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PACIFIC GAS & ELECTRIC COMPANY

NUCLEAR SAFETY-RELATED PROCESS PROTECTION SYSTEM REPLACEMENT DIABLO CANYON POWER PLANT

VALIDATION TEST SPECIFICATION (VTS)

Document No. 993754-1-812 (-NP)

Revision 1

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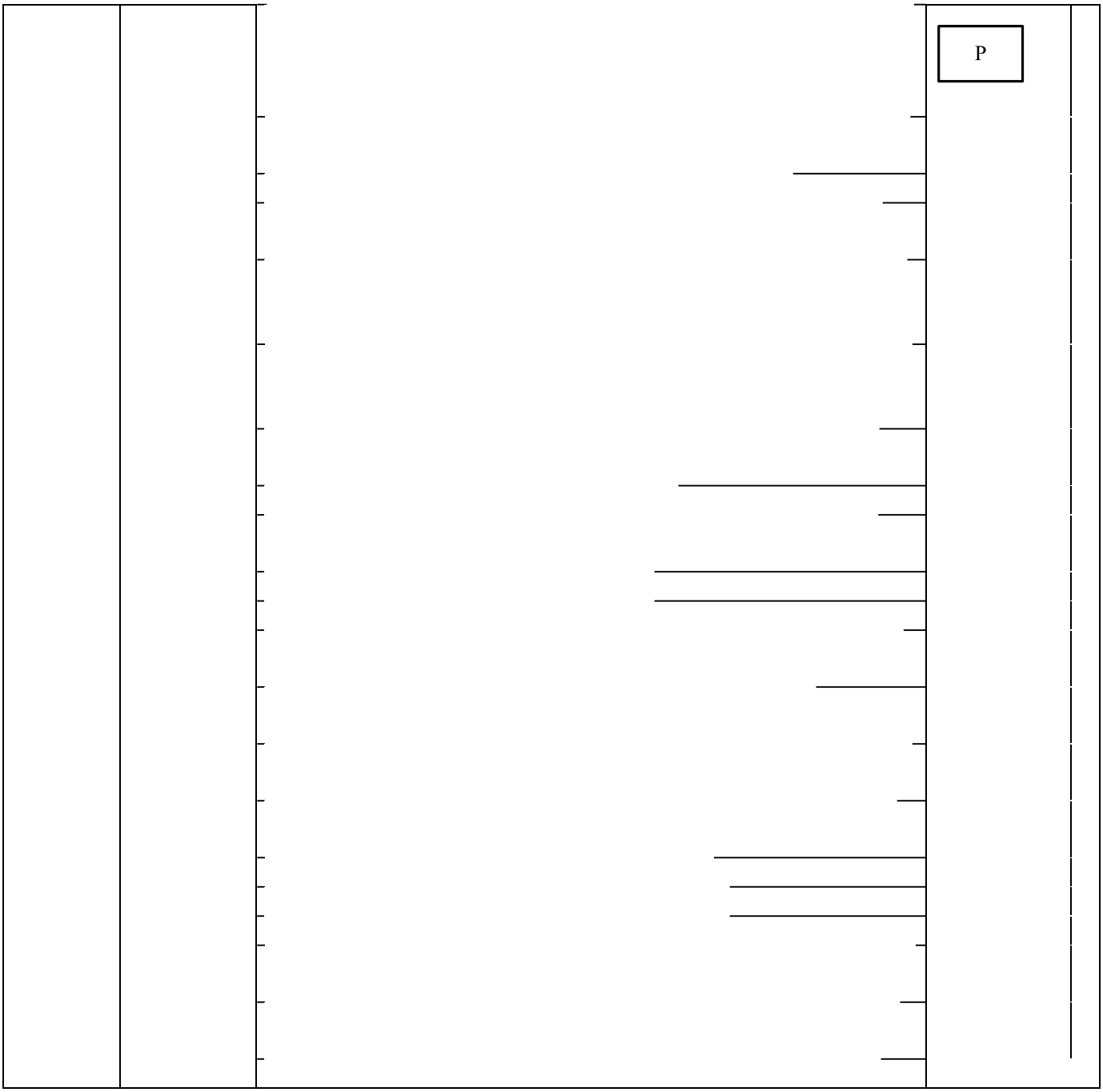

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1 Purpose

This document constitutes the entire validation test specification (VTS) for the Invensys Operations Management (IOM) portion of the Diablo Canyon Power Plant Process Protection System Replacement Project. Per PG&E's request, and as described fully in the validation test plan [Ref 3.2.5], this specification also addresses specific communication interface testing of the Tricon, NetOptics Network Port Aggregator Tap (hereafter, "port aggregator"), Maintenance Workstation (MWS) and KVM switch.

Under IOM process, hardware validation testing is embedded in the system validation test plans and test specifications. Therefore, this document addresses the design of protection set Tricon hardware validation testing. Note that, under IOM process, hardware validation includes a considerable amount of hardware *verification* testing; i.e., assessing conformance of the hardware to Hardware Requirement Specifications (HRS).

IOM's deliverables to PG&E consist primarily of four V10 Tricon systems, executing application specific TriStation Application Projects (TSAPs). The V10 Tricons are major elements in the four protection sets that make up the plant protection system; one Tricon per protection set.

The detailed description of IOM's scope of delivery, which effectively defines the items subject to validation, is provided in the project management plan (PMP) [Ref 3.2.2]. Hereafter, the four Tricons subject to this validation test are referred to collectively as the "V10 Tricon Protection Set". Individually, the protections sets are denoted as Protection Set I, Protection Set II, Protection Set III, and Protection Set IV (using a Roman numeral convention).

The protection sets include equipment outside IOM's scope of delivery. Except where noted, in this document the terms Protection Set I, Protection Set II, Protection Set III, and Protection Set IV refer exclusively to the protection set components with Invensys scope of supply.

This document describes the design of all validation tests to be carried out on the V10 Tricon Protection Set. Several tests are common to one or more V10 Tricon Protection Sets, because of redundant functionality and/or design among them. Some tests are unique to a specific V10 Tricon Protection Set, because of its unique functions or design.

This document contains sufficient detail to permit the development of the validation test cases and procedures, although test case and procedure details will draw upon information in the engineering documents.

This VTS was developed in accordance with PPM 6.0: *Test Control* [Ref 3.2.1] and conforms to IEEE-829-1983: *IEEE Standard for Software Test Documentation* [Ref 3.4.2] and NRC guidance documents (Section 3.3). Table 1 describes the correlation between PPM development requirements, IEEE-829-1983 guidance, and the layout of this document.

Table 1: Validation Test Specification Outline

PPM 6.0 Section 4.2.1	IEEE 829-1998 Sections 5.0	VTS Sections
Cover Page	5.0 Test Design Specification	Cover Page
1.0 Purpose	5.1 Purpose	1. Purpose
2.0 Test Outline 2.1 Scope	5.2 Outline	2. Scope
	5.2.1 Test design specification Identifier	5. Test Specification Identifier
	5.2.2 Feature to be tested	6. Features to be Tested 7. Features not to be Tested
2.2 Test Approach	5.2.3 Approach refinements	8. Test Approach Refinements
2.3 Test Elements	5.2.4 Test Identification	9. Test Identification
2.4 Acceptance Criteria	5.2.5 Feature Pass/Fail Criteria	10. Feature Pass/Fail Criteria
3.0 Test Requirements		8.2 Hardward Validation Testing 8.3 System Validation Testing
4.0 References	None Apply	3. References
5.0 Terms, Definitions, and Acronyms.	None Apply	4. Definitions, Acroyms, and Abbreviations

2 Scope

The scope of this test specification is defined by the system validation test plan. In brief, this test specification will include hardware of all four V10 Tricon Protection Sets and their related TriStation Application Project (TSAP). MWS and the communication peripherals (media converters, port aggregator taps and touchscreen device via a KVM switch) will be utilized as test tools for complete interface tests between V10 Tricon Protection Set and MWS.

This specification does not encompass the validation testing for any other hardware or software, although it may describe the use of other hardware and software during validation testing.

As a validation test specification, this document describes those tests that assess the conformance of the test items against their requirements specifications, as found in the four V10 Tricon Protection Set software requirements specifications (SRSs) [Refs 3.2.7] and hardware requirements specifications (HRSs) [Refs 3.2.11 thru 9.2.14]. Thus, software verification testing is explicitly out-of-scope of this test specification. (Such testing is specified in the software verification test specification [Ref 3.2.6].)

In the DCPP PPS Replacement Project, there is no system requirements specification. Instead, there is a hardware requirements specification (HRS) and a software requirements specification (SRS). The SRS contains the bulk of the product functional requirements, since most functionality is implemented in software. Therefore, the SRS is tantamount to a system requirements specification, and the system validation test is carried out against the SRS. The HRS is also tantamount to a system hardware requirements specification, and the hardware validation test (HVT) is carried out against the HRS.

2.1 V10 Tricon Portion of the PPS

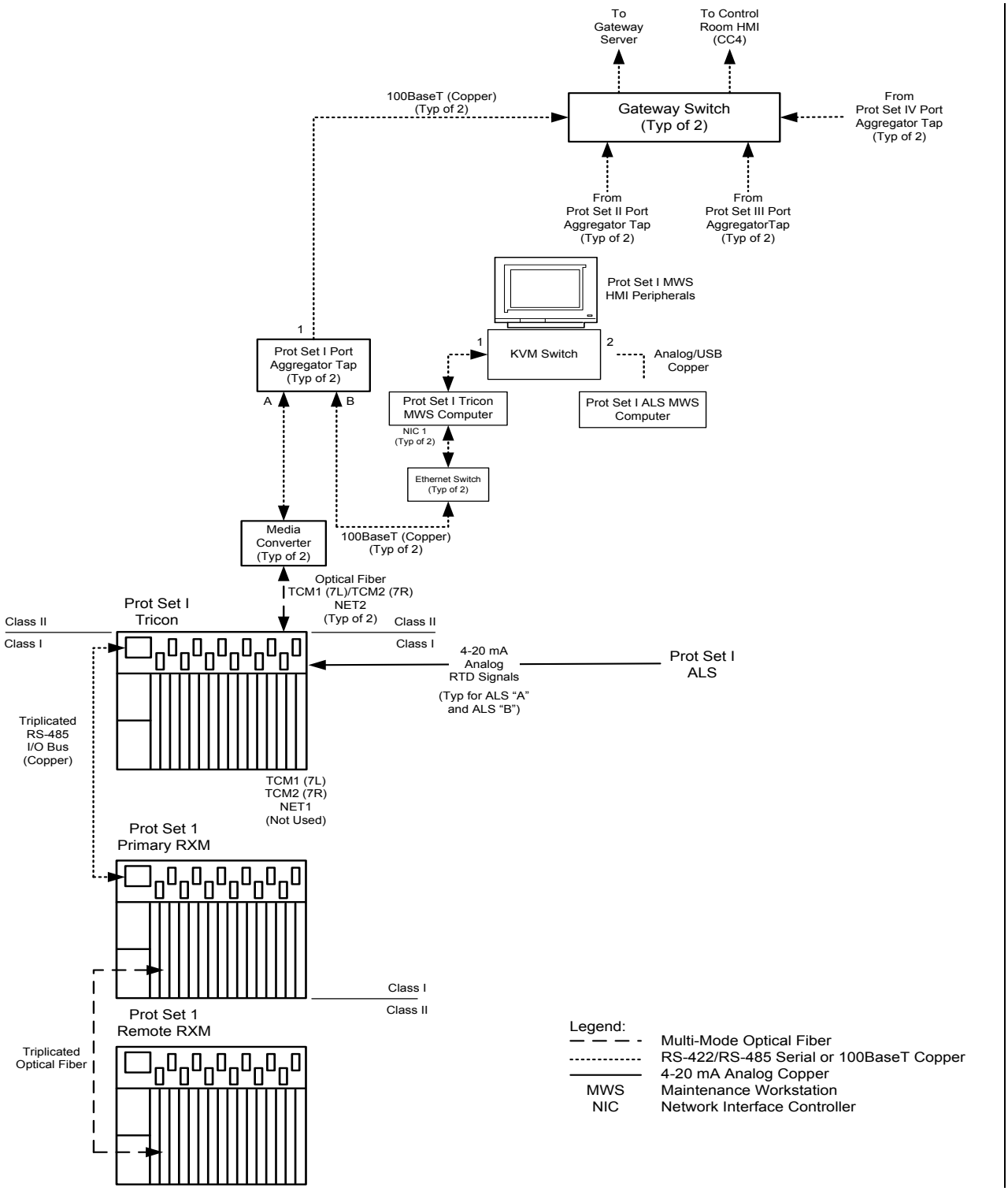

Figure 1: Tricon Protection Set Architecture for the PPS Replacement System.

3 References

3.1 PG&E Documents

3.1.1 Deleted
3.1.2 PG&E 08-0015-SP-001, Functional Requirements Specification (FRS) Revision 9.
3.1.3 Deleted
3.1.4 PG&E Process Protection System (PPS) Replacement Interface Requirements Specification (IRS) Revision 9.
3.1.5 Deleted
3.1.6 PG&E Project Letter 993756-35R, PG&E Plant Operating Data

3.2 Invensys Operations Management Documents

3.2.1 Invensys Project Procedures Manual (PPM).
3.2.2 Project Management Plan (PMP), 993754-1-905.
3.2.3 Software Quality Assurance Plan (SQAP), 993754-1-801.
3.2.4 Software Verification and Validation Plan (SVVP), 993754-1-802.
3.2.5 Validation Test Plan (VTP), 993754-1-813.
3.2.6 Software Verification Test Specification, 993754-1-869.
3.2.7 Software Requirements Specification, 993754-11-809.
3.2.8 Deleted
3.2.9 Deleted
3.2.10 Deleted
3.2.11 Hardware Requirements Specification Protection Set I, 993754-11-807.
3.2.12 Hardware Requirements Specification Protection Set II, 993754-12-807.
3.2.13 Hardware Requirements Specification Protection Set III, 993754-13-807.
3.2.14 Hardware Requirements Specification Protection Set IV, 993754-14-807.
3.2.15 Software Design Description, 993754-11-810.

3.3 NRC Documents

3.3.1 Branch Technical Position 7-14, Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems, Revision 5, U.S. Nuclear Regulatory Commission.
3.3.2 U.S. NRC Regulatory Guide (RG) 1.168, Verification, Validation, Reviews, and Audits for Digital Computer Software Used in Safety Systems of Nuclear Power Plants.
3.3.3 U.S. NRC Digital Instrumentation and Controls Interim Staff Guidance DI&C-ISG-06.
3.3.4 10 CFR50, Appendix A, GDC 21 “Protection System Reliability and Testability.
3.3.5 U.S. NRC Regulatory Guide (RG) 1.170, Software Test Documentation for Digital Computer Software used in Safety System of Nuclear Power Plants.

3.4 Industry Documents

3.4.1 IEEE 1012 - 1998, Standard for Software Verification and Validation.
3.4.2 IEEE 829 – 1983, Standard for Software Test Documentation.

3.4.3 IEEE 1074-1995, Standard for Developing Software Life Cycle Processes.
3.4.4 IEEE 610.12-1990, Standard Glossary of Software Engineering Terminology.

4 Definitions, Acronyms, and Abbreviations

4.1 Definitions

Acceptance (Pass/Fail) Criteria: Decision rules used to determine whether a software or hardware passes or fails a test.

Black Box Testing – (1) Testing that ignores the internal mechanism of a system or component and focuses solely on the outputs generated in response to selected inputs and execution conditions. (2) Testing conducted to evaluate the compliance of a system or component with specified functional requirements.

Factory Acceptance Test (FAT): See *System Validation Test*.

Project Traceability Matrix: A table that shows the trace of customer requirements to product requirements, to product design elements, to verification tests, and to validation tests.

System Validation Test: Also known as a factory acceptance test (FAT), when carried out at the supplier's facility, this test evaluates the product system against its requirements.

Test Plan: A document describing the scope, approach, resources, and schedule of intended testing activities. It identifies test items, the features to be tested, the testing tasks, who will do each task, and any risks requiring contingency planning.

Test Procedure: A document specifying the sequence of actions for the execution of a test.

Test Specification: A specification that translates customer requirements and design features into test specifications and test approaches for validation by testing. It may add to or refine the test approaches described in the Validation Test Plan. (Also known as the Test Design Specification.)

Validation: The process of assessing an item to determine its level of conformance with its requirements, i.e., to determine its level of quality. For example, software is validated at its software requirements specification. Validation answers, "Did we build the right thing?"

Verification: The process of assessing an item to determine whether it has been implemented in accordance with its design. Verification answers, "Did we build the thing right?"

4.2 Acronyms

AI	Analog Inputs
ALS	Advanced Logic SystemDCPP Diablo Canyon Power Plant
DTTA	Delta Temperature/Average Temperature
FAT	Factory Acceptance Test
FRS	Functional Requirements Specification
FSR	Full Scale Range
HRS	Hardware Requirements Specification
HVT	Hardware Validation Test
I/O	Input/Output

IRS	Interface Requirements Specification
IV&V	Independent Verification and Validation
LTOPS	Low Temperature Overpressure Protection System
M&TE	Measurement and Test Equipment
MWS	Maintenance Workstation
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
OOR	Out-of-Range
OOS	Out-of-Service
OPDT	Overpower Delta-T
OPTR	Overpressure Turbine Runback
OTDT	Overtemperature Delta-T
OTTR	Overtemperature Turbine Runback
PG&E	Pacific Gas and Electric
PMP	Project Management Plan
PPM	Project Procedures Manual
PPS	Process Protection System
PRC	Project Review Committee
PTM	Project Traceability Matrix
QA	Quality Assurance
RTS	Reactor Trip System
S/G	Steam Generator
SDD	Software Design Description
SIDR	System Integration Deficiency Report
SIL	Software Integrity Level
SQAP	System Quality Assurance Plan
SRS	Software Requirements Specification
SVT	Software Verification Test
SVVP	Software Verification and Validation Plan
TCM	Triconex Communications Module
TiB	Test-in-Bypass
TiT	Test-in-Trip
TS1131	TriStation 1131
TSAP	TriStation Application Project
TTD	Trip Time Delay
VTP	Validation Test Plan
VTS	Validation Test Specification

4.3 Abbreviations

None

5 Test Specification Identifier

This document is used as the system validation test specification for all protection set Tricons in the Diablo Canyon Power Plant Process Protection System Replacement Project. There are no other system validation test specifications for Tricon protection set.

This section discusses the overall identifier assignment scheme in the test design specification. Figure 2 shows the overall structure of the verification test documents for the PPS Project.

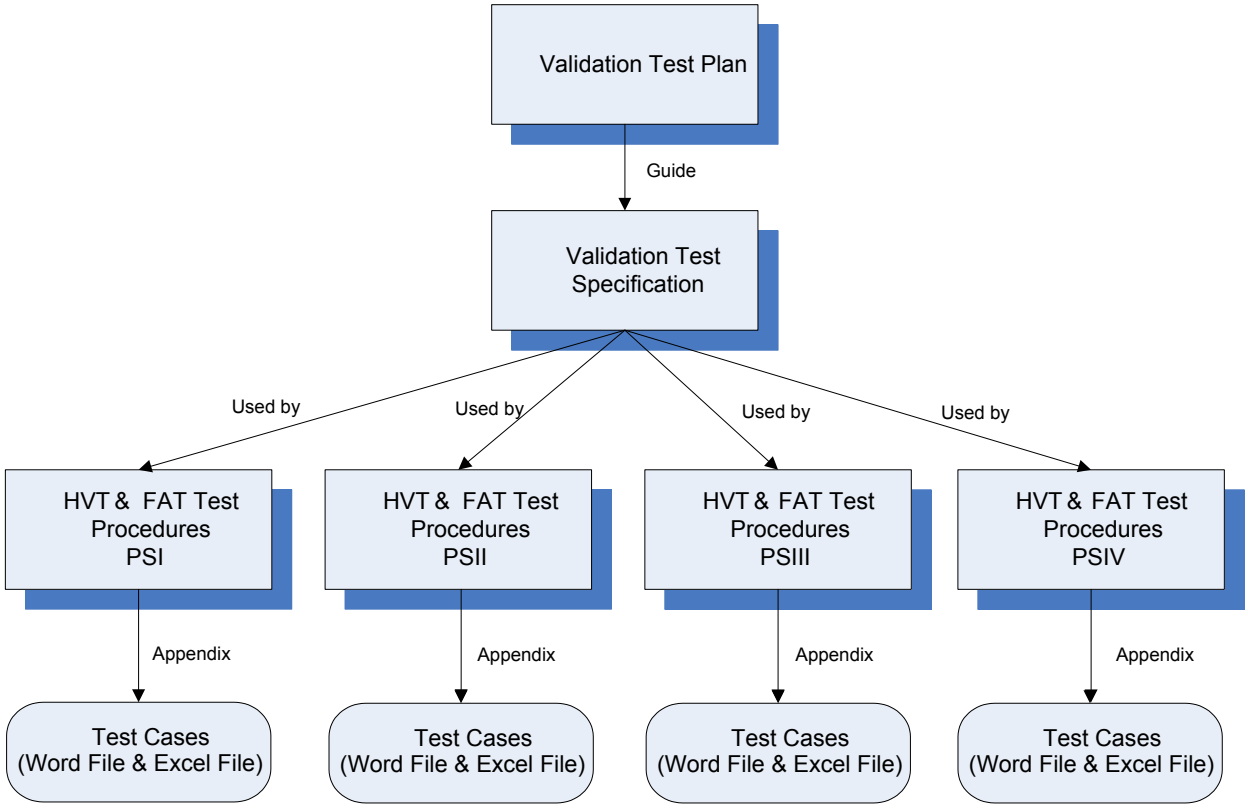

Figure 2: Overall Validation Test Document Structure.

- One Validation Test Plan is developed for the entire PPS Project (993754-1-813).
- One Validation Test Specification is generated for the entire PPS Project (993754-1-812).

- One Hardware Validation Test (HVT) Procedures and one Factory Acceptance Test (FAT) Procedure are specified for each PPS Protection Set. There are total four (4) sets of Hardware Validation Test Procedures and four (4) sets of Factory Acceptance Test Procedure.
- Each HVT Procedure has one appendix excel file (of test cases).
- Each FAT Procedure has multiple appendixes excel file and word file (of test cases).

The identifier assignment scheme is developed in accordance with PPM 4.0, *Project Document and Date Control*, and PMP Appendix B. The unique identifier assigned to this design specification is 993754-1-812. The identifiers assigned to the Hardware Validation Test Procedures and Factory Acceptance Test Procedures are shown below.

Protection Set Number	HVT Procedure Document Number (MS Word File)	FAT Procedure Document Number (MS Word File)
PS I	993754-11-902-0	993754-11-902-1
PS II	993754-12-902-0	993754-12-902-1
PS III	993754-13-902-0	993754-13-902-1
PS IV	993754-14-902-0	993754-14-902-1

6 Features to be Tested

This section describes the features (i.e., functional, performance, and other requirements) to be tested. It specifically identifies the features that apply to each of the four V10 Tricon Protection Sets, as well as to the port aggregator. Not all test item features will be validation tested. See Section 7 for identification of features that will not be tested, including justification for not testing those features during validation testing.

6.1 Hardware Validation Testing

Hardware validation testing, under IOM process, involves substantial hardware verification activity. HVT assesses whether the completed V10 Tricon Protection Sets satisfy the requirements specified in their respective hardware requirements specifications (HRSs). The Tricon platform is supplied with certificates of conformance for the internal components of the platform. No verification testing of those components is required. However, as further verification of the assembled hardware, the following features are tested as part of hardware validation testing:

- Tricon Power modules
- Tricon I/O modules
- I/O module points, including spare points specified in drawings or the HRS
- Tricon Communication Modules interface with MWS
- Loop Instrument power supplies

6.2 System Validation Testing

System validation testing assesses whether the completed V10 Tricon Protection Sets satisfy the requirements specified in their respective software requirements specifications (SRSs). The FRS [Ref 3.1.2], and IRS [Ref 3.1.4] provide the system-level requirements. The requirements applicable to the V10 Tricon (i.e., Invensys scope of supply) were translated into software and hardware requirements, and those are the basis of validation testing.

System validation testing addresses the requirements categories shown in Table 2, taken from the indicated sections of the SRS.

Table 2: V10 Tricon Protection Set Requirements Categories

SRS Section	Requirements Category
3.1 External Interface Requirements	
3.1.1	External Systems
3.1.2	Inputs/Outputs
3.1.3	User Interfaces
3.1.4	Hardware Interfaces
3.1.5	Software Interfaces
3.1.6	Communications Interfaces
3.2 External Input/Output	
3.2.1	Analog Output Signals
3.2.2	Analog Input Signals
3.2.3	Discrete Input Signals
3.2.4	Discrete Output Signals
3.3 Functional Requirements	
3.3.1	System Diagnostics
3.3.2	Applicable To All
3.3.3	Wide Range Reactor Coolant Temperature
3.3.4	Wide Range Reactor Coolant Pressure
3.3.5	Delta Temperature – Temperature Average (DTTA)
3.3.6	Pressurizer Level
3.3.7	Pressurizer Vapor Temperature
3.3.8	Steamflow
3.3.9	Steamline Break Protection
3.3.10	Steam Generator Narrow Range Level
3.3.11	Turbine Impulse Chamber Pressure
3.7 Software System Attributes	
3.7.4	Security
3.7.5	Maintainability

7 Features not to be Tested

This section describes all those requirements against which the V10 Tricon Protection Sets will not be validated.

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8 Test Approach Refinements

8.1 Validation Techniques

For the safety-related DCPP project, Invensys IV&V engineers employ rigorous validation testing techniques to ensure quality of the Tricon hardware and Tricon application software. The validation techniques facilitate both dynamic testing and static testing of the TSAP functionality.

8.1.1 Techniques for System Validation

During the Requirements Phase of the DCPP project, IV&V engineers employ the techniques below to validate four (4) system Protection Sets. The techniques are grouped under either dynamic testing or static testing.

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8.2 Hardware Validation Testing

Hardware validation testing validates the V10 Tricon Protection Sets' hardware against their respective HRSs. The HVT purpose and scope are defined in the validation test plan. That plan provides a basic description of the test approach. This document provides additional test approach information.

8.2.1 Hardware Configuration

The hardware being validated is the deliverable V10 Tricon Protection Set hardware for Protection Set I, Protection Set II, Protection Set III, and Protection Set IV. The V10 Tricon Protection Sets' components are provided with certificates of conformance from the IOM Tricon manufacturing facility. Prior to hardware validation testing, the hardware is assembled in the IOM Lake Forest facility, in a climate-controlled, secure test environment. All four V10 Tricon Protection Sets are received, assembled, and tested in this facility, at essentially the same time.

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8.2.2 Hardware Validation Test Prerequisites

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8.2.3 Outline of Hardware Validation Testing

HVT is performed in parallel (not necessarily "simultaneously"; i.e., in lock step) on each of the four V10 Tricon Protection Sets.

The testing first verifies that the hardware configuration is correct. This is accomplished through a series of inspections, power-on tests, and calibration verification steps, to confirm the hardware configuration conforms to design documentation and is in proper working order.

Testing continues via the execution of the hardware validation test procedures, which comprise the hardware validation test cases. (These tests identify the set of hardware validation tests that will sufficiently verify and validate the Tricon Protection Sets against their design descriptions and requirements specifications.)

Per the software verification and validation plan (SVVP) [Ref 3.2.4]; HVT results are documented in the hardware validation test report.

8.3 System Validation Testing

System Validation Testing (SysVT) validates the V10 Tricon Protection Sets against their respective software requirements specifications.

The test targets are the four deliverable V10 Tricon platforms loaded with the four deliverable TriStation application projects (TSAPs), each one developed specifically for a specific V10 Tricon Protection Set: Protection Set I, Protection Set II, Protection Set III, and Protection Set IV.

SysVT is performed on each V10 Tricon Protection Set using (via) Factory Acceptance Test procedure (FAT) by Nuclear IV&V personnel, supported by Nuclear Delivery personnel and Nuclear QA personnel. The tests may be witnessed by PG&E representatives.

Before System validation testing can begin on any individual V10 Tricon Protection Set, the following prerequisites must be met, in the order shown, for that V10 Tricon Protection Set.

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8.3.3 Test Anomalies

In the event a V10 Tricon Protection Set is found to be in nonconformance with its requirement specifications, or in case of any abnormal test conditions, the anomaly is documented on a System Integration Deficiency Report (SIDR), in accordance to PPM 6.0 and PPM 10.0, *Nonconformance and Corrective Action*. Software anomalies are also documented per PPM 7.0.

8.3.4 Test Environmental Conditions

System validation tests are carried out under the normal environmental conditions (temperature and humidity) of the Triconex facility.

9 Test Identification

9.1 Hardware Validation Tests Identification

The hardware validation test procedures and test cases are developed in four separate documents, one for each of the V10 Tricons in Protection Set I, Protection Set II, Protection Set III, and Protection Set IV:

Title	Document Number
Protection Set I HVT Procedures	993754-11-902-0
Protection Set II HVT Procedures	993754-12-902-0
Protection Set III HVT Procedures	993754-13-902-0
Protection Set IV HVT Procedures	993754-14-902-0

These documents therefore specify all the hardware validation test procedures and their supporting test cases. Complete execution of these procedures, with acceptable results, constitutes validation of the V10 Tricon Protection Sets' hardware. No other hardware validation testing is necessary, prior to execution of the system validation tests.

9.1.1 Hardware Validation Test Case Identifier

The unique test case identifier will be used in two places:

1. In PTM as test case traceability tag
2. In Word file as test case number

The test case identifier has the following ID convention:

<***Test Category***>-<***Protection Set***>-<***Group of Tests***>-<***Test Case Index***>

Where:

Attributes	Description / Format / Acceptable Values
<***Test Category***>	Description: indicates the Test Category of the test case. Format: 3 characters are used to abbreviate the Test Category. Acceptable Values: • HVT (Hardware Validation Test)
<***Protection Set***>	Description: indicates the Protection Set to which the test case is assigned. Format: 2 digits are used. Acceptable Values: • 11 (Protection Set I) • 12 (Protection Set II) • 13 (Protection Set III) • 14 (Protection Set IV)
<***Group of Tests***>	Description: to indicate which Group of Test for each test case intends to verify. Format: 3 characters are used to abbreviate the Group of Tests. Acceptable Values: • PUT (Power-up Test) • FIO (Field Input/Output)

<***Test Case Index***>	Description: to indicate the test case number. Format: 3 digits are used. Acceptable Values: • 1 … 999

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9.2 Hardware Validation Test Design

9.3 Factory Acceptance Tests Identification

The factory acceptance test procedures and test cases are developed in four separate documents, one for each of the V10 Tricons in Protection Set I, Protection Set II, Protection Set III, and Protection Set IV:

Title	Document Number
Protection Set I Factory Acceptance Test Procedures	993754-11-902-1
Protection Set II Factory Acceptance Test Procedures	993754-12-902-1
Protection Set III Factory Acceptance Test Procedures	993754-13-902-1
Protection Set IV Factory Acceptance Test Procedures	993754-14-902-1

These documents therefore specify all the factory acceptance test procedures and their supporting test cases. Complete execution of these procedures, with acceptable results, constitutes validation of the deliverable V10 Tricon Protection Sets. No other factory acceptance testing is necessary, prior to delivery of the V10 Tricon Protection Sets to PG&E.

9.3.1 Factory Acceptance Test Case Identifier

The unique test case identifier will be used in two places:

1. In PTM as test case traceability tag
2. In Word file as test case number

The test case identifier has the following ID convention:

<***Test Category***>-<***Protection Set***>-<***Group of Tests***>-<***Test Case Index***>

Where:

Attributes	Description / Format / Acceptable Values
<***Test Category***>	Description: indicates the Test Category of the test case. Format: 3 characters are used to abbreviate the Test Category. Acceptable Values: • FAT (Factory Acceptance Test)
<***Protection Set***>	Description: indicates the Protection Set to which the test case is assigned. Format: 2 digits are used. Acceptable Values: • 11 (Protection Set I) • 12 (Protection Set II) • 13 (Protection Set III) • 14 (Protection Set IV)

9.3.2 SRS Tag Traceability

In general, each test case identifier is traceable to a single or multiple requirment elements in the SRS. Each requirment element is tagged by a base requirement ID (R-#) or a derived requirement ID (DR-#), which is specified in the SRS.

The test cases traceability is documented in the initial revision of the Validation Test Specification. As the Validation Test Specification is updated with PG&E design inputs revision 9, it is also streamlined with the removal of the test cases traceability from this revision of the specification and moving forward. The test cases traceability will be part of the Implementation-phase PTM referenced by this specification.

The streamlining effort of moving the test cases traceability from the Validation Test Specification to the PTM complies with IEEE 829-1983 guidance on the test cases traceability and requirement coverage and completeness.

9.4 Factory Acceptance Tests Design

The following sections represent the general categories of V10 Tricon Protection Set features subject to system validation testing. Each section identifies system validation "tests" of those features.

The tests are assigned identifiers that are used as the test procedure identifiers. Only a brief description of the test is provided, the aim being only to identify the number and types of tests that make up factory acceptance testing. Test details are provided in the test procedures and test cases.

Tracing back to the SRS requirements is accomplished via the test identifier and the project traceability matrix.

9.4.1 External Interface Requirements

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Tricon Protection Set to interface with other systems.

9.4.1.1 Inputs/Outputs

[NO REQUIREMENTS]

9.4.1.2 User Interfaces

[NO REQUIREMENTS]

9.4.1.3 Hardware Interfaces

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Tricon Protection Set to interface with other systems.

9.4.1.4 Manual Trip Switches and Indications

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Manual Trip Switches and Indication.

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9.4.1.5 Manual Bypass Switches

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Manual Bypass Switches and Indication.

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9.4.1.6 Out-of-Service Switches (OOS)

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Out-of-Service Switches and Indication.

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9.4.1.7 Trip and Bypass Test Features

This test verifies that the Tricon TSAP satisfies the requirements imposed on the Trip and Bypass Test Features.

P

9.4.1.8 Software Interfaces

[NO REQUIREMENTS]

9.4.1.9 Communication Interfaces

This test verifies that the Tricon TSAP satisfies the requirements utilize the TSAA protocol for runtime non-safety Ethernet communications.

P

9.4.2 External Input/Output

[NO REQUIREMENTS]

9.4.3 Functional Requirements

9.4.3.1 System Diagnostics

This test verifies that the Tricon TSAP satisfies the requirement to provide capabilities for diagnostics and error handling of Tricon Protection Set System. This test design is created based on the function requirements of section 3.3.1 (System Diagnostic) in the SRS.

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9.4.3.2 Failure Alarms

This test verifies that the Tricon TSAP satisfies the requirement to provide Failure Alarm for Tricon Protection Set System. This test design is created based on the function requirements of section 3.3.1.2.2 (Failure Alarms) in the SRS.

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9.4.3.3 Trouble Alarms

This test verifies that the Tricon TSAP satisfies the requirement to provide Trouble Alarm for Tricon Protection Set System. This test design is created based on the function requirements of section 3.3.1.2.3 (Trouble Alarms) in the SRS.

P

or Test Conditions	

9.4.3.4 Bypass Alarms

This test verifies that the Tricon TSAP satisfies the requirement to provide Bypass Alarm for Tricon Protection Set System. This test design is created based on the function requirements of section 3.3.1.2.4 (Bypass Alarms) in the SRS.

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9.4.3.5 RTD Failure Alarms

This test verifies that the Tricon TSAP satisfies the requirement to provide RTD Failure Alarm for Tricon Protection Set System. This test design is created based on the function requirements in the SRS.

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9.4.3.6 Out-of-Service Alarms

This test verifies that the Tricon TSAP satisfies the requirement to provide Out-of-Service Alarm for Tricon Protection Set System. This test design is created based on the function requirements of section 3.3.1.2.6 (Out-of-Servcie Alarms) in the SRS.

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9.4.3.7 Remove From Service (RFS) Indication

This test verifies that the Tricon TSAP satisfies the requirement to provide an indication for each T_{Hot} or T_{Cold} signal if a signal has been removed from service.

P

9.4.3.8 Time Response

This test verifies that the Tricon TSAP satisfies the requirements total throughput time shall not exceed 200 msec for Tricon Protection Set System. This test design is created based on the function requirements in the SRS.

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Requirements Applicable to All Protective Functions

9.4.4 Online Test and Calibration Access

This test design is to verify the initiation (enabling) of the Online Test and Maintenance process. This test design is created base on the Online Test and Calibration Access of section 3.3.2.1.1 in the SRS.

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9.4.4.1 Online Test and Calibration Access

9.4.4.2 Test Analog Indication

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9.4.4.3 Annunciator Output

P

P

9.4.4.4 Channel in Maintenance

9.4.4.5 Test-In-Trip

P

9.4.4.6 Test-In-Bypass

P

P

9.4.4.7 Tunable Constants and Setpoints

9.4.4.8 Data Retention after Power Cycle

P

9.4.5 Wide Range Reactor Coolant Temperature

Purpose of this test design is to test the correctness of the Wide Range Reactor Coolant Temperature trip determination and its outputs. This test design is created based on the function requirements of section 3.3.3 (Wide Range Reactor Coolant Temperature) in the SRS.

P

9.4.6 Wide Range Reactor Coolant Pressure

Purpose of this test design is to test the correctness of the Wide Range Reactor Coolant Pressure trip determination and its outputs. This test design is created based on the function requirements of section 3.3.4 (Wide Range Reactor Coolant Pressure) in the SRS.

P

9.4.7 Delta Temperature – Temperature Average (DTTA)

Purpose of this test design is to test the correctness of the overall DTTA function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.5 (Delta Temperature – Temperature Average) in the SRS.

P

9.4.8 Pressurizer Level

Purpose of this test design is to test the correctness of the Pressurizer Level function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.6 (Pressurizer Level) in the SRS.

P

9.4.9 Pressurizer Vapor Temperature

Purpose of this test design is to test the correctness of the Pressurizer Vapor Temperature function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.7 (Pressurizer Vapor Temperature) in the SRS.

P

9.4.10 Steamflow

Purpose of this test design is to test the correctness of the Steamflow Compensation determination and its outputs. This test design is created based on the function requirements of section 3.3.8 (Steamflow) in the SRS.

P

9.4.11 Steamline Break Protection

Purpose of this test design is to test the correctness of the Steamline Break Protection function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.9 (Steamline Break Protection) in the SRS.

P

9.4.12 Steam Generator Narrow Range Level

Purpose of this test design is to test the correctness of the Steam Generator Narrow Range Level function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.10 (Steam Generator Narrow Range Level) in the SRS.

P

9.4.13 Turbine Impulse Chamber Pressure

Purpose of this test design is to test the correctness of the Turbine Impulse Chamber Pressure function trip determination and its outputs. This test design is created based on the function requirements of section 3.3.11 (Turbine Impulse Chamber Pressure) in the SRS.

P

9.4.14 Security

Purpose of this test design is to test the system logon access to the Tricon Protection Set TSAP via the MWS will be administratively control using physical security and passwork logon security measures.

P

9.4.15 Maintainability

Purpose of this test design is to test the capability to place and maintain multiple channels Out of Service (Trip or bypass).

P

10 Feature Pass / Fail Criteria

Two methods, one qualitative and one quantitative, are used to establish the pass/fail criteria. The pass/fail criteria are specified within each of the test cases. Alternately, the test procedure may specify the pass/fail criteria, for test cases in which pass/fail is dependent on the specific test procedure employed.

P

P