Supervisory Control and Data Acquisition System (SCADA) Substation C3S4 Acceptance Test Procedure

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Release Approval

10/17/00
Date

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Supervisory Control and Data Acquisition System (SCADA)

SUBSTATION C3S4 ACCEPTANCE TEST PROCEDURE

HNF-7120, Rev. 0

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**Supervisory Control and Data Acquisition System
(SCADA)**

**SUBSTATION C3S4
ACCEPTANCE TEST PROCEDURE**

HNF-7120, Rev. 0

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SUBSTATION C3S4
ACCEPTANCE TEST PROCEDURE

(SCADA)

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Supervisory Control and Data Acquisition System
(SCADA)

SUBSTATION C3S4
ACCEPTANCE TEST PROCEDURE

1.0 INTRODUCTION

The purpose of this acceptance test procedure (ATP) is to demonstrate that the newly installed Supervisory Control and Data Acquisition (SCADA) computer system functions as intended by the design.

2.0 RESPONSIBILITIES

Each organization participating in the conduct of this ATP will designate personnel to assume the responsibilities and duties as defined herein for their respective roles. The names of these designees shall be provided to the Recorder for listing on the Recorder's copy of the TEST EXECUTION SHEET prior to the performance of any part of this ATP.

2.1 CONSTRUCTION ENGINEER

- 2.1.1 Designate a Test Director and Recorder.
- 2.1.2 Act as liaison between the participants in acceptance testing.
- 2.1.3 Distribute the approved testing schedule as soon as approval has been obtained (one or more weeks prior to testing).
- 2.1.4 Notify the persons performing and witnessing the test two working days prior to the start of the testing that the test will begin as scheduled.
- 2.1.5 Notify all parties concerned as soon as testing schedule is changed.
- 2.1.6 Take necessary action to clear exceptions to the ATP.
- 2.1.7 Obtain an ATP rerun schedule from the Planning & Scheduling authority when rerun is necessary.
- 2.1.8 Obtain the approval signatures of objecting party or parties on the Recorder's copy of the EXCEPTIONS page in Appendix A after action taken on the exception has been approved.
- 2.1.9 Provide a distribution list for the Approved and Accepted Acceptance Test Report (ATR).

2.2 TEST DIRECTOR

- 2.2.1 Coordinate all acceptance testing.
- 2.2.2 Confirm that the field testing and inspection of the system or portion of the system to be tested has been completed.
- 2.2.3 Stop any test which in the judgement of the Test Director may cause damage to the system or endanger personnel.
- 2.2.4 Obtain revisions to the ATP to comply with any field changes or as-built conditions and to correct any problems found per Step 2.2.3.
- 2.2.5 Approve record changes, as permitted in paragraph 3.0 below.
- 2.2.6 Evaluate recorded data, discrepancies, and exceptions.
- 2.2.7 Obtain required signatures on the ATP after any exceptions have been resolved.
- 2.2.8 Limit the scope of analog and pulse accumulator testing to only those circuits actually in service if in the judgement of the Test Director, proper functionality of the Systems Northwest/Ilex telemetry has been adequately demonstrated.

2.3 WITNESSES

- 2.3.1 Witness the tests.
- 2.3.2 Evaluate results of testing.
- 2.3.3 Assist the Test Director as requested.
- 2.3.4 Sign and date under "This Section Complete" on each Operational Test Form in the space provided that the test has been executed whether or not exceptions have been taken to the test.

2.4 RECORDER

- 2.4.1 Record names of all participating personnel on Recorder's copy of the ATP in section 2.5.5 below prior to start of testing.
- 2.4.2 Observe tests and record test data and results in ink on Recorder's copy of the ATP.
- 2.4.3 Mark each test step on the Recorder's copy as it is completed with a "C" or an "X" as indicated in steps 4.1 and 4.2 below. Upon completion of each column on the Operational Test Form mark the date that column of steps was completed in the space at the bottom of the column.

- 2.4.4 Sign and date under "This Section Complete" on each Operational Test Form in the space provided that the test has been executed whether or not exceptions have been taken to the test.
- 2.4.5 Document record changes on Recorder's copy of ATP as required in section 3.0 below.
- 2.4.6 Record objections (exceptions) and Test Steps which are not performed on the EXCEPTIONS page in Appendix A. Additional EXCEPTIONS page(s) are to be added as needed. Format may be expanded or condensed to fit the length of the exceptions.
- 2.4.7 Submit the completed ATP to the Test Director for approval signature and distribution.

2.5 TEST PERFORMANCE PARTY

- 2.5.1 Organize and perform this Acceptance Test under supervision of the Test Director.
- 2.5.2 Confirm that all equipment required for performing this test will be available at the start of testing.
- 2.5.3 Provide equipment required for performing this Acceptance Test which has not been designated as being provided by other(s).
- 2.5.4 Request in writing from the Project Engineer those services, materials, or equipment having been designated as being supplied by the government or other(s).
- 2.5.5 Test Participants:

<u>Participant Name</u>	<u>Role/Capacity</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

3.0 TEST CHANGE CONTROL

Acceptance testing is to be conducted in accordance with the steps and requirements specified in this procedure. Any changes or deviations required must be accomplished in a prompt and controlled manner as outlined below.

Should it become apparent a portion of this ATP is unworkable in its published form, equipment shall be returned to pre test conditions and testing shall be halted until a revision can be issued to the affected portion of this ATP.

Should any representative of the witness and approval party object to the results obtained during acceptance testing or to the test procedure, he shall so notify the Test Director. Any such notice, if not resolved directly to the representative's satisfaction, shall be confirmed in writing within two working days of that portion of test to which exception is taken. The notice shall summarize the objections and state reasons for same.

Exceptions as noted above that require revision of this ATP shall be executed using the Engineering Change Notice (ECN) process as defined in HNF-PRO-440.

Certain minor exceptions to the test may be of sufficiently small magnitude that a qualified test approval may be given. In this case, a list of such exceptions shall be entered on the EXCEPTIONS page in Appendix A. They shall be listed with a description of the problem and a resolution, signed and dated by the Recorder, one witness and the Design Authority. These signatures shall indicate that the exceptions are of such a nature that future rerun of the ATP is not necessary to demonstrate that the exceptions have been adequately rectified. Shortcomings or errors that are found during the test shall be marked in the Recorder's copy of the ATP and approved by all witnesses and corrected in the ATR.

4.0 TEST APPROVAL AND ACCEPTANCE

4.1 TEST EXECUTION - WITHOUT EXCEPTION

Mark the applicable space on the Operational Test Form with a "C" indicating that the ATP has been performed without exception.

Sign and date the Operational Test Form in the spaces provided as indicated in steps 2.3.4 and 2.4.4 above.

4.2 TEST EXECUTION - WITH EXCEPTION

Mark the applicable space on the Operational Test Form with a "X" indicating that the ATP has been performed with exception(s) and list Minor Exceptions on the EXCEPTIONS page in Appendix A.

NOTE: Part or all of the exceptions may have been resolved prior to sign-off of the Operational Test Form.

Sign and date the Operational Test Form in the spaces provided as indicated in steps 2.3.4 and 2.4.4 above.

4.2.1 Resolving Exceptions

Sign and date each exception as it is resolved.

Sign and date the Operational Test Form in the spaces provided as indicated in steps 2.3.4 and 2.4.4 above.

4.3 ACCEPTANCE TEST REPORT

The approved, completed ATP is to be released as an Acceptance Test Report as indicated by Project Hanford Policies and Procedures - Engineering Program Procedure HNF-PRO-446 "Testing Requirements".

Return the filled out and approved Recorder's copy to the appropriate Design Document Control Station to be released as an ATR. Transcribing hand written notes and performance completion marks to a new copy of the ATP for purposes of converting the completed ATP to an ATR is acceptable.

5.0 TEST CONDITIONS AND EQUIPMENT REQUIRED

5.1 GENERAL

The following conditions shall exist at the start of the acceptance testing for that portion of the system being tested.

5.1.1 Substation transducers have been calibrated at least once since installation.

5.1.2 The Ilex SCADA computer system is programmed and operational.

5.1.3 The Systems Northwest RTU Modem Card is set for the correct communication parameters (see Appendix B Table #1 for correct DIP switch settings).

5.1.4 The EPROM containing the Conitel 2020 Protocol has been installed in the Systems Northwest RTU Transceiver Card and the DIP switches on

the Transceiver Card are correctly set (see Appendix B for correct DIP switch settings).

- 5.1.5 COMM line (telephone circuit) has been transferred from the existing SCADA computer system to the new SCADA computer system and connected to SNW COMMLINE #2.
- 5.1.6 Supervisory control switches are set to the local control position.
- 5.1.7 The Ilex SCADA computer system is communicating with the Systems Northwest RTU.
- 5.1.8 Dispatcher's Display (Mimic) Board wiring has been transferred to the DataPic lampdriver and the Ilex SCADA computer system is communicating with the lamp driver.
- 5.1.9 The Ilex SCADA computer system is communicating with the system event loggers (printers).
- 5.1.10 The Substation RTU Local/Remote switch status is transmitted to the Ilex SCADA computer system and is displayed on both the terminal screen and system logger.
- 5.1.11 The Ilex SCADA computer system is receiving communications from the substation annunciator.
- 5.1.12 Local PCB status indicating lamps are all functional.

Test equipment connection points for the tests to be performed are listed in Appendix C (when/if provided).

5.2 EQUIPMENT REQUIRED

The following test equipment is required for the performance of this ATP. It shall be available, within the calibration expiration date and in good working order.

- Ilex Remote CRT with modem card, power supply and cables
- Epson FX-850 (or equal) printer with paper for use as a field logger
- Digital Multimeter (Fluke or equal)
- Digital Instrument Calibrator (Transmation or equal)
- Power Circuit Breaker Simulator
- Variable Current and Voltage Source (MultiAmp Epoch-10 or equal)
- Power Circuit Breaker test extension cables.

5.3 INFORMATIONAL DATA

The spaces on the Operational Test Forms for recording addresses, test connections and transducer and alarm settings, are for DynCorp TriCities

Services Inc. Electrical Utilities informational purposes and only for the purposes of facilitating the performance of this ATP.

6.0 ENERGIZATION TEST PROCEDURE OUTLINE

The following procedure will test each component of the remote control and indication systems to assure that it performs in accordance with the intent of the procurement specification, installation design and database programming.

The instructions for testing the SCADA points associated with substation C3S4 are integrated into the forms identified in Section 6.1, 6.2, 6.3 and 6.4. All the forms listed under Section 6.1 and 6.2 must be completed to validate the operation of the new SCADA computer (except those points and/or tests that are shaded or marked N/A).

Forms listed under Sections 6.3 and 6.4 for analog and pulse accumulator points shall be completed (except those points and/or tests that are shaded or marked N/A) for points that are in active service. Testing of points that are not in active service may, at the discretion of the Test Director, be left untested if as noted above in section 2.2.8 and if proper functionality of the Systems Northwest/Ilex telemetry has been adequately demonstrated by those points that are in active service.

Located in the "Point Description" row of each form are the SCADA points to be tested. When all the tests have been completed and the system has been returned to normal, sign and date the forms.

Appendix C (if included with this ATP) is provided as an aid to this test procedure to increase efficiency. Appendix C identifies the isolation or terminal strip location at which test equipment is to be connected or test signals are to be inserted. Appendix C summarizes the information found on the drawings identified in Section 7.2 of this test procedure.

6.1 POWER CIRCUIT BREAKERS

Power circuit breakers (PCBs) shall be tested for proper operation using the PCB Simulator. As an alternative to the use of the PCB Simulator, PCBs may be tested by racking the PCB out to the test position or otherwise isolating it from energized high voltage circuits and operating it directly. Tests will be performed for remote breaker open and close, status indication of both the breaker and the supervisory control switch under normal conditions, status indication under inhibited conditions and status indication under local breaker operations.

If the PCB is so equipped, tests shall also be performed on the recloser system. Tests will include remotely placing the recloser in and out of service, status indication of both the recloser and the recloser cutoff switch under normal conditions and status indication under inhibited conditions.

Tests will be documented on the attached Power Circuit Breaker Operational Test Form.

Applicable form for power circuit breaker test is:

<u>Test Description</u>	<u>Forms</u>
Power Circuit Breaker Operational Test	Form PCB-1A

The PCB Simulator, if used, is connected to power supply, control and indication points using the five pairs of test leads provided. Care must be exercised in connecting the simulator leads for the proper polarity.

6.2 SUBSTATION ALARMS

Substation alarms shall be tested for proper operation. Each alarm point will be brought into alarm status by forcing the alarm condition and observing for the proper response. Alarm Acknowledgement, Alarm Clear and Alarm Logging functions will also be tested.

Applicable forms for the substation alarms test are:

<u>Test Description</u>	<u>Forms</u>
Alarm Point Operational Tests	Form AL-1A, AL-1B, AL-1C

6.3 SUBSTATION AND PCB ANALOG SIGNALS

Substation and power circuit breaker analog signals shall be tested for proper operation using a precise source such as precision power supply and digital voltmeter or the digital instrument calibrator. Zero and span and upper and lower limits and associated alarm functions will be tested as applicable for proper response for each point.

Prior to proceeding with the analog signal tests, it is necessary to recalibrate the Systems Northwest A/D Converter on the first analog signal input board. The full scale must be changed from +2000 counts to +2047 counts. Both zero (offset trimpot R42) and span (gain trimpot R45) must be adjusted to achieve correct output readings for inputs of zero and +5 volts DC (see Systems Northwest SR8000 Service and Installation Manual, chapter on Differential AD Converter, section on "Analog Inputs To The A/D Converter Module").

Analog input #2, the RTU five volt DC reference check point can be used for this purpose by disconnecting the leads from the RTU power supply and connecting an instrument calibrator in their place. Either the RTU test set or the Ilex SCADA display or both can be used to confirm the output value of the A/D converter.

Alarm limits for the purposes of this test have been selected according to the following criteria. Line Feeder Amps shall be set to 80% of the lowest conductor segment ampacity of the feeder, riser, line combination prior to the first line tap as found in the applicable tables in the National Electric Code (NFPA 70) or Westinghouse T&D Book. Incomers and tie breaker shall be set to 80% of the circuit breaker frame size. Bus volts shall be set to nominal plus 10% for the High limit and nominal minus 10% for the Low limit.

Applicable forms for the substation and PCB analog signal tests are:

Test Description

Forms

Analog Point Operational Tests Form AN-1A, AN-1B, AN-1C

6.4 POWER CIRCUIT BREAKER PULSE ACCUMULATOR SIGNALS

Power circuit breaker pulse accumulator signals shall be tested for proper operation using a pulse generator test set. As an alternative, current and voltage sources can be used to drive the combination watt/watthour transducer to a known value (i.e. full scale) and pulses counted over a known interval of time using an accurate time measuring device such as a stop watch. Proper calibration of the SCADA software and resulting operator display will be verified for known signal inputs.

Applicable form for the PCB pulse accumulator signal test is:

Test Description

Forms

Pulse Accumulator Point Operational Test Form PA-1A

6.5 MISCELLANEOUS NOTES

- 6.5.1 Problems should be noted on test sheets by form and step number and described on the EXCEPTIONS page in Appendix A.

7.0 REFERENCES

7.1 PURCHASE SPECIFICATIONS

Acquisition Plan No.	Supervisory Control and Data
WHC-95-353936	Acquisition (SCADA) Computer System

7.2 DRAWINGS

H-3-56120	1	C3S4 13.8 KV ONE LINE DIAGRAM
H-3-56123	1	ELECTRICAL C3-S4 SUBSTATION RTU WIRING DIA, FRONT
H-3-56123	2	ELECTRICAL C3-S4 SUBSTATION RTU WIRING DIA, BACK

H-3-56124	1-3	ELECTRICAL C3-S4 SUBSTATION ANNUNCIATOR/TRANSDUCER RACK WIRING DIAGRAM
H-3-56125	1	ELECTRICAL C3-S4 SUBSTATION FACE ARRANGEMENTS PARTS, NOTES & LEGENDS
H-3-56125	3	ELECTRICAL C3S4 SUBSTATION FACE ARRANGEMENT 13.8 KV SWGR & DETAILS
H-3-56130	2	ELECTRICAL C3-S4 SUBSTATION SCADA INSTALLATION ARRANGEMENT & CABLE PLAN
H-3-56137	1	ELECTRICAL C3-S4 SUBSTATION SCADA CABLE SCHEDULE
H-3-56140	1-3	C3S4 13.8 KV SUBSTATION THREE-LINE DIAGRAM
H-3-56140	4	C3S4 13.8 KV SUBSTATION THREE-LINE DIAGRAM AND LOCKOUT CIRCUITS
H-3-56141	1	C3-S4 SUBSTA 13.8 KV SWGR UNIT 2 & 4 DC ELEMENTARY
H-3-56141	2	C3-S4 SUBSTA 13.8 KV SWGR UNIT 5 & 6 DC ELEMENTARY
H-3-56141	3	C3-S4 SUBSTA 13.8 KV SWGR UNIT 9 & 14 DC ELEMENTARY
H-3-56141	4	C3-S4 SUBSTA 13.8 KV SWGR UNIT 11 & 12 DC ELEMENTARY
H-3-56141	5	C3-S4 SUBSTA 13.8 KV SWGR UNIT 8 DC ELEMENTARY
H-3-56142	1	ELECTRICAL C3-S4 SUBSTATION UNIT 1 & 2 WIRING DIAG 13.8 KV SWGR
H-3-56142	2	ELECTRICAL C3-S4 SUBSTATION UNIT 3 & 4 WIRING DIAG 13.8 KV SWGR
H-3-56142	3	ELECTRICAL C3-S4 SUBSTATION UNIT 5 & 6 WIRING DIAG 13.8 KV SWGR
H-3-56142	4	ELECTRICAL C3-S4 SUBSTATION UNIT 7 & 8 WIRING DIAG 13.8 KV SWGR
H-3-56142	5	ELECTRICAL C3-S4 SUBSTATION UNIT 9 & 10 WIRING DIAG 13.8 KV SWGR
H-3-56142	6	ELECTRICAL C3-S4 SUBSTATION UNIT 11 & 12 WIRING DIAG 13.8 KV SWGR
H-3-56142	7	ELECTRICAL C3-S4 SUBSTATION UNIT 13 & 14 WIRING DIAG 13.8 KV SWGR
H-3-56143	1,2	ELECTRICAL C3-S4 SUBSTATION ANNUNCIATOR DIAGRAM 13.8 KV SWGR
H-3-56144	1	ELECTRICAL C3-S4 SUBSTATION DEVICE INTERNAL DIAGRAM 13.8 KV SWITCHGEAR

7.3 RELEVANT ACCEPTANCE TEST PROCEDURES

ATP Number P-5E1FX-ATP-01	2.4kV Substations C8-S3 and C8-S1 SCADA installation
SD Number HNF-2571	Supervisory Control and Data Acquisition (SCADA) Substation C8-S1 Acceptance Test Procedure
SD Number HNF-4146	Supervisory Control and Data Acquisition (SCADA) Substation A8 Acceptance Test Procedure
SD Number HNF-5223	Supervisory Control and Data Acquisition (SCADA) Substation A7 Acceptance Test Procedure
SD Number HNF-6417	Supervisory Control and Data Acquisition (SCADA) Substation B3S4 Acceptance Test Procedure

7.4 PROJECT HANFORD POLICIES AND PROCEDURES - ENGINEERING PROGRAM

HNF-PRO-440 REV 3 Engineering Document Change Control Requirements

HNF-PRO-1819 REV 4 Engineering requirements (subsection 2.10 Testing and Inspections).

7.5 GLOSSARY

The following terms are used throughout the test tables and are defined here for clarity.

L/R Local/Remote
PCB Power Circuit Breaker
SCS Supervisory Control Switch
RCS Recloser Cutoff Switch
RR Remote Recloser
CRT Cathode Ray Tube (Computer Monitor)
RTU Remote Terminal Unit

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8.0 POWER CIRCUIT BREAKER (PCB) OPERATIONAL TESTS 8.1 Form PCB-1A

Point Description		C3X131	C3X132	C3X133	C3X134	C3X135	C3X136	C3X137	C3X138	C3X139
Address	Control	01	02	03	04	05	06	07	08	09
	PCB Status	14	15	16	17	18	19	20	21	22
	SCS Status	03	04	05	06	07	08	09	10	11
	RR Control									
	RR Status									
	RCS Status									
A) Initial Conditions										
1) PCB racked out to test position (or isolated and PCB simulator connected) and closed. RTU L/R and PCB SCS switches in local with RCS switch (if equipped) OFF (local).										
2) CRT schematic symbol red and L/R & SCS symbols indicating local. All alarms acknowledged.										
B) Inhibited Conditions										
1) Switch RTU L/R to Remote.			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2) Acknowledge Alarm and observe status change on points list and schematic.			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3) Switch SCS to Remote.										
4) Acknowledge alarm and observe status change on points list and schematic.										
5) Switch RCS to ON (remote).		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6) Acknowledge alarm and observe status change on points list and schematic.		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7) Switch RCS to OFF.		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8) Acknowledge alarm and observe status change on points list and schematic.		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9) Verify proper logging.										
C) Automatic Operation										
1) Trip PCB with control switch.										

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8.0 POWER CIRCUIT BREAKER (PCB) OPERATIONAL TESTS 8.1 Form PCB-1A									
Point Description	C3X131	C3X132	C3X133	C3X134	C3X135	C3X136	C3X137	C3X138	C3X139
2) Observe CRT schematic symbol flashing green, and PCB operation descriptor on points and alarms lists flashing green.									
3) Acknowledge alarms (audible and schematic symbol).									
4) Close PCB with control switch.									
5) Observe CRT schematic symbol flashing red and PCB operation descriptor on points and alarm lists flashing red.									
6) Acknowledge alarms (audible and schematic symbol).									
7) Verify RCS OFF (if equipped) and relay trip PCB.									
8) Observe CRT schematic symbol flashing green and PCB operation descriptor on points and alarm lists flashing green.									
9) Acknowledge alarms (audible and schematic symbol).									
10) Using SCADA, Select PCB and close.									
11) Observe CRT schematic symbol turns steady red.									
12) Switch RCS to ON and verify relay RCS/X or SC/RCS is picked up.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13) Relay trip PCB.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
14) Observe CRT schematic symbol flash green then red and PCB operation descriptor on points and alarm lists flashing red.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15) Acknowledge alarms (Audible and schematic symbol) and breaker reclose.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16) Verify proper logging.									
D) SCADA Control									
1) Select PCB then trip PCB and observe CRT symbol and points list operation descriptor turn steady green.									

8.0 POWER CIRCUIT BREAKER (PCB) OPERATIONAL TESTS 8.1 Form PCB-1A									
Point Description	C3X131	C3X132	C3X133	C3X134	C3X135	C3X136	C3X137	C3X138	C3X139
2) Observe PCB is in tripped position with green light ON.									
3) Select PCB then close PCB and observe CRT symbol and points list operation descriptor turn steady red.									
4) Observe PCB in closed position with red light ON.									
5) Verify RCS in the ON position, select RR then trip RR if not already tripped.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6) Observe relay RCS/X or SC/RCS is dropped out, CRT symbol and points list operation descriptor turn steady green.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7) Verify RCS in the ON position, select RR then close RR.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8) Observe relay RCS/X or SC/RCS is picked up and CRT symbol and points list operation descriptor turn steady red.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9) Verify proper logging.									
This Section Complete Recorder: _____ Date: _____ Witness: _____ Date: _____ Witness: _____ Date: _____									

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9.0 ALARM POINT OPERATIONAL TESTS					9.1 Form AL-1A				
Point Description	LOCAL REMOTE	BATTERY TROUBLE	C3X131 PCB SCS	C3X132 PCB SCS	C3X133 PCB SCS	C3X134 PCB SCS	C3X135 PCB SCS	C3X136 PCB SCS	C3X137 PCB SCS
Identification Number (Points List)	01	02	03	04	05	06	07	08	09
A) Alarm Point Checks									
1) Bring alarm point into alarm status.									
2) Verify alarm point descriptor appears on alarms list in alarm condition and flashing.									
3) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
4) Momentarily return alarm point to normal.									
5) Verify alarm point descriptor appears on alarms list in normal condition and flashing then returns to alarm condition and flashing.									
6) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
7) Return alarm point to normal.									
8) Verify that the alarm descriptor has returned to normal and is flashing.									
9) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
10) Momentarily bring the alarm point into alarm status.									
11) Verify alarm point descriptor appears on alarms list in alarm condition and flashing then returns to normal condition and flashing.									
12) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
14) Verify proper logging.									

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9.0 ALARM POINT OPERATIONAL TESTS					9.1 Form AL-1A				
Point Description	LOCAL REMOTE	BATTERY TROUBLE	C3X131 PCB SCS	C3X132 PCB SCS	C3X133 PCB SCS	C3X134 PCB SCS	C3X135 PCB SCS	C3X136 PCB SCS	C3X137 PCB SCS
Identification Number (Points List)	01	02	03	04	05	06	07	08	09
This Section Complete									
Recorder: _____ Date: _____									
Witness: _____ Date: _____									
Witness: _____ Date: _____									

ALARM POINT OPERATIONAL TESTS						9.2 Form AL-1B			
Point Description	C3X138 PCB SCS	C3X139 PCB SCS	13.8KV BUS #1 PTNTL	13.8KV BUS #2 PTNTL	C3X131 PCB STATUS	C3X132 PCB STATUS	C3X133 PCB STATUS	C3X134 PCB STATUS	C3X135 PCB STATUS
Identification Number (Points List)	10	11	12	13	14	15	16	17	18
A) Alarm Point Checks									
1) Bring alarm point into alarm status.									
2) Verify alarm point descriptor appears on alarms list in alarm condition and flashing.									
3) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
4) Momentarily return alarm point to normal.									
5) Verify alarm point descriptor appears on alarms list in normal condition and flashing then returns to alarm condition and flashing.									
6) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
7) Return alarm point to normal.									
8) Verify that the alarm descriptor has returned to normal and is flashing.									
9) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
10) Momentarily bring the alarm point into alarm status.									
11) Verify alarm point descriptor appears on alarms list in alarm condition and flashing then returns to normal condition and flashing.									
12) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
14) Verify proper logging.									

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ALARM POINT OPERATIONAL TESTS					9.2 Form AL-1B				
Point Description	C3X138 PCB SCS	C3X139 PCB SCS	13.8KV BUS #1 PTNTL	13.8KV BUS #2 PTNTL	C3X131 PCB STATUS	C3X132 PCB STATUS	C3X133 PCB STATUS	C3X134 PCB STATUS	C3X135 PCB STATUS
Identification Number (Points List)	10	11	12	13	14	15	16	17	18
This Section Complete									
Recorder: _____ Date: _____									
Witness: _____ Date: _____									
Witness: _____ Date: _____									

ALARM POINT OPERATIONAL TESTS							9.3 Form AL-1C		
Point Description	C3X136 PCB STATUS	C3X137 PCB STATUS	C3X138 PCB STATUS	C3X139 PCB STATUS	13.8KV TRIP PTNTL	13.8KV CLOSE PTNTL	STATION SERVICE #1	STATION SERVICE #2	125VDC BATTERY TROUBLE
Identification Number (Points List)	19	20	21	22	47	48	49	50	54
A) Alarm Point Checks									
1) Bring alarm point into alarm status.									
2) Verify alarm point descriptor appears on alarms list in alarm condition and flashing.									
3) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
4) Momentarily return alarm point to normal.									
5) Verify alarm point descriptor appears on alarms list in normal condition and flashing then returns to alarm condition and flashing.									
6) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
7) Return alarm point to normal.									
8) Verify that the alarm descriptor has returned to normal and is flashing.									
9) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
10) Momentarily bring the alarm point into alarm status.									
11) Verify alarm point descriptor appears on alarms list in alarm condition and flashing then returns to normal condition and flashing.									
12) Acknowledge alarm and verify that alarms list indicates alarm acknowledged.									
14) Verify proper logging.									

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ALARM POINT OPERATIONAL TESTS						9.3 Form AL-1C			
Point Description	C3X136 PCB STATUS	C3X137 PCB STATUS	C3X138 PCB STATUS	C3X139 PCB STATUS	13.8KV TRIP PTNTL	13.8KV CLOSE PTNTL	STATION SERVICE #1	STATION SERVICE #2	125VDC BATTERY TROUBLE
Identification Number (Points List)	19	20	21	22	47	48	49	50	54
This Section Complete									
Recorder: _____ Date: _____									
Witness: _____ Date: _____									
Witness: _____ Date: _____									

10.0 ANALOG POINT CALIBRATION TESTS					10.1 Form AN-1A						
Point Description		0VDC CHECK SIGNAL	5VDC CHECK SIGNAL	C3X131 AMPS	C3X131 KW	C3X132 AMPS	C3X132 KW	C3X133 AMPS	C3X133 KW	C3X134 AMPS	
Analog Point Address		01	02	03	04	05	06	07	08	09	
Full Scale (2047 Counts)		5	5	600	14400	600	14400	200	4800	600	
ALARM LIMITS	HIGH	SCADA Set Point (80%)	0.5	5.0	288	N/A	480	N/A	160	N/A	136
		Digital Voltmeter (Vdc)	0.5	5.00	2.40	N/A	4.00	N/A	4.00	N/A	1.13
		Equivalent Counts	205	2047	983	N/A	1638	N/A	1638	N/A	464
	LOW	SCADA Set Point	-0.5	4.75	-288	N/A	-480	N/A	-160	N/A	-136
		Digital Voltmeter (Vdc)	-0.5	4.75	-2.4	N/A	-4.8	N/A	-4.8	N/A	-1.13
		Equivalent Counts	-205	1945	-983	N/A	-1638	N/A	-1638	N/A	-464
A) Initial Conditions											
1) Power supply & digital voltmeter connected to analog point. Remote CRT connected with scada software running. RTU L/R switch in remote.											
2) RTU display on CRT. All alarms acknowledged.											
B) Zero and Span Checks											
1) Adjust power supply for full scale transducer output of 1 mA.		N/A									
2) Observe full scale reading on CRT and record.		N/A									
3) Adjust power supply for zero scale transducer output of 0 mA.											
4) Observe zero reading on CRT and record.											
C) Deadband/Limit Checks											
1) Adjust power supply so that the analog value falls between upper and lower limits.											
2) Verify that the display value is normal.											

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10.0 ANALOG POINT CALIBRATION TESTS					10.1 Form AN-1A				
Point Description	0VDC CHECK SIGNAL	5VDC CHECK SIGNAL	C3X131 AMPS	C3X131 Kw	C3X132 AMPS	C3X132 Kw	C3X133 AMPS	C3X133 Kw	C3X134 AMPS
3) Adjust power supply until analog point just exceeds the upper limit.	N/A			N/A		N/A		N/A	
4) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A			N/A		N/A		N/A	
5) Acknowledge alarm.	N/A			N/A		N/A		N/A	
6) Adjust power supply until analog point just returns to normal.	N/A			N/A		N/A		N/A	
7) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A			N/A		N/A		N/A	
8) Adjust power supply so that the analog value exceeds the lower limit.	N/A			N/A		N/A		N/A	
9) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A			N/A		N/A		N/A	
10) Acknowledge alarm.	N/A			N/A		N/A		N/A	
11) Adjust power supply until analog point just returns to normal.	N/A			N/A		N/A		N/A	
12) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A			N/A		N/A		N/A	
13) Verify proper logging.									
This Section Complete									
Recorder: _____									
Date: _____									
Witness: _____									
Date: _____									
Witness: _____									
Date: _____									

ANALOG POINT CALIBRATION TESTS										10.2 Form AN-1B	
Point Description		C3X134 KW	C3X135 AMPS	C3X136 AMPS	C3X136 KW	C3X137 AMPS	C3X137 KW	C3X138 AMPS	C3X138 KW	C3X139 AMPS	
Analog Point Address		10	11	12	13	14	15	16	17	18	
Full Scale (2047 Counts)		14400	600	600	14400	200	4800	600	14400	600	
ALARM LIMITS	HIGH	SCADA Set Point	N/A	288	228	N/A	160	N/A	288	N/A	288
		Digital Voltmeter (Vdc)	N/A	2.40	1.90	N/A	4.00	N/A	2.40	N/A	2.40
		Equivalent Counts	N/A	983	778	N/A	1638	N/A	983	N/A	983
	LOW	SCADA Set Point	N/A	-288	-228	N/A	-160	N/A	-288	N/A	-288
		Digital Voltmeter (Vdc)	N/A	-2.4	-1.9	N/A	-4.0	N/A	-2.4	N/A	-2.4
		Equivalent Counts	N/A	-983	-778	N/A	-1638	N/A	-983	N/A	-983
A) Initial Conditions											
1) Power supply & digital voltmeter connected to analog point. Remote CRT connected with scada software running. RTU L/R switch in remote.											
2) RTU display on CRT. All alarms acknowledged.											
B) Zero and Span Checks											
1) Adjust power supply for full scale transducer output of 1 mA.											
2) Observe full scale reading on CRT and record.											
3) Adjust power supply for zero scale transducer output of 0 mA.											
4) Observe zero reading on CRT and record.											
C) Deadband/Limit Checks											
1) Adjust power supply so that the analog value falls between upper and lower limits.											
2) Verify that the display value is normal.											

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ANALOG POINT CALIBRATION TESTS						10.2 Form AN-1B			
Point Description	C3X134 KW	C3X135 AMPS	C3X136 AMPS	C3X136 KW	C3X137 AMPS	C3X137 KW	C3X138 AMPS	C3X138 KW	C3X139 AMPS
3) Adjust power supply until analog point just exceeds the upper limit.	N/A			N/A		N/A		N/A	
4) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A			N/A		N/A		N/A	
5) Acknowledge alarm.	N/A			N/A		N/A		N/A	
6) Adjust power supply until analog point just returns to normal.	N/A			N/A		N/A		N/A	
7) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A			N/A		N/A		N/A	
8) Adjust power supply so that the analog value exceeds the lower limit.	N/A			N/A		N/A		N/A	
9) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A			N/A		N/A		N/A	
10) Acknowledge alarm.	N/A			N/A		N/A		N/A	
11) Adjust power supply until analog point just returns to normal.	N/A			N/A		N/A		N/A	
12) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A			N/A		N/A		N/A	
13) Verify proper logging.									
This Section Complete									
Recorder: _____ Date: _____									
Witness: _____ Date: _____									
Witness: _____ Date: _____									

ANALOG POINT CALIBRATION TESTS				10.3 Form AN-1C										
Point Description				C3X139 KW	13.8KV BUS #1 PTNTL	13.8KV BUS #2 PTNTL								
Analog Point Address				19	20	21								
Full Scale (2047 Counts)				14400	18.0	18.0								
ALARM LIMITS	HIGH	SCADA Set Point	N/A	14.6	14.6									
		Digital Voltmeter (Vdc)	N/A	4.06	4.06									
		Equivalent Counts	N/A	1660	1660									
	LOW	SCADA Set Point	N/A	14.2	14.2									
		Digital Voltmeter (Vdc)	N/A	3.94	3.94									
		Equivalent Counts	N/A	1615	1615									
A) Initial Conditions														
1) Power supply & digital voltmeter connected to analog point. Remote CRT connected with scada software running. RTU L/R switch in remote.														
2) RTU display on CRT. All alarms acknowledged.														
B) Zero and Span Checks														
1) Adjust power supply for full scale transducer output of 1 mA.														
2) Observe full scale reading on CRT and record.														
3) Adjust power supply for zero scale transducer output of 0 mA.														
4) Observe zero reading on CRT and record.														
C) Deadband/Limit Checks														
1) Adjust power supply so that the analog value falls between upper and lower limits.														
2) Verify that the display value is normal.														

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ANALOG POINT CALIBRATION TESTS				10.3 Form AN-1C					
Point Description	C3X139 KW	13.8KV BUS #1 PTNTL	13.8KV BUS #2 PTNTL						
3) Adjust power supply until analog point just exceeds the upper limit.	N/A								
4) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A								
5) Acknowledge alarm.	N/A								
6) Adjust power supply until analog point just returns to normal.	N/A								
7) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A								
8) Adjust power supply so that the analog value exceeds the lower limit.	N/A								
9) Verify that the analog point has gone into alarm and record the logged value at which it alarmed.	N/A								
10) Acknowledge alarm.	N/A								
11) Adjust power supply until analog point just returns to normal.	N/A								
12) Verify that the analog point has returned to normal and record the logged value at which it returned to normal.	N/A								
13) Verify proper logging.									
This Section Complete									
Recorder: _____ Date: _____									
Witness: _____ Date: _____									
Witness: _____ Date: _____									

11.0 PULSE ACCUMULATOR CALIBRATION TESTS						11.1 Form PA-1A			
Point Description	C3X131 KWH	C3X132 KWH	C3X133 KWH	C3X134 KWH	C3X136 KWH	C3X137 KWH	C3X138 KWH	C3X139 KWH	
Accumulator Point Address	01	02	03	04	05	06	07	08	
Word Number	1B	2A	2B	3A	3B	4A	4B	5A	
KWH/count	1.44	1.44	0.48	1.44	1.44	0.48	1.44	1.44	
Primary Full Scale KW	14400	14400	4800	14400	14400	4800	14400	14400	
A) Initial Conditions									
1) Open all test switches feeding this transducer. Adjust transducer calibrator for full scale input (typically 1000 watts) to watt transducer.									
2) Select RTU display page containing pulse accumulators on CRT.									
B) Accumulated Energy - Simulated KWH									
1) Apply full scale amps and volts to the transducer.									
2) Observe KWH value just after update of the CRT display.									
3) Record the full two minute interval value after update for 2 minute demand KWH.									
4) Calculate 2 minute KWH: Primary KW x 120/3600 Hour.									
5) Verify proper logging.									
This Section Complete									
Recorder: _____									
Date: _____									
Witness: _____									
Date: _____									
Witness: _____									
Date: _____									

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APPENDIX A - EXCEPTIONS

Step #	Description of Problem	Corrective Action	By/Date
	Recorder: _____ Witness: _____		
	Design Authority: _____		
	Recorder: _____ Witness: _____		
	Design Authority: _____		
	Recorder: _____ Witness: _____		
	Design Authority: _____		
	Recorder: _____ Witness: _____		
	Design Authority: _____		
	Recorder: _____ Witness: _____		
	Design Authority: _____		

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Step #	Description of Problem	Corrective Action	By/Date
	Recorder: _____ Witness: _____ Design Authority: _____		
	Recorder: _____ Witness: _____ Design Authority: _____		
	Recorder: _____ Witness: _____ Design Authority: _____		
	Recorder: _____ Witness: _____ Design Authority: _____		
	Recorder: _____ Witness: _____ Design Authority: _____		
	Recorder: _____ Witness: _____ Design Authority: _____		

APPENDIX B - RTU DIP SWITCH SETTINGS

Systems Northwest RTU - Substation C3S4												
Post-Conversion	1=Open=Off 48 Analog points & 17 12-bit Pulse Accumulator Points											
DIP Sw #	MDM ¹	XCVR	A/D	AMUX1	AMUX2	AMUX3	AMUX4	AMUX5 ²				
1-6			0									
1-5			1									
1-4			0									
1-3			1									
1-2			0									
1-1			0									
2-8		0										
2-7		1										
2-6		1	0									
2-5		0	0									
2-4		0	1									
2-3		1	0									
2-2		0	0									
2-1		0	0									
3-8		0										
3-7		0										
3-6		0	1	1	1	1	1	1				
3-5		1	0	0	0	0	0	0				
3-4		0	0	0	0	0	0	0				
3-3		0	0	0	0	0	1	1				
3-2		1	0	0	1	1	0	0				
3-1		0	0	1	0	1	0	1				

¹ Move "RTS Continuous" jumper in upper left quadrant of the modem board to the "TC" position.

² Analog card not in service, points not accessible by ILEX/Conitel

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Systems Northwest RTU - Substation C3S4												
Post-Conversion	1=Open=Off											
DIP Sw #	IND1	IND2	IND3	IND4	IND5	IND6						
F/S	F	S	F	S	F	S						
1A Jmpr-A	3	3	3	3	L	L						
1A Jmpr-B	1	1	2	2	3	3						
7G-10	As	Bu	ild									
7G-9	Aft	er		test	ing							
7G-8	is	com	ple	ted								
7G-7												
7G-6												
7G-5												
7G-4												
7G-3												
7G-2												
7G-1												

Systems Northwest RTU - Substation C3S4												
Post-Conversion	1=Open=Off											
DIP Sw #	CTL1	CTL2										
Addr-4	0	0										
Addr-3	0	0										
Addr-2	0	0										
Addr-1	0	1										

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Systems Northwest RTU - Substation C3S4												
Post-Conversion	1=Closed=On											
DIP Sw #	PA1	PA2	PA3	PA4								
2-8	0	0	0	0								
2-7	1	1	1	1								
2-6	0	0	0	0								
2-5	0	0	0	0								
2-4	0	0	0	0								
2-3	0	0	0	0								
2-2	0	0	0	0								
2-1	0	0	0	1								
1-8	0	0	0	0								
1-7	0	0	0	0								
1-6	0	0	0	0								
1-5	0	0	1	1								
1-4	0	1	0	1								
1-3	0	0	0	0								
1-2	0	0	0	0								
1-1	0	0	0	0								