

GI-2007-12
Jackson Fuller 230 kV – 250 MW
Additional Contingency Studies Requested by Developer
April 15, 2014

Wind Turbine Generator Reactive Capability – 90% PF

Existing System, 16HS Peak Loads

Colorado South-North Flow Stress -

Lamar DC Tie – 101 MW Import

Colorado Green/Twin Buttes Wind – 97.3 MW

Fountain Valley – 242 MW

Table 1 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities¹ (Category B Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12 WTG RC = 90% PF			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category B Contingency Outage
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	150.4	100.3 / 78.3	168.6	112.4 / 87.8	12.1 / 9.5	Cottonwood N – Kettle Creek 115 kV
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	160.2	98.9 / 89.0	181.0	111.7 / 100.5	12.8 / 11.5	Briar Gate – Cottonwood S 115 kV
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	87.0	87.0 / 87.0	96.0	96.0 / 96.0	9.0 / 9.0	Midway BR – Rancho 115 kV

*Current-corrected flows for transmission lines only.

¹ Includes facilities with an Impact Factor of 2% or more of the proposed 249.9 MW generation.



Table 2 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities² (Category C Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category C Contingency Outage
Daniels Park – Jackson Fuller 230 kV	LN	PSCo	478 / 478	384.8	80.5 / 80.5	498.1	104.2 / 104.2	23.7 / 23.7	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	113.7	94.7 / 94.7	162.0	135.0 / 135.0	40.3 / 40.3	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	118.8	99.0 / 99.0	146.3	121.9 / 121.9	22.9 / 22.9	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	153.0	102.0 / 79.7	170.0	113.4 / 88.6	11.4 / 8.9	<u>Bus Fault</u> Cottonwood 115 kV N bus
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	145.6	89.9 / 80.9	165.3	102.1 / 91.9	12.2 / 11.0	<u>Bus Fault</u> Cottonwood 115 kV S bus
Kettle Creek – Flying Horse 115 kV	LN	CSU	162 / 180	133.6	82.5 / 74.2	183.4	113.2 / 101.9	30.7 / 27.7	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Kettle Creek – Flying Horse 115 kV	LN	CSU	162 / 180	135.4	83.6 / 75.2	163.5	100.9 / 90.8	17.3 / 15.6	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Monument – Flying Horse 115 kV	LN	CSU	142 / 156	123.7	87.1 / 79.3	173.4	122.1 / 111.2	35.0 / 31.9	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Monument – Flying Horse 115 kV	LN	CSU	142 / 156	135.6	95.5 / 86.9	135.7	95.5 / 87.0	0.0 / 0.1	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	110.8	110.8 / 110.8	128.1	128.1 / 128.1	17.3 / 17.3	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker

*Current-corrected flows for transmission lines only.

² Includes facilities with an Impact Factor of 2% or more of the proposed 249.9 MW generation.



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Phase-Shifting Transformer Added in the Monument-Palmer Lake 115 kV Line at Monument – Regulating to 25 MW
 No Phase-Shifter adjustment following contingency
 Existing System, 16HS Peak Loads
 Colorado South-North Flow Stress - Lamar DC Tie – 101 MW Import
 Colorado Green/Twin Buttes Wind – 97.3 MW
 Fountain Valley – 242 MW

Table 3 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities³ (Category B Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category B Contingency Outage
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	138.4	92.3 / 72.1	145.2	96.8 / 75.6	4.5 / 3.5	Cottonwood N – Kettle Creek 115 kV
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	145.9	90.0 / 81.0	153.5	94.7 / 85.3	4.4 / 4.3	Briar Gate – Cottonwood S 115 kV
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	82.7	82.7 / 82.7	87.7	87.7 / 87.7	4.3 / 4.3	Midway BR – Rancho 115 kV

*Current-corrected flows for transmission lines only.

³ Includes facilities with an Impact Factor of 2% or more of the proposed 249.9 MW generation.



Table 4 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities⁴ (Category C Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category C Contingency Outage
Daniels Park – Jackson Fuller 230 kV	LN	PSCo	478 / 478	408.5	85.5 / 85.5	532.8	111.5 / 111.5	26.0 / 26.0	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	66.9	55.7 / 55.7	84.8	70.6 / 70.6	14.9 / 14.9	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	67.1	55.9 / 55.9	71.0	59.2 / 59.2	3.3 / 3.3	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	141.9	94.6 / 73.9	147.8	98.5 / 77.0	3.9 / 3.1	<u>Bus Fault</u> Cottonwood 115 kV N bus
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	134.1	82.8 / 74.5	141.5	87.4 / 78.6	4.6 / 4.1	<u>Bus Fault</u> Cottonwood 115 kV S bus
Kettle Creek – Flying Horse 115 kV	LN	CSU	162 / 180	104.9	64.8 / 58.3	136.2	84.1 / 75.7	19.3 / 17.4	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Kettle Creek – Flying Horse 115 kV	LN	CSU	162 / 180	127.2	78.5 / 70.7	127.3	78.6 / 70.7	0.1 / 0.0	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Monument – Flying Horse 115 kV	LN	CSU	142 / 156	137.6	96.9 / 88.2	137.6	96.9 / 88.2	0.0 / 0.0	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	116.2	116.2 / 116.2	127.5	127.5 / 127.5	11.3 / 11.3	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker

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Phase-Shifting Transformer Added in the Monument-Palmer Lake 115 kV Line at Monument – Regulating to 0 MW
 No Phase-Shifter adjustment following contingency

Existing System, 16HS Peak Loads

Colorado South-North Flow Stress - Lamar DC Tie – 101 MW Import
 Colorado Green/Twin Buttes Wind – 97.3 MW
 Fountain Valley – 242 MW

Table 5 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities⁵ (Category B Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	Cat B Flow in MVA (Current Equiv*)	Cat B Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category B Contingency Outage
Daniels Park – Happy Canyon 115 kV	LN	PSCo	120 / 120	125.8	104.8 / 104.8	126.5	105.4 / 105.4	0.6 / 0.6	Bayou – Parker PS 115 kV
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	125.2	83.5 / 65.2	132.1	88.1 / 68.8	4.6 / 3.6	Cottonwood N – Kettle Creek 115 kV
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	131.0	80.9 / 72.8	138.9	85.7 / 77.1	4.8 / 4.3	Briar Gate – Cottonwood S 115 kV
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	78.2	78.2 / 78.2	83.2	83.2 / 83.2	5.0 / 5.0	Midway BR – Rancho 115 kV

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⁵ Includes facilities with an Impact Factor of 2% or more of the proposed 249.9 MW generation.



Table 6 – GI-2007-12 Summary Listing of Worst Case Overloaded Facilities⁶ (Category C Contingencies)

				Branch Contingency Loading Without GI-2007-12		Branch Contingency Loading With GI-2007-12			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA (Norm/Emer)	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	Cat C Flow in MVA (Current Equiv*)	Cat C Flow in % Current Equiv of Normal/Emer Rating	% Change	NERC Category C Contingency Outage
Daniels Park – Jackson Fuller 230 kV	LN	PSCo	478 / 478	419.3	87.7 / 87.7	543.7	113.7 / 113.7	26.0 / 26.0	<u>Double-Circuit Tower</u> Comanche – Daniels Park 345 kV 1 & 2
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	44.5	37.1 / 37.1	62.4	52.0 / 52.0	14.9 / 14.9	<u>Double-Circuit Tower</u> Midway – Waterton 345 kV Daniels Park – Jackson Fuller 230 kV
Monument – Palmer Lake 115 kV	LN	PSCo / CSU	120 / 120	50.0	41.6 / 41.6	51.9	43.3 / 43.3	1.7 / 1.7	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Briar Gate – Cottonwood S 115 kV	LN	CSU	150 / 192	128.8	85.9 / 67.1	135.0	90.0 / 70.3	4.1 / 3.2	<u>Bus Fault</u> Cottonwood 115 kV N bus
Cottonwood N – Kettle Creek 115 kV	LN	CSU	162 / 180	120.1	74.2 / 66.7	127.8	78.9 / 71.0	4.7 / 4.3	<u>Bus Fault</u> Cottonwood 115 kV S bus
Kettle Creek – Flying Horse 115 kV	LN	CSU	162 / 180	126.5	78.1 / 70.3	126.7	78.2 / 70.4	0.1 / 0.1	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Monument – Flying Horse 115 kV	LN	CSU	142 / 156	136.9	96.4 / 87.8	137.0	96.5 / 87.8	0.1 / 0.0	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker
Jackson Fuller 230/115 kV T1 (Informational)	TR	TSGT	100 / 100	108.0	108.0 / 108.0	119.4	119.4 / 119.4	11.4 / 11.4	<u>Breaker Failure</u> Cottonwood 115 kV Tie Breaker

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