watercure 345 kV & 230 kV substations and Hillside 230 kV substation due to the Watercure 345/230 kV transformer out-of-service

It should be noted that fault duty studies are intended to be conservative in nature in order to provide an adequate margin of design safety and reliability. For example, the 2010 assessment has assumed that all generation and transmission are in service, while in actual operations it is highly likely that some generation and transmission facilities are out of service due to transmission constraints, economic generation dispatch, or forced outages. Conversely, the NYISO has not taken into account other factors such as reclosing, circuit breaker age, or fault current asymmetry which may lower breaker ratings or increase fault levels interrupted by the breakers. Facility owners have the responsibility for rating their equipment correctly, and as such shall routinely evaluate the interrupting capability of the circuit breakers using their own methods or industry standards.

Based on the above discussion, the NYISO recommends continued application of the Interim Operating Protocol for Astoria East and West Fault Current Mitigation approved by the Operating Committee on May 6, 2010 to prevent overduty conditions at Astoria East, Astoria West, and Corona 138 kV stations. The Interim Operating Protocol indicates that the acceptable Astoria West station configuration will be all three (3) units of the NYPA 500 MW combined cycle plant, two (2) Astoria Generating Company L.P. dual yard units (Astoria 3, 4 or 5), and the NRG GT 10-13 units, and the acceptable Astoria East station configuration will be all three (3) units of the Astoria East Energy 500MW combined cycle plant, one (1) Astoria Generating Company L.P. dual yard unit (Astoria 3, 4 or 5), the Astoria Generating Company L.P. Astoria 2 unit, and the NRG GT 2, 3, 4, 5, 7 and 8 units, unless for reliability reasons a different configuration for each station is required.

ATTACHMENT 1 -2010 BUS FAULT SUMMARY

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	2009 Maximum Bus Fault (kA)	2010 Maximum Bus Fault (kA)	Delta (10-09) Bus Fault (kA)	IBA Required (Y/N)
Marcy	765	63	9.7	9.7	0	N
Massena	765	63	7.8	7.8	0	N
AES Somerset	345	32	18	18	0	N
Alps	345	40	15.4	17.8	2.4	N
Athens	345	50	33.2	33.9	0.7	N
Bowline 2	345	40	26.5	26.7	0.2	N
Bowline 1	345	40	26.6	26.8	0.2	N
Buchanan N.	345	63	28.9	29.1	0.2	N
Buchanan S.	345	40	38.4	38.8	0.4	N
Clay	345	50	33.9	33.9	0	N
Coopers Corners	345	32	15.6	15.4	-0.2	N
Dewitt	345	40	19.3	19.3	0	N
Dunwoodie	345	63	50.6	50.8	0.2	N
East Fishkill	345	63	39	39.4	0.4	N
Edic	345	40	32.3	32.4	0.1	N
East Garden City	345	63	25.3	25.6	0.3	N
Elbridge	345	40	16.4	16.4	0	N
Farragut	345	63	61.4	58.5	-2.9	N
Fitzpatrick	345	37	42.4	42.4	0	Y
Fresh Kills	345	63	40.5	39.6	-0.9	N
Fraser	345	29.6	17.4	17.4	0	N
Gilboa	345	40	22.6	25.4	2.8	N
Goethals N.	345	63	40.1	39.6	-0.5	N
Goethals S.	345	63	40.9	40.4	-0.5	N
Gowanus N.	345	63	49.4	48	-1.4	N
Gowanus S.	345	63	49.6	48.1	-1.5	N
Hurley Avenue	345	40	17.1	17.2	0.1	N
Independence	345	50	39.3	39.3	0	N
Ladentown	345	63	38.4	38.6	0.2	N
Lafayette	345	40	18.1	18.3	0.2	N
Leeds	345	40	33.8	34.6	0.8	N
Marcy	345	63	31.5	31.6	0.1	N
Middletown Tap	345	63	17	16	-1	N
Millwood	345	63	44.5	44.8	0.3	N
Mott Haven	345	63	50.5	49.1	-1.4	N
Niagara	345	63	34.1	34.1	0	N
Nine Mile Point 1	345	50	44.7	44.7	0	N
New Scotland	345	32	30.3	31.6	1.3	N
Oakdale	345	29.6	12.6	12.3	-0.3	N
Oswego	345	50	32.7	32.6	-0.1	N
Pleasant Valley	345	63	40.5	41.1	0.6	N
Poletti	345	63	45.8	n/a	n/a	n/a
Pleasantville	345	63	21.9	22.1	0.2	N
Rainey	345	63	57.3	55.3	-2	N
Ramapo	345	63	42	42.2	0.2	N
Reynolds Road	345	50	11.9	14.8	2.9	N
Rock Tavern	345	38	26.4	26.2	-0.2	N
Roseton	345	63	34.6	34.8	0.2	N
South Mahwah-A	345	40	33.3	33.4	0.1	N

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	2009 Maximum Bus Fault (kA)	2010 Maximum Bus Fault (kA)	Delta (10-09) Bus Fault (kA)	IBA Required (Y/N)
South Mahwah- B	345	40	32.9	33.1	0.1	N
Station 80	345	32	17.1	17.1	0	N
Station 122	345	32	17.1	17	-0.1	N
Scriba	345	50	48.2	48.2	0	N
Shore Road	345	63	27.8	28.1	0.3	N
Sprain Brook	345	63	51.8	52	0.2	N
Stolle Road	345	32	4	4	0	N
Volney	345	40	37.2	37.3	0.1	N
West 49th Street	345	63	51.5	49.8	-1.7	N
West Haverstraw	345	none	27.8	28	0.2	n/a
Watercure	345	29.6	7.9	5.4	-2.5	N
Adirondack	230	25	9.7	9.7	0	N
Dunkirk	230	26	15.2	15.4	0.2	N
Gardenville	230	30	22.4	22.2	-0.2	N
Hillside	230	28.6	11.9	8.1	-3.8	N
Huntley	230	27	26.3	26.1	-0.2	N
Meyer	230	28.6	6.6	6.2	-0.4	N
Niagara	230	63	55.7	55.7	0	N
Oakdale	230	none	6.5	6.2	-0.3	n/a
Packard	230	50	39.5	39.5	0	N
Porter	230	25	19.5	19.5	0	N
Robinson Road	230	34.4	14.4	14.4	0	N
Rotterdam	230	20	12.4	12.4	0	N
South Ripley	230	40	9.1	9.1	0	N
St. Lawrence	230	37	33.2	33.5	0.3	N
Stolle Road	230	28.6	13.9	13.8	-0.1	N
Watercure	230	26.4	11.9	7.9	-4	N
Willis	230	37	11.2	11.8	0.6	N
Astoria East (1)(2)	138	63	56.5	56.8	0.3	N
Astoria West (3)	138	45	46	46.2	0.2	Y
Barrett	138	59.2	49.2	49.3	0.1	N
Brookhaven	138	35.4	26.6	26.6	0	N
Buchanan	138	40	15.8	15.9	0.1	N
Corona (2)	138	63	54.7	54.9	0.2	N
Dunwoodie No.	138	40	32.6	33.3	0.7	N
Dunwoodie So.	138	40	30.4	30.7	0.3	N
East 13th	138	63	47.1	47.3	0.2	N
East 179th	138	63	43.7	44.1	0.4	N
Eastview	138	63	36.5	37	0.5	N
East Garden City	138	80	72.4	72.7	0.3	N
Fox Hills 1	138	63	33.9	34.3	0.4	N
Fox Hills 2	138	40	34.3	34.7	0.4	N
Fresh Kills	138	40	37.4	37.8	0.4	N
Freeport	138	63	36.1	36.3	0.2	N
Greenwood	138	63	50.7	51.2	0.5	N
HG5	138	63	42.2	42.4	0.2	N
HG6	138	63	42.2	42.5	0.3	N
Holbrook	138	52.2	47.7	47.9	0.2	N
Hudson E	138	40	38.6	39.0	0.4	N
Jamaica	138	45	48	48.3	0.3	Y

Substation Name	Nominal kV	Lowest Rated Circuit Breaker (kA)	2009 Maximum Bus Fault (kA)	2010 Maximum Bus Fault (kA)	Delta (10-09) Bus Fault (kA)	IBA Required (Y/N)
Lake Success	138	57.8	39.5	39.7	0.2	N
Millwood	138	20	19.3	19.5	0.2	N
Newbridge Road	138	80	73.3	73.7	0.4	N
Northport	138	56.2	60	60.4	0.4	Y
Pilgrim	138	63	59.5	59.9	0.4	N
Port Jefferson	138	63	32.2	32.2	0	N
Queensbridge	138	63	44.1	44.4	0.3	N
Riverhead	138	63	17.2	17.3	0.1	N
Ruland	138	63	45.7	46	0.3	N
SB TR S6	138	63	28.1	28.6	0.5	N
SB TR N7	138	63	26.7	27.0	0.3	N
Sherman Creek	138	63	39.9	40.3	0.4	N
Shore Road	138	57.8	49.2	49.4	0.2	N
Shoreham	138	52.2	25	25.1	0.1	N
Tremont	138	63	38.9	39.3	0.4	N
Vernon East	138	40	37.3	38	0.7	N
Vernon West	138	40	33.7	34.5	0.8	N
Valley Stream	138	57.8	53.4	53.5	0.1	N
Clay	115	60	38.1	38	-0.1	N
Porter	115	43	41.4	41.4	0	N
E River	69	50	49.5	50.1	0.6	Y

Notes:

1. In the event of Astoria 4 and 5 dual yard steam units in the East and all other Astoria East units running, 138 kV circuit breakers, 1E, 2E, 3E, 6W, and 7W, at Astoria East are overdutied.
2. In the event of all three Astoria dual yard steam units in the East and all other Astoria East units running, all 138 kV circuit breakers at Astoria East, except the BT tie-bus breaker, are overdutied and all 138 kV circuit breakers at Corona, except 5S and BT tie-bus breakers, are overdutied.
3. In the event of all three Astoria dual yard steam units in the West and all other Astoria West units running, Astoria 3 generator lead breakers G1N and G2N are overdutied.