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AZ CORP COMMISSION
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January 30, 2012

Arizona Corporation Commission
DOCKETED

JAN 31 2012

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Docket Control
Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007

RE: SWAT-CATS Project Outage Study for 2012 Biennial Electric Transmission Assessment 2012-2021. Docket No. E-00000D-11-0017

Dear Sir/Madam:

The Southwest Area Transmission (SWAT) Sub-Regional Transmission Planning Group is comprised of transmission regulators/governmental entities, transmission users, transmission owners, transmission providers, transmission operators, transmission developers, generation developers, and environmental entities. The group was formed to promote regional planning across the entire Southwest area of the Western Electricity Coordinating Council. SWAT operates in a public forum and is open to any entity or persons interested in the development and future of the electric transmission system. SWAT encourages collaborative efforts and joint participation to address issues. A key goal of SWAT is to maximize use and benefits of the existing and future regional transmission system.

As members of SWAT, the Arizona Transmission Providers have participated in various SWAT Technical Subcommittees, Task Forces, Work Groups and the Oversight Committee. The Subcommittees, Task Forces, and Work Groups have been involved in study efforts investigating renewable energy resources such as solar and wind energy, new base load generation, transmission to access renewable resources, how to meet load growth and enhance the utilization of the existing transmission system, and coordination with neighboring Sub-Regional Planning Groups. Due to the nature of performing joint study work, Arizona Transmission Providers are dependent on the technical studies performed under the direction of SWAT for development of their Ten Year Plans.

The attached study work was prepared by the SWAT subcommittee, Central Arizona Transmission System (CATS), and was approved at their January 19, 2012 meeting. The report

has been prepared to support Transmission Provider's Ten Year Plan submittals in January 2012 and for use during the ACC's Seventh Biennial Transmission Assessment (BTA).

The CATS 2011 Ten Year Snapshot Study fulfills the BTA requirement to study ten-year transmission plan projects submitted to the ACC and includes "Project Outage" (formerly known as N-1-1) analysis, for the state of Arizona.

SWAT strongly supports the coordinated effort between the utilities and stakeholders and supports the enclosed study report.

Sincerely,

LeeAnn Torkelson

LeeAnn Torkelson
SWAT Chairman

Jason Spitzkoff

Jason Spitzkoff
CATS Chairman

Enclosure

cc: Prem Bahl (ACC)
Jana Brandt (SRP)
Bruce Evans (SWTC)
Gary Trent (TEP)
Jason Spitzkoff (APS)
Joshua Johnson (WAPA)

Original and 13 copies of the foregoing filed with Docket Control.

January 19, 2012

2011 Ten Year Snapshot Study

A report to address Arizona Corporation Commission Biennial Transmission Assessment (BTA) requirements

Rev #3

Salt River Project

SWAT
Southwest Area Transmission

Central Arizona Transmission System (CATS) Subcommittee

Chairman: Jason Spitzkoff

Executive Summary

The Ten Year Snapshot Study is an assessment of the ten year high voltage and extra high voltage transmission plans developed by transmission owners in Arizona. The developed plans used a coordinated base case, which models the expected transmission system in 2021. The 2021 Western Electricity Coordinating Council (WECC) HS1A base case was used as the seed base case. Forecasted loads, resources, underlying transmission system, as well as planned facilities for transmission owners in the 2021 timeframe were added to the seed case to develop the 2021 Central Arizona Transmission System (CATS) case used in this study.

This study includes reviewing impacts statewide. A state-wide view assists in coordinating this and other study efforts (and results) among the various planning groups in Arizona.

The assessment of the ten year plan consisted of conducting N-0 and N-1 power flow analyses on the coordinated 2021 detail CATS base case to verify that there were no thermal overloads or voltage problems for the 2021 time frame with participants' 2021 planned facilities. Project Outage (N-1-1) power flow analyses were conducted to show the impact on the surrounding transmission system by removing an individual participant's Project from the ten year plan.

The base case showed prior to any outages (N-0 conditions) there are no busses outside of voltage criteria and no overloaded elements. Single contingency (N-1) analysis showed overloads on transmission elements and voltage deviations that will need further investigation. These thermal violations and voltage deviation issues have been seen by the utilities in internal studies and have solutions either identified or being investigated.

The Project Outage (N-1-1) portion of the study, taking out facilities associated with a Ten Year Planned Project and running contingencies, showed that with the exception of SRP03 and TEP01, a delay of a single Project would generally not cause significant impact to the remaining transmission system. Thirteen Project Outages were studied, seven APS Projects, four SRP Projects, one SWP Project, and one TEP Project. Delay of the following projects beyond the ten year window had the greatest impact (5% or greater loading as compared to the base case for the same contingency) to the transmission system:

Case # - Description
SRP03 Pinal West – Duke – Pinal Central 500kV line (South East Valley)
TEP01 Pinal Central – Tortolita 500 kV line

The results of the Ten Year Snapshot study indicates the planned 2021 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of either of the two planned projects above will have a significant impact on the remaining transmission system. A significant impact does not imply a violation of criteria; rather it merely reflects that in a comparison of the base case (N-0 conditions) to the Project Outage cases (N-1-1) a difference exists between the results that exceeds the monitoring criteria as specified in this study.

2011 Ten Year Snapshot Study

A report to address Biennial Transmission Assessment (BTA) requirements

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Introduction

The Ten Year Snapshot Study was performed to coincide with the biennial filings with the Arizona Corporate Commission (ACC). The Ten Year Snapshot Study is a collaborative effort to assess the ten-year transmission plans for Arizona.

The objective of the study is to analyze how the participants' ten year plans perform as whole in a regional environment and the effect of omitting an individual planned transmission project from the plan.

The transmission system performance is assessed by studying N-0, N-1 and Project Outage (N-1-1) conditions on a transmission system topography, load level, and generation dispatch forecasted in a tenth year. The study consisted of a screening of voltage and thermal violations for N-0, N-1, and the Project Outage scenarios. The system performance is assessed by reviewing thermal and voltage violations under all lines in service and outage conditions. The violations are identified if thermal or voltage excursions exceed criteria determined by the North American Electric Reliability Council (NERC) transmission planning (TPL) standards.

This report is one of a series of reports required to be filed with the ACC on a biennial basis as result of Orders issued by the Arizona Corporation Commission from previous Biennial Transmission Assessments. Other reports, including the Corridor Outage Studies and Extreme Contingencies Studies, are not included with this report but will be submitted separately under separate cover.

Study Methodology

Case building

The study began with development of a power flow case that reflected a 2021 timeframe and included participant's Ten Year Plan (TYP) projects. Annually, entities planning to build transmission or generation above 100kV or 100MW must file a TYP with the Arizona Corporation Commission (ACC).

This year's planning case, reflective of a 2021 transmission and generation topology, was a 2021 case modified by Arizona Public Service (APS), Salt River Project (SRP), Electrical District #3 (ED3), Tucson Electric Power (TEP), Southwest Transmission Cooperative (SWTC), and Western Area Power Administration (WAPA).

After a round-robin approach to updating the case, the study work began with reviewing the system under "all lines in service" or "ALIS" conditions. Overloads or voltage violations were corrected to alleviate any ALIS issues. This analysis is also known as "N-0" analysis which indicates the number of lines out of service is "0", zero.

Case Highlights for Arizona

Generation

The generation capacity modeled for Arizona was 38,502MW with 30,346MW online.

Planned Generation

The following announced generation was modeled in the case:

Fuel Type	Project Name	Modeled	MW Dispatched
Natural Gas	Bowie	Yes	500
Natural Gas	Abel	Yes	450
Solar	Agua Caliente	Yes	290
Solar	Solana-Gila Bend area	Yes	280
Wind	Perrin Ranch	No[1]	0
Wind	SunZia	Yes	1500

Table 1 - Announced Generation

Load

The state of Arizona was modeled with 22,825 MW of load in this 2021 study. In the 2009 Ten Year Snapshot Study, the state of Arizona was modeled with 25,340 MW of load in the 2019 study. The modest load in this 2021 study is in part due to estimates of load reductions expected in the ten year time frame in response to the ongoing recession.

State Status

The 2021 case shows Arizona generating 6,600MW more than required to serve Arizona loads. Arizona continues to export generation, primarily to California.

[1] Because generation information was not well known at the time of the study, the generation at Perrin Ranch was not included as part of this study. The addition of Perrin Ranch should not have an effect on any of the results presented in this report.

N-1 and Project Outage (N-1-1) Contingency Analysis

Once a base case was finalized contingency analysis was performed. Contingency analysis (also known as N-1 analysis) simulates taking an element out of service (maintenance, fire, storm damage, etc.) and assessing the impact to the remainder of the system due to the loss of that facility. The utilities reviewed the resultant violations and provided mitigation.

The last step of the study was the Project Outage analysis (also known as N-1-1) which resulted in thirteen additional cases. Each Project Outage case removed a Project (transmission facility/ies) and single contingencies were applied. The following Project Outages (separated into two tables) were considered for this analysis:

APS Project Outage cases included:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • Bullet items are facilities identified for removal for the project	In service Date
APS01	Palo Verde-Sun Valley-Morgan 500 and 230 kV system • Palo Verde - Delaney 500kV line • Delaney-Sun Valley 500 kV line • Sun Valley-Morgan 500kV line • Sun Valley 500/230kV transformer (T1) • Sun Valley-Trilby Wash 230kV line • Trilby Wash 230/69 kV transformer	2014-2016
APS02	Palm Valley-TS2-Trilby Wash 230kV line • Palm Valley-TS2 230kV line • TS2-Trilby Wash 230kV line	2015
APS03	APS01 plus APS02 • Palo Verde-Sun Valley-Morgan 500 and 230kV system • Palm Valley-TS2-Trilby Wash 230kV line	2015
APS04	Sun Valley –Morgan 500kV line • Sun Valley – Morgan 500kV line	2016
APS05	Hassayampa-North Gila-TS8 500 and 230 kV systems • Hassayampa-North Gila #2 500kV line • North Gila-TS8 230kV line	2014
APS06	Pinal Central-Sundance 230kV line • Pinal Central-Sundance 230kV line	2014
APS07	Desert Basin-Pinal Central-Sundance 230kV line • All of APS06 plus • Pinal Central-Desert Basin 230kV line	2014

Table 2 - APS Project Outage Cases

Project Outage cases for SRP, TEP and Southwestern Power Group (SWP) are shown below:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis • Bullet items are facilities identified for removal for the project	In service Date
SRP01	Desert Basin-Pinal Central 230kV line • Pinal Central-Desert Basin 230kV line	2014
SRP02	Abel • All Abel Gen	2017
SRP03	Pinal West-Duke-Pinal Central 500kV line (South East Valley) • Pinal West – Pinal Central 500kV line • Pinal Central-Browning 500kV line • Pinal Central-Tortolita 500kV line • Desert Basin-Pinal Central-Sun Dance 230kV line • Pinal Central-Randolph 230kV line (*put Randolph-Browning 230kV line back in service) • Pinal Central 500/230kV transformer (T1) • Pinal Central 500/230kV transformer (T2) • Duke 500/230kV transformers (T1 and T2)	2014
SRP04	RS24 All 230 kV lines and 230/69kV transformers at RS24 • RS24-Abel • RS24 230/69kV transformer (T1) • RS24-Santan • Abel-Schrader 230kV line	2019
SWP01	SunZia • SunZia South – Luna 500/345kV transformers (T1 and T2) • SunZia South – Willow 500kV lines (1 and 2) • SunZia South – SunZia East 500kV lines (1 and 2) • All SunZia Gen	2015
SWP02	SunZia Sensitivity Study[2] • All of SWP01 plus • All of SRP03	2014-2015
TEP01	Pinal Central-Tortolita 500kV line • Pinal Central-Tortolita 500kV line	2014

Table 3 – SRP, TEP, and SWP Project Outage Cases

[2] A sensitivity study, SWP02, was requested by one of the study participants after reviewing the results of the SRP03 outage and the impact of the SWP01 projects' resources on the remainder of the system. The results of SWP02 are not incorporated in the tables of this report, but are included in Appendix B: Contingency Results.

Monitoring Criteria

This analysis monitors thermal loading of transmission facilities and voltage deviation at substations caused by system disturbances (contingencies). The criteria in Table 4 - Monitoring criteria highlights the criteria used to identify violations for this study. Exceeding the criteria below can cause damage to the electric system. Elements that exceed the criteria indicate where problems in the system may exist and that need further review to appropriately address the thermal or voltage deviation issue. The voltage and thermal criteria used in this analysis were:

Outage Type		Thermal Criteria	Voltage Criteria
N-0	No Outage, All lines in service	No element exceeding 100% of its normal rating	Less than .95 or Greater than 1.05 [3]
N-1	Single Element Outage	No element exceeding 100% of its emergency rating	No voltage deviation greater than 5%
Project Outage (N-1-1)	Project Outage (with system adjustments) followed by another contingency	Reducing loadings to 100% (or less) of normal rating following the removal of a project and 100% or less of the emergency rating for the subsequent outage	No voltage deviation greater than 5%

Table 4 - Monitoring criteria

All thermal overloading results were screened to show only elements above 115kV. Voltage results were also screened for bus voltages 115kV and higher. Voltage deviation calculated as the difference in voltage between post and pre outage voltage on buses. If the voltage deviation exceeds 5%, the bus is listed as exceeding criteria.

The Project Outage (N-1-1) thermal overload results were benchmarked against the N-1 results to distinguish loadings that were only associated with the N-1-1 and were not pre-existing in the N-1 base case. Highlighting was applied to the results where flow increased 5% or more in the Project Outage scenario on the same element for the same contingency as compared to the base case.

The N-1-1 voltage deviation results were also benchmarked against N-1 results. Highlighting was applied on the same busses where voltage deviations were greater than three percent more as compared to the base case for the same bus and contingency.

Monitored Elements

All transmission facilities in Arizona with voltage greater than 115kV were monitored for thermal and voltage criteria.

System Disturbances (Contingencies)

The contingencies studied included all Arizona transmission facilities (lines, transformers, and capacitors) with voltages equal to or greater than 115kV.

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[3] Arizona utilities typically screen for voltage below 0.95 per unit and above 1.05 per unit on all systems less than 500kV. The 500kV system is typically operated at 525kV which results in a per unit voltage acceptable at 1.10 per unit.

Base case results

The base case results include voltage and thermal results with all lines in service (no contingencies) as well as voltage and thermal results under simulated contingency conditions.

The Base case showed no thermal violations (flow on elements exceeding an element's normal rating). Also, there were no voltage violations in the Base case. All 115kV and above busses were within the WECC criteria and showed acceptable system voltages.

Under contingency conditions, the following busses showed voltage deviations in excess of 5% (.05) for the simulated outages. The voltage deviations shown in Table 5 – Base Case Voltage Violations indicate solutions for these violations.

Delta Voltage Violations (voltage drop, per unit)						
Name	**kV**	**CONTINGENCY DESCRIPTION**			**Voltage Deviation**	**SOLUTIONS**
EASTINA	138	Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1	-0.17	This issue will be mitigated with a new line between the La Canada and the proposed Naranja substations. In addition, the Tortolita – Proposed Naranja – Rancho Vistoso line will be reconfigured as a North Loop – Proposed Naranja – Rancho Vistoso line.
ORNGROVE	138	Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1	-0.17	This issue will be mitigated with a new line between the La Canada and the proposed Naranja substations. In addition, the Tortolita – Proposed Naranja – Rancho Vistoso line will be reconfigured as a North Loop – Proposed Naranja – Rancho Vistoso line.
LACANADA	138	Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1	-0.16	This issue will be mitigated with a new line between the La Canada and the proposed Naranja substations. In addition, the Tortolita – Proposed Naranja – Rancho Vistoso line will be reconfigured as a North Loop – Proposed Naranja – Rancho Vistoso line.
RANVISTO	138	Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1	-0.14	This issue will be mitigated with a new line between the La Canada and the proposed Naranja substations. In addition, the Tortolita – Proposed Naranja – Rancho Vistoso line will be reconfigured as a North Loop – Proposed Naranja – Rancho Vistoso line.
NARANJA	138	Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1	-0.12	This issue will be mitigated with a new line between the La Canada and the proposed Naranja substations. In addition, the Tortolita – Proposed Naranja – Rancho Vistoso line will be reconfigured as a North Loop – Proposed Naranja – Rancho Vistoso line.

Table 5 – Base Case Voltage Violations

Thermal overloads due to contingencies are shown in Table 6 - Base Case Thermal Violations along with the solution to the overload.

Thermal Violations (overloads, per unit)											
Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION			RTG #	MVA RTG	Overload	Solutions
TECHPARK	138	VAIL	138	1	Line VAIL	345.0 to SOUTH	345.0 Ckt 1	2	418	1.05[4]	TEP's 10-year plans that will be filed subsequent to the interconnection study of SunZia will include any project(s) necessary to mitigate this issue[4].
IRVNGTN	138	TECHPARK	138	1	Line VAIL	345.0 to SOUTH	345.0 Ckt 1	2	418	1.00[4]	TEP's 10-year plans that will be filed subsequent to the interconnection study of SunZia will include any project(s) necessary to mitigate this issue[4].

Table 6 - Base Case Thermal Violations

[4] This line appears as overloaded in this study due to the addition of the SunZia project to the base case. The SunZia project has not requested interconnection with TEP. Once a valid transmission interconnection request is submitted to TEP, an interconnection study can be performed to identify all impacts and any required mitigation. Any mitigation that is required will be included in TEP's Ten-Year Plans filed subsequent to the interconnection study.

Project Outage (N-1-1) Contingency Results

The tables below highlight the impact due to the delay of a project beyond 2021 on the remaining transmission system. The Project Outage analysis is a screening tool to assist in identifying criticality of projects to the interconnected system if not in service at the end of the ten year timeframe.

For the APS Project Outage cases (APS01-APS07), all of the voltage violations and thermal violations were similar to the Base case. These results are included in Appendix B: Contingency Results.

For the SRP, TEP, and SWP Project Outage cases, there were a few significant differences found. The first difference being that several "No Solves" occurred during the SRP03 and TEP01 Project Outage cases. A "No Solve" occurs when the case cannot accommodate the change in power flows as a result of the outage and no thermal or voltage results can be determined. Highlighting on the following table (Table 7) shows where a "No Solve" occurred in each case and the contingency that resulted in the "No Solve". SRP03 results in the SunZia Transmission project terminating at the Pinal Central 500kV bus with no alternative path for that generation to flow.

No Solves (contingencies that resulted in no solves)-SRP, TEP, and SWP Cases

Outage	CONTINGENCY DESCRIPTION	BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	solved	solved	solved	Pmis 16725 TUBAC 138.00 = 8546.0 Qmis 16725 TUBAC 138.00 1195	solved	solved	solved
line_410	Line SPRINGR 345.0 to CORONADO 345.0 Ckt 1	solved	solved	solved	Pmis 16333 IRVMID3 138.00 = 13502.1 Qmis 16509 SUNDTGE3 13.80 6742	solved	solved	solved
line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	solved	solved	solved	Pmis 16722 SONOITA 138.00 = 126583.3 Qmis 16722 SONOITA 138.00 100	solved	solved	solved
line_419	Line WINCHSTR 345.0 to VAIL 345.0 Ckt 1	solved	solved	solved	Pmis 16114 PINALWES 345.00 = 461.0 Qmis 16111 BOWIE 345.00 308	solved	solved	Pmis 16400 DMP 47.20 = 63808.4 Qmis 16400 DMP
line_420	Line WINCHSTR 345.0 to WILLOW 345.0 Ckt 1	solved	solved	solved	Pmis 16410 N. LOOP2 47.20 = 50323.4 Qmis 16410 N. LOOP2 47.20 1344	solved	solved	solved
line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	solved	solved	solved	Pmis 16216 SOUTH 138.00 = 62356.7 Qmis 16216 SOUTH 138.00 1064	solved	solved	solved
tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	solved	solved	solved	Pmis 17501 B.VISTA 69.00 = 1290195.8 Qmis 17501 B.VISTA 69.00 16	solved	solved	solved

Table 7 – No Solves for SRP, TEP, and SWP Cases

Similar to the Base case results, Table 8 below shows the voltage deviations for the SRP, TEP, and SWP Project Outage cases. The shaded cells indicate where voltage deviations were 3% greater than the Base case results. For comparison purposes, the table below shows the voltage deviation in the base case for each contingency taken (Column BASE) and then shows the voltage deviation for the same contingency in each Project Outage case (Column SRP01, SRP02, etc). Most deviations were insignificant (less than 3%), with the exception of the shaded cells below.

The Project showing the greatest impact to voltage violations was

- SRP03 Pinal West – Duke – Pinal Central 500kV line (South East Valley)

Delta Voltage Violations (voltage drop, per unit)-SRP, TEP, and SWP Cases

Bus #	Name	kV	Outage	CONTINGENCY DESCRIPTION	BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
17020	SAN RAF	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.11	-0.04	-0.03	-0.05
17007	BUTERFLD	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.10	-0.04	-0.03	-0.04
17016	PANTANO	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.07	-0.02	-0.01	-0.02
17676	NEWTUCSN	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.06	-0.02	-0.01	-0.02
17015	PANTANO	115	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	0.00	-0.01
17018	RED TAIL	230	line_525	Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.07	-0.04	-0.03	-0.03
17089	SNDARIO	115	line_534	Line AVRA 115.0 to SNDARIO 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	0.00	-0.01
17039	KARTCHNR	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.03	-0.03	-0.03	-0.07	-0.03	-0.02	-0.03
17015	PANTANO	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.06	-0.02	-0.02	-0.03
16722	SONOITA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16723	VALNCIA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	-0.01	-0.01
16721	CANEZ	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16725	TUBAC	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16720	KANTOR	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16247	HARRISON	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.05	-0.05	-0.05	-0.08	-0.05	-0.04	-0.05

Delta Voltage Violations (voltage drop, per unit)-SRP, TEP, and SWP Cases													
Bus #	Name	kV	Outage	CONTINGENCY DESCRIPTION			BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
16211	ROBERTS	138	line_435	Line E. LOOP	138.0 to HARRISON	138.0 Ckt 1	-0.04	-0.04	-0.04	-0.07	-0.04	-0.04	-0.04
17023	VALEN-SW	115	line_537	Line MARANA	115.0 to AVRA	115.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	0.00	-0.01
17022	THREEPNT	115	line_537	Line MARANA	115.0 to AVRA	115.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	0.00	-0.01
17089	SNDARIO	115	line_537	Line MARANA	115.0 to AVRA	115.0 Ckt 1	0.00	0.00	0.00	-0.07	0.00	0.01	-0.01
17003	AVRA	115	line_537	Line MARANA	115.0 to AVRA	115.0 Ckt 1	0.00	0.00	0.00	-0.07	0.00	0.01	0.00
17023	VALEN-SW	115	line_538	Line MARANATP	115.0 to MARANA	115.0 Ckt 1	-0.01	-0.01	-0.01	-0.08	-0.01	0.00	-0.01
17022	THREEPNT	115	line_538	Line MARANATP	115.0 to MARANA	115.0 Ckt 1	-0.01	-0.01	-0.01	-0.07	-0.01	0.00	-0.01
17012	MARANA	115	line_538	Line MARANATP	115.0 to MARANA	115.0 Ckt 1	0.00	0.00	0.00	-0.11	0.00	0.01	-0.01
17089	SNDARIO	115	line_538	Line MARANATP	115.0 to MARANA	115.0 Ckt 1	0.00	0.00	0.00	-0.09	0.00	0.02	0.00
17003	AVRA	115	line_538	Line MARANATP	115.0 to MARANA	115.0 Ckt 1	0.01	0.01	0.01	-0.09	0.01	0.02	0.00
17039	KARTCHNR	115	line_530	Line PANTANO	115.0 to KARTCHNR	115.0 Ckt 1	0.01	0.01	0.01	0.05	0.01	0.00	0.01
17039	KARTCHNR	115	tran_702	Tran PANTANO	230.00 to PANTANO	115.00 Ckt 1	0.01	0.01	0.01	0.05	0.01	0.00	0.01

Table 8 – Voltage Violations – SRP, TEP, and SWP Project Outage cases

Table 8 shows that if SRP03 is delayed beyond the 2021 year timeframe, voltage deviations are increased by >3% when compared to the Base case results.

The following table (Table 9) shows thermal overloads due to the SRP, TEP, and SWP Project outage analyses. Highlighting on this table indicates where overloads exceed base case loading by 5%. For comparison purposes, Table 9 below shows the thermal overloads in the base case for each contingency taken (Column BASE) and then shows the thermal overloads for the same contingency in each Project Outage case (Column SRP01, SRP02, etc). Most overloads did not exceed base case loading and were insignificant (less than 5%), with the exception of the shaded cells below. These thermal overload results indicate a delay in the following Projects could increase loading on the remaining system under contingency conditions:

- SRP03 Pinal West – Duke – Pinal Central 500kV line (South East Valley)
- TEP01 Pinal Central – Tortolita 500 kV line

Thermal Violations (overloads, per unit)-SRP, TEP, and SWP Cases																
FName	FkV	TName	TkV	Ckt	Outage	CONTINGENCY DESCRIPTION	RTG	MVA RTG	BASE	SRP01	SRP02	SRP03		SRP04	SWP01	TEP01
TECHPARK	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.05	1.05	1.05	1.59	A	1.051	0.93	1.13
TECHPARK	138	VAIL	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	0.93	0.93	0.93	1.25	A	0.93	< 0.90	1.03
TECHPARK	138	VAIL	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.20	A	< 0.90	< 0.90	0.98
TECHPARK	138	VAIL	138	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	NoSolve		< 0.90	< 0.90	1.05
IRVNGTN	138	TECHPARK	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.00	1.00	1.00	1.54	A	1.00	< 0.90	1.08
IRVNGTN	138	TECHPARK	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.20	A	< 0.90	< 0.90	0.98
IRVNGTN	138	TECHPARK	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.16	A	< 0.90	< 0.90	0.94
IRVNGTN	138	TECHPARK	138	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	NoSolve		< 0.90	< 0.90	1.01
WINCHSTR	345	WILLOW	345	1	base	Base system (n-0)	1	925	0.81	0.81	0.80	1.42		0.81	0.63	0.87
WINCHSTR	345	WILLOW	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.29	A	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_3	Line FOURCORN 500.0 to MOENKOPI 500.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.25	A	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_545	Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.29	A	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	NoSolve		< 0.90	< 0.90	0.95
WINCHSTR	345	WILLOW	345	1	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	NoSolve		< 0.90	< 0.90	0.95
WINCHSTR	345	VAIL	345	1	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.37	A	< 0.90	< 0.90	0.95
WINCHSTR	345	VAIL	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.31	A	< 0.90	< 0.90	< 0.90
WINCHSTR	345	VAIL	345	1	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.30	A	< 0.90	< 0.90	< 0.90
WINCHSTR	345	VAIL	345	1	base	Base system (n-0)	1	1195	0.76	0.76	0.75	1.21		0.76	0.62	0.81
WINCHSTR	345	VAIL	345	1	line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	2	1195	0.98	0.98	0.98	NoSolve		0.98	< 0.90	1.05
WINCHSTR	345	VAIL	345	1	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	2	1195	0.98	0.98	0.98	NoSolve		0.98	< 0.90	1.05
WINCHSTR	345	VAIL	345	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	NoSolve		< 0.90	< 0.90	0.95
LOSREALS	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.08		< 0.90	< 0.90	< 0.90
LOSREALS	138	VAIL	138	1	line_488	Line TECHPARK 138.0 to VAIL 138.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.06		< 0.90	< 0.90	< 0.90
LOSREALS	138	VAIL	138	1	line_444	Line IRVNGTN 138.0 to TECHPARK 138.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.04		< 0.90	< 0.90	< 0.90
WILLOW	500	WILLOW	345	1	tran_730	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 2	2	806	< 0.90	< 0.90	< 0.90	1.06		< 0.90	< 0.90	< 0.90
WILLOW	500	WILLOW	345	2	tran_729	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 1	2	806	< 0.90	< 0.90	< 0.90	1.06		< 0.90	< 0.90	< 0.90
CORONADO	500	CORONADO	345	2	tran_670	Tran CORONADO 500.00 to CORONADO 345.00 Ckt 1	2	806	< 0.90	< 0.90	< 0.90	1.02		< 0.90	< 0.90	< 0.90
COPPERVR	345	COPPERVR	230	1	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	< 0.90	1.01		< 0.90	< 0.90	0.91
COPPERVR	345	COPPERVR	230	2	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	< 0.90	1.01		< 0.90	< 0.90	0.91

Table 9 - Thermal Overloads SRP, TEP, and SWP Project Outage Cases

[A] The top three most heavily loaded (worst) thermal violations shown for that specific line segment. Reporting of overloads was limited to control the volume of data in the report.

Again, SRP03 results in the SunZia Generation project terminating at the Pinal Central 500kV bus with no alternative path for that generation to flow. As a result, the power flows from SunZia South 500kV to Willow 345kV, then to Winchester 345kV through to Vail 345kV. This automatically causes two overloads on TEP's system (as seen on Table 9):

- Winchester – Willow 345kV line
- Winchester – Vail 345kV line

As can be expected, taking additional contingencies only aggravates the system in that area. An observation from the N-1 results of SRP03 (South East Valley) project outage case was the contribution from resources associated with the SWP01 (SunZia) project. A sensitivity study was performed that combined the Project Outage cases SRP03 with SWP01. The results of this sensitivity are located in Appendix B: Contingency Results. The results showed that the thermal violations and voltage deviations shown for SRP03 in Tables 8 and 9 can be attributed to the generation resources associated with SWP01. By reducing the contributions from SunZia, these overloads and voltage deviations may be lessened but not eliminated.

The delay of SRP03 and/or TEP01 will have an impact on the overall system. The magnitude of that impact depends on the planned generation resources dispatched to Southern Arizona. Since the contingencies related to these thermal violations were not causing thermal violations in the base case (without removal of the planned project), these findings show that SRP03 and TEP01 should not be delayed past the 2021 timeframe.

Study Findings

The Ten Year Snapshot study (aka the BTA study) investigating the coordinated impact of utilities and developers ten year plans on the Arizona extra high voltage (EHV) system found that:

- The 2021 system is robust
- Planned projects support the loads estimated for the 2021 timeframe

The Project Outage analysis (an N-1-1 analysis) indicated that the delay of any one project beyond the 2021 timeframe results in consistent thermal and voltage violations of the base case, with the exception of:

Case # - Description
SRP03 Pinal West – Duke – Pinal Central 500kV line (South East Valley)
TEP01 Pinal Central – Tortolita 500 kV line

Both projects listed above resulted in thermal loadings 5% or more than the base case (for contingencies). A delay of either of the two planned projects will have an impact on the overall system. The sensitivity study performed (SWP02) confirmed that the magnitude of that impact depends on the planned generation resources dispatched to Southern Arizona. Since the contingencies related to these thermal violations were not causing thermal violations in the base case (without removal of the planned project), these findings show that SRP03 and TEP01 should not be delayed past the 2021 timeframe. As a screening analysis, the Project Outage portion of the Ten Year Snapshot study indicates that the EHV system can support changes in the timing of most of the transmission and generation projects without significant adverse effects on the remaining system.

The results of this study could be interpreted that the delay of one project doesn't have a negative impact on the remaining system and therefore that particular project isn't needed. This interpretation of the data presented would be false. Utilities plan their transmission systems for reliability, redundancy, transmission scheduling capability, and economic considerations. This ten year snapshot is intended to view the combined impact of a state-wide collaboration of projects that perhaps individual utilities might not see when planning for the near term (5-6 years). Because all utilities' planned projects are modeled in this longer term view, and with the interconnected nature of the transmission system, removal of a single project results in redistribution of power on the remaining projects and system. This redistribution reduces the impact of the delay of an individual project and does not point to a conclusion supporting a lack of need for that individual project.

The results of the Ten Year Snapshot study indicates the planned 2021 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of either of the two planned projects out of the thirteen studied have a significant impact on the remaining transmission system. A significant impact does not imply a violation of criteria; rather it merely reflects that in a comparison of the base case (N-0 conditions) to the Project Outage cases (N-1-1) a difference exists between the results that exceeds the monitoring criteria as specified in this study.

Appendices

Appendix A: Contingency List

```
# Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV
# Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV
line 1            "Line CHOLLA       500.0 to SAGUARO      500.0 Circuit 1"
1.000
 line     14000     14004   "1 "  1 0
0
line 2            "Line CHOLLA       500.0 to SILVERKG     500.0 Circuit 1"
1.000
 line     14000     15041   "1 "  1 0
0
line 3            "Line FOURCORN     500.0 to MOENKOPI     500.0 Circuit 1"
1.000
 line     14001     14002   "1 "  1 0
0
#line_4            "Line FOURCORN     500.0 to FCW          500.0 Circuit 1"
1.000
# line     14001     14030   "1 "  1 0
#0
line 5            "Line MOENKOPI     500.0 to YAVAPAI      500.0 Circuit 1"
1.000
 line     14002     14006   "1 "  1 0
0
line 6            "Line MOENKOPI     500.0 to RME          500.0 Circuit 1"
1.000
 line     14002     14032   "1 "  1 0
0
line 7            "Line MOENKOPI     500.0 to ELDORDO      500.0 Circuit 1"
1.000
 line     14002     24042   "1 "  1 0
0
#line_8            "Line MOENKOPI     500.0 to MARKETPL     500.0 Circuit 1"
1.000
# line     14002     26044   "1 "  1 0
#0
line 9            "Line NAVAJO       500.0 to DUGAS        500.0 Circuit 1"
1.000
 line     14003     14018   "1 "  1 0
0
line 10           "Line NAVAJO       500.0 to RME          500.0 Circuit 1"
1.000
 line     14003     14032   "1 "  1 0
0
line 11           "Line NAVAJO       500.0 to CRYSTAL      500.0 Circuit 1"
1.000
 line     14003     26123   "1 "  1 0
0
line 12           "Line YAVAPAI      500.0 to WESTWING     500.0 Circuit 1"
1.000
 line     14006     14005   "1 "  1 0
0
line 13           "Line SNVLY        500.0 to MORGAN       500.0 Circuit 1"
1.000
 line     14010     14011   "1 "  1 0
0
line 14           "Line MORGAN       500.0 to WESTWING     500.0 Circuit 1"
1.000
 line     14011     14005   "1 "  1 0
0
line 15           "Line MORGAN       500.0 to PNPKAPS      500.0 Circuit r1"
1.000
 line     14011     14016   "r1"  1 0
0
line 16           "Line DELANY       500.0 to SNVLY        500.0 Circuit 1"
1.000
 line     14012     14010   "1 "  1 0
0
line_17           "Line SGRLF        500.0 to CHOLLA       500.0 Circuit 1"
```



```
1.000
 line     14017     14000   "1 "  1 0
0
line 18           "Line DUGAS        500.0 to MORGAN       500.0 Circuit 1"
1.000
 line     14018     14011   "1 "  1 0
0
#line_19           "Line DRPP         500.0 to FCW          500.0 Circuit 1"
1.000
# line     14031     14030   "1 "  1 0
#0
#line_20           "Line DRPP         500.0 to FCW          500.0 Circuit 2"
1.000
# line     14031     14030   "2 "  1 0
#0
line 21           "Line RME          500.0 to FCW          500.0 Circuit 1"
1.000
 line     14032     14030   "1 "  1 0
0
line 22           "Line CHOLLA       345.0 to PRECHCYN     345.0 Circuit 1"
1.000
 line     14100     14103   "1 "  1 0
0
line 23           "Line CHOLLA       345.0 to MAZATZAL     345.0 Circuit 1"
1.000
 line     14100     14107   "1 "  1 0
0
line 24           "Line FOURCORN     345.0 to SAN_JUAN     345.0 Circuit 1"
1.000
 line     14101     10292   "1 "  1 0
0
line 25           "Line FOURCORN     345.0 to WESTMESA     345.0 Circuit 1"
1.000
 line     14101     10369   "1 "  1 0
0
line 26           "Line FOURCORN     345.0 to RIOPUERC     345.0 Circuit 1"
1.000
 line     14101     10390   "1 "  1 0
0
line 27           "Line FOURCORN     345.0 to CHOLLA       345.0 Circuit 1"
1.000
 line     14101     14100   "1 "  1 0
0
line 28           "Line FOURCORN     345.0 to CHOLLA       345.0 Circuit 2"
1.000
 line     14101     14100   "2 "  1 0
0
line 29           "Line PRECHCYN     345.0 to PNPKAPS      345.0 Circuit 1"
1.000
 line     14103     14102   "1 "  1 0
0
line 30           "Line MAZATZAL     345.0 to PNPKAPS      345.0 Circuit 1"
1.000
 line     14107     14102   "1 "  1 0
0
line 31           "Line BUCKEYE      230.0 to LIBERTY      230.0 Circuit 1"
1.000
 line     14201     19052   "1 "  1 0
 tran     14201     84409   "1 "  0    85941
 tran     14201     84409   "2 "  0    85940
0
line 31a "Line BUCKEYE-LIBERTY & BUCKEYE2-BUCKEYE  "
 line     14201     19052   "1 "  1 0    /*"BUCKEYE  230.00  LIBERTY  230.00
 Circuit 1 " */
 line     14213     14201   "1 "  1 1    /*"BUCKEYE2 230.00  BUCKEYE  230.00
        Circuit 1 " */
0
```

```
line 32          "Line CACTUS       230.0 to OCOTILLO     230.0 Circuit 1"
1.000
 line     14202     14219   "1 "  1 0
0
line 33          "Line CACTUS       230.0 to PPAPS N      230.0 Circuit 1"
1.000
 line     14202     14278   "1 "  1 0
0
line 34          "Line CASGRAPS     230.0 to DBG          230.0 Circuit 1"
1.000
 line     14203     15235   "1 "  1 0
0
line 35          "Line CHOLLA       230.0 to LEUPP        230.0 Circuit 1"
1.000
 line     14204     14215   "1 "  1 0
0
line 36          "Line COCONINO     230.0 to VERDE S      230.0 Circuit 1"
1.000
 line     14205     14247   "1 "  1 0
0
line 37          "Line CTRYCLUB     230.0 to LINCSTRT     230.0 Circuit 1"
1.000
 line     14206     14216   "1 "  1 0
0
line 38          "Line CTRYCLUB     230.0 to GRNDTRML     230.0 Circuit 1"
1.000
 line     14206     14270   "1 "  1 0
0
line 39          "Line DEERVALY     230.0 to WESTWNGE     230.0 Circuit 1"
1.000
 line     14207     14259   "1 "  1 0
0
line 40          "Line DEERVALY     230.0 to ALEXANDR     230.0 Circuit 1"
1.000
 line     14207     15202   "1 "  1 0
0
line 41          "Line DEERVALY     230.0 to PINPKSRP     230.0 Circuit 1"
1.000
 line     14207     15211   "1 "  1 0
0
#line_42          "Line BUCKEYE2     230.0 to BUCKEYE      230.0 Circuit 1"
1.000
# line     14213     14201   "1 "  1 0
#0
line 43          "Line EL SOL       230.0 to AGUAFRIA     230.0 Circuit 1"
1.000
 line     14210     15201   "1 "  1 0
0
line 44          "Line FOURCORN     230.0 to PILLAR       230.0 Circuit 1"
1.000
 line     14211     10248   "1 "  1 0
0
line 45          "Line GLENDALE     230.0 to GRNDTRML     230.0 Circuit 1"
1.000
 line     14212     14270   "1 "  1 0
0
line 46          "Line LEUPP        230.0 to COCONINO     230.0 Circuit 1"
1.000
 line     14215     14205   "1 "  1 0
 line     14204     14215   "1 "  1 0
0
line 47          "Line LINCSTRT     230.0 to OCOTILLO     230.0 Circuit 1"
1.000
 line     14216     14219   "1 "  1 0
0
line 48          "Line LINCSTRT     230.0 to WPHXAPSN     230.0 Circuit 1"
1.000
```



```
 line     14216     14239   "1 "  1 0
0
line 49          "Line LONEPEAK     230.0 to SUNYSLOP     230.0 Circuit 1"
1.000
 line     14217     14227   "1 "  1 0
0
line 50          "Line LONEPEAK     230.0 to PPAPS E      230.0 Circuit 1"
1.000
 line     14217     14261   "1 "  1 0
0
line 51          "Line MEADOWBK     230.0 to CTRYCLUB     230.0 Circuit 1"
1.000
 line     14218     14206   "1 "  1 0
0
line 52          "Line MEADOWBK     230.0 to SUNYSLOP     230.0 Circuit 1"
1.000
 line     14218     14227   "1 "  1 0
0
line 53          "Line REACH        230.0 to LONEPEAK     230.0 Circuit 1"
1.000
 line     14220     14217   "1 "  1 0
0
line 54          "Line REACH        230.0 to PPAPS C      230.0 Circuit 1"
1.000
 line     14220     14260   "1 "  1 0
0
#line_55          "Line PPAPS W      230.0 to PPAPS C      230.0 Circuit 1"
1.000
# line     14221     14260   "1 "  1 0
#0
line 56          "Line PPAPS W      230.0 to PINPK        230.0 Circuit 1"
1.000
 line     14221     19062   "1 "  1 0
0
line 57          "Line JOJOBA       230.0 to GILARIVR     230.0 Circuit 1"
1.000
 line     14224     14238   "1 "  1 0
0
line 58          "Line SAGUARO      230.0 to TATMOMLI     230.0 Circuit 1"
1.000
 line     14225     14229   "1 "  1 0
0
line 59          "Line SAGUARO      230.0 to MILLIGAN     230.0 Circuit 1"
1.000
 line     14225     14271   "1 "  1 0
0
line 60          "Line SNTAROSA     230.0 to TATMOMLI     230.0 Circuit 1"
1.000
 line     14226     14229   "1 "  1 0
0
line 61          "Line SNTAROSA     230.0 to DBG          230.0 Circuit 1"
1.000
 line     14226     15235   "1 "  1 0
0
line 62          "Line SNTAROSA     230.0 to TESTTRAK     230.0 Circuit 1"
1.000
 line     14226     19068   "1 "  1 0
0
line 63          "Line SURPRISE     230.0 to EL SOL       230.0 Circuit 1"
1.000
 line     14228     14210   "1 "  1 0
0
line 64          "Line SURPRISE     230.0 to WESTWNGW     230.0 Circuit 1"
1.000
 line     14228     14231   "1 "  1 0
0
line_65          "Line VERDE N      230.0 to VERDE S      230.0 Circuit 1"
```

```
1.000
 line     14230     14247   "1 "  1 0
0
#line_66            "Line WESTWNGW     230.0 to EL SOL       230.0 Circuit 1"
1.000
# line     14231     14210   "1 "  1 0
#0
#line_67            "Line WESTWNGW     230.0 to WESTWNGE     230.0 Circuit 1"
1.000
# line     14231     14259   "1 "  1 0
#0
line 68            "Line WESTWNGW     230.0 to PINPK        230.0 Circuit 1"
1.000
 line     14231     19062   "1 "  1 0
0
line 69            "Line WHTNKAPS     230.0 to EL SOL       230.0 Circuit 1"
1.000
 line     14232     14210   "1 "  1 0
0
line 70            "Line WHTNKAPS     230.0 to RUDD         230.0 Circuit 1"
1.000
 line     14232     15230   "1 "  1 0
0
line 71            "Line SNVLY        230.0 to HASSY AZ     230.0 Circuit 1"
1.000
 line     14265     15173   "1 "  1 0
0
#line_72            "Line WPHXAPSS     230.0 to WPHXAPSN     230.0 Circuit 1"
1.000
# line     14233     14239   "1 "  1 0
#0
line 73            "Line WPHXAPSS     230.0 to RUDD         230.0 Circuit 1"
1.000
 line     14233     15230   "1 "  1 0
0
line 74            "Line YAVAPAI      230.0 to VERDE N      230.0 Circuit 1"
1.000
 line     14234     14230   "1 "  1 0
0
line 75            "Line YAVAPAI      230.0 to WILOWLKE     230.0 Circuit 1"
1.000
 line     14234     14249   "1 "  1 0
 shunt "BAGCAP   115.00" "b4" 1 .1260
0
line 76            "Line KYR-NEW      230.0 to OCOTILLO     230.0 Circuit 1"
1.000
 line     14236     14219   "1 "  1 0
0
line 77            "Line KYR-NEW      230.0 to KNOX         230.0 Circuit 1"
1.000
 line     14236     15219   "1 "  1 0
0
line 78            "Line GILARIVR     230.0 to GILABEND     230.0 Circuit 1"
1.000
 line     14238     14235   "1 "  1 0
 shunt "GILABEND  69.00" "b1" 1 .1800
0
line 79            "Line WPHXAPSN     230.0 to WHTNKAPS     230.0 Circuit 1"
1.000
 line     14239     14232   "1 "  1 0
0
#line_80            "Line FORTROCK     230.0 to ROUNDVLY     230.0 Circuit 1"
1.000
# line     14240     14223   "1 "  1 0
#0
#line_81            "Line FORTROCK     230.0 to JUNIPRMT     230.0 Circuit 1"
1.000
```



```
# line     14240     14264   "1 "  1 0
#0
line 82            "Line ALEXNDR      230.0 to ALEXANDR     230.0 Circuit 1"
1.000
 line     14241     15202   "1 "  1 0
0
line 83            "Line RACEWAY      230.0 to RACEWYWA     230.0 Circuit 1"
1.000
 line     14246     19115   "1 "  1 0
0
line 84            "Line GLENDALW     230.0 to GLENDALE     230.0 Circuit 1"
1.000
 line     14248     14212   "1 "  1 0
0
line 85            "Line GLENDALW     230.0 to AGUAFRIA     230.0 Circuit 1"
1.000
 line     14248     15201   "1 "  1 0
0
line 86            "Line WILOWLKW     230.0 to PRESCOTT     230.0 Circuit 1"
1.000
 line     14250     14222   "1 "  1 0
0
line 87            "Line WILOWLKW     230.0 to WILOWLKE     230.0 Circuit 1"
1.000
 line     14250     14249   "1 "  1 0
0
line 88            "Line AVERY        230.0 to RACEWAY      230.0 Circuit 1"
1.000
 line     14253     14246   "1 "  1 0
0
line 89            "Line AVERY        230.0 to SCTWSH       230.0 Circuit 1"
1.000
 line     14253     14257   "1 "  1 0
0
line 90            "Line TRLBY        230.0 to TS2          230.0 Circuit 1"
1.000
 line     14254     14255   "1 "  1 0
0
line 91            "Line TRLBY        230.0 to SNVLY        230.0 Circuit 1"
1.000
 line     14254     14265   "1 "  1 0
0
line 92            "Line TS2          230.0 to PLMVLY       230.0 Circuit 1"
1.000
 line     14255     14252   "1 "  1 0
0
line 93            "Line SCTWSH       230.0 to PPAPS W      230.0 Circuit 1"
1.000
 line     14257     14221   "1 "  1 0
0
line 94            "Line TS4          230.0 to JOJOBA       230.0 Circuit 1"
1.000
 line     14258     14224   "1 "  1 0
0
line 95            "Line TS4          230.0 to PLMVLY       230.0 Circuit 1"
1.000
 line     14258     14252   "1 "  1 0
0
line 96            "Line PPAPS C      230.0 to PPAPS E      230.0 Circuit 1"
1.000
 line     14260     14261   "1 "  1 0
0
#line_97            "Line JUNIPRMT     230.0 to SELIGMAN     230.0 Circuit 1"
1.000
# line     14264     14244   "1 "  1 0
#0
line_98            "Line N.GILA       230.0 to TS8          230.0 Circuit 1"
```

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1.000
 line     14267     14214   "1 "  1 0
0
line 99            "Line MILLIGAN     230.0 to CASGRAPS     230.0 Circuit 1"
1.000
 line     14271     14203   "1 "  1 0
0
line 100           "Line PPAPS N      230.0 to OCOTILLO     230.0 Circuit 1"
1.000
 line     14278     14219   "1 "  1 0
0
#line_101           "Line PPAPS N      230.0 to PPAPS E      230.0 Circuit 1"
1.000
# line     14278     14261   "1 "  1 0
#0
line 102           "Line PPAPS N      230.0 to PINPKSRP     230.0 Circuit 1"
1.000
 line     14278     15211   "1 "  1 0
0
line 103           "Line PPAPS N      230.0 to PINPKSRP     230.0 Circuit 2"
1.000
 line     14278     15211   "2 "  1 0
0
#line_104           "Line ADAMS        115.0 to ADAMS TP     115.0 Circuit 1"
1.000
# line     14350     19060   "1 "  1 0
#0
line 105           "Line BONNYBKE     115.0 to BONNYBRK     115.0 Circuit 1"
1.000
 line     14354     14352   "1 "  1 0
0
line 106           "Line SAG.EAST     115.0 to SAG.WEST     115.0 Circuit 1"
1.000
 line     14356     14357   "1 "  1 0
0
line 107           "Line SAG.EAST     115.0 to ORACLE       115.0 Circuit 1"
1.000
 line     14356     19057   "1 "  1 0
0
line 108           "Line SAG.WEST     115.0 to SNMANUEL     115.0 Circuit 1"
1.000
 line     14357     14358   "1 "  1 0
0
line 109           "Line SAG.WEST     115.0 to ED-5         115.0 Circuit 1"
1.000
 line     14357     19067   "1 "  1 0
0
line 110           "Line SAG.WEST     115.0 to ED-5B        115.0 Circuit 1"
1.000
 line     14357     19069   "1 "  1 0
0
line 111           "Line VLYFARMS     115.0 to ORACLE       115.0 Circuit 1"
1.000
 line     14359     19057   "1 "  1 0
0
#line_112           "Line BOOTHILL     115.0 to ADAMS        115.0 Circuit 1"
1.000
# line     14362     14350   "1 "  1 0
#0
#line_113           "Line BOOTHILL     115.0 to MURAL        115.0 Circuit 1"
1.000
# line     14362     14353   "1 "  1 0
#0
line 114           "Line CORONADO     500.0 to SGRLF        500.0 Circuit 1"
1.000
 line     15001     14017   "1 "  1 0
0
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line 115           "Line CORONADO     500.0 to SILVERKG     500.0 Circuit 1"
1.000
 line     15001     15041   "1 "  1 0
0
line 116           "Line PALOVRDE     500.0 to WESTWING     500.0 Circuit 1"
1.000
 line     15021     14005   "1 "  1 0
0
line 117           "Line PALOVRDE     500.0 to WESTWING     500.0 Circuit 2"
1.000
 line     15021     14005   "2 "  1 0
0
line 118           "Line PALOVRDE     500.0 to DELANY       500.0 Circuit 1"
1.000
 line     15021     14012   "1 "  1 0
0
line 119           "Line PALOVRDE     500.0 to RUDD         500.0 Circuit 1"
1.000
 line     15021     15061   "1 "  1 0
0
line 120           "Line PALOVRDE     500.0 to COLRIVER     500.0 Circuit 1"
1.000
 line     15021     24900   "1 "  1 0
0
#line_121           "Line PERKINPS     500.0 to WESTWING     500.0 Circuit 1"
1.000
# line     15033     14005   "1 "  1 0
#0
line 122           "Line SILVERKG     500.0 to SAGUARO      500.0 Circuit 1"
1.000
 line     15041     14004   "1 "  1 0
0
line 123           "Line ABEL         500.0 to BROWNING     500.0 Circuit 1"
1.000
 line     15070     15051   "1 "  1 0
0
line 124           "Line PINAL_C      500.0 to ABEL         500.0 Circuit 1"
1.000
 line     15080     15070   "1 "  1 0
0
line 125           "Line JOJOBA       500.0 to GILARIVR     500.0 Circuit 1"
1.000
 line     15089     14007   "1 "  1 0
0
line 126           "Line JOJOBA       500.0 to GILARIVR     500.0 Circuit 2"
1.000
 line     15089     14007   "2 "  1 0
0
line 127           "Line JOJOBA       500.0 to KYRENE       500.0 Circuit 1"
1.000
 line     15089     15011   "1 "  1 0
0
line 128           "Line HASSYAMP     500.0 to PALOVRDE     500.0 Circuit 1"
1.000
 line     15090     15021   "1 "  1 0
0
line 129           "Line HASSYAMP     500.0 to PALOVRDE     500.0 Circuit 2"
1.000
 line     15090     15021   "2 "  1 0
0
line 130           "Line HASSYAMP     500.0 to PALOVRDE     500.0 Circuit 3"
1.000
 line     15090     15021   "3 "  1 0
0
line 131           "Line HASSYAMP     500.0 to PINAL_W      500.0 Circuit 1"
1.000
 line     15090     15088   "1 "  1 0
```

```
0
line 132          "Line HASSYAMP     500.0 to JOJOBA       500.0 Circuit 1"
1.000
 line     15090     15089   "1 "  1 0
0
line 133          "Line HASSYAMP     500.0 to ARLINTON     500.0 Circuit 1"
1.000
 line     15090     15092   "1 "  1 0
0
line 134          "Line HASSYAMP     500.0 to HARQUAHA     500.0 Circuit 1"
1.000
 line     15090     15093   "1 "  1 0
0
line 135          "Line HASSYAMP     500.0 to MESQUITE     500.0 Circuit 1"
1.000
 line     15090     15094   "1 "  1 0
0
line 136          "Line HASSYAMP     500.0 to N.GILA       500.0 Circuit 2"
1.000
 line     15090     22536   "2 "  1 0
0
line 137          "Line BONNEYTP     115.0 to BONNYBRK     115.0 Circuit 1"
1.000
 line     15103     14352   "1 "  1 0
0
line 138          "Line BONNEYTP     115.0 to COOLIDGE     115.0 Circuit 1"
1.000
 line     15103     19044   "1 "  1 0
0
line 139          "Line ELLISON      115.0 to 843E2.7N     115.0 Circuit 1"
1.000
 line     15105     15133   "1 "  1 0
0
line 140          "Line FRAZIER      115.0 to MOONSHIN     115.0 Circuit 1"
1.000
 line     15106     15115   "1 "  1 0
0
line 141          "Line FRAZIER      115.0 to ROOSEVLT     115.0 Circuit 1"
1.000
 line     15106     15134   "1 "  1 0
0
line 142          "Line GOLDFELD     115.0 to HORSMESA     115.0 Circuit 1"
1.000
 line     15107     15109   "1 "  1 0
0
line 143          "Line HAYDENAZ     115.0 to KEARNYTP     115.0 Circuit 1"
1.000
 line     15108     15112   "1 "  1 0
 shunt "HAYDENAZ 115.00" "b " 1 0
0
line 144          "Line HORSMESA     115.0 to MRMNFLAT     115.0 Circuit 1"
1.000
 line     15109     15117   "1 "  1 0
0
line 145          "Line KEARNYTP     115.0 to MORRISAZ     115.0 Circuit 1"
1.000
 line     15112     15116   "1 "  1 0
 shunt "HAYDENAZ 115.00" "b " 1 0
0
line 146          "Line KNOLL        115.0 to MORRISAZ     115.0 Circuit 1"
1.000
 line     15113     15116   "1 "  1 0
0
line 147          "Line MIAMI        115.0 to PINAL        115.0 Circuit 1"
1.000
 line     15114     15119   "1 "  1 0
0
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line 148          "Line MIAMI        115.0 to PINTOVLY     115.0 Circuit 1"
1.000
 line     15114     15121   "1 "  1 0
0
line 149          "Line MIAMI        115.0 to 843E2.7N     115.0 Circuit 1"
1.000
 line     15114     15133   "1 "  1 0
0
line 150          "Line MOONSHIN     115.0 to PINAL        115.0 Circuit 1"
1.000
 line     15115     15119   "1 "  1 0
0
line 151          "Line MOONSHIN     115.0 to 842E2.7N     115.0 Circuit 1"
1.000
 line     15115     15132   "1 "  1 0
0
line 152          "Line OAKFLAT      115.0 to SILVERT1     115.0 Circuit 1"
1.000
 line     15118     15126   "1 "  1 0
0
line 153          "Line PINAL        115.0 to SILVERT1     115.0 Circuit 1"
1.000
 line     15119     15126   "1 "  1 0
0
line 154          "Line RAY          115.0 to KNOLL        115.0 Circuit 1"
1.000
 line     15122     15113   "1 "  1 0
0
line 155          "Line RAY          115.0 to SUPERIOR     115.0 Circuit 1"
1.000
 line     15122     15129   "1 "  1 0
0
line 156          "Line REFINERY     115.0 to 842E2.7N     115.0 Circuit 1"
1.000
 line     15123     15132   "1 "  1 0
0
line 157          "Line SILVERK1     115.0 to SILVERT1     115.0 Circuit 1"
1.000
 line     15124     15126   "1 "  1 0
0
line 158          "Line SILVERK2     115.0 to SUPERIOR     115.0 Circuit 1"
1.000
 line     15125     15129   "1 "  1 0
0
line 159          "Line SPURLOCK     115.0 to SUPERIOR     115.0 Circuit 1"
1.000
 line     15127     15129   "1 "  1 0
0
line 160          "Line 842E2.7N     115.0 to 843E2.7N     115.0 Circuit 1"
1.000
 line     15132     15133   "1 "  1 0
0
line 161          "Line SNYDHLAZ     115.0 to SNYDHILL     115.0 Circuit 1"
1.000
 line     15181     19214   "1 "  1 0
0
line 162          "Line AGUAFRIA     230.0 to WESTWNGW     230.0 Circuit 1"
1.000
 line     15201     14231   "1 "  1 0
0
line 163          "Line AGUAFRIA     230.0 to ALEXANDR     230.0 Circuit 1"
1.000
 line     15201     15202   "1 "  1 0
0
line 164          "Line AGUAFRIA     230.0 to WHITETNK     230.0 Circuit 1"
1.000
 line     15201     15218   "1 "  1 0
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0
line 165          "Line ANDERSON     230.0 to KYR-NEW      230.0 Circuit 1"
1.000
 line     15203     14236   "1 "  1 0
0
line 166          "Line BRANDOW      230.0 to KYRENE       230.0 Circuit 1"
1.000
 line     15204     15207   "1 "  1 0
0
line 167          "Line BRANDOW      230.0 to PAPAGOBT     230.0 Circuit 1"
1.000
 line     15204     15209   "1 "  1 0
0
line 168          "Line BRANDOW      230.0 to WARD         230.0 Circuit 1"
1.000
 line     15204     15217   "1 "  1 0
0
line 169          "Line BRANDOW      230.0 to WARD         230.0 Circuit 2"
1.000
 line     15204     15217   "2 "  1 0
0
line 170          "Line CORBELL      230.0 to KYRENE       230.0 Circuit 1"
1.000
 line     15205     15207   "1 "  1 0
0
line 171          "Line KYRENE       230.0 to KYR-NEW      230.0 Circuit 1"
1.000
 line     15207     14236   "1 "  1 0
0
line 172          "Line KYRENE       230.0 to SCHRADER     230.0 Circuit 1"
1.000
 line     15207     15214   "1 "  1 0
0
line 173          "Line ORME         230.0 to ANDERSON     230.0 Circuit 1"
1.000
 line     15208     15203   "1 "  1 0
0
line 174          "Line ORME         230.0 to ANDERSON     230.0 Circuit 2"
1.000
 line     15208     15203   "2 "  1 0
0
line 175          "Line ORME         230.0 to RUDD         230.0 Circuit 1"
1.000
 line     15208     15230   "1 "  1 0
0
line 176          "Line ORME         230.0 to RUDD         230.0 Circuit 2"
1.000
 line     15208     15230   "2 "  1 0
0
line 177          "Line PAPAGOBT     230.0 to KYR-NEW      230.0 Circuit 1"
1.000
 line     15209     14236   "1 "  1 0
0
line 178          "Line PAPAGOBT     230.0 to PINPKSRP     230.0 Circuit 1"
1.000
 line     15209     15211   "1 "  1 0
0
line 179          "Line PINPKSRP     230.0 to BRANDOW      230.0 Circuit 1"
1.000
 line     15211     15204   "1 "  1 0
0
line 180          "Line PINPKSRP     230.0 to BRANDOW      230.0 Circuit 2"
1.000
 line     15211     15204   "2 "  1 0
0
line 181          "Line ROGERS       230.0 to THUNDRST     230.0 Circuit 1"
1.000
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 line     15212     15216   "1 "  1 0
0
line 182          "Line ROGERS       230.0 to ROGSWAPA     230.0 Circuit 1"
1.000
 line     15212     19502   "1 "  1 0
0
line 183          "Line ROGERS       230.0 to ROGSWAPA     230.0 Circuit 2"
1.000
 line     15212     19502   "2 "  1 0
0
line 184          "Line SANTAN       230.0 to CORBELL      230.0 Circuit 1"
1.000
 line     15213     15205   "1 "  1 0
0
line 185          "Line SANTAN       230.0 to THUNDRST     230.0 Circuit 1"
1.000
 line     15213     15216   "1 "  1 0
0
line 186          "Line SCHRADER     230.0 to SANTAN       230.0 Circuit 1"
1.000
 line     15214     15213   "1 "  1 0
0
line 187          "Line SILVERKG     230.0 to GOLDFELD     230.0 Circuit 1"
1.000
 line     15215     15206   "1 "  1 0
0
line 188          "Line THUNDRST     230.0 to GOLDFELD     230.0 Circuit 1"
1.000
 line     15216     15206   "1 "  1 0
0
line 189          "Line THUNDRST     230.0 to GOLDFELD     230.0 Circuit 2"
1.000
 line     15216     15206   "2 "  1 0
0
line 190          "Line KNOX         230.0 to SNTAROSA     230.0 Circuit 1"
1.000
 line     15219     14226   "1 "  1 0
0
line 191          "Line BROWNING     230.0 to RANDOLPH     230.0 Circuit 1"
1.000
 line     15222     15240   "1 "  1 0
0
line 192          "Line ABEL         230.0 to SCHRADER     230.0 Circuit 1"
1.000
 line     15224     15214   "1 "  1 0
0
line 193          "Line ABEL         230.0 to DINOSAUR     230.0 Circuit 1"
1.000
 line     15224     15223   "1 "  1 0
0
line 194          "Line ABEL         230.0 to RS-24        230.0 Circuit 1"
1.000
 line     15224     15225   "1 "  1 0
0
line 195          "Line RUDD         230.0 to PLMVLY       230.0 Circuit 1"
1.000
 line     15230     14252   "1 "  1 0
0
line 196          "Line RUDD         230.0 to WHITETNK     230.0 Circuit 1"
1.000
 line     15230     15218   "1 "  1 0
0
line 197          "Line PINAL_C      230.0 to DBG          230.0 Circuit 1"
1.000
 line     15231     15235   "1 "  1 0
0
line_198          "Line PINAL_C      230.0 to RANDOLPH     230.0 Circuit 1"
```

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1.000
 line     15231     15240   "1 "  1 0
0
line 199          "Line COPPERVR     230.0 to FRISCO       230.0 Circuit 1"
1.000
 line     16901     16902   "1 "  1 0
0
line 200          "Line PD-MORNC     230.0 to FRISCO       230.0 Circuit 1"
1.000
 line     16903     16902   "1 "  1 0
0
line 201          "Line HENDRSON     230.0 to MEAD N       230.0 Circuit 1"
1.000
 line     18006     19011   "1 "  1 0
0
line 202          "Line BC TAP       230.0 to MEAD N       230.0 Circuit 1"
1.000
 line     18055     19011   "1 "  1 0
0
line 203          "Line H ALLEN      500.0 to MEAD         500.0 Circuit 1"
1.000
 line     18450     19038   "1 "  1 0
0
line 204          "Line EQUEST N     500.0 to MEAD         500.0 Circuit 1"
1.000
 line     18455     19038   "1 "  1 0
0
line 205          "Line MEAD N       230.0 to ARDEN        230.0 Circuit 1"
1.000
 line     19011     18004   "1 "  1 0
0
line 206          "Line MEAD N       230.0 to EASTSIDE     230.0 Circuit 1"
1.000
 line     19011     18016   "1 "  1 0
0
line 207          "Line MEAD N       230.0 to NEWPORT      230.0 Circuit 1"
1.000
 line     19011     18021   "1 "  1 0
0
line 208          "Line MEAD N       230.0 to EQUEST       230.0 Circuit 2"
1.000
 line     19011     18600   "2 "  1 0
0
line 209          "Line MEAD N       230.0 to SINATRA      230.0 Circuit 1"
1.000
 line     19011     18618   "1 "  1 0
0
line 210          "Line MEAD N       230.0 to HVRA3A4      230.0 Circuit 1"
1.000
 line     19011     19043   "1 "  1 0
0
#line_211          "Line MEAD S       230.0 to PAHRUMP      230.0 Circuit 1"
1.000
# line     19012     18023   "1 "  1 0
#0
line 212          "Line MEAD S       230.0 to EQUEST       230.0 Circuit 1"
1.000
 line     19012     18600   "1 "  1 0
0
line 213          "Line MEAD S       230.0 to GREENWAY     230.0 Circuit 1"
1.000
 line     19012     18674   "1 "  1 0
0
line 214          "Line MEAD S       230.0 to DIAMOND      230.0 Circuit 1"
1.000
 line     19012     18915   "1 "  1 0
0
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line 215          "Line MEAD S       230.0 to DIAMOND      230.0 Circuit 2"
1.000
 line     19012     18915   "2 "  1 0
0
line 216          "Line MEAD S       230.0 to MEAD N       230.0 Circuit 1"
1.000
 line     19012     19011   "1 "  1 0
0
line 217          "Line MEAD S       230.0 to ELDORDO      230.0 Circuit 1"
1.000
 line     19012     24041   "1 "  1 0
0
line 218          "Line MEAD S       230.0 to ELDORDO      230.0 Circuit 2"
1.000
 line     19012     24041   "2 "  1 0
0
line 219          "Line MEAD S       230.0 to MCCULLGH     230.0 Circuit 1"
1.000
 line     19012     26046   "1 "  1 0
0
line 220          "Line MEAD S       230.0 to MCCULLGH     230.0 Circuit 2"
1.000
 line     19012     26046   "2 "  1 0
0
line 221          "Line BLYTHE       161.0 to BUCKBLVD     161.0 Circuit 1"
1.000
 line     19020     19101   "1 "  1 0
0
line 222          "Line BLYTHE       161.0 to GLT TAP      161.0 Circuit 1"
1.000
 line     19020     19105   "1 "  1 0
0
line 223          "Line BLYTHE       161.0 to HEADGATE     161.0 Circuit 1"
1.000
 line     19020     19206   "1 "  1 0
0
line 224          "Line BLYTHE       161.0 to BLYTHEAZ     161.0 Circuit 1"
1.000
 line     19020     19603   "1 "  1 0
0
line 225          "Line BLYTHE       161.0 to NILAND       161.0 Circuit 1"
1.000
 line     19020     21047   "1 "  1 0
0
line 226          "Line BLYTHE       161.0 to BLYTHESC     161.0 Circuit 1"
1.000
 line     19020     24017   "1 "  1 0
0
line 227          "Line DAVIS        230.0 to MEAD N       230.0 Circuit 1"
1.000
 line     19022     19011   "1 "  1 0
0
line 228          "Line DAVIS        230.0 to LONGTIN      230.0 Circuit 1"
1.000
 line     19022     19224   "1 "  1 0
0
line 229          "Line DAVIS        230.0 to TOPOCK       230.0 Circuit 2"
1.000
 line     19022     19320   "2 "  1 0
0
line 230          "Line DAVIS        230.0 to MCCULLGH     230.0 Circuit 1"
1.000
 line     19022     26046   "1 "  1 0
0
line 231          "Line HOVRA5A6     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19029     19012   "1 "  1 0
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0
line 232          "Line HOVRA7-9     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19030     19012   "1 "  1 0
0
line 233          "Line MEAD         500.0 to WESTWING     500.0 Circuit 1"
1.000
 line     19038     14005   "1 "  1 0
0
#line_234          "Line MEAD         500.0 to PERKINS      500.0 Circuit 1"
1.000
# line     19038     15034   "1 "  1 0
#0
line 235          "Line MEAD         500.0 to MARKETPL     500.0 Circuit 1"
1.000
 line     19038     26044   "1 "  1 0
0
line 236          "Line PARKER       161.0 to BLYTHE       161.0 Circuit 1"
1.000
 line     19041     19020   "1 "  1 0
0
line 237          "Line PARKER       161.0 to BOUSE        161.0 Circuit 1"
1.000
 line     19041     19046   "1 "  1 0
0
line 238          "Line PARKER       161.0 to HEADGATE     161.0 Circuit 1"
1.000
 line     19041     19206   "1 "  1 0
0
line 239          "Line PARKER       161.0 to PARKERAZ     161.0 Circuit 1"
1.000
 line     19041     19602   "1 "  1 0
0
line 240          "Line PARKER       230.0 to EAGLEYE      230.0 Circuit 1"
1.000
 line     19042     14209   "1 "  1 0
0
line 241          "Line PARKER       230.0 to BLK MESA     230.0 Circuit 1"
1.000
 line     19042     19019   "1 "  1 0
0
line 242          "Line PARKER       230.0 to HAVASU       230.0 Circuit 1"
1.000
 line     19042     19075   "1 "  1 0
0
line 243          "Line PARKER       230.0 to HARCUVAR     230.0 Circuit 1"
1.000
 line     19042     19204   "1 "  1 0
0
line 244          "Line PARKER       230.0 to GENE         230.0 Circuit 1"
1.000
 line     19042     25402   "1 "  1 0
0
line 245          "Line COOLIDGE     115.0 to VLYFARMS     115.0 Circuit 1"
1.000
 line     19044     14359   "1 "  1 0
 shunt "VLYFARMS  69.00" "b1" 1 .1440
0
line 246          "Line COOLIDGE     115.0 to ED-2         115.0 Circuit 1"
1.000
 line     19044     19065   "1 "  1 0
0
line 247          "Line COOLIDGE     115.0 to SIGNAL       115.0 Circuit 1"
1.000
 line     19044     19066   "1 "  1 0
0
line_248          "Line COOLIDGE     115.0 to COOLDGAZ     115.0 Circuit 1"
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1.000
 line     19044     19600   "1 "  1 0
0
line 249          "Line COOLIDGE     230.0 to SUN ARIZ     230.0 Circuit 1"
1.000
 line     19045     19410   "1 "  1 0
0
line 250          "Line COOLIDGE     230.0 to SUN ARIZ     230.0 Circuit 2"
1.000
 line     19045     19410   "2 "  1 0
0
line 251          "Line BOUSE        161.0 to KOFA         161.0 Circuit 1"
1.000
 line     19046     19100   "1 "  1 0
0
line 252          "Line BOUSE        161.0 to BOUSE AZ     161.0 Circuit 1"
1.000
 line     19046     19601   "1 "  1 0
0
line 253          "Line DEL BAC      115.0 to NOGALES      115.0 Circuit 1"
1.000
 line     19047     19221   "1 "  1 0
0
line 254          "Line EMPIRE       115.0 to CASAGRND     115.0 Circuit 1"
1.000
 line     19048     19222   "1 "  1 0
0
line 255          "Line GILA         161.0 to KNOB         161.0 Circuit 1"
1.000
 line     19050     19051   "1 "  1 0
0
line 256          "Line GILA         161.0 to DOME TAP     161.0 Circuit 1"
1.000
 line     19050     19070   "1 "  1 0
0
line 257          "Line KNOB         161.0 to PILOTKNB     161.0 Circuit 1"
1.000
 line     19051     21059   "1 "  1 0
0
line 258          "Line LIBERTY      230.0 to WESTWNGW     230.0 Circuit 1"
1.000
 line     19052     14231   "1 "  1 0
0
line 259          "Line LIBERTY      230.0 to TS4          230.0 Circuit 1"
1.000
 line     19052     14258   "1 "  1 0
0
line 260          "Line LIBERTY      230.0 to LONE BUT     230.0 Circuit 1"
1.000
 line     19052     19055   "1 "  1 0
0
line 261          "Line LIBERTY      230.0 to PHXWAPA      230.0 Circuit 1"
1.000
 line     19052     19061   "1 "  1 0
0
line 262          "Line LIBERTY      345.0 to PEACOCK      345.0 Circuit 1"
1.000
 line     19053     19315   "1 "  1 0
0
line 263          "Line LONE BUT     230.0 to TESTTRAK     230.0 Circuit 1"
1.000
 line     19055     19068   "1 "  1 0
0
line 264          "Line LONE BUT     230.0 to SUN ARIZ     230.0 Circuit 1"
1.000
 line     19055     19410   "1 "  1 0
0
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line 265          "Line MCCONICO     230.0 to DAVIS        230.0 Circuit 1"
1.000
 line     19056     19022   "1 "  1 0
0
line 266          "Line MCCONICO     230.0 to GRIFFITH     230.0 Circuit 1"
1.000
 line     19056     19310   "1 "  1 0
0
line 267          "Line MCCONICO     230.0 to HARRIS       230.0 Circuit 1"
1.000
 line     19056     19651   "1 "  1 0
0
line 268          "Line ORACLE       115.0 to ORACLEAZ     115.0 Circuit 1"
1.000
 line     19057     19652   "1 "  1 0
0
line 269          "Line ADAMS TP     115.0 to NOGALES      115.0 Circuit 1"
1.000
 line     19060     19221   "1 "  1 0
0
line 270          "Line PHXWAPA      230.0 to LONE BUT     230.0 Circuit 1"
1.000
 line     19061     19055   "1 "  1 0
0
line 271          "Line PINPK        230.0 to PINPKSRP     230.0 Circuit 1"
1.000
 line     19062     15211   "1 "  1 0
0
line 272          "Line PINPK        230.0 to PINPKSRP     230.0 Circuit 2"
1.000
 line     19062     15211   "2 "  1 0
0
line 273          "Line WLTNMOHK     161.0 to GILA         161.0 Circuit 1"
1.000
 line     19063     19050   "1 "  1 0
0
line 274          "Line WLTNMOHK     161.0 to DOME TAP     161.0 Circuit 1"
1.000
 line     19063     19070   "1 "  1 0
0
line 275          "Line TUCSON       115.0 to DEL BAC      115.0 Circuit 1"
1.000
 line     19064     19047   "1 "  1 0
0
line 276          "Line TUCSON       115.0 to ORACLE       115.0 Circuit 1"
1.000
 line     19064     19057   "1 "  1 0
0
line 277          "Line ED-2         115.0 to SIGNAL       115.0 Circuit 1"
1.000
 line     19065     19066   "1 "  1 0
0
line 278          "Line ED-2         115.0 to ED-4         115.0 Circuit 1"
1.000
 line     19065     19071   "1 "  1 0
0
line 279          "Line ED-2         115.0 to BRADY        115.0 Circuit 1"
1.000
 line     19065     19202   "1 "  1 0
0
line 280          "Line ED-5         115.0 to ED-5B        115.0 Circuit 1"
1.000
 line     19067     19069   "1 "  1 0
0
line 281          "Line TESTTRAK     230.0 to CASAGRND     230.0 Circuit 1"
1.000
 line     19068     19218   "1 "  1 0
```



```
0
line 282          "Line ED-5B        115.0 to EMPIRE       115.0 Circuit 1"
1.000
 line     19069     19048   "1 "  1 0
0
line 283          "Line ED-4         115.0 to ED-5         115.0 Circuit 1"
1.000
 line     19071     19067   "1 "  1 0
0
line 284          "Line HILLTOP      230.0 to MCCONICO     230.0 Circuit 1"
1.000
 line     19072     19056   "1 "  1 0
0
line 285          "Line N.HAVASU     230.0 to PARKER       230.0 Circuit 1"
1.000
 line     19074     19042   "1 "  1 0
0
line 286          "Line N.HAVASU     230.0 to TOPOCK       230.0 Circuit 1"
1.000
 line     19074     19320   "1 "  1 0
0
line 287          "Line HOVRN7N8     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19079     19012   "1 "  1 0
0
line 288          "Line HOVRN5N6     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19080     19012   "1 "  1 0
0
line 289          "Line HOVRN3N4     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19081     19012   "1 "  1 0
0
line 290          "Line HOVRN1N2     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19082     19012   "1 "  1 0
0
line 291          "Line HOVRA1A2     230.0 to MEAD S       230.0 Circuit 1"
1.000
 line     19083     19012   "1 "  1 0
0
line 292          "Line KOFA         161.0 to DOME TAP     161.0 Circuit 1"
1.000
 line     19100     19070   "1 "  1 0
0
line 293          "Line GLT TAP      161.0 to KNOB         161.0 Circuit 1"
1.000
 line     19105     19051   "1 "  1 0
0
line 294          "Line PRSCOTWA     230.0 to PRESCOTT     230.0 Circuit 1"
1.000
 line     19106     14222   "1 "  1 0
0
line 295          "Line PRSCOTWA     230.0 to RNDVLYTP     230.0 Circuit 1"
1.000
 line     19106     19501   "1 "  1 0
0
line 296          "Line GAVLINWA     230.0 to GAVILNPK     230.0 Circuit 1"
1.000
 line     19107     14243   "1 "  1 0
0
line 297          "Line GAVLINWA     230.0 to PINPK        230.0 Circuit 1"
1.000
 line     19107     19062   "1 "  1 0
0
line 298          "Line GAVLINWA     230.0 to PRSCOTWA     230.0 Circuit 1"
1.000
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 line     19107     19106   "1 "  1 0
0
line 299          "Line RACEWYWA     230.0 to WESTWNGE     230.0 Circuit 1"
1.000
 line     19115     14259   "1 "  1 0
0
line 300          "Line SLRC         230.0 to GILA         230.0 Circuit 1"
1.000
 line     19120     19124   "1 "  1 0
0
line 301          "Line SLRC         230.0 to GILA         230.0 Circuit 2"
1.000
 line     19120     19124   "2 "  1 0
0
line 302          "Line GILA         230.0 to NGL-E        230.0 Circuit 1"
1.000
 line     19124     19125   "1 "  1 0
0
line 303          "Line GILA         230.0 to NGL-W        230.0 Circuit 1"
1.000
 line     19124     19126   "1 "  1 0
0
line 304          "Line BLACKMTN     115.0 to BLKMTNAZ     115.0 Circuit 1"
1.000
 line     19201     15182   "1 "  1 0
0
line 305          "Line BLACKMTN     115.0 to DEL BAC      115.0 Circuit 1"
1.000
 line     19201     19047   "1 "  1 0
0
line 306          "Line BLACKMTN     115.0 to SNYDHILL     115.0 Circuit 1"
1.000
 line     19201     19214   "1 "  1 0
0
line 307          "Line BRADY        115.0 to BRADYAZ      115.0 Circuit 1"
1.000
 line     19202     15174   "1 "  1 0
0
line 308          "Line BRADY        115.0 to PICACHOW     115.0 Circuit 1"
1.000
 line     19202     19209   "1 "  1 0
0
line 309          "Line BRAWLEY      115.0 to BRAWLYAZ     115.0 Circuit 1"
1.000
 line     19203     15179   "1 "  1 0
0
line 310          "Line BRAWLEY      115.0 to SANXAVER     115.0 Circuit 1"
1.000
 line     19203     19213   "1 "  1 0
0
line 311          "Line HARCUVAR     230.0 to HARCU AZ     230.0 Circuit 1"
1.000
 line     19204     15172   "1 "  1 0
0
line 312          "Line HARCUVAR     230.0 to HASSYTAP     230.0 Circuit 1"
1.000
 line     19204     19500   "1 "  1 0
0
line 313          "Line N.WADDEL     230.0 to RACEWYWA     230.0 Circuit 1"
1.000
 line     19208     19115   "1 "  1 0
0
line 314          "Line PICACHOW     115.0 to PICACHAZ     115.0 Circuit 1"
1.000
 line     19209     15175   "1 "  1 0
0
line_315          "Line PICACHOW     115.0 to RED ROCK     115.0 Circuit 1"
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1.000
 line     19209     19211   "1 "  1 0
0
line 316          "Line RATTLSNK     115.0 to TUCSON       115.0 Circuit 1"
1.000
 line     19210     19064   "1 "  1 0
0
line 317          "Line RATTLSNK     115.0 to TWINPEAK     115.0 Circuit 1"
1.000
 line     19210     19216   "1 "  1 0
0
line 318          "Line RED ROCK     115.0 to SAG.EAST     115.0 Circuit 1"
1.000
 line     19211     14356   "1 "  1 0
0
line 319          "Line RED ROCK     115.0 to REDRCKAZ     115.0 Circuit 1"
1.000
 line     19211     15176   "1 "  1 0
0
line 320          "Line SANDARIO     115.0 to BRAWLEY      115.0 Circuit 1"
1.000
 line     19212     19203   "1 "  1 0
0
line 321          "Line SANDARIO     115.0 to SANDARAZ     115.0 Circuit 1"
1.000
 line     19212     15178   "1 "  1 0
0
line 322          "Line SANXAVER     115.0 to SANXAVAZ     115.0 Circuit 1"
1.000
 line     19213     15180   "1 "  1 0
0
line 323          "Line SANXAVER     115.0 to SNYDHILL     115.0 Circuit 1"
1.000
 line     19213     19214   "1 "  1 0
0
line 324          "Line SPKHILTP     230.0 to COOLIDGE     230.0 Circuit 1"
1.000
 line     19215     19045   "1 "  1 0
0
line 325          "Line TWINPEAK     115.0 to TWINPKAZ     115.0 Circuit 1"
1.000
 line     19216     15177   "1 "  1 0
0
line 326          "Line TWINPEAK     115.0 to SANDARIO     115.0 Circuit 1"
1.000
 line     19216     19212   "1 "  1 0
0
line 327          "Line LONGTIN      230.0 to TOPOCK       230.0 Circuit 1"
1.000
 line     19224     19320   "1 "  1 0
0
line 328          "Line GRIFFITH     230.0 to PEACOCK      230.0 Circuit 1"
1.000
 line     19310     19314   "1 "  1 0
0
line 329          "Line PEACOCK      230.0 to HILLTOP      230.0 Circuit 1"
1.000
 line     19314     19072   "1 "  1 0
0
line 330          "Line PEACOCK      345.0 to MEAD         345.0 Circuit 1"
1.000
 line     19315     19037   "1 "  1 0
0
line 331          "Line TOPOCK       230.0 to BLK MESA     230.0 Circuit 1"
1.000
 line     19320     19019   "1 "  1 0
0
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line 332          "Line TOPOCK       230.0 to SOPOINT      230.0 Circuit 1"
1.000
 line     19320     19316   "1 "  1 0
0
line 333          "Line TOPOCK       230.0 to SOPOINT      230.0 Circuit 2"
1.000
 line     19320     19316   "2 "  1 0
0
line 334          "Line SUN ARIZ     230.0 to PINAL_C      230.0 Circuit 1"
1.000
 line     19410     15231   "1 "  1 0
0
line 335          "Line HASSYTAP     230.0 to HASSY AZ     230.0 Circuit 1"
1.000
 line     19500     15173   "1 "  1 0
0
line 336          "Line HASSYTAP     230.0 to LIBERTY      230.0 Circuit 1"
1.000
 line     19500     19052   "1 "  1 0
0
line 337          "Line RNDVLYTP     230.0 to ROUNDVLY     230.0 Circuit 1"
1.000
 line     19501     14223   "1 "  1 0
0
line 338          "Line RNDVLYTP     230.0 to PEACOCK      230.0 Circuit 1"
1.000
 line     19501     19314   "1 "  1 0
0
line 339          "Line ROGSWAPA     230.0 to PINPK        230.0 Circuit 1"
1.000
 line     19502     19062   "1 "  1 0
0
line 340          "Line ROGSWAPA     230.0 to PINPK        230.0 Circuit 2"
1.000
 line     19502     19062   "2 "  1 0
0
line 341          "Line ROGSWAPA     230.0 to SPKHILTP     230.0 Circuit 1"
1.000
 line     19502     19215   "1 "  1 0
0
line 342          "Line TURLY_S      115.0 to BLANCO       115.0 Circuit 1"
1.000
 line     19573     19574   "1 "  1 0
0
line 343          "Line GALLEGOS     115.0 to BERGIN       115.0 Circuit 1"
1.000
 line     19700     19702   "1 "  1 0
0
line 344          "Line ANIMAS       115.0 to SULLIVAN     115.0 Circuit 1"
1.000
 line     19701     19712   "1 "  1 0
0
line 345          "Line ANIMAS       115.0 to BLUFVIEW     115.0 Circuit 1"
1.000
 line     19701     19720   "1 "  1 0
0
line 346          "Line BERGIN       115.0 to LAKEVIEW     115.0 Circuit 1"
1.000
 line     19702     19721   "1 "  1 0
0
line 347          "Line BERGIN       115.0 to WESTFORK     115.0 Circuit 1"
1.000
 line     19702     19724   "1 "  1 0
0
line 348          "Line FOOTHILS     115.0 to HOODMESA     115.0 Circuit 1"
1.000
 line     19703     19707   "1 "  1 0
```



```
0
line 349          "Line FOOTHILS     115.0 to LAKEVIEW     115.0 Circuit 1"
1.000
 line     19703     19721   "1 "  1 0
0
line 350          "Line FRUITAP      115.0 to FRUITLND     115.0 Circuit 1"
1.000
 line     19704     19705   "1 "  1 0
0
line 351          "Line FRUITAP      115.0 to HOODMESA     115.0 Circuit 1"
1.000
 line     19704     19707   "1 "  1 0
0
line 352          "Line GLADETAP     115.0 to LAPLATA      115.0 Circuit 1"
1.000
 line     19706     19708   "1 "  1 0
0
line 353          "Line GLADETAP     115.0 to BLKGLADS     115.0 Circuit 1"
1.000
 line     19706     72774   "1 "  1 0
0
line 354          "Line GLADETAP     115.0 to ELPASOTP     115.0 Circuit 1"
1.000
 line     19706     79260   "1 "  1 0
0
line 355          "Line NAVAJO       115.0 to SAN JUAN     115.0 Circuit 1"
1.000
 line     19710     19711   "1 "  1 0
0
line 356          "Line BLUFVIEW     115.0 to MESA FM      115.0 Circuit 1"
1.000
 line     19720     19709   "1 "  1 0
0
line 357          "Line COLLTAP      115.0 to HOODMESA     115.0 Circuit 1"
1.000
 line     19722     19707   "1 "  1 0
0
line 358          "Line COLLTAP      115.0 to SULLIVAN     115.0 Circuit 1"
1.000
 line     19722     19712   "1 "  1 0
0
line 359          "Line COLLTAP      115.0 to COLLEG       115.0 Circuit 1"
1.000
 line     19722     19723   "1 "  1 0
0
line 360          "Line HARE         115.0 to TURLY_S      115.0 Circuit 1"
1.000
 line     19725     19573   "1 "  1 0
0
line 361          "Line HARE         115.0 to WESTFORK     115.0 Circuit 1"
1.000
 line     19725     19724   "1 "  1 0
0
line 362          "Line HARE         115.0 to MILAGR       115.0 Circuit 1"
1.000
 line     19725     19726   "1 "  1 0
0
line 363          "Line HARE         115.0 to ENRON        115.0 Circuit 1"
1.000
 line     19725     19731   "1 "  1 0
0
line 364          "Line HARTCYN      115.0 to GLADETAP     115.0 Circuit 1"
1.000
 line     19727     19706   "1 "  1 0
0
line 365          "Line HARTCYN      115.0 to H-H          115.0 Circuit 1"
1.000
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 line     19727     19728   "1 "  1 0
0
line 366          "Line H-H          115.0 to HARE        115.0 Circuit 1"
1.000
 line     19728     19725   "1 "  1 0
0
line 367          "Line WESTLOOP     115.0 to HOGBAK      115.0 Circuit 1"
1.000
 line     19729     19572   "1 "  1 0
0
line 368          "Line WESTLOOP     115.0 to GLADETAP    115.0 Circuit 1"
1.000
 line     19729     19706   "1 "  1 0
0
line 369          "Line WESTLOOP     115.0 to HOODMESA    115.0 Circuit 1"
1.000
 line     19729     19707   "1 "  1 0
0
line 370          "Line WESTLOOP     115.0 to MESA FM     115.0 Circuit 1"
1.000
 line     19729     19709   "1 "  1 0
0
line 371          "Line WESTLOOP     115.0 to PRAXAR      115.0 Circuit 1"
1.000
 line     19729     19730   "1 "  1 0
0
line 372          "Line A-R          115.0 to TURLY_S     115.0 Circuit 1"
1.000
 line     19732     19573   "1 "  1 0
0
line 373          "Line A-R          115.0 to SAN JUAN    115.0 Circuit 1"
1.000
 line     19732     19711   "1 "  1 0
0
line 374          "Line CAMINO       230.0 to MEAD S      230.0 Circuit E"
1.000
 line     24019     19012   "E "  1 0
0
line 375          "Line CAMINO       230.0 to MEAD S      230.0 Circuit W"
1.000
 line     24019     19012   "W "  1 0
0
line 376          "Line FOURCORN     345.0 to PINTO PS    345.0 Circuit 1"
1.000
 line     14101     66235   "1 "  1 0
0
line 377          "Line SIGURDPS     230.0 to GLENCANY    230.0 Circuit 1"
1.000
 line     66355     79031   "1 "  1 0
0
line 378          "Line FLAGSTAF     345.0 to GLENCANY    345.0 Circuit 1"
1.000
 line     79024     79032   "1 "  1 0
0
line 379          "Line FLAGSTAF     345.0 to GLENCANY    345.0 Circuit 2"
1.000
 line     79024     79032   "2 "  1 0
0
line 380          "Line FLAGSTAF     345.0 to PINPKBRB    345.0 Circuit 1"
1.000
 line     79024     79053   "1 "  1 0
0
line 381          "Line FLAGSTAF     345.0 to PINPKBRB    345.0 Circuit 2"
1.000
 line     79024     79053   "2 "  1 0
0
line_382          "Line GLEN PS      230.0 to NAVAJO      230.0 Circuit 1"
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1.000
 line     79028     79093   "1 "  1 0
0
line 383          "Line KAYENTA      230.0 to SHIPROCK    230.0 Circuit 1"
1.000
 line     79043     79063   "1 "  1 0
0
line 384          "Line KAYENTA      230.0 to LNGHOUSE    230.0 Circuit 1"
1.000
 line     79043     79096   "1 "  1 0
0
line 385          "Line SHIPROCK     115.0 to FRUITAP     115.0 Circuit 1"
1.000
 line     79062     19704   "1 "  1 0
0
line 386          "Line SHIPROCK     115.0 to PRAXAR      115.0 Circuit 1"
1.000
 line     79062     19730   "1 "  1 0
0
line 387          "Line SHIPROCK     230.0 to BLKGLADE    230.0 Circuit 1"
1.000
 line     79063     72770   "1 "  1 0
0
line 388          "Line SHIPROCK     345.0 to SAN_JUAN    345.0 Circuit 1"
1.000
 line     79064     10292   "1 "  1 0
0
line 389          "Line SHIPROCK     345.0 to FOURCORN    345.0 Circuit 1"
1.000
 line     79064     14101   "1 "  1 0
0
line 390          "Line NAVAJO       230.0 to LNGHOUSE    230.0 Circuit 1"
1.000
 line     79093     79096   "1 "  1 0
0
line 391          "Line ABEL         230.0 to RANDOLPH    230.0 Circuit 1"
1.000
 line     15224     15240   "1 "  1 0
0
line 392          "Line LIBERTY      230.0 to LIBTYPHS    230.0 Circuit 1"
1.000
 line     19052     19054   "1 "  1 0
 line     19053     19315   "1 "  1 0
 line     19053     19315   "1 "  2 0
0
line 393          "Line PINAL_C      500.0 to TORTOLIT    500.0 Circuit 1"
1.000
 line     15080     16000   "1 "  1 0
0
line 394          "Line SAGUARO      500.0 to TORTLIT2    500.0 Circuit 1"
1.000
 line     14004     16001   "1 "  1 0
0
line 395          "Line SAGUARO      500.0 to TORTOLIT    500.0 Circuit 1"
1.000
 line     14004     16000   "1 "  1 0
0
line 396          "Line SAGUARO      500.0 to TORTOLIT    500.0 Circuit 2"
1.000
 line     14004     16000   "2 "  1 0
0
line 398          "Line GREENLEE     345.0 to COPPERVR    345.0 Circuit 1"
1.000
 line     16101     16900   "1 "  1 0
0
line 399          "Line GREENLEE     345.0 to WILLOW      345.0 Circuit 1"
1.000
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 line     16101     16112   "1 "  1 0
0
line 400          "Line GREENLEE     345.0 to WINCHSTR     345.0 Circuit 1"
1.000
 line     16101     16109   "1 "  1 0
0
line 401          "Line HIDALGO      345.0 to GREENLEE     345.0 Circuit 1"
1.000
 line     11080     16101   "1 "  1 0
0
line 402          "Line MCKINLEY     345.0 to SPRINGR      345.0 Circuit 1"
1.000
 line     16102     16104   "1 "  1 0
0
line 403          "Line MCKINLEY     345.0 to SPRINGR      345.0 Circuit 2"
1.000
 line     16102     16104   "2 "  1 0
0
#line_404          "Line PINALWES     345.0 to 3PTS345      345.0 Circuit 1"
1.000
# line     16114     16126   "1 "  1 0
#0
line 405          "Line PINALWES     345.0 to SOUTH        345.0 Circuit 1"
1.000
 line     16114     16103   "1 "  1 0
0
line 406          "Line SAN_JUAN     345.0 to MCKINLEY     345.0 Circuit 1"
1.000
 line     10292     16102   "1 "  1 0
0
line 407          "Line SAN_JUAN     345.0 to MCKINLEY     345.0 Circuit 2"
1.000
 line     10292     16102   "2 "  1 0
0
line 408          "Line SOUTH        345.0 to GATEWAY      345.0 Circuit 1"
1.000
 line     16103     16108   "1 "  1 0
0
line 409          "Line SOUTH        345.0 to GATEWAY      345.0 Circuit 2"
1.000
 line     16103     16108   "2 "  1 0
0
line 410          "Line SPRINGR      345.0 to CORONADO     345.0 Circuit 1"
1.000
 line     16104     16100   "1 "  1 0
0
line 411          "Line SPRINGR      345.0 to GREENLEE     345.0 Circuit 1"
1.000
 line     16104     16101   "1 "  1 0
0
line 412          "Line SPRINGR      345.0 to LUNA         345.0 Circuit 1"
1.000
 line     16104     11093   "1 "  1 0
0
line 413          "Line SPRINGR      345.0 to VAIL2        345.0 Circuit 1"
1.000
 line     16104     16106   "1 "  1 0
0
line 414          "Line TORTOLIT     345.0 to NLOOP345     345.0 Circuit 1"
1.000
 line     16115     16124   "1 "  1 0
0
line 415          "Line VAIL         345.0 to SOUTH        345.0 Circuit 1"
1.000
 line     16105     16103   "1 "  1 0
0
line_416          "Line WESTWING     345.0 to PINALWES     345.0 Circuit 1"
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1.000
 line     16107     16114   "1 "  1 0
0
line 417          "Line WILLOW       345.0 to BOWIE        345.0 Circuit 1"
1.000
 line     16112     16111   "1 "  1 0
0
line 418          "Line WILLOW       345.0 to BOWIE        345.0 Circuit 2"
1.000
 line     16112     16111   "2 "  1 0
0
line 419          "Line WINCHSTR     345.0 to VAIL         345.0 Circuit 1"
1.000
 line     16109     16105   "1 "  1 0
 shunt "NEWTUCSN 230.00" "b2" 1 .0720
 shunt "KARTCHNR  69.00" "b2" 1 .1440
0
line 420          "Line WINCHSTR     345.0 to WILLOW       345.0 Circuit 1"
1.000
 line     16109     16112   "1 "  1 0
0
line 421          "Line CANEZ        138.0 to SONOITA      138.0 Circuit 1"
1.000
 line     16721     16722   "1 "  1 0
0
line 422          "Line CIENEGA      138.0 to S.TRAIL      138.0 Circuit 1"
1.000
 line     16243     16213   "1 "  1 0
0
line 423          "Line CORONA       138.0 to IRVNGTN      138.0 Circuit 1"
1.000
 line     16238     16204   "1 "  1 0
0
line 424          "Line CORONA       138.0 to SOUTH        138.0 Circuit 1"
1.000
 line     16238     16216   "1 "  1 0
0
line 425          "Line CRYCROFT     138.0 to NE.LOOP      138.0 Circuit 1"
1.000
 line     16239     16208   "1 "  1 0
0
line 426          "Line DELCERRO     138.0 to WESTINA      138.0 Circuit 1"
1.000
 line     16229     16221   "1 "  1 0
0
line 427          "Line DMP          138.0 to ANKLAM       138.0 Circuit 1"
1.000
 line     16200     16253   "1 "  1 0
0
line 428          "Line DMP          138.0 to NL. EXP      138.0 Circuit 1"
1.000
 line     16200     16999   "1 "  1 0
0
line 429          "Line DMP          138.0 to N. LOOP      138.0 Circuit 1"
1.000
 line     16200     16207   "1 "  1 0
0
line 430          "Line DMP          138.0 to NE.LOOP      138.0 Circuit 1"
1.000
 line     16200     16208   "1 "  1 0
0
line 431          "Line DMP          138.0 to SN.CRUZ      138.0 Circuit 1"
1.000
 line     16200     16214   "1 "  1 0
0
line 432          "Line DMP          138.0 to TUCSON       138.0 Circuit 1"
1.000
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 line     16200     16218   "1 "  1 0
0
line 433          "Line DREXEL       138.0 to IRVNGTN      138.0 Circuit 1"
1.000
 line     16201     16204   "1 "  1 0
0
line 434          "Line DREXEL       138.0 to MIDVALE      138.0 Circuit 1"
1.000
 line     16201     16206   "1 "  1 0
0
line 435          "Line E. LOOP      138.0 to HARRISON     138.0 Circuit 1"
1.000
 line     16202     16247   "1 "  1 0
0
line 436          "Line E. LOOP      138.0 to NE.LOOP      138.0 Circuit 1"
1.000
 line     16202     16208   "1 "  1 0
0
line 437          "Line E. LOOP      138.0 to PANTANO      138.0 Circuit 1"
1.000
 line     16202     16224   "1 "  1 0
0
line 438          "Line E. LOOP      138.0 to ROBERTS      138.0 Circuit 1"
1.000
 line     16202     16211   "1 "  1 0
0
line 439          "Line GATEWAY      138.0 to VALNCIA      138.0 Circuit 1"
1.000
 line     16724     16723   "1 "  1 0
0
line 440          "Line GREENVLY     138.0 to CANOARCH     138.0 Circuit 1"
1.000
 line     16232     16227   "1 "  1 0
0
line 441          "Line HARTT        138.0 to GREENVLY     138.0 Circuit 1"
1.000
 line     16242     16232   "1 "  1 0
0
line 442          "Line IRVNGTN      138.0 to KINO         138.0 Circuit 1"
1.000
 line     16204     16246   "1 "  1 0
0
line 443          "Line IRV_RING     138.0 to SOUTH        138.0 Circuit 1"
1.000
 line     16261     16216   "1 "  1 0
0
line 444          "Line IRVNGTN      138.0 to TECHPARK     138.0 Circuit 1"
1.000
 line     16204     16233   "1 "  1 0
0
line 445          "Line IRVNGTN      138.0 to TUCSON       138.0 Circuit 1"
1.000
 line     16204     16218   "1 "  1 0
0
line 446          "Line IRVNGTN      138.0 to VAIL         138.0 Circuit 2"
1.000
 line     16204     16220   "2 "  1 0
0
line 447          "Line KANTOR       138.0 to CANEZ        138.0 Circuit 1"
1.000
 line     16720     16721   "1 "  1 0
0
line 448          "Line KANTOR       138.0 to TUBAC        138.0 Circuit 1"
1.000
 line     16720     16725   "1 "  1 0
0
line_449          "Line LOSREALS     138.0 to VAIL         138.0 Circuit 1"
```



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1.000
 line     16223     16220   "1 "  1 0
0
line 450          "Line MIDVALE      138.0 to RAYTHEON     138.0 Circuit 1"
1.000
 line     16206     16257   "1 "  1 0
0
line 451          "Line MIDVALE      138.0 to SPNCER       138.0 Circuit 1"
1.000
 line     16206     16235   "1 "  1 0
0
line 452          "Line N. LOOP      138.0 to NL. EXP      138.0 Circuit 1"
1.000
 line     16207     16999   "1 "  1 0
0
line 453          "Line NL. EXP      138.0 to MARANA       138.0 Circuit 1"
1.000
 line     16999     16244   "1 "  1 0
0
line 454          "Line N. LOOP      138.0 to RANVISTO     138.0 Circuit 1"
1.000
 line     16207     16209   "1 "  1 0
0
line 455          "Line NL. EXP      138.0 to RILLITO      138.0 Circuit 1"
1.000
 line     16999     16210   "1 "  1 0
0
line 456          "Line NL. EXP      138.0 to WESTINA      138.0 Circuit 1"
1.000
 line     16999     16221   "1 "  1 0
0
line 457          "Line NE.LOOP      138.0 to NELP_SVC     138.0 Circuit 1"
1.000
 line     16208     16298   "1 "  1 0
0
line 458          "Line NE.LOOP      138.0 to RILLITO      138.0 Circuit 1"
1.000
 line     16208     16210   "1 "  1 0
0
line 459          "Line NOGALES      138.0 to KANTOR       138.0 Circuit 1"
1.000
 line     16719     16720   "1 "  1 0
0
line 460          "Line ORNGROVE     138.0 to EASTINA      138.0 Circuit 1"
1.000
 line     16251     16254   "1 "  1 0
0
line 461          "Line ORNGROVE     138.0 to LACANADA     138.0 Circuit 1"
1.000
 line     16251     16205   "1 "  1 0
0
line 462          "Line ORNGROVE     138.0 to RILLITO      138.0 Circuit 1"
1.000
 line     16251     16210   "1 "  1 0
0
line 463          "Line PANTANO      138.0 to LOSREALS     138.0 Circuit 1"
1.000
 line     16224     16223   "1 "  1 0
0
line 464          "Line RANVISTO     138.0 to LACANADA     138.0 Circuit 1"
1.000
 line     16209     16205   "1 "  1 0
0
line 465          "Line RANVISTO     138.0 to NARANJA      138.0 Circuit 1"
1.000
 line     16209     16245   "1 "  1 0
0
```

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line 466          "Line RANVISTO     138.0 to CATALINA     138.0 Circuit 1"
1.000
 line     16209     16226   "1 "  1 0
0
line 467          "Line RAYTHEON     138.0 to MEDINA       138.0 Circuit 1"
1.000
 line     16257     16255   "1 "  1 0
0
line 468          "Line RBWILMOT     138.0 to IRVNGTN      138.0 Circuit 1"
1.000
 line     16222     16204   "1 "  1 0
0
line 469          "Line RBWILMOT     138.0 to VAIL         138.0 Circuit 1"
1.000
 line     16222     16220   "1 "  1 0
0
line 470          "Line RILLITO      138.0 to LACANADA     138.0 Circuit 1"
1.000
 line     16210     16205   "1 "  1 0
0
line 471          "Line ROBERTS      138.0 to HARRISON     138.0 Circuit 1"
1.000
 line     16211     16247   "1 "  1 0
0
line 472          "Line S.TRAIL      138.0 to ROBERTS      138.0 Circuit 1"
1.000
 line     16213     16211   "1 "  1 0
0
line 473          "Line SN.CRUZ      138.0 to ANKLAM       138.0 Circuit 1"
1.000
 line     16214     16253   "1 "  1 0
0
line 474          "Line SN.CRUZ      138.0 to IRVNGTN      138.0 Circuit 1"
1.000
 line     16214     16204   "1 "  1 0
0
line 475          "Line SNYDER       138.0 to CRYCROFT     138.0 Circuit 1"
1.000
 line     16215     16239   "1 "  1 0
0
line 476          "Line SNYDER       138.0 to E. LOOP      138.0 Circuit 1"
1.000
 line     16215     16202   "1 "  1 0
0
line 477          "Line SNYDER       138.0 to NE.LOOP      138.0 Circuit 1"
1.000
 line     16215     16208   "1 "  1 0
0
line 478          "Line SONOITA      138.0 to VALNCIA      138.0 Circuit 1"
1.000
 line     16722     16723   "1 "  1 0
0
line 479          "Line SOUTH        138.0 to ASARCO       138.0 Circuit 1"
1.000
 line     16216     16225   "1 "  1 0
0
line 480          "Line SOUTH        138.0 to CYPRUS       138.0 Circuit 1"
1.000
 line     16216     16228   "1 "  1 0
0
line 481          "Line SOUTH        138.0 to GREENVLY     138.0 Circuit 1"
1.000
 line     16216     16232   "1 "  1 0
0
line 482          "Line SOUTH        138.0 to HARTT        138.0 Circuit 1"
1.000
 line     16216     16242   "1 "  1 0
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```
0
line 483          "Line SOUTH        138.0 to MEDINA       138.0 Circuit 1"
1.000
 line     16216     16255   "1 "  1 0
0
line 484          "Line SOUTH        138.0 to MIDVALE      138.0 Circuit 1"
1.000
 line     16216     16206   "1 "  1 0
0
line 485          "Line SOUTH        138.0 to RAYTHEON     138.0 Circuit 1"
1.000
 line     16216     16257   "1 "  1 0
0
line 486          "Line SOUTH        138.0 to SPNCER       138.0 Circuit 1"
1.000
 line     16216     16235   "1 "  1 0
0
line 487          "Line SPNCER       138.0 to MEDINA       138.0 Circuit 1"
1.000
 line     16235     16255   "1 "  1 0
0
line 488          "Line TECHPARK     138.0 to VAIL         138.0 Circuit 1"
1.000
 line     16233     16220   "1 "  1 0
0
line 489          "Line TORTOLIT     138.0 to MARANA       138.0 Circuit 1"
1.000
 line     16217     16244   "1 "  1 0
0
line 490          "Line TORTOLIT     138.0 to N. LOOP      138.0 Circuit 4"
1.000
 line     16217     16207   "4 "  1 0
0
line 491          "Line TORTOLIT     138.0 to NL. EXP      138.0 Circuit 4"
1.000
 line     16217     16999   "4 "  1 0
0
line 492          "Line TORTOLIT     138.0 to NL. EXP      138.0 Circuit 3"
1.000
 line     16217     16999   "3 "  1 0
0
line 493          "Line TORTOLIT     138.0 to NL. EXP      138.0 Circuit 2"
1.000
 line     16217     16999   "2 "  1 0
0
line 494          "Line TORTOLIT     138.0 to NL. EXP      138.0 Circuit 1"
1.000
 line     16217     16999   "1 "  1 0
0
line 495          "Line TORTOLIT     138.0 to N. LOOP      138.0 Circuit 3"
1.000
 line     16217     16207   "3 "  1 0
0
line 496          "Line TORTOLIT     138.0 to RANVISTO     138.0 Circuit 1"
1.000
 line     16217     16209   "1 "  1 0
0
line 497          "Line TUBAC        138.0 to CANEZ        138.0 Circuit 1"
1.000
 line     16725     16721   "1 "  1 0
0
line 498          "Line TUCSON       138.0 to DELCERRO     138.0 Circuit 1"
1.000
 line     16218     16229   "1 "  1 0
0
line 499          "Line TUCSON       138.0 to KINO         138.0 Circuit 1"
1.000
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 line     16218     16246   "1 "  1 0
0
line 500          "Line TWNTYSEC     138.0 to E. LOOP      138.0 Circuit 1"
1.000
 line     16219     16202   "1 "  1 0
0
line 501          "Line TWNTYSEC     138.0 to IRVNGTN      138.0 Circuit 1"
1.000
 line     16219     16204   "1 "  1 0
0
line 502          "Line UA MED       138.0 to KINO         138.0 Circuit 1"
1.000
 line     16256     16246   "1 "  1 0
0
line 503          "Line UA MED       138.0 to TUCSON       138.0 Circuit 1"
1.000
 line     16256     16218   "1 "  1 0
0
line 504          "Line VAIL         138.0 to CIENEGA      138.0 Circuit 1"
1.000
 line     16220     16243   "1 "  1 0
0
line 505          "Line VAIL         138.0 to FT.HUACH     138.0 Circuit 1"
1.000
 line     16220     16230   "1 "  1 0
0
line 506          "Line VAIL         138.0 to NOGALES      138.0 Circuit 1"
1.000
 line     16220     16719   "1 "  1 0
0
line 507          "Line VAIL         138.0 to S.TRAIL      138.0 Circuit 1"
1.000
 line     16220     16213   "1 "  1 0
0
line 508          "Line BLACKMTN     115.0 to SPNCER       115.0 Circuit 1"
1.000
 line     19201     16414   "1 "  1 0
0
line 509          "Line ROSEMONT     138.0 to GRTRVL       138.0 Circuit 1"
1.000
 line     16920     16259   "1 "  1 0
0
line 510          "Line SANRIT_S     138.0 to GREENVLY     138.0 Circuit 1"
1.000
 line     16258     16232   "1 "  1 0
0
line 511          "Line SANRIT_S     138.0 to HARTT        138.0 Circuit 1"
1.000
 line     16258     16242   "1 "  1 0
0
line 512          "Line SANRIT_S     138.0 to ROSEMONT     138.0 Circuit 1"
1.000
 line     16258     16920   "1 "  1 0
 line     16258     16920   "1 "  2 0
0
line 513          "Line SOUTH        138.0 to SANRIT_S     138.0 Circuit 1"
1.000
 line     16216     16258   "1 "  1 0
0
line 514          "Line TORTOLIT     138.0 to NARANJA      138.0 Circuit 1"
1.000
 line     16217     16245   "1 "  1 0
0
line 515          "Line SOUTH        138.0 to CLEAR        138.0 Circuit 1"
1.000
 line     16216     16260   "1 "  1 0
0
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line 516          "Line CANOARCH     138.0 to CLEAR        138.0 Circuit 1"
1.000
 line     16227     16260   "1 "  1 0
0
line 517          "Line CYPRUS       138.0 to CLEAR        138.0 Circuit 1"
1.000
 line     16228     16260   "1 "  1 0
0
line 518          "Line KANTOR       115.0 to CANEZ        115.0 Circuit 1"
1.000
 line     16700     16701   "1 "  1 0
0
line 519          "Line CANEZ        115.0 to SONOITA      115.0 Circuit 1"
1.000
 line     16701     16702   "1 "  1 0
0
line 520          "Line SONOITA      115.0 to VALNCIA      115.0 Circuit 1"
1.000
 line     16702     16703   "1 "  1 0
0
line 521          "Line GATEWAY      115.0 to VALNCIA      115.0 Circuit 1"
1.000
 line     16704     16703   "1 "  1 0
0
line 522          "Line NOGALES      115.0 to KANTOR       115.0 Circuit 1"
1.000
 line     19221     16700   "1 "  1 0
0
line 523          "Line SAG.EAST     115.0 to MARANATP     115.0 Circuit 1"
1.000
 line     14356     17013   "1 "  1 0
0
line 524          "Line APACHE       230.0 to BUTERFLD     230.0 Circuit 1"
1.000
 line     17002     17007   "1 "  1 0
 shunt "NEWTUCSN 230.00" "b1" 1 .1440
 shunt "NEWTUCSN 230.00" "b2" 1 .0720
 shunt "KARTCHNR  69.00" "b1" 1 .1800
 shunt "KARTCHNR  69.00" "b2" 1 .1440
0
line 525          "Line APACHE       230.0 to RED TAIL     230.0 Circuit 1"
1.000
 line     17002     17018   "1 "  1 0
 shunt "RED TAIL 230.00" "b " 1 .1280
 0
line 526          "Line APACHE       230.0 to WINCHSTR     230.0 Circuit 1"
1.000
 line     17002     17105   "1 "  1 0
0
line 527          "Line BICKNELL     115.0 to THREEPNT     115.0 Circuit 1"
1.000
 line     17006     17022   "1 "  1 0
0
line 528          "Line BUTERFLD     230.0 to SAN RAF      230.0 Circuit 1"
1.000
 line     17007     17020   "1 "  1 0
0
line 529          "Line DOSCONDO     230.0 to HACKBERY     230.0 Circuit 1"
1.000
 line     17008     17044   "1 "  1 0
0
line 530          "Line PANTANO      115.0 to KARTCHNR     115.0 Circuit 1"
1.000
 line     17015     17039   "1 "  1 0
0
line 531          "Line PANTANO      230.0 to NEWTUCSN     230.0 Circuit 1"
1.000
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 line     17016     17676   "1 "  1 0
0
line 532          "Line THREEPNT     115.0 to VALEN-SW     115.0 Circuit 1"
1.000
 line     17022     17023   "1 "  1 0
0
line 533          "Line APACHE       115.0 to SNM1         115.0 Circuit 1"
1.000
 line     17001     17037   "1 "  1 0
0
line 534          "Line AVRA         115.0 to SNDARIO      115.0 Circuit 1"
1.000
 line     17003     17089   "1 "  1 0
0
line 535          "Line BUTERFLD     230.0 to PANTANO      230.0 Circuit 1"
1.000
 line     17007     17016   "1 "  1 0
0
line 537          "Line MARANA       115.0 to AVRA         115.0 Circuit 1"
1.000
 line     17012     17003   "1 "  1 0
 shunt "AVRA     115.00" "b1" 1 .1890
0
line 538          "Line MARANATP     115.0 to MARANA       115.0 Circuit 1"
1.000
 line     17013     17012   "1 "  1 0
 shunt "AVRA     115.00" "b1" 1 .1890
 shunt "AVRA     115.00" "b2" 1 .1890
0
line 539          "Line MORENCI      230.0 to PD-MORNC     230.0 Circuit 1"
1.000
 line     17014     16903   "1 "  1 0
0
line 540          "Line MORENCI      230.0 to GREEN-SW     230.0 Circuit 1"
1.000
 line     17014     17009   "1 "  1 0
0
line 541          "Line RED TAIL     230.0 to DOSCONDO     230.0 Circuit 1"
1.000
 line     17018     17008   "1 "  1 0
0
line 542          "Line THREEPNT     115.0 to SNDARIO      115.0 Circuit 1"
1.000
 line     17022     17089   "1 "  1 0
0
line 543          "Line SNM1         115.0 to SNMANUEL     115.0 Circuit 1"
1.000
 line     17037     14358   "1 "  1 0
0
line 544          "Line SNM1         115.0 to HAYDENAZ     115.0 Circuit 1"
1.000
 line     17037     15108   "1 "  1 0
0
line 545          "Line HACKBERY     230.0 to MORENCI      230.0 Circuit 1"
1.000
 line     17044     17014   "1 "  1 0
0
line 546          "Line SAHUARIT     230.0 to BICKNELL     230.0 Circuit 1"
1.000
 line     17102     17004   "1 "  1 0
0
line 547          "Line S.BRKRCH     115.0 to SNMANUEL     115.0 Circuit 1"
1.000
 line     17608     14358   "1 "  1 0
0
line 548          "Line NEWTUCSN     230.0 to SAHUARIT     230.0 Circuit 1"
1.000
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 line     17676     17102   "1 "  1 0
0
line 550          "Line BICKNELL     345.0 to VAIL         345.0 Circuit 1"
1.000
 line     17005     16105   "1 "  1 0
0
line 552          "Line MARANATP     115.0 to RATTLSNK     115.0 Circuit 1"
1.000
 line     17013     19210   "1 "  1 0
0
line 553          "Line DAVIS        230.0 to RIVIERA      230.0 Circuit 1"
1.000
 line     19022     17087   "1 "  1 0
0
line 554          "Line ORACLE       115.0 to S.BRKRCH     115.0 Circuit 1"
1.000
 line     19057     17608   "1 "  1 0
0
line 555          "Line ADAMS TP     115.0 to APACHE       115.0 Circuit 1"
1.000
 line     19060     17001   "1 "  1 0
0
line 556          "Line BROWNING     230.0 to SANTAN       230.0 Circuit 1"
1.000
 line     15222     15213   "1 "  1 0
0
line 557          "Line KYRENE       500.0 to BROWNING     500.0 Circuit 1"
1.000
 line     15011     15051   "1 "  1 0
0
#line_558          "Line PERK PS2     500.0 to PERKINPS     500.0 Circuit 1"
1.000
# line     15032     15033   "1 "  1 0
#0
#line_559          "Line PERKINPS     500.0 to PERK PS1     500.0 Circuit 1"
1.000
# line     15033     15031   "1 "  1 0
#0
#line_560          "Line PERKINS      500.0 to PERKINPS     500.0 Circuit 1"
1.000
# line     15034     15033   "1 "  1 0
#0
line 561          "Line BROWNING     500.0 to SILVERKG     500.0 Circuit 1"
1.000
 line     15051     15041   "1 "  1 0
0
line 562          "Line PINAL_C      500.0 to DUKE         500.0 Circuit 1"
1.000
 line     15080     15087   "1 "  1 0
0
line 563          "Line PINAL_W      500.0 to DUKE         500.0 Circuit 1"
1.000
 line     15088     15087   "1 "  1 0
0
line 564          "Line HASSYAMP     500.0 to MESQUIT2     500.0 Circuit 2"
1.000
 line     15090     15091   "2 "  1 0
0
line 565          "Line ASARCOSR     115.0 to ASARCOTP     115.0 Circuit 1"
1.000
 line     15101     15102   "1 "  1 0
0
line 566          "Line ASARCOTP     115.0 to HAYDENAZ     115.0 Circuit 1"
1.000
 line     15102     15108   "1 "  1 0
0
line_567          "Line ASARCOTP     115.0 to CRUSHER      115.0 Circuit 1"
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1.000
 line     15102     15138   "1 "  1 0
0
line 568          "Line BONNEYTP     115.0 to CRUSHER      115.0 Circuit 1"
1.000
 line     15103     15138   "1 "  1 0
0
line 569          "Line CARLOTA      115.0 to PINTOVLY     115.0 Circuit 1"
1.000
 line     15104     15121   "1 "  1 0
0
line 570          "Line CARLOTA      115.0 to SILVERK2     115.0 Circuit 1"
1.000
 line     15104     15125   "1 "  1 0
0
line 571          "Line FRAZIER      115.0 to HORSMESA     115.0 Circuit 1"
1.000
 line     15106     15109   "1 "  1 0
0
line 572          "Line GOLDFELD     115.0 to 461E5.1N     115.0 Circuit 1"
1.000
 line     15107     15139   "1 "  1 0
0
line 573          "Line GASCLEAN     115.0 to 843E2.7N     115.0 Circuit 1"
1.000
 line     15110     15133   "1 "  1 0
0
line 574          "Line KEARNY       115.0 to KEARNYTP     115.0 Circuit 1"
1.000
 line     15111     15112   "1 "  1 0
0
line 575          "Line MIAMI        115.0 to MIAMI  3     115.0 Circuit 1"
1.000
 line     15114     15137   "1 "  1 0
0
line 576          "Line OAKFLAT      115.0 to TRASK        115.0 Circuit 1"
1.000
 line     15118     15131   "1 "  1 0
0
line 577          "Line SILVERK2     115.0 to PINTOVLY     115.0 Circuit 1"
1.000
 line     15125     15121   "1 "  1 0
0
line 578          "Line SUPERIOR     115.0 to TRASK        115.0 Circuit 1"
1.000
 line     15129     15131   "1 "  1 0
0
line 579          "Line CARREL       115.0 to GOLDFELD     115.0 Circuit 1"
1.000
 line     15130     15107   "1 "  1 0
0
line 580          "Line CARREL       115.0 to SPURLOCK     115.0 Circuit 1"
1.000
 line     15130     15127   "1 "  1 0
0
line 581          "Line MIAMI  4     115.0 to 843E2.7N     115.0 Circuit 1"
1.000
 line     15135     15133   "1 "  1 0
0
line 582          "Line MIAMI  3     115.0 to PINAL        115.0 Circuit 1"
1.000
 line     15137     15119   "1 "  1 0
0
line 583          "Line MIAMI  3     115.0 to MIAMI  4     115.0 Circuit 1"
1.000
 line     15137     15135   "1 "  1 0
0
```



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line 584          "Line 461E5.1N     115.0 to MRMNFLAT     115.0 Circuit 1"
1.000
 line     15139     15117   "1 "  1 0
0
line 585          "Line 461E5.1N     115.0 to STEWMTN1     115.0 Circuit 1"
1.000
 line     15139     15128   "1 "  1 0
0
line 586          "Line MESQUITE     230.0 to MESQUI S     230.0 Circuit 1"
1.000
 line     15163     15156   "1 "  1 0
0
line 587          "Line MESQUITE     230.0 to MESQUI S     230.0 Circuit 2"
1.000
 line     15163     15156   "2 "  1 0
0
line 588          "Line SANTAN       230.0 to RS-24        230.0 Circuit 1"
1.000
 line     15213     15225   "1 "  1 0
0
line 589          "Line SCHRADER     230.0 to RS-24        230.0 Circuit 1"
1.000
 line     15214     15225   "1 "  1 0
0
line 590          "Line BROWNING     230.0 to DINOSAUR     230.0 Circuit 1"
1.000
 line     15222     15223   "1 "  1 0
0
line 591          "Line ABEL         230.0 to RS-24        230.0 Circuit 2"
1.000
 line     15224     15225   "2 "  1 0
0
line 592          "Line LIBERTY      230.0 to RUDD         230.0 Circuit 1"
1.000
 line     19052     15230   "1 "  1 0
0
line 593          "Line HASSYAMP     500.0 to HDWSH        500.0 Circuit 1"
1.000
 line     15090     14013   "1 "  1 0
0
line 594          "Line Q043B1       500.0 to HDWSH        500.0 Circuit 1"
1.000
 line     94350     14013   "1 "  1 0
0
line 595          "Line Q043B2       500.0 to HDWSH        500.0 Circuit 1"
1.000
 line     94360     14013   "1 "  1 0
0
line 596          "Line Q044         230.0 to GILARIVR     230.0 Circuit 1"
1.000
 line     94410     14238   "1 "  1 0
0
line 597          "Line PRESCOTT     115.0 to BAGCAP       115.0 Circuit 1"
1.000
 line     14355     14361   "1 "  1 0
0
line 598          "Line BAGCAP       115.0 to BAGDAD       115.0 Circuit 1"
1.000
 line     14361     14351   "1 "  1 0
 tran     14351     85646   "1 "  0    0
 shunt "BAGCAP   115.00" "b1" 1 0
 shunt "BAGCAP   115.00" "b3" 1 0
 load  "BAGDAD   115.00" "AP" 0
 load  "BAGDAD    12.50" "AP" 0
0
line 599          "Line EAGLEYE      230.0 to BUCKEYE2     230.0 Circuit 1"
1.000
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 line     14209     14213   "1 "  1 0
0
line 600          "Line BUCKEYE2     230.0 to LIBERTY      230.0 Circuit 1"
1.000
 line     14213     19052   "1 "  1 0
0
line 601          "Line BOUSE        161.0 to BLACK PK     161.0 Circuit 1"
1.000
 line     19046     14301   "1 "  1 0
0
line 602          "Line TS12         230.0 to SAGUARO      230.0 Circuit 1"
1.000
 line     14277     14225   "1 "  1 0
0
line 603          "Line MILLIGAN     230.0 to TS12         230.0 Circuit 1"
1.000
 line     14271     14277   "1 "  1 0
0
line 604          "Line WILLOW       500.0 to PINAL_C      500.0 Circuit 1"
1.000
 line     16012     15080   "1 "  1 0
0
line 605          "Line WILLOW       500.0 to PINAL_C      500.0 Circuit 2"
1.000
 line     16012     15080   "2 "  1 0
0
line 606          "Line WILLOW       500.0 to SUNZIA S     500.0 Circuit 1"
1.000
 line     16012     16020   "1 "  1 0
0
line 607          "Line WILLOW       500.0 to SUNZIA S     500.0 Circuit 2"
1.000
 line     16012     16020   "2 "  1 0
0
line 608          "Line SUNZIA E     500.0 to SUNZIA S     500.0 Circuit 1"
1.000
 line     16030     16020   "1 "  1 0
0
line 609          "Line SUNZIA E     500.0 to SUNZIA S     500.0 Circuit 2"
1.000
 line     16030     16020   "2 "  1 0
0
tran 610          "Tran GALLEGOS     230.00 to GALLEGOS     115.00 Circuit 1
0.00"   1.000
 tran     10111     19700   "1 "  0       -1
0
tran 611          "Tran SAN_JUAN     230.00 to HOGBAK       115.00 Circuit 1
0.00"   1.000
 tran     10291     19572   "1 "  0       -1
0
tran 612          "Tran WESTWING     500.00 to WESTWNGW     230.00 Circuit
2WESTWG 4      34.50"   1.000
 tran     14005     14231   "2 "  0    14409
0
tran 613          "Tran WESTWING     500.00 to WESTWNGW     230.00 Circuit
3WESTWG10      34.50"   1.000
 tran     14005     14231   "3 "  0    14410
0
tran 614          "Tran WESTWING     500.00 to WESTWNGE     230.00 Circuit
1WESTWG 1      34.50"   1.000
 tran     14005     14259   "1 "  0    14408
 line     14231     14259   "1 "  1 1    /* "Line WESTWNGW     230.0 to
 WESTWNGE     230.0 Circuit 1" */
0
tran 615          "Tran GILARIVR     500.00 to GILARIVR     230.00 Circuit 1
0.00"   1.000
 tran     14007     14238   "1 "  0       -1
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0
tran_616          "Tran PNPKAPS      500.00 to PPAPS W      230.00 Circuit 1PP
W          34.50"   1.000
 tran     14016     14221   "1 "  0    85739
0
tran_617          "Tran PNPKAPS      500.00 to PPAPS E      230.00 Circuit 1PP
E          34.50"   1.000
 tran     14016     14261   "1 "  0    85737
0
tran_618          "Tran PNPKAPS      500.00 to PPAPS N      230.00 Circuit 1PP
N          34.50"   1.000
 tran     14016     14278   "1 "  0    85738
0
tran 619          "Tran N.GILA       500.00 to N.GILA       230.00 Circuit
1N.GIL10T      34.50"   1.000
 tran     22536     14267   "1 "  0    85795
0
tran 620          "Tran PNPKAPS      345.00 to PPAPS C      230.00 Circuit
1PNPK  7T      14.40"   1.000
 tran     14102     14260   "1 "  0    85911
0
tran 621          "Tran PNPKAPS      345.00 to PPAPS E      230.00 Circuit
3PNPK T14      14.40"   1.000
 tran     14102     14261   "3 "  0    14402
0
tran 622          "Tran PNPKAPS      345.00 to PPAPS N      230.00 Circuit
2PNPK  T4      14.40"   1.000
 tran     14102     14278   "2 "  0    14403
0
tran_623          "Tran SAGUARO      230.00 to SAG.EAST     115.00 Circuit
1SAG  10T      12.50"   1.000
 tran     14225     14356   "1 "  0    85915
0
tran_624          "Tran SAGUARO      230.00 to SAG.WEST     115.00 Circuit
1SAG   1T      12.50"   1.000
 tran     14225     14357   "1 "  0    85921
0
tran 625          "Tran KYRENE       500.00 to KYR-NEW      230.00 Circuit
6KYRENE6       34.50"   1.000
 tran     15011     14236   "6 "  0    15013
0
tran 626          "Tran KYRENE       500.00 to KYRENE       230.00 Circuit
7KYRENE7       34.50"   1.000
 tran     15011     15207   "7 "  0    15015
0
tran 627          "Tran KYRENE       500.00 to KYRENE       230.00 Circuit
8KYRENE8       34.50"   1.000
 tran     15011     15207   "8 "  0    15017
0
tran 628          "Tran SILVERKG     500.00 to SILVERKG     230.00 Circuit
1SILVERKG      34.50"   1.000
 tran     15041     15215   "1 "  0    15043
0
tran 629          "Tran BROWNING     500.00 to BROWNING     230.00 Circuit
1BROWNIN1      12.47"   1.000
 tran     15051     15222   "1 "  0    15053
0
tran 630          "Tran BROWNING     500.00 to BROWNING     230.00 Circuit
2BROWNIN2      12.47"   1.000
 tran     15051     15222   "2 "  0    15055
0
tran 631          "Tran RUDD         500.00 to RUDD         230.00 Circuit
1RUDD1         12.47"   1.000
 tran     15061     15230   "1 "  0    15063
0
tran 632          "Tran RUDD         500.00 to RUDD         230.00 Circuit
2RUDD2         12.47"   1.000
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 tran     15061     15230   "2 "  0    15064
0
tran 633          "Tran RUDD         500.00 to RUDD         230.00 Circuit
3RUDD3         12.47"   1.000
 tran     15061     15230   "3 "  0    15066
0
tran 634          "Tran RUDD         500.00 to RUDD         230.00 Circuit 4
0.00"   1.000
 tran     15061     15230   "4 "  0       -1
0
tran 635          "Tran ABEL         500.00 to ABEL         230.00 Circuit 1
0.00"   1.000
 tran     15070     15224   "1 "  0       -1
0
tran 636          "Tran ABEL         500.00 to ABEL         230.00 Circuit 2
0.00"   1.000
 tran     15070     15224   "2 "  0       -1
0
tran 637          "Tran PINAL_C      500.00 to PINAL_C      230.00 Circuit 1
0.00"   1.000
 tran     15080     15231   "1 "  0       -1
0
tran 638          "Tran PINAL_C      500.00 to PINAL_C      230.00 Circuit 2
0.00"   1.000
 tran     15080     15231   "2 "  0       -1
0
tran 639          "Tran MESQUITE     500.00 to MESQUITE     230.00 Circuit 1
0.00"   1.000
 tran     15094     15163   "1 "  0       -1
0
tran 640          "Tran GOLDFELD     230.00 to GOLDFELD     115.00 Circuit 1
0.00"   1.000
 tran     15206     15107   "1 "  0       -1
0
tran 641          "Tran GOLDFELD     230.00 to GOLDFELD     115.00 Circuit 2
0.00"   1.000
 tran     15206     15107   "2 "  0       -1
0
tran 642          "Tran SILVERKG     230.00 to SILVERK1     115.00 Circuit 1
0.00"   1.000
 tran     15215     15124   "1 "  0       -1
0
tran 643          "Tran SILVERKG     230.00 to SILVERK2     115.00 Circuit 1
0.00"   1.000
 tran     15215     15125   "1 "  0       -1
0
tran 644          "Tran COPPERVR     345.00 to COPPERVR     230.00 Circuit 1
0.00"   1.000
 tran     16900     16901   "1 "  0       -1
0
tran 645          "Tran COPPERVR     345.00 to COPPERVR     230.00 Circuit 2
0.00"   1.000
 tran     16900     16901   "2 "  0       -1
0
tran 646          "Tran MEAD S       230.00 to MEAD         287.00 Circuit 1
0.00"   1.000
 tran     19012     26051   "1 "  0       -1
0
tran 647          "Tran MEAD         345.00 to MEAD N       230.00 Circuit 1
0.00"   1.000
 tran     19037     19011   "1 "  0       -1
0
tran 648          "Tran MEAD         500.00 to MEAD N       230.00 Circuit 1
0.00"   1.000
 tran     19038     19011   "1 "  0       -1
0
tran_649          "Tran MEAD         500.00 to MEAD N       230.00 Circuit 2
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0.00"   1.000
 tran     19038     19011   "2 "  0       -1
0
tran 650          "Tran PARKER       161.00 to PARKER       230.00 Circuit 1
0.00"   1.000
 tran     19041     19042   "1 "  0       -1
0
tran 651          "Tran PARKER       161.00 to PARKER       230.00 Circuit 2
0.00"   1.000
 tran     19041     19042   "2 "  0       -1
0
tran 652          "Tran COOLIDGE     230.00 to COOLIDGE     115.00 Circuit 1
0.00"   1.000
 tran     19045     19044   "1 "  0       -1
0
tran 653          "Tran COOLIDGE     230.00 to COOLIDGE     115.00 Circuit 2
0.00"   1.000
 tran     19045     19044   "2 "  0       -1
0
tran 654          "Tran GILA         161.00 to GILA         230.00 Circuit 1
0.00"   1.000
 tran     19050     19124   "1 "  0       -1
0
tran 655          "Tran LIBERTY      345.00 to LIBTYPHS     230.00 Circuit 1
0.00"   1.000
 tran     19053     19054   "1 "  0       -1
 line     19053     19315   "1 "  1 0
 line     19053     19315   "1 "  2 0
0
tran 656          "Tran NGL-E        230.00 to N.GILA       500.00 Circuit 1
0.00"   1.000
 tran     19125     22536   "1 "  0       -1
0
tran 657          "Tran NGL-W        230.00 to N.GILA       500.00 Circuit 1
0.00"   1.000
 tran     19126     22536   "1 "  0       -1
0
tran 658          "Tran CASAGRND     230.00 to CASAGRND     115.00 Circuit 1
0.00"   1.000
 tran     19218     19222   "1 "  0       -1
0
tran 659          "Tran PEACOCK      345.00 to PEACOCK      230.00 Circuit 1
0.00"   1.000
 tran     19315     19314   "1 "  0       -1
0
tran 660          "Tran GLEN PS      230.00 to GLENCANY     230.00 Circuit 1
0.00"   1.000
 tran     79028     79031   "1 "  0       -1
0
tran 661          "Tran GLENCANY     345.00 to GLENCANY     230.00 Circuit 1
0.00"   1.000
 tran     79032     79031   "1 "  0       -1
0
tran 662          "Tran GLENCANY     345.00 to GLENCANY     230.00 Circuit 2
0.00"   1.000
 tran     79032     79031   "2 "  0       -1
0
tran 663          "Tran PINPKBRB     345.00 to PINPK        230.00 Circuit 1
0.00"   1.000
 tran     79053     19062   "1 "  0       -1
0
tran 664          "Tran PINPKBRB     345.00 to PINPK        230.00 Circuit 2
0.00"   1.000
 tran     79053     19062   "2 "  0       -1
0
tran 665          "Tran PINPKBRB     345.00 to PINPK        230.00 Circuit 3
0.00"   1.000
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 tran     79053     19062   "3 "  0       -1
0
tran 666          "Tran SHIP PS      230.00 to SHIPROCK     230.00 Circuit 1
0.00"   1.000
 tran     79061     79063   "1 "  0       -1
0
tran 667          "Tran SHIPROCK     230.00 to SHIPROCK     115.00 Circuit 1
0.00"   1.000
 tran     79063     79062   "1 "  0       -1
0
tran 668          "Tran SHIPROCK     345.00 to SHIPROCK     230.00 Circuit 1
0.00"   1.000
 tran     79064     79063   "1 "  0       -1
0
tran 669          "Tran LIBTYPHS     230.00 to LIBERTY      230.00 Circuit 2
0.00"   1.000
 tran     19054     19052   "2 "  0       -1
0
tran 670          "Tran CORONADO     500.00 to CORONADO     345.00 Circuit 1
0.00"   1.000
 tran     15001     16100   "1 "  0       -1
0
tran 671          "Tran CORONADO     500.00 to CORONADO     345.00 Circuit 2
0.00"   1.000
 tran     15001     16100   "2 "  0       -1
0
tran 672          "Tran PINAL_W      500.00 to PINALWES     345.00 Circuit 1
0.00"   1.000
 tran     15088     16114   "1 "  0       -1
0
tran 673          "Tran TORTOLIT     500.00 to TORTOLIT     345.00 Circuit 1
0.00"   1.000
 tran     16000     16115   "1 "  0       -1
0
tran 674          "Tran WESTWING     500.00 to WESTWING     345.00 Circuit
1WESTWING      34.50"   1.000
 tran     14005     16107   "1 "  0    16637
0
tran 675          "Tran MCKINLEY     345.00 to YAHTAHEY     115.00 Circuit 1
0.00"   1.000
 tran     16102     10382   "1 "  0       -1
0
tran 676          "Tran SOUTH        345.00 to SOUTH        138.00 Circuit
1SOUTH2        13.80"   1.000
 tran     16103     16216   "1 "  0    16627
0
tran 677          "Tran SOUTH        345.00 to SOUTH        138.00 Circuit
2SOUTH2        13.80"   1.000
 tran     16103     16216   "2 "  0    16627
0
tran 678          "Tran VAIL         345.00 to VAIL         138.00 Circuit
1VAIL          13.80"   1.000
 tran     16105     16220   "1 "  0    16630
0
tran 679          "Tran VAIL         345.00 to VAIL         138.00 Circuit
3VAIL          13.80"   1.000
 tran     16105     16220   "3 "  0    16630
0
tran 680          "Tran VAIL2        345.00 to VAIL         138.00 Circuit 1
0.00"   1.000
 tran     16106     16220   "1 "  0       -1
0
tran 681          "Tran VAIL2        345.00 to VAIL         138.00 Circuit 2
0.00"   1.000
 tran     16106     16220   "2 "  0       -1
0
tran_682          "Tran GATEWAY      138.00 to GATEWAY      345.00 Circuit 1
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0.00"   1.000
 tran     16724     16108   "1 "  0       -1
0
tran 683          "Tran IRVMID3      138.00 to IRVNGTN      138.00 Circuit 1
0.00"   1.000
 tran     16333     16204   "1 "  0       -1
0
tran 684          "Tran IRVMID4      138.00 to IRVNGTN      138.00 Circuit 1
0.00"   1.000
 tran     16334     16204   "1 "  0       -1
0
tran 685          "Tran SPNCER       138.00 to SPNCER       115.00 Circuit
1SPNCER        13.80"   1.000
 tran     16235     16414   "1 "  0    16669
0
tran 686          "Tran TORTOLIT     138.00 to SAG.EAST     115.00 Circuit 1
0.00"   1.000
 tran     16217     14356   "1 "  0       -1
0
tran 687          "Tran TORTOLIT     138.00 to SAG.WEST     115.00 Circuit 1
0.00"   1.000
 tran     16217     14357   "1 "  0       -1
0
tran 688          "Tran TORTOLIT     138.00 to TORTLIT2     500.00 Circuit 1
0.00"   1.000
 tran     16217     16001   "1 "  0       -1
0
tran 689          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Circuit 1
0.00"   1.000
 tran     16217     16000   "1 "  0       -1
0
tran 690          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Circuit 2
0.00"   1.000
 tran     16217     16000   "2 "  0       -1
0
tran 691          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Circuit 3
0.00"   1.000
 tran     16217     16000   "3 "  0       -1
0
tran 692          "Tran TORTOLIT     138.00 to TORTOLIT     500.00 Circuit 4
0.00"   1.000
 tran     16217     16000   "4 "  0       -1
0
tran 693          "Tran MCKINLEY     345.00 to YAHTAHEY     115.00 Circuit 2
0.00"   1.000
 tran     16102     10382   "2 "  0       -1
0
tran 694          "Tran APACHE       230.00 to APACHE       115.00 Circuit 1
0.00"   1.000
 tran     17002     17001   "1 "  0       -1
0
tran 695          "Tran APACHE       230.00 to APACHE       115.00 Circuit 2
0.00"   1.000
 tran     17002     17001   "2 "  0       -1
0
tran 696          "Tran BICKNELL     230.00 to BICKNELL     115.00 Circuit 1
0.00"   1.000
 tran     17004     17006   "1 "  0       -1
0
tran 697          "Tran BICKNELL     230.00 to BICKNELL     115.00 Circuit 2
0.00"   1.000
 tran     17004     17006   "2 "  0       -1
0
tran 698          "Tran BICKNELL     345.00 to BICKNELL     230.00 Circuit 1
0.00"   1.000
 tran     17005     17004   "1 "  0       -1
0
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tran 700          "Tran GREEN-SW     345.00 to GREEN-SW     230.00 Circuit 1
0.00"   1.000
 tran     17010     17009   "1 "  0       -1
0
tran 701          "Tran GREEN-SW     345.00 to GREEN-SW     230.00 Circuit 2
0.00"   1.000
 tran     17010     17009   "2 "  0       -1
0
tran 702          "Tran PANTANO      230.00 to PANTANO      115.00 Circuit 1
0.00"   1.000
 tran     17016     17015   "1 "  0       -1
0
tran 703          "Tran WINCHSTR     345.00 to WINCHSTR     230.00 Circuit 1
0.00"   1.000
 tran     16109     17105   "1 "  0       -1
0
#tran_704          "Tran PERKINS      500.00 to PERK PS1     500.00 Circuit 1
0.00"   1.000
# tran     15034     15031   "1 "  0       -1
#0
#tran_705          "Tran PERKINS      500.00 to PERK PS2     500.00 Circuit 1
0.00"   1.000
# tran     15034     15032   "1 "  0       -1
#0
tran 706          "Tran RUDD         500.00 to RUDD         230.00 Circuit
3ARUDD 3a       34.50"   1.000
 tran     15061     15230   "3A"  0    15068
0
tran 707          "Tran DUKE         500.00 to TESTTRAK     230.00 Circuit 1
0.00"   1.000
 tran     15087     19068   "1 "  0       -1
0
tran 708          "Tran DUKE         500.00 to TESTTRAK     230.00 Circuit 2
0.00"   1.000
 tran     15087     19068   "2 "  0       -1
0
tran 709          "Tran MESQUIT2     500.00 to MESQUITE     230.00 Circuit 2
0.00"   1.000
 tran     15091     15163   "2 "  0       -1
0
tran 710          "Tran PRESCOTT     230.00 to PRESCOTT     115.00 Circuit
1PRESCT1T      12.50"   1.000
 tran     14222     14355   "1 "  0    85913
0
tran 711          "Tran PRESCOTT     230.00 to PRESCOTT     115.00 Circuit
2PRESCT2T      12.50"   1.000
 tran     14222     14355   "2 "  0    85914
0
#tran_712          "Tran SNMANUEL     115.00 to SNMANUEL     100.00 Circuit 1
0.00"   1.000
# tran     14358     14550   "1 "  0       -1
#0
tran 713          "Tran FOURCORN     500.00 to FOURCORN     345.00 Circuit 14C
1AA T      13.80"   1.000
 tran     14001     14101   "1 "  0    85903
0
tran 714          "Tran FOURCORN     345.00 to FOURCORN     230.00 Circuit
1FOURCN4T      14.40"   1.000
 tran     14101     14211   "1 "  0    85909
0
tran 715          "Tran FOURCORN     345.00 to FOURCORN     230.00 Circuit
2FOURCN8T      14.40"   1.000
 tran     14101     14211   "2 "  0    85910
0
tran 716          "Tran CHOLLA       500.00 to CHOLLA       345.00 Circuit
1CHOLLA3T      34.50"   1.000
 tran     14000     14100   "1 "  0    85901
```



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0
tran 717          "Tran CHOLLA       500.00 to CHOLLA       345.00 Circuit
2CHOLLA6T      34.50"   1.000
 tran     14000     14100   "2 "  0    85902
0
tran 718          "Tran CHOLLA       345.00 to CHOLLA       230.00 Circuit
1CHOLLA7T      12.50"   1.000
 tran     14100     14204   "1 "  0    85908
0
tran 719          "Tran MORGAN       500.00 to RACEWAY      230.00 Circuit
1MOR1          34.50"   1.000
 tran     14011     14246   "1 "  0    85740
0
tran 720          "Tran MORGAN       500.00 to RACEWAY      230.00 Circuit
2MOR2          34.50"   1.000
 tran     14011     14246   "2 "  0    85741
0
tran 721          "Tran YAVAPAI      500.00 to YAVAPAI      230.00 Circuit
1YAVAP 1T      12.47"   1.000
 tran     14006     14234   "1 "  0    85906
0
tran 722          "Tran YAVAPAI      500.00 to YAVAPAI      230.00 Circuit
2YAVAP 3T      12.47"   1.000
 tran     14006     14234   "2 "  0    85907
0
tran 723          "Tran SAGUARO      500.00 to SAG.EAST     115.00 Circuit
1SAGUAR7T      34.50"   1.000
 tran     14004     14356   "1 "  0    85904
0
tran 724          "Tran SAGUARO      500.00 to SAG.WEST     115.00 Circuit
1SAGUAR4T      34.50"   1.000
 tran     14004     14357   "1 "  0    85905
0
tran 725          "Tran SNVLY        500.00 to SNVLY        230.00 Circuit
1SNVLYT1T      12.47"   1.000
 tran     14010     14265   "1 "  0    85988
0
tran 726          "Tran SNVLY        500.00 to SNVLY        230.00 Circuit
2SNVLYT2T      12.47"   1.000
 tran     14010     14265   "2 "  0    85989
0
tran 727          "Tran SUNZIA S     500.00 to LUNA         345.00 Circuit 1
0.00"   1.000
 tran     16020     11093   "1 "  0       -1
0
tran 728          "Tran SUNZIA S     500.00 to LUNA         345.00 Circuit 2
0.00"   1.000
 tran     16020     11093   "2 "  0       -1
0
tran 729          "Tran WILLOW       500.00 to WILLOW       345.00 Circuit 1
0.00"   1.000
 tran     16012     16112   "1 "  0       -1
0
tran 730          "Tran WILLOW       500.00 to WILLOW       345.00 Circuit 2
0.00"   1.000
 tran     16012     16112   "2 "  0       -1
0
svd 800           "SVD  KNOLL  115                                    "
 svd "KNOLL  115.0"  "v "  0
0
svd 801           "SVD  NELP_SVC 138                                  "
 svd "NELP_SVC 138.0"  "SV"  0
0
svd 802           "SVD  NE.LOOP  138                                  "
 svd "NE.LOOP  138.0"  "MS"  0
0
svd_803           "SVD  KYRENE 230                                    "
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 svd "KYRENE 230.0"  "v "  0
0
svd 804           "SVD  WARD   230                                  "
 svd "WARD   230.0"  "v "  0
0
svd 822           "SVD  RUDD   230                                  "
 svd "RUDD   230.0"  "v "  0
0
end
# End of Contingency List, 753 Contingencies Added to List
```

Appendix B: Contingency Results

Central Arizona Transmission System - 2021 BTA Study Work

No Solves (contingencies that resulted in no solves)

Outage	CONTINGENCY DESCRIPTION	BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	solved	solved	solved	Pmis 16725 TUBAC 138.00 = 8546.0 Qmis 16	solved	solved	solved
line_410	Line SPRINGR 345.0 to CORONADO 345.0 Ckt 1	solved	solved	solved	Pmis 16333 IRVMID3 138.00 = 13502.1 Qmis	solved	solved	solved
line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	solved	solved	solved	Pmis 16722 SONOITA 138.00 = 126583.3 Qmis	solved	solved	solved
line_419	Line WINCHSTR 345.0 to VAIL 345.0 Ckt 1	solved	solved	solved	Pmis 16114 PINALWES 345.00 = 461.0 Qmis 1	solved	solved	Pmis 16400 DMP 47.20 = 63808.4 Qmis
line_420	Line WINCHSTR 345.0 to WILLOW 345.0 Ckt 1	solved	solved	solved	Pmis 16410 N. LOOP2 47.20 = 50323.4 Qmis 1	solved	solved	solved
line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	solved	solved	solved	Pmis 16216 SOUTH 138.00 = 62356.7 Qmis 1	solved	solved	solved
tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	solved	solved	solved	Pmis 17501 B.VISTA 69.00 = 1290195.8 Qmis	solved	solved	solved

Colored cells indicate where no solves occurred

Central Arizona Transmission System - 2021 BTA Study Work

Thermal Violations for APS Cases (overloads, per unit)

FName	FkV	TName	TkV	Ckt	Outage	CONTINGENCY DESCRIPTION			RTG	MVA RTG	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07
TECHPARK	138	VAIL	138	1	line_415	Line VAIL	345.0 to SOUTH	345.0 Ckt 1	2	418	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
IRVNGTN	138	TECHPARK	138	1	line_415	Line VAIL	345.0 to SOUTH	345.0 Ckt 1	2	418	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2021 BTA Study Work

Thermal Violations for SRP, TEP, and SWP Cases (overloads, per unit)

FName	FkV	TName	TkV	Ckt	Outage	CONTINGENCY DESCRIPTION	RTG	MVA RTG	BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
TECHPARK	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.05	1.05	1.05	1.59 [A]	1.05	0.93	1.13
TECHPARK	138	VAIL	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	0.93	0.93	0.93	1.25 [A]	0.93	< 0.90	1.03
TECHPARK	138	VAIL	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.20 [A]	< 0.90	< 0.90	0.98
TECHPARK	138	VAIL	138	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	NoSolve	< 0.90	< 0.90	1.05
IRVNGTN	138	TECHPARK	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.00	1.00	1.00	1.54 [A]	1.00	< 0.90	1.08
IRVNGTN	138	TECHPARK	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.20 [A]	< 0.90	< 0.90	0.98
IRVNGTN	138	TECHPARK	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	1.16 [A]	< 0.90	< 0.90	0.94
IRVNGTN	138	TECHPARK	138	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	418	< 0.90	< 0.90	< 0.90	NoSolve	< 0.90	< 0.90	1.01
WINCHSTR	345	WILLOW	345	1	base	Base system (n-0)	1	925	0.81	0.81	0.80	1.42	0.81	0.63	0.87
WINCHSTR	345	WILLOW	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.29 [A]	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_3	Line FOURCORN 500.0 to MOENKOPI 500.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.25 [A]	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_545	Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	1.29 [A]	< 0.90	< 0.90	< 0.90
WINCHSTR	345	WILLOW	345	1	line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	NoSolve	< 0.90	< 0.90	0.95
WINCHSTR	345	WILLOW	345	1	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	2	1110	< 0.90	< 0.90	< 0.90	NoSolve	< 0.90	< 0.90	0.95
WINCHSTR	345	VAIL	345	1	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.37 [A]	< 0.90	< 0.90	0.95
WINCHSTR	345	VAIL	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.31 [A]	< 0.90	< 0.90	< 0.90
WINCHSTR	345	VAIL	345	1	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	1.30 [A]	< 0.90	< 0.90	< 0.90
WINCHSTR	345	VAIL	345	1	base	Base system (n-0)	1	1195	0.76	0.76	0.75	1.21	0.76	0.62	0.81
WINCHSTR	345	VAIL	345	1	line_413	Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1	2	1195	0.98	0.98	0.98	NoSolve	0.98	< 0.90	1.05
WINCHSTR	345	VAIL	345	1	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	2	1195	0.98	0.98	0.98	NoSolve	0.98	< 0.90	1.05
WINCHSTR	345	VAIL	345	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	1195	< 0.90	< 0.90	< 0.90	NoSolve	< 0.90	< 0.90	0.95
LOSREALS	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.08	< 0.90	< 0.90	< 0.90
LOSREALS	138	VAIL	138	1	line_488	Line TECHPARK 138.0 to VAIL 138.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.06	< 0.90	< 0.90	< 0.90
LOSREALS	138	VAIL	138	1	line_444	Line IRVNGTN 138.0 to TECHPARK 138.0 Ckt 1	2	406	< 0.90	< 0.90	< 0.90	1.04	< 0.90	< 0.90	< 0.90
WILLOW	500	WILLOW	345	1	tran_730	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 2	2	806	< 0.90	< 0.90	< 0.90	1.06	< 0.90	< 0.90	< 0.90
WILLOW	500	WILLOW	345	2	tran_729	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 1	2	806	< 0.90	< 0.90	< 0.90	1.06	< 0.90	< 0.90	< 0.90
CORONADO	500	CORONADO	345	2	tran_670	Tran CORONADO 500.00 to CORONADO 345.00 Ckt 1	2	806	< 0.90	< 0.90	< 0.90	1.02	< 0.90	< 0.90	< 0.90
FLAGSTAF	345	GLENCANY	345	1	line_379	Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 2	2	1089	0.98	0.98	0.98	1.02	0.99	0.97	0.98
FLAGSTAF	345	GLENCANY	345	2	line_378	Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 1	2	1089	0.98	0.98	0.98	1.01	0.98	0.96	0.97
COPPERVR	345	COPPERVR	230	1	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	< 0.90	1.01	< 0.90	< 0.90	0.91
COPPERVR	345	COPPERVR	230	2	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	< 0.90	1.01	< 0.90	< 0.90	0.91
NL. EXP	138	RILLITO	138	1	line_514	Line TORTOLIT 138.0 to NARANJA 138.0 Ckt 1	2	382	0.99	0.99	0.99	< 0.90	0.99	1.01	0.92
APACHE	230	BUTERFLD	230	1	line_419	Line WINCHSTR 345.0 to VAIL 345.0 Ckt 1	2	431	0.92	0.92	0.92	NoSolve	0.92	< 0.90	NoSolve

Colored cells indicate where flows increased by 5% or more, as compared to the base case flows

[A] The top three most heavily loaded (worst) thermal violations shown for that specific line segment. Reporting of overloads was limited to control the volume of data in the report.

Central Arizona Transmission System - Sensitivity Study Results of SWP02

Thermal Violations (overloads, per unit)

Fname	FkV	TName	TkV	Ckt	Outage	CONTINGENCY DESCRIPTION	RTG	MVA RTG	BASE	SWP01	SRP03	SWP02
TECHPARK	138	VAIL	138	1	line_1	Line CHOLLA 500.0 to SAGUARO 500.0 Ckt 1	2	418	< 0.90	< 0.90	NoSolve	1.03
TECHPARK	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.05	0.93	1.59	1.01
TECHPARK	138	VAIL	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	0.93	< 0.90	1.25	0.98
FLAGSTAF	345	GLENCANY	345	1	line_379	Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 2	2	1089	0.98	0.97	1.02	0.96
FLAGSTAF	345	GLENCANY	345	2	line_378	Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 1	2	1089	0.98	0.96	1.01	0.96
IRVNGTN	138	TECHPARK	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	418	1.00	< 0.90	1.54	0.96
NL. EXP	138	RILLITO	138	1	line_514	Line TORTOLIT 138.0 to NARANJA 138.0 Ckt 1	2	382	0.99	1.01	< 0.90	0.95
IRVNGTN	138	TECHPARK	138	1	line_449	Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	418	< 0.90	< 0.90	1.2	0.93
TECHPARK	138	VAIL	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	1.20	0.93
WINCHSTR	345	VAIL	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1195	< 0.90	< 0.90	1.31	< 0.90
WINCHSTR	345	VAIL	345	1	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	2	1195	< 0.90	< 0.90	1.37	< 0.90
WINCHSTR	345	VAIL	345	1	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	2	1195	< 0.90	< 0.90	1.30	< 0.90
WINCHSTR	345	WILLOW	345	1	line_3	Line FOURCORN 500.0 to MOENKOPI 500.0 Ckt 1	2	1110	< 0.90	< 0.90	1.25	< 0.90
WINCHSTR	345	WILLOW	345	1	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	2	1110	< 0.90	< 0.90	1.29	< 0.90
WINCHSTR	345	WILLOW	345	1	line_545	Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	2	1110	< 0.90	< 0.90	1.29	< 0.90
IRVNGTN	138	TECHPARK	138	1	line_463	Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	418	< 0.90	< 0.90	1.16	< 0.90
LOSREALS	138	VAIL	138	1	line_415	Line VAIL 345.0 to SOUTH 345.0 Ckt 1	2	406	< 0.90	< 0.90	1.08	< 0.90
LOSREALS	138	VAIL	138	1	line_444	Line IRVNGTN 138.0 to TECHPARK 138.0 Ckt 1	2	406	< 0.90	< 0.90	1.04	< 0.90
LOSREALS	138	VAIL	138	1	line_488	Line TECHPARK 138.0 to VAIL 138.0 Ckt 1	2	406	< 0.90	< 0.90	1.06	< 0.90
COPPERVR	345	COPPERVR	230	1	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	1.01	< 0.90
COPPERVR	345	COPPERVR	230	2	line_540	Line MORENCI 230.0 to GREEN-SW 230.0 Ckt 1	2	224	< 0.90	< 0.90	1.01	< 0.90
CORONADO	500	CORONADO	345	2	tran_670	Tran CORONADO 500.00 to CORONADO 345.00 Ckt 1	2	806	< 0.90	< 0.90	1.02	< 0.90
WILLOW	500	WILLOW	345	1	tran_730	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 2	2	806	< 0.90	< 0.90	1.06	< 0.90
WILLOW	500	WILLOW	345	2	tran_729	Tran WILLOW 500.00 to WILLOW 345.00 Ckt 1	2	806	< 0.90	< 0.90	1.06	< 0.90
WINCHSTR	345	WILLOW	345	1	base	Base system (n-0)	1	925	0.81	0.63	1.42	0.66
WINCHSTR	345	VAIL	345	1	base	Base system (n-0)	1	1195	0.76	0.62	1.21	0.64

Colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2021 BTA Study Work

Delta Voltage Violations for APS Cases (voltage drop, per unit)

Bus #	Name	kV	Outage	CONTINGENCY DESCRIPTION	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07
16254	EASTINA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17
16251	ORNGROVE	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17	-0.17
16205	LACANADA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16	-0.16
16209	RANVISTO	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14
16245	NARANJA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12	-0.12
16720	KANTOR	138	line_478	Line SONOITA 138.0 to VALNCIA 138.0 Ckt 1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
16725	TUBAC	138	line_478	Line SONOITA 138.0 to VALNCIA 138.0 Ckt 1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
16720	KANTOR	138	line_448	Line KANTOR 138.0 to TUBAC 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	line_459	Line NOGALES 138.0 to KANTOR 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	line_506	Line VAIL 138.0 to NOGALES 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	line_421	Line CANEZ 138.0 to SONOITA 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	line_497	Line TUBAC 138.0 to CANEZ 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_478	Line SONOITA 138.0 to VALNCIA 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16725	TUBAC	138	line_448	Line KANTOR 138.0 to TUBAC 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16725	TUBAC	138	line_459	Line NOGALES 138.0 to KANTOR 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16725	TUBAC	138	line_506	Line VAIL 138.0 to NOGALES 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16725	TUBAC	138	line_421	Line CANEZ 138.0 to SONOITA 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16725	TUBAC	138	line_497	Line TUBAC 138.0 to CANEZ 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16722	SONOITA	138	line_478	Line SONOITA 138.0 to VALNCIA 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_448	Line KANTOR 138.0 to TUBAC 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_459	Line NOGALES 138.0 to KANTOR 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_497	Line TUBAC 138.0 to CANEZ 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_506	Line VAIL 138.0 to NOGALES 138.0 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16721	CANEZ	138	line_421	Line CANEZ 138.0 to SONOITA 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	line_421	Line CANEZ 138.0 to SONOITA 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	line_448	Line KANTOR 138.0 to TUBAC 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	line_459	Line NOGALES 138.0 to KANTOR 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	line_497	Line TUBAC 138.0 to CANEZ 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	line_506	Line VAIL 138.0 to NOGALES 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_421	Line CANEZ 138.0 to SONOITA 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_448	Line KANTOR 138.0 to TUBAC 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_459	Line NOGALES 138.0 to KANTOR 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_478	Line SONOITA 138.0 to VALNCIA 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_497	Line TUBAC 138.0 to CANEZ 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16723	VALNCIA	138	line_506	Line VAIL 138.0 to NOGALES 138.0 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16106	VAIL2	345	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Colored cells indicate where voltage deviation increased by >3% as compared to voltage deviation in the base case.

Central Arizona Transmission System - 2021 BTA Study Work

Delta Voltage Violations for SRP, TEP, and SWP Cases (voltage drop, per unit)

Bus #	Name	kV	Outage	CONTINGENCY DESCRIPTION	BASE	SRP01	SRP02	SRP03	SRP04	SWP01	TEP01
16254	EASTINA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.17	-0.17	-0.17	NoSolve	-0.17	-0.14	-0.19
16251	ORNGROVE	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.17	-0.17	-0.17	NoSolve	-0.17	-0.14	-0.19
16205	LACANADA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.16	-0.16	-0.16	NoSolve	-0.16	-0.13	-0.18
16209	RANVISTO	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.14	-0.14	-0.14	NoSolve	-0.14	-0.12	-0.16
16245	NARANJA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Ckt 1	-0.12	-0.12	-0.12	NoSolve	-0.12	-0.09	-0.14
16106	VAIL2	345	line_419	Line WINCHSTR 345.0 to VAIL 345.0 Ckt 1	-0.05	-0.05	-0.05	NoSolve	-0.05	-0.04	NoSolve
17012	MARANA	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.07	-0.05	-0.05	-0.05
17013	MARANATP	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.07	-0.05	-0.05	-0.05
16900	COPPERVR	345	line_398	Line GREENLEE 345.0 to COPPERVR 345.0 Ckt 1	-0.05	-0.05	-0.05	-0.06	-0.05	-0.05	-0.05
16247	HARRISON	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.05	-0.05	-0.05	-0.08	-0.05	-0.04	-0.05
17005	BICKNELL	345	line_550	Line BICKNELL 345.0 to VAIL 345.0 Ckt 1	-0.04	-0.04	-0.04	-0.02	-0.04	-0.05	-0.04
19203	BRAWLEY	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15179	BRAWLYAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15178	SANDARAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19212	SANDARIO	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15180	SANXAVAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19213	SANXAVER	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19214	SNYDHILL	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19201	BLACKMTN	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15182	BLKMTNAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19210	RATTLSNK	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15181	SNYDHLAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
19216	TWINPEAK	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
15177	TWINPKAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.05	-0.05
17020	SAN RAF	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.11	-0.04	-0.03	-0.05
17003	AVRA	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.06	-0.04	-0.04	-0.04
16211	ROBERTS	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.04	-0.04	-0.04	-0.07	-0.04	-0.04	-0.04
17007	BUTERFLD	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.10	-0.04	-0.03	-0.04
17089	SNDARIO	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.04	-0.05	-0.04	-0.04	-0.04
17018	RED TAIL	230	line_525	Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.07	-0.04	-0.03	-0.03
16213	S.TRAIL	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.03	-0.03	-0.03	-0.05	-0.03	-0.03	-0.04
17039	KARTCHNR	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.03	-0.03	-0.03	-0.07	-0.03	-0.02	-0.03
17015	PANTANO	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.06	-0.02	-0.02	-0.03
17016	PANTANO	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.07	-0.02	-0.01	-0.02
17676	NEWTUCSN	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.02	-0.02	-0.06	-0.02	-0.01	-0.02
16722	SONOITA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16723	VALNCIA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	-0.01	-0.01
16721	CANEZ	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16725	TUBAC	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
16720	KANTOR	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
17023	VALEN-SW	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.08	-0.01	0.00	-0.01
17022	THREEPNT	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.07	-0.01	0.00	-0.01
17089	SNDARIO	115	line_534	Line AVRA 115.0 to SNDARIO 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	0.00	-0.01
17023	VALEN-SW	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	0.00	-0.01
17022	THREEPNT	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	-0.01	-0.01	-0.01	-0.05	-0.01	0.00	-0.01
17015	PANTANO	115	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.01	-0.01	-0.01	-0.06	-0.01	0.00	-0.01
17012	MARANA	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.00	0.00	0.00	-0.11	0.00	0.01	-0.01
17089	SNDARIO	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	0.00	0.00	0.00	-0.07	0.00	0.01	-0.01
17003	AVRA	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	0.00	0.00	0.00	-0.07	0.00	0.01	0.00
17089	SNDARIO	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.00	0.00	0.00	-0.09	0.00	0.02	0.00
17039	KARTCHNR	115	line_530	Line PANTANO 115.0 to KARTCHNR 115.0 Ckt 1	0.01	0.01	0.01	0.05	0.01	0.00	0.01
17039	KARTCHNR	115	tran_702	Tran PANTANO 230.00 to PANTANO 115.00 Ckt 1	0.01	0.01	0.01	0.05	0.01	0.00	0.01
17003	AVRA	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.01	0.01	0.01	-0.09	0.01	0.02	0.00
16106	VAIL2	345	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	0.14	0.14	0.14	NoSolve	0.14	0.13	0.14
16259	GRTRVL	138	line_512	Line SANRIT_S 138.0 to ROSEMONT 138.0 Ckt 1	NoSolve	0.01	0.01	0.06	0.01	0.00	0.02
16920	ROSEMONT	138	line_512	Line SANRIT_S 138.0 to ROSEMONT 138.0 Ckt 1	NoSolve	0.02	0.02	0.07	0.02	0.01	0.03

Colored cells indicate where voltage deviation increased by >3% as compared to voltage deviation in the base case

Central Arizona Transmission System - Sensitivity Study Results of SWP02

Delta Voltage Violations (voltage drop, per unit)

Bus #	Name	kV	Outage	CONTINGENCY DESCRIPTION	BASE	SWP01	SRP03	SWP02
16254	EASTINA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1	-0.17	-0.14	NoSolve	-0.19
16251	ORNGROVE	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1	-0.17	-0.14	NoSolve	-0.18
16205	LACANADA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1	-0.16	-0.13	NoSolve	-0.18
16209	RANVISTO	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1	-0.14	-0.12	NoSolve	-0.16
16245	NARANJA	138	line_462	Line ORNGROVE 138.0 to RILLITO 138.0 Circuit 1	-0.12	-0.09	NoSolve	-0.13
17012	MARANA	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Circuit 1	-0.05	-0.05	-0.07	-0.05
17013	MARANATP	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Circuit 1	-0.05	-0.05	-0.07	-0.05
16900	COPPERVR	345	line_398	Line GREENLEE 345.0 to COPPERVR 345.0 Circuit 1	-0.05	-0.05	-0.06	-0.05
17020	SAN RAF	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.03	-0.11	-0.04
17012	MARANA	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.00	0.01	-0.11	0.01
17007	BUTERFLD	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.03	-0.10	-0.04
17003	AVRA	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.01	0.02	-0.09	0.02
17089	SNDARIO	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	0.00	0.02	-0.09	0.01
16247	HARRISON	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.05	-0.04	-0.08	-0.04
17023	VALEN-SW	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	-0.01	0.00	-0.08	-0.01
17022	THREEPNT	115	line_538	Line MARANATP 115.0 to MARANA 115.0 Ckt 1	-0.01	0.00	-0.07	-0.01
17018	RED TAIL	230	line_525	Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.04	-0.03	-0.07	-0.03
17003	AVRA	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	0.00	0.01	-0.07	0.01
17016	PANTANO	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.01	-0.07	-0.02
16211	ROBERTS	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.04	-0.04	-0.07	-0.04
17089	SNDARIO	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	0.00	0.01	-0.07	0.00
17039	KARTCHNR	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.03	-0.02	-0.07	-0.02
17003	AVRA	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.06	-0.04
17676	NEWTUCSN	230	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.02	-0.01	-0.06	-0.01
19203	BRAWLEY	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15179	BRAWLYAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15180	SANXAVAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19213	SANXAVER	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19214	SNYDHILL	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15178	SANDARAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19212	SANDARIO	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19201	BLACKMTN	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15182	BLKMTNAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15181	SNYDHLAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19216	TWINPEAK	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
15177	TWINPKAZ	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
19210	RATTLSNK	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.05	-0.06	-0.04
17089	SNDARIO	115	line_534	Line AVRA 115.0 to SNDARIO 115.0 Ckt 1	-0.01	0.00	-0.06	-0.01
17015	PANTANO	115	line_524	Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.01	0.00	-0.06	-0.01
17015	PANTANO	115	line_535	Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1	-0.02	-0.02	-0.06	-0.02
16723	VALNCIA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.06	-0.01
16213	S.TRAIL	138	line_435	Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1	-0.03	-0.03	-0.05	-0.03
17089	SNDARIO	115	line_523	Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1	-0.04	-0.04	-0.05	-0.04
16722	SONOITA	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.05	-0.01
16721	CANEZ	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.05	-0.01
17023	VALEN-SW	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	-0.01	0.00	-0.05	-0.01
16725	TUBAC	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.05	-0.01
17022	THREEPNT	115	line_537	Line MARANA 115.0 to AVRA 115.0 Ckt 1	-0.01	0.00	-0.05	-0.01
16720	KANTOR	138	line_115	Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1	-0.01	-0.01	-0.05	-0.01
17005	BICKNELL	345	line_550	Line BICKNELL 345.0 to VAIL 345.0 Ckt 1	-0.04	-0.05	-0.02	-0.05
17039	KARTCHNR	115	line_530	Line PANTANO 115.0 to KARTCHNR 115.0 Ckt 1	0.01	0.00	0.05	0.01
17039	KARTCHNR	115	tran_702	Tran PANTANO 230.00 to PANTANO 115.00 Ckt 1	0.01	0.00	0.05	0.01
16259	GRTRVL	138	line_512	Line SANRIT_S 138.0 to ROSEMONT 138.0 Ckt 1	NoSolve	0.00	0.06	0.01
16920	ROSEMONT	138	line_512	Line SANRIT_S 138.0 to ROSEMONT 138.0 Ckt 1	NoSolve	0.01	0.07	0.02
16106	VAIL2	345	tran_680	Tran VAIL2 345.00 to VAIL 138.00 Ckt 1	0.14	0.13	NoSolve	0.14

Colored cells indicate where voltage deviation increased by >3% as compared to voltage deviation in the base case.