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January 30, 2006

Ernest Johnson
Director, Utilities Division
ARIZONA CORPORATION COMMISSION
1200 West Washington Street
Phoenix, AZ 85007

RE: 10-Year Plan E-00000D-05-0040

Dear Mr. Johnson:

In Compliance with A.R.S. § 40-360.02 and pursuant to Arizona Corporation Commission ("Commission") Decision No. 63876 (July 25, 2001), enclosed please find Arizona Public Service Company's ("APS" or "Company") 2006-2015 Ten-Year Plan for major transmission facilities, along with associated system ratings and Reliability Must-Run Analysis for 2006-2015.

The 2006-2015 Ten-Year Plan describes planned transmission lines of 115 kV or higher that APS may construct over the next 10 years. This Ten-Year Plan includes approximately 226 miles of new 500 kV transmission lines, 84 miles of new 230 kV transmission lines, and 18 new bulk transformers. The APS investment needed to construct these projects is currently estimated to exceed $1billion. When completed, these projects are expected to add approximately 2000 MW of additional Extra-High Voltage scheduling capacity, as well as 4680 MW of import capability into the Metropolitan Phoenix Area and 295 MW of import capability into Yuma.

These new transmission projects, coupled with additional distribution and sub-transmission investments, will support reliable power delivery in both APS' service area and in the western United States. The Ten-Year Plan, as well as other APS reliability-related infrastructure investments, however, are premised on a number of assumptions including the regulatory treatment of such investments by the Commission and the Federal Energy Regulatory Commission ("FERC"), other state and federal policies affecting transmission, and, of course, APS' ability to finance large investments of this nature on commercially-reasonable terms.

Please contact me if you have any questions or desire additional information concerning this filing.

Sincerely,

Justin H. Thompson

JHT:rdp
Enclosures
Cc/encl: Docket Control (Original, plus 13 copies)
Laurie Woodall, Assistant Attorney General

ARIZONA PUBLIC SERVICE COMPANY
2006–2015
TEN-YEAR PLAN

Prepared for the

Arizona Corporation Commission

January 2006

TEN YEAR PLAN
2006-2015

ARIZONA PUBLIC SERVICE COMPANY
2006–2015
TEN-YEAR PLAN

Prepared for the

Arizona Corporation Commission

January 2006

ARIZONA PUBLIC SERVICE COMPANY
2006 - 2015
TEN-YEAR PLAN

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ARIZONA PUBLIC SERVICE COMPANY
2006–2015
TEN-YEAR PLAN

GENERAL INFORMATION

Pursuant to A.R.S. § 40-360.02, Arizona Public Service Company ("APS") submits its 2006-2015 Ten-Year Plan. Additionally, pursuant to Arizona Corporation Commission ("Commission") Decision No. 63876 (July 25, 2001) concerning the first Biennial Transmission Assessment, APS is including with this filing its Transmission Planning Process and Guidelines and maps showing system ratings on APS' transmission system. The Transmission Planning Process and Guidelines outline generally APS' internal planning for its high voltage and extra-high voltage transmission system, including a discussion of APS' planning methodology, planning assumptions, and its guidelines for system performance. The system ratings maps show emergency and continuous system ratings on APS' extra-high voltage system, and on its Metro, Northern, and Southern 230kV systems.

This 2006–2015 Ten-Year Plan describes planned transmission lines of 115kV or higher voltage that APS may construct over the next ten-year period. Pursuant to A.R.S. § 40-360(10), underground facilities are not included. There are approximately 226 miles of 500kV transmission lines, 84 miles of 230kV transmission lines, and 18 bulk transformers contained in the projects in this Ten-Year Plan filing. The total investment for the APS projects and the anticipated APS portion of the participation projects as they are modeled in this filing is estimated to be approximately $1 billion and the projects will add approximately 2000 MW of additional EHV scheduling capability. Also, over the next ten years the import capability into the Phoenix area will increase by 4680 MW, while the import capability into the Yuma area will

increase by 295 MW. The following table shows a breakdown of the projects contained in this Ten-Year Plan.

	Projects in Ten-Year Plan
500kV transmission lines	226 miles
230kV transmission lines	84 miles
Bulk Transformers	18
Total Investment	$1 billion
EHV Scheduling Capability	+2000 MW (+28 %)[1]
Total Phoenix Area Import	+4680 MW (+53 %)[1]
Yuma Area Import	+295 MW (+51 %)[1]

[1] Based on 2005 values.

Also, some of the previously reported facilities that have been completed, canceled, or deferred beyond the upcoming ten-year period are not included. The projects at the end of this Ten-Year Plan that have in-service dates of To Be Determined (TBD) are projects that have been identified, but are either still outside of the ten-year planning window or their in-service dates have not yet been established. They have been included in this filing for informational purposes. A summary of changes from last year's plan is provided below, along with a list of projects that have been added to this years Ten-Year Plan. Also, a section has been added that briefly describes any projects that are still in the feasibility planning phase.

For the convenience of the reader, APS has included system maps showing the electrical connections and in-service dates for all overhead transmission projects planned by APS for Arizona, the Phoenix Metropolitan Area, and the Yuma Area. Written descriptions of each proposed transmission project are provided on subsequent pages in the currently expected chronological order of each project. The line routings shown on the system maps and the descriptions of each transmission line are intended to be general, showing electrical connections and not specific routings, and are subject to revision. Specific routing is recommended by the Arizona Power Plant and Transmission Line Siting Committee and ultimately approved by the Commission when issuing a Certificate of Environmental Compatibility and through subsequent

right-of-way acquisition. Pursuant to A.R.S. § 40-360.02, this filing also includes technical study results for the projects identified. The technical study results show project needs which are generally based on either security (contingency performance), adequacy (generator interconnection or increasing transfer capability) or both.

APS participates in numerous regional planning organizations and in the WestConnect Public Utilities organization. Through membership and participation in these organizations the needs of multiple entities, and the region as a whole, can be identified and studied. This allows for the potential of maximizing the effectiveness and utilization of new projects. Some regional organizations that APS is a member of include the Western Electricity Coordinating Council (WECC), the Southwest Area Transmission Planning (SWAT), the Southwest Transmission Expansion Plan (STEP), and the Seams Steering Group – Western Interconnection (SSG-WI). Some of the plans included in this filing are the result of these coordinated planning efforts. APS is open to other entities participating in any existing or future planned projects.

APS believes that the projects identified in this 2006-2015 Ten-Year Plan, with their associated in-service dates, will ensure that APS' transmission system meets all applicable reliability criteria. However, changes in regulatory requirements or underlying assumptions such as load forecasts, generation or transmission expansions, economic issues, and other utilities' plans, may substantially impact this Ten-Year Plan and could result in changes to anticipated in-service dates or project scopes. Additionally, future federal and regional mandates may impact this Ten-Year Plan specifically and the transmission planning process in general. This Ten-Year Plan is tentative information only and, pursuant to A.R.S. § 40-360.02(F), is subject to change without notice at the discretion of APS, based on land usage, growth pattern changes, regulatory or legal developments, or for other reasons.

Changes from 2005-2014 Ten-Year Plan

The following is a list of projects that were changed or removed from the Ten-Year plan filed last year, along with a brief description of why the change was made.

- Hassayampa – Pinal West 500kV line

  APS is no longer a participant in this project.

- Pinal West – Santa Rosa – Browning 500kV line

  APS is no longer a participant in this project.

- Mazatzal 345/69kV loop-in of Cholla-Pinnacle Peak 345kV line

  The in-service date for the Mazatzal 345/69kV substation that will be connected into the Cholla to Pinnacle Peak 345kV line has been changed from TBD to 2011. APS' studies have shown that the rate of load growth in the area will require the 345kV source provided by this project in 2011.

- Palo Verde Hub – TS5 500kV line

  A Certificate of Environmental Compatibility (CEC) for the Palo Verde Hub to TS5 500kV Transmission project was granted on August 17, 2005. The CEC gives APS the flexibility to connect the project at the Palo Verde switchyard, a new 500kV switchyard located at the Arlington Valley Energy facility, and/or a proposed Harquahala Junction switchyard. Due to new subtransmission plans and load forecasts the latest planning studies show the needed in-service date for the project has changed from 2007 to 2009.

- TS5 – TS1 230kV line

  A CEC for the West Valley North 230kV Transmission Line project was granted on May 5, 2005. The West Valley North project consists of double circuit 230kV lines from a new TS5 substation to a new TS1 substation and from the TS1

substation to a new TS2 substation. The 2005-2014 Ten-Year Plan showed the first circuit of the TS5-TS1 230kV lines with an in-service date of 2007. Due to new subtransmission plans and load forecasts the latest planning studies show the needed in-service date for the first circuit of this project has changed from 2007 to 2009.

- Palm Valley – TS2 – TS1 230kV lines

  The TS3 substation has been named Palm Valley. The 2005-2014 Ten-Year Plan showed the in-service date for the first circuit of these projects as 2008. With new subtransmission facilities in the area and the latest projected load growth for the area, the most recent planning studies show that the in-service date for the first circuit of these projects can be delayed until 2010.

- Raceway – Pinnacle Peak 500kV line

  The 2005-2014 Ten-Year Plan showed the in-service date for the project as 2012. The latest planning studies have shown the need for the import capability this project brings to the Phoenix Metropolitan Valley in 2010. Therefore, the in-service date for this project has been advanced to 2010.

- Raceway – Avery 230kV line

  The 2005-2014 Ten-Year Plan showed the in-service date for the project as 2008. With new transmission plans, subtransmission plans, and load forecasts the latest planning studies show that the in-service date for the project can be delayed until 2009.

- Avery – TS6 – Pinnacle Peak 230kV line

  The 2005-2014 Ten-Year Plan showed the in-service date for the project as 2009. With new transmission plans, subtransmission plans, and load forecasts the

latest planning studies show that the in-service date for the project can be delayed until 2010.

- TS5 – Raceway 500kV line

  The 2005-2014 Ten-Year Plan showed the in-service date for the project as 2010. With the advancement of the Raceway-Pinnacle Peak 500kV line the latest planning studies show that the in-service date for the project can be delayed until 2012.

- Westwing – Raceway 230kV line

  The 2005-2014 Ten-Year Plan showed the in-service date for the project as 2010. With the advancement of the Raceway-Pinnacle Peak 500kV line the latest transmission planning studies show that the in-service date for the project can be delayed beyond 2015.

New Projects in the 2006-2015 Ten-Year Plan

The following is a list of projects that are in the 2006-2015 Ten-Year Plan that were not in the 2005-2014 Ten-Year Plan.

- VV1 loop-in of Navajo – Westwing 500kV line

  This project has an in-service date of 2009. It is planned to be a 500/69kV substation interconnected into the Navajo-Westwing 500kV line. This project is to support the existing electrical system and serve the electrical needs of the growing communities in the Verde Valley and Prescott area.

- North Gila – TS8 and TS8 – Yucca 230kV lines

  This project is a 230kV line from the North Gila substation to a new TS8 substation and from the TS8 substation to a new 230kV bus at the Yucca substation.

Studies have shown the need for the North Gila-TS8 230kV line in 2012 in order to support the subtransmission system in meeting the growing load in Yuma. The needed in-service date for the Yucca-TS8 230kV line will continue to be evaluated as the electrical demands of the area continue to grow.

Conceptual Projects in the Feasibility Planning Phase

The following projects, described below for informational purposes, are still in a preliminary planning phase.

- Santa Rosa – Pinal South 230kV line

  This project will be a 230kV line that will be under built on the South East Valley 500kV line between the Santa Rosa substation and the future Pinal South substation. The timing for this project is currently listed as To Be Determined.

- 230kV lines west of the White Tanks

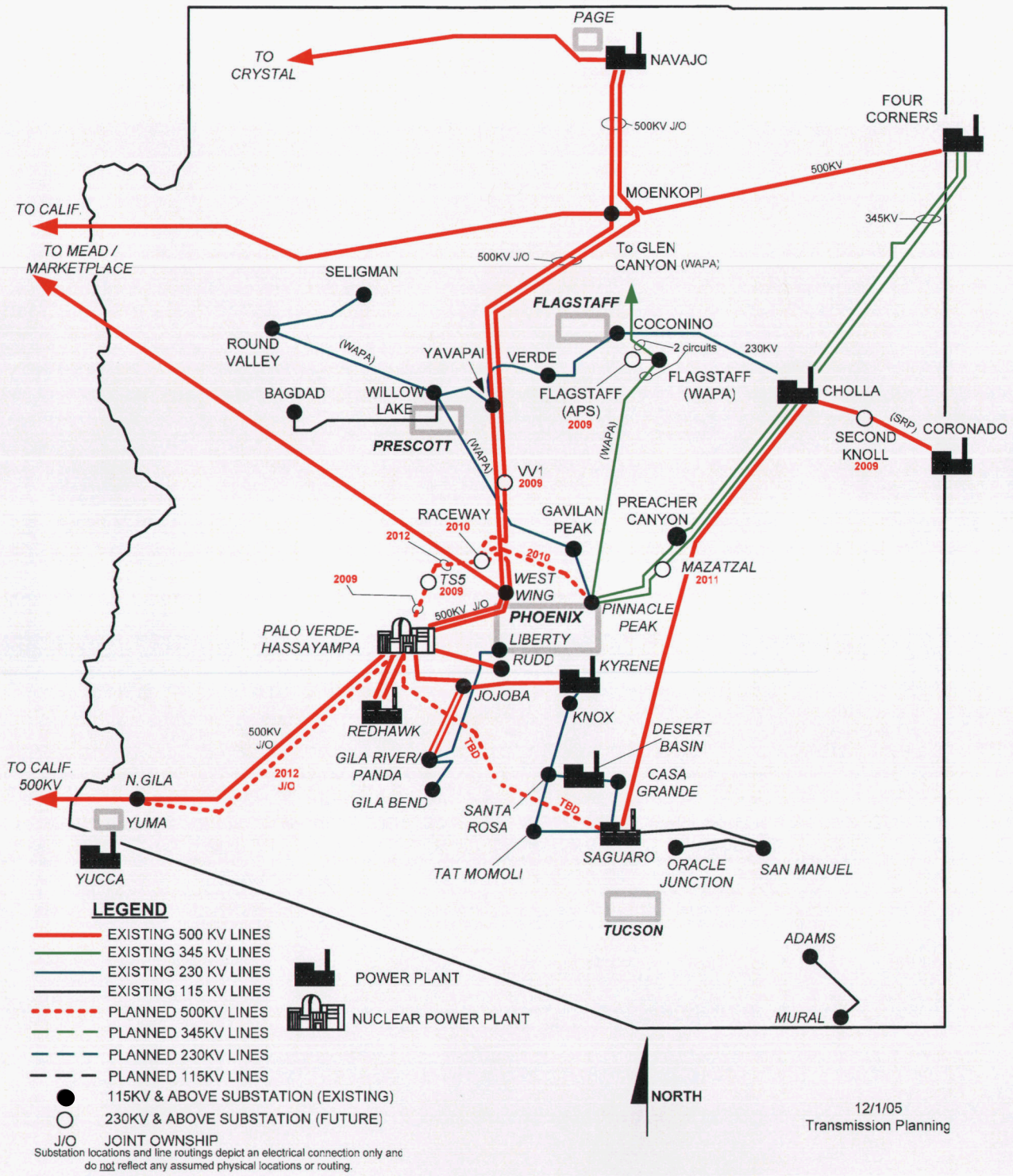
  New electrical facilities will be needed to serve the electrical needs of the new master planned developments in the communities located on the western side of the White Tank Mountains. The timing of these facilities will be based upon the growth of the new developments in the area. The plans for these facilities are being coordinated with the developers and still are in the preliminary phase. Therefore, in this filing no project description page will be included for this project.

- TransWest Express Project

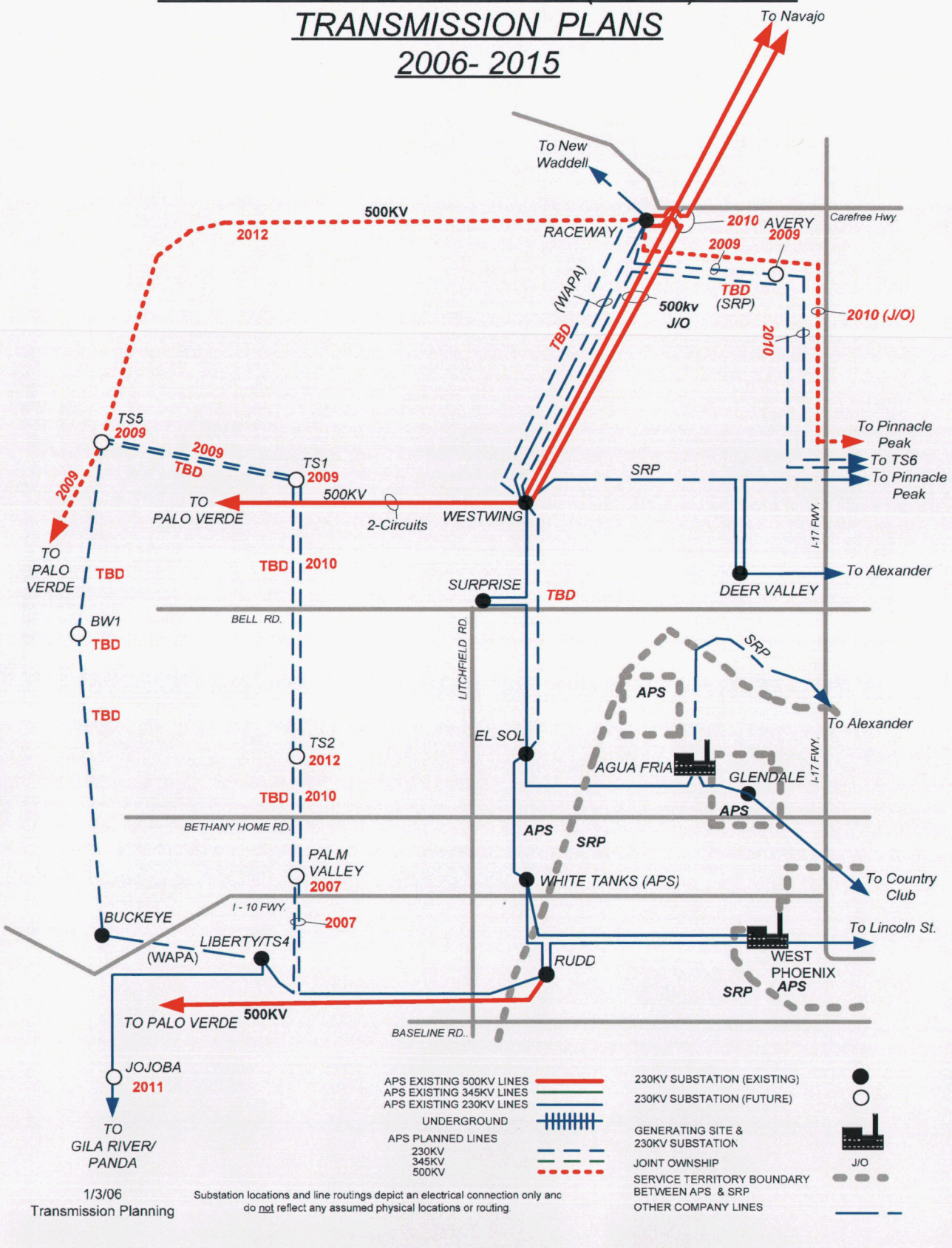
  In 2005, APS announced that it will explore building two 500kV transmission lines from Wyoming to northern Arizona. The completion of the TransWest Express Project would provide Arizona and other western states increased capability to access electricity generated from coal, wind and other resources in Wyoming. Desire to

access future base load coal generation and renewable resources such as wind has resulted in APS' decision to initiate the feasibility study for the project. APS is seeking input and participation of interested parties to jointly examine the technical and economic feasibility of the project and the relevant environmental and regulatory considerations. This joint feasibility analysis will be performed within the various regional and sub-regional transmission planning groups and reliability organizations.

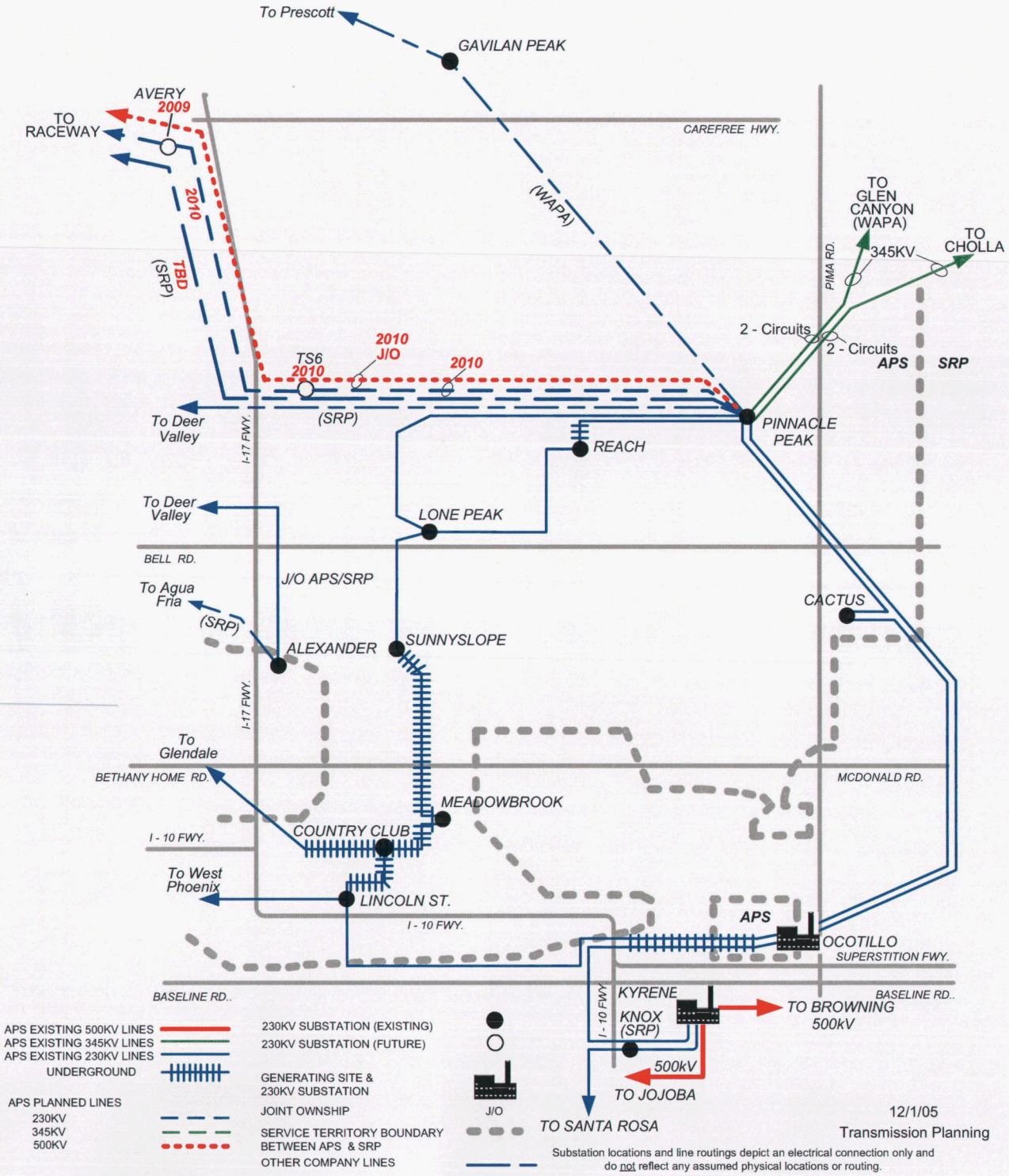
APS EHV & OUTER DIVISION 115/230 KV TRANSMISSION PLANS 2006 - 2015



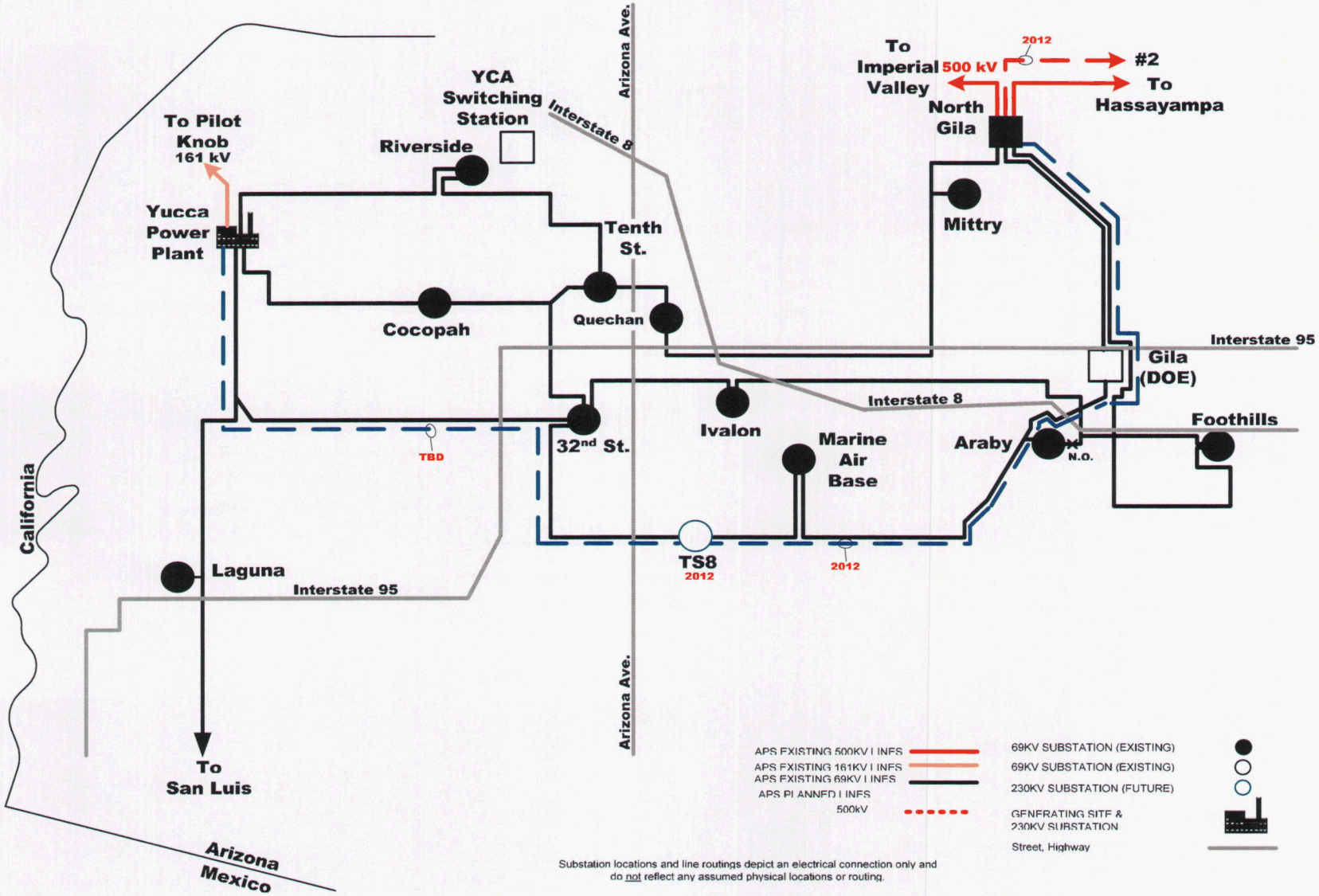
PHOENIX METROPOLITAN (WEST) AREA TRANSMISSION PLANS 2006- 2015



PHOENIX METROPOLITAN (EAST) AREA TRANSMISSION PLANS 2006- 2015



Yuma Area Transmission Plans 2006-2015



Substation locations and line routings depict an electrical connection only and do not reflect any assumed physical locations or routing.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2007

Line Designation	Rudd – Palm Valley – TS4 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Rudd-Liberty 230kV transmission line near the intersection of Broadway Road and Perryville Road; within Sec. 28, T1N, R1W.
(d) Intermediate Point	Palm Valley 230/69kV substation to be constructed in 2007 near the corner of Camelback Rd. and Cotton Ln.; Sec. 24, T2N, R2W.
(e) Point of Termination	A new TS4 230kV substation located just south of the WAPA Liberty substation, Sec. 19, T1N, R2W.
(f) Length	Approximately 7 miles of double-circuit 230kV.
Routing	North from the existing Rudd-Liberty 230kV transmission line approximately 7 miles to the Palm Valley substation and returning south, back to the existing line. Also, the termination of the line will be moved from the Liberty substation to the TS4 substation.
Purpose	This project will provide a source for the Palm Valley 230/69kV substation and 69kV substations planned in the western and southwestern Phoenix Metropolitan area to accommodate the growing need for electric energy in the area. Increased reliability and quality of service will result for customers served by the 230/69kV substation.
Date	
(a) Construction Start	2002 (The component that was already certificated in Case No. 115, Decision No. 64473, Rudd-Liberty was in-service for the summer of 2003.) Construction for the double-circuit to Palm Valley will start in 2007.
(b) Estimated In Service	2007

Certificate of Environmental Compatibility issued 2/12/02 (Case No. 115, Decision No. 64473, Southwest Valley Project). Revised on 4/9/02, Decision No. 64704. This CEC is for the 230kV line, Rudd-Liberty, running east and west on the same poles as the Palo Verde-Rudd 500kV line. The portion of line running from the existing Rudd-Liberty line to the Palm Valley substation and for the TS4 substation was sited as part of the West Valley South230kV Transmission Line Project and a Certificate of Environmental Compatibility was issued 12/24/03 (Case No. 122, Decision No. 66646, West Valley South 230kV Transmission Line Project).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	Second Knoll loop-in of Coronado-Cholla 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Coronado-Cholla 500kV line; Sec. 9, T14N, R21E.
(d) Intermediate Point	None.
(e) Point of Termination	Second Knoll 500/69kV substation to be built in 2009; Sec. 9, T14N, R21E.
(f) Length	Two single-circuit lines, not to exceed two spans, from the existing line corridor to the Second Knoll substation.
Routing	The Second Knoll substation will be built adjacent to the Coronado-Cholla 500kV line, therefore limiting the distance to not exceed two spans.
Purpose	This project will be needed to serve projected need for electric energy in Show Low and the surrounding communities.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2009

A Certificate of Environmental Compatibility is not needed for this project.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	345/69kV interconnection at WAPA's Flagstaff 345kV bus.
Size	
(a) Voltage	345kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	WAPA's Flagstaff 345kV substation; Sec. 24, T21N, R9E.
(d) Intermediate Point	None.
(e) Point of Termination	A new 69kV substation to be built in 2009 adjacent to WAPA's Flagstaff substation; Sec. 24, T21N, R9E.
(f) Length	Not to exceed two spans.
Routing	A 345/69kV transformer will interconnect into WAPA's Flagstaff substation.
Purpose	This project will serve projected need for electric energy in APS' northern service area. The project will improve reliability and continuity of service for the growing communities in northern Arizona.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2009

A Certificate of Environmental Compatibility is not needed for this project.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	VV1 loop-in of Navajo-Westwing 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Navajo-Westwing 500kV line, near the crossing of the Navajo-Westwing 500kV line with APS' Willow Lake-Childs 69kV line; location to be determined.
(d) Intermediate Point	None.
(e) Point of Termination	VV1 500/69kV substation to be built in 2009 near the crossing of the Navajo-Westwing 500kV line with APS' Willow Lake-Childs 69kV line; location to be determined.
(f) Length	Two single-circuit lines, not to exceed two spans, from the existing Navajo-Westwing line corridor to the VV1 substation.
Routing	The VV1 substation will be built adjacent to the Navajo-Westwing 500kV line, therefore limiting the distance to not exceed two spans.
Purpose	This project will serve projected electrical needs and provide support to the existing subtransmission system in the Verde Valley and Prescott areas.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2009

A Certificate of Environmental Compatibility is not needed for this project.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	Palo Verde-TS5 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Palo Verde switchyard or a new switchyard at Arlington Valley Energy facility.
(d) Intermediate Point	Proposed Harquahala Junction switchyard.
(e) Point of Termination	TS5 500/230kV substation to be constructed in 2009; Sec. 29, T4N, R4W.
(f) Length	Approximately 45 miles of single-circuit line.
Routing	Generally leaving the Palo Verde vicinity following the Palo Verde-Devers and the Hassayampa-Harquahala 500kV lines until crossing the CAP canal. Then following the canal to the new TS5 substation.
Purpose	This line will serve projected need for electric energy in the area immediately north and west of the Phoenix Metropolitan area. It will increase the import capability to the Phoenix Metropolitan area as well as increase the export capability from the Palo Verde hub. This is a joint participation project with APS as the project manager.
Date	
(a) Construction Start	2007
(b) Estimated In Service	2009

Certificate of Environmental Compatibility issued 8/17/05 (Case No. 128, Decision No. 68063, Palo Verde Hub to TS5 500kV Transmission project). APS, as project manager, holds the CEC.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	TS5-TS1 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	1200 MVA.
(c) Point of Origin	TS5 500/230kV substation to be constructed in 2009; Sec. 29, T4N, R4W.
(d) Intermediate Point	None.
(e) Point of Termination	TS1 230/69kV substation to be constructed in 2009; Sec. 20, T4N, R2W.
(f) Length	Approximately 15 miles of double-circuit 230kV line.
Routing	East from TS5 substation along the CAP canal to approximately 243rd Ave., south until the existing 500kV transmission line corridor, and then east along the corridor to the TS1 substation.
Purpose	This project is required to serve the increasing need for electric energy in the western Phoenix Metropolitan area, providing more capability to import power into the Phoenix Metropolitan area along with improved reliability and continuity of service for growing communities such as El Mirage, Surprise, Youngtown, and Buckeye. The first circuit is scheduled to be in-service for the summer of 2009 and the in-service date for the second circuit will be evaluated in future planning studies.
Date	
(a) Construction Start	2007
(b) Estimated In Service	2009

Certificate of Environmental Compatibility issued 5/5/05 (Case No. 127, Decision No. 67828, West Valley North 230kV Transmission Line project).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2009

Line Designation	Raceway-Avery 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	1200 MVA.
(c) Point of Origin	Raceway substation located along the Westwing-New Waddell 230kV line, approximately 3 miles south of the New Waddell Dam; Sec. 4, T5N, R1E.
(d) Intermediate Point	None.
(e) Point of Termination	A new Avery substation near Dove Valley Road and 39th Avenue; Sec. 15, T5N, R2E.
(f) Length	Approximately 10 miles of double-circuit line.
Routing	South from Raceway substation approximately 1 mile, paralleling existing transmission lines, then east approximately 9 miles to the new Avery substation.
Purpose	This line will serve projected need for electric energy in the area immediately north of the Phoenix Metropolitan area. Additionally, improved reliability and continuity of service will result for the area's growing communities such as Anthem, Desert Hills and New River. The first circuit is scheduled to be in-service for the summer of 2009 and the in-service date for the second circuit will be evaluated in future planning studies by SRP as part of their planned Westwing-Pinnacle Peak 230kV project.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2009

Certificate of Environmental Compatibility issued 6/18/03 (Case No. 120, Decision No. 64473, North Valley Project).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2010

Line Designation	Pinnacle Peak-TS6-Avery 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	1200 MVA.
(c) Point of Origin	Pinnacle Peak substation; Sec. 10, T4N, R4E.
(d) Intermediate Point	TS6 substation to be constructed in 2010; Sec. 8, T4N, R3E.
(e) Point of Termination	Avery substation to be constructed in 2009 near Dove Valley Road and 39th Avenue; Sec. 15, T5N, R2E.
(f) Length	Approximately 16 miles of double-circuit line.
Routing	Along the existing 230kV right-of-way, west 10 miles from Pinnacle Peak substation to approximately Interstate 17, generally parallel to and south of Happy Valley Road; then north 5 miles, generally parallel to Interstate 17, to Dove Valley Road, then west to the new Avery substation.
Purpose	This project will serve projected need for electric energy in the area immediately north of the Phoenix Metropolitan area. Additionally, improved reliability and continuity of service will result for the growing communities in the areas of Anthem, Desert Hills, New River, and north Phoenix. The first circuit is scheduled to be in-service for the summer of 2010 and the in-service date for the second circuit will be evaluated in future planning studies by SRP as part of their planned Westwing-Pinnacle Peak 230kV project.
Date	
(a) Construction Start	2004
(b) Estimated In Service	2010

Certificate of Environmental Compatibility issued 6/18/03 (Case No. 120, Decision No. 64473, North Valley Project).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2010

Line Designation	Palm Valley-TS2-TS1 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Palm Valley 230/69kV substation to be constructed in 2007 near the corner of Camelback Rd. and Cotton Ln.; Sec. 24, T2N, R2W.
(d) Intermediate Point	TS2 230/69kV substation to be constructed in 2011; Sec. 25, T3N, R2W.
(e) Point of Termination	TS1 230/69kV substation to be constructed in 2009; Sec. 20, T4N, R2W.
(f) Length	Approximately 12 miles of double-circuit 230kV line.
Routing	North from the Palm Valley substation, generally following the Loop 303, to the TS1 substation passing the location of the future TS2 substation which is currently projected to be in-service in 2011.
Purpose	This project is required to serve the increasing need for electric energy in the western Phoenix Metropolitan area, providing more capability to import power into the Phoenix Metropolitan area along with improved reliability and continuity of service for growing communities such as El Mirage, Surprise, Youngtown, and Buckeye. The first circuit is scheduled to be in-service for the summer of 2010 and the in-service date for the second circuit will be evaluated in future planning studies.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2010

The Palm Valley-TS2 230kV line portion was sited as part of the West Valley South 230kV Transmission Line project and a Certificate of Environmental Compatibility was issued 12/24/03 (Case No. 122, Decision No. 66646). The TS1-TS2 230kV line portion was sited as part of the West Valley North 230kV Transmission Line project and a Certificate of Environmental Compatibility was issued 5/5/05 (Case No. 127, Decision No. 67828).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2010

Line Designation	Raceway – Pinnacle Peak 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Raceway 500kV substation to be constructed in 2010 adjacent to the Navajo-Westwing 500kV line and approximately 1 mile from the existing Raceway 230kV substation; approximately Sec. 33, T6N, R1E.
(d) Intermediate Point	None.
(e) Point of Termination	Pinnacle Peak 500kV substation to be constructed in 2010 near the location of the existing Pinnacle Peak 345/230kV substation; Sec. 10, T4N, R4E.
(f) Length	Approximately 26 miles of single-circuit line.
Routing	East from Raceway 500kV substation to a new Pinnacle Peak 500kV substation.
Purpose	This line is a result of joint planning through the SWAT forum. The project is needed to increase the import capability to the Phoenix Metropolitan area and strengthen the transmission system on the east side of the Phoenix Metropolitan valley. This will be a joint participation project with APS as the project manager. The loop-in of a Navajo-Westwing 500kV transmission line into the Raceway 500kV substation will be part of this project.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2010

An application for a Certificate of Environmental Compatibility is expected to be filed in 2006.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2010

Line Designation	Raceway 500kV to Raceway 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Raceway 500kV substation to be constructed in 2010 adjacent to the Navajo-Westwing 500kV line and approximately 1 mile from the existing Raceway 230kV substation; approximately Sec. 33, T6N, R1E.
(d) Intermediate Point	None.
(e) Point of Termination	Raceway 230kV substation; Sec. 4, T5N, R1E.
(f) Length	Approximately 1 mile of double-circuit 230kV lines from the 500/230kV transformers at the Raceway 500kV substation to the Raceway 230kV substation.
Routing	The 230kV lines would run south from the Raceway 500kV substation to the Raceway 230kV substation.
Purpose	The Raceway 500kV substation will be located north of the existing Raceway 230kV substation due to physical/geographic constraints. The 500/230kV transformers will be located at the Raceway 500kV substation, therefore 230kV lines are needed between the 500/230kV transformers and the Raceway 230kV substation.
Date	
(a) Construction Start	2009
(b) Estimated In Service	2010

An application for a Certificate of Environmental Compatibility has not yet been filed. It is anticipated that this project will be filed with the Raceway-Pinnacle Peak 500kV Transmission project.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2011

Line Designation	Jojoba loop-in of TS4-Panda 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	188 MVA.
(c) Point of Origin	TS4-Panda 230kV line near the existing Jojoba 500kV switchyard; Sec. 25, T2S, R4W.
(d) Intermediate Point	None.
(e) Point of Termination	Jojoba 230/69kV substation to be built in 2011, adjacent to the existing Jojoba 500kV switchyard; Sec. 25, T2S, R4W.
(f) Length	Two single-circuit lines, not to exceed two spans, from the existing line corridor to the Jojoba 230/69kV substation.
Routing	Jojoba 230/69kV substation will be adjacent to the TS4-Panda 230kV line so it will not exceed two spans.
Purpose	This substation will be needed to serve projected need for electric energy for the growing communities in the areas of Buckeye, Goodyear, and Gila Bend.
Date	
(a) Construction Start	2010
(b) Estimated In Service	2011

Certificate of Environmental Compatibility issued 10/16/00 (Case No. 102, Decision No. 62960, Gila River Transmission Project).

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2011

Line Designation	Mazatzal loop-in of Cholla-Pinnacle Peak 345kV line.
Size	
(a) Voltage	345kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Cholla-Pinnacle Peak 345kV line; near Sec. 3, T8N, R10E.
(d) Intermediate Point	None.
(e) Point of Termination	Mazatzal 345/69kV substation; approximately Sec. 3, T8N, R10E.
(f) Length	Two single-circuit lines, not to exceed two spans, from the existing Cholla-Pinnacle Peak line corridor to the Mazatzal substation.
Routing	The Mazatzal substation will be built adjacent to the Cholla-Pinnacle Peak 345kV line so it will not exceed two spans.
Purpose	This substation will serve projected need for electric energy in the area of Payson and the surrounding communities. Additionally, improved reliability and continuity of service will result for the growing communities in the Payson area.
Date	
(a) Construction Start	2010
(b) Estimated In Service	2011

A Certificate of Environmental Compatibility is not needed for this project.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2012

Line Designation	North Gila – TS8 230kV Line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	North Gila 230kV substation to be constructed in 2012; Sec 11, T8S, R22W.
(d) Intermediate Point	None.
(e) Point of Termination	TS8 230kV substation to be constructed in 2012; location to be determined.
(f) Length	Approximately 15 miles of 230kV line on double-circuit poles.
Routing	The routing for this line has not yet been determined.
Purpose	This project is required to serve the increasing need for electric energy in the city of Yuma. Additionally, improved reliability and continuity of service will result for the fast growing Yuma County.
Date	
(a) Construction Start	2010
(b) Estimated In Service	2012

An application for a Certificate of Environmental Compatibility has not yet been filed.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2012

Line Designation	TS5 – Raceway 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	TS5 500/230kV substation to be constructed in 2009; Sec. 29, T4N, R4W.
(d) Intermediate Point	None.
(e) Point of Termination	Raceway 500kV substation to be constructed in 2010 adjacent to the Navajo-Westwing 500kV line and approximately 1 mile from the existing Raceway 230kV substation; approximately Sec. 33, T6N, R1E.
(f) Length	Approximately 40 miles of single-circuit line.
Routing	North from TS5 substation and then in a northeasterly direction to the Raceway substation.
Purpose	This line will be needed to serve projected need for electric energy in the area immediately north and west of the Phoenix Metropolitan area. It will increase the import capability to the Phoenix Metropolitan area as well as increase the export capability from the Palo Verde hub and provide support for multiple Westwing 500/230kV transformer outages. This will be a joint participation project with APS as the project manager.
Date	
(a) Construction Start	2010
(b) Estimated In Service	2012

An application for a Certificate of Environmental Compatibility has not yet been filed.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

2012

Line Designation	Palo Verde switchyard (or vicinity)-North Gila 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Palo Verde switchyard or vicinity.
(d) Intermediate Point	None.
(e) Point of Termination	North Gila 500/69kV substation or another substation adjacent to the North Gila location; Sec. 11, T8S, R22N.
(f) Length	Approximately 115 miles of single-circuit line.
Routing	West and south from Palo Verde area to the Yuma area.
Purpose	This line is expected to be a joint project. As a new transmission path to Yuma area, this 500kV line will provide transmission capacity required to supplement limited transmission and generation resources in the Yuma area.
Date	
(a) Construction Start	2008
(b) Estimated In Service	2012

An application for a Certificate of Environmental Compatibility has not yet been filed.

TBD

Line Designation	Yucca – TS8 230kV Line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Yucca 230kV substation that would be constructed in the future; Sec 11, T8S, R22W.
(d) Intermediate Point	None.
(e) Point of Termination	TS8 230kV substation to be constructed in 2012; location to be determined.
(f) Length	Approximately 30 miles of 230kV line on double-circuit poles.
Routing	The routing for this line has not yet been determined.
Purpose	This project would serve the increasing need for electric energy in the city of Yuma. Additionally, improved reliability and continuity of service will result for the fast growing Yuma County.
Date	
(a) Construction Start	TBD
(b) Estimated In Service	TBD

An application for a Certificate of Environmental Compatibility has not yet been filed.

TBD

Line Designation	Westwing-El Sol 230kV line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Westwing substation; Sec. 12, T4N, R1W.
(d) Intermediate Point	None.
(e) Point of Termination	El Sol substation; Sec. 30, T3N, R1E.
(f) Length	Approximately 11 miles of single-circuit line.
Routing	Per Certificate.
Purpose	This line will increase system capacity to serve growing demand for electric energy in the Phoenix Metropolitan area, while maintaining system reliability and integrity for delivery of bulk power from Westwing south into the APS Phoenix Metropolitan area 230kV transmission system.
Date	
(a) Construction Start	TBD
(b) Estimated In Service	TBD

Certificate of Environmental Compatibility issued 7/26/73 (Case No. 9, docket No. U-1345). Note that this Certificate authorizes two double-circuit lines. Construction of the first double-circuit line was completed in March 1975. Construction of the second line, planned to be built with double-circuit capability but initially operated with a single circuit, is described above.

TBD

Line Designation	Westwing – Raceway 230kV Line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Westwing substation; Sec 12, T4N, R1W.
(d) Intermediate Point	None.
(e) Point of Termination	Raceway 230kV substation located along the Westwing-New Waddell 230kV line, approximately 3 miles south of the Waddell Dam; Sec. 4, T5N, R1E.
(f) Length	Approximately 7 miles of 230kV line on double-circuit poles.
Routing	Northeast from Westwing substation paralleling existing transmission lines to the Raceway 230kV substation.
Purpose	This line will serve increasing loads in the far north and northwest parts of the Phoenix Metropolitan area and provide contingency support for multiple Westwing 500/230kV transformer outages. The in-service date for the first circuit will continue to be evaluated in future planning studies by APS and the in-service date for the second circuit will be evaluated in future planning studies by SRP.
Date	
(a) Construction Start	TBD
(b) Estimated In Service	TBD

Certificate of Environmental Compatibility issued 6/18/03 (Case No. 120, Decision No. 64473, North Valley 230kV Transmission Line Project).

TBD

Line Designation	Santa Rosa – Pinal South 230kV Line.
Size	
(a) Voltage	230kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Santa Rosa substation; Sec 30, T5S, R4E.
(d) Intermediate Point	None.
(e) Point of Termination	Proposed Pinal South substation; location to be determined.
(f) Length	Approximately 30 miles of 230kV line on 500/230kV double-circuit poles.
Routing	The 230kV line would be on the same structures as the approved 500kV South East Valley line.
Purpose	This line will serve increasing loads in Pinal County and will improve reliability and continuity of service for the rapidly growing communities.
Date	
(a) Construction Start	TBD
(b) Estimated In Service	TBD

Authority for the 230kV line strung on the 500kV structures was granted in the Certificate of Environmental Compatibility issued in 2005, Case No. 126, Decision Nos. 68093 and 68291.

Arizona Public Service Company
2006 – 2015
Ten-Year Plan
Planned Transmission Description

TBD

Line Designation	Palo Verde - Saguaro 500kV line.
Size	
(a) Voltage	525kV AC.
(b) Capacity	To be determined.
(c) Point of Origin	Palo Verde Switchyard; Sec. 34, T1N, R6W.
(d) Intermediate Point	None.
(e) Point of Termination	Saguaro substation; Sec. 14, T10S, R10E.
(f) Length	Approximately 130 miles of new line to be built on single-circuit poles or towers. Some sections may be built on double-circuit structures.
Routing	South and east from the Palo Verde switchyard, paralleling existing transmission lines for part of the route. The approved corridor is defined in the CEC identified below.
Purpose	This line is the result of the joint participation CATS study. The line will be needed to increase the adequacy of the existing EHV transmission system and permit increased power delivery throughout the state. It is anticipated the line will be a joint participation project.
Date	
(a) Construction Start	TBD
(b) Estimated In Service	TBD

Certificate of Environmental Compatibility issued 01/23/1976 (Case No. 24, Decision No. 46802).

TRANSMISSION PLANNING PROCESS & GUIDELINES

A subsidiary of Pinnacle West Capital Corporation

TRANSMISSION PLANNING PROCESS AND GUIDELINES

APS Transmission Planning

January 2006

TRANSMISSION PLANNING PROCESS AND GUIDELINES

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I. INTRODUCTION AND PURPOSE

The Transmission Planning Process and Guidelines (Guidelines) are used by Arizona Public Service Company (APS) to assist in planning its Extra High Voltage (EHV) transmission system (345kV and 500kV) and High Voltage transmission system (230kV and 115kV). In addition to these Guidelines, APS follows the Western Electricity Coordinating Council's (WECC) regional planning reliability criteria for system disturbance and performance levels. These WECC Reliability Criteria are (1) WECC/NERC Reliability Criteria for Transmission System Planning and (2) Minimum Operating Reliability Criteria, which can be found in their entirety on the WECC website; (http://www.wecc.biz/documents/library/procedures/CriteriaMaster.pdf). These Guidelines are for internal use by APS and may be changed or modified. Thus, others should not use these Guidelines without consultation with APS.

II. PLANNING METHODOLOGY

A. General

APS uses a deterministic approach for transmission system planning. Under this approach, system performance should meet certain specific criteria under normal conditions (all lines in-service) and for any single contingency condition (any one element out-of-service). In general, an adequately planned transmission system will:

- Provide an acceptable level of service that is cost-effective for normal and single contingency operating conditions.
- Maintain service to all firm loads for any single contingency outage; except for radial loads.
- Not result in overloaded equipment or unacceptable voltage conditions for single contingency outages.
- Not result in cascading for single or double contingency outages.
- Provide for the proper balance between the transmission import capability and local generation requirements for an import limited load area.

Although APS uses a deterministic approach for transmission system planning, the WECC reliability planning criteria provides for exceptions based upon a probalistic approach. APS uses these probabilistic criteria when/where appropriate in the transmission planning process. Historical system reliability performance is analyzed on a periodic basis and the results are used in the design of planned facilities.

These planning methodologies, assumptions, and guidelines are used as the basis for the development of future transmission facilities. Additionally, consideration of potential alternatives to transmission facilities (such as distributed generation or new technologies) is evaluated on a case-specific basis.

As new planning tools and/or information become available revisions or additions to these guidelines will be made as appropriate.

B. Transmission Planning Process

APS' transmission planning process consists of an assessment of the following needs:

- Provide adequate transmission to access sufficient resources in-order to reliably and economically serve loads.
- Support APS' local transmission and sub-transmission systems.
- Provide for interconnection for new resources.
- Accommodate requests for long-term transmission access.

During this process, consideration is given to load growth patterns, other system changes affected by right-of-way, facilities siting constraints, routing of future transportation corridors, and joint planning with neighboring utilities and governmental entities.

1. EHV Transmission Planning Process

APS' EHV transmission system, which consists of 500kV and 345kV, has primarily been developed to provide transmission to bring the output of large base-loaded generators to load centers, such as Phoenix. Need for new EHV facilities may result from any of the bullet items described above. APS' annual planning process includes an assessment of APS' transmission

capability to ensure that sufficient resources can be accessed to reliably and economically serve loads. In addition, biennial RMR studies are performed to ensure that proper balance between the transmission import capability and local generation requirements for an import limited load area are maintained.

2. 230kV Transmission Planning Process

APS' 230kV transmission system has primarily been developed to provide transmission to distribute power from the EHV bulk power substations and local generators to the distribution system and loads throughout the load areas.

Planning for the 230kV system assesses the need for new 230/69kV substations to support local sub-transmission and distribution system growth and the reliability performance of the existing 230kV system. This process takes into account the future land use plans that were developed by government agencies, Landis aerial photo maps, master plans that were provided by private developers, and APS' long-range forecasted load densities per square mile for residential, commercial, and industrial loads.

3. Transmission Facilities Required for Generation/Resource Additions

New transmission facilities may also be required in conjunction with generation resources due to (1) a "merchant" request by an Independent Power Producer (IPP) for generator interconnection to the APS system, (2) a "merchant" request for point-to-point transmission service from the generator (receipt point) to the designated delivery point, or (3) designation of new resources or re-designation of existing units to serve APS network load (including removal of an older units' native load designation). These studies/processes are performed pursuant to the APS Open Access Transmission Tariff (OATT).

C. Ten Year Transmission System Plans

Each year APS uses the planning process described in section B to update the Ten-Year Transmission System Plan. The APS Ten Year Transmission System Plan identifies all new transmission facilities, 115kV and above, and all

facility replacements/upgrades required over the next ten years to reliably and economically serve the load.

D. Regional Coordinated Planning

1. Western Electricity Coordinating Council (WECC)

APS is a member of the Western Electricity Coordinating Council. The focus of the WECC is on promoting the reliability of the interconnected bulk electric system. The WECC provides the means for:

- Developing regional planning and operating criteria.
- Coordinating future plans.
- Compiling regional data banks for use by the member systems and the WECC in conducting technical studies.
- Assessing and coordinating operating procedures and solutions to regional problems.
- Establishing an open forum with interested non-project participants to review the plan of service for a project.

APS works with WECC to adhere to these planning practices.

2. Sub-Regional Planning Groups

Southwest Area Transmission Planning (SWAT), Southwest Transmission Expansion Plan (STEP), Seams Steering Group – Western Interconnection (SSG-WI), and other sub-regional planning groups provide a forum for entities within a region, and any other interested parties, to determine and study the needs of the region as a whole. It also provides a forum for specific projects to be exposed to potential partners and allows for joint studies and participation from interested parties.

3. Joint Studies

In many instances, transmission projects can serve the needs of several utilities and/or IPPs. To this end, joint study efforts may be undertaken. Such joint study efforts endeavor to develop a plan that will meet the needs and desires of all individual companies involved.

E. Generation Schedules

For planning purposes, economic dispatches of network resources are determined for APS' system peak load in the following manner:

a. Determine base generation available and schedule these units at maximum output.
b. Determine resources purchased from other utilities, IPPs, or power marketing agencies.
c. Determine APS' spinning reserve requirements.
d. Schedule intermediate generation (oil/gas steam units) such that the spinning reserve requirements, in section (c) above, are met.
e. Determine the amount of peaking generation (combustion turbine units) required to supply the remaining system peak load.

Phoenix area network resources are dispatched based on economics and any existing import limitations. When possible, spinning reserve will be carried on higher cost Phoenix area network generating units.

Generation output schedules for interconnected utilities and IPPs are based upon consultation with the neighboring utilities and IPPs or as modeled in the latest data in WECC coordinated study cases.

F. Load Projections

APS substation load projections are based on the APS Corporate Load Forecast. Substation load projections for neighboring interconnected utilities or power agencies operating in the WECC area are based on the latest data in WECC coordinated study cases. Heavy summer loads are used for the Ten-Year Transmission System Plans.

G. Alternative Evaluations

1. General

In evaluating several alternative plans, comparisons of power flows, transient stability tests, and fault levels are made first. After the alternatives are found that meet the system performance criteria in each of these three

areas comparisons may be made of the losses, transfer capability, impact on system operations, and reliability of each of the plans. Finally, the costs of facility additions (capital cost items), costs of losses, and relative costs of transfer capabilities are determined. A brief discussion of each of these considerations follows.

2. Power Flow Analyses

   Power flows of base case (all lines in-service) and single contingency conditions are tested and should conform to the system performance criteria set forth in Section IV of these Guidelines. Double or multiple contingencies are examined, but in general, no facilities are planned for such conditions. Normal system voltages, voltage deviations, and voltage extreme limitations are based upon operating experience resulting in acceptable voltage levels to the consumer. Power flow limits are based upon the thermal ratings and/or sag limitations of conductors or equipment, as applicable.

3. Transient Stability Studies

   Stability guidelines are established to maintain system stability for single contingency, three-phase fault conditions. Double or multiple contingencies are examined, but in general, no facilities are planned for such conditions.

4. Short Circuit Studies

   Three-phase and single-phase-to-ground fault studies are performed to ensure the adequacy of system protection equipment to clear and isolate faults.

5. Reactive Power Margin Analyses

   Reactive Power Margin analyses are performed when steady-state analyses indicate possible insufficient voltage stability margins. V-Q curve analyses are used to determine post-transient voltage stability.

6. Losses Analyses

   A comparison of individual element and overall transmission system losses are made for each alternative plan being studied. The losses computed in the power flow program consist of the I^2R losses of lines and transformers and the core losses in transformers, where represented.

7. Transfer Capability Studies

In evaluating the relative merits of one or more EHV transmission plans, both simultaneous and non-simultaneous transfer capability studies are performed to determine the magnitude of transfer capabilities between areas or load centers.

8. Subsynchronous Resonance (SSR)

SSR phenomenon result from the use of series capacitors in the network where the tuned electrical network exchanges energy with a turbine generator at one or more of the natural frequencies of the mechanical system. SSR countermeasures are applied to prevent damage to machines as a result of transient current or sustained oscillations following a system disturbance. SSR studies are not used directly in the planning process. SSR countermeasures are determined after the transmission plans are finalized.

9. FACTS (Flexible AC Transmission System)

FACTS essentially involves the controlling of series capacitor impedances. A series capacitor bank can be controlled by thyristors to do the following:

a) change its effective impedance to control the power flow
b) to make dynamic changes in its impedance in-order to provide damping of oscillations

FACTS will be evaluated as a means of power flow control and/or to provide damping to dynamic oscillations where a need is identified and it is economically justified.

10. Economic Evaluation

In general, an economic evaluation of alternative plans consists of a cumulative present worth or equivalent annual cost comparison of capital costs.

III. PLANNING ASSUMPTIONS

A. General

1. Loads

Loads used for the APS system originate from the latest APS Corporate Load Forecast. In most cases, the corrected power factor of APS loads is 99.5% at 69kV substations.

2. Generation and Other Resources

Generation dispatch is based on firm power and/or transmission wheeling contracts including network resources designations.

3. Normal Voltage Levels

a. Nominal EHV design voltages are 500kV, 345kV, 230kV, and 115kV.

b. Nominal EHV operating voltages are 535kV, 348kV, 239kV, and 119kV.

4. Sources of Databases

WECC Heavy Summer base cases are the sources of the databases. Loop flow (unscheduled flow), of a reasonable amount and direction, will be allowed for use in planning studies.

5. Voltage Control Devices

Devices which can control voltages are shunt capacitors, shunt reactors, tap-changing-under-load (TCUL) and fixed-tap transformers, static VAR compensators, and machine VAR capabilities. If future voltage control devices are necessary, these devices will be evaluated based upon economics and the equipment's ability to obtain an adequate voltage profile on the EHV and HV systems.

6. Phase Shifters

In general, where phase shifters are used, schedules are held across the phase shifter in base case power flows and the phase shifter tap remains fixed in the outage cases.

7. Conductor Sizes

Existing transmission voltages utilized by APS are 230kV, 345kV, and 500kV. It is presently planned that the 345kV transmission system will not be expanded, thus all future APS EHV lines will be 500kV or 230kV. Planned

500kV lines will initially be modeled using tri-bundled 1780 kCM ACSR conductor (Chukar). Preferred construction for 230kV lines consists of 2156 kCM ACSS conductor on steel poles.

8. 69kV System Modeling

230kV facility outages may result in problems to the underlying 69kV system due to the interconnection of those systems. For this reason, power flow cases include a detailed 69kV system representation. Solutions to any problems encountered on the 69kV system are coordinated with the subtransmission planning engineers.

9. Substation Transformers

a. 500kV and 345kV Substations

Bulk substation transformer banks may be made up of one three-phase or three single-phase transformers, depending upon bank size and economics. For larger banks where single-phase transformers are used, a fourth (spare) single-phase transformer will be used in a jack-bus arrangement to improve reliability and facilitate connection of the spare in the event of an outage of one of the single-phase transformers. TCUL will be considered in the high voltage windings, generally with a range of plus or minus 10%. High voltage ratings will be 500kV or 345kV class and low voltage windings will be 230kV, 115kV, or 69kV class.

b. 230kV Substations

For high-density load areas, both 230/69kV and 69/12.5kV transformers can be utilized. 230/69kV transformers will be rated at 113/150/188 MVA with a 65°C temperature rise, unless otherwise specified. 69/12.5kV transformers will be rated at 25/33/41 MVA with a 65°C temperature rise, unless otherwise specified.

With all elements in service, a transformer may be loaded up to its top Forced Oil Air (FOA) rating without sustaining any loss of service life. For a single contingency outage (loss of one transformer) the remaining transformer or transformers may be loaded up to 20% above their top FOA rating, unless heat test data indicate a different overload capability. The

loss of service life sustained will depend on the transformer pre-loading and the outage duration. Tap setting adjustment capabilities on 230/69kV transformers will be ±5% from the nominal voltage setting (230/69kV) at 2½% increments.

10. Switchyard Arrangements

a. 500kV and 345kV Substations

Existing 345kV switchyard arrangements use breaker-and-one-half, main-and-transfer, or modified paired-element circuit breaker switching schemes. Because of the large amounts of power transferred via 500kV switchyards and the necessity of having adequate reliability, all 500kV circuit breaker arrangements are planned for an ultimate breaker-and-one-half scheme. If only three or four elements are initially required, the circuit breakers are connected in a ring bus arrangement, but physically positioned for a breaker-and-one-half scheme. The maximum desired number of elements to be connected in the ring bus arrangement is four. System elements such as generators, transformers, and lines will be arranged in breaker-and-one-half schemes such that a failure of a center breaker will not result in the loss of two lines routed in the same general direction and will minimize the impact of losing two elements.

b. 230kV Substations

Future 230/69kV substations should be capable of serving up to 452 MVA of load. 400 MVA has historically been the most common substation load level in the Phoenix Metropolitan area. Future, typical 230/69kV substations should accommodate up to four 230kV line terminations and up to three 230/69kV transformer bays. Based upon costs, as well as reliability and operating flexibility considerations, a breaker-and-one-half layout should be utilized for all future 230/69kV Metropolitan Phoenix Area substations, with provision for initial development to be a ring bus. Any two 230/69kV transformers are to be

separated by two breakers, whenever feasible, so that a stuck breaker will not result in an outage of both transformers.

11. Series Capacitor Application

Series capacitors may be used on EHV lines to increase system stability, for increased transfer capability, and/or for control of power flow. The series capacitors may be lumped at one end of a line because of lower cost; however, the capacitors are generally divided into two banks, one at either end of a line, for improved voltage profile.

12. Shunt and Tertiary Reactor Application

Shunt and/or tertiary reactors may be installed to prevent open end line voltages from being excessive, in addition to voltage control. The open end line voltage must not be more than 0.05 per unit voltage greater than the sending end voltage. Tertiary reactors may also be used for voltage and VAR control as discussed above.

B. Power Flow Studies

1. System Stressing

Realistic generation capabilities and schedules should be used to stress the transmission system in order to maximize the transfer of resources during the maximum load condition.

2. Displacement

In cases where displacements (due to power flow opposite normal generation schedules) may have an appreciable effect on transmission line loading, a reasonable amount of displacement (Generation Units) may be removed in-order to stress a given transmission path.

C. Transient Stability Studies

1. Fault Simulation

When studying system disturbances caused by faults, two conditions will be simulated:

a. Three-phase-to-ground faults, and

b. Single-line-to-ground faults with a stuck circuit breaker in one phase with back-up delayed clearing.

2. Margin

   a. Generation margin may be applied for the contingencies primarily affected by generation, or

   b. Power flow margin may be applied for the contingencies primarily affected by power flow.

3. Unit Tripping

   Generator unit tripping may be allowed in-order to increase system stability performance.

4. Machine Reactance Representation

   For transient stability studies, the unsaturated transient reactance of machines with full representation will be used.

5. Fault Damping

   Fault damping will be applied to the generating units adjacent to faults. Fault damping will be determined from studies that account for the effect of generator amortisseur windings and the SSR filters.

6. Series Capacitor Switching

   Series capacitors, locations to be determined from short circuit studies, will be flashed and reinserted as appropriate.

D. Short Circuit Studies

Three-phase and single-phase-to-ground faults will be evaluated.

1. Generation Representation

   All generation will be represented.

2. Machine Reactance Representation

   The saturated subtransient reactance (X''_d) values will be used.

3. Line Representation

   The transmission line zero sequence impedance (X_0) is assumed to be equal to three times the positive sequence impedance (X_1).

4. Transformer Representation

The transformer zero sequence impedance (X_0) is assumed to be equal to the positive sequence impedance (X_1). Bulk substation transformers are modeled as auto-transformers. The two-winding model is that of a grounded-wye transformer. The three-winding model is that of a wye-delta-wye with a solid ground.

E. Reactive Power Margin Studies

Using Q-V curve analyses, APS assesses the interconnected transmission system to ensure there are sufficient reactive resources located throughout the electric system to maintain post-transient voltage stability for system normal conditions and certain contingencies.

IV. SYSTEM PERFORMANCE

A. Power Flow Studies

1. Normal (Base Case Conditions)

a. Voltage Levels

1) General

(a) 500kV bus voltages will be maintained between 1.05 and 1.08 p.u. on a 500kV base.

(b) 345kV bus voltages will range between .99 and 1.04 p.u. on the 345kV system.

(c) 500kV and 345kV system voltages are used to maintain proper 230kV bus voltages.

(d) Voltage on the 230kV and 115kV system should be between 1.01 p.u. and 1.05 p.u.

(e) Tap settings for 230/69kV and 345/69kV transformers should be used to maintain low side (69kV) voltages of 1.03 to 1.04 p.u. Seasonal tap changes may be required.

2) Specific Buses

(a) APS Pinnacle Peak 230kV bus voltage should be between 1.025 p.u. and 1.035 p.u.

(b) APS Westwing 230kV bus voltage should be between 1.04 p.u. and 1.05 p.u.

(c) Saguaro 115kV bus voltage will be approximately 1.035 p.u.

(d) Voltage at the Prescott (DOE) 230kV bus should be approximately 1.02 p.u.

b. Facility Loading Limits

1) Transmission Lines

Transmission line loading cannot exceed 100% of the continuous rating, which is based upon established conductor temperature limit or sag limitation.

2) Underground Cable

Underground cable loading should not exceed 100% of the continuous rating with all elements in service. This rating is based on a cable temperature of 85°C with no loss of cable life.

3) Transformers

Transformers cannot exceed 100% of top FOA, 65°C rise, nameplate ratings.

4) Series Capacitors

Series Capacitors cannot exceed 100% of continuous rating.

c. Interchange of VARs

Interchange of VARs between companies at interconnections will be reduced to a minimum and maintained near zero.

d. Distribution of Flow

Schedules on a new project will be compared to simulated power flows to ensure a reasonable level of flowability.

2. Single Contingency Outages

a. Voltage Levels

Maximum voltage deviation on APS' major buses cannot exceed 5%. This deviation level yields a close approximation to the post-transient VAR margin requirements of WECC.

b. Facilities Loading Limits

1) Transmission Lines

Transmission line loading cannot exceed 100% of the lesser of the sag limit or the emergency rating (30-minute rating) which is based upon established conductor temperature limits.

2) Underground Cable

Underground cable loading should not exceed the emergency rating during a single-contingency outage. This rating is based on a cable temperature of 105°C for two hours of emergency operation with no loss of cable life.

3) Transformers

Transformers cannot exceed 120% of top FOA, 65°C rise, nameplate ratings.

4) Series Capacitors

Series Capacitors cannot exceed 100% of emergency rating.

c. Generator Units

Generator units used for controlling remote voltages will be modified to hold their base case terminal voltages.

d. Impact on Interconnected System

Single contingency outages will not cause overloads upon any neighboring transmission system.

B. Transient Stability Studies

Transient stability studies are primarily performed on the 500kV and 345kV systems.

1. Fault Simulation

Three-phase-to-ground faults and single-line-to-ground faults, simulating a stuck circuit breaker in one phase with back-up delayed clearing will be simulated. Fault clearing times of four cycles after fault inception (5 cycles for a 230kV fault) and a back-up clearing time of twelve cycles after fault inception is utilized. System elements are switched out at the appropriate clearing times, as applicable. Fault damping will be applied when applicable at fault inception.

2. Series Capacitor Switching

Series capacitors, at locations determined from short-circuit studies, will be flashed at fault inception and will be reinserted depending on their reinsertion types.

3. System Stability

The system will be considered stable if the following conditions are met:

a. All machines in the system remain synchronized as demonstrated by the relative rotor angles.

b. Positive system damping exists as demonstrated by the damping of relative rotor angles and the damping of voltage magnitude swings. For N-1 disturbances, voltages for the first swing after fault clearing should not drop below 75% of pre-fault value with maximum time duration of 20 cycles for voltage dip exceeding 20%.

4. Re-closing

Automatic re-closing of circuit breakers controlling EHV facilities is not utilized.

C. Short Circuit Studies

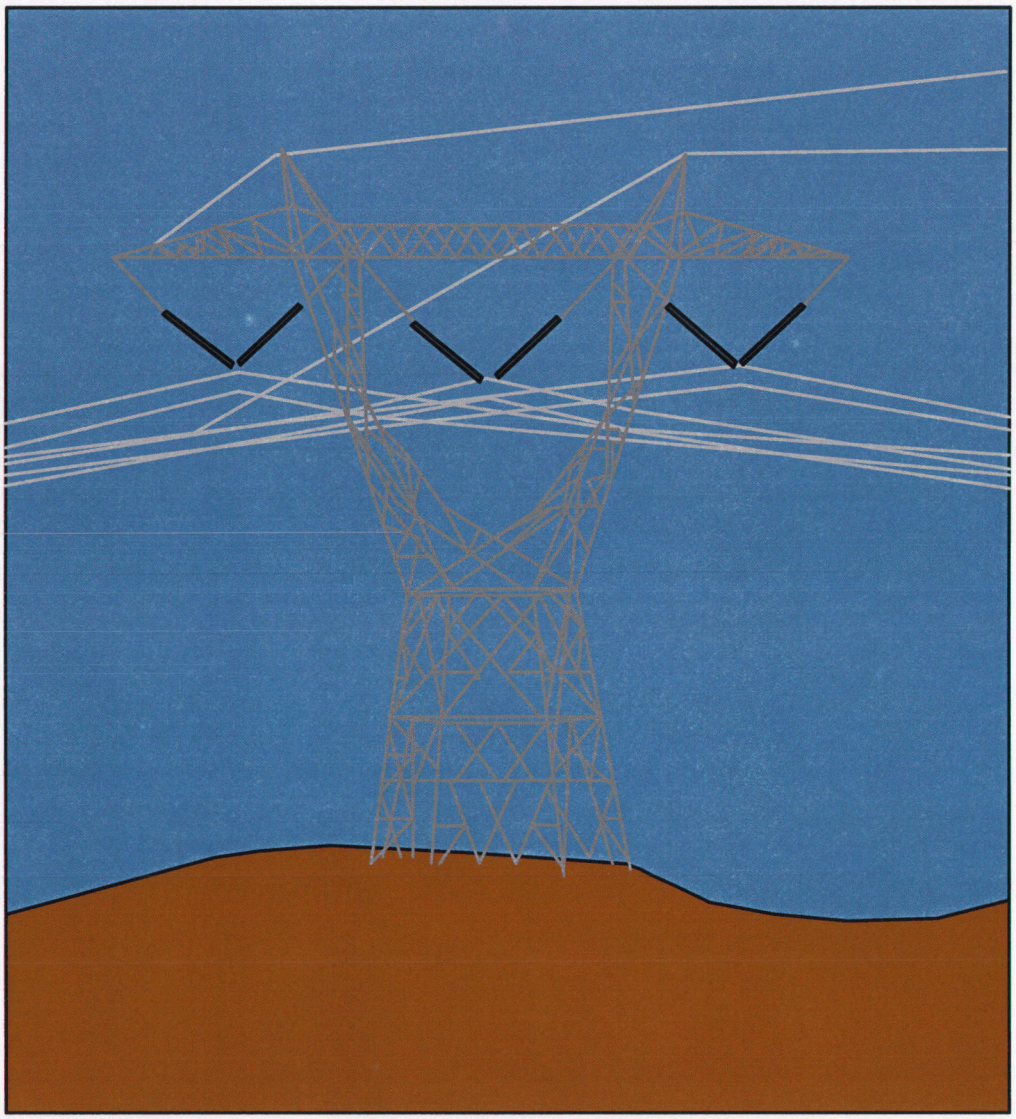
Fault current shall not exceed 100% of the applicable breaker fault current interruption capability for three-phase or single-line-to-ground faults.

D. Reactive Power Margin Studies

For system normal conditions or single contingency conditions, post-transient voltage stability is required with a path or load area modeled at a minimum of 105% of the path rating or maximum planned load limit for the area under study, whichever is applicable. For multiple contingencies, post-transient voltage stability is required with a path or load area modeled at a minimum of 102.5% of the path rating or maximum planned load limit for the area under study, whichever is applicable.

2005 SYSTEM RATING MAPS

2005 SYSTEM RATING MAPS



Prepared By

Transmission Operations
August, 2005

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METRO 230KV ---------- 6

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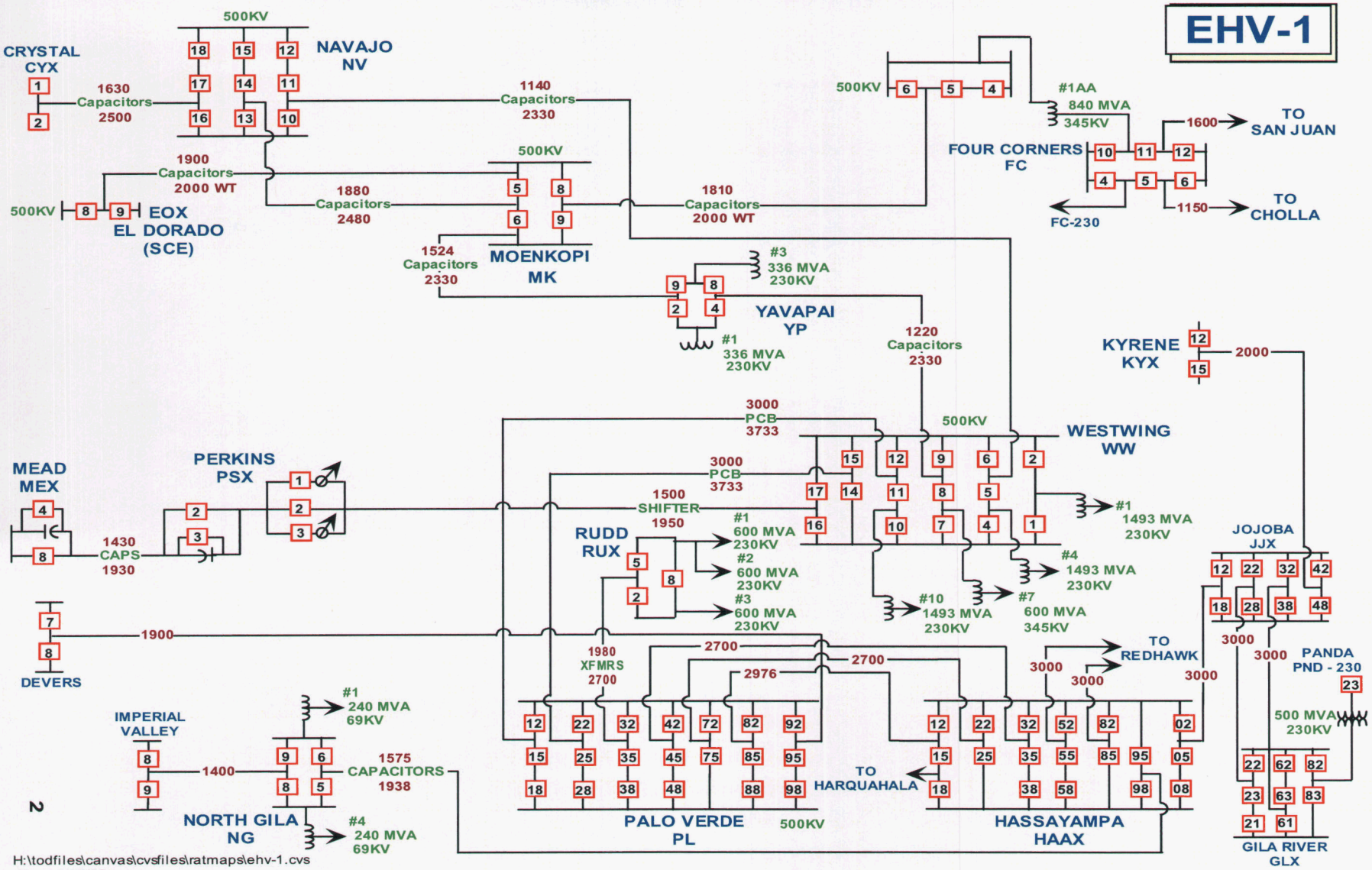
LEGEND
SYSTEM RATING MAPS

SYMBOL	DESCRIPTION
###	CURRENT LIMIT IN AMPS
—— ### ——	LIMITING ELEMENT
###	CONDUCTOR LIMIT IN AMPS
	TRANSFORMER LIMITS ARE IN MVA
————————	OVERHEAD TRANSMISSION LINE
– – – – – –	UNDERGROUND CABLE
M	MOTOR OPERATED SWITCH
V	VACCUM SWITCH
H	HYDRAULIC SWITCH
1	BREAKER NUMBER

EHV-1



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EHV-1

EMERGENCY RATINGS

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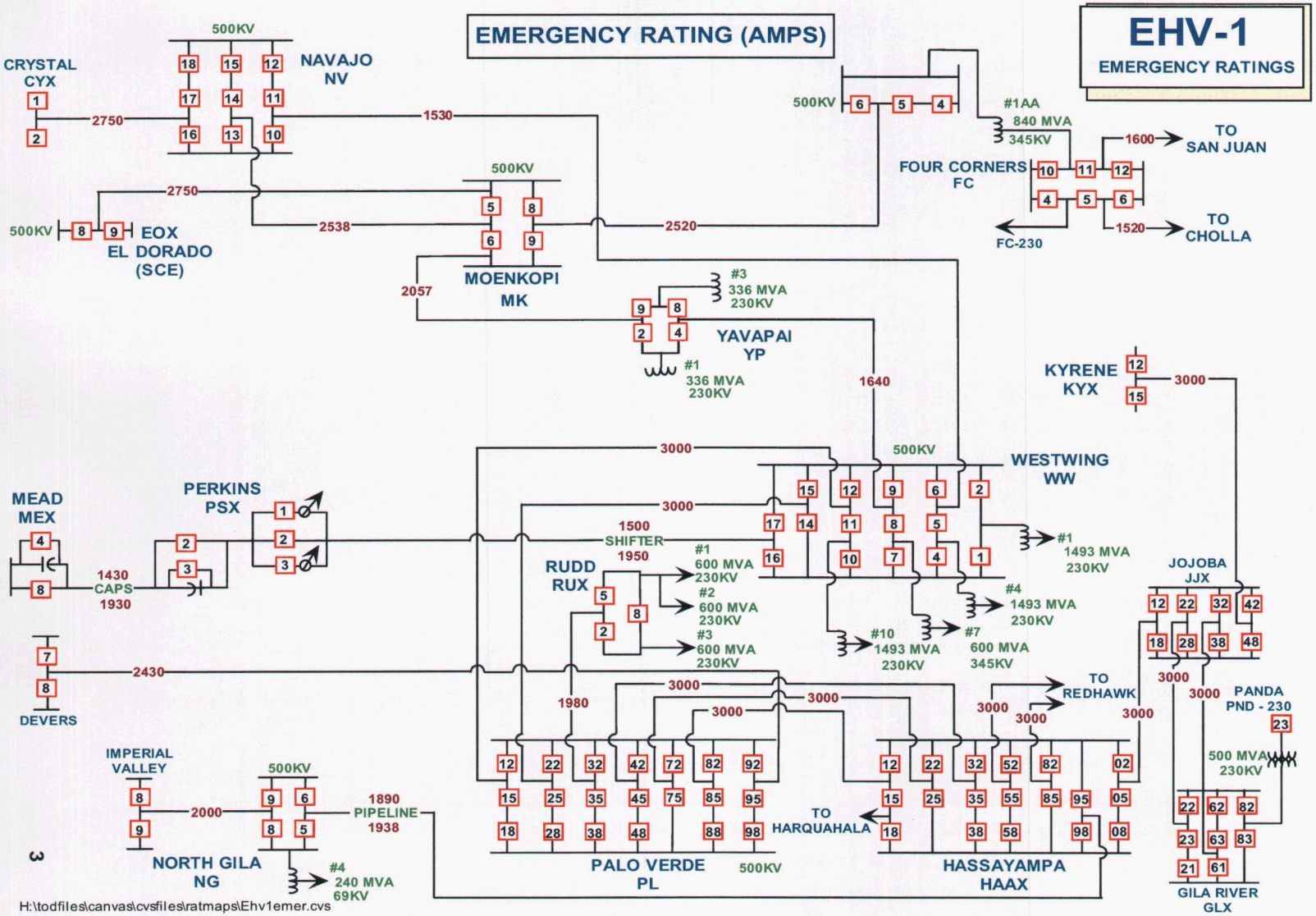

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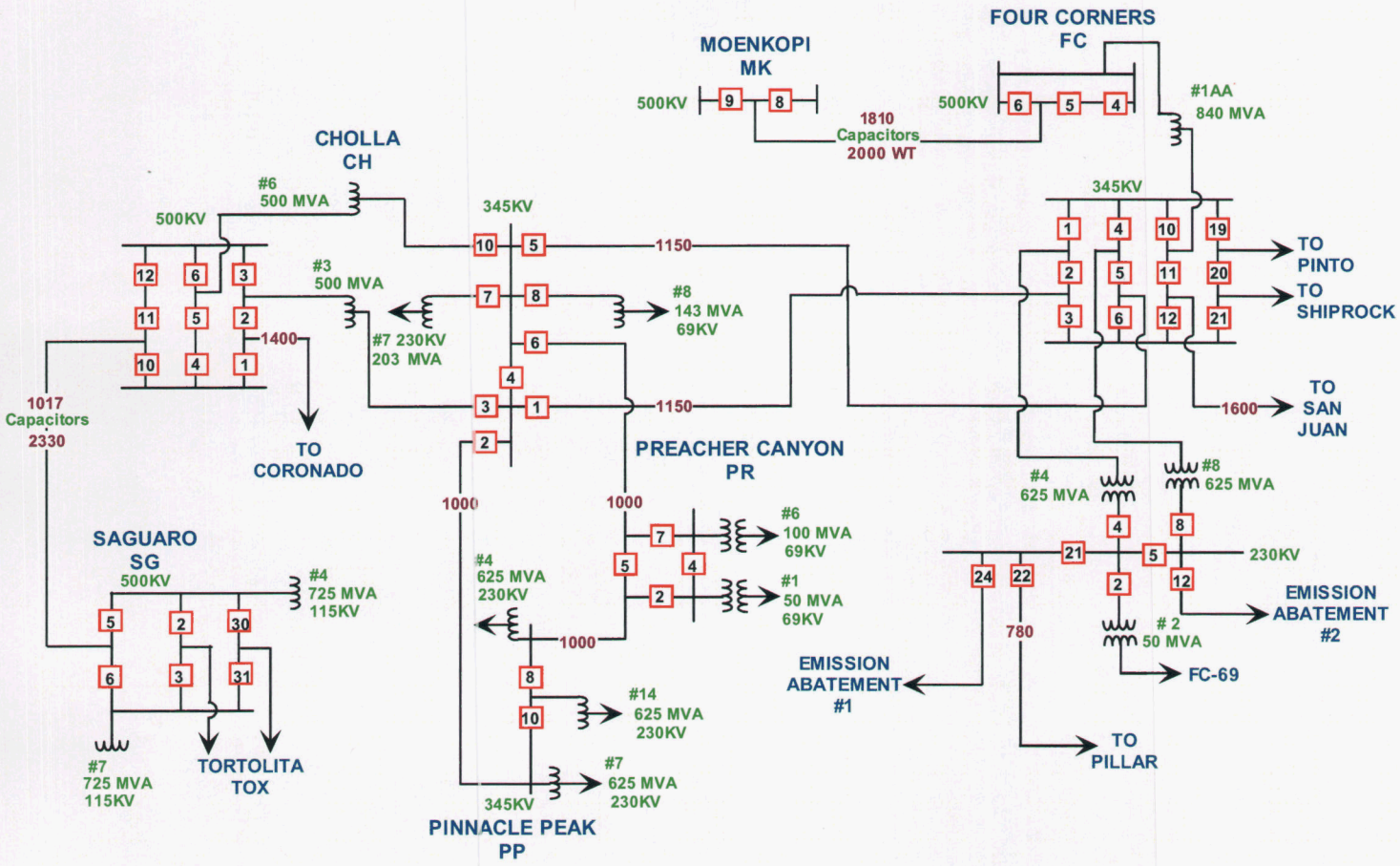

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Rev. 8/17/05

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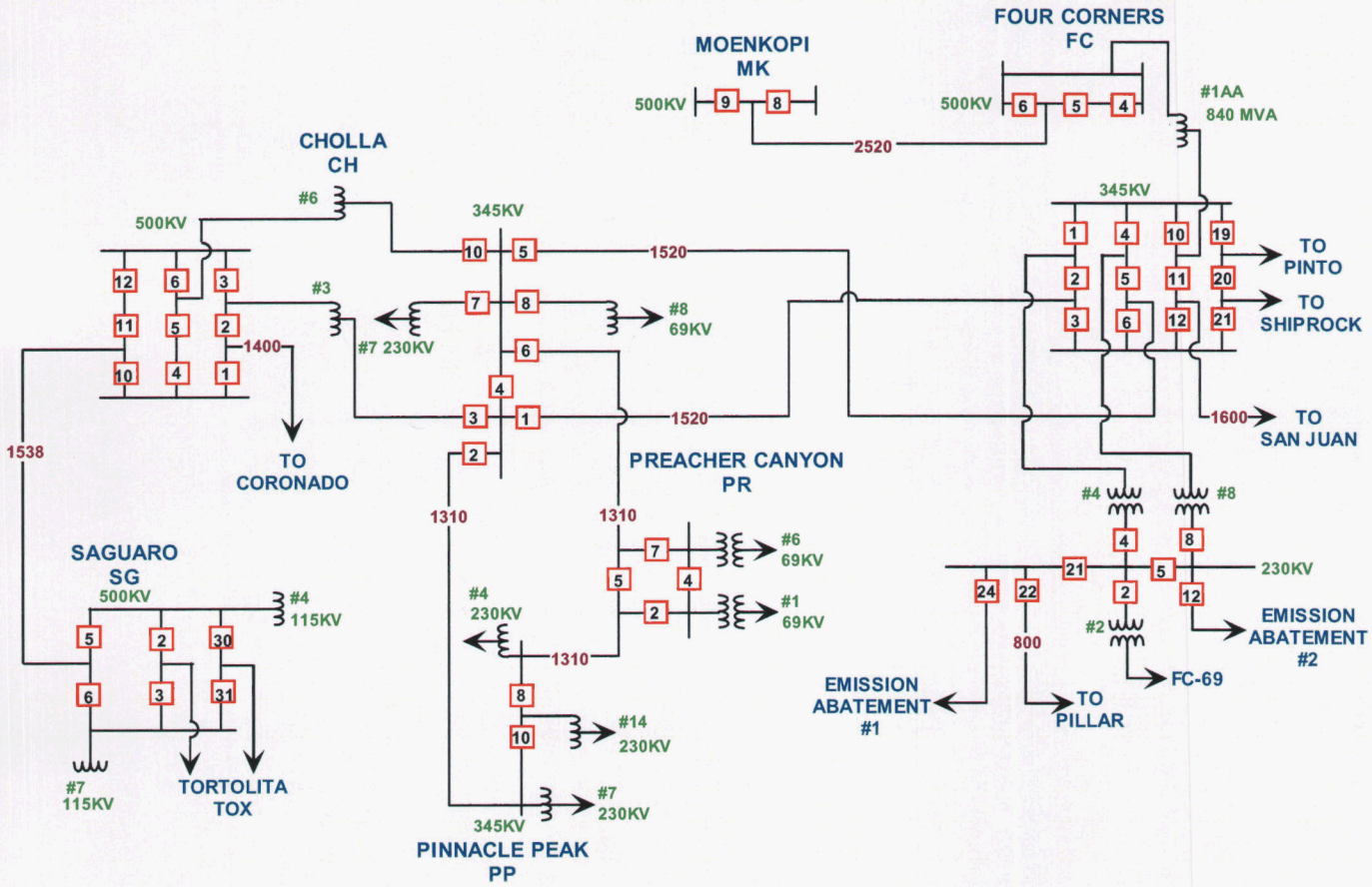
EHV-2
EMERGENCY RATINGS



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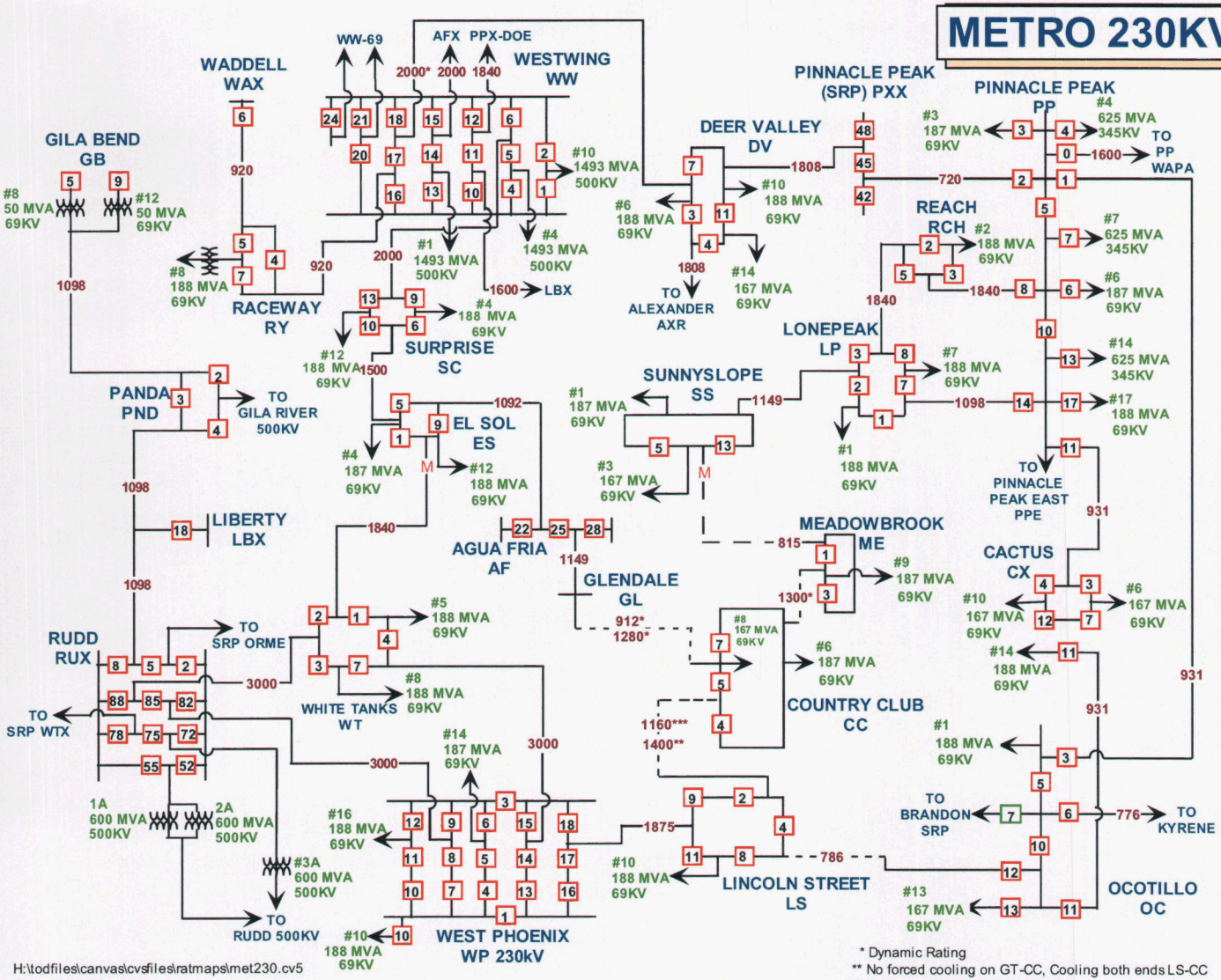
Rev. 08/17/05

METRO 230KV



* Dynamic Rating
** No forced cooling on GT-CC, Cooling both ends LS-CC
*** Forced cooling on GT-CC, Cooling one end LS-CC

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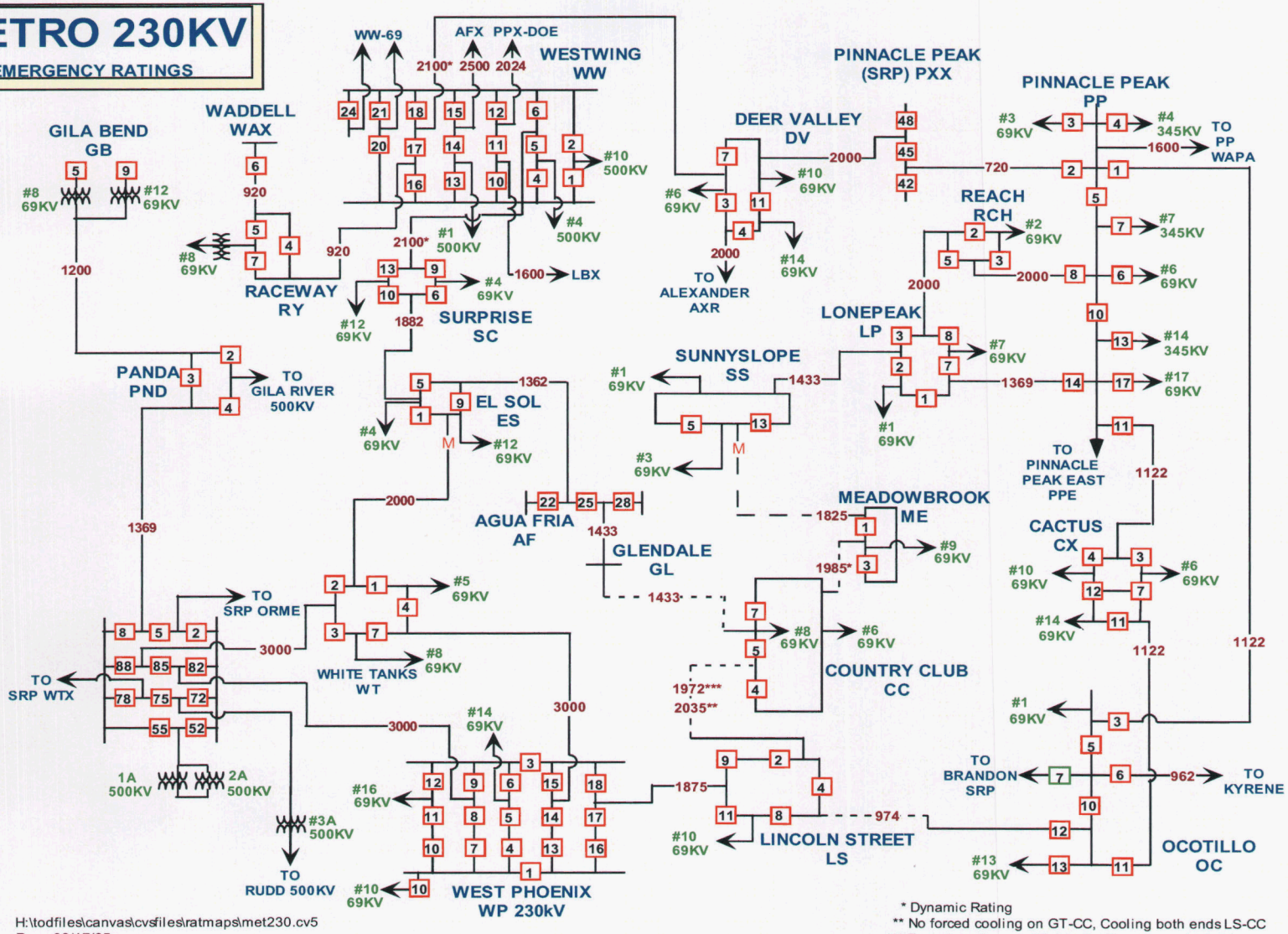
Rev. 08/17/05

METRO 230KV

EMERGENCY RATINGS



* Dynamic Rating
** No forced cooling on GT-CC, Cooling both ends LS-CC
*** Forced cooling on GT-CC, Cooling one end LS-CC

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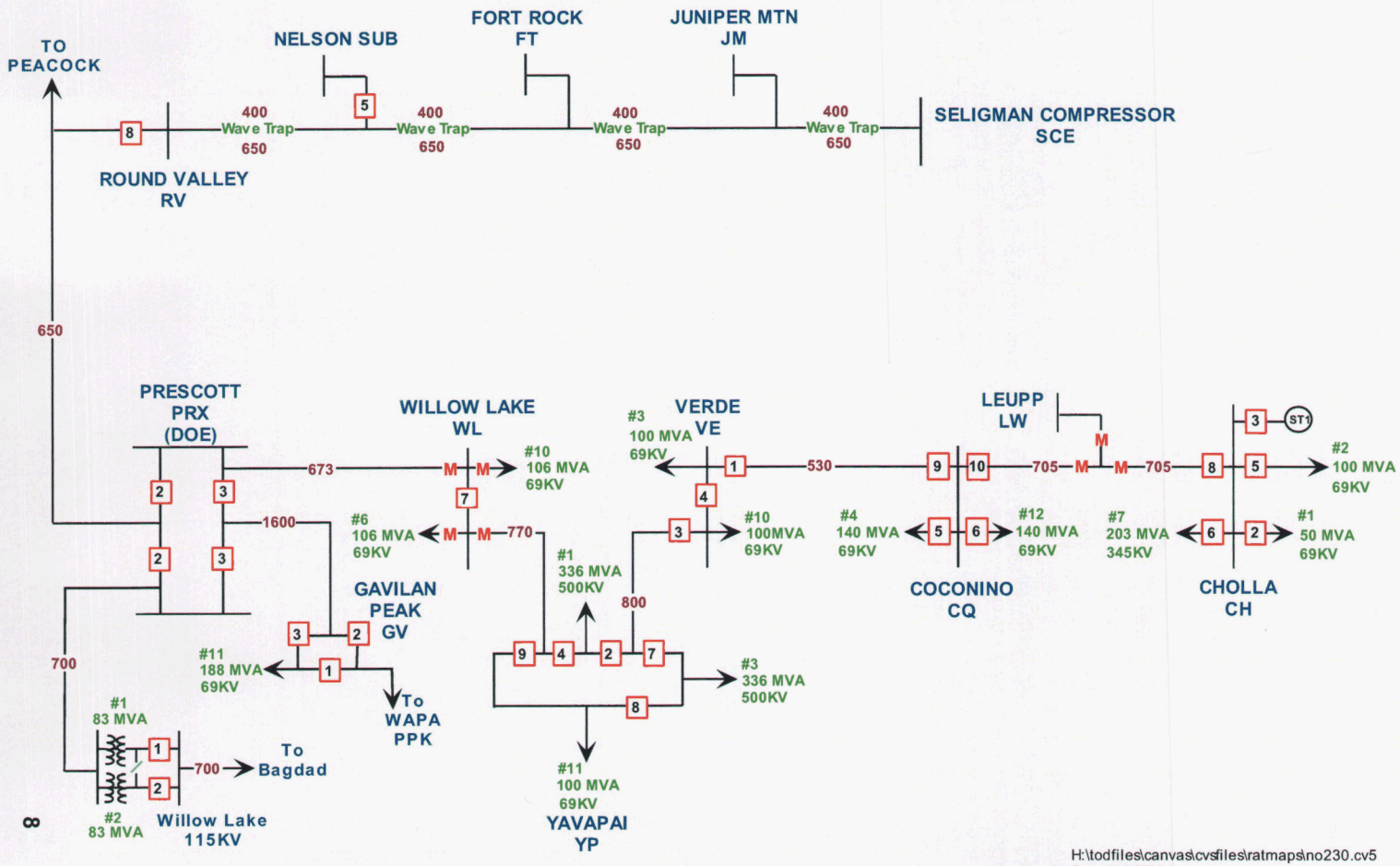
NORTHERN 230KV



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NORTHERN 230KV

EMERGENCY RATINGS

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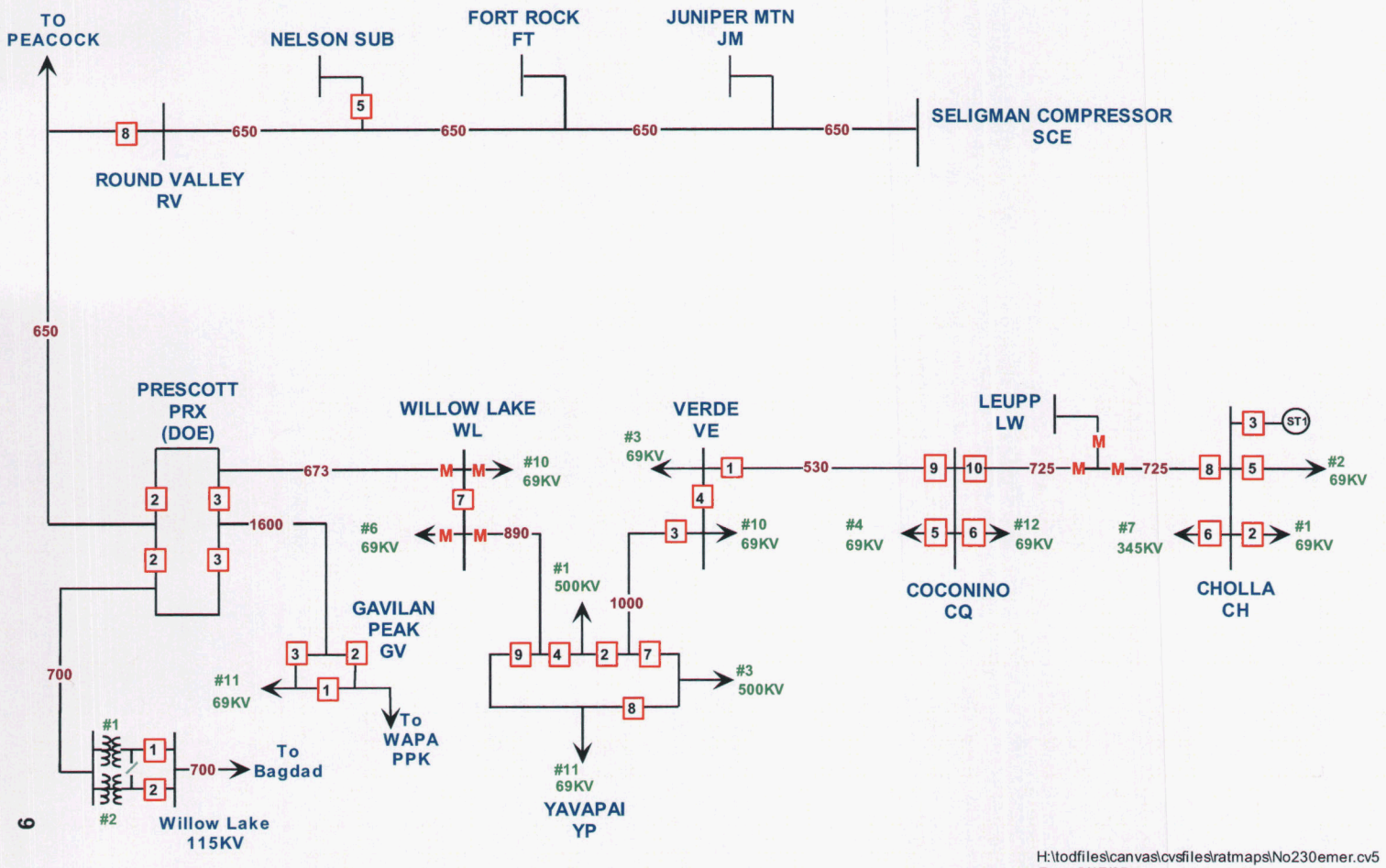

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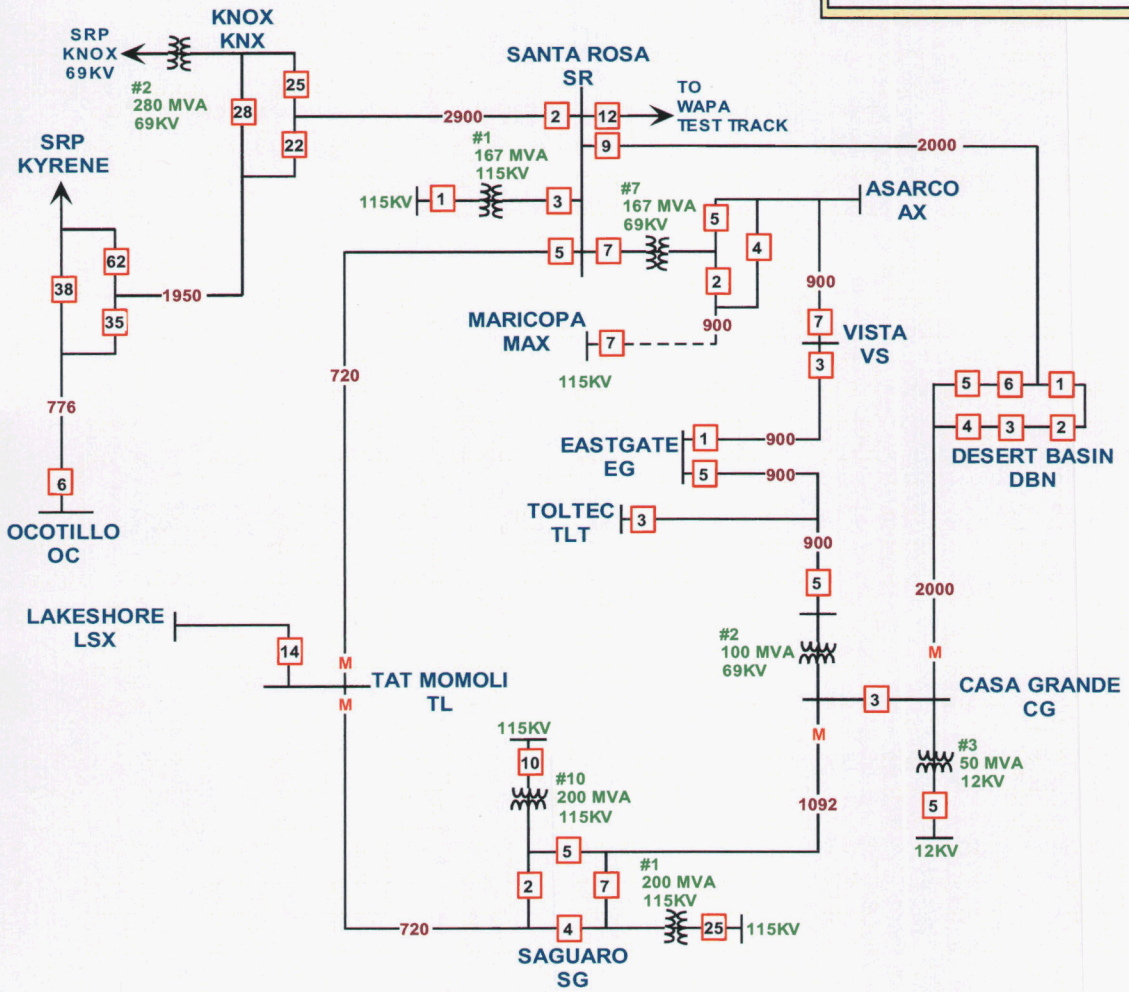

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SOUTHERN 230KV

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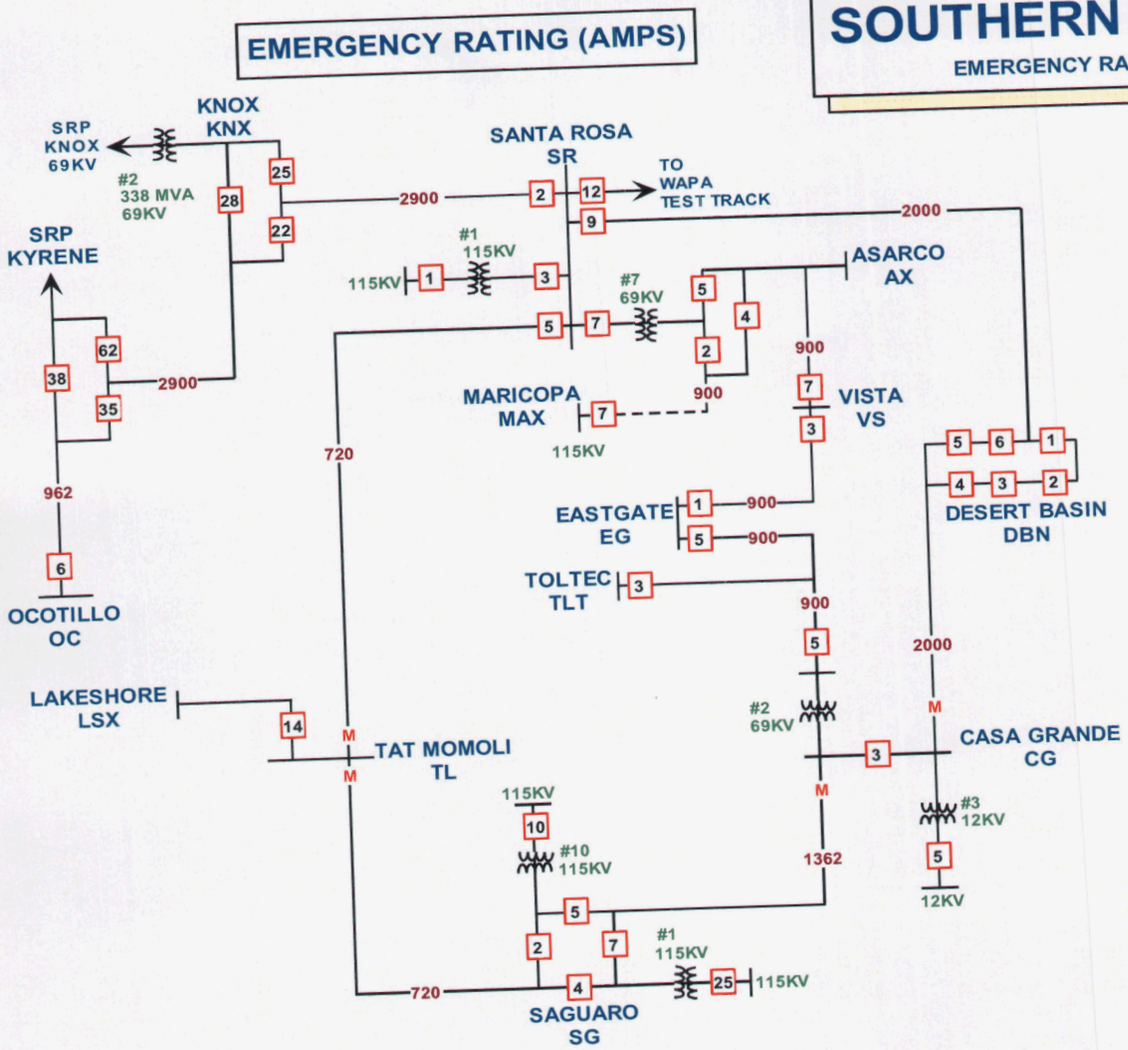

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Rev. 08/17/05

TECHNICAL STUDY REPORT

ARIZONA PUBLIC SERVICE COMPANY

TEN-YEAR PLAN

2006 – 2015

TECHNICAL STUDY REPORT

FOR

THE ARIZONA CORPORATION COMMISSION

JANUARY 2006

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ARIZONA PUBLIC SERVICE COMPANY
2006-2015
TEN-YEAR PLAN
TECHNICAL STUDY REPORT

I. Introduction

This technical study report is filed with the Arizona Corporation Commission ("Commission") pursuant to ARS 40-360.02 and Commission Decision No. 63876 (July 25, 2001). This report summarizes the results of power flow analyses and stability analyses for the APS system. Power flow analyses were performed for two scenarios: (i) assumption that all transmission system elements are in service and within continuous ratings; and (ii) assumption of an outage on a single element, with all remaining system elements remaining within emergency ratings. Voltage deviations for these scenarios must also be within established guidelines. These voltage deviation guidelines closely approximate post-transient var margin requirements of the Western Electricity Coordinating Council. More detail is provided in APS' Transmission Planning Process and Guidelines, which is also included in this filing.

The stability analyses were performed to simulate electrical disturbances on the transmission system and evaluate the system response. The desired result is that all generators will remain on line, no additional lines will open, and the system oscillations will damp out.

Results of the power flow and stability analyses aid in determining when and where new electrical facilities are needed because of reliability or security reasons. Additionally, some facilities are planned to address adequacy concerns. These include the interconnection of generation to the transmission system or efforts to increase import capability to load-constrained or other areas.

II. Power Flow Analyses

Power flow cases were created for each year of the 2006-2015 study time frame. These cases represent the latest transmission and sub-transmission plans, load projections, and resource plans of utilities and independent power producers. Base case and single contingency conditions are evaluated to determine system needs and timing. Various iterations of possible solutions lead to the final plans for transmission additions.

The contingency analysis involves simulations for every non-radial 115kV or above line that APS owns, partially owns, or operates. Transformer outages are also evaluated. Results of the power flow studies are tabulated in a Security Needs Table and an Adequacy Needs Table, below. These tables identify sixteen transmission projects that are included in this Ten-Year Plan filing. Some of the projects were classified as Adequacy Needs because of the uncertainty of generation location, size, and availability in the later years. As projects near the five-year planning time frame, they may be redefined as Security Needs projects. Selected maps of the power flow simulations are contained in the appendix. Some projects reference study work that was performed in

Regional Planning Groups and will not have any power flow maps associated with them in this filing.

Security Needs Table

Transmission Project	In Service Year	Critical Outage	Limiting Element	Map
Rudd-Palm Valley-TS4 230kV lines.	2007	White Tanks 230/69kV transformer.	White Tanks 230/69kV xfmr #2 & voltage deviation at White Tanks & 69kV system busses.	A1-A2
PV-TS5 500kV line & TS5-TS1 230kV line.	2009	Loss of Javelina-Surprise 69kV line.	Overloads the Dysart-Waddell 69kV line.	A3-A4
Raceway-Avery 230kV line.	2009	Loss of Westwing-Hatfield 69kV line.	Overloads Deer Valley-Adobe 69kV line.	A5-A6
Second Knoll 500kV substation.	2009	Cholla-Zeniff 69kV line or Cholla-Showlow 69kV line.	Voltage deviations and line overloads on the sub-transmission system in the area resulting in load shedding.	A7-A8
VV1 500kV substation.	2009	Verde-Cottonwood 69kV line 69kV line.	Voltage deviations and line overloads on the sub-transmission system in the area resulting in load shedding.	A9-A10
Flagstaff 345/69kV interconnection.	2009	Loss of the 230kV lines at Coconino	Voltage deviations and line overloads on the sub-transmission system in the area resulting in load shedding.	A11-A12
Pinnacle Peak-TS6-Avery 230kV lines.	2010	A Pinnacle Peak 230/69kV transformer.	The remaining two 230/69kV transformers at Pinnacle Peak.	A13-A14
Loop-in of TS4-Panda 230kV line to Jojoba 230kV substation	2011	Buckeye 230/69kV #6 transformer	Buckeye 230/69kV #2 transformer	A15-A16
Mazatzal 345kV substation.	2011	Preacher Canyon-Tonto 69kV line	Voltage deviations and line overloads on the sub-transmission system in the area resulting in load shedding.	A17-A18

Adequacy Needs Table

Transmission Project	In Service Year	System Benefits	Map
Palm Valley-TS2-TS1 230kV line.	2010	Provides a second source for TS1 so TS1 is not served as a radial substation, thereby increasing system reliability. Also provides the transmission sources for the TS2 substation in 2012.	No Map.
Raceway-Pinnacle Peak 500kV line.	2010	Increases import capability for the Phoenix Metropolitan area. Increases transmission system reliability and ability to deliver power.	No Map. See SWAT study report.
Loop-in of Navajo-Westwing 500kV to Raceway 500kV substation, Raceway 500kV to 230kV substation.	2010	Provides a source for the Raceway-Pinnacle Peak 500kV line. Also, provides a backup for outage of Westwing 500/230kV transformers and adds another source for the Raceway 230kV substation. Increases import capability for the Phoenix metropolitan area, increases the export capability from the PV area.	No Map.
TS5-Raceway 500kV line.	2012	Provides a second source for TS5. Increases import capability for the Phoenix Metropolitan area, increases the export capability from the PV area.	No Map.
Palo Verde vicinity to North Gila 500kV.	2012	Increases import capability for the Yuma area allowing APS to serve the growing load. Increases transmission system reliability.	No Map.
North Gila-TS8 230kV line.	2012	Increase transmission system reliability and ability to deliver power in the Yuma area.	No Map.

III. Stability Analyses

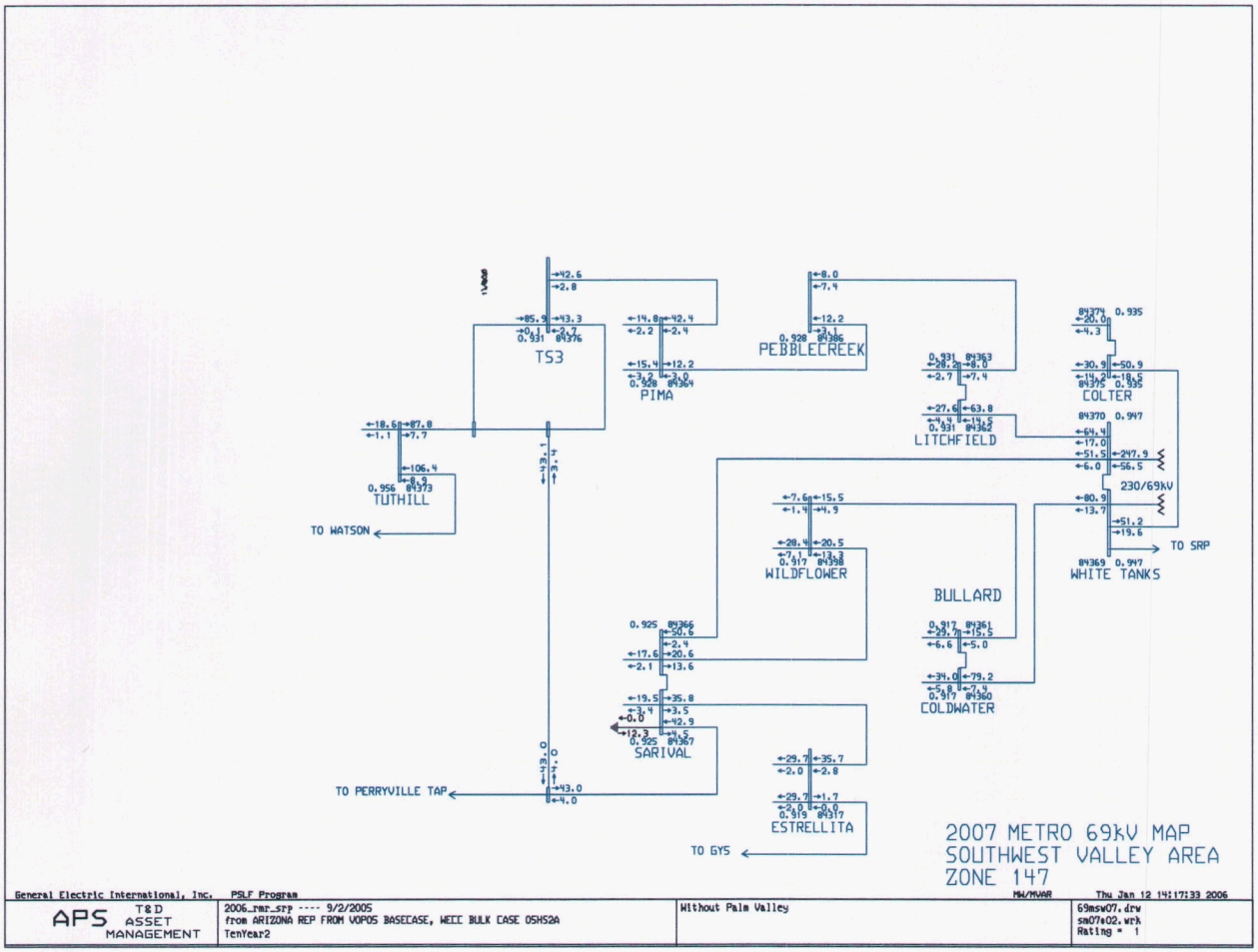
A stability simulation for simulated three-phase faults was performed for 2009 and 2014 for every 345kV or 500kV line that APS owns (totally or partially) or operates. It has been APS' experience that stability concerns do not manifest on the 230kV system, which is primarily designed to deliver power to load. Therefore, no 230kV simulations were performed. Additionally, every new proposed generation plant will be required to perform stability evaluations prior to receiving permission to interconnect to the transmission system.

Each simulation modeled a 3-phase bus fault, appropriate series capacitor flashing and reinsertion, and fault removal and transmission line removal. System performance was evaluated by monitoring representative generator rotor angles, bus voltages and system frequency. Plots of these system parameters are included in Appendices B and C. The stability simulations performed to date indicate that no stability problems limit the transmission system.

APPENDIX A
POWER FLOW MAPS

APPENDIX A

Power Flow Maps


TS3
PEBBLECREEK
PIMA
COLTER
LITCHFIELD
TUTHILL
TO WATSON
230/69kV
TO SRP
WHITE TANKS
WILDFLOWER
BULLARD
COLDWATER
SARIVAL
TO PERRYVILLE TAP
ESTRELLITA
TO GYS
2007 METRO 69kV MAP
SOUTHWEST VALLEY AREA
ZONE 147
General Electric International, Inc.
PSLF Program
MW/MVAR
Thu Jan 12 14:17:33 2006
APS T&D ASSET MANAGEMENT
2006_rmr_srp ---- 9/2/2005
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TenYear2
Without Palm Valley
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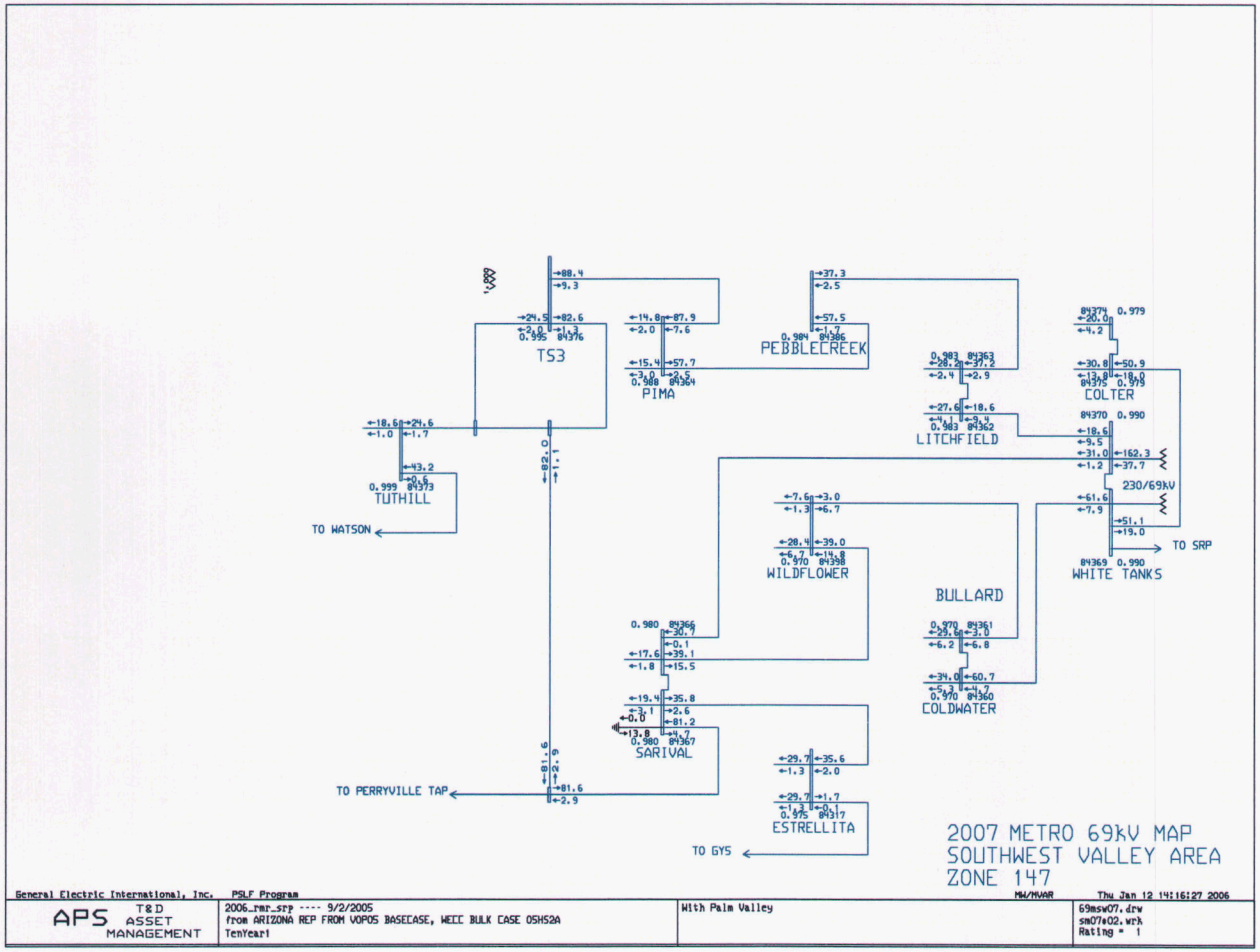
TS3
PIMA
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LITCHFIELD
COLTER
TUTHILL
TO WATSON
WILDFLOWER
BULLARD
WHITE TANKS
230/69kV
TO SRP
COLDWATER
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TO GYS
2007 METRO 69kV MAP
SOUTHWEST VALLEY AREA
ZONE 147
General Electric International, Inc.
PSLF Program
MW/MVAR
Thu Jan 12 14:16:27 2006
APS T&D ASSET MANAGEMENT
2006_rmr_srp ---- 9/2/2005
from ARIZONA REP FROM VOPOS BASECASE, WECC BULK CASE OSHS2A
TenYear1
With Palm Valley
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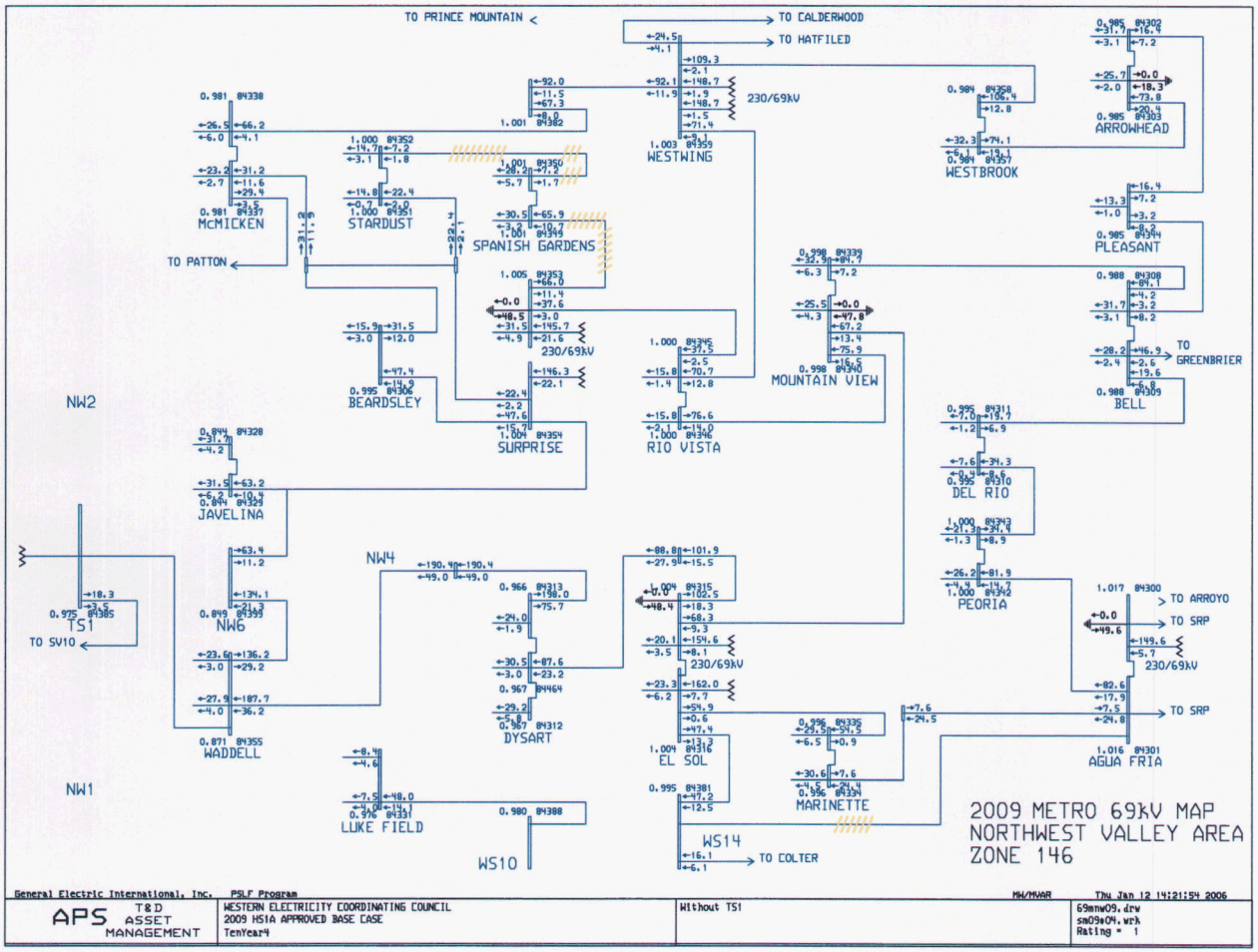
TO PRINCE MOUNTAIN
TO CALDERWOOD
TO HATFILED
230/69kV
WESTWING
WESTBROOK
ARROWHEAD
McMICKEN
TO PATTON
STARDUST
SPANISH GARDENS
PLEASANT
MOUNTAIN VIEW
TO GREENBRIER
BELL
BEARDSLEY
SURPRISE
RIO VISTA
JAVELINA
DEL RIO
NW2
NW4
TS1
TO SV10
NW6
PEORIA
TO ARROYO
TO SRP
WADDELL
DYSART
EL SOL
MARINETTE
AGUA FRIA
NW1
LUKE FIELD
WS10
WS14
TO COLTER
2009 METRO 69kV MAP
NORTHWEST VALLEY AREA
ZONE 146
General Electric International, Inc.
PSLF Program
MW/MVAR
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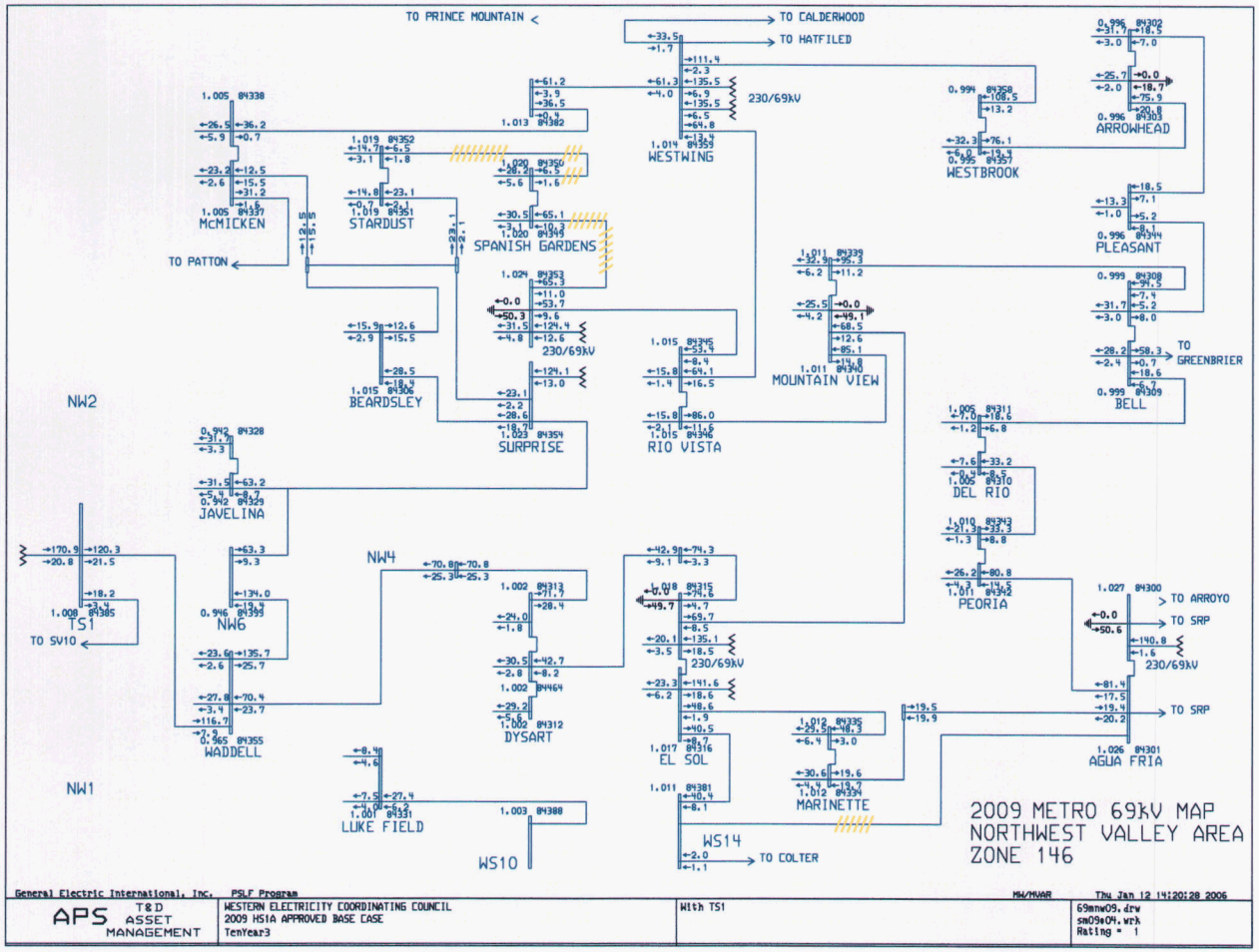
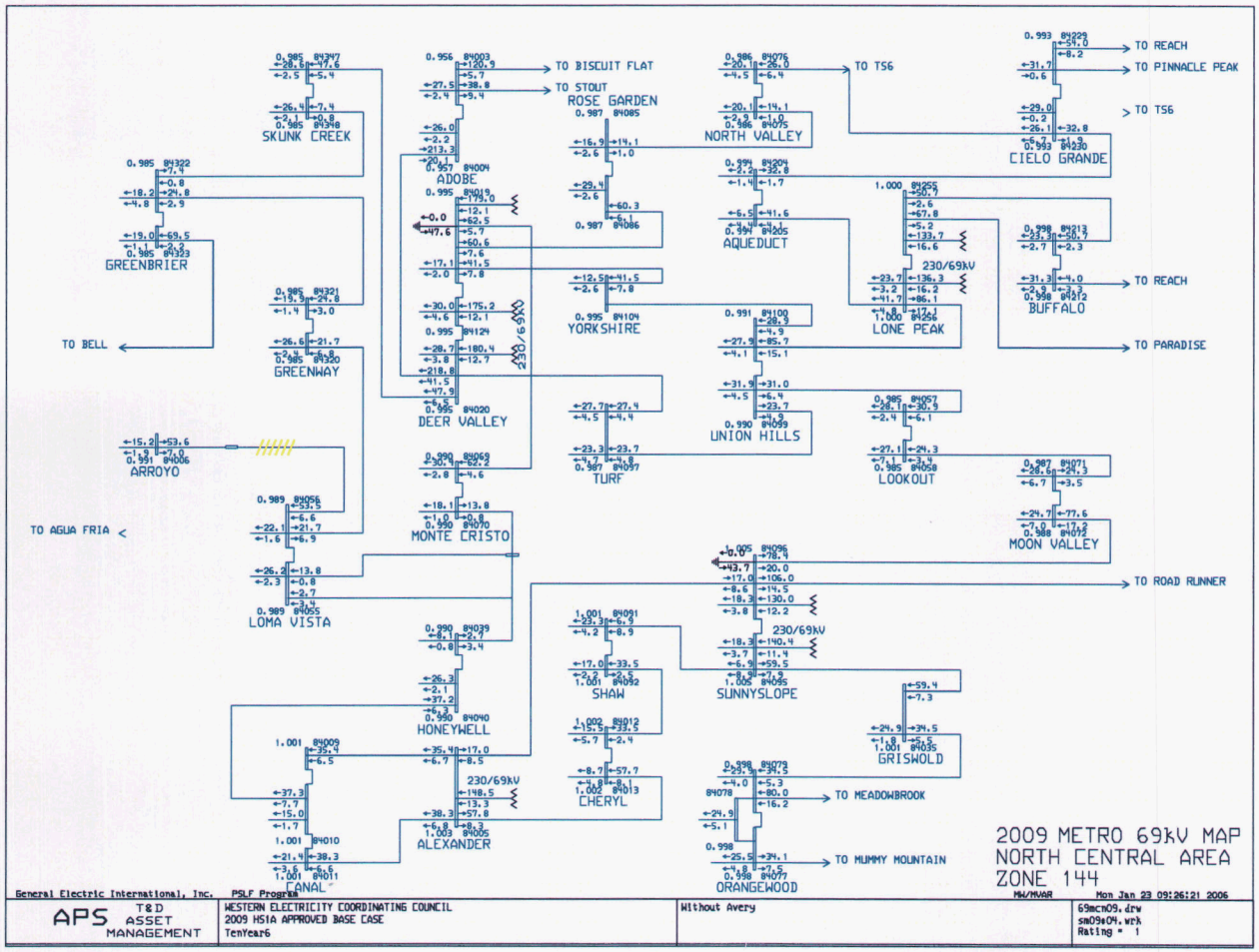
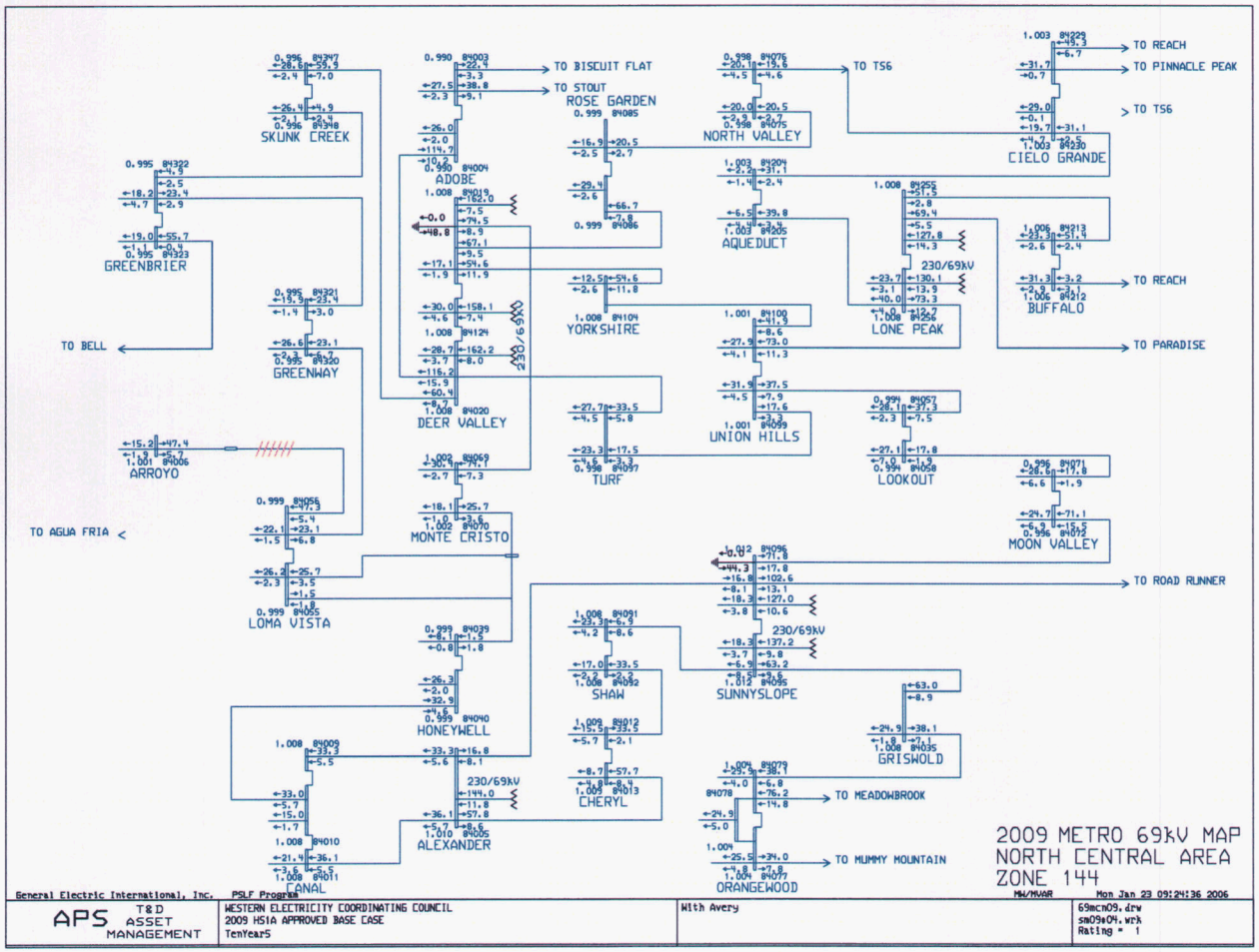
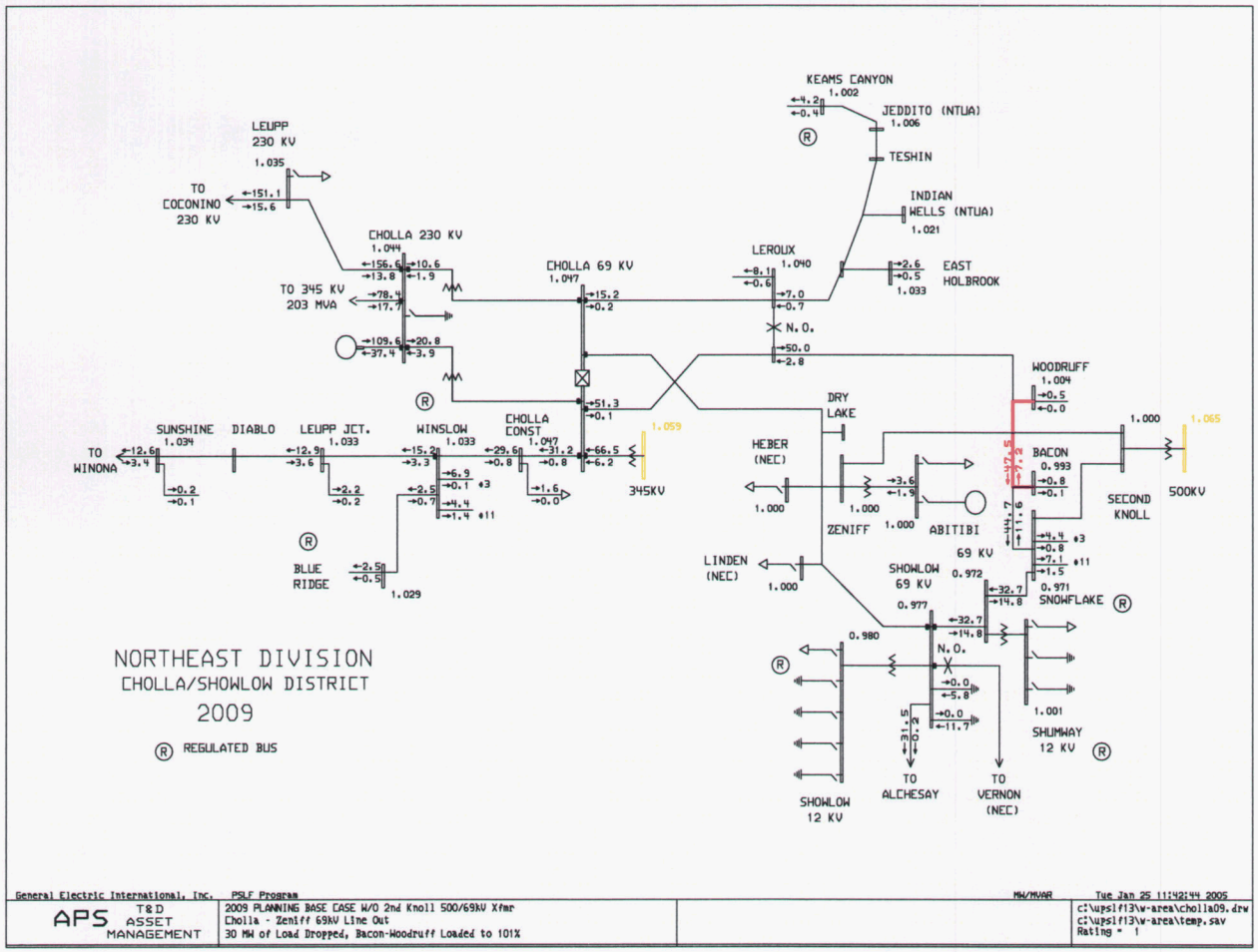
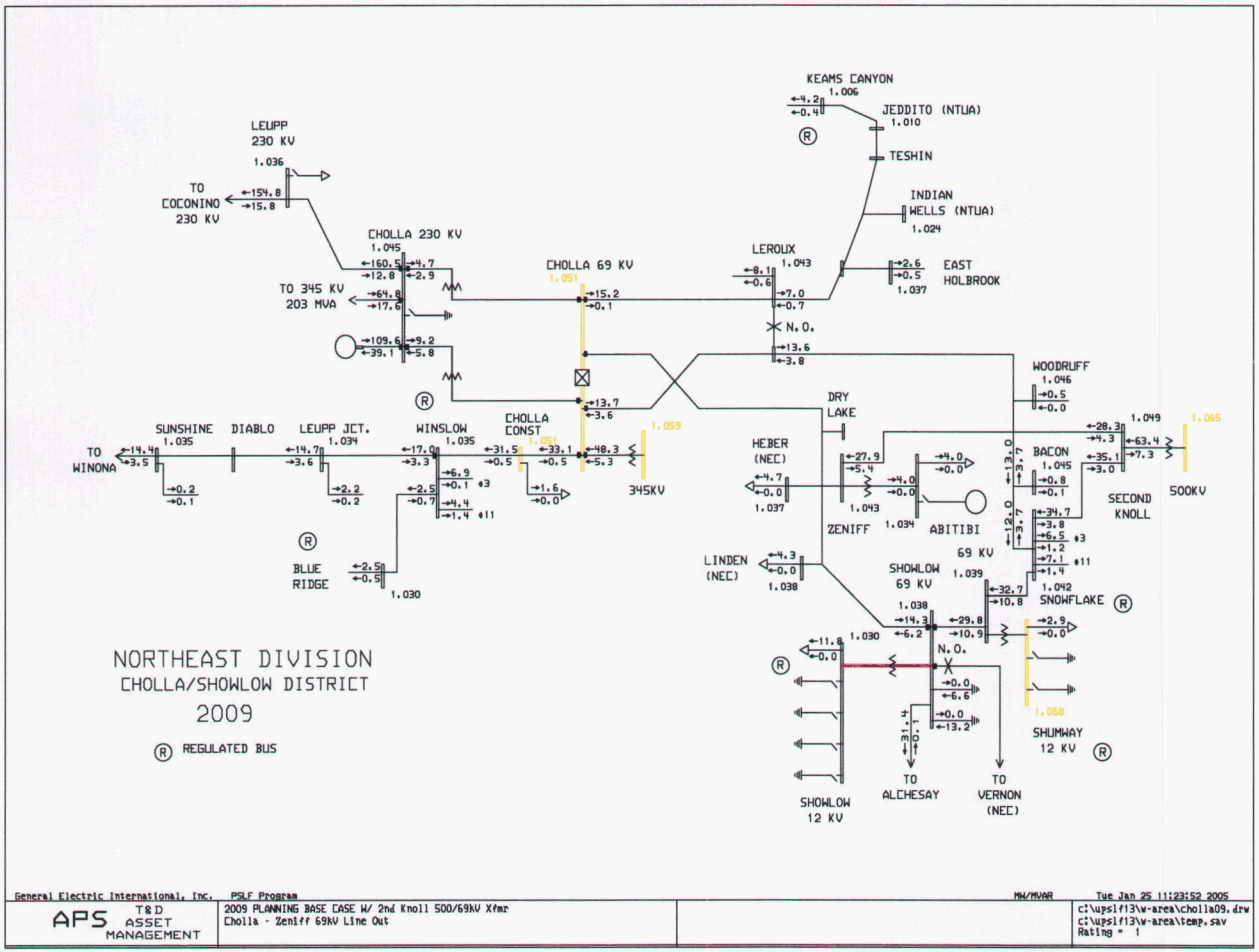

TO PRINCE MOUNTAIN
TO CALDERWOOD
TO HATFILED
230/69kV
WESTWING
WESTBROOK
ARROWHEAD
McMICKEN
TO PATTON
STARDUST
SPANISH GARDENS
PLEASANT
MOUNTAIN VIEW
TO GREENBRIER
BELL
BEARDSLEY
SURPRISE
RIO VISTA
DEL RIO
JAVELINA
NW2
NW4
NW6
TS1
TO SV10
PEORIA
TO ARROYO
TO SRP
AGUA FRIA
DYSART
WADDELL
EL SOL
MARINETTE
LUKE FIELD
NW1
WS10
WS14
TO COLTER
2009 METRO 69kV MAP
NORTHWEST VALLEY AREA
ZONE 146
General Electric International, Inc.
PSLF Program
MW/MVAR
Thu Jan 12 14:20:28 2006
APS T&D ASSET MANAGEMENT
WESTERN ELECTRICITY COORDINATING COUNCIL
2009 HS1A APPROVED BASE CASE
TenYear3
With TS1
69mnw09.drw
sm09e04.wrk
Rating = 1


2009 METRO 69kV MAP
NORTH CENTRAL AREA
ZONE 144
MW/MVAR
Mon Jan 23 09:26:21 2006
General Electric International, Inc.
PSLF Program
APS T&D ASSET MANAGEMENT
WESTERN ELECTRICITY COORDINATING COUNCIL
2009 HS1A APPROVED BASE CASE
TenYear6
Without Avery
69mcm09.drw
sm09s04.wrk
Rating = 1
TO BISCUIT FLAT
TO STOUT
ROSE GARDEN
TO TS6
TO REACH
TO PINNACLE PEAK
TO TS6
CIELO GRANDE
SKUNK CREEK
ADOBE
NORTH VALLEY
GREENBRIER
AQUEDUCT
BUFFALO
TO REACH
TO BELL
GREENWAY
YORKSHIRE
LONE PEAK
TO PARADISE
DEER VALLEY
UNION HILLS
ARROYO
TURF
LOOKOUT
MONTE CRISTO
MOON VALLEY
TO AGUA FRIA
TO ROAD RUNNER
LOMA VISTA
SHAW
SUNNYSLOPE
HONEYWELL
GRISWOLD
CHERYL
TO MEADOWBROOK
ALEXANDER
TO MUMMY MOUNTAIN
CANAL
ORANGEWOOD
230/69kV


2009 METRO 69kV MAP
NORTH CENTRAL AREA
ZONE 144
MW/MVAR
Mon Jan 23 09:24:36 2006
General Electric International, Inc.
PSLF Program
APS T&D ASSET MANAGEMENT
WESTERN ELECTRICITY COORDINATING COUNCIL
2009 HS1A APPROVED BASE CASE
TenYear5
With Avery
69mcn09.drw
sm09s04.wrk
Rating = 1
TO BISCUIT FLAT
TO STOUT
ROSE GARDEN
TO TS6
TO REACH
TO PINNACLE PEAK
TO TS6
SKUNK CREEK
ADOBE
NORTH VALLEY
CIELO GRANDE
GREENBRIER
AQUEDUCT
BUFFALO
TO BELL
GREENWAY
YORKSHIRE
LONE PEAK
TO PARADISE
DEER VALLEY
UNION HILLS
ARROYO
TURF
LOOKOUT
MOON VALLEY
TO AGUA FRIA
MONTE CRISTO
TO ROAD RUNNER
LOMA VISTA
SHAW
SUNNYSLOPE
HONEYWELL
GRISWOLD
CHERYL
ALEXANDER
TO MEADOWBROOK
CANAL
ORANGEWOOD
TO MUMMY MOUNTAIN
230/69kV


NORTHEAST DIVISION
CHOLLA/SHOWLOW DISTRICT
2009
R REGULATED BUS
LEUPP 230 KV
1.035
TO COCONINO 230 KV
CHOLLA 230 KV
1.044
TO 345 KV 203 MVA
CHOLLA 69 KV
1.047
KEAMS CANYON
1.002
JEDDITO (NTUA)
1.006
TESHIN
INDIAN WELLS (NTUA)
1.021
LEROUX
1.040
EAST HOLBROOK
1.033
N.O.
WOODRUFF
1.004
DRY LAKE
TO WINONA
SUNSHINE
1.034
DIABLO
LEUPP JCT.
1.033
WINSLOW
1.033
CHOLLA CONST
1.047
1.059
345KV
HEBER (NEC)
1.000
ZENIFF
1.000
ABITIBI
1.000
BACON
0.993
1.000
1.065
SECOND KNOLL
500KV
BLUE RIDGE
1.029
LINDEN (NEC)
1.000
SHOWLOW 69 KV
0.977
69 KV
0.972
0.971
SNOWFLAKE
0.980
N.O.
1.001
SHUMWAY 12 KV
SHOWLOW 12 KV
TO ALCHESAY
TO VERNON (NEC)
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 25 11:42:44 2005
APS T&D ASSET MANAGEMENT
2009 PLANNING BASE CASE W/O 2nd Knoll 500/69kV Xfmr
Cholla - Zeniff 69kV Line Out
30 MW of Load Dropped, Bacon-Woodruff Loaded to 101%
c:\upslf13\w-area\cholla09.drw
c:\upslf13\w-area\temp.sav
Rating = 1


NORTHEAST DIVISION
CHOLLA/SHOWLOW DISTRICT
2009
R REGULATED BUS
LEUPP 230 KV
1.036
TO COCONINO 230 KV
CHOLLA 230 KV
1.045
TO 345 KV 203 MVA
CHOLLA 69 KV
1.051
KEAMS CANYON
1.006
JEDDITO (NTUA)
1.010
TESHIN
INDIAN WELLS (NTUA)
1.024
LEROUX
1.043
EAST HOLBROOK
1.037
N.O.
WOODRUFF
1.046
DRY LAKE
SUNSHINE
1.035
DIABLO
LEUPP JCT.
1.034
WINSLOW
1.035
CHOLLA CONST
1.059
345KV
TO WINONA
HEBER (NEC)
1.037
ZENIFF
1.043
1.034
ABITIBI
BACON
1.045
1.049
1.065
500KV
SECOND KNOLL
BLUE RIDGE
1.030
LINDEN (NEC)
1.038
SHOWLOW 69 KV
1.039
69 KV
1.042
SNOWFLAKE
1.038
1.030
SHUMWAY 12 KV
1.068
SHOWLOW 12 KV
TO ALCHESAY
TO VERNON (NEC)
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 25 11:23:52 2005
APS T&D ASSET MANAGEMENT
2009 PLANNING BASE CASE W/ 2nd Knoll 500/69kV Xfmr
Cholla - Zeniff 69kV Line Out
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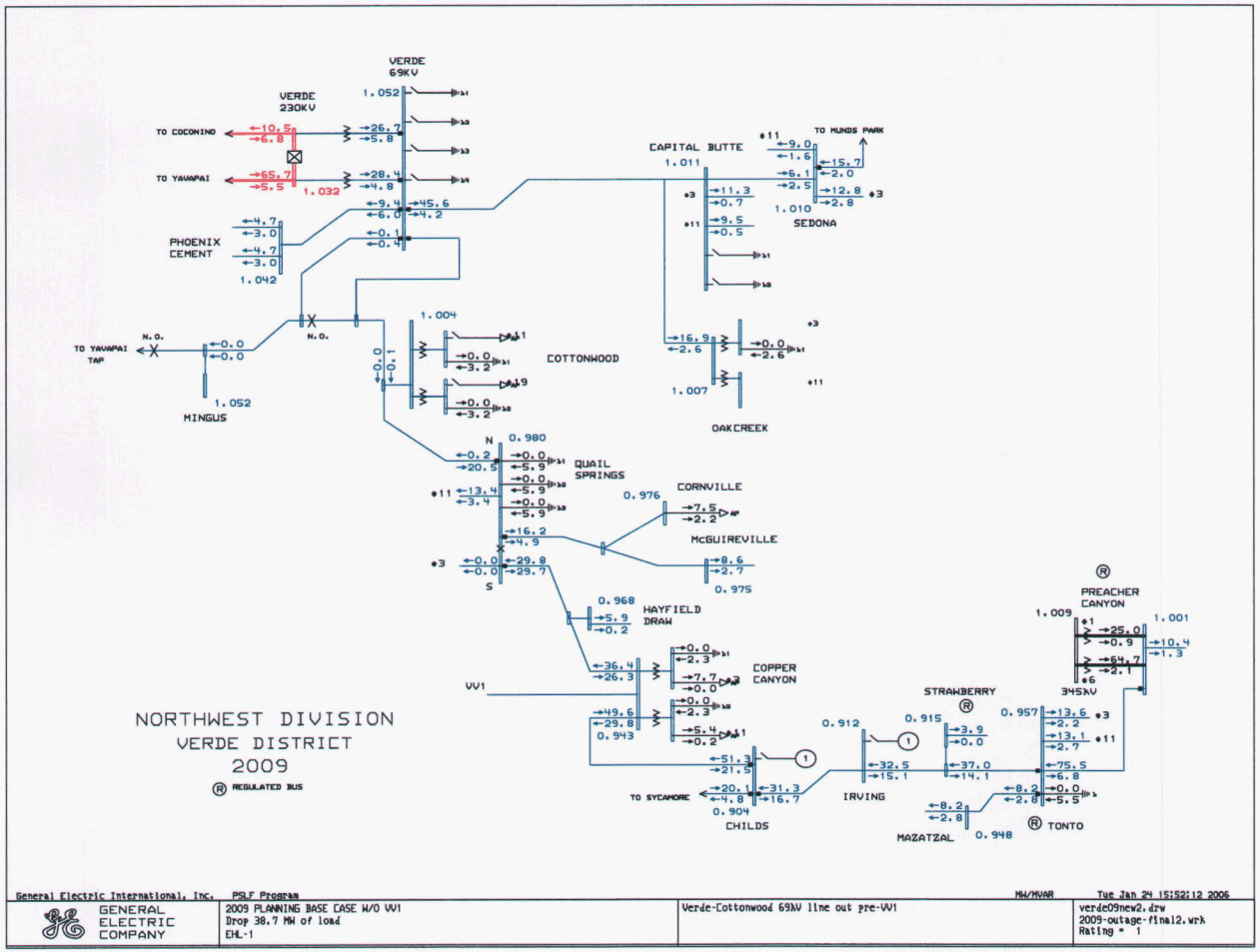
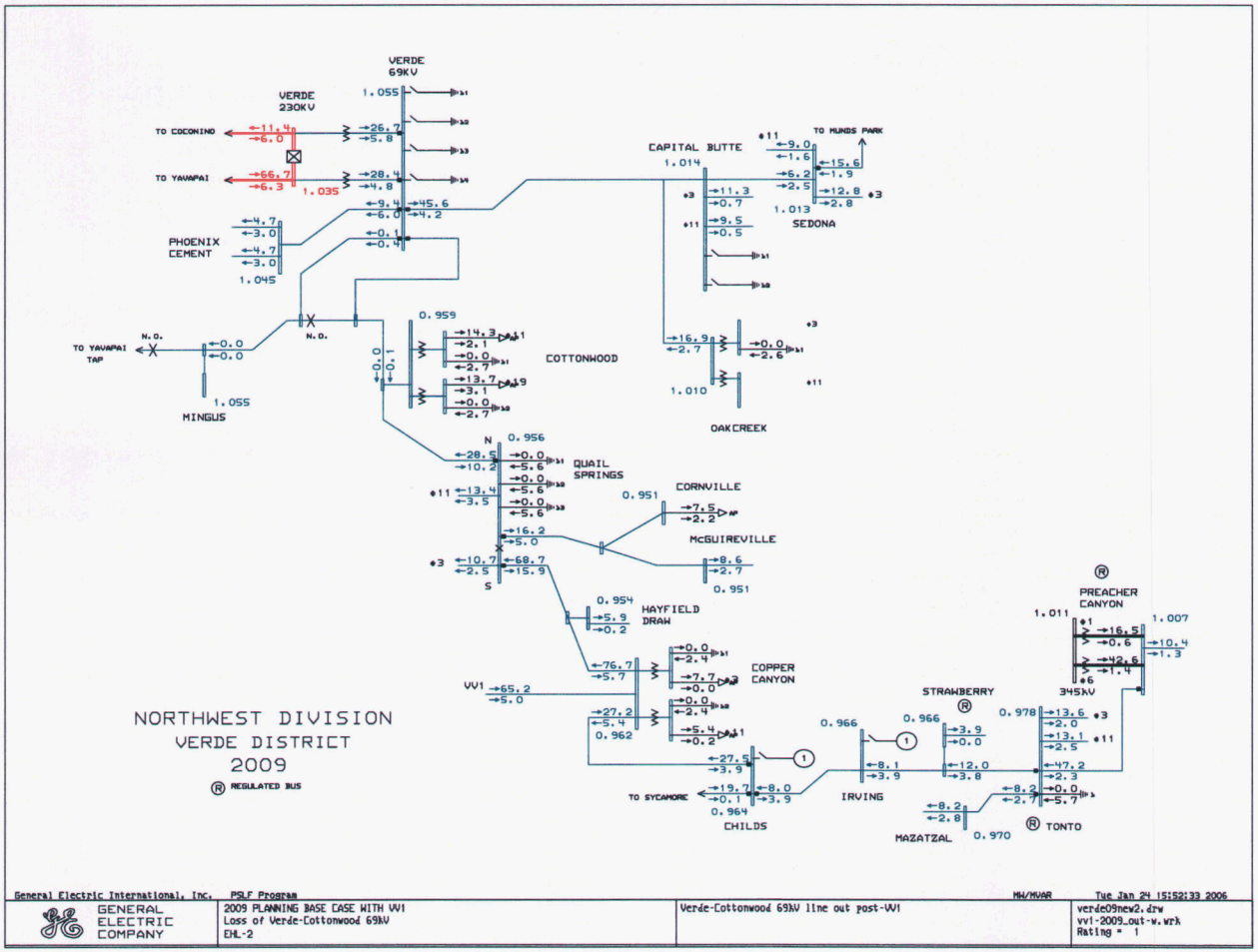
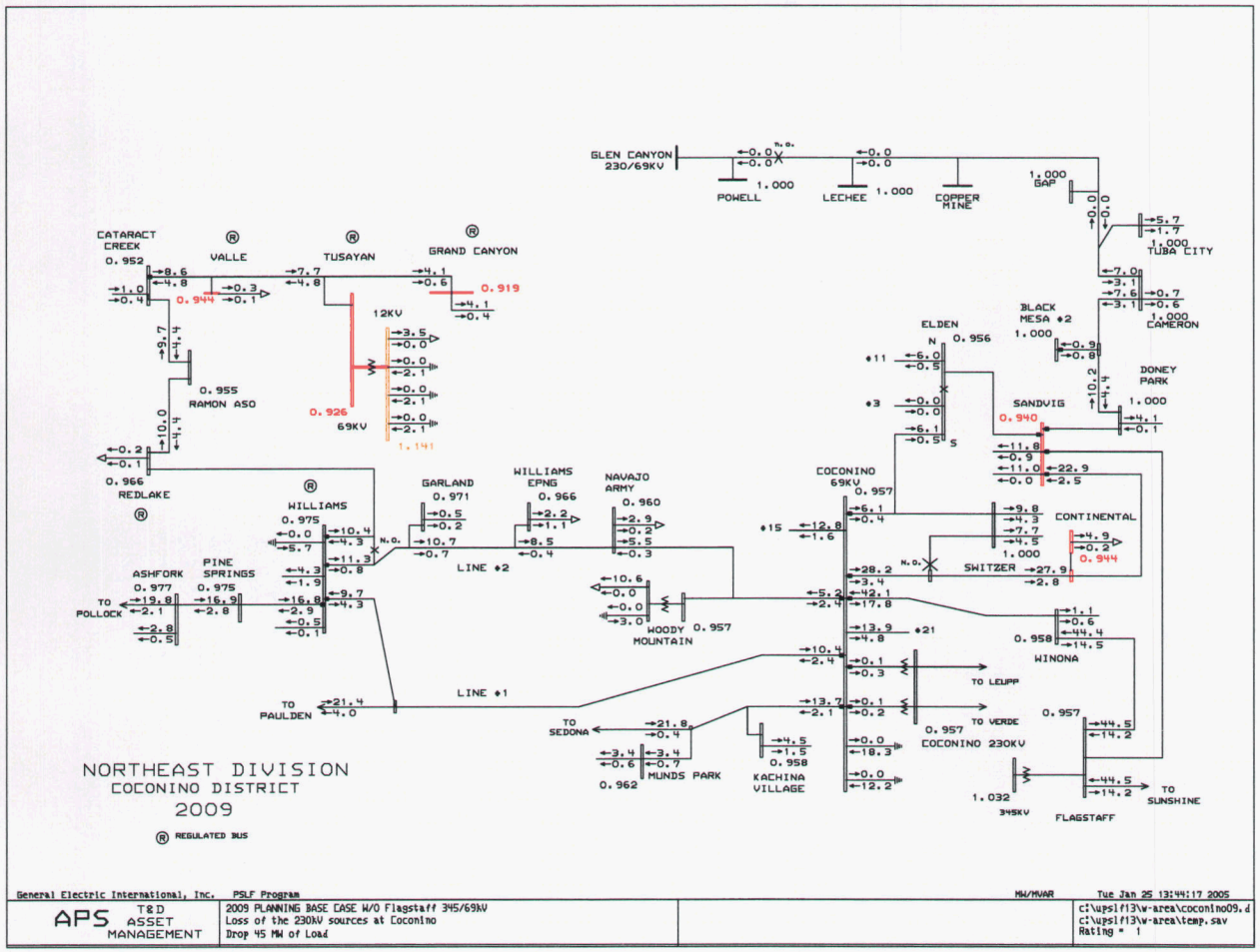
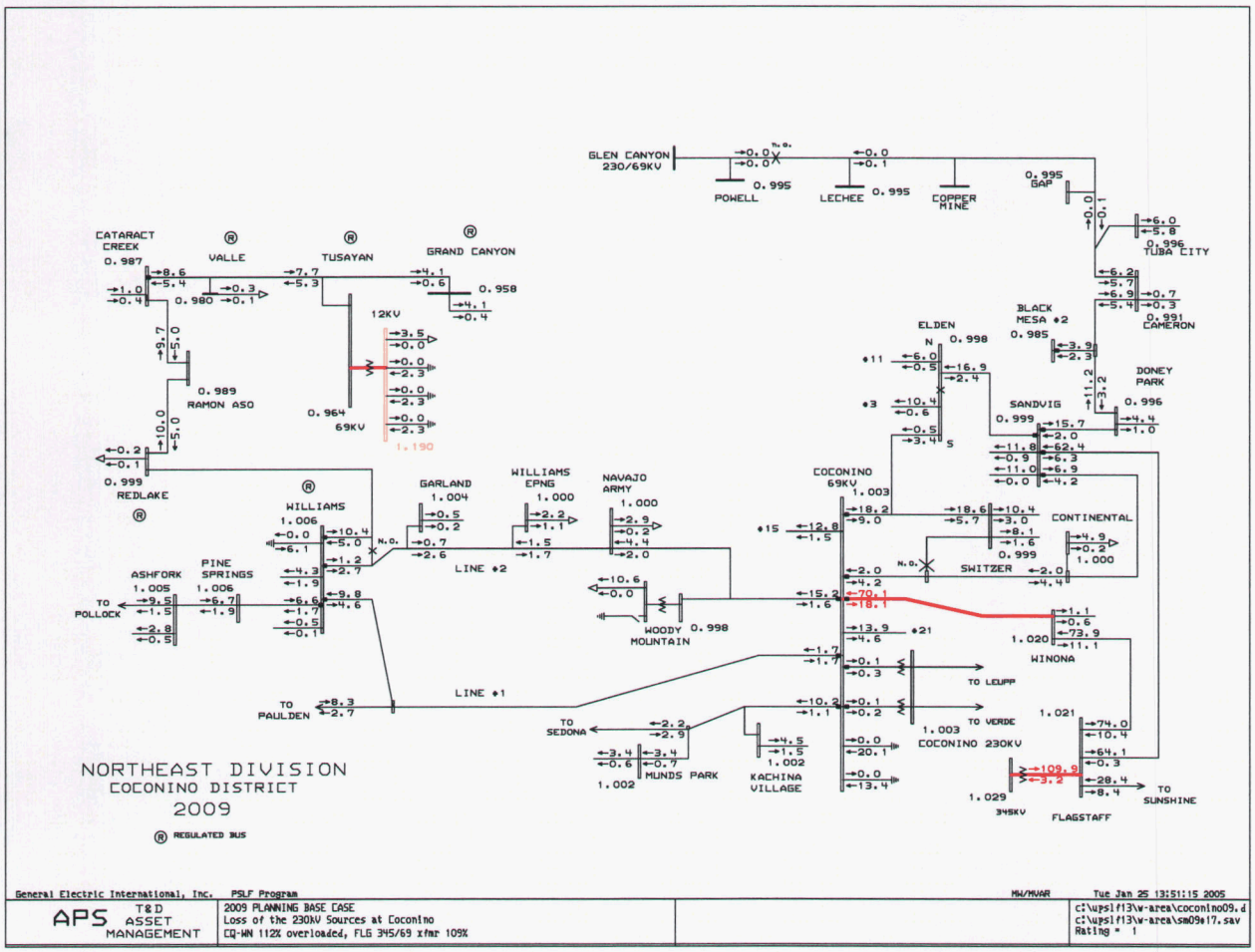
Rating = 1


VERDE 69KV
VERDE 230KV
TO COCONINO
TO YAVAPAI
PHOENIX CEMENT
TO YAVAPAI TAP
MINGUS
COTTONWOOD
CAPITAL BUTTE
TO MUNDS PARK
SEDONA
OAKCREEK
QUAIL SPRINGS
CORNVILLE
McGUIREVILLE
HAYFIELD DRAW
COPPER CANYON
VV1
TO SYCAMORE
CHILDS
IRVING
STRAWBERRY
MAZATZAL
TONTO
PREACHER CANYON
345KV
NORTHWEST DIVISION
VERDE DISTRICT
2009
REGULATED BUS
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 24 15:52:12 2006
GENERAL ELECTRIC COMPANY
2009 PLANNING BASE CASE W/O VV1
Drop 38.7 MW of load
EHL-1
Verde-Cottonwood 69kV line out pre-VV1
verde09new2.drw
2009-outage-final2.wrk
Rating = 1


VERDE 69KV
VERDE 230KV
TO COCONINO
TO YAVAPAI
PHOENIX CEMENT
MINGUS
TO YAVAPAI TAP
CAPITAL BUTTE
TO MUNDS PARK
SEDONA
COTTONWOOD
OAKCREEK
QUAIL SPRINGS
CORNVILLE
McGUIREVILLE
HAYFIELD DRAW
COPPER CANYON
VV1
TO SYCAMORE
CHILDS
IRVING
STRAWBERRY
MAZATZAL
TONTO
PREACHER CANYON
345kV
NORTHWEST DIVISION
VERDE DISTRICT
2009
REGULATED BUS
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 24 15:52:33 2006
GENERAL ELECTRIC COMPANY
2009 PLANNING BASE CASE WITH VV1
Loss of Verde-Cottonwood 69kV
EHL-2
Verde-Cottonwood 69kV line out post-VV1
verde09new2.drw
vv1-2009_out-w.wrk
Rating = 1


GLEN CANYON 230/69KV
POWELL
LECHEE
COPPER MINE
GAP
TUBA CITY
CAMERON
CATARACT CREEK
VALLE
TUSAYAN
GRAND CANYON
12KV
69KV
RAMON ASO
REDLAKE
ELDEN
BLACK MESA #2
DONEY PARK
SANDVIG
COCONINO 69KV
CONTINENTAL
SWITZER
WILLIAMS
GARLAND
WILLIAMS EPNG
NAVAJO ARMY
LINE #2
ASHFORK
PINE SPRINGS
TO POLLOCK
WOODY MOUNTAIN
WINONA
TO LEUPP
TO VERDE
COCONINO 230KV
LINE #1
TO PAULDEN
TO SEDONA
MUNDS PARK
KACHINA VILLAGE
FLAGSTAFF
TO SUNSHINE
NORTHEAST DIVISION
COCONINO DISTRICT
2009
REGULATED BUS
General Electric International, Inc. PSLF Program
MW/MVAR
Tue Jan 25 13:44:17 2005
APS T&D ASSET MANAGEMENT
2009 PLANNING BASE CASE W/O Flagstaff 345/69kV
Loss of the 230kV sources at Coconino
Drop 45 MW of Load
c:\upslf13\w-area\coconino09.d
c:\upslf13\w-area\temp.sav
Rating = 1


GLEN CANYON 230/69KV
POWELL
LECHEE
COPPER MINE
GAP
TUBA CITY
CAMERON
CATARACT CREEK
VALLE
TUSAYAN
GRAND CANYON
12KV
69KV
RAMON ASO
REDLAKE
ELDEN
BLACK MESA #2
DONEY PARK
SANDVIG
COCONINO 69KV
CONTINENTAL
SWITZER
WILLIAMS
GARLAND
WILLIAMS EPNG
NAVAJO ARMY
LINE #2
ASHFORK
PINE SPRINGS
TO POLLOCK
WOODY MOUNTAIN
WINONA
TO LEUPP
TO PAULDEN
LINE #1
TO SEDONA
TO VERDE
MUNDS PARK
KACHINA VILLAGE
COCONINO 230KV
345KV
FLAGSTAFF
TO SUNSHINE
NORTHEAST DIVISION
COCONINO DISTRICT
2009
REGULATED BUS
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 25 13:51:15 2005
APS T&D ASSET MANAGEMENT
2009 PLANNING BASE CASE
Loss of the 230kV Sources at Coconino
CQ-WN 112% overloaded, FLG 345/69 xfmr 109%
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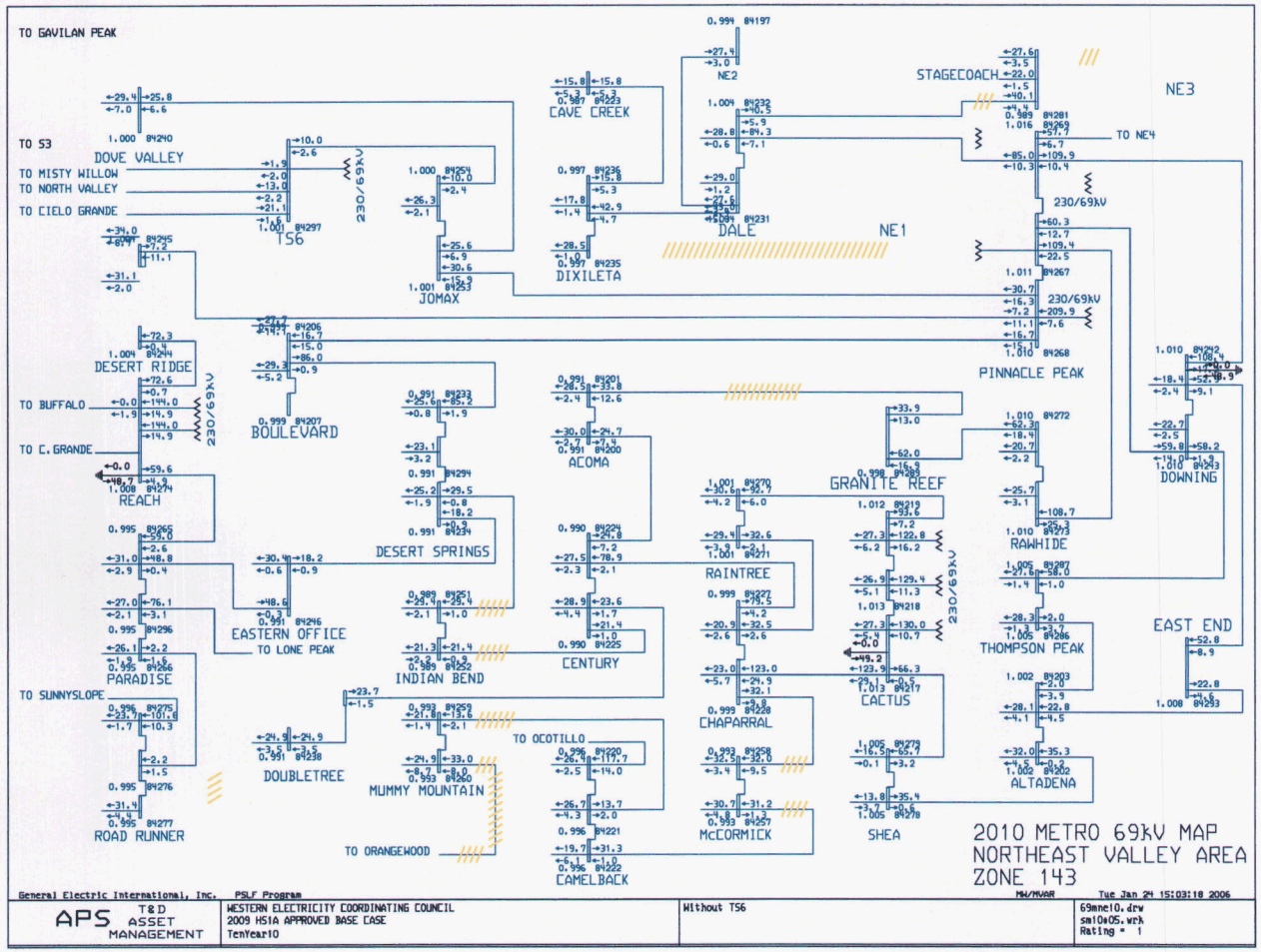
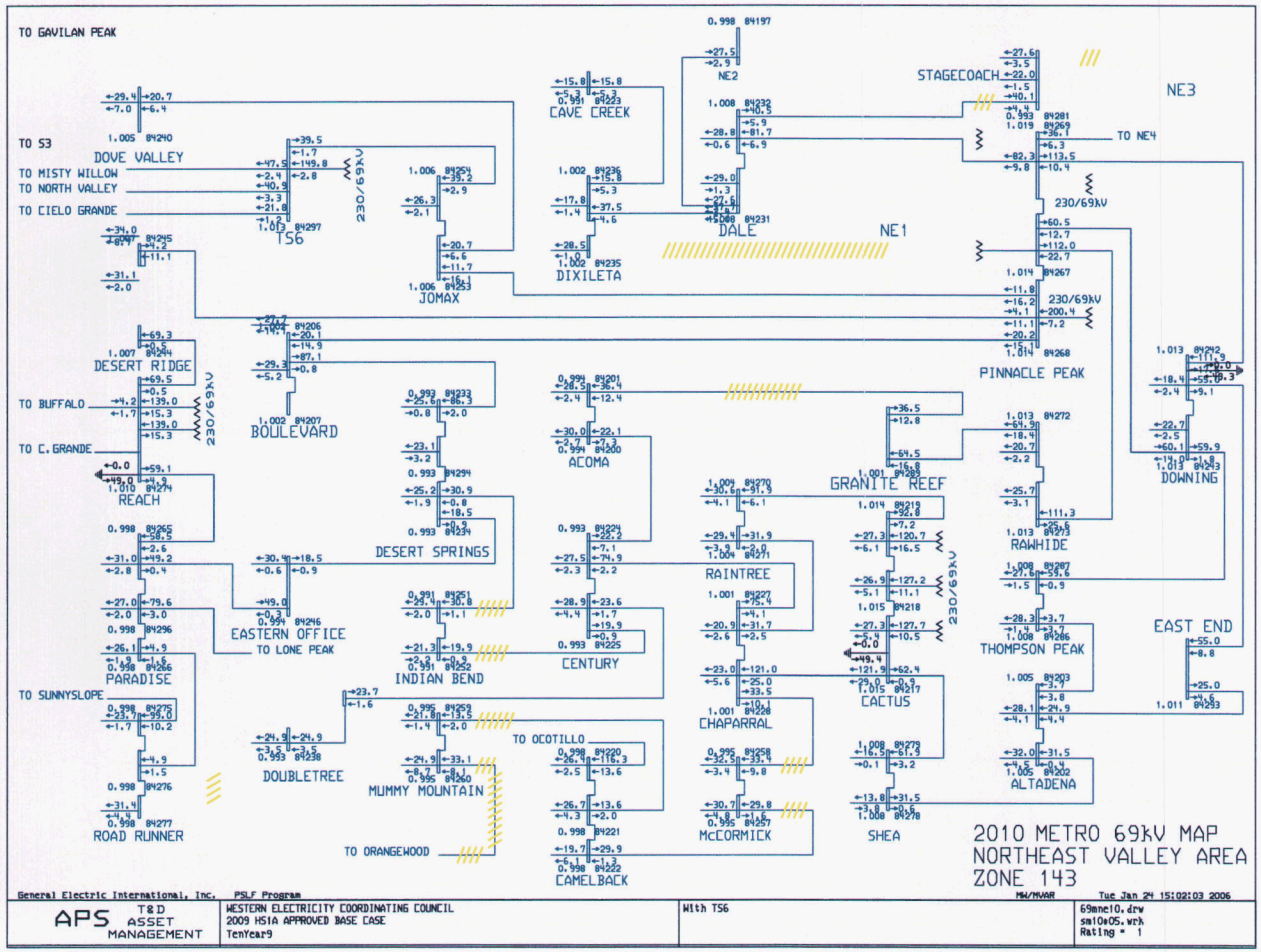
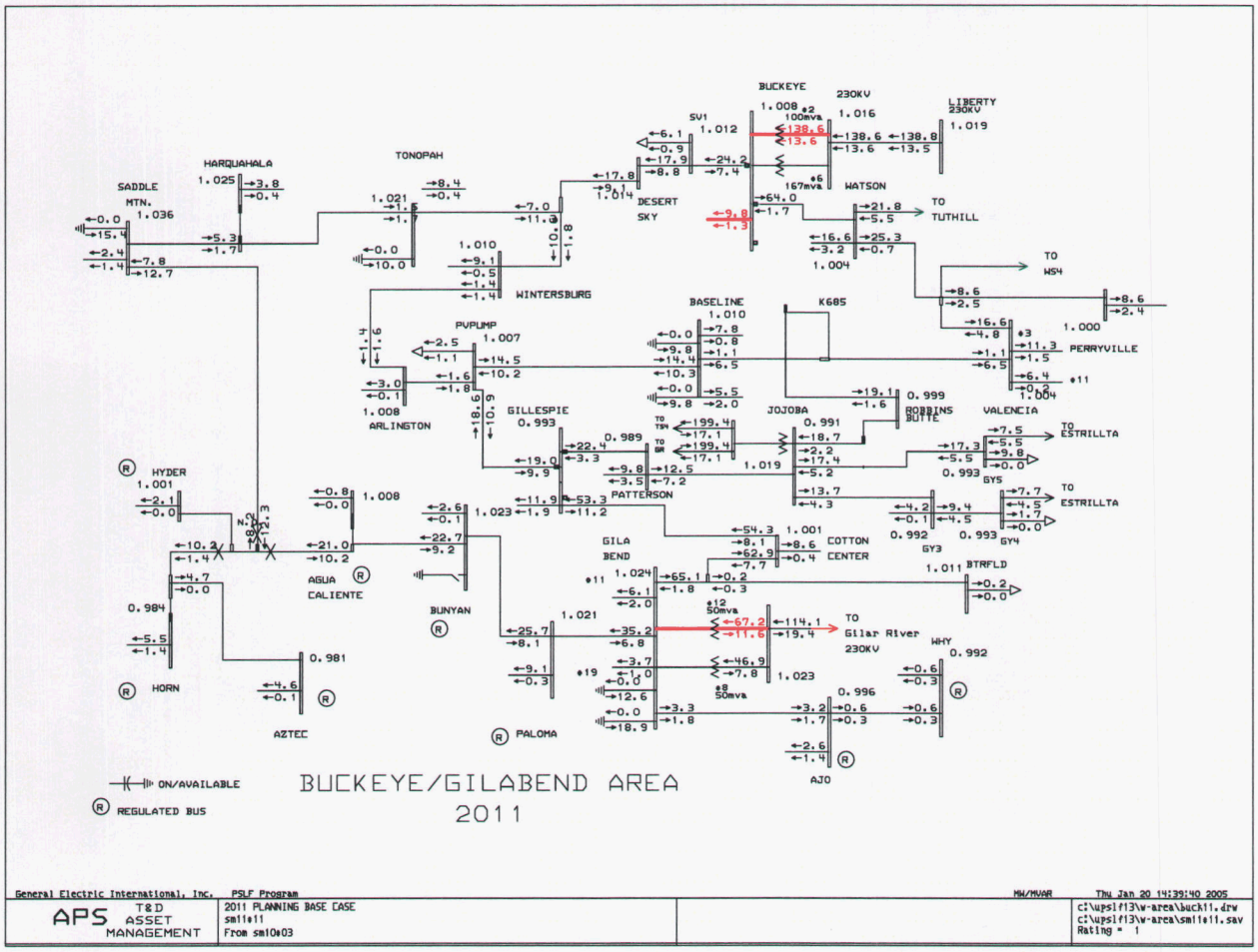
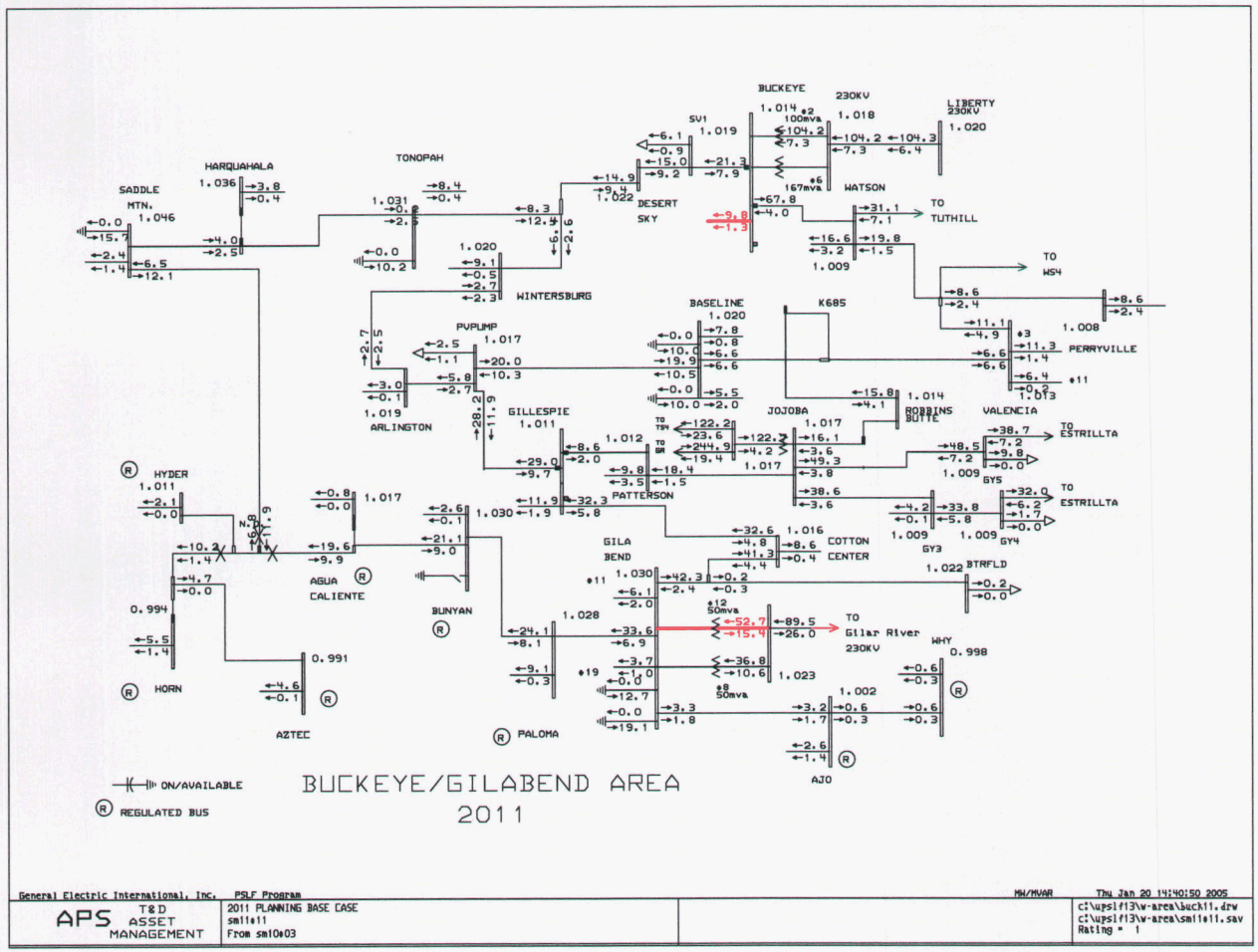
c:\upslf13\w-area\sm09#17.sav
Rating = 1


TO GAVILAN PEAK
TO S3
DOVE VALLEY
TO MISTY WILLOW
TO NORTH VALLEY
TO CIELO GRANDE
TS6
230/69kV
JOMAX
CAVE CREEK
NE2
DALE
NE1
DIXILETA
STAGECOACH
NE3
TO NE4
PINNACLE PEAK
DESERT RIDGE
TO BUFFALO
TO C. GRANDE
REACH
BOULEVARD
DESERT SPRINGS
EASTERN OFFICE
TO LONE PEAK
PARADISE
TO SUNNYSLOPE
INDIAN BEND
DOUBLETREE
MUMMY MOUNTAIN
ROAD RUNNER
TO OCOTILLO
TO ORANGEWOOD
ACOMA
CENTURY
CAMELBACK
RAINTREE
CHAPARRAL
McCORMICK
GRANITE REEF
CACTUS
SHEA
RAWHIDE
THOMPSON PEAK
ALTADENA
DOWNING
EAST END
2010 METRO 69kV MAP
NORTHEAST VALLEY AREA
ZONE 143
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 24 15:03:18 2006
APS T&D ASSET MANAGEMENT
WESTERN ELECTRICITY COORDINATING COUNCIL
2009 HS1A APPROVED BASE CASE
TenYear10
Without TS6
69mne10.drw
sm10e05.wrk
Rating = 1


TO GAVILAN PEAK
TO S3
DOVE VALLEY
TO MISTY WILLOW
TO NORTH VALLEY
TO CIELO GRANDE
TS6
230/69kV
JOMAX
CAVE CREEK
NE2
DALE
NE1
DIXILETA
STAGECOACH
NE3
TO NE4
PINNACLE PEAK
DESERT RIDGE
TO BUFFALO
TO C. GRANDE
REACH
BOULEVARD
DESERT SPRINGS
ACOMA
GRANITE REEF
DOWNING
RAWHIDE
THOMPSON PEAK
EAST END
ALTADENA
EASTERN OFFICE
TO LONE PEAK
PARADISE
TO SUNNYSLOPE
INDIAN BEND
CENTURY
RAINTREE
CHAPARRAL
CACTUS
DOUBLETREE
MUMMY MOUNTAIN
TO OCOTILLO
ROAD RUNNER
TO ORANGEWOOD
CAMELBACK
McCORMICK
SHEA
2010 METRO 69kV MAP
NORTHEAST VALLEY AREA
ZONE 143
General Electric International, Inc.
PSLF Program
MW/MVAR
Tue Jan 24 15:02:03 2006
APS T&D ASSET MANAGEMENT
WESTERN ELECTRICITY COORDINATING COUNCIL
2009 HS1A APPROVED BASE CASE
TenYear9
With TS6
69mne10.drw
sm10e05.wrk
Rating = 1


BUCKEYE/GILABEND AREA
2011
ON/AVAILABLE
REGULATED BUS
BUCKEYE
230KV
LIBERTY 230KV
SV1
DESERT SKY
WATSON
TO TUTHILL
TO WS4
HARQUAHALA
SADDLE MTN.
TONOPAH
WINTERSBURG
BASELINE
K685
PERRYVILLE
PVPUMP
ARLINGTON
GILLESPIE
JOJOBA
ROBBINS BUTTE
VALENCIA
TO ESTRILLTA
HYDER
PATTERSON
GILA BEND
COTTON CENTER
BTRFLD
AGUA CALIENTE
BUNYAN
TO Gilar River 230KV
WHY
HORN
AZTEC
PALOMA
AJO
General Electric International, Inc.
PSLF Program
MW/MVAR
Thu Jan 20 14:39:40 2005
APS T&D ASSET MANAGEMENT
2011 PLANNING BASE CASE
sm11#11
From sm10#03
c:\upslf13\w-area\buck11.drw
c:\upslf13\w-area\sm11#11.sav
Rating = 1


BUCKEYE
230KV
LIBERTY
230KV
SV1
DESERT
SKY
WATSON
TO
TUTHILL
TO
WS4
HARQUAHALA
SADDLE
MTN.
TONOPAH
WINTERSBURG
BASELINE
K685
PERRYVILLE
PVPUMP
ARLINGTON
GILLESPIE
JOJOBA
ROBBINS
BUTTE
VALENCIA
TO
ESTRILLTA
GYS
GY3
GY4
PATTERSON
GILA
BEND
COTTON
CENTER
BTRFLD
HYDER
AGUA
CALIENTE
BUNYAN
TO
Gilar River
230KV
WHY
HORN
AZTEC
PALOMA
AJO
ON/AVAILABLE
REGULATED BUS
BUCKEYE/GILABEND AREA
2011
General Electric International, Inc.
PSLF Program
MW/MVAR
Thu Jan 20 14:40:50 2005
APS
T&D
ASSET
MANAGEMENT
2011 PLANNING BASE CASE
sm11e11
From sm10e03
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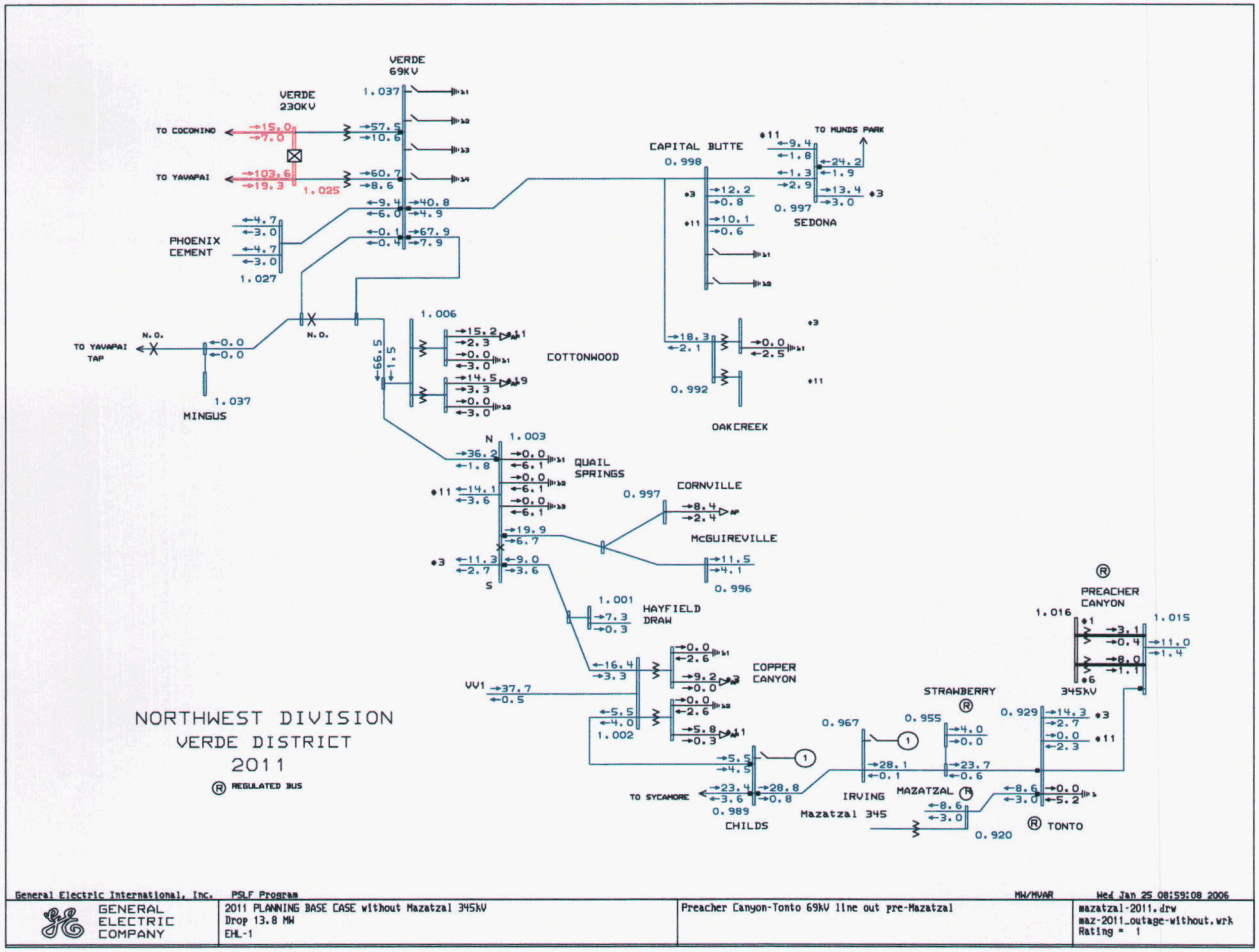
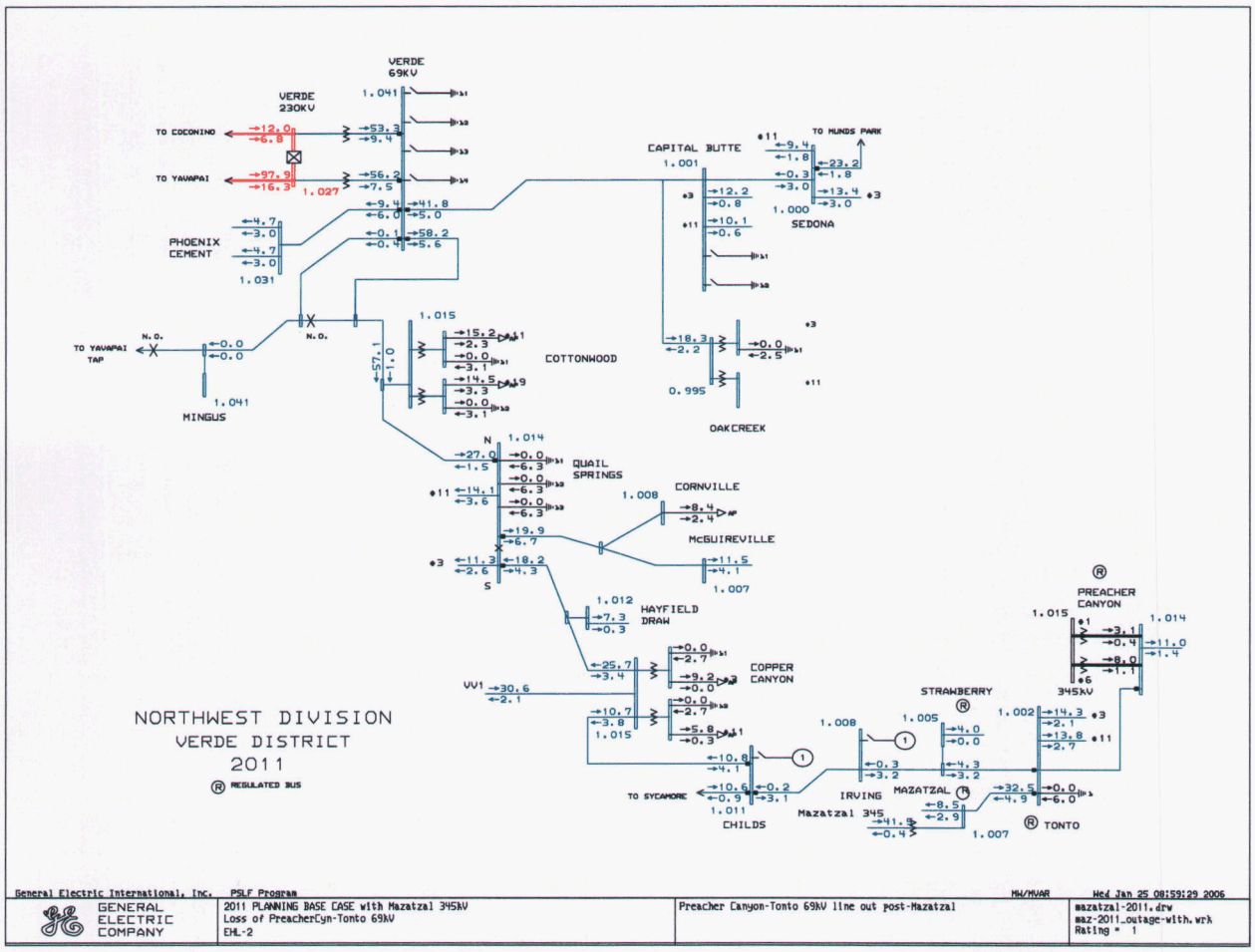
c:\upslf13\w-area\sm11e11.sav
Rating = 1


VERDE 69KV
VERDE 230KV
TO COCONINO
TO YAVAPAI
PHOENIX CEMENT
TO YAVAPAI TAP
MINGUS
COTTONWOOD
CAPITAL BUTTE
TO MUNDS PARK
SEDONA
OAKCREEK
QUAIL SPRINGS
CORNVILLE
McGUIREVILLE
HAYFIELD DRAW
COPPER CANYON
VV1
TO SYCAMORE
CHILDS
IRVING
Mazatzal 345
MAZATZAL
STRAWBERRY
PREACHER CANYON
345KV
TONTO
NORTHWEST DIVISION
VERDE DISTRICT
2011
REGULATED BUS
General Electric International, Inc.
PSLF Program
MW/MVAR
Wed Jan 25 08:59:08 2006
GENERAL ELECTRIC COMPANY
2011 PLANNING BASE CASE without Mazatzal 345kV
Drop 13.8 MW
EHL-1
Preacher Canyon-Tonto 69kV line out pre-Mazatzal
mazatzal-2011.drw
maz-2011_outage-without.wrk
Rating = 1


VERDE 69KV
VERDE 230KV
TO COCONINO
TO YAVAPAI
PHOENIX CEMENT
TO YAVAPAI TAP
MINGUS
CAPITAL BUTTE
TO MUNDS PARK
SEDONA
COTTONWOOD
OAKCREEK
QUAIL SPRINGS
CORNVILLE
McGUIREVILLE
HAYFIELD DRAW
COPPER CANYON
PREACHER CANYON
345KV
STRAWBERRY
IRVING
MAZATZAL
TO SYCAMORE
CHILDS
Mazatzal 345
TONTO
NORTHWEST DIVISION
VERDE DISTRICT
2011
REGULATED BUS
General Electric International, Inc.
PSLF Program
MW/MVAR
Wed Jan 25 08:59:29 2006
GENERAL ELECTRIC COMPANY
2011 PLANNING BASE CASE with Mazatzal 345kV
Loss of PreacherCyn-Tonto 69kV
EHL-2
Preacher Canyon-Tonto 69kV line out post-Mazatzal
mazatzal-2011.drw
maz-2011_outage-with.wrk
Rating = 1

APPENDIX B
2009 STABILITY PLOTS

APPENDIX B

2009
Stability Plots

Table of Contents

Simulation **Page**

Arlington Valley 500kv
- Arlington-Hassayampa outage 1
- Arlington-TS5 outage 2

Cholla 500 & 345kv
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- Cholla-Four Corners outage 4
- Cholla-Pinnacle Peak outage 5
- Cholla-Saguaro outage 6

Four Corners 500 & 345kv
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- Four Corners-Moenkopi outage 8

Hassayampa 500kv
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- Hassayampa-Jojoba outage 10
- Hassayampa-North Gila outage 11

Jojoba 500kv
- Jojoba-Gila River outage 12
- Jojoba-Hassayampa outage 13
- Jojoba-Kyrene outage 14

Kyrene 500kv
- Kyrene-Browning outage 15
- Kyrene-Jojoba outage 16

Moenkopi 500kv
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- Moenkopi-Navajo outage 18
- Moenkopi-Yavapai outage 19

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- Navajo-Moenkopi outage 23
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- Palo Verde-Rudd outage 27
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- Westwing-Palo Verde outage 34

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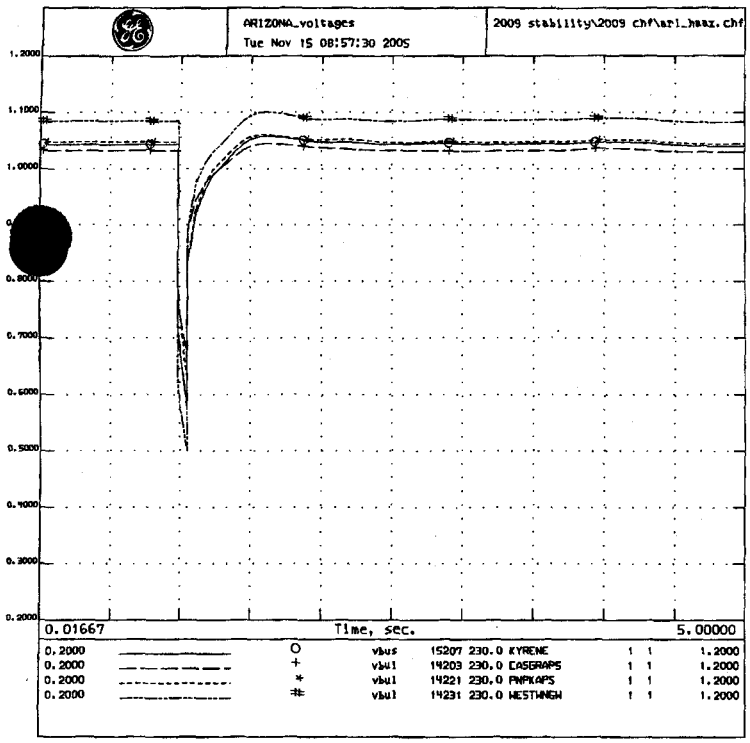
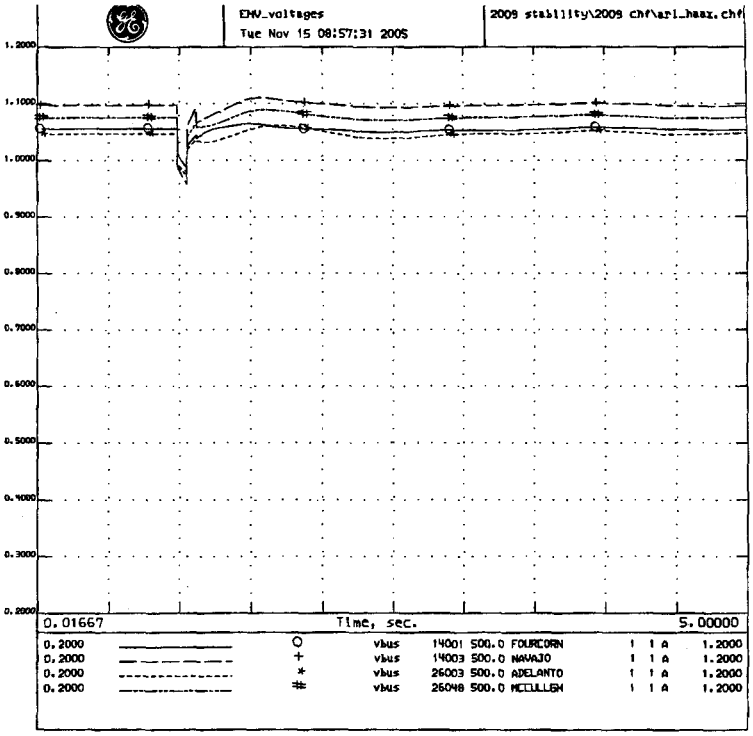
Yavapai-Moenkopi outage 36
Yavapai-Westwing outage 37



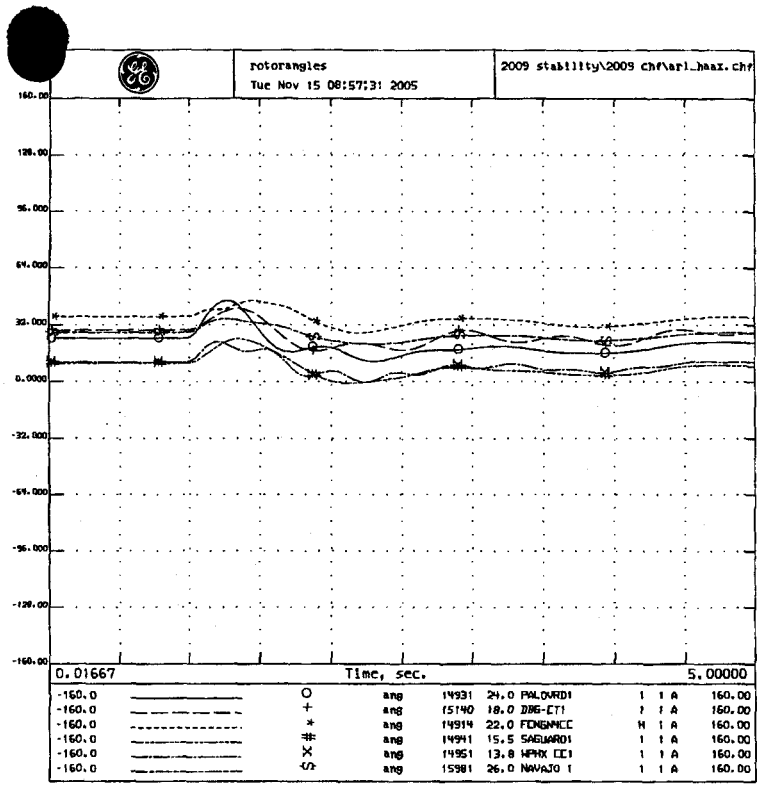
ARLINGTON FLT ARL-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



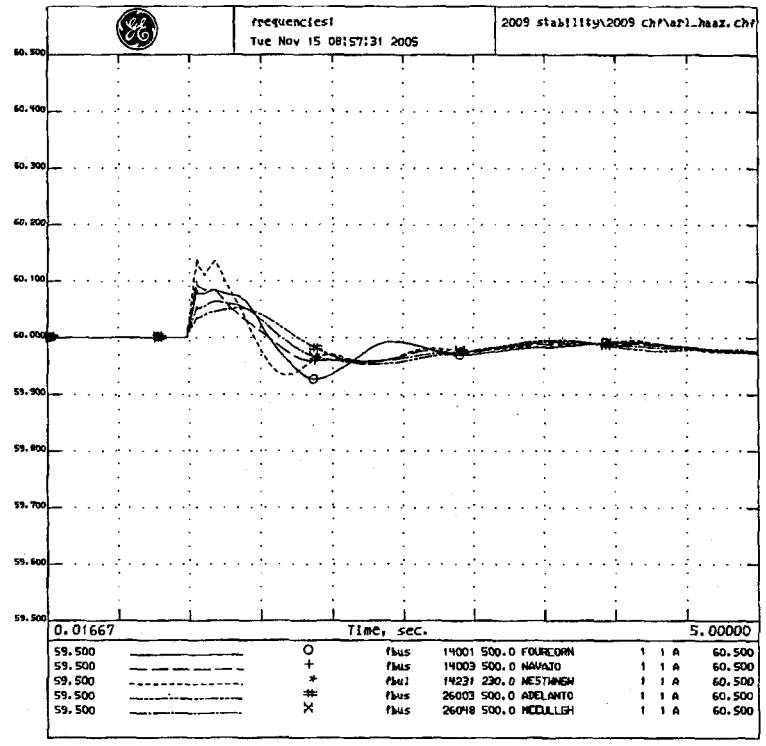
ARLINGTON FLT ARL-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



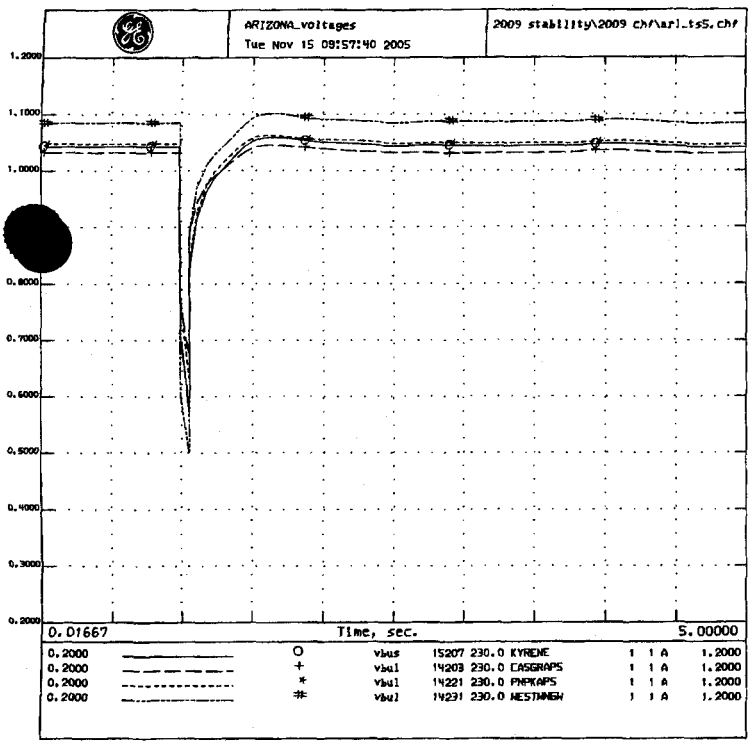
ARLINGTON FLT ARL-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



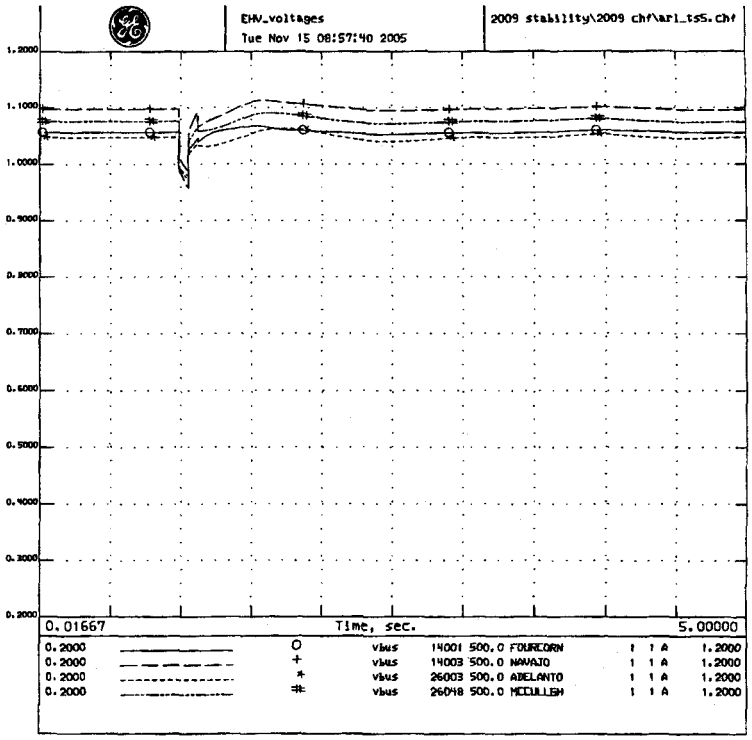
ARLINGTON FLT ARL-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



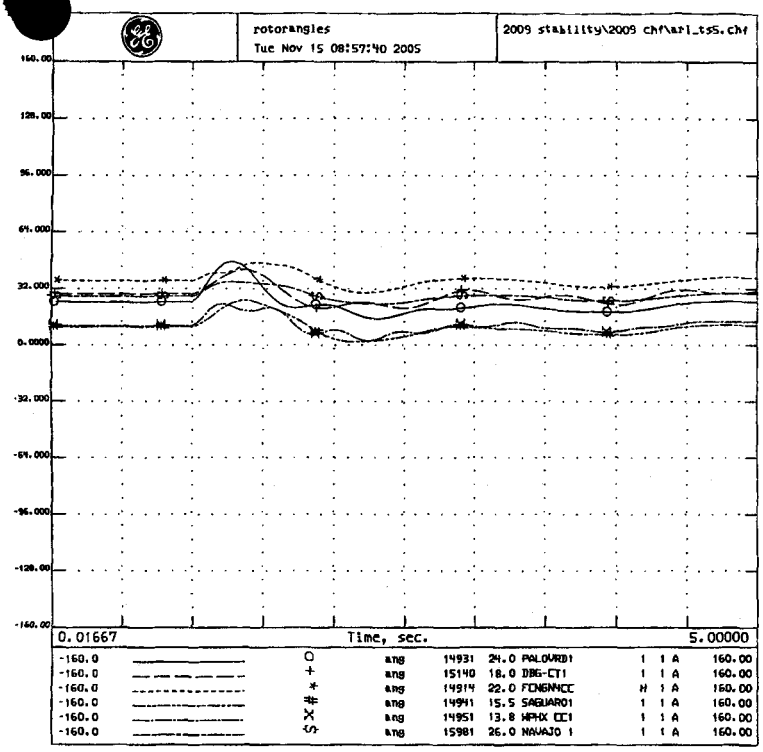
ARLINGTON FLT ARL-TSS LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-TSS STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TSS;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



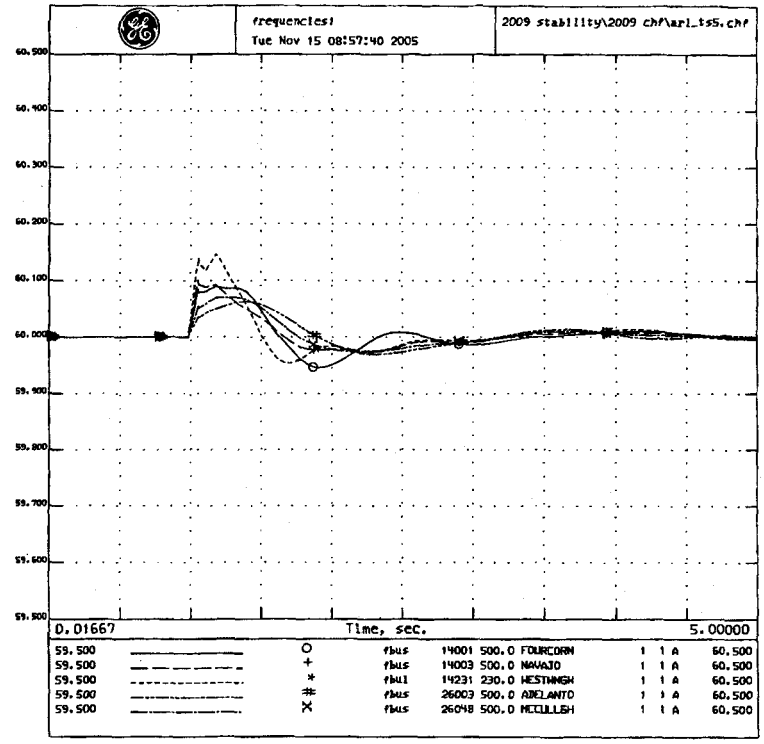
ARLINGTON FLT ARL-TSS LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-TSS STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TSS;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



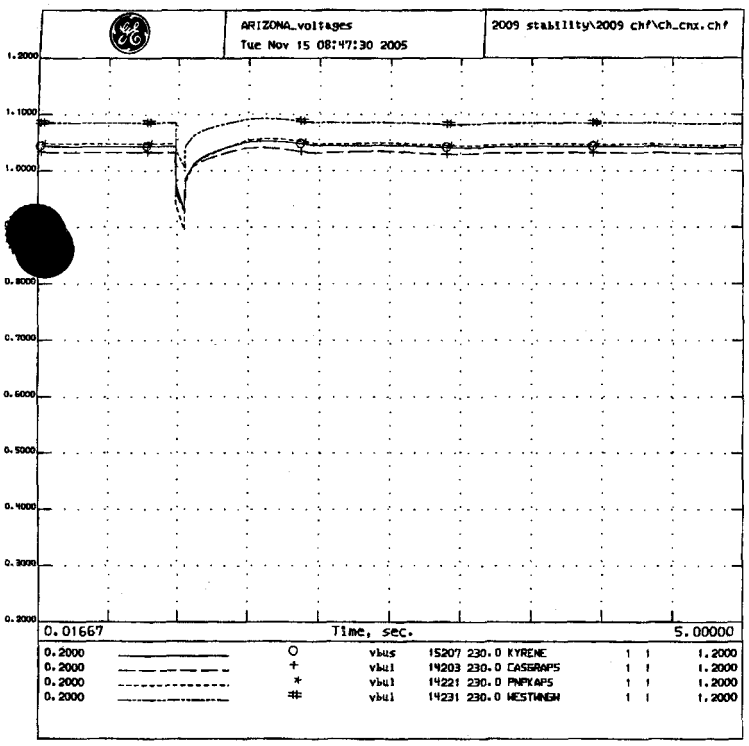
ARLINGTON FLT ARL-TSS LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-TSS STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TSS;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



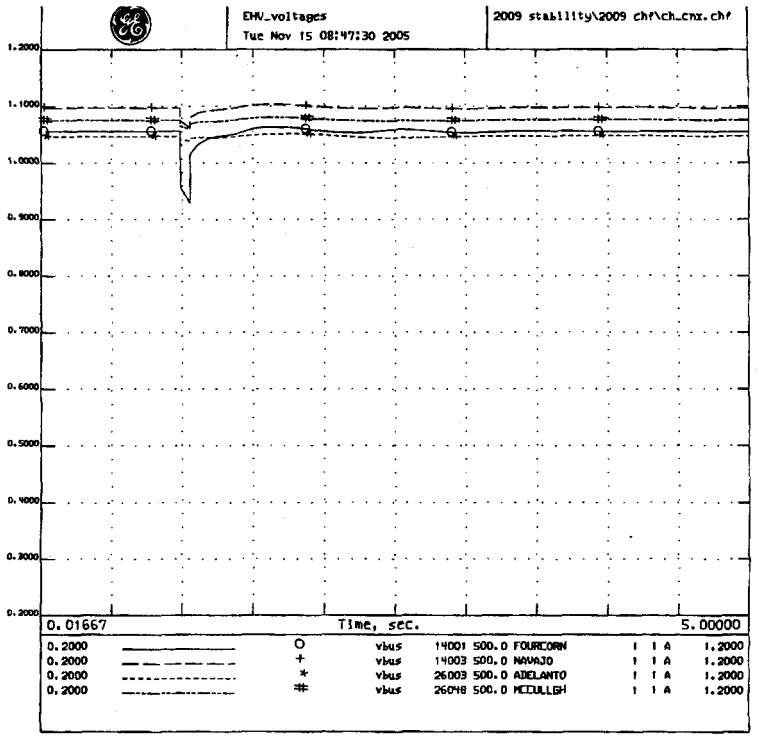
ARLINGTON FLT ARL-TSS LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
ARL-TSS STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TSS;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



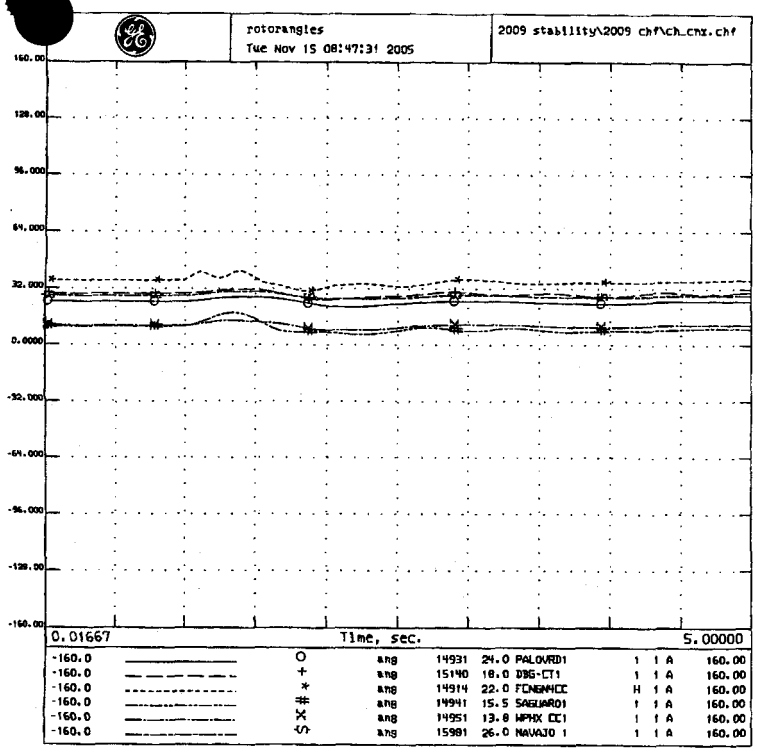
CHOLLA 500KV FLT CH-CNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-CNX STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-CNX;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



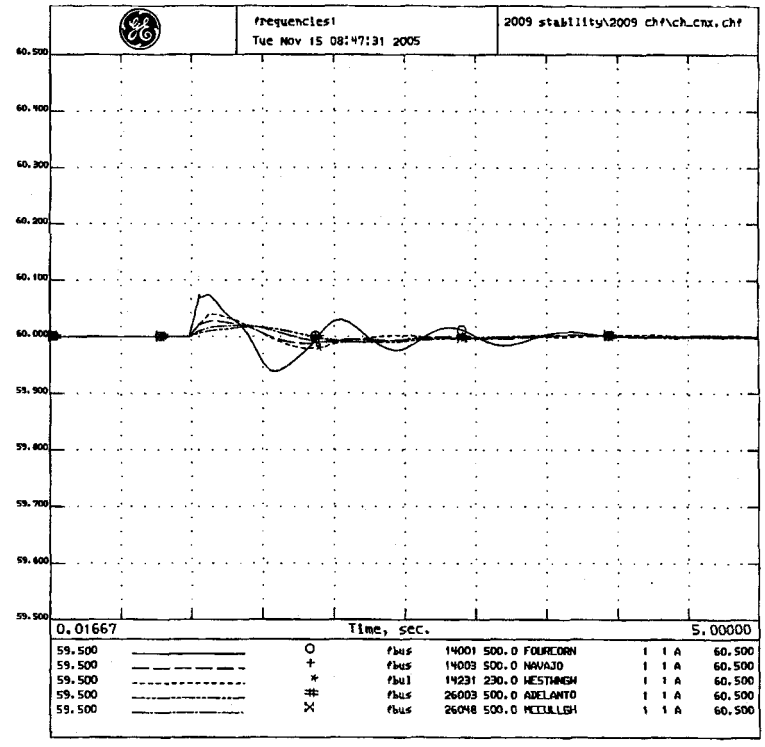
CHOLLA 500KV FLT CH-CNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-CNX STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-CNX;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



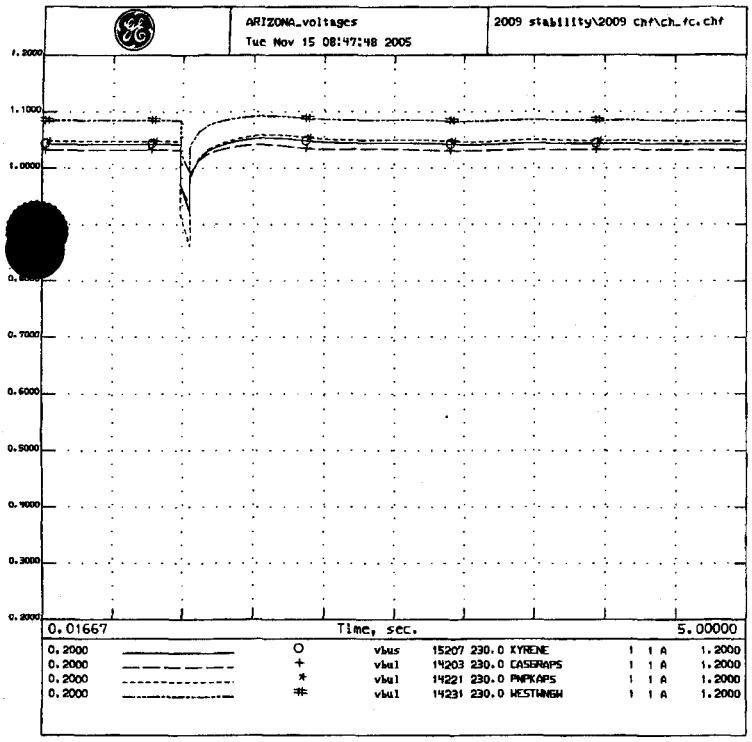
CHOLLA 500KV FLT CH-CNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-CNX STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-CNX;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



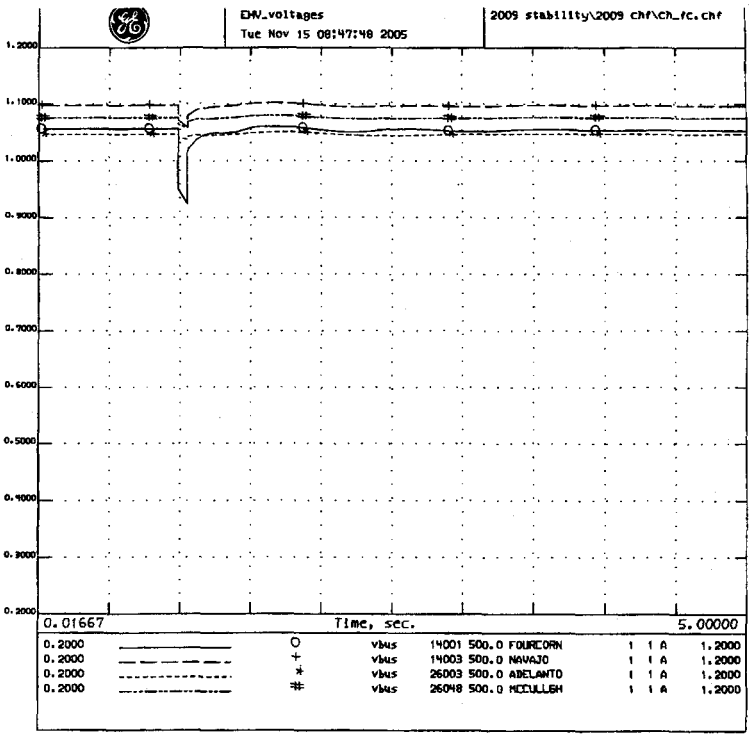
CHOLLA 500KV FLT CH-CNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-CNX STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-CNX;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



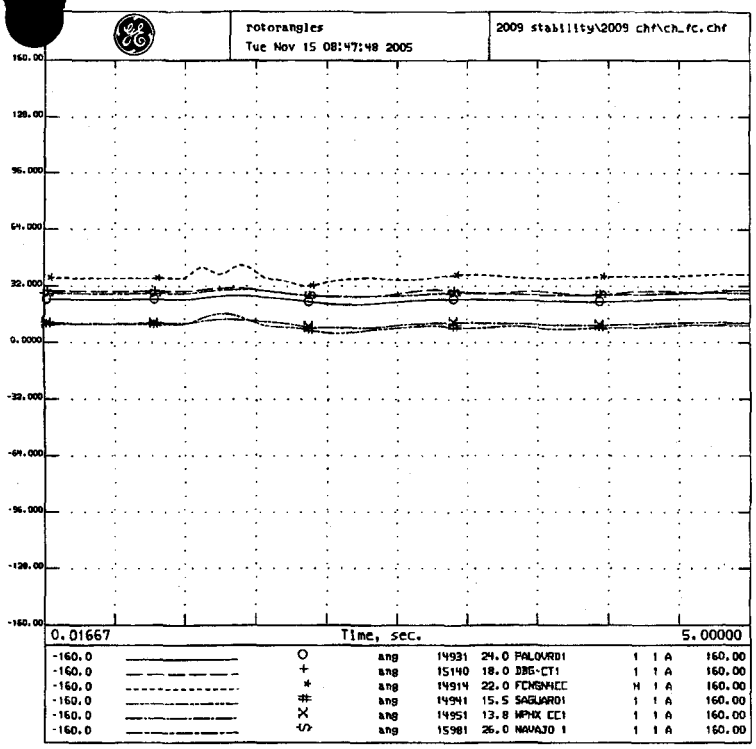
CHOLLA FLT CH-FC LINE OUT1
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC #1;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



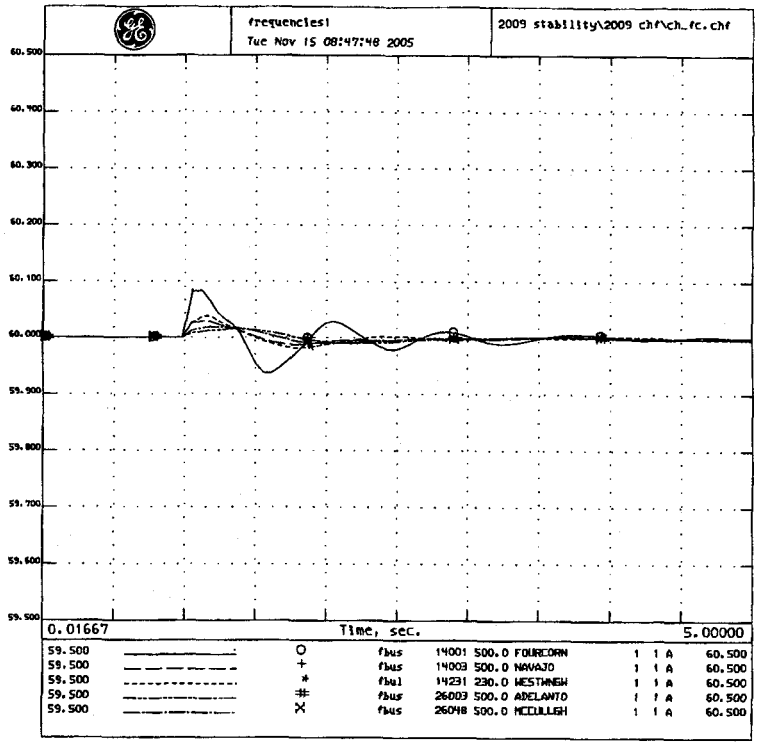
CHOLLA FLT CH-FC LINE OUT1
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC #1;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



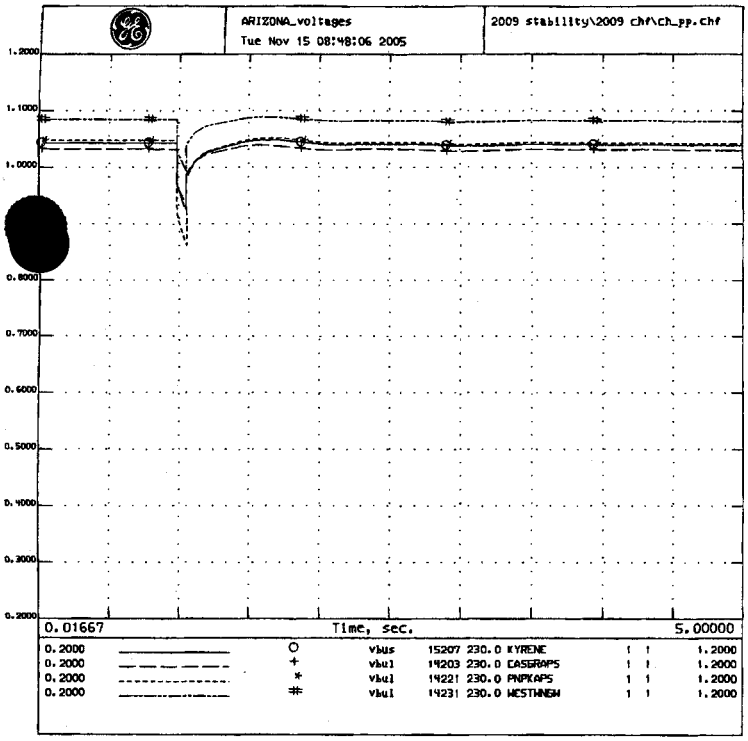
CHOLLA FLT CH-FC LINE OUT1
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC #1;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



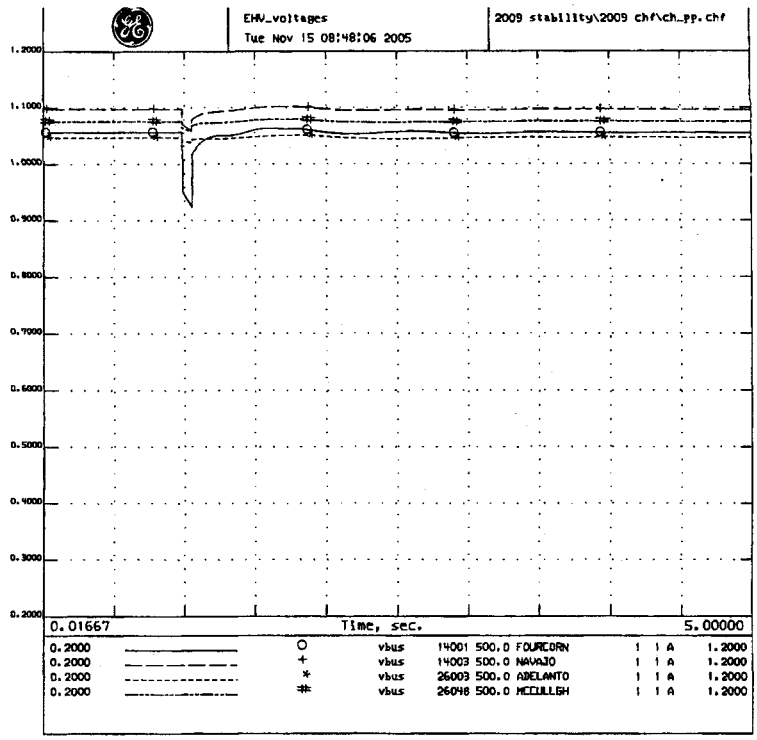
CHOLLA FLT CH-FC LINE OUT1
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC #1;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



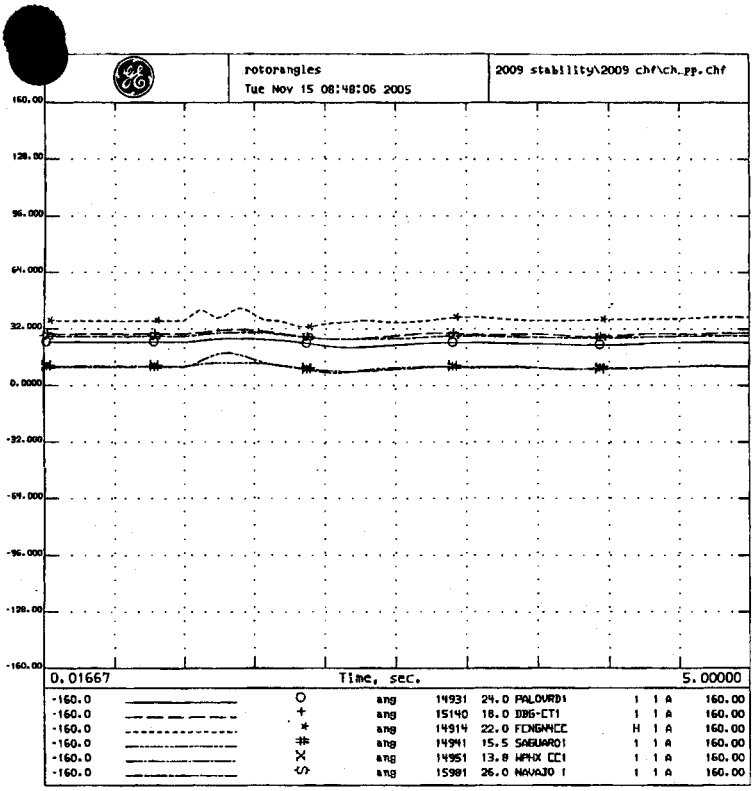
CHOLLA FLT CH-PP LINE OUT!
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



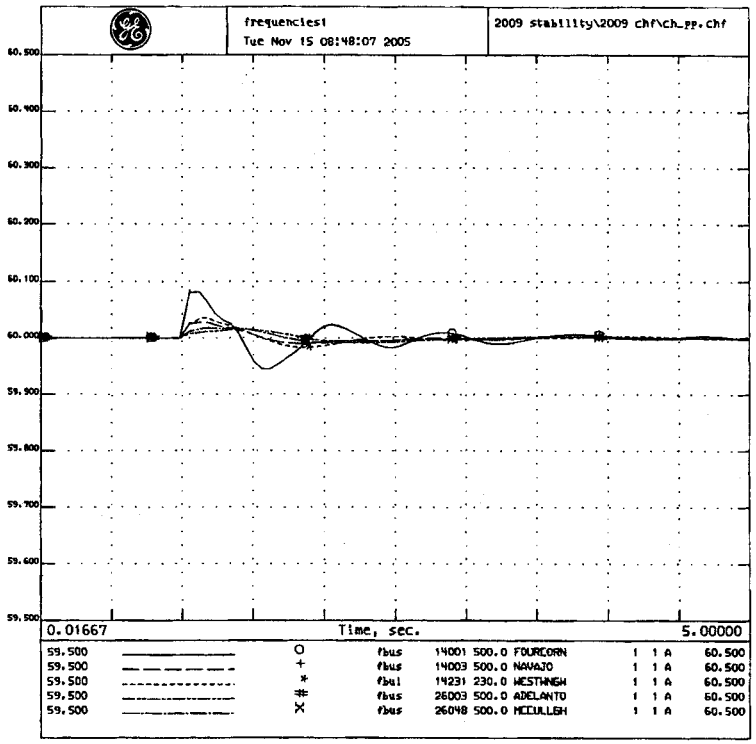
CHOLLA FLT CH-PP LINE OUT!
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



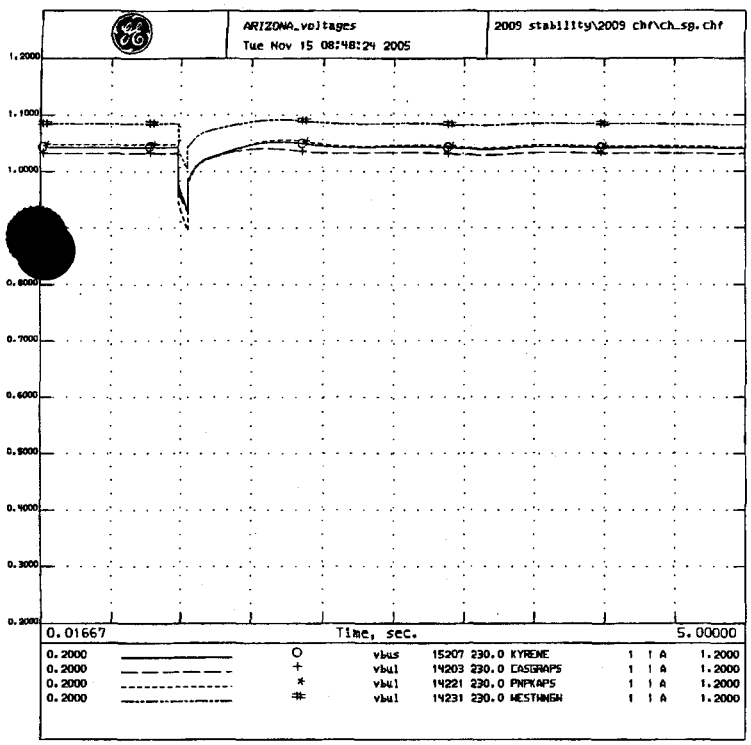
CHOLLA FLT CH-PP LINE OUT!
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



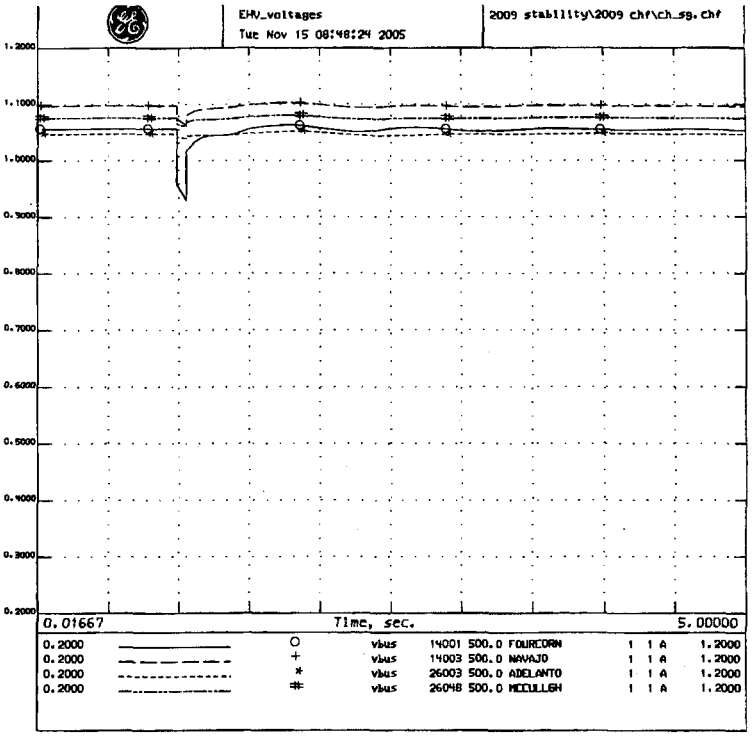
CHOLLA FLT CH-PP LINE OUT!
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



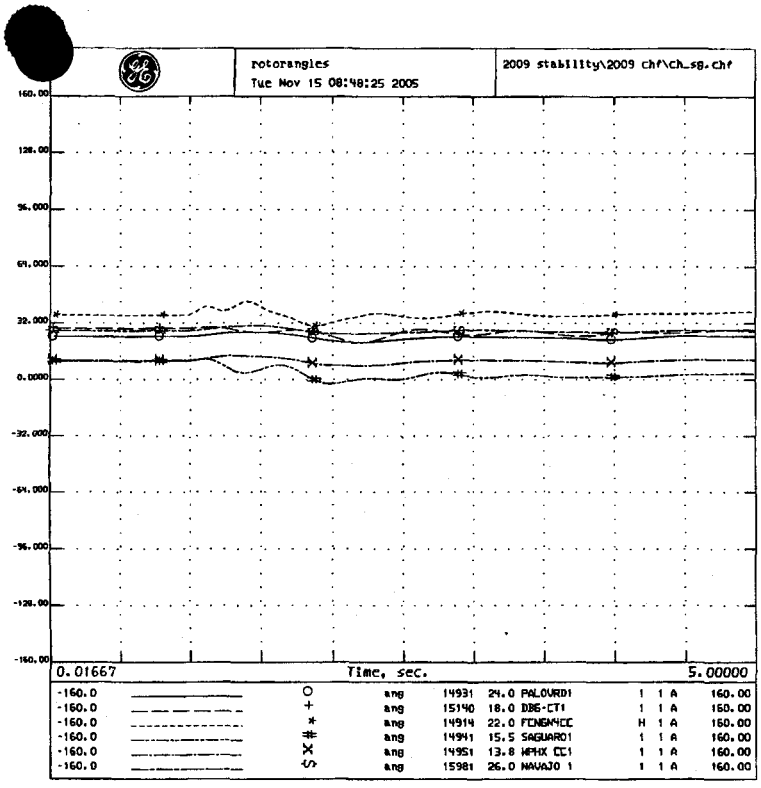
CHOLLA 500KV FLT CH-SG LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



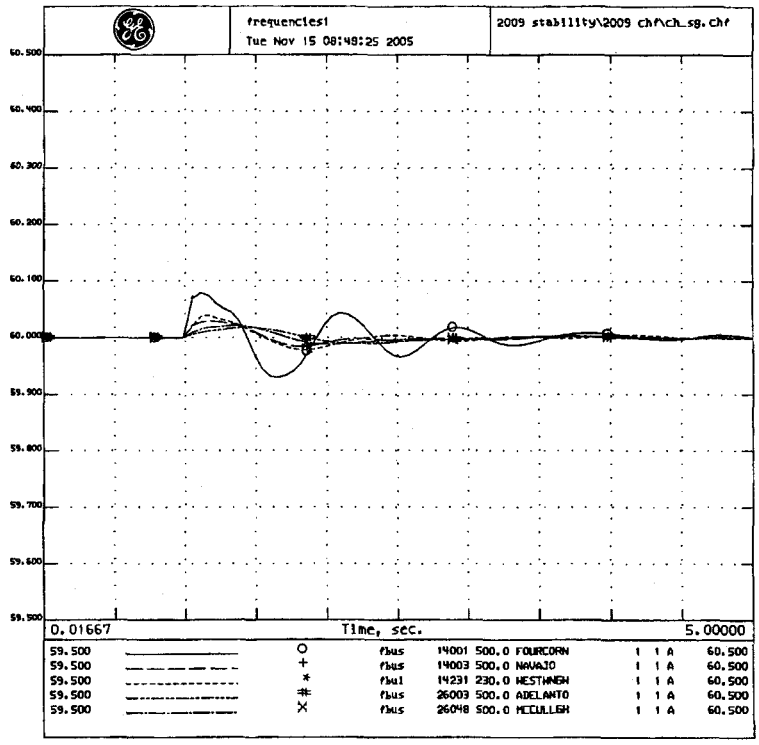
CHOLLA 500KV FLT CH-SG LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



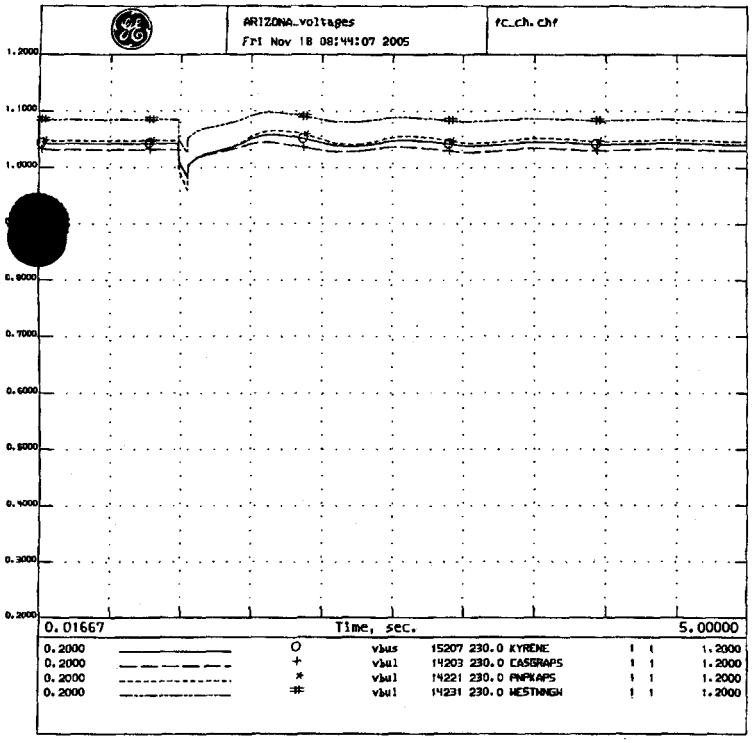
CHOLLA 500KV FLT CH-SG LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



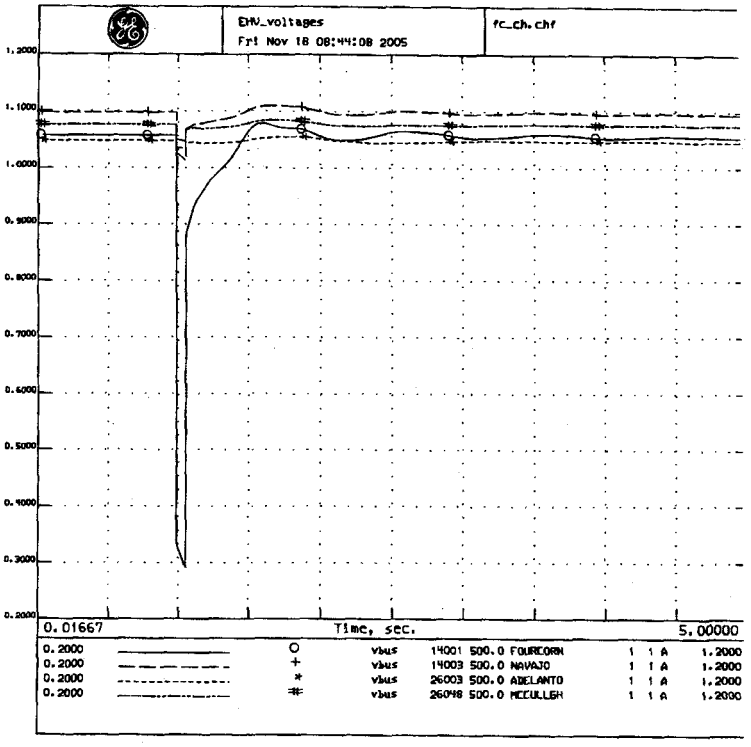
CHOLLA 500KV FLT CH-SG LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



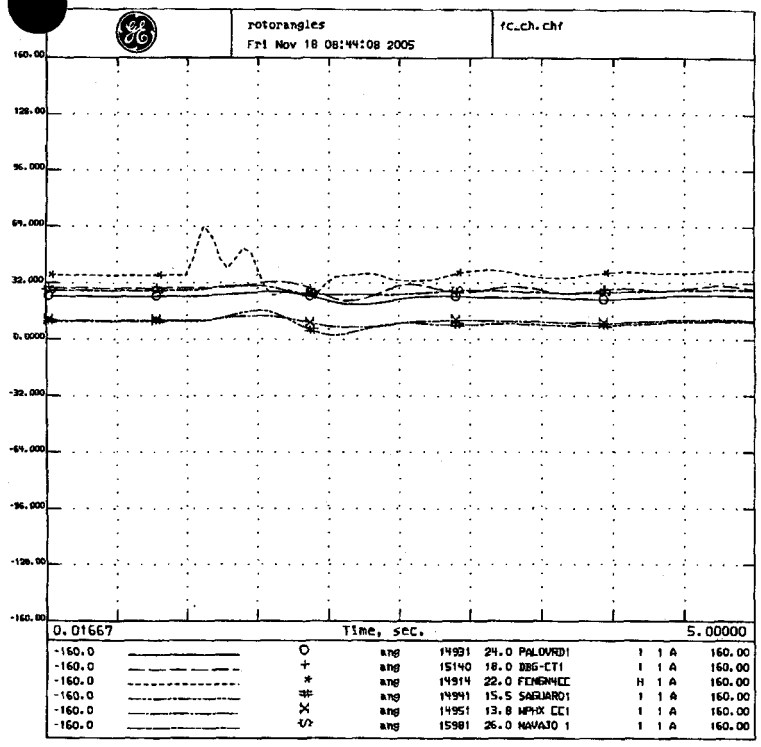
FOUR CORNERS fault w/FC-CH line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



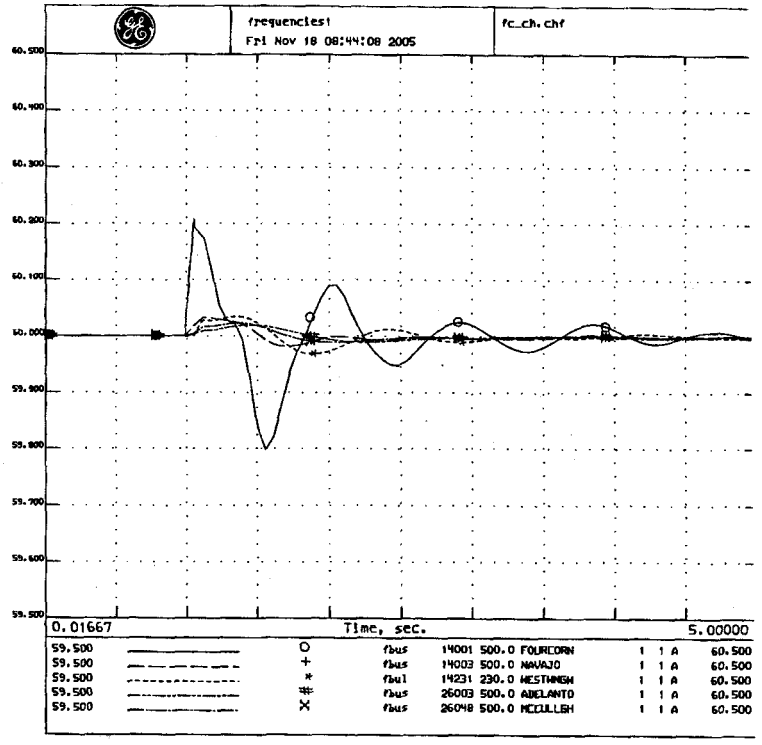
FOUR CORNERS fault w/FC-CH line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



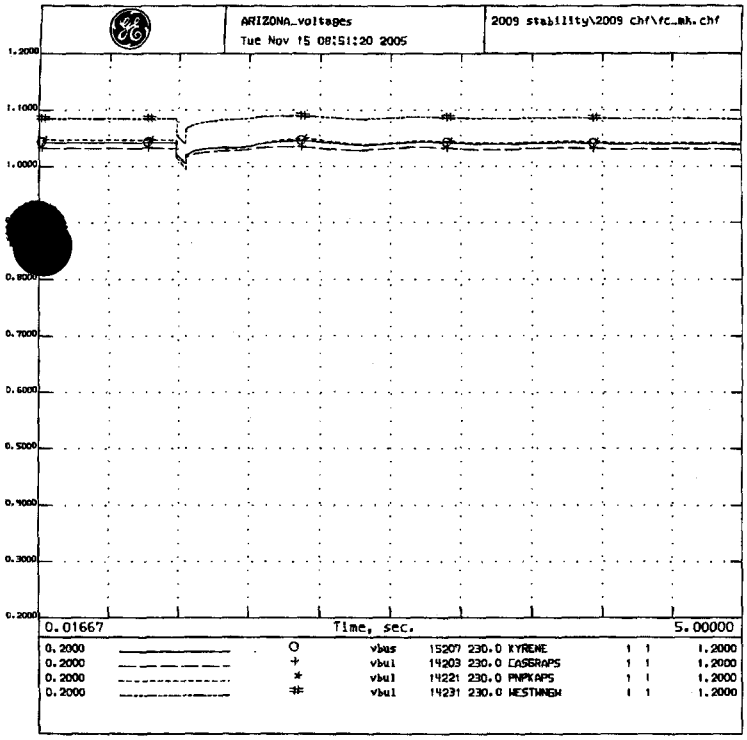
FOUR CORNERS fault w/FC-CH line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



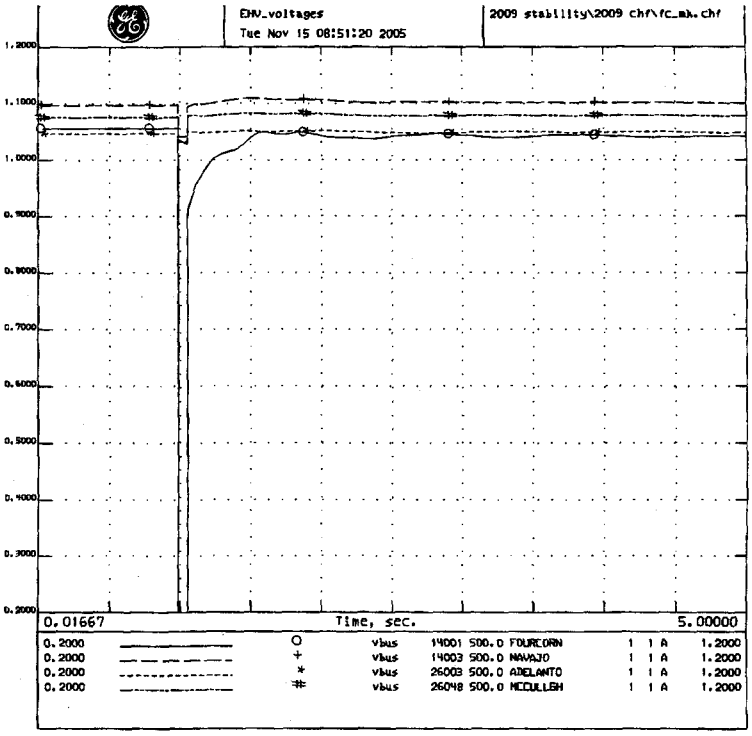
FOUR CORNERS fault w/FC-CH line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



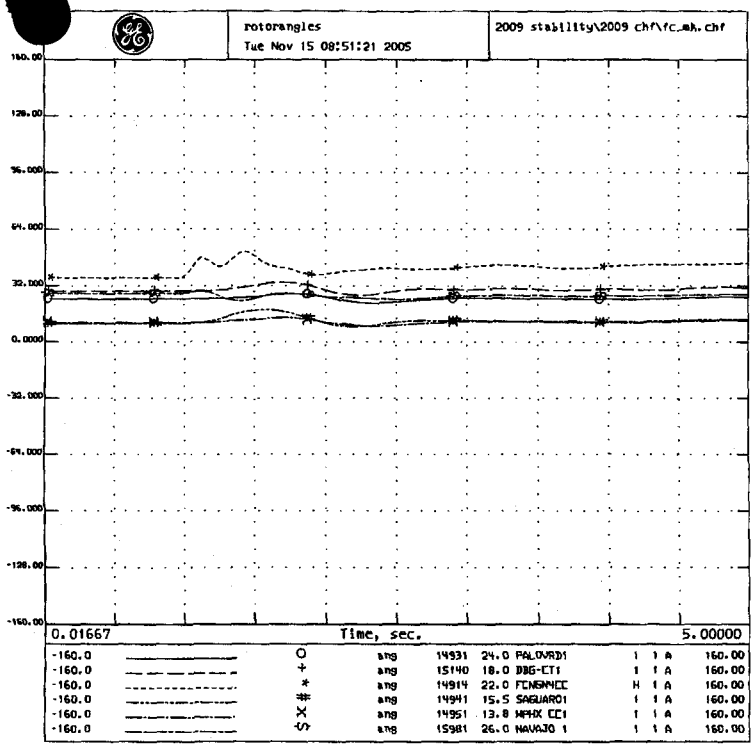
FOUR CORNERS FLT500 FC-MK out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-MK STAB; 1/06; T=0 3P FLT FC500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



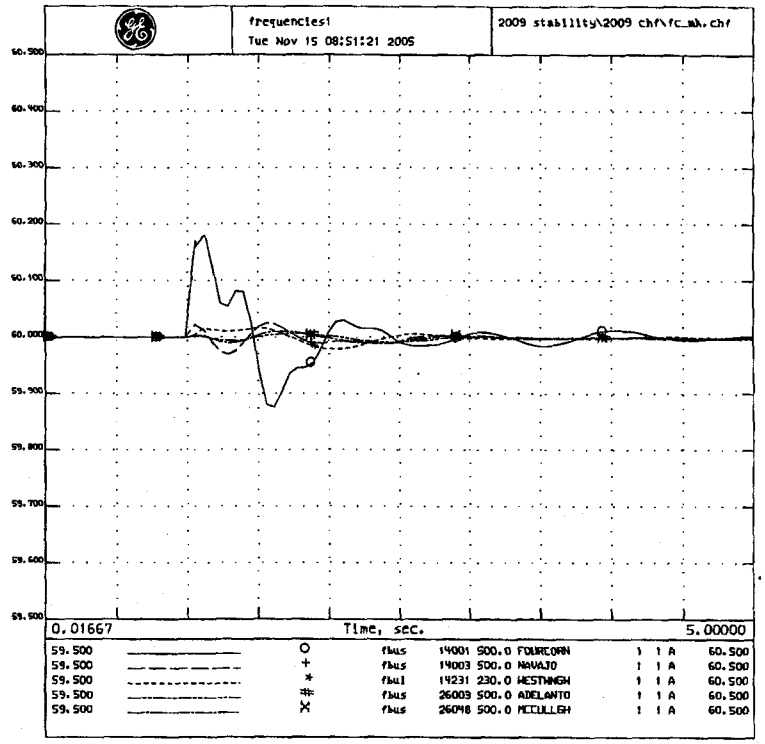
FOUR CORNERS FLT500 FC-MK out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-MK STAB; 1/06; T=0 3P FLT FC500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



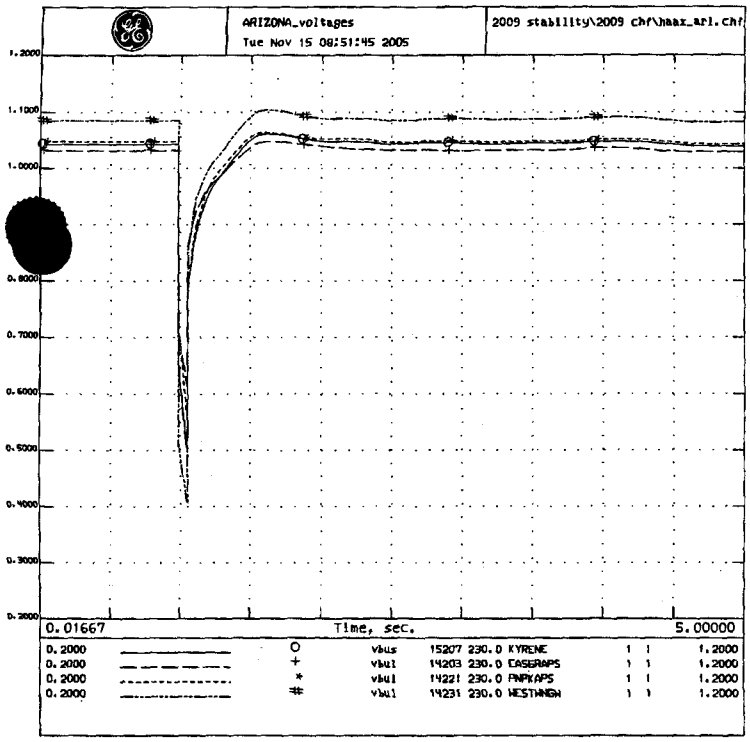
FOUR CORNERS FLT500 FC-MK out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-MK STAB; 1/06; T=0 3P FLT FC500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



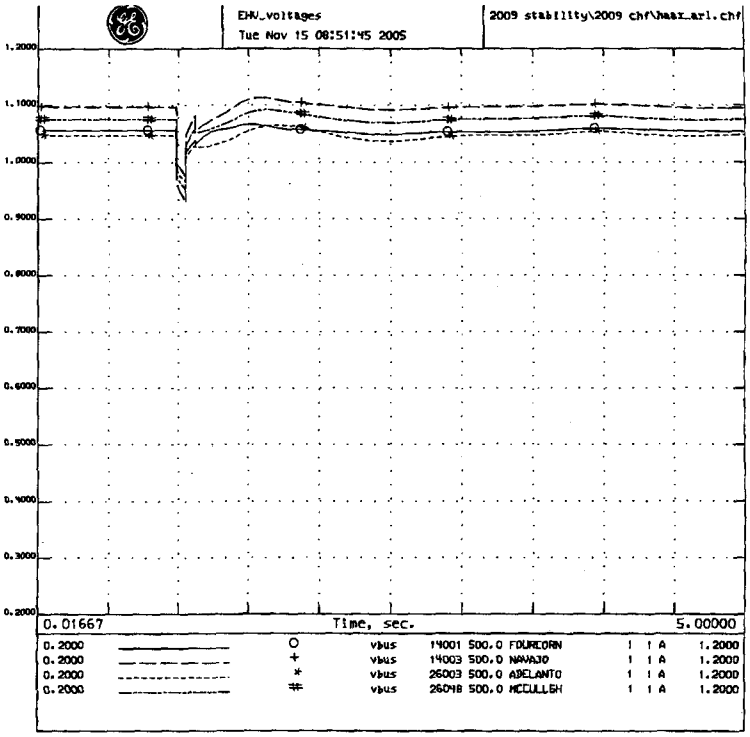
FOUR CORNERS FLT500 FC-MK out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
FC-MK STAB; 1/06; T=0 3P FLT FC500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



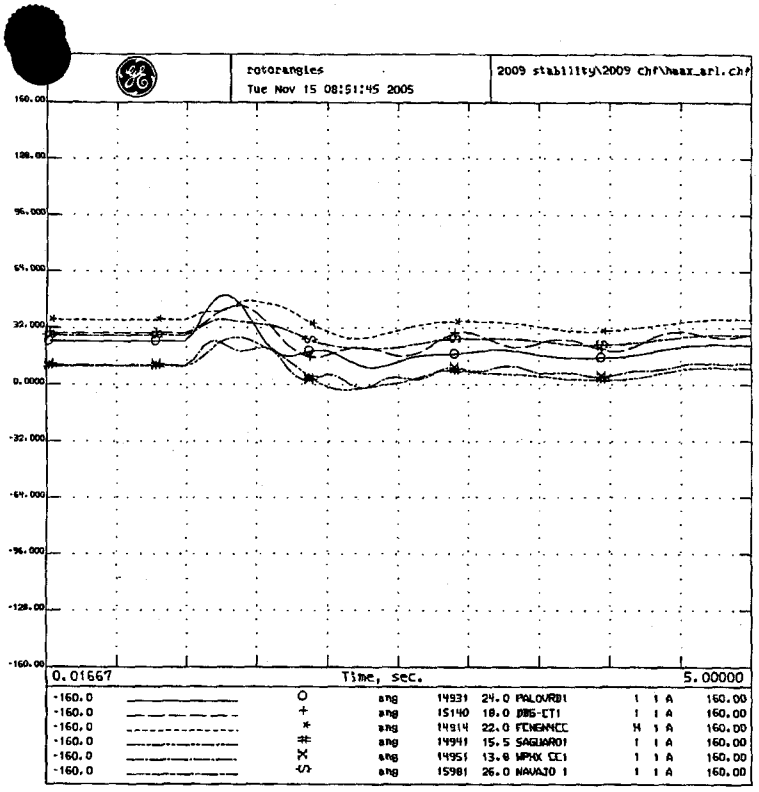
HASSAYAMPA FLT HAAX-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



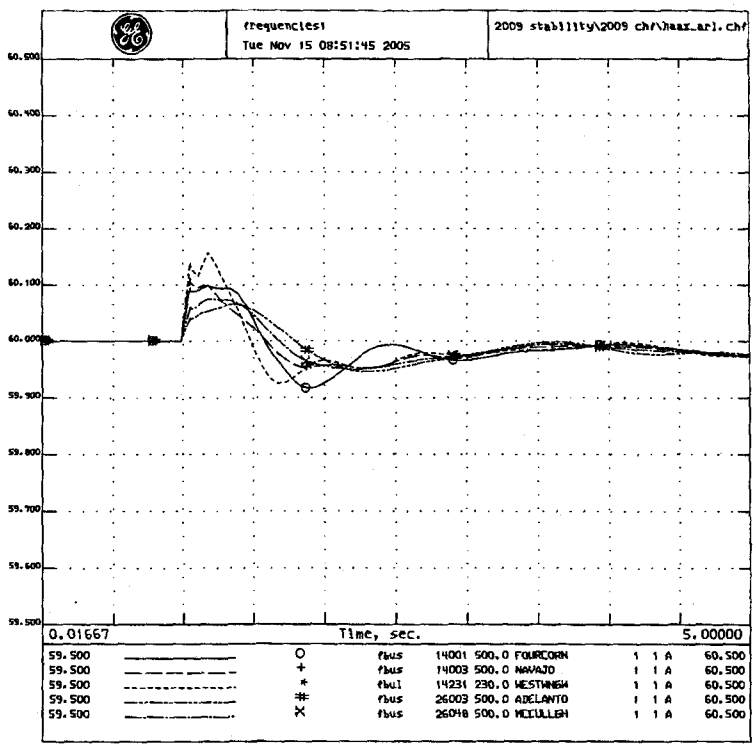
HASSAYAMPA FLT HAAX-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



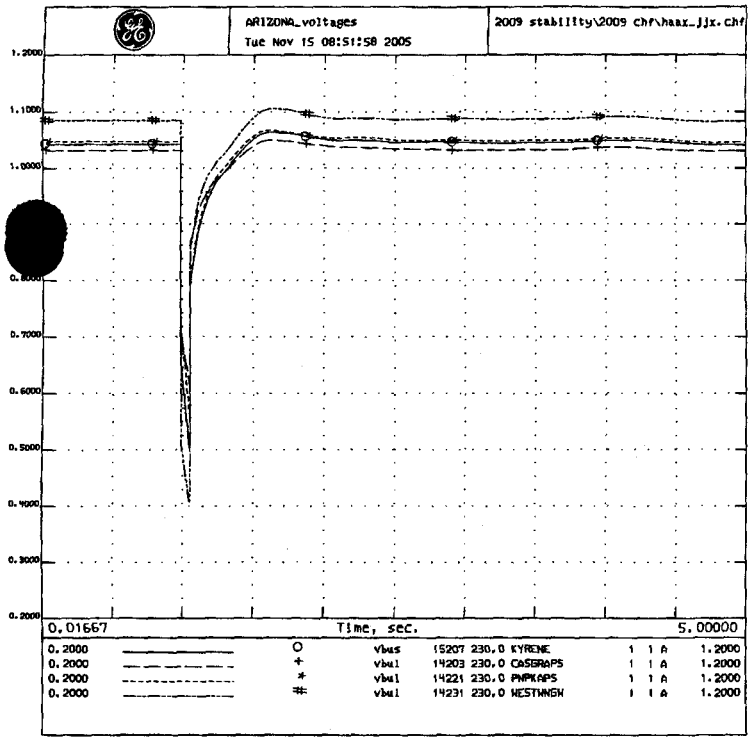
HASSAYAMPA FLT HAAX-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



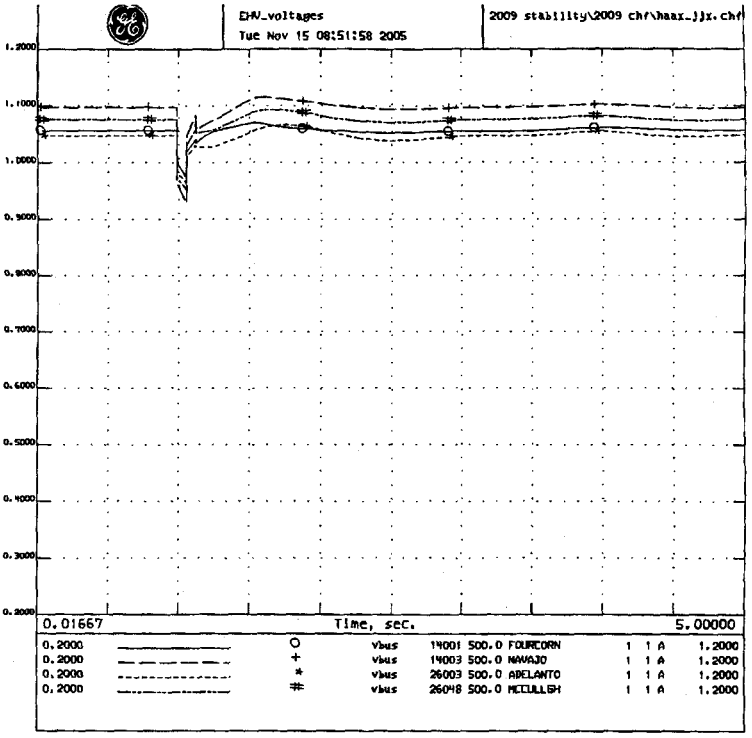
HASSAYAMPA FLT HAAX-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



HASSAYAMPA FLT HAAX-JJX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



HASSAYAMPA FLT HAAX-JJX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

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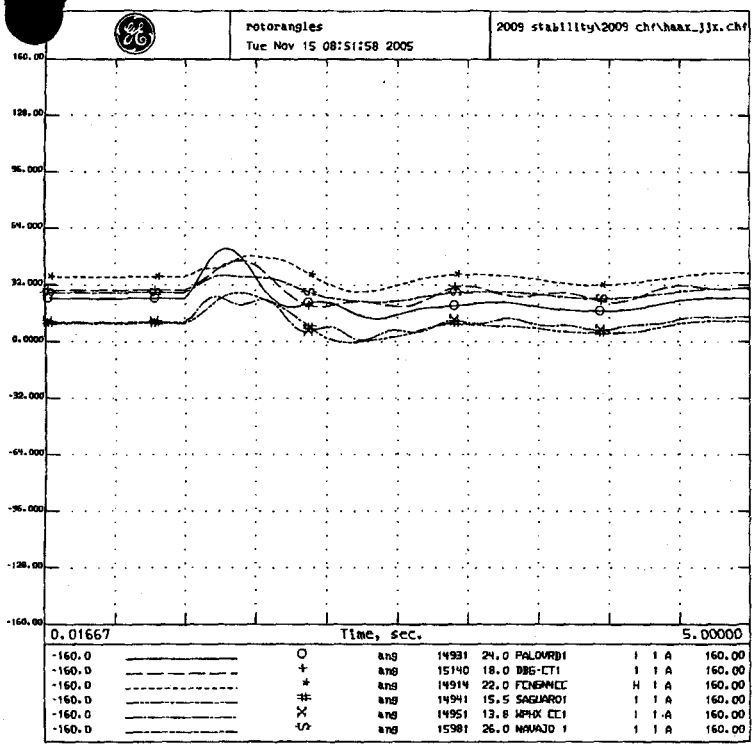

HASSAYAMPA FLT HAAX-JJX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

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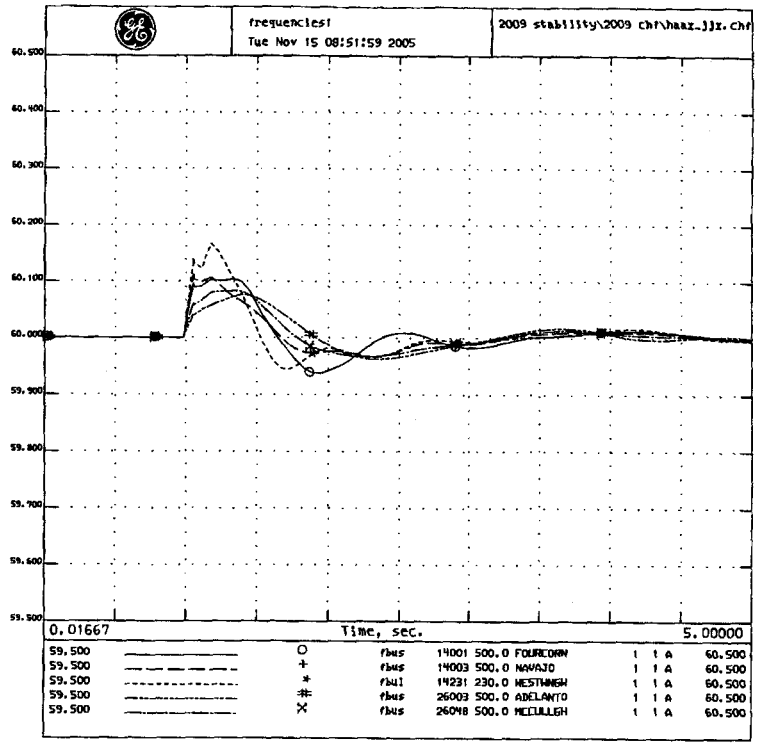

HASSAYAMPA FLT HAAX-JJX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

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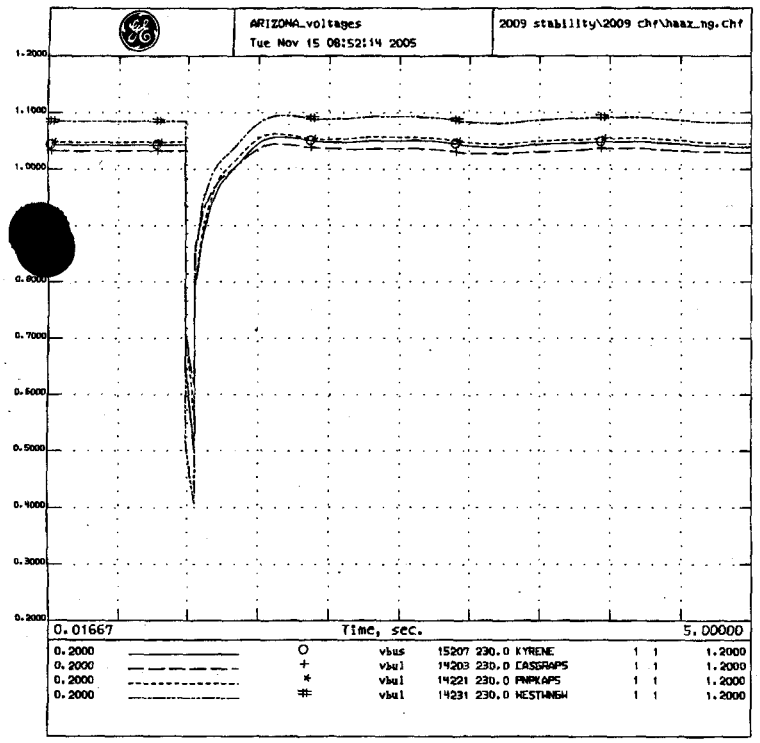
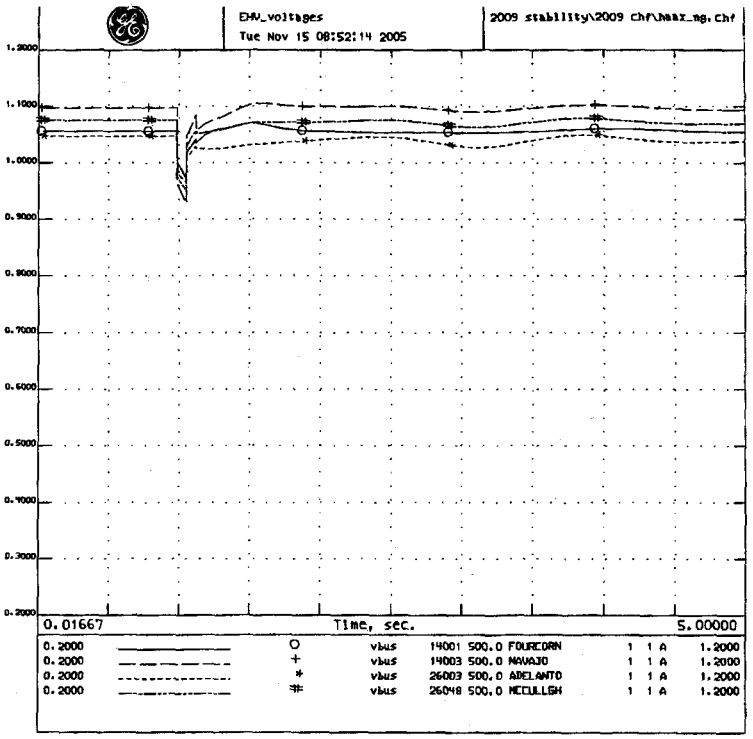


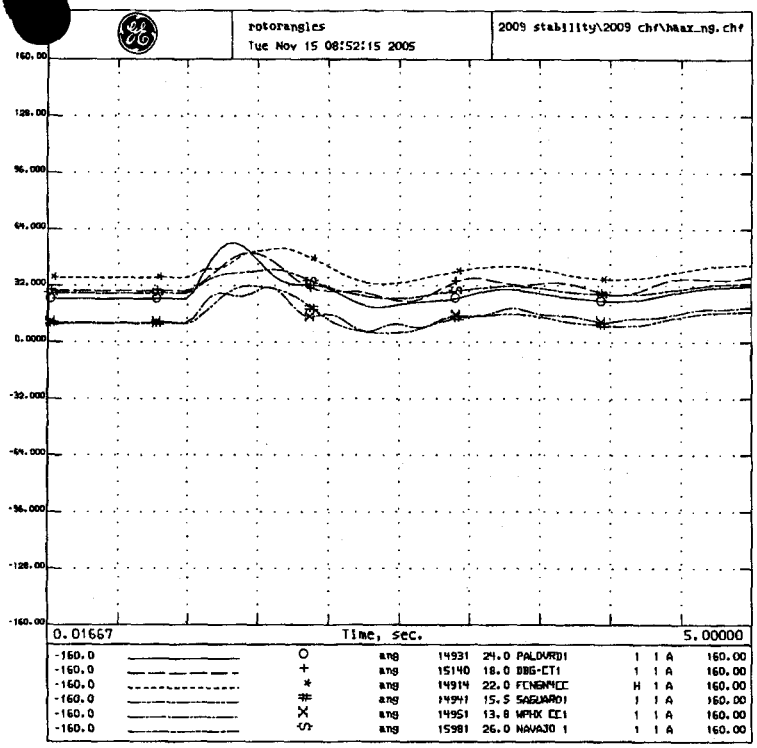
HASSAYAMPA FLT. w/HAAX-NG line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



HASSAYAMPA FLT. w/HAAX-NG line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



HASSAYAMPA FLT. w/HAAX-NG line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2009.dyd;HSCC.bat

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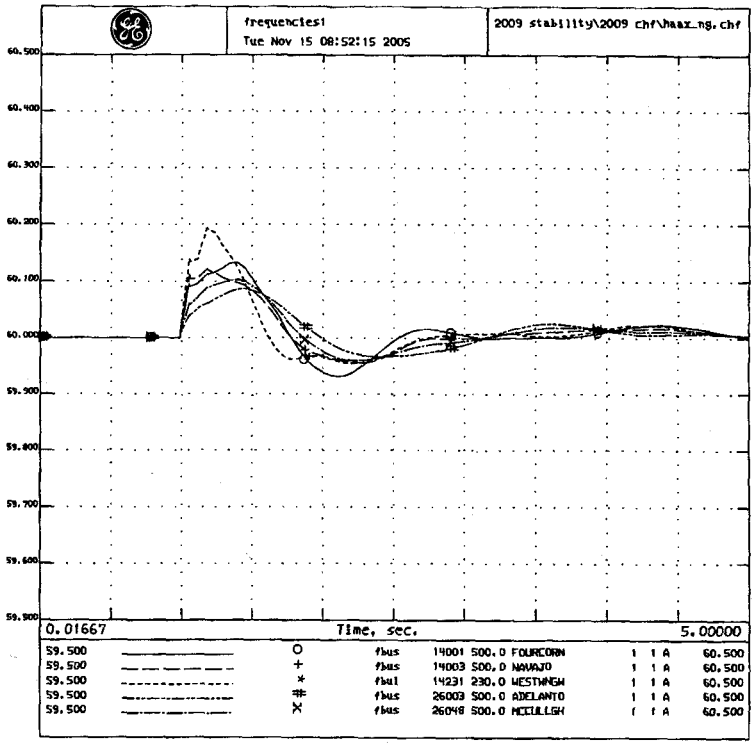

HASSAYAMPA FLT. w/HAAX-NG line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2009.dyd;HSCC.bat

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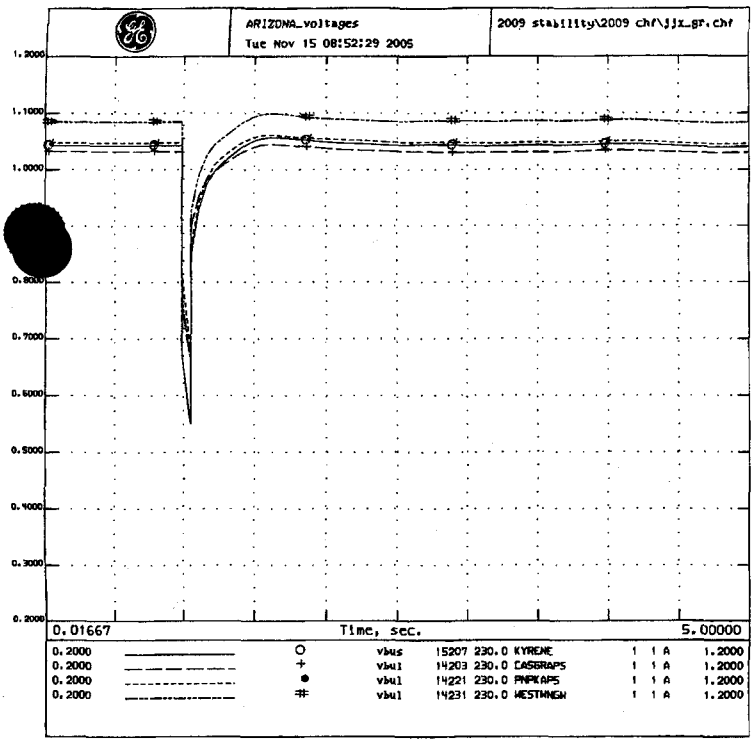

JOJOBA FLT JJX-GR LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-GR;8C REIN;2009.dyd;WSCC.bpt

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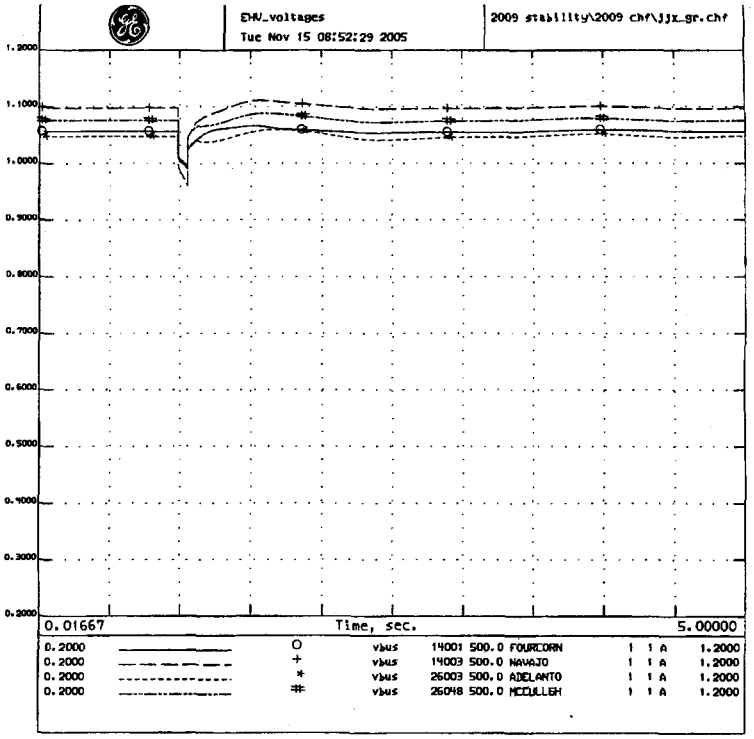

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2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
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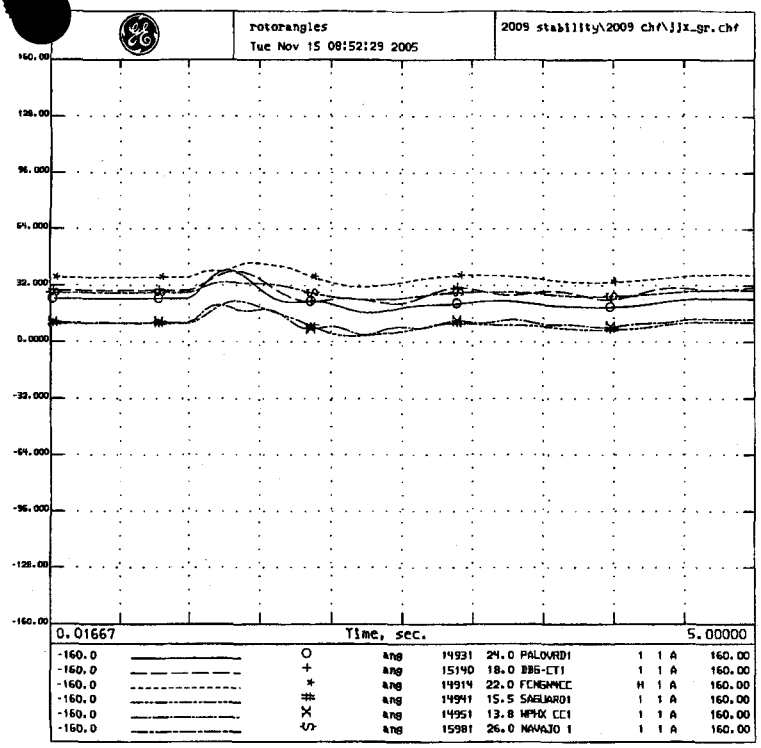

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APRIL 21, 2005
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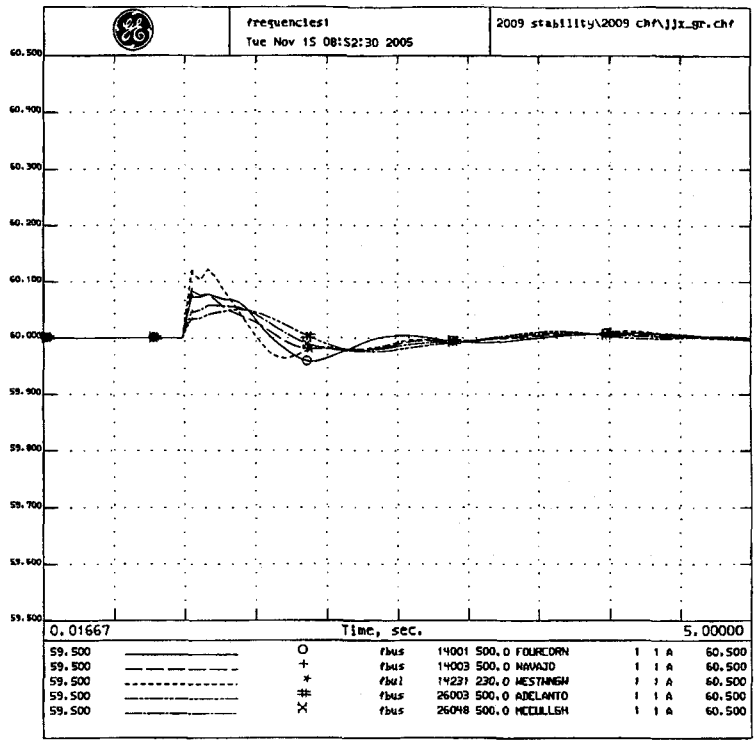

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2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
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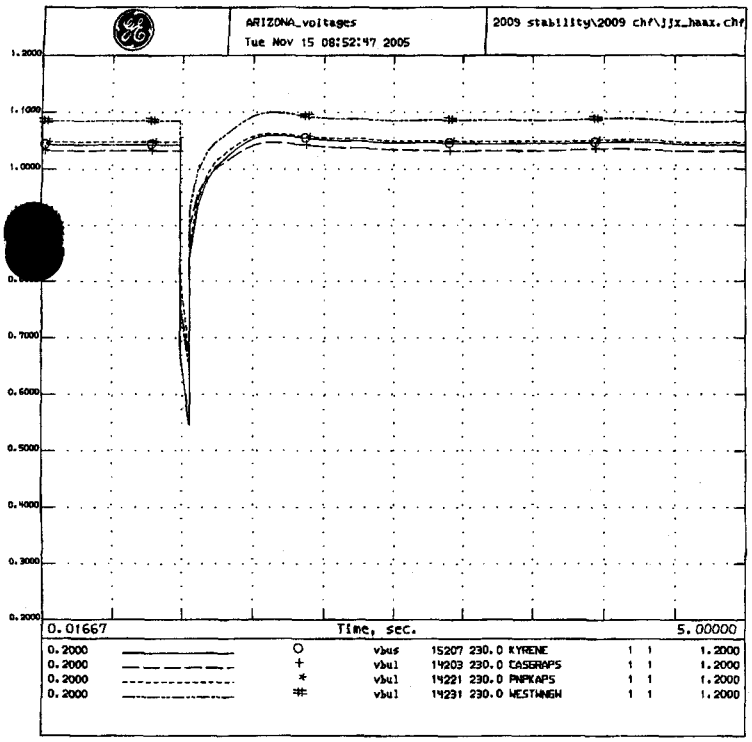

JOJOBA FLT JJX-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-HAAX STAB; 01/06; T=0 3P FLT JJXS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

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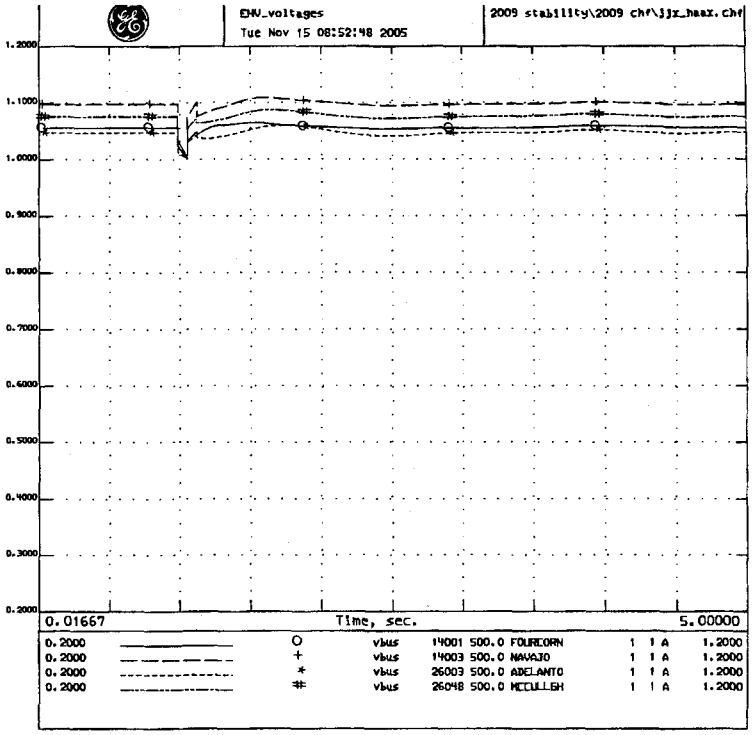

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2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-HAAX STAB; 01/06; T=0 3P FLT JJXS00;10% FLT DMPING;FLSH CAPS
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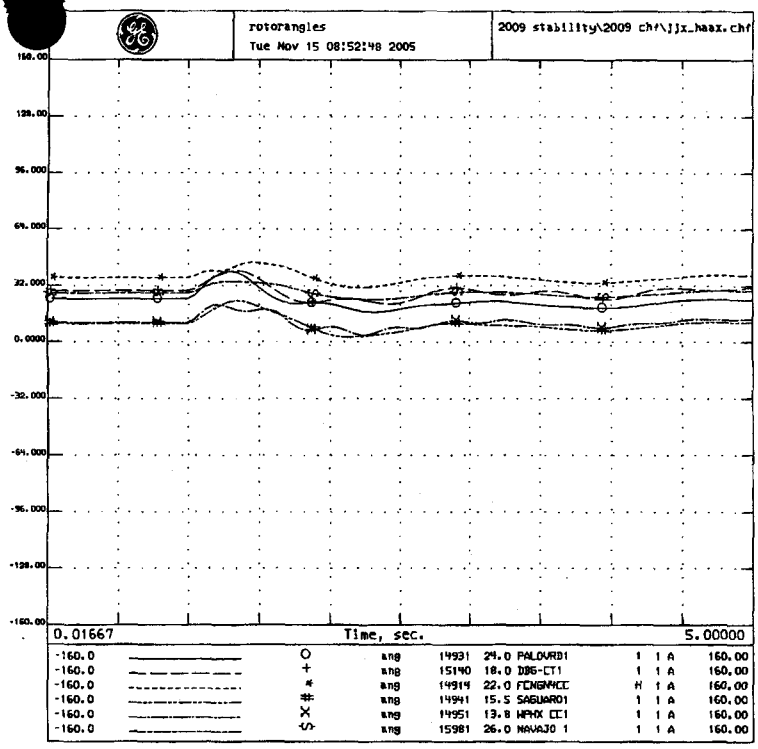

JOJOBA FLT JJX-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-HAAX STAB; 01/06; T=0 3P FLT JJXS00;10% FLT DMPING;FLSH CAPS
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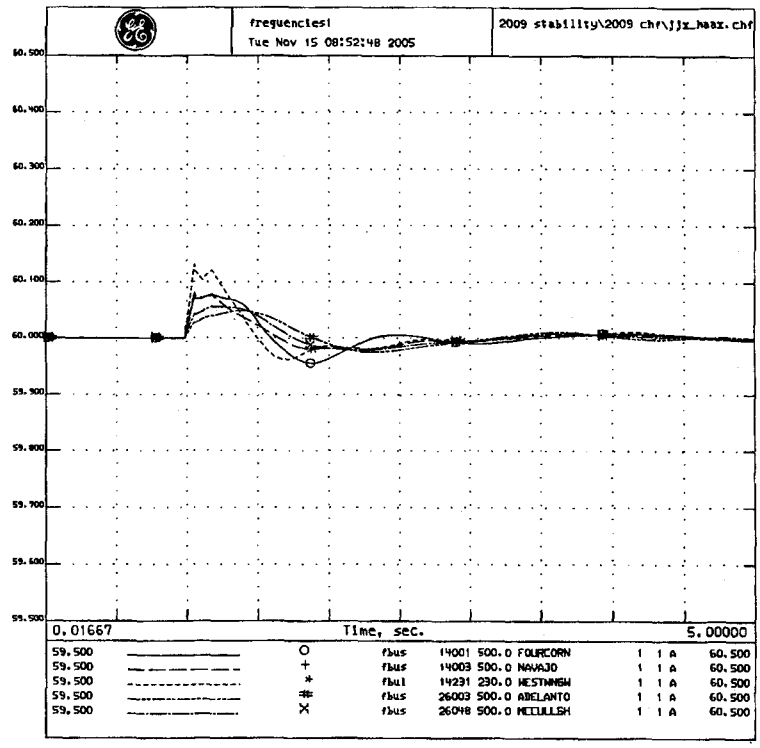

JOJOBA FLT JJX-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-HAAX STAB; 01/06; T=0 3P FLT JJXS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2009.dyd;WSCC.bpt

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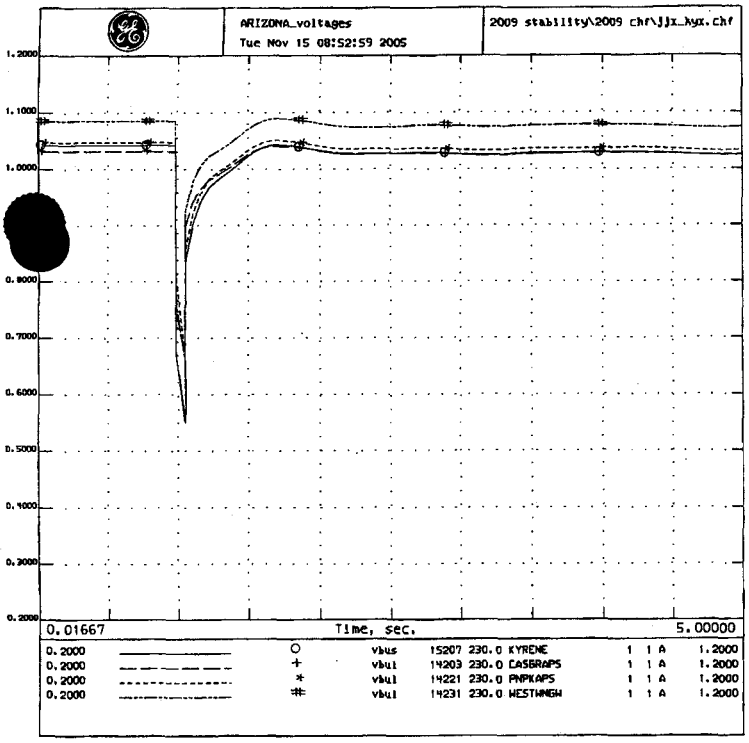
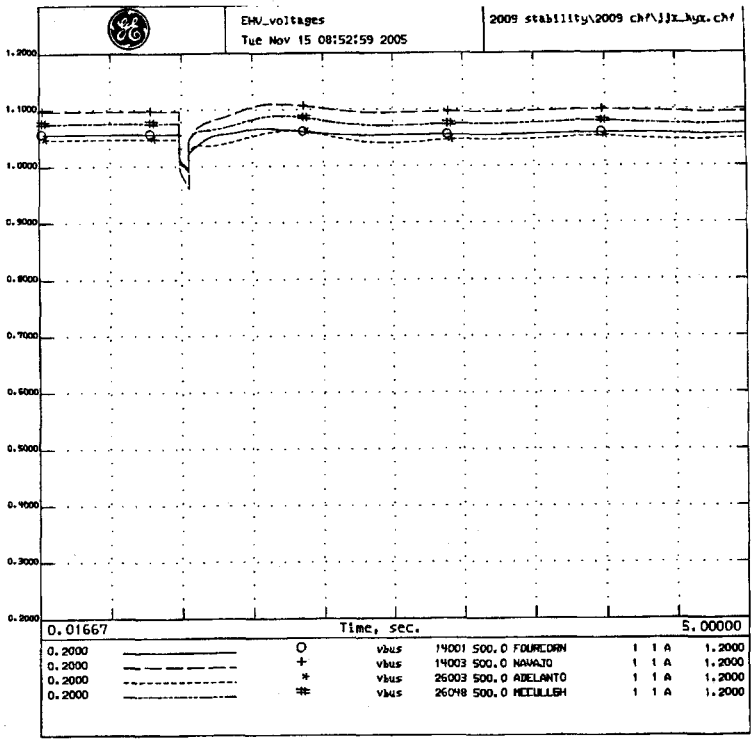


JOJOBA FLT JJX-KYX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



JOJOBA FLT JJX-KYX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2009.dyd;WSCC.bpt

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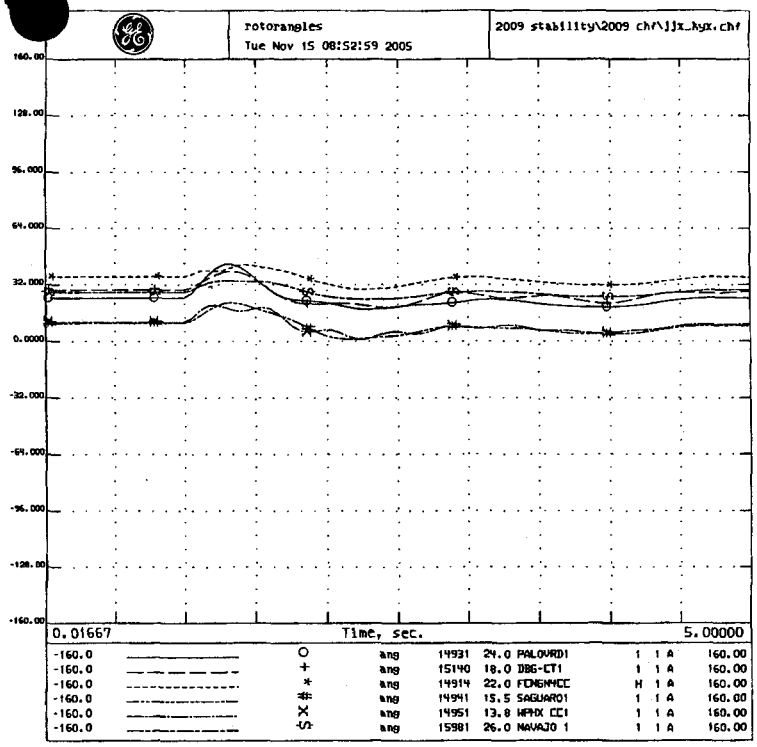

JOJOBA FLT JJX-KYX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2009.dyd;WSCC.bpt

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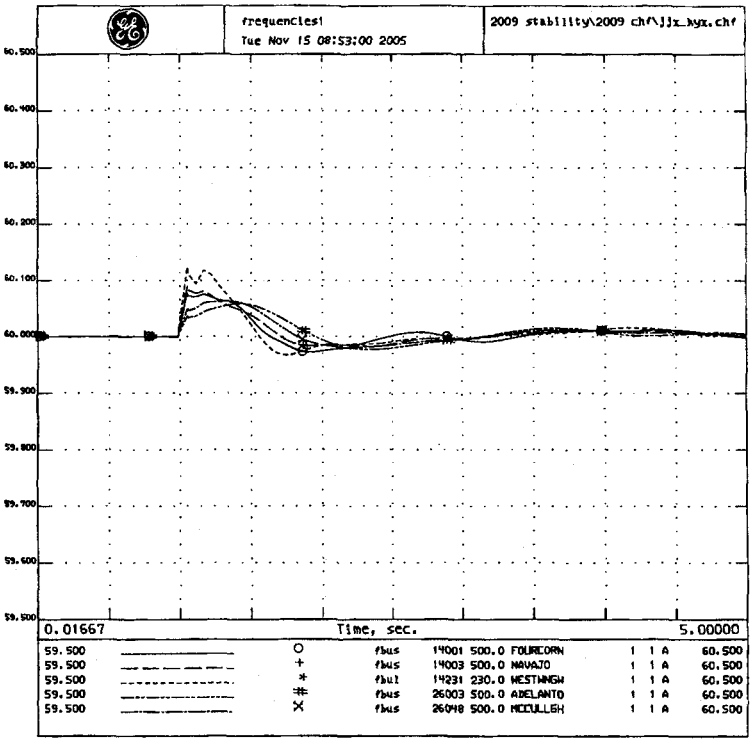

JOJOBA FLT JJX-KYX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2009.dyd;WSCC.bpt

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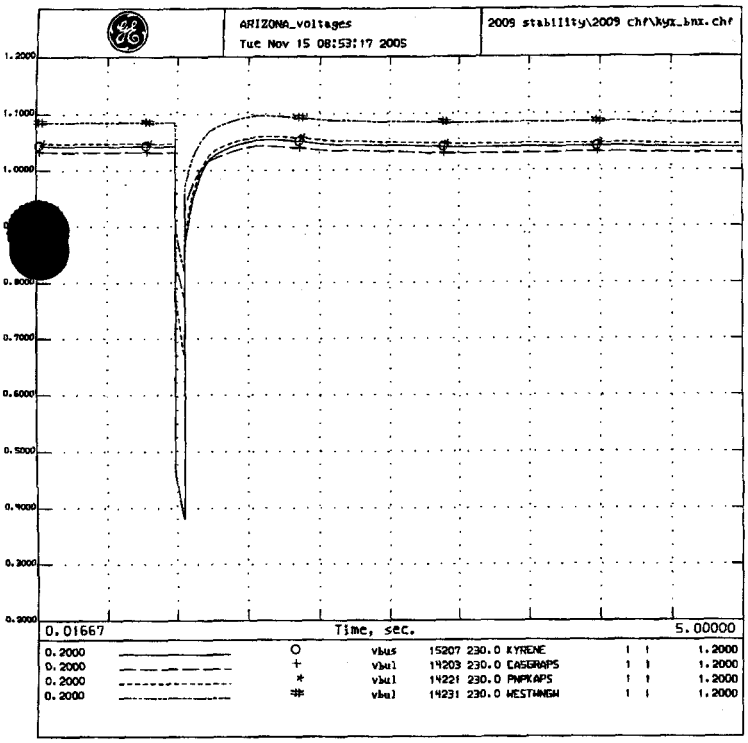

KYRENE FLT KYX-BNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
KYX-BNX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2009.dyd;HSCC.bpt

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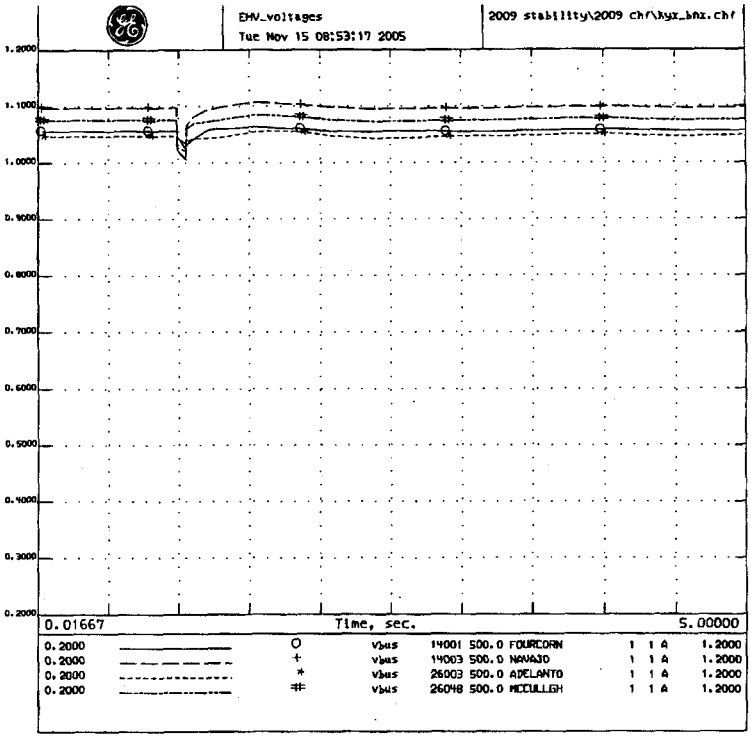

KYRENE FLT KYX-BNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
KYX-BNX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2009.dyd;HSCC.bpt

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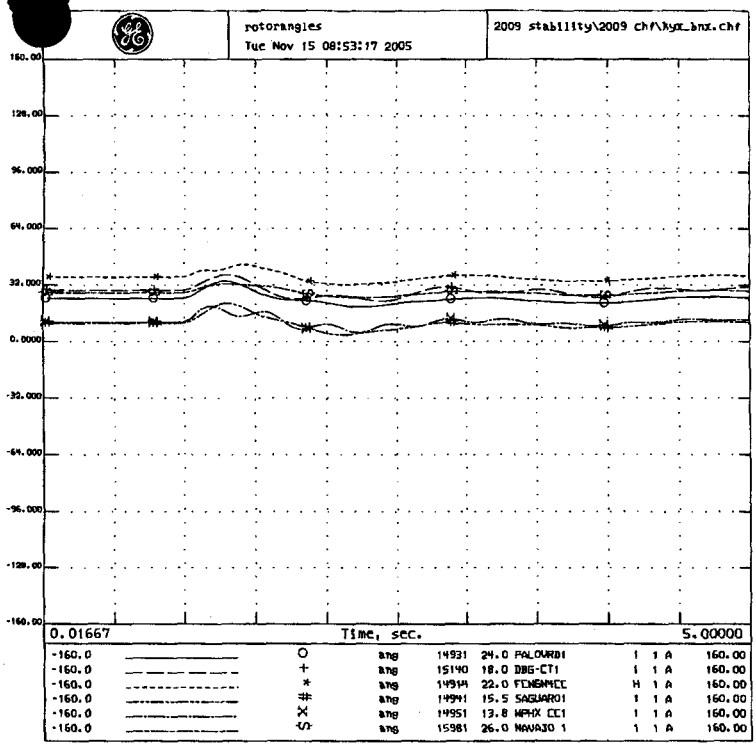

KYRENE FLT KYX-BNX LINE OUT
2009 HS1A APPROVED BASE CASE
PRIL 21, 2005
X-BNX STAB #1; 01/06; T=0 3P FLT KYX500;
CLR FLT W/KYX-BNX;2009.dyd;HSCC.bpt

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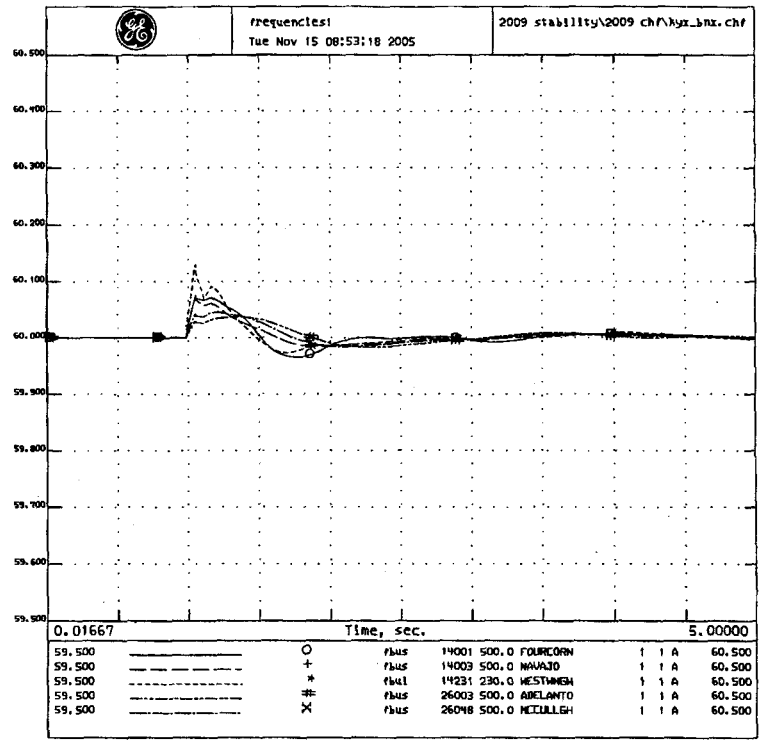

KYRENE FLT KYX-BNX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
KYX-BNX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2009.dyd;HSCC.bpt

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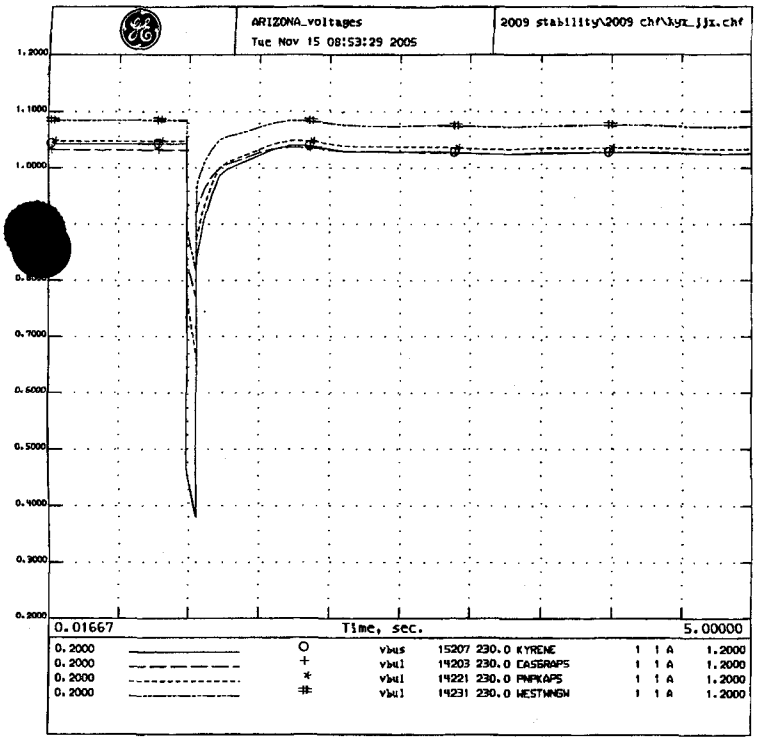

KYRENE FLT KYX-JJX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
KYX-JJX STAB ;1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2009.dyd;WSCC.bpt

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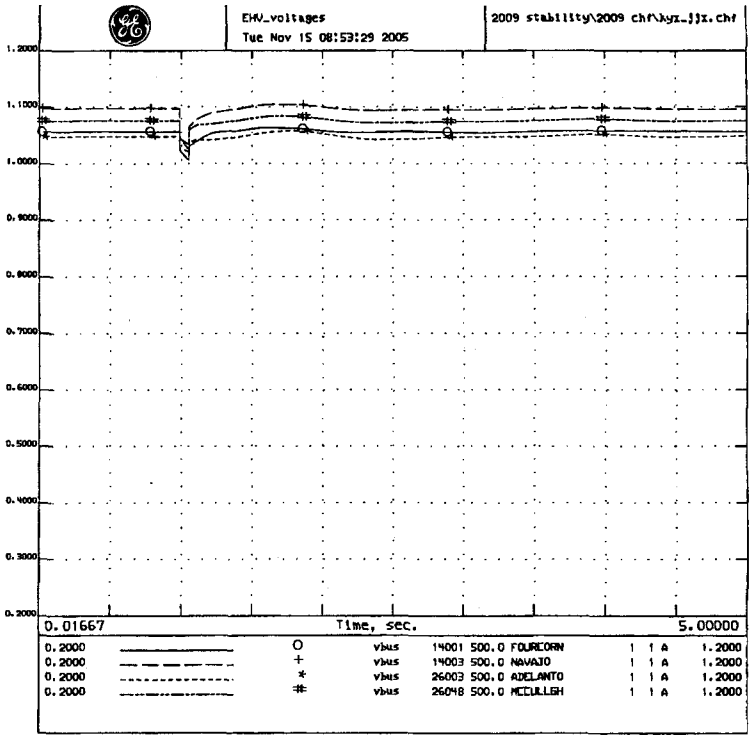

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2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
KYX-JJX STAB ;1; 01/06; T=0 3P FLT KYX500;
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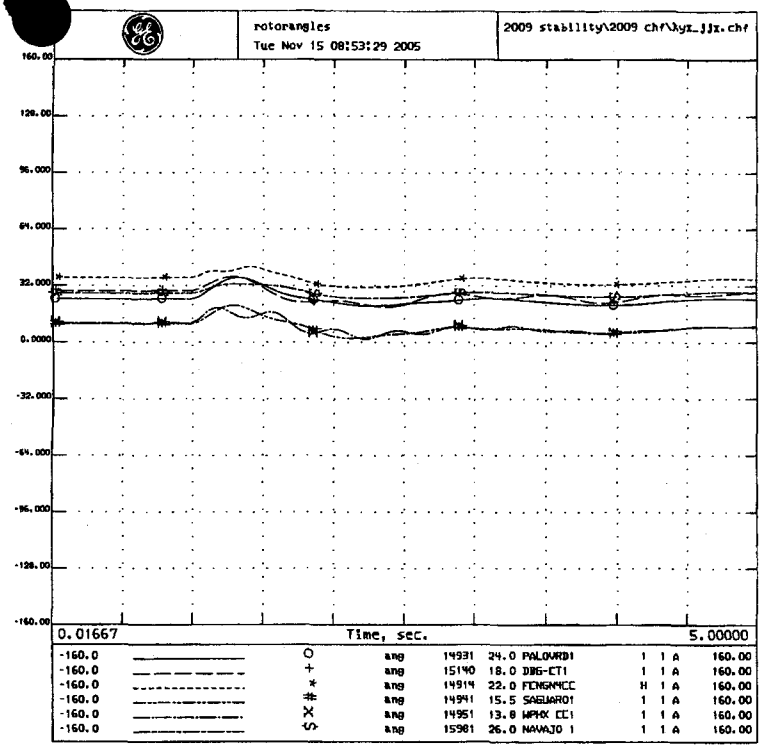

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APRIL 21, 2005
KYX-JJX STAB ;1; 01/06; T=0 3P FLT KYX500;
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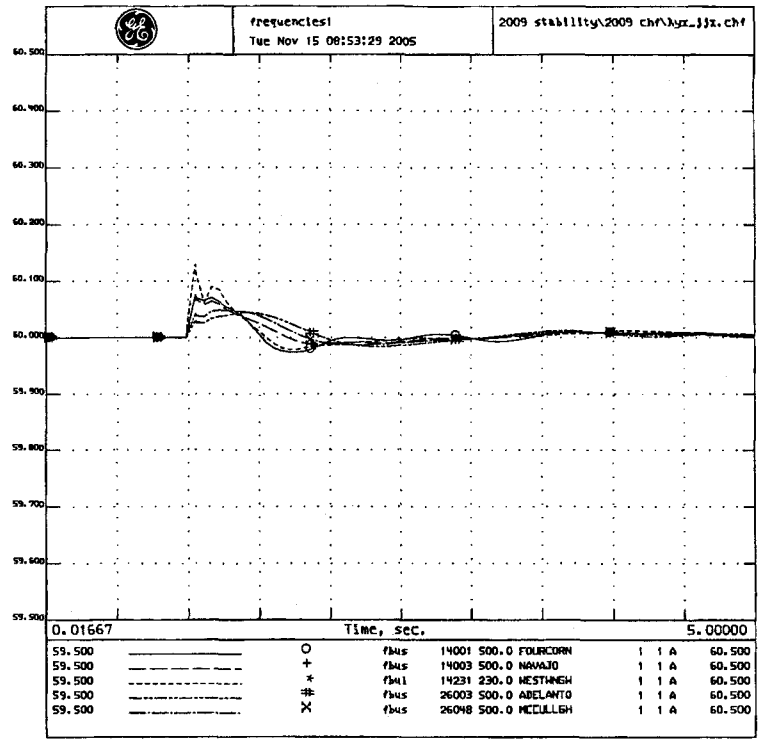

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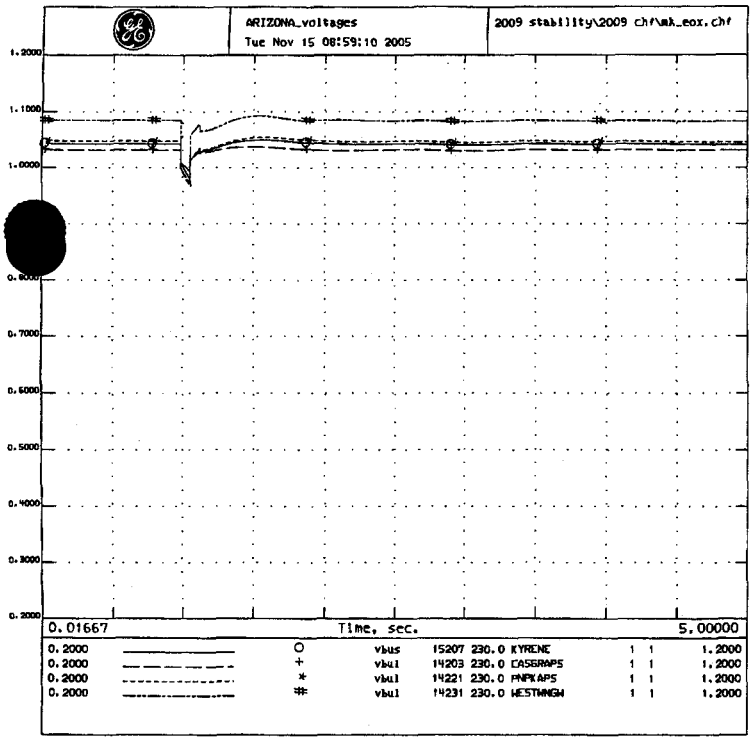
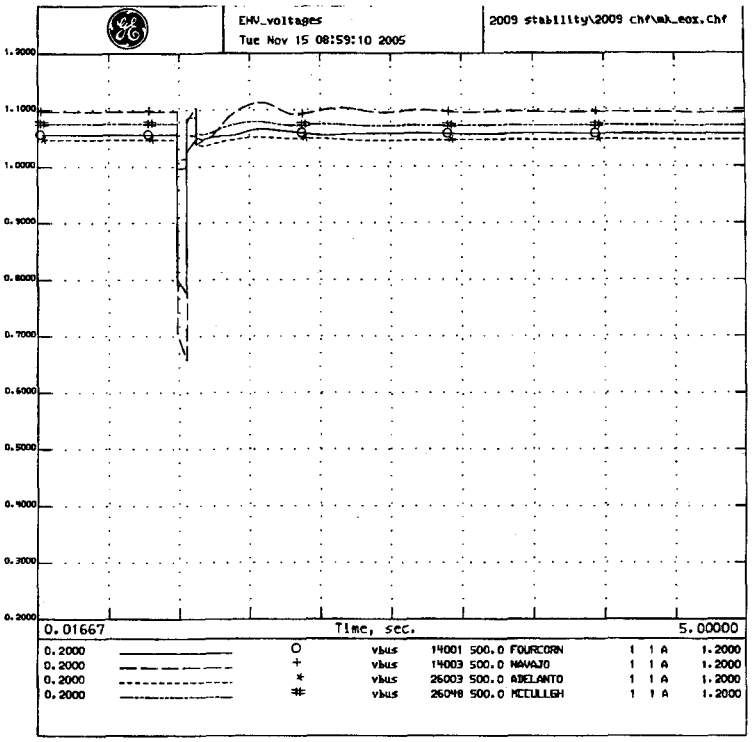
APRIL 21, 2005
KYX-JJX STAB ;1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



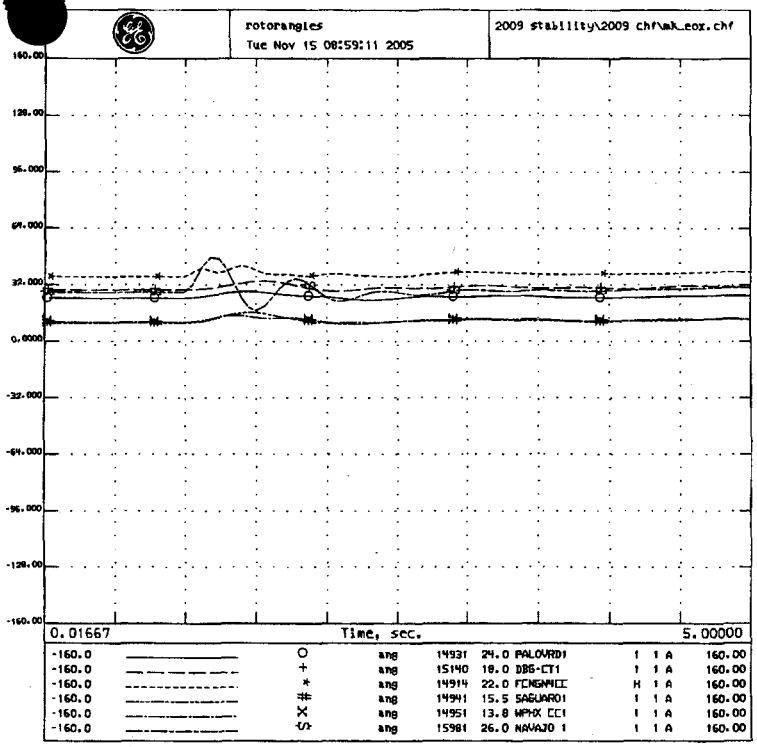
MOENKOPI FLT. MK-EOX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YU/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



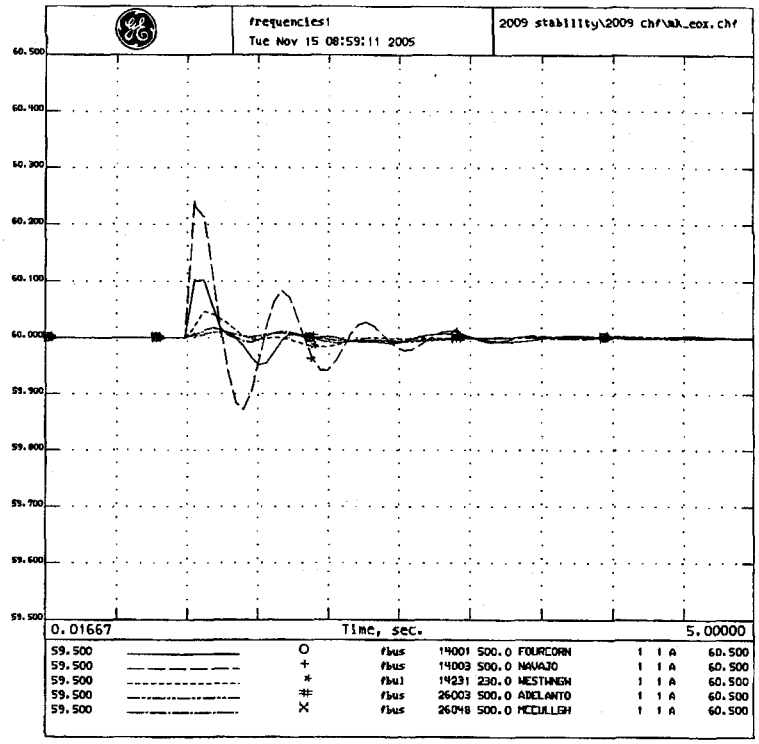
MOENKOPI FLT. MK-EOX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YU/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



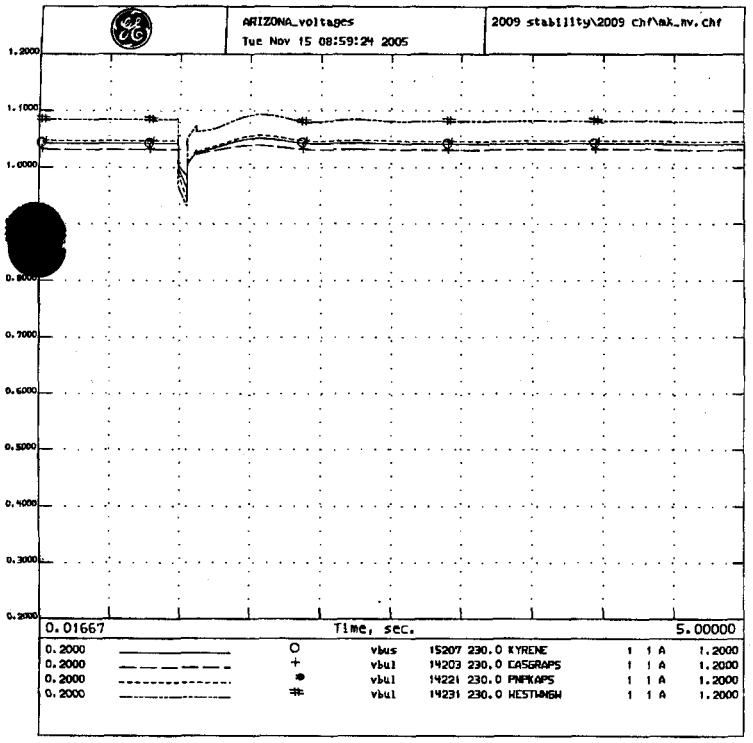
MOENKOPI FLT. MK-EOX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
K-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YU/YV-WW,
-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2009.dyd;WSCC.bat

LL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



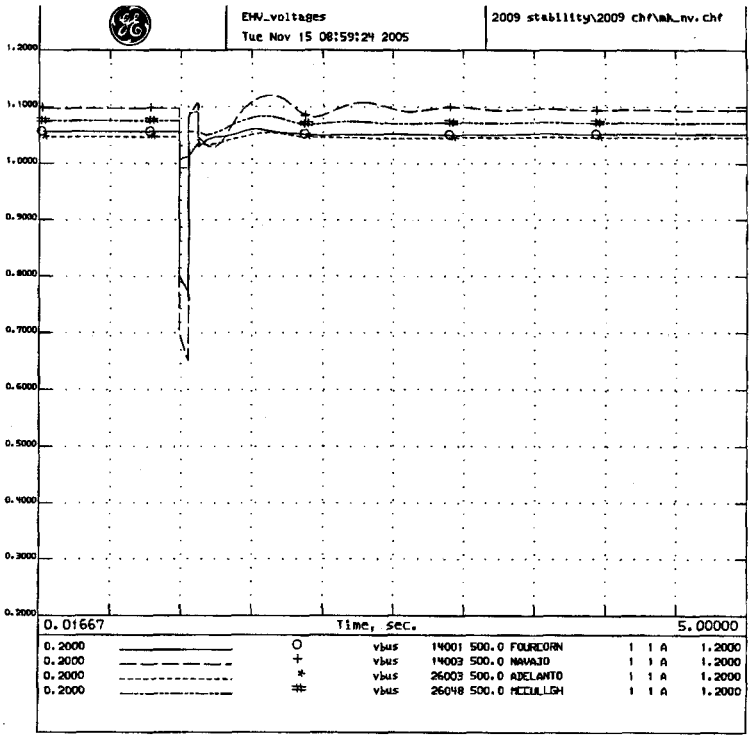
MOENKOPI FLT. MK-EOX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YU/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



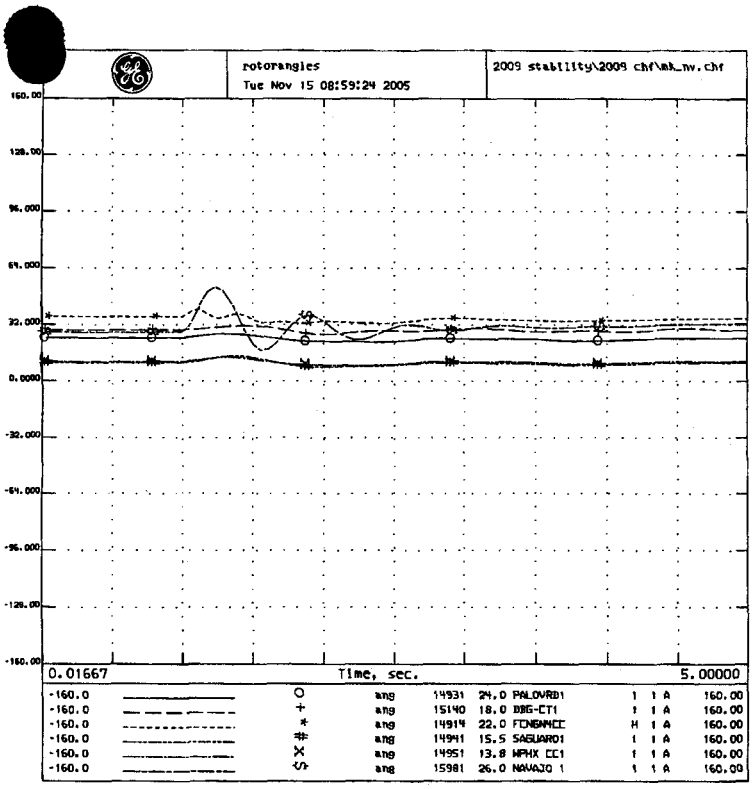
MOENKOPI FLT. MK-NV. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-NV STAB; 1/06; T=0 3P FLT MKS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



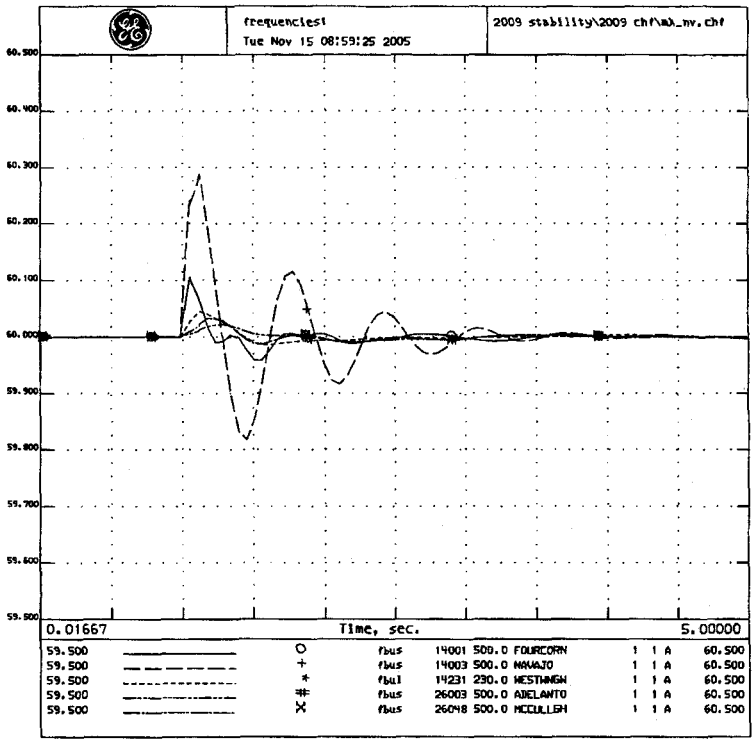
MOENKOPI FLT. MK-NV. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-NV STAB; 1/06; T=0 3P FLT MKS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



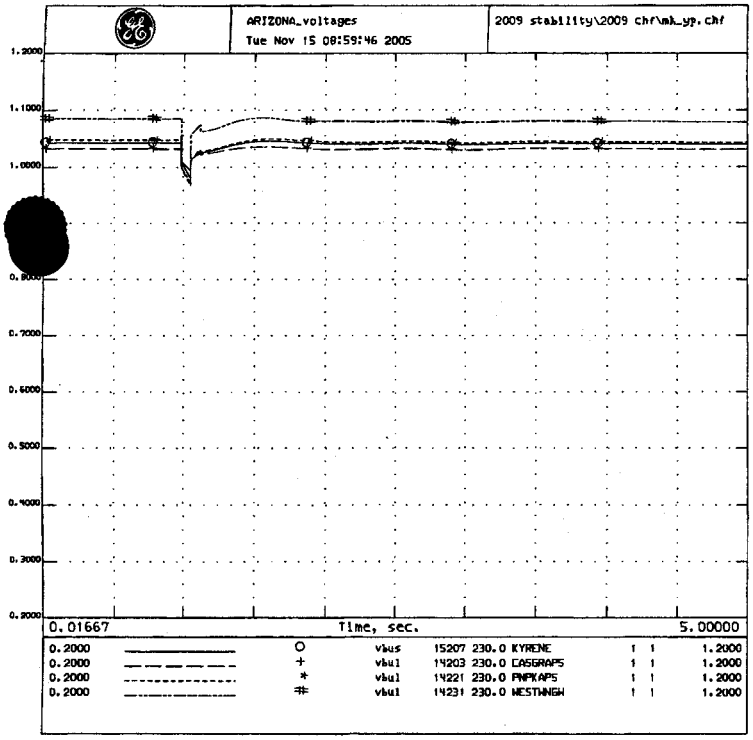
MOENKOPI FLT. MK-NV. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-NV STAB; 1/06; T=0 3P FLT MKS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



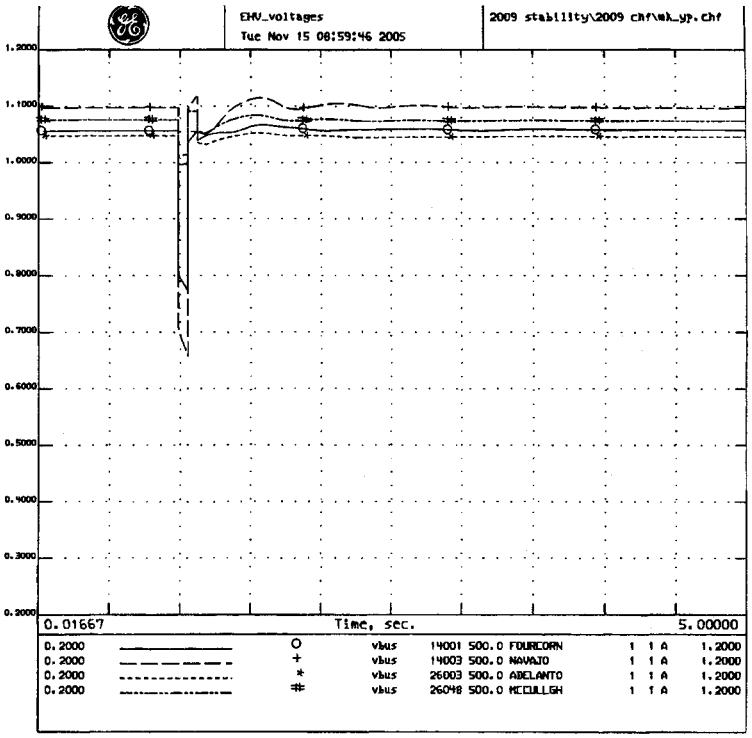
MOENKOPI FLT. MK-NV. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-NV STAB; 1/06; T=0 3P FLT MKS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2009.dyd;HSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



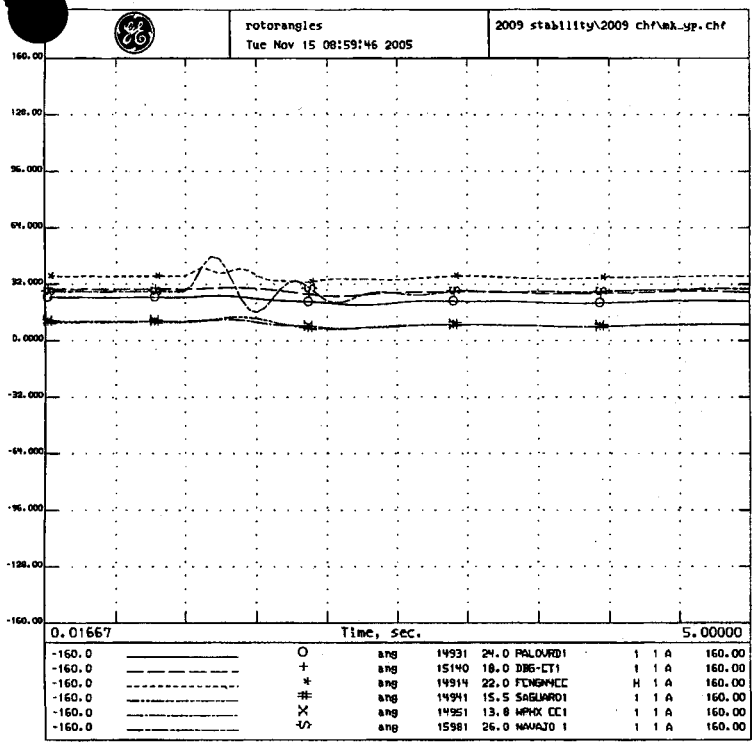
MOENKOPI FLT MK-YV line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



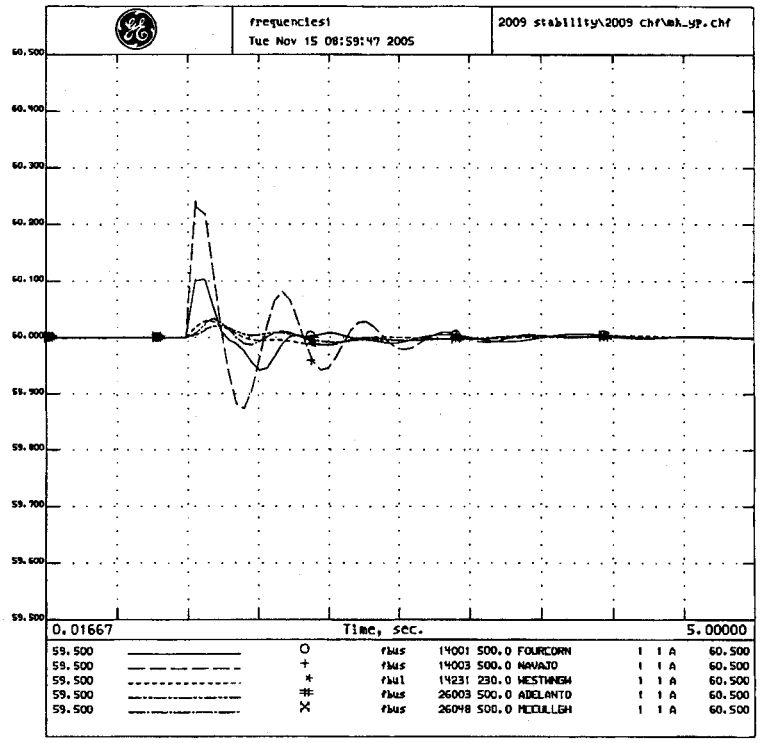
MOENKOPI FLT MK-YV line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



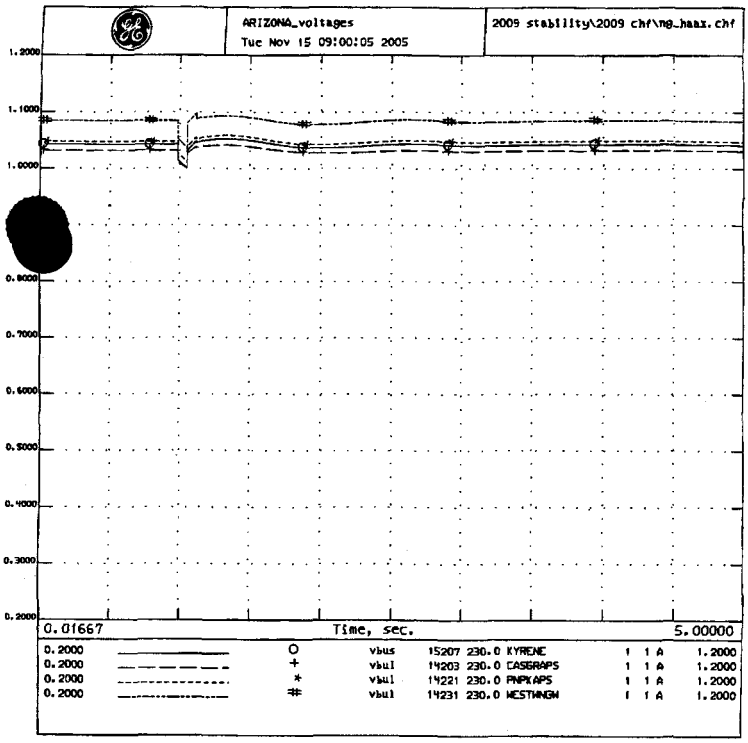
MOENKOPI FLT MK-YV line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



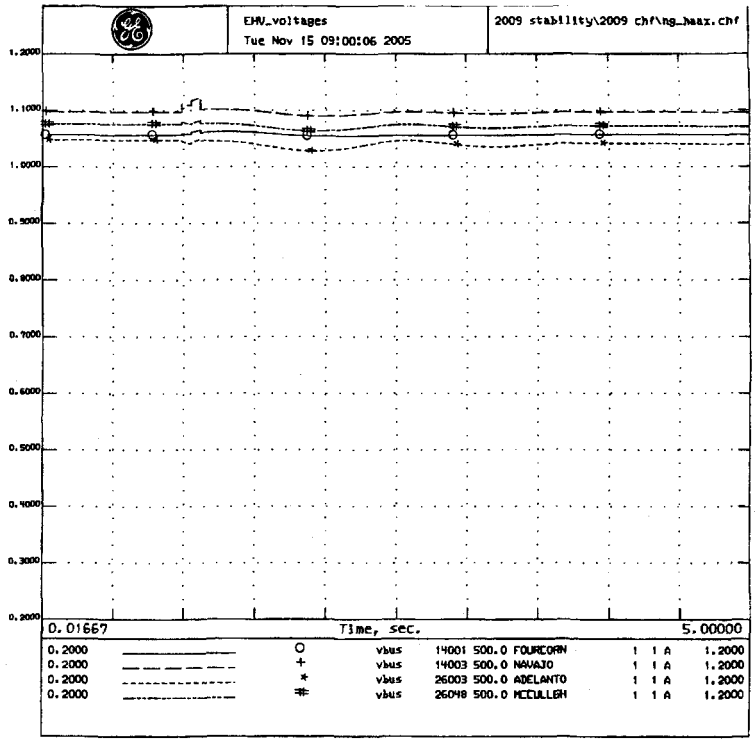
MOENKOPI FLT MK-YV line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-WW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



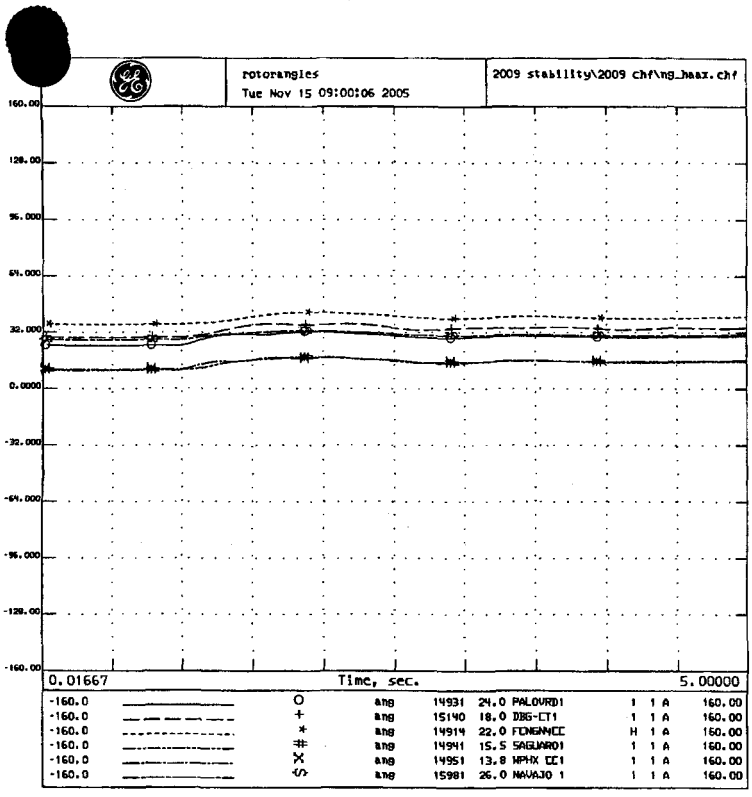
N.GILA FLT NG-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



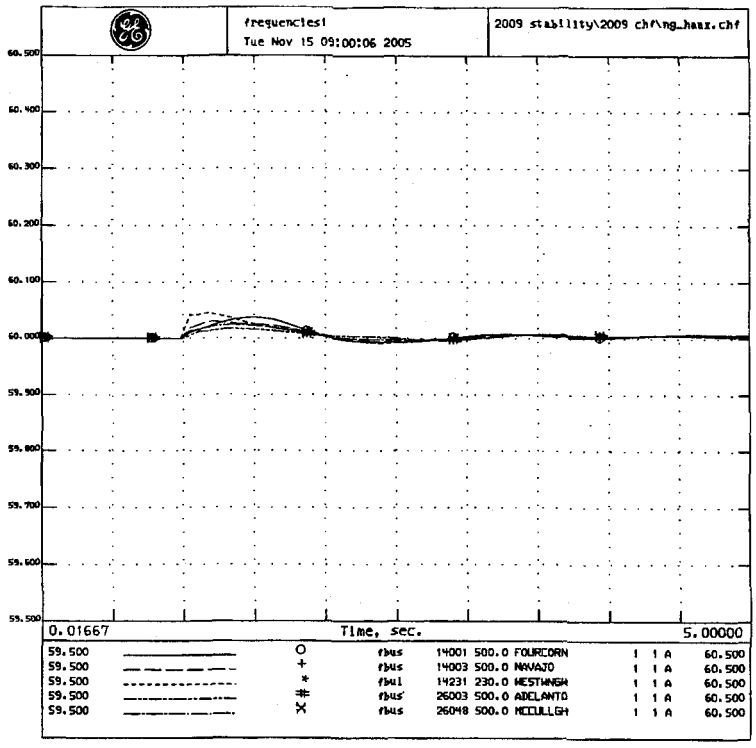
N.GILA FLT NG-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



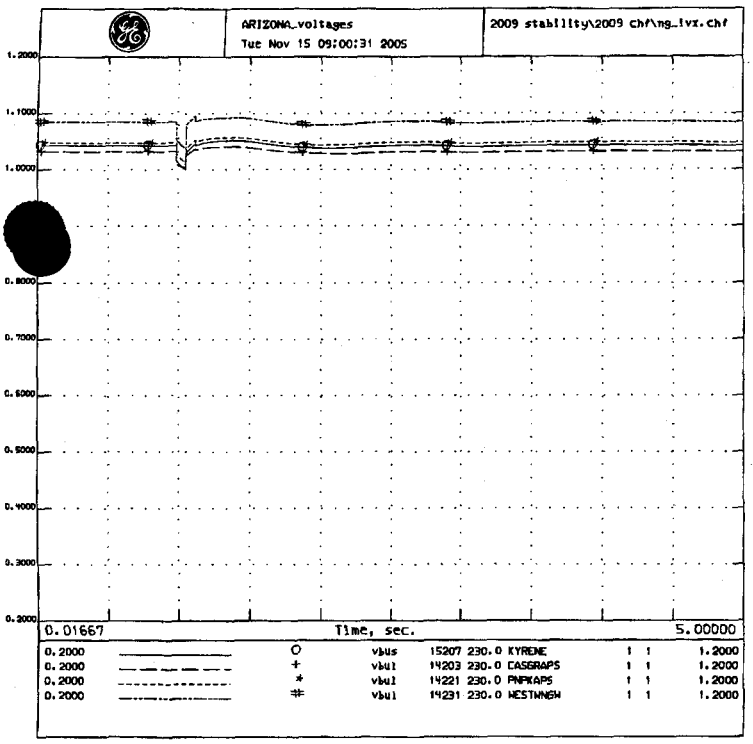
N.GILA FLT NG-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



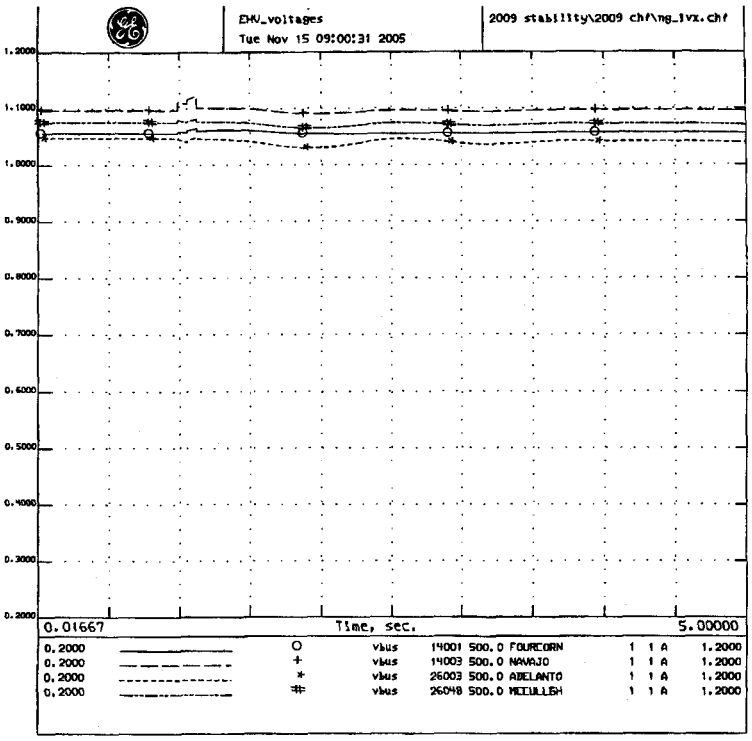
N.GILA FLT NG-HAAX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



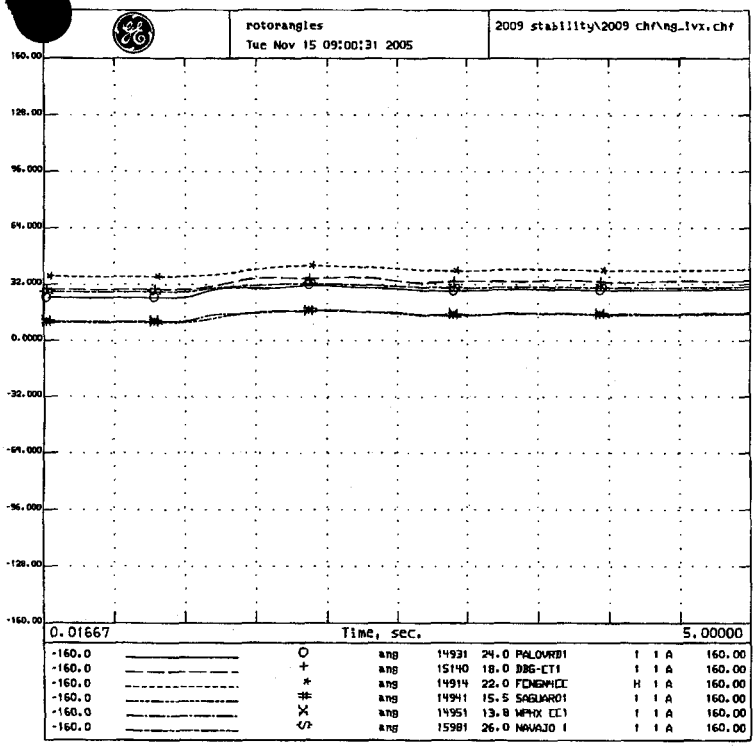
N.GILA FLT NG-IVX. V LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



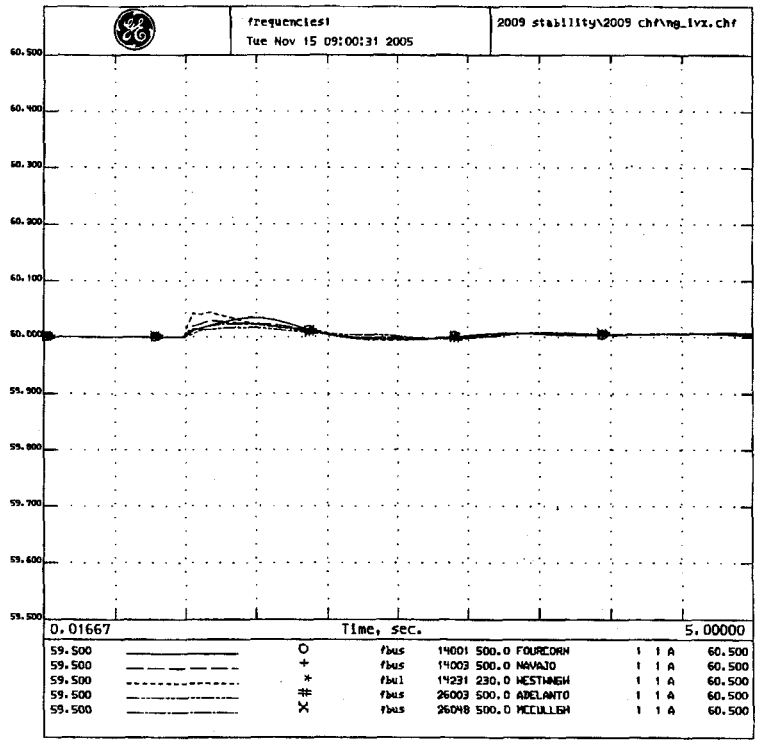
N.GILA FLT NG-IVX. V LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



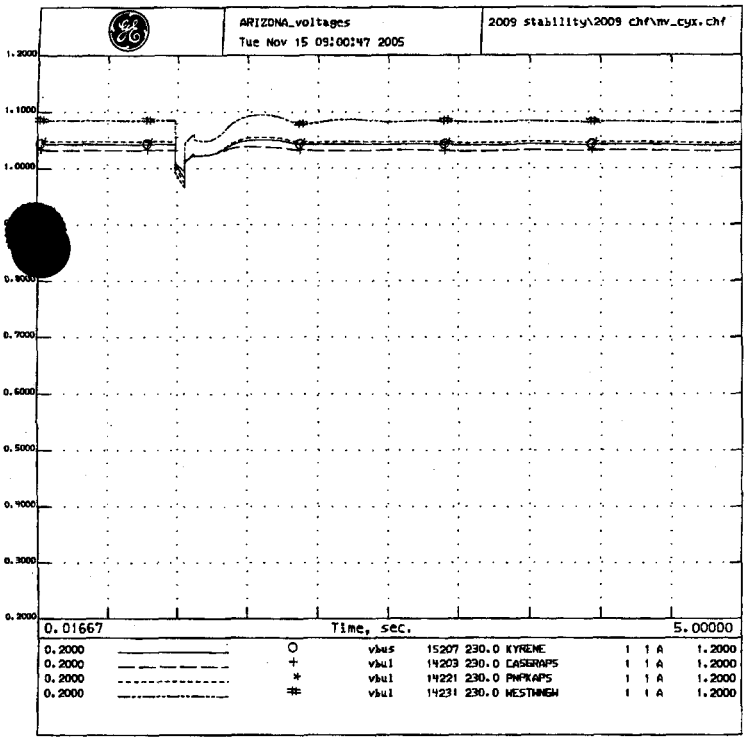
N.GILA FLT NG-IVX. V LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



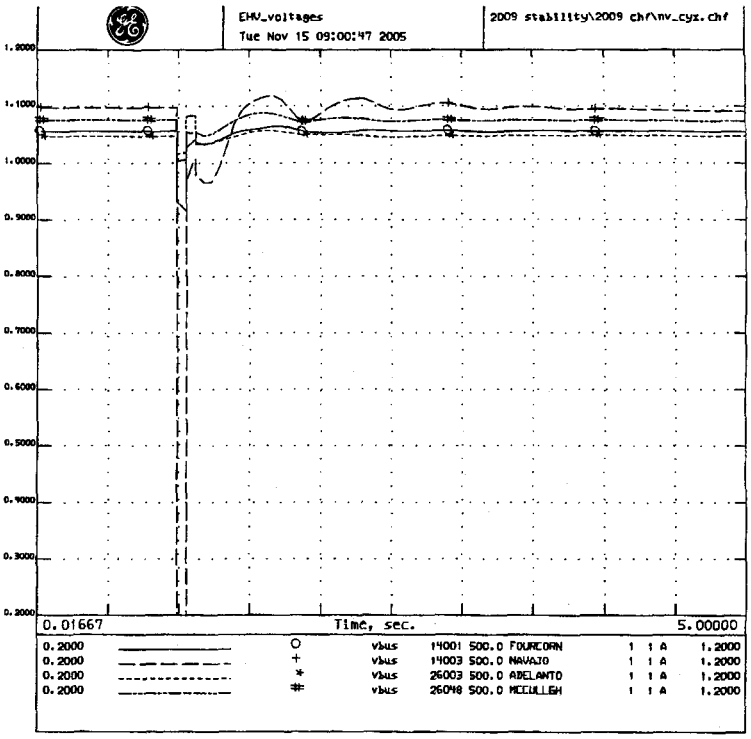
N.GILA FLT NG-IVX. V LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



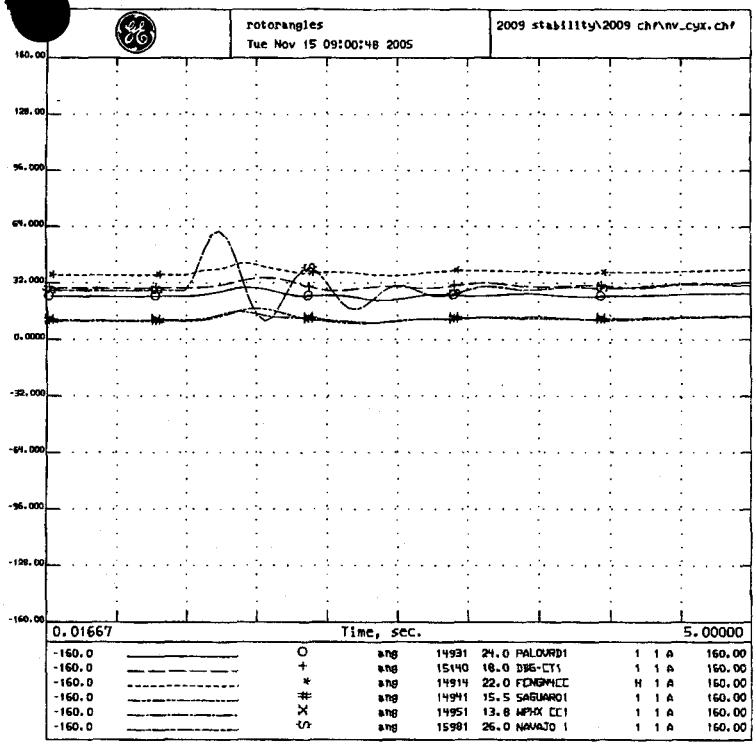
NAVAJO FLT. NV-CYX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



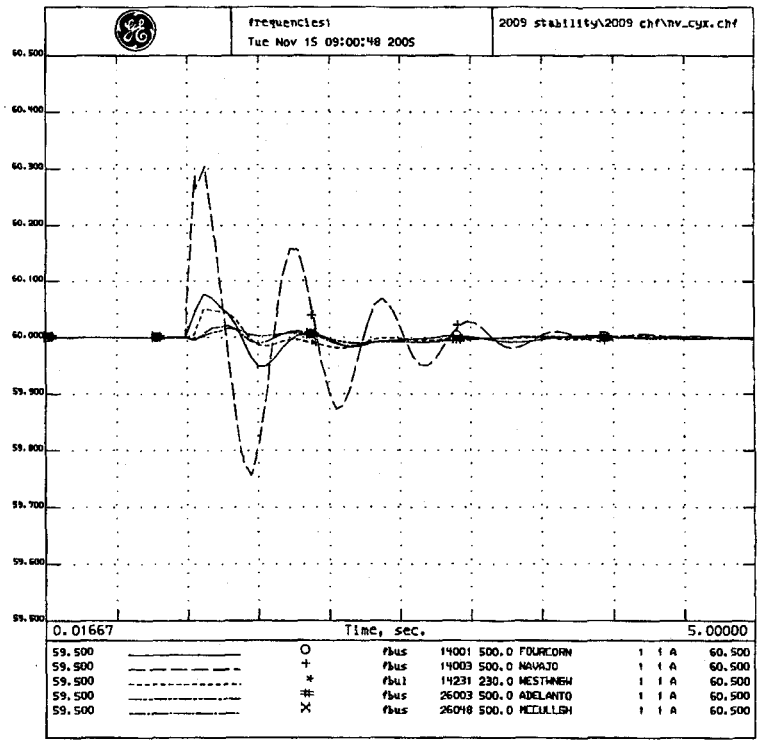
NAVAJO FLT. NV-CYX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



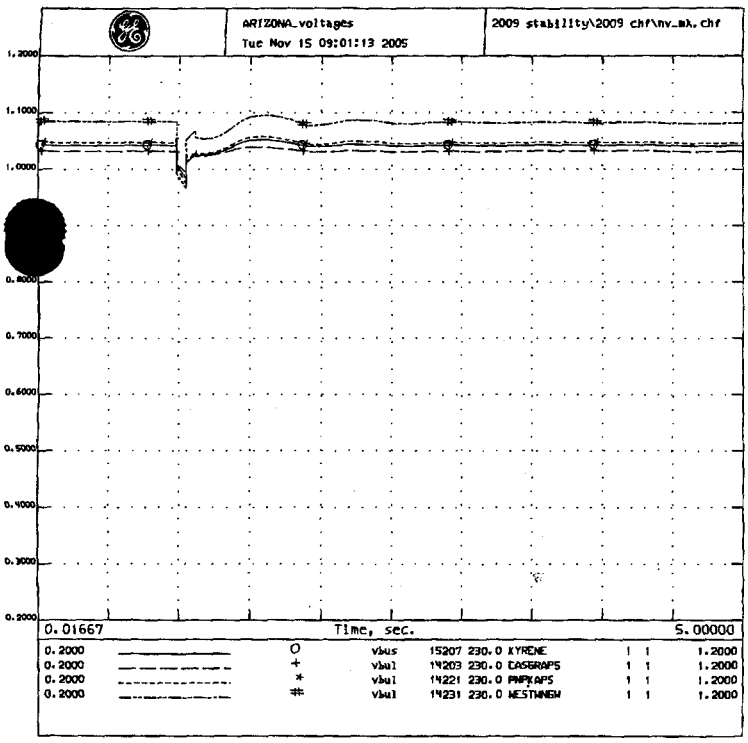
NAVAJO FLT. NV-CYX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



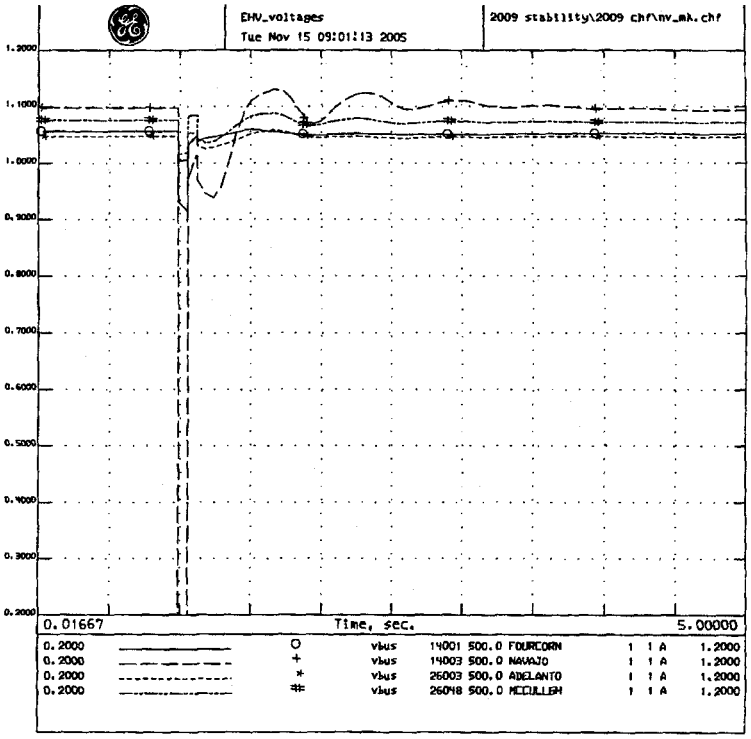
NAVAJO FLT. NV-CYX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



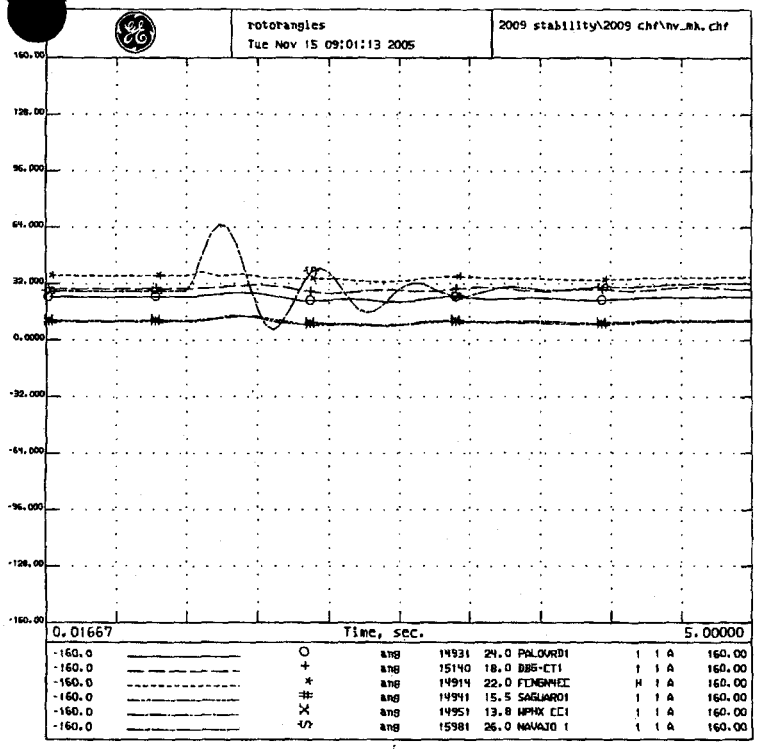
NAVAJO FLT. NV-MK. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-MK STAB; 1/06; T=0 3P FLT NVS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



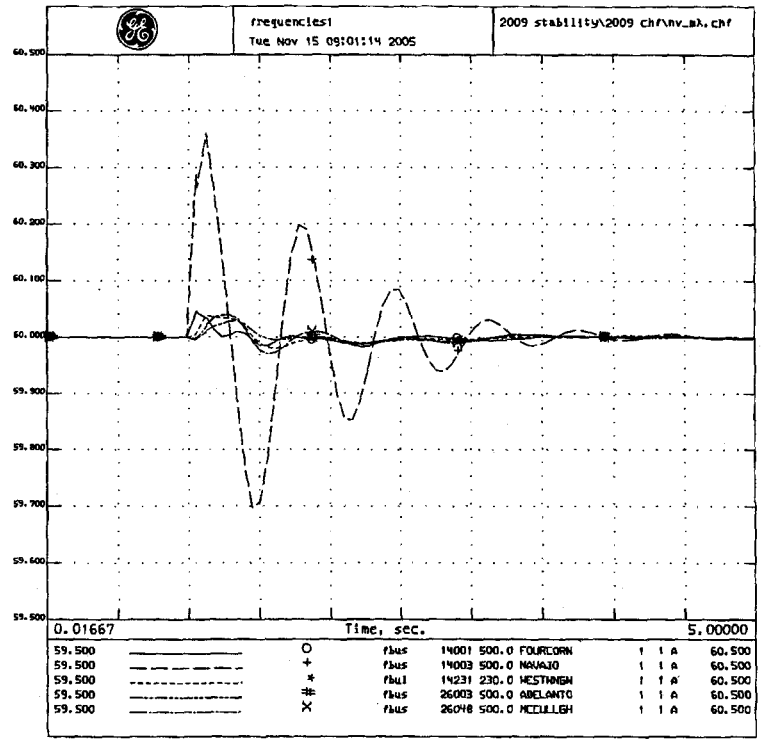
NAVAJO FLT. NV-MK. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-MK STAB; 1/06; T=0 3P FLT NVS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



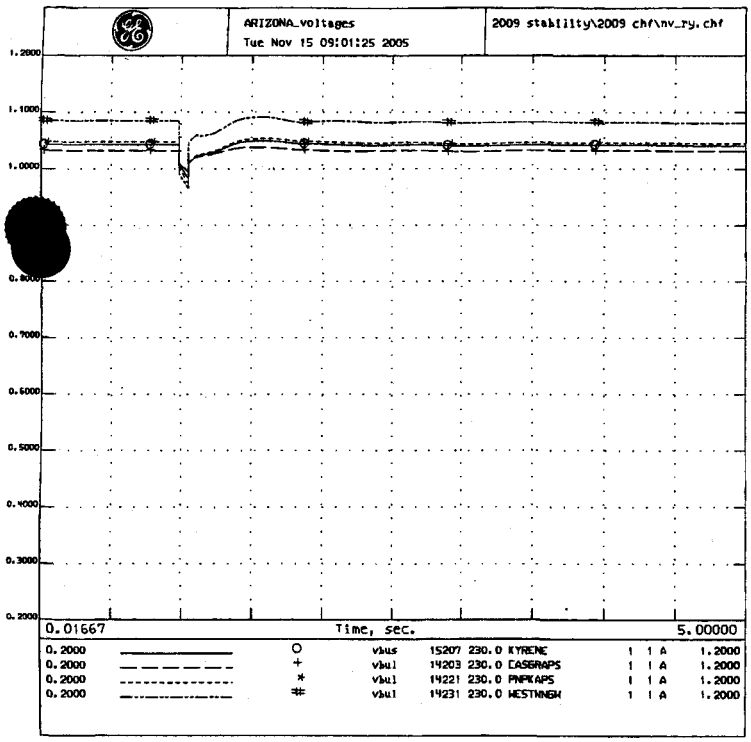
NAVAJO FLT. NV-MK. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-MK STAB; 1/06; T=0 3P FLT NVS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



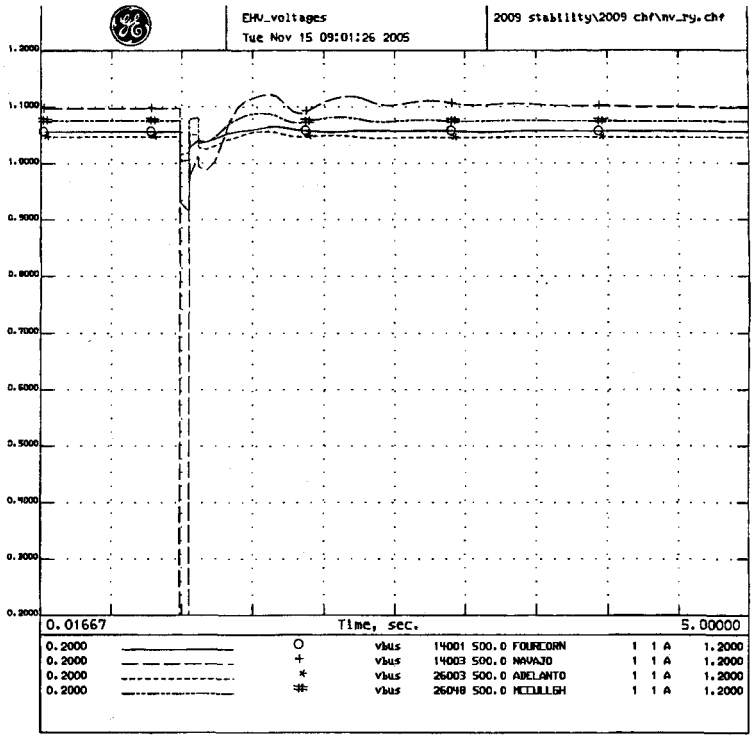
NAVAJO FLT. NV-MK. line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-MK STAB; 1/06; T=0 3P FLT NVS00; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



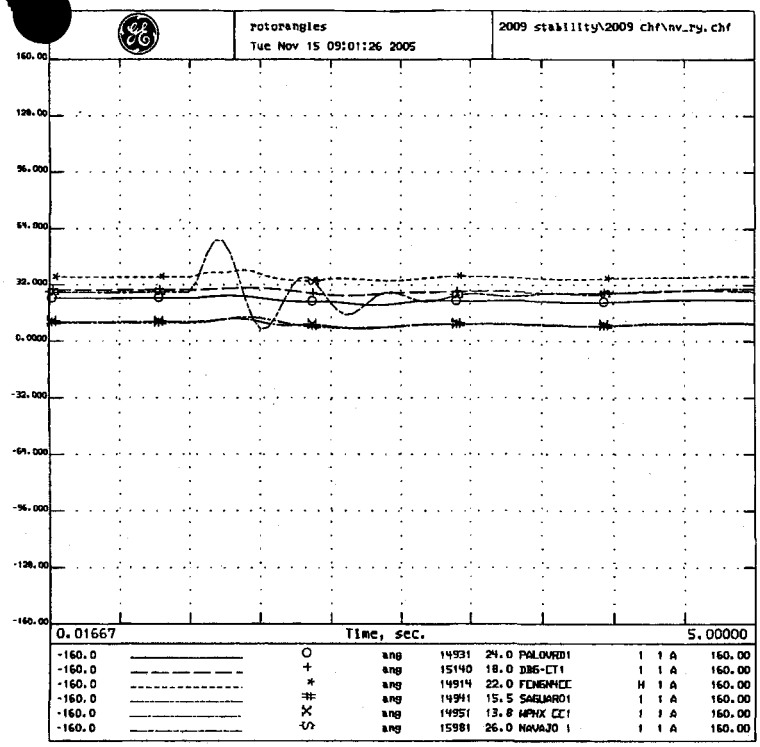
NAVAJO FLT NV-RY LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-RY STAB; 1/06; T=0 3P FLT NV500; 6% FLT IMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-RY;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



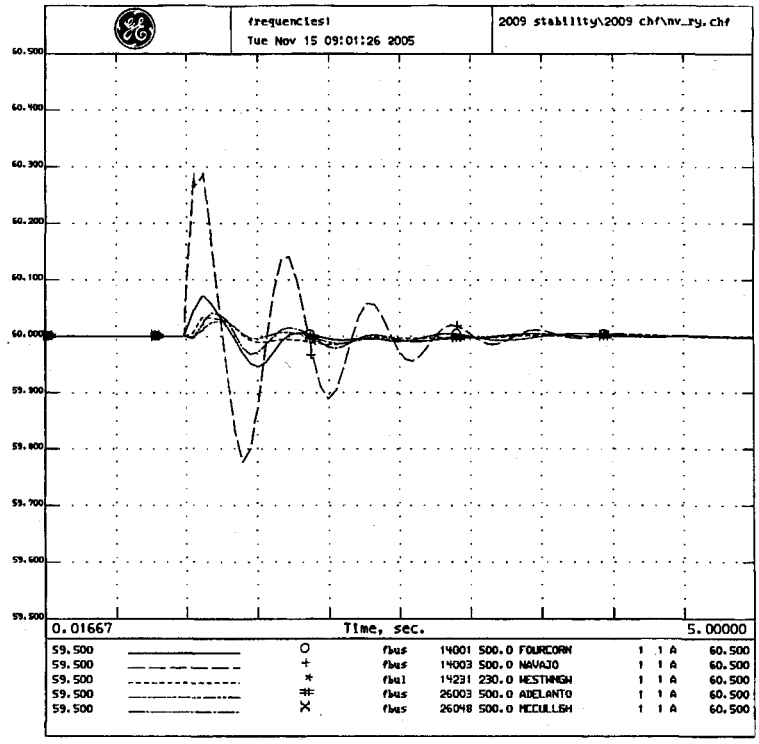
NAVAJO FLT NV-RY LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-RY STAB; 1/06; T=0 3P FLT NV500; 6% FLT IMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-RY;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



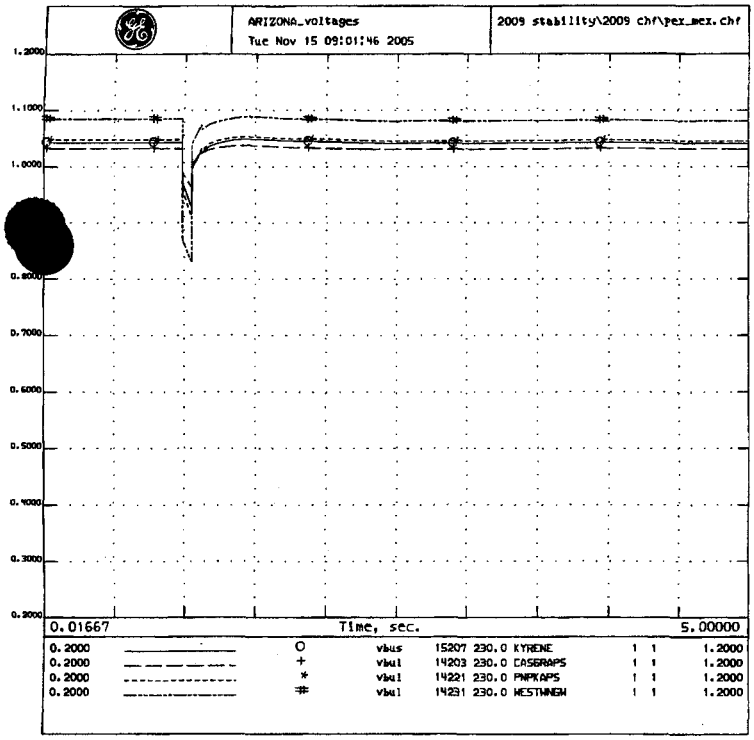
NAVAJO FLT NV-RY LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-RY STAB; 1/06; T=0 3P FLT NV500; 6% FLT IMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-RY;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



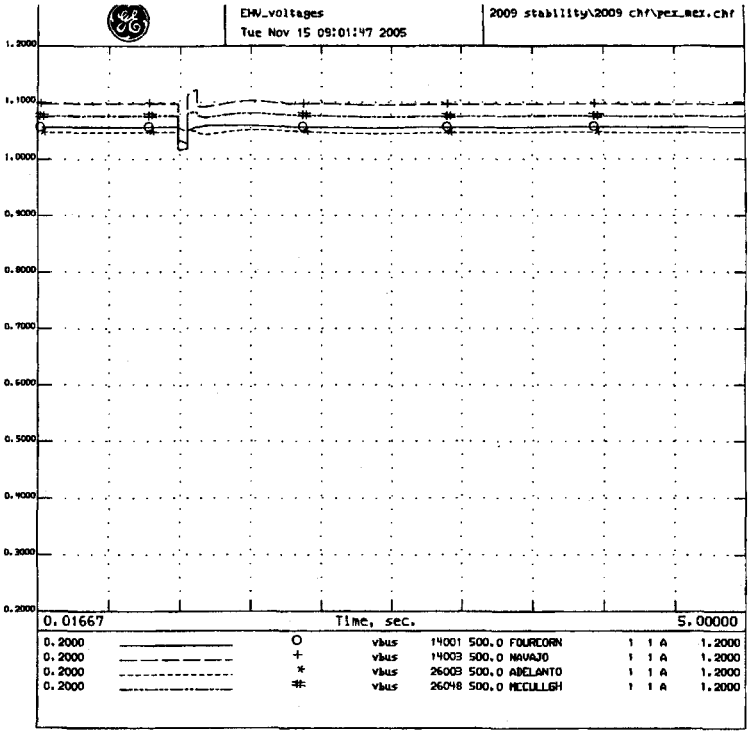
NAVAJO FLT NV-RY LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
NV-RY STAB; 1/06; T=0 3P FLT NV500; 6% FLT IMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-RY;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



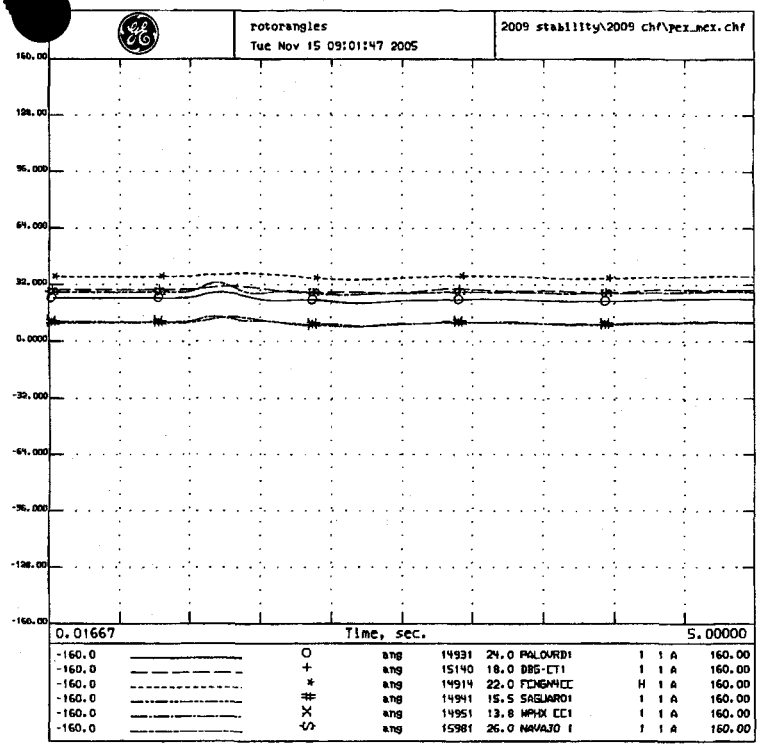
PERKINS FLT PEX-MEX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YV/YV-WW,
NV-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



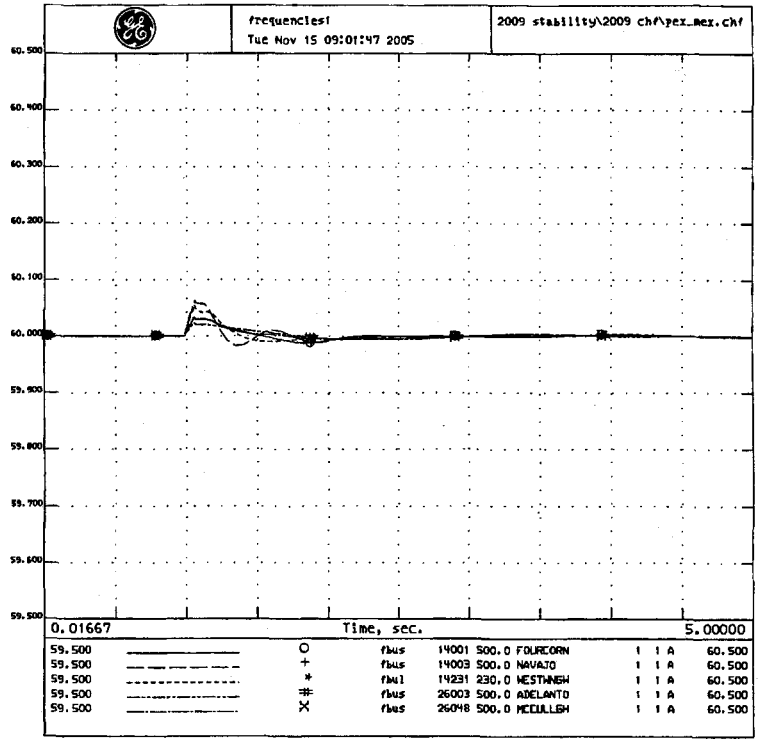
PERKINS FLT PEX-MEX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YV/YV-WW,
NV-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



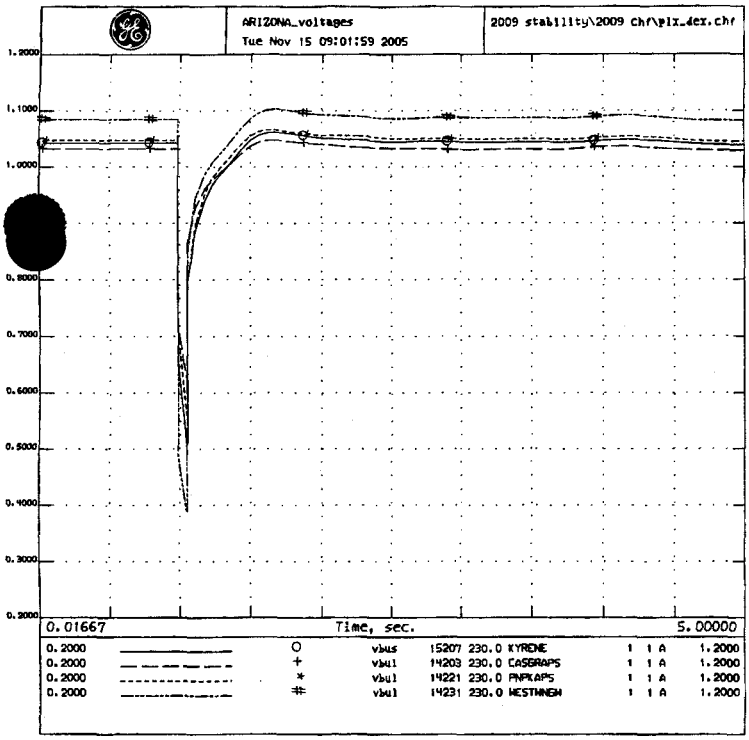
PERKINS FLT PEX-MEX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YV/YV-WW,
NV-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



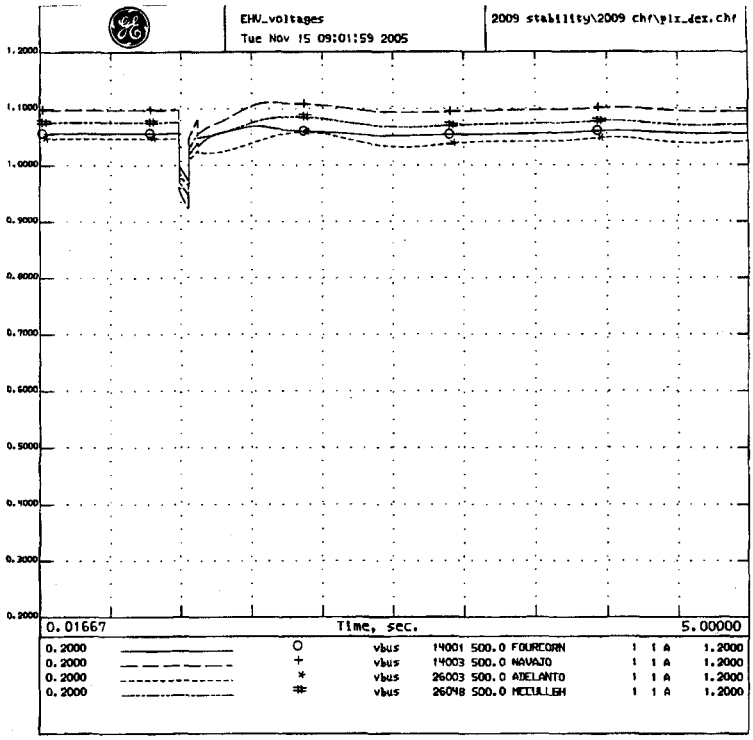
PERKINS FLT PEX-MEX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YV/YV-WW,
NV-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



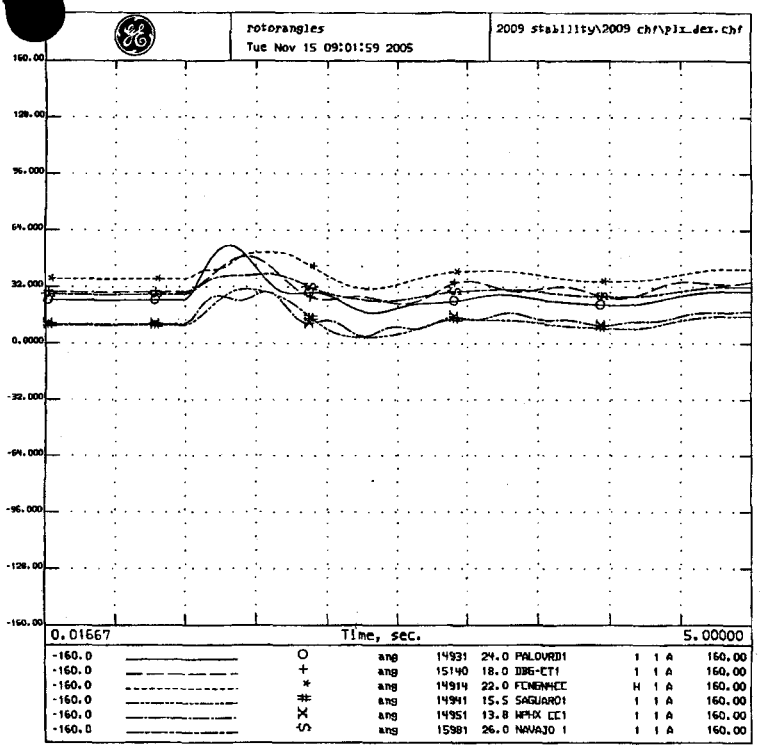
PALO VERDE FLT. w/PLX-DEX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



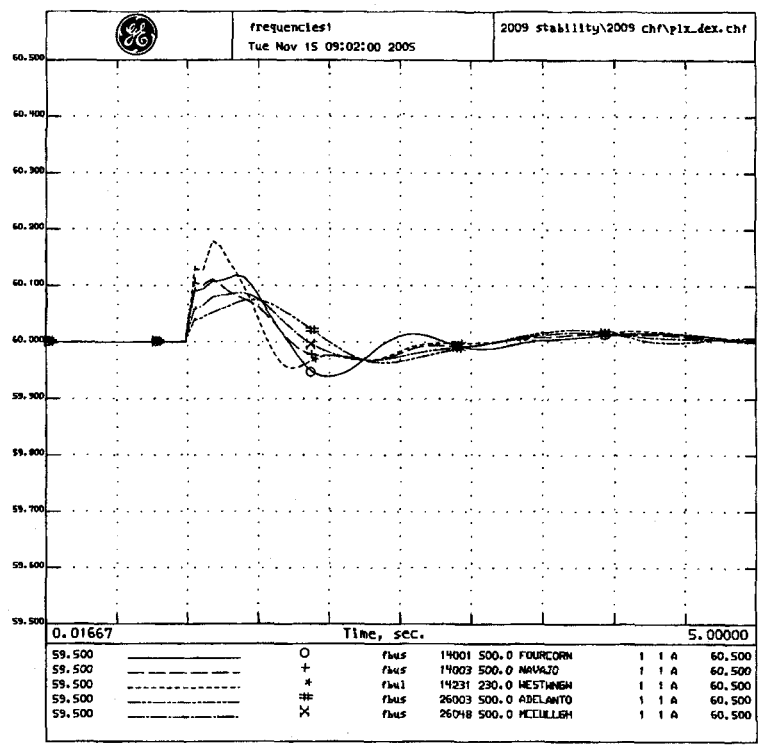
PALO VERDE FLT. w/PLX-DEX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



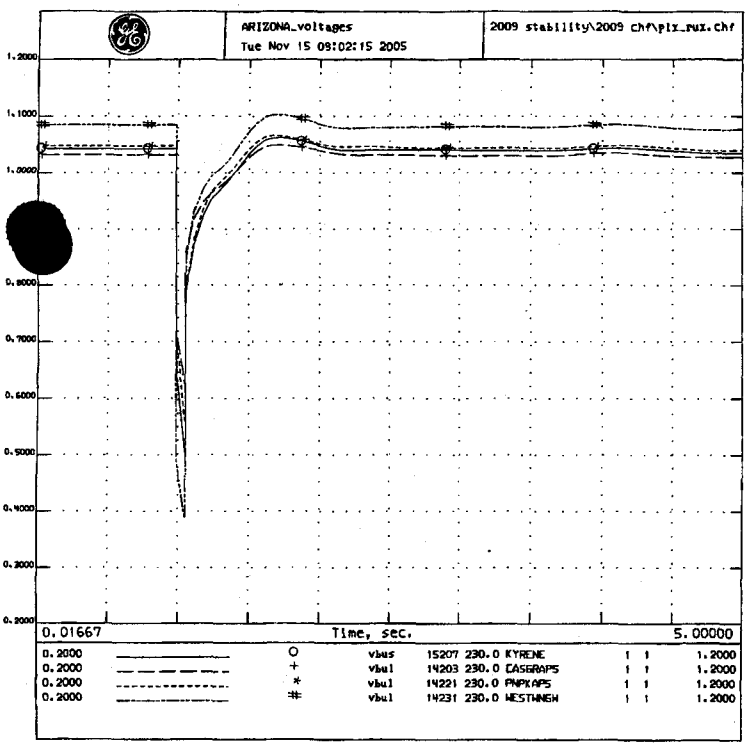
PALO VERDE FLT. w/PLX-DEX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



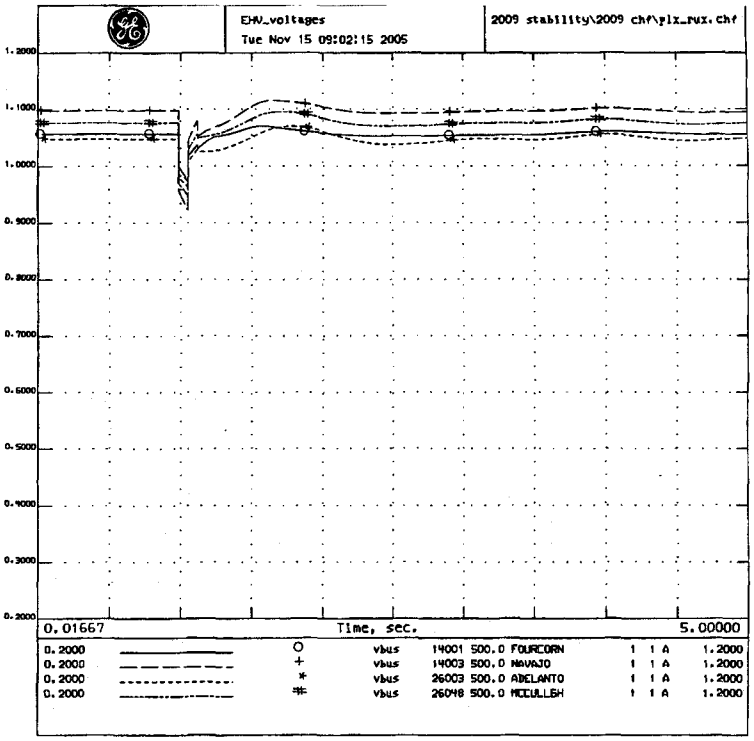
PALO VERDE FLT. w/PLX-DEX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



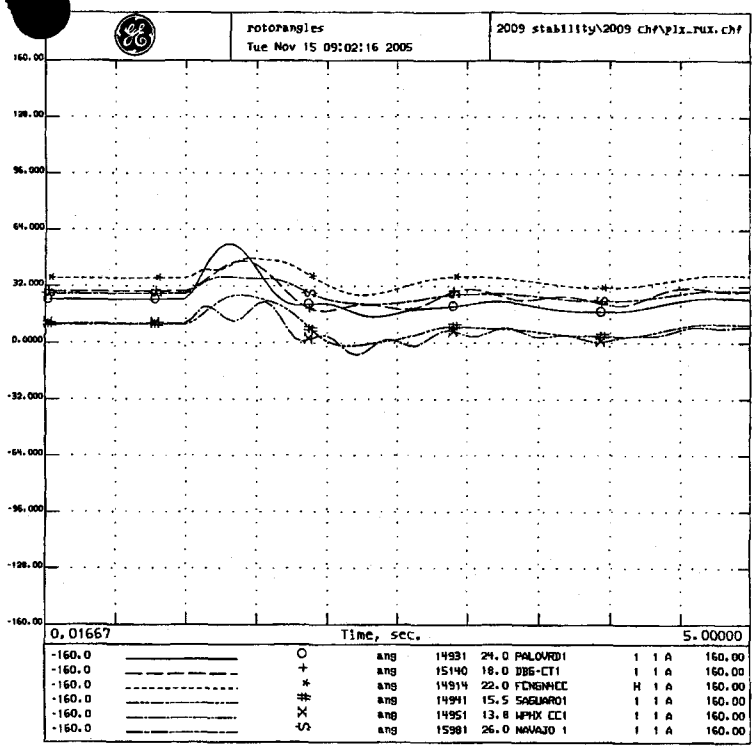
PALO VERDE FLT PLX-RUX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



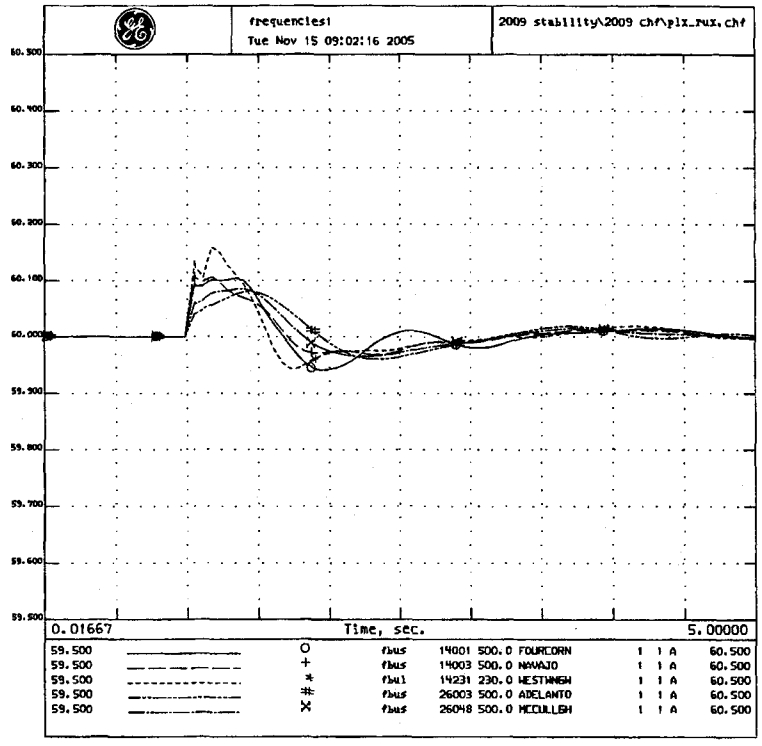
PALO VERDE FLT PLX-RUX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



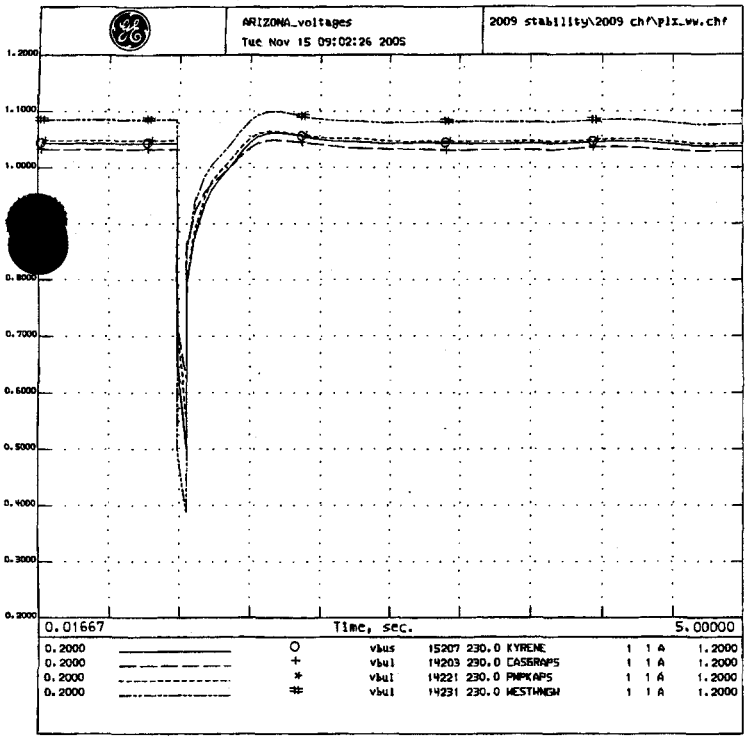
PALO VERDE FLT PLX-RUX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



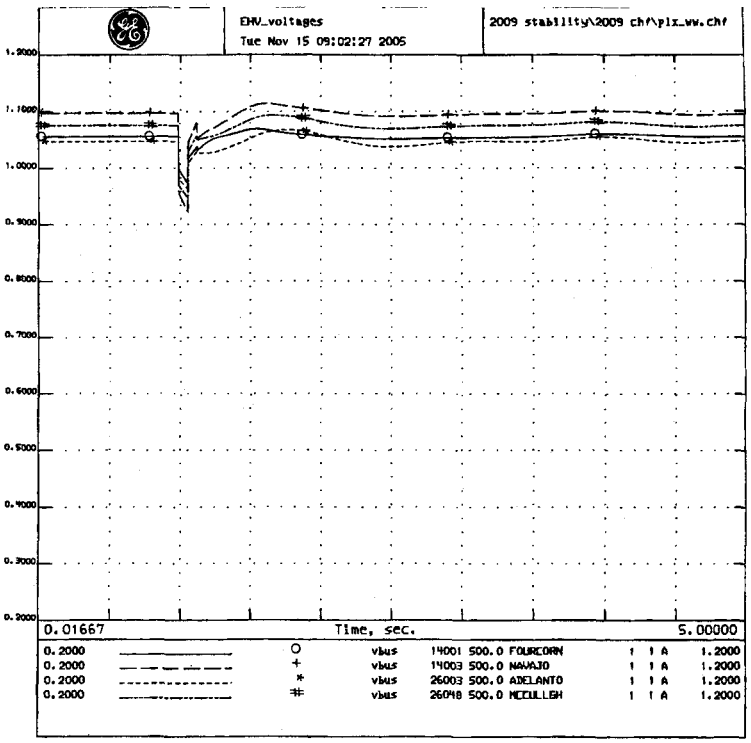
PALO VERDE FLT PLX-RUX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



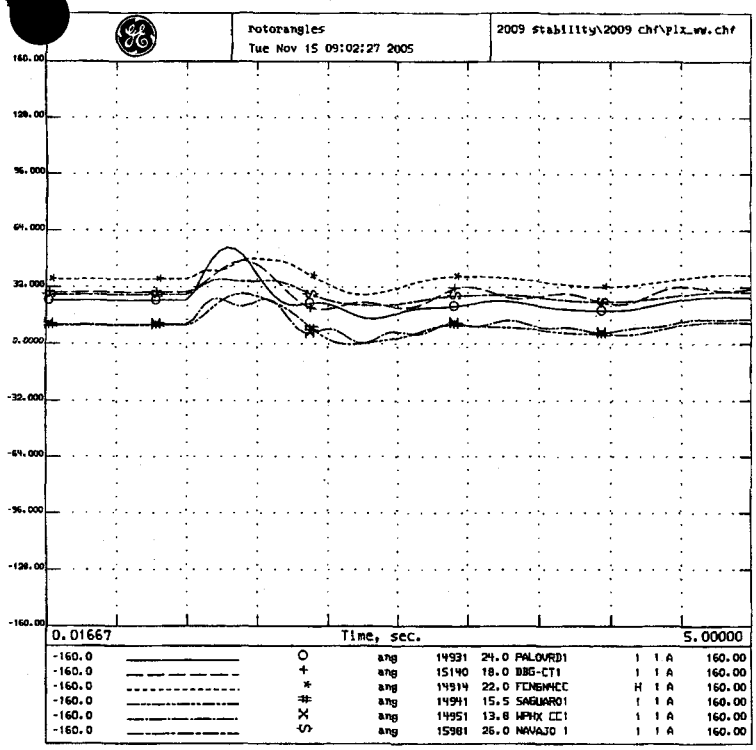
PALO VERDE FLT w/PLX-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



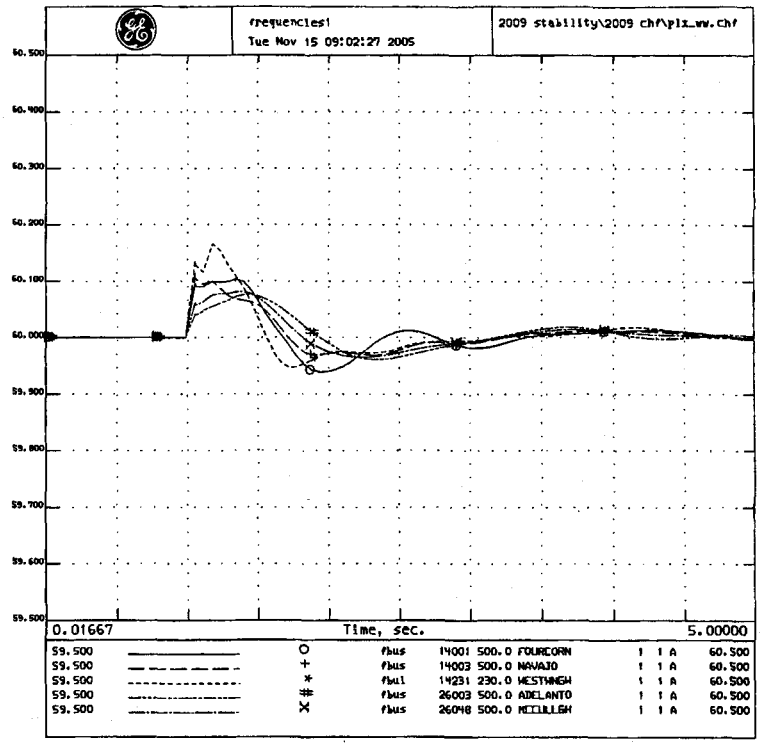
PALO VERDE FLT w/PLX-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



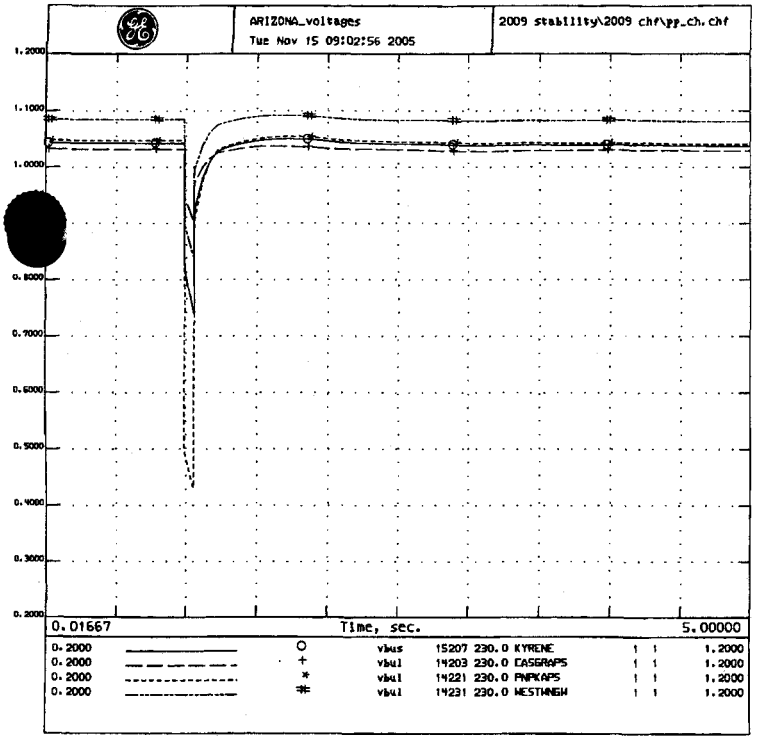
PALO VERDE FLT w/PLX-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



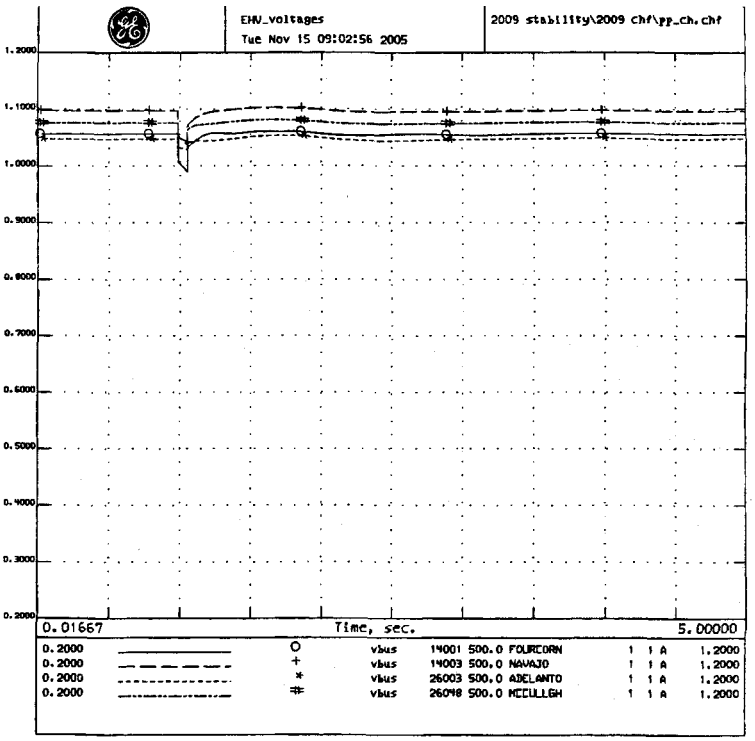
PALO VERDE FLT w/PLX-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2009.dyd;WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



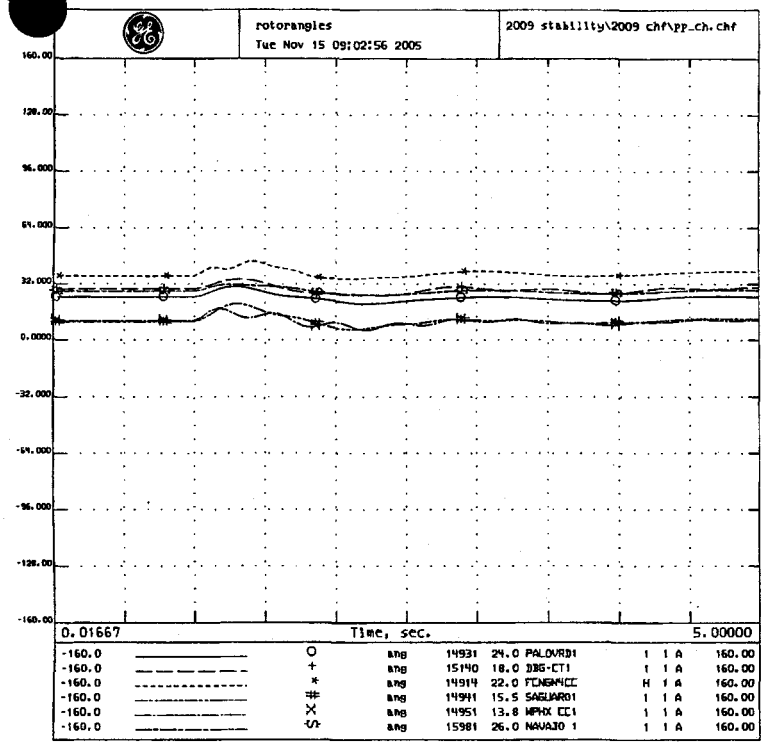
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



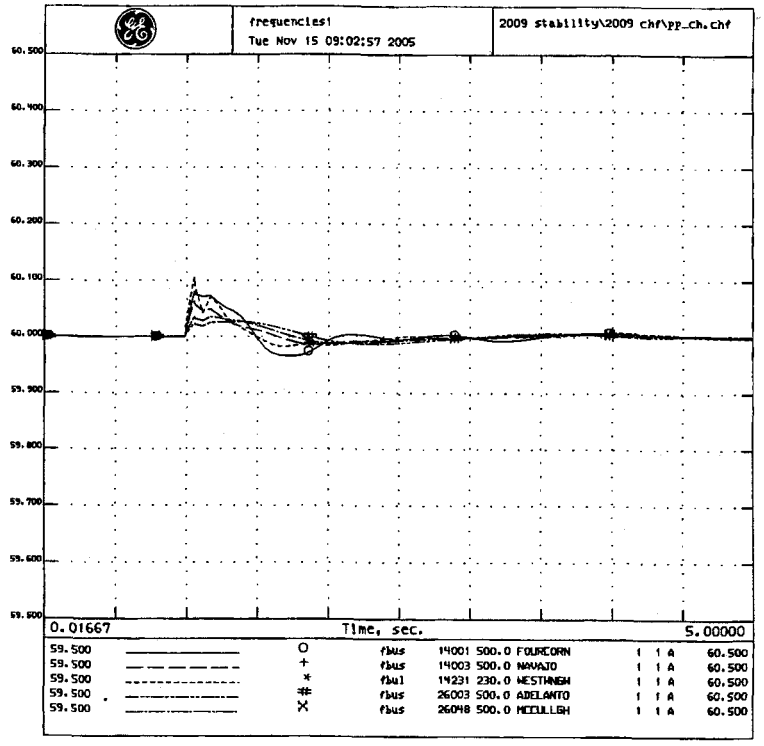
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



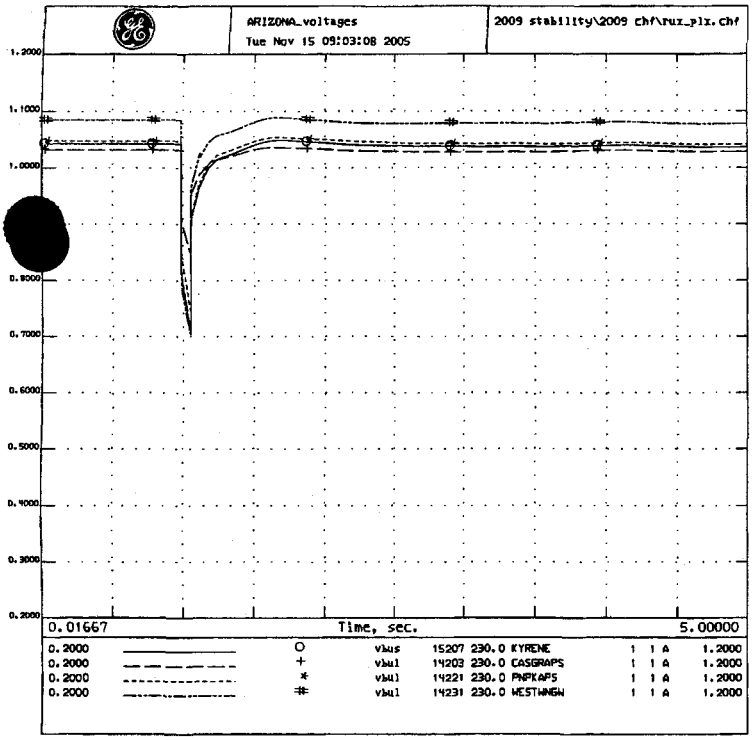
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



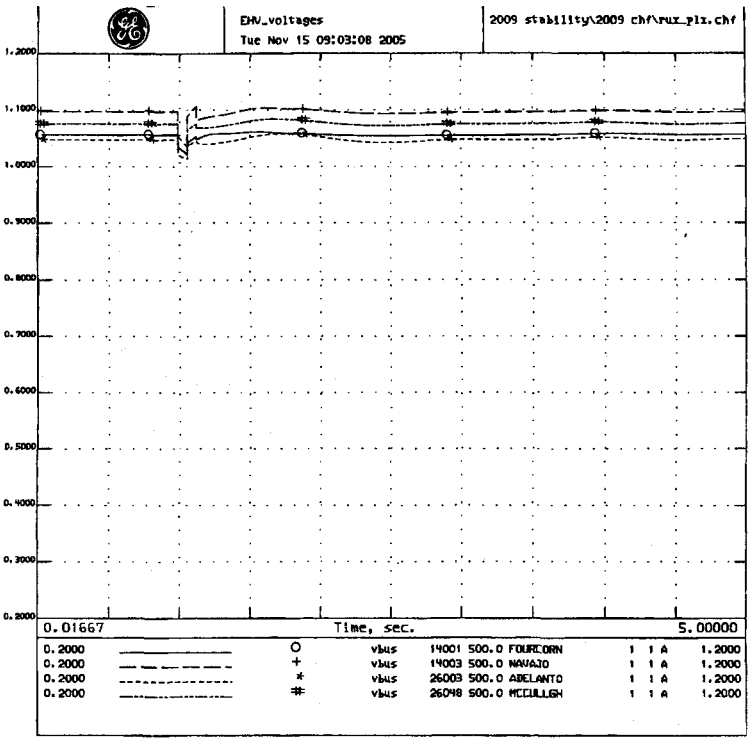
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



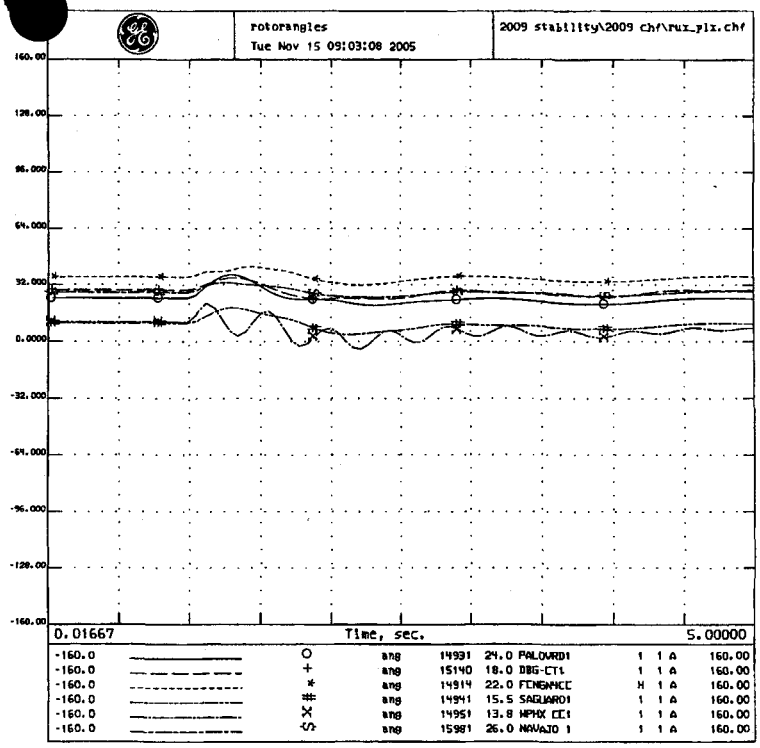
RUDD FLT RUX-PLX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
RUX-PLX STAB e1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



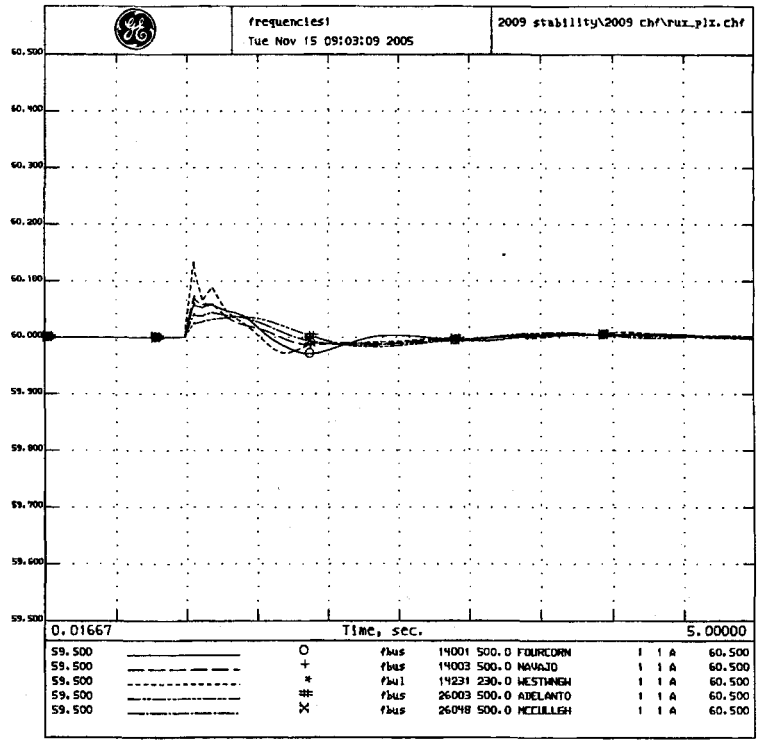
RUDD FLT RUX-PLX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
RUX-PLX STAB e1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



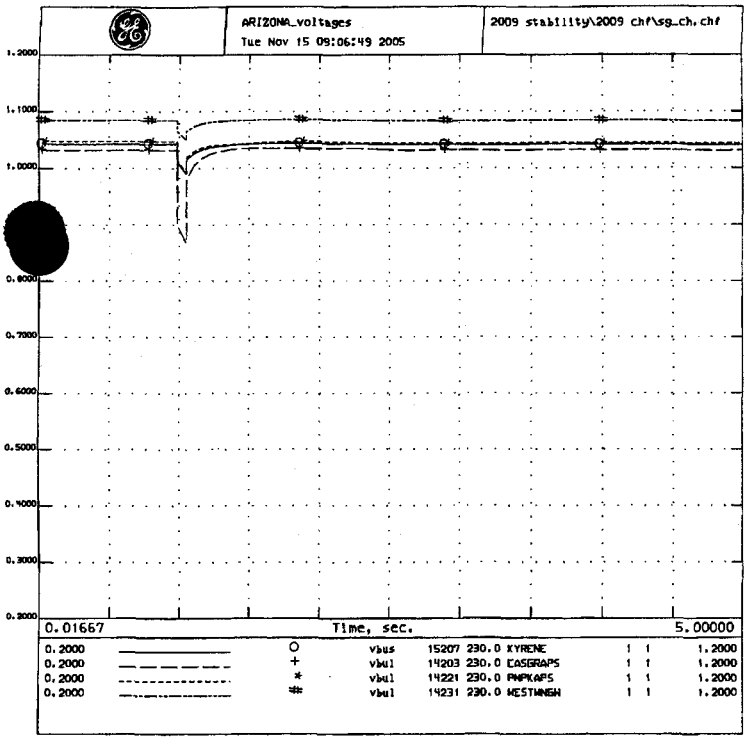
RUDD FLT RUX-PLX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
RUX-PLX STAB e1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



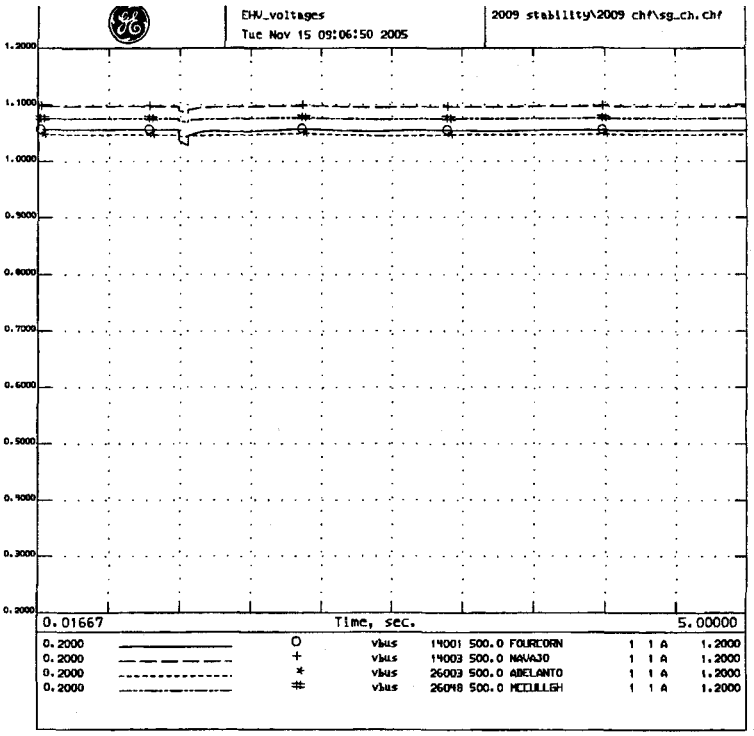
RUDD FLT RUX-PLX LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
RUX-PLX STAB e1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



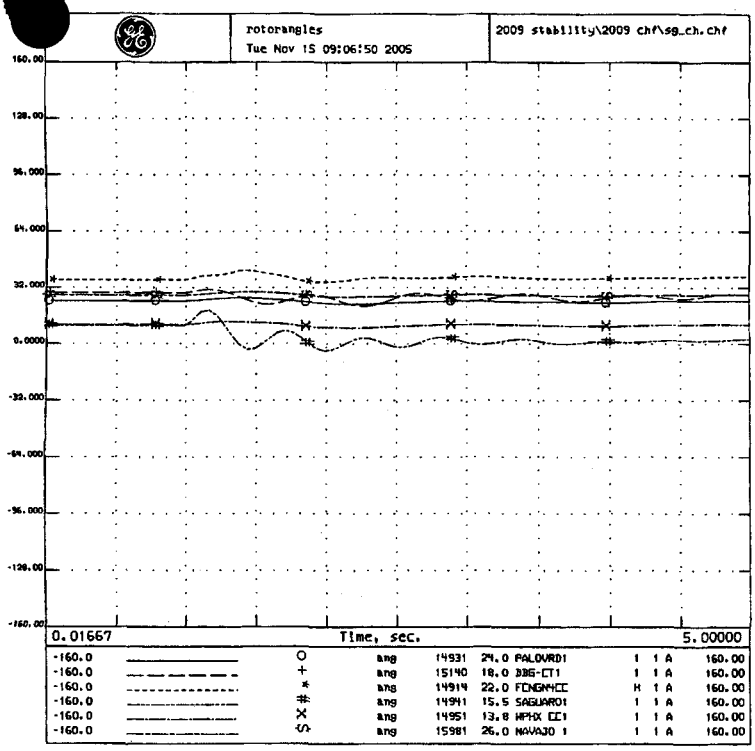
SAGUARO FLT SG-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



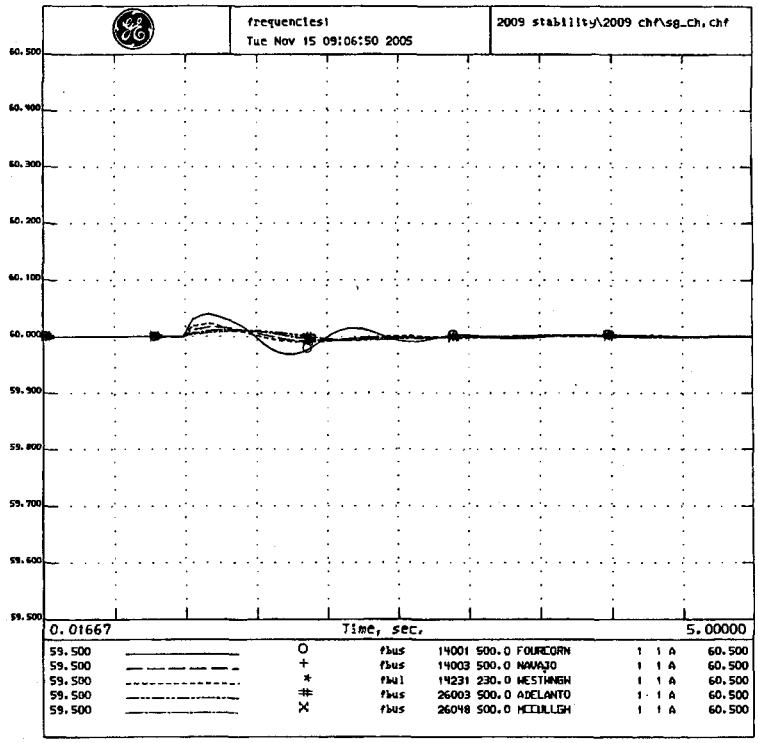
SAGUARO FLT SG-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



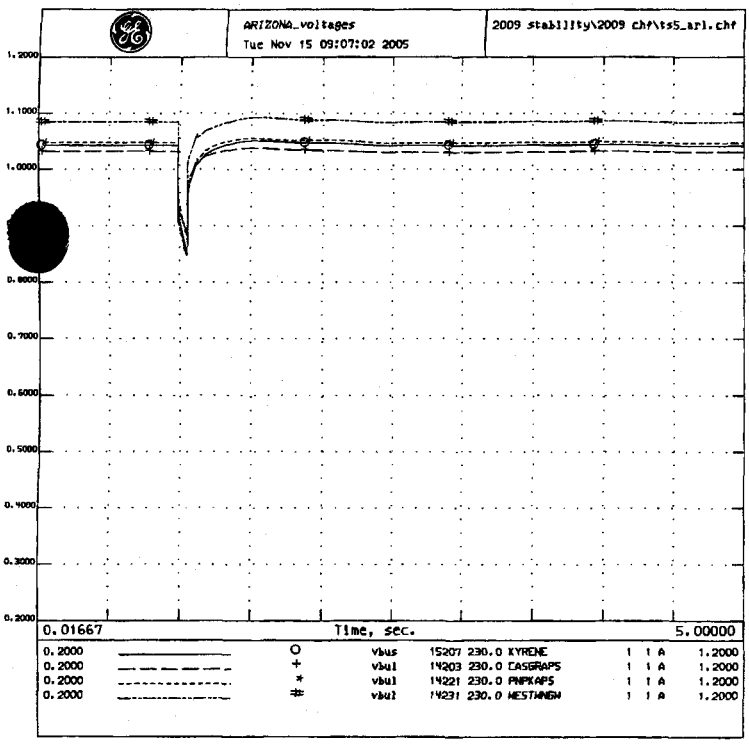
SAGUARO FLT SG-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



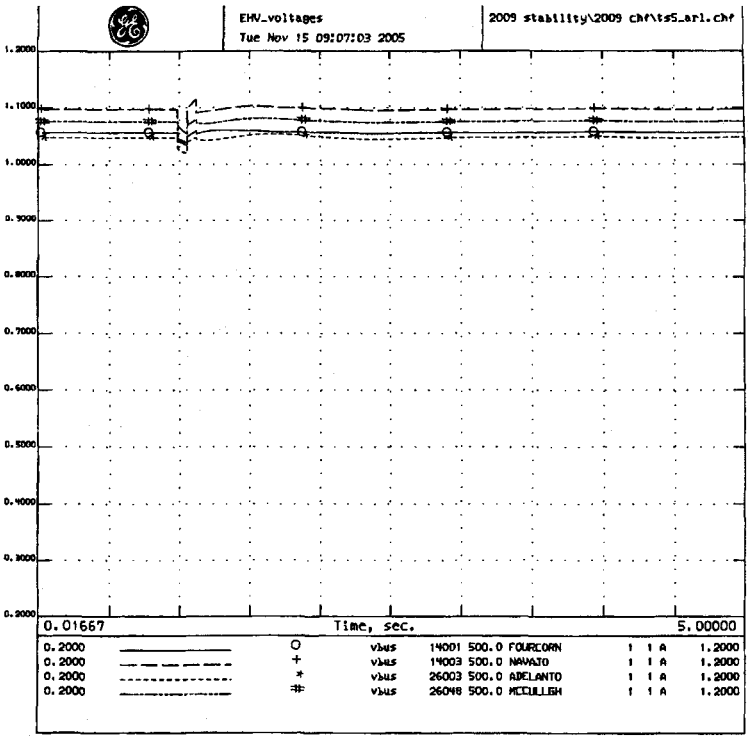
SAGUARO FLT SG-CH LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



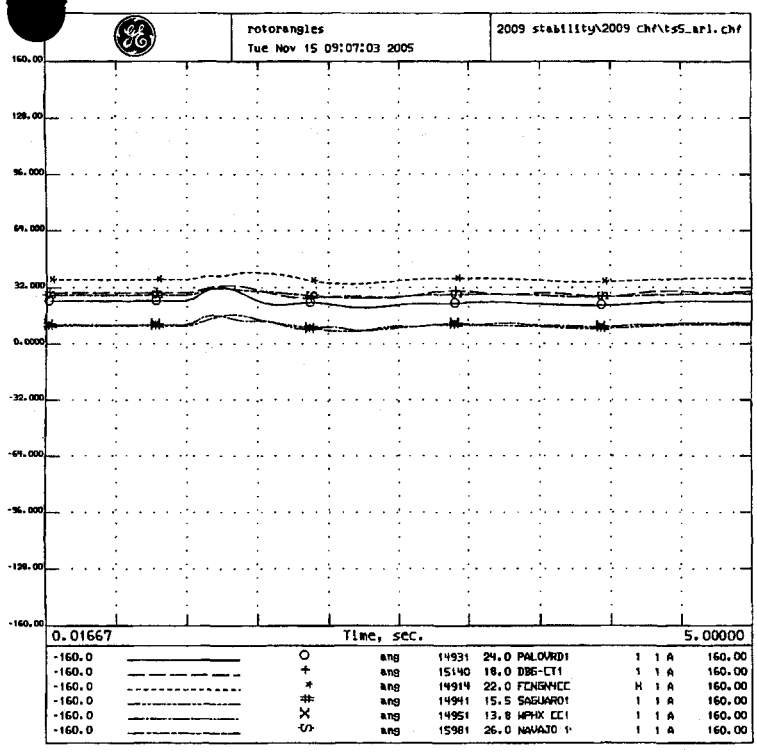
TSS FLT TSS-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



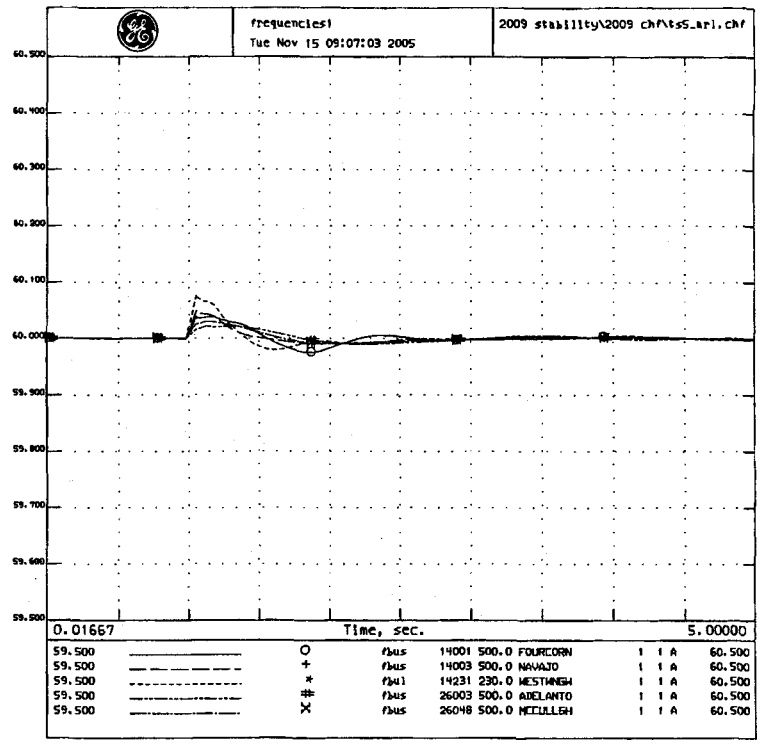
TSS FLT TSS-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



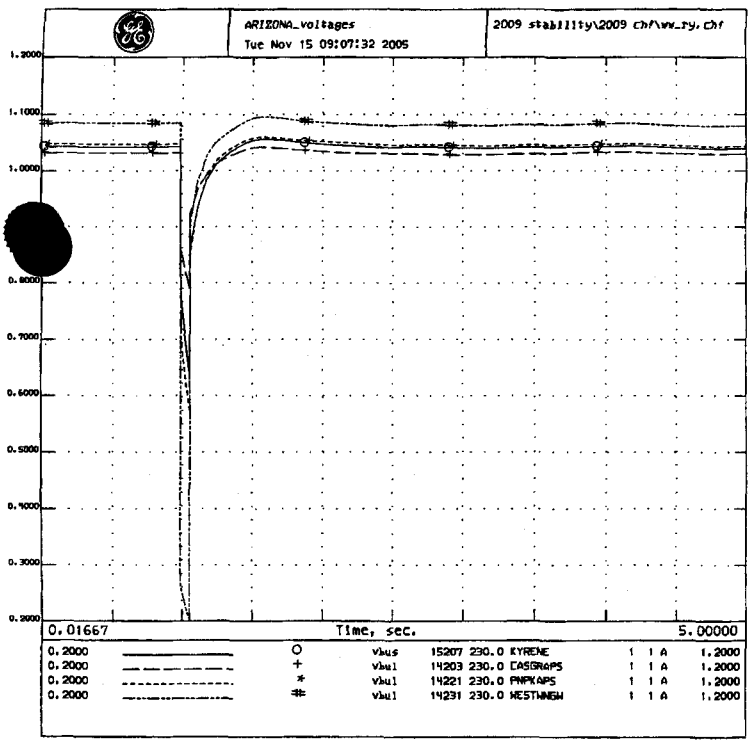
TSS FLT TSS-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



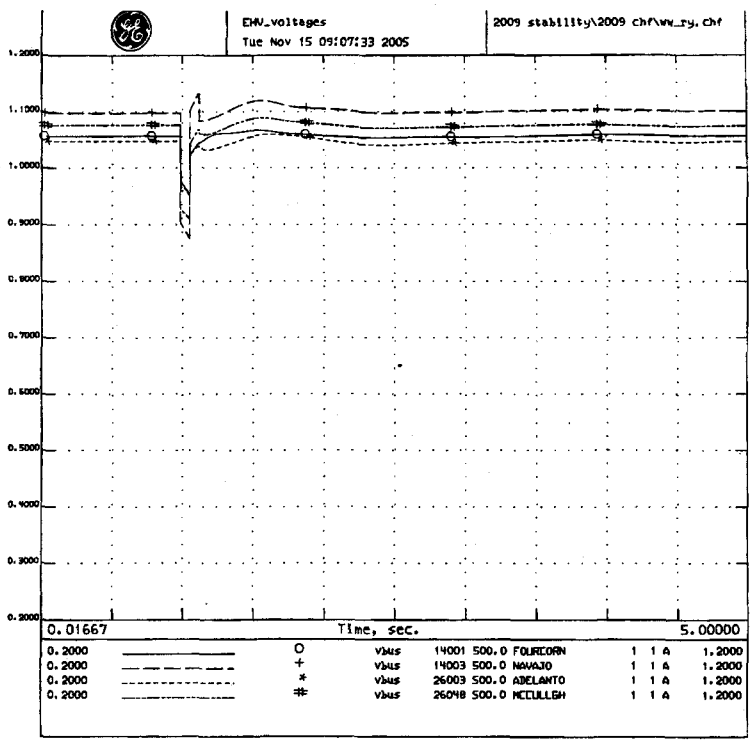
TSS FLT TSS-ARL LINE OUT
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2009.dyd;WSCC.bpt

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



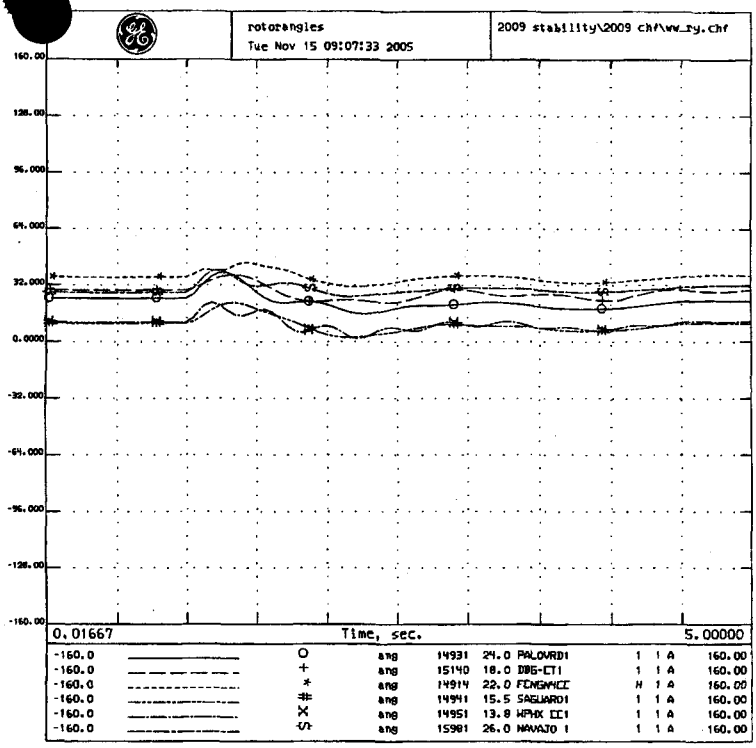
WESTWING FLT. WW-RY line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



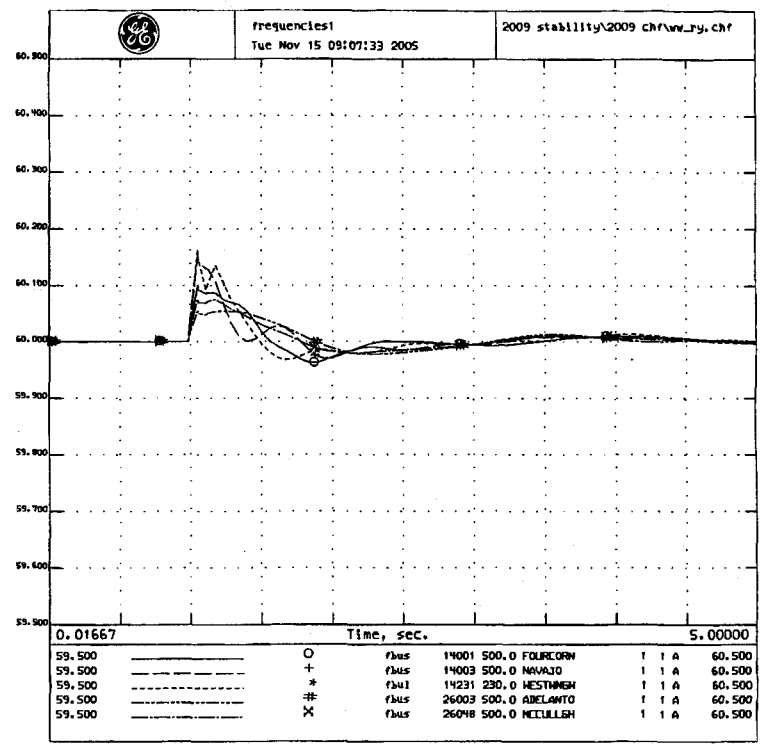
WESTWING FLT. WW-RY line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



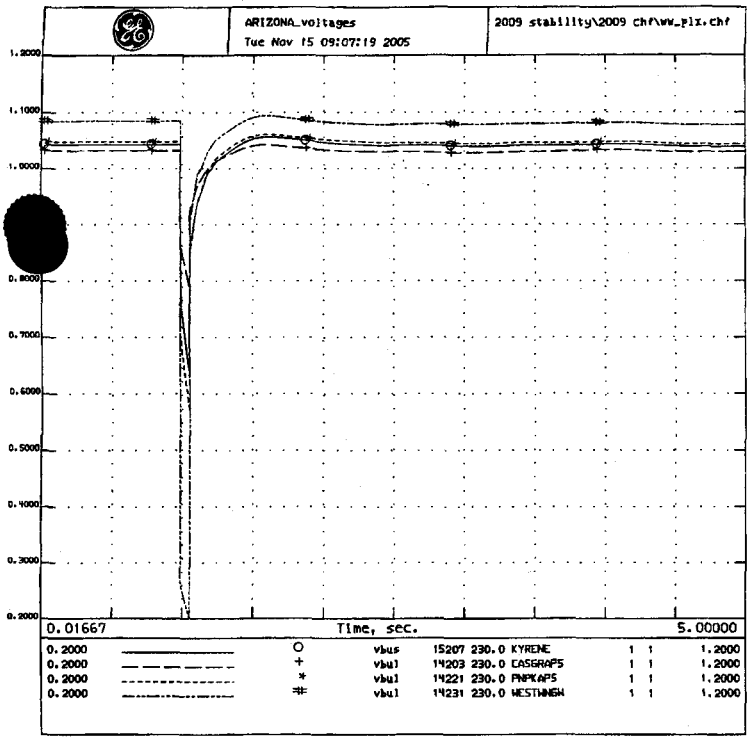
WESTWING FLT. WW-RY line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



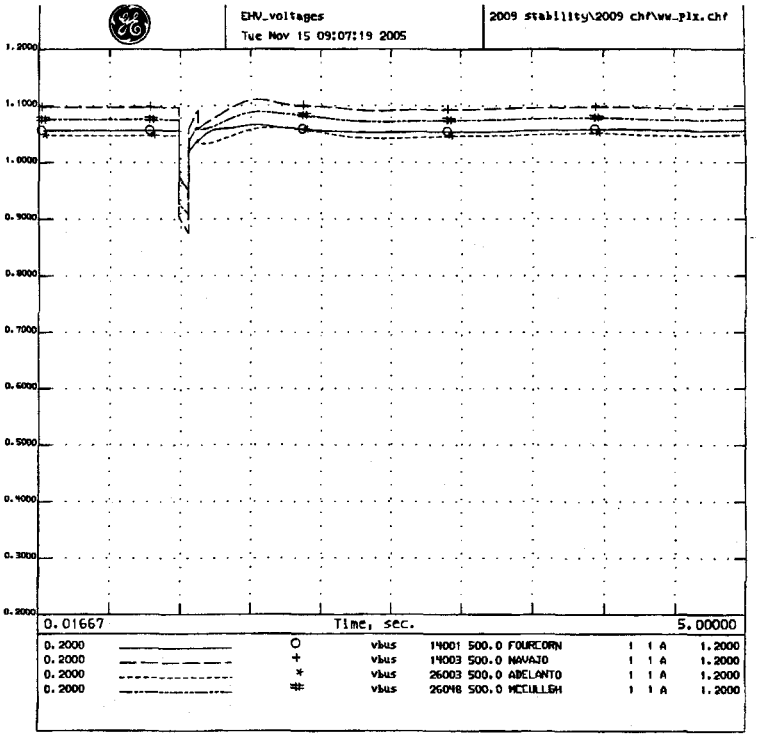
WESTWING FLT. WW-RY line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



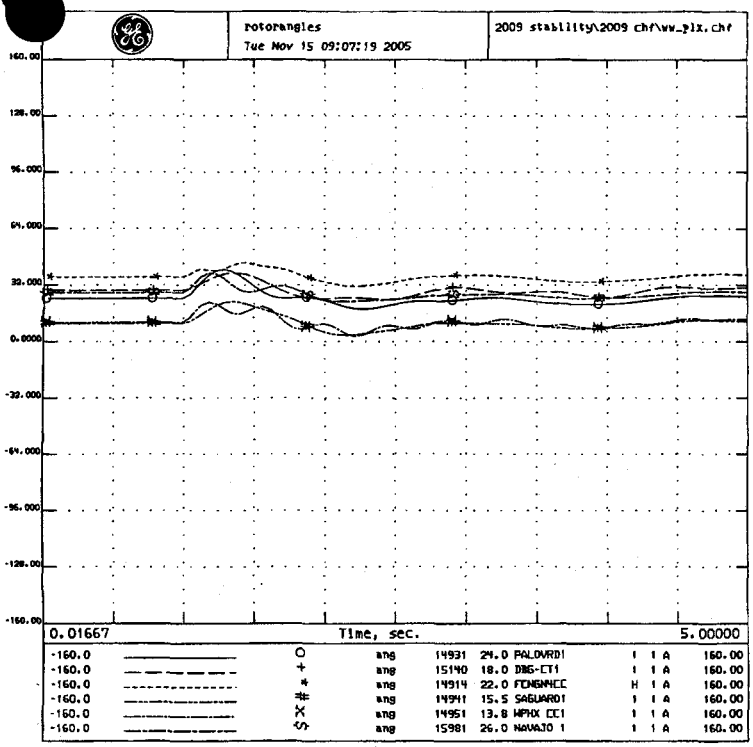
WESTWING FLT. WW-PLX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-PLX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-PLX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
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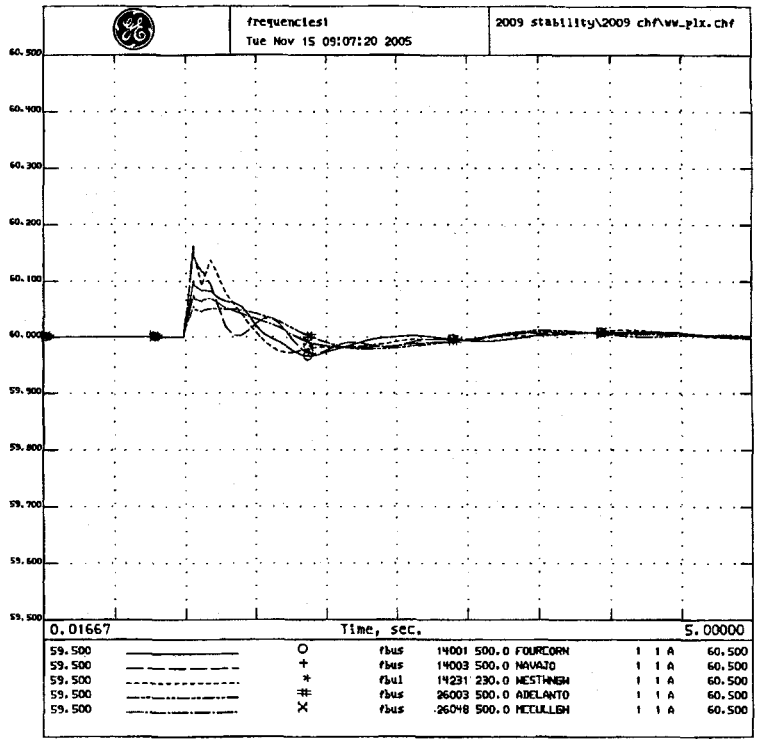
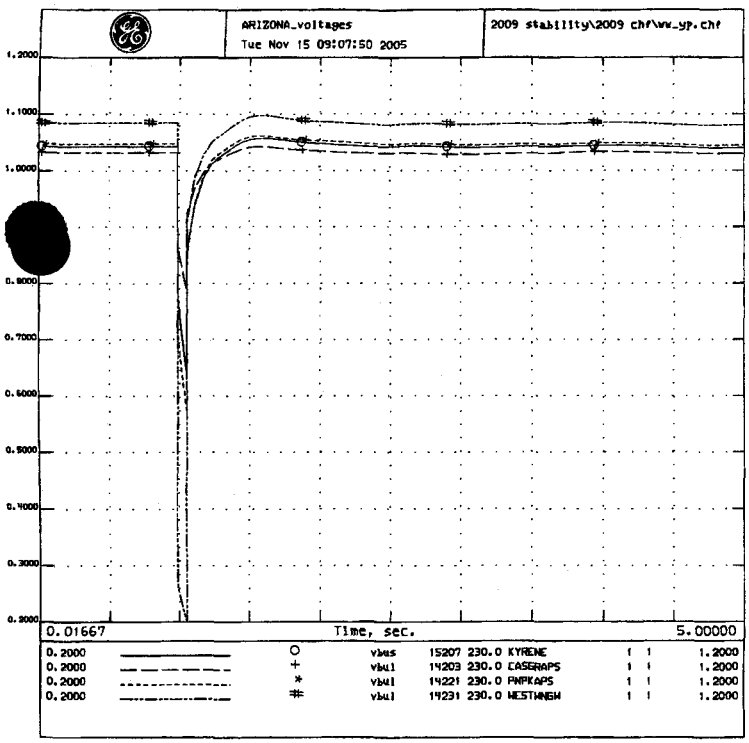
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-PLX line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-YP line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MX-YP/YP-WW,
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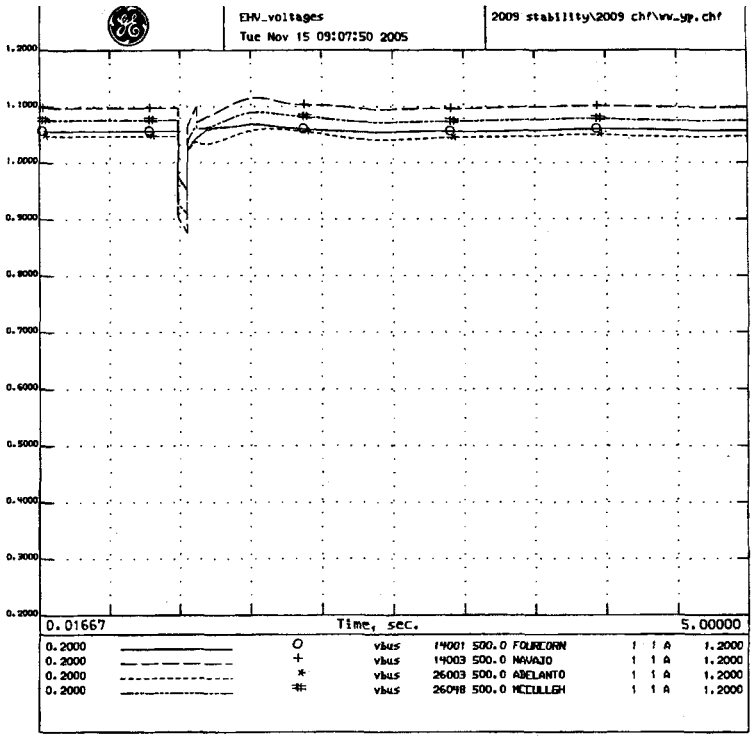
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-YP line out
2009 HS1A APPROVED BASE CASE
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WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MX-YP/YP-WW,
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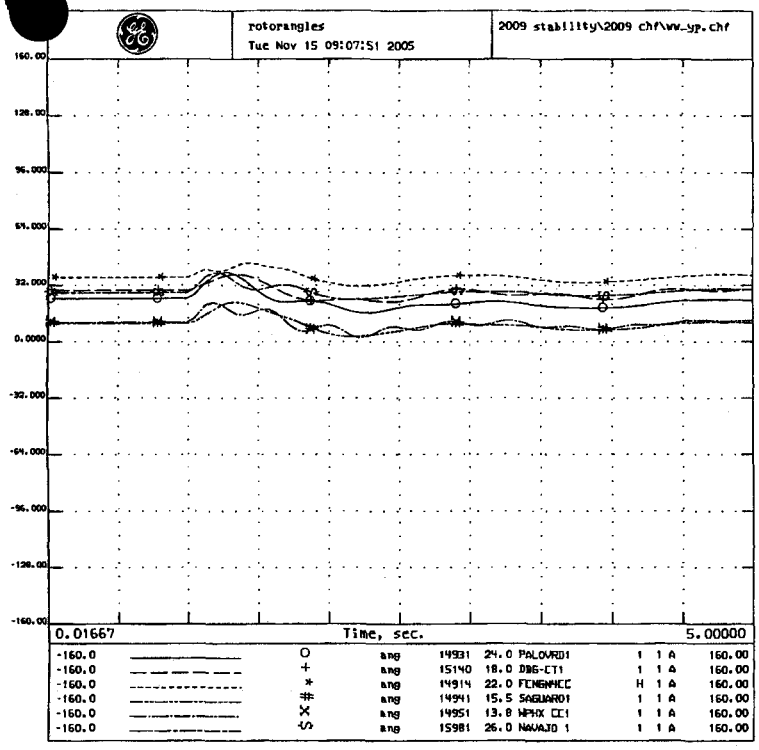
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-YP line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MX-YP/YP-WW,
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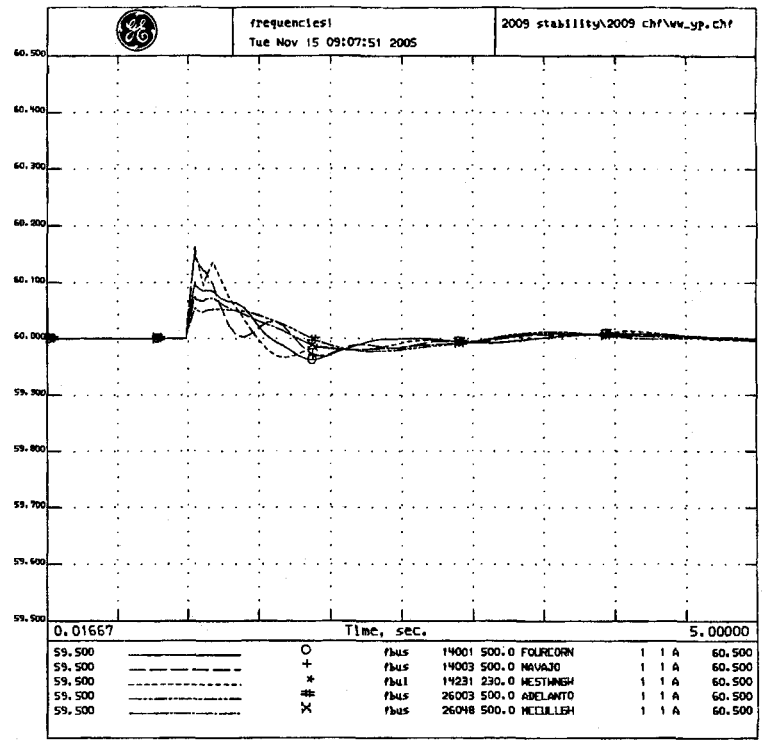
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



WESTWING FLT. WW-YP line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MX-YP/YP-WW,
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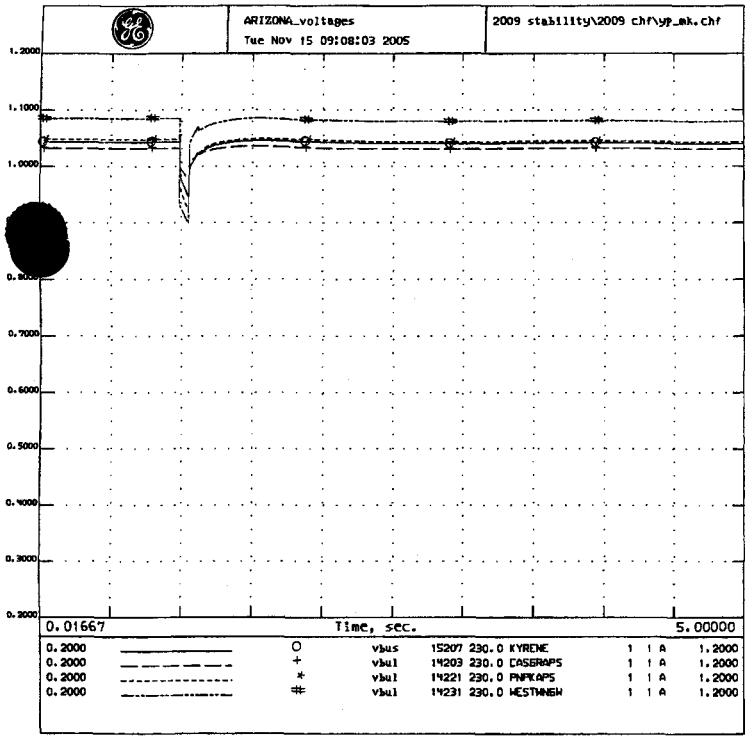
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



YAVAPAI FLT, YP-MK line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
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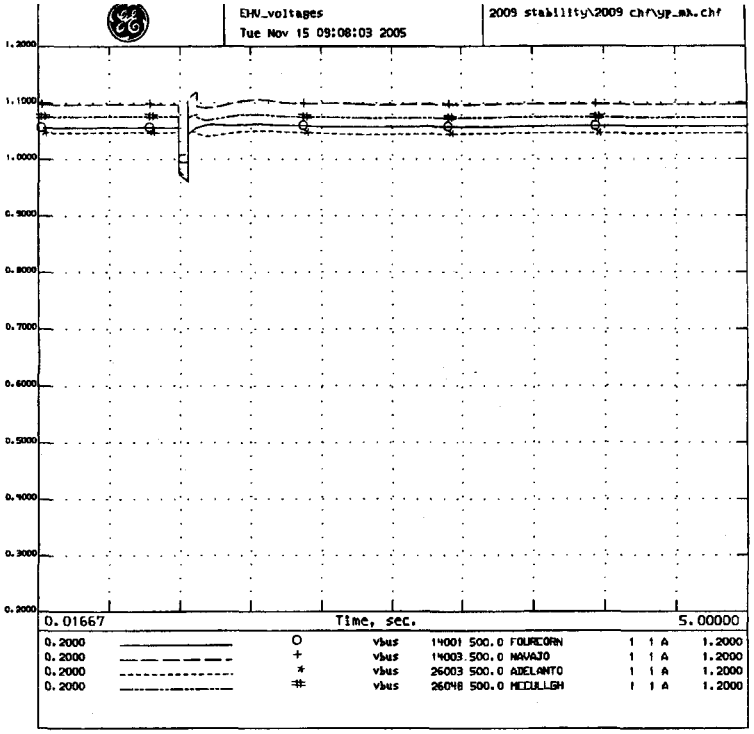
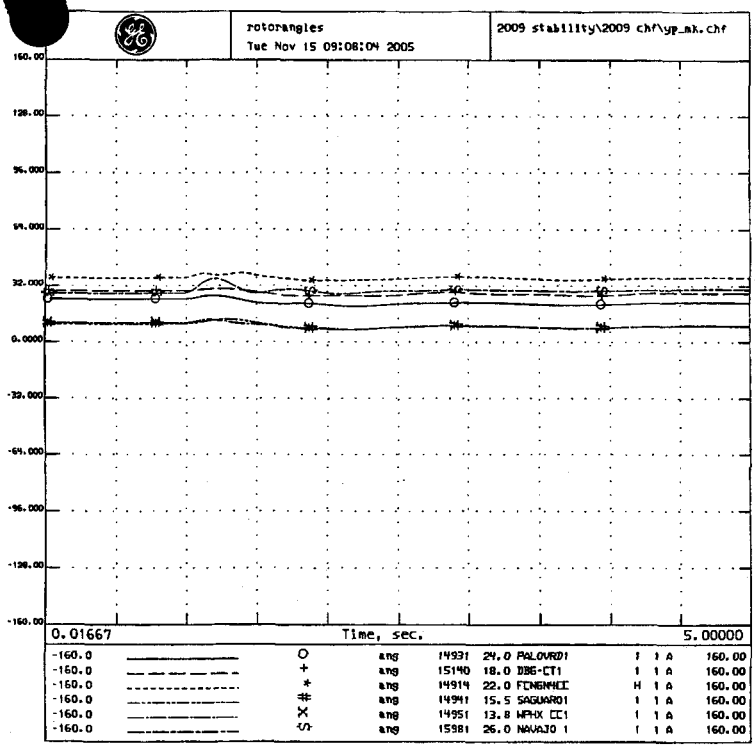
ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



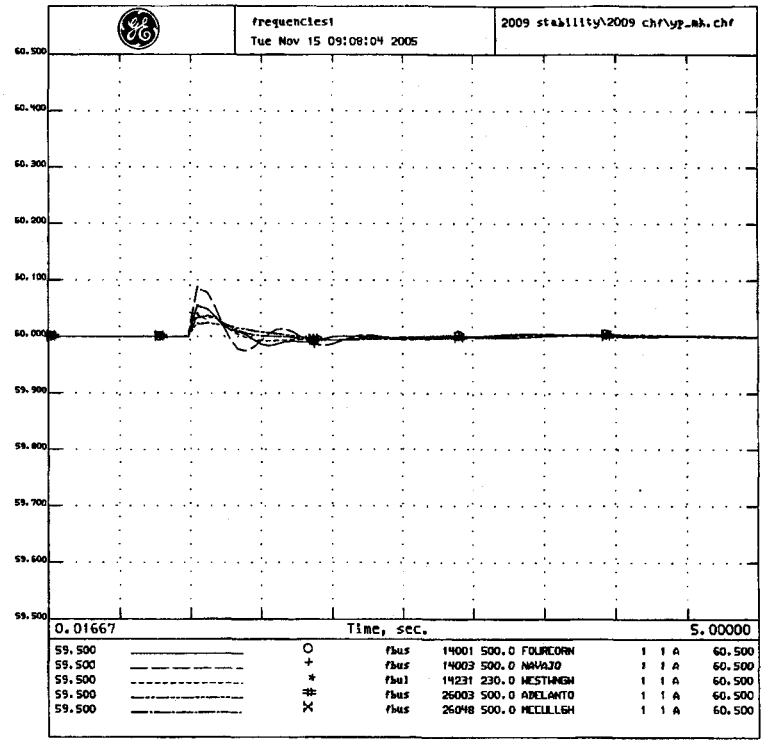
YAVAPAI FLT, YP-MK line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



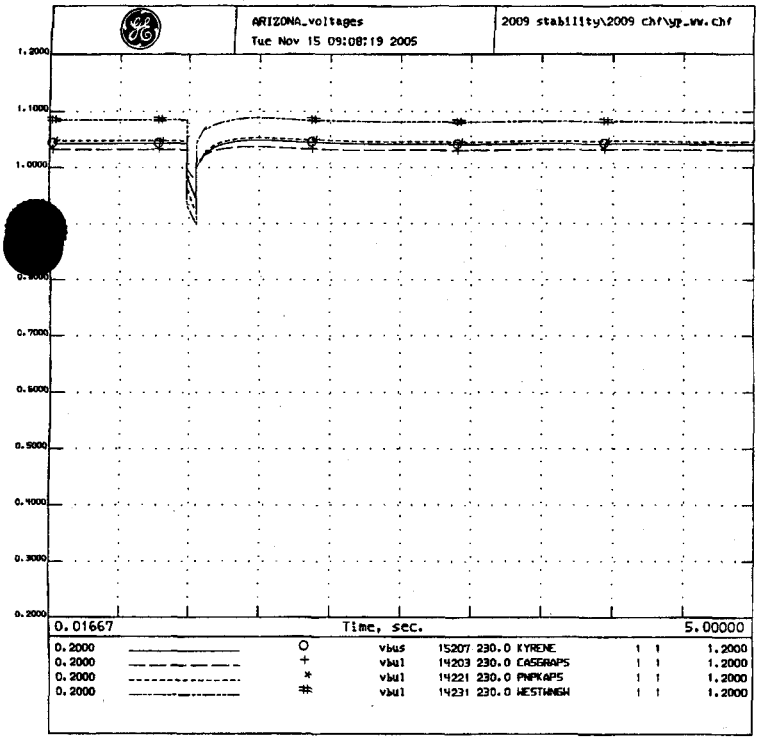
YAVAPAI FLT, YP-MK line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



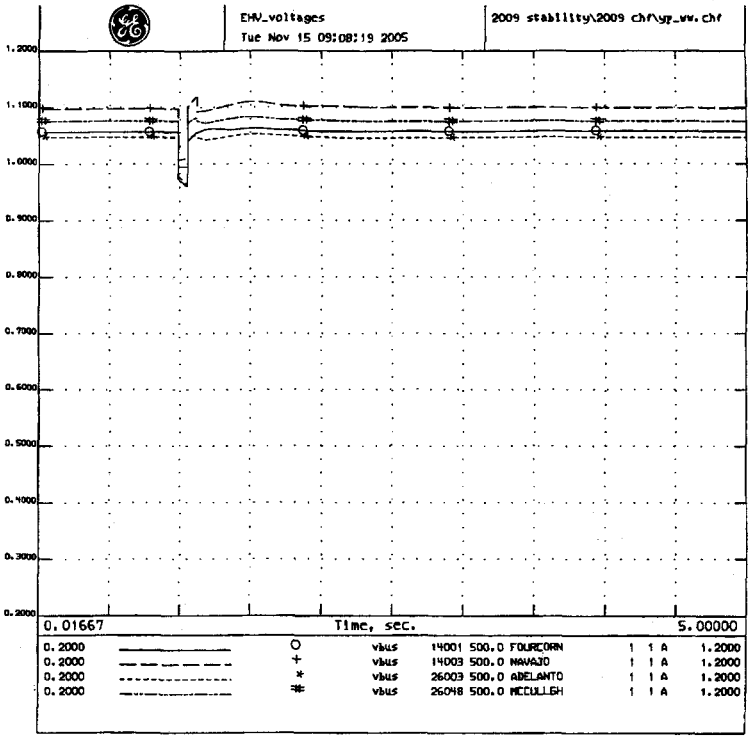
YAVAPAI FLT, YP-MK line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



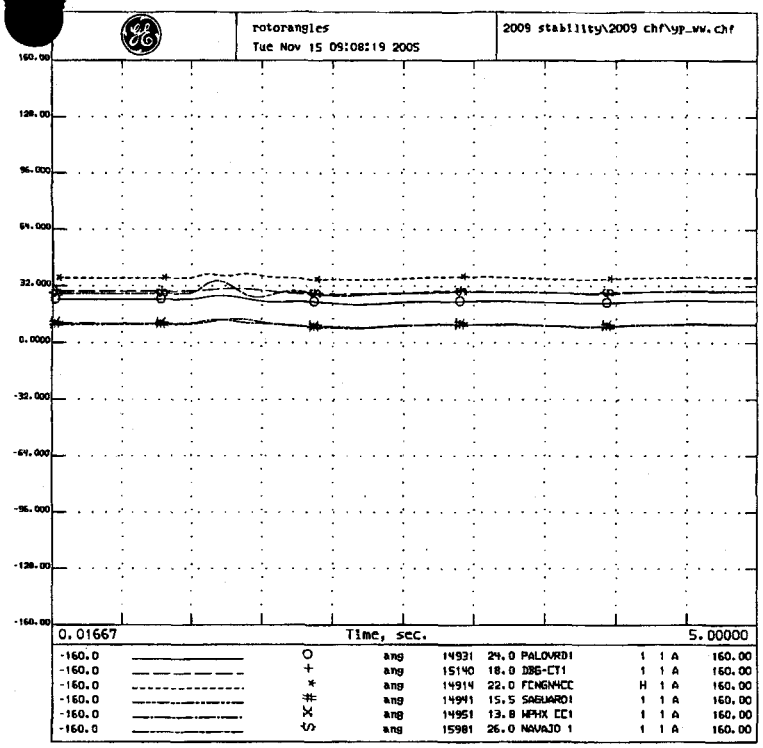
YAVAPAI FLT. YP-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-WW;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



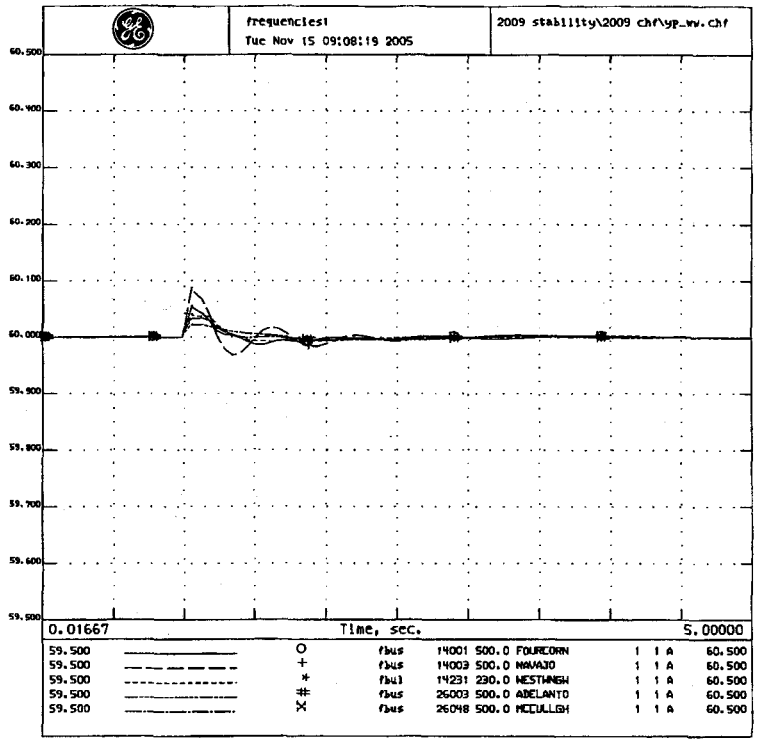
YAVAPAI FLT. YP-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-WW;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



YAVAPAI FLT. YP-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-WW;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.



YAVAPAI FLT. YP-WW line out
2009 HS1A APPROVED BASE CASE
APRIL 21, 2005
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-WW;8C REIN;2009.dyd WSCC.bat

ALL COMMENTS RESULTING FROM THE TSS REVIEW ARE INCLUDED.

APPENDIX C
2014 STABILLITY PLOTS

APPENDIX C

2014
Stability Plots

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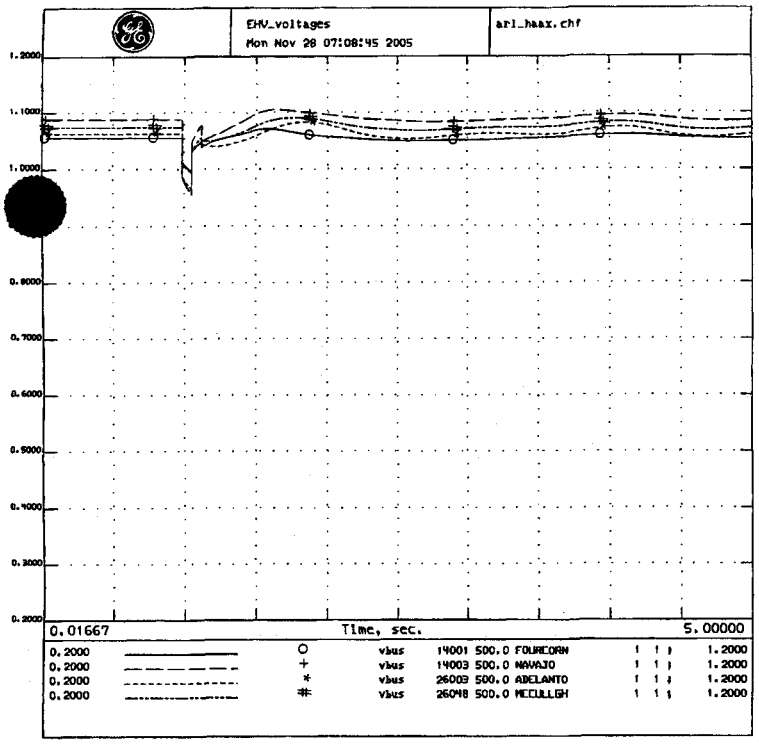
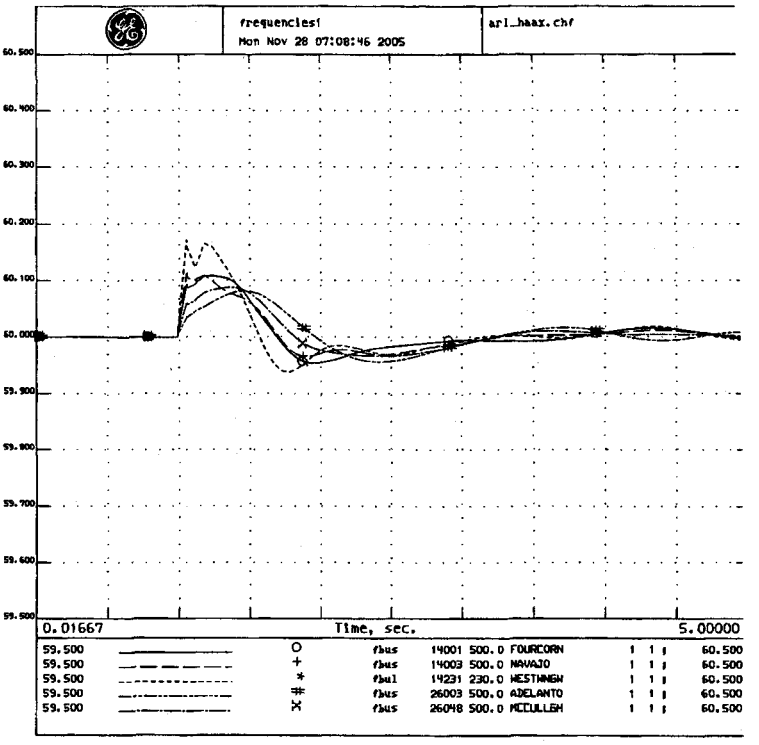


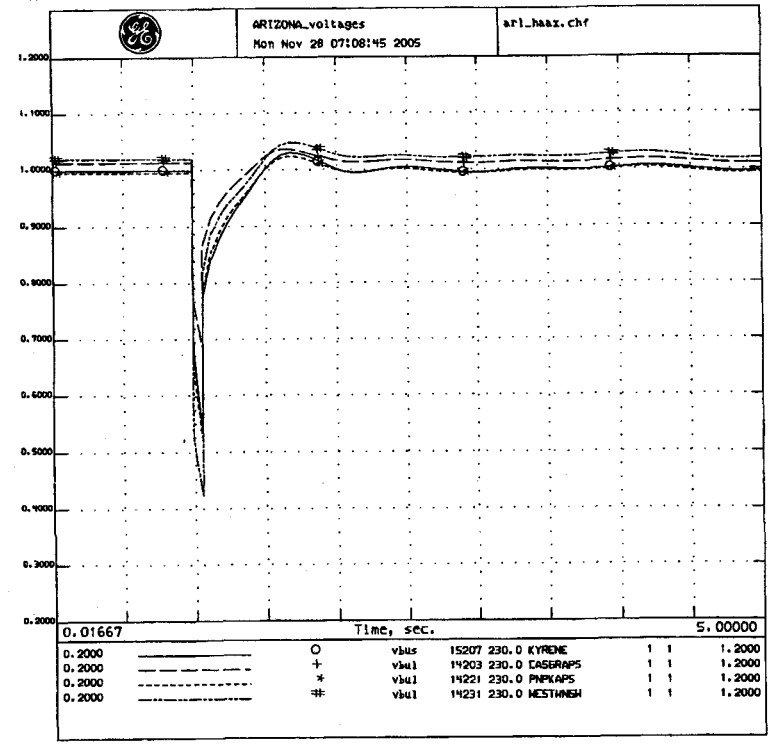
ARLINGTON FLT ARL-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



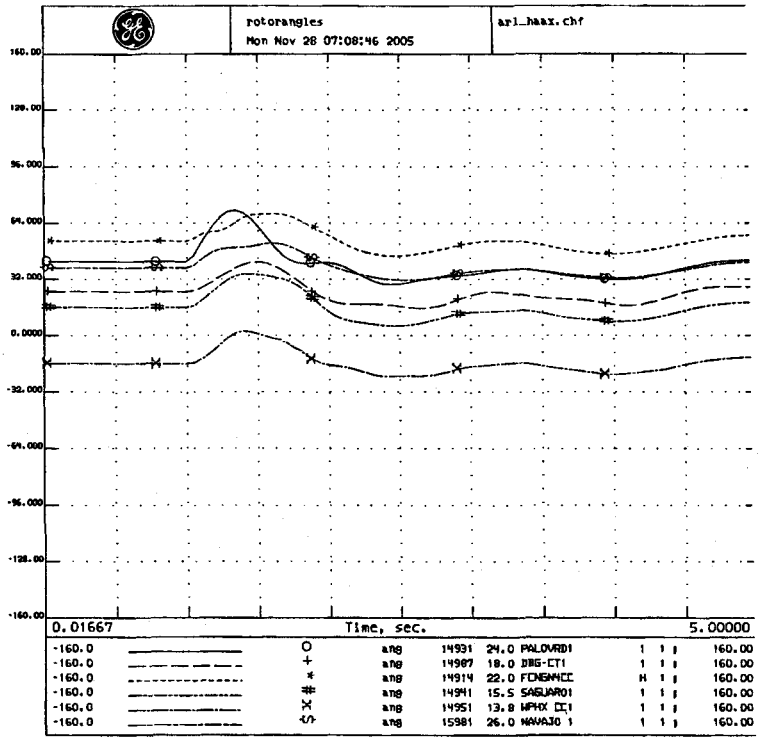
ARLINGTON FLT ARL-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



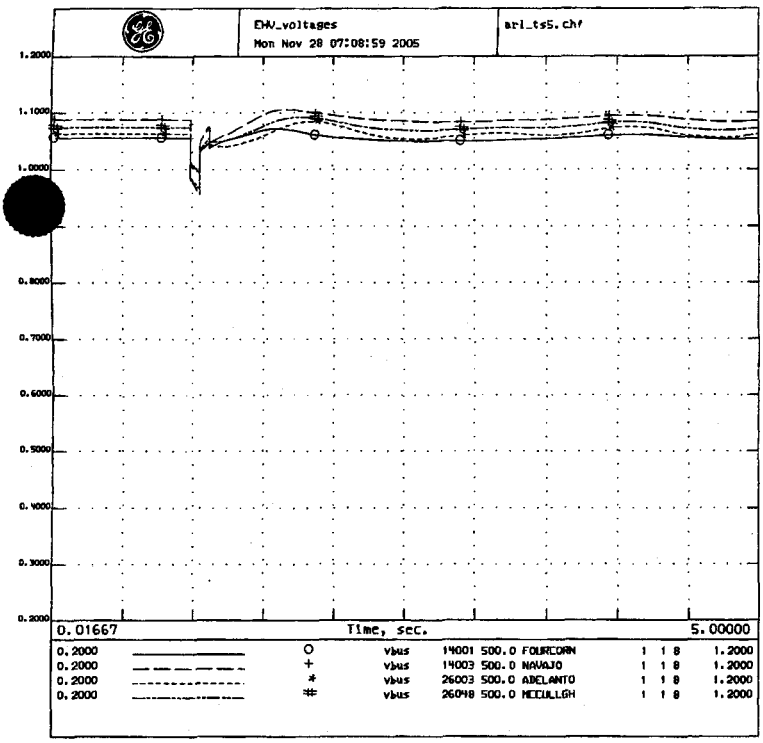
ARLINGTON FLT ARL-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



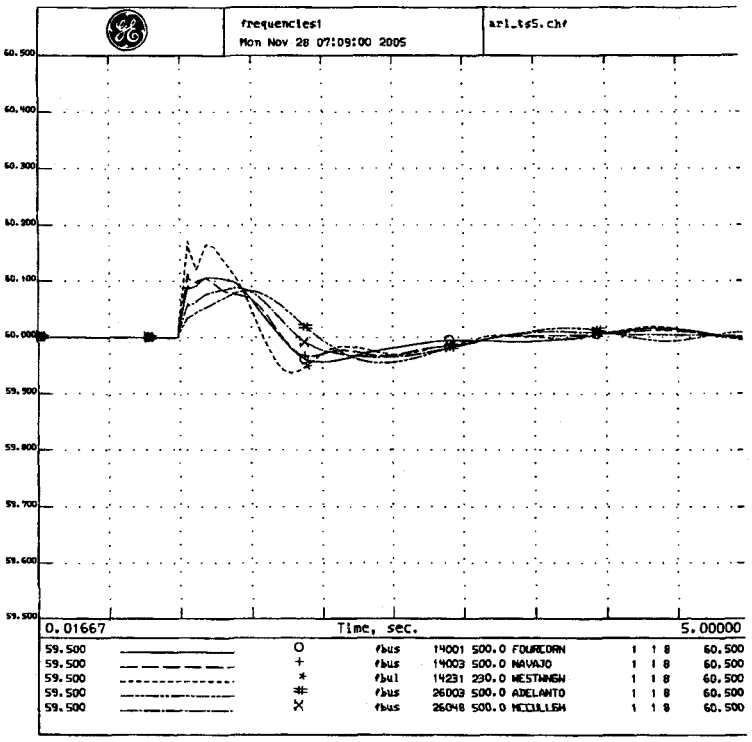
ARLINGTON FLT ARL-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-HAAX STAB; 01/06; T=0 3P FLT ARL500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-HAAX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



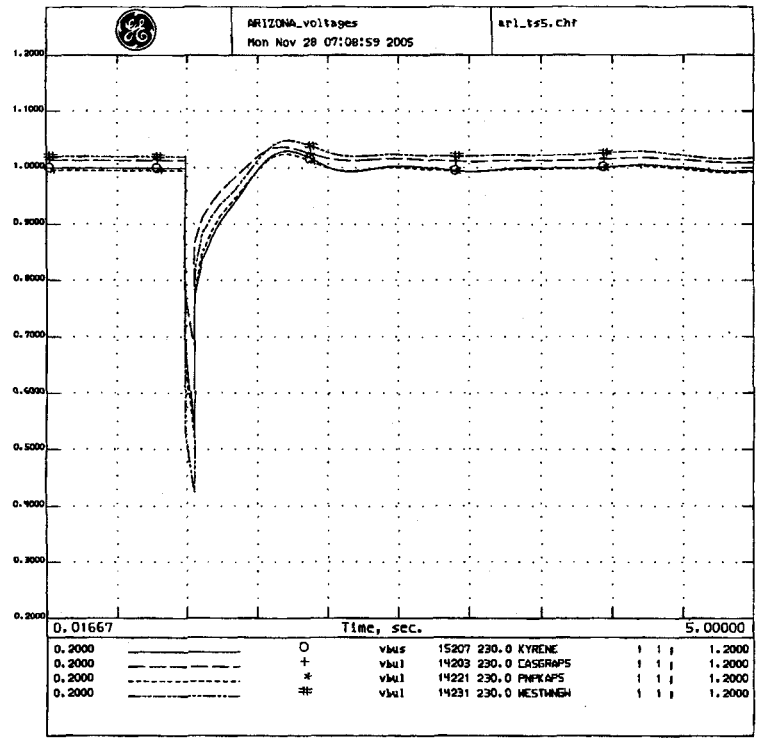
ARLINGTON FLT ARL-TS5 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-TS5 STAB; 01/06; T=0 3P FLT ARLS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TS5;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



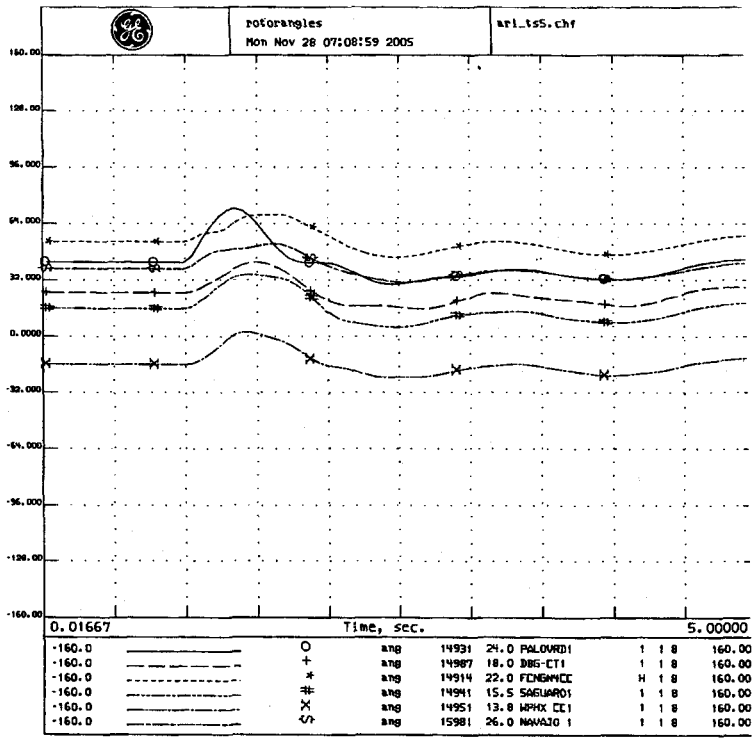
ARLINGTON FLT ARL-TS5 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-TS5 STAB; 01/06; T=0 3P FLT ARLS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TS5;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



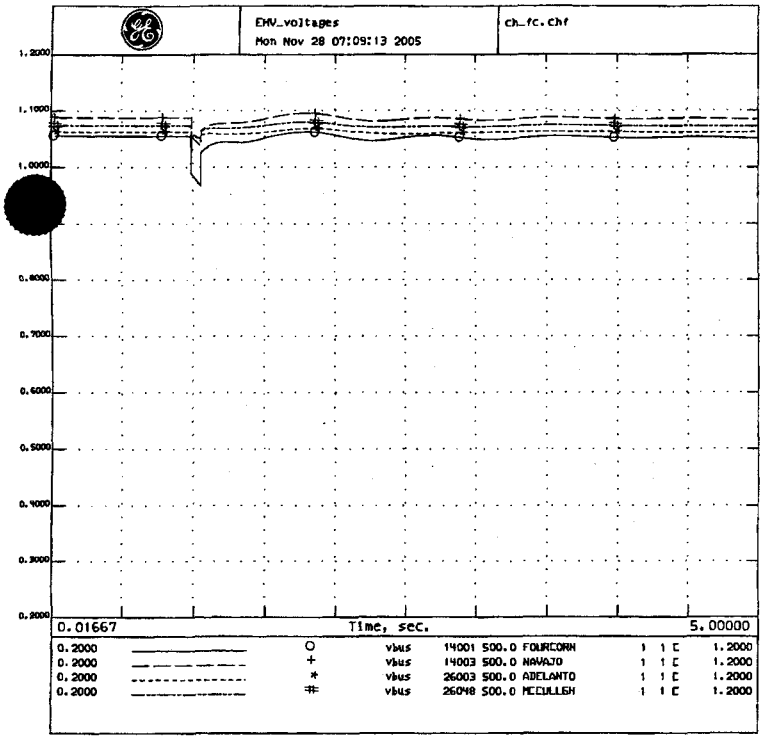
ARLINGTON FLT ARL-TS5 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-TS5 STAB; 01/06; T=0 3P FLT ARLS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TS5;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



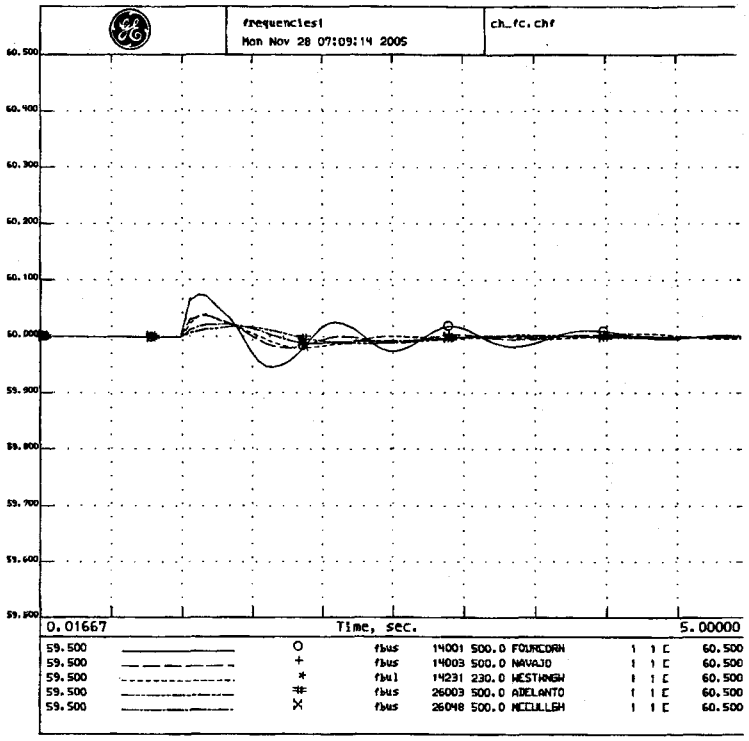
ARLINGTON FLT ARL-TS5 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
ARL-TS5 STAB; 01/06; T=0 3P FLT ARLS00;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/ARL-TS5;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



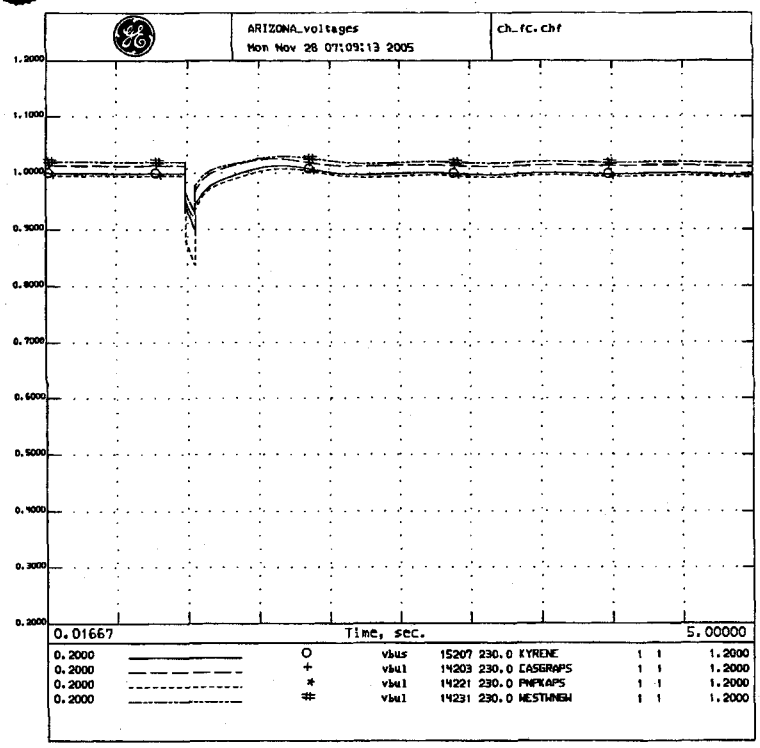
CHOLLA FLT CH-FC LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC e1;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



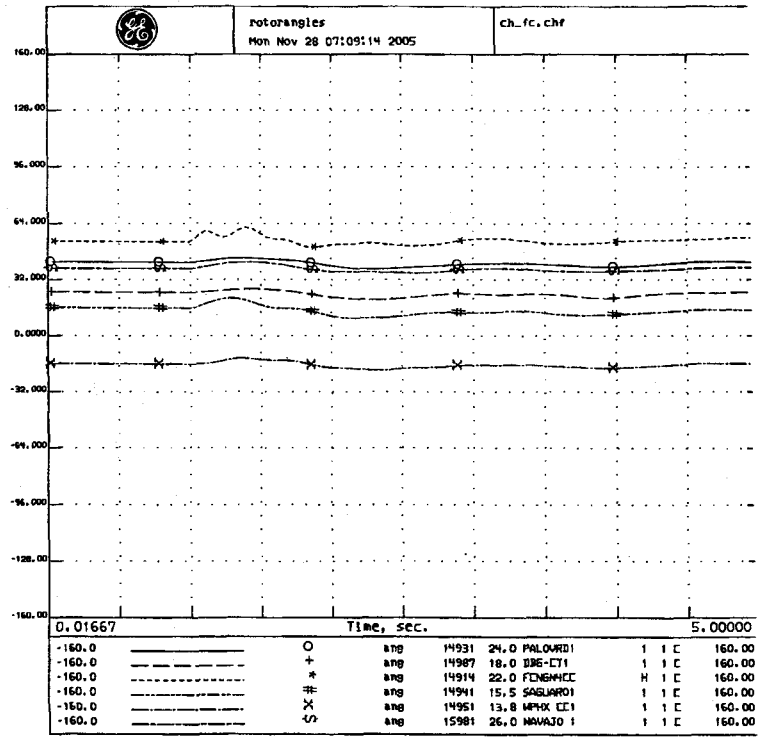
CHOLLA FLT CH-FC LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC e1;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



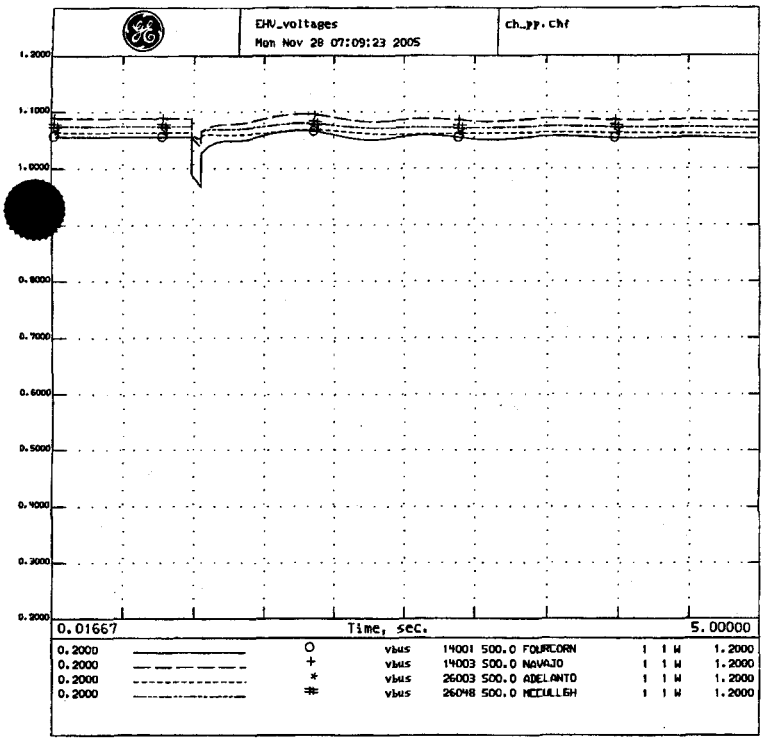
CHOLLA FLT CH-FC LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC e1;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



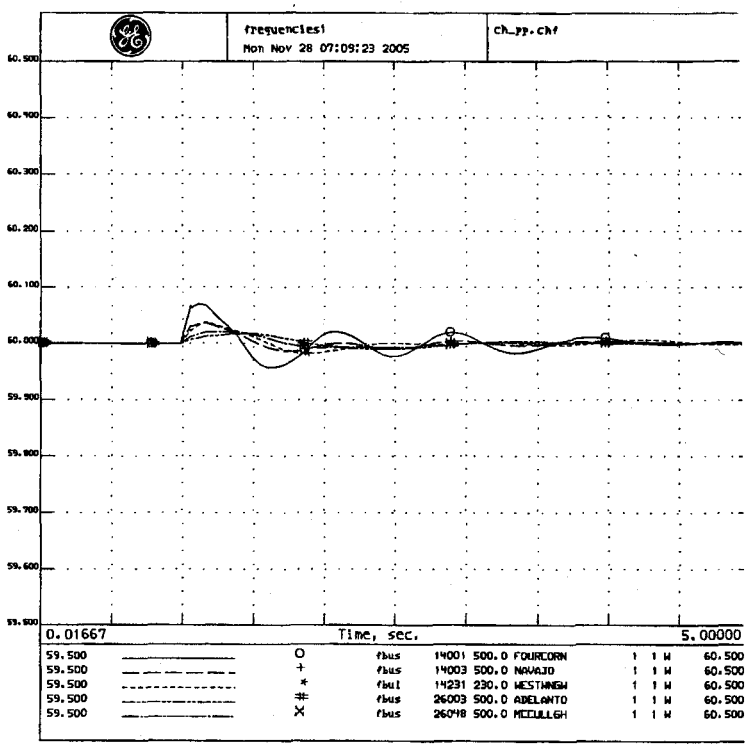
CHOLLA FLT CH-FC LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-FC STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-FC e1;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



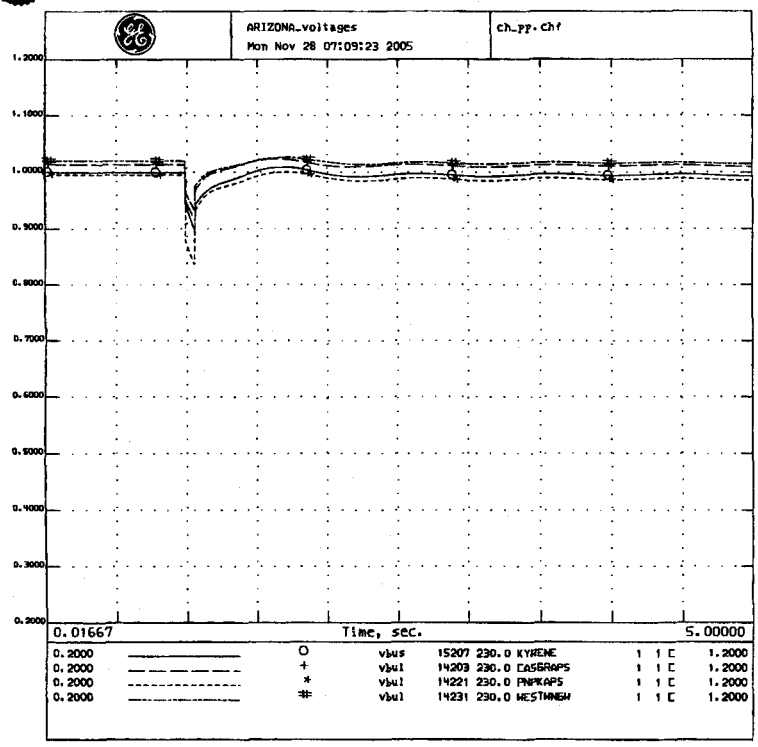
CHOLLA FLT CH-PP LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



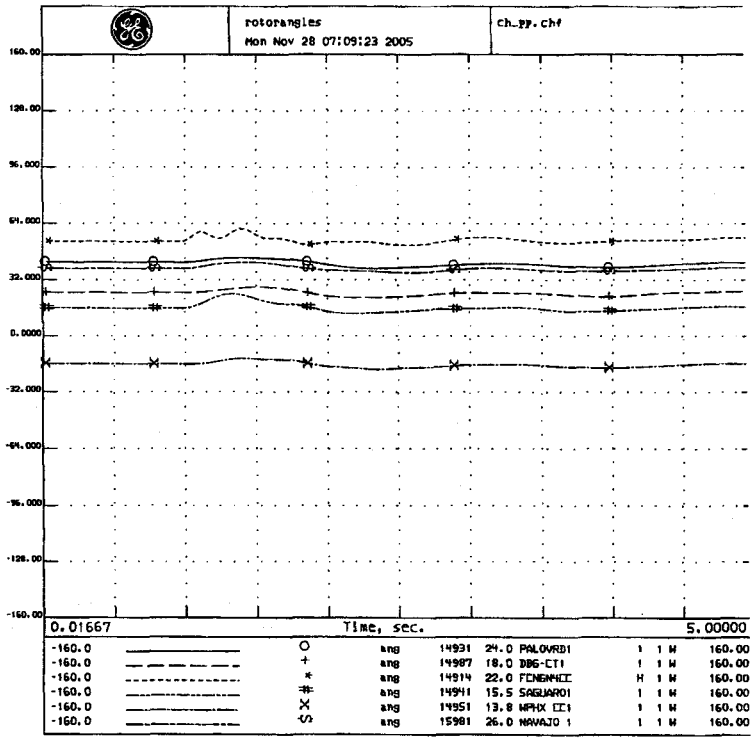
CHOLLA FLT CH-PP LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



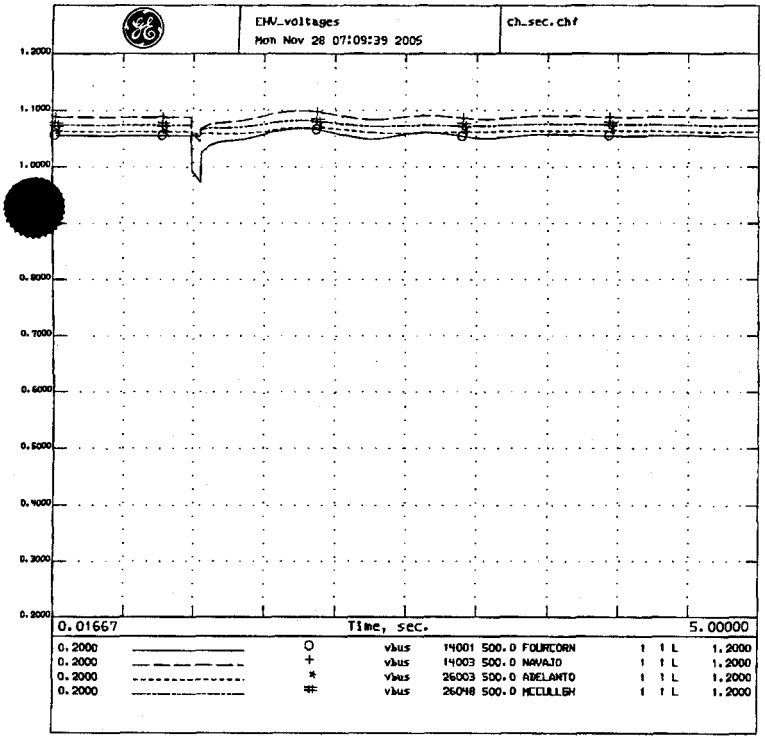
CHOLLA FLT CH-PP LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



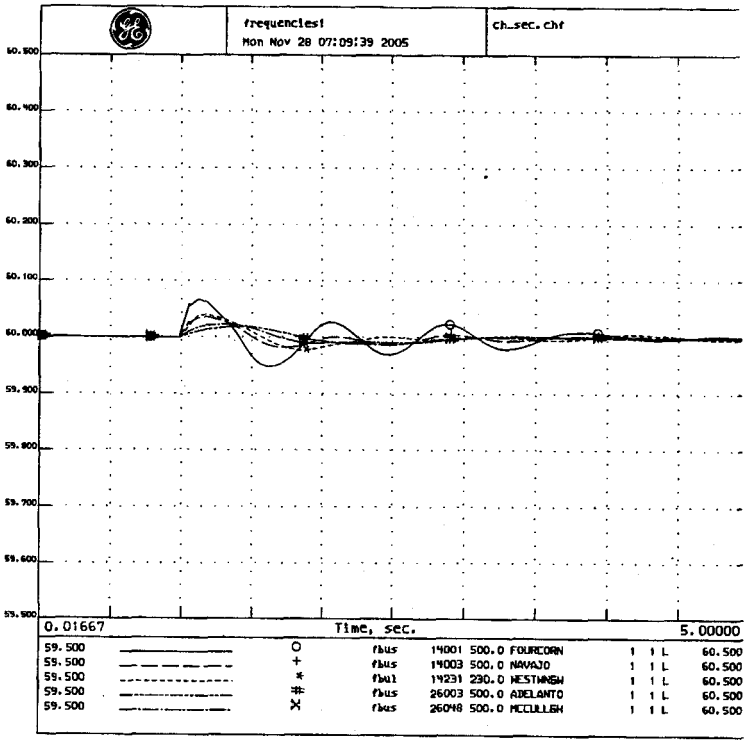
CHOLLA FLT CH-PP LINE OUT!
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-PP STAB; 01/06; T=0 3P FLT CH345;FLSH FC-CH CAPS;
4C CLR FLT W/CH-PP #1;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



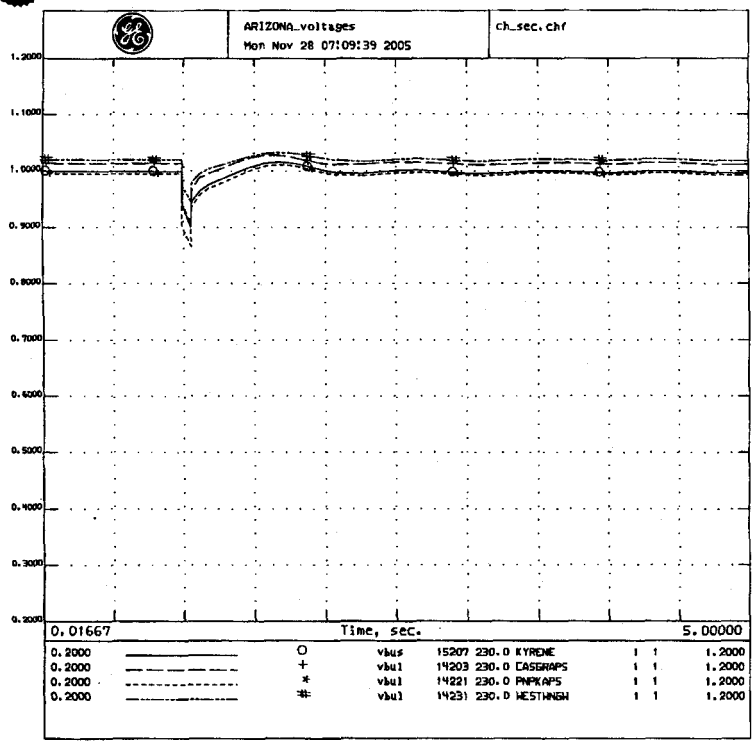
CHOLLA 500KV FLT CH-SEC LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SEC STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SEC;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



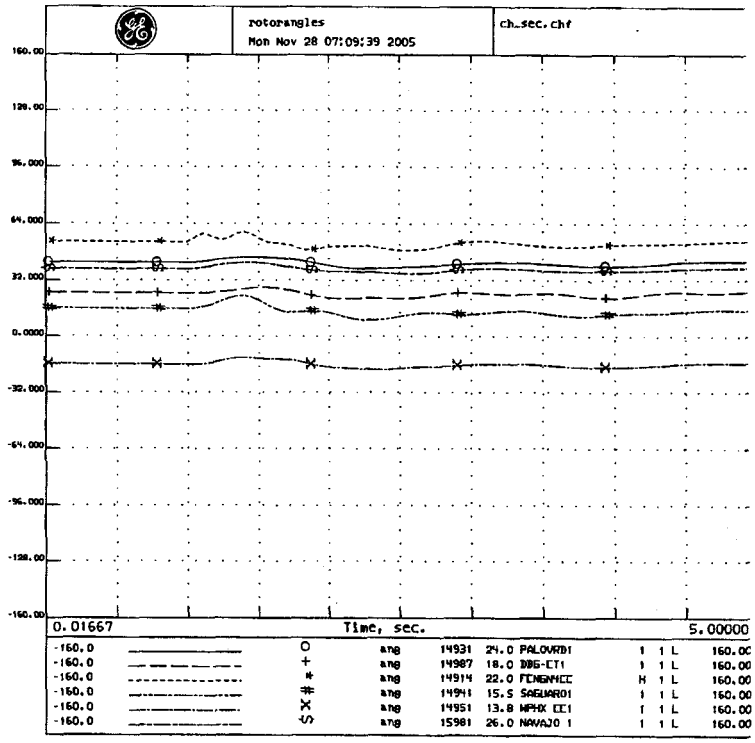
CHOLLA 500KV FLT CH-SEC LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SEC STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SEC;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



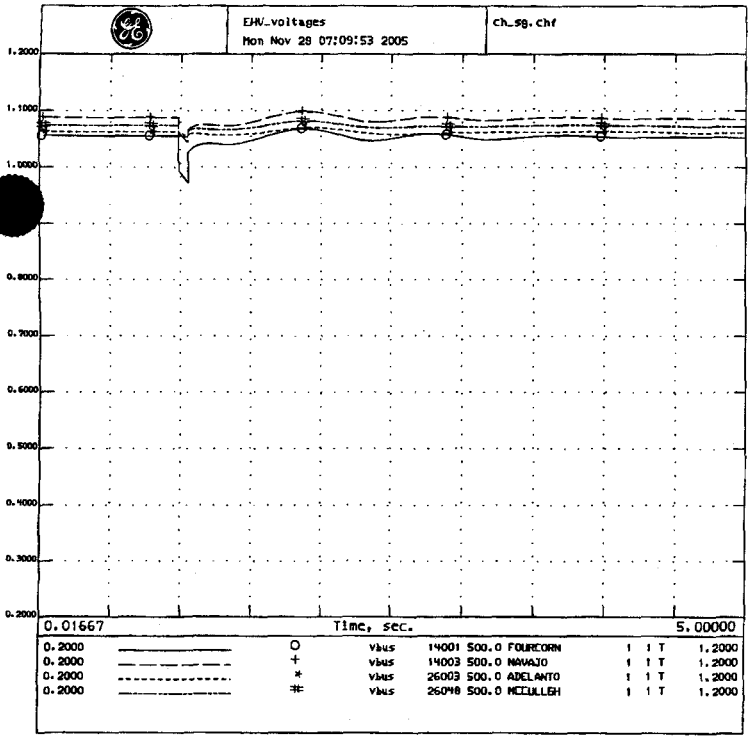
CHOLLA 500KV FLT CH-SEC LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SEC STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SEC;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



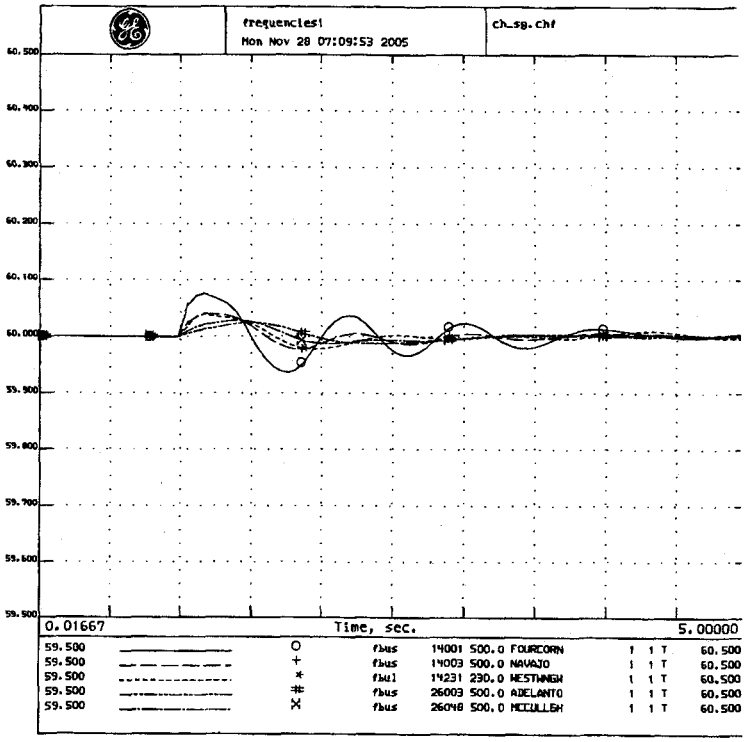
CHOLLA 500KV FLT CH-SEC LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SEC STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SEC;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



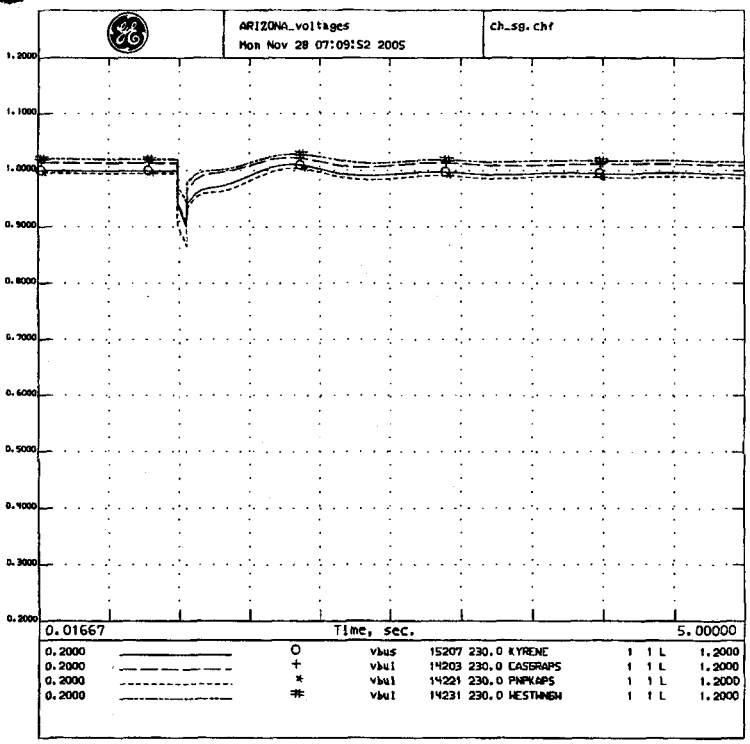
CHOLLA 500KV FLT CH-SG LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



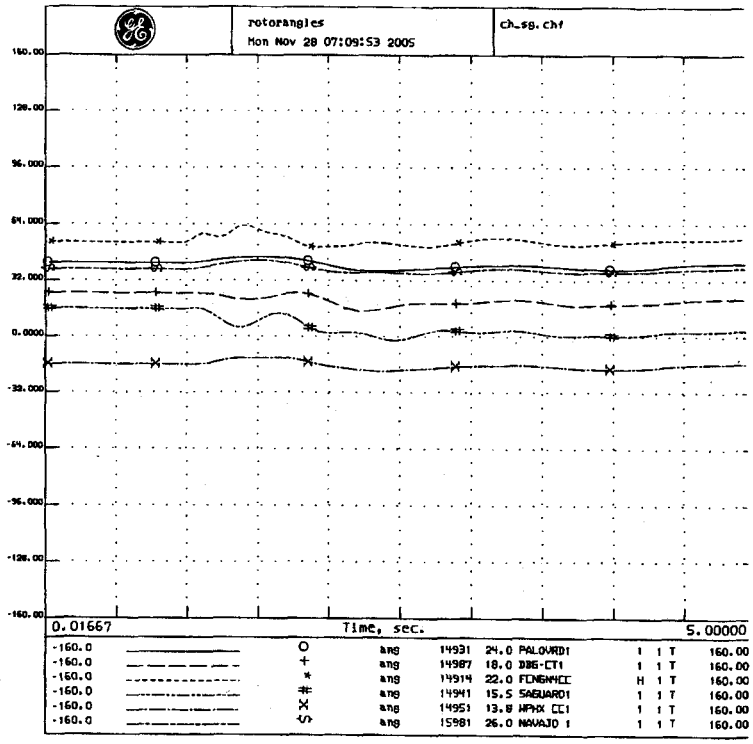
CHOLLA 500KV FLT CH-SG LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



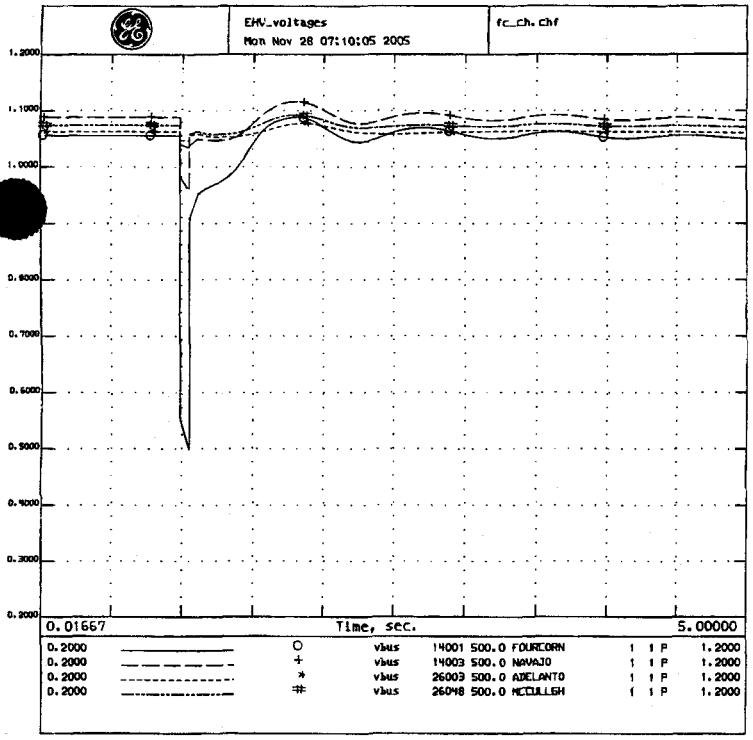
CHOLLA 500KV FLT CH-SG LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



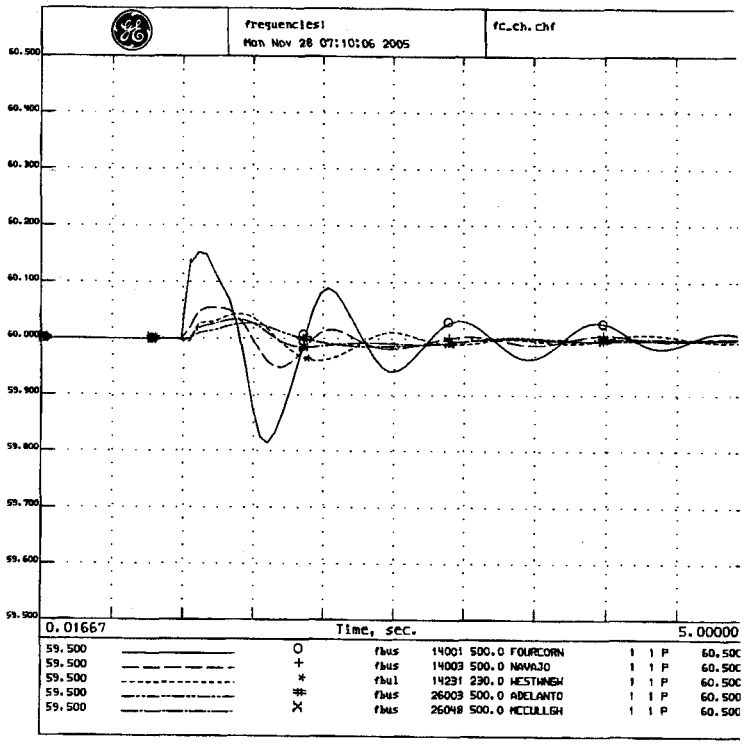
CHOLLA 500KV FLT CH-SG LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
CH-SG STAB; 1/06; T=0 3P FLT CH500;4C CLR FLT
W/CH-SG;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



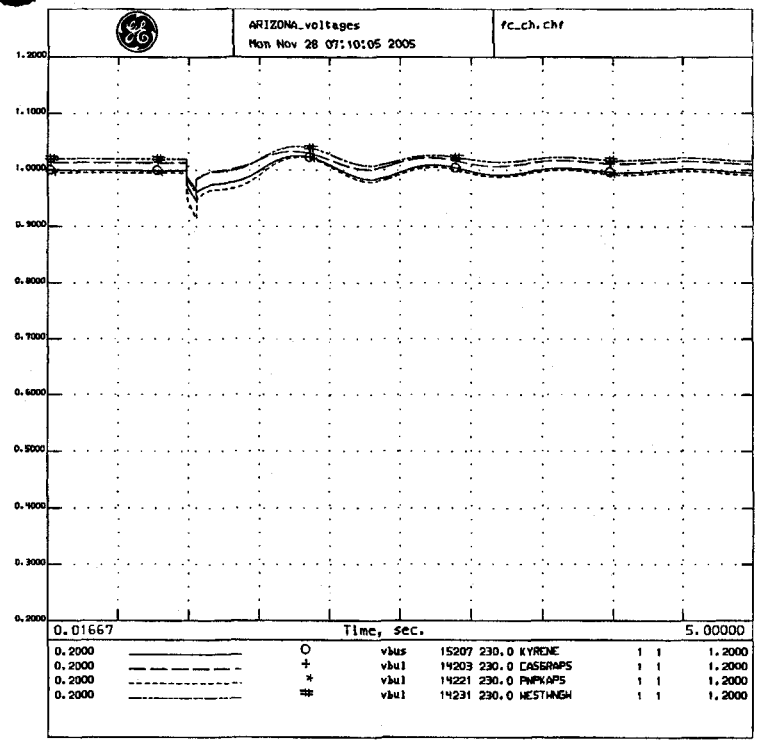
FOUR CORNERS fault w/FC-CH line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



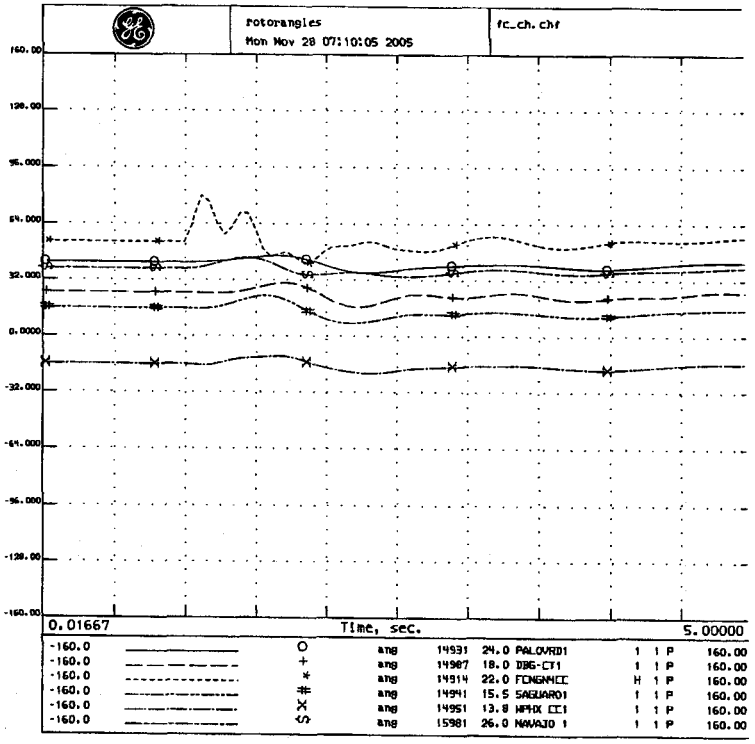
FOUR CORNERS fault w/FC-CH line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



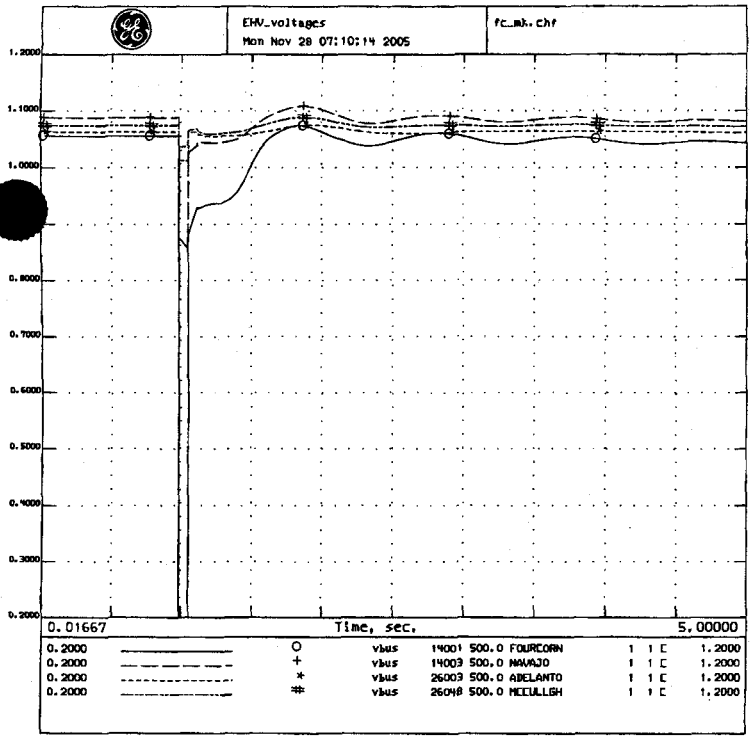
FOUR CORNERS fault w/FC-CH line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



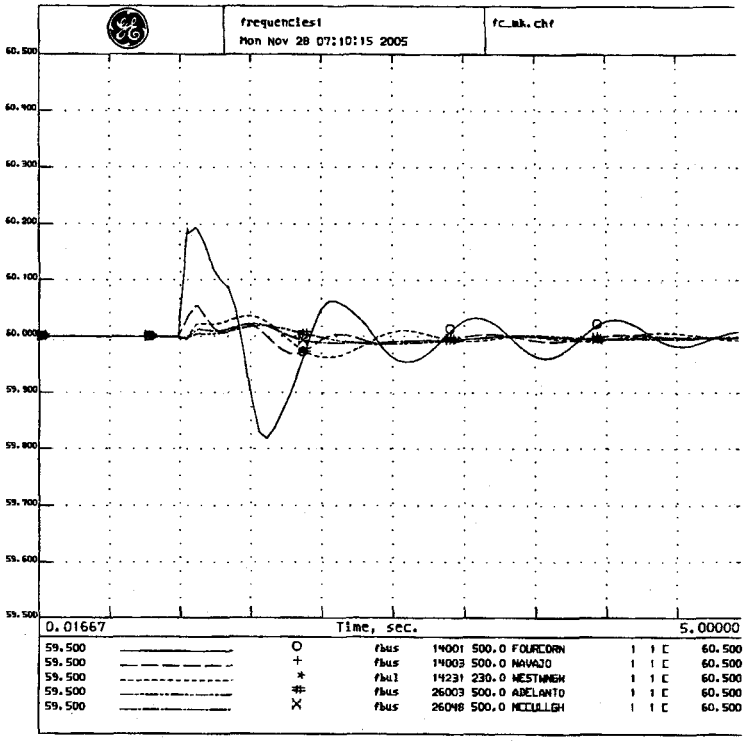
FOUR CORNERS fault w/FC-CH line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-CH STAB; 1/06; T=0 3P FLT FC345;10% FLT DMPING;FLSH
CAPS FC-CH;4C CLR FLT W/FC-CH #1; 8C REIN CAPS;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



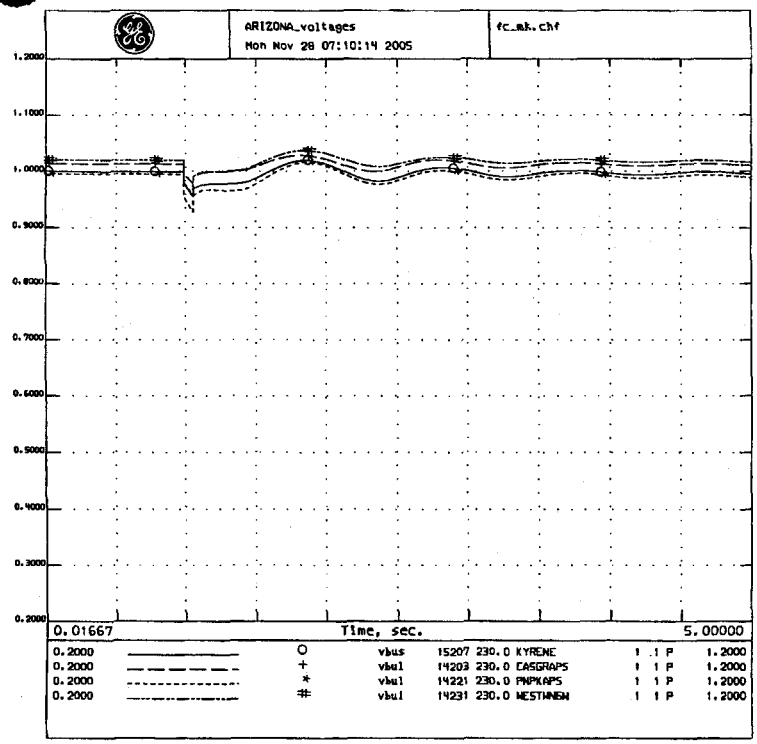
FOUR CORNERS FLT500 FC-MK out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-MK STAB; 1/06; T=0 3P FLT FCS00;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



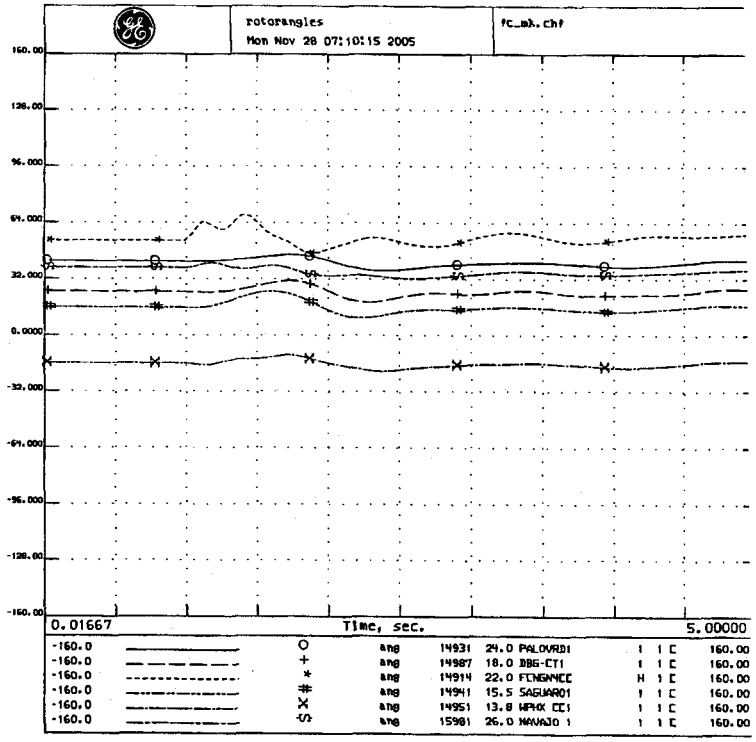
FOUR CORNERS FLT500 FC-MK out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-MK STAB; 1/06; T=0 3P FLT FCS00;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



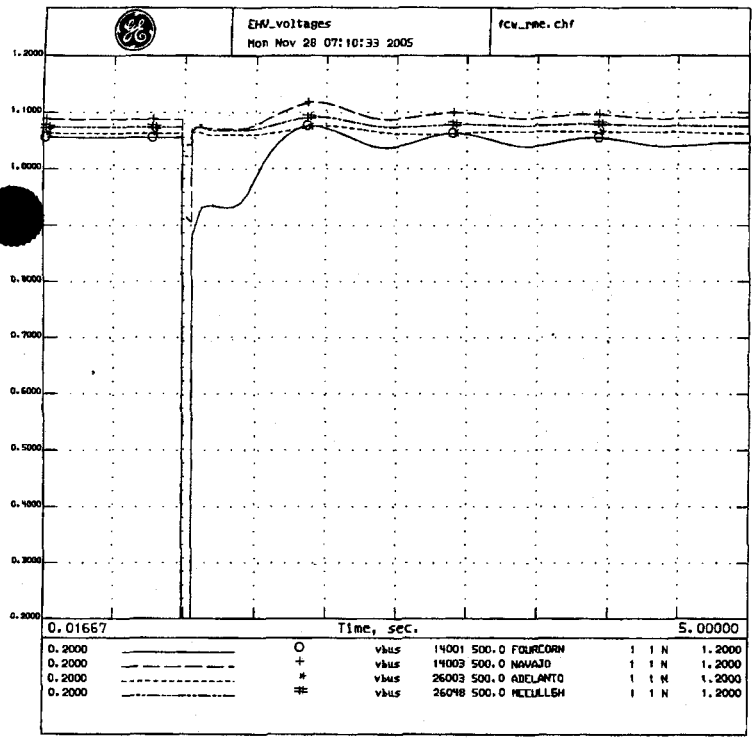
FOUR CORNERS FLT500 FC-MK out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-MK STAB; 1/06; T=0 3P FLT FCS00;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



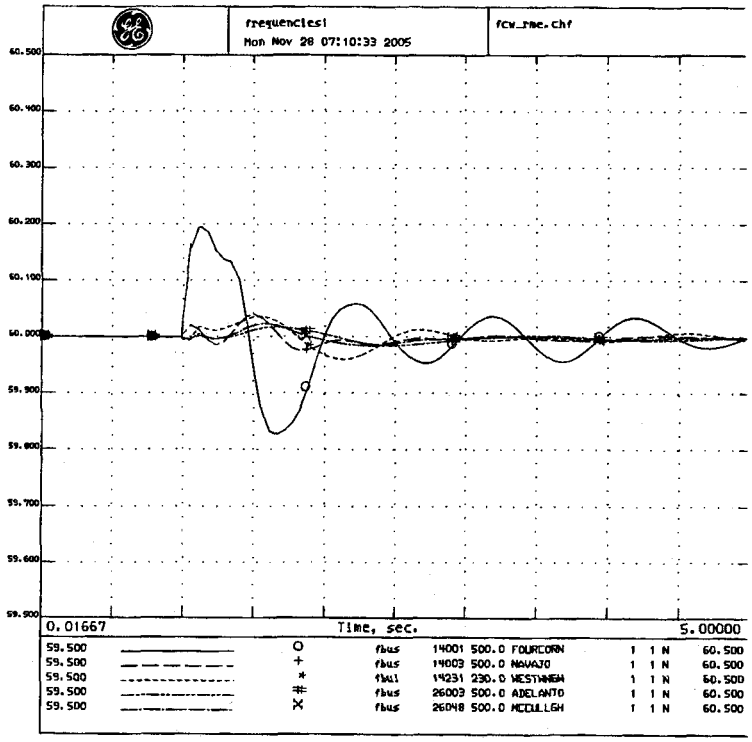
FOUR CORNERS FLT500 FC-MK out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FC-MK STAB; 1/06; T=0 3P FLT FCS00;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FC-MK;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



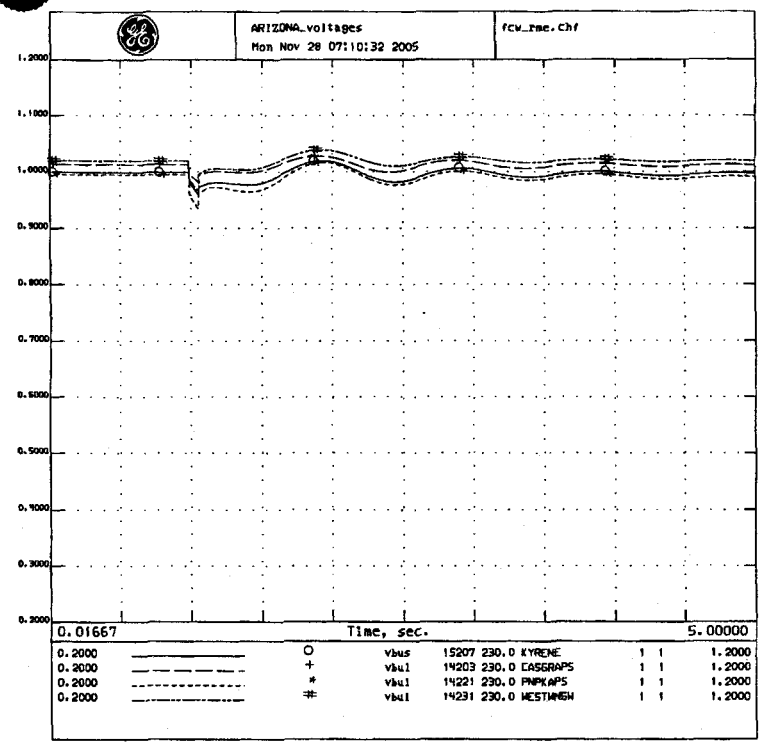
FOUR CORNERS FLT500 FCW-RME out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FCW-RME STAB; 1/06; T=0 3P FLT FCW500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FCW-RME;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



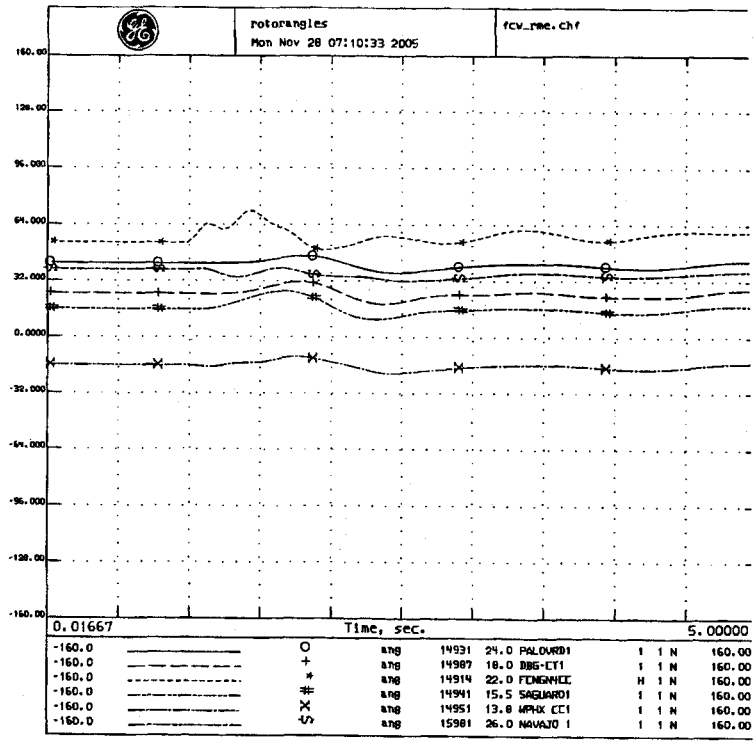
FOUR CORNERS FLT500 FCW-RME out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FCW-RME STAB; 1/06; T=0 3P FLT FCW500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FCW-RME;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



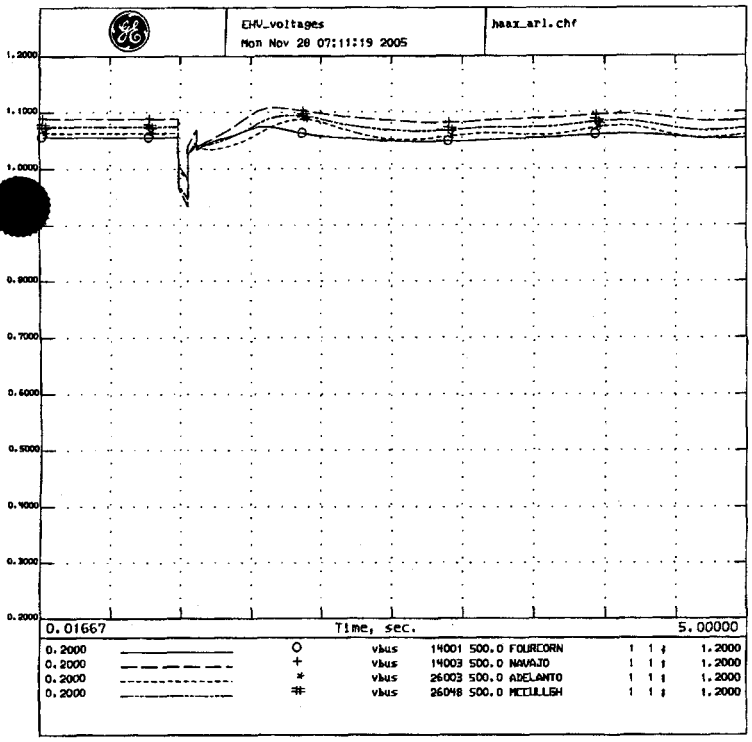
FOUR CORNERS FLT500 FCW-RME out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FCW-RME STAB; 1/06; T=0 3P FLT FCW500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FCW-RME;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



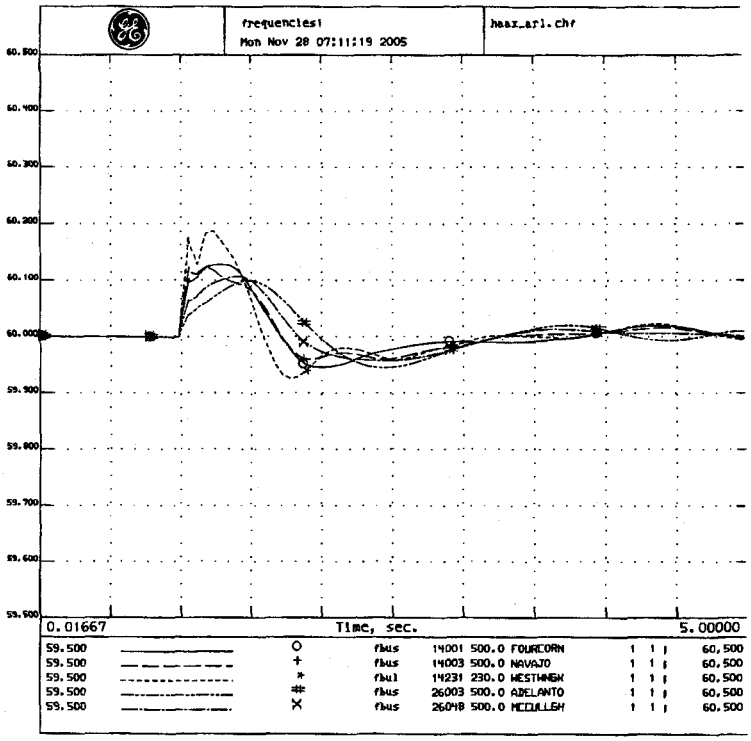
FOUR CORNERS FLT500 FCW-RME out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
FCW-RME STAB; 1/06; T=0 3P FLT FCW500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/FCW-RME;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



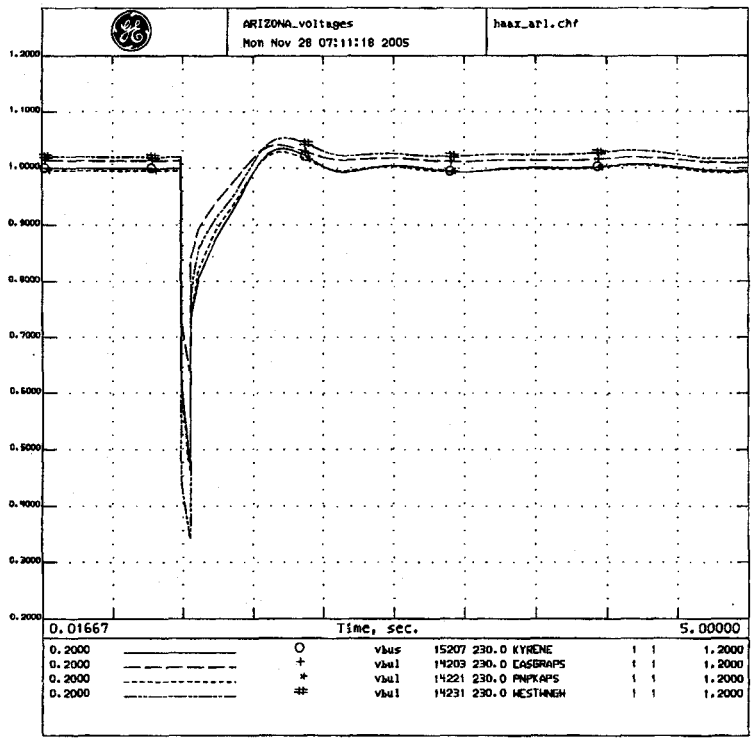
HASSAYAMPA FLT HAAX-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



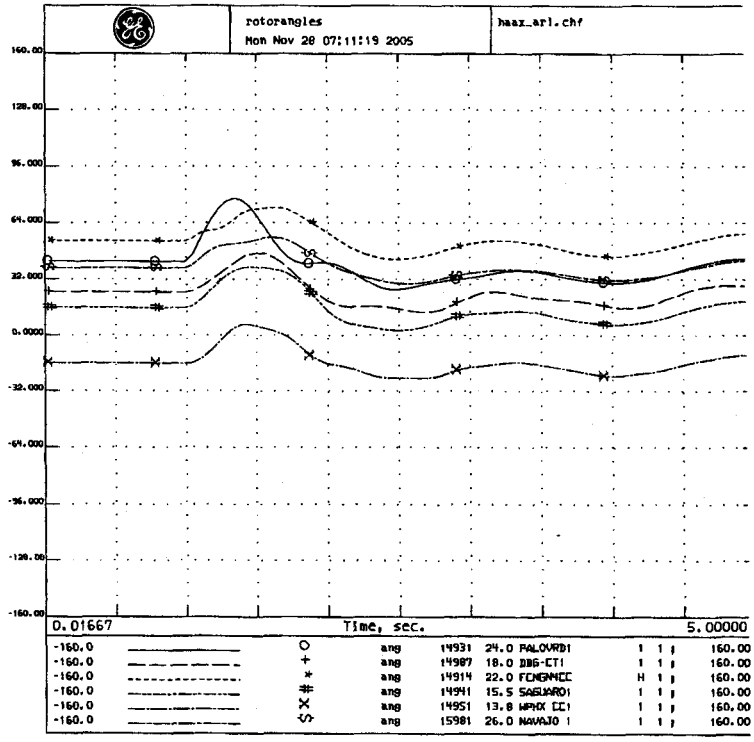
HASSAYAMPA FLT HAAX-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



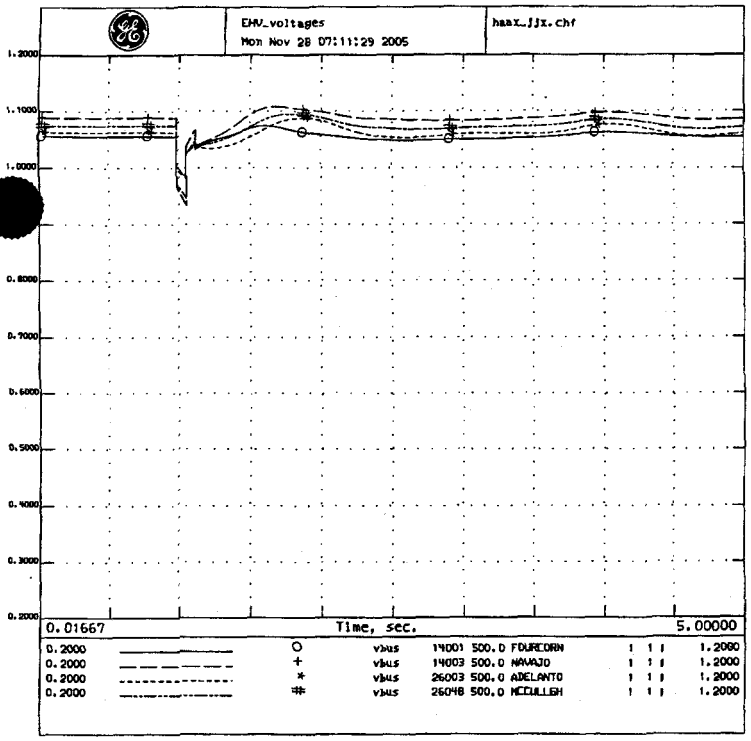
HASSAYAMPA FLT HAAX-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



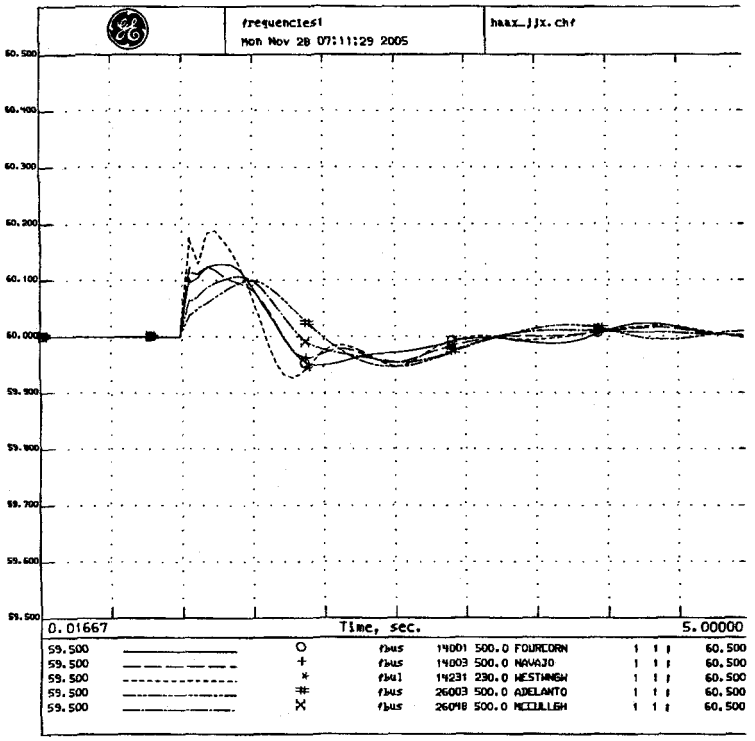
HASSAYAMPA FLT HAAX-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-ARL STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



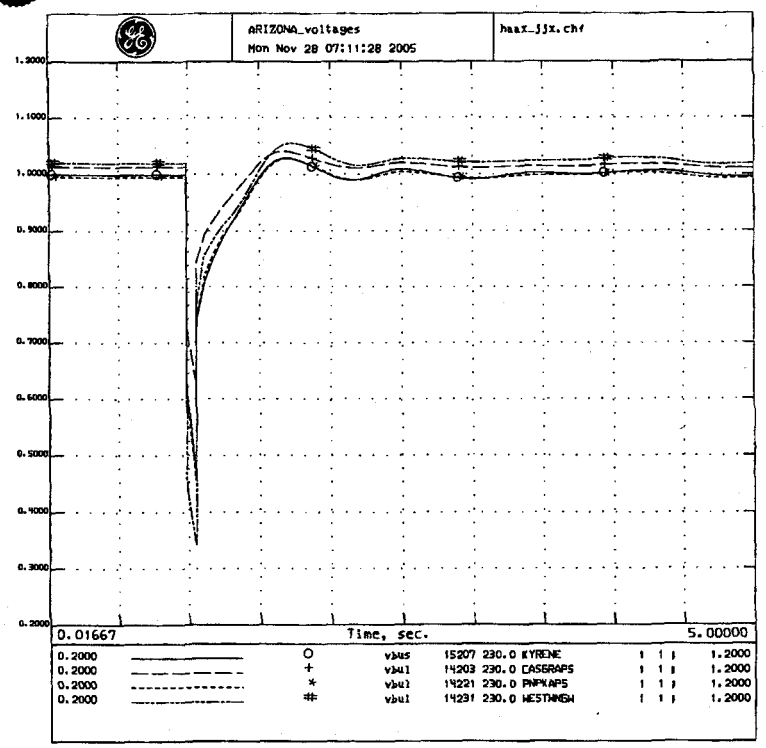
HASSAYAMPA FLT HAAX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



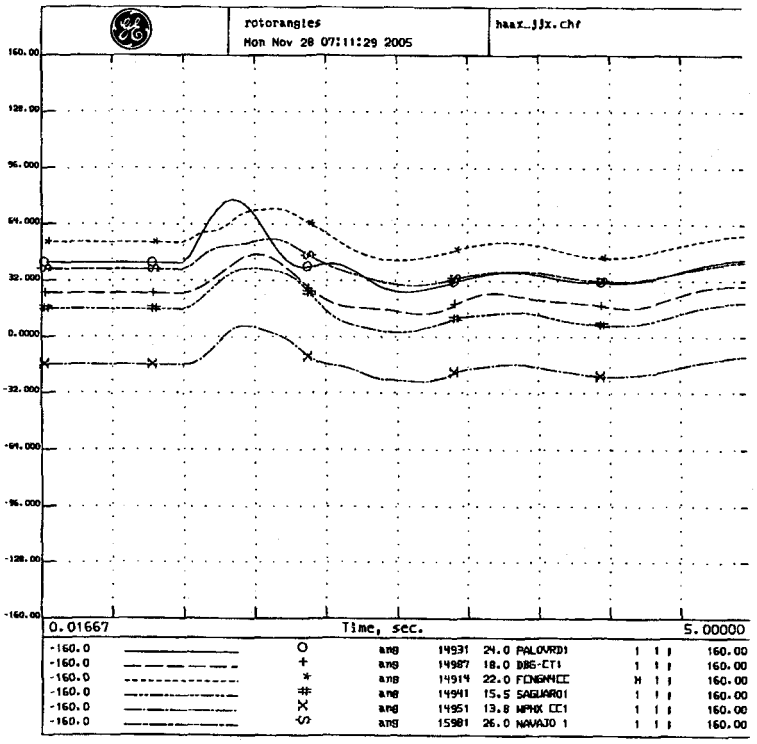
HASSAYAMPA FLT HAAX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



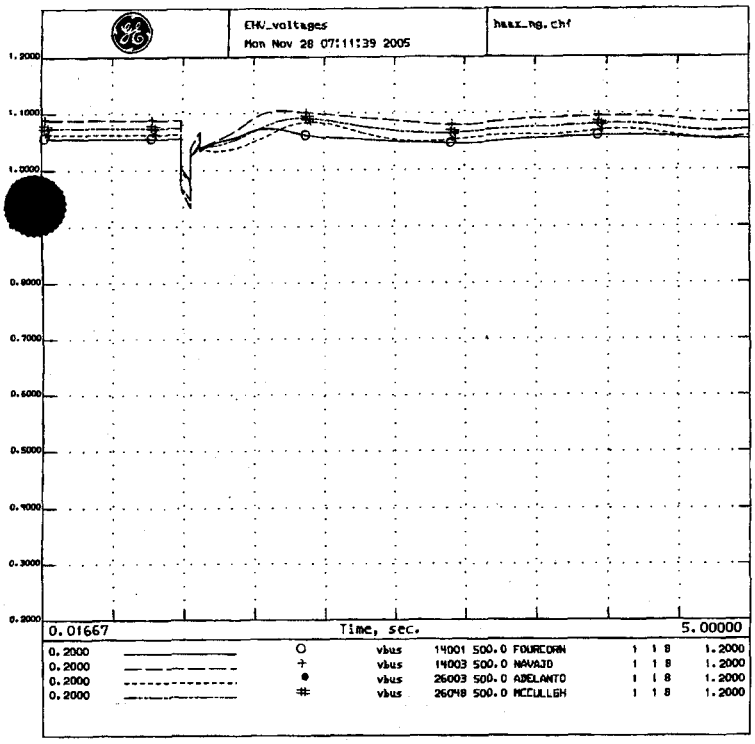
HASSAYAMPA FLT HAAX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



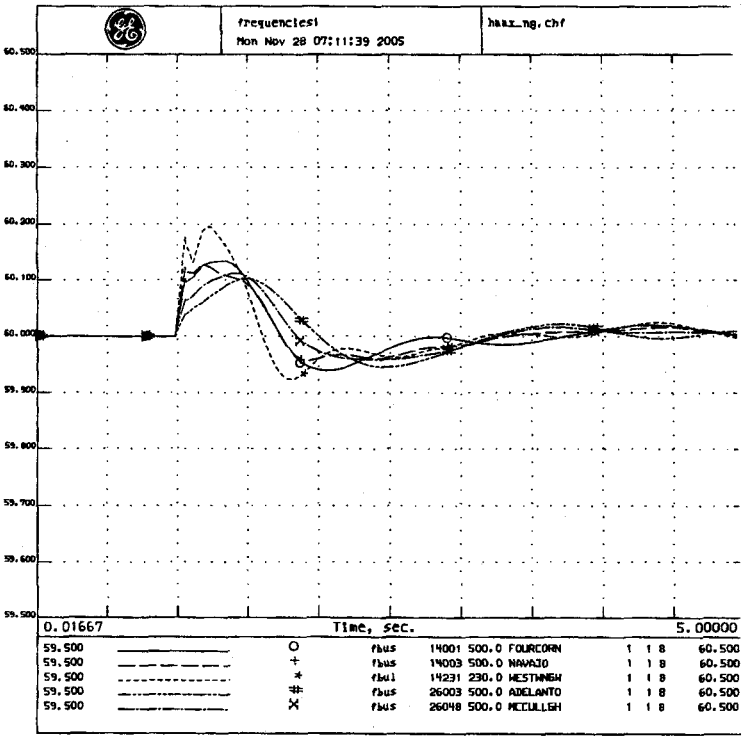
HASSAYAMPA FLT HAAX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-JJX STAB; 01/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



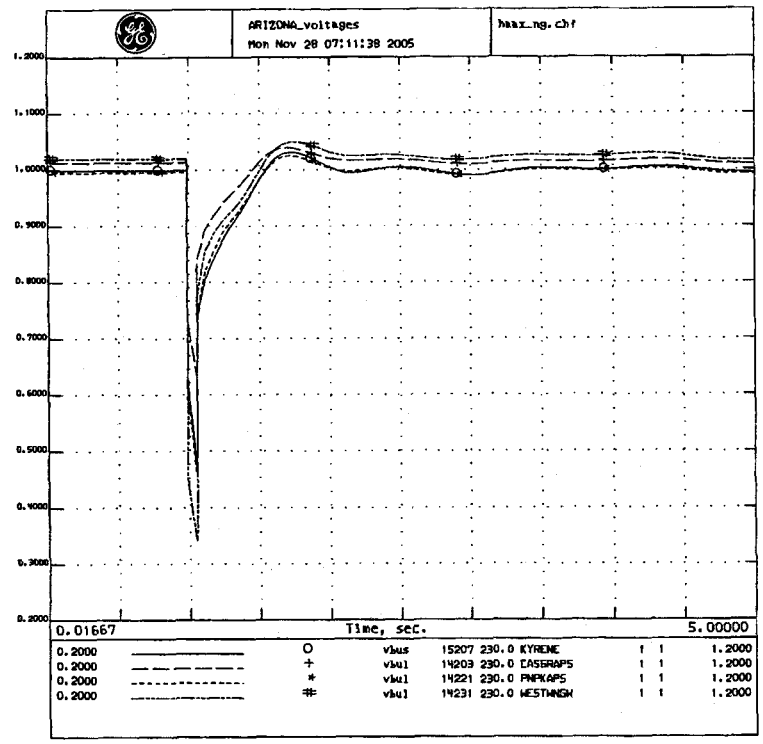
HASSAYAMPA FLT. w/HAAX-NG line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



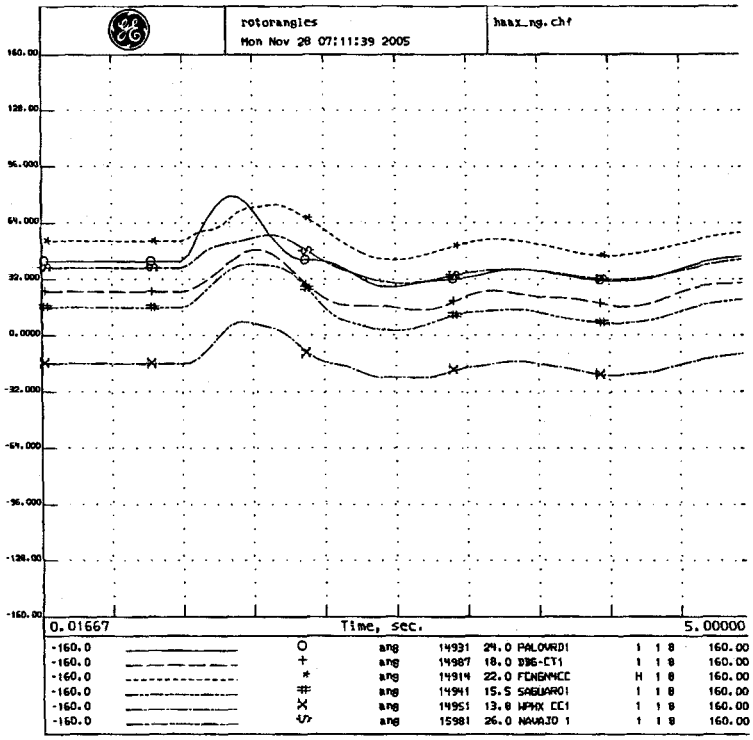
HASSAYAMPA FLT. w/HAAX-NG line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



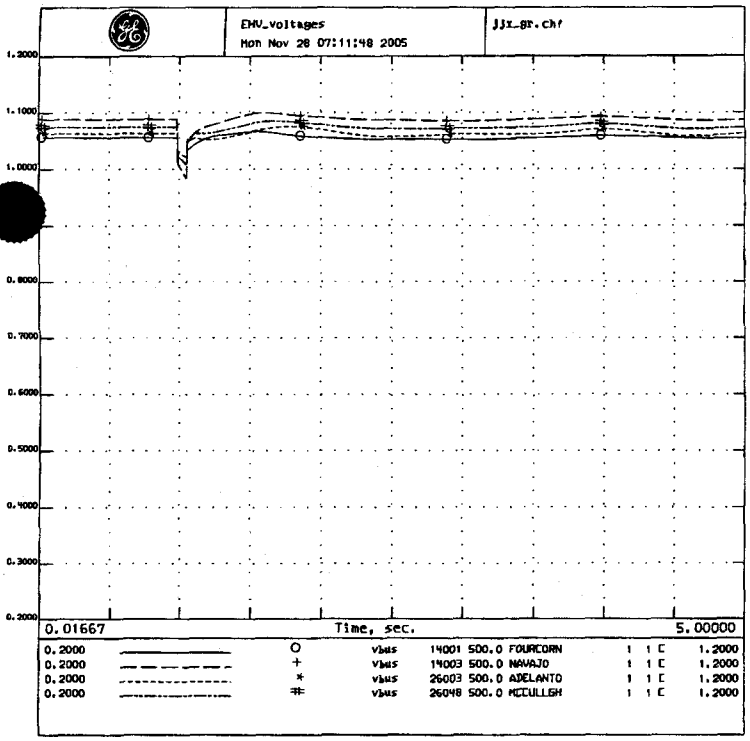
HASSAYAMPA FLT. w/HAAX-NG line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



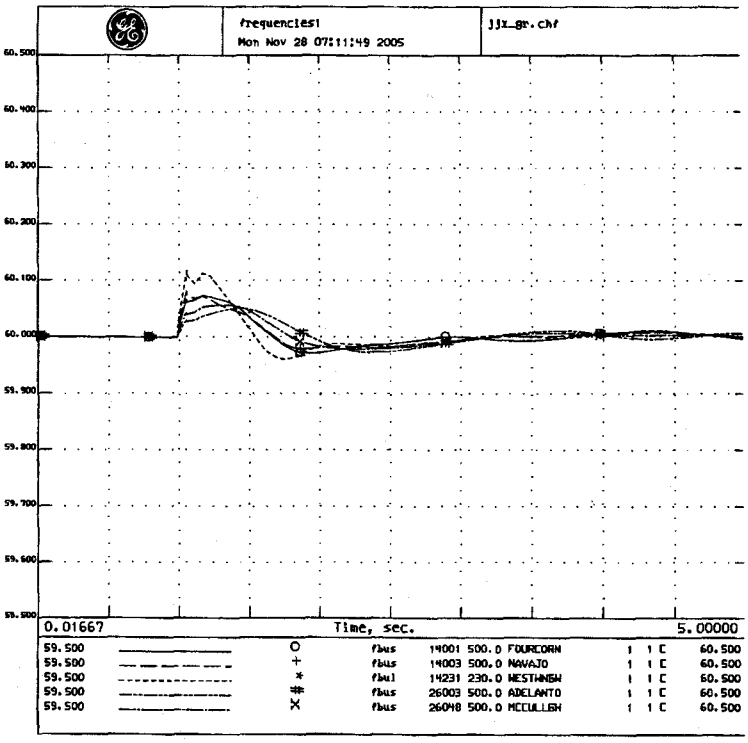
HASSAYAMPA FLT. w/HAAX-NG line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
HAAX-NG STAB; 1/06; T=0 3P FLT HAAX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-NG;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



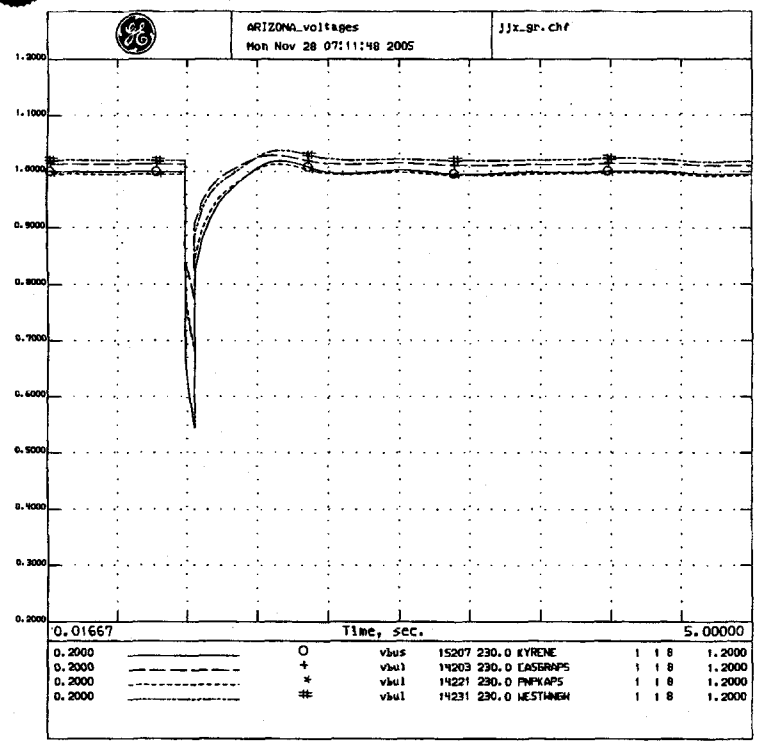
JOJOBA FLT JJX-GR LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-GR;8C REIN;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



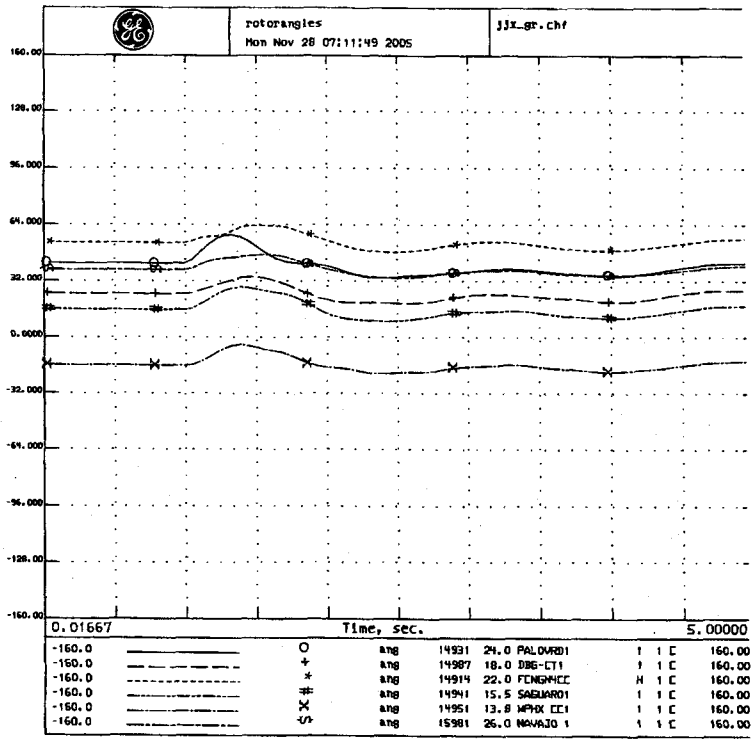
JOJOBA FLT JJX-GR LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-GR;8C REIN;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



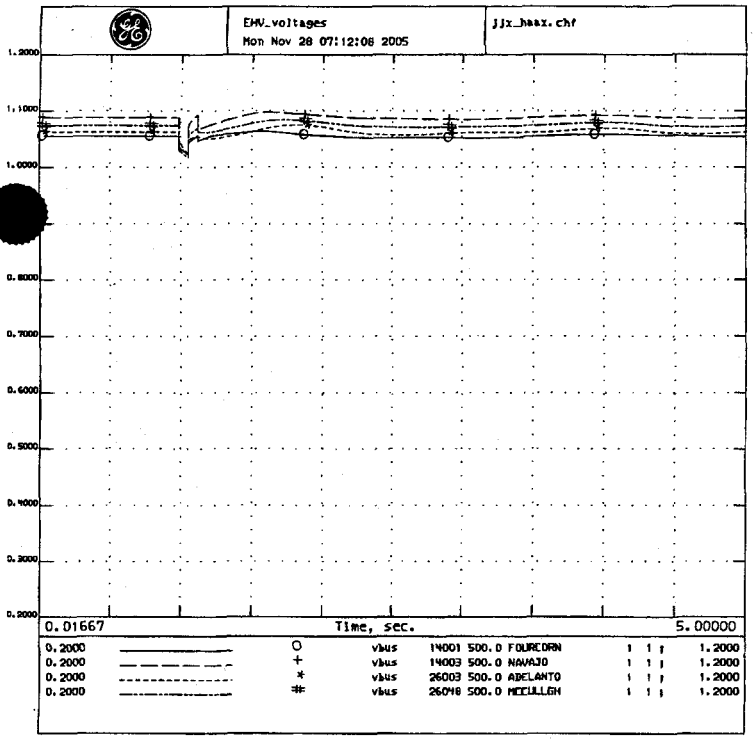
JOJOBA FLT JJX-GR LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-GR;8C REIN;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



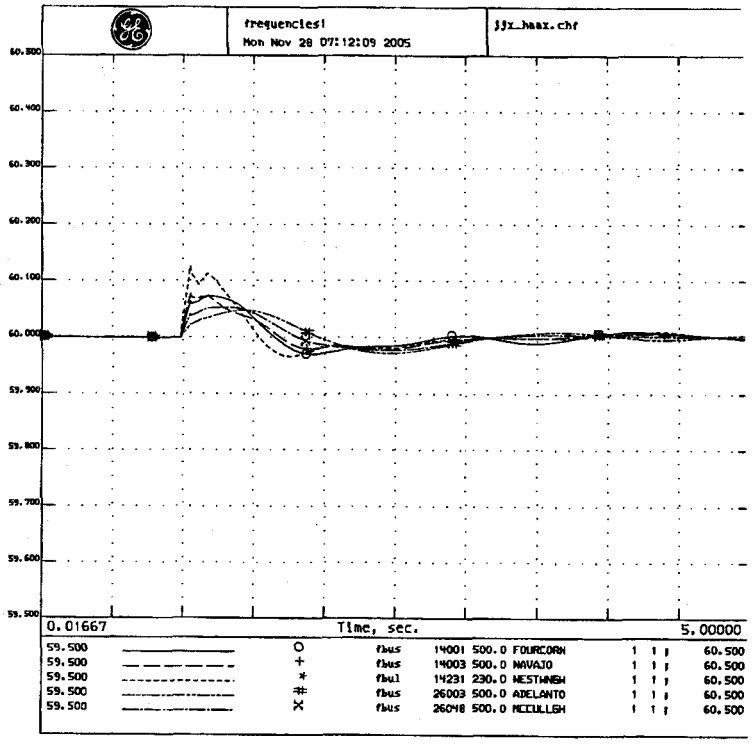
JOJOBA FLT JJX-GR LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-GR STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-GR;8C REIN;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



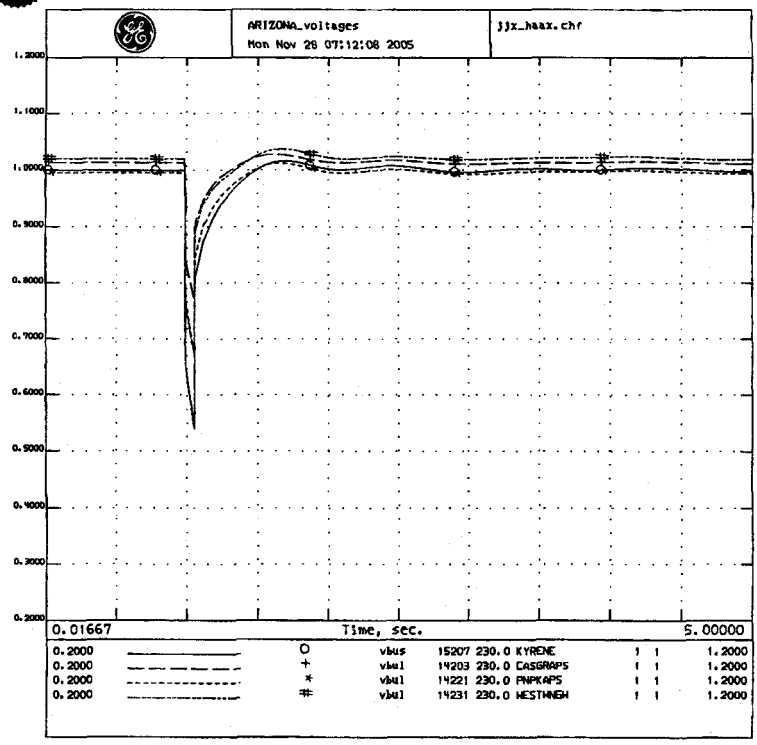
JOJOBA FLT JJX-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-HAAX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



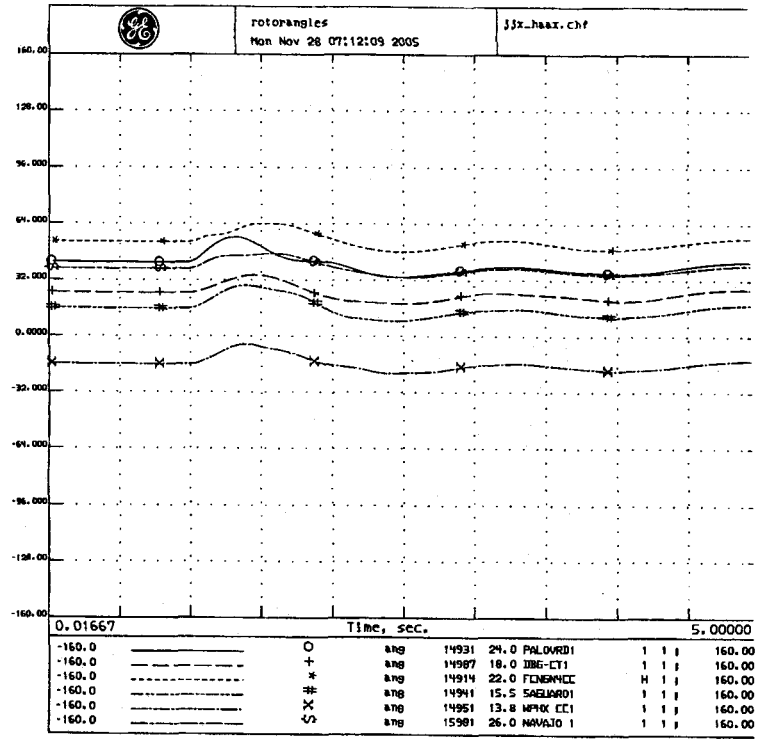
JOJOBA FLT JJX-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-HAAX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



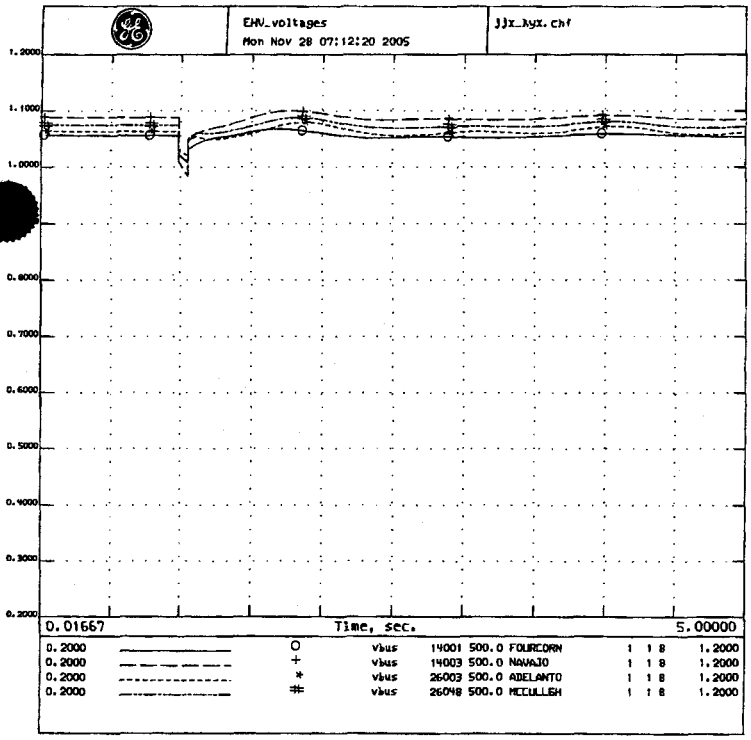
JOJOBA FLT JJX-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-HAAX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



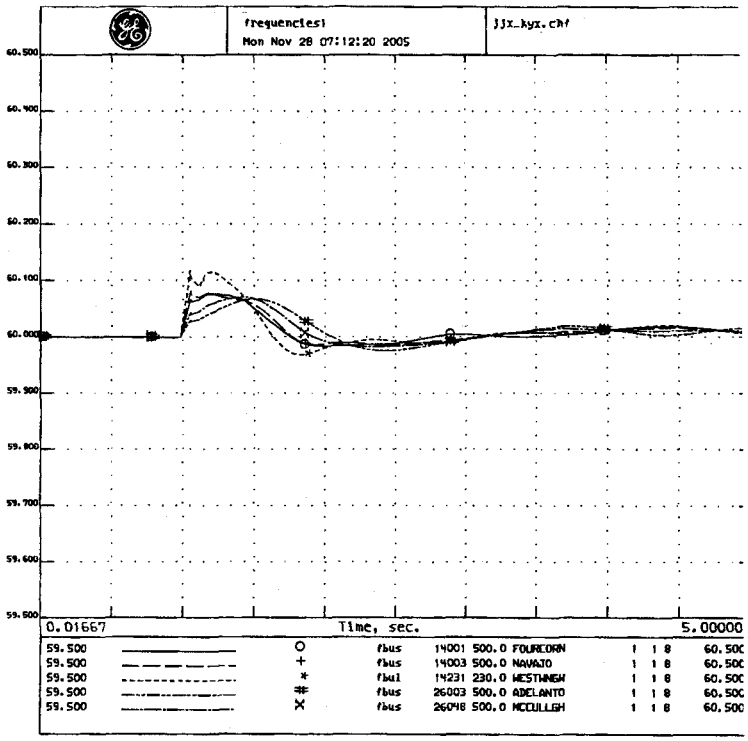
JOJOBA FLT JJX-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-HAAX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/HAAX-JJX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



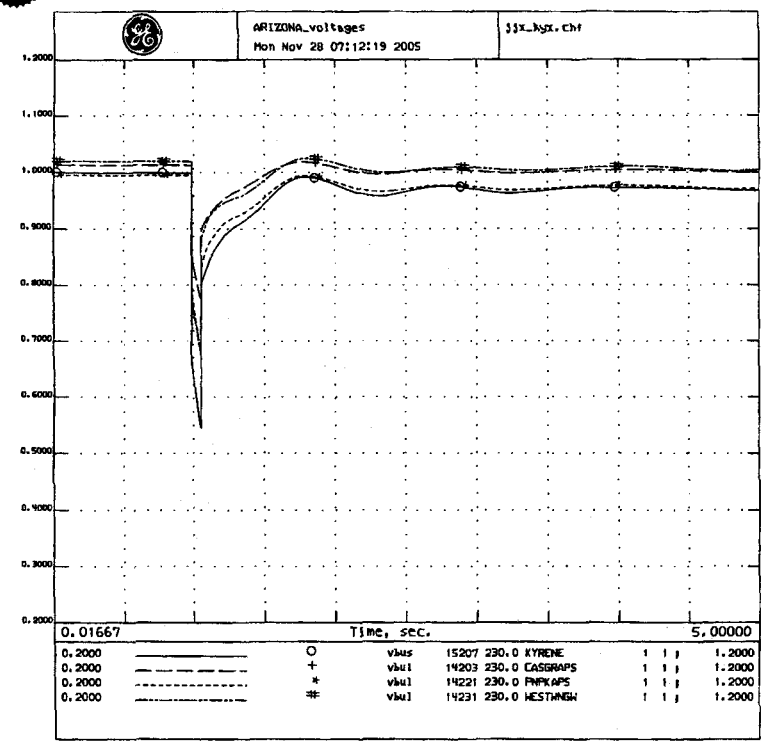
JOJOBA FLT JJX-KYX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



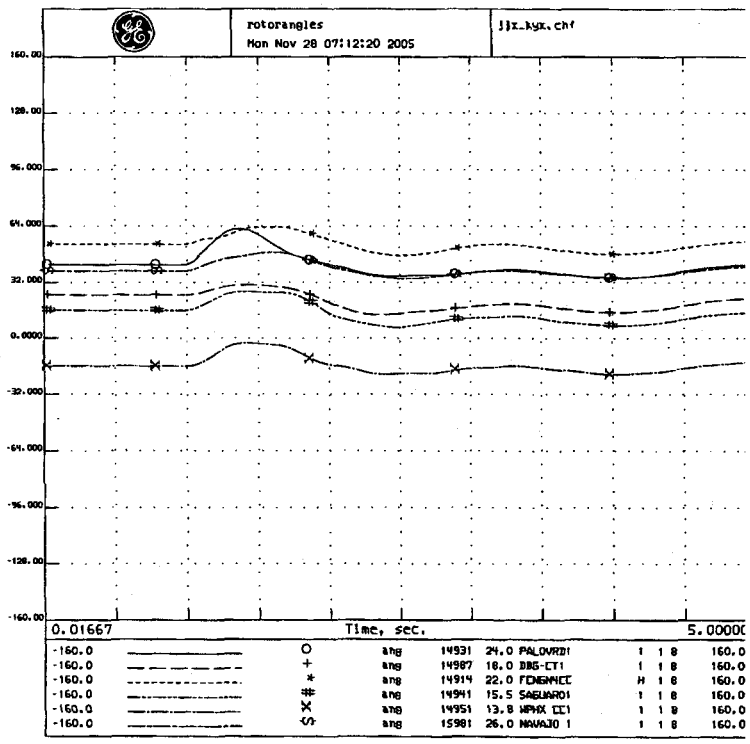
JOJOBA FLT JJX-KYX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



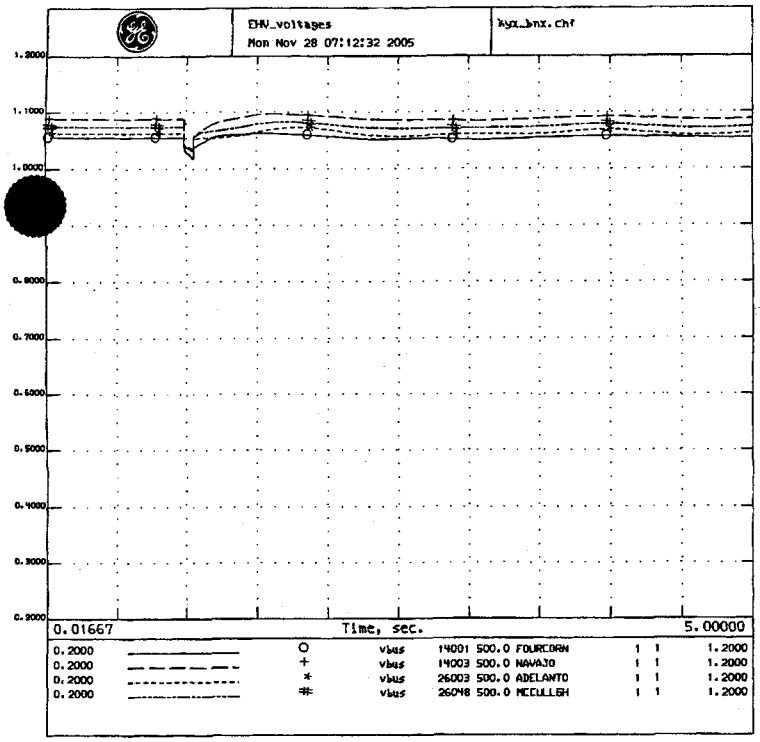
JOJOBA FLT JJX-KYX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



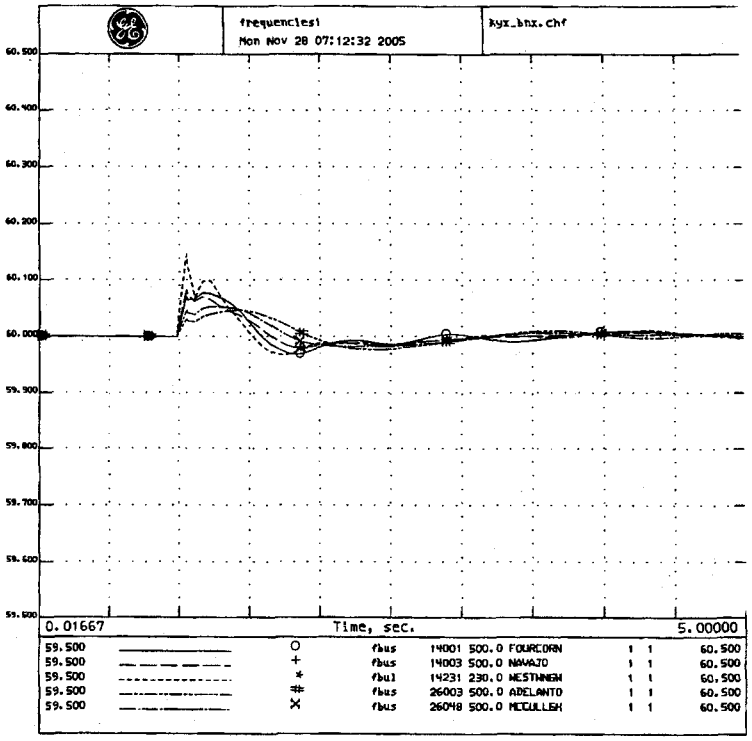
JOJOBA FLT JJX-KYX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
JJX-KYX STAB; 01/06; T=0 3P FLT JJX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/JJX-KYX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



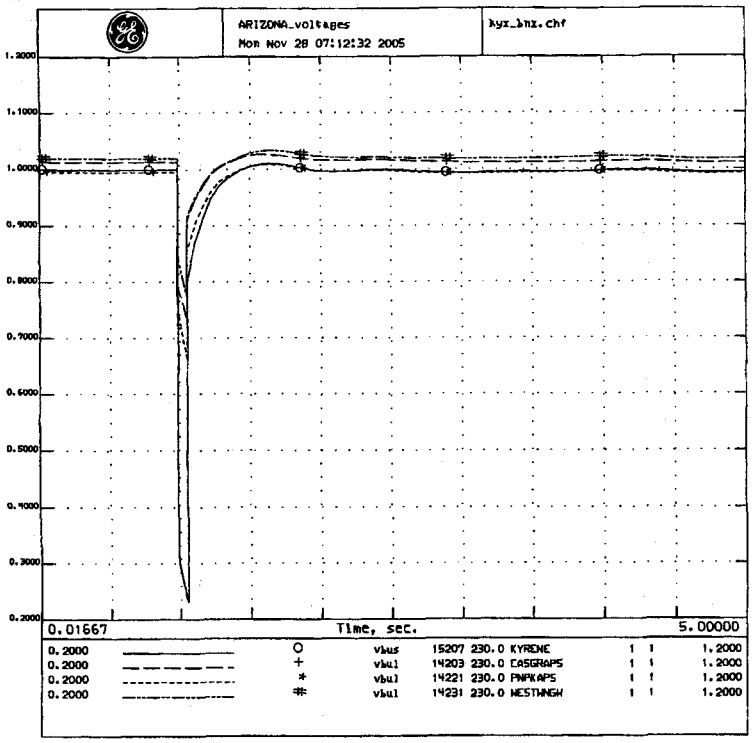
KYRENE FLT KYX-BNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-BNX STAB ●1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



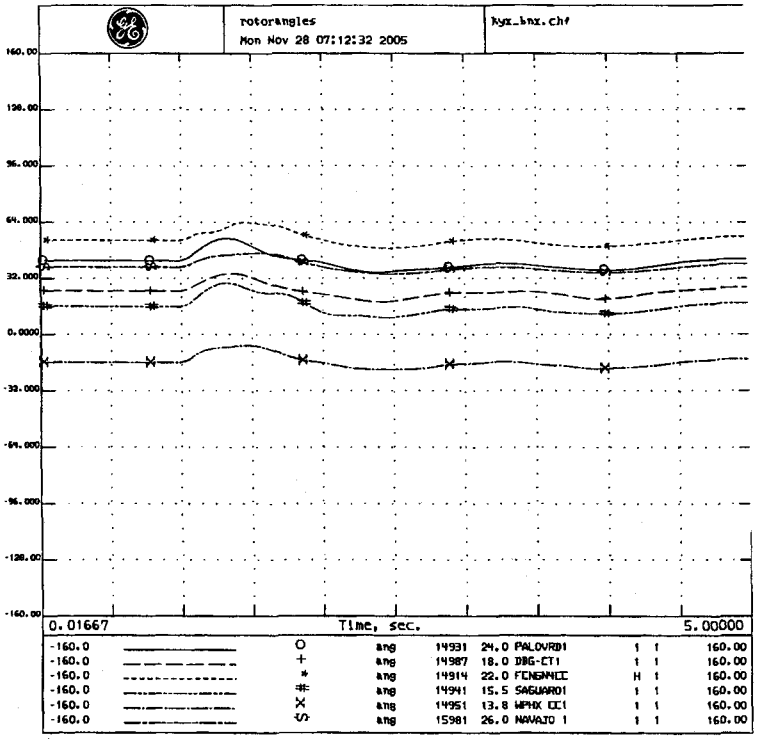
KYRENE FLT KYX-BNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-BNX STAB ●1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



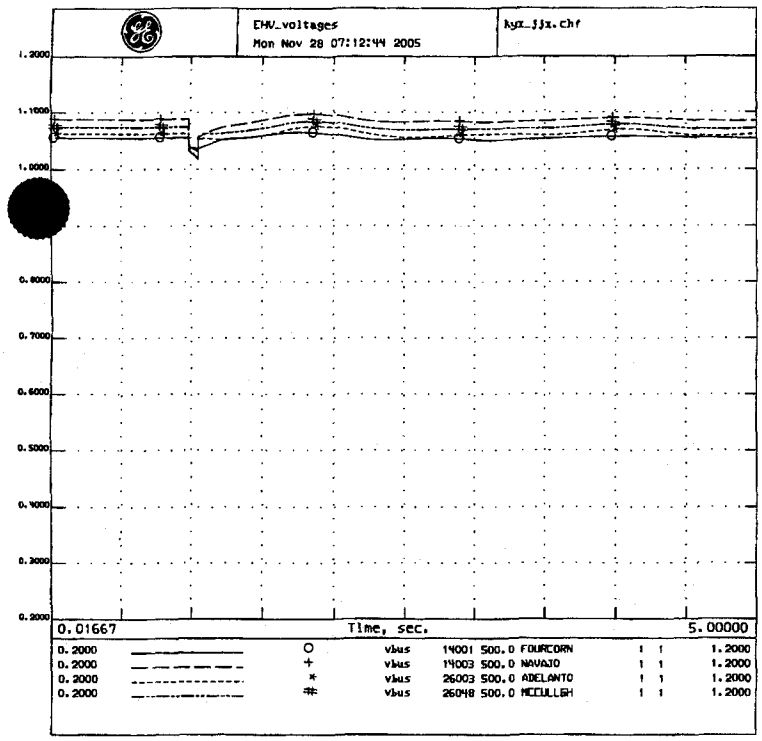
KYRENE FLT KYX-BNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-BNX STAB ●1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



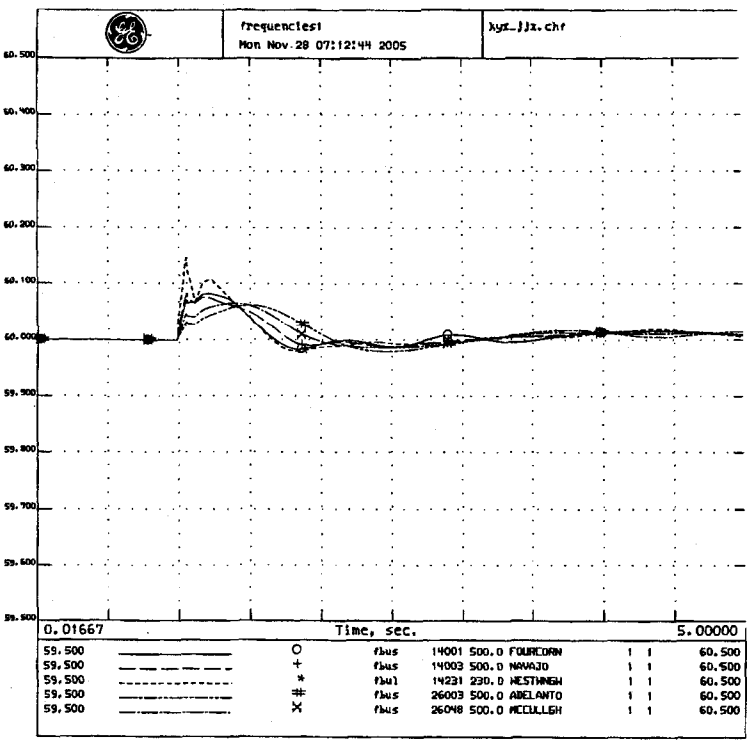
KYRENE FLT KYX-BNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-BNX STAB ●1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-BNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



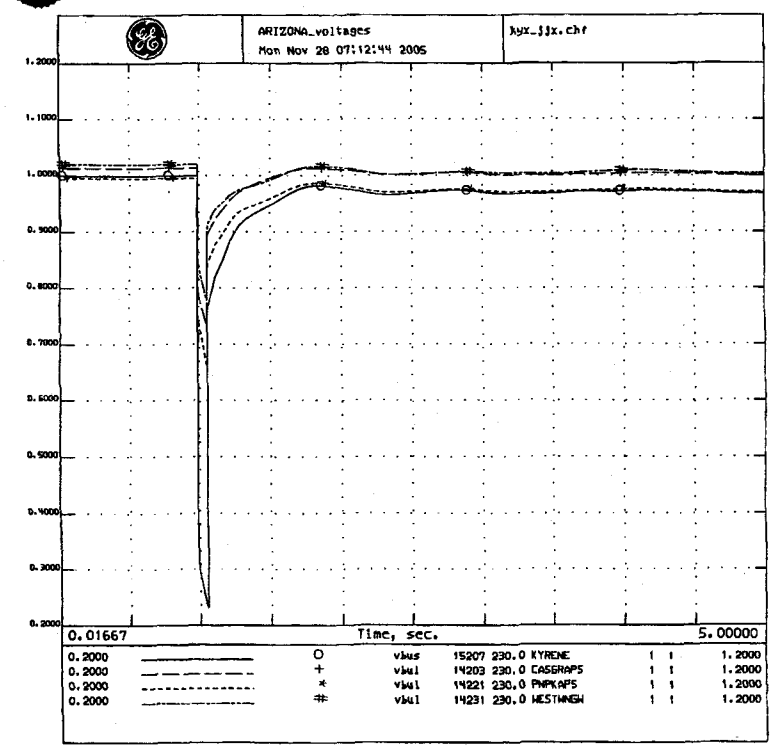
KYRENE FLT KYX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-JJX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



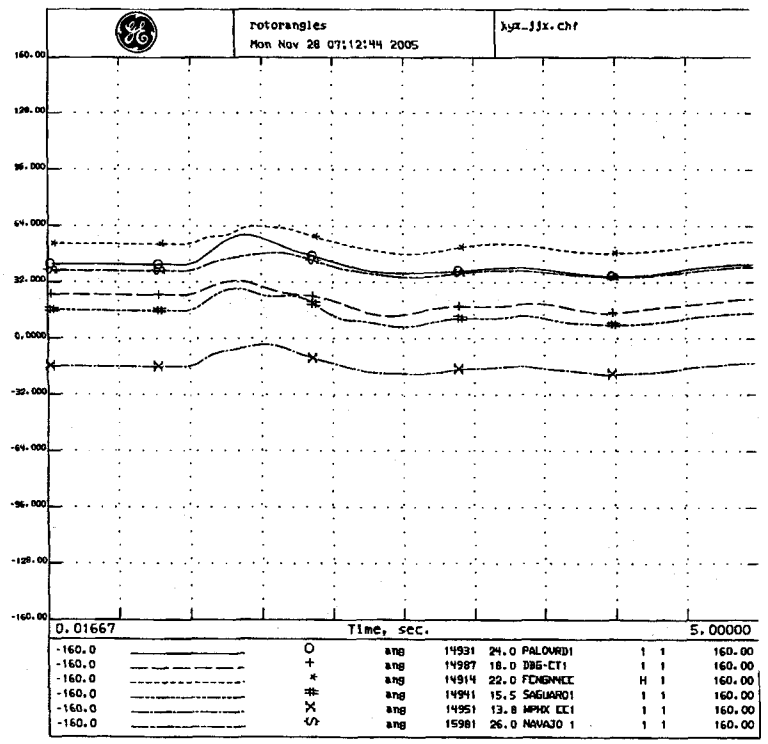
KYRENE FLT KYX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-JJX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



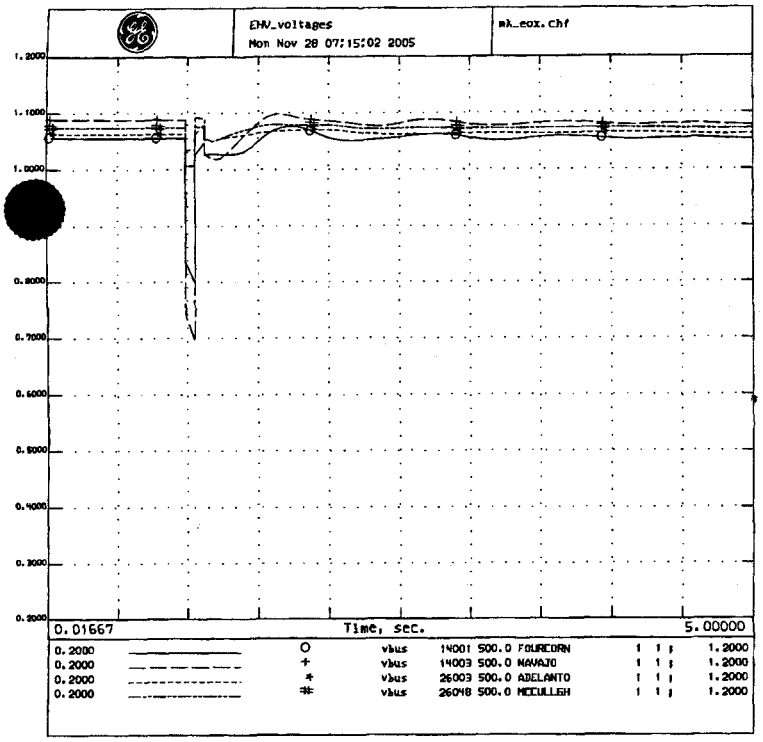
KYRENE FLT KYX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-JJX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



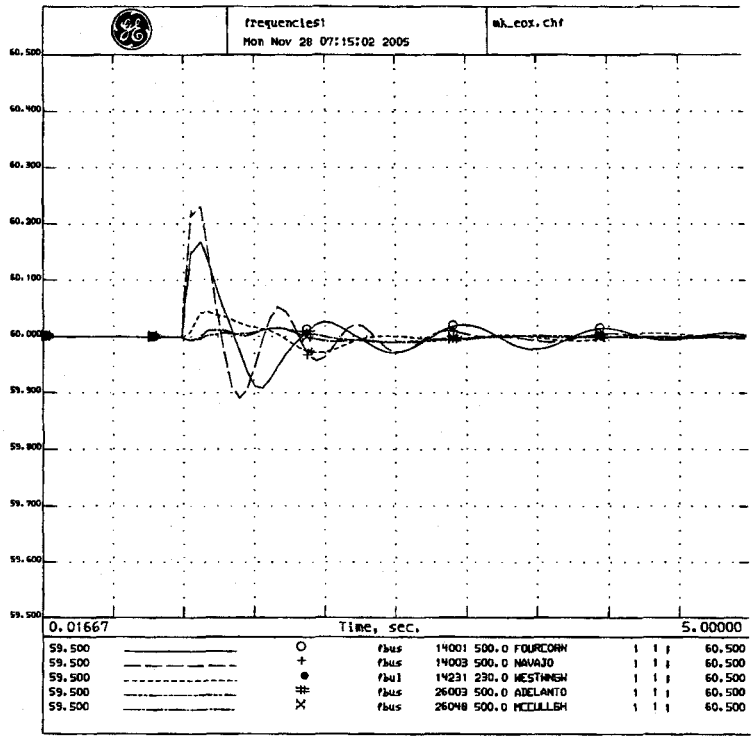
KYRENE FLT KYX-JJX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
KYX-JJX STAB #1; 01/06; T=0 3P FLT KYX500;
4C CLR FLT W/KYX-JJX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



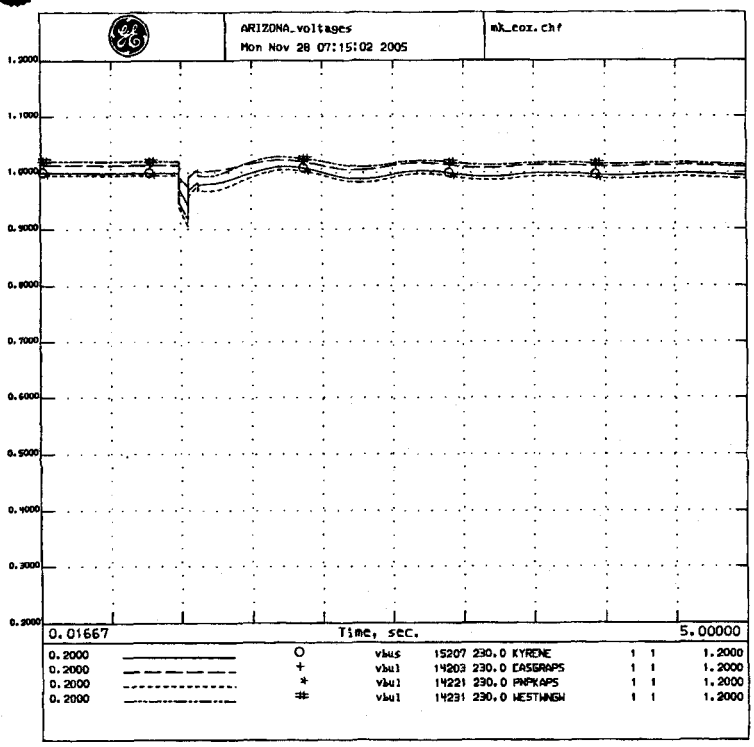
MOENKOPI FLT. MK-EOX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



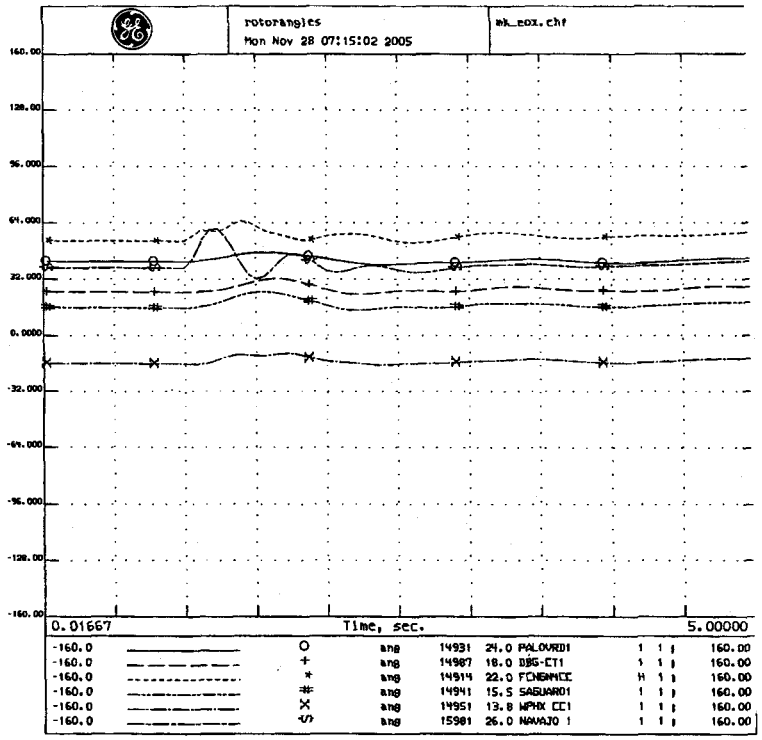
MOENKOPI FLT. MK-EOX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



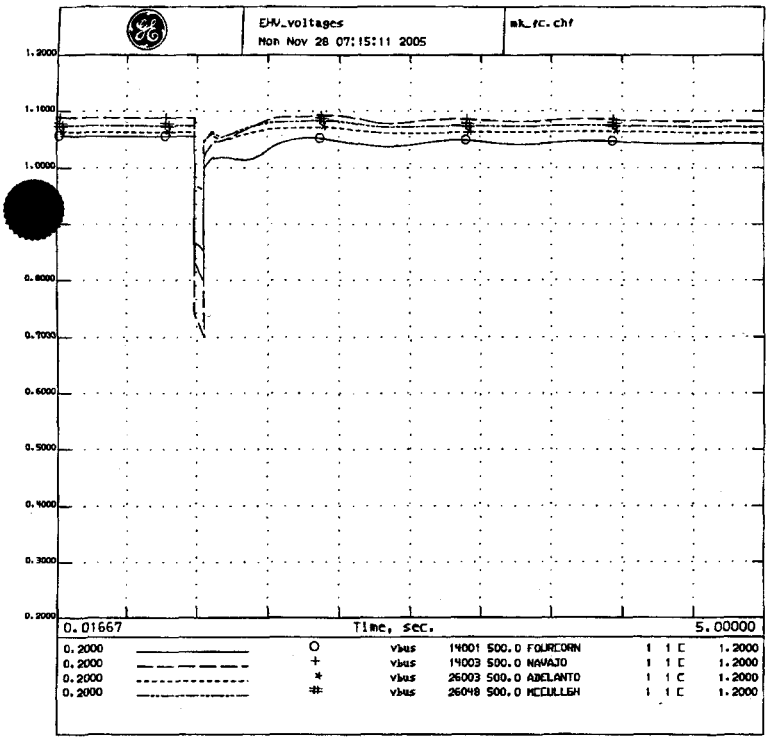
MOENKOPI FLT. MK-EOX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



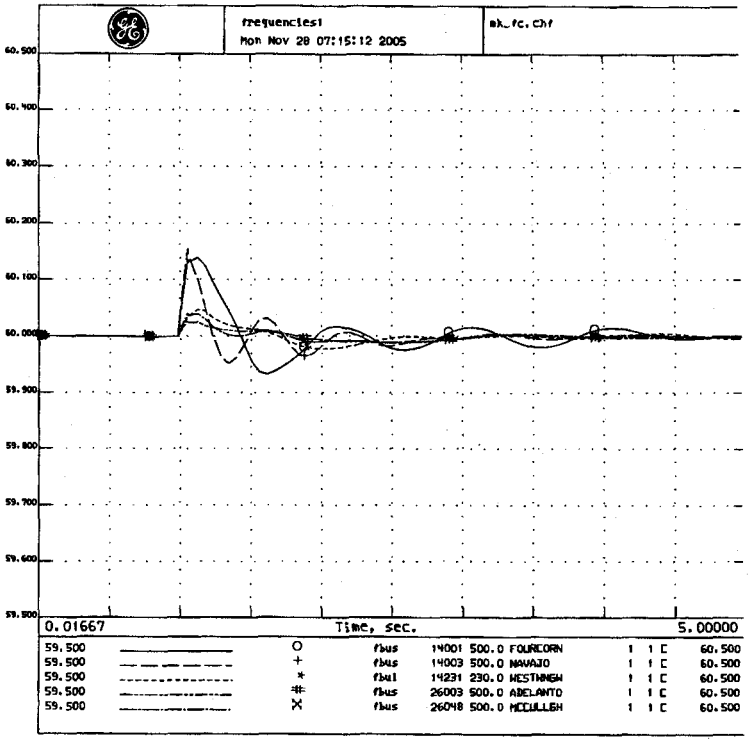
MOENKOPI FLT. MK-EOX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-EOX STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-EOX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



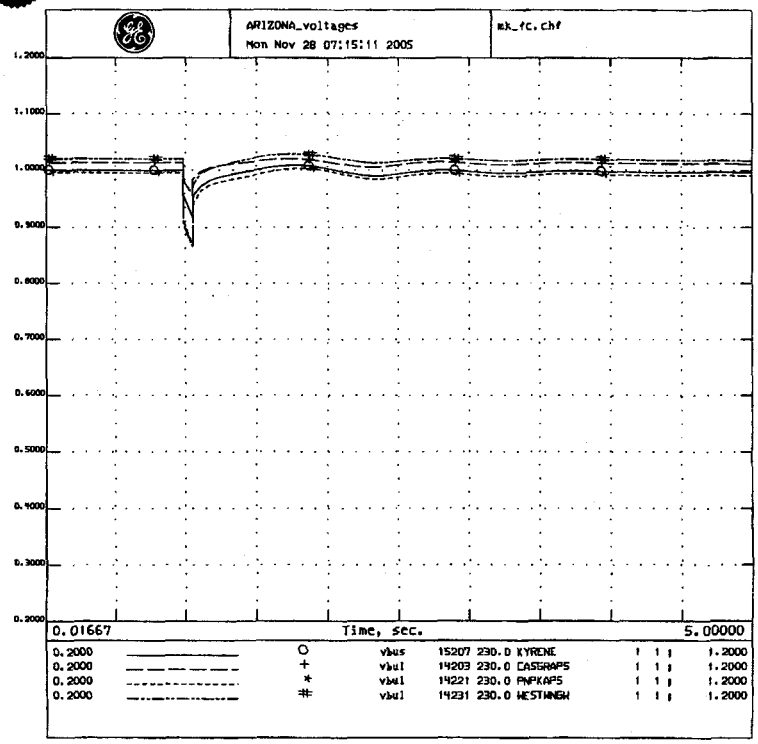
MOENKOPI FLT500 MK-FC out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-FC STAB; 1/06; T=0 3P FLT MK500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/MK-FC;8C REIN CAPS;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



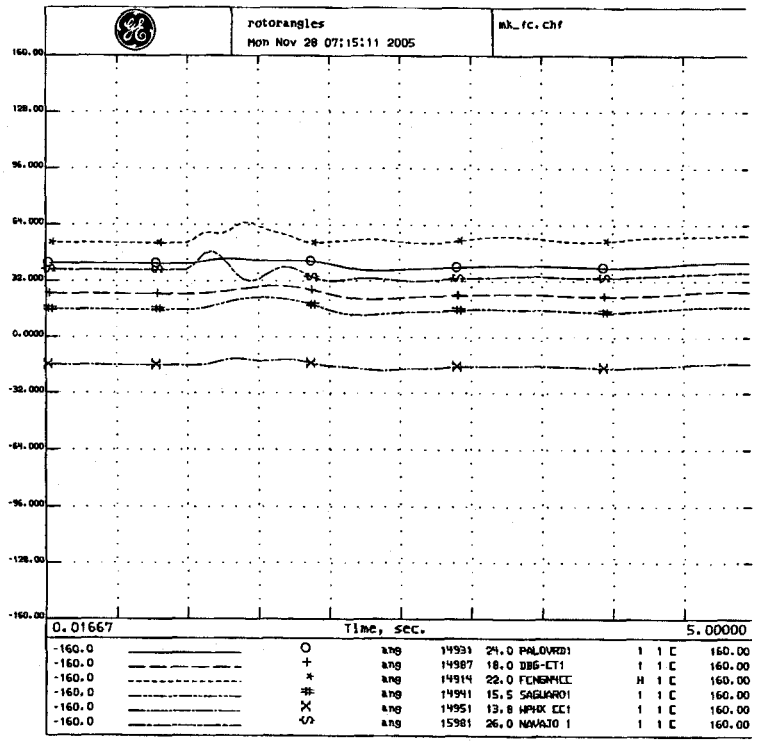
MOENKOPI FLT500 MK-FC out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-FC STAB; 1/06; T=0 3P FLT MK500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/MK-FC;8C REIN CAPS;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



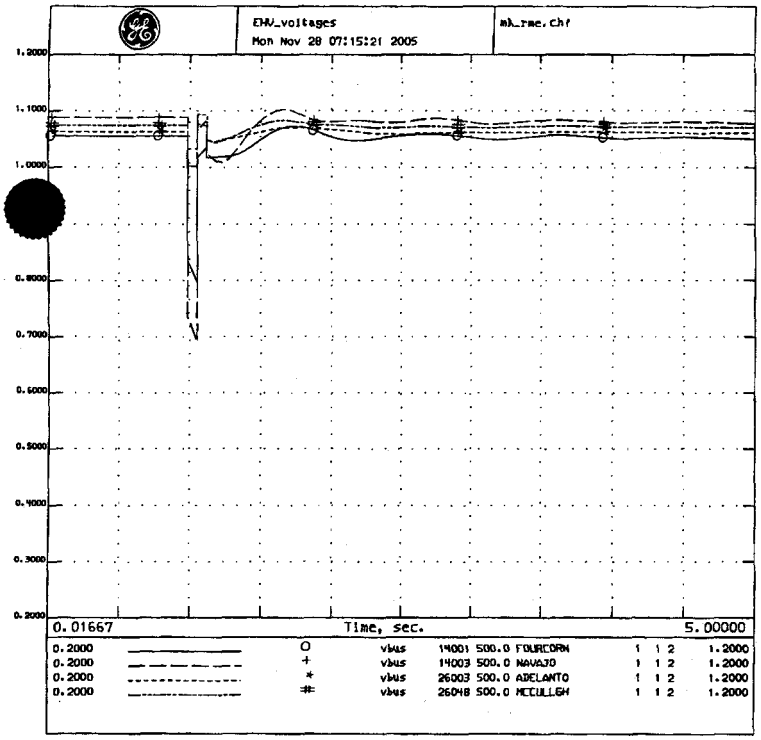
MOENKOPI FLT500 MK-FC out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-FC STAB; 1/06; T=0 3P FLT MK500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/MK-FC;8C REIN CAPS;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



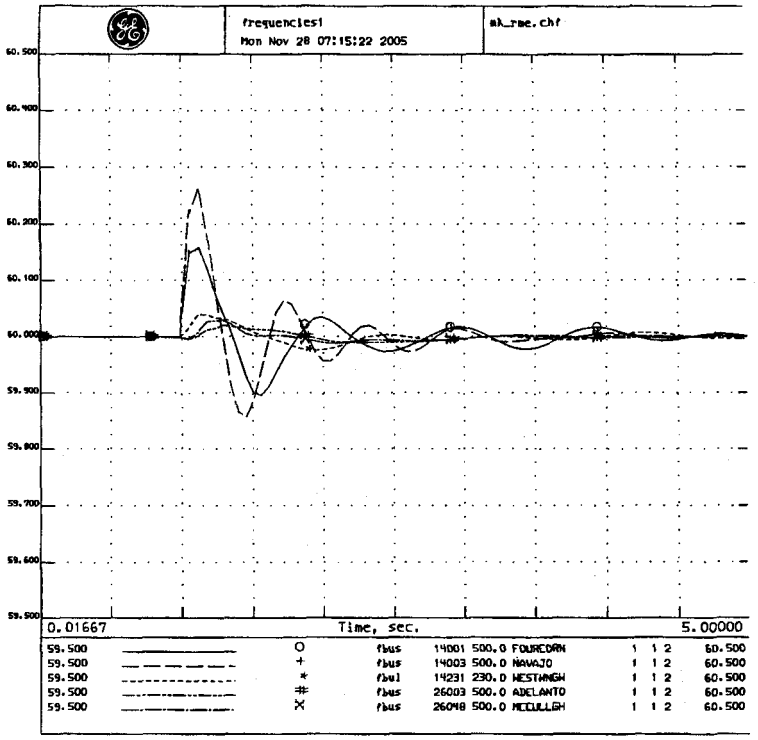
MOENKOPI FLT500 MK-FC out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-FC STAB; 1/06; T=0 3P FLT MK500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/MK-FC;8C REIN CAPS;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



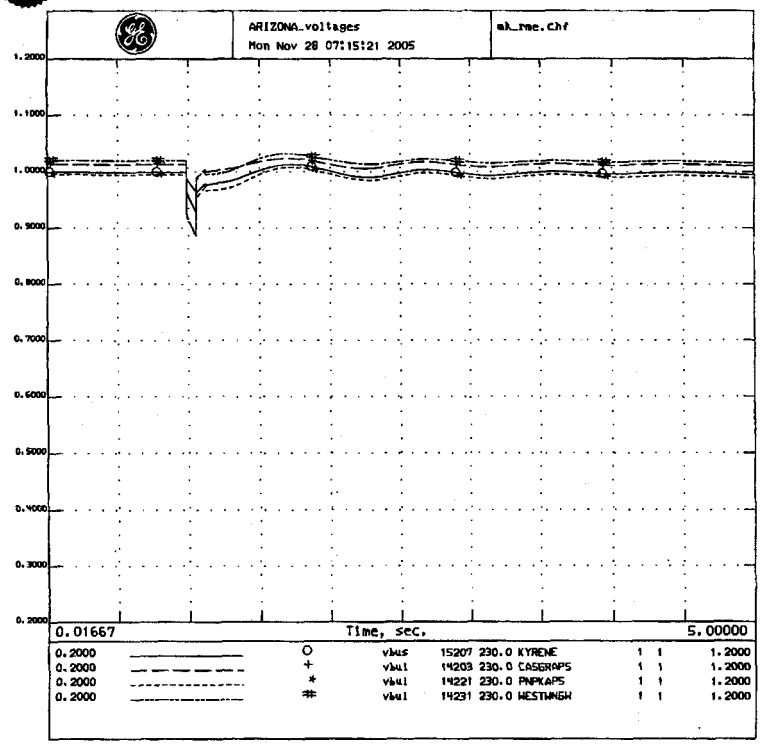
MOENKOPI FLT. MK-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-RME STAB; 1/06; T=0 3P FLT MK500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



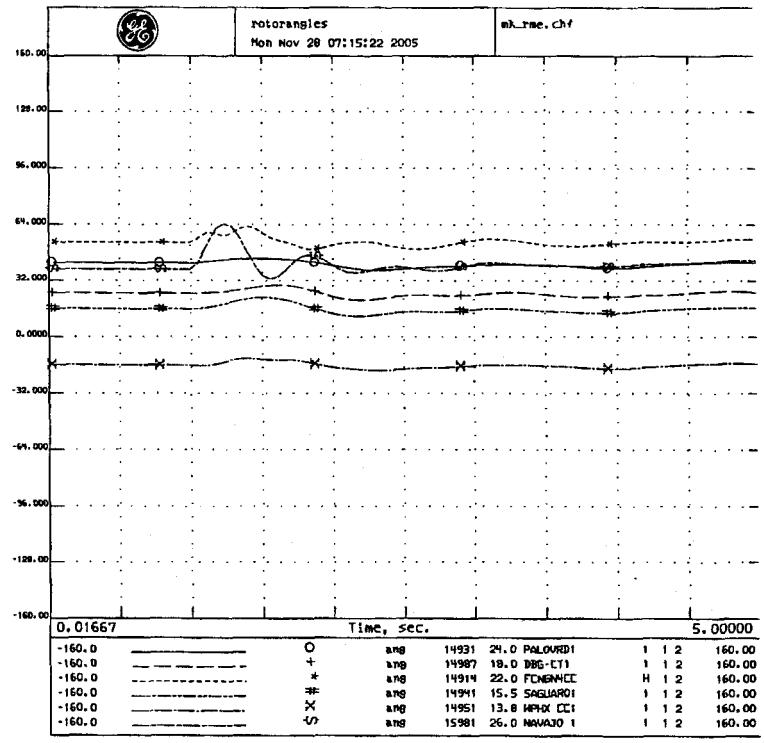
MOENKOPI FLT. MK-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-RME STAB; 1/06; T=0 3P FLT MK500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



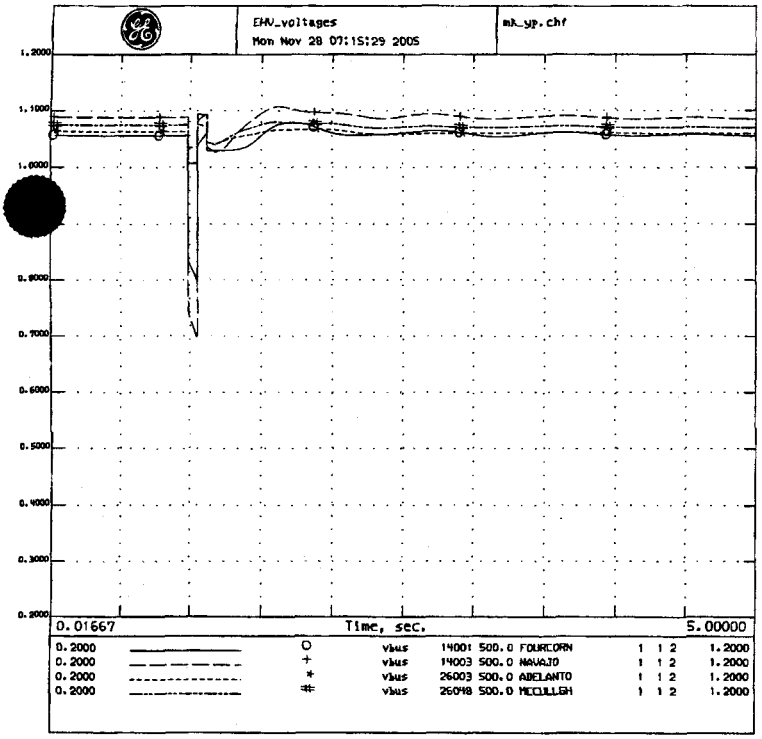
MOENKOPI FLT. MK-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-RME STAB; 1/06; T=0 3P FLT MK500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



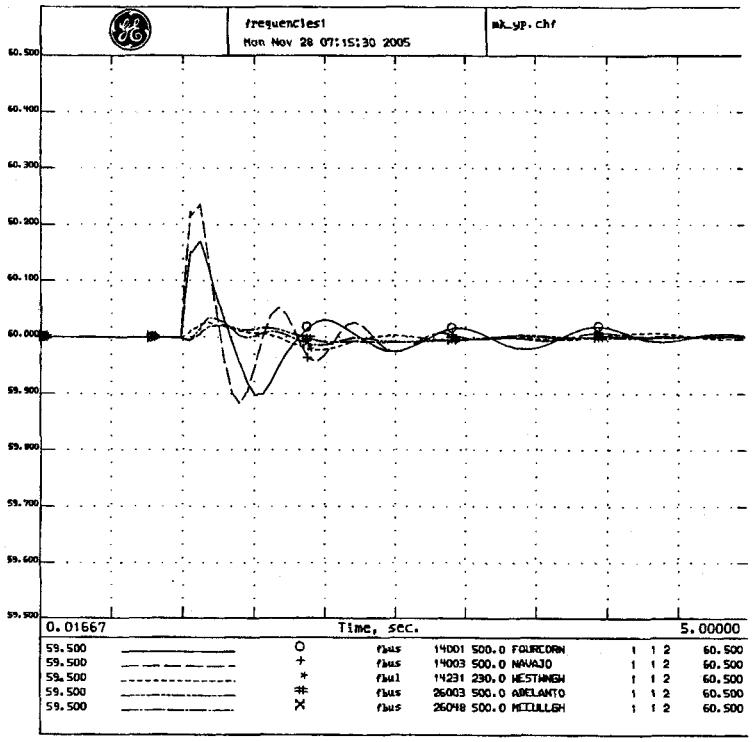
MOENKOPI FLT. MK-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-RME STAB; 1/06; T=0 3P FLT MK500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



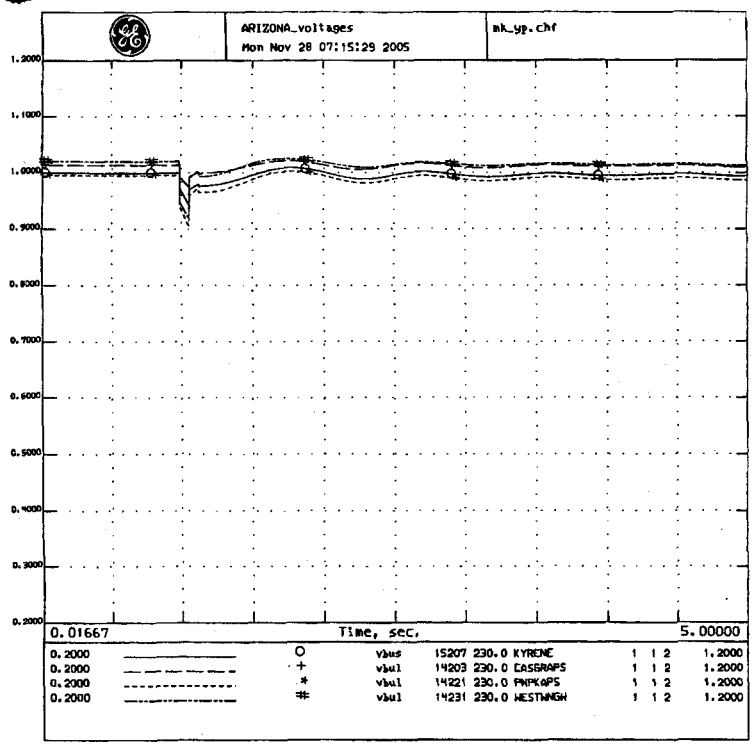
MOENKOPI FLT MK-YV line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



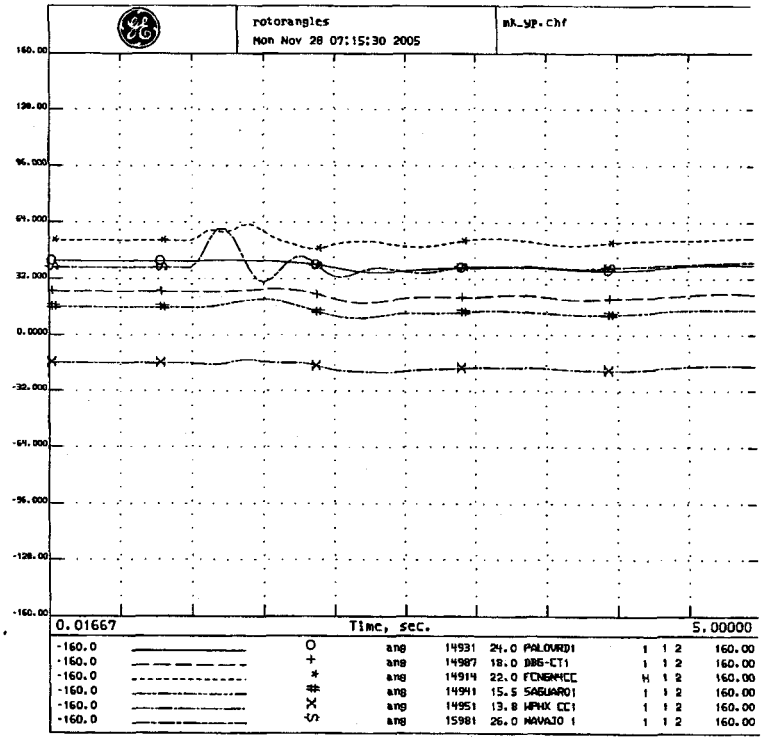
MOENKOPI FLT MK-YV line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



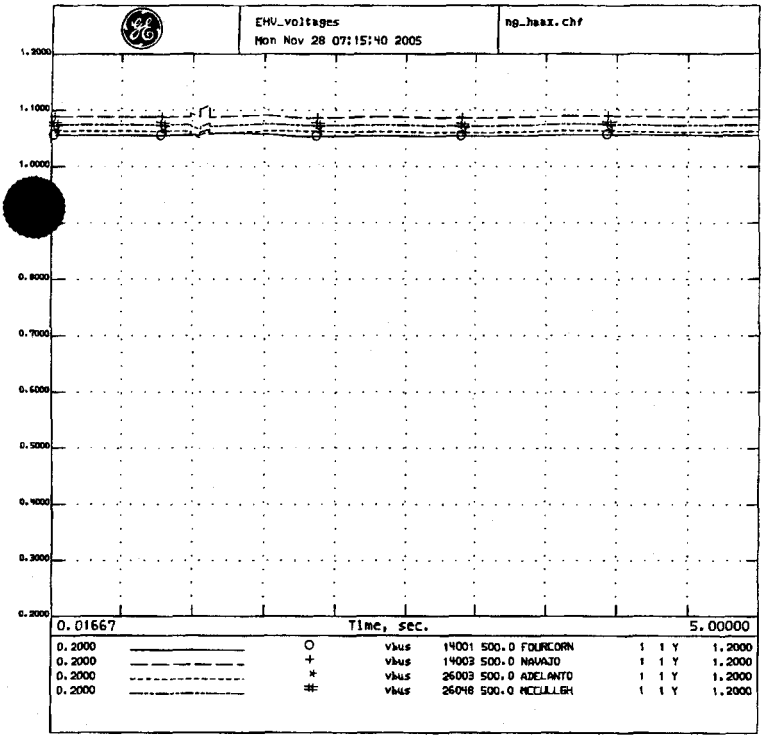
MOENKOPI FLT MK-YV line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



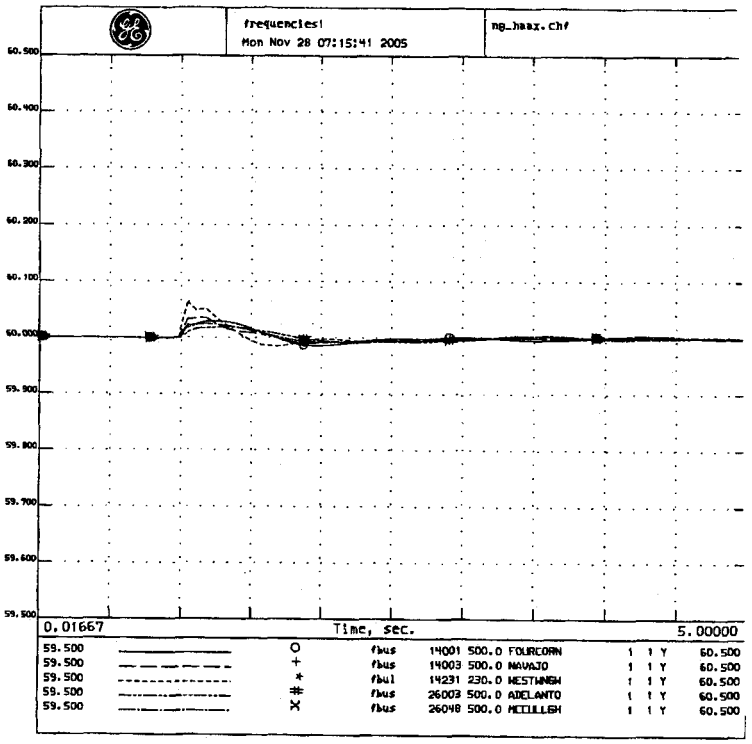
MOENKOPI FLT MK-YV line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
MK-YV STAB; 1/06; T=0 3P FLT MK500;FLSH CAPS MK-YV/YV-HW,
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-YV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



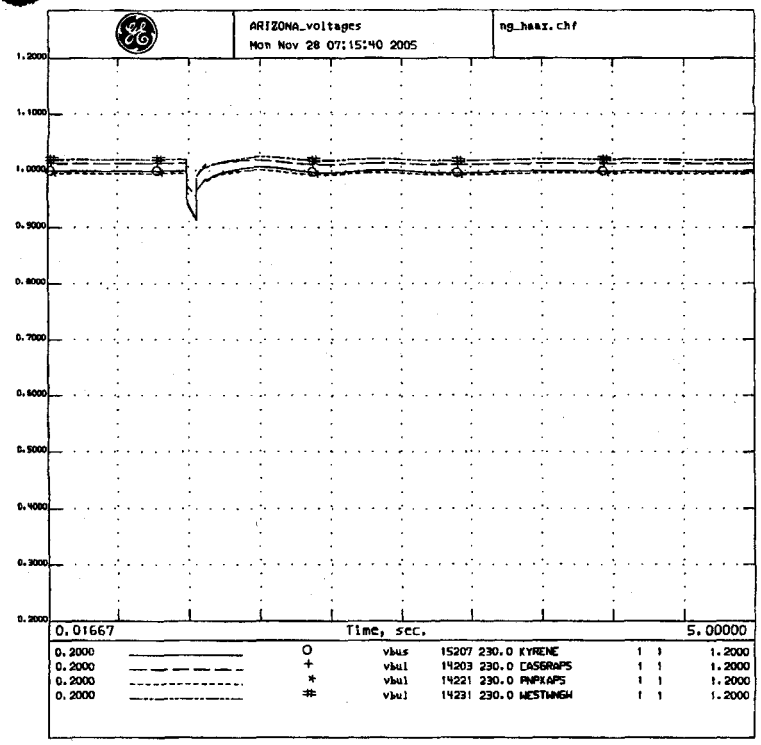
N.GILA FLT NG-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



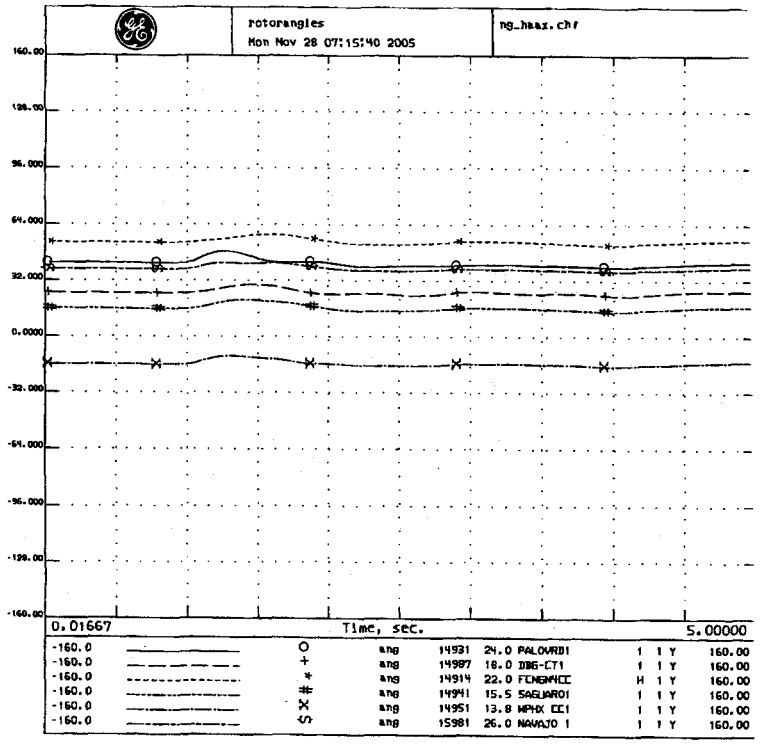
N.GILA FLT NG-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



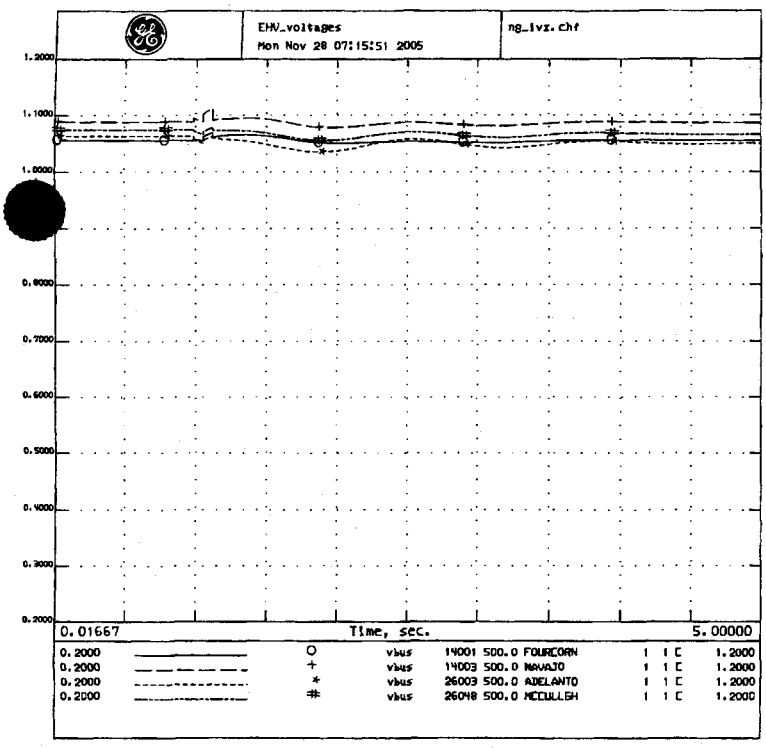
N.GILA FLT NG-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



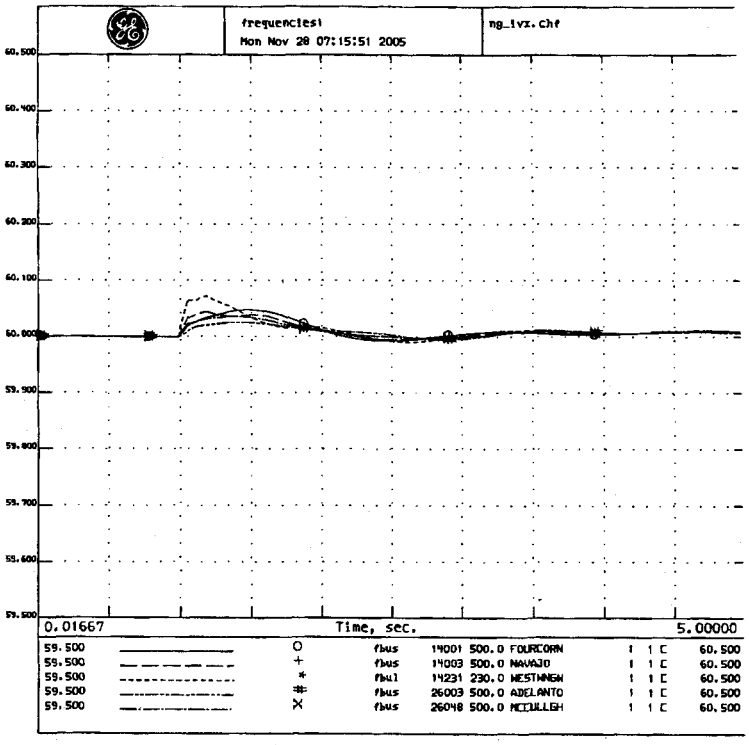
N.GILA FLT NG-HAAX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-HAAX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



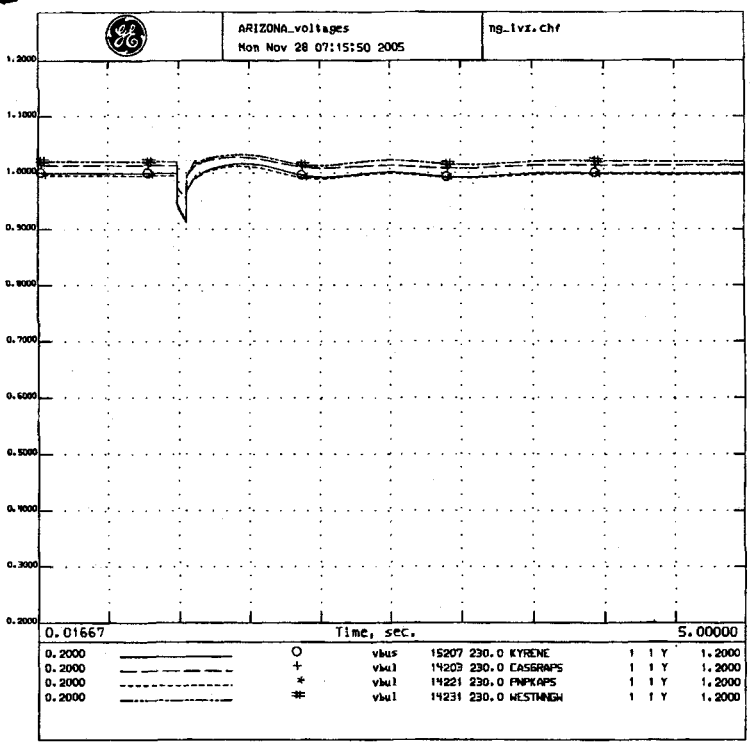
N.GILA FLT NG-IVX. V LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



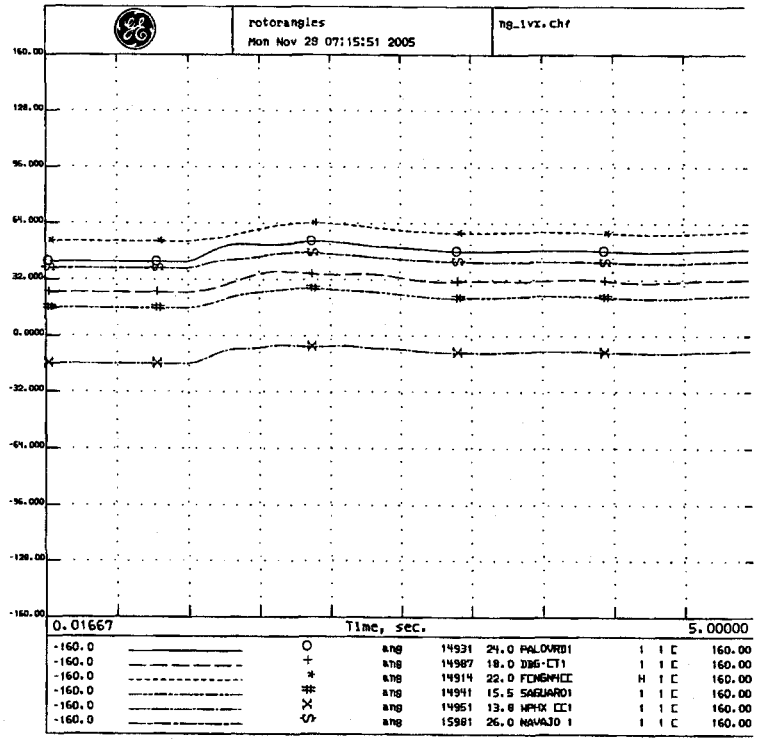
N.GILA FLT NG-IVX. V LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



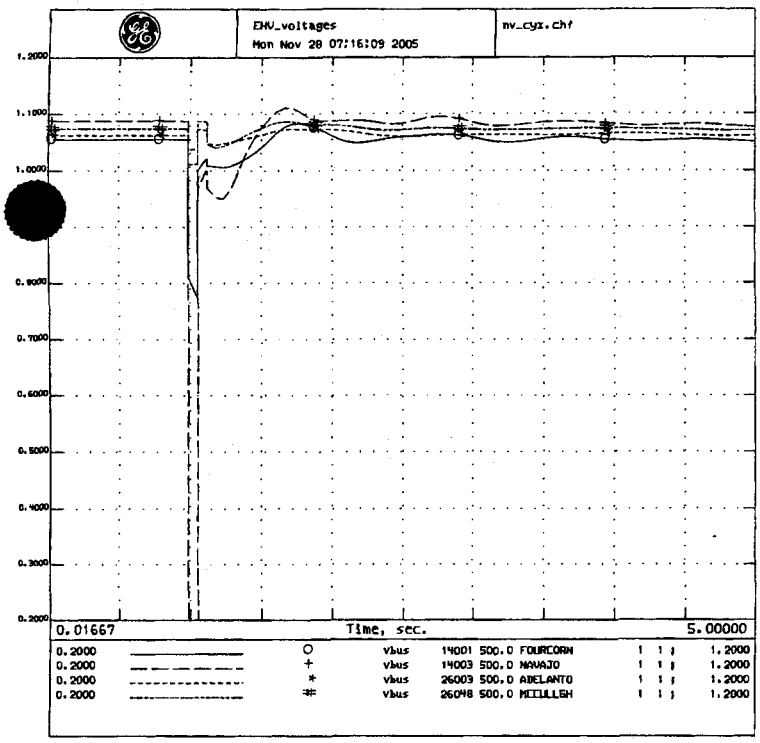
N.GILA FLT NG-IVX. V LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



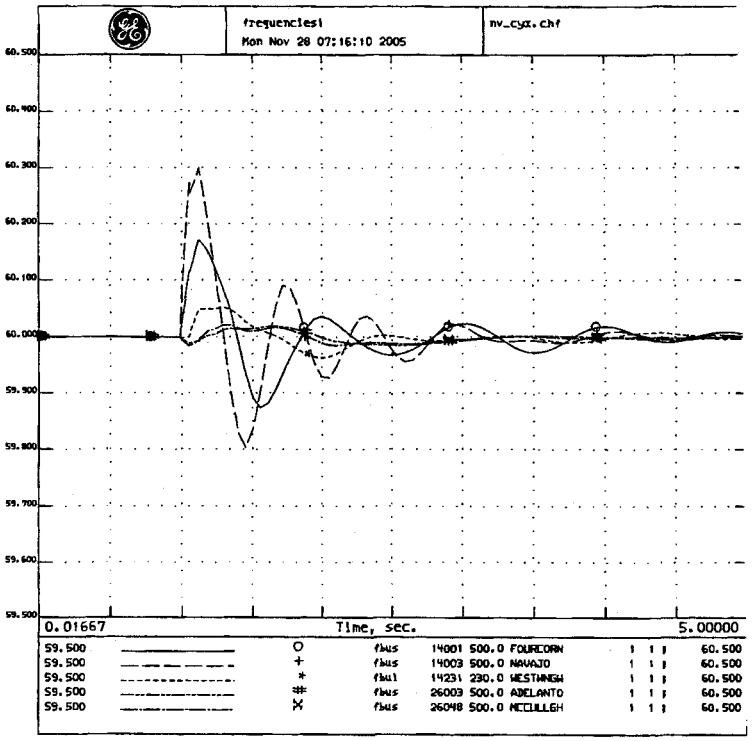
N.GILA FLT NG-IVX. V LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NG STAB,3 PH FLT NG500KV
FLASH CAPS,W/4 CYC CLR FLT;NG-IVX OUT;4/8 CYC REIN CAPS

Changes from APS/SRP/WAPA/TEP



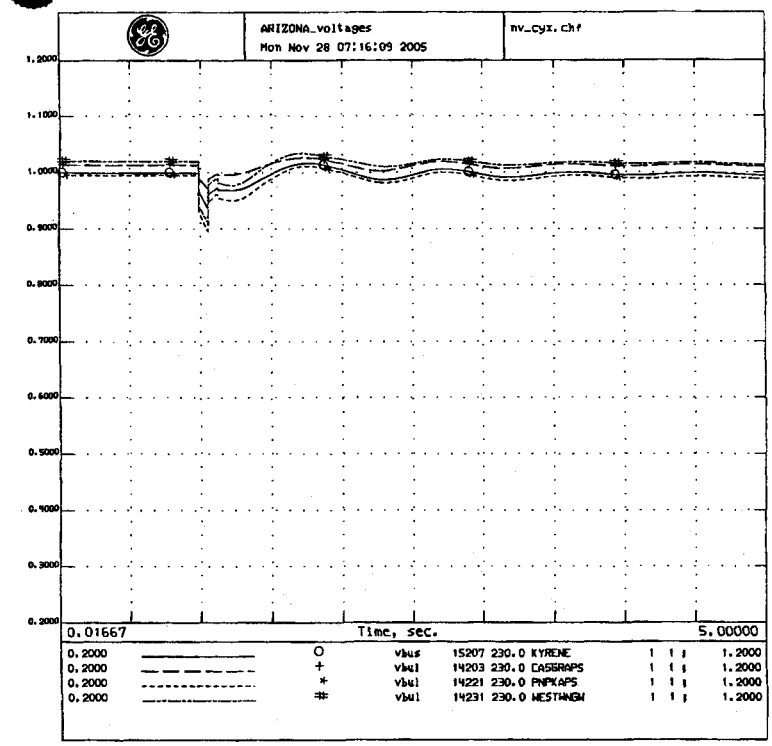
NAVAJO FLT. NV-CYX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



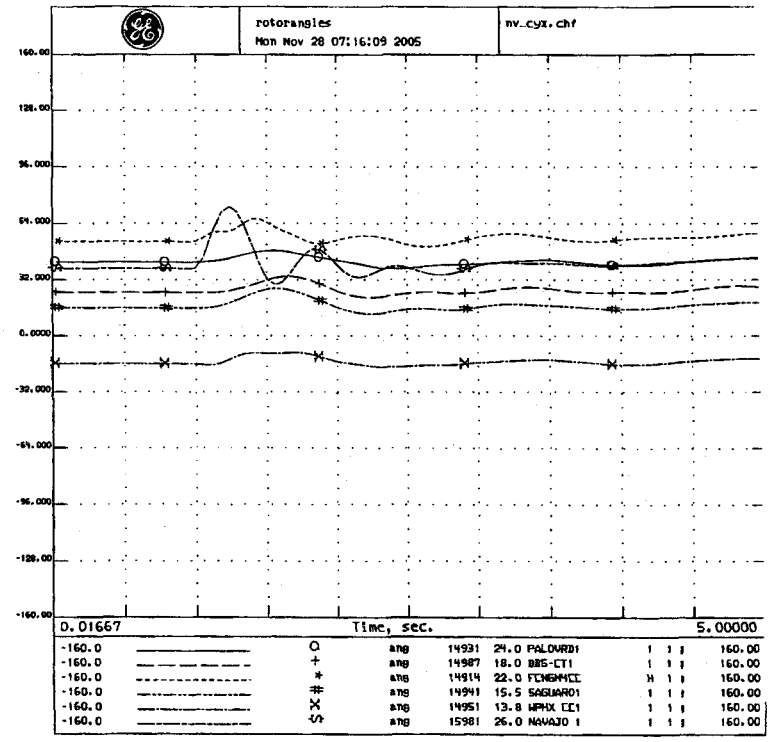
NAVAJO FLT. NV-CYX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



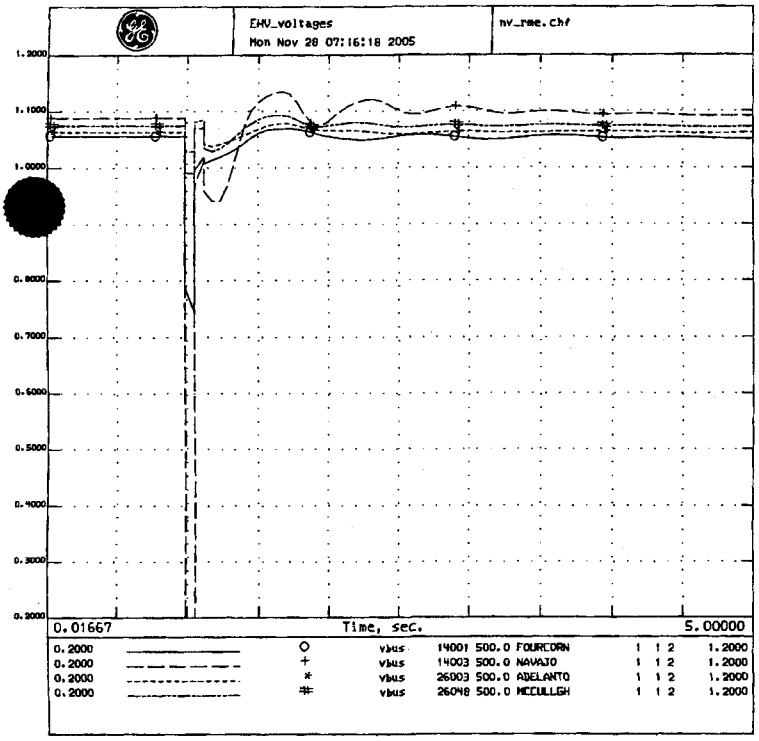
NAVAJO FLT. NV-CYX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



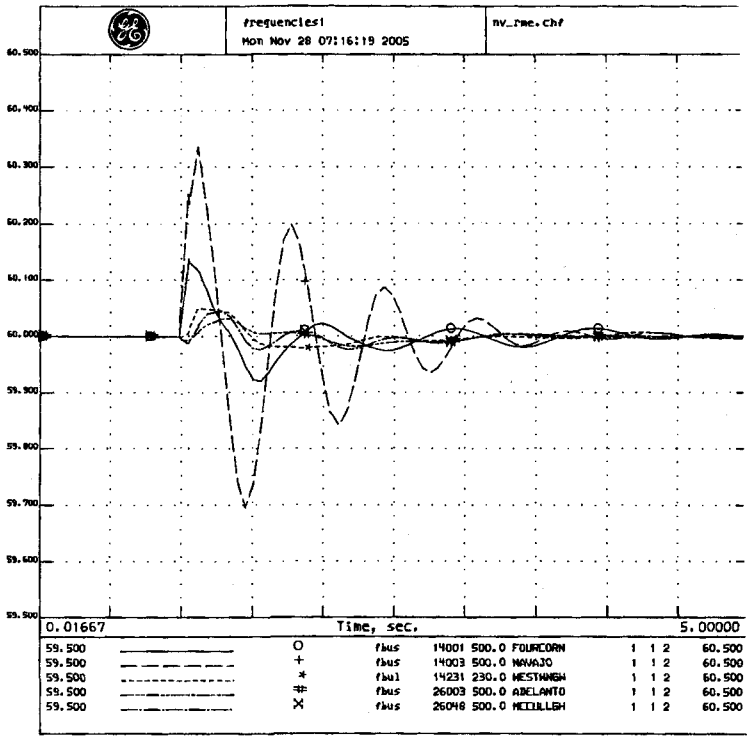
NAVAJO FLT. NV-CYX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-CYX STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-CYX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



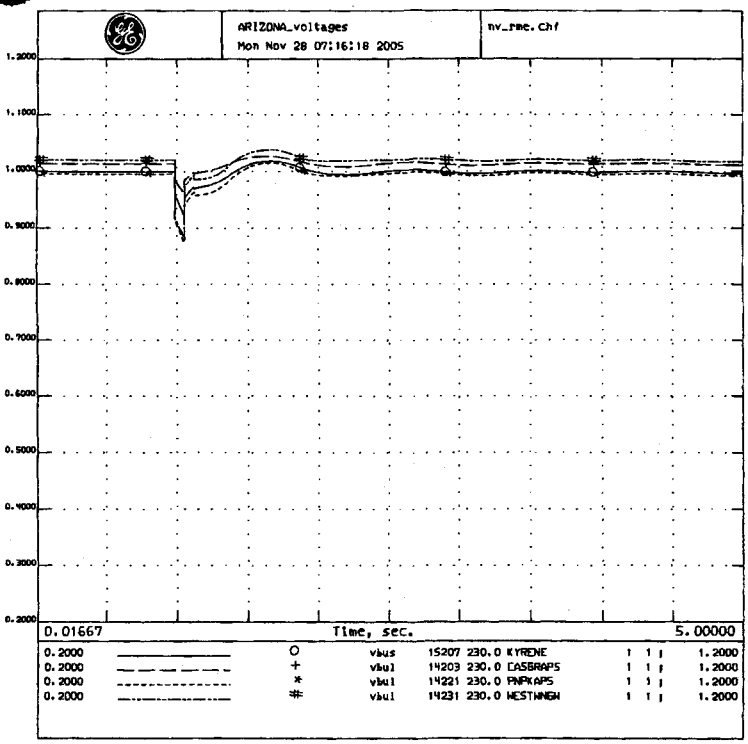
NAVAJO FLT. NV-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-RME STAB; 1/06; T=0 3P FLT NV500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



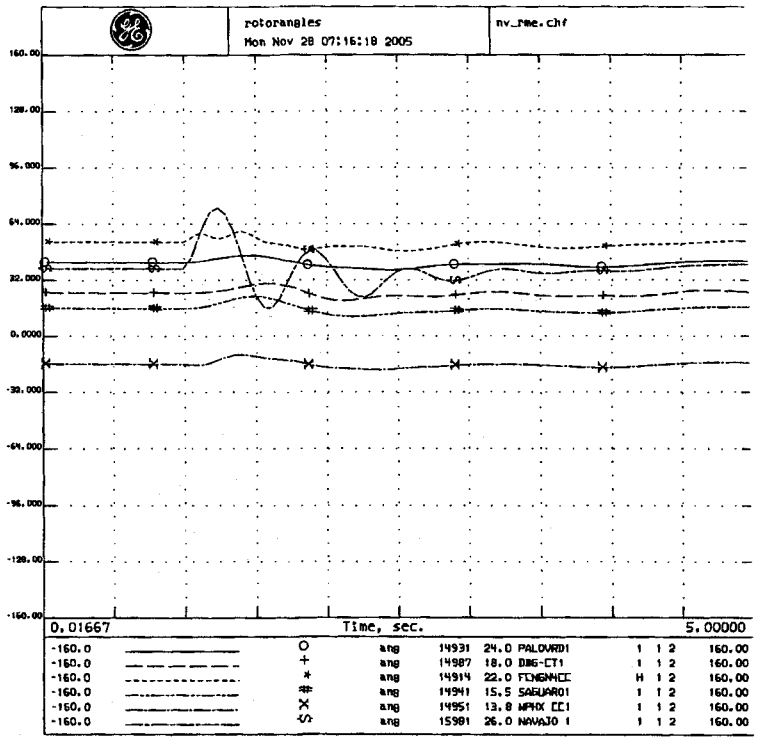
NAVAJO FLT. NV-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-RME STAB; 1/06; T=0 3P FLT NV500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



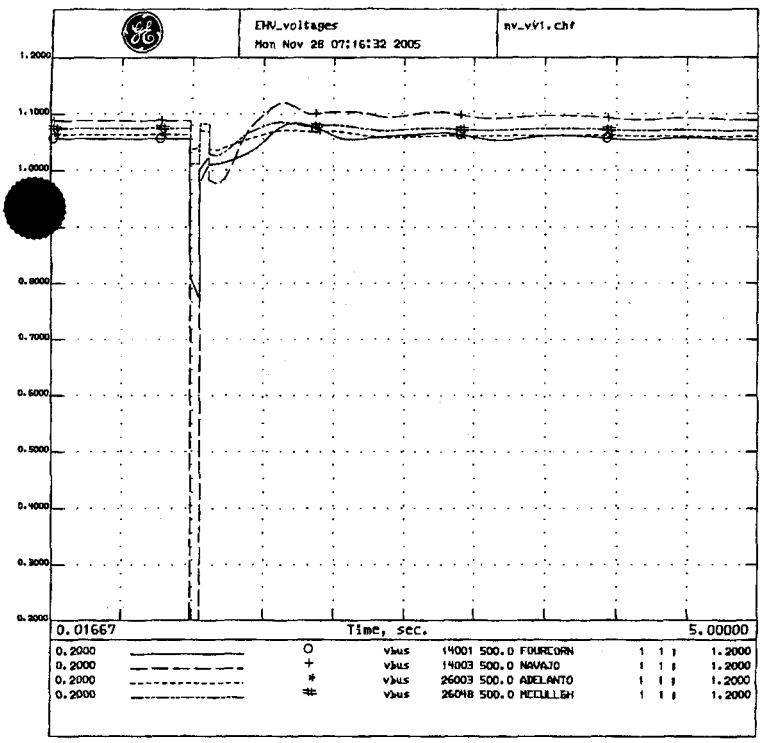
NAVAJO FLT. NV-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-RME STAB; 1/06; T=0 3P FLT NV500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



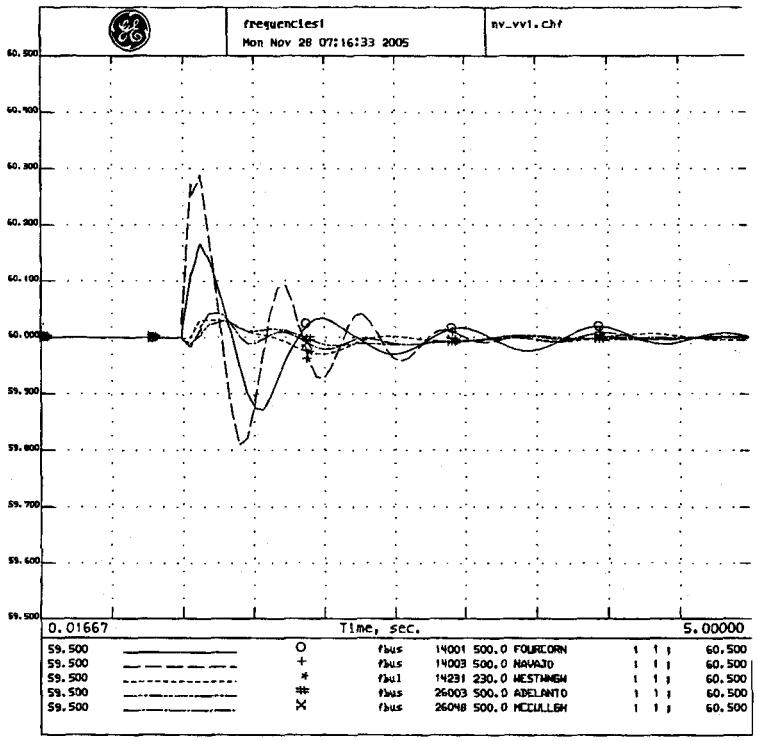
NAVAJO FLT. NV-RME. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-RME STAB; 1/06; T=0 3P FLT NV500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



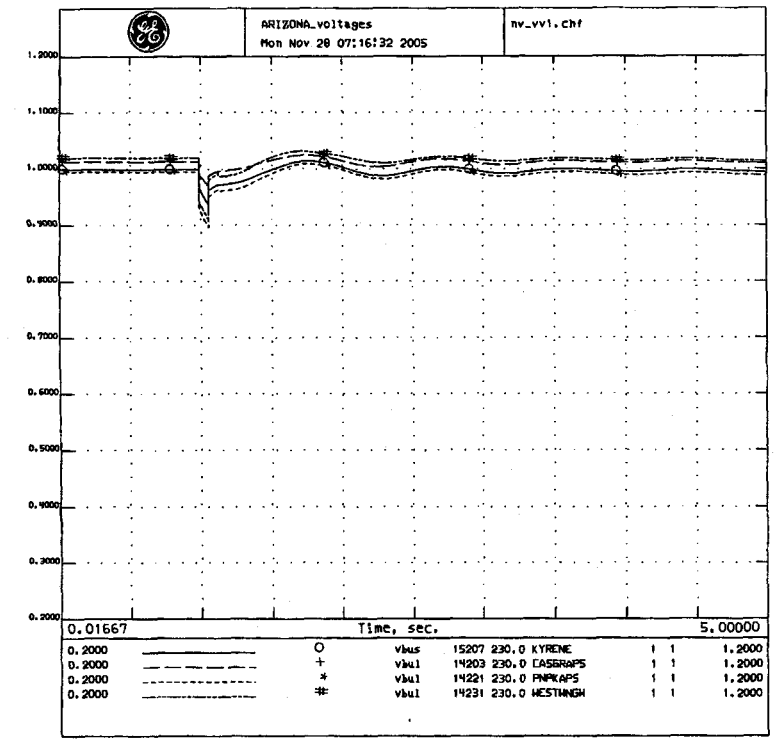
NAVAJO FLT NV-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-VV1 STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



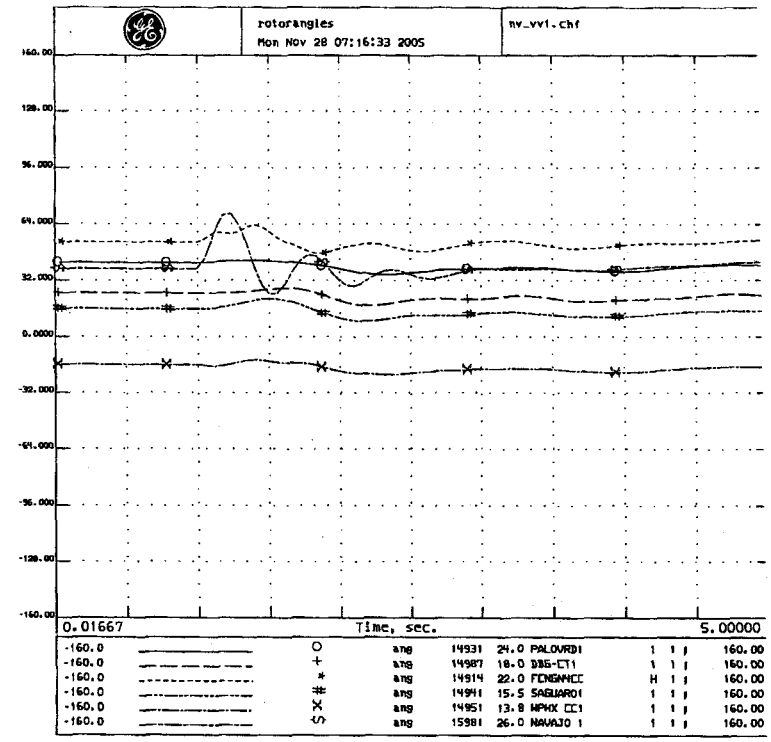
NAVAJO FLT NV-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-VV1 STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



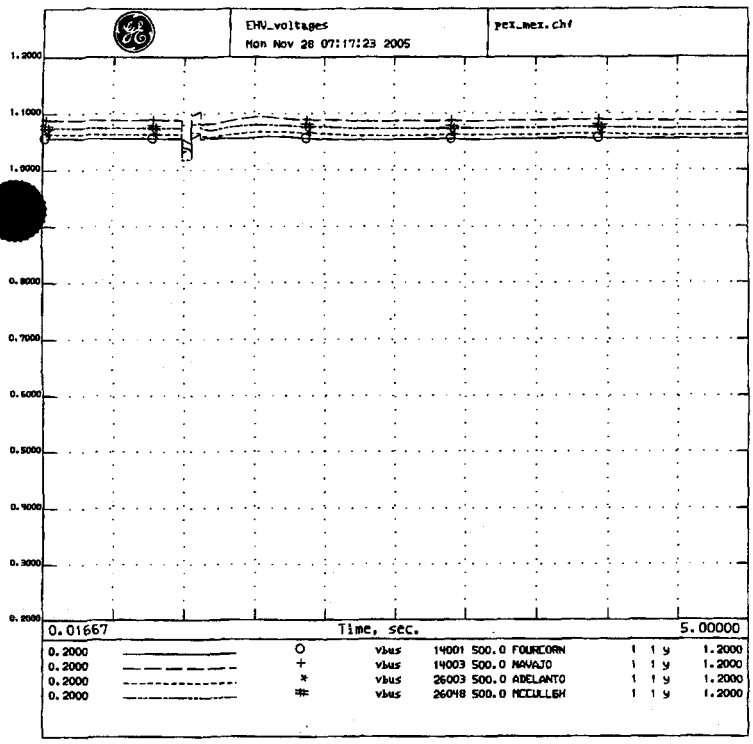
NAVAJO FLT NV-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-VV1 STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



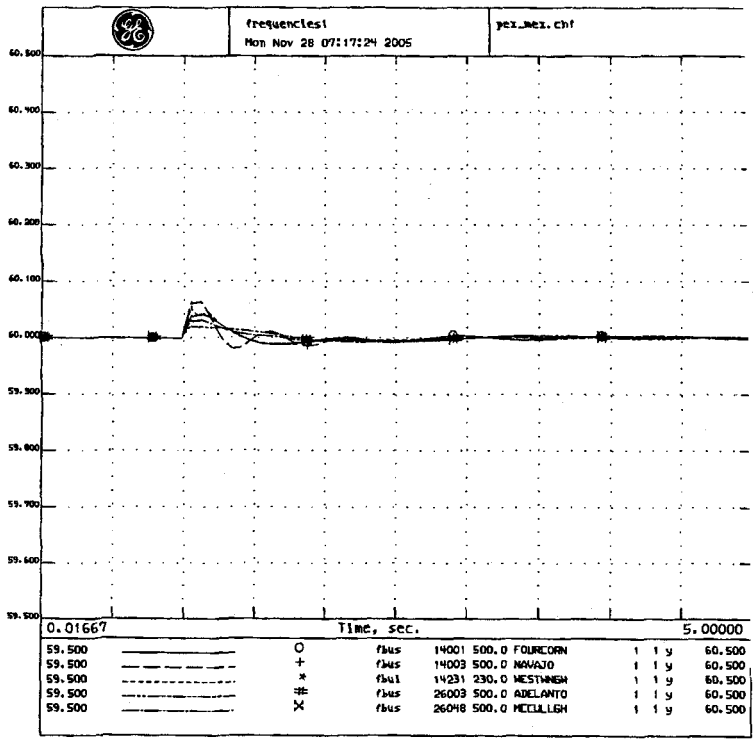
NAVAJO FLT NV-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
NV-VV1 STAB; 1/06; T=0 3P FLT NV500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



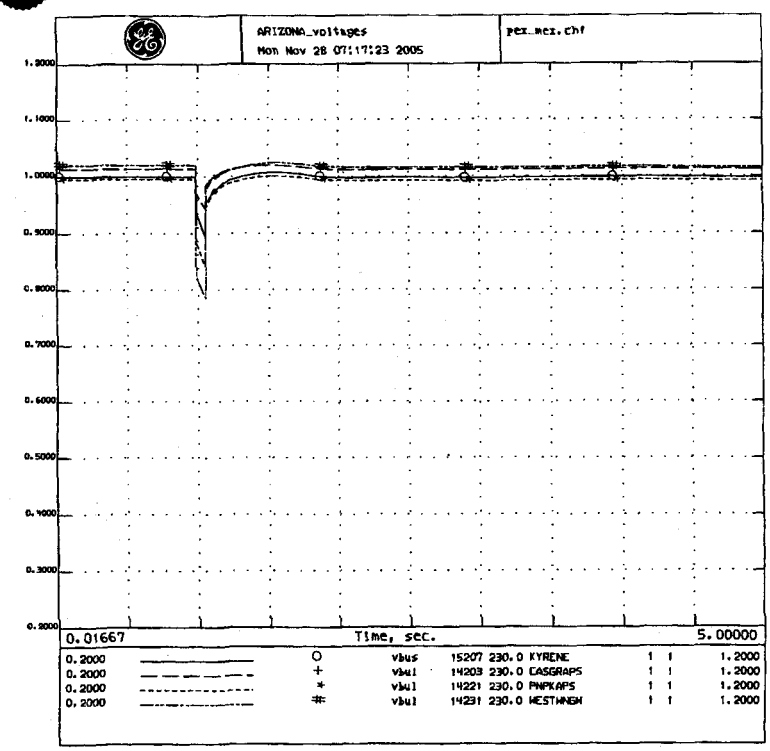
PERKINS FLT PEX-MEX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YU/YU-WW,
NU-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



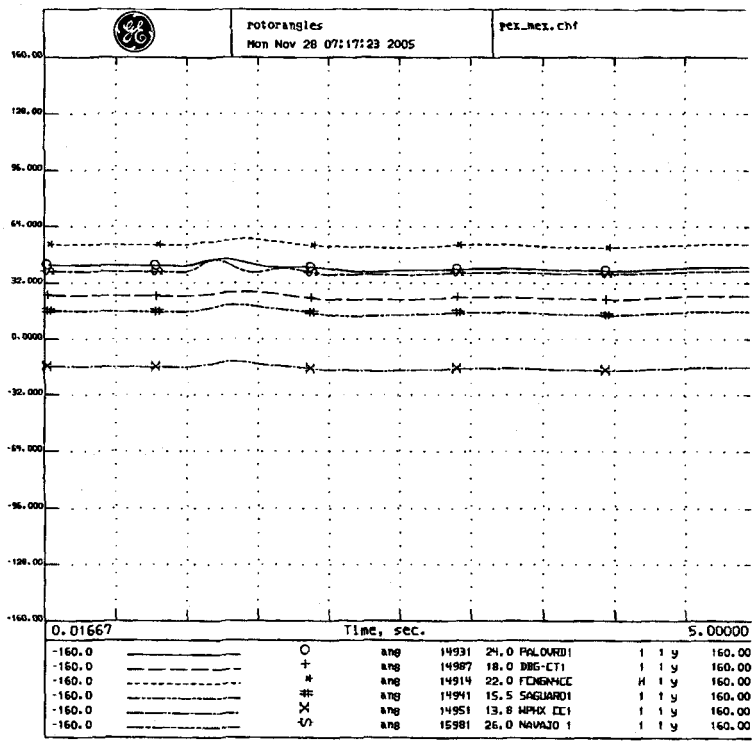
PERKINS FLT PEX-MEX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YU/YU-WW,
NU-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



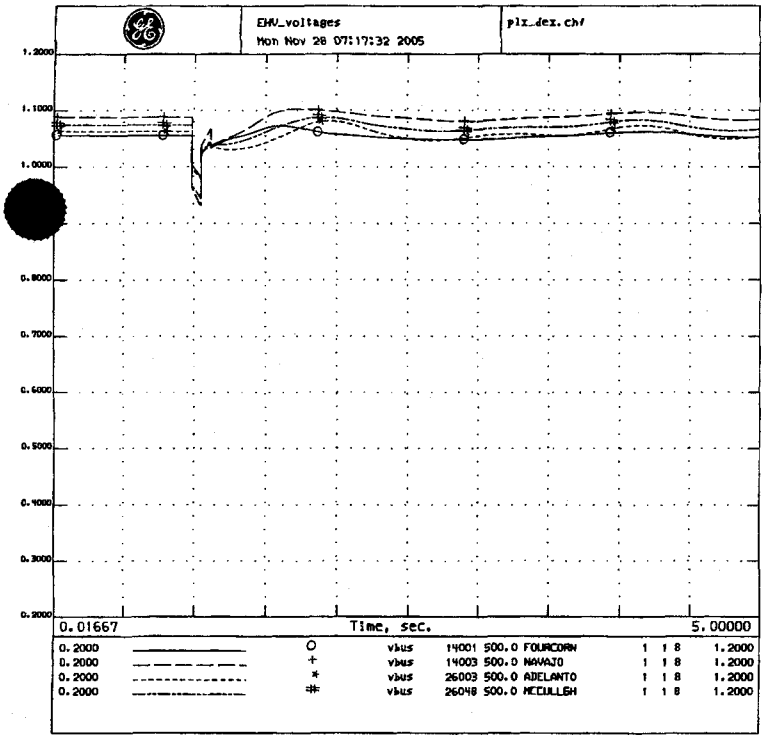
PERKINS FLT PEX-MEX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YU/YU-WW,
NU-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



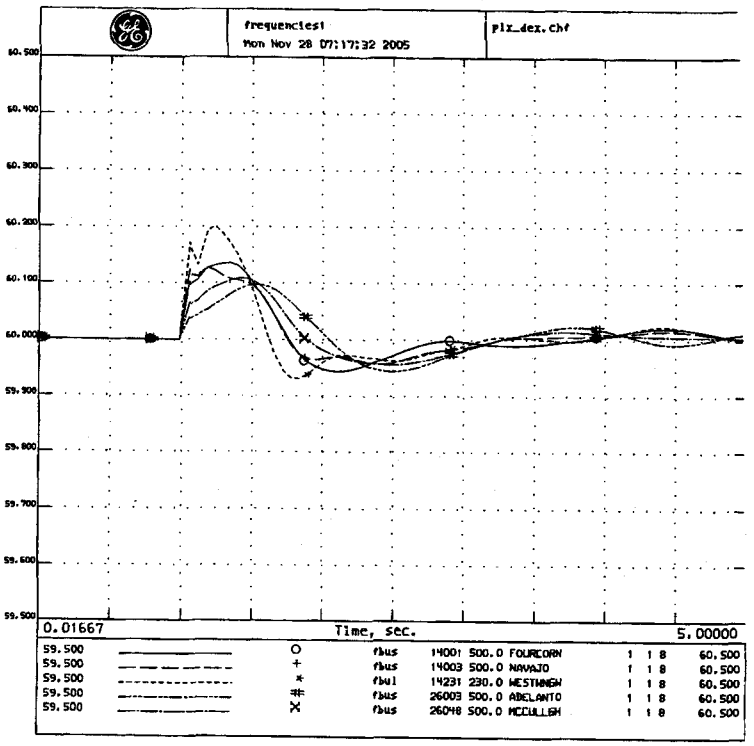
PERKINS FLT PEX-MEX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PEX-MEX STAB; 01/06; T=0 3P FLT PEX500;FLSH CAPS MK-YU/YU-WW,
NU-MK/WW;4C CLR FLT W/PEX-MEX;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



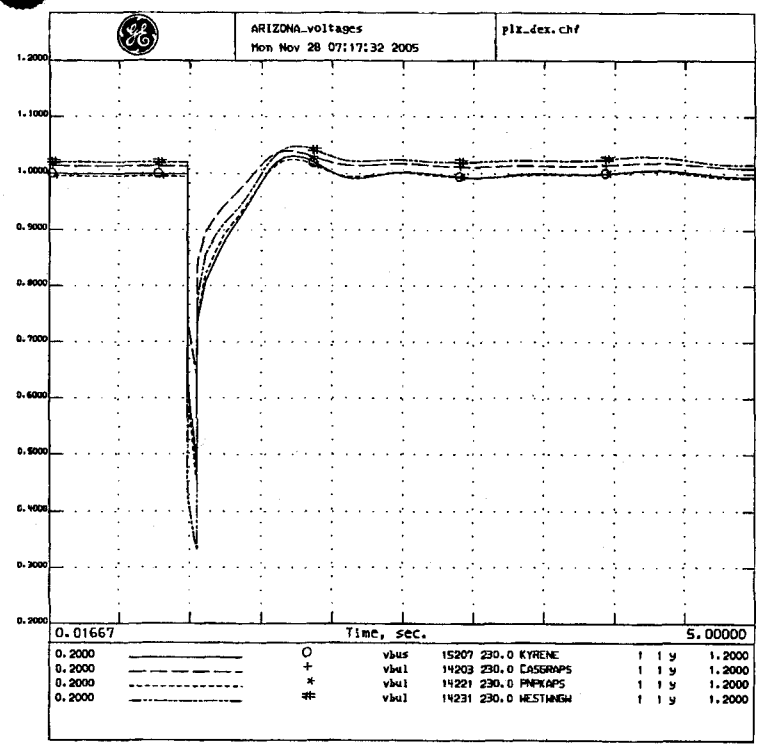
PALO VERDE FLT. w/PLX-DEX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



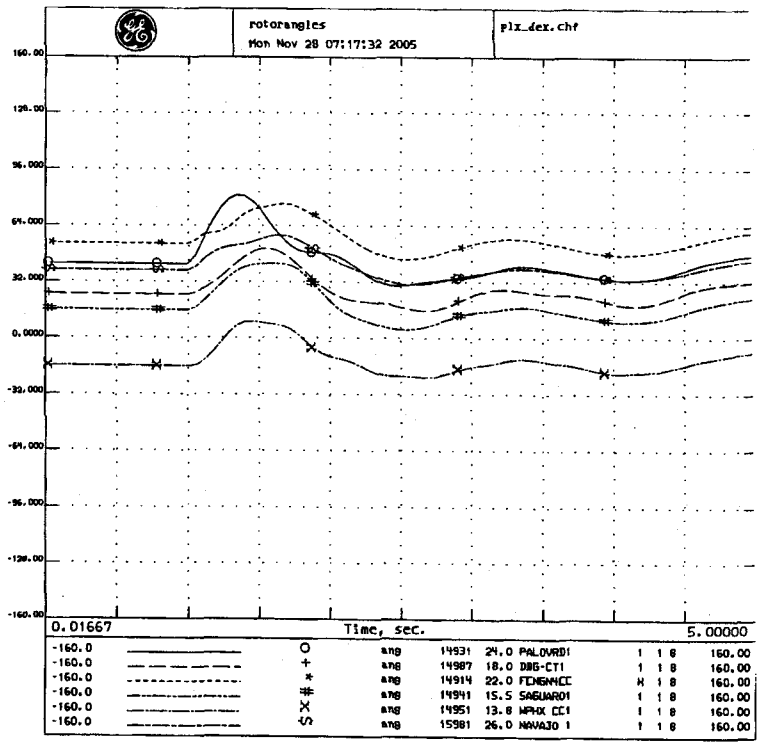
PALO VERDE FLT. w/PLX-DEX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



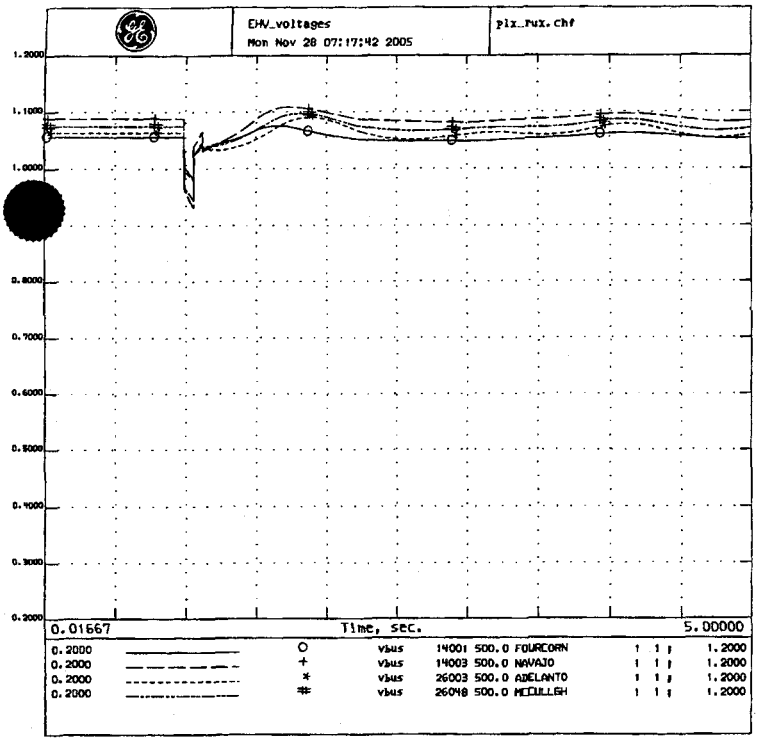
PALO VERDE FLT. w/PLX-DEX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



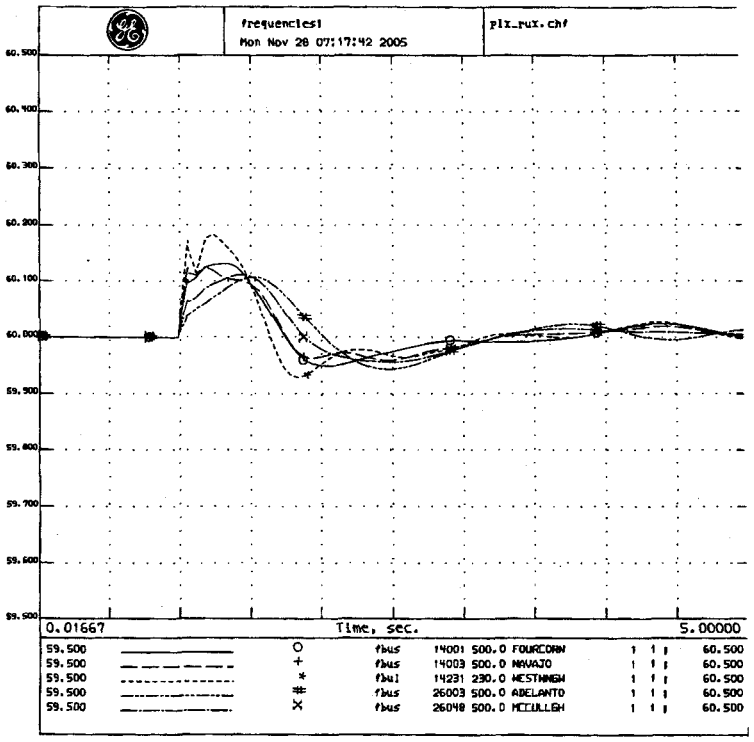
PALO VERDE FLT. w/PLX-DEX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-DVX STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-DVX;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



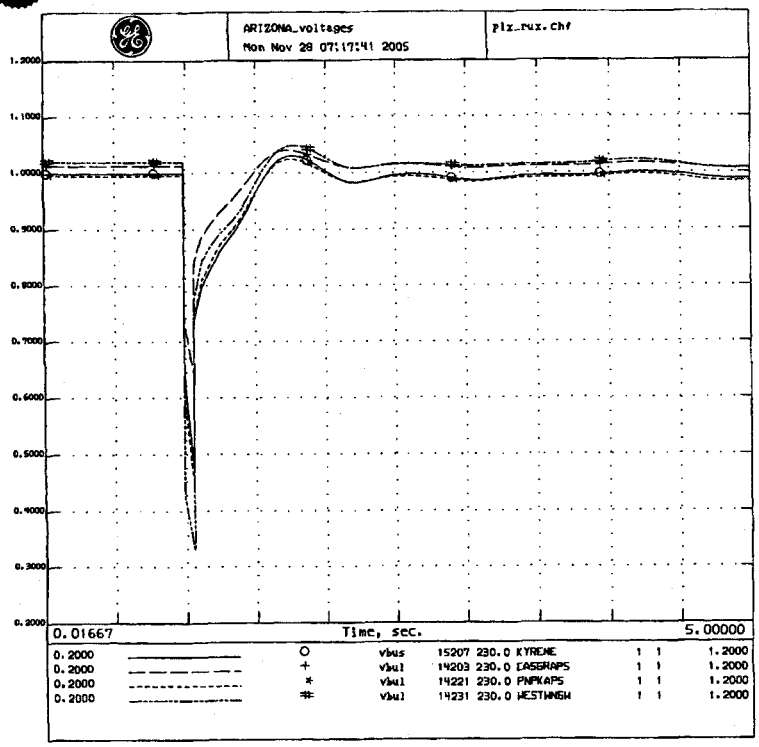
PALO VERDE FLT PLX-RUX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



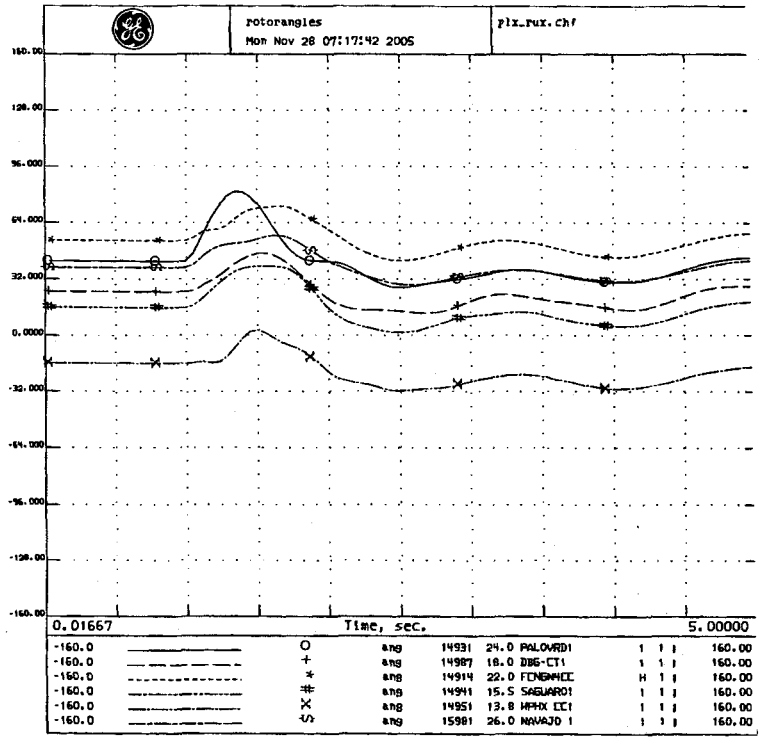
PALO VERDE FLT PLX-RUX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



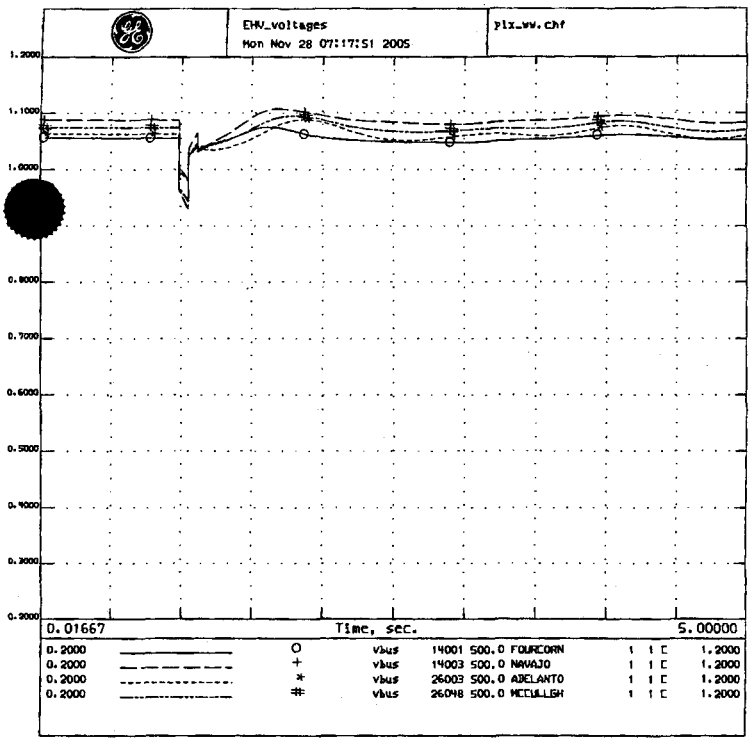
PALO VERDE FLT PLX-RUX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



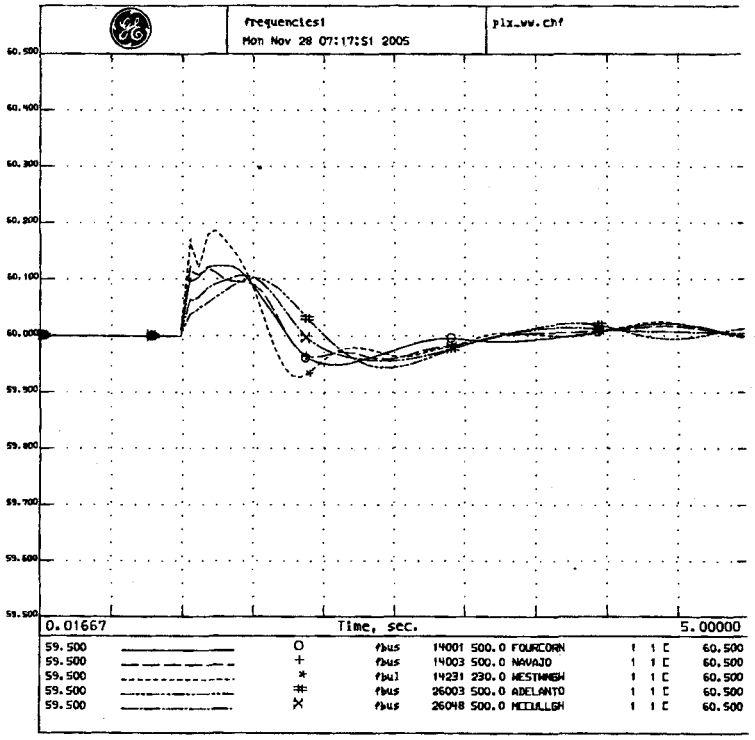
PALO VERDE FLT PLX-RUX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-RUX STAB; 01/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MKP/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-RUX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



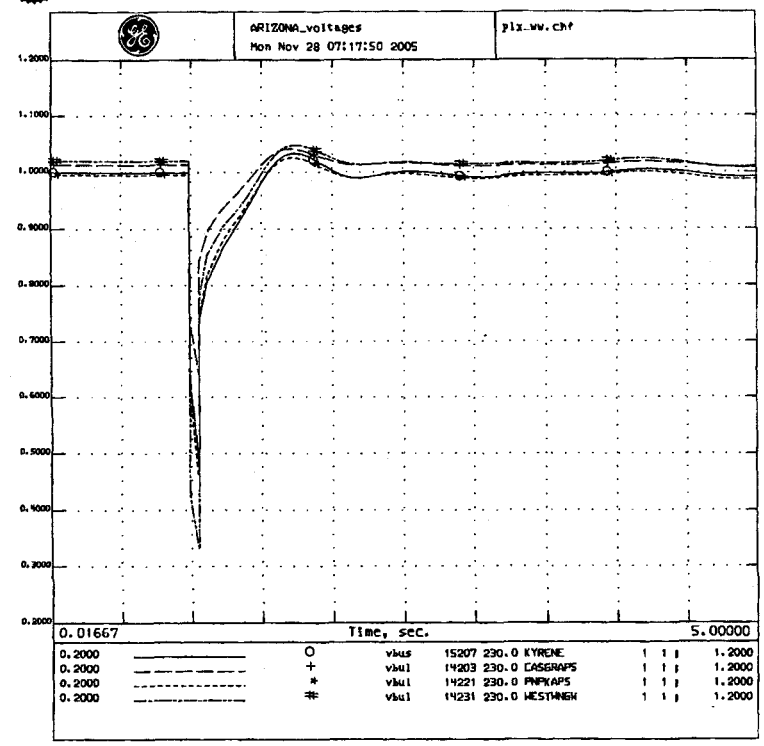
PALO VERDE FLT w/PLX-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



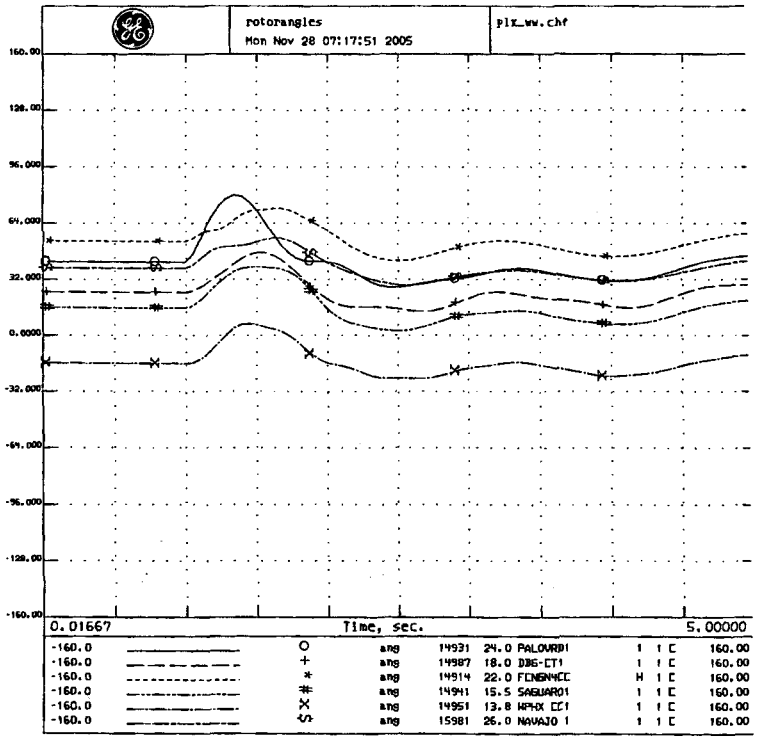
PALO VERDE FLT w/PLX-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



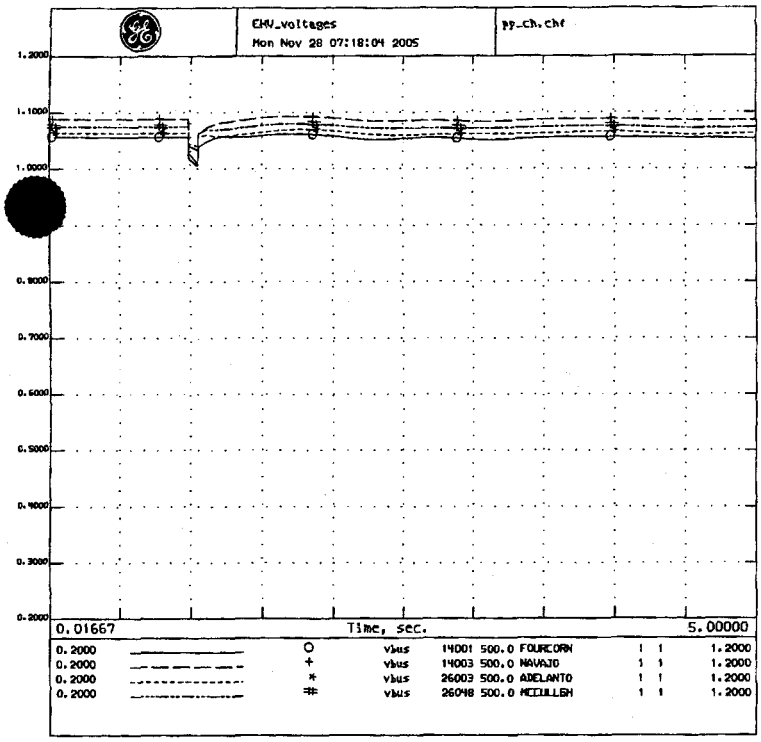
PALO VERDE FLT w/PLX-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



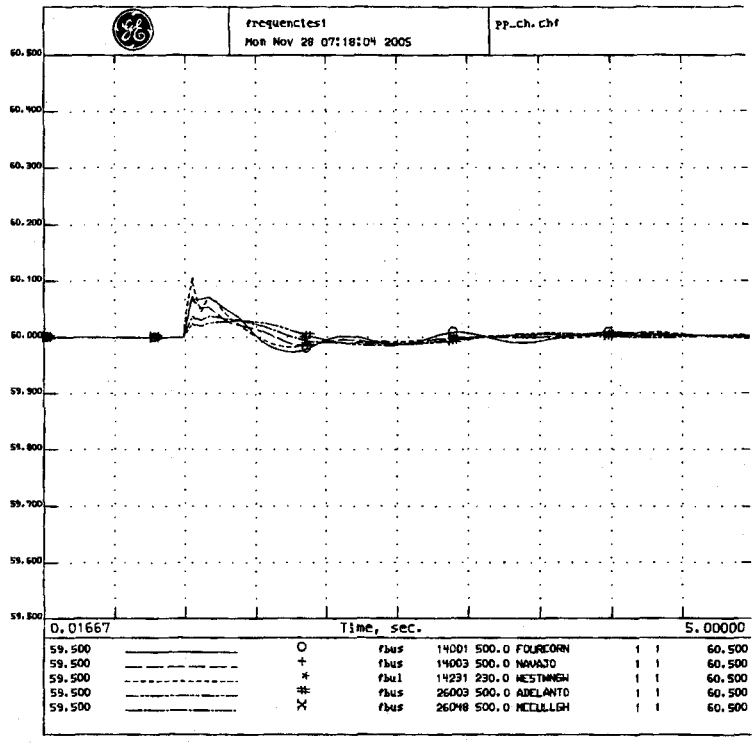
PALO VERDE FLT w/PLX-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PLX-WW STAB; 1/06; T=0 3P FLT PLX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/PLX-WW;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



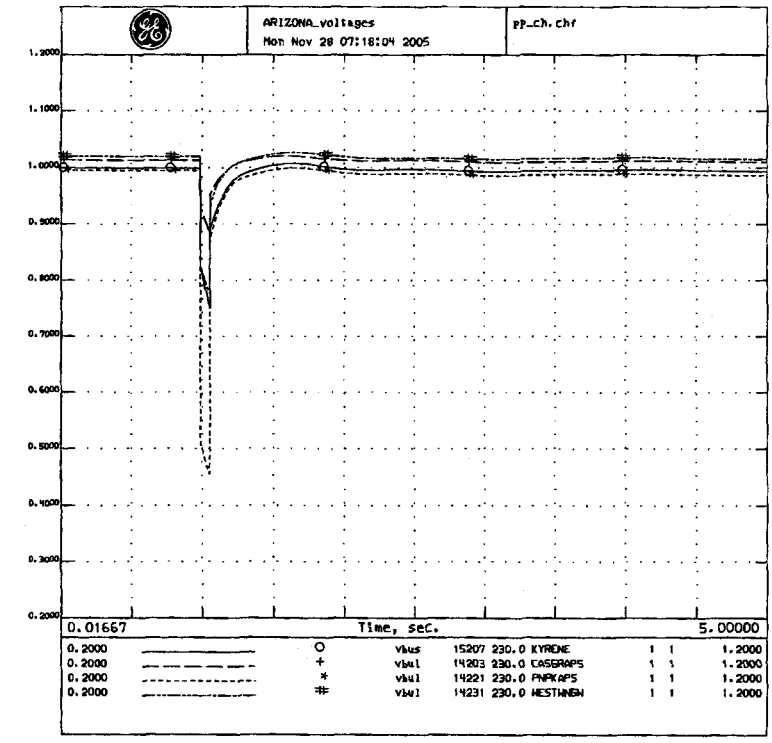
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



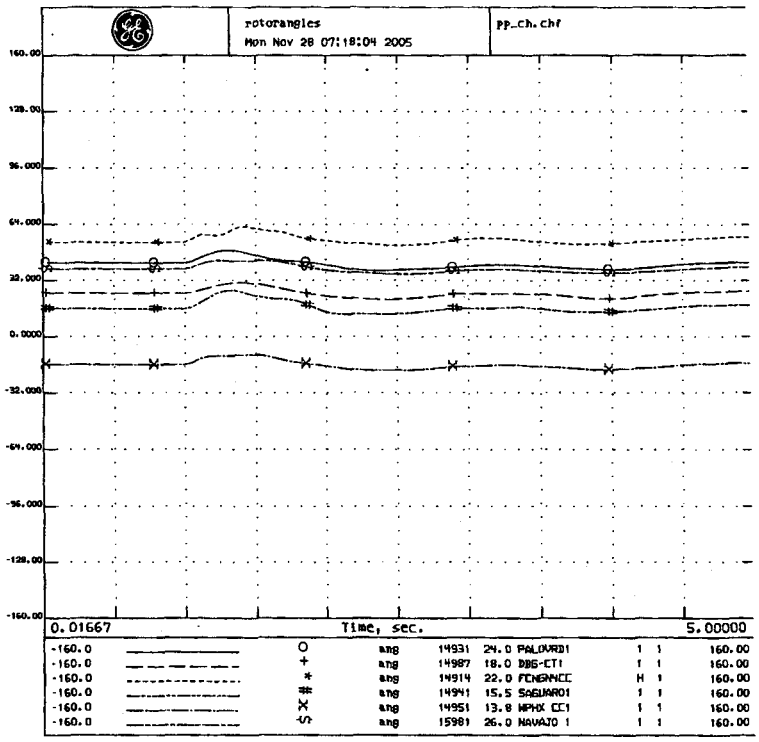
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



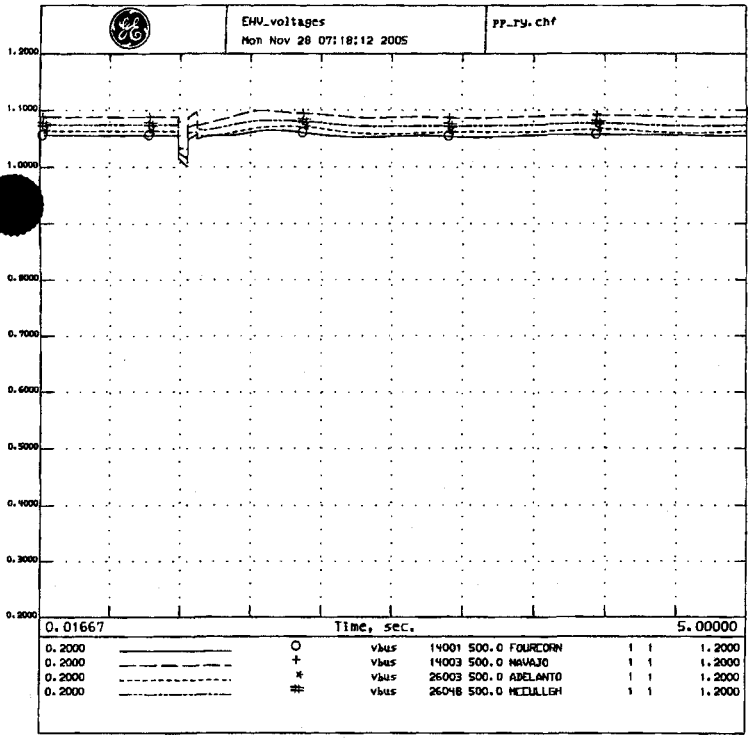
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



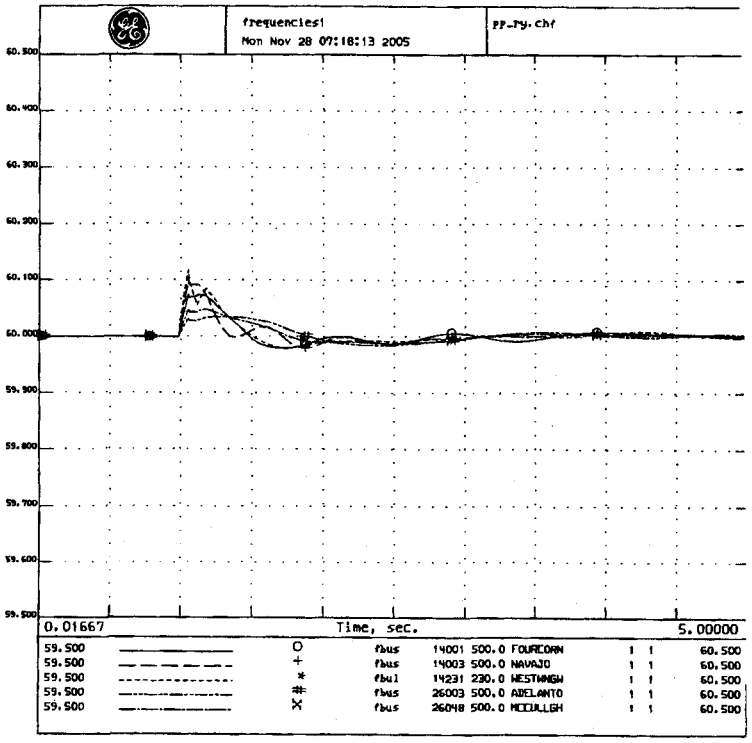
PINNACLE PEAK 345KV FLT PP-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-CH STAB; 01/06; T=0 3P FLT PP345;
4C CLR FLT W/PP-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



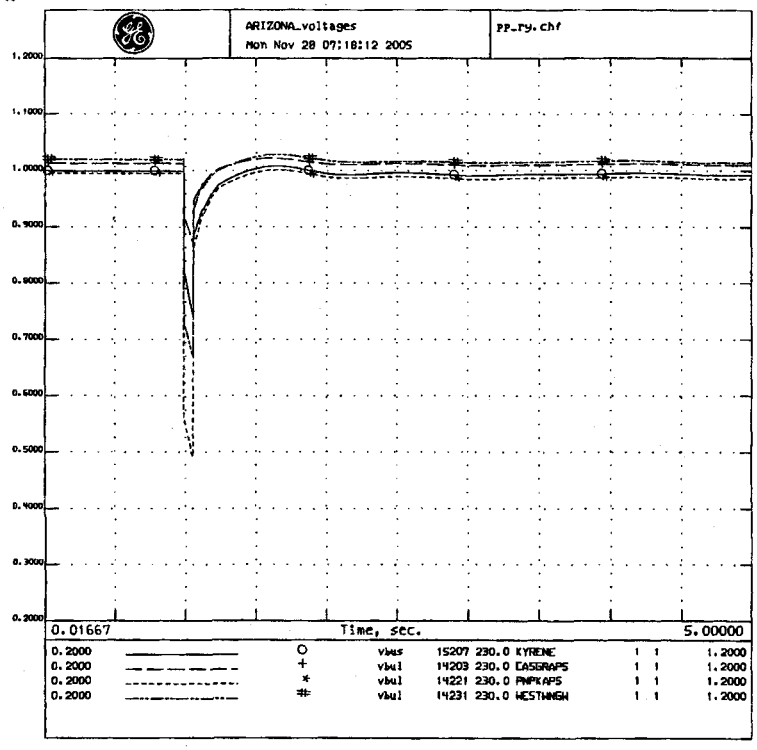
PINNACLE PEAK FLT. PP-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-RY STAB; 1/06; T=0 3P FLT PPS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/PP-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



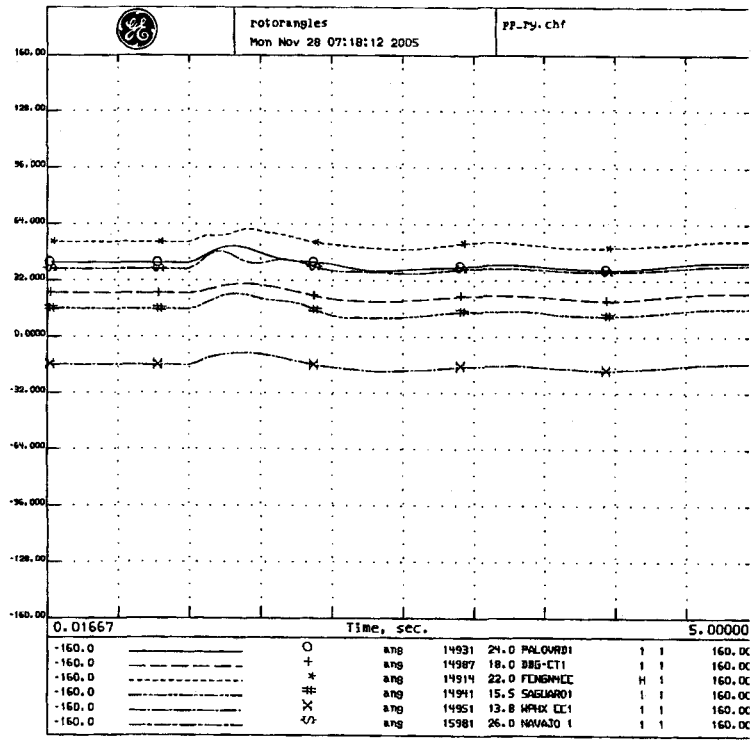
PINNACLE PEAK FLT. PP-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-RY STAB; 1/06; T=0 3P FLT PPS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/PP-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



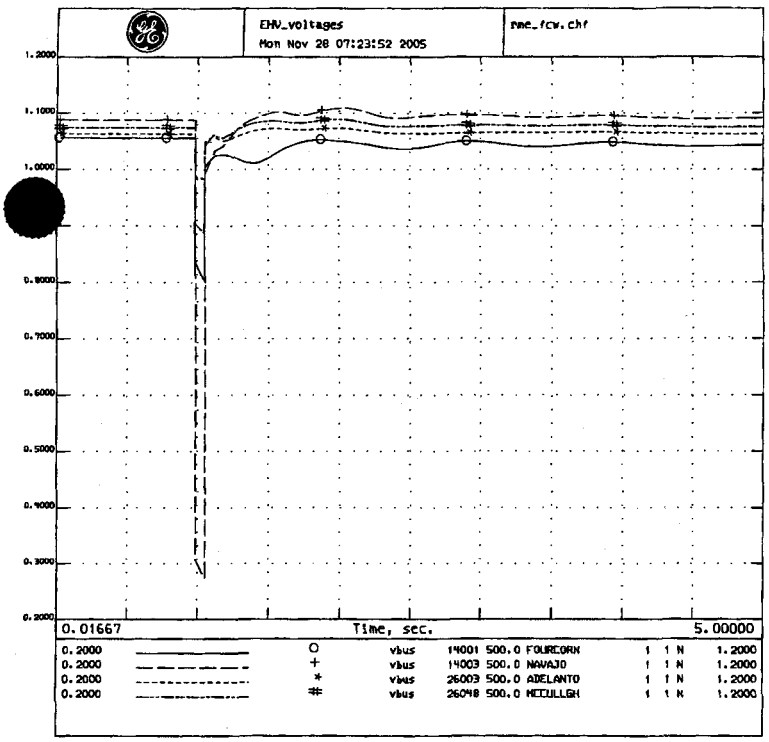
PINNACLE PEAK FLT. PP-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-RY STAB; 1/06; T=0 3P FLT PPS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/PP-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



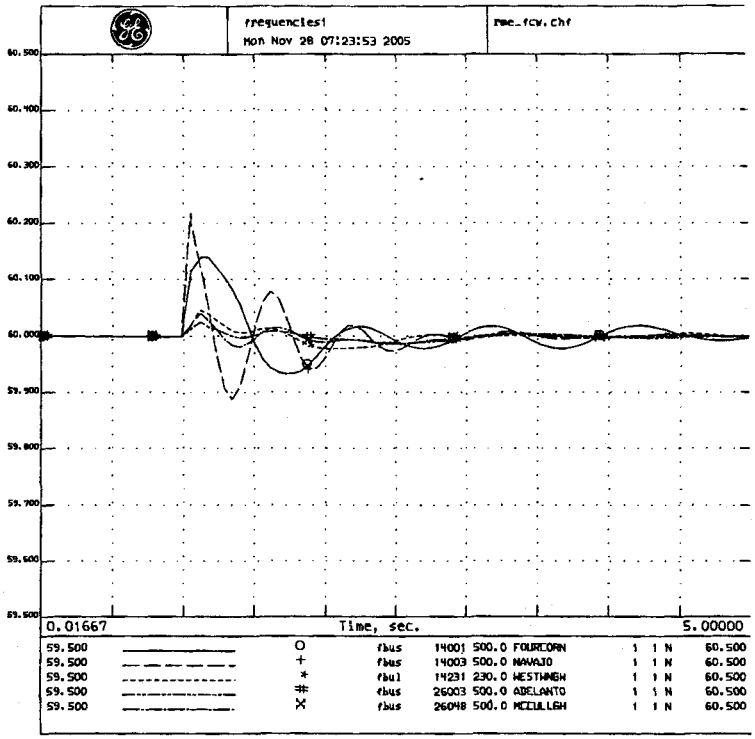
PINNACLE PEAK FLT. PP-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
PP-RY STAB; 1/06; T=0 3P FLT PPS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/PP-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



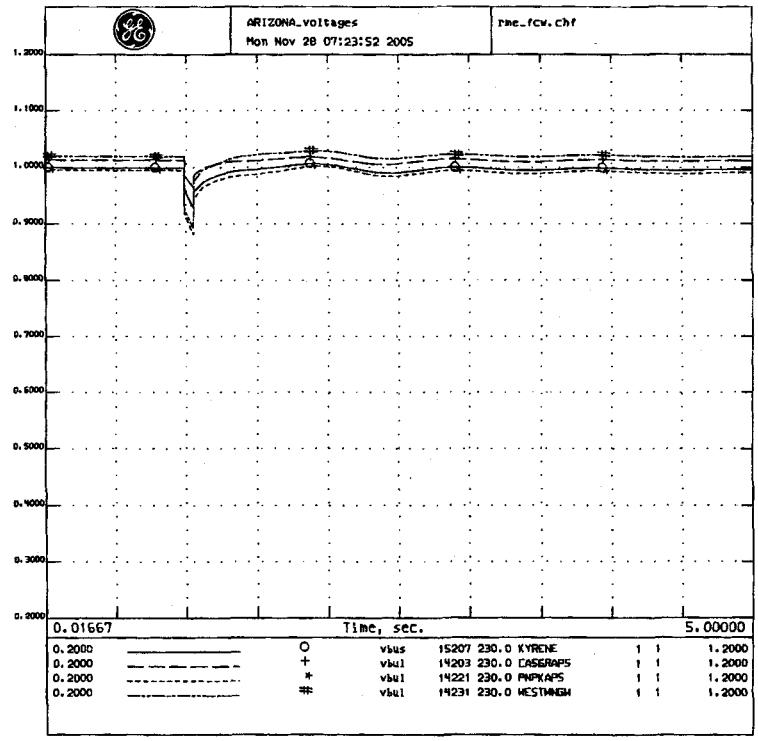
RME FLT500 RME-FCW out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-FCW STAB; 1/06; T=0 3P FLT RME500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/RME-FCW;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



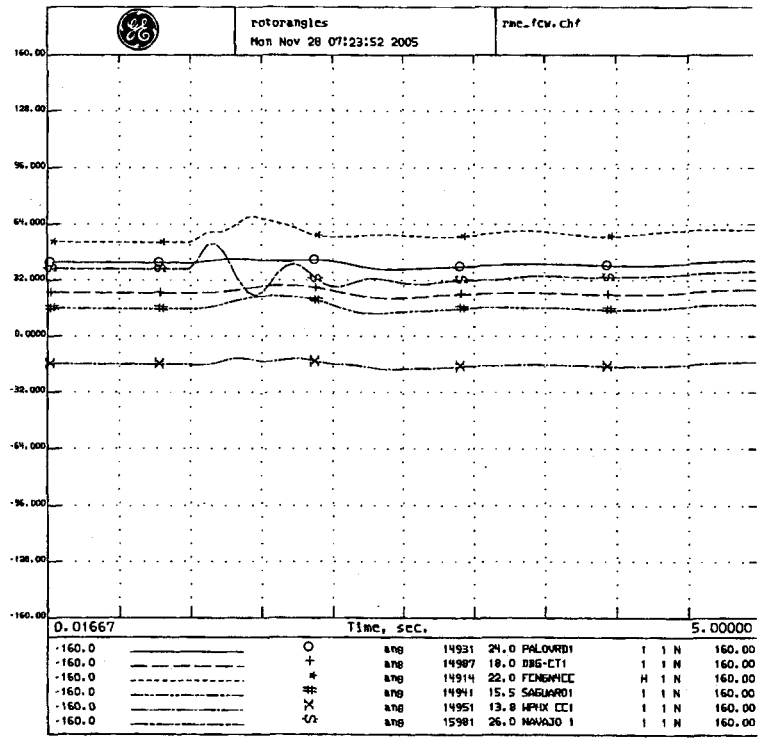
RME FLT500 RME-FCW out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-FCW STAB; 1/06; T=0 3P FLT RME500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/RME-FCW;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



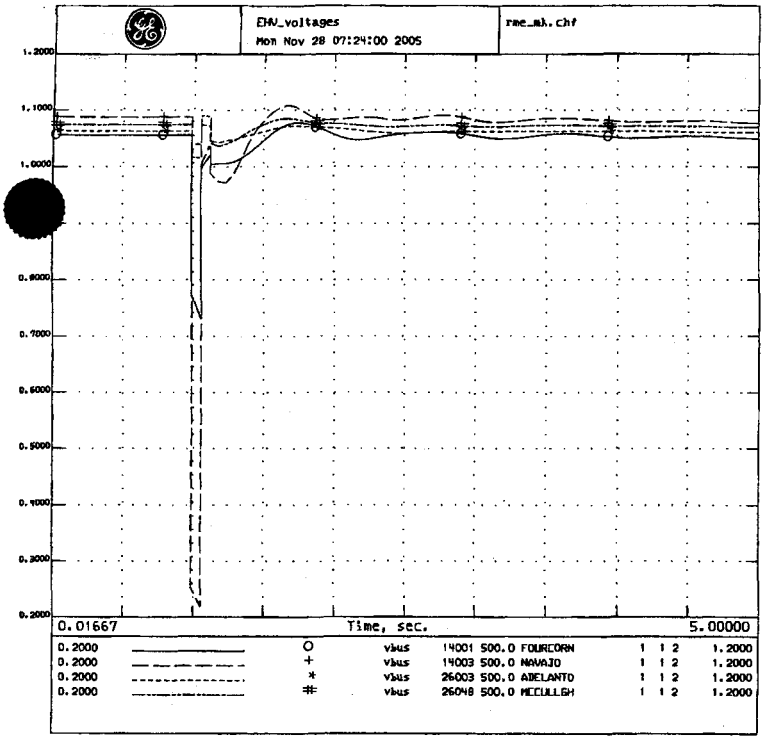
RME FLT500 RME-FCW out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-FCW STAB; 1/06; T=0 3P FLT RME500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/RME-FCW;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



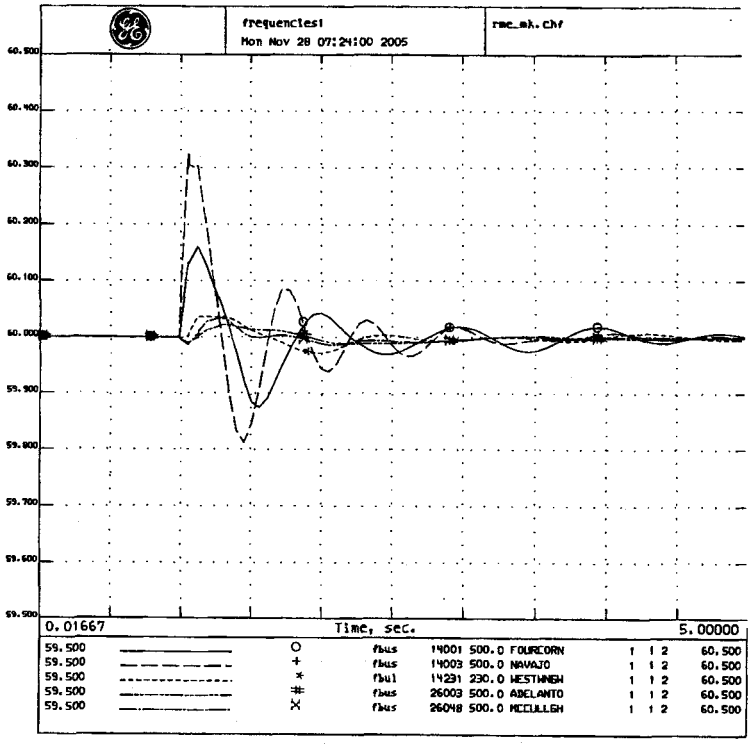
RME FLT500 RME-FCW out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-FCW STAB; 1/06; T=0 3P FLT RME500;10% FLT DMPING;FLSH
CAPS FC-MK/NV-MK;4C CLR FLT W/RME-FCW;8C REIN CAPS;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



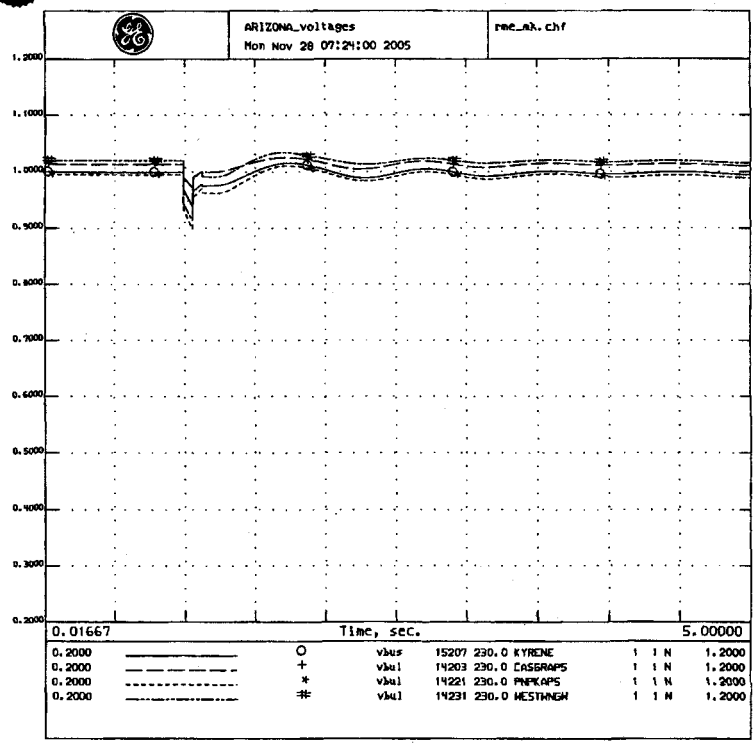
RME FLT. RME-MK. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-MK STAB; 1/06; T=0 3P FLT RME500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



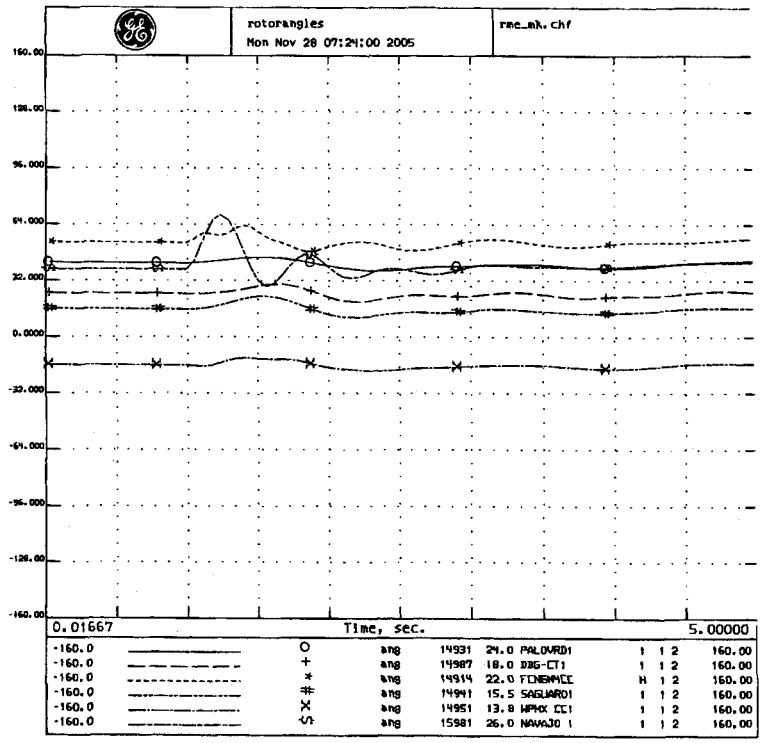
RME FLT. RME-MK. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-MK STAB; 1/06; T=0 3P FLT RME500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



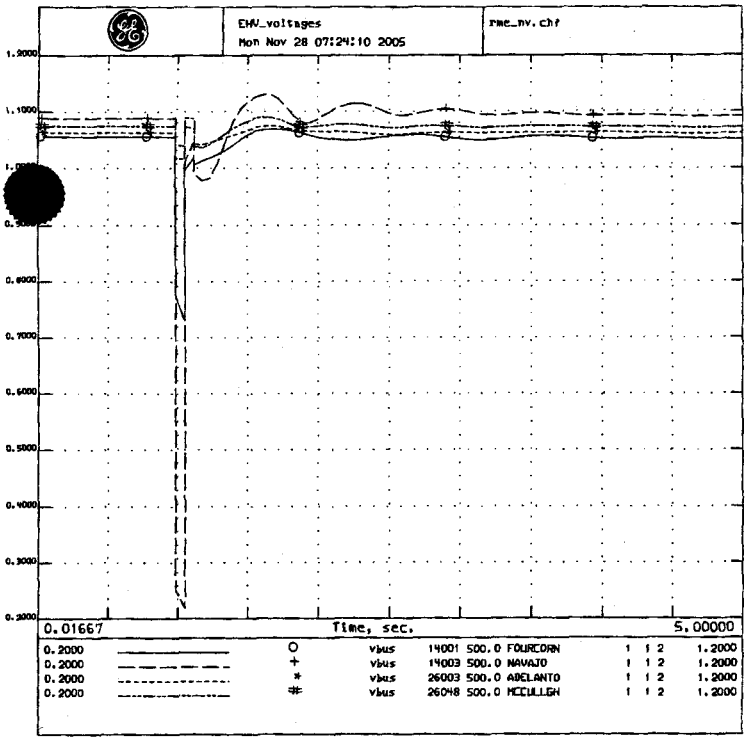
RME FLT. RME-MK. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-MK STAB; 1/06; T=0 3P FLT RME500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



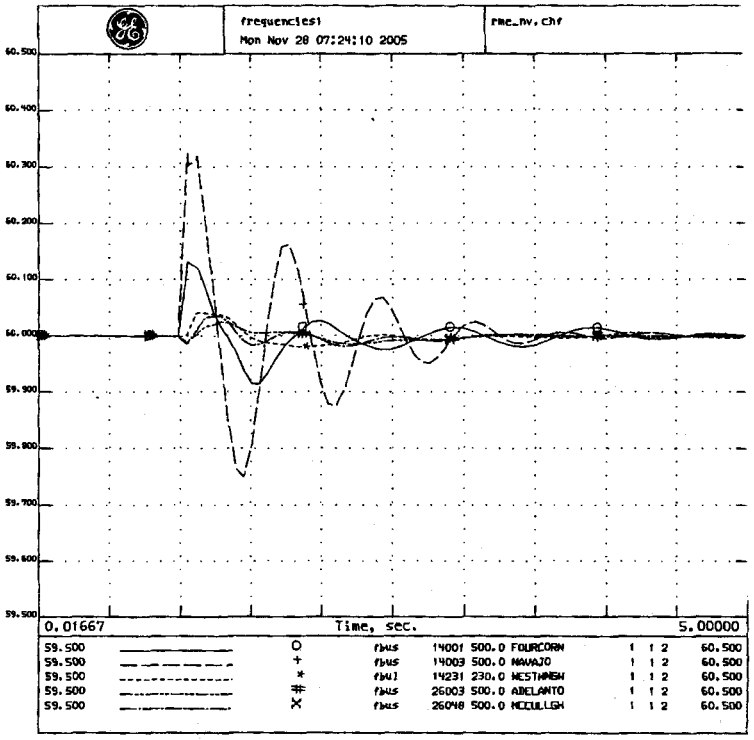
RME FLT. RME-MK. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-MK STAB; 1/06; T=0 3P FLT RME500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/MK-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



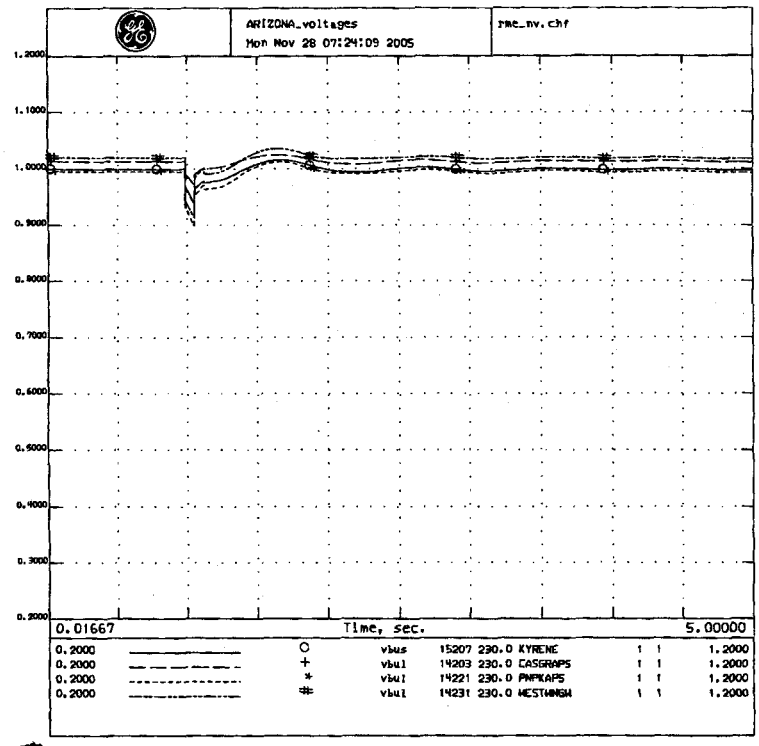
RME FLT. RME-NV. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-NV STAB; 1/06; T=0 3P FLT RME500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



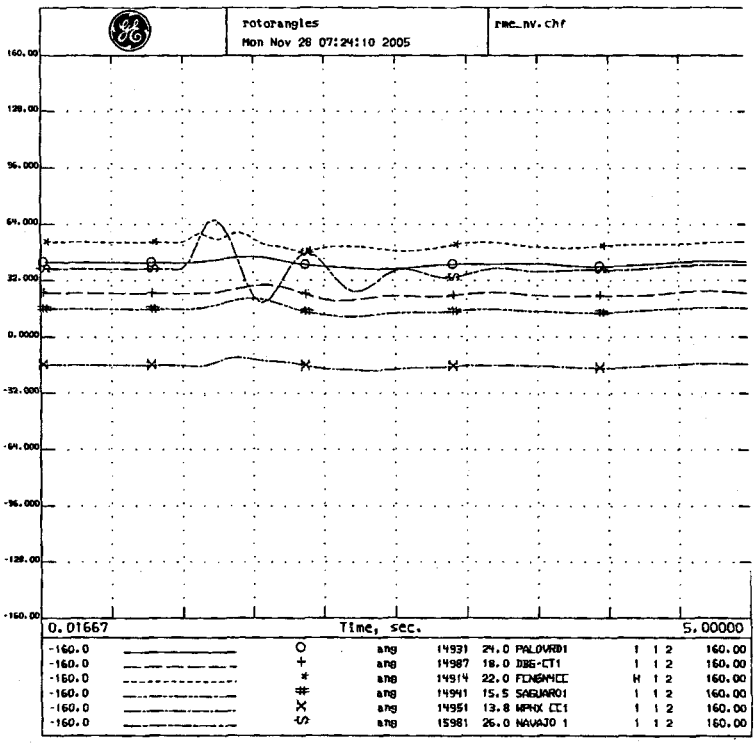
RME FLT. RME-NV. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-NV STAB; 1/06; T=0 3P FLT RME500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



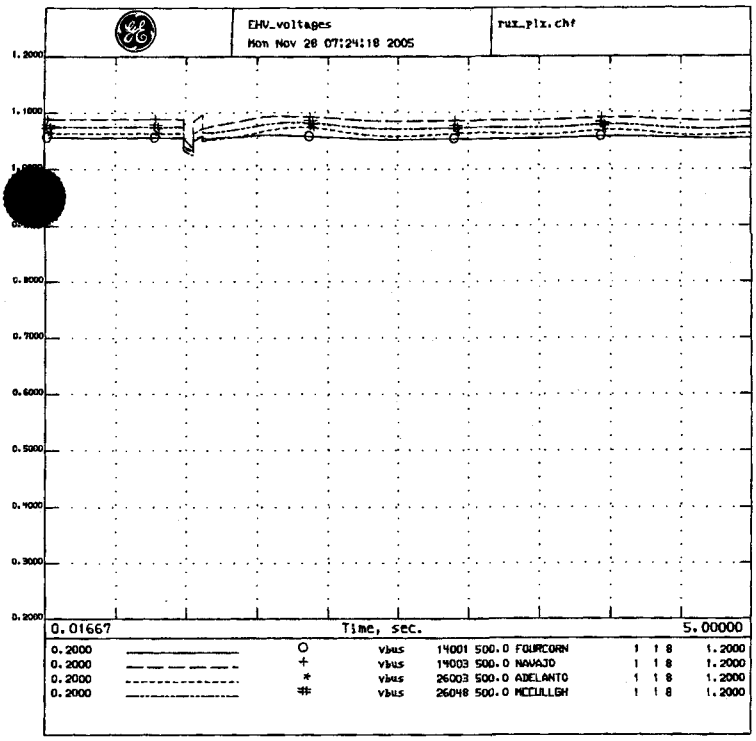
RME FLT. RME-NV. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-NV STAB; 1/06; T=0 3P FLT RME500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



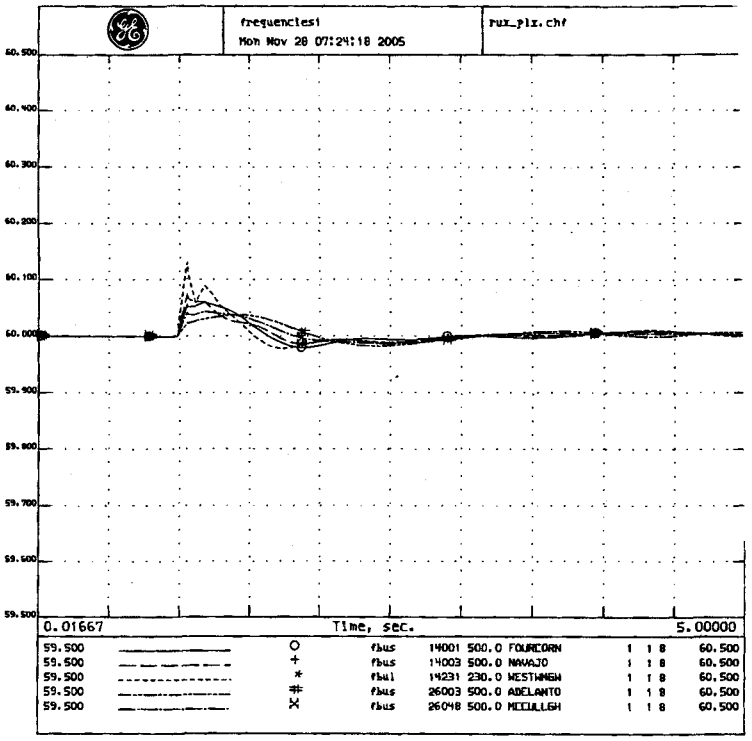
RME FLT. RME-NV. line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RME-NV STAB; 1/06; T=0 3P FLT RME500; 6X FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/NV-MK;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



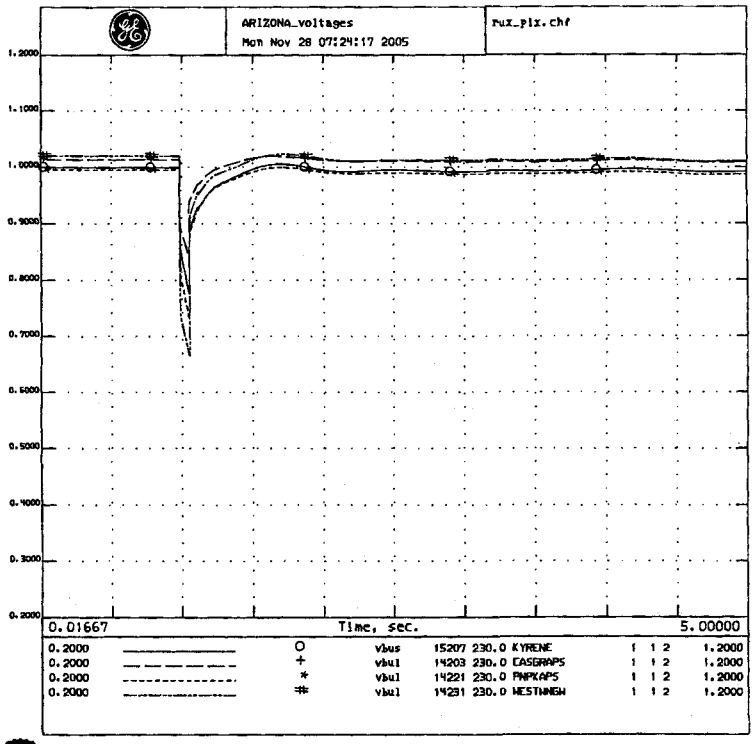
RUDD FLT RUX-PLX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RUX-PLX STAB #1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



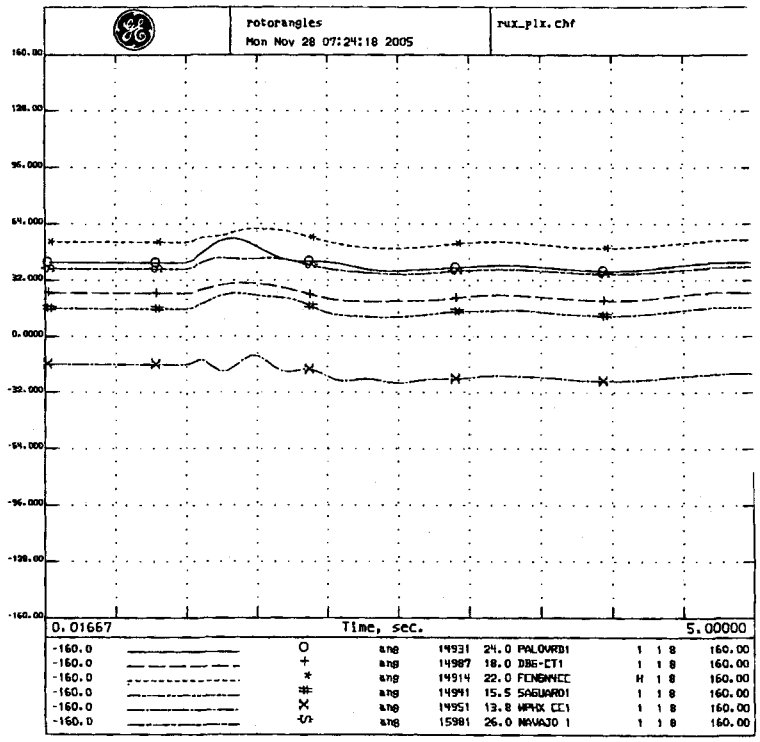
RUDD FLT RUX-PLX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RUX-PLX STAB #1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



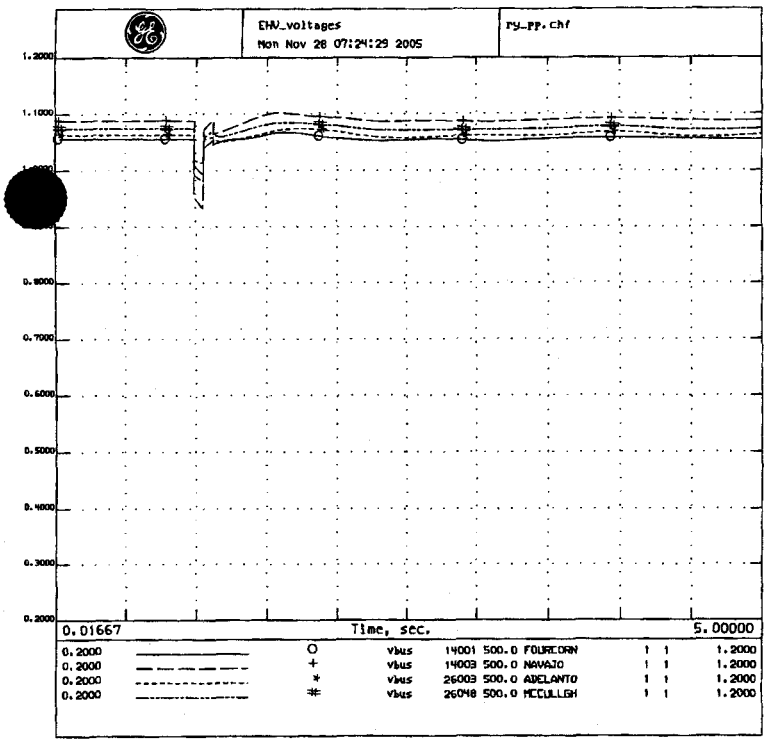
RUDD FLT RUX-PLX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RUX-PLX STAB #1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



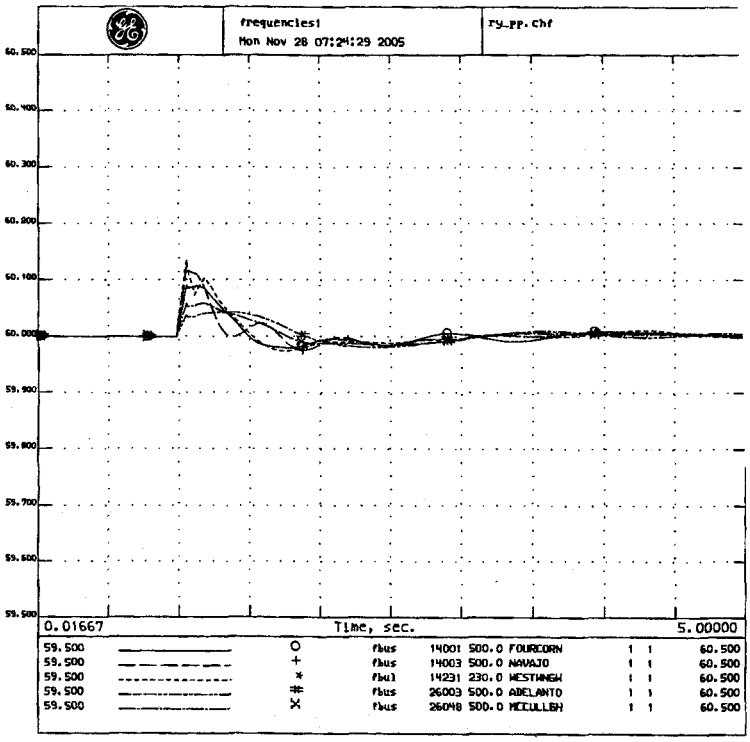
RUDD FLT RUX-PLX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RUX-PLX STAB #1; 01/06; T=0 3P FLT RUX500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/RUX-PLX;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



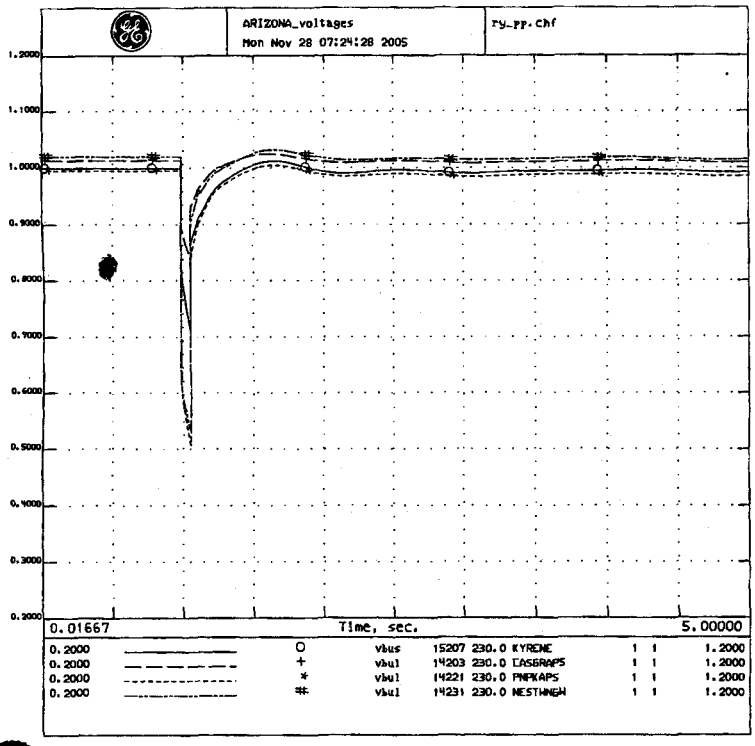
RACEWAY FLT. RY-PP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-PP STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-PP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



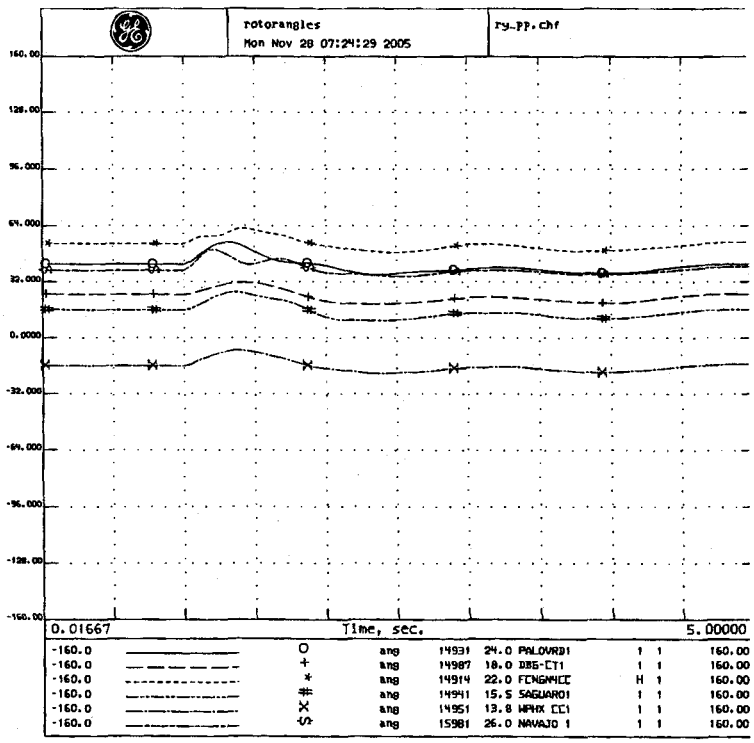
RACEWAY FLT. RY-PP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-PP STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-PP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



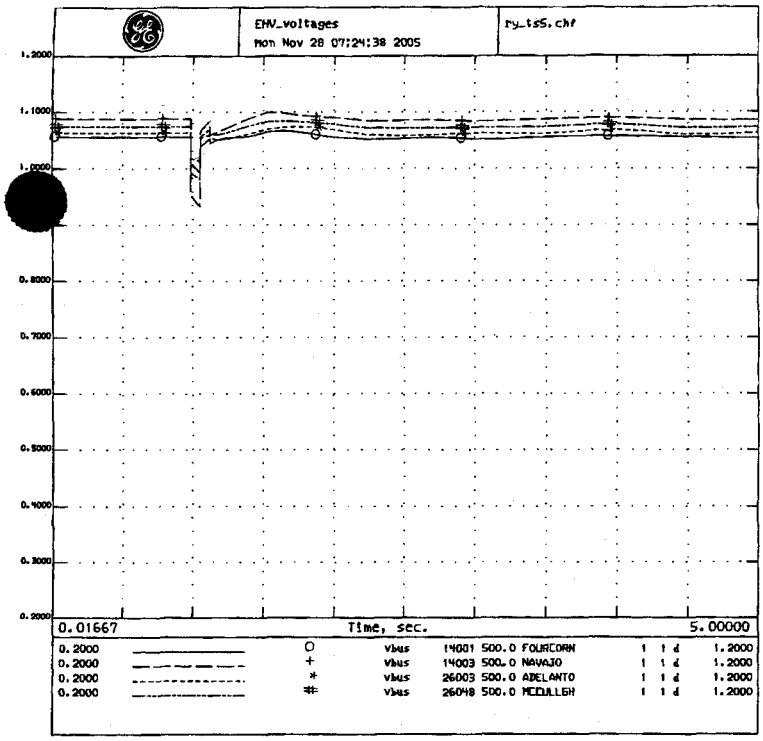
RACEWAY FLT. RY-PP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-PP STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-PP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



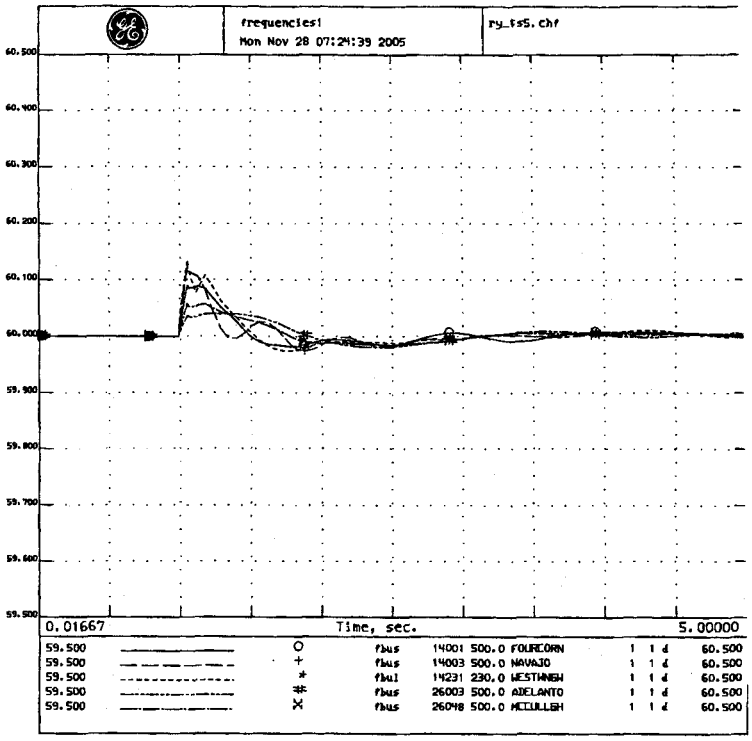
RACEWAY FLT. RY-PP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-PP STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-PP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



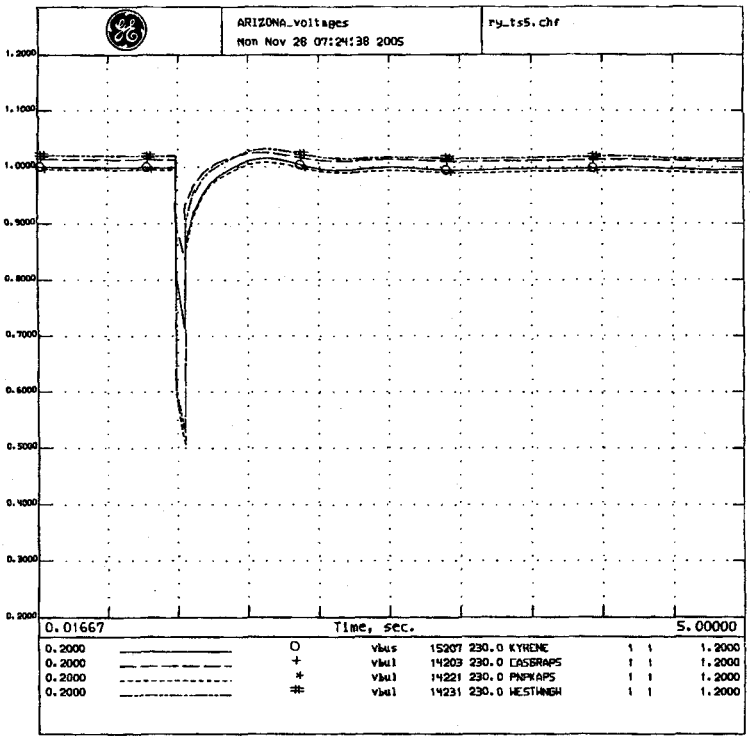
RACEWAY FLT. RY-TSS line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-TSS STAB; 1/06; T=0 3P FLT RYS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-TSS;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



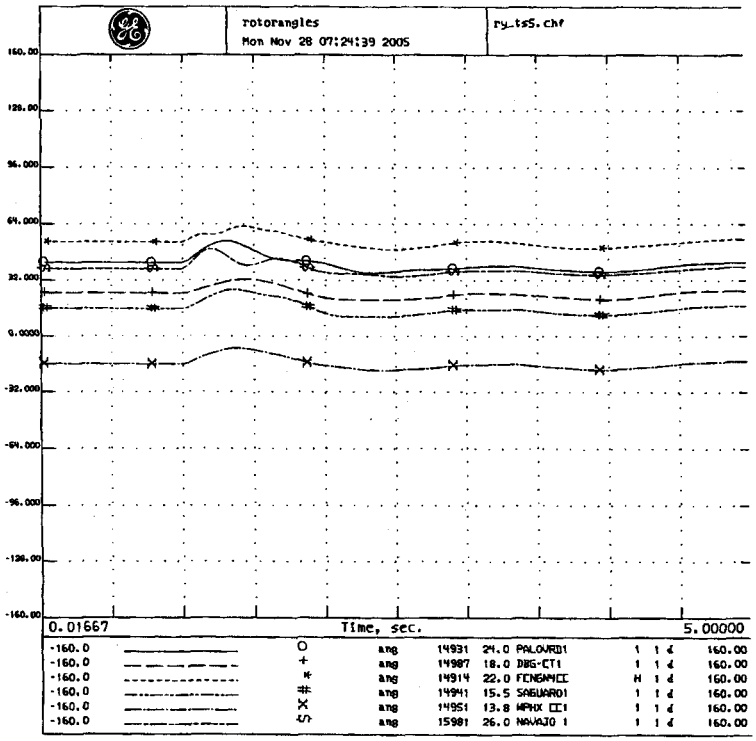
RACEWAY FLT. RY-TSS line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-TSS STAB; 1/06; T=0 3P FLT RYS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-TSS;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



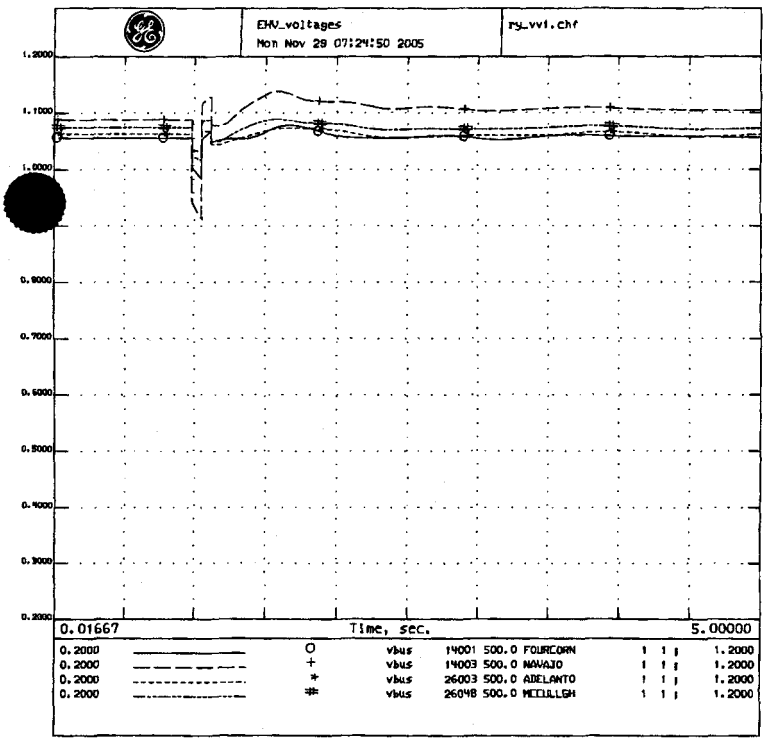
RACEWAY FLT. RY-TSS line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-TSS STAB; 1/06; T=0 3P FLT RYS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-TSS;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



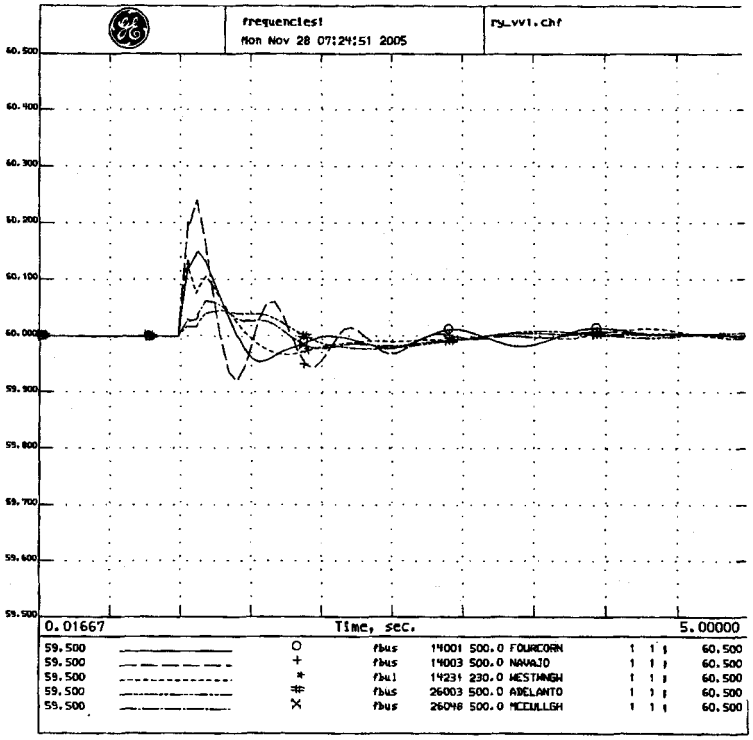
RACEWAY FLT. RY-TSS line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-TSS STAB; 1/06; T=0 3P FLT RYS00;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-TSS;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



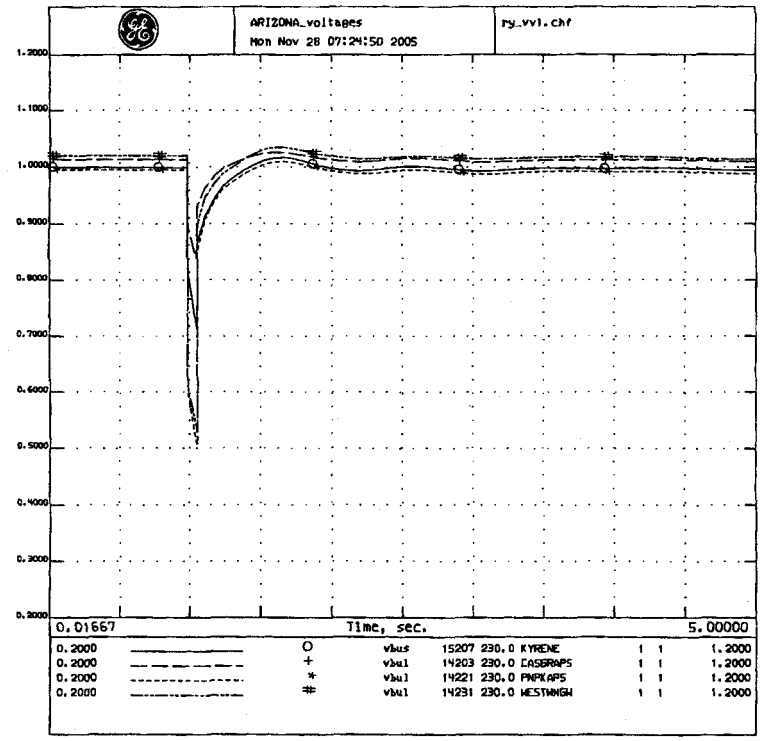
RY FLT RY-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-VV1 STAB; 1/06; T=0 3P FLT RY500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/RY-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



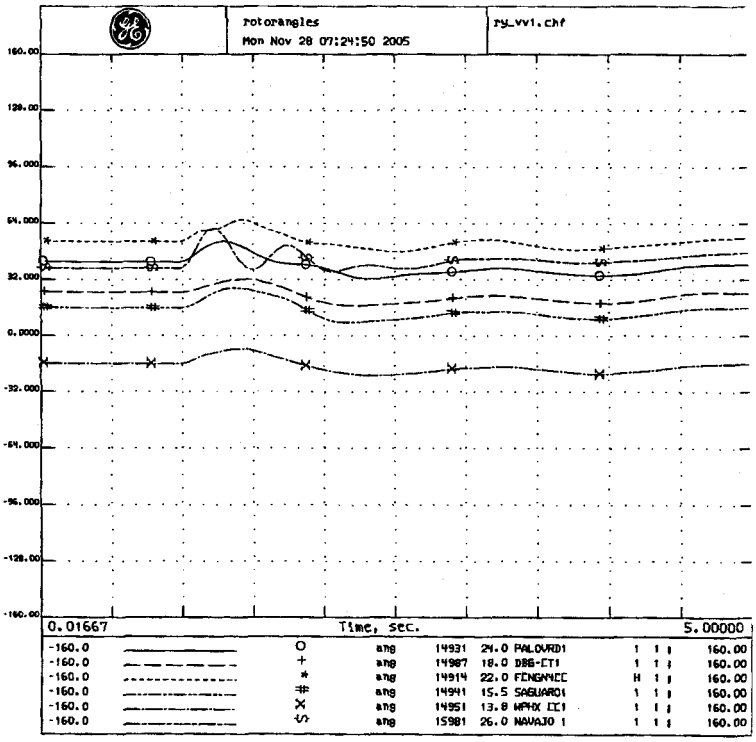
RY FLT RY-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-VV1 STAB; 1/06; T=0 3P FLT RY500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/RY-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



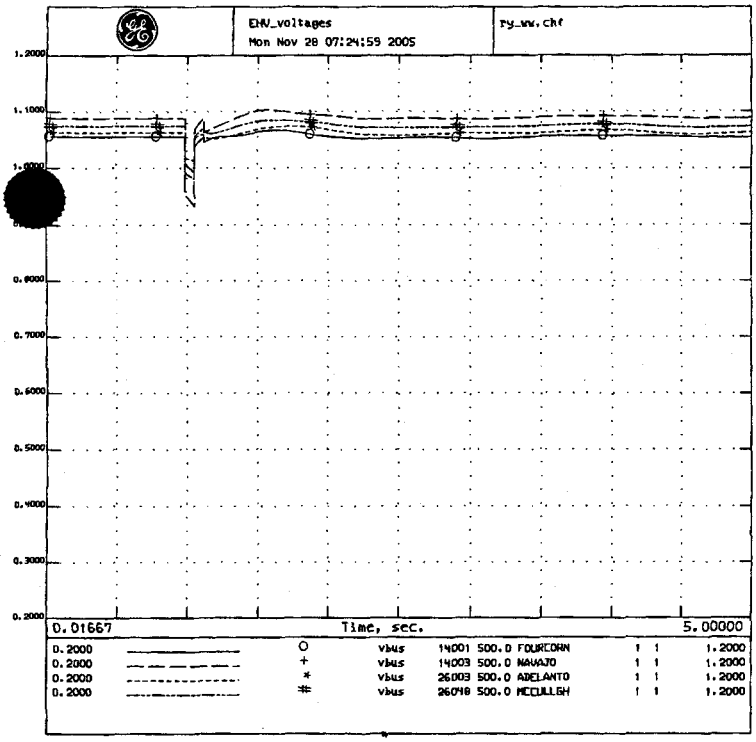
RY FLT RY-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-VV1 STAB; 1/06; T=0 3P FLT RY500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/RY-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



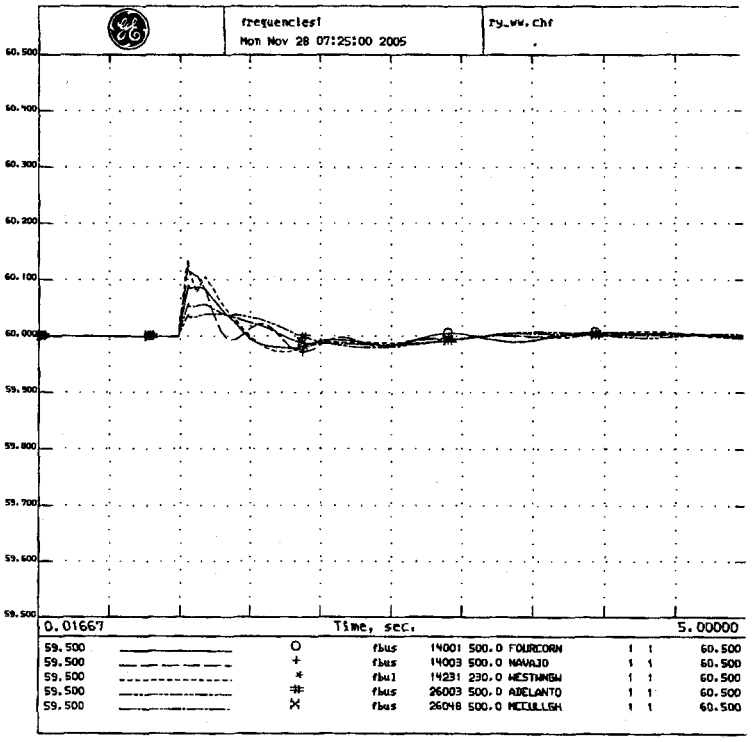
RY FLT RY-VV1 LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-VV1 STAB; 1/06; T=0 3P FLT RY500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/RY-VV1;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



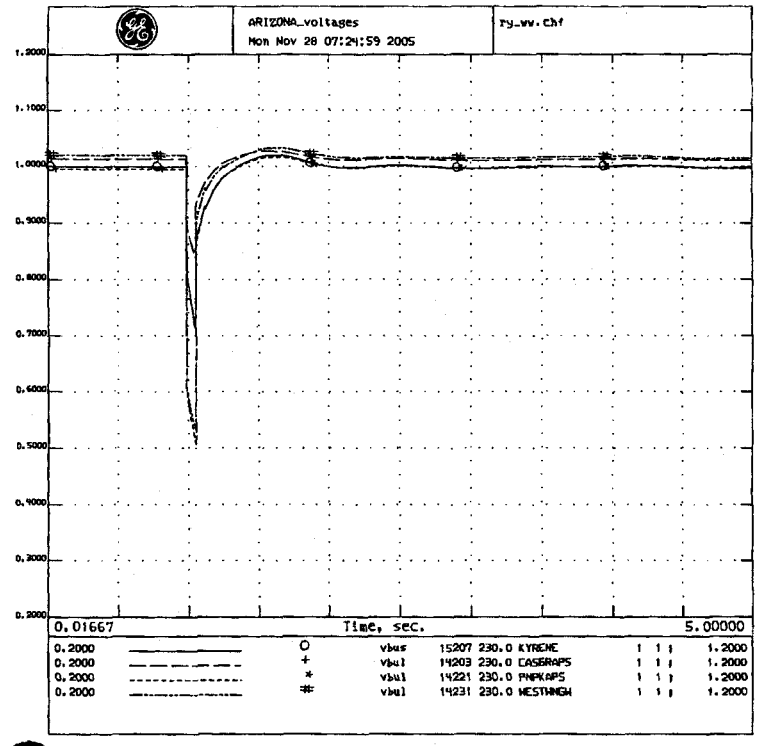
RACEWAY FLT. RY-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-WW STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-WW;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



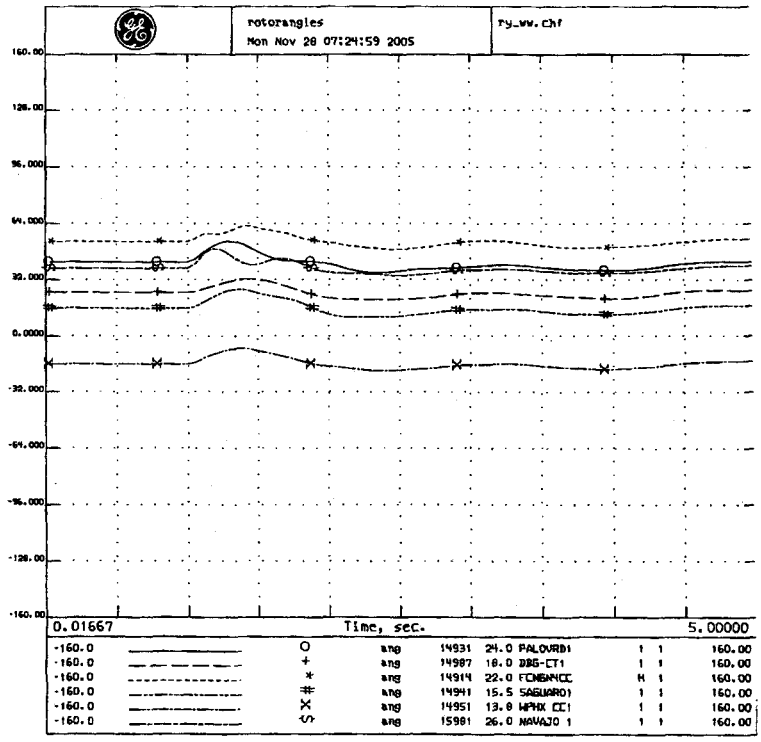
RACEWAY FLT. RY-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-WW STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-WW;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



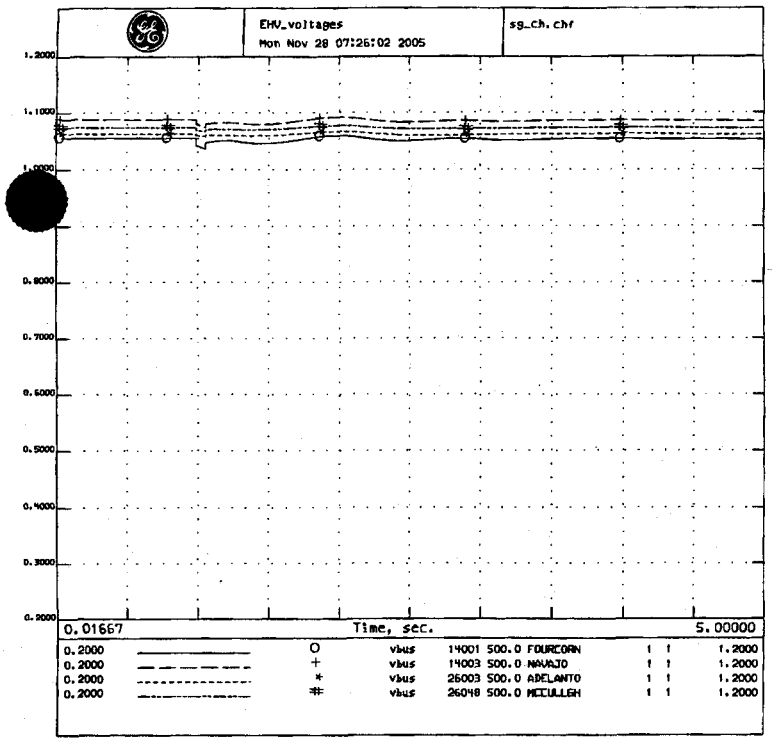
RACEWAY FLT. RY-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-WW STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-WW;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



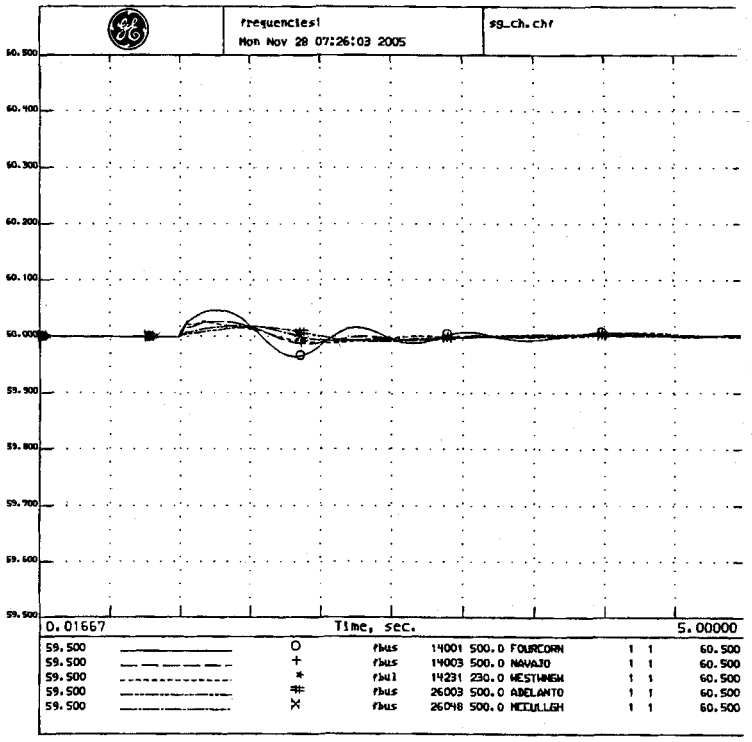
RACEWAY FLT. RY-WW line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
RY-WW STAB; 1/06; T=0 3P FLT RY500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/RY-WW;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



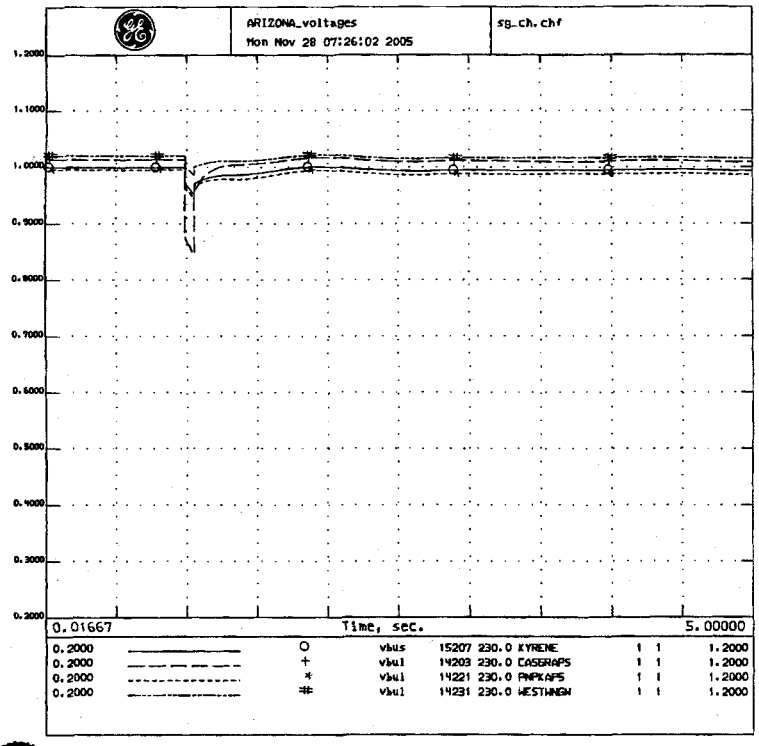
SAGUARO FLT SG-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



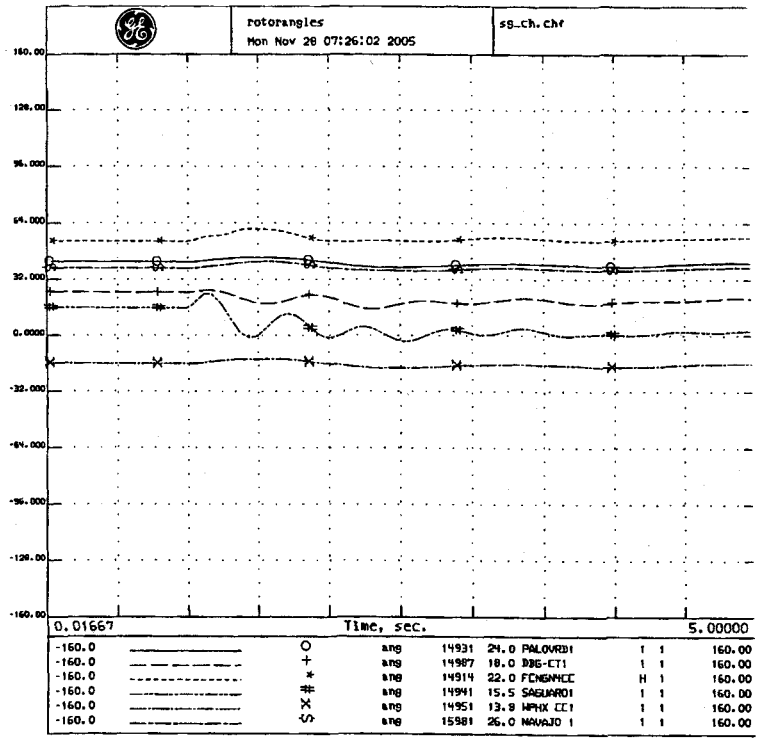
SAGUARO FLT SG-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



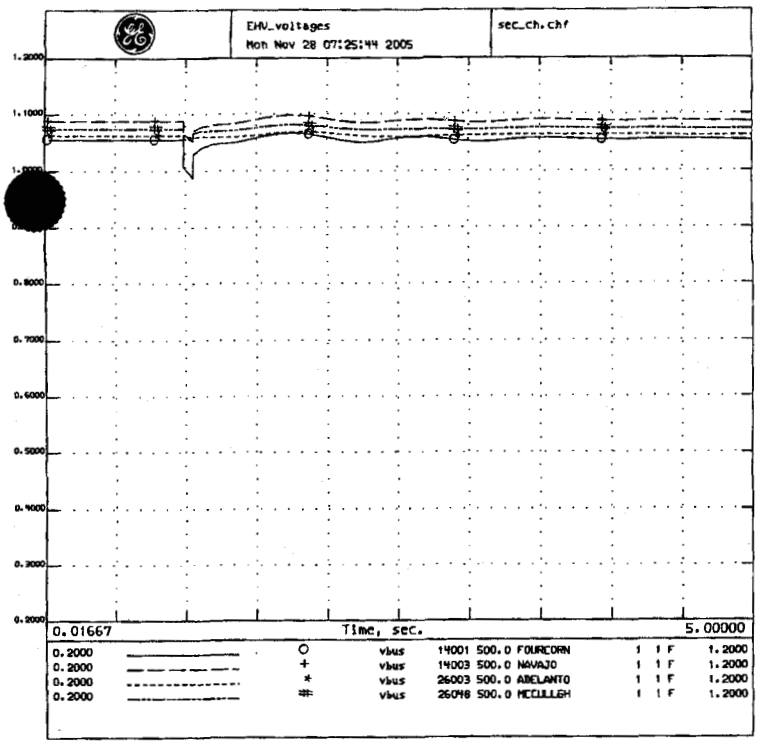
SAGUARO FLT SG-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



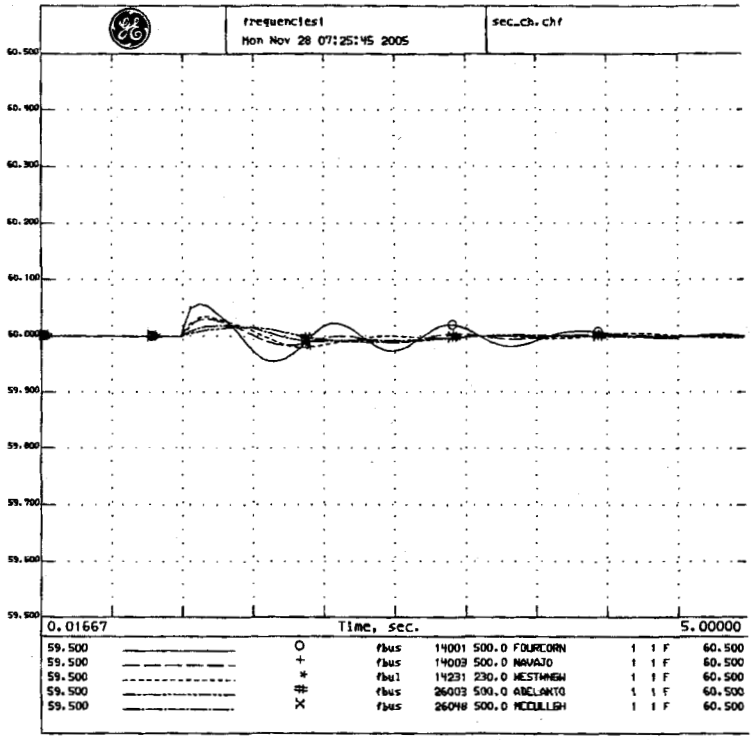
SAGUARO FLT SG-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SG-CH STAB; 01/06; T=0 3P FLT SG500;
4C CLR FLT W/SG-CH;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



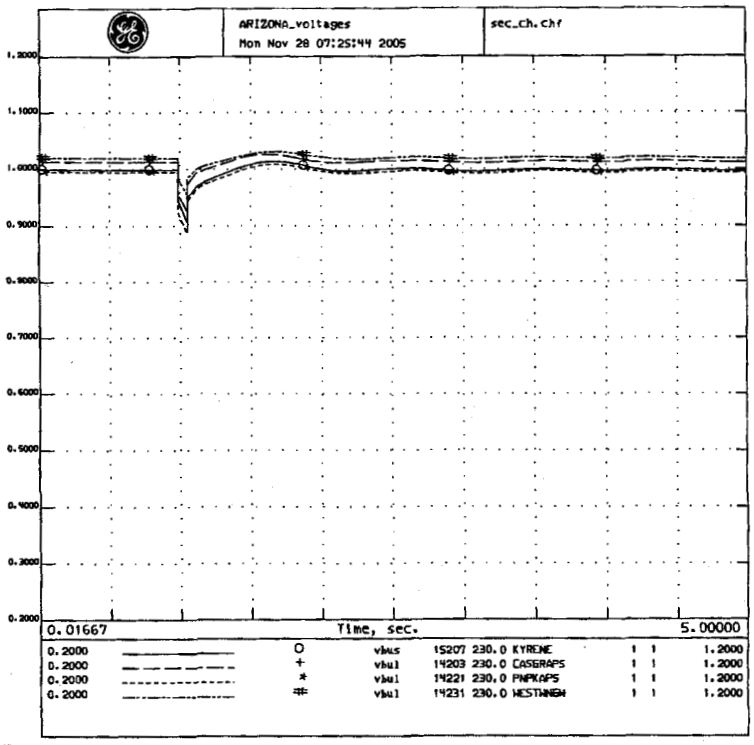
SECOND KNOLL 500KV FLT SEC-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CH STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CH;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



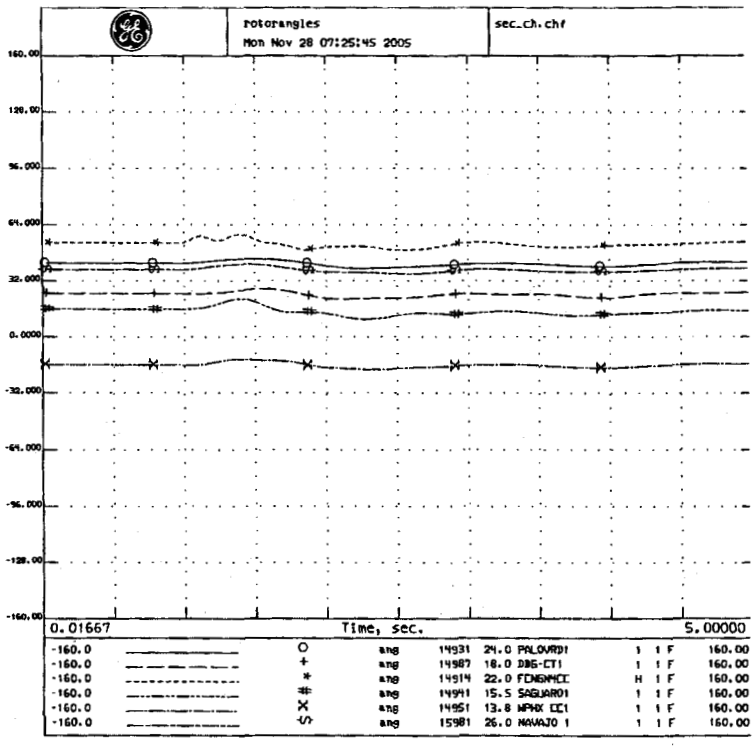
SECOND KNOLL 500KV FLT SEC-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CH STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CH;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



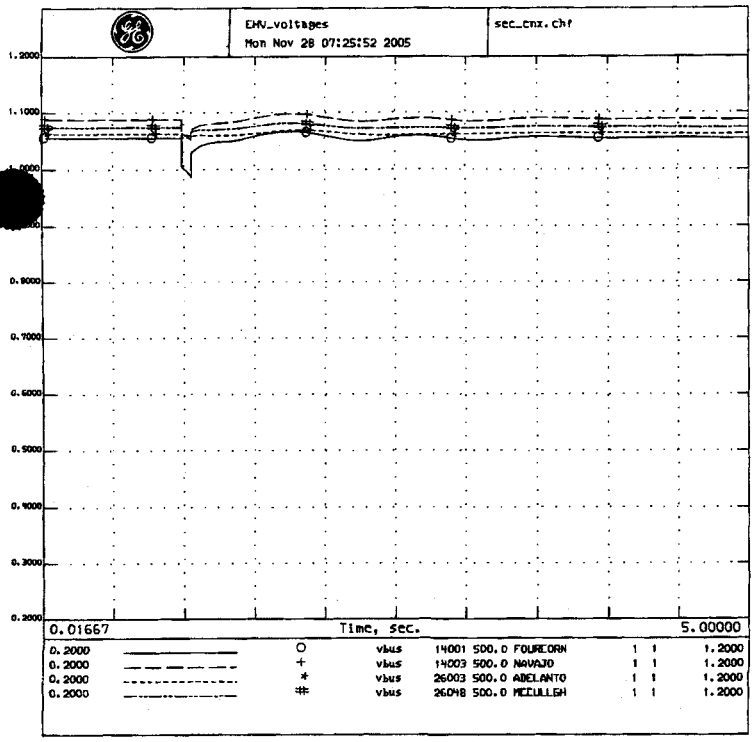
SECOND KNOLL 500KV FLT SEC-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CH STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CH;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



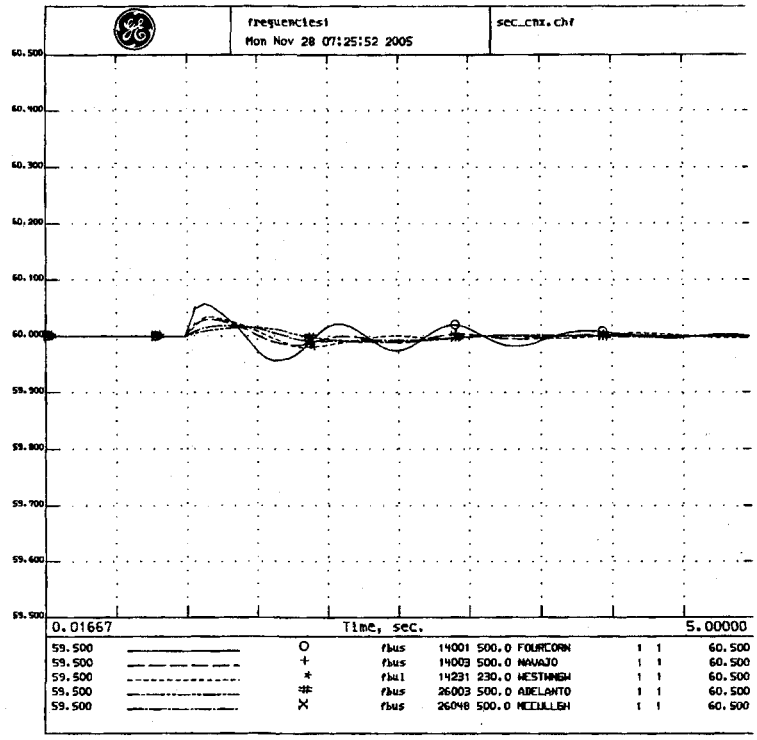
SECOND KNOLL 500KV FLT SEC-CH LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CH STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CH;2014.dyd;HSCC.bpt

Changes from APS/SRP/WAPA/TEP



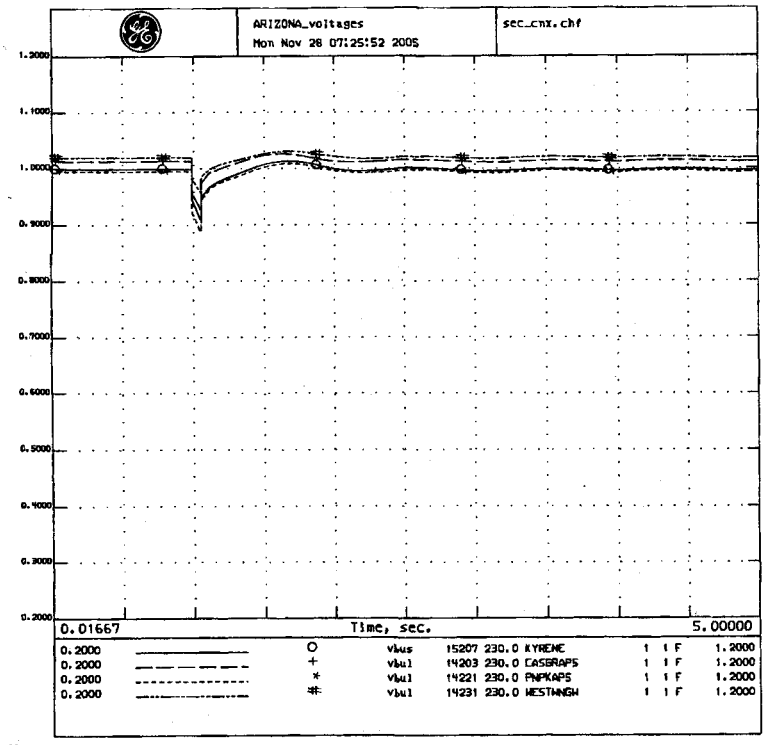
SECOND KNOLL 500KV FLT SEC-CNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CNX STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



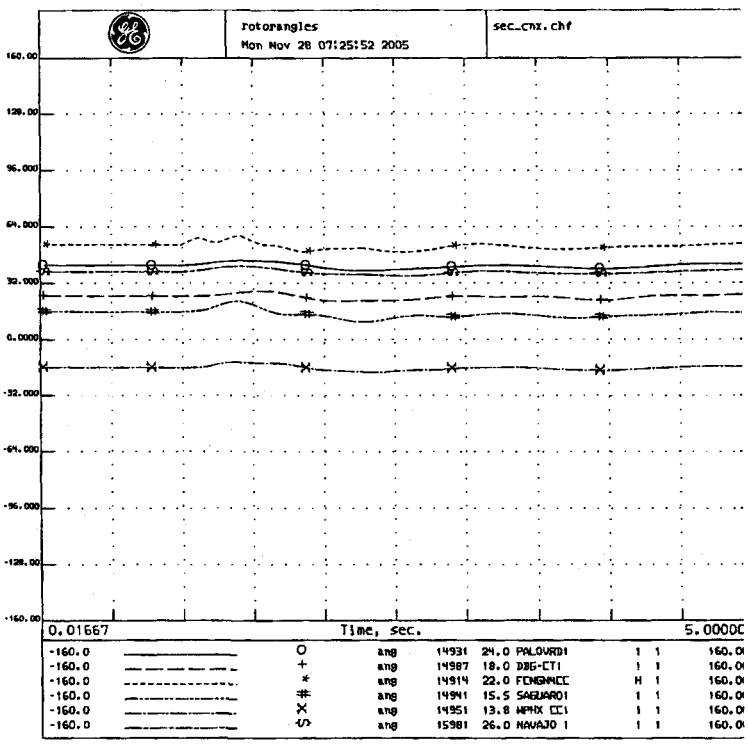
SECOND KNOLL 500KV FLT SEC-CNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CNX STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



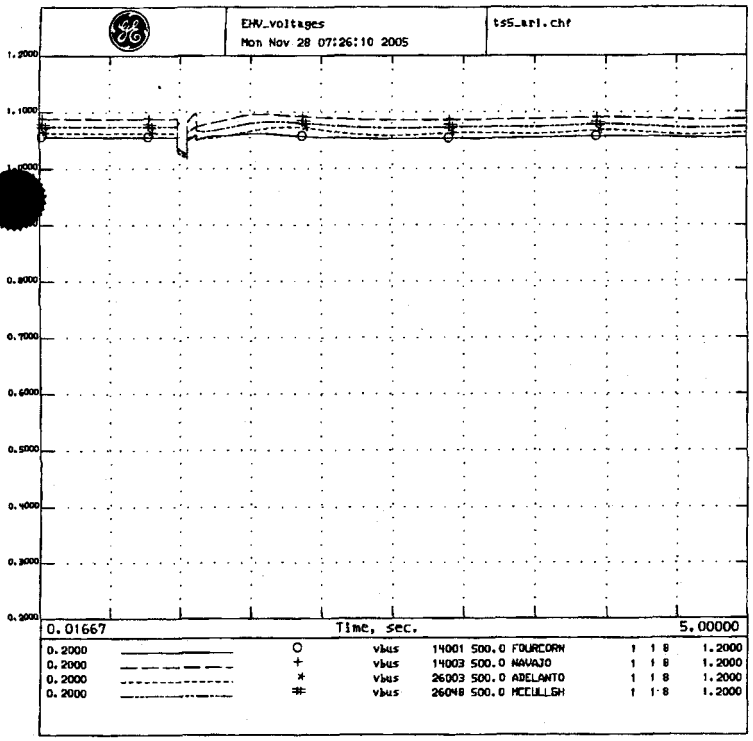
SECOND KNOLL 500KV FLT SEC-CNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CNX STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



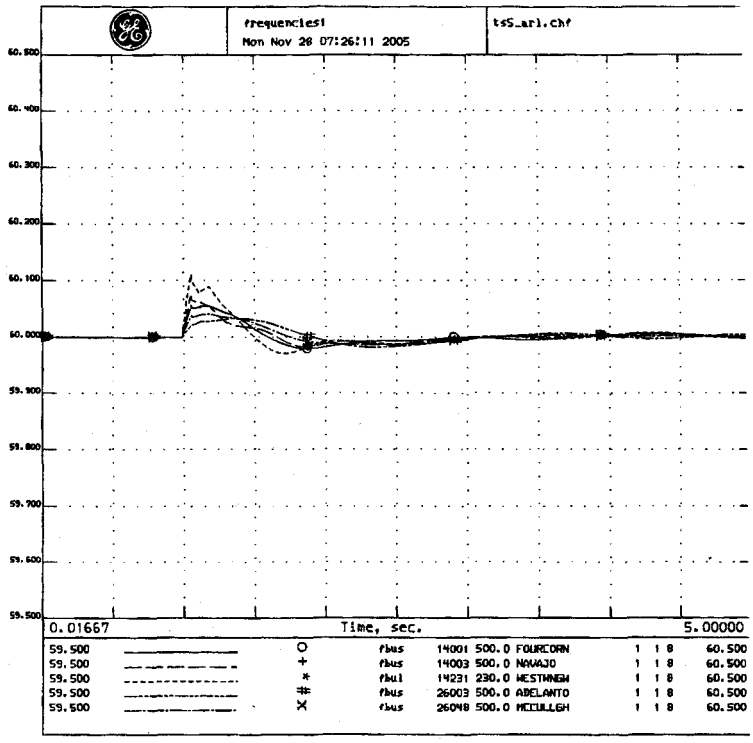
SECOND KNOLL 500KV FLT SEC-CNX LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
SEC-CNX STAB; 1/06; T=0 3P FLT SEC500;4C CLR FLT
W/SEC-CNX;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



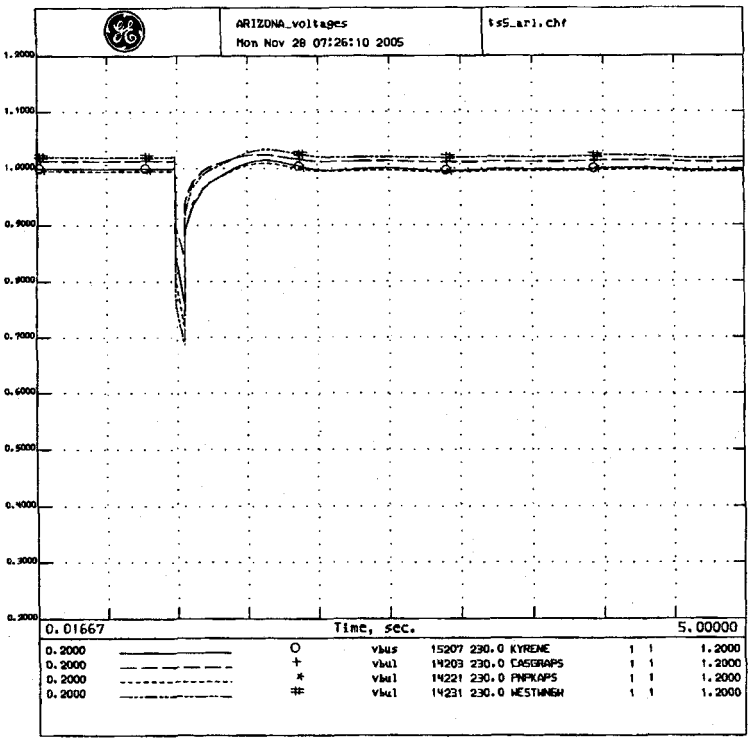
TSS FLT TSS-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



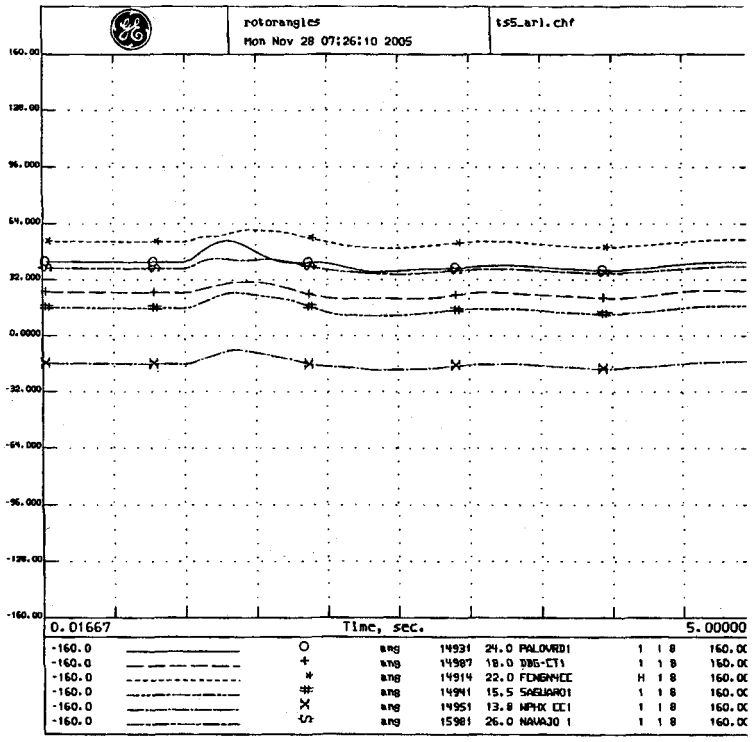
TSS FLT TSS-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



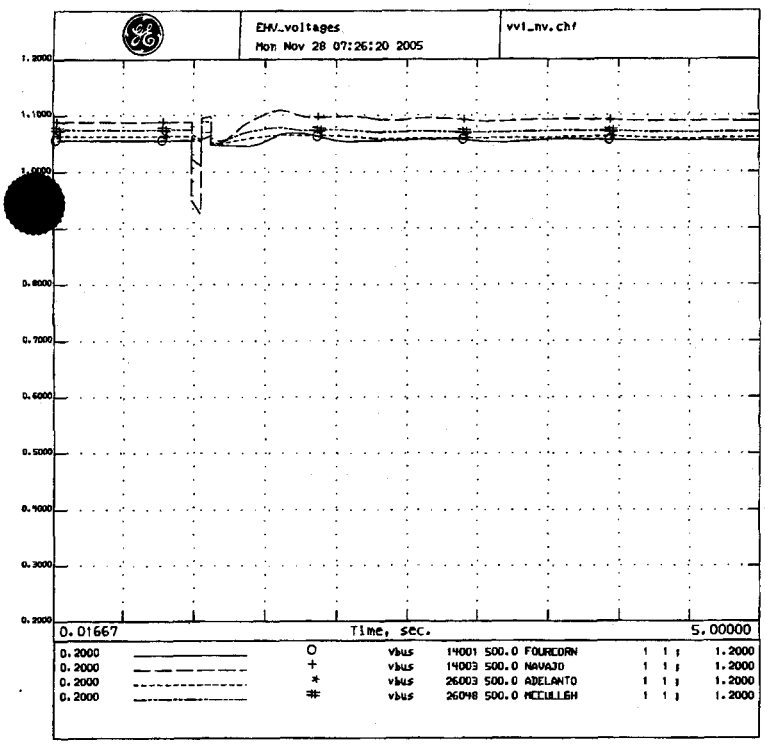
TSS FLT TSS-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



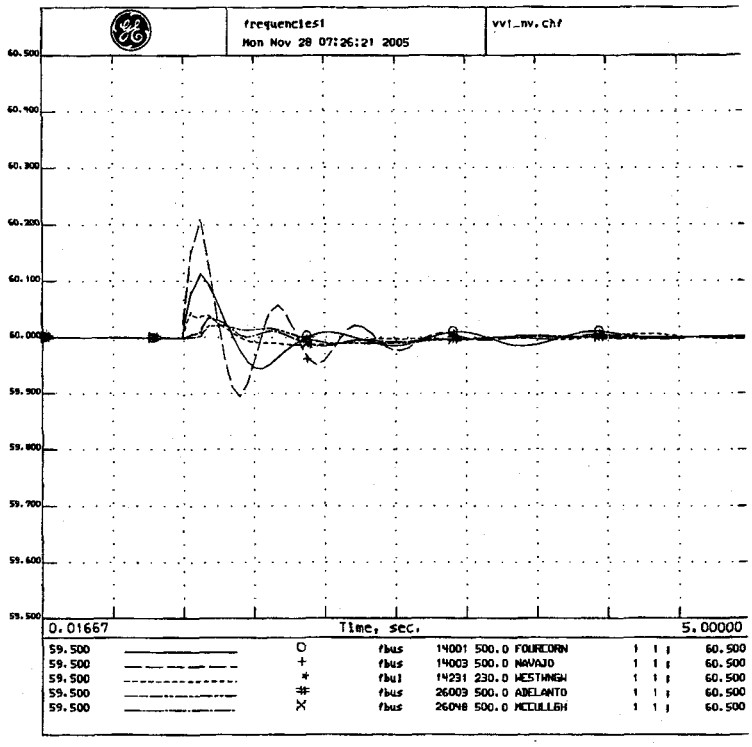
TSS FLT TSS-ARL LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
TSS-ARL STAB; 01/06; T=0 3P FLT TSS500;10% FLT DMPING;FLSH CAPS
NV-MK/MK-YV,PLX-DEX/NG;4C CLR FLT W/TSS-ARL;8C REIN;2014.dyd;WSCC.bpt

Changes from APS/SRP/WAPA/TEP



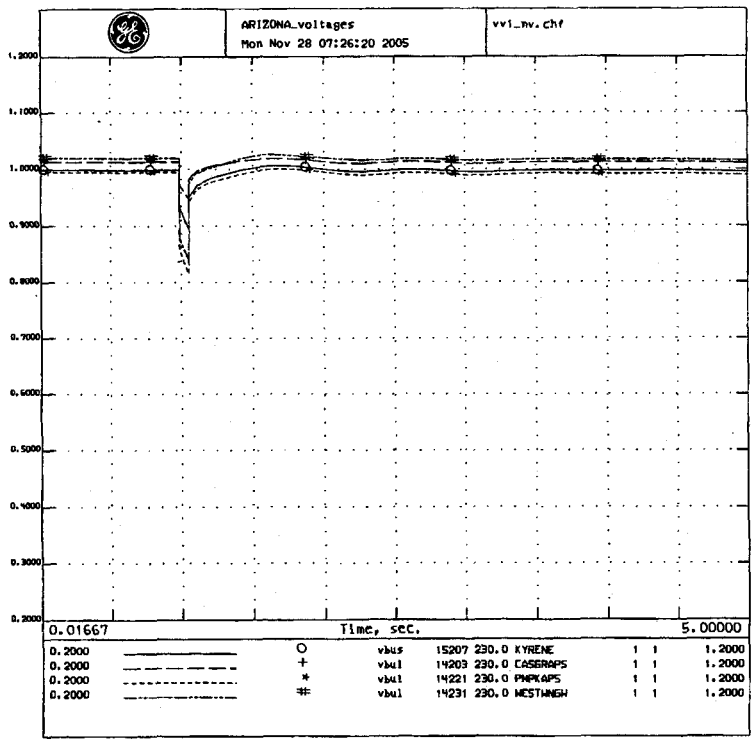
VV1 FLT VV1-NV LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-NV STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



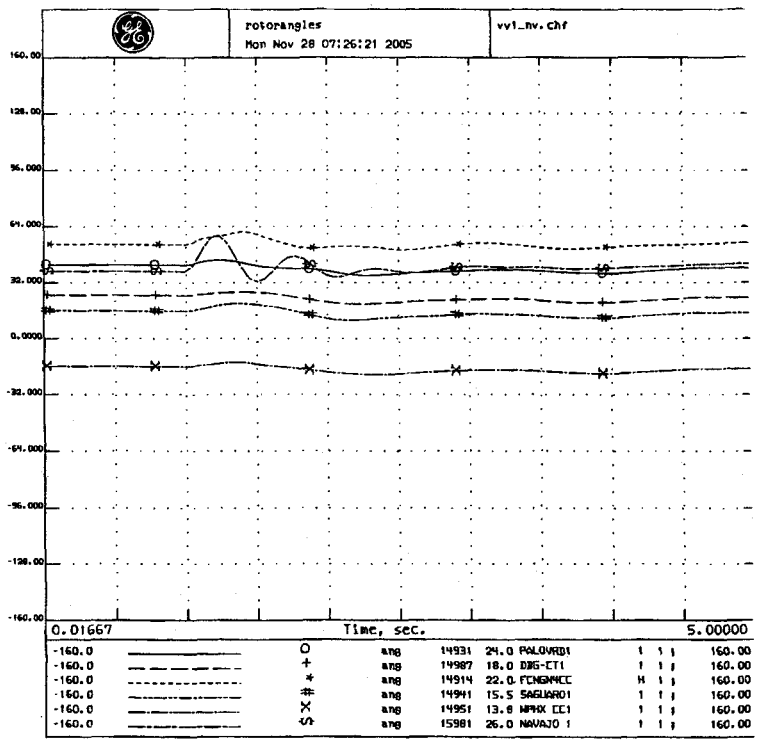
VV1 FLT VV1-NV LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-NV STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



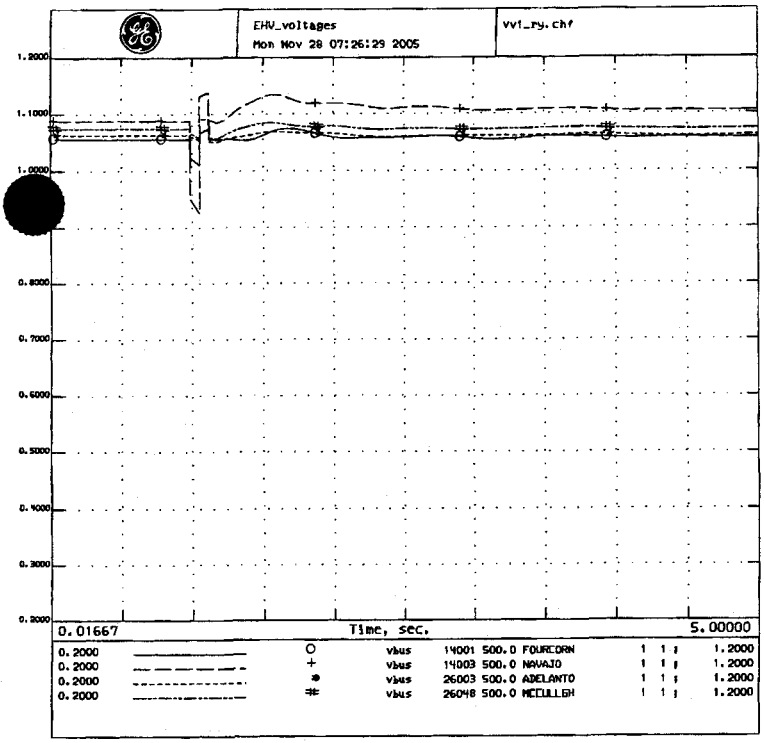
VV1 FLT VV1-NV LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-NV STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



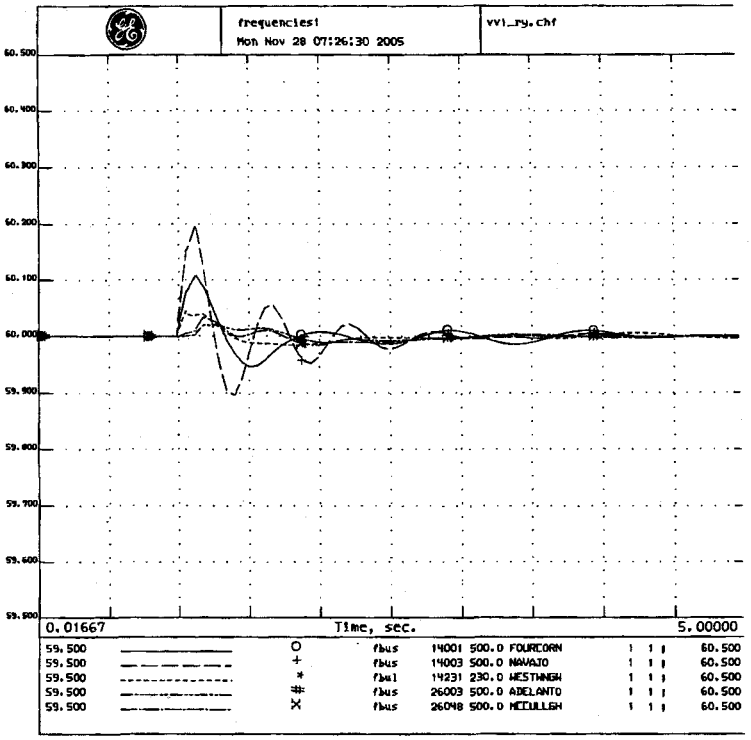
VV1 FLT VV1-NV LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-NV STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-NV;8C REIN;2014.dyd;WSCC.bat

Changes from APS/SRP/WAPA/TEP



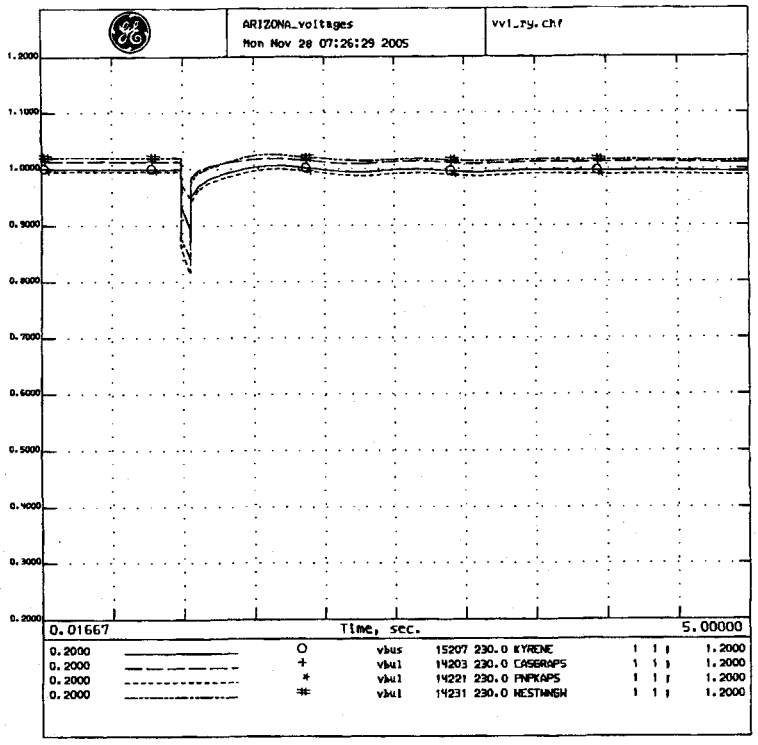
VV1 FLT VV1-RY LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-RY STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-RY;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



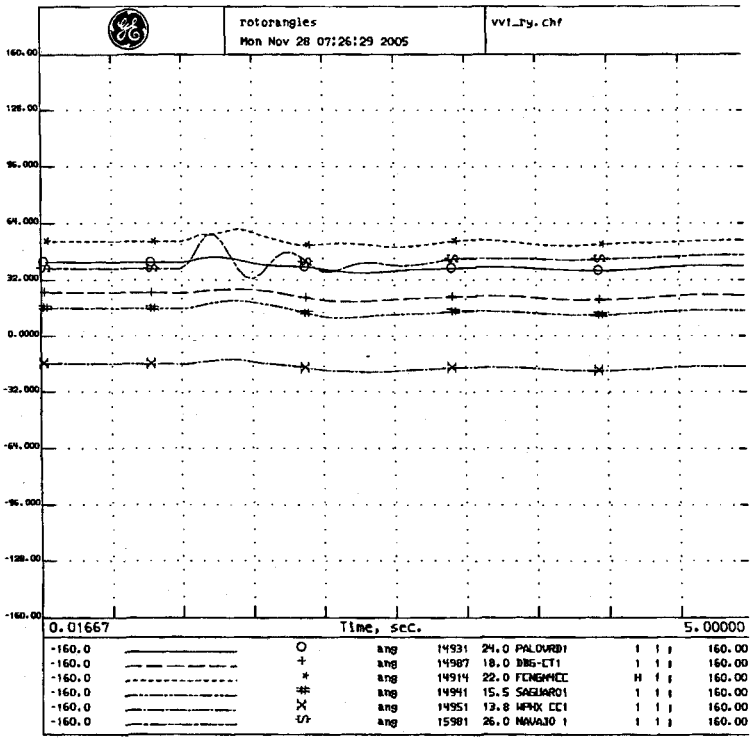
VV1 FLT VV1-RY LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-RY STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-RY;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



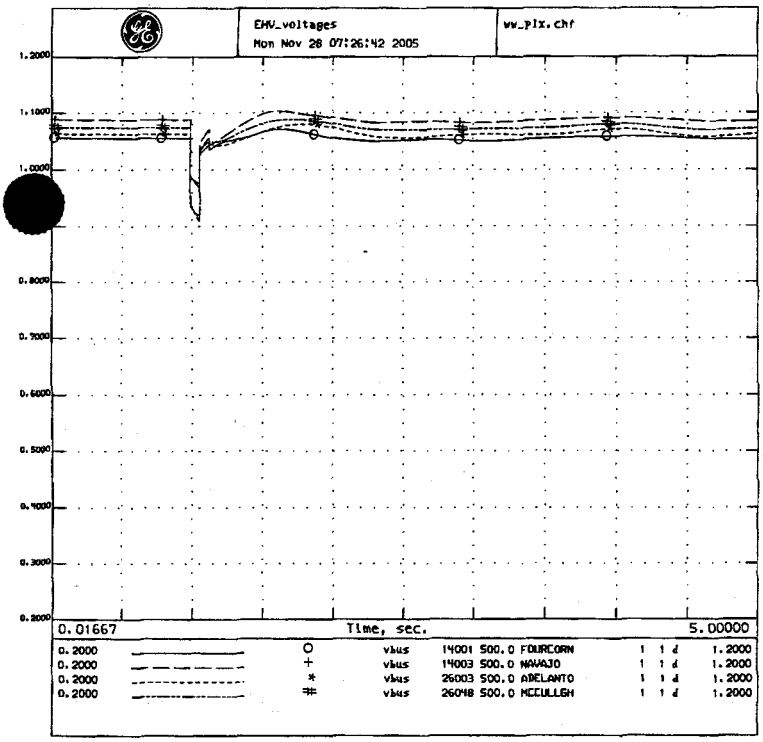
VV1 FLT VV1-RY LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-RY STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-RY;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



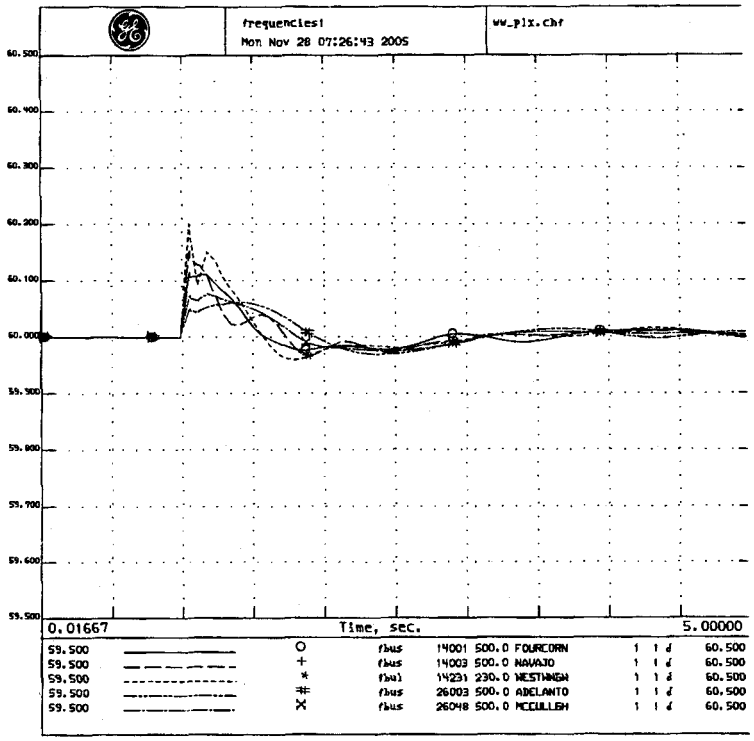
VV1 FLT VV1-RY LINE OUT
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
VV1-RY STAB; 1/06; T=0 3P FLT VV1500; 6% FLT DMPING;FLSH CAPS
NV-MCX/MK,MK-EOX;4C CLR FLT W/VV1-RY;8C REIN;2014.dyd;HSCC.bat

Changes from APS/SRP/WAPA/TEP



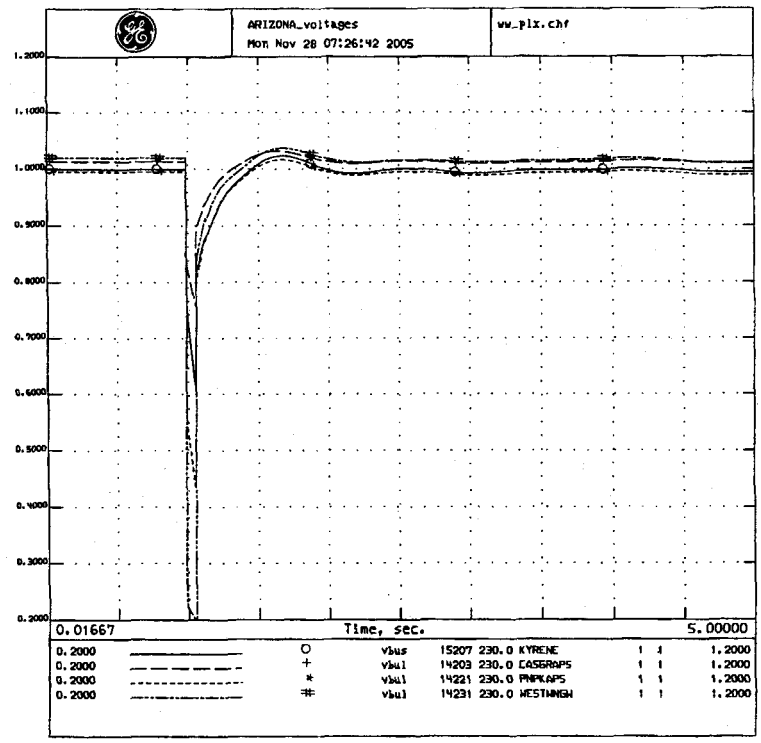
WESTWING FLT, WW-PLX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



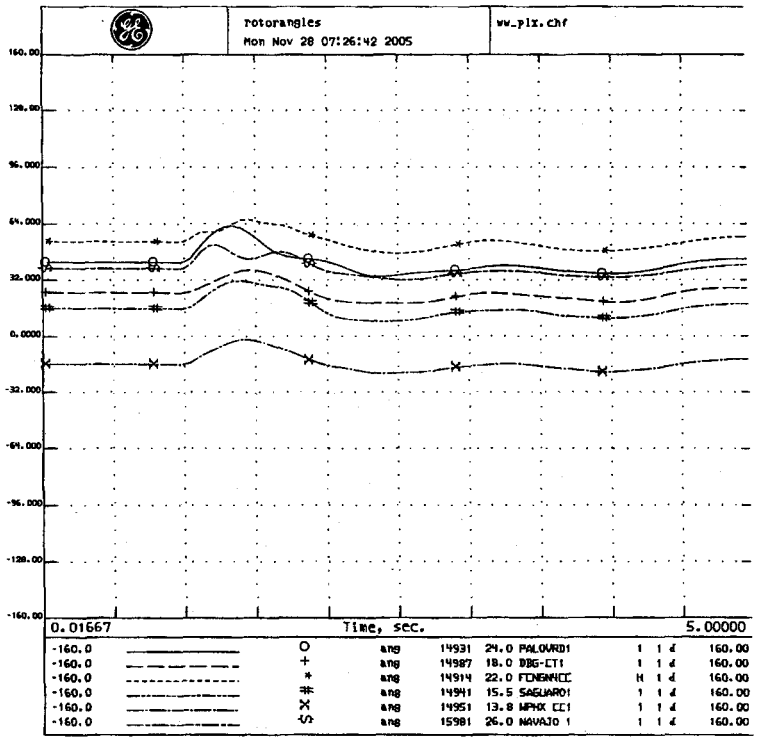
WESTWING FLT, WW-PLX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



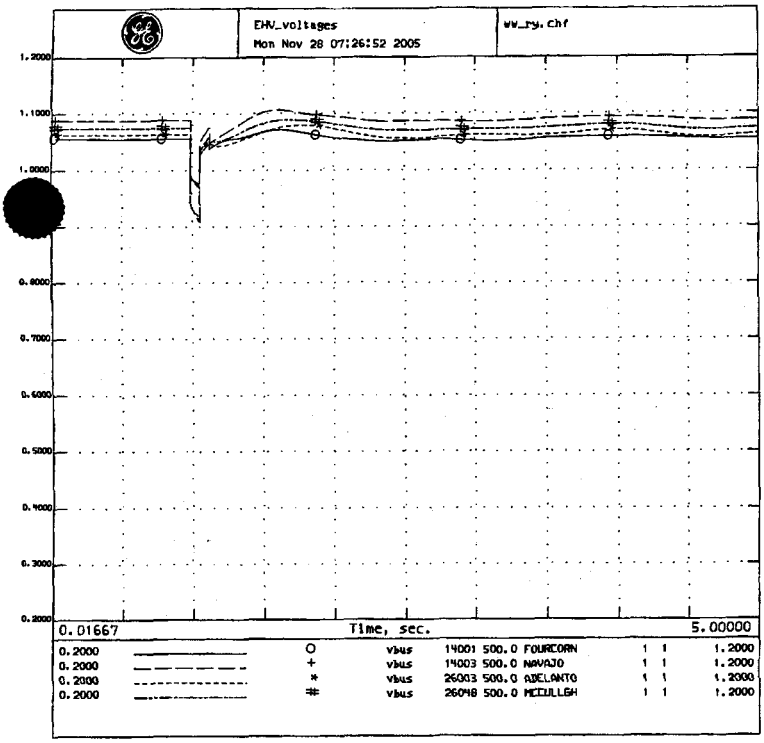
WESTWING FLT, WW-PLX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



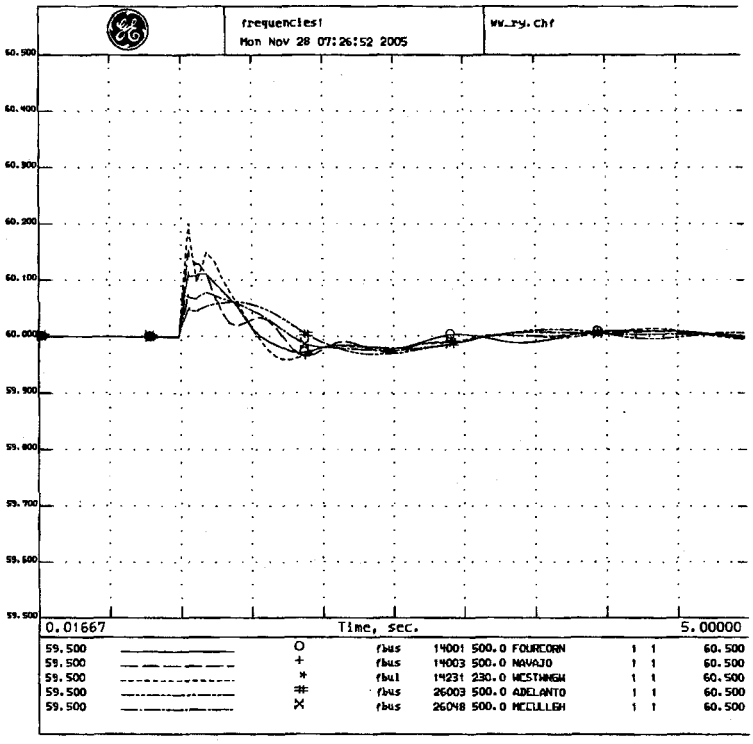
WESTWING FLT, WW-PLX line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-PLX STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-PLX;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



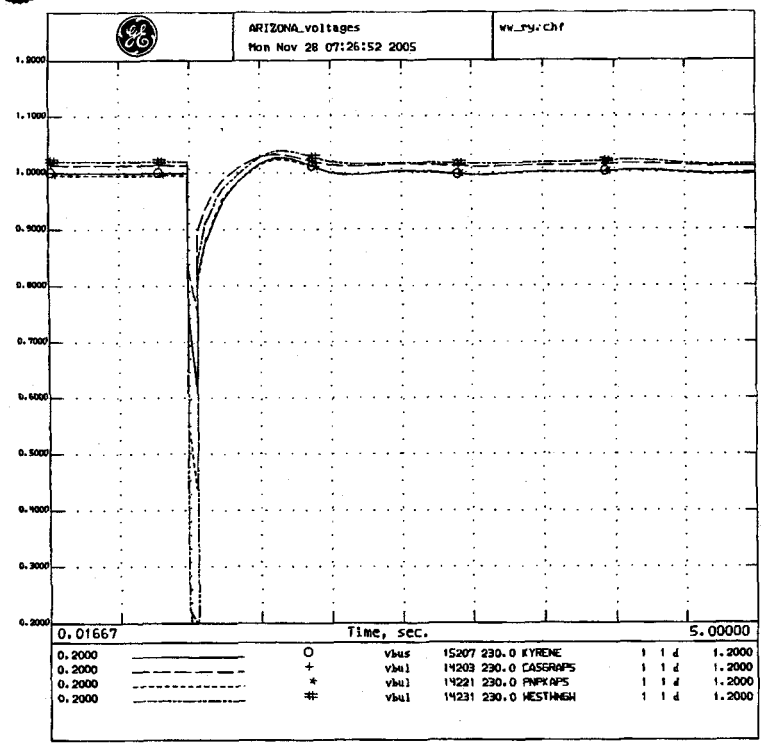
WESTWING FLT. WW-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



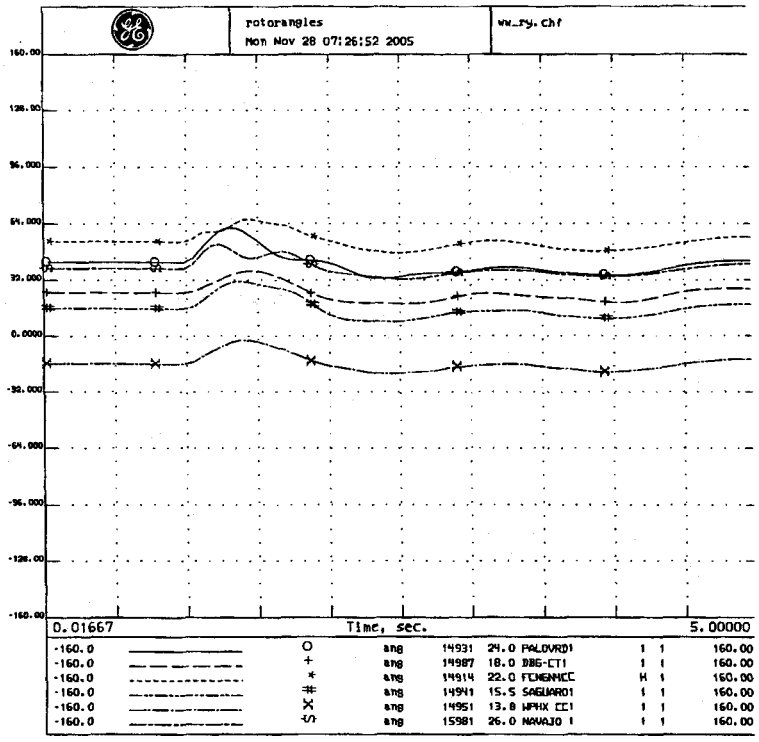
WESTWING FLT. WW-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



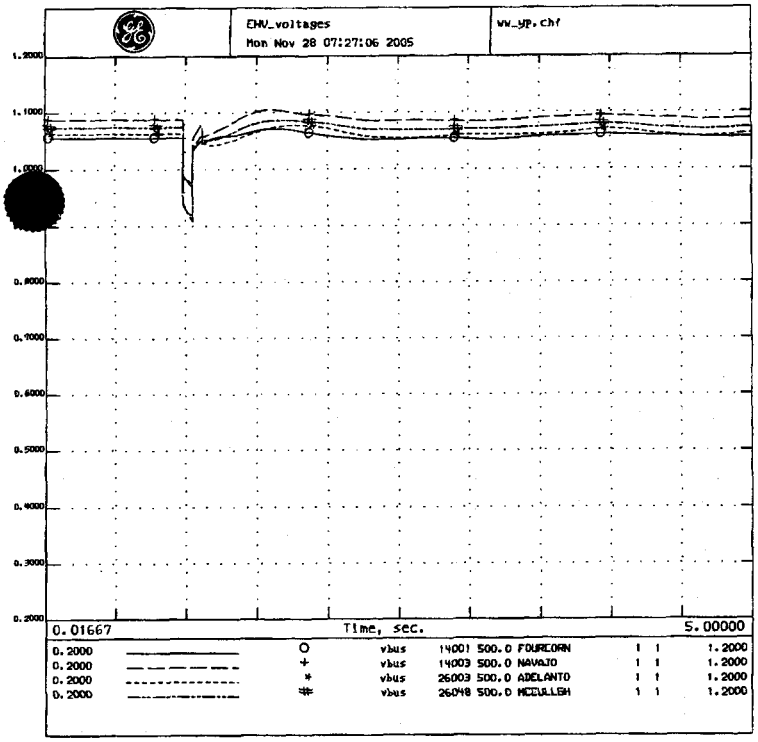
WESTWING FLT. WW-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



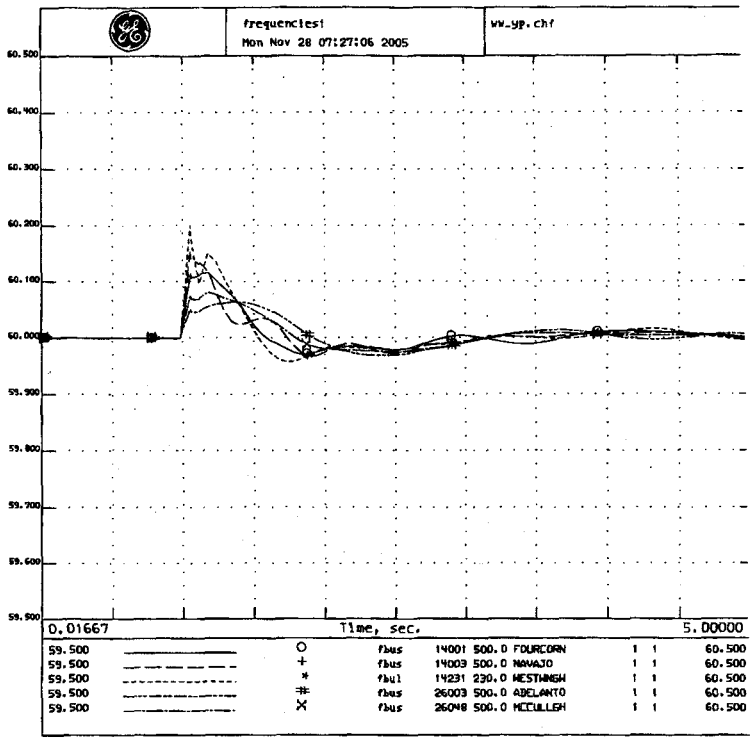
WESTWING FLT. WW-RY line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-RY STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-RY;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



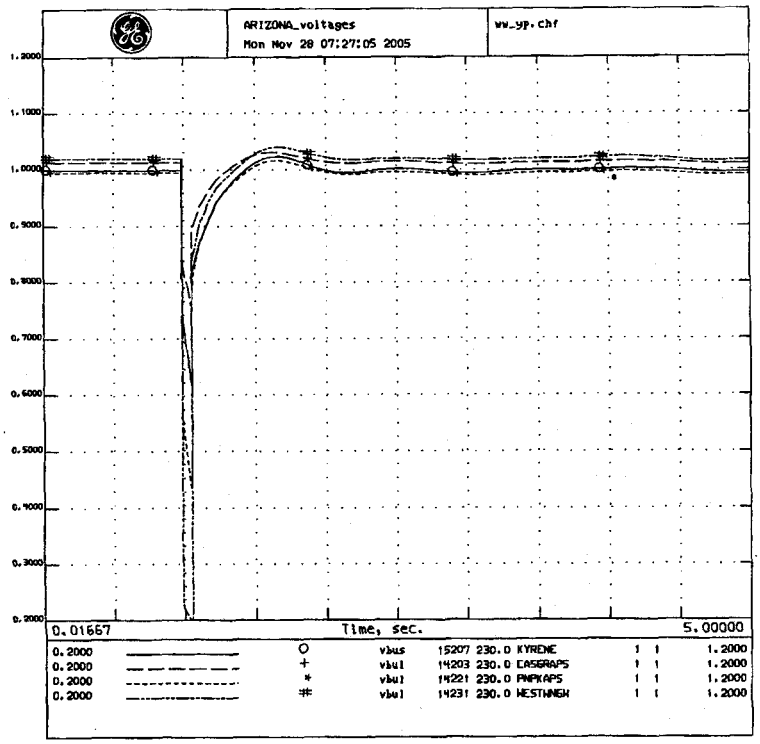
WESTWING FLT. WW-YP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-YP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



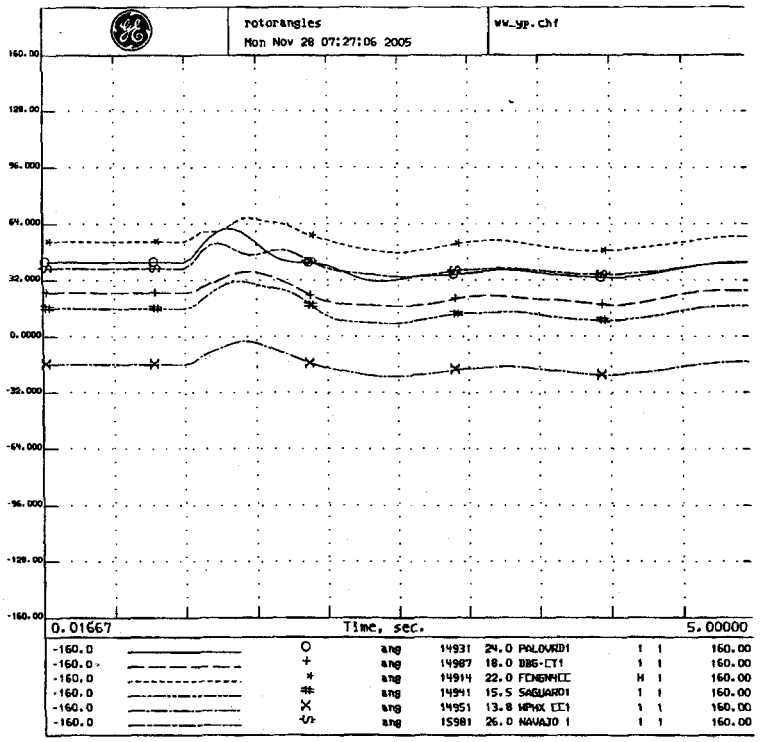
WESTWING FLT. WW-YP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-YP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



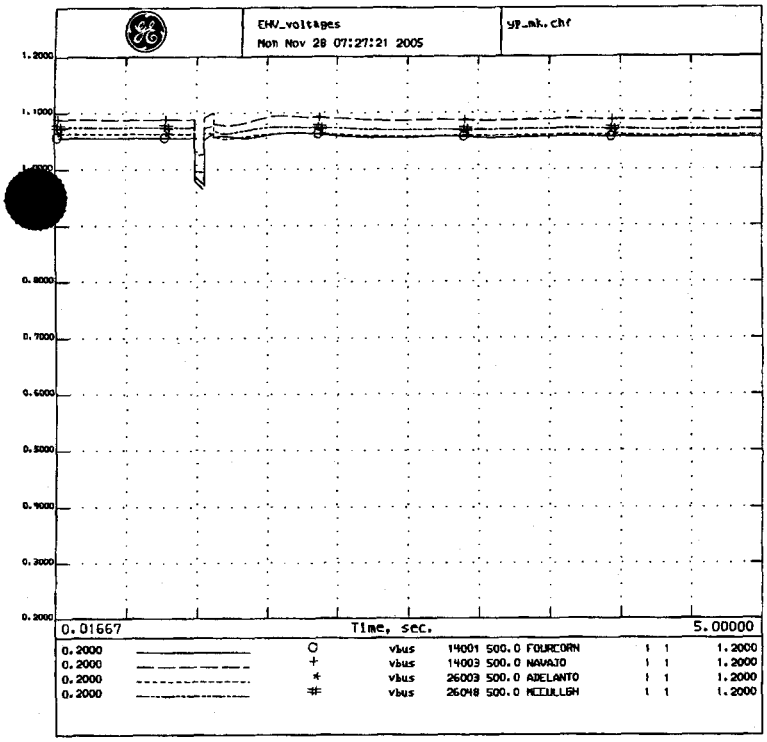
WESTWING FLT. WW-YP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-YP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



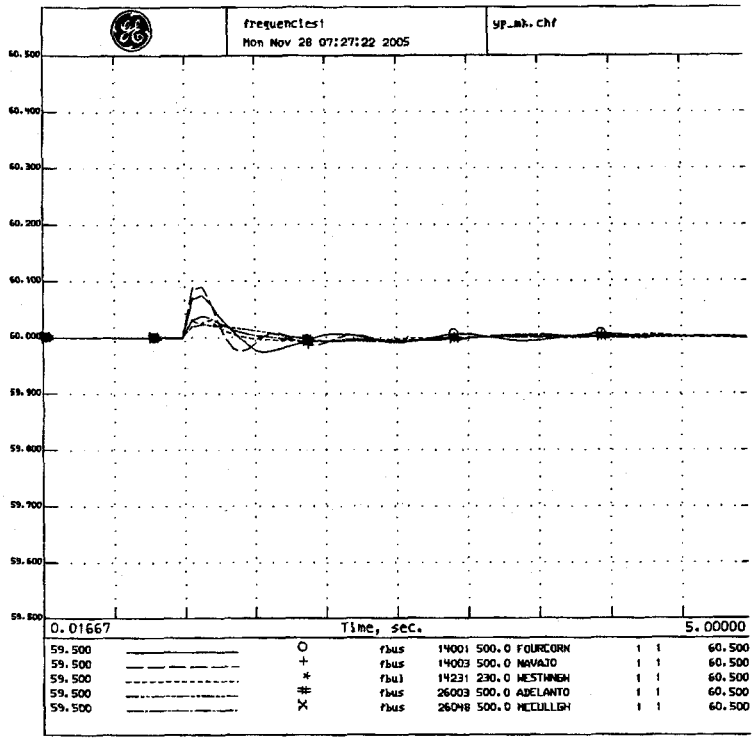
WESTWING FLT. WW-YP line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
WW-YP STAB; 1/06; T=0 3P FLT WW500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/WW-YP;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP



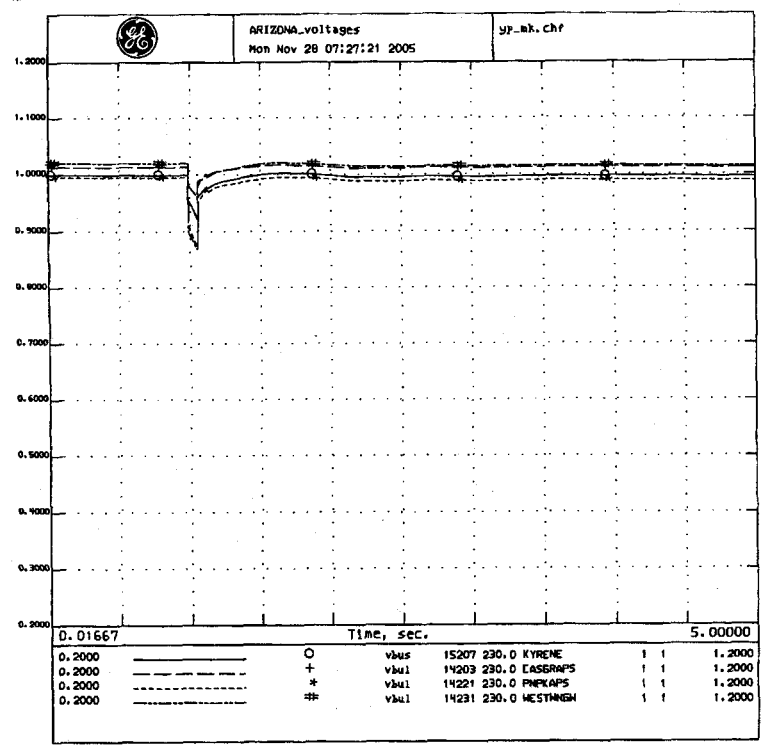
YAVAPAI FLT. YP-MK line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2014.dyd HSCC.bat

Changes from APS/SRP/WAPA/TEP



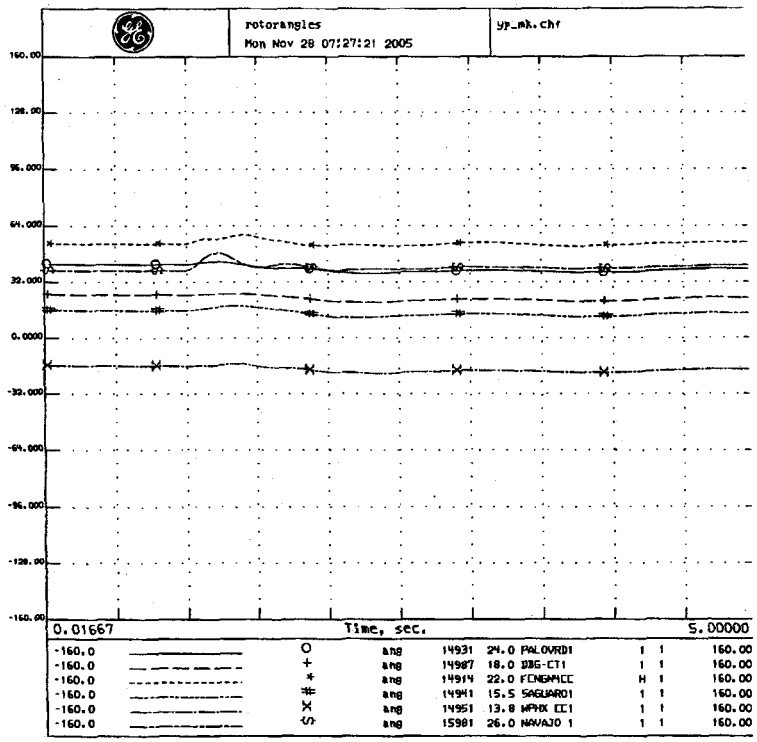
YAVAPAI FLT. YP-MK line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2014.dyd HSCC.bat

Changes from APS/SRP/WAPA/TEP



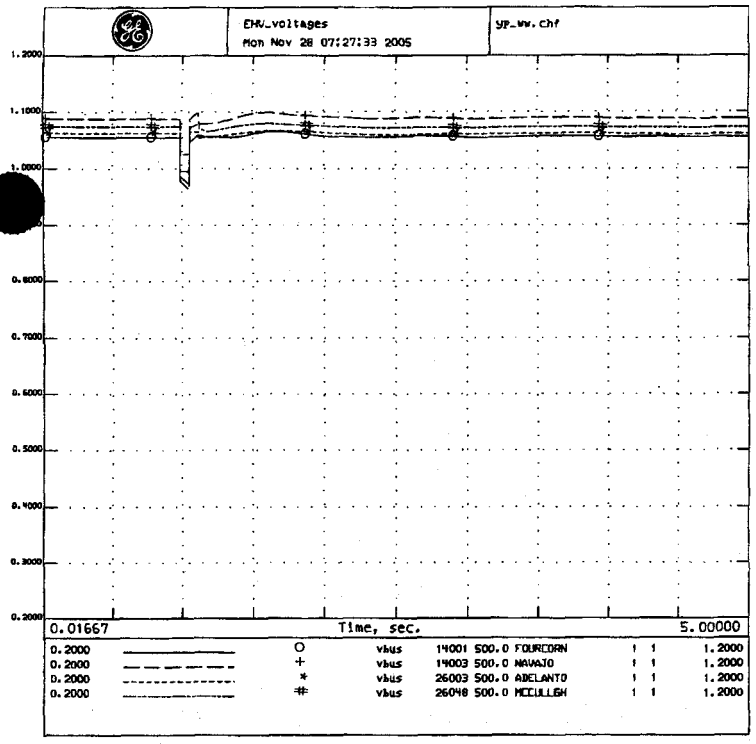
YAVAPAI FLT. YP-MK line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2014.dyd HSCC.bat

Changes from APS/SRP/WAPA/TEP



YAVAPAI FLT. YP-MK line out
2014 HS1A APPROVED BASE CASE
SEPTEMBER 21, 2004
YP STAB; 1/06; T=0 3P FLT YP500;FLSH CAPS MK-YP/YP-WW,
NV-MK/WW;4C CLR FLT W/YP-MK;8C REIN;2014.dyd HSCC.bat

Changes from APS/SRP/WAPA/TEP



YAVAPAI FLT. YP-WW line out
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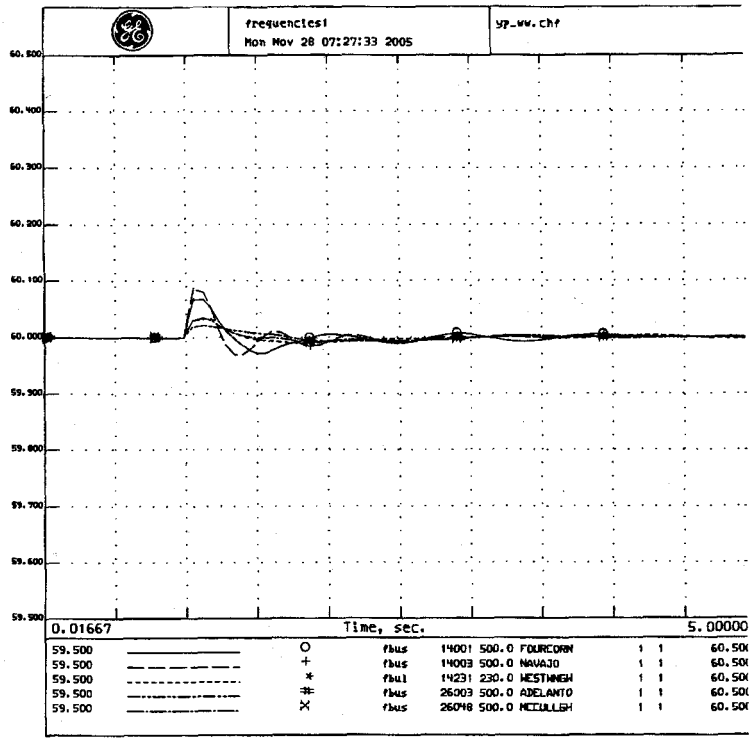

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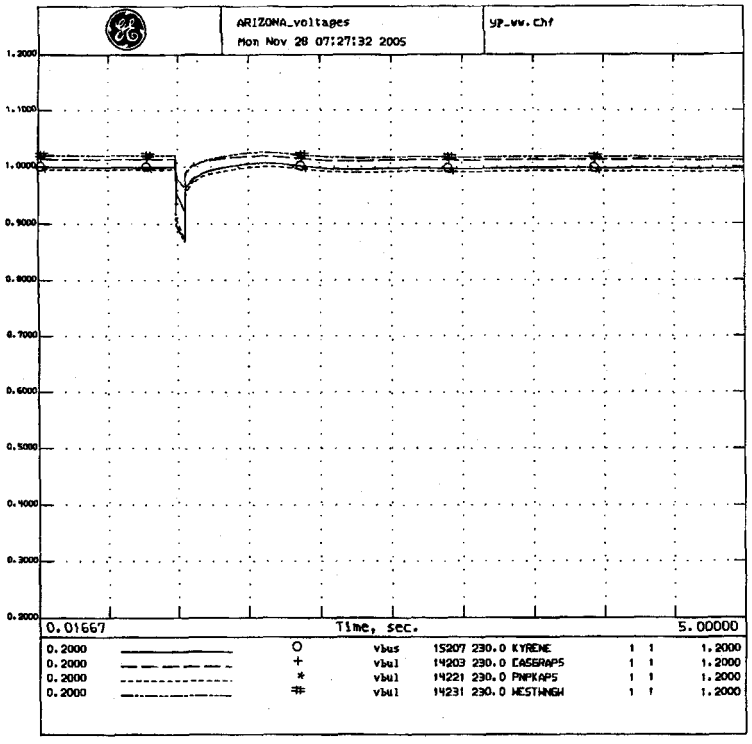

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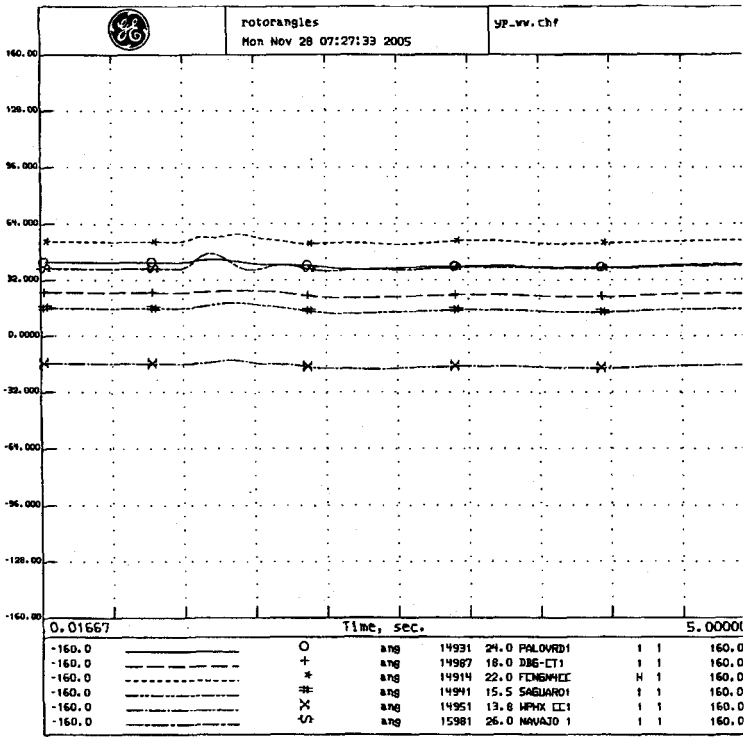

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NV-MK/WW;4C CLR FLT W/YP-WW;8C REIN;2014.dyd WSCC.bat

Changes from APS/SRP/WAPA/TEP

RMR ANALYSIS
2006-2015

Reliability Must-Run Analysis

2006–2015

January 30, 2006
APS Transmission Planning

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APS Reliability Must-Run Analysis 2006-2015

I. EXECUTIVE SUMMARY

This report documents the study methodology, results, and conclusions of Arizona Public Service Company's (APS) Reliability Must-Run (RMR) Analysis for the ten years from 2006 to 2015 (2006 RMR Analysis). This analysis was conducted in response to the Arizona Corporation Commission's (ACC) Second Biennial Transmission Assessment and Decision No. 65476 (December 19, 2002). The 2006 RMR Analysis covers a ten-year period and includes detailed analysis of the years 2008 and 2015.

If a city or load pocket must be served by local generating units at certain peak times, then those units are designated as "reliability must-run" or RMR units. There are two major areas where load cannot be served totally by power imported over transmission lines in the APS service territory – the Phoenix metropolitan area, which is served by a combination of APS and Salt River Project (SRP) facilities, and the APS service territory in the Yuma area.

Although ninety-nine percent of the Phoenix area energy requirements can be met by remote generation, local generation is critically important for the reliability of the local power system. The November 2003 U.S.-Canada Power System Outage Task Force Interim Report: Causes of the August 14th Blackout in the United States and Canada pointed out the importance of the reactive capability of voltage support from local generation. Local generation can provide critical support for transmission contingencies and other power system disturbances and can prevent customer outages including blackout conditions such as those experienced in the Northeast on August 14, 2003.

Comments during the workshop for the 2003 RMR analysis held in February 2003 indicated that electric power system industry participants desired to have a more participative role in the 2004 RMR analysis. To facilitate this participation, APS and the other Arizona transmission providers utilized the Central Arizona Transmission Study (CATS) forum to publicly develop the 2004 RMR study plan, after extensive discussion on study models and preliminary results. APS and the other Arizona transmission providers conducted a workshop on January 15, 2004 to present the study results for comment. This process led to the decision to study the Phoenix area as a combined APS and SRP network and a determination of the specific loads to include in the Phoenix area for the study years.

The ACC Third Biennial Transmission Assessment determined that RMR studies must be performed on a biennial basis, with the next report being filed with the ten year plan in January 2006. The Southwest Area Transmission (SWAT) planning group was utilized to facilitate the public discussions and input for this 2006 RMR Analysis. The years 2008 and 2015 were selected because the Seams Steering Group-Western Interconnection (SSG-WI) was preparing publicly available databases for those years only. At the time this study was performed, the SSG-WI 2008 database was available and was used. The 2008 database was then modified to reflect anticipated 2015 conditions including planned projects throughout Arizona.

Unlike previous RMR studies, where the first year was used as a benchmark to compare the results to the RMR study preceding it, in this study, the 2008 case cannot be used to make a direct comparison to the 2008 results in the previous RMR study. This is due to the difference in the assumption about which transmission projects would be in-service for the summer of 2008 and the explosion of growth within the Yuma load area. However, the results of this study for 2008 are similar to those from the previous RMR study for 2008 in that there is negligible impact of RMR in Phoenix. Also, in the previous RMR study, it was noted that in 2012 the available Phoenix generation reserves were projected to be less than the desired reserve margin. With new planned transmission projects, the available Phoenix generation reserves are projected to meet or exceed the required generation reserves through 2015.

The cost of using must-run units can be measured by the difference between generation costs with the transmission limit and costs without the limit. This report looks at and compares the cost of serving these two areas with and without the existing transmission constraints.

This report concludes that for the Phoenix metropolitan area, the cost of RMR with the transmission limit is not significant and does not at present outweigh the cost of transmission improvements beyond those already included in the APS and SRP ten-year plans. For Yuma, the report shows that there is some RMR cost for 2008. The 2015 results show that the planned Palo Verde to North Gila 500-kV transmission line and the North Gila to TS8 230-kV line, included in the present APS ten-year plan, are sufficient to mitigate the costs associated with the RMR conditions. Due to the scope and location of both projects, it would not be feasible to advance their in-service dates. Environmental effects for both areas with and without transmission constraints are also documented in this report. Because there is such a small RMR requirement for both areas in the two years studied, the environmental effects of RMR are minimal.

A. Study Overview

The existence of transmission import limited areas is not uncommon in the United States, and particularly in the West where load centers are generally separated by long distances. APS has transmission import-limited areas in Phoenix and Yuma. An import area is transmission limited when all load cannot be served solely by importing resources over local transmission lines, thus requiring some use of local generating units to reliably meet peak load.

The two transmission import-limited areas in APS' system were studied to determine:

- The system simultaneous import limit (SIL), which is the maximum amount of capacity that can be reliably imported into an area with no local generation;
- The maximum load serving capability (MLSC), which is the total load that can be reliably served from imports and from local generation;
- Annual RMR conditions, including magnitude of load in excess of the import capability and number of hours the load exceeds the SIL; and
- Estimated economic and environmental impacts of the import limits.

The Phoenix area is a tight network of APS and SRP load, resources, and transmission facilities. Because the Phoenix system is highly integrated, the import limits must be determined for the

combined area. This analysis was coordinated with SRP personnel, who had significant involvement in the study and were helpful in the overall analysis. The Western Area Power Administration (WAPA) also coordinated with APS and SRP in the study because their transmission facilities interface with the Phoenix network.

After the combined import limits for the Phoenix area were determined, RMR conditions were evaluated for the Phoenix area based on the Phoenix area import limits, the Phoenix area load, and Phoenix area local generation, which includes generation owned by APS and SRP. Since the previous RMR study was performed, the generation that was owned by Pinnacle West Energy Corporation (PWEC) has been transferred to APS.

The Yuma area, which has a forecast 2008 summer peak demand of approximately 426 MW, is served by an internal APS 69-kV sub-transmission network containing all of the load in the import-limited area. There are external ties to WAPA and the Imperial Irrigation District (IID), as well as a bulk power interface with the Hassayampa-to-North Gila transmission system. This analysis was coordinated with the WAPA Phoenix office to ensure accurate modeling.

B. Summary of Results

Results of the analysis for the two years of the study, 2008 and 2015, assumed that present plans for system improvements in place, when the study was conducted, are completed on schedule.

The following table summarizes the estimated RMR conditions and costs for the Phoenix area.

Table ES1
Phoenix Area RMR Conditions and Costs

Year	SIL[1] (MW)	Peak Demand (MW)	Max RMR[2] (MW)	RMR[3] Hours	RMR Energy[4] (GWH)	RMR Energy (% of total)	RMR Cost[5] ($M)
2008	9,700	12,625	2,583	845	650	1.1	0.0
2015	13,004	16,100	2,811	548	419	0.6	0.0

Table Key:
[1]**SIL** – System Simultaneous Import Limit is the maximum amount of capacity that can be reliably imported into the area with no local generation operating.
[2]**Max RMR** – The amount of local generation required to meet the area peak demand (Peak Demand minus Import Capability).
[3]**RMR Hours** – The number of hours that the area's demand exceeds the SIL, thus requiring the use of local generation to meet load, even if otherwise economically dispatched.
[4]**RMR Energy** – The annual energy required to be met by local generation (in excess of the SIL).
[5]**RMR Cost** – The difference in annual generation cost with and without the transmission limitation.

The following table summarizes the estimated RMR conditions and costs for the Yuma area.

Table ES2
Yuma Area RMR Conditions and Costs

Year	SIL[1] (MW)	Peak Demand (MW)	Max RMR[2] (MW)	RMR[3] Hours	RMR Energy[4] (GWH)	RMR Energy (% of total)	RMR Cost[5] ($M)
2008	264	426	134	1,703	75	4.0	1.3
2015	453	563	95	553	14	0.6	0.0

Table Key:
[1]**SIL** – System Simultaneous Import Limit is the maximum amount of capacity that can be reliably imported into the area with no local generation operating.
[2]**Max RMR** – The amount of local generation required to meet the area peak demand (Peak Demand minus Import Capability).
[3]**RMR Hours** – The number of hours that the area's demand exceeds the SIL, thus requiring the use of local generation to meet load, even if otherwise economically dispatched.
[4]**RMR Energy** – The annual energy required to be met by local generation (in excess of the SIL).
[5]**RMR Cost** – The difference in annual generation cost with and without the transmission limitation.

The following table shows the Phoenix area Maximum Load-Serving Capability (MLSC) for the two years studied and compares the MLSC to the forecasted peak demand. This includes the new generation of Santan 6 in the 2008 study. The MLSC is determined by performing power flow studies and determining the maximum amount of load that can be served with the local Phoenix generation at maximum output. APS determined the Phoenix area reserve requirements by performing a probabilistic analysis that considered the size and forced outage rates of the local generating units and resulted in 99 percent reliability of serving all load. This analysis resulted in reserve requirements of 865 MW for the Phoenix area for the years studied.

Table ES3
Phoenix Area Maximum Load Serving Capability

Year	SIL	Local Generation	Required Reserves	MLSC	Peak Demand (MW)	Projected Reserves
2008	9,700	3,674	865	13,860	12,625	1,235
2015	13,004	3,674	865	17,051	16,100	951

The following table summarizes the Yuma area MLSC. The reserve requirements for the Yuma area were determined to be 138 MW for the years studied.

Table ES4
Yuma Area Maximum Load Serving Capability

Year	SIL	Local Generation	Required Reserves	MLSC	Peak Demand (MW)	Projected Reserves
2008	264	367	138	545	426	233
2015	453	367	138	826	563	263

Local generating units are dispatched based on cost. Thus, most of the RMR hours shown above are dispatched in merit order. However, the presence of a transmission constraint may require local generation to be dispatched out of merit order or "out of the money." This report considered all Phoenix area and Yuma area transmission limitations and generation resources in determining the overall RMR situation. The economic impact of RMR can be seen from the following tables.

The following table summarizes the estimated total number of hours that local Phoenix generation must run out of economic dispatch, the amount of energy that is produced out of economic dispatch and the associated cost.

Table ES5

Phoenix Area RMR Outside Economic Dispatch

Year	Hours outside economic dispatch	Energy outside economic dispatch (GWH)	RMR Cost ($M)
2008	13	12.6	<1
2015	0	1.5	<1

The following table summarizes the estimated total number of hours that APS local Yuma generation must run out of economic dispatch, the amount of energy that is produced out of economic dispatch and the associated cost.

Table ES6
APS Yuma Area RMR Outside Economic Dispatch

Year	Hours outside economic dispatch	Energy outside economic dispatch (GWH)	RMR Cost ($M)
2008	1,253	47.2	1.3
2015	151	2.8	<1

C. Report Conclusions

Phoenix area Conclusions

1. All Phoenix area transmission and local generation are necessary to reliably serve Phoenix area peak load in 2008 and 2015 with the projected local generation reserve margin exceeding the required reserve margin.

2. During the summer, Phoenix area load is expected to exceed the available transmission import capability for approximately 845 hours in 2008 and 548 hours in 2015. These hours represent only approximately one percent of the annual energy requirements for the Phoenix area.

3. From a total Phoenix load, transmission, and resources viewpoint, import limits are expected to cause a minimal amount of local generation to be dispatched out of economic dispatch order in 2008 and 2015.

4. The estimated annual economic cost of Phoenix area RMR generation is negligible, therefore advancement of transmission projects to increase import capability are presently not cost justified.

5. Removing the transmission constraint would reduce total Phoenix area air emissions by a minimal amount for years 2008 and 2015 due to the few hours of operating local generation.

Table ES7
Phoenix area Air Emissions Reduction

Pollutant	Reduction[1] (tons/year)	Reduction of Phoenix Area Emissions (% of total emissions from all sources)
VOC	0.0	0.0
NO_x	0.0	0.0
CO	0.0	0.0
PM_{10}	0.0	0.0

[1]2008 results, impact for 2015 is identical

6. Removing the import restriction into the Phoenix area has a minimal impact on local generation capacity factor. The capacity factor ranges from approximately 15% in 2008 to 11% in 2015.

7. Removing the transmission constraint could reduce total yearly natural gas consumption by the Phoenix area generators by 53.6 MMBTU and 6.3 MMBTU for 2008 and 2015, respectively.

Yuma Area Conclusions

8. All existing Yuma area transmission and generation resources are necessary to reliably serve the Yuma area load.

9. The Yuma area load is expected to exceed the available transmission import capability for 1,703 hours in 2008 and 553 hours in 2015. These hours represent approximately 4% of the annual energy requirements for Yuma in 2008 and less than 1% in 2015.

10. From a total Yuma load, transmission, and resources viewpoint, the import constraint could cause APS Yuma generation to be dispatched out of economic dispatch order for 1,253 hours in 2008 and 151 hours in 2015.

11. The estimated annual economic cost of Yuma area generation required to run out of economic dispatch order is approximately $1.3 million for 2008. By 2015, due to APS' transmission plans, those costs are negligible.

12. Removing the transmission constraint would reduce total Yuma area air emissions by a minimal amount for years 2008 and 2015.

Table ES8
Yuma Area Air Emissions Reduction

Pollutant	Reduction[1] (tons/year)	Reduction of Yuma Area Emissions (% of total emissions from all sources)
VOC	0.0	Data Unavailable
NO_x	0.0	Data Unavailable
CO	0.0	Data Unavailable
PM_{10}	0.0	0.000

[1]2008 results, impact for 2015 is identical

13. Removing the import restriction into the Yuma area could reduce the APS Yuma generation capacity factor from 0.4 percent to 0.0 percent in 2008.

14. Removing the transmission constraint could reduce total yearly natural gas consumption by the Yuma area generators by 493.9 MMBTU and 28.2 MMBTU for 2008 and 2015, respectively.

D. Report Organization

This report is organized in seven sections. Section I provides an executive summary of the report. Section II provides general background information of the study requirements, an overview of RMR, and describes the study methodology. Section III describes the Phoenix area, the nature of the import limit, the resulting import limits for 2008 and 2015, and the impact of various generators in and around the Phoenix area on the import limit. Section IV provides a similar discussion of the Yuma area. Section V describes the RMR conditions such as number of hours, maximum capacity, and annual energy for the Phoenix and Yuma areas. Section VI provides results of the economic analysis of the Phoenix and Yuma area RMR conditions performed utilizing a regional planning model (GridView) and emissions impact. Finally, Section VII lists the conclusions of the analysis.

II. INTRODUCTION

A. Background of Study Requirement

Like all large electric utilities, Arizona utilities have historically relied on both transmission, to deliver remote generation into its load centers, as well as local generation to reliably serve its customers. Due in part to environmental, economic, and fuel availability considerations, large base-load thermal generators have typically been located away from the load centers while smaller but less efficient intermediate and peaking units, with lower capacity factors, were located within the load centers. Although this local generation is relied on for a relatively small amount of energy, this local generation is critically important for the reliability of the local power system. The November 2003 U.S.-Canada Power System Outage Task Force Interim Report: Causes of the August 14th Blackout in the United States and Canada pointed out the importance of the reactive capability of voltage support from local generation. Local generation can provide critical support for transmission contingencies and other power system disturbances and can prevent customer outages including blackout conditions such as those experienced in the Northeast on August 14, 2003. Local generation also results in lower power system losses and lower capital expenses for transmission infrastructure.

In the past, vertically-integrated utilities, such as APS, managed the siting and construction of both generation and transmission resources needed to serve their customers. Electric systems were designed based on a detailed integrated resource planning process used to evaluate the appropriate balance of generation, transmission, and demand-side resources. Interconnections with neighboring systems were primarily intended to improve system reliability and lower the costs of reserves by allowing for sharing of capacity reserves by multiple systems. Each utility's system was primarily designed to accommodate that utility's resources and that utility's load.

The Commission's Second Biennial Transmission Assessment required "any [Utility Distribution Company] that currently relies on local generation, or foresees a future time period when utilization of local generation may be required to assure reliable service for a local area, [to] perform and report the findings of an RMR study as a feature of their ten year plan filing with the Commission in January 2003 and 2004." The Assessment required that the RMR study filed in January 2003 evaluate RMR conditions through the 2005 summer peak. The January 2004 RMR study covers the 10-year period from 2004 to 2013. The Commission's Third Biennial Transmission Assessment determined that RMR studies must be performed on a biennial basis, with the next report being filed with the ten year plan filed in January 2006.

B. Overview of RMR

Local "load pockets" are areas that do not have enough transmission import capability to serve all load in the area solely by importing remote generation over local transmission facilities. For these areas, during peak hours of the year, local generation is required to serve that portion of the load that cannot reliably be served by transmission imports. This local generation requirement is often referred to as Reliability Must-Run or RMR generation. In these areas, during peak

conditions, load is served by a combination of importing remote generation over transmission lines and operating local generation.

The maximum load that can be served in a load pocket with all of the local generation operating – in other words, the maximum load that can be served by importing remote generation and local generation – is referred to as the system Maximum Load Serving Capability (MLSC). The MLSC is established through technical studies by ensuring that:

- With the local load at the MLSC and all local generation operating there are no transmission system normal operating (N-0) limit violations of thermal loading or voltages, and
- Under all single contingency outage events (N-1) there are no emergency operating limit violations of thermal loading or voltages, and no system instability.

The maximum load that can be served in a load pocket with no local generation operating — in other words, the maximum load that can be served solely by importing remote generation — is referred to as the system Simultaneous Import Limit (SIL). The SIL is established through technical studies by ensuring that:

- With the local load at the SIL and no local generation operating there are no transmission system normal operating (N-0) limit violations of thermal loading or voltages, and
- Under all single contingency outage events (N-1) there are no emergency operating limit violations of thermal loading or voltages, and no system instability.

C. Study Methodology

Import limit analysis was performed for the Phoenix and Yuma areas. The import limit area or load pocket is defined as that load which, when increased, would increase the severity of the limiting contingency. For example, load in Flagstaff has no impact on the severity of the limiting contingency for the Phoenix import limited area, and therefore Flagstaff is not included in the Phoenix load pocket. In contrast, downtown Phoenix load does impact the severity of the limiting contingency and therefore is included in the load pocket. All area contingencies known to result in system stress were evaluated to determine the critical contingency for the area. Import limits were determined by contingency conditions of thermal loading at the emergency rating of a facility, steady state voltages at the emergency voltage limit, and system instability including voltage instability.

Import limits were determined for the Phoenix and Yuma areas with no local generation operating, with maximum local generation operating, and sufficient points in between to determine curves which define import limits at all load levels. This methodology was applied to studies of the Phoenix area, which for 2008 is constrained by thermal loadings and in 2015 is constrained by voltage instability. For the Yuma studies, the limitations are primarily post-disturbance thermal constraints. Generator sensitivities were performed to determine the relative impact of various generators on the import limits for the Phoenix area.

From each year's forecasted peak load and historical daily load cycles, the annual RMR conditions were determined, including magnitude of local load, both demand and energy, expected to exceed the SIL and the annual hours for which local load is expected to exceed the SIL.

An economic analysis was performed in each area for each year using the ABB GridView market simulation program to determine the cost of the import limits. The SSG-WI has utilized ABB GridView to build a western regional generation and transmission simulation model.

Additional transmission alternatives to mitigate the import limits of the Phoenix area were not studied due to the minimal amounts of RMR conditions that were identified in the study. The cost for any transmission alternative would significantly exceed the costs associated with any RMR conditions. Additional transmission alternatives to mitigate the import limits in 2008 for the Yuma area were not studied because no transmission project could be completed before 2012. This report concludes that the cost of RMR with the transmission import limit is not significant for the Phoenix metropolitan area.

D. Determination of SIL and RMR Conditions

In this analysis, assessments of the SIL and RMR conditions for the Phoenix area and the Yuma area were performed for the years 2008 and 2015. The years 2008 and 2015 were selected because of the work being performed in the Seams Steering Group-Western Interconnection (SSG-WI). The 2005 study plan for SSG-WI included building western regional models for 2008 and 2015 for the ABB GridView application. At the time this RMR study was performed, the 2008 database was available and was utilized. For 2015, the model was upgraded to include new projects in the study area. Comments from the Third Biennial Transmission Assessment stated a desire for the RMR studies to utilize public data. The work being done by SSG-WI provides that public database. The years 2008 and 2015 are also good representative years during the ten-year window. Base case and contingency power flow, stability, and voltage stability analyses were performed to determine import limitations. The initial starting cases were based on WECC heavy summer full loop base cases in GE Power Flow format for the corresponding year. Those base cases model the entire Western Interconnection's transmission system and were reviewed and then updated to represent expected loads and system configuration for 2008 and 2015. Both cases were coordinated between APS, SRP, Tucson Electric Power Company (TEP), Southwest Transmission Cooperative (SWTC), and WAPA to capture the most accurate expected operating conditions for the Arizona transmission system.

III. PHOENIX LOAD POCKET

A. Description of Phoenix Area

During summer 2008, the Phoenix area — which consists of both APS' and SRP's integrated network — will be served from the following major Extra High Voltage (EHV) substations: Westwing, Pinnacle Peak, Kyrene, Rudd, Browning, and Silverking. These EHV stations form the "cornerstones" of an extensive internal network of 230-kV transmission lines that constitute the high voltage energy delivery system within the Phoenix load area. By summer 2015, three new EHV substations will be added to the existing major EHV substations serving the Phoenix area. They are the TS5 substation, a new Raceway 500-kV substation, and the South East Valley (SEV) substation.

Since the summer of 2002, APS has served some northwest Phoenix area load from the Raceway 230-kV substation, which has been built as an interconnection to the WAPA Westwing-to-Waddell 230-kV line. Because this line has no interconnections with other Phoenix area 230-kV lines, this load does not significantly impact the contingency response of the Phoenix area and is therefore not included in the Phoenix area load determination, until the 2015 case, by when the Raceway 230-kV substation will have become interconnected to Pinnacle Peak substation and the new 500-kV substation.

Because the City of Mesa load is served by dedicated resources external to Phoenix, the economic RMR analysis is performed with this load excluded.

Energy flows into the EHV delivery points from the EHV transmission lines and then is stepped down to 230-kV and transmitted into the load center via the 230-kV transmission lines. These loads, with area losses, are measured by determining the flows from the EHV substations into the load area to include all of these load stations. The specific loads to be included in the Phoenix area load for each of the three years was determined by sensitivity analysis performed in the previous RMR study effort which determined the impact of various loads on the severity of the critical contingencies. Figure 1 shows all of the loads included for the 2008 study. Figure 2 shows, in 2015, the Phoenix area load is expanded to include loads supplied by the new bulk power substations TS5, Raceway 500-kV, and South East Valley (SEV).

Figure 1

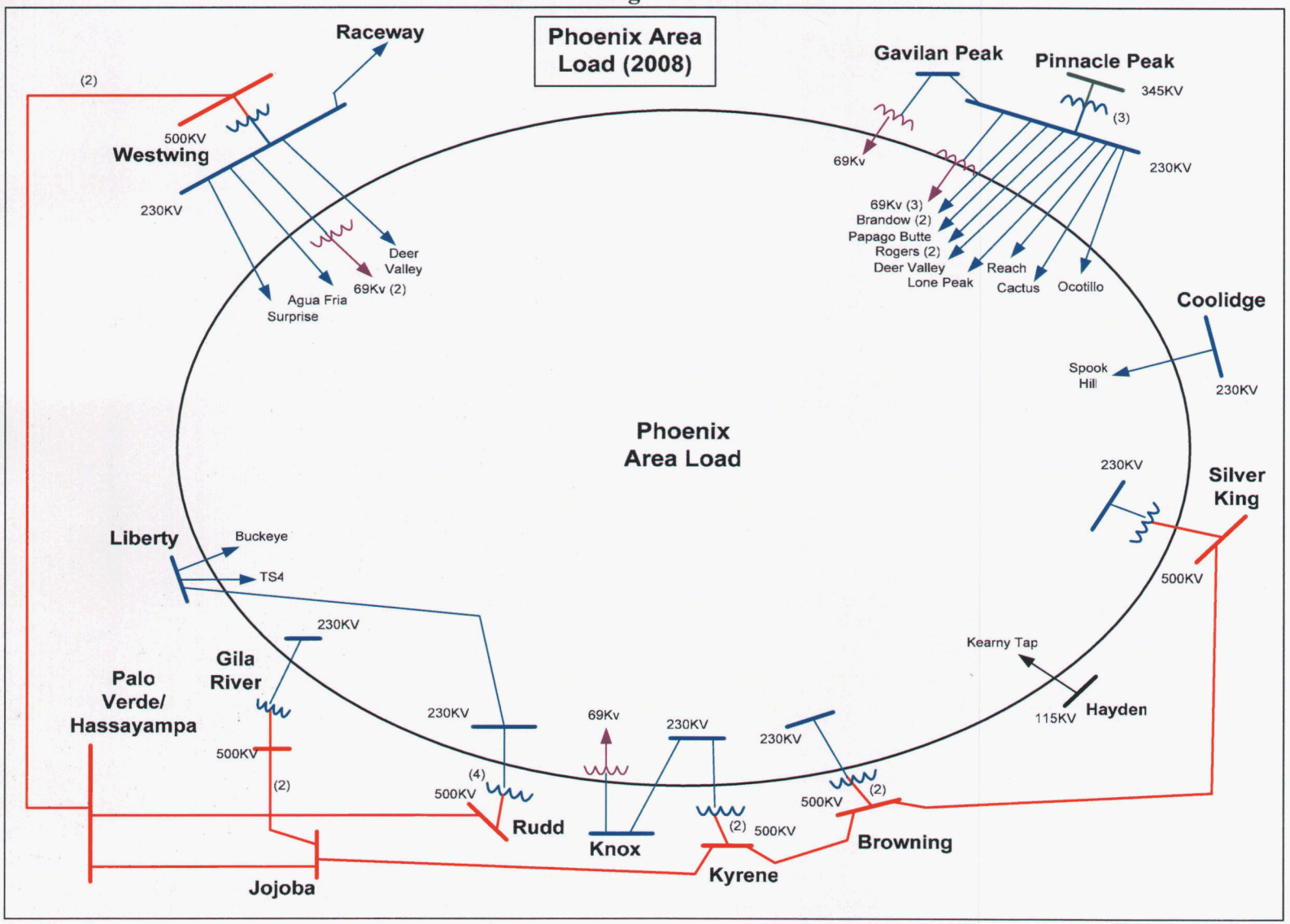
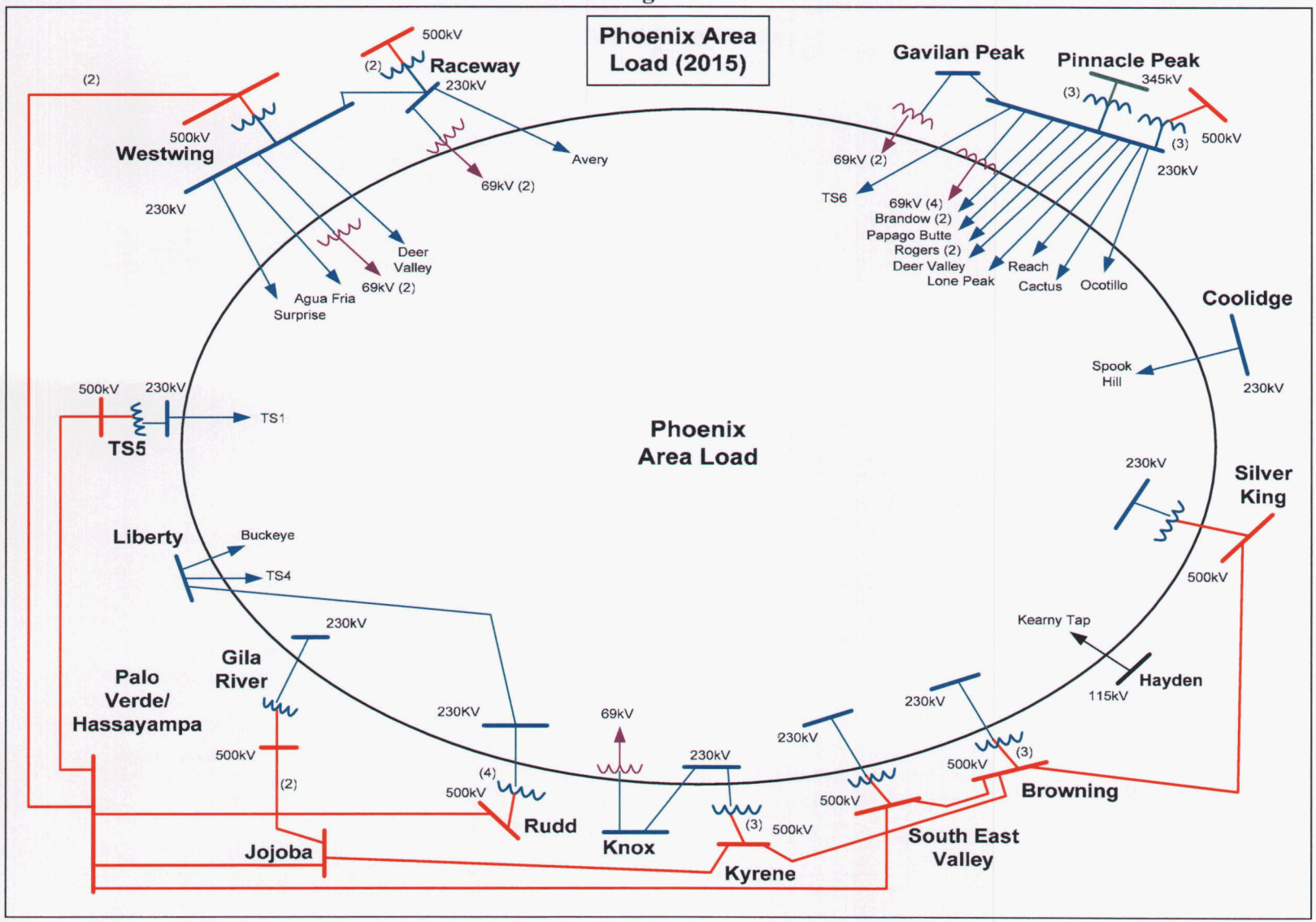

Phoenix Area Load (2008)
Raceway
(2)
500KV
Westwing
230KV
Deer Valley
69Kv (2)
Agua Fria
Surprise
Gavilan Peak
Pinnacle Peak
345KV
(3)
69Kv
230KV
69Kv (3)
Brandow (2)
Papago Butte
Rogers (2)
Deer Valley
Lone Peak
Reach
Cactus
Ocotillo
Coolidge
Spook Hill
230KV
Phoenix Area Load
230KV
Silver King
500KV
Liberty
Buckeye
TS4
230KV
Gila River
Palo Verde/ Hassayampa
500KV
(2)
Kearny Tap
115KV
Hayden
230KV
69Kv
230KV
230KV
(4)
500KV
Rudd
Knox
(2)
500KV
Kyrene
500KV
(2)
Browning
Jojoba

Figure 2


Phoenix Area Load (2015)
Phoenix Area Load
500kV
(2)
Raceway
230kV
Avery
69kV (2)
Westwing
500kV
(2)
230kV
Deer Valley
69kV (2)
Agua Fria
Surprise
Gavilan Peak
Pinnacle Peak
345kV
(3)
(3)
500kV
230kV
69kV (2)
TS6
69kV (4)
Brandow (2)
Papago Butte
Rogers (2)
Deer Valley
Lone Peak
Reach
Cactus
Ocotillo
Coolidge
Spook Hill
230kV
500kV
230kV
TS1
TS5
230kV
Silver King
500kV
Liberty
Buckeye
TS4
Kearny Tap
Hayden
115kV
230kV
Gila River
Palo Verde/ Hassayampa
500kV
(2)
230KV
69kV
230kV
(4)
500kV
Rudd
Knox
(3)
500kV
Kyrene
230kV
500kV
(3)
Browning
South East Valley
Jojoba

In performing the Phoenix area studies several planned projects were added to reflect transmission system upgrades for the next ten years. They are listed below under one of the two study years they will first appear:

Projects in service by 2008

- Phase I of the South East Valley project; Hassayampa-Pinal South 500-kV line
- A new Palm Valley 230/69-kV substation with a 230/69-kV transformer and connected to Rudd-TS4 230-kV line
- Lincoln Street 2nd 230/69-kV transformer addition
- West Phoenix-Lincoln Street 230-kV line reconductor
- Surprise 3rd 230/69-kV transformer addition
- Westwing-Surprise 230-kV line reconductor
- Meadowbrook-Sunnyslope 230-kV underground circuit upgraded
- Rudd 4th 500/230-kV transformer addition
- Rudd 230-kV substation is looped in and out of the Liberty-Orme 230-kV line
- A second Orme-Anderson 230-kV line
- Shunt capacitors added in the eastern portion of the system
- Santan CC6 275 MW generation addition
- Mohave generation was modeled as out-of-service

Projects in service by 2015

- A new TS5 500/230-kV substation with two 500/230-kV transformers, a 500-kV line to Palo Verde area
- A new TS1 230-kV substation with a 230/69-kV transformer and TS5-TS1 230-kV line
- A new TS2 230-kV substation with a 230/69-kV transformer
- A new TS1-TS2-Palm Valley 230-kV line
- A new Raceway 500-kV substation with two 500/230-kV transformers and connected to Navajo-Westwing 500-kV line
- A new Pinnacle Peak 500-kV substation with three 500/230-kV transformers and a 500-kV line to Raceway 500-kV substation
- A new TS5-Raceway 500-kV line
- A new Avery 230/69-kV substation with a 230/69-kV transformer and a new Raceway-Avery 230-kV substation
- A new TS6 230/69-kV substation with a 230/69-kV transformer and a new Avery-TS6-Pinnacle Peak 230-kV line
- Meadowbrook 2nd 230/69-kV transformer addition
- Alexander 2nd 230/69-kV transformer addition
- New coal generation at Four Corners of 1400 MW
- A new Red Mesa East 500-kV substation connected to Navajo-Moenkopi 500-kV line
- A new Harquahala-Devers 500-kV line
- A new Four Corners-Red Mesa East 500-kV line

- A new South East Valley (SEV) 500/230-kV substation with two 500/230-kV transformers
- A new Santa Rosa 500-kV substation with a 500/230-kV transformer
- Phase II of the South East Valley project; Pinal West-Santa Rosa-SEV-Browning 500-kV line
- A third 500/230-kV transformer at Kyrene and Browning substations
- Shunt capacitors were added in the northern and eastern parts of the valley
- Mohave generation units were modeled as in-service

B. Phoenix Area Critical Outages

1. 2008

The analysis determined that the critical single contingency for the Phoenix load area at the SIL point is the loss of the Jojoba-to-Kyrene 500-kV transmission line. The loss of this major 500-kV line to the Phoenix area results in a thermal overload of the Kyrene-to-Corbell 230-kV line. With local Phoenix area generation at high levels the critical single contingency for the Phoenix load area is the loss of the West Phoenix-to-Lincoln Street 230-kV line. The loss of this 230kV line results in a thermal overload of the Agua Fria-to-Glendale 230-kV line. Thus, the system is constrained by these thermal overloads at the two ends of the nomogram.

2. 2015

The analysis determined that the critical single contingency for the Phoenix load area at all load and generation levels is the loss of the Jojoba-to-Kyrene 500-kV transmission line. The loss of this major 500-kV line results in significantly higher flows on the remaining transmission lines and the underlying 230-kV transmission system and causes a large increase in reactive power (Var) losses in the transmission network. The increase in Var consumption results in insufficient Vars for voltage support in the load area. Consequently, this condition creates low voltages in the system and makes the area deficient in reactive power.

The voltage stability analysis was performed using Q-V analysis on the most reactive deficient buses in the Phoenix area. These buses were the Kyrene 500-kV, Kyrene 230-kV, Browning 230-kV, Westwing 230-kV, and the Pinnacle Peak 230-kV buses.

Q-V analysis is performed by adding reactive load at the critical bus until the voltage reaches a minimum value which indicates potential voltage instability. The import limit is determined as the lesser of 95% of the import with zero reactive margin or 100% of the import with a 5% voltage drop following the worst single-contingency per WECC planning criteria.

C. Phoenix Area – SIL and MLSC for 2008 and 2015

Analysis of the Phoenix area transmission network resulted in area import limits based on the limits discussed in the previous section (B. Phoenix Area Critical Outages). Operation of the Phoenix system within these limits ensures that the area does not experience voltage instability or thermal overloading of a system element after a critical contingency. Voltage instability is characterized by a progressive fall in voltage magnitude at a particular location of the power system that may spread throughout the network causing a complete area voltage collapse and blackout. A thermal overload occurs when more power flows through an element than the emergency rating of that element. The Phoenix area SIL and MLSC for the years 2008 and 2015 are outlined in Table 1.

Table 1
2008 and 2015 Phoenix area Simultaneous Import Limit

Year	SIL (MW)	MLSC (MW)
2008	9,700	13,860
2015	13,004	17,051

The maximum Phoenix area load-serving capability for various generation levels is shown in Figures 3 and 4.

Figure 3
Phoenix Area 2008 Load Serving Capability

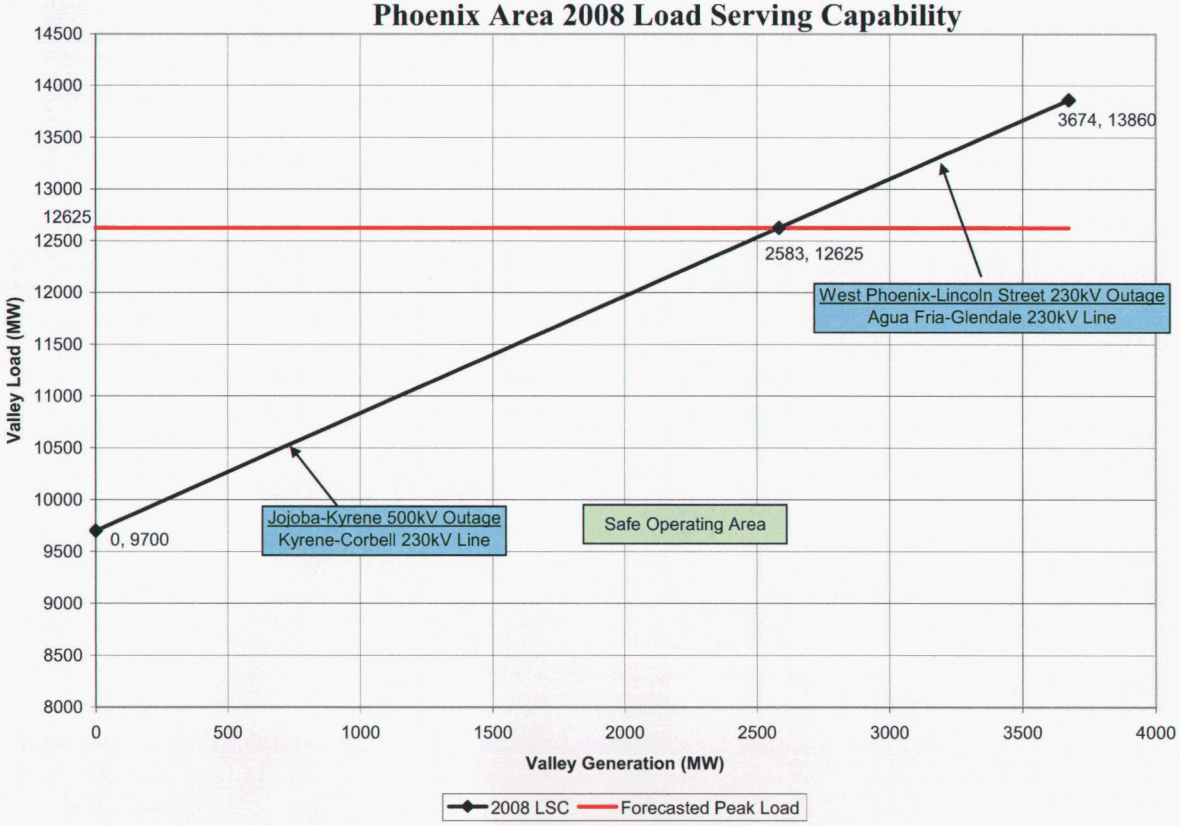
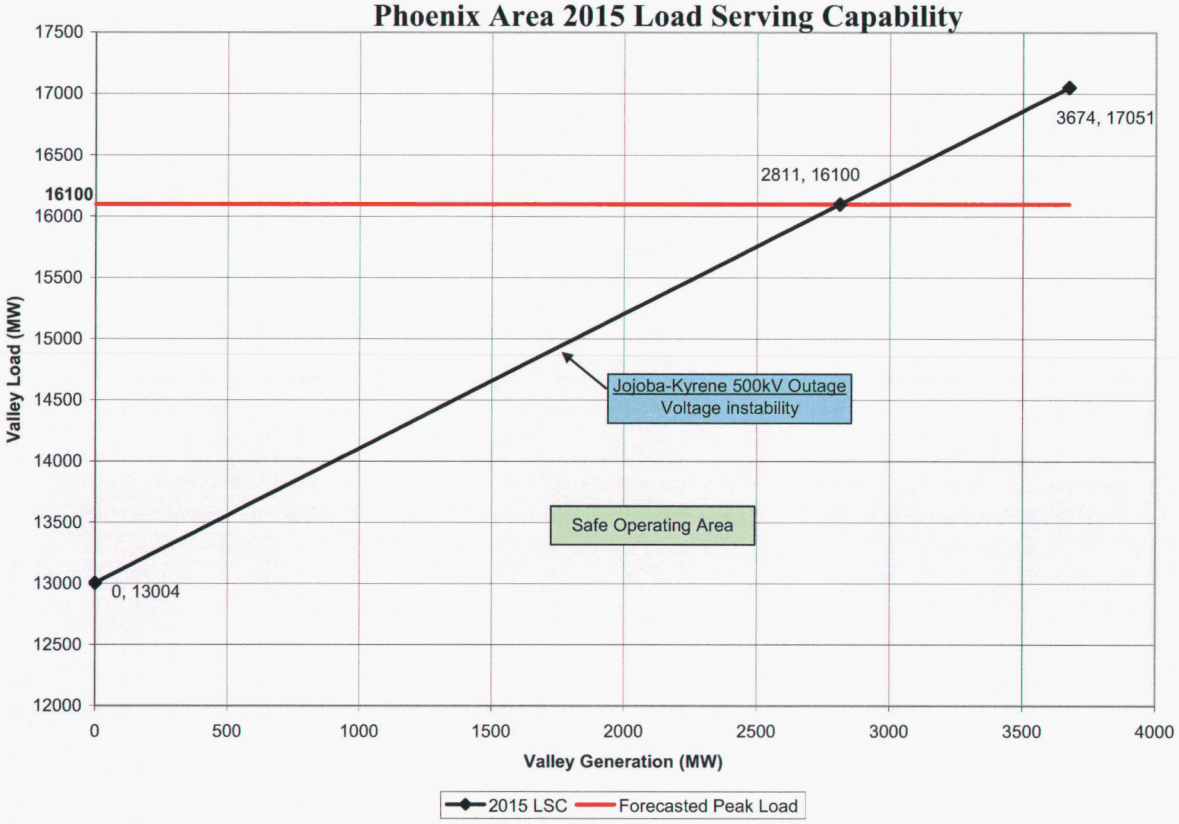


Figure 4
Phoenix Area 2015 Load Serving Capability



D. Generation Sensitivities

Sensitivity analyses of generation impact on load-serving capability were also conducted. These sensitivities were done with the maximum level of local generation. The following tables provide the results of these analyses for units that are both within and outside the Phoenix area.

Generation sensitivities inside the Phoenix area are listed in Table 2.

Table 2
Generation Sensitivities Inside Phoenix

Generation Source Increase by 100 MW	2008 Load Serving Capability Increase (MW)	2015 Load Serving Capability Increase (MW)
Agua Fria Generation	-230	100
Kyrene Generation	80	120
Ocotillo Generation	310	110
Santan Generation	80	115
West Phoenix Generation	-100	105

Generation sensitivities outside of the Phoenix Metro area are listed in Table 3.

Table 3
Generation Sensitivities Outside Phoenix

Generation Source Increase by 100 MW	2008 Load Serving Capability Increase (MW)	2015 Load Serving Capability Increase (MW)
Sundance Generation	50	60
Desert Basin Generation	20	40
Hassayampa Area Generation	0	40
Gila River Power Station Generation	0	0

The results indicate that the effectiveness of a generator is dependant upon the critical outage, whether the limitation is thermal or voltage, the critical element, and the location of the generator in respect to the direction the power is flowing through the critical element. For example, in 2008, with the critical outage being the West Phoenix-Lincoln Street 230-kV line and the critical element being the Agua Fria-Glendale 230-kV line, the Ocotillo generators are most effective in increasing the load-serving capability because they inject power into Lincoln Street from the east. In contrast, with the Agua Fria generators injecting power immediately upstream of the critical element, they will exacerbate the overload and decrease the load-serving capability.

IV. YUMA AREA

A. Description of Yuma Area

Currently the Yuma area is served from three transmission sources:

- APS' North Gila 500/69-kV substation, which is located east of Yuma. Two 69-kV lines extend west and southwest from this substation into Yuma to serve Yuma area load. A third 69-kV line interconnects into WAPA's Gila 161/69-kV substation.
- WAPA's Gila 161/69-kV substation, which is also located east of Yuma. From this substation, APS has one 69-kV line into the Yuma load area and one 69-kV tie to APS' North Gila substation.
- APS' Yucca 69-kV station, which is located on the west side of Yuma near the Colorado River. APS' local generation is located at this station, along with three 69-kV lines into the load area and an interconnection to IID's 161-kV system through two 161/69-kV transformers. The IID 75 MW steam-generating unit is also located at this substation.

For 2008, a fourth 69-kV line is planned to be in-service from the Yucca 69-kV substation into the load area and 100 MW of new generation was assumed to be in-service and connected at the Yucca substation. Figure 5 shows the transmission system in 2008 and the metering points for the Yuma area load pocket. Listed below, under one of the two study years they will first appear, is a list of the planned projects that were added to reflect the system upgrades for the next ten years.

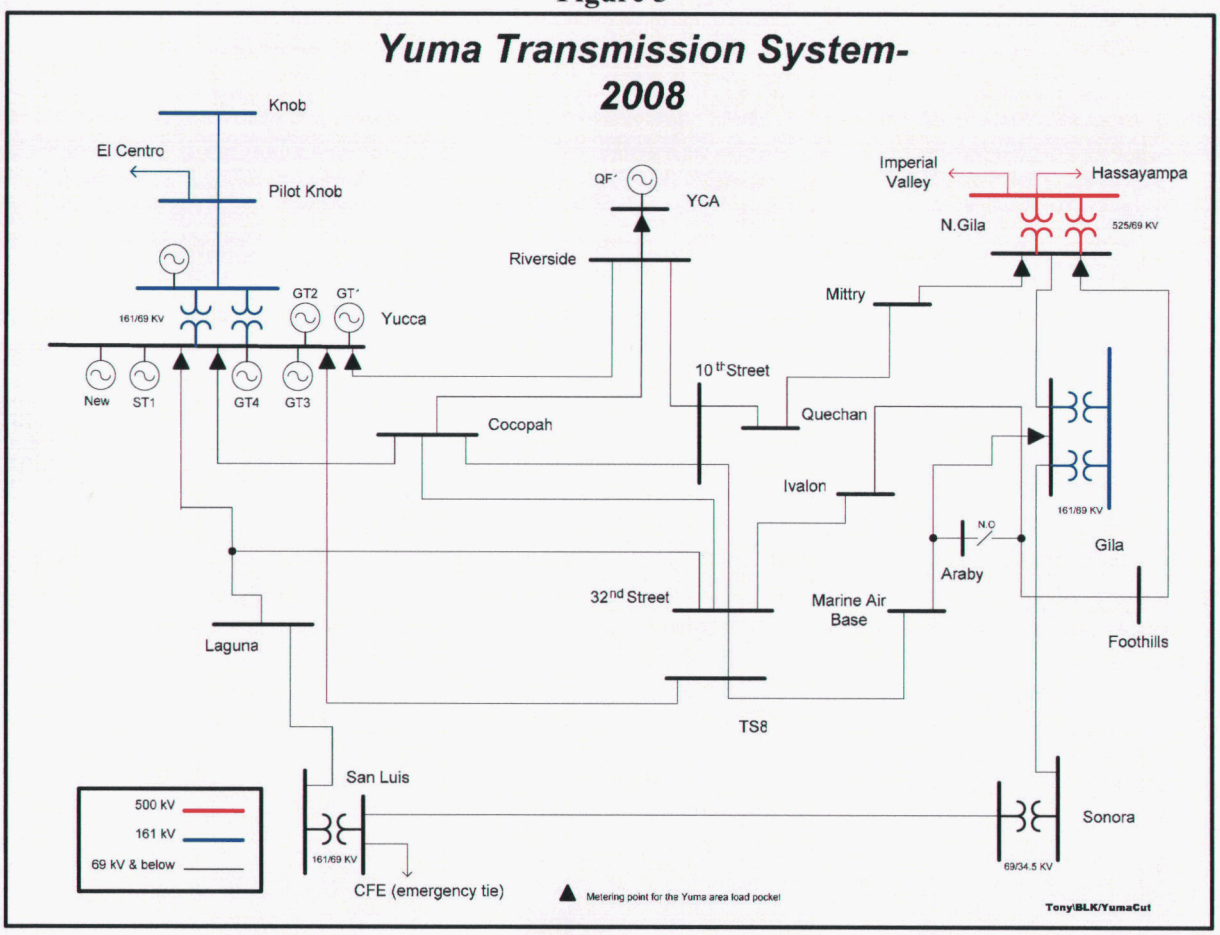
Projects in service by 2008

- 100 MW of new generation at Yucca substation.
- TS8 69-kV substation looped in and out of Marine Air Base-32nd Street 69-kV line and a new TS8-Yucca 69-kV line.
- Riverside-Cocopah and Cocopah-32nd Street 69-kV line
- Reconductor Foothills-Foothills tap 69 kV line
- Reconductor Yucca-Laguna Tap 69-kV line
- Reconductor a portion of 32nd Street-Ivalon 69 kV line

Projects in service by 2015

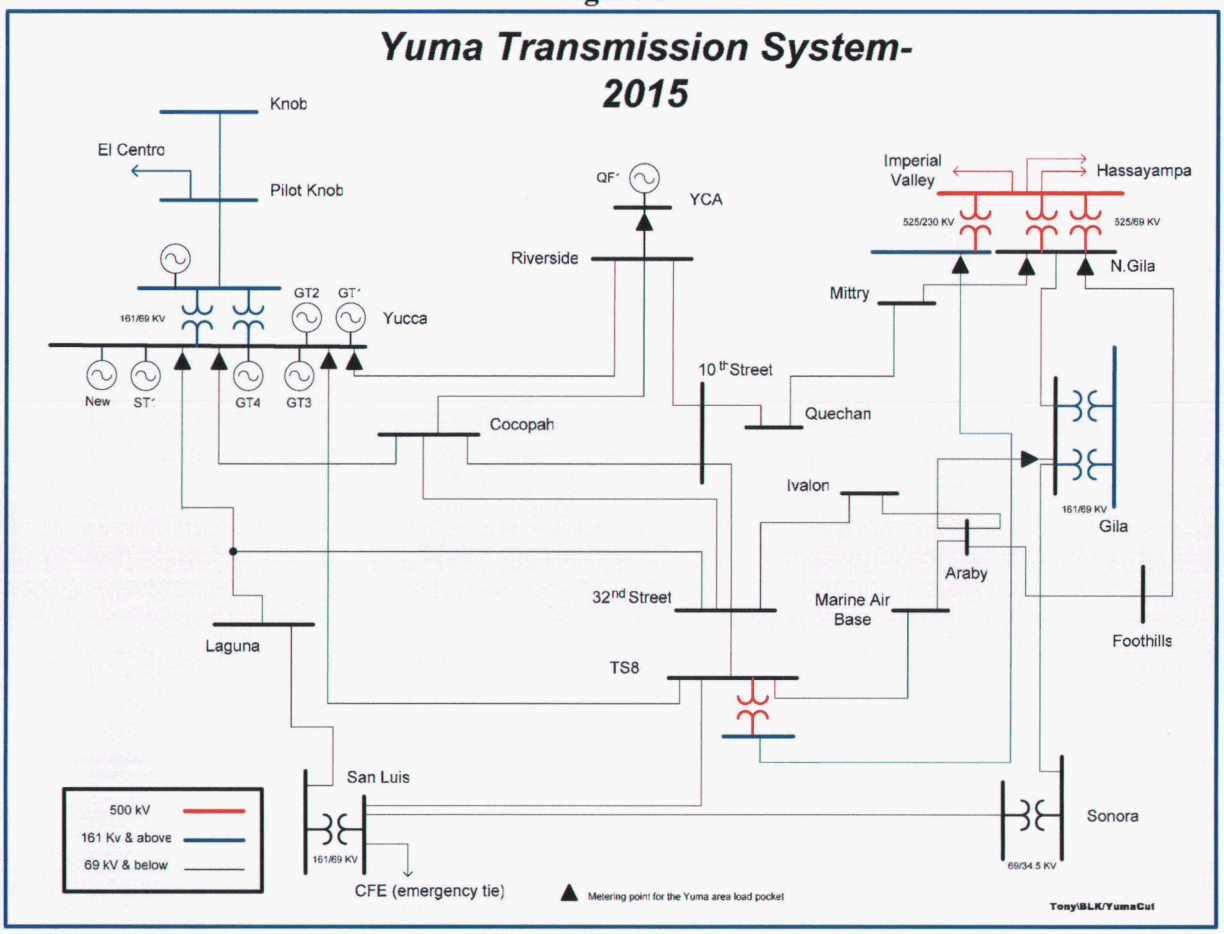
- Construct a new North Gila-Hassayampa 500 kV line.
- Construct a new North Gila 230-kV bus with a 500/230-kV transformer
- Construct a new TS8 230-kV substation with a 230/69-kV transformer and a North Gila-TS8 230-kV line.
- Construct a new TS8-San Luis 69-kV line.
- Reconductor North Gila-Mittry and Mittry-Quechan 69 kV lines.
- Reconductor TS8-32nd Street 69 kV line.
- Reconductor Ivalon-Araby 69 kV line.

Figure 5



The only changes in the model of the Yuma area for 2015 were the addition of the 230-kV line from North Gila to the new TS8 230-kV substation and a second 500-kV line from the Palo Verde area to North Gila. This can be seen in Figure 6.

Figure 6



B. Yuma Area Critical Outages

Several critical contingencies exist affecting the determination of the system import limit for the Yuma area during the 2008 and 2015 time frame. For the 2008 year, the primary critical outage is the existing Hassayampa-N.Gila 500-kV line and the limiting element is a thermal overload on the Pilot Knob-Yucca 161 kV line. In 2015, the critical outage is the N.Gila-TS8 230 kV line and the limiting element is a thermal overload of the Pilot Knob-Yucca 161 kV line.

C. Yuma Area – SIL and MLSC for 2008 and 2015

With planned system additions for the Yuma area, along with some accelerated projects, the SIL and MLSC for the Yuma area will increase enough to serve the rapidly growing load and maintain the desired generation reserves. For 2008 and 2015 the SIL will be 264 MW and 453 MW, respectively. The MLSC for 2008 and 2015 will be 545 MW and 826 MW, respectively. Results of these studies are shown in Figures 7 and 8.

Figure 7
Yuma Area 2008 Load Serving Capability

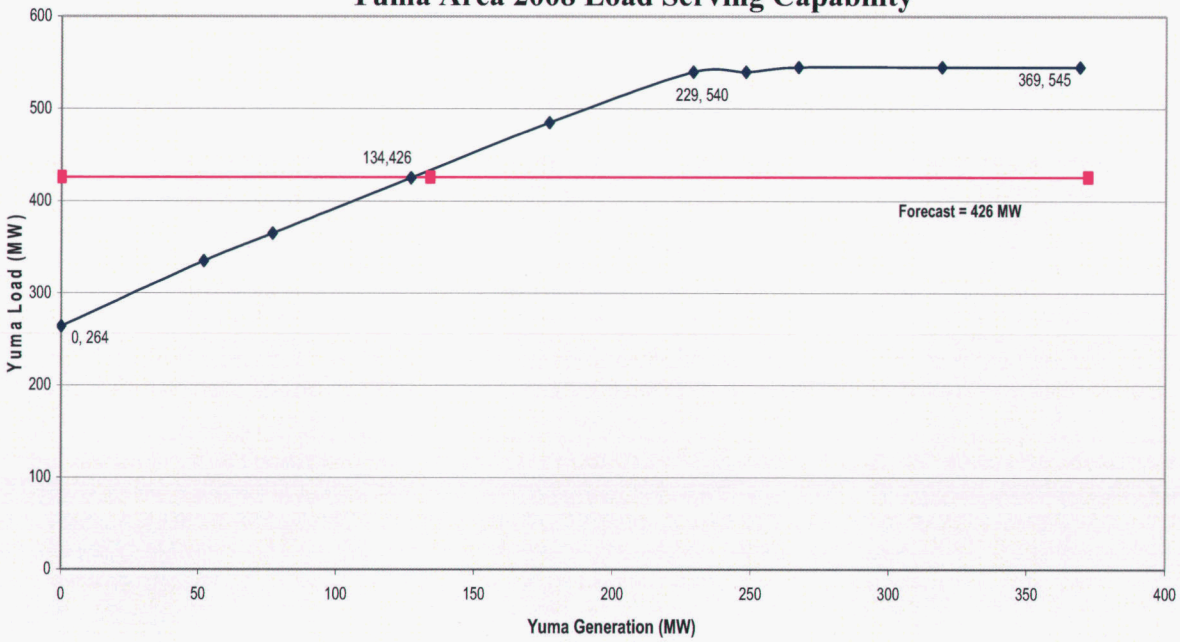
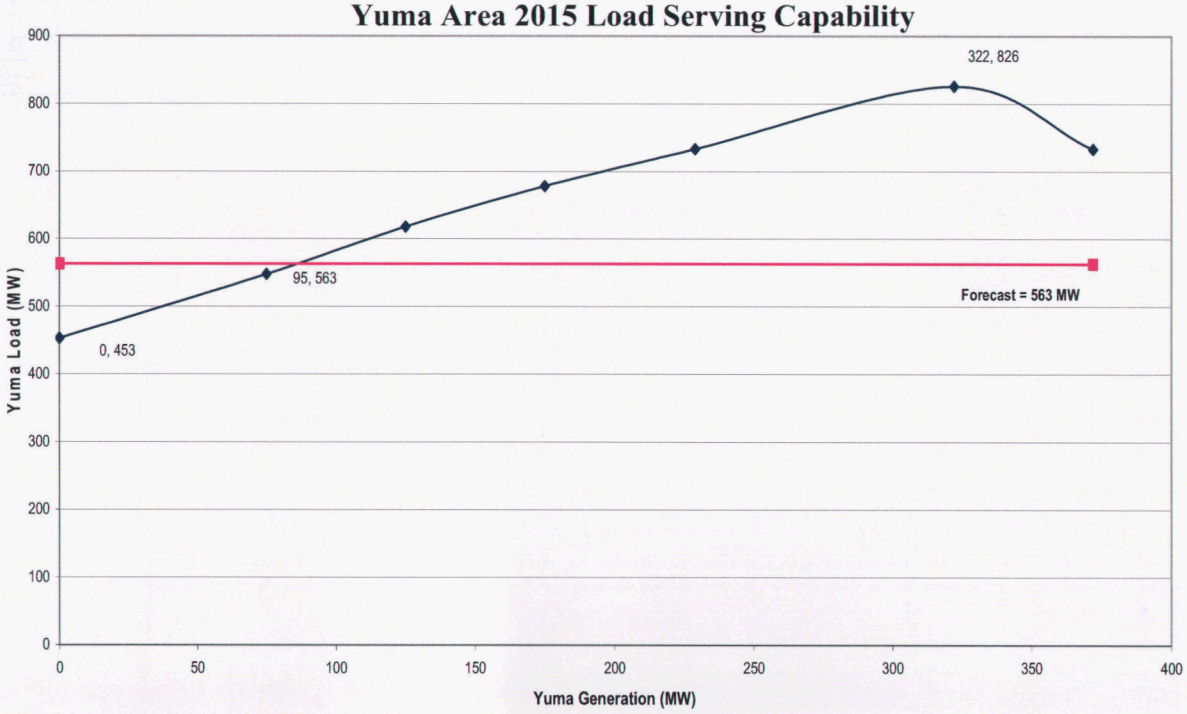


Figure 8
Yuma Area 2015 Load Serving Capability



V. Analysis of RMR Conditions

A. Phoenix Area

1. Annual RMR Conditions

An RMR condition exists when the local load is greater than the SIL. In such cases, the RMR condition is the amount of generation that must be located inside of the constrained load area to meet the utility's peak load. RMR conditions for the Phoenix area are shown in Table 4 and are represented in the load-duration curves in Figures 9 and 10.

Table 4

Phoenix RMR Conditions Without Valley Generation

(MW)

	PHOENIX	
	2008	2015
Peak Load	12,625	16,100
Generation	-	-
Reserves	-	-
Net Valley Generation	-	-
Import Capability	10,042	13,289
Net Gen + Import	10,042	13,289
Must-Run Generation	2,583	2,811
Hours Load Exceeds Gen + Imp	845	548
Energy - GWH	650	419
Energy Percent of Valley Load	1.1%	0.6%

Figure 9

PHOENIX LOAD DURATION & RMR CONDITION (2008)

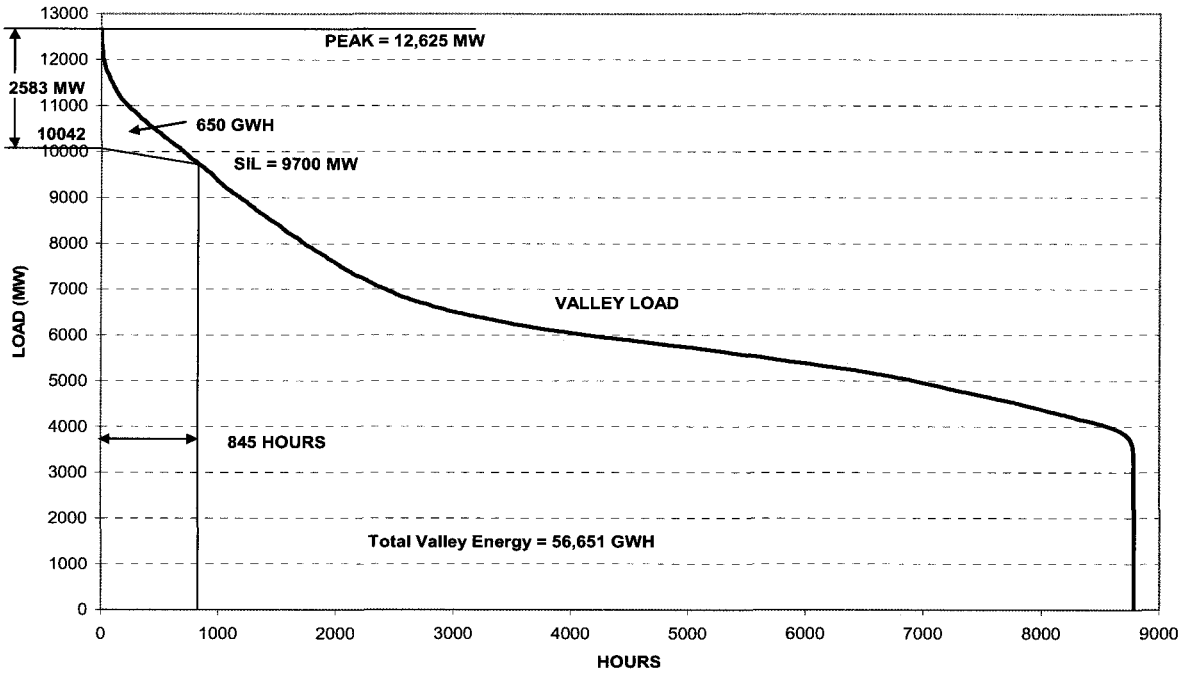


Figure 10

PHOENIX LOAD DURATION & RMR CONDITION (2015)

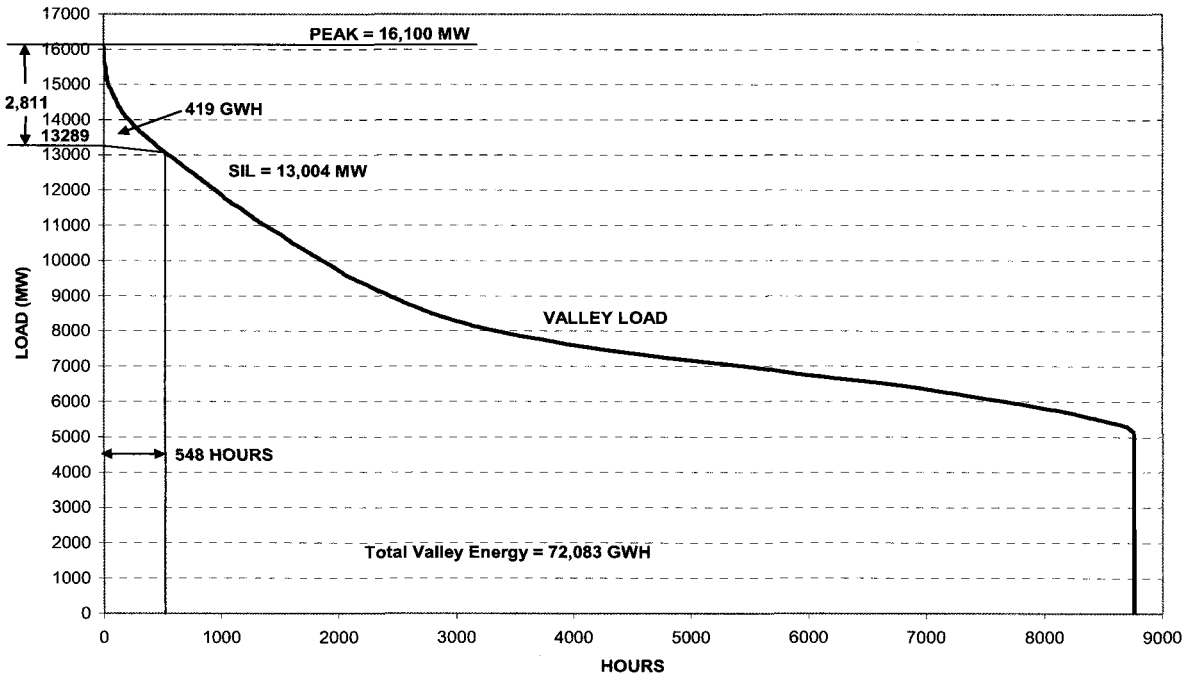


Table 4 shows that Phoenix is expected to require from 2,583 MW to 2,811 MW of local generation resources over and above its import capability to meet peak load. These resources can be located inside the Phoenix area constraint. For Phoenix, generation is estimated to be in a must-run condition for between 548 to 845 hours per year. However, because RMR occurs only at peak, the amount of associated energy is only approximately one percent of the total Phoenix area energy requirements, as shown in Figures 9 and 10.

2. Maximum Load Serving Capability (MLSC)

MLSC is the maximum load that can be reliably served in the load pocket. It is the import capability plus the generation capability located inside the load pocket, minus a reserve margin allowance for generation reliability. Based on the load forecast and SIL presented in this analysis, and existing and planned local generation, the following MLSCs for Phoenix were developed. The approach used also shows how much generation or transmission may be needed to reliably meet load.

These results along with the generation and transmission assumptions are depicted in Table 5. As shown on this table, additional resources, beyond those projects in APS' Ten-Year Plan, are not required in years 2008 and 2015.

Table 5

Phoenix Area Maximum Load Serving Capability
(MW)

	PHOENIX	
	2008	2015
Peak Load	12,625	16,100
Valley Generation	3,674	3,674
Required Reserves	(865)	(865)
Net Valley Generation	2,809	2,809
Import Capability	10,186	13,377
MLSC	13,860	17,051
Projected Reserves	1,235	951
Hours Load Exceeds MLSC	-	-
Energy - GWH	-	-
Energy Percent of Valley Load	0.0%	0.0%

3. Area Load Forecast

The historical peak load within the Phoenix area constraint is shown in Table 6 for 2001-2005, along with forecasted peak load for 2008 and 2015. This peak load represents load growth as well as the expanding boundaries of the Phoenix area, as discussed in Section III, part A and shown in Figures 1, and 2. Forecasted peak load is based on the same assumptions embodied in APS' total system load forecast used for budgeting and planning. This peak load is the load measured within the defined Phoenix area constraint. The peak load is net of EHV transmission losses of about 3.8 percent.

Table 6

Phoenix and Yuma Load and Energy Forecast
(MW / GWH)

	HISTORICAL					FORECAST	
	2001	2002	2003	2004	2005	2008	2015
PHOENIX							
LOAD	9,179	9,290	9,663	10,076	10,499	12,625	16,100
ENERGY	39,654	40,426	42,140	44,103	44,623	56,651	72,083
Load Factor	49.3%	49.7%	49.8%	49.8%	48.5%	51.1%	51.1%
APS YUMA							
LOAD	296	292	336	342	370	426	563
ENERGY	1,330	1,332	1,420	1,518	1,609	1,892	2,492
Load Factor	51.2%	52.0%	48.2%	50.5%	49.7%	50.6%	50.5%

Phoenix area APS load forecasts were developed through the use of a multiple regression model using historic hourly load data, weather, and number of retail customers. These historic relationships (correlations) were used against the metro area customer forecast and a forecast of Phoenix weather to produce the APS Phoenix area load. The SRP forecast, obtained from SRP, was then added to the APS forecast to obtain a total valley load forecast.

4. Generation

Currently, APS owns 1,330 MW and SRP owns 2,344 MW of generation electrically located inside the Phoenix area. In 2005, the Arizona generation that was owned by PWEC was transferred to APS. Load serving entities (i.e., APS and SRP) now own the entirety of local generation that is currently in service inside the Phoenix area. Table 7 shows operational data associated with each unit.

Table 7

PHOENIX AREA GENERATION

OWNER	PLANT	TYPE	SUMMER CAPABILITY	MINIMUM LOAD	MINIMUM UP TIME	MINIMUM DOWN TIME	FOR	EFOR	FUEL TYPE
APS	Ocotillo 1	ST	110	20	8	8	4%	6%	NG
APS	Ocotillo 2	ST	110	20	8	8	4%	6%	NG
APS	Ocotillo GT1	GT	55	4	2	1	10%	12%	NG
APS	Ocotillo GT2	GT	55	4	2	1	10%	12%	NG
APS	West Phoenix GT1	GT	55	4	2	1	10%	12%	NG
APS	West Phoenix GT2	GT	55	4	2	1	10%	12%	NG
APS	West Phoenix CC1	CC	85	20	8	6	3.5%	7%	NG
APS	West Phoenix CC2	CC	85	20	8	6	3.5%	7%	NG
APS	West Phoenix CC3	CC	85	55	8	6	3.5%	7%	NG
APS	West Phoenix CC4	CC	110	77	8	3	5%	7%	NG
APS	West Phoenix CC5	CC	525	160	8	6	8%	10%	NG
SRP	Agua Fria 1	ST	113	57	8	8	4%	6%	NG
SRP	Agua Fria 2	ST	113	57	8	8	4%	6%	NG
SRP	Agua Fria 3	ST	181	92	8	8	4%	6%	NG
SRP	Agua Fria 4	GT	73	35	1	8	10%	12%	NG
SRP	Agua Fria 5	GT	73	32	1	8	10%	12%	NG
SRP	Agua Fria 6	GT	73	32	1	8	10%	12%	NG
SRP	Crosscut HY1	HY	3	N/A	N/A	N/A	0%	0%	WAT
SRP	Kyrene 1	ST	34	14	8	8	4%	6%	NG
SRP	Kyrene 2	ST	72	29	8	8	4%	6%	NG
SRP	Kyrene GT4	GT	59	25	1	8	10%	12%	NG
SRP	Kyrene GT5	GT	53	24	1	8	10%	12%	NG
SRP	Kyrene GT6	GT	53	24	1	8	10%	12%	NG
SRP	Kyrene CC1	CC	250	161	4	4	8%	8%	NG
SRP	Santan 1	CC	92	35	3	8	3.5%	7%	NG
SRP	Santan 2	CC	92	35	3	8	3.5%	7%	NG
SRP	Santan 3	CC	92	36	3	8	3.5%	7%	NG

SRP	**Santan 4**	**CC**	**92**	**35**	**3**	**8**	**3.5%**	**7%**	**NG**
SRP2	**Santan 5**	**CC**	**550**	**330**	**4**	**4**	**8%**	**8%**	**NG**
SRP2	**Santan 6**	**CC**	**275**	**165**	**6**	**4**	**8%**	**8%**	**NG**
SRP	**South Consolidated 1**	**HY**	**1**						**WAT**
SRP	**Transport GT1**	**GT**	**4**						**NG**
PHOENIX TOTAL			**3,674**						

NOTES: 1) Based on WECC data as of 1/1/2006
2) Santan expansion assumes an in-service date of 5/2006 (ST6)

APS owns West Phoenix CC 1-2-3-4-5, West Phoenix CT 1-2, Ocotillo ST 1-2, and Ocotillo CT 1-2. With the exception of West Phoenix CC 4-5, these units collectively have a 695 MW summer rating, have historically operated at capacity factors in the 3-30 percent range, and are expected to operate at lower capacity factors for the next few years as new high-efficiency plants come on line in Arizona and the Southwest. West Phoenix CC 4 (110 MW), which went into service in June 2001, and West Phoenix CC 5 (525 MW), which came on-line in July 2003, improve reliability to the Phoenix area. These units have operated at capacity factors in the 10-50 percent range.

SRP owns the Agua Fria, Kyrene and Santan generating stations inside the Phoenix area, totaling 2,344 MW of generation. These units were built in the late 1950s to the mid-1970s, with two exceptions -- a new Kyrene CC unit went into service in 2002 and a new Santan 5 unit went into service in 2005. For this study, it is assumed that Santan 6 will be in-service in 2006.

5. Reserves

Reliability within a load pocket such as Phoenix must be evaluated differently than for an unconstrained system. For example, although a 15 percent reserve margin or a largest hazard margin may be adequate for unconstrained total system loads, it may not provide adequate reliability to load pockets that may not have access to all reserves present in the WECC interconnected system. APS performs an analysis that considers the size, forced outage rate, and effective forced outage rate of each generating unit in the load pocket to determine the probability that enough generation will be available when needed. The required reserve values used for this study were based on a 99% reliability criteria. This criteria results in a reserve requirement for Phoenix of 865 MW, once Santan unit 6 is in-service. It means that at least 2809 MW (3674 MW Phx generation less 865 MW reserves) will be available to meet load 99% of the time. In other words, if the GridView simulation was run for 100 simulated years, all load would be served in 99 of them. The reserve requirement will change as resources are installed and/or retired.

The reserve values are used in calculating the load serving capability for the Phoenix load area. In addition, the loads used in this analysis are based on Phoenix experiencing average weather. If the Phoenix area has a hot summer, the load would be higher than projected, and the gas turbine and combined-cycle units' output would be reduced due to the hotter weather.

B. Yuma Area

1. Annual RMR Conditions

RMR conditions for the Yuma constrained area are shown in Table 8 and pictorially represented in a load-duration curve in Figures 11 and 12. Table 8 shows that APS requires 134 MW (2008) of resources over and above its transmission import capability to meet peak load in Yuma. These resources can be APS-owned generation or non-APS owned generation located within the constrained area. APS is in a must-run condition for between 1703 to 553 hours per year in

Yuma and the amount of associated energy is between 4.0 percent to 0.6 percent of APS' total Yuma energy requirement.

Table 8

Yuma RMR Conditions Without Generation
(MW)

		YUMA
	2008	2015
Peak Load	426	563
Generation	-	-
Reserves	-	-
Net Generation	-	-
Import Capability	292	468
Net Gen + Import	292	468
Must-Run Generation	134	95
Hours Load Exceeds Gen + Imp	1703	553
Energy - GWH	75	14
Energy Percent of Yuma Load	4.0%	0.6%

Figure 11

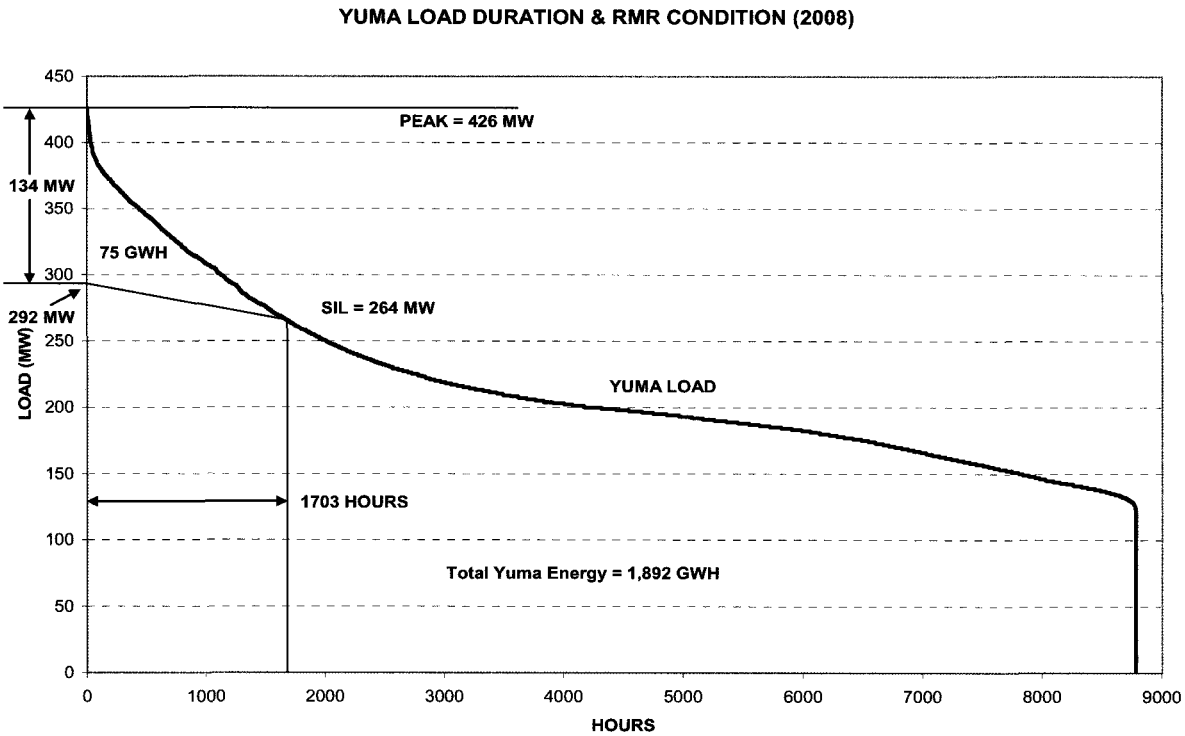
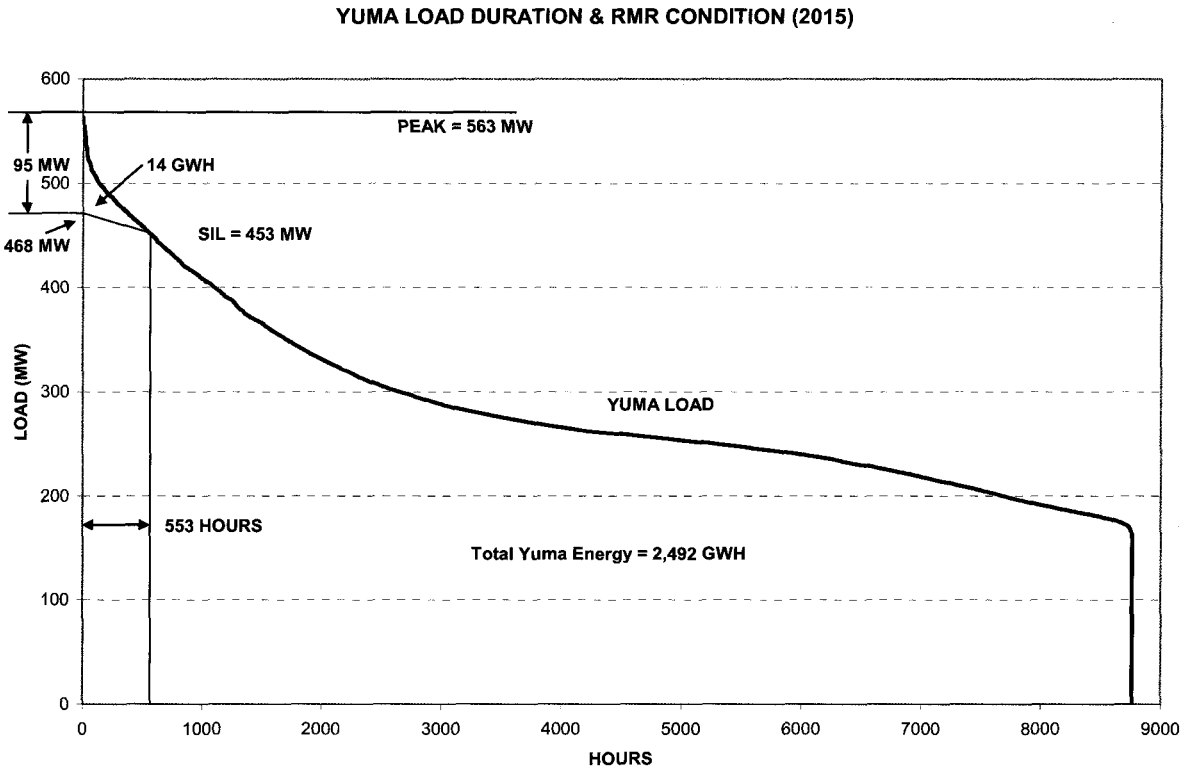


Figure 12



2. Maximum Load Serving Capability (MLSC)

Based on the load forecast, SIL and MLSC presented in this report, and the 367 MW of local generation listed in Table 10 (Yuma Area Generation), the following SILs and MLSCs were developed. This approach also shows how much generation or transmission may be needed to reliably meet load. As shown in Table 9, from 2008 to 2015 APS could serve 545 to 826 MW of load without additional resources. With a load forecast of between 426 MW to 563 MW, this resource need can be met from non-APS owned generation (Yucca steam and YCA units) within the load pocket. Also, when the Yucca steam and YCA units are running, APS' requirement for generation inside the load pocket is reduced on a one-for-one basis.

Table 9

Yuma Area Maximum Load Serving Capability
(MW)

	YUMA	
	2008	2015
Peak Load	426	563
Local Generation	367	367
Required Reserves	(138)	(138)
Net Local Generation	229	229
Import Capability	292	468
MLSC	545	826
Projected Reserves (For 2008 calculated at peak demand)	233	263
Hours Load Exceeds MLSC	-	-
Energy - GWH	-	-
Energy Percent of Yuma Load	0.0%	0.0%

3. Area Load Forecast

Table 6 shows APS' Yuma historical peak load for 2001-2005 and forecasted peak load for 2008 and 2015. Forecasted peak load is based on the same assumptions used in APS' total system load forecast used for budgeting and planning. This peak is the load measured just inside the Yuma area. It is net of EHV transmission losses of about 3.8 percent. Yuma load represents approximately 5 percent of APS' total system load. Yuma area APS load forecasts were developed through the use of a multiple regression model using historic hourly load data, weather, and number of retail customers. These historic relationships (correlations) were used against the Yuma area customer forecast, and a forecast of Yuma weather to produce the Yuma area load.

4. Generation

APS, IID and YCA own generation within the Yuma load pocket. These plants have an aggregate summer capacity rating of 267 MW. Five of the six units run on natural gas while the other plant (Yucca CT 4) runs on oil. Also by 2008, 100 MW of new generation is assumed to be in-service at the Yucca substation which would bring the total generation inside the Yuma load pocket to 367 MW. Additional power plant data for this generation is provided in Table 10. Of these plants, only the combustion turbines are owned by APS. The ownership of the 100 MW of new generation is not known at this time.

Although operated by APS, IID dispatches its steam plant to meet its load and spinning reserve needs. YCA is a cogeneration plant that has a contract with San Diego Gas & Electric (SDG&E). Although APS has no dispatch rights to these units, whenever the units are running they provide internal generation in the Yuma area for purposes of using the import nomogram.

Table 10

YUMA AREA GENERATION

OPERATOR	PLANT	TYPE	SUMMER CAPABILITY[1]	MINIMUM LOAD	MINIMUM UP TIME	MINIMUM DOWN TIME	FOR	EFOR	FUEL TYPE
APS	Yucca GT1	GT	18	2	2	1	10%	10%	NG
APS	Yucca GT2	GT	18	2	2	1	10%	10%	NG
APS	Yucca GT3	GT	52	5	2	1	10%	10%	NG
APS	Yucca GT4	GT	51	5	2	1	10%	10%	FO2
APS SUBTOTAL			139						
IID	Yuma Axis 1	ST	75	18	8	8	4%	6%	NG
YCA	Yuma Cogen 1	CC	36	14	N/A	N/A	3.5%	7%	NG
YCA	Yuma Cogen 2	CC	17	7	N/A	N/A	3.5%	7%	NG
YCA SUBTOTAL			53						
New Generation	New Yucca	GT	100	N/A	N/A	N/A	N/A	N/A	NG
YUMA TOTAL			367						

NOTES: 1) Based on WECC data as of 1/1/2005

5. Reserves

Using a probabilistic generation analysis, the required reserve margin for Yuma was calculated to be 138 MW.

VI. ECONOMIC ANALYSIS OF RMR

A. Introduction

To consider potential economic effects resulting from using local generation or arising from RMR conditions, an economic analysis was performed using a regional dispatch model. For this economic analysis, the production cost of meeting Phoenix loads was determined with the existing transmission import limitations in place. Next, a second hypothetical case was built in which the transmission import limits were removed. Comparing the two cases shows the economic costs of the transmission constraint.

These two cases were simulated with GridView and their outputs were compared to determine the cost of transmission constraints. GridView is a detailed regional production-costing model that includes the generation and transmission system of the entire WECC. GridView dispatches all generators on an economic basis to meet the overall WECC system load, within constraints for individual system control area's reserve requirements and within transmission constraints. The GridView model also shows sales of economic generation to, and economic purchases from, other utilities in the region subject to regional transmission constraints.

Much of the data used in modeling comes from public sources and has been gathered by the SSG-WI group. The GridView database was developed by the participants of SSG-WI to evaluate the economics of intraregional and interregional transmission projects. This model includes all new generation expected to be built in the West by 2008, including 100 MW at Yucca. The 2015 model also has new generation expected to be built near Four Corners. The 2008 model has the Mohave generating units modeled out-of-service, while the 2015 model has the Mohave generating units modeled in-service.

The transmission modelings in GridView are based on the WECC's bulk power flow cases, and were updated to reflect expected system enhancements for 2008. The model for 2015 was updated by APS to capture the transmission projects, in and around Arizona, which will be in-service between 2008 and 2015. The transmission model is an electrical flow model as opposed to a transport model. That means that transmission flows are subject to physical electrical constraints as well as scheduling constraints. Electrical constraints of the system are based on the WECC's path rating catalog, with additional local constraints such as the Phoenix import constraints.

The following items were quantified based on the GridView simulations:

- Number of hours per year the Phoenix and Yuma area transmission system is expected to be constrained by the import limits;
- Phoenix and Yuma generation capacity factors;
- Cost to serve the Phoenix system, including fuel, variable O&M, purchase power cost and wholesale interchange sales margins; and
- Phoenix and Yuma generation emissions.
- Phoenix and Yuma natural gas consumption

B. Phoenix

1. Phoenix Imports

Table 11 shows that under economic dispatch conditions for Phoenix area generation, Phoenix approached its transmission import limits less than 0.2% of the hours in a year.

Table 11

IMPACT OF ELIMINATING PHOENIX IMPORT LIMITS

	With Import Limits		Without Import Limits		Difference (With minus Without)	
	2008	2015	2008	2015	2008	2015
Hours Limiting	13	0	0	0	13	0
Phx Plant Generation (GWH)	5,034	3,570	5,021	3,569	13	1
Phx Plant Capacity Factor	15.4%	10.9%	15.4%	10.9%	0.0%	0.0%
Cost of Constraints ($M)					0	0

2. Operation of Phoenix area Generating Units

Historically, the Phoenix area's combined-cycle power plant capacity factors have ranged from 10 to 46 percent, with an average of about 22 percent. Capacity factors for steam-fired plants ranged from 6 to 42 percent, averaging about 13 percent. Capacity factors for simple-cycle combustion turbines ranged 0 to 22 percent, averaging about 3 percent. Historical capacity factors are shown in Table 12 by plant type for the period 1993 to 2002.

Capacity factors of these units in 1999-2002 were higher than the historical average because the Western Interconnection and the Phoenix area both experienced high price volatility, high load growth, and few new generation resources had been added since the 1980s. With new higher-efficiency power plants coming on line, as well as the presence of the new Palo Verde-Rudd 500 kV transmission line, the older Phoenix area units are expected to run at lower capacity factors. As noted above, however, these units remain critical to maintaining Phoenix area reliability.

Even if the Phoenix area transmission import limits were totally eliminated, these older units would still be needed to economically meet summer peak loads. Elimination of the constraints has a minor impact on the capacity factors of all Phoenix area plants. Removing the transmission constraint reduces the use of local generation by less than 13 GWH per year. Table 11 summarizes the results of the simulation analysis.

Table 12

PHOENIX AREA POWER PLANT HISTORICAL CAPACITY FACTOR (%)

	1995	1996	1997	1998	1999	2000	2001	2002	2003
TOTAL PHOENIX									
STEAM	6.5	6.7	7.1	10.0	21.2	26.5	42.0	14.2	12.0
COMBINED CYCLE	17.2	12.9	10.6	17.0	27.7	36.3	46.1	34.3	22.6
COMBUSTION TURBINE	0.4	0.5	1.0	1.8	2.6	5.8	21.9	4.2	1.7

3. Cost Impacts

An estimate of the cost of the transmission import constraints can be determined by comparing the system cost to serve Phoenix customers with and without constraints. Costs included in the analysis are fuel, variable O&M, purchased power and wholesale sale margin credits. The results of this analysis showed no significant costs as a result of the constraint. See Table 11.

4. Emissions Impact

In addition to economic modeling, the GridView analysis evaluated the change in plant air emissions that would result from removing the transmission constraint. Specifically, the emission impact to the Phoenix area from removing transmission constraints and "moving" generation outside the Phoenix area was calculated. Four criteria pollutants are routinely tracked for power plants: NO_X, CO, VOCs and PM_{10}. Maricopa County is a non-attainment area for CO and PM_{10}. NO_X and VOCs are precursors for ozone and therefore are included.

The emissions impact from power plant emissions in the Phoenix area was estimated by using the average emission rates of normal operation (such as starts-and-stops, short run times) of APS Phoenix area units along with the modeled change in energy production. Emissions were also estimated for the other non-APS Phoenix area units. Changes in emissions resulting from entirely eliminating the transmission import constraint into Phoenix are shown in Table 13. For comparison purposes, total emissions in Maricopa County were estimated by Maricopa County Environmental Services Department for 1999. Their emissions estimates include all stationary point sources, area sources, non-road mobile sources and on-road mobile and biogenic sources. To put the results into perspective, changes in Phoenix area power plant emissions are shown as a percentage of total Maricopa County emissions.

Table 13
Phoenix Area Air Emissions Reduction

Pollutant	Reduction[1] (tons/year)	Reduction of Phoenix Area Emissions (% of total emissions from all sources)
VOC	0.0	0.000
NO_x	0.0	0.000
CO	0.0	0.000
PM_{10}	0.0	0.000

[1]2008 results, impact for 2015 is also negligible

Table 14 shows APS and Phoenix area emissions by type.

Table 14

PHOENIX POWER PLANT EMISSIONS (TONS)						
	With Import Limits		Without Import Limits		Difference (With minus Without)	
	2008	2015	2008	2015	2008	2015
NOx	1.70	1.54	1.70	1.54	0	0
CO	0.48	0.45	0.48	0.45	0	0
PM_{10}	0.19	0.17	0.19	0.17	0	0
VOC	0.13	0.12	0.13	0.12	0	0

5. Natural Gas Impact

The GridView analysis was used to evaluate the change in natural gas consumption that would result from removing the transmission constraint. In 2008, by entirely eliminating the transmission import constraint into Phoenix, the generation units within Phoenix would reduce their consumption of natural gas by 53.6 MMBTU. For 2015, the Phoenix units would reduce their consumption of natural gas by 6.3 MMBTU.

C. Yuma

1. Yuma Imports

Unlike the Phoenix area, the Yuma imports do approach their limits at various times throughout the year. Table 15 shows that, for 2008, APS could approach its import limits for 1253 hours in the year. The energy associated with these hours amounts to 47.2 GWH. Table 15 also shows that, for 2015, APS could approach its import limits for 151 hours in the year. The energy associated with these hours amounts to 2.8 GWH. During these hours, it would have been more economical to import cheaper power either generated on APS' own units outside the Yuma area or purchased from the wholesale market if the import limits were increased.

Table 15

IMPACT OF ELIMINATING YUMA IMPORT LIMITS

	With Import Limits		Without Import Limits		Difference	
	2008	2015	2008	2015	2008	2015
Hours Limiting	1253	151	0	0	1253	151
Yuma Generation (GWH)						
APS	7.9	0	0	0	7.9	0
Yuma	39.3	7.9	0	5.1	39.3	2.8
Yuma Plant Capacity Factor						
APS	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Yuma	1.8%	0.7%	0.0%	0.4%	1.8%	0.3%
Cost of Constraints ($M)						
APS					1.3	0

2. Operation of Yuma Units

Historically, the Yucca CTs have operated at capacity factors of between 0.5 up to 18 percent, as shown in Table 16. On average they are in the 1 to 2 percent range.

Table 16

YUMA POWER PLANTS HISTORICAL CAPACITY FACTOR (%)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
YUCCA										
CT1	0.4	0.4	1.1	1.5	1.4	5.0	23.4	4.0	2.6	2.8
CT2	0.5	0.4	1.2	1.5	1.4	6.9	21.8	4.6	2.3	3.6
CT3	1.0	1.4	2.8	3.6	3.5	12.2	22.0	14.4	6.8	9.2
CT4	0.0	0.2	0.2	0.7	0.3	4.8	11.9	0.3	0.4	0.5
Total Yucca	0.5	0.7	1.4	2.0	1.8	7.9	18.4	6.6	3.3	4.5
YUMA AXIS	15.3	33.3	45.2	45.4	53.7	41.3	53.0	48.0	32.5	30.3
TOTAL YUMA	5.5	11.7	16.2	16.7	19.3	19.2	30.1	20.6	13.2	13.2

3. Cost Impacts

The GridView analysis indicates that the Yuma import limit will be constraining from 1,253 hours in 2008 and 151 hours in 2015. The cost of this constraint in 2008 is approximately $1,300,000. See Table 15.

4. Emission Impacts

The emission impact on the Yuma area due to a potential relieving of transmission constraints and "moving" generation outside of the Yuma area was determined by GridView similarly to the Phoenix analysis. Unlike Phoenix, however, Yuma County is a non-attainment area for PM_{10} only. Impacts on power plant emissions in Yuma were estimated by using average emission rates of normal operation (such as starts-and-stops, short run times) of APS units along with the change in energy production. Emissions were also estimated for the other non-APS units. By entirely eliminating the import limits into Yuma, emissions produced by power plants located inside the Yuma load pocket would change as shown in Table 17.

Table 17

YUMA POWER PLANT EMISSIONS (TONS)
(Includes Yucca 1-4 and Yuma Axis)

	With Import Limits		Without Import Limits		Difference (With minus Without)	
	2008	2015	2008	2015	2008	2015
NOx	0	0	0	0	0	0
CO	0	0	0	0	0	0
PM_{10}	0	0	0	0	0	0
VOC	0	0	0	0	0	0

5. Natural Gas Impact

The GridView analysis was used to evaluate the change in natural gas consumption that would result from removing the transmission constraint. In 2008, by entirely eliminating the transmission import constraint into Yuma, the generation units within Yuma would reduce their consumption of natural gas by 493.9 MMBTU. For 2015, the Yuma units would reduce their consumption of natural gas by 28.2 MMBTU.

VII. CONCLUSIONS

Phoenix area Conclusions

1. All Phoenix area transmission and local generation resources are necessary to reliably serve Phoenix area peak load in 2008 and 2015 with the projected local generation reserve margin exceeding the required reserve margin.

2. During the summer, Phoenix area load is expected to exceed the available transmission import capability for approximately 845 hours in 2008 and 548 hours in 2015. These hours represent approximately one percent of the annual energy requirements for the Phoenix area.

3. From a total Phoenix load, transmission, and resources viewpoint, import limits are expected to cause a minimal amount of local generation to be dispatched out of economic dispatch order in 2008 and 2015.

4. Because the estimated annual economic cost of Phoenix area RMR generation is negligible, advancement of transmission projects to increase import capability presently is not cost justified.

5. Removing the transmission constraint would reduce total Phoenix area air emissions by a minimal amount for years 2008 and 2015 due to the few hours of operating local generation.

Table C1
Phoenix area Air Emissions Reduction

Pollutant	Reduction[1] (tons/year)	Reduction of Phoenix Area Emissions (% of total emissions from all sources)
VOC	0.0	0.0
NO_x	0.0	0.0
CO	0.0	0.0
PM_{10}	0.0	0.0

[1]2008 results, impact for 2015 is identical

6. Removing the import restriction into the Phoenix area has no impact on local generation capacity factor. The capacity factor ranges from approximately 15% in 2008 to 11% in 2015.

7. Removing the transmission constraint could reduce total yearly natural gas consumption by the Phoenix area generators by 53.6 MMBTU and 6.3 MMBTU for 2008 and 2015, respectively.

Yuma Area Conclusions

8. All existing Yuma area transmission and generation resources are necessary to reliably serve the Yuma area load.

9. The Yuma area load is expected to exceed the available transmission import capability for 1,703 hours in 2008 and 553 hours in 2015. These hours represent approximately 4% of the annual energy requirements for Yuma in 2008 and less than 1% in 2015.

10. From a total Yuma load, transmission, and resources viewpoint, the import constraint could cause APS Yuma generation to be dispatched out of economic dispatch order for 1,255 hours in 2008 and 151 hours in 2015.

11. The estimated annual economic cost of Yuma area generation required to run out of economic dispatch order is approximately $1.3 million for 2008. As indicated in its 2006 10-Year Plan, due to APS' transmission plans, those costs are negligible by 2015.

12. Removing the transmission constraint would reduce total Yuma area air emissions by a minimal amount for years 2008 and 2015.

Table C2
Yuma Area Air Emissions Reduction

Pollutant	Reduction[1] (tons/year)	Reduction of Yuma Area Emissions (% of total emissions from all sources)
VOC	0.0	Data Unavailable
NO_x	0.0	Data Unavailable
CO	0.0	Data Unavailable
PM_{10}	0.0	0.000

[1]2008 results, impact for 2015 is identical

13. Removing the import restriction into the Yuma area could reduce the APS Yuma generation capacity factor from 0.4 percent to 0.0 percent in 2008.

14. Removing the transmission constraint could reduce total yearly natural gas consumption by the Yuma area generators by 493.9 MMBTU and 28.2 MMBTU for 2008 and 2015, respectively.