Public Service Company of Colorado
5909 East 38th Avenue, Denver, Colorado, 80207

May 28, 1982
Fort St. Vrain
Unit No. 1
P-82169

Mr. George Kuzmycz, Project Manager
Special Projects Branch
Division of Project Management
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. 50-267

Subject: Electrical Power Systems

References: 1) G-80149
2) G-80150

Dear Mr. Kuzmycz:

The purpose of this letter is to incorporate PSC previous and new responses to the above referenced letters into one letter.

This letter consists of the following attachments:

ATTACHMENT 1 Response to G-80149 (Tedesco to Warembourg dtd 8/25/80)
ATTACHMENT 2 Response to G-80150 (Tedesco to Warembourg dtd 8/25/80)
ATTACHMENT 3 Electrical Power System Figures Including Proposed Modifications
ATTACHMENT 4 Documentation of Voltage Studies (will be forwarded by a separate cover letter within 10 days)
ATTACHMENT 5 T-184 Verification of Analytical Studies

If you have any questions concerning this matter do not hestitate to call.

Very truly yours,

H. L. Brey, Manager
Nuclear Engineering Division

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ATTACHMENT 1

Response to G-80149 (Tedesco to Warembourg dtd 8/25/80)

NRC Requests:

We request that you compare the current design of the emergency power systems at your facility(ies) with the Staff Positions stated in the enclosure and:

(1) propose plant modifications as necessary to meet the Staff Positions, or

(2) provide a detailed analysis which shows your facility design has equivalent capabilities and protective features.

Additionally, we require that certain technical specifications to be incorporated into all facility operating licenses. Model technical specifications, consistent with the Staff Positions contained in Enclosure 1, are provided in Enclosure 2.

PSC Response: Plant Modifications are Being Proposed:

As we indicated in our letter P-81317 (dated 12/16/81 Brey to Kuzmycz), PSC has been pursuing the upgrading of the 3 essential 480 volt buses. The most prudent method of implementing the two levels of undervoltage protection is to do so when the switchgear is being changed out (two units are scheduled to be replaced during the 3rd refueling). The remaining existing units' relaying would be modified to provide the same voltage protection as the new units at that time. It is felt that this is the most viable approach because of the difficulty associated with the timely purchasing of Class 1E voltage transformers and undervoltage relays to modify the existing switchgear.

NRC Positions

NRC Position 1: "Second Level of Under-or-Over Voltage Protection with a Time Delay"

"We require that a second level of voltage protection for the onsite power system be provided and that this second level of voltage protection shall satisfy the following criteria:"

NRC Position 1a: "The selection of voltage and time setpoints shall be determined from an analysis of the voltage requirements of the safety related loads at all onsite system distribution levels;"

PSC Reply 1A:

All safety related equipment items at Fort St. Vrain are powered at the 480 volt level and below. The largest safety related motor is rated 150 horsepower. Voltage and time setpoints were selected based on the guidelines furnished by G-80150 (Tedesco to Warembourg dtd 8/25/80) at all onsite distribution levels. These setpoints will be reviewed by the PSC system protection engineering group and then placed into Technical Specification form. Once the draft Technical Specification has received approval by the FSV Nuclear Facility Safety Committee (NFSC), it will be forwarded for NRC review. We anticipate receiving NFSC approval in October 1982.

NRC Position 1B: "The voltage protection shall include coincidence logic to preclude spurious trips of the offsite power source;"

PSC Reply 1b: Coincidence logic will be utilized in the design. (Refer to PSC response to NRC position 1c for complete details).

NRC Position 1c: "The time delay selected shall be based on the following conditions:"

(1) The allowable time delay, including margin, shall not exceed the maximum time delay that is assumed in the FSAR accident analysis;"

(2) "The time delay shall minimize the effect of short duration disturbances from reducing the availability of the offsite power source(s); and"

(3) "The allowable time duration of a degraded voltage condition at all distribution system levels shall not result in failure of safety systems or components;"

PSC Reply 1c:

(1) The Fort St. Vrain Station is not a Light Water Reactor and does not have the critical "timing" concerns of a Light Water Reactor. There is no need to immediately start reactor coolant or safety injection pumps. These types of cooling systems do not exist at Fort St. Vrain. Recognizing this, there was not and is not a need to analyze the aforementioned time delay in the FSAR.

(2) This feature is present in the existing Fort St. Vrain design and will be present in any redesign.

(3) The feature is present in the existing Fort St. Vrain design and will be present in any redesign.

NRC Position 1d: "The voltage monitors shall automatically initiate the disconnection of offsite power sources whenever the voltage setpoint and time delay limits have been exceeded;"

PSC Reply 1d:

This is currently a design feature of the Fort St. Vrain 4KV bus relays. After replacement of the essential 480 volt switchgear this will be a design feature of the 480 volt bus relays.

NRC Position 1e: "The voltage monitors shall be designed to satisfy the requirements of IEEE Std. 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations;"

PSC Reply 1e

Per discussions with the NRC's consultant on this effort, Allen Udy of EGG Idaho, the connection to offsite power is defined as the connection of the 480 volt safety related switchgear to the non-safety related 4160V switchgear.

Two level voltage relaying will be added to the safety related switchgear. These relays will be applied so that coincidence logic is utilized and so that the intent of IEEE 279 is met. See ATTACHMENT 4 for further details.

NRC Position 1f: "The Technical Specifications shall include limiting conditions for operation, surveillance requirements, trip setpoints with minimum and maximum limits, and allowable values for the second level voltage protection monitors."

PSC Reply 1f:

PSC will provide a draft of the necessary Technical Specification changes after acquiring the approval of the Fort St. Vrain NFSC.

NRC Position 2: "Interaction of Onsite Power Sources with Load Shed Feature"

"We require that the current system designs automatically prevent load shedding of the emergency buses once the onsite sources are supplying power to all sequenced loads on the emergency buses. The design shall also include the capability of the load shedding feature to be automatically reinstated if the onsite source supply breakers are tripped. The automatic bypass and reinstatement feature shall be verified during the periodic testing identified in Position 3."

PSC Reply Position 2a: These features are in the existing Fort St. Vrain Design and will be present in any redesign.

NRC Position 3: "Onsite Power Testing"

We require that the Technical Specifications include a test requirement to demonstrate the full functional operability and independence of the onsite power sources at least once per 18 months during shutdown. The Technical Specifications shall include a requirement for tests: (1) Simulating loss of offsite power in conjunction with a safety injection actuation signal; and (2) Simulating interruption and subsequent reconnection of onsite power sources to their respective buses. Proper operation shall be determined by:

a) Verifying that on loss of offsite power the emergency buses have been de-energized and that the loads have been shed from the emergency buses in accordance with design requirements.

b) Verifying that on loss of offsite power the diesel generators start from ambient condition on the auto start signal, the emergency buses are energized with permanently connected loads, the auto connected emergency loads are energized through the load sequencer, and the system operates for five minutes while the generators are loaded with emergency loads.

c) Verifying that an interruption of the onsite sources the loads are shed from the emergency buses in accordance with design requirements and that subsequent loading of the onsite sources is through the load sequencer.

PSC Reply 3:

Complete provision regarding onsite power testing will be part of the aforementioned Technical Specification revision.

ATTACHMENT 2

Response to G-80150 (Tedesco to Warembourg dated 8/25/80)

In the referenced correspondence, the NRC stated a need to confirm the acceptability of voltage conditions on the Fort St. Vrain Station Electric Distribution System. Specifically, this was to be in regard to;

(1) potential overloading due to transfers of either safety or nonsafety loads, and

(2) potential starting transient problems in addition to the concerns expressed in the NRC's June 2, 1977 correspondence with regard to degraded voltage conditions due to conditions originating on the grid.

The concerns and/or questions have been extracted from the Staff's letter, assigned a number and listed below to insure response to each point:

(1) Based on the experience at ANO, the NRC is requiring all licensees to review the electric power systems at each of their nuclear power plants to determine analytically if, assuming all onsite sources of AC power are not available, the offsite power system is of sufficient capacity and capability to automatically start, as well as operate, all required safety loads within their required voltage ratings in the event of (a) an anticipated transient (such as a unit trip) or (b) an accident (such as a LOCA) regardless of other actions the electric power system is designed to automatically initiate and without the need for manual load shedding of any electric loads.

PSC Response 1

Offsite Power System

Five 230Kv transmission lines from widely separated power system grid locations are connected to the Fort St. Vrain switchyard (See Figure 1 of ATTACHMENT 3 for further details). Any one of these lines alone can easily handle the safe shutdown cooling load (less than 1 megawatt) at Fort St. Vrain. These lines are individually protected through the application of modern protective relaying practices, thus the simultaneous loss of all offsite power is extremely unlikely.

Interface with Onsite Distribution System

Offsite power can be supplied to the Fort St. Vrain 4160 volt buses (Note-All 4160v buses are non-safety related) through either the

Reserve Auxiliary Transformers (RAT) or Unit Auxiliary Transformer (UAT) from any one of the five transmission lines.

Supply from RAT

If any of various electrical problems (including undervoltage) are encountered during normal operation (i.e. 4160v buses powered from the main turbine generator through the UAT), or a unit trip occurs, automatic transfer to offsite power via the RAT is initiated.

Supply from UAT

It is also possible to supply station auxiliaries from offsite power through the main power transformer and the UAT by disconnecting the isolated phase bus links in the main generator leads.

Unit Trips and/or LOFC (Loss of Forced Circulation Cooling)

The Fort St. Vrain Station does not employ a Light Water Reactor. Therefore, during a unit trip or LOFC situation, there is no requirement to immediately start large safety injection pumps or reactor coolant pumps. These equipment items are not utilized in the FSV High Temperature Gas-Cooled Reactor Design.

The Fort St. Vrain safe shutdown cooling systems utilize normally operating plant equipment. Thus, the equipment requirements for responding to a unit trip or to a LOFC situation are not significantly different. Likewise, the electrical requirements for responding to a unit trip or LOFC are not significantly different from normal plant operating load. The safe shutdown cooling load is less than plant operating load.

Protection from undervoltage conditions is provided on the non-safety related 4kv system and on the safety related 480 v system Analytical verification of the capabilities of the Fort St. Vrain distribution system when powered from offsite sources provided as ATTACHMENT 4

NRC Position 2

Protection of safety loads from undervoltage conditions must be designed to provide the required protection without causing voltages in excess of maximum voltage ratings of safety loads and without causing spurious separations of safety buses from offsite power.

PSC Response 2

During normal offsite power conditions no situations exist at Fort St. Vrain where high voltage conditions, in excess of equipment ratings, exist during light load conditions. This is verified by ATTACHMENT 4.

NRC Position 3

NRC should be informed of any required sequential loading of any portion of the offsite power system or the onsite distribution system which is needed to assure that power provided to all safety related loads is within the voltage limits for these safety loads. Guidance on evaluating the performance of electric power systems with regard to voltage drops is provided.

PSC Response 3

No sequential loading of the offsite power system or of the onsite distribution system (when powered from the offsite source) is required at Fort St. Vrain.

Automatic transfer to the offsite source (via the RAT), following a unit trip, takes place in less than two cycles. Ocsillographs have verified that Bus Voltage changes are hardly noticeable during this type of transfer.

The above transfer method is backed up by a second automatic transfer that occurs in 2-3 seconds following 4kv buses undervoltage or a unit trip. During this method, motor voltage is allowed to decay to a safe level before the transfer is made. Rotating equipment will still be rotating and current in rush and voltage conditions are within equipment ratings. If the offsite system (via the RAT), has low voltage, both of the above transfers are blocked. The 4kv buses are disconnected from the UAT and RAT and large motors are tripped. Safety related equipment is also load shed from the safety related 480v buses. Therefore, the worst case undervoltage situation in terms of motor starts is identical to that occurring during normal plant start-up and operation.

NRC Position 4

The adequacy of the onsite distribution of power from the offsite circuits shall be verified by test to assure that analysis results are valid. Please provide (a) a description of the method for performing this verification and (b) the test results. If previous tests, verify the results of the analysis, then test results should be submitted and additional tests need not be performed.

PSC Response 4

As previously stated, safe shutdown cooling equipment is normally operating prior to a unit trip or a LOFC situation. Therefore, the need to start and operate equipment is no different than during normal plant operation.

Capacity of the RAT and its capability to maintain adequate voltage at the terminals of equipment has been verified by operational experience on a regular basis. Each time the Fort St. Vrain station goes through start up or shutdown, the safety equipment is operated from the RAT. There have been no motors or other equipment that have failed to start because of undervoltage or that have been damaged because of undervoltage conditions.

The UAT is approximately 2 MVA (55°C rise FA rating) larger than the RAT. Therefore, it also has adequate capacity and capability.

Verification of the analytical studies was accomplished by test T-184 the results of which are included as ATTACHMENT 5.

NRC Position 5

In addition, you are requested to review the electric power systems of your nuclear station to determine if there are any events or conditions which could result in the simultaneous or consequential loss of both required circuits to the offsite network to determine if any potential exists for violation of GDC-17 in this regard.

PSC Response 5

No conditions were found that could result in the simultaneous loss of the required circuits to the offsite network. Therefore, no potential violations of GDC-17 were identified.

VOLTAGE DROP CALCULATION GUIDELINES

The following is PSC's discussion regarding the NRC guidelines for voltage drop calculations.

NRC Guideline 1

Separate analyses should be performed assuming the power source to safety buses is (a) the unit auxiliary transformer; (b) the startup transformer; and (c) other available connections to the offsite network one by one assuming the need for electric power is initiated by (1) an anticipated transient (e.g., unit trip) or (2) an accident, whichever presents the largest load demand situation.

PSC Discussion 1

Analyses were performed on both the unit auxiliary transformer and the reserve auxiliary (startup) transformer.

The largest load demand situation is the unit trip situation, details and assumptions regarding analyses maybe found in ATTACHMENT 4.

NRC Guideline 2

For multi-unit stations a separate analysis should be performed for each unit assuming (1) an accident in the unit being analyzed and simultaneous shutdown of all other units at that station; or (2) an anticipated transient in the unit being analyzed (e.g., unit trip) and simultaneous shutdown of all other units at that station, whichever presents the largest load demand situation.

PSC Discussion 2

Fort St. Vrain is a single unit station therefore guideline 2 does not apply.

NRC Guideline 3

All actions the electric power system are designed to automatically initiate should be assumed to occur as designed (e.g., automatic bulk or sequential loading or automatic transfers of bulk loads from one transformer to another). Included should be consideration of starting of large non-safety loads (e.g., condensate pumps).

PSC Discussion 3

No sequential loading is utilized when transferring the 4kv buses to the RAT from the UAT following a unit trip. Large pumps such as the boiler feed pump (4500hp) or the condensate pumps (1500hp), if they are not running, require manual starting.

NRC Guideline 4

Manual load shedding should not be assumed.

PSC Discussion 4

No manual load shedding was considered.

PSC Discussion 5

These topics are discussed in ATTACHMENT 4.

NRC Guideline 5

For each event analyzed, the maximum load necessitated by the event and the mode of operation of the plant at the time of the event should be assumed in addition to all loads caused by expected automatic actions and manual actions permitted by administrative procedures.

NRC Guideline 6

The voltage at the terminals of each safety load should be calculated based on the above listed considerations and assumptions and based on the assumption that the grid voltage is at the "minimum expected value". The "minimum expected value" should be selected based on the least of the following

a. The minimum steady-state voltage experienced at the connection to the offsite circuit.

b. The minimum voltage expected at the connection to the offsite circuit due to contingency plans which may result in reduced voltage from this grid

c. The minimum predicted grid voltage from grid stability analysis. (e.g., load flow studies).

In the report to NRC on this matter the licensee should state planned actions, including any proposed "Limiting Conditions for Operation" for Technical Specifications, in response to experiencing voltage at the connection to the offsite circuit which is less than the "minimum expected value " A copy of the plant procedure in this regard should be provided.

PSC Discussion 6

The minimum expected grid voltage was based on the minimum experienced value.

NOMINAL GRID VOLTAGE	MAXIMUM EXPERIENCED GRID VOLTAGE	MINIMUM EXPERIENCED GRID VOLTAGE
230KV	237KV	222KV

As indicated previously, a draft Technical Specification, including LCO's will be submitted after it has received approval of the Fort St Vrain NFSC.

NRC Guideline 7

The voltage analysis should include documentation for each condition analyzed, of the voltage at the input and output of each transformer and at each intermediate bus between the connection to the offsite circuit and the terminals of each safety load.

PSC Discussion 7

The analysis is provided by ATTACHMENT 4.

NRC Guideline 8

The analysis should document the voltage setpoint and any inherent or adjustable (with nominal setting) time delay for relays which (1) initiate or execute automatic transfer of loads from one source to another; (2) initiate or execute automatic load shedding; or (3) initiate or execute automatic load sequencing.

PSC Discussion 8

The analysis will document the above. Details will be provided after approval of the proposal Technical Specification Revision by the Fort St. Vrain NFSC.

NRC Guideline 9

The calculated voltages at the terminals of each safety load should be compared with the required voltage range for normal operation and starting of that load. Any identified inadequacies of calculated voltage require immediate remedial action and notification of NRC.

PSC Discussion 9

The voltage range for starting and/or normal operation of Class 1E equipment is as follows:

Equipment	Nominal Design Input Voltage	Maximum Continuous Voltage	Minimum Continuous Voltage	Notes
150 HP Class 1E Motors	3Ø - 460 VAC	+10% Nominal	-10% Nominal	1
Battery Chargers 1A & 1B	3Ø - 460 VAC	+10% Nominal	-10% Nominal	
Charger/ Inverter 1C	3Ø - 208 VAC	+10% Nominal	-10% Nominal	
Inverters 1A & 1B	120 VDC			2
MCC Motor Controllers	3Ø 440 - 550 VAC	N/A	N/A	3

NOTE 1: The largest Class 1E motors at FSV are rated 150 HP for 3Ø 460V operation with a 1.15 service factor at an altitude of 4790 feet above sea level.

Motor starting voltage calculations are included in ATTACHMENT 4.

NOTE 2: Inverters at FSV are supplied from DC buses, there are no AC supplies to inverters.

NOTE 3: FSV MCC's are rated at 600V. The nameplate rating of the starters is 440 V to 550 V. The control power transformers have a 4 to 1 turn ratio. Starter coils are rated at 120 VAC. Starter pickup values (contactor and auxiliary relay) are 85% rated voltage or 90% rated voltage when fed via a control power transformer. Dropout values are lower than pickup, experience at FSV and other PSC facilities through the years has shown the dropout value to be in the range of 60 to 80%.

Additionally, Allen Udy requested the following information in regards to NRC Guideline 9:

120 VAC buses 1A & 1B are supplied by 120V/208V bus 3 only when the inverters are out for maintenance. This action is controlled by Technical Specification LCO4.6.1 (quoted below):

"4.6.1 f) The PPS battery charger/inverter and both the instrument inverters are operable. One inverter may be inoperable for 24 hours provided the following conditions are satisfied.

1. 480V essential buses 1A and 1C are operable.

2. Both diesel-generator sets are operable.

3. The PPS or instrument bus associated with the out-of-service inverter is energized from its backup source."

NRC Guideline 10

For each case evaluated the calculated voltages on each safety bus should be compared with the voltage-time settings for the undervoltage relays on these safety buses. Any identified inadequacies in undervoltage relay settings require immediate remedial action and notification of NRC.

PSC Discussion 10

The existing relaying has been reviewed and no inadequacies were found.

NRC Guideline 11

To provide assurance that actions taken to assure adequate voltage levels for safety loads do not result in excessive voltage, assuming the maximum expected value of voltage at the connection to the offsite circuit, a determination should be made of the maximum voltage expected at the terminals of each safety load and its starting circuit. If this voltage exceeds the maximum voltage rating of any item of safety equipment immediate remedial action is required and NRC shall be notified

PSC Discussion 11

As indicated in the discussion for NRC Guideline 7, several cases were run with the grid at the maximum expected value.

NRC Guideline 12

Voltage-time settings for undervoltage relays shall be selected so as to avoid spurious separation of safety buses from offsite power during plant startup, normal operation and shutdown due to startup and/or operation of electric loads.

PSC Discussion 12

Voltage and time setpoints are being selected based on the analysis discussed under Guideline 7. The above will be considered in the setpoint selections.

NRC Guideline 13

Analysis documentation should include a statement of the assumptions for each case analyzed.

PSC Discussion 13

A statement of assumptions has been provided for each case.

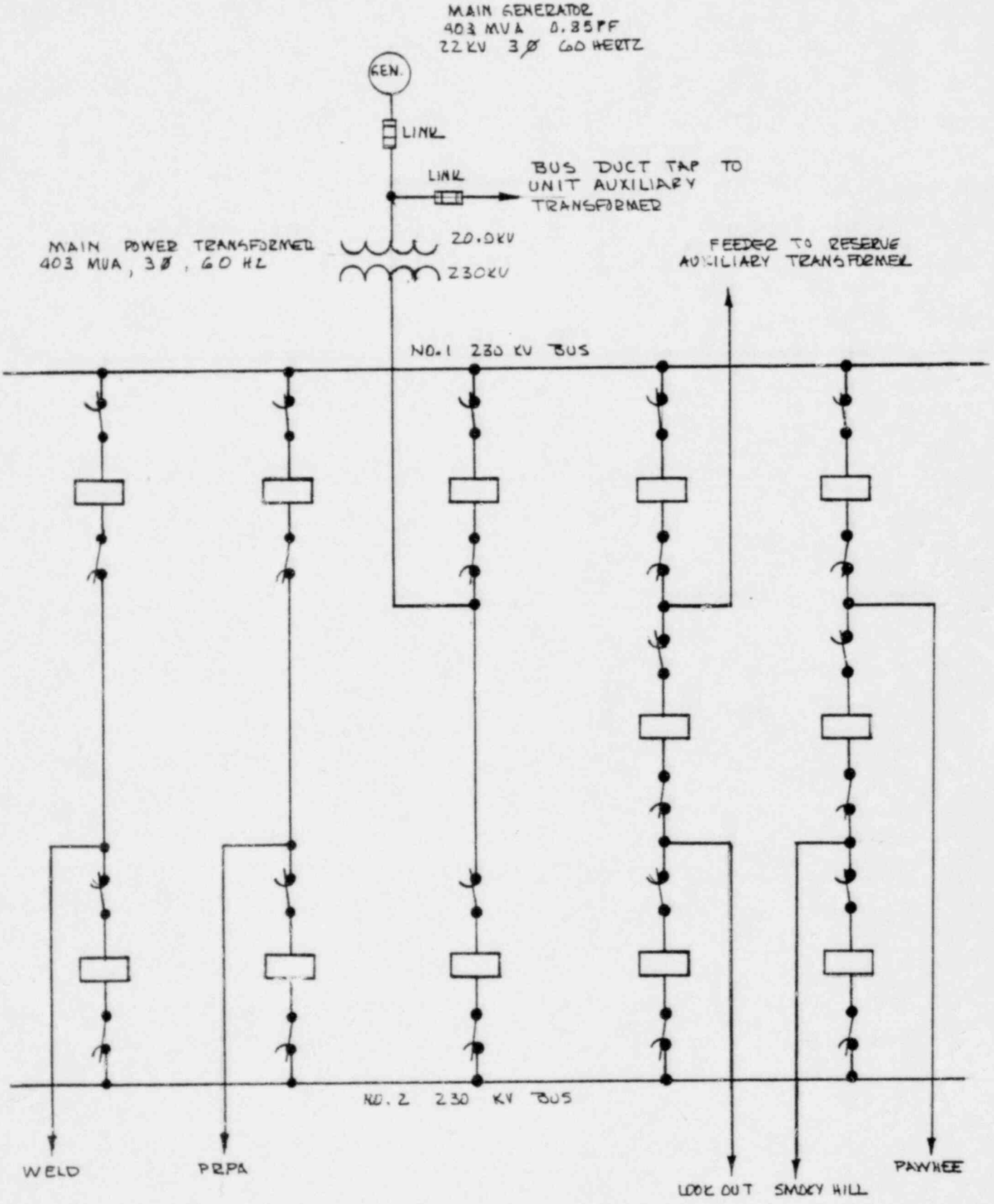
ATTACHMENT 3 consists of the following figures:

Figure 1 Electrical Single Line Diagram, Fort St. Vrain Interconnection to Primary Power System

Figure 2 Electrical Single Line Diagram, Fort St. Vrain Onsite Distribution system

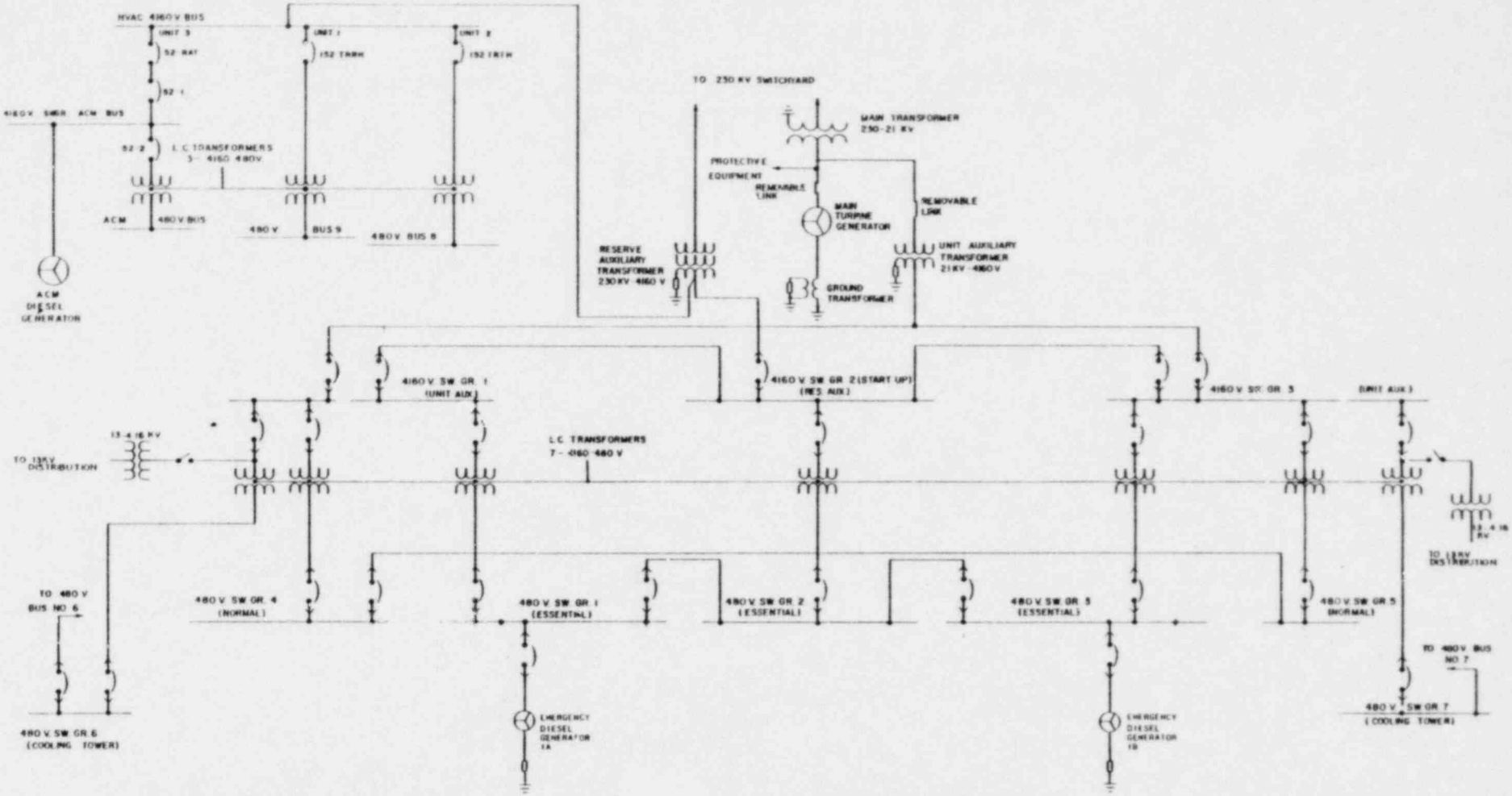
Figure 3 Existing Undervoltage Relaying Functions and Setpoints

Figure 4 Undervoltage Relaying Functions Following Changeout of the 3 Essential 480V Buses

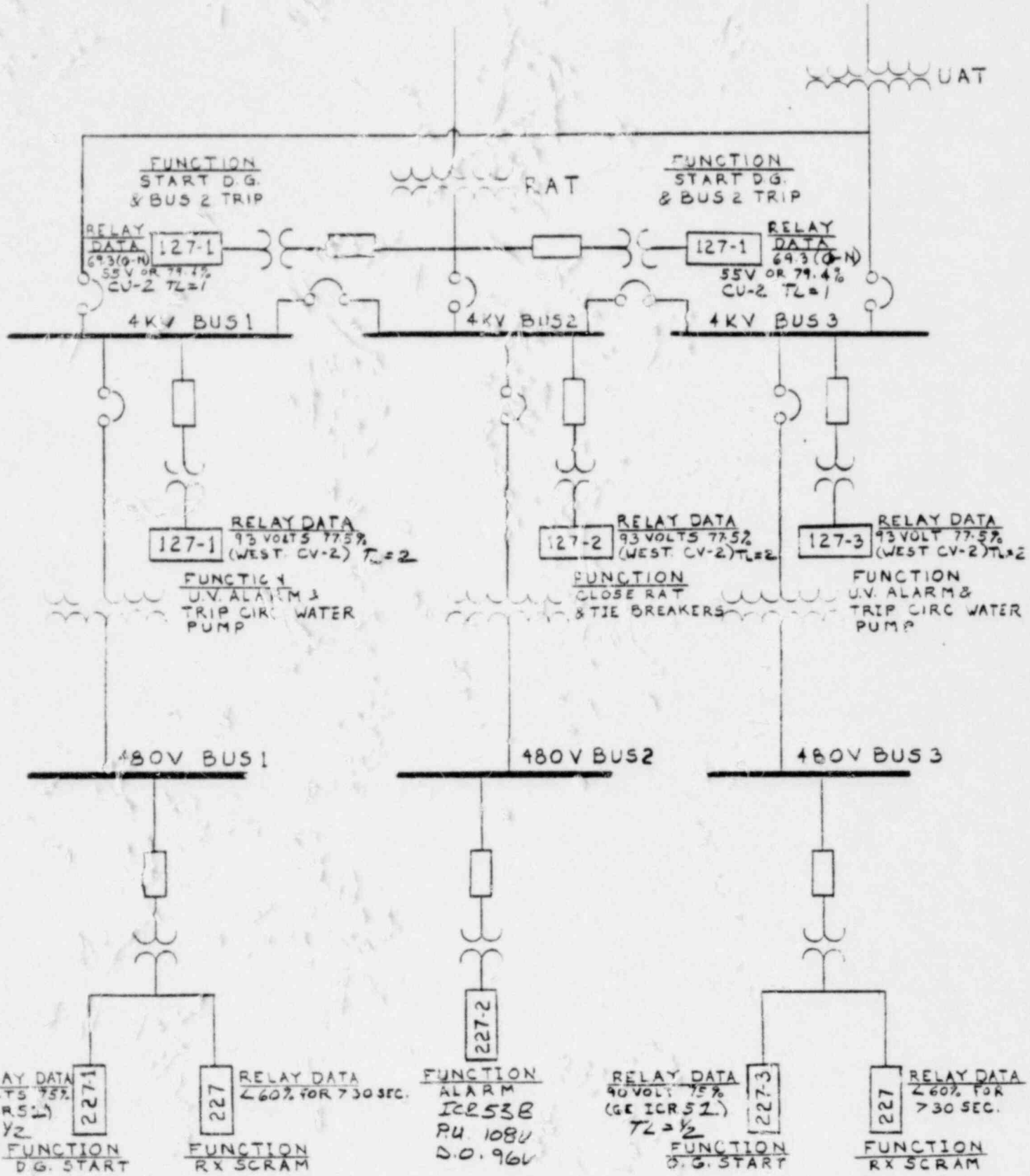


ATTACHMENT 3

FIGURE 1 - ELECTRICAL SINGLE LINE DIAGRAM P.T. S.T. VRAIN INTERCONNECTION TO PRIMARY POWER SYSTEM.

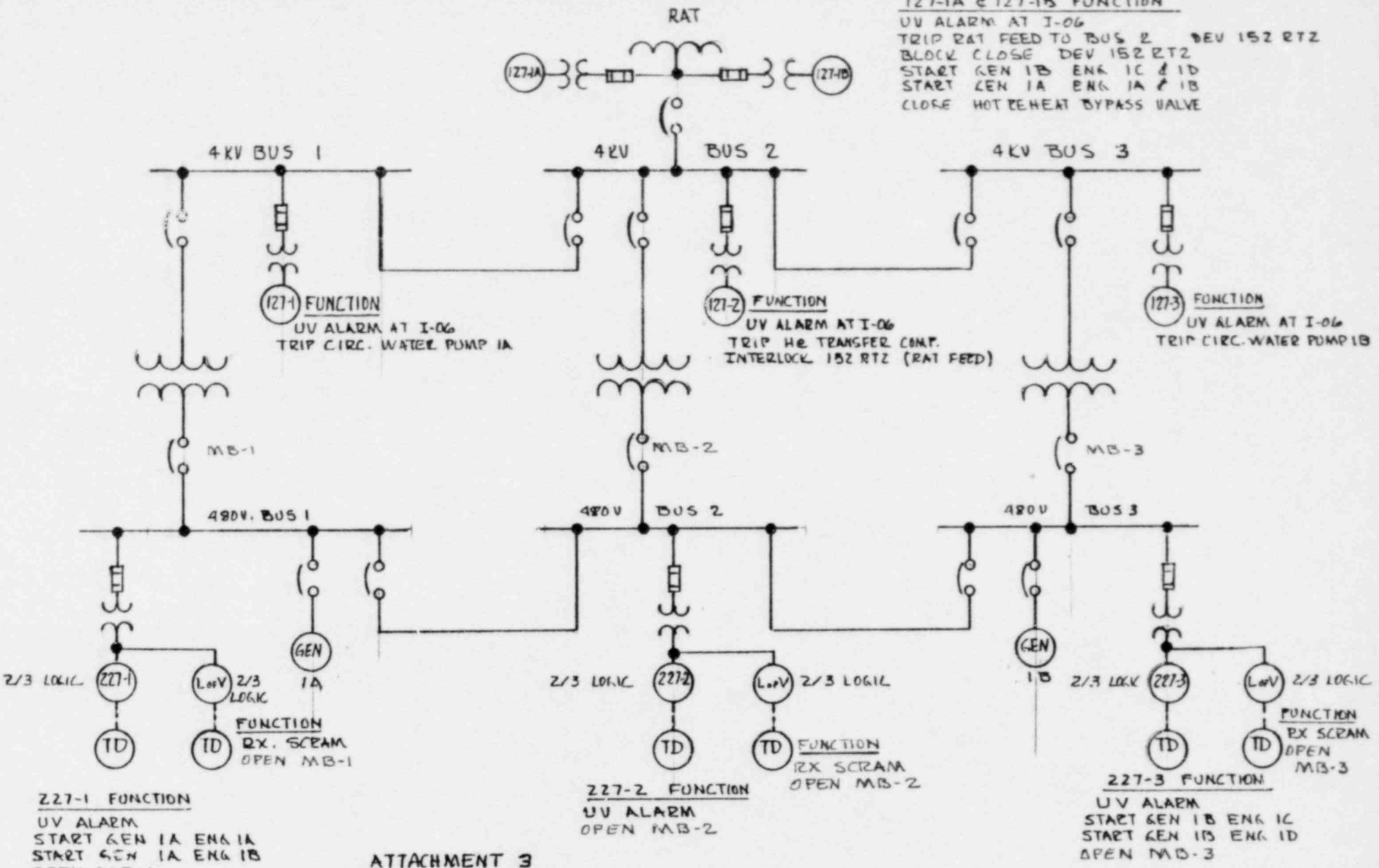


ATTACHMENT 3
FIGURE 2 - ELECTRICAL SINGLE LINE DIAGRAM
FT. ST. VRAIN ONSITE DISTRIBUTION
SYSTEM.



ATTACHMENT 3
FIG 3

EXISTING UNDERVOLTAGE RELAYING
FUNCTIONS AND SETPOINTS



ATTACHMENT 3
FIG. 4

UNDERVOLTAGE RELAY FUNCTIONS FOLLOWING CHANGE OUT OF THE 3 ESSENTIAL BUSES.

COMPARISON OF TEST RESULT AND ANALYTICAL RESULTS - FSV VOLTAGE STUDIES

T-184 consisted of identifying the equipment running at the time of the test and placing this information in the Voltage Study Program. Two pumps were then started.

1) The safety-related 150hp fire water pump

2) The non-safety related 4500hp boiler feed pump.

Voltage condition prior to START, during START and following START were then recorded

The following is a comparison of the test results and analytical results:

P-3102 START (BFP)

TIME DATA	DATA SOURCE	BUS DATA		
		4KV Bus 2	480 Bus 1	P4501 MOTOR TERMINALS
A) Before START:	TEST	4073V	470	456
	Analysis	4096V	466	455
B) During START:	TEST	3380	382	372
	Analysis	3417	382	368
C) After START:	TEST	3987	456	442
	Analysis	3985	453	441

P-4501 START (FWP)

A) Before START	TEST	4030	461	0
	Analysis	3990	456	0
B) During START	TEST	3986	441	412
	Analysis	3961	437	406
C) After START:	TEST	3987	456	442
	Analysis	3985	453	441

DESCRIPTION OF COMPUTER PROGRAM

The entered data is the first part of the printout. Bus data (loads) is denoted by a "B" in the first column. KW and KVAR's are indicated for running loads. Line data is denoted by a "L" in the first column. Line impedance is indicated for appropriate lines. Transformer data is denoted by a "T" in the first column. Transformer impedance and ratings are shown.

The second part of the program has various pieces of information in it, such as: System data (total load and losses). Summary of buses with voltage greater than 1.05 per unit. Summary of buses with voltage less than .95 per unit. summary of overloaded transformers.

NOTE In order to obtain correct values from this program you must take the Mega (value) and muntiply by ten. This will give you the actual kilo (value). ie=computer printout says 10 MVAR. Actual value would be 10 x 10 = 100 KVAR. Also the per unit voltage value at the motor terminals is based on 480V. FSV motors are rated at 460V, therefore, in order to obtain the per unit voltage at the correct motor rating muntiply the programs per unit value by (480/460).

Attachment 5
P-82169

PUBLIC SERVICE COMPANY OF COLORADO
FORT ST. VRAIN NUCLEAR GENERATING STATION

TEST REF. NO. T-184
SYST. REF. NO. 92
PAGE 1 OF 16

REQUEST FOR TEST

WORKING COPY

PREPARED BY: James Henderson — 11/2/81 (DATE)

REVIEWED BY: M E Nichoff — 11-10-81 (DATE)

CONCUR WITH SAR: ☑ YES ☐ NO Roger Heller (TECHNICAL SERVICES) — 11-23-81 (DATE)

ISSUE 1 REVIEWED, PORC # PORC 440 NOV 24 1981 — (DATE)

APPROVED & ISSUED: Edited by Martin Block (SIGNATURE) — 11/25/81 (DATE)

SAFETY SIGNIFICANT: ☐ YES ☒ NO

NFSC REVIEW:

RECORD AND CONTROL OF ISSUE

ISSUE NO.	PREPARED BY	PORC APPROVAL	APPROVED AND ISSUED EFFECTIVE DATE OF REVISION
2			
3			
4			
5			
6			
7			
8			

COMPLETED TEST REVIEWED: _____ (OPERATIONS MANAGER (OR DESIGNEE) SIGNATURE) _____ (DATE)

FORM 372 - 22 - 3396

REQUEST FOR TEST

1 PURPOSE OF TEST To obtain data for voltage drop study being performed by the Nuclear Engineering Department per NRC request.

2 TEST OBJECTIVES Determine the effects on various buses and loads when starting the Boiler Feed Pump and to verify analytical studies on plant buses.

3 DESCRIPTION OF TEST (Use attached sheets if necessary) Record voltage from 4160V Bus 2, 480V Bus 1, P4501 Motor terminal and the starter contacts on the Boiler Feed and Fire Water Pumps. Start the Fire Water Pump. Start the Boiler Feed Pump. Record Voltages. See attached Instructions.

4 DATA REQUIRED (Include applicable data sheets and integrate with procedure if possible) - Include room for "Remarks": Plant Bus configuration and 4KV and 480V equipment running during test. List attached. Voltage readings on 4160V Bus 2, 480V Bus 1, P4501 motor terminal, when P4501 and P3102 are started. This will be recorded on film in visacorder.

5 ANTICIPATED RESULTS: Expect to be able to determine voltage at 4160V Bus, 480V Bus and P4501 motor terminal when Boiler Feed Pump is started, and to verify analytical work already done.

6 ACCEPTANCE CRITERIA: Fire Water Pump, P4501, should be running when P3102 is started to determine if voltage drops below the minimum running voltage. P3102 should be running when P4501 is started. Voltages from test points should be from the same phases, Phase A and Phase C, with the exception of the 4160V Bus. It's voltage is taken across Phase A and B. Visacorder must be calibrated on each channel used since voltage magnitude is of concern.

NOTE: UPON COMPLETION OF THE TEST, DATA SHALL BE APPROPRIATELY ANALYZED AND TEST RESULTS AND RECOMMENDATION AND/OR EVALUATION SHALL BE SUMMARIZED AND PRESENTED TO THE SUPERINTENDENT OF OPERATIONS FOR FINAL APPROVAL AND FURTHER REVIEW BY PORC AND THE NFSC AND/OR FURTHER REPORT AND DOCUMENTATION REQUIREMENTS.

7 PRECAUTIONS, LIMITATIONS, AND SPECIAL ASSISTANCE (INCLUDE PROVISIONS TO VERIFY THAT LIMITATIONS ARE NOT EXCEEDED):

When connecting and disconnecting voltage from 4160V Bus 2 undervoltage relay, all relays in the associated circuit will have their trip function blocked. Line from 4160V Bus 2 undervoltage relay to test meter should be fused to prevent fault in meter from tripping relay.

8 STANDARD OPERATING PROCEDURES

9 SAFETY EVALUATION See attached.

PUBLIC SERVICE COMPANY OF COLORADO

FORT ST. VRAIN NUCLEAR GENERATING STATION

REQUEST FOR TEST

TEST REF. NO. T-184
SYST. REF. NO. 92
PAGE 5 OF 16

10 TEST EQUIPMENT (IF REQUIRED)

NAME	IDENTIFICATION NUMBER	LAST CALIBRATION DATE

11 TEST CONDUCTOR (INCLUDE ALL ASSISTANTS)

LAMB, R.
FLORES F.
BRAXCORT, M.
ALLOMOBE, C.

PERMISSION TO INITIATE TEST _____ 5-5-82
(SHIFT SUPERVISOR - SIGNATURE) (DATE)

12 PROCEDURE (SEE ATTACHED PAGES 5a, 5b, etc.)

FORM 372-22-3402

13 VERIFY THAT THE SYSTEM HAS BEEN RETURNED TO NORMAL:

[signature] 5/5/82
(SHIFT SUPERVISOR - SIGNATURE) (DATE)

14 TECHNICAL SERVICES ACTION:

10 CFR 50.59 REPORT REQUIRED ☐ YES ☐ NO

TECH SPEC REPORT REQUIRED ☐ YES ☐ NO

REVIEWED BY _____ _____
(SIGNATURE) (DATE)

PUBLIC SERVICE COMPANY OF COLORADO
FORT ST. VRAIN NUCLEAR GENERATING STATION

CN / TCR / SCR / PC NO. T-184
PAGE 7 of 16

SAFETY EVALUATION

TYPE:

☐ CHANGE NOTICE (CN) OVERALL ☐ CHANGE NOTICE (CN) SUBMITTAL ☐ PROCEDURE CHANGE (FSAR)
☐ TEMPORARY CONFIGURATION ☐ SETPOINT CHANGE ☒ TEST REQUEST

CLASSIFICATION: ARE THE SYSTEM(S) EQUIPMENT OR STRUCTURES INVOLVED, OR DOES THE ACTIVITY AFFECT:

CLASS 1	☒ YES	☐ NO	ENGINEERED SAFEGUARD	☐ YES	☒ NO
SAFE SHUTDOWN	☒ YES	☐ NO	PLANT PROTECTIVE SYSTEM	☐ YES	☒ NO
SAFETY RELATED	☒ YES	☐ NO	SECURITY SYSTEM	☐ YES	☒ NO

REMARKS

EVALUATION: USE ADDITIONAL SHEETS IF REQUIRED

1. DETERMINE WHETHER OR NOT THE ACTIVITY INVOLVED IS IDENTIFIED IN THE FSAR OR TECH SPEC.
LIST THE APPLICABLE SECTIONS REVIEWED: The Electric Fire Water Pump and Electric Boiler Feed Pump are identified. Reviewed FSAR sections 9.8.3, 10.3.9, 10.3.10, 12.4, 10.2, 10.2.3.1, 10.3.1, 10.3.2. Tech Spec. sections LC04.2, SR5.2.10, SR5.2.24.

2. DOES THE ACTIVITY REQUIRE THAT CHANGE(S) BE MADE TO THE FSAR OR TECH SPEC? ☐ YES ☒ NO
LIST SECTIONS TO BE CHANGED AND THE CHANGES TO BE MADE: No changes needed.

3. DETERMINE WHETHER OR NOT THE ACTIVITY INVOLVED IS AN UNREVIEWED SAFETY QUESTION UTILIZING THE FOLLOWING GUIDELINES.

(A) HAS THE PROBABILITY OF OCCURRENCE OR THE CONSEQUENCES OF AN ACCIDENT OR MALFUNCTION OF EQUIPMENT IMPORTANT TO SAFETY PREVIOUSLY EVALUATED IN THE FSAR BEEN INCREASED?
☐ YES ☒ NO STATE BASIS: This test connects to 4160V Bus undervoltage relay. Test meter will be fused to protect relay; therefore, the probability of accident or malfunction has not been increased.

(B) HAS THE POSSIBILITY OF AN ACCIDENT OR MALFUNCTION OF A DIFFERENT TYPE THAN ANY EVALUATION PREVIOUSLY IN THE FSAR BEEN CREATED? ☐ YES ☒ NO STATE BASIS: No change is made to existing equipment.

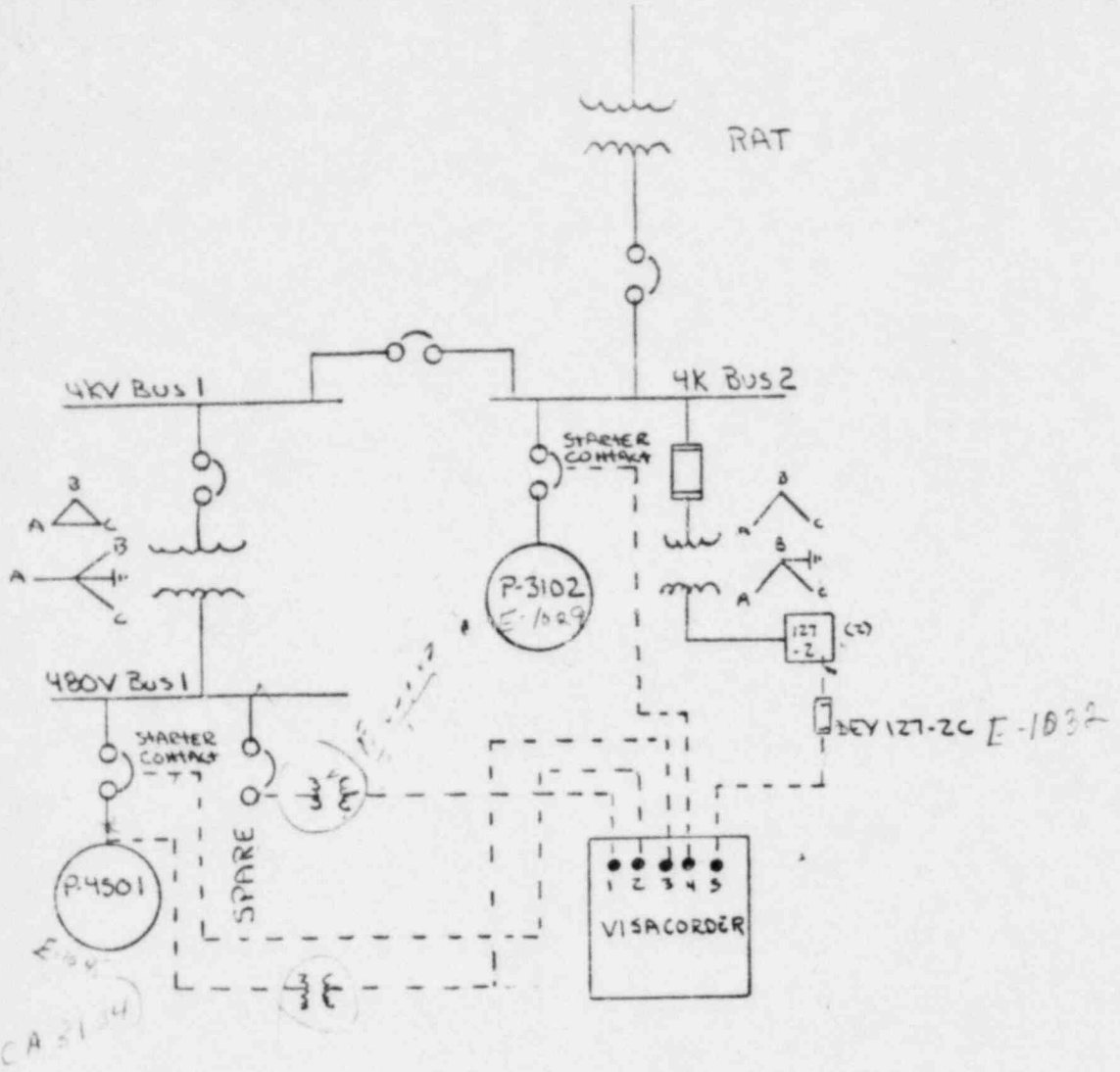
(C) HAS THE MARGIN OF SAFETY, AS DEFINED IN THE BASIS FOR ANY TECHNICAL SPECIFICATION OR IN THE FSAR BEEN REDUCED? ☐ YES ☒ NO STATE BASIS: No changes made to design.

DOES THE ACTIVITY APPEAR TO: INVOLVE AN UNREVIEWED SAFETY QUESTION ☐ YES ☒ NO
BE SAFETY SIGNIFICANT ☐ YES ☒ NO

BY [signature] (SIGNATURE) 11/2/81 (DATE) *APPROVED (SIGNATURE) (DATE)

*REQUIRED ONLY FOR CHANGE NOTICE

FORM 370.02-3382



SINGLE LINE DIAGRAM

OF TEST Hookup

INFORMATION ONLY

GENERAL

Visacorder will be located in 4KV Switchgear cubicle.

2/C #12 cable to be used from voltage points to Visacorder. (Code #3387420)

Test personnel to determine routing of cables from test points to test instrument.

Visacorder must be calibrated on each channel used.

Indicate running loads and amp reading as indicated on attached sheets (3).

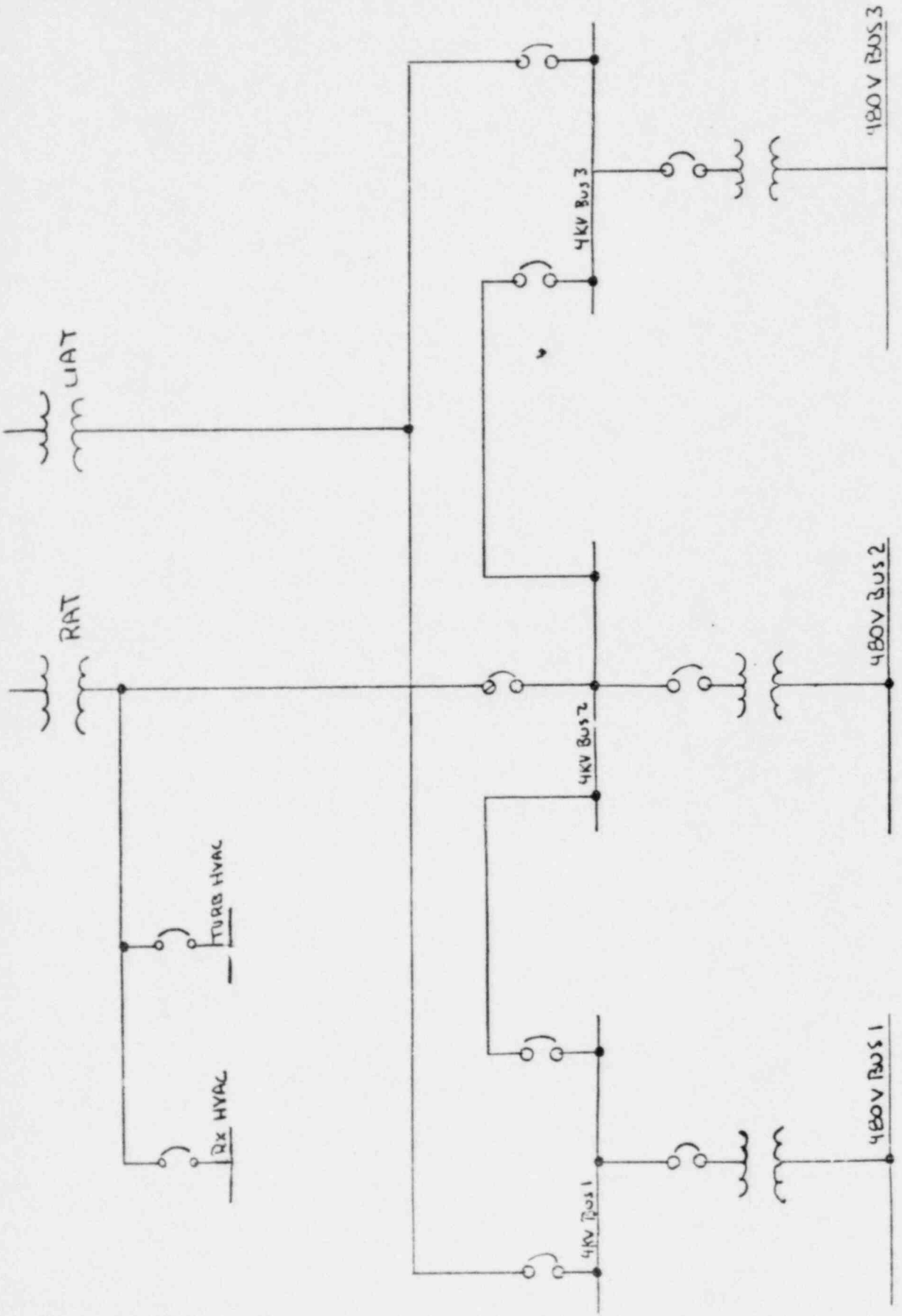
Indicate plant Bus configuration on attached sheet. Place an "X" on Breakers that are closed.

	ON	OFF
4KV SWGR 1		
MC XFMR 6	✓	
P-4101 Circ. Water Pump 1A	✓	
P-3104 Condensate Pump 1A	✓	
LC SWGR 4		
4KV SWGR 2		
P-3102 Boiler Feed Pump 1B		✓
C-2401 Helium Transfer Compressor		✓
4KV SWGR 3		
MC XFMR 7	✓	
P-4102 Circ. Water Pump 1B		✓
LC SWGR 5	✓	
P-3105 Condensate Pump 1B		✓
480V Bus 1		
N-9229 Rx Pl. MCC 1C	✓	
P-4118S Circ. Water Make-up Pump 1B		✓
P-4501 Fire Water Pump	✓	
P-4103 Circ. Water Pump 1C	✗	✓
N-9236 Inst. Power Transformer 1A	✓	
P-2106 Bearing Water Pump 1E	✓	
N-9240 Battery Charger 1A	✓	
P-4601 Cooling Water Pump 1A	✓	
P-3106 Condensate Pump 1C	✓	
P-2101 Bearing Water Pump 1A	✓	
C-8201 Instrument Air Comp. 1A	✓	
N-9229 Rx Pl MCC 1A	✓	
N-9219 Turb. Pl MCC 1	✓	
P-4201 Service Water Pump 1A	✓	

		ON	OFF	
480V Bus 2				
		✓	✓	AUTO
S-7537	Control Room Wtr. Chiller		✓	
P-5107X	EHC Fluid Pump 1A	✓		
C-8201S	Instrument Air Compressor 1B		✓	
S-7538	Service Bldg. Water Chiller		✓	
P-4602S	Cooling Water Pump 1D	✓		
P-2102S	Bearing Water Pump 1D	✓		
N-9218	Water Treatment MCC		✓	
P-4601S	Cooling Water Pump 1B		✓	
C-7307	PCRV Piping Cavity Recirc. Fan 1A		✓	
P-2101S	Bearing Water Pump 1B	✓		
N-9230	Rx Pl MCC #2	✓		
N-9220	Turb. Pl. MCC 2	✓		
P-4202	Service Water Pump 1B	✓		
P-8401S	Aux. Blr. Fd. Wtr. Pump 1B		✓	
C-2109	N_2 Recycle Compressor 1A	✓	✗	
N-9246	Helium Purification Comp. 1A M-G Set		✓	AUTO
P-2103	Turbine Water Removal Pump 1A	✓		
S-7307S	Rx Pl Water Chiller 1C			
480V Bus 3				
P-8401	Aux. Boiler Feed Water Pump 1A		✓	
P-2105	Bearing Water Make-up Pump	✓		
C-2109S	N_2 Recycle Compressor 1B		✓	
N-9236S	Inst. Power Transformer 1B	✓		
C-8203	Inst. Air Compressor 1C		✓	
N-9247	Helium Purification Comp. 1B M-G Set		✓	
P-2103S	Turb. Water Removal Pump 1B		✓	
P-3106S	Condensate Pump 1D	✓		
N-9241	Battery Charger 1B	✓		
P-5107SX	EHC Fluid Pump 1B	✓		
P-2107	Bearing Water Pump 1F		✓	
P-2102	Bearing Water Pump 1C	✓		
C-7307S	PCRV Piping Cavity Recirc. Fan 1B	✓		
P-4602	Cooling Water Pump 1C		✓	
P-4202S	Service Water Pump 1C		✓	
P-4104	Circulating Water Pump 1D	✓		
N-9218	Turb. Pl. MCC3	✓		
N-923	Rx Pl MCC 5		✓	
P-4118	Circ. Water Make Up Pump 1A			

Load	Amp Reading
480 V Load Center 1	160 Amp
480 V Load Center 2	107
480 V Load Center 3	118
480 V Load Center 4	62
480 V Load Center 5	63
480 V MC XFMR 6	85
480 V MC XFMR 7	90

INDICATE PLANT BUS CONFIGURATION ON THIS SHEET



Connect Voltages to Visacorder as follows:

Channel 1 - From 480V Bus 1

Take voltage from spare breaker located in 480V Bus 1 compartment N11. Connect 480/120V potential transformer (supplied by test personnel) to output of breaker. Phase A and Phase C should be used. Connect 120V side of transformer to test instrument.

Channel 2 - From P4501 (Electric Fire Water Pump) Starter Contact

Connect voltage to test meter through starter contact per attached sketch.

Channel 3 - From P4501 Motor Terminals.

Take voltage from the motor terminals. Connect 480/120V potential transformer (supplied by test personnel) to motor terminals. Phases A and C should be used. Connect 120V side of transformer to test instrument.

Channel 4 - From P3102 (Boiler Feed Pump 1B) Starter Contact

Connect voltage to test meter through starter contact per attached sketch.

Channel 5 - From 4160V Bus 2

Take voltage from DEV 127-2C located in 4160V Bus 2, Unit 12. Connection to be made across terminals 8 and 9. Prior to connection DEV 127-2A and DEV 127-2C in 4160V Bus 2, Unit 12 will have to have their trip function blocked. Place a 1 amp inline fuse in meter circuit. Hot side comes into terminal 8 on relay.

Test

Make Visacorder Operable

Part 1: Ensure P3102 is running.

Start P4501 (Electric Fire Water Pump)

Record all channels.

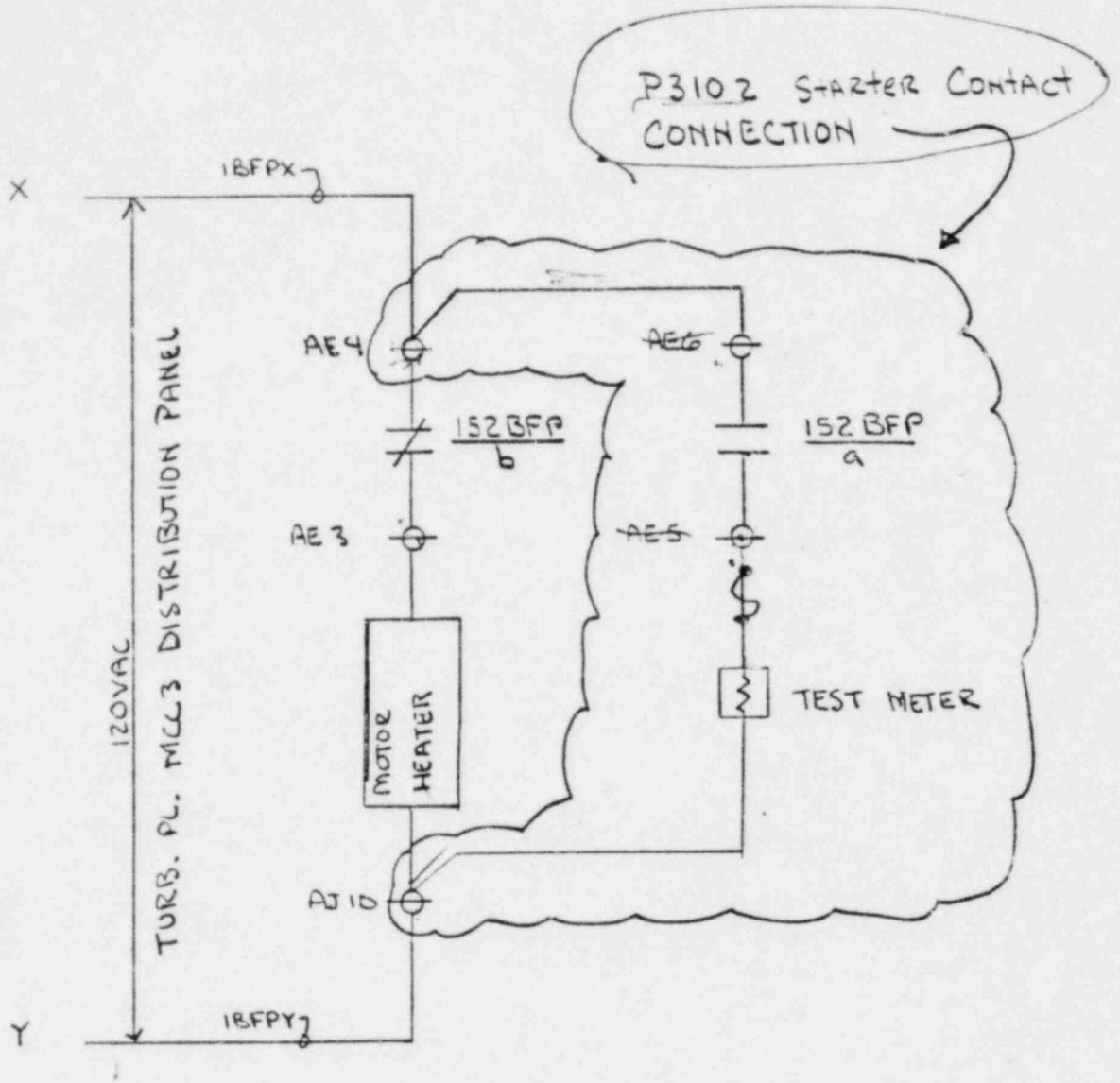
Part 2: With P4501 Running

Start P-3102 (Boiler Feed Pump)

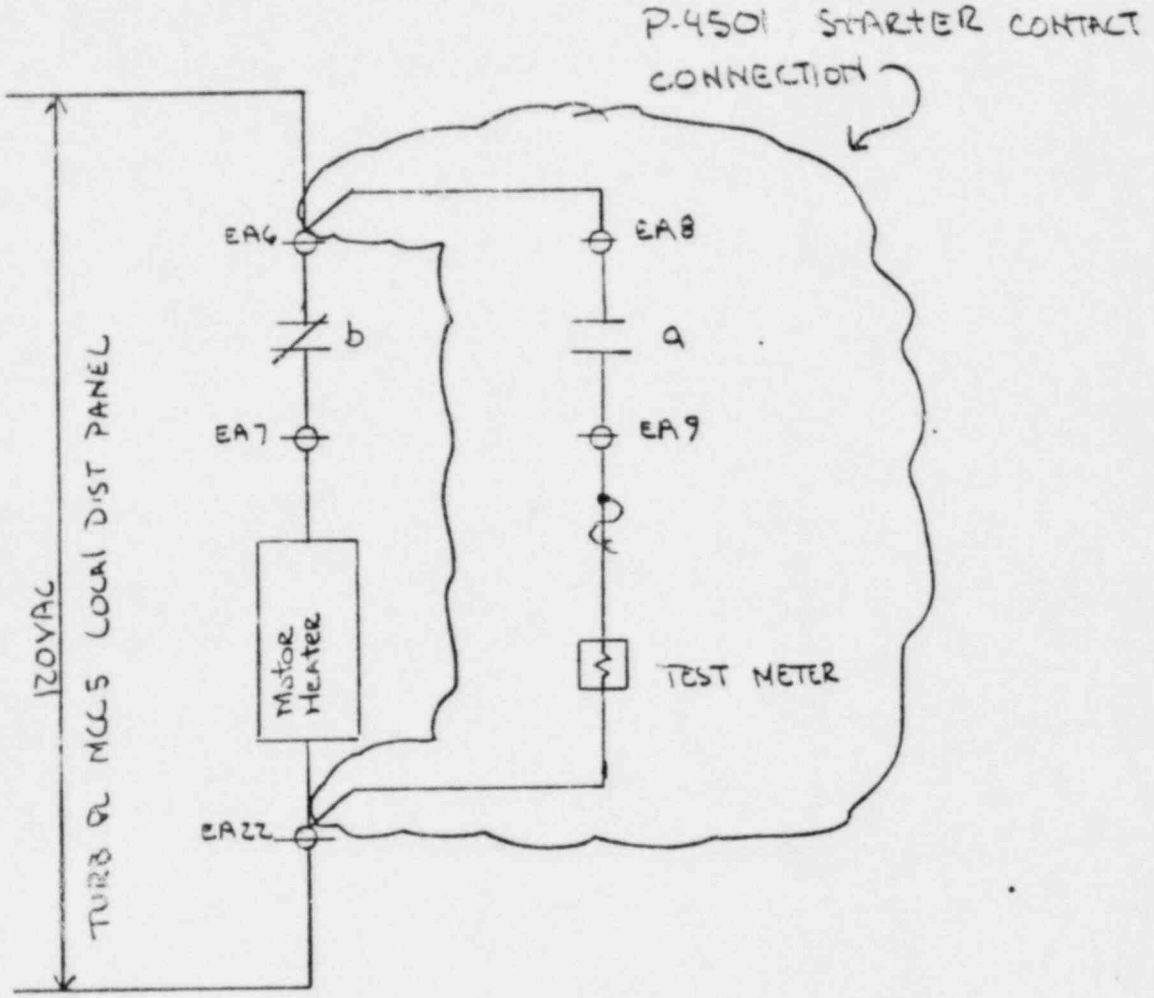
Record all channels.

End of Test

Place P3102 and P4501 in their original configuration
Remove test leads from test point and visacorder.



REFERANCE DWG E-1014



REFERANCE DWG E1203 p.78

FORM 159-22-0058 INTER-DEPARTMENT MEMO – PUBLIC SERVICE COMPANY OF COLORADO

DATE May 25, 1982 NDG-82-0492

TO Test File T-184
DEPARTMENT OR DIVISION

FROM Mike Henderson Nuclear Engineering Division
DEPARTMENT OR DIVISION

ATTN. Jim Liebelt

SUBJ. T-184

My review of the oscillagraph produced the following results:

1. Boiler Water Feed Pump Start

	4KV Bus 2	480V Bus 1	P4501 Term
Voltage Before Pump Start	4073	470	456
Voltage At Pump Start	3380	382	372
Voltage After Pump Start	3987	456	442

2. Fire Water Pump Start

	4KV Bus 2	480V Bus 1	P4501 Term
Voltage Before Pump Start	4030	461	0
Voltage At Pump Start	3986	441	412
Voltage After	3987	456	442

This data is within 0% to 1.5% of data obtained analytically.

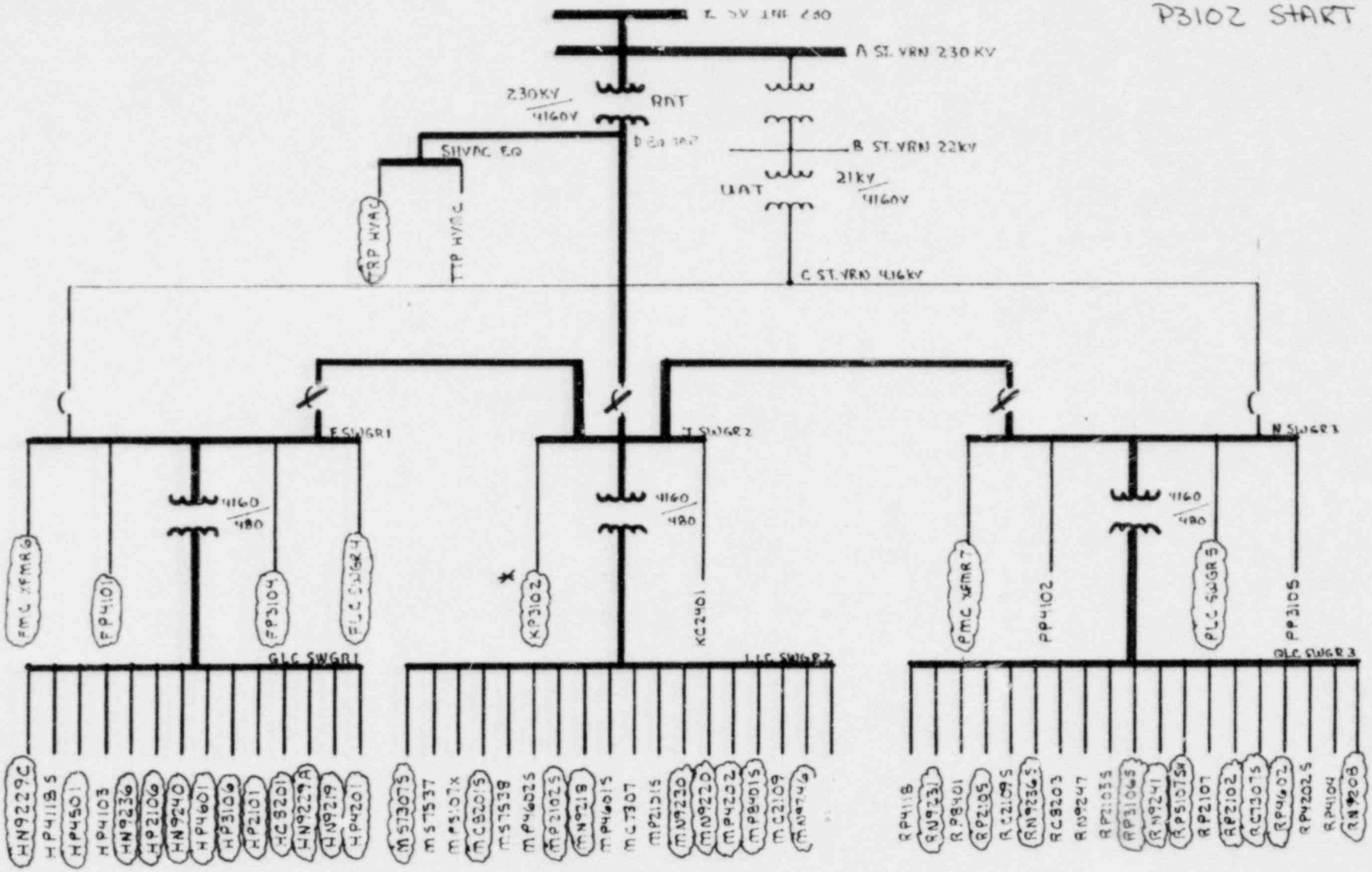
Mike Henderson

Mike Henderson

MH/mh 5/27/82

ATTACHMENT 5
P-82169

RAT IN SERVICE
P3102 START



* THIS LOAD VARIES IN THE THREE COMPUTER RUNS. IT IS OFF IN THE FIRST RUN, STARTED ON THE SECOND RUN AND RUNNING ON THE THIRD RUN.

Attachment 5
P-82169

FSVRAT 26
P4501 RUNNING
P3102 OFF
231.6KV

WSCC POWER FLOW PROGRAM REVISION 55
POWER FLOW HISTORY TAPE - - - FORMAT B

UNLESS NOTED OTHERWISE DIAGNOSTICS WILL APPEAR ABOVE THE
DATA WHICH HAS THE ERROR.

#3 BLUE
#4 RED

CONTROL CARD 17 6 0 0 0 0 0 0.0 0.0 00 0

CONTROL CARD HDG 0 0 0 0 0 0 0.0 0.0 00 0

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-17-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT26

CONTROL CARD DAS 0 0 0 0 0 0 0.0 0.0 00 0

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRD150 05-17-82 INPUT DATA LISTING
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
#SV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVPAT26

#3 BLUE
#4 RED
#1 TAN
#2 GREEN

```
ENTERING DATA INPUT ROUTINE-ALL BUS CARDS WILL BE PROCESSED FIRST
          FE    ZS.V.INF230.PS                                        1007
          B     AST.VRN.230.PS
          B     B EQ TAP4.16PS
          B     SHVAC E04.16PS
          B     E SWGR 14.16PS
          B     FLCSWGR44.16PS 37.6 24.0
          B     FMCXFMR64.16PS 51.9 32.4
          B     F P3104 4.16PS 37.6 24.0
          B     F P4101 4.16PS131.286.46
          B     GECSWGR1.480PS
          B     H C2201 .480PS 6.36 4.25
          B     H N9219 .480PS 3.73 2.50
          B     H N9229A.480PS 3.73 2.50
          B     H N9229C.480PS 3.73 2.50
          B     H N9236 .480PS 6.49 4.35
          B     H N9240 .480PS 3.04 2.03
          B     H P2101 .480PS11.61 7.77
          B     H P2106 .480PS11.61 7.77
          B     H P3106 .480PS11.95 8.00
          B     H P4103 .480PS
          B     H P4116S.480PS
          B     H P4201 .480PS12.09 8.09
          B     H P4501 .480PS12.09 8.09
          B     H P4601 .480PS 7.88 5.27
          B     J SWGR 24.16PS
          B     K C2401 4.16PS
          B     K P3102 4.16PS
          B     LECSWGR2.480PS
          B     M C2109 .480PS
          B     M C7307 .480PS
          B     M C8201S.480PS 6.47 4.08
          B     M N9218 .480PS 3.17 1.99
          B     M N9220 .480PS 3.17 1.99
          B     M N9230 .480PS 3.17 1.99
          B     M N9246 .480PS 4.99 3.15
          B     M P2101S.480PS
          B     M P2102S.480PS11.82 7.45
          B     M P2103 .480PS
          B     M P4202 .480PS12.19 7.62
          B     M P4601S.480PS
          B     M P4602S.480PS
          B     M P5107X.480PS
          B     M P8401S.480PS 8.16 5.14
          B     M S7307S.480PS14.91 9.40
          B     M S7537 .480PS
          B     M S7538 .480PS
          B     N SWGR 34.16PS
          B     PLCSWGR54.16PS 37.2 24.0
          B     PMCXFMR74.16PS 56.8 32.6
```

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
B     P P3105 4.16PS
E     P P4102 4.16PS
B     GLCSWGR3.480PS
R     R C21055.480PS
B     R C23075.480PS 7.55 5.45
F     R C8203 .480PS
B     R N9208 .480PS 4.72 3.40
E     R N9231 .480PS 4.72 3.40
B     R N9235S.480PS 2.76 1.99
F     R N9241 .480PS 3.98 2.87
G     R N9247 .480PS
F     R P2102 .480PS11.33 8.17
B     R P2103S.480PS
E     R P2105 .480PS11.80 8.51
F     R P2107 .480PS
B     R P3106S.480PS11.66 8.41
E     R P4104 .480PS
B     R P4118 .480PS
B     R P4202S.480PS
E     R P4602 .480PS 7.69 5.54
F     RFS107SX.480PS 5.60 4.04
E     R RP401 .480PS
B     TRPHVAC 4.16PS 74.7 60.3
E     TIPHVAC 4.16PS
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-17-R2 INPUT DATA LISTING →
PLANT OFF LINE-14.6MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 251.6KV--MVA*10 GIVES KVA FSVRAT26

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 252 12-1994

ALL BUS CARDS PROCESSED-WILL PROCESS LINE AND TEMP CARDS NEXT

```
L     ZS.V.INF230.  AST.VRN.230.    0000                .00035
L     D EQ TAP4.16  SHVAC EQ4.16    0000          .00001.00001
L     D EQ TAP4.16  J SWGR 24.16    0000          .00001.00001
L     J SWGR 24.16  N SWGR 34.16    0000                .00001
L     J SWGR 24.16  E SWGR 14.16    0000                .00001
L     E SWGR 14.16  ELCSWGR44.16    0000          .00107.00028
L     E SWGR 14.16  FMCXFMR64.16    0000          .00257.00126
L     E SWGR 14.16  F P3104 4.16    0000          .00128.00028
L     E SWGR 14.16  F P4101 4.16    0000          .00176.00117
L     J SWGR 24.16  K C2401 4.16    0000          .00235.00051
L     J SWGR 24.16  K P3102 4.16    0000          .00018.00026
L     N SWGR 34.16  ELCSWGR54.16    0000          .00086.00029
L     N SWGR 34.16  FMCXFMR74.16    0000          .00278.00135
L     N SWGR 34.16  P P3105 4.16    0000          .00117.00026
L     N SWGR 34.16  P P4102 4.16    0000          .00177.00118
L     SHVAC EQ4.16  TRPHVAC 4.16    0000          .00161.00066
L     SHVAC EQ4.16  TTPHVAC 4.16    0000          .00046.00019
L     GLCSWGR1.480  H C2201 .480    0000          .03320.00879
L     GLCSWGR1.480  H N9219 .480    0000          .02344.02179
L     GLCSWGR1.480  H N9229A.480    0000          .01094.01525
L     GLCSWGR1.480  H N9229C.480    0000          .03275.01598
L     GLCSWGR1.480  H N9236 .480    0000          .07031.00634
L     GLCSWGR1.480  H N9240 .480    0000          .07031.00634
L     GLCSWGR1.480  H P2101 .480    0000          .08268.03385
L     GLCSWGR1.480  H P2106 .480    0000          .08268.03385
L     GLCSWGR1.480  H P3106 .480    0000          .04679.02283
L     GLCSWGR1.480  H P4103 .480    0000          .05467.07626
L     GLCSWGR1.480  H P4118S.480    0000          .18130.08847
L     GLCSWGR1.480  H P4201 .480    0000          .15206.07420
L     GLCSWGR1.480  H P4501 .480    0000          .13569.06621
L     GLCSWGR1.480  H P4601 .480    0000          .07747.02051
L     LLCSWGR2.480  M C2109 .480    0000          .08767.01172
L     LLCSWGR2.480  M C7307 .480    0000          .08854.02344
L     LLCSWGR2.480  M CR201S.480    0000          .03320.00879
L     LLCSWGR2.480  M N9218 .480    0000          .03509.01712
L     LLCSWGR2.480  M N9220 .480    0000          .03760.02510
L     LLCSWGR2.480  M N9230 .480    0000          .01172.01089
L     LLCSWGR2.480  M N9246 .480    0000          .11398.01569
L     LLCSWGR2.480  M P2101S.480    0000          .06201.02539
L     LLCSWGR2.480  M P2102S.480    0000          .03445.01411
L     LLCSWGR2.480  M P2103 .480    0000          .06433.03139
L     LLCSWGR2.480  M P4202 .480    0000          .15206.07420
L     LLCSWGR2.480  M P4601S.480    0000          .04427.01172
L     LLCSWGR2.480  M P4602S.480    0000          .04427.01172
L     LLCSWGR2.480  M P5107X.480    0000          .17535.02413
L     LLCSWGR2.480  M PR401S.480    0000          .15038.04219
L     LLCSWGR2.480  M S7307S.480    0000          .02344.02179
L     LLCSWGR2.480  M S7537 .480    0000          .15743.02112
L     LLCSWGR2.480  M S7538 .480    0000          .07518.03016
L     GLCSWGR3.480  R C2109S.480    0000          .08767.01207
```

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRB150 05-17-82 INPUT DATA LISTING
PLANT OFF LINE-14.8MVA RES AUX TRANSF IN SERVICE AE-ED
FSV 345-KV BUS HELD AT 231.0KV--MVA*10 GIVES KVA FSVEA126

#3 BLUE
#4 RED

	L	GLCSWGR3.480	R C23075.480	8888		.06198.01641			
	L	GLCSWGR3.480	R CR203 .480	8888		.02214.00586			
	L	GLCSWGR3.480	R N9208 .480	8888		.01367.01906			
	L	GLCSWGR3.480	R N9231 .480	8888		.01367.01906			
	L	GLCSWGR3.480	R N9234S.480	8888		.03516.00717			
	L	GLCSWGR3.480	R N9241 .480	8888		.03516.00317			
	L	GLCSWGR3.480	R N9247 .480	8888		.13151.01810			
	L	GLCSWGR3.480	R P2102 .480	8888		.04823.01975			
	L	GLCSWGR3.480	R P21035.480	8888		.05264.02588			
	L	GLCSWGR3.480	R P2105 .480	8888		.04884.01988			
	L	GLCSWGR3.480	R P2107 .480	8888		.03445.01411			
	L	GLCSWGR3.480	R P31065.480	8888		.05381.02625			
	L	GLCSWGR3.480	R P4104 .480	8888		.04297.03992			
	L	GLCSWGR3.480	R P411R .480	8888		.18715.09132			
	L	GLCSWGR3.480	R P42025.480	8888		.12867.06278			
#1 TAN	L	GLCSWGR3.480	R PA402 .480	8888		.04427.01172			
#2 GREEN	L	GLCSWGR3.480	PPS107SX.480	8888		.14005.02061			
	L	GLCSWGR3.480	R PR401 .480	8888		.14167.03750			
	T	AST.VRN.230.	D EQ TAP4.16	8888	1400	.0006 .00881		224.2	4.16
	T	E SWGR 14.16	GLCSWGR1.480	8888	133	.0075 .04590		4.056	.480
	T	J SWGR 24.16	LLCSWGR2.480	8888	133	.0075 .04053		4.056	.480
	T	N SWGR 34.16	GLCSWGR3.480	8888	133	.0075 .04027		4.056	.480

ENTERING SUBROUTINE SHUFLE

FORM 202 12 1994

```
FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--PER GR0150        05-17-82                                    INPUT DATA LISTING
PLANT OFF LINE-14.0MVA PES AUX TRANSF IN SERVICE               AG-DD
FSV 230-KV BUS HELD AT 251.4KV--MVA*10 GIVES KVA               FSVRAT26

ALL BUS AND LINE CARDS PROCESSED-NOW PROCESS REG XFMR, AREA, REACTANCE SWITCHING AND DC LINES
         A   ZONE 004 ZS.V.INF230.      0.0 PS

********** WARNING-AES&TOTAL SCHEDULED GENERATION-TOTAL LOAD-NET AREA EXPORT) .GT. .2*TOTAL LOAD FOR AREA  ZONE ONE




SYSTEM DATA PROCESSED.

THERE WERE   0 FATAL ERRORS

RETURNING TO MAIN PROGRAM

CONTROL CARD SOL    0    9    0    0  -30  ZS.V.INF230. 0      0.0        0.0            00    0
```

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF CASE1SC 05-17-82
PLANT DEF LINE-14.0MVA RES AUX TRANSF IN SERVICE AC-DD
FSV 230-KV BUS HELD AT 221.6KV--MVA*10 GIVES KVA FSVRAT2K

RENUMBERING OF 73 NODES WILL REQUIRE 72 OFF DIAGONALS
THE MAXIMUM NUMBER OF BRANCHES IS 20
PRIM SOLUTION WITH 73 BUSES AND 72 BRANCHES 5/17/1982 7:31: 6

ITERATION	SUM OF ABSOLUTE MISMATCHES-PU MEGAWATTS	MEGAVARS	BUSES UNSOLVED	MATRIX SIZE
1	7.866	308.225	46	572
2	2.396	22.806	47	572
3	0.078	0.196	11	572
4	0.000	0.000	0	572

ADJUSTMENTS MADE AT START OF ITERATION

ITERATION	R	RQ RN	RP RM	BV	BQ	BC	BG	BX	TIES	CC
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0

CASE SOLVED 5/17/1982 7:31: 6

ENTERING TAPE4

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

TYPE OF BUS		ACTUAL	MAXIMUM
P AND E - NO Q LIMITS	(BE)	1	2000
P AND Q - NO V LIMITS	(BQ)	72	2000
DC TERMINAL BUSES	(BD)	0	20
TOTAL NON-REGULATING BUSES		73	2000
P AND E - SELF VAR LIMITS	(BG)	0	1200
P AND E - USE REMOTE VARS	(BC)	0	50
P AND Q - V LIMITS	(BV)	0	1200
P - SUPPLY REMOTE VARS	(BG)	0	250
TOTAL REGULATING BUSES		0	1200
TOTAL BUSES THIS STUDY		73	2000
ASSOCIATED WITH NON-REG ARE			
P AND Q - V BY REG XFMR	(BT)	0	200
SWITCHED REACTANCE BUSES	(BX)	0	100

P .U. VOLTAGE LIMITS ARE 0.70 TO 1.50

TYPE OF LINE (SECTION)		ACTUAL	MAXIMUM
BUS TIES	(Z=0)	0	200
FIXED TAP XFMR	(T)	4	3500
FIXED PHASE SHIFTER	(TP)	0	100
VARIABLE TAP OR PHASE	(R)	0	200
DC LINES-TWO TERMINAL	(LD)	0	10
LINE EQUIVALENTS	(E)	0	3500
NORMAL PI LINES	(L)	68	3500
TOTAL LINE SECTIONS		72	3500
TOTAL BRANCHES		72	3500
MISCELLANEOUS INFORMATION			
NO. OF ITERATIONS		4	30
NO. OF INTERCHANGE AREAS		1	60
NO. OF ZONES		1	90
NO. OF BUSES OUT OF TOLERANCE		0	0
TOLERANCE AT EACH BUS-MW OR MVAR		0.01000	

TIE LINE CONTROL NOT EXERCISED

SYSTEM DATA	MEGAWATTS	MEGAVARS
TOTAL LOAD	660.280	443.470
LOSSES-I*I(R+X)	9.673	75.919
CHARGING-E*E(Y-PI),	0.0	0.0
NET SHUNT ADM	0.0	0.0
SYSTEM MISMATCH	0.000	0.000
TOTAL GENERATION	669.953	519.389
MAXIMUM POWER	0.0	
PMAX LESS GENERATION	-669.953	

NOTE-- CHARGING INCLUDES REAL AND REACTIVE COMPONENTS OF POWER (P+JQ) DERIVED FROM EQUIVALENT Y-PI LINES
(SOME ARE DEVELOPED INTERNALLY FROM COMPOSITE LINES COMBINED USING ABCD CONSTANTS)
P(CHARGING) IS TREATED AS A MW LOAD
Q(CHARGING) IS TREATED AS A SOURCE (MVAR)
BOTH MAY BE EITHER POSITIVE OR NEGATIVE

SYSTEM SLACK BUS IS ZS.V.INF230.

#3 - BLUE
#4 - RED
#1 - TAN
#2 - GREEN

FOR THE BUSSES LISTED BELOW PGEN IS NEGATIVE, PMAX IS
LESS THAN PGEN, OR PMAX IS POSITIVE AND PGEN IS ZERO:

BUS NAME	KV	ZONE	AREA	PGEN (MW)	PMAX (MW)
ZS.V.INF230.	23	ZONE ONE		669.95	0.0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF GENERATOR DATA

BUS NAME	PGEN MW	PMAX MW	QGEN MVAR	QMAX MVAR	QMIN MVAR	ACTUAL VOLTAGE	DESIRED VOLTAGE	
S.V.INF230.	449.95	0.0	519.39			1.002		SYSTEM SLACK BUS

SUMMARY OF 0 BUSES WITH VOLTAGE OVER 1.05 PER UNIT

SUMMARY OF 2 BUSES WITH VOLTAGE UNDER 0.95 PER UNIT

BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV
H P4201 .480	PS	0.946	0.5	H P4501 .480	PS	0.949	0.5				

THERE ARE NO OVERLOADED TRANSMISSION LINES

THERE ARE NO OVERLOADED TRANSFORMERS

THERE ARE NO REGULATING TRANSFORMERS

#1 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF LOSSES BY OWNER IN MEGAWATTS

OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES
	9.673						

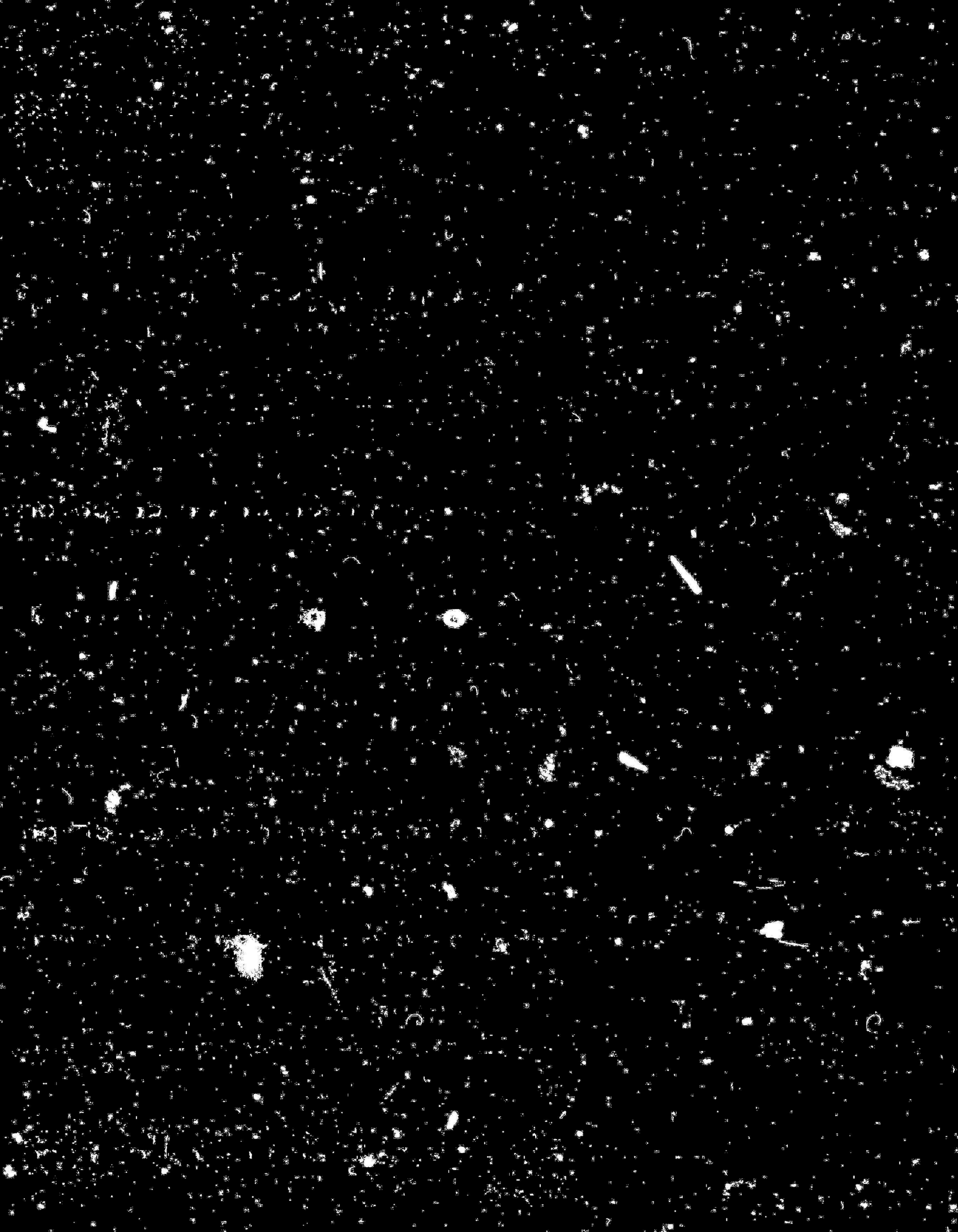
********** TOTAL SYSTEM LOSSES ARE 9.673 MW **********

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME
ASI.VRN.230.	(PS)	ZONE ONE	D EG TAP4.16	(PS)	ZONE ONE	E SWGR 14.16	(PS)	ZONE ONE	E P3104 4.16	(PS)	ZONE ONE
E P4101 4.16	(PS)	ZONE ONE	ELCSWGR44.16	(PS)	ZONE ONE	EMCXFMR64.16	(PS)	ZONE ONE	GLCSWGR1.480	(PS)	ZONE ONE
H C8201 .480	(PS)	ZONE ONE	H N9219 .480	(PS)	ZONE ONE	H N9229A.480	(PS)	ZONE ONE	H N9229C.480	(PS)	ZONE ONE
H N9236 .480	(PS)	ZONE ONE	H N9240 .480	(PS)	ZONE ONE	H P2101 .480	(PS)	ZONE ONE	H P2106 .480	(PS)	ZONE ONE
H P3106 .480	(PS)	ZONE ONE	H P4103 .480	(PS)	ZONE ONE	H P4118S.480	(PS)	ZONE ONE	H P4201 .480	(PS)	ZONE ONE
H P4501 .480	(PS)	ZONE ONE	H P4601 .480	(PS)	ZONE ONE	J SWGR 24.16	(PS)	ZONE ONE	K C2401 4.16	(PS)	ZONE ONE
K P3102 4.16	(PS)	ZONE ONE	LLCSWGR2.480	(PS)	ZONE ONE	M C2109 .480	(PS)	ZONE ONE	M C7307 .480	(PS)	ZONE ONE
M C8201S.480	(PS)	ZONE ONE	M N9218 .480	(PS)	ZONE ONE	M N9220 .480	(PS)	ZONE ONE	M N9230 .480	(PS)	ZONE ONE
M N9246 .480	(PS)	ZONE ONE	M P2101S.480	(PS)	ZONE ONE	M P2102S.480	(PS)	ZONE ONE	M P2103 .480	(PS)	ZONE ONE
M P4202 .480	(PS)	ZONE ONE	M P4601S.480	(PS)	ZONE ONE	M P4602S.480	(PS)	ZONE ONE	M P5107X.480	(PS)	ZONE ONE
M P8401S.480	(PS)	ZONE ONE	M S7307S.480	(PS)	ZONE ONE	M S7537 .480	(PS)	ZONE ONE	M S753R .480	(PS)	ZONE ONE
N SWGR 34.16	(PS)	ZONE ONE	P P3105 4.16	(PS)	ZONE ONE	P P4102 4.16	(PS)	ZONE ONE	PLCSWGR54.16	(PS)	ZONE ONE
PMCXFMR74.16	(PS)	ZONE ONE	GLCSWGR3.480	(PS)	ZONE ONE	R C2109S.480	(PS)	ZONE ONE	R C7307S.480	(PS)	ZONE ONE
R EA203 .480	(PS)	ZONE ONE	R N9208 .480	(PS)	ZONE ONE	R N9231 .480	(PS)	ZONE ONE	R N9236S.480	(PS)	ZONE ONE
R N9241 .480	(PS)	ZONE ONE	R N9247 .480	(PS)	ZONE ONE	R P2102 .480	(PS)	ZONE ONE	R P2103S.480	(PS)	ZONE ONE
R P2105 .480	(PS)	ZONE ONE	R P2107 .480	(PS)	ZONE ONE	R P3106S.480	(PS)	ZONE ONE	R P4104 .480	(PS)	ZONE ONE
R P4118 .480	(PS)	ZONE ONE	R P4202S.480	(PS)	ZONE ONE	R P4602 .480	(PS)	ZONE ONE	R P8401 .480	(PS)	ZONE ONE
S5107SX.480	(PS)	ZONE ONE	SHVAC EQ4.16	(PS)	ZONE ONE	TRPHVAC 4.16	(PS)	ZONE ONE	TTPHVAC 4.16	(PS)	ZONE ONE
ZS.V.IMP230.	(PS)	ZONE ONE		( )			( )			( )	

#1 TAN
#2 GREEN
#3 BLUE
#4 RED



FORM 292 - 12 1994

#1. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF 680150 05-17-R2 POWER FLOW REPORT PAGE NO. 2
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DE ZONE( ) OF AREA(ZONE ONE)
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA ESVRAT24 5/17/1982 7:51: 6

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
H N9236 .480	0.9665	0.0	0.0	6.5	4.4	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-6.5	-4.3	0.0	0.0	
H N9240 .480	0.9691	0.0	0.0	3.0	2.0	0.0	0.0	--					
0.5 KV	-5.5							GLCSWGR1.480	-3.6	-2.0	0.0	0.0	
H P2101 .480	0.9587	0.0	0.0	11.6	7.8	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
H P2106 .480	0.9587	0.0	0.0	11.6	7.8	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
H P3106 .480	0.9638	0.0	0.0	12.0	8.0	0.0	0.0	--					
0.5 KV	-5.5							GLCSWGR1.480	-12.0	-8.0	0.1	0.1	
H P4103 .480	0.9715	0.0	0.0	0.0	0.0	0.0	0.0	--					
0.5 KV	-5.6							GLCSWGR1.480	0.0	0.0	0.0	0.0	
H P4105.480	0.9715	0.0	0.0	0.0	0.0	0.0	0.0	--					
0.5 KV	-5.6							GLCSWGR1.480	0.0	0.0	0.0	0.0	
H P4201 .480	0.9457	0.0	0.0	12.1	8.1	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-12.1	-8.1	0.4	0.2	
H P4501 .480	0.9485	0.0	0.0	12.1	8.1	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-12.1	-8.1	0.3	0.2	
H P4601 .480	0.9648	0.0	0.0	7.9	5.3	0.0	0.0	--					
0.5 KV	-5.4							GLCSWGR1.480	-7.9	-5.3	0.1	0.0	
J SWGR 24.16	0.9845	0.0	0.0	0.0	0.0	0.0	0.0	--					
4.1 KV	-3.3							D E0 TAP4.16	-591.0	-397.2	0.1	0.1	
								E SWGR 14.16	355.6	237.3	0.0	0.0	
								K C2401 4.16	-0.0	-0.0	0.0	0.0	
								K P3102 4.16	-0.0	-0.0	0.0	0.0	
						TAP	4.06/ 0.48	LLCSWGR2.480	69.2	45.9	0.5	2.7	62.4
								N SWGR 34.16	166.3	113.9	0.0	0.0	
K C2401 4.16	0.9845	0.0	0.0	0.0	0.0	0.0	0.0	--					
4.1 KV	-3.3							J SWGR 24.16	0.0	0.0	0.0	0.0	
K P3102 4.16	0.9845	0.0	0.0	0.0	0.0	0.0	0.0	--					
4.1 KV	-3.3							J SWGR 24.16	0.0	0.0	0.0	0.0	
LLCSWGR2.480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	--					
0.5 KV	-4.7							J SWGR 24.16	-68.7	-43.1	0.5	2.7	61.0
								M C2109 .480	-0.0	-0.0	0.0	0.0	
								M C7307 .480	-0.0	-0.0	0.0	0.0	
								M CP201S.480	6.5	4.1	0.0	0.0	
								M N9218 .480	3.2	2.0	0.0	0.0	
								M N9220 .480	3.2	2.0	0.0	0.0	
								M N9230 .480	3.2	2.0	0.0	0.0	
								M N9246 .480	5.0	3.2	0.0	0.0	
								M P2101S.480	-0.0	-0.0	0.0	0.0	
								M P2102S.480	11.9	7.5	0.1	0.0	
								M P2103 .480	-0.0	-0.0	0.0	0.0	
								M P4202 .480	12.4	7.8	0.3	0.2	
								M P4601S.480	-0.0	-0.0	0.0	0.0	
								M P4602S.480	-0.0	-0.0	0.0	0.0	
								M P5107X.480	-0.0	-0.0	0.0	0.0	

(.9485)(480) = 455.3V

(.9845)(4160) = 4095.5V

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
								M PR4015.480	8.3	5.2	0.2	0.0	
								M S73075.480	15.0	9.5	0.1	0.1	
								M S7537 .480	-0.0	-0.0	0.0	0.0	
								M S7538 .480	-0.0	-0.0	0.0	0.0	
M C2109 .480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C7307 .480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M CR2015.480	0.9860	0.0	0.0	6.5	4.1	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	-6.5	-4.1	0.0	0.0	
M N9218 .480	0.9859	0.0	0.0	3.2	2.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9228 .480	0.9858	0.0	0.0	3.2	2.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9238 .480	0.9859	0.0	0.0	3.2	2.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9246 .480	0.9862	0.0	0.0	5.0	3.2	0.0	0.0	----------					
0.5 KV	-4.5							LLCSWGR2.480	-5.0	-3.1	0.0	0.0	
M P2101S.480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P2102S.480	0.9813	0.0	0.0	11.8	7.5	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	-11.8	-7.4	0.1	0.0	
M P2103 .480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4202 .480	0.9815	0.0	0.0	12.1	7.6	0.0	0.0	----------					
0.5 KV	-4.5							LLCSWGR2.480	-12.1	-7.6	0.3	0.2	
M P4601S.480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4602S.480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P5107X.480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M PR4015.480	0.9709	0.0	0.0	8.2	5.1	6.0	0.0	----------					
0.5 KV	-4.4							LLCSWGR2.480	-8.2	-5.1	0.2	0.0	
M S73075.480	0.9809	0.0	0.0	14.9	9.4	0.0	0.0	----------					
0.5 KV	-4.8							LLCSWGR2.480	-14.9	-9.4	0.1	0.1	
M S7537 .480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M S7538 .480	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-4.7							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M SWGR 24.16	0.9865	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.1 KV	-3.3							J SWGR 24.16	-166.3	-113.9	0.0	0.0	
								P P3105 4.16	-0.0	-0.0	0.0	0.0	
								P P4102 4.16	-0.0	0.0	0.0	0.0	
								PLCSWGR54.16	37.2	26.0	0.0	0.0	
								PMCXFMR74.16	56.1	32.7	0.1	0.1	
				TAP	4.06/	0.48		OLCSWGR3.480	72.9	55.3	0.6	3.3	68.8

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P3105 4.16	0.9845	0.0	0.0	0.0	0.0	0.0	0.0						
4.1 KV	-3.3							N SWGR 34.16	0.0	0.0	0.0	0.0	
P P4102 4.16	0.9845	0.0	0.0	0.0	0.0	0.0	0.0						
4.1 KV	-3.3							N SWGR 34.16	0.0	-0.0	0.0	0.0	
PLCSWGR34.16	0.9841	0.0	0.0	37.2	26.0	0.0	0.0						
4.1 KV	-3.3							N SWGR 34.16	-37.2	-26.0	0.0	0.0	
PMCXFMR74.16	0.9825	0.0	0.0	56.0	32.6	0.0	0.0						
4.1 KV	-3.3							N SWGR 34.16	-56.0	-32.6	0.1	0.1	
GLCSWGR3.480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-4.7							N SWGR 34.16	-72.3	-52.0	0.6	3.3	67.0
								P C2109S.480	-0.0	-0.0	0.0	0.0	
								P C7307S.480	7.6	5.5	0.1	0.0	
								R CR203 .480	-0.0	-0.0	0.0	0.0	
								R N9208 .480	4.7	3.4	0.0	0.0	
								R N9231 .480	4.7	3.4	0.0	0.0	
								R N9236S.480	2.8	2.0	0.0	0.0	
								R N9241 .480	4.0	2.9	0.0	0.0	
								R N9247 .480	-0.0	-0.0	0.0	0.0	
								R P2102 .480	11.4	8.2	0.1	0.0	
								R P2103S.480	-0.0	-0.0	0.0	0.0	
								R P2105 .480	11.9	8.6	0.1	0.0	
								R P2107 .480	-0.0	-0.0	0.0	0.0	
								R P3106S.480	11.8	8.5	0.1	0.1	
								R P4104 .480	-0.0	-0.0	0.0	0.0	
								R P4118 .480	-0.0	-0.0	0.0	0.0	
								R P4202S.480	-0.0	-0.0	0.0	0.0	
								R P4602 .480	7.7	5.6	0.0	0.0	
								R P8401 .480	-0.0	-0.0	0.0	0.0	
								RP5107SX.480	5.7	4.1	0.1	0.0	
P C2109S.480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-4.7							GLCSWGR3.480	0.0	0.0	0.0	0.0	
P C7307S.480	0.9769	0.0	0.0	7.6	5.5	0.0	0.0						
0.5 KV	-4.6							GLCSWGR3.480	-7.5	-5.4	0.1	0.0	
R CR203 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-4.7							GLCSWGR3.480	0.0	0.0	0.0	0.0	
R N9208 .480	0.9813	0.0	0.0	4.7	3.4	0.0	0.0						
0.5 KV	-4.8							GLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9231 .480	0.9813	0.0	0.0	4.7	3.4	0.0	0.0						
0.5 KV	-4.8							GLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9236S.480	0.9816	0.0	0.0	2.8	2.0	0.0	0.0						
0.5 KV	-4.7							GLCSWGR3.480	-2.8	-2.0	0.0	0.0	
R N9241 .480	0.9811	0.0	0.0	4.0	2.9	0.0	0.0						
0.5 KV	-4.7							GLCSWGR3.480	-4.0	-2.9	0.0	0.0	
R N9247 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-4.7							GLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2102 .480	0.9754	0.0	0.0	11.3	8.2	0.0	0.0						
0.5 KV	-4.6							GLCSWGR3.480	-11.3	-8.2	0.1	0.0	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	IF	BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P21455.480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P2105 .480	0.9759	0.0	0.0	11.8	8.5	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	-11.8	-8.5	0.1	0.0	
P P2107 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P3106S.480	0.9759	0.0	0.0	11.7	8.4	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	-11.7	-8.4	0.1	0.1	
P P4104 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4116 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4202S.480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4602 .480	0.9715	0.0	0.0	7.7	5.5	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	-7.7	-5.5	0.0	0.0	
P P5401 .480	0.9826	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-4.7								GLCSWGR3.480	0.0	0.0	0.0	0.0	
XP5107SX.480	0.9732	0.0	0.0	5.6	4.0	0.0	0.0							
0.5 KV	-4.5								GLCSWGR3.480	-5.6	-4.0	0.1	0.0	
SHVAC EQ4.16	0.9846	0.0	0.0	0.0	0.0	0.0	0.0							
4.1 KV	-3.3								D EQ TAP4.16	-74.9	-60.4	0.0	0.0	
									TRPHVAC 4.16	74.9	60.4	0.2	0.1	
									TTPHVAC 4.16	-0.0	-0.0	0.0	0.0	
TRPHVAC 4.16	0.9830	0.0	0.0	74.7	60.3	0.0	0.0							
4.1 KV	-3.3								SHVAC EQ4.16	-74.7	-60.3	0.2	0.1	
TTPHVAC 4.16	0.9846	0.0	0.0	0.0	0.0	0.0	0.0							
4.1 KV	-3.3								SHVAC EQ4.16	0.0	0.0	0.0	0.0	
ZS.V.INF230.	1.0070	670.0	519.4	0.0	0.0	0.0	0.0							
231.6 KV	0.0								AST.VRN.230.	670.0	519.4	0.0	2.5	

END OF REPORT FOR THIS CASE

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF 880150 05-17-82 DATA TABLE LISTING PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE A6-DE 5/17/1982 7:31: 4
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT26

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QMIN MVAR	VOLT LIMITS VMAX VHOLD	VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
B		AST.VPN.236.	PS												60	
B		D EQ 1AP4.16	PS												60	
B		E SWGR 14.16	PS												60	
B		F P3104 4.16	PS	37.6	24.0										50	
B		F P4101 4.16	PS	131.2	86.5										70	
B		FLESWGR44.16	PS	37.6	24.0										60	
B		FMCXFMR6A.16	PS	51.9	32.4										80	
B		GLESWGR1.480	PS												50	
B		H CR201 .480	PS	6.4	4.3										80	
B		H N9219 .480	PS	3.7	2.5										70	
B		H N9229A.480	PS	3.7	2.5										60	
B		H N9229C.480	PS	3.7	2.5										60	
B		H N9236 .480	PS	6.5	4.3										60	
B		H N9240 .480	PS	3.0	2.0										80	
B		H P2101 .480	PS	11.6	7.8										60	
B		H P2106 .480	PS	11.6	7.8										60	
B		H P3106 .480	PS	11.9	8.0										60	
B		H P4103 .480	PS												80	
B		H P4118S.480	PS												60	
B		H P4201 .480	PS	12.1	8.1										80	
B		H P4501 .480	PS	12.1	8.1										60	
B		H P4601 .480	PS	7.9	5.3										80	
B		J SWGR 24.16	PS												80	
B		K C2401 4.16	PS												80	
B		K P3102 4.16	PS												80	
B		LLESWGR2.480	PS												60	
B		M C2102 .480	PS												60	
B		M C7307 .480	PS												80	
B		M CR201S.480	PS	6.5	4.1										60	
B		M N9218 .480	PS	3.2	2.0										60	
B		M N9220 .480	PS	3.2	2.0										60	
B		M N9230 .480	PS	3.2	2.0										60	
B		M N9246 .480	PS	5.0	3.1										60	
B		M P2101S.480	PS												80	
B		M P2102S.480	PS	11.8	7.4										60	
B		M P2103 .480	PS												60	
B		M P4202 .480	PS	12.1	7.6										60	
B		M P4601S.480	PS												80	
B		M P4602S.480	PS												60	
B		M PS107X.480	PS												60	
B		M CR401S.480	PS	8.2	5.1										60	
B		M S7307S.480	PS	14.9	9.4										80	
B		M S7537 .480	PS												80	
B		M S753R .480	PS												60	
B		N SWGR 34.16	PS												60	

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
B		P P3105 4.16	PS												00	
B		P P4102 4.16	PS												00	
B		PLCSWGR54.16	PS	37.2	26.0										00	
B		PNCXFMR74.16	PS	56.0	32.6										00	
B		PLCSWGR3.480	PS												00	
B		R C21095.480	PS												00	
B		R C23075.480	PS	7.5	5.4										00	
B		R C8205 .480	PS												00	
B		R N5208 .480	PS	4.7	3.4										00	
B		R N5231 .480	PS	4.7	3.4										00	
B		R N5235.480	PS	2.8	2.0										00	
B		R N5241 .480	PS	4.0	2.9										00	
B		R N5247 .480	PS												00	
B		R P2102 .480	PS	11.3	8.2										00	
B		R P2103S.480	PS												00	
B		R P2105 .480	PS	11.8	8.5										00	
B		R P2107 .480	PS												00	
B		R P3106S.480	PS	11.7	8.4										00	
B		R P4104 .480	PS												00	
B		P P4110 .480	PS												00	
B		R P4202S.480	PS												00	
B		R P4602 .480	PS	7.7	5.5										00	
B		R P8401 .480	PS												00	
B		RPS1075X.480	PS	5.6	4.0										00	
B		SHVAC E04.16	PS												00	
B		TRFRVAC 4.16	PS	74.7	60.3										00	
B		TTFRVAC 4.16	PS												00	
RE		ZS.V.INF230.	PS						670.0			1.007			00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
ASI.VRN.230.	ZS.V.INF230.	L							0.0003								(R)
230.	D EQ TAP4.16	T				1400.		0.0006	0.0088					224.20	4.16	FIX TAP	
D EQ TAP4.16	ASI.VRN.230.	T				1400.		0.0006	0.0088					4.16	224.20	FIX TAP	(R)
4.16	SHVAC E04.16	L															
4.16	J SWGR 24.16	L															
E SWGR 14.16	FLCSWGR44.16	L						0.0011	0.0003								
4.16	FMCXFMR64.16	L						0.0026	0.0013								
4.16	F P3104 4.16	L						0.0013	0.0003								
4.16	F P4101 4.16	L						0.0018	0.0012								
4.16	GLCSWGR1.480	T				133.0		0.0075	0.0459					4.06	0.48	FIX TAP	
4.16	J SWGR 24.16	L															(R)
F P3104 4.16	E SWGR 14.16	L						0.0013	0.0003								(R)
F P4101 4.16	E SWGR 14.16	L						0.0018	0.0012								(R)
FLCSWGR44.16	E SWGR 14.16	L						0.0011	0.0003								(R)
FMCXFMR64.16	E SWGR 14.16	L						0.0026	0.0013								(R)
GLCSWGR1.480	E SWGR 14.16	T				133.0		0.0075	0.0459					0.48	4.06	FIX TAP	(R)
.480	H CR2P1 .480	L						0.0332	0.0088								
.480	H N9219 .480	L						0.0234	0.0218								
.480	H N9229A.480	L						0.0109	0.0152								
.480	H N9229C.480	L						0.0328	0.0160								
.480	H N9236 .480	L						0.0705	0.0063								
.480	H N9240 .480	L						0.0703	0.0063								
.480	H P2101 .480	L						0.0827	0.0338								
.480	H P2106 .480	L						0.0827	0.0338								
.480	H P3106 .480	L						0.0468	0.0228								
.480	H P4103 .480	L						0.0547	0.0763								
.480	H P411RS.480	L						0.1813	0.0885								
.480	H P4201 .480	L						0.1521	0.0742								
.480	H P4501 .480	L						0.1357	0.0662								
.480	H P4601 .480	L						0.0775	0.0205								
H CR2P1 .480	GLCSWGR1.480	L						0.0332	0.0088								(R)
H N9219 .480	GLCSWGR1.480	L						0.0234	0.0218								(R)
H N9229A.480	GLCSWGR1.480	L						0.0109	0.0152								(R)
H N9229C.480	GLCSWGR1.480	L						0.0328	0.0160								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
H N923A .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H N924A .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H P2101 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H P2106 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H P3106 .480	GLCSWGR1.480	L						0.0468	0.0228								(R)
H P4103 .480	GLCSWGR1.480	L						0.0547	0.0763								(R)
H P4118S.480	GLCSWGR1.480	L						0.1813	0.0885								(R)
H P4201 .480	GLCSWGR1.480	L						0.1521	0.0742								(R)
H P4501 .480	GLCSWGR1.480	L						0.1357	0.0662								(R)
H P4601 .480	GLCSWGR1.480	L						0.0775	0.0205								(R)
J SWGR 24.16	0 EG TAP4.16	L															(R)
4.16	E SWGR 14.16	L															
4.16	K C2401 4.16	L						0.0024	0.0005								
4.16	K P3102 4.16	L						0.0002	0.0003								
4.16	LLCSWGR2.480	T				133.0		0.0075	0.0406					4.06	0.48	FIX TAP	
4.16	N SWGR 34.16	L															
K C2401 4.16	J SWGR 24.16	L						0.0024	0.0005								(R)
K P3102 4.16	J SWGR 24.16	L						0.0002	0.0003								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#2 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PII G1	Y-PII B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
LLCSWGR3.480	J SWGR 24.16	T				133.0		0.0075	0.0406					0.48	4.06	FIX TAP (R)
.480	M C2109 .480	L						0.0877	0.0117							
.480	M C7307 .480	L						0.0885	0.0234							
.480	M C8201S.480	L						0.0332	0.0088							
.480	M N9218 .480	L						0.0351	0.0171							
.480	M N9220 .480	L						0.0376	0.0251							
.480	M N9230 .480	L						0.0117	0.0109							
.480	M N9246 .480	L						0.1140	0.0157							
.480	M P2101S.480	L						0.0620	0.0254							
.480	M P2102S.480	L						0.0345	0.0141							
.480	M P2103 .480	L						0.0643	0.0314							
.480	M P4202 .480	L						0.1521	0.0742							
.480	M P4601S.480	L						0.0443	0.0117							
.480	M P4602S.480	L						0.0443	0.0117							
.480	M P5107x.480	L						0.1753	0.0241							
.480	M P8401S.480	L						0.1594	0.0422							
.480	M S7307S.480	L						0.0234	0.0218							
.480	M S7537 .480	L						0.1534	0.0211							
.480	M S7538 .480	L						0.2192	0.0302							
M C2109 .480	LLCSWGR3.480	L						0.0877	0.0117							(R)
M C7307 .480	LLCSWGR3.480	L						0.0885	0.0234							(R)
M C8201S.480	LLCSWGR3.480	L						0.0332	0.0088							(R)
M N9218 .480	LLCSWGR3.480	L						0.0351	0.0171							(R)
M N9220 .480	LLCSWGR3.480	L						0.0376	0.0251							(R)
M N9230 .480	LLCSWGR3.480	L						0.0117	0.0109							(R)
M N9246 .480	LLCSWGR3.480	L						0.1140	0.0157							(R)
M P2101S.480	LLCSWGR3.480	L						0.0620	0.0254							(R)
M P2102S.480	LLCSWGR3.480	L						0.0345	0.0141							(R)
M P2103 .480	LLCSWGR3.480	L						0.0643	0.0314							(R)
M P4202 .480	LLCSWGR3.480	L						0.1521	0.0742							(R)
M P4601S.480	LLCSWGR3.480	L						0.0443	0.0117							(R)
M P4602S.480	LLCSWGR3.480	L						0.0443	0.0117							(R)

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
M P5107X.480	LLCSWGR2.480	L						0.1753	0.0241								(R)
M P8401S.480	LLCSWGR2.480	L						0.1594	0.0422								(R)
M S73075.480	LLCSWGR2.480	L						0.0234	0.0218								(R)
M S7537 .480	LLCSWGR2.480	L						0.1534	0.0211								(R)
M S7538 .480	LLCSWGR2.480	L						0.2192	0.0302								(R)
M SWGR 24.16	J SWGR 24.16	L															(R)
4.16	PLCSWGR5A.16	L						0.0009	0.0003								
4.16	PMCXFMR74.16	L						0.0028	0.0014								
4.16	P P3105 4.16	L						0.0012	0.0003								
4.16	P P4102 4.16	L						0.0018	0.0012								
4.16	SLCSWGR3.480	T				133.0		0.0075	0.0403					4.06	0.48	FIX TAP	
P P3105 4.16	N SWGR 34.16	L						0.0012	0.0003								(R)
P P4102 4.16	N SWGR 34.16	L						0.0018	0.0012								(R)
PLCSWGR5A.16	N SWGR 34.16	L						0.0009	0.0003								(R)
PMCXFMR74.16	N SWGR 34.16	L						0.0028	0.0014								(R)
SLCSWGR3.480	N SWGR 34.16	T				133.0		0.0075	0.0403					0.48	4.06	FIX TAP	(R)
.480	P C2109S.480	L						0.0877	0.0121								
.480	P C7107S.480	L						0.0620	0.0164								
.480	P CR203 .480	L						0.0221	0.0059								
.480	P N9208 .480	L						0.0137	0.0191								
.480	P N9231 .480	L						0.0137	0.0191								
.480	P N9236S.480	L						0.0352	0.0032								
.480	P N9241 .480	L						0.0352	0.0032								
.480	P N9247 .480	L						0.1315	0.0181								
.480	P P2102 .480	L						0.0482	0.0128								
.480	P P2103S.480	L						0.0526	0.0057								
.480	P P2105 .480	L						0.0409	0.0200								
.480	P P2107 .480	L						0.0345	0.0141								
.480	P P3106S.480	L						0.0538	0.0263								
.480	P P4104 .480	L						0.0430	0.0589								
.480	P P4118 .480	L						0.1872	0.0913								
.480	P P4202S.480	L						0.1287	0.0628								
.480	P P4602 .480	L						0.0443	0.0117								
.480	PFS1075X.480	L						0.1498	0.0205								
.480	P PB401 .480	L						0.1417	0.0275								

#2 BLUE
#4 RED

#1 TAN
#3 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N	C/S	RATE	O	Z-R1 R	Z-R1 X	Y-R11 G1	Y-R11 B1	Y-R12 G2	Y-R12 B2	TAP 1	TAP 2	REMARKS	
R C21495.480	GLCSWGR3.480	L						0.0877	0.0121								(R)
R C23675.480	GLCSWGR3.480	L						0.0620	0.0164								(R)
R C8203 .480	GLCSWGR3.480	L						0.0221	0.0059								(R)
R N9208 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
R N9231 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
R N9236S.480	GLCSWGR3.480	L						0.0352	0.0032								(R)
R N9241 .480	GLCSWGR3.480	L						0.0352	0.0032								(R)
R N9247 .480	GLCSWGR3.480	L						0.1315	0.0181								(R)
R P2102 .480	GLCSWGR3.480	L						0.0482	0.0198								(R)
R P2103S.480	GLCSWGR3.480	L						0.0526	0.0257								(R)
R P2105 .480	GLCSWGR3.480	L						0.0409	0.0200								(R)
R P2107 .480	GLCSWGR3.480	L						0.0345	0.0141								(R)
R P31065.480	GLCSWGR3.480	L						0.0538	0.0263								(R)
R P4104 .480	GLCSWGR3.480	L						0.0430	0.0599								(R)
R P4110 .480	GLCSWGR3.480	L						0.1872	0.0013								(R)
R P4202S.480	GLCSWGR3.480	L						0.1287	0.0628								(R)
R P4602 .480	GLCSWGR3.480	L						0.0443	0.0117								(R)
R P8401 .480	GLCSWGR3.480	L						0.1417	0.0375								(R)
RPS1975X.480	GLCSWGR3.480	L						0.1490	0.0205								(R)
SHVAC F04.16	D EQ TAP4.16	L															(R)
4.16	TRPHVAC 4.16	L						0.0016	0.0007								
4.16	TTPHVAC 4.16	L						0.0005	0.0002								
TRPHVAC 4.16	SHVAC F04.16	L						0.0016	0.0007								(R)
TTPHVAC 4.16	SHVAC F04.16	L						0.0005	0.0002								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-17-82 DATA TABLE LISTING PAGE NO. 8
PLANT OFF LINE-14.0MVA PES AUX TRANSF IN SERVICE AC-DC 5/17/1982 7:51:
FSV 230-KV BUS HELD AT 251.6KV--MVA*10 GIVES KVA FSVRAT26

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N M C/S	RATE	Z-PI O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
VS.V.INF230.	AST.VEN.230.	L						0.0003							

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

PROGRAM CONSTANTS SUBJECT TO MODIFICATION UNDER CONTROL CARD TYPE 6 (TOL)
(SEE POWER FLOW MANUAL.)

#3 BLUE
#4 RED

NUMBER OF DECIMAL PLACES FOR MAPPING

BUS VOLTAGE MAGNITUDE (P.U.)	3
BUS VOLTAGE ANGLE (DEGREES)	2
LOAD AND GENERATION (MW AND MVAR)	2
CAPACITORS AND REACTORS (MW AND MVAR) . . .	2
LINE FLOWS (MW AND MVAR)	2
TRANSFORMER TAPS (P.U.)	3

#1 TAN
#2 GREEN

MW OR MVAR SOLUTION TOLERANCE AT EACH BUS	0.10000
MW OR MVAR TOLERANCE FOR AREA INTERCHANGE EXPORT SOLUTION	1.00000
MW OR MVAR TOLERANCE FOR FLOWS CONTROLLED BY TCULS OR PHASE SHIFTERS	1.00000
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY MVAR	0.00100
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY TCUL	0.00100
MW OR MVAR THRESHOLD FOR MISMATCH TABLE PRINTOUT	2.00000

FORM 292 - 12 1994

Attachment 5
P82169

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
            RRRRRRRRRR     555555555555        11           00000000         00000000      777777777777     JJJJJJJJJ   HH          HH
           RRRRRRRRRRR    555555555555        111         0000000000       0000000000     77777777777     JJJJJJJJJ   HH          HH
          RR        RR   55                  1111        00      0000  00       0000  77       77           JJ       HH          HH
         RR        RR   55                    11        00     00 00  00     00 00          77            JJ       HH          HH
        RR        RR   55                    11        00    00  00  00    00  00          77             JJ      HH          HH
       RRRRRRRRRRRR   555555555             11        00   00   00  00   00   00         77              JJ     HHHHHHHHHHHH
      RRRRRRRRRRR    5555555555            11        00  00    00  00  00    00         77              JJ     HHHHHHHHHHHH
     RR      RR                55         11        00 00     00  00 00     00         77             JJ     HH          HH
    RR      RR                55         11        0000      00  0000      00         77       JJ    JJ     HH          HH
   RR      RR                55         11        000       00  000       00         77       JJ    JJ     HH          HH
  RR      RR   555555555555   1111111111   0000000000   0000000000        77       JJJJJJJJ     HH          HH
 RR      RR   55555555555    1111111111   00000000     00000000         77        JJJJJJ      HH          HH


              JJJJJJJJJ   2222222222   555555555555   333333333
              JJJJJJJJJ  222222222222  555555555555  33333333333
                 JJ     22         22  55            33         33
                 JJ                22  55                       33
                 JJ                22  55                       33
                 JJ               22   555555555             3333
                 JJ             22     5555555555            3333
                 JJ           22                55              33
          JJ     JJ         22                  55              33
          JJ     JJ       22                    55   33         33
          JJJJJJJJ       222222222222  555555555555  33333333333
           JJJJJJ        222222222222  55555555555    333333333
```

FSV RAT27
P4501 Running
Start P3102
231.6KV

```
RRRRRRRRRRR
RRRRRRRRRRRR
RR        RR
RR        RR
RR        RR
RRRRRRRRRRRR
RRRRRRRRRRR
RR    RR
RR     RR
RR      RR
RR       RR
RR        RR
```

```
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
****R  START  JOB  253  R51007JH  NUCLEAR NEMD        ROOM @@@@  10.25.17 AM 18 MAY 82  R1.PR1  SYS AA32  JOB  253  START  R****
```

WSCC POWER FLOW PROGRAM REVISION 55
POWER FLOW HISTORY TAPE - - - FORMAT 8

UNLESS NOTED OTHERWISE DIAGNOSTICS WILL APPEAR ABOVE THE
DATA WHICH HAS THE ERROR.

#3 BLUE
#4 RED

CONTROL CARD 17 6 0 0 0 0 0 0.0 0.0 00 0

CONTROL CARD HDG 0 0 0 0 0 0 0.0 0.0 00 0

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82
PLANT OFF LINE-18.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT27

CONTROL CARD DAS 0 0 0 0 0 0 0.0 0.0 00 0

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FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF CR0150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA ESVBAT27

INPUT DATA LISTING

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
ENTERING DATA INPUT ROUTINE-ALL BUS CARDS WILL BE PROCESSED FIRST
          BE     ZS.V.1NE230.FS                                        1007
          B      AST.VEN.230.PS
          B      D EQ TAP4.16PS
          B      SHVAC EQ4.16PS
          B      E SWGR 14.16PS
          B      FLCSWER44.16PS 37.6 24.0
          B      FMCXFMR64.16PS 51.9 32.4
          B      F P3104 4.16PS 37.6 24.0
          B      F P4101 4.16PS131.286.46
          B      GLCSWGR1.480PS
          B      H CR201 .480PS 6.36 4.25
          B      H N9219 .480PS 3.73 2.50
          B      H N9223A.480PS 3.73 2.50
          B      H N9223C.480PS 3.73 2.50
          B      H N9236 .480PS 6.49 4.35
          B      H N9240 .480PS 3.04 2.03
          B      H P2101 .480PS11.61 7.77
          B      H P2104 .480PS11.61 7.77
          B      H P3106 .480PS11.95 8.00
          B      H P4103 .480PS
          B      H P411RS.480PS
          B      H P4201 .480PS12.09 8.09
          B      H P4501 .480PS12.09 8.09
          B      H P4601 .480PS 7.88 5.27
          B      J SWGR 24.16PS
          B      K C2401 4.16PS
          B      K P3102 4.16PS327.9 1312
          B      LLCSWGR2.480PS
          B      M C2109 .480PS
          B      M C7307 .480PS
          B      M CR201S.480PS 6.47 4.08
          B      M N9219 .480PS 3.17 1.99
          B      M N9220 .480PS 3.17 1.99
          B      M N9230 .480PS 3.17 1.99
          B      M N9246 .480PS 4.99 3.15
          B      M P2101S.480PS
          B      M P2102S.480PS11.82 7.45
          B      M P2103 .480PS
          B      N P4202 .480PS12.10 7.62
          B      M P4601S.480PS
          B      M P4602S.480PS
          B      N P5107X.480PS
          B      N PR401S.480PS 8.16 5.14
          B      M S7307S.480PS14.91 9.40
          B      M S7537 .480PS
          B      M S7539 .480PS
          B      N SWGR 34.16PS
          B      PLCSWGR54.16PS 37.2 24.0
          B      PMCXFMR74.16PS 56.0 32.6
```

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
B     P P3105 4.16PS
B     P P4102 4.16PS
B     GLCSVGR3.480PS
B     R C2109S.480PS
B     R C7307S.480PS 7.55 5.45
B     R C8203 .480PS
B     R N9208 .480PS 4.72 3.40
B     R N9231 .480PS 4.72 3.40
B     R N9236S.480PS 2.76 1.99
B     R N9241 .480PS 3.98 2.87
B     R N9247 .480PS
B     R P2102 .480PS11.33 8.17
B     R P2103S.480PS
B     R P2105 .480PS11.80 8.51
B     P P2107 .480PS
B     R P3106S.480PS11.66 8.41
B     R P4104 .480PS
B     R P4118 .480PS
B     R P4202S.480PS
B     R P4602 .480PS 7.69 5.54
B     RF5107SX.480PS 5.60 4.04
B     R P8401 .480PS
B     TRPHVAC 4.16PS 74.7 60.3
B     TIPHVAC 4.16PS
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAI27

INPUT DATA LISTING →

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#1 TAN
#2 GREEN
#3 BLUE
#4 RED

ALL BUS CARDS PROCESSED-WILL PROCESS LINE AND XFMR CARDS NEXT

```
L     ZS.V.INF230.  AST.VP4.230.    0000
L     D EQ TAP4.16  SHVAC EQ4.16    0000          .00035
L     D EQ TAP4.16  J SWGR 24.16    0000          .00001.00001
L     J SWGR 24.16  N SWGR 34.16    0000          .00001.00001
L     J SWGR 24.16  E SWGR 14.16    0000          .00001
L     E SWGR 14.16  ELCSWGR44.16    0000          .00001
L     E SWGR 14.16  EMCXFMR64.16    0000          .00107.00028
L     E SWGR 14.16  E P3104 4.16    0000          .00257.00126
L     E SWGR 14.16  E P4101 4.16    0000          .00128.00028
L     J SWGR 24.16  K C2401 4.16    0000          .00176.00117
L     J SWGR 24.16  K P3102 4.16    0000          .00235.00051
L     N SWGR 34.16  ELCSWGR54.16    0000          .00018.00026
L     N SWGR 34.16  EMCXFMR74.16    0000          .00086.00028
L     N SWGR 34.16  P P3105 4.16    0000          .00278.00135
L     N SWGR 34.16  P P4102 4.16    0000          .00117.00026
L     SHVAC EQ4.16  TRPHVAC 4.16    0000          .00177.00118
L     SHVAC EQ4.16  TTPHVAC 4.16    0000          .00161.00066
L     GLCSWGR1.480  H C8201 .480    0000          .00046.00010
L     GLCSWGR1.480  H N9219 .480    0000          .03320.00879
L     GLCSWGR1.480  H N9229A.480    0000          .02344.02179
L     GLCSWGR1.480  H N9229C.480    0000          .01094.01525
L     GLCSWGR1.480  H N9236 .480    0000          .03275.01598
L     GLCSWGR1.480  H N9240 .480    0000          .07031.00634
L     GLCSWGR1.480  H P2101 .480    0000          .07031.00634
L     GLCSWGR1.480  H P2106 .480    0000          .08268.03385
L     GLCSWGR1.480  H P3106 .480    0000          .08268.03385
L     GLCSWGR1.480  H P4103 .480    0000          .04679.02283
L     GLCSWGR1.480  H P4118S.480    0000          .05469.07626
L     GLCSWGR1.480  H P4201 .480    0000          .18130.08847
L     GLCSWGR1.480  H P4501 .480    0000          .15206.07420
L     GLCSWGR1.480  H P4601 .480    0000          .13569.06621
L     LLCSWGR2.480  M C2109 .480    0000          .07747.02051
L     LLCSWGR2.480  M C7307 .480    0000          .08767.01172
L     LLCSWGR2.480  M C8201S.480    0000          .08854.02344
L     LLCSWGR2.480  M N9218 .480    0000          .03320.00879
L     LLCSWGR2.480  M N9228 .480    0000          .03509.01712
L     LLCSWGR2.480  M N9230 .480    0000          .03760.02510
L     LLCSWGR2.480  M N9246 .480    0000          .01172.01088
L     LLCSWGR2.480  M P2101S.480    0000          .11398.01569
L     LLCSWGR2.480  M P2102S.480    0000          .06201.02539
L     LLCSWGR2.480  M P2103 .480    0000          .03445.01411
L     LLCSWGR2.480  M P4202 .480    0000          .06433.03139
L     LLCSWGR2.480  M P4601S.480    0000          .15206.07420
L     LLCSWGR2.480  M P4602S.480    0000          .04427.01172
L     LLCSWGR2.480  M P5107X.480    0000          .04427.01172
L     LLCSWGR2.480  M P5401S.480    0000          .17935.02413
L     LLCSWGR2.480  M S7307S.480    0000          .15938.04219
L     LLCSWGR2.480  M S7537 .480    0000          .02344.02179
L     LLCSWGR2.480  M S7538 .480    0000          .15343.02112
L     GLCSWGR3.480  P C2109S.480    0000          .21918.03016
                                                  .08767.01207
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 INPUT DATA LISTING
PLANT OFF LINE-14.0MVA PES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT27

#1 TAN
#2 GREEN
#3 BLUE
#4 RED

```
        L     GLCSWGR3.480  R C7307S.480    0000          .06198.01641
        L     GLCSWGR3.480  R CR203 .480    0000          .02214.00588
        L     GLCSWGR3.480  R N9208 .480    0000          .01367.01906
        L     GLCSWGR3.480  R N9231 .480    0000          .01367.01906
        L     GLCSWGR3.480  R N9236S.480    0000          .03516.00317
        L     GLCSWGR3.480  R N9241 .480    0000          .03516.00317
        L     GLCSWGR3.480  R N9247 .480    0000          .13151.01810
        L     GLCSWGR3.480  R P2102 .480    0000          .04823.01975
        L     GLCSWGR3.480  R P2103S.480    0000          .05264.02568
        L     GLCSWGR3.480  R P2105 .480    0000          .04034.01998
        L     GLCSWGR3.480  R P2107 .480    0000          .03445.01411
        L     GLCSWGR3.480  R P3106S.480    0000          .05381.02625
        L     GLCSWGR3.480  R P4104 .480    0000          .04297.05992
        L     GLCSWGR3.480  R P4118 .480    0000          .18715.09132
        L     GLCSWGR3.480  R P4202S.480    0000          .12867.06278
        L     GLCSWGR3.480  R P4602 .480    0000          .04427.01172
        L     GLCSWGP3.480  RP5107SX.480    0000          .14905.02051
        L     GLCSWGR3.480  R PR401 .480    0000          .14167.03750
        T     AST.VRN.230.  D EQ TAP4.16    0000  1400 .0006 .00881          224.2 4.16
        T     E SWGR 14.16  GLCSWGR1.480    0000   133 .0075 .04590          4.056 .480
        T     J SWGR 24.16  GLCSWGR2.480    0000   133 .0075 .04057          4.056 .480
        T     N SWGR 34.16  GLCSWGR3.480    0000   133 .006  .04027          4.056 .480

ENTERING SUBROUTINE SHUFLE
```

FI. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRD150 05-18-82 INPUT DATA LISTING
PLANT OFF LINE-19.0MVA RES AUX TRANSF IN SERVICE AC-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAI27

ALL BUS AND LINE CARDS PROCESSED-NOW PROCESS REG XFMR. AREA. REACTANCE SWITCHING AND DC LINES
A ZONE ONE ZS.V.INF230. 0.0 PS

********** WARNING-AES(TOTAL SCHEDULED GENERATION-TOTAL LOAD-NET AREA EXPORT) .GT. .2*TOTAL LOAD FOR AREA ZONE ONE

SYSTEM DATA PROCESSED.

THERE WERE 0 FATAL ERRORS

RETURNING TO MAIN PROGRAM

CONTROL CARD SOL 0 0 0 0 -30 ZS.V.INF230. 0 0.0 0.0 DD 0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

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FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82
PLANT OFF LINE-14.0MVA PES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVPAT27

RENUMBERING OF 73 NODES WILL REQUIRE 72 OFF DIAGONALS
THE MAXIMUM NUMBER OF BRANCHES IS 20 5/18/1982 10: 8:38
BEGIN SOLUTION WITH 73 BUSES AND 72 BRANCHES

ITERATION	SUM OF ABSOLUTE MISMATCHES-PU MEGAWATTS	MEGAVARS	BUSES UNSOLVED	MATRIX SIZE
1	11.145	321.545	47	572
2	5.885	28.062	48	572
3	1.005	0.955	43	572
4	0.017	0.011	5	572
5	0.000	0.000	0	572

ADJUSTMENTS MADE AT START OF ITERATION

R	BQ RN	BP RM	BV	BQ	BC	BG	BX	TIES	DC
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

5/18/1982 10: 8:39

CASE SOLVED

ENTERING TAPE4

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

TYPE OF BUS		ACTUAL	MAXIMUM
P AND E - NO G LIMITS	(BE)	1	2000
P AND Q - NO V LIMITS	(B)	72	2000
DC TERMINAL BUSES	(BD)	0	20
TOTAL NON-REGULATING BUSES		73	2000
P AND E - SELF VAR LIMITS	(BQ)	0	1200
P AND E - USE REMOTE VARS	(BC)	0	50
P AND Q - V LIMITS	(BV)	0	1200
P - SUPPLY REMOTE VARS	(BG)	0	250
TOTAL REGULATING BUSES		0	1200
TOTAL BUSES THIS STUDY		73	2000
ASSOCIATED WITH NON-REG ARE			
P AND Q - V BY REG XFMR	(BT)	0	200
SWITCHED REACTANCE BUSES	(BX)	0	100

P .U. VOLTAGE LIMITS ARE 0.70 TO 1.50

TYPE OF LINE (SECTION)		ACTUAL	MAXIMUM
BUS TIES	(Z=0)	0	200
FIXED TAP XFMR	(T)	4	3500
FIXED PHASE SHIFTER	(TP)	0	100
VARIABLE TAP OR PHASE	(R)	0	200
DC LINES-TWO TERMINAL	(LD)	0	10
LINE EQUIVALENTS	(E)	0	3500
NORMAL PI LINES	(L)	68	3500
TOTAL LINE SECTIONS		72	3500
TOTAL BRANCHES		72	3500

MISCELLANEOUS INFORMATION		
NO. OF ITERATIONS	5	30
NO. OF INTERCHANGE AREAS	1	60
NO. OF ZONES	1	90
NO. OF BUSES OUT OF TOLERANCE	0	0
TOLERANCE AT EACH BUS-MW OR MVAR		0.01000

TIE LINE CONTROL NOT EXERCISED

SYSTEM DATA	MEGAWATTS	MEGAVARS
TOTAL LOAD	988.180	1755.470
LOSSES-I*I(R+X)	51.046	597.999
CHARGING-E*E(Y-PI),	0.0	0.0
NET SHUNT ADM	0.0	0.0
SYSTEM MISMATCH	0.000	0.000
TOTAL GENERATION	1039.226	2353.469
MAXIMUM POWER	0.0	
PMAX LESS GENERATION	-1039.226	

NOTE-- CHARGING INCLUDES REAL AND REACTIVE COMPONENTS OF POWER (P+JQ) DERIVED FROM EQUIVALENT Y-PI LINES
(SC ' ARE DEVELOPED INTERNALLY FROM COMPOSITE LINES COMBINED USING ABCD CONSTANTS)
P(HARGING) IS TREATED AS A MW LOAD
Q(HARGING) IS TREATED AS A SOURCE (MVAR)
BOT MAY BE EITHER POSITIVE OR NEGATIVE

SYSTEM SLACK BUS IS ZS.V.INF230.

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FOR THE BUSSES LISTED BELOW PGEN IS NEGATIVE, PMAX IS
LESS THAN PGEN, OR PMAX IS POSITIVE AND PGEN IS ZERO:

BUS NAME	KV	ZONE	AREA	PGEN (MW)	PMAX (MW)
?S.V.INF230.		PS	ZONE ONE	1039.23	0.0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF GENERATOR DATA

BUS NAME	PGEN MW	PMAX MW	QGEN MVAR	QMAX MVAR	QMIN MVAR	ACTUAL VOLTAGE	DESIRED VOLTAGE	
ZS.V.INF230.	1039.23	0.0	2353.47			1.007		SYSTEM SLACK BUS

SUMMARY OF 0 BUSES WITH VOLTAGE OVER 1.05 PER UNIT

SUMMARY OF 71 BUSES WITH VOLTAGE UNDER 0.95 PER UNIT

BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV
D EQ TAP4.16	PS	0.822	3.4	E SWGR 14.16	PS	0.821	3.4	F P3104 4.16	PS	0.821	3.4
F P4101 4.16	PS	0.817	3.4	FLCSWGR44.16	PS	0.821	3.4	FMCXFMR64.16	PS	0.819	3.4
GLCSWGR1.480	PS	0.795	0.4	H C8201 .480	PS	0.792	0.4	H N9219 .480	PS	0.793	0.4
H N9229A.480	PS	0.794	0.4	H N9229C.480	PS	0.793	0.4	H N9236 .480	PS	0.789	0.4
H N9240 .480	PS	0.792	0.4	H P2101 .480	PS	0.779	0.4	H P2106 .480	PS	0.779	0.4
H P3106 .480	PS	0.785	0.4	H P4103 .480	PS	0.795	0.4	H P4118S.480	PS	0.795	0.4
H P4201 .480	PS	0.763	0.4	H P4501 .480	PS	0.767	0.4	H P4601 .480	PS	0.786	0.4
J SWGR 24.16	PS	0.821	3.4	K C2401 4.16	PS	0.821	3.4	K P3102 4.16	PS	0.816	3.4
LLCSWGR2.480	PS	0.814	0.4	M C2109 .480	PS	0.814	0.4	M C7307 .480	PS	0.814	0.4
M C8201S.480	PS	0.811	0.4	M N9218 .480	PS	0.812	0.4	M N9220 .480	PS	0.812	0.4
M N9230 .480	PS	0.813	0.4	M N9246 .480	PS	0.806	0.4	M P2101S.480	PS	0.814	0.4
M P2102S.480	PS	0.808	0.4	M P2103 .480	PS	0.814	0.4	M P4202 .480	PS	0.783	0.4
M P4601S.480	PS	0.814	0.4	M P4602S.480	PS	0.814	0.4	M P5107X.480	PS	0.814	0.4
M P8491S.480	PS	0.795	0.4	M S7307S.480	PS	0.807	0.4	M S7537 .480	PS	0.814	0.4
M S7538 .480	PS	0.814	0.4	N SWGR 34.16	PS	0.821	3.4	P P3105 4.16	PS	0.821	3.4
P P4102 4.16	PS	0.821	3.4	PLCSWGR54.16	PS	0.821	3.4	PMCXFMR74.16	PS	0.819	3.4
RLCSWGR3.480	PS	0.809	0.4	R C2109S.480	PS	0.809	0.4	R C7307S.480	PS	0.802	0.4
R C8203 .480	PS	0.809	0.4	R N9208 .480	PS	0.808	0.4	R N9231 .480	PS	0.808	0.4
R N9236S.480	PS	0.808	0.4	R N9241 .480	PS	0.807	0.4	R N9247 .480	PS	0.809	0.4
R P2102 .480	PS	0.800	0.4	R P2103S.480	PS	0.809	0.4	R P2105 .480	PS	0.801	0.4
R P2107 .480	PS	0.809	0.4	R P3106S.480	PS	0.799	0.4	R P4104 .480	PS	0.809	0.4
R P4118 .480	PS	0.809	0.4	R P4202S.480	PS	0.809	0.4	R P4602 .480	PS	0.804	0.4
R P8401 .480	PS	0.809	0.4	RP5107SX.480	PS	0.798	0.4	SHVAC EQ4.16	PS	0.822	3.4
TRPHVAC 4.16	PS	0.820	3.4	TTPHVAC 4.16	PS	0.822	3.4				

THERE ARE NO OVERLOADED TRANSMISSION LINES

SUMMARY OF OVERLOADED TRANSFORMERS

FROM BUS	ZONE	TO BUS	ZONE	CKT	MVA FLOW	RATING	PERCENT
AST.VRN.230.	PS	D EQ TAP4.16	PS		2551.8	1400.0	182.3

THERE ARE NO REGULATING TRANSFORMERS

SUMMARY OF LOSSES BY OWNER IN MEGAWATTS

OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES
	51.046						

********** TOTAL SYSTEM LOSSES ARE 51.046 MW **********

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 ALPHABETIC BUS LIST PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 10: 8:39
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA ESVRAT27

BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME
AST.VRN.230.	(PS)	ZONE ONE	D EQ TAP4.16	(PS)	ZONE ONE	E SWGR 14.16	(PS)	ZONE ONE	F P3104 4.16	(PS)	ZONE ONE
F P4101 4.16	(PS)	ZONE ONE	ELCSWGR44.16	(PS)	ZONE ONE	FMCXFMR44.16	(PS)	ZONE ONE	GLCSWGR1.480	(PS)	ZONE ONE
H CP201 .480	(PS)	ZONE ONE	H N9219 .480	(PS)	ZONE ONE	H N9229A.480	(PS)	ZONE ONE	H N9229C.480	(PS)	ZONE ONE
H N9236 .480	(PS)	ZONE ONE	H N9240 .480	(PS)	ZONE ONE	H P2101 .480	(PS)	ZONE ONE	H P2106 .480	(PS)	ZONE ONE
H P3106 .480	(PS)	ZONE ONE	H P4103 .480	(PS)	ZONE ONE	H P4118S.480	(PS)	ZONE ONE	H P4201 .480	(PS)	ZONE ONE
H P4501 .480	(PS)	ZONE ONE	H P4601 .480	(PS)	ZONE ONE	J SWGR 24.16	(PS)	ZONE ONE	K C2401 4.16	(PS)	ZONE ONE
K P3102 4.16	(PS)	ZONE ONE	LLCSWGR2.480	(PS)	ZONE ONE	M C2109 .480	(PS)	ZONE ONE	M C7307 .480	(PS)	ZONE ONE
M CP201S.480	(PS)	ZONE ONE	M N9218 .480	(PS)	ZONE ONE	M N9220 .480	(PS)	ZONE ONE	M N9230 .480	(PS)	ZONE ONE
M N9246 .480	(PS)	ZONE ONE	M P2101S.480	(PS)	ZONE ONE	M P2102S.480	(PS)	ZONE ONE	M P2103 .480	(PS)	ZONE ONE
M P4202 .480	(PS)	ZONE ONE	M P4601S.480	(PS)	ZONE ONE	M P4602S.480	(PS)	ZONE ONE	M P5107X.480	(PS)	ZONE ONE
M P8401S.480	(PS)	ZONE ONE	M S7307S.480	(PS)	ZONE ONE	M S7537 .480	(PS)	ZONE ONE	M S7538 .480	(PS)	ZONE ONE
N SWGF 34.16	(PS)	ZONE ONE	P P3105 4.16	(PS)	ZONE ONE	P P4102 4.16	(PS)	ZONE ONE	PLCSWGR54.16	(PS)	ZONE ONE
PMCXFMR74.16	(PS)	ZONE ONE	QLCSWGR3.480	(PS)	ZONE ONE	R C2109S.480	(PS)	ZONE ONE	R C7307S.480	(PS)	ZONE ONE
R CP203 .480	(PS)	ZONE ONE	R N9208 .480	(PS)	ZONE ONE	R N9231 .480	(PS)	ZONE ONE	R N9236S.480	(PS)	ZONE ONE
R N9241 .480	(PS)	ZONE ONE	R N9247 .480	(PS)	ZONE ONE	R P2102 .480	(PS)	ZONE ONE	R P2103S.480	(PS)	ZONE ONE
R P2105 .480	(PS)	ZONE ONE	R P2107 .480	(PS)	ZONE ONE	R P3106S.480	(PS)	ZONE ONE	R P4104 .480	(PS)	ZONE ONE
R P4118 .480	(PS)	ZONE ONE	R P4202S.480	(PS)	ZONE ONE	R P4602 .480	(PS)	ZONE ONE	R P8401 .480	(PS)	ZONE ONE
RP5107SX.480	(PS)	ZONE ONE	SHVAC EQ4.16	(PS)	ZONE ONE	TRPHVAC 4.16	(PS)	ZONE ONE	TTPHVAC 4.16	(PS)	ZONE ONE
ZS.V.INF230.	(PS)	ZONE ONE		( )			( )			( )	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12.1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 POWER FLOW REPORT PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAI27 5/18/1982 10: 8:39

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	GENERATION MW	GENERATION MVAR	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	ID	BUS NAME	LINE FLOWS MW	LINE FLOWS MVAR	LINE LOSSES MW	LINE LOSSES MVAR	PCT LOAD
AST.VRN.230.	0.9986	0.0	0.0	0.0	0.0	0.0	0.0							
229.7 KV	-0.2				TAP	224.20/	4.16	D	EQ TAP4.16	1039.2	2330.6	37.2	546.4	182.3*
									ZS.V.INF230.	-1039.2	-2330.6	0.0	22.8	
D EQ TAP4.16	0.8217	0.0	0.0	0.0	0.0	0.0	0.0							
3.4 KV	-5.5								AST.VRN.230.	-1002.0	-1784.2	37.2	546.4	146.2*
									J SWGR 24.16	927.1	1723.8	0.6	0.6	
									SHVAC EQ4.16	74.9	60.4	0.0	0.0	
E SWGR 14.16	0.8213	0.0	0.0	0.0	0.0	0.0	0.0							
3.4 KV	-5.5								F P3104 4.16	37.6	24.0	0.0	0.0	
									F P4101 4.16	131.9	86.9	0.7	0.4	
									ELCSWGR44.16	37.6	24.0	0.0	0.0	
									EMCXFMR64.16	52.0	32.5	0.1	0.1	
					TAP	4.06/	0.48		GLCSWGR1.480	97.9	73.7	1.6	9.7	92.1
									J SWGR 24.16	-357.0	-241.1	0.0	0.0	
F P3104 4.16	0.8207	0.0	0.0	37.6	24.0	0.0	0.0							
3.4 KV	-5.5								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
F P4101 4.16	0.8173	0.0	0.0	131.2	86.5	0.0	0.0							
3.4 KV	-5.5								E SWGR 14.16	-131.2	-86.5	0.7	0.4	
ELCSWGR44.16	0.8208	0.0	0.0	37.6	24.0	0.0	0.0							
3.4 KV	-5.5								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
EMCXFMR64.16	0.8192	0.0	0.0	51.9	32.4	0.0	0.0							
3.4 KV	-5.5								E SWGR 14.16	-51.9	-32.4	0.1	0.1	
GLCSWGR1.480	0.7949	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-8.9								E SWGR 14.16	-96.3	-64.0	1.6	9.7	86.9
									H CB201 .480	6.4	4.3	0.0	0.0	
									H N9219 .480	3.7	2.5	0.0	0.0	
									H N9229A.480	3.7	2.5	0.0	0.0	
									H N9229C.480	3.7	2.5	0.0	0.0	
									H N9236 .480	6.6	4.4	0.1	0.0	
									H N9240 .480	3.1	2.0	0.0	0.0	
									H P2101 .480	11.9	7.9	0.3	0.1	
									H P2106 .480	11.9	7.9	0.3	0.1	
									H P3106 .480	12.1	8.1	0.2	0.1	
									H P4103 .480	-0.0	-0.0	0.0	0.0	
									H P4118S.480	-0.0	-0.0	0.0	0.0	
									H P4201 .480	12.6	8.4	0.6	0.3	
									H P4501 .480	12.6	8.3	0.5	0.2	
									H P4601 .480	8.0	5.3	0.1	0.0	
H CB201 .480	0.7918	0.0	0.0	6.4	4.3	0.0	0.0							
0.4 KV	-8.8								GLCSWGR1.480	-6.4	-4.2	0.0	0.0	
H N9219 .480	0.7931	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-8.9								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229A.480	0.7930	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-8.9								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229C.480	0.7929	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-8.8								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

(.7949)(480) = 381.6V

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 POWER FLOW REPORT PAGE NO. 2
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT27 5/18/1982 10: 8:39

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	GENERATION MW	GENERATION MVAR	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	ID	BUS NAME	LINE FLOWS MW	LINE FLOWS MVAR	LINE LOSSES MW	LINE LOSSES MVAR	PCT LOAD
M N9236 .480	0.7888	0.0	0.0	6.5	4.4	0.0	0.0							
0.4 KV	-8.6								GLCSWGR1.480	-6.5	-4.3	0.1	0.0	
M N9240 .480	0.7928	0.0	0.0	3.0	2.0	0.0	0.0							
0.4 KV	-8.8								GLCSWGR1.480	-3.0	-2.0	0.0	0.0	
M P2101 .480	0.7792	0.0	0.0	11.6	7.8	0.0	0.0							
0.4 KV	-8.6								GLCSWGR1.480	-11.6	-7.8	0.3	0.1	
M P2106 .480	0.7792	0.0	0.0	11.6	7.8	0.0	0.0							
0.4 KV	-8.6								GLCSWGR1.480	-11.6	-7.8	0.3	0.1	
M P3106 .480	0.7855	0.0	0.0	12.0	8.0	0.0	0.0							
0.4 KV	-8.8								GLCSWGR1.480	-11.9	-8.0	0.2	0.1	
M P4103 .480	0.7949	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-8.9								GLCSWGR1.480	0.0	0.0	0.0	0.0	
M P4118S.480	0.7949	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-8.9								GLCSWGR1.480	0.0	0.0	0.0	0.0	
M P4201 .480	0.7629	0.0	0.0	12.1	8.1	0.0	0.0							
0.4 KV	-8.5								GLCSWGR1.480	-12.1	-8.1	0.6	0.3	
M P4501 .480	0.7665	0.0	0.0	12.1	8.1	0.0	0.0							
0.4 KV	-8.6								GLCSWGR1.480	-12.1	-8.1	0.5	0.2	
M P4601 .480	0.7858	0.0	0.0	7.9	5.3	0.0	0.0							
0.4 KV	-8.6								GLCSWGR1.480	-7.9	-5.3	0.1	0.0	
J SWGR 24.16	0.8214	0.0	0.0	0.0	0.0	0.0	0.0							
3.4 KV	-5.5								D EG TAP4.16	-926.5	-1723.3	0.6	0.6	
									E SWGR 14.16	357.0	241.1	0.0	0.0	
									K C2401 4.16	-0.0	-0.0	0.0	0.0	
									K P3102 4.16	332.8	1319.1	4.9	7.1	
						TAP	4.06/	0.48	LLCSWGR2.480	69.8	47.4	0.8	4.1	63.4
									N SWGR 34.16	166.9	115.7	0.0	0.0	
K C2401 4.16	0.8214	0.0	0.0	0.0	0.0	0.0	0.0							
3.4 KV	-5.5								J SWGR 24.16	0.0	0.0	0.0	0.0	
K P3102 4.16	0.8165	0.0	0.0	327.9	1312.0	0.0	0.0							
3.4 KV	-5.4								J SWGR 24.16	-327.9	-1312.0	4.9	7.1	
LLCSWGR2.480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								J SWGR 24.16	-69.8	-43.3	0.8	4.1	61.3
									M C2109 .480	-0.0	-0.0	0.0	0.0	
									M C7307 .480	-0.0	-0.0	0.0	0.0	
									M CR201S.480	6.5	4.1	0.0	0.0	
									M N9218 .480	3.2	2.0	0.0	0.0	
									M N9220 .480	3.2	2.0	0.0	0.0	
									M N9230 .480	3.2	2.0	0.0	0.0	
									M N9246 .480	5.1	3.2	0.1	0.0	
									M P2101S.480	-0.0	-0.0	0.0	0.0	
									M P2102S.480	11.9	7.5	0.1	0.0	
									M P2103 .480	-0.0	-0.0	0.0	0.0	
									M P4202 .480	12.6	7.9	0.5	0.2	
									M P4601S.480	-0.0	-0.0	0.0	0.0	
									M P4602S.480	-0.0	-0.0	0.0	0.0	
									M P5107X.480	-0.0	-0.0	0.0	0.0	

(.7665)(480) = 367.9V

(.8214)(4160) = 3417.0V

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID	BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
									M P8401S.480	8.4	5.2	0.2	0.1	
									M S7307S.480	15.0	9.5	0.1	0.1	
									M S7537 .480	-0.0	-0.0	0.0	0.0	
									M S7538 .480	-0.0	-0.0	0.0	0.0	
M C2109 .480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C7307 .480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C8201S.480	0.8108	0.0	0.0	6.5	4.1	0.0	0.0							
0.4 KV	-7.5								LLCSWGR2.480	-6.5	-4.1	0.0	0.0	
M N9218 .480	0.8122	0.0	0.0	3.2	2.0	0.0	0.0							
0.4 KV	-7.5								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9228 .480	0.8119	0.0	0.0	3.2	2.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9238 .480	0.8132	0.0	0.0	3.2	2.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9246 .480	0.8063	0.0	0.0	5.0	3.2	0.0	0.0							
0.4 KV	-7.3								LLCSWGR2.480	-5.0	-3.2	0.1	0.0	
M P2101S.480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P2102S.480	0.8076	0.0	0.0	11.8	7.5	0.0	0.0							
0.4 KV	-7.5								LLCSWGR2.480	-11.8	-7.4	0.1	0.0	
M P2103 .480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4202 .480	0.7832	0.0	0.0	12.1	7.6	0.0	0.0							
0.4 KV	-7.3								LLCSWGR2.480	-12.1	-7.6	0.5	0.2	
M P4601S.480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4602S.480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P5107X.480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P8401S.480	0.7948	0.0	0.0	8.2	5.1	0.0	0.0							
0.4 KV	-7.1								LLCSWGR2.480	-8.2	-5.1	0.2	0.1	
M S7307S.480	0.8071	0.0	0.0	14.9	9.4	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	-14.9	-9.4	0.1	0.1	
M S7537 .480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M S7538 .480	0.8139	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M SWGR 24.16	0.8214	0.0	0.0	0.0	0.0	0.0	0.0							
3.4 KV	-5.5								J SWGR 24.16	-166.9	-115.7	0.0	0.0	
									P P3105 4.16	-0.0	-0.0	0.0	0.0	
									P P4102 4.16	-0.0	-0.0	0.0	0.0	
									PLCSWGR54.16	37.2	26.0	0.0	0.0	
									PNCXFMR74.16	56.2	32.7	0.2	0.1	
					TAP	4.067	0.48		GLCSWGR3.480	73.5	57.0	0.9	4.9	69.9

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P3105 4.16	0.8214	0.0	0.0	0.0	0.0	0.0	0.0						
3.4 KV	-5.5							N SWGR 34.16	0.0	0.0	0.0	0.0	
P P4102 4.16	0.8214	0.0	0.0	0.0	0.0	0.0	0.0						
3.4 KV	-5.5							N SWGR 34.16	0.0	0.0	0.0	0.0	
PLCSWGR34.16	0.8209	0.0	0.0	37.2	26.0	0.0	0.0						
3.4 KV	-5.5							N SWGR 34.16	-37.2	-26.0	0.0	0.0	
PMCXFMR74.16	0.8189	0.0	0.0	56.0	32.6	0.0	0.0						
3.4 KV	-5.5							N SWGR 34.16	-56.0	-32.6	0.2	0.1	
QLCSWGR3.480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							N SWGR 34.16	-72.6	-52.1	0.9	4.9	67.1
								R C2109S.480	-0.0	-0.0	0.0	0.0	
								R C7307S.480	7.6	5.5	0.1	0.0	
								R CR203 .480	-0.0	-0.0	0.0	0.0	
								R N9208 .480	4.7	3.4	0.0	0.0	
								R N9231 .480	4.7	3.4	0.0	0.0	
								R N9236S.480	2.8	2.0	0.0	0.0	
								R N9241 .480	4.0	2.9	0.0	0.0	
								R N9247 .480	-0.0	-0.0	0.0	0.0	
								R P2102 .480	11.5	8.2	0.1	0.1	
								R P2103S.480	-0.0	-0.0	0.0	0.0	
								R P2105 .480	11.9	8.6	0.1	0.1	
								R P2107 .480	-0.0	-0.0	0.0	0.0	
								R P3106S.480	11.8	8.5	0.2	0.1	
								R P4104 .480	-0.0	-0.0	0.0	0.0	
								R P4118 .480	-0.0	-0.0	0.0	0.0	
								R P4202S.480	-0.0	-0.0	0.0	0.0	
								R P4602 .480	7.8	5.6	0.1	0.0	
								R P8401 .480	-0.0	-0.0	0.0	0.0	
								RP5107SX.480	5.7	4.1	0.1	0.0	
R C2109S.480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R C7307S.480	0.8022	0.0	0.0	7.6	5.5	0.0	0.0						
0.4 KV	-7.4							QLCSWGR3.480	-7.5	-5.4	0.1	0.0	
R CR203 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R N9208 .480	0.8076	0.0	0.0	4.7	3.4	0.0	0.0						
0.4 KV	-7.7							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9231 .480	0.8076	0.0	0.0	4.7	3.4	0.0	0.0						
0.4 KV	-7.7							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9236S.480	0.8079	0.0	0.0	2.8	2.0	0.0	0.0						
0.4 KV	-7.6							QLCSWGR3.480	-2.8	-2.0	0.0	0.0	
R N9241 .480	0.8074	0.0	0.0	4.0	2.9	0.0	0.0						
0.4 KV	-7.5							QLCSWGR3.480	-4.0	-2.9	0.0	0.0	
R N9247 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2102 .480	0.8004	0.0	0.0	11.3	8.2	0.0	0.0						
0.4 KV	-7.5							QLCSWGR3.480	-11.3	-8.2	0.1	0.1	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 POWER FLOW REPORT PAGE NO. 5
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT27 5/18/1982 10: 8:39

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION... MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID / BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
R P21035.480	0.8052	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2105 .480	0.8010	0.0	0.0	11.8	8.5	0.0	0.0	----------					
0.4 KV	-7.5							QLCSWGR3.480	-11.8	-8.5	0.1	0.1	
R P2107 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P31365.480	0.7986	0.0	0.0	11.7	8.4	0.0	0.0	----------					
0.4 KV	-7.5							QLCSWGR3.480	-11.7	-8.4	0.2	0.1	
R P4104 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4118 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P42025.480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4602 .480	0.8042	0.0	0.0	7.7	5.5	0.0	0.0	----------					
0.4 KV	-7.5							QLCSWGR3.480	-7.7	-5.5	0.1	0.0	
R P8451 .480	0.8092	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.4 KV	-7.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
RP5107SX.480	0.7977	0.0	0.0	5.6	4.0	0.0	0.0	----------					
0.4 KV	-7.2							QLCSWGR3.480	-5.6	-4.0	0.1	0.0	
SHVAC EQ4.16	0.8217	0.0	0.0	0.0	0.0	0.0	0.0	----------					
3.4 KV	-5.5							D EQ TAP4.16	-74.9	-60.4	0.0	0.0	
								TRPHVAC 4.16	74.9	60.4	0.2	0.1	
								TTPHVAC 4.16	-0.0	-0.0	0.0	0.0	
TRPHVAC 4.16	0.8197	0.0	0.0	74.7	60.3	0.0	0.0	----------					
3.4 KV	-5.5							SHVAC EQ4.16	-74.7	-60.3	0.2	0.1	
TTPHVAC 4.16	0.8217	0.0	0.0	0.0	0.0	0.0	0.0	----------					
3.4 KV	-5.5							SHVAC EQ4.16	0.0	0.0	0.0	0.0	
ZS.V.INF230.	1.0070	1039.2	2353.5	0.0	0.0	0.0	0.0	----------					
231.6 KV	0.0							AST.VRN.230.	1039.2	2353.5	0.0	22.9	

END OF REPORT FOR THIS CASE

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
R		AST.VRN.230.	PS												00	
B		D EQ TAP4.16	PS												00	
B		E SWGR 14.16	PS												00	
B		F P3104 4.16	PS	37.6	24.0										00	
B		F P4101 4.16	PS	131.2	86.5										00	
B		FLCSWGR44.16	PS	37.6	24.0										00	
B		FRCXFMR64.16	PS	51.9	32.4										00	
B		GLCSWGR1.480	PS												00	
B		H C8201 .480	PS	6.4	4.3										00	
B		H N9219 .480	PS	3.7	2.5										00	
B		H N9229A.480	PS	3.7	2.5										00	
B		H N9229C.480	PS	3.7	2.5										00	
B		H N9236 .480	PS	6.5	4.3										00	
B		H N9240 .480	PS	3.0	2.0										00	
B		H P2101 .480	PS	11.6	7.8										00	
B		H P2106 .480	PS	11.6	7.8										00	
B		H P3106 .480	PS	11.9	8.0										00	
B		H P4103 .480	PS												00	
B		H P4118S.480	PS												00	
B		H P4201 .480	PS	12.1	8.1										00	
B		H P4501 .480	PS	12.1	8.1										00	
R		H P4601 .480	PS	7.9	5.3										00	
B		J SWGR 24.16	PS												00	
R		K C2401 4.16	PS												00	
B		K P3102 4.16	PS	327.9	1312.0										00	
B		LLCSWGR2.480	PS												00	
R		M C2102 .480	PS												00	
B		M C7307 .480	PS												00	
B		M CR201S.480	PS	6.5	4.1										00	
B		M N9218 .480	PS	3.2	2.0										00	
B		M N9220 .480	PS	3.2	2.0										00	
B		M N9230 .480	PS	3.2	2.0										00	
B		M N9246 .480	PS	5.0	3.1										00	
B		M P2101S.480	PS												00	
B		M P2102S.480	PS	11.8	7.4										00	
B		M P2103 .480	PS												00	
B		M P4202 .480	PS	12.1	7.6										00	
B		M P4601S.480	PS												00	
B		M P4602S.480	PS												00	
B		M P5107X.480	PS												00	
R		N P8401S.480	PS	8.2	5.1										00	
B		N S7307S.480	PS	14.9	9.4										00	
B		N S7537 .480	PS												00	
B		N S7538 .480	PS												00	
B		N SWGR 34.16	PS												00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
R		P P5105 4.16	PS												00	
B		P P4102 4.16	PS												00	
B		PLCSWGR54.16	PS	37.2	26.0										00	
B		PMCXFMR74.16	PS	56.0	32.6										00	
B		QLCSWGR3.480	PS												00	
B		R C2109S.480	PS												00	
B		R C7307S.480	PS	7.5	5.4										00	
B		R CR203 .480	PS												00	
B		R N9208 .480	PS	4.7	3.4										00	
B		R N9231 .480	PS	4.7	3.4										00	
B		R N9236S.480	PS	2.8	2.0										00	
B		R N9241 .480	PS	4.0	2.9										00	
B		R N9247 .480	PS												00	
B		R P2102 .480	PS	11.3	8.2										00	
B		R P2103S.480	PS												00	
B		R P2105 .480	PS	11.8	8.5										00	
B		R P2107 .480	PS												00	
B		R P3106S.480	PS	11.7	8.4										00	
B		R P4104 .480	PS												00	
B		R P411R .480	PS												00	
B		R P4202S.480	PS												00	
B		R P4602 .480	PS	7.7	5.5										00	
B		S P8401 .480	PS												00	
B		RPS107SX.480	PS	5.6	4.0										00	
B		SHVAC EQ4.16	PS												00	
B		TRFHVAC 4.16	PS	74.7	60.3										00	
B		TTPHVAC 4.16	PS												00	
HE		ZS.V.1NF230.	PS						1039.2			1.007			00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
AST.VRN.230.	ZS.V.IRF230.	L							0.0003								(R)
230.	D EQ TAP4.16	T				1400.		0.0006	0.0088					224.20	4.16	FIX TAP	
D EQ TAP4.16	AST.VRN.230.	T				1400.		0.0006	0.0088					4.16	224.20	FIX TAP	(R)
4.16	SHVAC EQ4.16	L															
4.16	J SWGR 24.16	L															
E SWGR 14.16	ELCSWGR44.16	L						0.0011	0.0003								
4.16	EMCXFMR64.16	L						0.0026	0.0013								
4.16	E P3104 4.16	L						0.0013	0.0003								
4.16	E P4101 4.16	L						0.0018	0.0012								
4.16	GLCSWGR1.480	T				133.0		0.0075	0.0459					4.06	0.48	FIX TAP	
4.16	J SWGR 24.16	L															(R)
E P3104 4.16	E SWGR 14.16	L						0.0013	0.0003								(R)
E P4101 4.16	E SWGR 14.16	L						0.0018	0.0012								(R)
ELCSWGR44.16	E SWGR 14.16	L						0.0011	0.0003								(R)
EMCXFMR64.16	E SWGR 14.16	L						0.0026	0.0013								(R)
GLCSWGR1.480	E SWGR 14.16	T				133.0		0.0075	0.0459					0.48	4.06	FIX TAP	(R)
.480	H CB201 .480	L						0.0332	0.0088								
.480	H N9219 .480	L						0.0234	0.0218								
.480	H N9229A.480	L						0.0109	0.0152								
.480	H N9229C.480	L						0.0328	0.0160								
.480	H N9237 .480	L						0.0703	0.0063								
.480	H N9240 .480	L						0.0703	0.0063								
.480	H P2101 .480	L						0.0827	0.0338								
.480	H P2106 .480	L						0.0827	0.0338								
.480	H P3106 .480	L						0.0468	0.0228								
.480	H P4103 .480	L						0.0547	0.0763								
.480	H P4118S.480	L						0.1813	0.0885								
.480	H P4201 .480	L						0.1521	0.0742								
.480	H P4501 .480	L						0.1357	0.0662								
.480	H P4601 .480	L						0.0775	0.0205								
H CB201 .480	GLCSWGR1.480	L						0.0332	0.0088								(R)
H N9219 .480	GLCSWGR1.480	L						0.0234	0.0218								(R)
H N9229A.480	GLCSWGR1.480	L						0.0109	0.0152								(R)
H N9229C.480	GLCSWGR1.480	L						0.0328	0.0160								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	.....Z-PI..... R	X	.....Y-PI1..... G1	B1	.....Y-PI2..... G2	B2	TAP 1	TAP 2	REMARKS	
H N9234 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H N9240 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H P2101 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H P2106 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H P3106 .480	GLCSWGR1.480	L						0.0468	0.0228								(R)
H P4103 .480	GLCSWGR1.480	L						0.0547	0.0763								(R)
H P4118S.480	GLCSWGR1.480	L						0.1817	0.0885								(R)
H P4201 .480	GLCSWGR1.480	L						0.1521	0.0742								(R)
H P4501 .480	GLCSWGR1.480	L						0.1357	0.0662								(R)
H P4601 .480	GLCSWGR1.480	L						0.0775	0.0205								(R)
J SWGR 24.16	D EQ TAP4.16	L															(R)
4.16	E SWGR 14.16	L															
4.16	K C2401 4.16	L						0.0024	0.0005								
4.16	K P3102 4.16	L						0.0002	0.0003								
4.16	LLCSWGR2.480	T				133.0		0.0075	0.0406					4.06	0.48	FIX TAP	
4.16	N SWGR 34.16	L															
K C2401 4.16	J SWGR 24.16	L						0.0024	0.0005								(R)
K P3102 4.16	J SWGR 24.16	L						0.0002	0.0003								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
LLCSWGR2.480	J SWGR 24.16	T				133.0		0.0075	0.0406					0.48	4.06	FIX TAP (R)
.480	M C2189 .480	L						0.0877	0.0117							
.480	M C7307 .480	L						0.0885	0.0234							
.480	M CR201S.480	L						0.0332	0.0088							
.480	M N9218 .480	L						0.0351	0.0171							
.480	M N9220 .480	L						0.0376	0.0251							
.480	M N9230 .480	L						0.0117	0.0109							
.480	M N9246 .480	L						0.1140	0.0157							
.480	M P2101S.480	L						0.0620	0.0254							
.480	M P2102S.480	L						0.0345	0.0141							
.480	M P2103 .480	L						0.0643	0.0314							
.480	M P4202 .480	L						0.1521	0.0742							
.480	M P4601S.480	L						0.0443	0.0117							
.480	M P4602S.480	L						0.0443	0.0117							
.480	M P5107X.480	L						0.1753	0.0241							
.480	M P8401S.480	L						0.1554	0.0422							
.480	M S7307S.480	L						0.0234	0.0218							
.480	M S7537 .480	L						0.1534	0.0211							
.480	M S7538 .480	L						0.2192	0.0302							
M C2189 .480	LLCSWGR2.480	L						0.0877	0.0117							(R)
M C7307 .480	LLCSWGR2.480	L						0.0885	0.0234							(R)
M CR201S.480	LLCSWGR2.480	L						0.0332	0.0088							(R)
M N9218 .480	LLCSWGR2.480	L						0.0351	0.0171							(R)
M N9220 .480	LLCSWGR2.480	L						0.0376	0.0251							(R)
M N9230 .480	LLCSWGR2.480	L						0.0117	0.0109							(R)
M N9246 .480	LLCSWGR2.480	L						0.1140	0.0157							(R)
M P2101S.480	LLCSWGR2.480	L						0.0620	0.0254							(R)
M P2102S.480	LLCSWGR2.480	L						0.0345	0.0141							(R)
M P2103 .480	LLCSWGR2.480	L						0.0643	0.0314							(R)
M P4202 .480	LLCSWGR2.480	L						0.1521	0.0742							(R)
M P4601S.480	LLCSWGR2.480	L						0.0443	0.0117							(R)
M P4602S.480	LLCSWGR2.480	L						0.0443	0.0117							(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
M P5107X.480	LLCSWGR2.480	L						0.1753	0.0241								(P)
M P8401S.480	LLCSWGR2.480	L						0.1594	0.0422								(P)
M S73075.480	LLCSWGR2.480	L						0.0234	0.0218								(P)
M S7537 .480	LLCSWGR2.480	L						0.1534	0.0211								(P)
M S7538 .480	LLCSWGR2.480	L						0.2192	0.0302								(P)
B SWGR 34.16	J SWGR 24.16	L															(P)
4.16	PLCSWGR54.16	L						0.0009	0.0003								
4.16	PMCXFMR74.16	L						0.0028	0.0014								
4.16	P P3105 4.16	L						0.0012	0.0003								
4.16	P P4102 4.16	L						0.0018	0.0012								
4.16	GLCSWGR3.480	T				133.0		0.0075	0.0403					4.06	0.48	FIX TAP	
P P3105 4.16	N SWGR 34.16	L						0.0012	0.0003								(P)
P P4102 4.16	N SWGR 34.16	L						0.0018	0.0012								(P)
PLCSWGR54.16	N SWGR 34.16	L						0.0009	0.0003								(P)
PMCXFMR74.16	N SWGR 34.16	L						0.0028	0.0014								(P)
GLCSWGR3.480	N SWGR 34.16	T				133.0		0.0075	0.0403					0.48	4.06	FIX TAP	(P)
.480	R C21095.480	L						0.0877	0.0121								
.480	R C73075.480	L						0.0620	0.0164								
.480	R C8203 .480	L						0.0221	0.0059								
.480	R N9208 .480	L						0.0137	0.0191								
.480	R N9231 .480	L						0.0137	0.0191								
.480	R N9236S.480	L						0.0352	0.0032								
.480	R N9241 .480	L						0.0352	0.0032								
.480	R N9247 .480	L						0.1315	0.0181								
.480	R P2102 .480	L						0.0482	0.0198								
.480	R P2103S.480	L						0.0526	0.0257								
.480	R P2105 .480	L						0.0409	0.0200								
.480	R P2107 .480	L						0.0345	0.0141								
.480	R P3106S.480	L						0.0538	0.0263								
.480	R P4104 .480	L						0.0430	0.0599								
.480	R P4118 .480	L						0.1872	0.0913								
.480	R P4202S.480	L						0.1207	0.0628								
.480	R P4302 .480	L						0.0443	0.0117								
.480	PF5107SX.480	L						0.1490	0.0205								
.480	R P8401 .480	L						0.1417	0.0375								

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
C21095.480	GLCSWGR3.480	L						0.0877	0.0121								(R)
C23075.480	GLCSWGR3.480	L						0.0620	0.0164								(R)
C8203 .480	GLCSWGR3.480	L						0.0221	0.0059								(R)
N9208 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
N9231 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
N9236S.480	GLCSWGR3.480	L						0.0352	0.0832								(R)
N9241 .480	GLCSWGR3.480	L						0.0352	0.0032								(R)
N9247 .480	GLCSWGR3.480	L						0.1315	0.0181								(R)
P2102 .480	GLCSWGR3.480	L						0.0482	0.0198								(R)
P2103S.480	GLCSWGR3.480	L						0.0526	0.0257								(R)
P2105 .480	GLCSWGR3.480	L						0.0409	0.0200								(R)
P2107 .480	GLCSWGR3.480	L						0.0345	0.0141								(R)
P3106S.480	GLCSWGR3.480	L						0.0538	0.0263								(R)
P4104 .480	GLCSWGR3.480	L						0.0430	0.0599								(R)
P4118 .480	GLCSWGR3.480	L						0.1872	0.0913								(R)
P4202S.480	GLCSWGR3.480	L						0.1287	0.0628								(R)
P4602 .480	GLCSWGR3.480	L						0.0443	0.0117								(R)
P8401 .480	GLCSWGR3.480	L						0.1417	0.0375								(R)
RP51075X.480	GLCSWGR3.480	L						0.1490	0.0205								(R)
SHVAC E04.16	P E0 TAP4.16	L															(R)
4.16	TRPHVAC 4.16	L						0.0016	0.0007								
4.16	TIPHVAC 4.16	L						0.0005	0.0002								
TRPHVAC 4.16	SHVAC E04.16	L						0.0016	0.0007								(R)
TIPHVAC 4.16	SHVAC E04.16	L						0.0005	0.0002								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--PEF GR0150 85-1B-R2 DATA TABLE LISTING PAGE NO. 8
PLANT OFF LINE-14.8MVA RES AUX TRANSF IN SERVICE AC-DC 5/18/1982 10: 8:39
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT27

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	O	R	X	G1	B1	G2	B2	TAP 1	TAP 2	REMARKS
							N	.....Z-PI.....		.....Y-PI1.....		.....Y-PI2.....				
FS.V.INF230-	AST.VRN.230.	L							0.0003							

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

PROGRAM CONSTANTS SUBJECT TO MODIFICATION UNDER CONTROL CARD TYPE 6 (TOL)
(SEE POWER FLOW MANUAL.)

#3 BLUE
#4 RED

NUMBER OF DECIMAL PLACES FOR MAPPING

BUS VOLTAGE MAGNITUDE (P.U.)	3
BUS VOLTAGE ANGLE (DEGREES)	2
LOAD AND GENERATION (MW AND MVAR)	2
CAPACITORS AND REACTORS (MW AND MVAR)	2
LINE FLOWS (MW AND MVAR)	2
TRANSFORMER TAPS (P.U.)	3

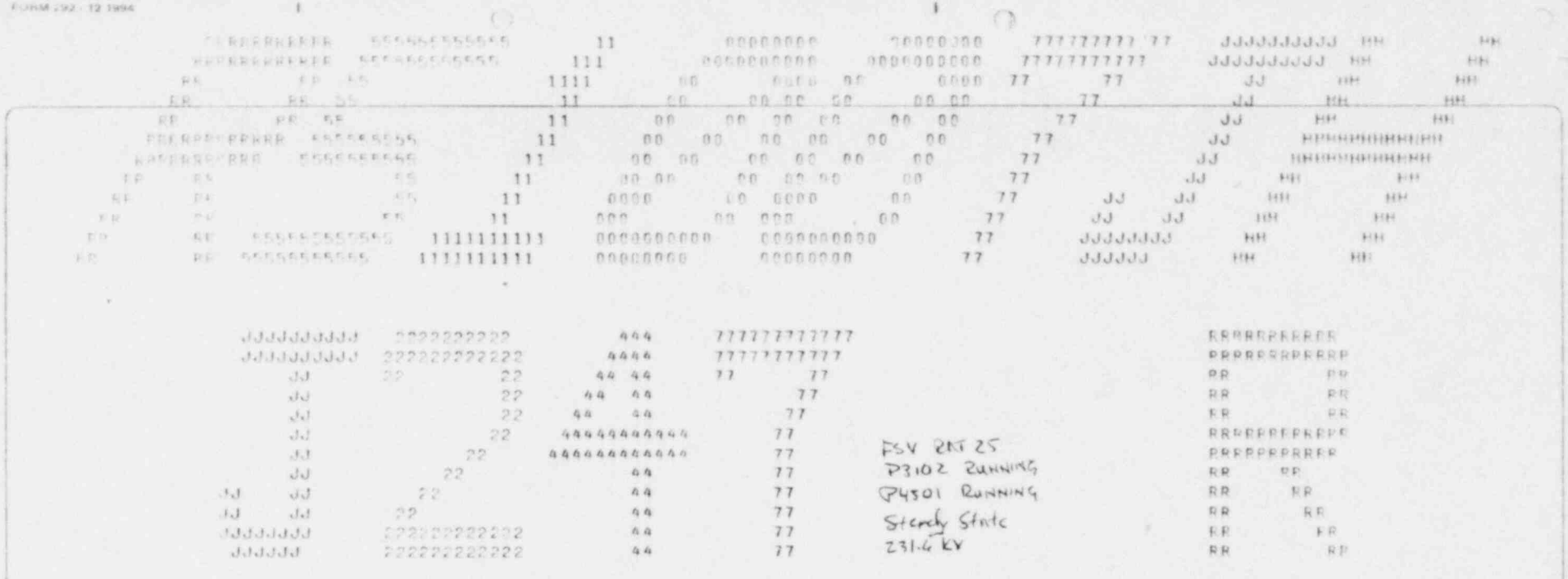
#1 TAN
#2 GREEN

MW OR MVAR SOLUTION TOLERANCE AT EACH BUS	0.10000
MW OR MVAR TOLERANCE FOR AREA INTERCHANGE EXPORT SOLUTION	1.00000
MW OR MVAR TOLERANCE FOR FLOWS CONTROLLED BY TCULS OR PHASE SHIFTERS	1.00000
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY MVAR	0.00100
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY TCUL	0.00100
MW OR MVAR THRESHOLD FOR MISMATCH TABLE PRINTOUT	2.00000

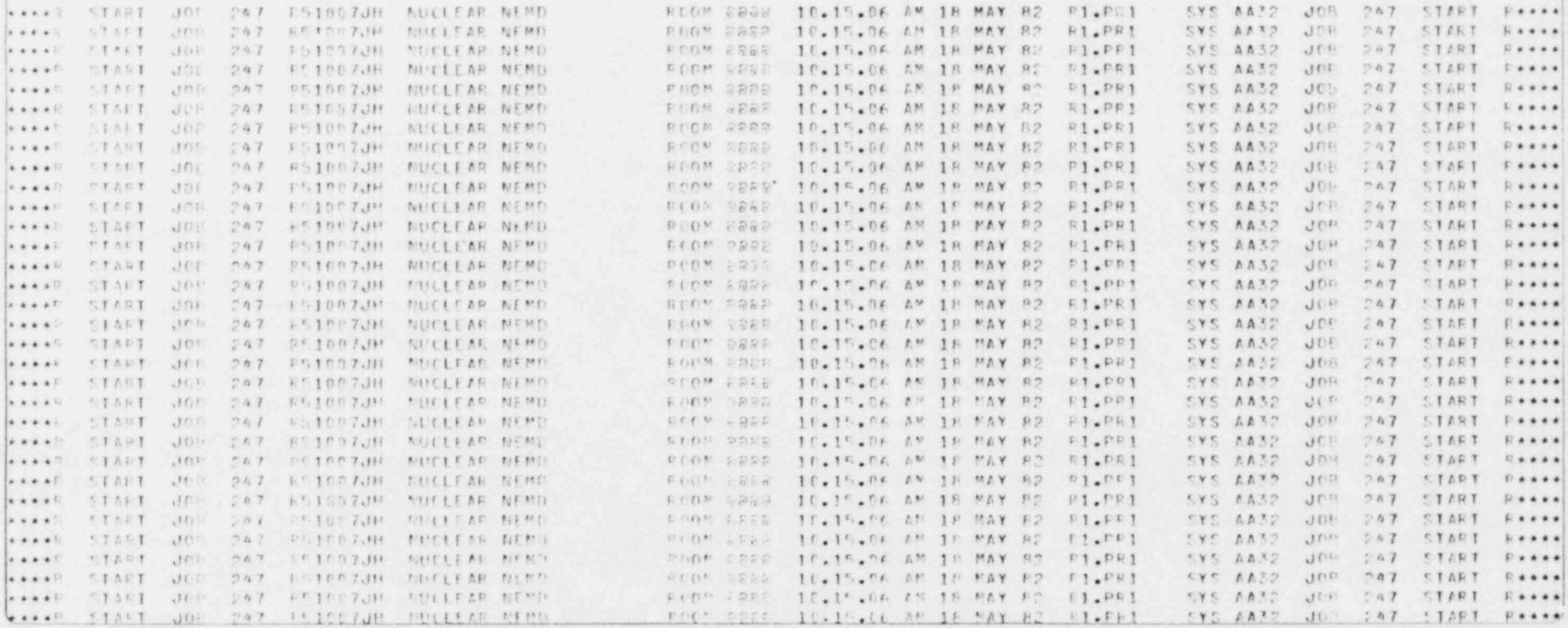
ATTACHMENT 5
P-82169

#3 BLUE
#4 RED

#1 TAN
#2 GREEN



FSV RNT 25
P3102 RUNNING
P4501 RUNNING
Steady State
231.6 KV



#3 BLUE
#4 RED

#1 TAN
#2 GREEN

WSCC POWER FLOW PROGRAM REVISION 55
POWER FLOW HISTORY TAPE - - - FORMAT 8

UNLESS NOTED OTHERWISE DIAGNOSTICS WILL APPEAR ABOVE THE
DATA WHICH HAS THE ERROR.

CONTROL CARD 17 6 0 0 0 0 0 0.0 0.0 00 0

CONTROL CARD HDG 0 0 0 0 0 0 0.0 0.0 00 0

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT25

CONTROL CARD BAS 0 0 0 0 0 0 0.0 0.0 00 0

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GA0150 05-18-82 INPUT DATA LISTING
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVBAI25

ENTERING DATA INPUT ROUTINE-ALL BUS CARDS WILL BE PROCESSED FIRST

```
          BE    ZS.V.INF230.PS                                    1007
          B     ASI.VRN.230.PS
          E     D EQ TAP4.16PS
          B     SHVAC EQ4.16PS
          B     E SWGR 14.16PS
          B     FLCSWGR44.16PS 37.6 24.0
          E     FMCXFMR64.16PS 51.9 32.4
          C     F P3104 4.16PS 37.6 24.0
          B     F P4101 4.16PS131.2286.46
          B     GLCSWGR1.480PS
          B     H C9201 .480PS 6.36 4.25
          B     H N9219 .480PS 3.73 2.50
          B     H N9229A.480PS 3.73 2.50
          B     H N9229C.480PS 3.73 2.50
          B     H N9236 .480PS 6.40 4.35
          B     H N9240 .480PS 3.04 2.03
          B     H P2101 .480PS11.61 7.77
          B     H P2106 .480PS11.61 7.77
          B     H P3106 .480PS11.95 8.00
          B     H P4103 .480PS
          B     H P4118S.480PS
          B     H P4201 .480PS12.09 8.09
          B     H P4501 .480PS12.09 8.09
          B     H P4601 .480PS 7.88 5.27
          B     J SWGR 24.16PS
          B     K C2401 4.16PS
          B     K P3102 4.16PS327.9216.0
          B     LLCSWGR2.480PS
          B     M C2109 .480PS
          B     M C7307 .480PS
          B     M CR201S.480PS 6.47 4.08
          B     M N9218 .480PS 3.17 1.99
          B     M N9220 .480PS 3.17 1.99
          B     M N9230 .480PS 3.17 1.99
          B     M N9246 .480PS 4.99 3.15
          B     M P2101S.480PS
          B     M P2102S.480PS11.82 7.45
          B     M P3103 .480PS
          B     M P4202 .480PS12.10 7.62
          B     M P4601S.480PS
          B     M P4602S.480PS
          B     M PS107X.480PS
          B     M PP401S.480PS 8.16 5.14
          B     M S7307S.480PS14.91 9.40
          B     M S7537 .480PS
          B     M S7538 .480PS
          B     N SWGR 34.16PS
          B     PLCSWGR54.16PS 37.2 24.0
          B     PMCXFMR74.16PS 56.0 32.6
```

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
B     P P3105 4.16PS
B     P P4102 4.16PS
B     OLCSWGR3.480PS
B     R C2109S.480PS
B     R C7307S.480PS 7.55 5.45
B     R CP203 .480PS
B     R N9209 .480PS 4.72 3.40
B     R N9231 .480PS 4.72 3.40
B     R N9236S.480PS 2.76 1.99
B     R N9241 .480PS 3.98 2.87
B     R N9247 .480PS
B     R P2102 .480PS11.33 8.17
B     R P2103S.480PS
B     R P2105 .480PS11.80 8.51
B     R P2107 .480PS
B     R P3106S.480PS11.66 8.41
B     R P4104 .480PS
B     R P411R .480PS
B     R P4202S.480PS
B     R P4602 .480PS 7.69 5.54
B     RP5107SX.480PS 5.60 4.04
B     R P8401 .480PS
B     TRPHVAC 4.16PS 74.7 60.3
B     TTPHVAC 4.16PS
```

ALL BUS CARDS PROCESSED-WILL PROCESS LINE AND XFMR CARDS NEXT

L	ZS.V.INF230.	AST.VRN.230.	0000		.00035
L	D EQ TAP4.16	SHVAC EQ4.16	0000		.00001.00001
L	D EQ TAP4.16	J SWGR 24.16	0000		.00001.00001
L	J SWGR 24.16	N SWGR 34.16	0000		.00001
L	J SWGR 24.16	E SWGR 14.16	0000		.00001
L	E SWGR 14.16	FLCSWGR44.16	0000		.00107.00029
L	E SWGR 14.16	FMCXFMR64.16	0000		.00257.00126
L	E SWGR 14.16	E P3104 4.16	0000		.00128.00028
L	E SWGR 14.16	E P4101 4.16	0000		.00176.00117
L	J SWGR 24.16	K C2401 4.16	0000		.00235.00051
L	J SWGR 24.16	K P3102 4.16	0000		.00018.00026
L	N SWGR 34.16	PLCSWGR54.16	0000		.00086.00029
L	N SWGR 34.16	FMCXFMR74.16	0000		.00278.00135
L	N SWGR 34.16	P P3105 4.16	0000		.00117.00026
L	N SWGR 34.16	P P4102 4.16	0000		.00177.00118
L	SHVAC EQ4.16	TRPHVAC 4.16	0000		.00161.00066
L	SHVAC EQ4.16	TTPHVAC 4.16	0000		.00046.00019
L	GLCSWGR1.480	H C8201 .480	0000		.03320.00879
L	GLCSWGR1.480	H N9219 .480	0000		.02344.02179
L	GLCSWGR1.480	H N9229A.480	0000		.01094.01525
L	GLCSWGR1.480	H N9229C.480	0000		.03275.01598
L	GLCSWGR1.480	H N9236 .480	0000		.07031.00634
L	GLCSWGR1.480	H N9240 .480	0000		.07031.00634
L	GLCSWGR1.480	H P2101 .480	0000		.08268.03385
L	GLCSWGR1.480	H P2106 .480	0000		.08268.03385
L	GLCSWGR1.480	H P3106 .480	0000		.04679.02283
L	GLCSWGR1.480	H P4103 .480	0000		.05469.07626
L	GLCSWGR1.480	H P4118S.480	0000		.18130.08847
L	GLCSWGR1.480	H P4201 .480	0000		.15206.07420
L	GLCSWGR1.480	H P4501 .480	0000		.13569.06621
L	GLCSWGR1.480	H P4601 .480	0000		.07747.02051
L	LLCSWGR2.480	M C2109 .480	0000		.08767.01172
L	LLCSWGR2.480	M C7307 .480	0000		.08854.02344
L	LLCSWGR2.480	M C8201S.480	0000		.03320.00879
L	LLCSWGR2.480	M N9218 .480	0000		.03509.01712
L	LLCSWGR2.480	M N9220 .480	0000		.03760.02510
L	LLCSWGR2.480	M N9230 .480	0000		.01172.01089
L	LLCSWGR2.480	M N9246 .480	0000		.11398.01569
L	LLCSWGR2.480	M P2101S.480	0000		.06201.02539
L	LLCSWGR2.480	M P2102S.480	0000		.03445.01411
L	LLCSWGR2.480	M P2103 .480	0000		.06433.03139
L	LLCSWGR2.480	M P4202 .480	0000		.15206.07420
L	LLCSWGR2.480	M P4601S.480	0000		.04427.01172
L	LLCSWGR2.480	M P4602S.480	0000		.04427.01172
L	LLCSWGR2.480	M P5107X.480	0000		.17535.02413
L	LLCSWGR2.480	M PP401S.480	0000		.15938.04219
L	LLCSWGR2.480	M S7307S.480	0000		.02344.02179
L	LLCSWGR2.480	M S7537 .480	0000		.15343.02112
L	LLCSWGR2.480	M S7538 .480	0000		.21918.03016
L	GLCSWGR3.480	P C2109S.480	0000		.08767.01207

#1 TAN
#2 GREEN
#3 BLUE
#4 RED

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

L	GLCSWGR3.480	R C7307S.480	0000		.06198	.01641				
L	GLCSWGR3.480	R CR203 .480	0000		.02214	.00586				
L	GLCSWGR3.480	R N9208 .480	0000		.01367	.01906				
L	GLCSWGR3.480	R N9231 .480	0000		.01367	.01906				
L	GLCSWGR3.480	R N9236S.480	0000		.03516	.00317				
L	GLCSWGR3.480	R N9241 .480	0000		.03516	.00317				
L	GLCSWGR3.480	R N9247 .480	0000		.13151	.01810				
L	GLCSWGR3.480	R P2102 .480	0000		.04823	.01975				
L	GLCSWGR3.480	R P2103S.480	0000		.05264	.02568				
L	GLCSWGR3.480	R P2105 .480	0000		.04094	.01998				
L	GLCSWGR3.480	R P2107 .480	0000		.03445	.01411				
L	GLCSWGR3.480	R P3106S.480	0000		.05381	.02625				
L	GLCSWGR3.480	R P4104 .480	0000		.04297	.05992				
L	GLCSWGR3.480	R P4118 .480	0000		.19715	.09132				
L	GLCSWGR3.480	R P4202S.480	0000		.12867	.06278				
L	GLCSWGR3.480	R P4602 .480	0000		.04427	.01172				
L	GLCSWGR3.480	RP5107SX.480	0000		.14905	.02051				
L	GLCSWGR3.480	R P8401 .480	0000		.14167	.03750				
T	AST.VRN.230.	D EQ TAP4.16	0000	1400	.0006	.00881		224.2	4.16	
T	F SWGR 14.16	GLCSWGR1.480	0000	133	.0075	.04590		4.056	.480	
T	J SWGR 24.16	LLCSWGR2.480	0000	133	.0075	.04057		4.056	.480	
T	N SWGR 34.16	GLCSWGR3.480	0000	133	.0075	.04027		4.056	.480	

ENTERING SUBROUTINE SHUFLE

FORM 292 12 1994

ST. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 INPUT DATA LISTING
PLANT OFF LINE-18.3MVA REG AUX TRANSF IN SERVICE AC-DD
ESV 230-KV BUS HELD AT 241.6KV--KVA*10 GIVES KVA ESVRAT25

ALL BUS AND LINE CARDS PROCESSED-NOW PROCESS REG XFMR, AREA, REACTANCE SWITCHING AND DC LINES
A ZONE ONE ZS.V.INF230. 0.0 PS

********** WARNING-ABS(TOTAL SCHEDULED GENERATION-TOTAL LOAD-NET AREA EXPORT) .GT. .2*TOTAL LOAD FOR AREA ZONE ONE

SYSTEM DATA PROCESSED.

THERE WERE 0 FATAL ERRORS

RETURNING TO MAIN PROGRAM

CONTROL CARD SOL 0 0 0 0 -30 ZS.V.INF230. 0 0.0 0.0 DD 0

#2 BLUE
#4 RED

#1 TAN
#3 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF 680150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT25

RENUMBERING OF 75 NODES WILL REQUIRE 72 OFF DIAGONALS
THE MAXIMUM NUMBER OF BRANCHES IS 20
BEGIN SOLUTION WITH 75 BUSES AND 72 BRANCHES 5/18/1982 10: 4:49

ITERATION	SUM OF ABSOLUTE MISMATCHES-PU MEGAWATTS	MEGAVARS	BUSES UNSOLVED	MATRIX SIZE	ADJUSTMENTS MADE AT START OF ITERATION P	RQ RN	RP RM	SV	BQ	BC	BS	BX	TIES	DC
1	11.145	310.585	47	572	0	0	0	0	0	0	0	0	0	0
2	3.814	23.379	48	572	0	0	0	0	0	0	0	0	0	0
*	0.169	0.247	17	572	0	0	0	0	0	0	0	0	0	0
4	0.000	0.000	0	572	0	0	0	0	0	0	0	0	0	0

CASE SOLVED 5/18/1982 10: 4:49

ENTERING TAPE4

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

TYPE OF BUS		ACTUAL	MAXIMUM
P AND E - NO G LIMITS	(PE)	1	2000
P AND G - NO V LIMITS	(P)	72	2000
DC TERMINAL BUSES	(BD)	0	20
TOTAL NON-REGULATING BUSES		73	2000
P AND E - SELF VAR LIMITS	(BQ)	0	1200
P AND E - USE REMOTE VARS	(BC)	0	50
P AND G - V LIMITS	(BV)	0	1200
P - SUPPLY REMOTE VARS	(BC)	0	250
TOTAL REGULATING BUSES		0	1200
TOTAL BUSES THIS STUDY		73	2000
ASSOCIATED WITH NON-REG ARE			
P AND Q - V BY REG XFMR	(BT)	0	200
SWITCHED REACTANCE BUSES	(BX)	0	100

P .U. VOLTAGE LIMITS ARE 0.70 TO 1.50

TYPE OF LINE (SECTION)		ACTUAL	MAXIMUM
BUS TIES	(Z=0)	0	200
FIXED TAP XFMR	(T)	4	3500
FIXED PHASE SHIFTER	(TP)	0	100
VARIABLE TAP OR PHASE	(R)	0	200
DC LINES-TWO TERMINAL	(LD)	0	10
LINE EQUIVALENTS	(E)	0	3500
NORMAL PI LINES	(L)	68	3500
TOTAL LINE SECTIONS		72	3500
TOTAL BRANCHES		72	3500

MISCELLANEOUS INFORMATION		
NO. OF ITERATIONS	4	30
NO. OF INTERCHANGE AREAS	1	60
NO. OF ZONES	1	90
NO. OF BUSES OUT OF TOLERANCE	0	0
TOLERANCE AT EACH BUS-MW OR MVAR		0.01000

TIE LINE CONTROL NOT EXERCISED

SYSTEM DATA	MEGAWATTS	MEGAVARS
TOTAL LOAD	986.180	659.470
LOSSES-I*I(R+X)	15.800	159.937
CHARGING-E*E(Y-PI),	0.0	0.0
NET SHUNT ADM	0.0	0.0
SYSTEM MISMATCH	0.000	0.000
TOTAL GENERATION	1003.980	819.407
MAXIMUM POWER	0.0	
PMAX LESS GENERATION	-1003.980	

NOTE-- CHARGING INCLUDES REAL AND REACTIVE COMPONENTS OF POWER (P+JQ) DERIVED FROM EQUIVALENT Y-PI LINES
(SOME ARE DEVELOPED INTERNALLY FROM COMPOSITE LINES COMBINED USING ABCD CONSTANTS)
P(CHARGING) IS TREATED AS A MW LOAD
Q(CHARGING) IS TREATED AS A SOURCE (MVAR)
BOTH MAY BE EITHER POSITIVE OR NEGATIVE

SYSTEM SLACK BUS IS ZS.V.INF230.

FOR THE BUSSES LISTED BELOW PGEN IS NEGATIVE, PMAX IS
LESS THAN PGEN, OR PMAX IS POSITIVE AND PGEN IS ZERO:

BUS NAME	KV	ZONE	AREA	PGEN (MW)	PMAX (MW)
FS.V.INF	230.	FS	ZONE ONE	1003.98	0.0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF GENERATOR DATA

BUS NAME	PGEN MW	PMAX MW	QGEN MVAR	QMAX MVAR	QMIN MVAR	ACTUAL VOLTAGE	DESIRED VOLTAGE	
5.V.INF230.	1003.98	0.0	819.41			1.007		SYSTEM SLACK BUS

SUMMARY OF 0 BUSES WITH VOLTAGE OVER 1.05 PER UNIT

SUMMARY OF 22 BUSES WITH VOLTAGE UNDER 0.95 PER UNIT

BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV
ELCSWGR1.480	PS	0.943	0.5	H C8201 .480	PS	0.940	0.5	H N9219 .480	PS	0.942	0.5
H N9229A.480	PS	0.942	0.5	H N9229C.480	PS	0.941	0.5	H N9236 .480	PS	0.938	0.5
H N9240 .480	PS	0.941	0.5	H P2101 .480	PS	0.930	0.4	H P2106 .480	PS	0.930	0.4
H P3106 .480	PS	0.935	0.4	H P4103 .480	PS	0.943	0.5	H P4118S.480	PS	0.943	0.5
H P4201 .480	PS	0.916	0.4	H P4551 .480	PS	0.913	0.4	H P4601 .480	PS	0.935	0.4
H P4202 .480	PS	0.933	0.4	H PPA01S.480	PS	0.942	0.5	R C7307S.480	PS	0.949	0.5
R P2102 .480	PS	0.947	0.5	R P2105 .480	PS	0.948	0.5	R P3106S.480	PS	0.946	0.5
RP5107SX.480	PS	0.945	0.5								

THERE ARE NO OVERLOADED TRANSMISSION LINES

THERE ARE NO OVERLOADED TRANSFORMERS

THERE ARE NO REGULATING TRANSFORMERS

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF LOSSES BY OWNER IN MEGAWATTS

OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES
	15.000						

********** TOTAL SYSTEM LOSSES ARE 15.000 MW **********

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRC150 05-18-82 ALPHABETIC BUS LIST PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 10: 4:49
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT25

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME
ASI.VPN.230.	(PS)	ZONE ONE	D EQ TAP4.16	(PS)	ZONE ONE	E SWGR 14.16	(PS)	ZONE ONE	F P3104 4.16	(PS)	ZONE ONE
F P4101 4.16	(PS)	ZONE ONE	FLCSWGR44.16	(PS)	ZONE ONE	FMCXFMR64.16	(PS)	ZONE ONE	GLCSWGR1.480	(PS)	ZONE ONE
H C0201 .480	(PS)	ZONE ONE	H N9219 .480	(PS)	ZONE ONE	H N9229A.480	(PS)	ZONE ONE	H N9229C.480	(PS)	ZONE ONE
H N9236 .480	(PS)	ZONE ONE	H N9240 .480	(PS)	ZONE ONE	H P2101 .480	(PS)	ZONE ONE	H P2106 .480	(PS)	ZONE ONE
H P3106 .480	(PS)	ZONE ONE	H P4103 .480	(PS)	ZONE ONE	H P4118S.480	(PS)	ZONE ONE	H P4201 .480	(PS)	ZONE ONE
H P4501 .480	(PS)	ZONE ONE	H P4601 .480	(PS)	ZONE ONE	J SWGR 24.16	(PS)	ZONE ONE	K C2401 4.16	(PS)	ZONE ONE
K P3102 4.16	(PS)	ZONE ONE	LLCSWGR2.480	(PS)	ZONE ONE	M C2109 .480	(PS)	ZONE ONE	M C7307 .480	(PS)	ZONE ONE
M C8201S.480	(PS)	ZONE ONE	M N9218 .480	(PS)	ZONE ONE	M N9220 .480	(PS)	ZONE ONE	M N9230 .480	(PS)	ZONE ONE
M N9246 .480	(PS)	ZONE ONE	M P2101S.480	(PS)	ZONE ONE	M P2102S.480	(PS)	ZONE ONE	M P2103 .480	(PS)	ZONE ONE
M P4202 .480	(PS)	ZONE ONE	M P4601S.480	(PS)	ZONE ONE	M P4602S.480	(PS)	ZONE ONE	M P5107X.480	(PS)	ZONE ONE
M P8401S.480	(PS)	ZONE ONE	M S7307S.480	(PS)	ZONE ONE	M S7537 .480	(PS)	ZONE ONE	M S7538 .480	(PS)	ZONE ONE
N SWGR 34.16	(PS)	ZONE ONE	P P3105 4.16	(PS)	ZONE ONE	P P4102 4.16	(PS)	ZONE ONE	PLCSWGR54.16	(PS)	ZONE ONE
PMCXFMR74.16	(PS)	ZONE ONE	QLCSWGR3.480	(PS)	ZONE ONE	R C2109S.480	(PS)	ZONE ONE	R C7307S.480	(PS)	ZONE ONE
R C0203 .480	(PS)	ZONE ONE	R N9208 .480	(PS)	ZONE ONE	R N9231 .480	(PS)	ZONE ONE	R N9236S.480	(PS)	ZONE ONE
R N9241 .480	(PS)	ZONE ONE	R N9247 .480	(PS)	ZONE ONE	P P2102 .480	(PS)	ZONE ONE	R P2103S.480	(PS)	ZONE ONE
R P2105 .480	(PS)	ZONE ONE	R P2107 .480	(PS)	ZONE ONE	R P3106S.480	(PS)	ZONE ONE	R P4104 .480	(PS)	ZONE ONE
R P4118 .480	(PS)	ZONE ONE	R P4202S.480	(PS)	ZONE ONE	R P4602 .480	(PS)	ZONE ONE	R P8401 .480	(PS)	ZONE ONE
RPS107SX.480	(PS)	ZONE ONE	SHVAC EQ4.16	(PS)	ZONE ONE	TRPHVAC 4.16	(PS)	ZONE ONE	TTPHVAC 4.16	(PS)	ZONE ONE
ZS.V.INF230.	(PS)	ZONE ONE		( )			( )			( )	

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	GENERATION MW	GENERATION MVAR	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	ID	BUS NAME	LINE FLOWS MW	LINE FLOWS MVAR	LINE LOSSES MW	LINE LOSSES MVAR	PCT LOAD
AST.VRN.230.	1.0042	0.0	0.0	0.0	0.0	0.0	0.0							
231.0 KV	-0.2				TAP	224.20/	4.16		D EQ TAP4.16	1004.0	813.6	9.4	138.6	92.3
									ZS.V.INF230.	-1004.0	-813.6	0.0	5.8	
D EQ TAP4.16	0.9581	0.0	0.0	0.0	0.0	0.0	0.0							
4.0 KV	-5.1								AST.VRN.230.	-994.5	-675.0	9.4	138.6	85.0
									J SWGR 24.16	919.7	614.6	0.1	0.1	
									SHVAC E04.16	74.9	60.4	0.0	0.0	
E SWGR 14.16	0.9580	0.0	0.0	0.0	0.0	0.0	0.0							
4.0 KV	-5.1								F P3104 4.16	37.6	24.0	0.0	0.0	
									F P4101 4.16	131.7	86.8	0.5	0.3	
									FLCSWGR44.16	37.6	24.0	0.0	0.0	
									FMCXFMR64.16	52.0	32.5	0.1	0.1	
					TAP	4.067	0.48		GLCSWGR1.480	96.8	70.5	1.1	6.8	90.1
									J SWGR 24.16	-355.7	-237.8	0.0	0.0	
F P3104 4.16	0.9574	0.0	0.0	37.6	24.0	0.0	0.0							
4.0 KV	-5.0								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
F P4101 4.16	0.9545	0.0	0.0	131.2	86.5	0.0	0.0							
4.0 KV	-5.1								E SWGR 14.16	-131.2	-86.5	0.5	0.3	
FLCSWGR44.16	0.9575	0.0	0.0	37.6	24.0	0.0	0.0							
4.0 KV	-5.1								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
FMCXFMR64.16	0.9561	0.0	0.0	51.9	32.4	0.0	0.0							
4.0 KV	-5.0								E SWGR 14.16	-51.9	-32.4	0.1	0.1	
GLCSWGR1.480	0.9430	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-7.5								F SWGR 14.16	-95.7	-63.7	1.1	6.8	86.4
									H C8201 .480	6.4	4.3	0.0	0.0	
									H N9219 .480	3.7	2.5	0.0	0.0	
									H N9229A.480	3.7	2.5	0.0	0.0	
									H N9229C.480	3.7	2.5	0.0	0.0	
									H N9236 .480	6.5	4.4	0.0	0.0	
									H N9240 .480	3.1	2.0	0.0	0.0	
									H P2101 .480	11.8	7.8	0.2	0.1	
									H P2106 .480	11.8	7.8	0.2	0.1	
									H P3106 .480	12.1	8.1	0.1	0.1	
									H P4103 .480	-0.0	-0.0	0.0	0.0	
									H P411RS.480	-0.0	-0.0	0.0	0.0	
									H P4201 .480	12.5	8.3	0.4	0.2	
									H P4501 .480	12.4	8.3	0.3	0.2	
									H P4601 .480	8.0	5.3	0.1	0.0	
H C8201 .480	0.9404	0.0	0.0	6.4	4.3	0.0	0.0							
0.5 KV	-7.9								GLCSWGR1.480	-6.4	-4.2	0.0	0.0	
H N9219 .480	0.9415	0.0	0.0	3.7	2.5	0.0	0.0							
0.5 KV	-7.5								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229A.480	0.9422	0.0	0.0	3.7	2.5	0.0	0.0							
0.5 KV	-7.5								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229C.480	0.9413	0.0	0.0	3.7	2.5	0.0	0.0							
0.5 KV	-7.5								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

(.9430)(480) = 452.6 V

#2 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
M N9246 .480	0.9379	0.0	0.0	6.5	4.4	0.0	0.0						
0.5 KV	-7.3							GLCSWGR1.480	-6.5	-4.3	0.0	0.0	
M N9240 .480	0.9406	0.0	0.0	3.0	2.0	0.0	0.0						
0.5 KV	-7.4							GLCSWGR1.480	-3.0	-2.0	0.0	0.0	
M P2101 .480	0.9299	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
M P2106 .480	0.9299	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
M P3106 .480	0.9351	0.0	0.0	12.0	8.0	0.0	0.0						
0.4 KV	-7.4							GLCSWGR1.480	-11.9	-8.0	0.1	0.1	
M P4103 .480	0.9430	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.5							GLCSWGR1.480	0.0	0.0	0.0	0.0	
M P4118S.480	0.9430	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.5							GLCSWGR1.480	0.0	0.0	0.0	0.0	
M P4201 .480	0.9164	0.0	0.0	12.1	8.1	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-12.1	-8.1	0.4	0.2	
M P4501 .480	0.9193	0.0	0.0	12.1	8.1	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-12.1	-8.1	0.3	0.2	
M P4601 .480	0.9353	0.0	0.0	7.9	5.3	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-7.9	-5.3	0.1	0.0	
J SWGR 24.16	0.9580	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							D EQ TAP4.16	-919.5	-614.5	0.1	0.1	
								E SWGR 14.16	355.7	237.8	0.0	0.0	
								K C2401 4.16	-0.0	-0.0	0.0	0.0	
								K P3102 4.16	328.2	216.4	0.3	0.4	
						TAP	4.067 0.48	LLCSWGR2.480	69.3	46.1	0.5	2.9	62.5
								N SWGR 34.16	166.3	114.2	0.0	0.0	
K C2401 4.16	0.9580	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							J SWGR 24.16	0.0	0.0	0.0	0.0	
K P3102 4.16	0.9568	0.0	0.0	327.9	216.0	0.0	0.0						
4.0 KV	-5.1							J SWGR 24.16	-327.9	-216.0	0.3	0.4	
LLCSWGR2.480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							J SWGR 24.16	-68.7	-43.2	0.5	2.9	61.0
								M C2109 .480	-0.0	-0.0	0.0	0.0	
								M C7307 .480	-0.0	-0.0	0.0	0.0	
								M CR201S.480	6.5	4.1	0.0	0.0	
								M N9218 .480	3.2	2.0	0.0	0.0	
								M N9220 .480	3.2	2.0	0.0	0.0	
								M N9230 .480	3.2	2.0	0.0	0.0	
								M N9246 .480	5.0	3.2	0.0	0.0	
								M P2101S.480	-0.0	-0.0	0.0	0.0	
								M P2102S.480	11.9	7.5	0.1	0.0	
								M P2103 .480	-0.0	-0.0	0.0	0.0	
								M P4202 .480	12.5	7.8	0.4	0.2	
								M P4601S.480	-0.0	-0.0	0.0	0.0	
								M P4602S.480	-0.0	-0.0	0.0	0.0	
								M P5107X.480	-0.0	-0.0	0.0	0.0	

(.9193)(480) = 441.3V

(.9580)(4160) = 3985.3V

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
								M P8401S.480	8.3	5.2	0.2	0.0	
								M S7307S.480	15.0	9.5	0.1	0.1	
								M S7537 .480	-0.0	-0.0	0.0	0.0	
								M S7538 .480	-0.0	-0.0	0.0	0.0	
M C2109 .480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C7337 .480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M CR201S.480	0.9560	0.0	0.0	6.5	4.1	0.0	0.0						
0.5 KV	-6.5							LLCSWGR2.480	-6.5	-4.1	0.0	0.0	
M N9218 .480	0.9571	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV	-6.5							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9220 .480	0.9568	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9230 .480	0.9580	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9246 .480	0.9521	0.0	0.0	5.0	3.2	0.0	0.0						
0.5 KV	-6.4							LLCSWGR2.480	-5.0	-3.1	0.0	0.0	
M P2101S.480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P2102S.480	0.9532	0.0	0.0	11.8	7.5	0.0	0.0						
0.5 KV	-6.5							LLCSWGR2.480	-11.8	-7.4	0.1	0.0	
M P2103 .480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4202 .480	0.9328	0.0	0.0	12.1	7.6	0.0	0.0						
0.4 KV	-6.4							LLCSWGR2.480	-12.1	-7.6	0.4	0.2	
M P4601S.480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4602S.480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P5107X.480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P8401S.480	0.9425	0.0	0.0	8.2	5.1	0.0	0.0						
0.5 KV	-6.3							LLCSWGR2.480	-8.2	-5.1	0.2	0.0	
M S7307S.480	0.9128	0.0	0.0	14.9	9.4	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	-14.9	-9.4	0.1	0.1	
M S7537 .480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M S7538 .480	0.9586	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							LLCSWGR2.480	0.0	0.0	0.0	0.0	
J SWGR 34.16	0.9580	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							J SWGR 24.16	-166.3	-114.2	0.0	0.0	
								P P3105 4.16	-0.0	-0.0	0.0	0.0	
								P P4102 4.16	-0.0	0.0	0.0	0.0	
								PLCSWGR54.16	37.2	26.0	0.0	0.0	
								PMCXFMR74.16	56.1	32.7	0.1	0.1	
					TAP	4.06/	0.48	PLCSWGR3.480	73.0	55.5	0.7	3.5	68.9

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P3105 4.16	0.9548	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							N SWGR 34.16	0.0	0.0	0.0	0.0	
P P4102 4.16	0.9580	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							N SWGR 34.16	0.0	-0.0	0.0	0.0	
PLCSWGR34.16	0.9576	0.0	0.0	37.2	26.0	0.0	0.0						
4.0 KV	-5.1							N SWGR 34.16	-37.2	-26.0	0.0	0.0	
PMCXFMR74.16	0.9559	0.0	0.0	56.0	32.6	0.0	0.0						
4.0 KV	-5.0							N SWGR 34.16	-56.0	-32.6	0.1	0.1	
QLCSWGRT.480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							N SWGR 34.16	-72.3	-52.0	0.7	3.5	67.0
								R C2109S.480	-0.0	-0.0	0.0	0.0	
								R C7307S.480	7.6	5.5	0.1	0.0	
								R CR203 .480	-0.0	-0.0	0.0	0.0	
								R N9208 .480	4.7	3.4	0.0	0.0	
								R N9231 .480	4.7	3.4	0.0	0.0	
								R N9236S.480	2.8	2.0	0.0	0.0	
								R N9241 .480	4.0	2.9	0.0	0.0	
								R N9247 .480	-0.0	-0.0	0.0	0.0	
								R P2102 .480	11.4	8.2	0.1	0.0	
								R P2103S.480	-0.0	-0.0	0.0	0.0	
								R P2105 .480	11.9	8.6	0.1	0.0	
								R P2107 .480	-0.0	-0.0	0.0	0.0	
								R P3106S.480	11.8	8.5	0.1	0.1	
								R P4104 .480	-0.0	-0.0	0.0	0.0	
								R P4118 .480	-0.0	-0.0	0.0	0.0	
								R P4202S.480	-0.0	-0.0	0.0	0.0	
								R P4602 .480	7.7	5.6	0.0	0.0	
								R P8401 .480	-0.0	-0.0	0.0	0.0	
								RP5107SX.480	5.7	4.1	0.1	0.0	
P C2109S.480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P C7307S.480	0.9487	0.0	0.0	7.6	5.5	0.0	0.0						
0.5 KV	-6.5							QLCSWGR3.480	-7.5	-5.4	0.1	0.0	
P CR203 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P N9208 .480	0.9532	0.0	0.0	4.7	3.4	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
P N9231 .480	0.9532	0.0	0.0	4.7	3.4	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
P N9236S.480	0.9535	0.0	0.0	2.8	2.0	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	-2.8	-2.0	0.0	0.0	
P N9241 .480	0.9530	0.0	0.0	4.0	2.9	0.0	0.0						
0.5 KV	-6.5							QLCSWGR3.480	-4.0	-2.9	0.0	0.0	
P N9247 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P P2102 .480	0.9471	0.0	0.0	11.3	8.2	0.0	0.0						
0.5 KV	-6.5							QLCSWGR3.480	-11.3	-8.2	0.1	0.0	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
R P2103S.480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2105 .480	0.9477	0.0	0.0	11.8	8.5	0.0	0.0	----------					
0.5 KV	-6.5							QLCSWGR3.480	-11.8	-8.5	0.1	0.0	
R P2107 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2108S.480	0.9454	0.0	0.0	11.7	8.4	0.0	0.0	----------					
0.5 KV	-6.5							QLCSWGR3.480	-11.7	-8.4	0.1	0.1	
R P4104 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4110 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4202S.480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4602 .480	0.9503	0.0	0.0	7.7	5.5	0.0	0.0	----------					
0.5 KV	-6.5							QLCSWGR3.480	-7.7	-5.5	0.0	0.0	
R P8401 .480	0.9546	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	0.0	0.0	0.0	0.0	
RDS1075X.480	0.9448	0.0	0.0	5.6	4.0	0.0	0.0	----------					
0.5 KV	-6.3							QLCSWGR3.480	-5.6	-4.0	0.1	0.0	
SHVAC EQ4.16	0.9581	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.1							D EQ TAP4.16	-74.9	-60.4	0.0	0.0	
								TRPHVAC 4.16	74.9	60.4	0.2	0.1	
								TTPHVAC 4.16	-0.0	-0.0	0.0	0.0	
TRPHVAC 4.16	0.9565	0.0	0.0	74.7	60.3	0.0	0.0	----------					
4.0 KV	-5.0							SHVAC EQ4.16	-74.7	-60.3	0.2	0.1	
TTPHVAC 4.16	0.9581	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.1							SHVAC EQ4.16	0.0	0.0	0.0	0.0	
ZS.V.INF230.	1.0070	1004.0	819.4	0.0	0.0	0.0	0.0	----------					
231.6 KV	0.0							AST.VRN.230.	1004.0	819.4	0.0	5.8	

END OF REPORT FOR THIS CASE

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF 6R0150 05-19-82 DATA TABLE LISTING PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/19/1982 10: 4:49
ESV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT25

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
R		AST.VRN.230.	PS												00	
R		D EQ TAP4.16	PS												00	
R		E SWGR 14.16	PS												00	
R		F P3104 4.16	PS	37.6	24.0										00	
R		F P4101 4.16	PS	131.2	86.5										00	
S		FLCSWGR44.16	PS	37.6	24.0										00	
R		FMCXFMR64.16	PS	51.9	32.4										00	
S		GLCSWGR1.480	PS												00	
R		H CR201 .480	PS	6.4	4.3										00	
R		H N9219 .480	PS	3.7	2.5										00	
R		H N9229A.480	PS	3.7	2.5										00	
R		H N9229C.480	PS	3.7	2.5										00	
R		H N9236 .480	PS	6.5	4.3										00	
R		H N9240 .480	PS	3.0	2.0										00	
R		H P2101 .480	PS	11.6	7.8										00	
R		H P2106 .480	PS	11.6	7.8										00	
R		H P3106 .480	PS	11.9	8.0										00	
R		H P4103 .480	PS												00	
R		H P411BS.480	PS												00	
R		H P4201 .480	PS	12.1	8.1										00	
R		H P4501 .480	PS	12.1	8.1										00	
R		H P4601 .480	PS	7.9	5.3										00	
S		J SWGR 24.16	PS												00	
R		K C2401 4.16	PS												00	
R		K P3102 4.16	PS	327.9	216.0										00	
S		LLCSWGR2.480	PS												00	
R		M C2109 .480	PS												00	
R		M C7307 .480	PS												00	
R		M CR201S.480	PS	6.5	4.1										00	
R		M N9218 .480	PS	3.2	2.0										00	
R		M N9220 .480	PS	3.2	2.0										00	
R		M N9230 .480	PS	3.2	2.0										00	
R		M N9246 .480	PS	5.0	3.1										00	
R		M P2101S.480	PS												00	
R		M P2102S.480	PS	11.8	7.4										00	
R		M P2103 .480	PS												00	
R		M P4202 .480	PS	12.1	7.6										00	
R		M P4601S.480	PS												00	
R		M P4602S.480	PS												00	
R		M P5107X.480	PS												00	
R		M PR401S.480	PS	8.2	5.1										00	
R		M S7307S.480	PS	14.9	9.4										00	
R		M S7537 .480	PS												00	
R		M S7538 .480	PS												00	
R		N SWGR 34.16	PS												00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 - BLUE
#4 - RED

#1 - TAN
#2 - GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
B		P P3105 4.16	PS												00	
B		P P4102 4.16	PS												00	
B		PLESW6854.16	PS	37.2	26.0										00	
B		PMCXFMR74.16	PS	56.0	32.6										00	
B		QLESW643.480	PS												00	
B		R C2109S.480	PS												00	
B		R C7307S.480	PS	7.5	5.4										00	
B		R CR203 .480	PS												00	
B		R N9208 .480	PS	4.7	3.4										00	
B		R N9231 .480	PS	4.7	3.4										00	
B		R N9236S.480	PS	2.8	2.0										00	
B		R N9241 .480	PS	4.0	2.9										00	
B		R N9247 .480	PS												00	
B		R P2102 .480	PS	11.3	8.2										00	
B		R P2103S.480	PS												00	
B		R P2105 .480	PS	11.8	8.5										00	
B		R P2107 .480	PS												00	
B		R P3106S.480	PS	11.7	8.4										00	
B		R P4104 .480	PS												00	
B		R P4118 .480	PS												00	
B		R P4202S.480	PS												00	
B		R P4602 .480	PS	7.7	5.5										00	
B		R P8401 .480	PS												00	
B		RPS107SX.480	PS	5.6	4.0										00	
B		SHVAC EQ4.16	PS												00	
B		TRPHVAC 4.16	PS	74.7	60.3										00	
B		TTPHVAC 4.16	PS												00	
DE		ZS.V.INF230.	PS						1004.0			1.007			00	

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
AST.VRN.230.	ZS.V.INF230.	L							0.0003								(R)
230.	D EQ TAP4.16	T				1400.		0.0006	0.0088					224.20	4.16	FIX TAP	
D EQ TAP4.16	AST.VRN.230.	T				1400.		0.0006	0.0088					4.16	224.20	FIX TAP	(R)
4.16	SHVAC EQ4.16	L															
4.16	J SWGR 24.16	L															
E SWGR 14.16	ELCSWGR44.16	L						0.0011	0.0003								
4.16	EMCXFMR64.16	L						0.0026	0.0013								
4.16	E P3104 4.16	L						0.0013	0.0003								
4.16	E P4101 4.16	L						0.0018	0.0012								
4.16	GLCSWGR1.480	T				133.0		0.0075	0.0459					4.06	0.48	FIX TAP	
4.16	J SWGR 24.16	L															(R)
E P3104 4.16	E SWGR 14.16	L						0.0013	0.0003								(R)
E P4101 4.16	E SWGR 14.16	L						0.0018	0.0012								(R)
ELCSWGR44.16	E SWGR 14.16	L						0.0011	0.0003								(R)
EMCXFMR64.16	E SWGR 14.16	L						0.0026	0.0013								(R)
GLCSWGR1.480	E SWGR 14.16	T				133.0		0.0075	0.0459					0.48	4.06	FIX TAP	(R)
.480	H CR201 .480	L						0.0332	0.0088								
.480	H N9219 .480	L						0.0234	0.0218								
.480	H N9229A.480	L						0.0109	0.0152								
.480	H N9229C.480	L						0.0328	0.0160								
.480	H N9236 .480	L						0.0703	0.0063								
.480	H N9240 .480	L						0.0703	0.0063								
.480	H P2101 .480	L						0.0827	0.0338								
.480	H P2106 .480	L						0.0827	0.0338								
.480	H P3106 .480	L						0.0468	0.0228								
.480	H P4103 .480	L						0.0547	0.0763								
.480	H P4118S.480	L						0.1813	0.0885								
.480	H P4201 .480	L						0.1521	0.0742								
.480	H P4501 .480	L						0.1357	0.0662								
.480	H P4601 .480	L						0.0775	0.0205								
H CR201 .480	GLCSWGR1.480	L						0.0332	0.0088								(R)
H N9219 .480	GLCSWGR1.480	L						0.0234	0.0218								(R)
H N9229A.480	GLCSWGR1.480	L						0.0109	0.0152								(R)
H N9229C.480	GLCSWGR1.480	L						0.0328	0.0160								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

	FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PII G1	Y-PII B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
H	N9236 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H	N9240 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H	P2101 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H	P2106 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H	P3106 .480	GLCSWGR1.480	L						0.0468	0.0228								(R)
H	P4103 .480	GLCSWGR1.480	L						0.0547	0.0763								(R)
H	P4118S.480	GLCSWGR1.480	L						0.1813	0.0885								(R)
H	P4201 .480	GLCSWGR1.480	L						0.1521	0.0742								(R)
H	P4501 .480	GLCSWGR1.480	L						0.1357	0.0662								(R)
H	P4601 .480	GLCSWGR1.480	L						0.0775	0.0205								(R)
J	SWGR 24.16	D EQ TAP4.16	L															(R)
	4.16	E SWGR 14.16	L															
	4.16	K C2401 4.16	L						0.0024	0.0005								
	4.16	K P3102 4.16	L						0.0002	0.0003								
	4.16	LLCSWGR2.480	T				133.0		0.0075	0.0406					4.06	0.48	FIX TAP	
	4.16	N SWGR 34.16	L															
K	C2401 4.16	J SWGR 24.16	L						0.0024	0.0005								(R)
K	P3102 4.16	J SWGR 24.16	L						0.0002	0.0003								(R)

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
LLCSWGR2.480	J SWGR 24.16	T				133.0		0.0075	0.0406					0.48	4.06	FIX TAP	(R)
.480	M C2109 .480	L						0.0877	0.0117								
.480	M C7307 .480	L						0.0885	0.0234								
.480	M C8201S.480	L						0.0332	0.0088								
.480	M N9218 .480	L						0.0351	0.0171								
.480	M N9220 .480	L						0.0376	0.0251								
.480	M N9230 .480	L						0.0117	0.0109								
.480	M N9246 .480	L						0.1140	0.0157								
.480	M P2101S.480	L						0.0620	0.0254								
.480	M P2102S.480	L						0.0345	0.0141								
.480	M P2103 .480	L						0.0643	0.0314								
.480	M P4202 .480	L						0.1521	0.0742								
.480	M P4601S.480	L						0.0443	0.0117								
.480	M P4602S.480	L						0.0443	0.0117								
.480	M P5107X.480	L						0.1753	0.0241								
.480	M P8401S.480	L						0.1594	0.0422								
.480	M S7307S.480	L						0.0234	0.0218								
.480	M S7537 .480	L						0.1534	0.0211								
.480	M S7538 .480	L						0.2192	0.0302								
M C2109 .480	LLCSWGR2.480	L						0.0877	0.0117								(R)
M C7307 .480	LLCSWGR2.480	L						0.0885	0.0234								(R)
M C8201S.480	LLCSWGR2.480	L						0.0332	0.0088								(R)
M N9218 .480	LLCSWGR2.480	L						0.0351	0.0171								(R)
M N9220 .480	LLCSWGR2.480	L						0.0376	0.0251								(R)
M N9230 .480	LLCSWGR2.480	L						0.0117	0.0109								(R)
M N9246 .480	LLCSWGR2.480	L						0.1140	0.0157								(R)
M P2101S.480	LLCSWGR2.480	L						0.0620	0.0254								(R)
M P2102S.480	LLCSWGR2.480	L						0.0345	0.0141								(R)
M P2103 .480	LLCSWGR2.480	L						0.0643	0.0314								(R)
M P4202 .480	LLCSWGR2.480	L						0.1521	0.0742								(R)
M P4601S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)
M P4602S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 DATA TABLE LISTING PAGE NO. 6
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 10: 4:49
FSV 230-KV BUS HELD AT 231.EKV--MVA*10 GIVES KVA FSVRAT2S

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
M P5107X.480	LLCSWGR2.480	L					0.1753	0.0241								(R)
M P8401S.480	LLCSWGR2.480	L					0.1594	0.0422								(R)
M S7307S.480	LLCSWGR2.480	L					0.0274	0.0218								(R)
M S7537 .480	LLCSWGR2.480	L					0.1534	0.0211								(R)
M S7538 .480	LLCSWGR2.480	L					0.2182	0.0302								(R)
N SWGR 34.16	J SWGR 24.16	L														(R)
4.16	PLCSWGR54.16	L					0.0009	0.0003								
4.16	PMCXFMR74.16	L					0.0028	0.0014								
4.16	P P3105 4.16	L					0.0012	0.0003								
4.16	P P4102 4.16	L					0.0018	0.0012								
4.16	QLCSWGR3.480	T			133.0		0.0075	0.0403					4.06	0.48	FIX TAP	
P P3105 4.16	N SWGR 34.16	L					0.0012	0.0003								(R)
P P4102 4.16	N SWGR 34.16	L					0.0018	0.0012								(R)
PLCSWGR54.16	N SWGR 34.16	L					0.0009	0.0003								(R)
PMCXFMR74.16	N SWGR 34.16	L					0.0028	0.0014								(R)
QLCSWGR3.480	N SWGR 34.16	T			133.0		0.0075	0.0403					0.48	4.06	FIX TAP	(R)
.480	R C2109S.480	L					0.0877	0.0121								
.480	R C7307S.480	L					0.0620	0.0164								
.480	R C8203 .480	L					0.0221	0.0059								
.480	R N9208 .480	L					0.0137	0.0191								
.480	R N9231 .480	L					0.0137	0.0191								
.480	R N9236S.480	L					0.0352	0.0032								
.480	R N9241 .480	L					0.0352	0.0032								
.480	R N9247 .480	L					0.1315	0.0181								
.480	R P2102 .480	L					0.0482	0.0198								
.480	R P2103S.480	L					0.0526	0.0257								
.480	R P2105 .480	L					0.0409	0.0200								
.480	R P2107 .480	L					0.0345	0.0141								
.480	R P3106S.480	L					0.0538	0.0263								
.480	R P4104 .480	L					0.0430	0.0599								
.480	R P4118 .480	L					0.1872	0.0913								
.480	R P4202S.480	L					0.1287	0.0628								
.480	R P4602 .480	L					0.0443	0.0117								
.480	RP5107SX.480	L					0.1490	0.0205								
.480	R P8401 .480	L					0.1417	0.0375								

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N P C/S	RATE	O	R	X	G1	B1	G2	B2	TAP 1	TAP 2	REMARKS	
R C21095.480	GLCSWGR3.480	L					0.0877	0.0121								(R)
R C73075.480	GLCSWGR3.480	L					0.0620	0.0164								(R)
R C8203 .480	GLCSWGR3.480	L					0.0221	0.0059								(R)
R N9208 .480	GLCSWGR3.480	L					0.0137	0.0191								(R)
R N9231 .480	GLCSWGR3.480	L					0.0137	0.0191								(R)
R N92365.480	GLCSWGR3.480	L					0.0352	0.0032								(R)
R N9241 .480	GLCSWGR3.480	L					0.0352	0.0032								(R)
R N9247 .480	GLCSWGR3.480	L					0.1315	0.0181								(R)
R P2102 .480	GLCSWGR3.480	L					0.0482	0.0198								(R)
R P21035.480	GLCSWGR3.480	L					0.0526	0.0257								(R)
R P2105 .480	GLCSWGR3.480	L					0.0409	0.0200								(R)
R P2107 .480	GLCSWGR3.480	L					0.0345	0.0141								(R)
R P3106S.480	GLCSWGR3.480	L					0.0538	0.0263								(R)
R P4104 .480	GLCSWGR3.480	L					0.0430	0.0599								(R)
R P4118 .480	GLCSWGR3.480	L					0.1872	0.0913								(R)
R P42025.480	GLCSWGR3.480	L					0.1287	0.0628								(R)
R P4602 .480	GLCSWGR3.480	L					0.0443	0.0117								(R)
R PP401 .480	GLCSWGR3.480	L					0.1417	0.0375								(R)
RPS1075X.480	GLCSWGR3.480	L					0.1400	0.0205								(R)
SHVAC E04.16	D EQ TAP4.16	L														(R)
W.16	TRPHVAC 4.16	L					0.0016	0.0007								
4.16	TTPHVAC 4.16	L					0.0005	0.0002								
TRPHVAC 4.16	SHVAC E04.16	L					0.0016	0.0007								(R)
TTPHVAC 4.16	SHVAC E04.16	L					0.0005	0.0002								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N M C/S	RATE	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
FS.V.INF230.	AST.VRN.230.	L					0.0003							

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

PROGRAM CONSTANTS SUBJECT TO MODIFICATION UNDER CONTROL CARD TYPE 6 (TOL)
(SEE POWER FLOW MANUAL.)

#3 BLUE
#4 RED

NUMBER OF DECIMAL PLACES FOR MAPPING

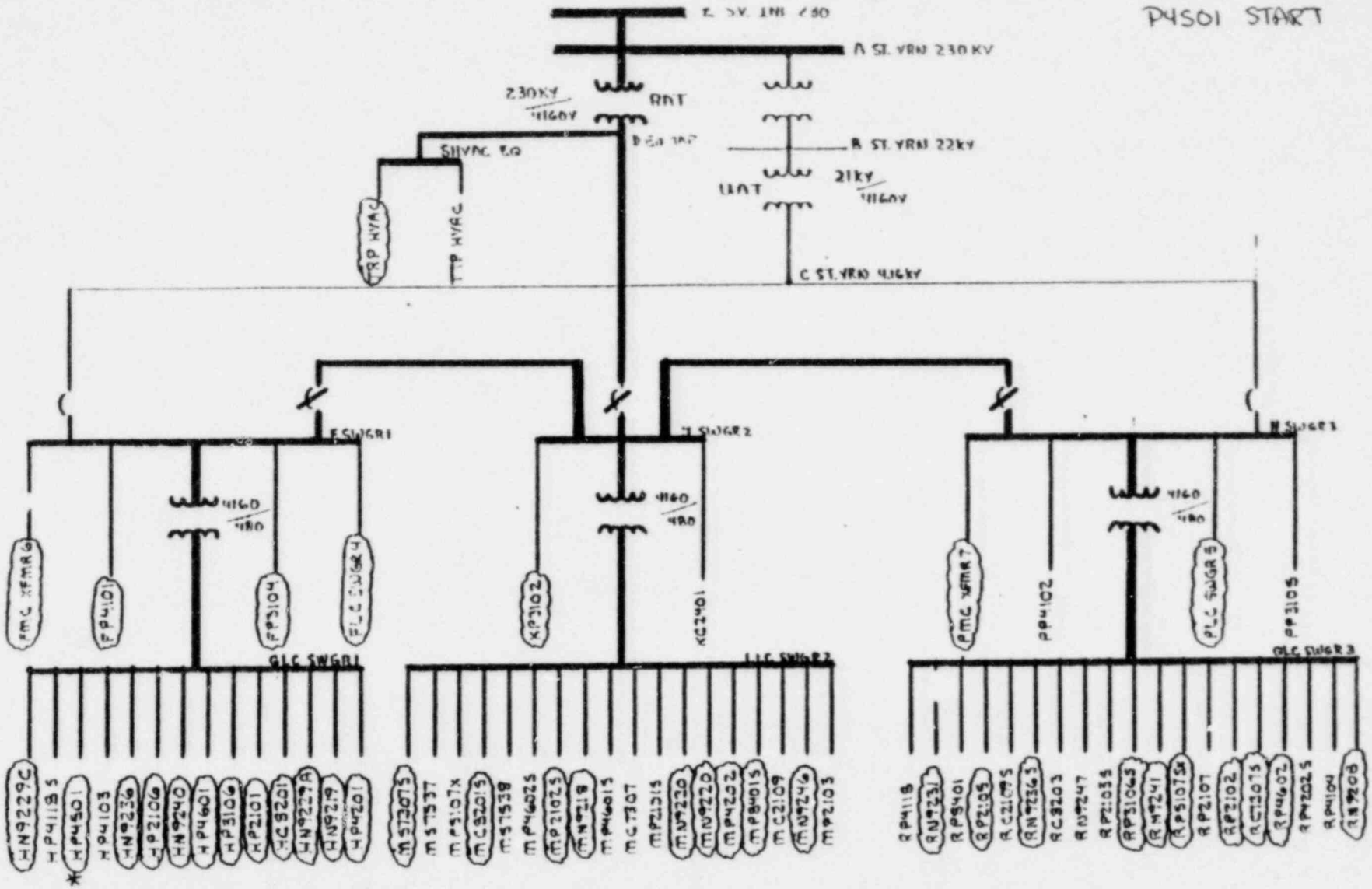
BUS VOLTAGE MAGNITUDE (P.U.)	3
BUS VOLTAGE ANGLE (DEGREES)	2
LOAD AND GENERATION (MW AND MVAR)	2
CAPACITORS AND REACTORS (MW AND MVAR)	2
LINE FLOWS (MW AND MVAR)	2
TRANSFORMER TAPS (P.U.)	3

#1 TAN
#2 GREEN

MW OR MVAR SOLUTION TOLERANCE AT EACH BUS	0.10000
MW OR MVAR TOLERANCE FOR AREA INTERCHANGE EXPORT SOLUTION	1.00000
MW OR MVAR TOLERANCE FOR FLOWS CONTROLLED BY TCUL OR PHASE SHIFTERS	1.00000
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY MVAR	0.00100
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY TCUL	0.00100
MW OR MVAR THRESHOLD FOR MISMATCH TABLE PRINTOUT	2.00000

ATTACHMENT 5
P-82169

RAT IN SERVICE
P4501 START



* THIS LOAD VARIES IN THE THREE COMPUTER RUNS IT IS OFF IN THE FIRST RUN, STARTED ON THE SECOND RUN AND RUNNING ON THE THIRD RUN.

NOTE: THE THIRD RUN FOR THIS STUDY IS THE SAME AS THE THIRD RUN FOR THE P3102 PUMP START

Attachment 5
P-82169

FORM 202 12-1994

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#4 Data Documents 10-96526

GE PSLF PROGRAM REVISION 15
POWER FLOW HISTORY TAPE - - - FORMAT 5

USERS NOTE: OTHERWISE DIAGNOSTICS WILL APPEAR ABOVE THE
DATA WHICH HAS NOT BEEN.

CONTROL CARD 17 4 0 0 0 0 0 0.0 0.0 00 0

CONTROL CARD FOR 0 0 0 0 0 0 0.0 0.0 00 0

FT. ST. VRAIN PLANT AUX VOLTAGE DEFI STUDY--DEF GP8150 05-12-92
PLANT DEF LINE-1A.BMVE FLT AUX TRANSF IN SERVICE 01-00
DEV 230-KV BUS HELD AT 241.6KV--MVA*10 GIVES MVA PSVFAT20

CONTROL CARD FOR 0 0 0 0 0 0 0.0 0.0 00 0

FT. ST. VRAIN PLANT AUX VOLTAGE PROF STUDY--REF GRD150 05-18-82
PLANT OFF LINE-34.0MVA RES AUX TRANSF IN SERVICE AC-EC
FSV 239-KV BUS HELD AT 251.5KV--MVA*10 GIVES KVA FSVRAT32

INPUT DATA LISTING

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
B     P F3105 4.16PS
B     P F4102 4.16PS
P     SLCSWGR3.480PS
B     P C21005.480PS
B     P C7307S.480PS 7.55 5.45
P     P C8203 .480PS
P     P H9208 .480PS 4.72 3.40
P     P H9221 .480PS 4.72 3.40
P     P H9236S.480PS 2.76 1.69
P     P H9241 .480PS 3.98 2.87
P     P H9247 .480PS
P     P F2102 .480PS11.53 8.17
P     P F2103S.480PS
P     P F2105 .480PS11.60 8.51
P     P F2107 .480PS
P     P F3106S.480PS11.66 8.41
P     P F4104 .480PS
P     P F4118 .480PS
P     P F4202S.480PS
P     P F4602 .480PS 7.69 5.54
P     P PF1075X.480VS 5.60 4.04
P     P F8401 .480PS
P     IP1HVAC 4.16PS 74.7 60.3
P     IT1HVAC 4.16PS
```

FORM 292 - 12 1094

FE. ST. VRAIE PLANT AUX VOLTAGE CODE STUDY--REF CASE50 05-18-82
PLANT FOR LINE-14.0MVA RES AUX TRANSF IN SERVICE A6-DD
RSV 230-KV BUS HELD AT 241.0KV--MVA*10 GIVES KVA RSVDAT32

INPUT DATA LISTING

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#1 TAN
#2 GREEN
#3 BLUE
#4 RED

ALL BUS CARDS PROCESSED-WILL PROCESS LINE AND XFMR CARDS NEXT

	L	ZS.V.INF230.	AST.VRN.230.	0000	.00035
	L	D EQ IAP4.16	SHVAC EQ4.16	0000	.00001.00001
	L	D EQ IAP4.16	J SWGR 24.16	0000	.00001.00001
	L	J SWGR 24.16	N SWGR 34.16	0000	.00001
	L	J SWGR 24.16	E SWGR 14.16	0000	.00001
	L	E SWGR 14.16	ELCSWGR44.16	0000	.00107.00028
	L	E SWGR 14.16	EMCXFMR64.16	0000	.00257.00126
	L	E SWGR 14.16	E P3104 4.16	0000	.00128.00028
	L	E SWGR 14.16	E P4101 4.16	0000	.00176.00117
	L	J SWGR 24.16	K C2401 4.16	0000	.00235.00051
	L	J SWGR 24.16	K P3102 4.16	0000	.00018.00026
	L	N SWGR 34.16	PLCSWGR54.16	0000	.00086.00028
	L	N SWGR 34.16	PMCXFMR74.16	0000	.00278.00135
	L	N SWGR 34.16	P P3105 4.16	0000	.00117.00026
	L	N SWGR 34.16	P P4102 4.16	0000	.00177.00118
	L	SHVAC EQ4.16	TRPHVAC 4.16	0000	.00161.00066
	L	SHVAC EQ4.16	TTPHVAC 4.16	0000	.00046.00019
	L	GLCSWGR1.480	H C8201 .480	0000	.03320.00879
	L	GLCSWGR1.480	H N9219 .480	0000	.02344.02179
	L	GLCSWGR1.480	H N9229A.480	0000	.01094.01525
	L	GLCSWGR1.480	H N9229C.480	0000	.03275.01598
	L	GLCSWGR1.480	H N9236 .480	0000	.07031.00634
	L	GLCSWGR1.480	H N9240 .480	0000	.07031.00634
	L	GLCSWGR1.480	H P2101 .480	0000	.08268.03385
	L	GLCSWGR1.480	H P2106 .480	0000	.08268.03385
	L	GLCSWGR1.480	H P3106 .480	0000	.04679.02283
	L	GLCSWGR1.480	H P4103 .480	0000	.05469.07626
	L	GLCSWGR1.480	H P4118S.480	0000	.18130.08847
	L	GLCSWGR1.480	H P4201 .480	0000	.15206.07420
	L	GLCSWGR1.480	H P4501 .480	0000	.13569.06621
	L	GLCSWGR1.480	H P4601 .480	0000	.07747.02051
	L	LLCSWGR2.480	M C2109 .480	0000	.08767.01172
	L	LLCSWGR2.480	M C7307 .480	0000	.08854.02344
	L	LLCSWGR2.480	M C8201S.480	0000	.03320.00879
	L	LLCSWGR2.480	M N9218 .480	0000	.03509.01712
	L	LLCSWGR2.480	M N9220 .480	0000	.03760.02510
	L	LLCSWGR2.480	M N9230 .480	0000	.01172.01089
	L	LLCSWGR2.480	M N9246 .480	0000	.11398.01569
	L	LLCSWGR2.480	M P2101S.480	0000	.06201.02539
	L	LLCSWGR2.480	M P2102S.480	0000	.03445.01411
	L	LLCSWGR2.480	M P2103 .480	0000	.06433.03139
	L	LLCSWGR2.480	M P4202 .480	0000	.15206.07420
	L	LLCSWGR2.480	M P4601S.480	0000	.04427.01172
	L	LLCSWGR2.480	M P4602S.480	0000	.04427.01172
	L	LLCSWGR2.480	M P5107X.480	0000	.17535.02413
	L	LLCSWGR2.480	M P8401S.480	0000	.15938.04219
	L	LLCSWGR2.480	M S7307S.480	0000	.02344.02179
	L	LLCSWGR2.480	M S7537 .480	0000	.15343.02112
	L	LLCSWGR2.480	M S7538 .480	0000	.21918.03016
	L	GLCSWGR3.480	R C2109S.480	0000	.08767.01207

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
        L     GLCSWGR3.480  R C7307S.480   0000          .06198.01641
        L     GLCSWGR3.480  R C8203 .480   0000          .02214.00586
        L     GLCSWGR3.480  R N9208 .480   0000          .01367.01906
        L     GLCSWGR3.480  R N9231 .480   0000          .01367.01906
        L     GLCSWGR3.480  R N92365.480   0000          .03516.00317
        L     GLCSWGR3.480  R N9241 .480   0000          .03516.00317
        L     GLCSWGR3.480  R N9247 .480   0000          .13151.01810
        L     GLCSWGR3.480  R P2102 .480   0000          .04823.01975
        L     GLCSWGR3.480  R P2103S.480   0000          .05264.02568
        L     GLCSWGR3.480  R P2105 .480   0000          .04094.01998
        L     GLCSWGR3.480  R P2107 .480   0000          .03445.01411
        L     GLCSWGR3.480  R P31065.480   0000          .05381.02625
        L     GLCSWGR3.480  R P4104 .480   0000          .04297.05992
        L     GLCSWGR3.480  R P4118 .480   0000          .18715.09132
        L     GLCSWGR3.480  R P4202S.480   0000          .12867.06278
        L     GLCSWGR3.480  R P4602 .480   0000          .04427.01172
        L     GLCSWGR3.480  RP5107SX.480   0000          .14905.02051
        L     GLCSWGR3.480  R P8401 .480   0000          .14167.03750
        T     ASI.VR        D EQ TAP4.16   0000  1400 .0006 .00881      224.2 4.16
        T     E SWG         GLCSWGR1.480   0000   133 .0075 .04590      4.056 .480
        T     J SWG         GLCSWGR2.480   0000   133 .0075 .04057      4.056 .480
        T     N SWG         GLCSWGR3.480   0000   133 .0075 .04027      4.056 .480

ENTERING SUBROUTINE SHUFIT
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRC150 05-18-82 INPUT DATA LISTING
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-ED
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32

ALL BUS AND LINE CARDS PROCESSED-NOW PROCESS REG XFMR, AREA, REACTANCE SWITCHING AND DC LINES
A ZONE ONE ZS.V.INF230. 0.0 PS

********** WARNING-ABS(TOTAL SCHEDULED GENERATION-TOTAL LOAD-NET AREA EXPORT) .GT. .2*TOTAL LOAD FOR AREA ZONE ONE

SYSTEM DATA PROCESSED.

THERE WERE 0 FATAL ERRORS

RETURNING TO MAIN PROGRAM

CONTROL CARD SOL 0 0 0 0 -30 ZS.V.INF230. 0 0.0 0.0 00 0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32

RENUMBERING OF 73 NODES WILL REQUIRE 72 OFF DIAGONALS
THE MAXIMUM NUMBER OF BRANCHES IS 20
BEGIN SOLUTION WITH 73 BUSES AND 72 BRANCHES 5/18/1982 12:42:44

#3 BLUE
#4 RED

ITERATION	SUM OF ABSOLUTE MISMATCHES-PU MEGAWATTS	MEGAVARS	BUSES UNSOLVED	MATRIX SIZE
1	11.145	310.848	47	572
2	3.979	23.687	48	572
3	0.198	0.280	18	572
4	0.001	0.000	0	572

ADJUSTMENTS MADE AT START OF ITERATION

ITERATION	R	RQ RN	RP RM	BV	BQ	BC	BG	BX	TIES	DC
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0

CASE SOLVED 5/18/1982 12:42:45

#1 TAN
#2 GREEN

ENTERING TAPE4

TYPE OF BUS		ACTUAL	MAXIMUM
P AND E - NO Q LIMITS	(BE)	1	2000
P AND Q - NO V LIMITS	(B)	72	2000
DC TERMINAL BUSES	(BD)	0	20
TOTAL NON-REGULATING BUSES		73	2000
P AND E - SELF VAR LIMITS	(BQ)	0	1200
P AND E - USE REMOTE VARS	(BC)	0	50
P AND Q - V LIMITS	(BV)	0	1200
P - SUPPLY REMOTE VARS	(BG)	0	250
TOTAL REGULATING BUSES		0	1200
TOTAL BUSES THIS STUDY		73	2000
ASSOCIATED WITH NON-REG ARE			
P AND Q - V BY REG XFMR	(BT)	0	200
SWITCHED REACTANCE BUSES	(BX)	0	100

P .U. VOLTAGE LIMITS ARE 0.70 TO 1.50

TYPE OF LINE (SECTION)		ACTUAL	MAXIMUM
BUS TIES	(Z=0)	0	200
FIXED TAP XFMR	(T)	4	3500
FIXED PHASE SHIFTER	(TP)	0	100
VARIABLE TAP OR PHASE	(R)	0	200
DC LINES-TWO TERMINAL	(LD)	0	10
LINE EQUIVALENTS	(E)	0	3500
NORMAL PI LINES	(L)	68	3500
TOTAL LINE SECTIONS		72	3500
TOTAL BRANCHES		72	3500

MISCELLANEOUS INFORMATION		
NO. OF ITERATIONS	4	30
NO. OF INTERCHANGE AREAS	1	60
NO. OF ZONES	1	80
NO. OF BUSES OUT OF TOLERANCE	0	0
TOLERANCE AT EACH BUS-MW OR MVAR		0.01000

TIE LINE CONTROL NOT EXERCISED

SYSTEM DATA	MEGAWATTS	MEGAVARS
TOTAL LOAD	988.180	705.780
LOSSES-I*I(R+X)	23.182	179.676
CHARGING-E*E(Y-PI),	0.0	0.0
NET SHUNT ADM	0.0	0.0
SYSTEM MISMATCH	0.000	0.000
TOTAL GENERATION	1011.362	885.456
MAXIMUM POWER	0.0	
PMAX LESS GENERATION	-1011.362	

NOTE-- CHARGING INCLUDES REAL AND REACTIVE COMPONENTS OF POWER (P+JQ) DERIVED FROM EQUIVALENT Y-PI LINES
(SOME ARE DEVELOPED INTERNALLY FROM COMPOSITE LINES COMBINED USING ABCD CONSTANTS)
P(CHARGING) IS TREATED AS A MW LOAD
Q(CHARGING) IS TREATED AS A SOURCE (MVAR)
BOTH MAY BE EITHER POSITIVE OR NEGATIVE

SYSTEM SLACK BUS IS ZS.V.IMF23C.

FOR THE BUSSES LISTED BELOW PGEN IS NEGATIVE, PMAX IS
LESS THAN PGEN, OR PMAX IS POSITIVE AND PGEN IS ZERO:

BUS NAME	KV	ZONE	AREA	PGEN (MW)	PMAX (MW)
FS.V.INF230.	PS		ZONE ONE	1011.36	0.0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF GENERATOR DATA

BUS NAME	PGEN MW	PMAX MW	QGEN MVAR	QMAX MVAR	QMIN MVAR	ACTUAL VOLTAGE	DESIRED VOLTAGE	
ZS.V.INF230.	1011.36	0.0	885.46			1.007		SYSTEM SLACK BUS

SUMMARY OF 0 BUSES WITH VOLTAGE OVER 1.05 PER UNIT

SUMMARY OF 42 BUSES WITH VOLTAGE UNDER 0.95 PER UNIT

BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV
P4101 4.16	PS	0.949	3.9	GLCSWGR1.480	PS	0.910	0.4	H C8201 .480	PS	0.908	0.4
H N9219 .480	PS	0.909	0.4	H N9229A.480	PS	0.910	0.4	H N9229C.480	PS	0.909	0.4
H N9236 .480	PS	0.905	0.4	H N9240 .480	PS	0.908	0.4	H P2101 .480	PS	0.897	0.4
H P2106 .480	PS	0.897	0.4	H P3106 .480	PS	0.902	0.4	H P4103 .480	PS	0.910	0.4
H P4118S.480	PS	0.910	0.4	H P4201 .480	PS	0.883	0.4	H P4501 .480	PS	0.845	0.4
H P46[illegible] .480	PS	0.902	0.4	M C8201S.480	PS	0.950	0.5	M N9246 .480	PS	0.946	0.5
M P21[illegible]S.480	PS	0.947	0.5	M P4202 .480	PS	0.926	0.4	M P8401S.480	PS	0.936	0.4
M S7307S.480	PS	0.947	0.5	QLCSWGR3.480	PS	0.948	0.5	R C2109S.480	PS	0.948	0.5
R C7307S.480	PS	0.942	0.5	R C8203 .480	PS	0.948	0.5	R N9208 .480	PS	0.947	0.5
R N9231 .480	PS	0.947	0.5	R N9236S.480	PS	0.94[illegible]	0.5	R N9241 .480	PS	0.947	0.5
R N9247 .480	PS	0.948	0.5	R P2102 .480	PS	0.941	0.5	R P2103S.480	PS	0.948	0.5
R P2105 .480	PS	0.941	0.5	R P2107 .480	PS	0.948	0.5	R P3106S.480	PS	0.939	0.5
R P4104 .480	PS	0.948	0.5	R P4118 .480	PS	0.948	0.5	R P4202S.480	PS	0.948	0.5
R P4602 .480	PS	0.944	0.5	R P8401 .480	PS	0.948	0.5	RP5107SX.480	PS	0.939	0.5

THERE ARE NO OVERLOADED TRANSMISSION LINES

SUMMARY OF OVERLOADED TRANSFORMERS

FROM BUS	ZONE	TO BUS	ZONE	CKT	MVA FLOW	RATING	PERCENT
E SWGR 14.16	PS	GLCSWGR1.480	PS		162.6	133.0	122.3

THERE ARE NO REGULATING TRANSFORMERS

SUMMARY OF LOSSES BY OWNER IN MEGAWATTS

OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES
	23.182						

********** TOTAL SYSTEM LOSSES ARE 23.182 MW **********

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-92 ALPHABETIC BUS LIST PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1992 12:42:45
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32

BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME
AST.VRN.230.	(PS)	ZONE ONE	D EQ TAP4.16	(PS)	ZONE ONE	E SWGR 14.16	(PS)	ZONE ONE	F P3104 4.16	(PS)	ZONE ONE
F P4101 4.16	(PS)	ZONE ONE	FLCSWGR44.16	(PS)	ZONE ONE	FMCXFMR64.16	(PS)	ZONE ONE	GLCSWGR1.480	(PS)	ZONE ONE
H C8201 .480	(PS)	ZONE ONE	H N9219 .480	(PS)	ZONE ONE	H N9229A.480	(PS)	ZONE ONE	H N9229C.480	(PS)	ZONE ONE
H N9236 .480	(PS)	ZONE ONE	H N9240 .480	(PS)	ZONE ONE	H P2101 .480	(PS)	ZONE ONE	H P2106 .480	(PS)	ZONE ONE
H P3106 .480	(PS)	ZONE ONE	H P4103 .480	(PS)	ZONE ONE	H P411BS.480	(PS)	ZONE ONE	H P4201 .480	(PS)	ZONE ONE
H P4501 .480	(PS)	ZONE ONE	H P4601 .480	(PS)	ZONE ONE	J SWGR 24.16	(PS)	ZONE ONE	K C2401 4.16	(PS)	ZONE ONE
K P3102 4.16	(PS)	ZONE ONE	LLCSWGR2.480	(PS)	ZONE ONE	M C2109 .480	(PS)	ZONE ONE	M C7307 .480	(PS)	ZONE ONE
M C8201S.480	(PS)	ZONE ONE	M N9218 .480	(PS)	ZONE ONE	M N9220 .480	(PS)	ZONE ONE	M N9230 .480	(PS)	ZONE ONE
M N9246 .480	(PS)	ZONE ONE	M P2101S.480	(PS)	ZONE ONE	M P2102S.480	(PS)	ZONE ONE	M P2103 .480	(PS)	ZONE ONE
M P4202 .480	(PS)	ZONE ONE	M P4601S.480	(PS)	ZONE ONE	M P4602S.480	(PS)	ZONE ONE	M P5107X.480	(PS)	ZONE ONE
M P8401S.480	(PS)	ZONE ONE	M S7307S.480	(PS)	ZONE ONE	M S7537 .480	(PS)	ZONE ONE	M S7538 .480	(PS)	ZONE ONE
N SWGR 34.16	(PS)	ZONE ONE	P P3105 4.16	(PS)	ZONE ONE	P P4102 4.16	(PS)	ZONE ONE	PLCSWGR54.16	(PS)	ZONE ONE
PMCXFMR74.16	(PS)	ZONE ONE	QLCSWGR3.480	(PS)	ZONE ONE	R C2109S.480	(PS)	ZONE ONE	R C7307S.480	(PS)	ZONE ONE
R C8203 .480	(PS)	ZONE ONE	R N9208 .480	(PS)	ZONE ONE	R N9231 .480	(PS)	ZONE ONE	R N9236S.480	(PS)	ZONE ONE
R N9241 .480	(PS)	ZONE ONE	R N9247 .480	(PS)	ZONE ONE	R P2102 .480	(PS)	ZONE ONE	R P2103S.480	(PS)	ZONE ONE
R P2105 .480	(PS)	ZONE ONE	R P2107 .480	(PS)	ZONE ONE	R P3106S.480	(PS)	ZONE ONE	R P4104 .480	(PS)	ZONE ONE
R P411A .480	(PS)	ZONE ONE	R P4202S.480	(PS)	ZONE ONE	R P4602 .480	(PS)	ZONE ONE	R P8401 .480	(PS)	ZONE ONE
RP5107SX.480	(PS)	ZONE ONE	SHVAC EQ4.16	(PS)	ZONE ONE	TRPHVAC 4.16	(PS)	ZONE ONE	TTPHVAC 4.16	(PS)	ZONE ONE
ZS.V.INF230.	(PS)	ZONE ONE		( )			( )			( )	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-1R-P2 POWER FLOW REPORT PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
FSV 230-KV BUS HELD AT 231.4KV--MVA*10 GIVES KVA FSVRAT32 5/18/1982 12:42:45

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID	BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
AST.VRN.230.	1.0039	0.0	0.0	0.0	0.0	0.0	0.0							
230.9 KV	-0.2				TAP	224.20/	4.16		D EQ TAP4.16	1011.9	879.2	10.2	149.2	95.7
									ZS.V.INF230.	-1011.4	-879.2	0.0	6.2	
D EQ TAP4.16	0.9523	0.0	0.0	0.0	0.0	0.0	0.0							
4.0 KV	-5.1								AST.VRN.230.	-1001.2	-730.1	10.2	149.2	88.5
									J SWGR 24.16	926.3	669.7	0.1	0.1	
									SHVAC EQ4.16	74.9	60.4	0.0	0.0	
E SWGR 14.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0							
4.0 KV	-5.1								E P3104 4.16	37.6	24.0	0.0	0.0	
									E P4101 4.16	131.7	86.8	0.5	0.3	
									ELCSWGR44.16	37.6	24.0	0.0	0.0	
									FMCXFMR64.16	52.0	32.5	0.1	0.1	
					TAP	4.06/	0.48		GLCSWGR1.480	103.4	125.5	2.1	12.7	122.3*
									J SWGR 24.16	-362.4	-292.8	0.0	0.0	
E P3104 4.16	0.9515	0.0	0.0	37.6	24.0	0.0	0.0							
4.0 KV	-5.1								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
E P4101 4.16	0.9486	0.0	0.0	131.2	86.5	0.0	0.0							
3.9 KV	-5.1								E SWGR 14.16	-131.2	-86.5	0.5	0.3	
ELCSWGR44.16	0.9516	0.0	0.0	37.6	24.0	0.0	0.0							
4.0 KV	-5.1								E SWGR 14.16	-37.6	-24.0	0.0	0.0	
FMCXFMR64.16	0.9503	0.0	0.0	51.9	32.4	0.0	0.0							
4.0 KV	-5.1								E SWGR 14.16	-51.9	-32.4	0.1	0.1	
GLCSWGR1.480	0.9104	0.0	0.0	0.0	0.0	0.0	0.0							
0.4 KV	-7.6								E SWGR 14.16	-101.3	-112.8	2.1	12.7	114.0*
									H CR201 .480	6.4	4.3	0.0	0.0	
									H N9219 .480	3.7	2.5	0.0	0.0	
									H N9229A.480	3.7	2.5	0.0	0.0	
									H N9229C.480	3.7	2.5	0.0	0.0	
									H N9236 .480	6.5	4.4	0.1	0.0	
									H N9240 .480	3.1	2.0	0.0	0.0	
									H P2101 .480	11.8	7.9	0.2	0.1	
									H P2106 .480	11.8	7.9	0.2	0.1	
									H P3106 .480	12.1	8.1	0.1	0.1	
									H P4103 .480	-0.0	-0.0	0.0	0.0	
									H P4118S.480	-0.0	-0.0	0.0	0.0	
									H P4201 .480	12.5	8.3	0.4	0.2	
									H P4501 .480	18.0	57.3	5.9	2.9	
									H P4601 .480	8.0	5.3	0.1	0.0	
H CR201 .480	0.9027	0.0	0.0	6.4	4.3	0.0	0.0							
0.4 KV	-7.5								GLCSWGR1.480	-6.4	-4.2	0.0	0.0	
H N9219 .480	0.9088	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-7.6								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229A.480	0.9095	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-7.6								GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229C.480	0.9086	0.0	0.0	3.7	2.5	0.0	0.0							
0.4 KV	-7.5								GLCSWGR1.480	.7	-2.5	0.0	0.0	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

(.9104)(480) = 437.0

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FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-18-82 POWER FLOW REPORT PAGE NO. 2
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
FSV 220-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32 5/18/1982 12:42:45

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
H N9234 .480	0.9858	0.0	0.0	6.5	4.4	0.0	0.0						
0.4 KV	-7.4							GLCSWGR1.480	-6.5	-4.3	0.1	0.0	
H N9240 .480	0.9879	0.0	0.0	3.0	2.0	0.0	0.0						
0.4 KV	-7.5							GLCSWGR1.480	-3.0	-2.0	0.0	0.0	
H P2101 .480	0.8867	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-7.4							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
H P2106 .480	0.8967	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-7.4							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
H P3106 .480	0.9022	0.0	0.0	12.0	8.0	0.0	0.0						
0.4 KV	-7.5							GLCSWGR1.480	-11.9	-8.0	0.1	0.1	
H P4103 .480	0.9104	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							GLCSWGR1.480	0.0	0.0	0.0	0.0	
H P4118S.480	0.9104	0.0	0.0	0.0	0.0	0.0	0.0						
0.4 KV	-7.6							GLCSWGR1.480	0.0	0.0	0.0	0.0	
H P4201 .480	0.8828	0.0	0.0	12.1	8.1	0.0	0.0						
0.4 KV	-7.3							GLCSWGR1.480	-12.1	-8.1	0.4	0.2	
H P4501 .480	0.8450	0.0	0.0	12.1	54.4	0.0	0.0						
0.4 KV	-2.7							GLCSWGR1.480	-12.1	-54.4	5.9	2.9	
H P4601 .480	0.9024	0.0	0.0	7.9	5.3	0.0	0.0						
0.4 KV	-7.4							GLCSWGR1.480	-7.9	-5.3	0.1	0.0	
J SWGR 24.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							D EQ TAP4.16	-926.2	-669.5	0.1	0.1	
								E SWGR 14.16	362.4	292.8	0.0	0.0	
								K C2401 4.16	-0.0	-0.0	0.0	0.0	
								K P3102 4.16	328.2	216.4	0.3	0.4	
						TAP	4.067	0.44					
								LLCSWGR2.480	69.3	46.1	0.5	2.9	62.6
								N SWGR 34.16	166.4	114.2	0.0	0.0	
K C2401 4.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							J SWGR 24.16	0.0	0.0	0.0	0.0	
K P3102 4.16	0.9509	0.0	0.0	327.9	216.0	0.0	0.0						
4.0 KV	-5.1							J SWGR 24.16	-327.9	-216.0	0.3	0.4	
LLCSWGR2.480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.6							J SWGR 24.16	-68.7	-43.2	0.5	2.9	61.0
								M C2109 .480	-0.0	-0.0	0.0	0.0	
								M C7307 .480	-0.0	-0.0	0.0	0.0	
								M CR201S.480	6.5	4.1	0.0	0.0	
								M N9218 .480	3.2	2.0	0.0	0.0	
								M N9220 .480	3.2	2.0	0.0	0.0	
								M N9230 .480	3.2	2.0	0.0	0.0	
								M N9246 .480	5.0	3.2	0.0	0.0	
								M P2101S.480	-0.0	-0.0	0.0	0.0	
								M P2102S.480	11.9	7.5	0.1	0.0	
								M P2103 .480	-0.0	-0.0	0.0	0.0	
								M P4202 .480	12.5	7.8	0.4	0.2	
								M P4601S.480	-0.0	-0.0	0.0	0.0	
								M P4602S.480	-0.0	-0.0	0.0	0.0	
								M P5107X.480	-0.0	-0.0	0.0	0.0	

(.8450)(480) = 405.6V

(.9521)(4160) = 3960.7V

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 POWER FLOW REPORT PAGE NO. 3
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AE-DD ZONE( ) OF AREA(ZONE ONE)
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32 5/18/1982 12:42:45

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION... MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID	BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
									M P8401S.480	8.3	5.2	0.2	0.0	
									M S7535.480	15.0	9.5	0.1	0.1	
									M S7537 .480	-0.0	-0.0	0.0	0.0	
									M S7538 .480	-0.0	-0.0	0.0	0.0	
M C2109 .480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C7307 .480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C8201S.480	0.9497	0.0	0.0	6.5	4.1	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	-6.5	-4.1	0.0	0.0	
M N9218 .480	0.9509	0.0	0.0	3.2	2.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9220 .480	0.9506	0.0	0.0	3.2	2.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9230 .480	0.9510	0.0	0.0	3.2	2.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9246 .480	0.9458	0.0	0.0	5.0	3.2	0.0	0.0							
0.5 KV	-6.4								LLCSWGR2.480	-5.0	-3.1	0.0	0.0	
M P2101S.480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P2102S.480	0.9470	0.0	0.0	11.8	7.5	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	-11.8	-7.4	0.1	0.0	
M P2103 .480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4202 .480	0.9264	0.0	0.0	12.1	7.6	0.0	0.0							
0.4 KV	-6.5								LLCSWGR2.480	-12.1	-7.6	0.4	0.2	
M P4601S.480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4602S.480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P5107X.480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P8401S.480	0.9362	0.0	0.0	8.2	5.1	0.0	0.0							
0.4 KV	-6.3								LLCSWGR2.480	-8.2	-5.1	0.2	0.0	
M S7307S.480	0.9465	0.0	0.0	14.9	9.4	0.0	0.0							
0.5 KV	-6.7								LLCSWGR2.480	-14.9	-9.4	0.1	0.1	
M S7537 .480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
M S7538 .480	0.9524	0.0	0.0	0.0	0.0	0.0	0.0							
0.5 KV	-6.6								LLCSWGR2.480	0.0	0.0	0.0	0.0	
N SWGR 34.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0							
4.0 KV	-5.1								J SWGR 24.16	-166.4	-114.2	0.0	0.0	
									P P3105 4.16	-0.0	-0.0	0.0	0.0	
									P P4102 4.16	-0.0	0.0	0.0	0.0	
									PLCSWGR54.16	37.2	26.0	0.0	0.0	
									PMCXFMR74.16	56.1	32.7	0.1	0.1	
					TAP	4.067	0.48		QLCSWGR3.480	73.0	55.5	0.7	3.6	69.0

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF CR0150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32

POWER FLOW REPORT PAGE NO. 4
ZONE( ) OF AREA(ZONE ONE)
5/18/1982 12:42:45

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	......LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P3105 4.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.1							N SWGR 34.16	0.0	0.0	0.0	0.0	
P4102 4.16	0.9521	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.1							N SWGR 34.16	0.0	-0.0	0.0	0.0	
QLCSWGR34.16	0.9517	0.0	0.0	37.2	26.0	0.0	0.0	----------					
4.0 KV	-5.1							N SWGR 34.16	-37.2	-26.0	0.0	0.0	
PMCXFMR74.16	0.9506	0.0	0.0	56.0	32.6	0.0	0.0	----------					
4.0 KV	-5.1							N SWGR 34.16	-56.0	-32.6	0.1	0.1	
QLCSWGR7.480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.7							N SWGR 34.16	-72.4	-52.0	0.7	3.6	67.0
								R C2109S.480	-0.0	-0.0	0.0	0.0	
								R C7307S.480	7.6	5.5	0.1	0.0	
								R CB203 .480	-0.0	-0.0	0.0	0.0	
								R N9208 .480	4.7	3.4	0.0	0.0	
								R N9231 .480	4.7	3.4	0.0	0.0	
								R N9236S.480	2.8	2.0	0.0	0.0	
								R N9241 .480	4.0	2.9	0.0	0.0	
								R N9247 .480	-0.0	-0.0	0.0	0.0	
								R P2102 .480	11.4	8.2	0.1	0.0	
								R P2103S.480	-0.0	-0.0	0.0	0.0	
								R P2105 .480	11.9	8.6	0.1	0.0	
								R P2107 .480	-0.0	-0.0	0.0	0.0	
								R P3106S.480	11.8	8.5	0.1	0.1	
								R P4104 .480	-0.0	-0.0	0.0	0.0	
								R P4118 .480	-0.0	-0.0	0.0	0.0	
								R P4202S.480	-0.0	-0.0	0.0	0.0	
								R P4602 .480	7.7	5.6	0.0	0.0	
								R PR401 .480	-0.0	-0.0	0.0	0.0	
								RP5107SX.480	5.7	4.1	0.1	0.0	
R C2109S.480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R C7307S.480	0.9424	0.0	0.0	7.6	5.5	0.0	0.0	----------					
0.5 KV	-6.5							QLCSWGR3.480	-7.6	-5.4	0.1	0.0	
R CB203 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R N9208 .480	0.9470	0.0	0.0	4.7	3.4	0.0	0.0	----------					
0.5 KV	-6.7							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9231 .480	0.9470	0.0	0.0	4.7	3.4	0.0	0.0	----------					
0.5 KV	-6.7							QLCSWGR3.480	-4.7	-3.4	0.0	0.0	
R N9236S.480	0.9473	0.0	0.0	2.8	2.0	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	-2.8	-2.0	0.0	0.0	
R N9241 .480	0.9468	0.0	0.0	4.0	2.9	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	-4.0	-2.9	0.0	0.0	
R N9247 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2102 .480	0.9408	0.0	0.0	11.3	8.2	0.0	0.0	----------					
0.5 KV	-6.6							QLCSWGR3.480	-11.3	-8.2	0.1	0.0	

#3 BLUE
#4 RED

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BUS NAME / ACTUAL KV	VOLTS-PU / ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P2103S.480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P2105 .480	0.9414	0.0	0.0	11.8	8.5	0.0	0.0						
0.5 KV	-6.8							QLCSWGR3.480	-11.8	-8.5	0.1	0.0	
P P2107 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P P3106S.480	0.9393	0.0	0.0	11.7	8.4	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	-11.7	-8.4	0.1	0.1	
R P4104 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4118 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4202S.480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
R P4602 .480	0.9441	0.0	0.0	7.7	5.5	0.0	0.0						
0.5 KV	-6.6							QLCSWGR3.480	-7.7	-5.5	0.0	0.0	
R P8401 .480	0.9484	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.7							QLCSWGR3.480	0.0	0.0	0.0	0.0	
P P5107SX.480	0.9386	0.0	0.0	5.6	4.0	0.0	0.0						
0.5 KV	-6.4							QLCSWGR3.480	-5.6	-4.0	0.1	0.0	
SHVAC E04.16	0.9523	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							D EQ TAP4.16	-74.9	-60.4	0.0	0.0	
								TRPHVAC 4.16	74.9	60.4	0.2	0.1	
								TTPHVAC 4.16	-0.0	0.0	0.0	0.0	
TRPHVAC 4.16	0.9506	0.0	0.0	74.7	60.3	0.0	0.0						
4.0 KV	-5.1							SHVAC E04.16	-74.7	-60.3	0.2	0.1	
TTPHVAC 4.16	0.9523	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.1							SHVAC E04.16	0.0	-0.0	0.0	0.0	
ZS.V.INF230.	1.0070	1011.4	885.5	0.0	0.0	0.0	0.0						
231.6 KV	0.0							AST.VRN.230.	1011.4	885.5	0.0	6.2	

END OF REPORT FOR THIS CASE

#3 BLUE
#4 RED
#1 TAN
#2 GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
B		AST.VRN.230.	PS												##	
B		D EQ TAP4.16	PS												##	
B		E SWGR 14.16	PS												##	
B		F P3104 4.16	PS	37.6	24.0										##	
B		F P4101 4.16	PS	131.2	86.5										##	
B		FLCSWGR44.16	PS	37.6	24.0										##	
B		FMCXFMR44.16	PS	51.9	32.4										##	
B		GLCSWGR1.480	PS												##	
B		H CR201 .480	PS	6.4	4.3										##	
B		H N9219 .480	PS	3.7	2.5										##	
B		H N9229A.480	PS	3.7	2.5										##	
B		H N9229C.480	PS	3.7	2.5										##	
B		H N9236 .480	PS	6.5	4.3										##	
B		H N9240 .480	PS	3.0	2.0										##	
B		H P2101 .480	PS	11.6	7.8										##	
B		H P2104 .480	PS	11.6	7.8										##	
B		H P3104 .480	PS	11.9	8.0										##	
B		H P4103 .480	PS												##	
B		H P4118S.480	PS												##	
B		H P4201 .480	PS	12.1	8.1										##	
B		H P4501 .480	PS	12.1	54.4										##	
B		H P4601 .480	PS	7.9	5.3										##	
B		J SWGR 24.16	PS												##	
B		K C2401 4.16	PS												##	
B		K P3102 4.16	PS	327.9	216.0										##	
B		LLCSWGR2.480	PS												##	
B		M C2109 .480	PS												##	
B		M C7307 .480	PS												##	
B		M CR201S.480	PS	6.5	4.1										##	
B		M N9218 .480	PS	3.2	2.0										##	
B		M N9228 .480	PS	3.2	2.0										##	
B		M N9238 .480	PS	3.2	2.0										##	
B		M N9246 .480	PS	5.0	3.1										##	
B		M P2101S.480	PS												##	
B		M P2102S.480	PS	11.8	7.4										##	
B		M P2103 .480	PS												##	
B		M P4202 .480	PS	12.1	7.6										##	
B		M P4601S.480	PS												##	
B		M P4602S.480	PS												##	
B		M P5107X.480	PS												##	
B		M P8401S.480	PS	8.2	5.1										##	
B		M S7307S.480	PS	14.9	9.4										##	
B		M S7537 .480	PS												##	
B		M S7538 .480	PS												##	
B		N SWGR 34.16	PS												##	

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
B		P P3105 4.16	PS												00	
B		P P4102 4.16	PS												00	
B		PLCSWGR54.16	PS	37.2	26.0										00	
B		PMCXFMR74.16	PS	56.0	32.6										00	
B		PLCSWGR3.480	PS												00	
B		P C2105S.480	PS												00	
B		R C7307S.480	PS	7.5	5.4										00	
B		R C8203 .480	PS												00	
B		R N9208 .480	PS	4.7	3.4										00	
B		R N9231 .480	PS	4.7	3.4										00	
B		R N9236S.480	PS	2.8	2.0										00	
B		R N9241 .480	PS	4.0	2.9										00	
B		R N9247 .480	PS												00	
B		R P2102 .480	PS	11.3	8.2										00	
B		R P2103S.480	PS												00	
B		R P2105 .480	PS	11.8	8.5										00	
B		R P2107 .480	PS												00	
B		R P3106S.480	PS	11.7	8.4										00	
B		R P4104 .480	PS												00	
B		R P4118 .480	PS												00	
B		R P4202S.480	PS												00	
B		R P4602 .480	PS	7.7	5.5										00	
B		R P8401 .480	PS												00	
B		RP5107SX.480	PS	5.6	4.0										00	
B		SHVAC E04.16	PS												00	
B		TRPHVAC 4.16	PS	74.7	60.3										00	
B		TTPHVAC 4.16	PS												00	
HE		ZS.V.INF230.	PS						1011.4			1.007			00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
AST.VRN.230.	ZS.V.INF230.	L							0.0003								(R)
230.	D EG TAP4.16	T				1400.		0.0006	0.0088					224.20	4.16	FIX TAP	
D EG TAP4.16	AST.VRN.230.	T				1400.		0.0006	0.0088					4.16	224.20	FIX TAP	(R)
4.16	SHVAC EQ4.16	L															
4.16	J SWGR 24.16	L															
E SWGR 14.16	ELCSWGR44.16	L						0.0011	0.0003								
4.16	EMCXFMR64.16	L						0.0026	0.0013								
4.16	E P3104 4.16	L						0.0013	0.0003								
4.16	E P4101 4.16	L						0.0018	0.0012								
4.16	GLCSWGR1.480	T				133.0		0.0075	0.0459					4.06	0.48	FIX TAP	
4.16	J SWGR 24.16	L															(R)
E P3104 4.16	E SWGR 14.16	L						0.0013	0.0003								(R)
E P4101 4.16	E SWGR 14.16	L						0.0018	0.0012								(R)
ELCSWGR44.16	E SWGR 14.16	L						0.0011	0.0003								(R)
EMCXFMR64.16	E SWGR 14.16	L						0.0026	0.0013								(R)
GLCSWGR1.480	E SWGR 14.16	T				133.0		0.0075	0.0459					0.48	4.06	FIX TAP	(R)
.480	H CR201 .480	L						0.0332	0.0088								
.480	H N9219 .480	L						0.0234	0.0218								
.480	H N9229A.480	L						0.0109	0.0152								
.480	H N9229C.480	L						0.0328	0.0160								
.480	H N9236 .480	L						0.0703	0.0063								
.480	H N9240 .480	L						0.0703	0.0063								
.480	H P2101 .480	L						0.0827	0.0338								
.480	H P2106 .480	L						0.0827	0.0338								
.480	H P3106 .480	L						0.0668	0.0228								
.480	H P4103 .480	L						0.0347	0.0763								
.480	H P4118S.480	L						0.1813	0.0885								
.480	H P4201 .480	L						0.1521	0.0742								
.480	H P4501 .480	L						0.1357	0.0662								
.480	H P4601 .480	L						0.0775	0.0205								
H CR201 .480	GLCSWGR1.480	L						0.0332	0.0088								(R)
H N9219 .480	GLCSWGR1.480	L						0.0234	0.0218								(R)
H N9229A.480	GLCSWGR1.480	L						0.0109	0.0152								(R)
H N9229C.480	GLCSWGR1.480	L						0.0328	0.0160								(R)

#3 - BLUE
#4 - RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

	FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N C/S	RATE	O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
M	B9236	.480	CLCSWGR	1.480	L			0.0703	0.0063								(R)
M	B9240	.480	CLCSWGR	1.480	L			0.0703	0.0063								(R)
M	P2101	.480	CLCSWGR	1.480	L			0.0827	0.0338								(R)
M	P2106	.480	CLCSWGR	1.480	L			0.0827	0.0338								(R)
M	P3106	.480	CLCSWGR	1.480	L			0.0468	0.0228								(R)
M	P4103	.480	CLCSWGR	1.480	L			0.0547	0.0763								(R)
M	P4118S	.480	CLCSWGR	1.480	L			0.1813	0.0885								(R)
M	P4201	.480	CLCSWGR	1.480	L			0.1521	0.0742								(R)
M	P4501	.480	CLCSWGR	1.480	L			0.1357	0.0662								(R)
M	P4601	.480	CLCSWGR	1.480	L			0.0775	0.0205								(R)
J	SWGR	24.16	D	EQ TAP	4.16	L											(R)
		4.16	E	SWGR	14.16	L											
		4.16	K	C2401	4.16	L		0.0024	0.0005								
		4.16	K	P3102	4.16	L		0.0002	0.0003								
		4.16	LLCSWGR	2.480	T		133.0	0.0075	0.0406					4.06	0.48	FIX TAP	
		4.16	N	SWGR	34.16	L											
K	C2401	4.16	J	SWGR	24.16	L		0.0024	0.0005								(R)
K	P3102	4.16	J	SWGR	24.16	L		0.0002	0.0003								(R)

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
LLCSWGR2.480	J SWGR 24.16	T				133.0		0.0075	0.0406					0.98	4.06	FIX TAP	(R)
.480	M C2109 .480	L						0.0877	0.0117								
.480	M C7357 .480	L						0.0885	0.0234								
.480	M C8201S.480	L						0.0332	0.0088								
.480	M N9218 .480	L						0.0351	0.0171								
.480	M N9220 .480	L						0.0376	0.0251								
.480	M N9230 .480	L						0.0117	0.0109								
.480	M N9246 .480	L						0.1140	0.0157								
.480	M P2101S.480	L						0.0620	0.0254								
.480	M P2102S.480	L						0.0345	0.0141								
.480	M P2103 .480	L						0.0643	0.0314								
.480	M P4202 .480	L						0.1521	0.0742								
.480	M P4601S.480	L						0.0443	0.0117								
.480	M P4602S.480	L						0.0443	0.0117								
.480	M P5107X.480	L						0.1753	0.0241								
.480	M P8401S.480	L						0.1594	0.0422								
.480	M S7307S.480	L						0.0234	0.0218								
.480	M S7937 .480	L						0.1534	0.0211								
.480	M S7938 .480	L						0.2192	0.0302								
M C2109 .480	LLCSWGR2.480	L						0.0877	0.0117								(R)
M C7357 .480	LLCSWGR2.480	L						0.0885	0.0234								(R)
M C8201S.480	LLCSWGR2.480	L						0.0332	0.0088								(R)
M N9218 .480	LLCSWGR2.480	L						0.0351	0.0171								(R)
M N9220 .480	LLCSWGR2.480	L						0.0376	0.0251								(R)
M N9230 .480	LLCSWGR2.480	L						0.0117	0.0109								(R)
M N9246 .480	LLCSWGR2.480	L						0.1140	0.0157								(R)
M P2101S.480	LLCSWGR2.480	L						0.0620	0.0254								(R)
M P2102S.480	LLCSWGR2.480	L						0.0345	0.0141								(R)
M P2103 .480	LLCSWGR2.480	L						0.0643	0.0314								(R)
M P4202 .480	LLCSWGR2.480	L						0.1521	0.0742								(R)
M P4601S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)
M P4602S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
M P5107X.480	LLCSWGR2.480	L						0.1753	0.0241								(R)
M PR401S.480	LLCSWGR2.480	L						0.1594	0.0422								(R)
M S7307S.480	LLCSWGR2.480	L						0.0234	0.0218								(R)
M S7537 .480	LLCSWGR2.480	L						0.1534	0.0211								(R)
M S7538 .480	LLCSWGR2.480	L						0.2192	0.0302								(R)
M SWGR 34.16	J SWGR 24.16	L															(R)
4.16	PLCSWGR54.16	L						0.0009	0.0003								
4.16	PMCXFMR74.16	L						0.0028	0.0014								
4.16	P P3105 4.16	L						0.0012	0.0003								
4.16	P P4102 4.16	L						0.0018	0.0012								
4.16	RLCSWGR3.480	T				133.0		0.0075	0.0403					4.06	0.48	FIX TAP	
P P3105 4.16	N SWGR 34.16	L						0.0012	0.0003								(R)
P P4102 4.16	N SWGR 34.16	L						0.0018	0.0012								(R)
PLCSWGR54.16	N SWGR 34.16	L						0.0009	0.0003								(R)
PMCXFMR74.16	N SWGR 34.16	L						0.0028	0.0014								(R)
RLCSWGR3.480	N SWGR 34.16	T				133.0		0.0075	0.0403					0.48	4.06	FIX TAP	(R)
.480	R C2109S.480	L						0.0877	0.0121								
.480	R C7307S.480	L						0.0620	0.0164								
.480	R C8203 .480	L						0.0221	0.0059								
.480	R N9208 .480	L						0.0137	0.0191								
.480	R N9231 .480	L						0.0137	0.0191								
.480	R N9236S.480	L						0.0352	0.0032								
.480	R N9241 .480	L						0.0352	0.0032								
.480	R N9247 .480	L						0.1315	0.0181								
.480	R P2102 .480	L						0.0482	0.0198								
.480	R P2103S.480	L						0.0526	0.0257								
.480	R P2105 .480	L						0.0409	0.0200								
.480	R P2107 .480	L						0.0345	0.0141								
.480	R P3106S.480	L						0.0538	0.0263								
.480	R P4104 .480	L						0.0430	0.0599								
.480	R P4118 .480	L						0.1872	0.0913								
.480	R P4202S.480	L						0.1287	0.0628								
.480	R P4602 .480	L						0.0443	0.0117								
.480	RP5107CX.480	L						0.1490	0.0205								
.480	R PR401 .480	L						0.1417	0.0375								

#3 - BLUE
#4 - RED

#1 - TAN
#2 - GREEN

FORM 202 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF G80150 05-18-82 DATA TABLE LISTING PAGE NO. 7
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 12:42:45
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT32

LINE DATA FOR AREA ZONE ONE

	FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
	C2109S.480	GLCSWGR3.480	L						0.0877	0.0121								(R)
	C7307S.480	GLCSWGR3.480	L						0.0620	0.0164								(R)
	C8203 .480	GLCSWGR3.480	L						0.0221	0.0059								(R)
	N9208 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
	N9231 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
	N9236S.480	GLCSWGR3.480	L						0.0352	0.0032								(R)
	N9241 .480	GLCSWGR3.480	L						0.0352	0.0032								(R)
	N9247 .480	GLCSWGR3.480	L						0.1315	0.0181								(R)
	P2102 .480	GLCSWGR3.480	L						0.0482	0.0198								(R)
	P2103S.480	GLCSWGR3.480	L						0.0526	0.0257								(R)
	P2105 .480	GLCSWGR3.480	L						0.0409	0.0200								(R)
	P2107 .480	GLCSWGR3.480	L						0.0345	0.0141								(R)
	P3106S.480	GLCSWGR3.480	L						0.0538	0.0263								(R)
	P4104 .480	GLCSWGR3.480	L						0.0430	0.0599								(R)
	P4118 .480	GLCSWGR3.480	L						0.1872	0.0913								(R)
	P4202S.480	GLCSWGR3.480	L						0.1287	0.0628								(R)
	P4602 .480	GLCSWGR3.480	L						0.0443	0.0117								(R)
	P8401 .480	GLCSWGR3.480	L						0.1417	0.0375								(R)
	PPS1075X.480	GLCSWGR3.480	L						0.1490	0.0205								(R)
	SHVAC EQ4.16	D EQ TAP4.16	L															(R)
	4.16	TRPHVAC 4.16	L						0.0016	0.0007								
	4.16	TTPHVAC 4.16	L						0.0005	0.0002								
	TRPHVAC 4.16	SHVAC EQ4.16	L						0.0016	0.0007								(R)
	TTPHVA 4.16	SHVAC EQ4.16	L						0.0005	0.0002								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	O	N R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
ZS.V.INF230.	AST.VRN.230.	L							0.0003							

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

PROGRAM CONSTANTS SUBJECT TO MODIFICATION UNDER CONTROL CARD TYPE 6 (TOL)
(SEE POWER FLOW MANUAL.)

#3 BLUE
#4 RED

NUMBER OF DECIMAL PLACES FOR MAPPING

BUS VOLTAGE MAGNITUDE (P.U.)	3
BUS VOLTAGE ANGLE (DEGREES)	2
LOAD AND GENERATION (MW AND MVAR)	2
CAPACITORS AND REACTORS (MW AND MVAR)	2
LINE FLOWS (MW AND MVAR)	2
TRANSFORMER TAPS (P.U.)	3

#1 TAN
#2 GREEN

MW OR MVAR SOLUTION TOLERANCE AT EACH BUS	0.10000
MW OR MVAR TOLERANCE FOR AREA INTERCHANGE EXPORT SOLUTION	1.00000
MW OR MVAR TOLERANCE FOR FLOWS CONTROLLED BY TCULS OR PHASE SHIFTERS	1.00000
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY MVAR	0.00100
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY TCUL	0.00100
MW OR MVAR THRESHOLD FOR MISMATCH TABLE PRINTOUT	2.00000

Attachment 5
P-82169

#3. BLUE
#4. RED

#1. TAN
#2. GREEN

```
                    ASEE POWER FLOW PROGRAM REVISION 55
                   POWER FLOW HISTORY TAPE - - - FORMAT 8


          UNLESS NOTED OTHERWISE DIAGNOSTICS WILL APPEAR ABOVE THE
          DATA WHICH HAS THE ERROR.
```

CONTROL CARD	17	4	0	0	0	0	0	0.0	0.0	00	0
CONTROL CARD NOS		0	0	0	0	0	0	0.0	0.0	00	0

```
 FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF CR0150        05-18-82
 PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE              AG-DD
 FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA              FSVRAT231
```

CONTROL CARD NOS		0	0	0	0	0	0	0.0	0.0	00	0

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GA0150 05-15-92 INPUT DATA LISTING →
PLANT DEF LINE-14.7MVA FES AUX TRANSF IN SERVICE A6-DD
ASV 13N-KV BUS NELG AT 231.6KV--MVA*10 GIVES KVA FSVBAT231

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

ENTERING DATA INPUT ROUTINE-ALL PUS CARDS WILL BE PROCESSED FIRST

```
                                                                    1987
BE    ZS.V.1NF230.PS
P     AST.VAA.230.PS
B     P FD TAP4.16PS
M     SHVAC FDA.16PS
B     F SWGR 14.16PS
B     FLCSWGR44.16PS 37.6 29.0
B     FMCXFMR14.16PS 51.9 32.4
C     F F2104 4.16PS 37.4 29.0
B     F F4101 4.16PS131.3 86.46
D     GLESWGE1.480PS
M     M CP201 .480PS 6.36 4.25
B     M NP219 .480PS 3.73 2.50
B     M NP225A.480PS 3.73 2.50
B     M NP225C.480PS 3.73 2.50
B     M NP236 .480PS 6.40 4.35
B     M NP240 .480PS 3.04 2.03
M     M P2101 .480PS11.61 7.77
B     M P2106 .480PS11.61 7.77
B     M P2109 .480PS11.95 8.00
B     M P4103 .480PS
B     M P4119S.480PS
B     M P4201 .480PS12.09 8.09
B     M P4F01 .480PS
B     M P4601 .480PS 7.88 5.27
B     J SWGR 24.16PS
B     K C2401 4.16PS
B     K P3102 4.16PS327.9216.0
B     LLCSWGR2.480PS
M     M C2109 .480PS
B     M C7507 .480PS
M     M CP201S.480PS 6.47 4.38
B     M NP218 .480PS 3.17 1.99
B     M NP220 .480PS 3.17 1.99
B     M NP230 .480PS 3.17 1.99
B     M NP246 .480PS 4.99 3.15
B     M P2101S.480PS
B     M P2102S.480PS11.82 7.45
B     M P2103 .480PS
B     M P4202 .480PS12.10 7.62
B     M P4F01S.480PS
B     M P4602S.480PS
B     M PS107X.480PS
P     M PP401S.480PS 8.16 5.14
B     M S2507S.480PS14.91 9.40
B     M S2537 .480PS
B     M S2538 .480PS
B     N SWGR 34.16PS
B     PLCSWGR54.16PS 37.9 26.0
B     PMCXFMR24.16PS 56.8 32.6
```

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
R      P 55105 4.16PS
R      P 59102 4.16PS
R      GE1SW663.480PS
R      S 591095.480PS
R      R 73575.480PS 7.55 5.45
R      R 59203 .480PS
R      R 59208 .480PS 4.72 3.40
E      R 59231 .480PS 4.72 3.40
E      R 592365.480PS 2.76 1.99
R      R 59241 .480PS 3.98 2.87
R      P 59247 .480PS
R      R 62102 .480PS11.33 8.17
R      P 621035.480PS
R      R 63105 .480PS11.80 8.51
R      P 67107 .480PS
R      P 631065.480PS11.66 8.41
R      R 69104 .480PS
S      R 6911R .480PS
R      R 692025.480PS
R      R 74602 .480PS 7.69 5.54
R      RF 1075X.480PS 5.60 4.04
E      P 78401 .480PS
R      TFFHVAC 4.16PS 74.7 60.3
R      TFFHVAC 4.16PS
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-10-92
PLANT DEF LINE-14.0MVA RFS AUX TRANSF IN SERVICE AG-DD
FSV 350-KV BUS HELD AT 231.KKV--MVA*10 GIVES KVA FSVPAT231

INPUT DATA LISTING

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 '994

ALL MDS CARDS PROCESSED-WILL PROCESS LINE AND XFMR CARDS NEXT

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
L     2*.V.INF230.  AST.VRN.230.    0.000                .00035
L     D FQ TAP4.16  SHVAC E04.16    0.000          .00001.00001
L     D FQ TAP4.16  J SWGR 24.16    0.000          .00001.00001
L     J SWGR 24.16  N SWGR 34.16    0.000                .00001
L     J SWGR 24.16  E SWGR 14.16    0.000                .00001
L     E SWGR 14.16  ELCSWGR44.16    0.000          .00107.00078
L     E SWGR 14.16  FMCXFMR64.16    0.000          .00257.00126
L     E SWGR 14.16  E P3104 4.16    0.000          .00128.00028
L     E SWGR 14.16  E P4101 4.16    0.000          .00176.00117
L     J SWGR 24.16  K C2401 4.16    0.000          .00235.00051
L     J SWGR 24.16  K P3102 4.16    0.000          .00018.00026
L     N SWGR 34.16  ELCSWGR54.16    0.000          .00086.00028
L     N SWGR 34.16  FMCXFMR74.16    0.000          .00278.00135
L     N SWGR 34.16  P P3105 4.16    0.000          .00117.00024
L     N SWGR 34.16  P P4102 4.16    0.000          .00177.00118
L     SHVAC E04.16  TRPHVAC 4.16    0.000          .00161.00066
L     SHVAC E04.16  TIPHVAC 4.16    0.000          .00046.00019
L     ELCSWGR1.480  H C2201 .480    0.000          .03320.00879
L     ELCSWGR1.480  H N2219 .480    0.000          .02344.02179
L     ELCSWGR1.480  H N9229A.480    0.000          .01094.01525
L     ELCSWGR1.480  H N9229C.480    0.000          .03275.01598
L     ELCSWGR1.480  H N9236 .480    0.000          .07031.00634
L     ELCSWGR1.480  H N9240 .480    0.000          .07031.00634
L     ELCSWGR1.480  H P2101 .480    0.000          .08268.03385
L     ELCSWGR1.480  H P2106 .480    0.000          .08268.03385
L     ELCSWGR1.480  H P3106 .480    0.000          .04679.02283
L     ELCSWGR1.480  H P4103 .480    0.000          .05469.07626
L     ELCSWGR1.480  H P4118S.480    0.000          .18130.08847
L     ELCSWGR1.480  H P4201 .480    0.000          .15206.07420
L     ELCSWGR1.480  H P4501 .480    0.000          .13569.06621
L     ELCSWGR1.480  H P4601 .480    0.000          .07747.02851
L     LLCSWGR2.480  M C2109 .480    0.000          .08767.01172
L     LLCSWGR2.480  M C7307 .480    0.000          .08854.02344
L     LLCSWGR2.480  M CB201S.480    0.000          .03320.00879
L     LLCSWGR2.480  M N9218 .480    0.000          .03509.01712
L     LLCSWGR2.480  M N9220 .480    0.000          .03760.02510
L     LLCSWGR2.480  M N9230 .480    0.000          .01172.01089
L     LLCSWGR2.480  M N9246 .480    0.000          .01398.01569
L     LLCSWGR2.480  M P2101S.480    0.000          .06201.02539
L     LLCSWGR2.480  M P2102S.480    0.000          .03445.01411
L     LLCSWGR2.480  M P2103 .480    0.000          .06433.03139
L     LLCSWGR2.480  M P4202 .480    0.000          .15206.07420
L     LLCSWGR2.480  M P4601S.480    0.000          .04427.01172
L     LLCSWGR2.480  M P4602S.480    0.000          .04427.01172
L     LLCSWGR2.480  M PS107X.480    0.000          .17535.02413
L     LLCSWGR2.480  M PA401S.480    0.000          .15938.04219
L     LLCSWGR2.480  M S7307S.480    0.000          .02344.02179
L     LLCSWGR2.480  M S7537 .480    0.000          .15343.02112
L     LLCSWGR2.480  M S7538 .480    0.000          .21915.03016
L     GLCSWGR3.480  M C2109S.480    0.000          .08767.01207
```

FT. ST. VRAIN-PEAK AND VOLTAGE TMOD STUDY--REF 000150 05-18-92 INPUT DATA LISTING
PLANT OFF LINE-19.0MVA REC AUX TRANSF IN SERVICE 16:00
ESV 230-KV BUS HELD AT 231.0KV--SVP-1E GIVES KVA FENKAI251

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

```
        L     GLESWER3.480  R C75075.480    0000          .05198.01641
        L     GLESWGR3.480  R C75207 .480    0000          .00716.00588
        L     GLESWER3.480  R N9266 .480     0000          .01347.01504
        L     GLESWER3.480  R N9231 .480     0000          .01347.01504
        L     GLESWER3.480  R N92362.480     0000          .03516.00317
        L     GLESWER3.480  R N9241 .480     0000          .03516.00317
        L     GLESWER3.480  R N9247 .480     0000          .13151.01810
        L     GLESWER3.480  R P2102 .480     0000          .04827.01975
        L     GLESWER3.480  R P21035.480     0000          .05264.02568
        L     GLESWER3.480  R P2105 .480     0000          .04894.01998
        L     GLESWER3.480  R P2107 .480     0000          .03445.01411
        L     GLESWER3.480  R P41065.480     0000          .05381.02625
        L     GLESWER3.480  R P4104 .480     0000          .04297.05992
        L     GLESWER3.480  R P4118 .480     0000          .18715.09132
        L     GLESWER3.480  R P42025.480     0000          .12967.06276
        L     GLESWER3.480  R P4602 .480     0000          .04427.01172
        L     GLESWER3.480  RP51075X.480     0000          .14905.02051
        L     GLESWER3.480  R P9401 .480     0000          .14167.03750
        T     AST.VRN.230.  0 EG TAP4.16     0000  1400 .0006 .00881          224.2 4.16
        T     E SWGR 14.1E  GLESWGR1.480     0000   133 .0075 .04590          4.056 .480
        T     J SWGR 24.1E  GLESWGR2.480     0000   133 .0075 .04057          4.056 .480
        T     N SWGR 34.1E  GLESWGR3.480     0000   133 .0075 .04027          4.056 .480

ENTERING SUBROUTINE SHUFLE
```

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-19-92 INPUT DATA LISTING
PLANT OFF LINE-14.0MVA PFS AUX TRANSF IN SERVICE AG-DD
FSV 230-KV BUS HELD AT 231.0KV--MVA*10 GIVES KVZ FSVRAT231

ALL BUS AND LINE CARDS PROCESSED-NOW PROCESS REG XFMR, AREA, REACTANCE SWITCHING AND DC LINES
A ZONE ONE ZS.V.INF230. 0.0 PS

********** WARNING-ABS(TOTAL SCHEDULED GENERATION-TOTAL LOAD-NET AREA EXPORT) .GT. .2*TOTAL LOAD FOR AREA ZONE ONE

#3 BLUE
#4 RED

SYSTEM DATA PROCESSED.

THERE WERE 0 FATAL ERRORS

RETURNING TO MAIN PROGRAM

CONTROL CARD SOL 0 0 0 0 -30 ZS.V.INF230. 0 0.0 0.0 00 0

#1 TAN
#2 GREEN

FORM 292 12 1964

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRD150 05-18-82
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE A6-PD
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT221

RENUMBERING OF 73 NODES WILL REQUIRE 72 OFF DIAGONALS
THE MAXIMUM NUMBER OF BRANCHES IS 20
BEGIN SOLUTION WITH 73 BUSES AND 72 BRANCHES 5/18/1982 12:39:18

ITERATION	SUM OF ABSOLUTE MISMATCHES-PU MEGAWATTS	MEGAVARS	BUSES UNSOLVED	MATRIX SIZE	ADJUSTMENTS MADE AT START OF ITERATION R	RC RN	RP RM	BV	BG	BC	PG	BX	TIES	PC
1	11.025	310.304	46	572	0	0	0	0	0	0	0	0	0	0
2	3.738	23.329	47	572	0	0	0	0	0	0	0	0	0	0
3	0.161	0.243	17	572	0	0	0	0	0	0	0	0	0	0
4	0.000	0.000	0	572	0	0	0	0	0	0	0	0	0	0

CASE SOLVED 5/18/1982 12:39:20

ENTERING TAPEA

#3 BLUE
#4 RED

TYPE OF BUS		ACTUAL	MAXIMUM
P AND E - NO Q LIMITS	(PE)	1	2000
P AND Q - NO V LIMITS	(PQ)	72	2000
DC TERMINAL BUSES	(PD)	0	20
TOTAL NON-REGULATING BUSES		73	2000
P AND E - SELF VAR LIMITS	(PO)	0	1200
P AND E - USE REMOTE VARS	(PC)	0	50
P AND Q - V LIMITS	(PV)	0	1200
P - SUPPLY REMOTE VARS	(PR)	0	250
TOTAL REGULATING BUSES		0	1200
TOTAL BUSES THIS STUDY		73	2000
ASSOCIATED WITH NON-REG ARE			
P AND Q - V BY REG XFMR	(RT)	0	200
SWITCHED REACTANCE BUSES	(RX)	0	100

#1 TAN
#2 GREEN

P.U. VOLTAGE LIMITS ARE 0.70 TO 1.50

TYPE OF LINE (SECTION)		ACTUAL	MAXIMUM
BUS TIES	(Z=0)	0	200
FIXED TAP XFMR	(T)	4	3500
FIXED PHASE SHIFTER	(TP)	0	100
VARIABLE TAP OR PHASE	(R)	0	200
DC LINES-TWO TERMINAL	(LD)	0	10
LINE EQUIVALENTS	(E)	0	3500
NORMAL PI LINES	(L)	68	3500
TOTAL LINE SECTIONS		72	3500
TOTAL BRANCHES		72	3500

MISCELLANEOUS INFORMATION

NO. OF ITERATIONS	4	30
NO. OF INTERCHANGE AREAS	1	60
NO. OF ZONES	1	90
NO. OF BUSES OUT OF TOLERANCE	0	0
TOLERANCE AT EACH BUS-MW OR MVAR		0.01000

TIE LINE CONTROL NOT EXERCISED

SYSTEM DATA	MEGAWATTS	MEGAVARS
TOTAL LOAD	976.090	651.380
LOSSES-I*I(R+X)	14.871	153.782
CHARGING-E*E(Y-PI).	0.0	0.0
NET SHUNT ADM	0.0	0.0
SYSTEM MISMATCH	0.000	0.000
TOTAL GENERATION	990.961	805.162
MAXIMUM POWER	0.0	
PMAX LESS GENERATION	-990.961	

NOTE-- CHARGING INCLUDES REAL AND REACTIVE COMPONENTS OF POWER (P+JQ) DERIVED FROM EQUIVALENT Y-PI LINES
(SOME ARE DEVELOPED INTERNALLY FROM COMPOSITE LINES COMBINED USING ABCD CONSTANTS)
P(CHARGING) IS TREATED AS A MW LOAD
Q(CHARGING) IS TREATED AS A SOURCE (MVAR)
BOTH MAY BE EITHER POSITIVE OR NEGATIVE

SYSTEM SLACK BUS IS ZS.V.INF230.

FOR THE BUSSES LISTED BELOW PGEN IS NEGATIVE, PMAX IS
LESS THAN PGEN, OR PMAX IS POSITIVE AND PGEN IS ZERO:

BUS NAME	KV	ZONE	AREA	PGEN (MW)	PMAX (MW)
FS.V.INF230.	FS	ZONE ONE		990.96	0.0

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

SUMMARY OF GENERATOR DATA

BUS NAME	PGEN MW	PMAX MW	QGEN MVAR	QMAX MVAR	QMIN MVAR	ACTUAL VOLTAGE	DESIRED VOLTAGE	
5.V.1GE230.	990.96	0.0	805.16			1.007		SYSTEM SLACK BUS

SUMMARY OF 0 BUSES WITH VOLTAGE OVER 1.05 PER UNIT

SUMMARY OF 21 BUSES WITH VOLTAGE UNDER 0.95 PER UNIT

BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV	BUS NAME	ZONE	P.U.	KV
LESVIR1.480	PS	0.950	0.5	H CR201 .480	PS	0.947	0.5	H N9219 .480	PS	0.948	0.5
H N9229A.480	PS	0.949	0.5	H N9229C.480	PS	0.948	0.5	H N9236 .480	PS	0.945	0.5
H N9248 .480	PS	0.947	0.5	H P2101 .480	PS	0.937	0.4	H P2106 .480	PS	0.937	0.4
H P3106 .480	PS	0.942	0.5	H P4103 .480	PS	0.950	0.5	H P4118S.480	PS	0.950	0.5
H P4201 .480	PS	0.923	0.4	H P4501 .480	PS	0.950	0.5	H P4601 .480	PS	0.942	0.5
H P4202 .480	PS	0.934	0.4	M P8401S.480	PS	0.944	0.5	R P2102 .480	PS	0.948	0.5
P P2105 .480	PS	0.949	0.5	R P3106S.480	PS	0.947	0.5	RP5107SX.480	PS	0.946	0.5

THERE ARE NO OVERLOADED TRANSMISSION LINES

THERE ARE NO OVERLOADED TRANSFORMERS

THERE ARE NO REGULATING TRANSFORMERS

SUMMARY OF LOSSES BY OWNER IN MEGAWATTS

OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES	OWNER	LOSSES
	14.871						

********** TOTAL SYSTEM LOSSES ARE 14.871 MW **********

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-82 ALPHABETIC BUS LIST PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 12:38:20
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVRAT231

BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME	BUS NAME	ZN	AREA NAME
AST.VRN.230.	(PS)	ZONE ONE	D EQ TAP4.16	(PS)	ZONE ONE	E SWGR 14.16	(PS)	ZONE ONE	F P3104 4.16	(PS)	ZONE ONE
F P4101 4.16	(PS)	ZONE ONE	FLCSWGR44.16	(PS)	ZONE ONE	FMCXFMR64.16	(PS)	ZONE ONE	GLCSWGR1.480	(PS)	ZONE ONE
H CB201 .480	(PS)	ZONE ONE	H N9219 .480	(PS)	ZONE ONE	H N9229A.480	(PS)	ZONE ONE	H N9229C.480	(PS)	ZONE ONE
H N9236 .480	(PS)	ZONE ONE	H N9240 .480	(PS)	ZONE ONE	H P2101 .480	(PS)	ZONE ONE	H P2106 .480	(PS)	ZONE ONE
H P5106 .480	(PS)	ZONE ONE	H P4103 .480	(PS)	ZONE ONE	H P4118S.480	(PS)	ZONE ONE	H P4201 .480	(PS)	ZONE ONE
H P4501 .480	(PS)	ZONE ONE	H P4601 .480	(PS)	ZONE ONE	J SWGR 24.16	(PS)	ZONE ONE	K C2401 4.16	(PS)	ZONE ONE
K P3102 4.16	(PS)	ZONE ONE	LLCSWGR2.480	(PS)	ZONE ONE	M C2109 .480	(PS)	ZONE ONE	M C7307 .480	(PS)	ZONE ONE
M CB261S.480	(PS)	ZONE ONE	M N9218 .480	(PS)	ZONE ONE	M N9220 .480	(PS)	ZONE ONE	M N9230 .480	(PS)	ZONE ONE
M N9246 .480	(PS)	ZONE ONE	M P2101S.480	(PS)	ZONE ONE	M P2102S.480	(PS)	ZONE ONE	M P2103 .480	(PS)	ZONE ONE
M P4202 .480	(PS)	ZONE ONE	M P4601S.480	(PS)	ZONE ONE	M P4602S.480	(PS)	ZONE ONE	M P5107X.480	(PS)	ZONE ONE
M P8401S.480	(PS)	ZONE ONE	M S7307S.480	(PS)	ZONE ONE	M S7537 .480	(PS)	ZONE ONE	M S7538 .480	(PS)	ZONE ONE
N SWGR 34.16	(PS)	ZONE ONE	P P3105 4.16	(PS)	ZONE ONE	P P4102 4.16	(PS)	ZONE ONE	PLCSWGR54.16	(PS)	ZONE ONE
PMCXFMR74.16	(PS)	ZONE ONE	QLCSWGR3.480	(PS)	ZONE ONE	R C2159S.480	(PS)	ZONE ONE	R C7307S.480	(PS)	ZONE ONE
R CN203 .480	(PS)	ZONE ONE	R N9208 .480	(PS)	ZONE ONE	R N9231 .480	(PS)	ZONE ONE	R N9236S.480	(PS)	ZONE ONE
R N9241 .480	(PS)	ZONE ONE	R N9247 .480	(PS)	ZONE ONE	R P2102 .480	(PS)	ZONE ONE	R P2103S.480	(PS)	ZONE ONE
R P2105 .480	(PS)	ZONE ONE	R P2107 .480	(PS)	ZONE ONE	R P3106S.480	(PS)	ZONE ONE	R P4104 .480	(PS)	ZONE ONE
R P4118 .480	(PS)	ZONE ONE	R P4202S.480	(PS)	ZONE ONE	R P4602 .480	(PS)	ZONE ONE	R P8401 .480	(PS)	ZONE ONE
RP5107SX.480	(PS)	ZONE ONE	SHVAC EQ4.16	(PS)	ZONE ONE	TRPHVAC 4.16	(PS)	ZONE ONE	TTPHVAC 4.16	(PS)	ZONE ONE
ZS.V.INF230.	(PS)	ZONE ONE		( )			( )			( )	

#3 BLUE
#4 RED
#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-18-92 POWER FLOW REPORT PAGE NO. 1
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD ZONE( ) OF AREA(ZONE ONE)
ESV 230-KV BUS HELD AT 231.0 KV--MVA*10 GIVES KVA ESVRAT231 5/18/1992 12:39:20

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
AST.VRN.230.	1.0042	0.0	0.0	0.0	0.0	0.0	0.0						
231.0 KV	-0.2				TAP	204.20/	4.16	0 EQ TAP4.16	991.0	799.5	0.2	134.4	98.9
								ZS.V.INF230.	-991.0	-799.5	0.0	5.6	
0 EQ TAP4.16	0.9994	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							AST.VRN.230.	-981.8	-664.9	0.2	134.6	84.7
								J SWGR 24.16	906.9	604.6	0.1	0.1	
								SHVAC E04.16	74.9	60.4	0.0	0.0	
E SWGR 14.16	0.9892	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							E P3104 4.16	37.6	24.0	0.0	0.0	
								E P4101 4.16	131.7	86.8	0.5	0.3	
								ELCSWGR44.16	37.6	24.0	0.0	0.0	
								EMCXFMR64.16	52.0	32.5	0.1	0.1	
					TAP	4.06/	0.48	GLCSWGR1.480	84.1	60.6	0.8	5.1	77.9
								J SWGR 24.16	-343.0	-227.8	-0.0	0.0	
E P3104 4.16	0.9886	0.0	0.0	37.6	24.0	0.0	0.0						
4.0 KV	-5.0							E SWGR 14.16	-37.6	-24.0	0.0	0.0	
E P4101 4.16	0.9857	0.0	0.0	131.2	86.5	0.0	0.0						
4.0 KV	-5.0							E SWGR 14.16	-131.2	-86.5	0.5	0.3	
ELCSWGR44.16	0.9887	0.0	0.0	37.6	24.0	0.0	0.0						
4.0 KV	-5.0							E SWGR 14.16	-37.6	-24.0	0.0	0.0	
EMCXFMR64.16	0.9874	0.0	0.0	51.9	32.4	0.0	0.0						
4.0 KV	-5.0							E SWGR 14.16	-51.9	-32.4	0.1	0.1	
GLCSWGR1.480	0.9498	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.1							E SWGR 14.16	-83.2	-55.5	0.8	5.1	75.2
								H CB201 .480	6.4	4.3	0.0	0.0	
								H N9219 .480	3.7	2.5	0.0	0.0	
								H N9229A.480	3.7	2.5	0.0	0.0	
								H N9229C.480	3.7	2.5	0.0	0.0	
								H N9236 .480	6.5	4.4	0.0	0.0	
								H N9240 .480	3.1	2.0	0.0	0.0	
								H P2101 .480	11.8	7.8	0.2	0.1	
								H P2106 .480	11.8	7.8	0.2	0.1	
								H P3106 .480	12.1	8.1	0.1	0.1	
								H P4103 .480	-0.0	0.0	0.0	0.0	
								H P4118S.480	-0.0	0.0	0.0	0.0	
								H P4201 .480	12.5	8.3	0.4	0.2	
								H P4501 .480	-0.0	0.0	0.0	0.0	
								H P4601 .480	8.0	5.3	0.1	0.0	
H CB201 .480	0.9471	0.0	0.0	6.4	4.3	0.0	0.0						
0.5 KV	-7.0							GLCSWGR1.480	-6.4	-4.2	0.0	0.0	
H N9219 .480	0.9483	0.0	0.0	3.7	2.5	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229A.480	0.9489	0.0	0.0	3.7	2.5	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	-3.7	-2.5	0.0	0.0	
H N9229C.480	0.9481	0.0	0.0	3.7	2.5	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	-3.7	-2.5	0.0	0.0	

(.9498)(480) = 455.9v

#1 TAN
#2 GREEN

#3 BLUE
#4 RED

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
M N9234 .480	0.9846	0.0	0.0	6.5	4.4	0.0	0.0						
0.5 KV	-6.9							GLCSWGR1.480	-6.5	-4.3	0.0	0.0	
M N9240 .480	0.9874	0.0	0.0	3.0	2.0	0.0	0.0						
0.5 KV	-7.0							GLCSWGR1.480	-3.0	-2.0	0.0	0.0	
M P2101 .480	0.9847	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-6.9							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
M P2102 .480	0.9847	0.0	0.0	11.6	7.8	0.0	0.0						
0.4 KV	-6.9							GLCSWGR1.480	-11.6	-7.8	0.2	0.1	
M P3106 .480	0.9819	0.0	0.0	12.0	8.0	0.0	0.0						
0.5 KV	-7.0							GLCSWGR1.480	-11.9	-8.0	0.1	0.1	
M P4103 .480	0.9808	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	0.0	-0.0	0.0	0.0	
M P4115 .480	0.9808	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	0.0	-0.0	0.0	0.0	
M P4201 .480	0.9834	0.0	0.0	12.1	8.1	0.0	0.0						
0.4 KV	-6.9							GLCSWGR1.480	-12.1	-8.1	0.4	0.2	
M P4501 .480	0.9808	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-7.1							GLCSWGR1.480	0.0	-0.0	0.0	0.0	
M P4601 .480	0.9821	0.0	0.0	7.9	5.3	0.0	0.0						
0.5 KV	-6.9							GLCSWGR1.480	-7.9	-5.3	0.1	0.0	
J SWGR 24.16	0.9592	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							D EQ TAP4.16	-906.8	-604.5	0.1	0.1	
								E SWGR 14.16	343.0	227.8	-0.0	0.0	
								K C2401 4.16	-0.0	-0.0	0.0	0.0	
								K P3102 4.16	328.2	216.4	0.3	0.4	
						TAP	4.067 0.48	LLCSWGR2.480	69.3	46.1	0.5	2.9	62.5
								N SWGR 34.16	166.3	114.2	0.0	0.0	
K C2401 4.16	0.9592	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							J SWGR 24.16	0.0	0.0	0.0	0.0	
K P3102 4.16	0.9560	0.0	0.0	327.9	216.0	0.0	0.0						
4.0 KV	-5.0							J SWGR 24.16	-327.9	-216.0	0.3	0.4	
LLCSWGR2.480	0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							J SWGR 24.16	-68.7	-43.2	0.5	2.9	61.0
								M C2109 .480	-0.0	-0.0	0.0	0.0	
								M C7307 .480	-0.0	-0.0	0.0	0.0	
								M CR201S.480	6.5	4.1	0.0	0.0	
								M N9218 .480	3.2	2.0	0.0	0.0	
								M N9220 .480	3.2	2.0	0.0	0.0	
								M N9230 .480	3.2	2.0	0.0	0.0	
								M N9246 .480	5.0	3.2	0.0	0.0	
								M P2101S.480	-0.0	-0.0	0.0	0.0	
								M P2102S.480	11.9	7.5	0.1	0.0	
								M P2103 .480	-0.0	-0.0	0.0	0.0	
								M P4202 .480	12.5	7.8	0.4	0.2	
								M P4601S.480	-0.0	-0.0	0.0	0.0	
								M P4602S.480	-0.0	-0.0	0.0	0.0	
								M P5107X.480	-0.0	-0.0	0.0	0.0	

(.9592)(4160) = 3990.3 V

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GRB1*0 05-19-82 POWER FLOW REPORT PAGE NO. 3
PLANT OFF LINE-14.3MVA RES AUX TRANSF IN SERVICE A6-00 ZONE( ) OF AREA(ZONE ONE)
230-KV BUS HELD AT 231.+KV--MVA*10 GIVES KVA FSVFAT231 5/19/1982 12:59:20

BUS NAME VOLTS-PU ACTUAL KV ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
							M P8401S.480	8.3	5.2	0.2	0.0	
							M S7307S.480	15.0	9.5	0.1	0.1	
							M S7537 .480	-0.0	-0.0	0.0	0.0	
							M S7538 .480	-0.0	-0.0	0.0	0.0	
M C2107 .480 0.9559	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C7307 .480 0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M C8201S.480 0.9573	0.0	0.0	6.5	4.1	0.0	0.0						
0.5 KV -6.4							LLCSWGR2.480	-6.5	-4.1	0.0	0.0	
M N9518 .480 0.9584	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9528 .480 0.9581	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9538 .480 0.9593	0.0	0.0	3.2	2.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	-3.2	-2.0	0.0	0.0	
M N9548 .480 0.9554	0.0	0.0	5.0	3.2	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	-5.0	-3.1	0.0	0.0	
M P2101S.480 0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P2102S.480 0.9545	0.0	0.0	11.8	7.5	0.0	0.0						
0.5 KV -6.4							LLCSWGR2.480	-11.8	-7.4	0.1	0.0	
M P2103 .480 0.9597	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4202 .480 0.9341	0.0	0.0	12.1	7.6	0.0	0.0						
0.4 KV -6.3							LLCSWGR2.480	-12.1	-7.6	0.4	0.2	
M P4601S.480 0.9509	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P4602S.480 0.9589	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P5107X.480 0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M P8401S.480 0.9438	0.0	0.0	8.2	5.1	0.0	0.0						
0.5 KV -6.2							LLCSWGR2.480	-8.2	-5.1	0.2	0.0	
M S7307S.480 0.9541	0.0	0.0	14.9	9.4	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	-14.9	-9.4	0.1	0.1	
M S7537 .480 0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M S7538 .480 0.9599	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV -6.5							LLCSWGR2.480	0.0	0.0	0.0	0.0	
M SWGR 24.16 0.9592	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV -6.0							J SWGR 24.16	-166.3	-114.1	0.0	0.0	
							P P2105 4.16	-0.0	-0.0	0.0	0.0	
							P P4102 4.16	-0.0	-0.0	0.0	0.0	
							PLCSWGR54.16	37.2	26.0	0.0	0.0	
							PMCXFMR74.16	56.1	32.7	0.1	0.1	
				TAP 4.06/	0.48		SLCSWGR3.480	73.0	55.5	0.7	3.5	68.9

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

#3 BLUE
#4 RED
#1 TAN
#2 GREEN

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P3105 4.16	0.9592	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.0							N SWGR 34.16	0.0	0.0	0.0	0.0	
P P4102 4.16	0.9592	0.0	0.0	0.0	0.0	0.0	0.0	----------					
4.0 KV	-5.0							N SWGR 34.16	0.0	0.0	0.0	0.0	
PLCSWGR34.16	0.9588	0.0	0.0	37.2	26.0	0.0	0.0	----------					
4.0 KV	-5.0							N SWGR 34.16	-37.2	-26.0	0.0	0.0	
PMCXFMR74.16	0.9571	0.0	0.0	96.0	32.6	0.0	0.0	----------					
4.0 KV	-5.0							N SWGR 34.16	-56.0	-32.6	0.1	0.1	
BLCSWGR3.480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.5							N SWGR 34.16	-72.3	-52.0	0.7	3.5	67.0
								P C2109S.480	-0.0	-0.0	0.0	0.0	
								P C7307S.480	7.6	5.5	0.1	0.0	
								P CR203 .480	-0.0	-0.0	0.0	0.0	
								P N9208 .480	4.7	3.4	0.0	0.0	
								P N9231 .480	4.7	3.4	0.0	0.0	
								P N9236S.480	2.8	2.0	0.0	0.0	
								P N9241 .480	4.0	2.9	0.0	0.0	
								P N9247 .480	-0.0	-0.0	0.0	0.0	
								P P2102 .480	11.4	8.2	0.1	0.0	
								P P2103S.480	-0.0	-0.0	0.0	0.0	
								P P2105 .480	11.9	8.6	0.1	0.0	
								P P2107 .480	-0.0	-0.0	0.0	0.0	
								P P3106S.480	11.8	8.5	0.1	0.1	
								P P4104 .480	-0.0	-0.0	0.0	0.0	
								P P4118 .480	-0.0	-0.0	0.0	0.0	
								P P4202S.480	-0.0	-0.0	0.0	0.0	
								P P4602 .480	7.7	5.6	0.0	0.0	
								P P8401 .480	-0.0	-0.0	0.0	0.0	
								RP5107SX.480	5.7	4.1	0.1	0.0	
P C2109S.480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.5							BLCSWGR3.480	0.0	0.0	0.0	0.0	
P C7307S.480	0.9588	0.0	0.0	7.6	5.5	0.0	0.0	----------					
0.5 KV	-6.4							BLCSWGR3.480	-7.6	-5.4	0.1	0.0	
P CR203 .480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.5							BLCSWGR3.480	0.0	0.0	0.0	0.0	
P N9208 .480	0.9545	0.0	0.0	4.7	3.4	0.0	0.0	----------					
0.5 KV	-6.6							BLCSWGR3.480	-4.7	-3.4	0.0	0.0	
P N9231 .480	0.9545	0.0	0.0	4.7	3.4	0.0	0.0	----------					
0.5 KV	-6.6							BLCSWGR3.480	-4.7	-3.4	0.0	0.0	
P N9236S.480	0.9548	0.0	0.0	2.8	2.0	0.0	0.0	----------					
0.5 KV	-6.5							BLCSWGR3.480	-2.8	-2.0	0.0	0.0	
P N9241 .480	0.9543	0.0	0.0	4.0	2.9	0.0	0.0	----------					
0.5 KV	-6.5							BLCSWGR3.480	-4.0	-2.9	0.0	0.0	
P N9247 .480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0	----------					
0.5 KV	-6.5							BLCSWGR3.480	0.0	0.0	0.0	0.0	
P P2102 .480	0.9484	0.0	0.0	11.3	8.2	0.0	0.0	----------					
0.5 KV	-6.9							BLCSWGR3.480	-11.3	-8.2	0.1	0.0	

BUS NAME ACTUAL KV	VOLTS-PU ANGLE	...GENERATION.. MW	MVAR	.....LOAD..... MW	MVAR	.....SHUNT..... MW	MVAR	ID BUS NAME	LINE FLOWS MW	MVAR	LINE LOSSES MW	MVAR	PCT LOAD
P P210SC.480	0.9659	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
W P2185 .480	0.9580	0.0	0.0	11.8	8.5	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	-11.8	-8.5	0.1	0.0	
P P2197 .480	0.9659	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
N P2105 .480	0.9569	0.0	0.0	11.7	8.4	0.0	0.0						
0.5 KV	-6.4							GLCSWGR3.480	-11.7	-8.4	0.1	0.1	
E P4109 .480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
E P4119 .480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4202S.480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
P P4602 .480	0.9516	0.0	0.0	7.7	5.5	0.0	0.0						
0.5 KV	-6.4							GLCSWGR3.480	-7.7	-5.5	0.0	0.0	
P P4401 .480	0.9559	0.0	0.0	0.0	0.0	0.0	0.0						
0.5 KV	-6.5							GLCSWGR3.480	0.0	0.0	0.0	0.0	
SPP1075X.480	0.9462	0.0	0.0	5.6	4.0	0.0	0.0						
0.5 KV	-6.2							GLCSWGR3.480	-5.6	-4.0	0.1	0.0	
SHVAC EQ4.16	0.9554	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							D EQ TAP4.16	-74.9	-60.4	0.0	0.0	
								TRPHVAC 4.16	74.9	60.4	0.2	0.1	
								TTPHVAC 4.16	-0.0	-0.0	0.0	0.0	
TRPHVAC 4.16	0.9577	0.0	0.0	74.7	60.3	0.0	0.0						
4.0 KV	-5.0							SHVAC EQ4.16	-74.7	-60.3	0.2	0.1	
TTPHVAC 4.16	0.9594	0.0	0.0	0.0	0.0	0.0	0.0						
4.0 KV	-5.0							SHVAC EQ4.16	0.0	0.0	0.0	0.0	
25.V.INF230.	1.0070	991.0	805.2	0.0	0.0	0.0	0.0						
231.5 KV	0.0							AST.VRN.230.	991.0	805.2	0.0	5.6	

END OF REPORT FOR THIS CASE

#2 BLUE
#4 RED

#1 TAN
#2 GREEN

FT. ST. VRAIN PLANT AUX VOLTAGE TRCF STUDY--PLF CRDITD 05-12-82 DATA TABLE LISTING PAGE NO. 1
PLANT OFF LINE-14.5MVA PCS ACX TRANSF IN SERVICE AG-DD . 5/18/1982 12:39:20
ASV 230-KV BUS HELD AT 231.-KV--MVA*10 GIVES KVA FSVBAT251

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	QMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
D		AS1.VFP.230.	PS												00	
P		D EQ TAP4.16	PS												00	
P		E SWGR 14.16	PS												00	
S		F AS1C4 4.16	PS	37.6	24.0										00	
B		F P41C1 4.16	PS	131.2	86.5										00	
D		FLCSWGR44.16	PS	37.6	24.0										00	
B		FMCXFMR44.16	PS	51.9	32.4										00	
F		GLCSWGR1.480	PS												00	
B		H C0201 .480	PS	6.8	4.3										00	
B		H N0319 .480	PS	3.7	2.5										00	
B		H N0320A.480	PS	3.7	2.5										00	
B		H N0325 .480	PS	3.7	2.5										00	
B		H N0336 .480	PS	6.7	4.3										00	
B		H N0340 .480	PS	3.0	2.0										00	
B		H P2101 .480	PS	11.6	7.8										00	
B		H P2106 .480	PS	11.6	7.8										00	
B		H P3106 .480	PS	11.9	8.0										00	
B		H P4105 .480	PS												00	
B		H P4115 .480	PS												00	
B		H P4201 .480	PS	12.1	8.1										00	
B		H P4501 .480	PS												00	
B		H P4601 .480	PS	7.9	5.3										00	
B		J SWGR 24.16	PS												00	
B		K C2401 4.16	PS												00	
B		K P3102 4.16	PS	327.9	216.0										00	
B		LLCSWGR2.480	PS												00	
D		M C2109 .480	PS												00	
D		M C7557 .480	PS												00	
B		M C8201S.480	PS	6.5	4.1										00	
B		M N0319 .480	PS	3.2	2.0										00	
B		M N0320 .480	PS	3.2	2.0										00	
B		M N0330 .480	PS	3.2	2.0										00	
B		M N0346 .480	PS	5.0	3.1										00	
D		M P2101S.480	PS												00	
B		M P2102S.480	PS	11.8	7.4										00	
B		M P2107 .480	PS												00	
B		M P4202 .480	PS	12.1	7.6										00	
B		M P4601S.480	PS												00	
B		M P4602S.480	PS												00	
B		M P5107X.480	PS												00	
D		M P84E1S.480	PS	8.2	5.1										00	
B		M S7307S.480	PS	14.9	9.4										00	
B		R S7557 .480	PS												00	
B		M S7558 .480	PS												00	
P		N SWGR 34.16	PS												00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

BUS DATA FOR AREA ZONE ONE

BUS TYPE	OWNER	BUS NAME	ZONE	LOAD MW	LOAD MVAR	SHUNT MW	SHUNT MVAR	PMAX MW	PGEN MW	QSCHED QMAX MVAR	QSCHED QMIN MVAR	VOLT LIMITS VMAX VHOLD	VOLT LIMITS VMIN	REMOTE BUS NAME	REMOTE BUS ZONE	PERCENT VARS SUPPLIED
P		P P5105 4.16	PS												00	
B		P P4102 4.16	PS												00	
B		PLCSWGR04.16	PS	37.2	26.0										00	
B		PMCXFMR74.16	PS	56.0	32.6										00	
R		GLCSWGR3.480	PS												00	
R		P C2105S.480	PS												00	
R		P C7307S.480	PS	7.5	5.4										00	
R		P C9207 .480	PS												00	
B		R N9206 .480	PS	4.7	3.4										00	
R		R N9231 .480	PS	4.7	3.4										00	
B		R N9236S.480	PS	2.8	2.0										00	
B		R N9241 .480	PS	4.0	2.9										00	
R		R N9247 .480	PS												00	
B		R P2102 .480	PS	11.3	8.2										00	
R		R P2104S.480	PS												00	
B		R P2105 .480	PS	11.8	8.5										00	
B		R P2107 .480	PS												00	
B		R P3106S.480	PS	11.7	8.4										00	
B		R P4104 .480	PS												00	
R		R P4110 .480	PS												00	
B		R P4202S.480	PS												00	
R		R P4602 .480	PS	7.7	5.5										00	
B		R P8401 .480	PS												00	
R		RPS107SX.480	PS	5.6	4.0										00	
B		SHVAC 104.16	PS												00	
B		TRFHVAC 4.16	PS	74.7	60.3										00	
R		TTPHVAC 4.16	PS												00	
PE		ZS.V.INF230.	PS						1.0			1.007			00	

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	N M C/S	RATE	O	R-PI X	G1	B1	G2	B2	TAP 1	TAP 2	REMARKS	
AST.VRN.230.	ZZ.V.IN230.	L					0.0003								(R)
	D EQ TAP4.16	T			1400.		0.0006 0.0088					224.20	4.16	FIX TAP	
D EQ TAP4.16	AST.VRN.230.	T			1400.		0.0006 0.0088					4.16	224.20	FIX TAP	(R)
	4.16 SHVAC E04.16	L													
	4.16 J SWGR 24.16	L													
E SWGR 14.16	FLCSW R44.16	L					0.0011 0.0003								
	4.16 FMCXFMR44.16	L					0.0026 0.0013								
	4.16 F P3104 4.16	L					0.0013 0.0003								
	4.16 F P4101 4.16	L					0.0018 0.0012								
	4.16 GLCSWGR1.480	T			133.0		0.0075 0.0459					4.06	0.48	FIX TAP	
	4.16 J SWGR 24.16	L													(R)
F P3104 4.16	E SWGR 14.16	L					0.0013 0.0003								(R)
F P4101 4.16	E SWGR 14.16	L					0.0018 0.0012								(R)
FLCSWGR44.16	E SWGR 14.16	L					0.0011 0.0003								(R)
FMCXFMR44.16	E SWGR 14.16	L					0.0026 0.0013								(R)
GLCSWGR1.480	E SWGR 14.16	T			133.0		0.0075 0.0459					0.48	4.06	FIX TAP	(R)
	.480 H CR201 .480	L					0.0332 0.0088								
	.480 H N9219 .480	L					0.0234 0.0218								
	.480 H N9229A.480	L					0.0109 0.0152								
	.480 H N9229C.480	L					0.0328 0.0160								
	.480 H N9236 .480	L					0.0704 0.0063								
	.480 H N9240 .480	L					0.0703 0.0063								
	.480 H P2101 .480	L					0.0827 0.0338								
	.480 H P2106 .480	L					0.0827 0.0338								
	.480 H P3104 .480	L					0.0468 0.0228								
	.480 H P4103 .480	L					0.0547 0.0763								
	.480 H P4118 .480	L					0.1813 0.0885								
	.480 H P4201 .480	L					0.1521 0.0742								
	.480 H P4501 .480	L					0.1357 0.0662								
	.480 H P4601 .480	L					0.0775 0.0205								
H CR201 .480	GLCSWGR1.480	L					0.0332 0.0088								(R)
H N9219 .480	GLCSWGR1.480	L					0.0234 0.0218								(R)
H N9229A.480	GLCSWGR1.480	L					0.0109 0.0152								(R)
H N9229C.480	GLCSWGR1.480	L					0.0328 0.0160								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

	FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
H	N9236 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H	N9240 .480	GLCSWGR1.480	L						0.0703	0.0063								(R)
H	P2101 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H	P2106 .480	GLCSWGR1.480	L						0.0827	0.0338								(R)
H	P3106 .480	GLCSWGR1.480	L						0.0468	0.0228								(R)
H	P4103 .480	GLCSWGR1.480	L						0.0547	0.0763								(R)
H	P4118S.480	GLCSWGR1.480	L						0.1813	0.0885								(R)
H	P4201 .480	GLCSWGR1.480	L						0.1521	0.0742								(R)
H	P4501 .480	GLCSWGR1.480	L						0.1357	0.0662								(R)
H	P4601 .480	GLCSWGR1.480	L						0.0775	0.0205								(R)
J	SWGR 24.16	D EQ TAP4.16	L															(R)
	4.16	E SWGR 14.16	L															
	4.16	K C2401 4.16	L						0.0024	0.0005								
	4.16	K P3102 4.16	L						0.0002	0.0003								
	4.16	LLCSWGR2.480	T				133.0		0.0075	0.0406					4.06	0.48	FIX TAP	
	4.16	N SWGR 34.16	L															
K	C2401 4.16	J SWGR 24.16	L						0.0024	0.0005								(R)
K	P3102 4.16	J SWGR 24.16	L						0.0002	0.0003								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
LLCSWGR2.480	J SWGR 24.16	T				133.0		0.0075	0.0406					0.48	4.06	FIX TAP	(R)
.480	M C2109 .480	L						0.0877	0.0117								
.480	M C7307 .480	L						0.0885	0.0234								
.480	M CR201S.480	L						0.0332	0.0088								
.480	M N9219 .480	L						0.0351	0.0171								
.480	M N9228 .480	L						0.0376	0.0251								
.480	M N9230 .480	L						0.0117	0.0109								
.480	M N9246 .480	L						0.1140	0.0157								
.480	M P2101S.480	L						0.0620	0.0254								
.480	M P2102S.480	L						0.0345	0.0141								
.480	M P2103 .480	L						0.0643	0.0314								
.480	M P4202 .480	L						0.1521	0.0742								
.480	M P4601S.480	L						0.0443	0.0117								
.480	M P4602S.480	L						0.0443	0.0117								
.480	M P5107X.480	L						0.1753	0.0241								
.480	M P8401S.480	L						0.1594	0.0422								
.480	M S7307S.480	L						0.0234	0.0218								
.480	M S7537 .480	L						0.1534	0.0211								
.480	M S753R .480	L						0.2192	0.0302								
M C2109 .480	LLCSWGR2.480	L						0.0877	0.0117								(R)
M C7307 .480	LLCSWGR2.480	L						0.0885	0.0234								(R)
M CR201S.480	LLCSWGR2.480	L						0.0332	0.0088								(R)
M N9219 .480	LLCSWGR2.480	L						0.0351	0.0171								(R)
M N9228 .480	LLCSWGR2.480	L						0.0376	0.0251								(R)
M N9230 .480	LLCSWGR2.480	L						0.0117	0.0109								(R)
M N9246 .480	LLCSWGR2.480	L						0.1140	0.0157								(R)
M P2101S.480	LLCSWGR2.480	L						0.0620	0.0254								(R)
M P2102S.480	LLCSWGR2.480	L						0.0345	0.0141								(R)
M P2103 .480	LLCSWGR2.480	L						0.0643	0.0314								(R)
M P4202 .480	LLCSWGR2.480	L						0.1521	0.0742								(R)
M P4601S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)
M P4602S.480	LLCSWGR2.480	L						0.0443	0.0117								(R)

#3 - BLUE
#4 - RED

#1 - TAN
#2 - GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	O	R	X	G1	B1	G2	B2	TAP 1	TAP 2	REMARKS	
								Z-PI		Y-PI1		Y-PI2					
M P5107X.480	LLCSWGR2.480	L						0.1753	0.0241								(R)
M P8431S.480	LLCSWGR2.480	L						0.1594	0.0422								(R)
M S73075.480	LLCSWGR2.480	L						0.0234	0.0218								(R)
M S7537 .480	LLCSWGR2.480	L						0.1534	0.0211								(R)
M S7538 .480	LLCSWGR2.480	L						0.2192	0.0302								(R)
N SWGR 34.16	J SWGR 24.16	L															(R)
4.16	PLCSWGR54.16	L						0.0009	0.0003								
4.16	PMCXFMR74.16	L						0.0028	0.0014								
4.16	P P3105 4.16	L						0.0012	0.0003								
4.16	P P4102 4.16	L						0.0018	0.0012								
4.16	DLCSWGR3.480	T				133.0		0.0075	0.0403					4.06	0.48	FIX TAP	
P P3105 4.16	N SWGR 34.16	L						0.0012	0.0003								(R)
P P4102 4.16	N SWGR 34.16	L						0.0018	0.0012								(R)
PLCSWGR54.16	N SWGR 34.16	L						0.0009	0.0003								(R)
PMCXFMR74.16	N SWGR 34.16	L						0.0028	0.0014								(R)
DLCSWGR3.480	N SWGR 34.16	T				133.0		0.0075	0.0403					0.48	4.06	FIX TAP	(R)
.480	R C2109S.480	L						0.0877	0.0121								
.480	R C7307S.480	L						0.0620	0.0164								
.480	R CR703 .480	L						0.0221	0.0059								
.480	R N9208 .480	L						0.0137	0.0191								
.480	R N9231 .480	L						0.0137	0.0191								
.480	R N9236S.480	L						0.0352	0.0032								
.480	R N9241 .480	L						0.0352	0.0032								
.480	R N9247 .480	L						0.1315	0.0181								
.480	R P2102 .480	L						0.0482	0.0198								
.480	R P2103S.480	L						0.0526	0.0257								
.480	R P2105 .480	L						0.0409	0.0200								
.480	R P2107 .480	L						0.0345	0.0141								
.480	R P3106S.480	L						0.0538	0.0263								
.480	P P4104 .480	L						0.0430	0.0599								
.480	P P4118 .480	L						0.1872	0.0913								
.480	R P4202S.480	L						0.1287	0.0628								
.480	R P4602 .480	L						0.0443	0.0117								
.480	RP5107SX.480	L						0.1493	0.0205								
.480	R P5401 .480	L						0.1417	0.0375								

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	N O	Z-PI R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS	
R C2103S.480	GLCSWGR3.480	L						0.0877	0.0121								(R)
R C7307S.480	GLCSWGR3.480	L						0.0620	0.0164								(R)
R CR203 .480	GLCSWGR3.480	L						0.0221	0.0059								(R)
R N9208 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
R N9231 .480	GLCSWGR3.480	L						0.0137	0.0191								(R)
R N9236S.480	GLCSWGR3.480	L						0.0352	0.0032								(R)
R N9241 .480	GLCSWGR3.480	L						0.0352	0.0032								(R)
R N9247 .480	GLCSWGR3.480	L						0.1315	0.0181								(R)
R P2102 .480	GLCSWGR3.480	L						0.0482	0.0198								(R)
R P2103S.480	GLCSWGR3.480	L						0.0526	0.0257								(R)
R P2105 .480	GLCSWGR3.480	L						0.0409	0.0200								(R)
R P2107 .480	GLCSWGR3.480	L						0.0345	0.0141								(R)
R P3106S.480	GLCSWGR3.480	L						0.0538	0.0263								(R)
R P4104 .480	GLCSWGR3.480	L						0.0430	0.0599								(R)
R P4118 .480	GLCSWGR3.480	L						0.1872	0.0913								(R)
R P4202S.480	GLCSWGR3.480	L						0.1287	0.0628								(R)
R P4602 .480	GLCSWGR3.480	L						0.0443	0.0117								(R)
R P8401 .480	GLCSWGR3.480	L						0.1417	0.0375								(R)
RP5107SX.480	GLCSWGR3.480	L						0.1490	0.0205								(R)
SHVAC EQ4.16	D EQ TAP4.16	L															(R)
4.16	TRPHVAC 4.16	L						0.0016	0.0007								
4.16	TTPHVAC 4.16	L						0.0005	0.0002								
TRPHVAC 4.16	SHVAC EQ4.16	L						0.0016	0.0007								(R)
TTPHVAC 4.16	SHVAC EQ4.16	L						0.0005	0.0002								(R)

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

FORM 292 - 12 1994

FT. ST. VRAIN PLANT AUX VOLTAGE DROP STUDY--REF GR0150 05-1P-R2 DATA TABLE LISTING PAGE NO. 8
PLANT OFF LINE-14.0MVA RES AUX TRANSF IN SERVICE AG-DD 5/18/1982 12:39:20
FSV 230-KV BUS HELD AT 231.6KV--MVA*10 GIVES KVA FSVPAT231

LINE DATA FOR AREA ZONE ONE

FROM BUS	TO BUS	LINE TYPE	LINE OWNER	M	C/S	RATE	O	R	Z-PI X	Y-PI1 G1	Y-PI1 B1	Y-PI2 G2	Y-PI2 B2	TAP 1	TAP 2	REMARKS
2S.V.INF230.	AST.VRM.230.	L							0.0003							

#3 BLUE
#4 RED

#1 TAN
#2 GREEN

PROGRAM CONSTANTS SUBJECT TO MODIFICATION UNDER CONTROL CARD TYPE 6 (TCL)
(SEE POWER FLOW MANUAL.)

#3. BLUE
#4. RED

NUMBER OF DECIMAL PLACES FOR MAPPING

BUS VOLTAGE MAGNITUDE (P.U.)	3
BUS VOLTAGE ANGLE (DEGREES)	2
LOAD AND GENERATION (MW AND MVAR)	2
CAPACITORS AND REACTORS (MW AND MVAR)	2
LINE FLOWS (MW AND MVAR)	2
TRANSFORMER TAPS (P.U.)	3

#1. TAN
#2. GREEN

MW OR MVAR SOLUTION TOLERANCE AT EACH BUS	0.10000
MW OR MVAR TOLERANCE FOR AREA INTERCHANGE EXPORT SOLUTION	1.00000
MW OR MVAR TOLERANCE FOR FLOWS CONTROLLED BY TCULS OR PHASE SHIFTERS	1.00000
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY MVAR	0.00100
VOLTAGE TOLERANCE (IN P.U.) FOR BUS VOLTAGE CONTROLLED BY TCUL	0.00100
MW OR MVAR THRESHOLD FOR MISMATCH TABLE PRINTOUT	2.00000