

TOT 7 and TOT 7A Operating Procedure

Effective: May 23, 2005 and Until Superseded

Purpose

The purpose of the recent analysis is to verify the maximum ratings of the TOT 7 and TOT 7A transfer path in the north-to-south direction and to establish real time limits for the 2005 summer season.

Update Status

On May 23, 2005, TOT 7 was put into service on the EMS system to provide real time limit update. Last Summer (July 9, 2004). TOT 7A went into service on the EMS system to provide real time limit update. Prior to that time the TOT 7A path was monitored but used the default minimum rating of 656 MVA. Studies run this spring found TOT 7 to now be a dynamic limit as a function of PRPA generation and Colorado Big Thompson (CBT) generation. The maximum rating of 890 MW was reconfirmed. The real time limit on TOT 7 ranges from this 890 MW down to 562 MW. It is expected that flows will hit the TOT 7A limit before the TOT 7 limits are reached. The TOT 7A real time limit ranges from 614 MW to 745 MW.

Scope

The study area includes WECC powerflow Zones 706 and 754 in the Foothills Area located in northern Colorado. The TOT 7 path is a 230 kV corridor on the eastern side of the Foothills Area between Ault and Ft. St.Vrain consisting of three transmission lines:

- Ault-Windsor 230 kV line Metered at Ault
- Weld-Ft. St.Vrain 230 kV line Metered at Weld
- Longs Peak-Ft. St.Vrain 230 kV line Metered at Ft. St.Vrain

TOT 7A is a subset of TOT 7 comprising the following lines (metered at FSV):

Ault-Windsor-Ft. St. Vrain 230-kV line (line 5313)

Weld-Ft. St. Vrain 230-kV line (line 5315)

Criteria

Normal system configuration

Voltage:	0.95 to 1.05 per unit
Line Loading:	100 percent of continuous rating
Transformer Loading:	100% of highest 65 °C rating

N-1 contingency system configuration

Voltage:	0.92 to 1.07 per unit (PRPA)
	0.90 to 1.10 per unit (all others)
Line Loading:	100 percent of continuous rating
	Emergency rating curve for the Weld-St.Vrain 230 kV
Transformer Loading:	100% of highest 65 °C rating

Procedure

1. The Foothills Area Planning Group (Foothills) participants reviewed the WECC 2005 HS2ap base case and modified it with the most recent load forecasts and project data to develop a peak load summer operating case.
2. Stressed the case to find maximum allowable TOT 7 and 7 A flows under various PRPA load levels and with CBT generation also varied.
3. Found the maximum allowable flow for projected summer peak conditions.
4. Used N-1 analysis. Ran a complete set of outages in Zones 706, 754, and 777.

Discussion and Results

In this report the "Load" referred to is the total of Zone 754 and 777 loads (Northern Front Range including PRPA area).

The maximum allowable TOT 7 flow varies as a function of the amount of local load and the level of nearby CBT hydro generation. As the load served along the Ault-Longs Peak-FSV 230 kV corridor increases, the flow on the Longs Peak-FSV component of TOT 7 decreases, shifting a higher percentage of TOT 7 flow to the other two TOT 7 lines. The maximum allowable flow can decrease with an increase in the diversity of the flows between all three TOT 7 lines. On the other hand, the maximum allowable flow over both TOT 7 increases as CBT generation increases.

The limiting outage for both TOT 7 and 7A is the Ault-Windsor 230 kV line. The limiting element for the maximum flow of TOT 7 flow of 890 MW is the Weld 230 kV bus tie with a 637 MVA continuous rating. The limiting element for other maximum flow scenarios may be the Timberline-Harmony 230 kV line with a 472 MVA continuous rating. The TOT 7A real time limit ranges from 614 MW to 745 MW.

The TOT 7 Limit is 890 MW with CBT = 185 and the load at 68 percent of peak (580/852=68%). In 2004 the PRPA load was less than or equal to 68 percent of the PRPA peak 91 percent of the time.

The TOT 7 Max. Flow is 700 MW with CBT=185 and the load at 100 percent of peak.

The TOT 7 Max. Flow is 695 MW with CBT=0 and the load at 84 percent of peak.

The following tables summarize the results. An additional series of cases were run to define a greater number of acceptable operating limits for TOTs 7 and 7A.

2005 Summer Results:

<u>TOT. 7</u> <u>Max Flow</u>	<u>Zones 754 plus 777</u> <u>Total Load (Percent of Historical Peak)</u>	<u>Colorado -Big Thompson Hydro</u> <u>Gen. (CBT)</u>
890	68 percent	185 MW
700	100 percent	185 MW
695	84 percent	0

