

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2023 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2023 Summer Peak Case		Facility Outage(s)
		% of Facility Rating	% of Nominal bus voltage	
1	Rocky Run 345/115-kV transformer #3	96.5 – 104.2%	--	Arpin – Sigel 138-kV line Rocky Run 345/115-kV transformer #2 Rocky Run 345/115-kV transformer #1 Arpin 345/138-kV transformer
1	Plover – Coyne 115-kV line	96.3%	--	Arpin-Sigel 138-kV line Hume Wildwood 115-kV line Arpin 345/138-kV transformer
1	Wien – Stratford 115-kV line	99.5 – 116.6%	--	Glavin-Hume 115-kV line Hume Wildwood 115-kV line Arpin 345/138-kV transformer
1	Stratford - McMillan 115-kV line	108.0%	--	Glavin-Hume 115-kV line
1	Sigel, Lakehead Vesper, Vulcan and Port Edwards 138-kV bus voltages	--	95.5% 84.3 – 91.5%	Base Case Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line Lakehead Vesper-Port Edwards 138-kV line
1	Port Edwards, Hollywood and Saratoga 138-kV bus voltages	--	95.5% 85.8 – 91.8%	Base Case Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line Lakehead Vesper-Port Edwards 138-kV line
1	Saratoga and Baker 115-kV bus voltage	--	95.8% 89.2 – 92.0%	Base Case Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line Baker-Coyne 115-kV line
1	Castle Rock – Quincy 69-kV line	95.2 – 108.4%	--	Big Pond-Necedah tap 69-kV line Necedah tap-Whistling Wings tap 69-kV line
1	Mckenna – Quincy 69-kV line	101.2%	--	Big Pond-Necedah tap 69-kV line
1	Chaffee Creek – Coloma 69-kV line	101.2%	--	Big Pond-Necedah tap 69-kV line
1	Council Creek and Petenwell 138-kV bus voltages	--	93.9 – 94.1% 87.7 – 92.0%	Base Case Arpin-Sigel 138-kV line Saratoga – Petenwell 138-kV line Sigel - Lakehead Vesper 138-kV line Hillsboro 161/69-kV transformer Plus other less severe outages
1	Tomah Industrial Park and Cardinal Glass 69-kV bus voltages	--	91.9%	Hillsboro 161/69-kV transformer
1	Necedah, Whistling Wings, Dellwood, Friendship, Houghton Rock and Mckenna 69-kV bus voltages	--	80.8 – 91.9%	Big Pond-Necedah tap 69-kV line Necedah tap-Whistling Wings tap 69-kV line Whistling Wings tap-Dellwood 69-kV line
1	Metomen 138/69-kV transformer	100.6 – 121.8%	--	Metomen-Rosendale 69-kV line Rosendale-North Fond du Lac 69-kV line Winneconne-Sunset Point 69-kV line North Randolph-Markesan tap 69-kV line Plus other less severe outages
1	Metomen – Ripon 69-kV line	97.4%	--	Winneconne-Sunset Point 69-kV line
1	NW Ripon – Ripon 69-kV line	97.1%	--	Winneconne-Sunset Point 69-kV line
1	Winneconne – Sunset Point 69-kV line	95.2 – 95.5%	--	NW Ripon – Ripon 69-kV line Metomen – Ripon 69-kV line
1	Wautoma 138/69-kV transformer	102.0%	--	Base Case
1	Harrison 138/69-kV transformer	97.0%	--	Base Case
1	Lakehead Portage, Endeavor, Roslin and Montello 69-kV bus voltages	--	88.2 – 91.7%	Portage-Lakehead Portage 69-kV line Lakehead Portage-Endeavor tap 69-kV line

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		% of Facility Rating	% of Nominal bus voltage	
1	Ripon, Ripon Industrial Park, NW Ripon, Dartford and SW Ripon 69-kV bus voltages	--	88.1 – 91.7%	Metomen-Ripon 69-kV line NW Ripon-Ripon 69-kV line Winneconne-Sunset Point 69-kV line Silver Lake-Wautoma 69-kV line Silver Lake-Spring Lake 69-kV line
1	Winneconne, Omro and Omro Industrial 69-kV bus voltages	--	83.5 – 91.8%	Winneconne-Sunset Point 69-kV line Omro-Winneconne 69-kV line Silver Lake-Wautoma 69-kV line
1	Silver Lake, Fountain Valley, Spring Lake, Red Granite and River Run 69-kV bus voltages	--	85.7 – 92.0%	Wautoma-Silver Lake 69-kV line Silver Lake-Spring Lake 69-kV line Spring Lake-Red Granite 69-kV line Fountain Valley-Red Granite 69-kV line Plus other less severe outages
1	Quincy (ACEC), Lincoln Pumping Station, Brooks (ACEC) and Grand Marsh 69-kV bus voltages	--	90.1 – 91.9%	Big Pond-Necedah tap 69-kV line
1	Fairwater 69-kV bus voltage	--	91.9%	Metomen 138/69-kV transformer
1	Sand Lake and Wautoma 138-kV bus voltage	--	95.0 – 95.3% 88.5 – 91.2%	Base Case Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line
1	Roeder and Green Lake 138-kV bus voltage	--	95.2 – 96.0%	Base Case
1	Metomen 138-kV bus voltage	--	94.7% 90.8%	Base Case Rosendale-North Fond du Lac 69-kV line
1	Hillsboro, Dorset Corners, Wonewoc, and Union Center 69-kV bus voltages	--	91.1 – 91.5%	Hillsboro 161/69-kV transformer
2	Delta – Mead 69-kV line	100-161%	-	Base Case Chandler-Lakehead Tap 69-kV line Lakehead Tap-Masonville 69-kV line Masonville-Gladstone 69-kV line Gladstone-North Bluff 69-kV line North Bluff-Bay Tap 69-kV line Bay Tap-Mead 69-kV line
2	Chandler – Delta 69 kV #1 line	116%	-	Chandler-Delta 69 kV #2 line
2	Chandler – Delta 69 kV #2 line	111%	-	Chandler-Delta 69 kV #1 line
2	Chandler 138/69-kV transformer	96-109%	-	Nordic-Mountain 69-kV line Mountain-Harris Tap 69-kV line Forsyth 138/69-kV transformer
2	Chandler – Lakehead Tap 69-kV line Masonville – Lakehead Tap 69-kV line Masonville – Gladstone 69-kV line Gladstone – North Bluff 69-kV line North Bluff – Bay Tap 69-kV line Mead – Bay Tap 69-kV line	126-165%	-	Delta-Mead 69-kV line
2	Forsyth 138/69-kV transformer	105%	-	Chandler 138/69-kV transformer
2	Atlantic-Henry St. Tap 69-kV line	99%	-	Base Case
2	Atlantic-M38 69-kV line	107%	-	Atlantic-M38 138-kV line Atlantic 138/69-kV transformer
2	Atlantic 138/69-kV transformer	106%	-	M38 138/69-kV transformer
2	Indian Lake 138/69-kV transformer 1, 2	97%	-	Indian Lake 138/69-kV transformer 1, 2
2	Valley, Indian Lake, Glen Jenks, Manistique, Blaney Park, Curtis, Gould City, Straits, Engadine, Hiawatha 69-kV bus voltages	-	105.1-105.8%	Base Case

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2	Delta, West Side, Escanaba, Masonville, Mead, Gladstone, Bay View, North Bluff, Harris 69-kV bus voltages	-	86.0-88.1 %	Chandler 138/69-kV transformer
2	Atlantic, Elevation St., Henry St., MTU, Osceola, Portage, Keweenaw 69 kV bus voltages	-	77.8-86.3%	Atlantic 138/69-kV transformer
3	North Monroe 138/69-kV transformer	106%	--	Base Case
3	Colley Road 138/69-kV transformer	99%	--	Base Case
3	Paddock 138/69-kV transformer	98.1%	--	Base Case
3	Wauzeka-Boscobel 69-kV line	96.8%	--	Base Case
3	Concord 4-Concord generation bus	99.4%	--	Base Case
3	North Stoughton-Stoughton East-Stoughton 69-kV line	142.4%-98.8%	--	McCue-Harmony 69-kV line Harmony-Lamar 69-kV line Fulton-Lamar 69-kV line Oak Ridge-Verona 138-kV line Verona 138/69-kV transformer
3	Sheepskin-Dana Tap 69-kV line	132%-126.1%	--	McCue-Harmony 69-kV line Harmony-Lamar 69-kV line
3	Fitchburg-Syene-Ninesprings 69-kV line	129%-110.4%	--	Royster-Pflaum Tap 69-kV line Pflaum-Pflaum Tap 69-kV line
3	Stage Coach-Black Earth-Mazomanie 69-kV line	126%-96.7%	--	Spring Green 138/69-kV transformer
3	Dane-Lodi Tap 69-kV line	126%-97.2%	--	Kirkwood-Island 69-kV line Island-Moore St 69-kV line Moore St-Baraboo 69-kV line Trienda-Lake Delton 138-kV line Lake Delton-City View 138-kV line City View-Kirkwood 138-kV line
3	Cobblestone-Zenda Tap 69-kV line	124.5%-96.6%	--	North Lake Geneva-Lake Geneva 69-kV line Lake Geneva-S Lake Geneva 69-kV line
3	Royster-Pflaum Tap-Pflaum 69-kV line	124.1%-104.2%	--	Fitchburg-Syene 69-kV line Nine Springs-Syene 69-kV line
3	Lake Geneva-S Lake Geneva-Katzenberg 69-kV line	123.1%-105.6%	--	Brick Church-Cobble Stone 69-kV line
3	West Middleton-Timberland-Stage Coach 69-kV line	119.1%-96%	--	Spring Green 138/69-kV transformer Nelson Dewey-Lancaster 138-kV line Lancaster-Eden 138-kV line
3	Colley Road 138/69-kV transformer	117.1%-96.2%	--	Paddock 138/69-kV transformer Paddock-Shirland Ave 69-kV line Shaw-Shirland 69-kV line Brick Church 138/69-kV transformer Colley Road-Dickinson 138-kV line
3	Enzyme Bio Systems-RC3-Clinton-Sharon 69-kV line	114.7%-97%	--	Colley Road-Dickinson 138-kV line Dickinson-Global Renewable Energy 138-kV line Brick Church 138/69-kV transformer Global Renewable Energy-Brick Church 138-kV line
3	North Monroe-Idle Hour 69-kV line	114.2%-95.7%	--	Darlington-Gratiot 69-kV line Gratiot-Wiota 69-kV line Wiota-Jennings Road 69-kV line Darlington 138/69-kV transformer Paddock-Newark 69-kV line Whistling Wind-Black Smith 69-kV line
3	South Fond Du Lac-Koch Oil-Waupun 69-kV line	114.1%-107.8%	--	North Randolph-Fox Lake 138-kV line Fox Lake-North Beaver Dam 138-kV line

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3	Kirkwood-Rock Springs Tap – Artesian 138-kV line	113.5%-106.8%	--	Trienda-Lewiston 138-kV line East Dells-Kilbourn 138-kV line East Dells-Lewiston 138-kV line
3	Gran Grae-Wauzeka-Boscobel-Blue River 69-kV line	113%-96.1%	--	Spring Green 138/69-kV transformer Nelson Dewey-Lancaster 138-kV line Lancaster-Eden 138-kV line Eden-Wyoming Valley 138-kV line Spring Green-Lone Rock 69-kV line King-Eau Claire-Arpin 345-kV line
3	East Rockton-Shaw-Shirland 69-kV line	112.7%-103.2%	--	Colley Road 138/69-kV transformer Paddock 138/69-kV transformer
3	McCue-Harmony-Lamar 69-kV line	112%-95.6%	--	Kegonsa 138/69-kV transformer Kegonsa-North Stoughton 69-kV line North Stoughton-Stoughton 69-kV line Brodhead Switching-Brodhead South 69-kV line Sheepskin generation outage
3	Academy-Columbus Muni 2 Tap 69-kV line and Columbus Muni 2 Tap- Columbus 69-kV line	111.9%-100.4%	--	North Randolph-Fox Lake 138-kV line Fox Lake-North Beaver Dam 138-kV line
3	Brick Church-Cobblestone 69-kV line	107.9%	--	North Lake Geneva-Lake Geneva 69-kV line
3	McCue-Milton Lawn 69-kV line	107.1%	--	Janesville 138/69-kV transformer
3	Stoughton-Aaker Road 69-kV line	106.9%	--	Oak Ridge-Verona 138-kV line Verona 138/69-kV transformer
3	Hillman 138/69-kV transformer	106.3%-97.6%	--	DPC Galena-Pilot 69-kV line Pilot-Terr Tap 69-kV line
3	North Monroe 138/69-kV transformer	104.6%-95.4%	--	Darlington 138/69-kV transformer Darlington-Gratiot 69-kV line Gratiot-Wiota 69-kV line Wiota-Jennings Road 69-kV line Darlington 138/69-kV transformer Paddock-Newark 69-kV line
3	Paddock-Shirland Ave 69-kV line	104.5%	--	Colley Road 138/69-kV transformer
3	Spring Green 138/69-kV transformer	104.1%-97.3%	--	Gran Grae-Wauzeka 69-kV line Wauzeka-Boscobel 69-kV line Black Earth-Stage Coach 69-kV line
3	Eden 138/69-kV transformer	103.9%-96.1%	--	Eden-Wyoming Valley 138-kV line Spring Green-Wyoming Valley 138-kV line Nelson Dewey-Potosi 138-kV line Potosi-Hillman 138-kV line
3	Hubbard-Horicon 69-kV line	103.9%-99.6%	--	North Randolph-Fox Lake 138-kV line Fox Lake-N Beaver Dam 138-kV line
3	Brownstown-South Monroe 69-kV line	103.7%	--	North Monroe 138/69-kV transformer North Monroe-Idle Hour 69-kV line
3	Zenda-Katzenberg 69-kV line	102.6%	--	North Lake Geneva-Lake Geneva 69-kV line
3	North Lake Geneva-Lake Geneva 69-kV line	101.9%	--	Brick Church-Cobble Stone 69-kV line
3	Concord 4-Concord Generation Bus	101.8%-99.4%	--	Saukville-Pleasant Valley 138-kV line Rockdale-Lake Cambridge 138-kV line Lake Cambridge-Jefferson 138-kV line
3	Portage-Columbia 138-kV line	100.7%	--	Second Portage-Columbia 138-kV line
3	Paddock 138/69-kV transformer	100.4%	--	Colley Road 138/69-kV transformer
3	Bloomington-La Pointe 69-kV line	100.1%	--	Gran Grae 161/69-kV transformer
3	Colley Road-Park Ave 69-kV line	98.6%	--	Paddock 138/69-kV transformer
3	Center Street-South Beaver Dam 69-kV line	98.6%	--	North Randolph-Fox Lake 138-kV line

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		% of Facility Rating	% of Nominal bus voltage	
3	Academy 138/69-kV transformer	95.7%	--	North Randolph-Fox Lake 138-kV line
3	West Middleton 138/69-kV transformer	97.1%	--	West Middleton 138/69-kV transformer
3	West Middleton-West Town 69-kV line	95.3%	--	West Middleton-Pleasant View 138-kV line
3	Whistling Wind-Black Smith 69-kV line	98.6%	--	North Monroe-Idle Hour 69-kV line
3	Gratiot-Wiota 69-kV line	97%-95.9%	--	North Monroe 138/69-kV transformer North Monroe-Idle Hour 69-kV line
3	Brick Church 138/69-kV transformer	98.5%	--	North Lake Geneva 138/69-kV transformer
3	Wauaukee Switching-Wauaukee Muni 2 69-kV line	96.7%	--	West Middleton-Pheasant Branch 69-kV line
3	Huiskamp-Wauaukee Industrial 69-kV line	99.5%	--	North Madison 138/69-kV transformer
3	Femrite-Royster 69-kV line	96.1%	--	Fitchburg-Syene 69-kV line
3	Portage-Trienda 138-kV line	98.3%	--	Second Portage-Trienda 138-kV line
3	West Middleton-Pleasant View 138-kV line	95.4%	--	Kegonsa-Christiana 138-kV line
3	Columbia T22 345/138-kV transformer	96.1%	--	Columbia T21 and T23 345/138-kV transformer
3	Columbia T21 and T23 345/138-kV transformer	95.4%	--	Columbia T22 345/138-kV transformer
3	Eden, Spring Green, Wyoming Valley, Lancaster and Troy 138-kV buses	--	90.7%-95.7%	Base Case
3	Oakridge, Hawk, Pleasant View, McFarland, Sprecher, Kegonsa, Colloday Point, Reiner Road, Cross County, Fitchburg, Sycamore, Femrite and Blount 138-kV buses	--	92.8%-95.4%	Base Case
3	Boscobel, Muscoda, Avoca and Blue River 69-kV buses	--	93.1%-94.1%	Base Case
3	East Beaver Dam, North Beaver Dam, Fox Lake, North Randolph, Fountain Prairie, Friesland and Academy 138-kV buses	--	94.6%-94.7%	Base Case
3	Okee and Lodi 69-kV buses	--	94.6%-95.2%	Base Case
3	Kirkwood, Lake Delton, City View, Rock Springs, Artesian and Nishan 138-kV buses and Reedsburg, Artesian 69-kV buses	--	94.8%-95.9%	Base Case
3	Mazomanie, Black Earth and Arena 69-kV buses	--	94.9%-95.6%	Base Case
3	Hustisford, Hubbard, Butler Ridge, Concord, Rockvale, Fort Atkinson, Crawfish, Lake Mills, Stoney Brook, Boxelder, Jefferson and Rubicon 138-kV buses	--	95.1%-95.9%	Base Case
3	Gaston Road and Cottage Grove 69-kV buses	--	95.7%	Base Case
3	Spring Green, Arena, Mazomanie, Mazomanie Industrial, Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages	--	75.9%-90.8%	Spring Green 138/69-kV transformer
3	Harmony, Lamar, Fulton, Saunders Creek, Dana Corp, Sheepskin Footville, RCEC Center, Bass Creek, Orfordville and Evansville 69-kV buses	--	80%-91.8%	McCue-Harmony 69-kV line Harmony-Lamar 69-kV line Lamar-Fulton 69-kV line
3	Wauzeka, Spring Green, Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni ,69-kV bus voltages, Spring Green, Eden and Wyoming Valley 138-kV bus voltages	--	79.5%-91.4%	Gran Grae-Wauzeka 69-kV line Wauzeka-Boscobel 69-kV line
3	Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni , Pine River, Brewer and Richland Center 69-kV bus voltages	--	82.9%-91.2%	Lone Rock-Spring Green 69-kV line
3	Hubbard, Hustisford, North Beaver Dam and Beaver Dam East 138-kV bus voltages	--	85%-85.8%	Rubicon-Hustisford 138-kV line Hubbard-Hustisford 138-kV line
3	Eden, Wyoming Valley, Spring Green, Troy and Lancaster 138-kV bus voltages, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages	--	83.8%-92%	Nelson Dewey-Lancaster 138-kV line Eden-Wyoming Valley 138-kV line Lancaster-Eden 138-kV line

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3	Dickinson, Global Renewable Energy, William Bay N Lake Geneva, Como, Elkhorn and Brick Church 138-kV buses	--	87%-91.8%	Colley Road – Dickinson 138-kV line Dickinson-Global Renewable Energy 138-kV line Global Renewable Energy-Brick Church 138-kV line
3	Idle Hour, Monroe, Black Smith, New Glarus, Monticello, Brown town, Monticello, New Glarus, Whistling Wind and S Monroe 69-kV buses	--	83.7%-92%	North Monroe-Idle Hour 69-kV line North Monroe 138/69-kV transformer Monroe-Idle Hour 69-kV line
3	Concord ,Hubbard, Hustisford, Rubicon, Rockvale, Crawfish, Jefferson, Fort Atkinson and Butler Ridge 138-kV bus voltages	--	85.6%-91.9%	Concord4-5 138-kV bus Hartford-St. Lawrence 138-kV line
3	Avoca, Muscoda, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages	--	88.2%-91.3%	Lone Rock-Avoca 69-kV line Avoca-Muscoda 69-kV line
3	Brodhead Muni 3, Brodhead Muni 2, Brodhead, Brodhead Muni 1, RCEC Orfordville, Orfordville, Bass Creek, Footville, RCEC Center, Evansville 69-kV bus voltages	--	84.8%-91.9%	Brodhead Switching Station-Brodhead Muni 3 69-kV line Brodhead Muni 2 -Brodhead Muni 3 69-kV line Brodhead Muni 2-Brodhead 69-kV line
3	Cobblestone, Lake Shore, Twin Lakes, Richmond and Zenda 69-kV buses	--	86.5%-91.1%	Brick Church-Cobblestone 69-kV line
3	Lake Geneva, South Lake Geneva, Richmond, Katzenberg and Twin Lake 69-kV buses	--	83.1%-92%	North Lake Geneva-Lake Geneva 69-kV line Lake Geneva-South Lake Geneva 69-kV line South Lake Geneva-Katzenberg 69-kV line
3	Burke, Sun Prairie, Token Creek, South, Colorado, Bird St, Gaston Road and Reiner 69-kV buses	--	88.1%-91.9%	Reiner Road 138/69-kV transformer Burke-Colorado 69-kV line Reiner Road-Burke 69-kV line
3	Evansville, Footville, Center and Bass Creek 69-kV bus voltages	--	87.2%-91.4%	Evansville-Sheepskin 69-kV line
3	Arena, Mazomanie and Black Earth 69-kV bus voltages	--	88.2%-91.7%	Spring Green-Arena 69-kV line
3	Eden, Wyoming Valley, Spring Green, Troy and Lancaster 138-kV bus voltages,	--	85.9%-90.1%	Spring Green-Troy 138-kV line Troy-Kirkwood 138-kV line
3	Island, Moore St, Baraboo, Dam Heights, Tower St , Eagle View, Lodi, Okee and Prairie Du Sac 69-kV bus voltages	--	86.2%-92%	Island-Kirkwood 69-kV line Island-Moore St 69-kV line
3	Rockvale 138-kV bus voltage	--	92%	Concord-Rockvale 138-kV line
3	Potosi, Hillman, Darlington, North Monroe and Lafayette Wind 138-kV bus voltages	--	87%-91.6%	Nelson Dewey-Potosi 138-kV line Potosi-Hillman 138-kV line Hillman-Lafayette Wind 138-kV line Lafayette Wind-Darlington 138-kV line
3	Albany, North Monroe, Darlington, Lafayette Wind 138-kV bus voltages	--	86.5%-91.6%	Townline-Albany 138-kV line Albany-North Monroe 138-kV line
3	Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages, Troy 138-kV bus voltage	--	88.4%-91.8%	Spring Green-Wyoming Valley 138-kV line
3	Pleasant View, Hawk, West Middleton, NE Cross Plains, Oakridge, Cross County, Fitchburg 138-kV buses	--	89.4%-91.9%	Rockdale-West Middleton 345-kV line West Middleton 345/138-kV transformer West Middleton 138/69-kV transformer Pleasant View-West Middleton 138-kV line
3	North Beaver Dam and East Beaver Dam 138-kV bus voltages, Koch Oil 69-kV bus voltage	--	91.5%-92%	South Fond Du Lac-Koch Oil 69-kV line Koch Oil-Waupun 69-kV line
3	Bluff Creek and Sugar Creek 138-kV bus voltage	--	91.6%-91.9%	University-Bluff Creek 138-kV line
3	Cottage Grove 69-kV bus voltage	--	91.4%	Kegonsa-Cottage Grove 69-kV line
3	McFarland, Femrite and Sprecher 138-kV bus voltages	--	90.3%-91.1%	Kegonsa-McFarland 138-kV line McFarland-Femrite 138-kV line
3	Lodi, Okee 69-kV bus voltages	--	88.8%-91.7%	Dane-Lodi Tap 69-kV line Lodi-Okee Tap 69-kV line

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3	Eagle View 69-kV bus voltage	--	91%	Eagle View-Dam Heights 69-kV line
3	Randolph, Didion and Cambria 69-kV bus voltages	--	89.4%-91.7%	North Randolph-Randolph Tap 69-kV line Didion- Randolph Tap 69-kV line
3	Boscobel, Blue River, Wauzeka, Gran Grae, La Pointe, Muscoda, Avoca 69-kV bus voltage	--	88.3%-91.9%	Gran Grae 138/69-kV transformer
3	Yahara, Vienna, Reiner Road, Sprecher, Femrite and American Center 138-kV bus voltages	--	91.2%-92%	North Madison-Yahara 138-kV line Vienna-Yahara 138-kV line
3	Horicon, Juneau and Horicon Industry 69-kV bus voltages, North Beaver Dam, Fox Lake and Beaver Dam East 138-kV bus voltages	--	89%-91.8%	Hubbard-Horicon Industrial 69-kV line Horicon-Horicon Industrial 69-kV line
3	LCI, Ninesprings and Pflaum 69-kV bus voltage	--	89.6-91.6%	Royster-Pflaum 69-kV line
3	Lewiston, East Dells, Kilbourn, Loch Mirror, Birchwood, Zobel, Nishan, Artesian, Rock Springs, Kirkwood, City View, Kirkwood, Lake Delton and Troy 138-kV bus voltages, Reedsburg and Artesian 69-kV bus voltages	--	87.4%-91.8%	City View-Kirkwood 138-kV line Kirkwood-Lake Delton 138-kV line Trienda-Lewiston 138-kV line Lewiston-East Dells 138-kV line East Dells-Kilbourn 138-kV line Trienda-Lake Delton 138-kV line Loch Mirror-Kilbourn 138-kV line Loch Mirror-Birchwood 138-kV line
3	Academy 138-kV bus voltage	--	91.9%	Boxelder-Academy 138-kV line
3	Aaker Road 69-kV bus voltage	--	91.1%	Stoughton-Aaker Road 69-kV line
3	Timberline, Stage Coach, Cross Plains, Black Earth, Spring Green, Arena, Mazomanie, Mazomanie Industrial, Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages	--	88.8%-92%	West Middleton-Timberline 69-kV line Black Earth-Mazomanie 69-kV line Stage Coach-Black Earth 69-kV line
3	West Darien, Southwest Delavan and North Shore 138-kV bus voltages	--	91.6%-91.8%	Bradford-West Darien 138-kV line
3	La Prairie, Bradford, West Darien, SW Delavan and N Shore 138-kV bus voltages	--	91.6%-91.7%	Rock River-La Prairie 138-kV line
3	Newark, Brodhead Switching, Brodhead South, Brodhead, Brodhead North, Orfordville, Bass Creek, Spring Grove and Footville 69-kV bus voltages	--	90.6%-92%	Paddock-Newark 69-kV line Newark-Brodhead Switching Station 69-kV line
3	Lone Rock, Muscoda, Avoca, Blue River, Pine River, Richland Center, Brewer and Seneca 69-kV bus voltages	--	89.9%-91.6%	Seneca-Bell Center 161-kV line
3	Lone Rock, Muscoda, Avoca, Pine River, Richland Center, Brewer 69-kV bus voltages	--	90.7%-91.9%	Hillsboro 161/69-kV transformer
3	Lone Rock, Muscoda, Avoca, Pine River, Richland Center, Brewer and Boscobel 69-kV bus voltages	--	89.3%-91.7%	Richland Center-T RC 69-kV line T RC-Dayton 69-kV line
3	Miner, Shullsburg 69-kV bus voltages	--	90.5%-92%	DPC Galena-Pilot 69-kV line Pilot-Terr Tap 69-kV line
3	Verona, Sun Valley, Montrose 69-kV bus voltages	--	90.3%-91.1%	Oak Ridge-Verona 138-kV line Verona 138/69-kV transformer
3	North Lake Geneva, Sugar Creek, Williams Bay, Como, Elkhorn and Brick Church 138-kV bus voltages	--	88.4%-92%	Burlington 138-kV Bus 1-2 outage Paris-Air Liquide 138-kV line Burlington-Air Liquide 138-kV line
3	Fox Lake, Beaver Dam East and North Beaver Dam 138-kV bus voltages	--	88.3%-89.7%	North Randolph-Fox Lake 138-kV line Fox Lake-North Beaver Dam 138-kV line
3	Reiner Road 138-kV bus voltage	--	91.7%	Reiner Road-Sycamore 138-kV line
3	Hamilton, North Beaver Dam and Beaver Dam East 138-kV bus voltages	--	91.8-91.9%	Portage-Hamilton 138-kV line
3	Cambridge, London 138-kV bus voltages	--	91.8%-92%	Rockdale-Cambridge Tap 138-kV line
3	N Monroe 138/69-kV transformer	108.6%	--	Columbia generator 1 or 2 outage

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2023 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2023 Summer Peak Case		Facility Outage(s)
		% of Facility Rating	% of Nominal bus voltage	
3	McCue-Harmony-Lamar 69-kV line	98.9%-95.8%	--	Columbia generator 1 or 2 outage
3	Wauzeka-Boscobel 69-kV line	107.1%	--	Columbia generator 1 or 2 outage
3	Troy, Eden, Kirkwood, City View, Lake Delton 138-kV bus voltages, Muscodia, Blue River, Boscobel, Avoca an Reedsburg 69-kV bus voltages	--	88.9%-91.8%	Columbia generator 1 or 2 outage
3	Nelson Dewey 161/138-kV transformer	102.1%-100.7%	--	Nelson Dewey generator 1 or 2 outage
3	McCue-Harmony-Lamar 69-kV line	111.8%-108.6%	--	Sheepskin generation outage
3	McCue 138/69-kV transformer	97.6%	--	Sheepskin generation outage
3	North Stoughton-Stoughton 69-kV line	105.5%	--	Sheepskin generation outage
3	Nelson Dewey-Gran Grae 161-kV line	98.3%	--	DPC Genoa generation outage
4	Pulliam-Suamico 69-kV line	134%	--	Base case
4	Edgewater 138/69-kV transformer #1 Edgewater 138/69-kV transformer #2	100-101%	--	Base case
4	Edgewater 138/69-kV transformer #1	96.4%	--	Edgewater 138/69-kV transformer #2
4	Edgewater-Washington St 69-kV line	104.4%	--	Edgewater-Nicolet 69-kV line
4	Pulliam-James St 138-kV line	96.2%	--	Green Bay South West-De Pere 138-kV line
4	Pioneer-Sobieski 69-kV line Pioneer 138/69-kV transformer	128-96.6%	--	Pulliam-Suamico 69-kV line followed by Sobieski-Pioneer 69-kV line close
4	Canal 138/69-kV transformer #1	99%	--	Canal 138/69-kV transformer #2
4	Canal 138/69-kV transformer #2	98.6%	--	Canal 138/69-kV transformer #1
4	Glenview 138/69-kV transformer #1	115.1%	--	Glenview 138/69-kV transformer #2
4	Glenview 138/69-kV transformer #2	114.6%	--	Glenview 138/69-kV transformer #1
4	Finger Road-Bluestone 69-kV line	96.3-126.2%	--	Wesmark-Kellnersville 69-kV line Kellnersville-Manrap 69-kV line Mishicot-Shoto 138-kV line
4	City Limits 138-kV bus tie 1-2 City Limit-Butte Des Morts 138-kV line City Limits-Combined Locks Tap 138-kV line	100-118.9%	--	North Appleton-Apple Hills 138-kV line
4	Manrap-Custer 69-kV line	95.4%	--	Revere-Lakefront 69-kV line
4	Sunset Point 138/69-kV transformer #1	100.3%	--	Sunset Point 138/69-kV transformer #2
4	Oak St-Ashland Ave 69-kV line	103.1%	--	Pulliam-South Broadway Tap 69-kV line
4	East Krok 138/69-kV transformer	96.9%	--	Canal-East Krok 138-kV line
4	Sobieski, Suamico 69-kV bus voltages	--	87.2-89.6%	Base case
4	Ashland 69-kV bus voltage	--	95.6%	Base case
4	Bluestone, Wesmark 69-kV bus voltages	--	Diverged	Finger Road-Bluestone 69-kV line
4	East Krok, Beardsley St, Barnett, Booster, Luxemburg 69-kV bus voltages	--	89.2-91.1%	East Krok 138/69-kV transformer
4	Combined Lock Taps, Maes, Apple Hills 138-kV bus voltages	--	90.7-91.9%	North Appleton-Apple Hills 138-kV line
4	Hickory, Forward Energy Center, Butternut 4, Butternut 5 138-kV bus voltages	--	91%	Hickory-South Fond du Lac 138-kV line
4	Forward Energy Center, Butternut 4, Butternut 5 138-kV bus voltages	--	91.8%	Hickory-Forward Energy Center 138-kV line
4	Butternut 4, Butternut 5 138-kV bus voltages	--	91.9%	Butternut-Forward Energy Center 138-kV line
4	Holland, Plymouth #4, Howards Grove, Meeme 138-kV bus voltages	--	87.1-91.6%	Charter Steel Industry-Holland 138-kV line Charter Steel Industry 138-kV bus plus Charter Steel-Cedarsauk 138-kV line
4	Lyndon 138-kV bus voltage	--	90.8%	Cedarsauk-Fredonia 138-kV line
4	Suamico, Sobieski 69-kV bus voltages	--	87-90.2%	Pulliam-Suamico 69-kV line followed by Sobieski-Pioneer 69-kV line close

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2023 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2023 Summer Peak Case		Facility Outage(s)
		% of Facility Rating	% of Nominal bus voltage	
5	Allerton 138-kV bus voltage Bark River 138-kV bus voltage Barton 138-kV bus voltage Cooney 138-kV bus voltage Cottonwood 138-kV bus voltage Hartford 138-kV bus voltage Merrill Hills 138-kV bus voltage St. Lawrence 138-kV bus voltage Summit 138-kV bus voltage Arthur Road 138-kV bus voltage Glacier 138-kV bus voltage	--	95.8% 95.5% 95.8% 95.4% 95.2% 95.1% 95.6% 95.6% 95.4% 95.5% 95.5%	Intact System
5	Oak Creek – Pennsylvania 138-kV line	106.3% 107.8% 107.6% 107.0% 106.4%	--	Intact System Nicholson – Oak Creek 138-kV line Oak Creek – Ramsey 138-kV line Nicholson – Ramsey 138-kV line Kansas – Ramsey 138-kV line Plus other less severe outages
5	Hartford 138-kV bus voltage	--	88.7%	Concord 138-kV bus split between 4 and 5
5	St. Lawrence and Arthur Road 138-kV buses	--	90.8%	Concord 138-kV bus split between 4 and 5
5	Glacier 138-kV bus voltage	--	91.8%	Concord 138-kV bus split between 4 and 5
5	Cooney, Cottonwood, Hartford, Summit 138-kV buses	--	90.2-91.9%	Concord 138-kV bus split between G and 4
5	Brookdale W – Kansas 138-kV line	95.5%	--	Bluemound – Brookdale W 138-kV line
5	Fredonia 138-kV bus voltage	--	89.2%	Cedarsauk – Fredonia 138-kV line
5	Swan 138-kV bus voltage	--	91.5%	Granville – Swan Tap 138-kV line
5	Bain 345/138-kV transformer T5	159.7%	--	Pleasant Prairie bus split between 3 and 4
5	Albers – Kenosha 138-kV line	104.0%	--	Bain – Kenosha 138-kV line
5	Pleasant Valley 138-kV bus	--	91.1%	Pleasant Valley – Saukville 138-kV line
5	Branch – Kansas 138-kV line	119.9%	--	Oak Creek – Pennsylvania 138-kV line
5	Nicholson – Ramsey 138-kV line	99.4%	--	Oak Creek – Pennsylvania 138-kV line
5	Oak Creek – Ramsey 138-kV line	99.2%	--	Oak Creek – Pennsylvania 138-kV line
5	Tichigan , Burlington1 138-kV bus voltages	--	83.1-84.2% 88.1–89.1%	Split Burlington 138-kV bus Burlington – Air Liquide – Paris 138-kV line
5	Arcadian 345/138-kV transformer #2	97.5 %		Arcadian 345/138-kV transformer #1
5	Arcadian 345/138-kV transformer #3	118.9%		Arcadian 345/138-kV transformer #1