

Engineering Procedure

SAEP-1630

28 February 2005

Preparation of Integration Test Procedure Document

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1 Scope

- 1.1 This Saudi Aramco Engineering Procedure (SAEP) provides instructions for the development and approval of the Integration Test Procedure Document for all Integrated Process Automation Systems.
- 1.2 The Integration Test Procedure is a document that specifies and describes the conditions, requirements, plans, procedures, success criteria, and responsibilities for performance of the integration test.
- 1.3 This document is only required if the project is delivering an Integrated Process Automation System (IPAS). The IPAS is a system with two or more Process Automation Systems (PAS) linked via a common backbone or a wide-area network. Examples of IPAS are DCS/MIS, SCADA/MIS, and DCS/SCADA. Systems connected by serial interfaces do not fall under the category of IPAS.
- 1.4 The Integration Test Procedure is part of the 601 and 602 series of NMRs (Non-Material Requirements) as described in [SAEP-16](#). It is required that this document be approved by Saudi Aramco prior to any integration testing.

2 Conflicts and Deviations

- 2.1 Any conflicts between this Procedure and other applicable Saudi Aramco Engineering Procedures (SAEPs), Saudi Aramco Engineering Standards (SAESs), Saudi Aramco Materials System Specifications (SAMSSs), Saudi Aramco Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Process & Control Systems Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this Procedure in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Process & Control Systems Department of Saudi Aramco, Dhahran.

3 Applicable Documents

All referenced Procedures, Standards, Specifications, Codes, Forms, Drawings, and similar material or equipment supplied shall be considered part of this Procedure to the extent specified herein and shall be of the latest issue (including all revisions, addenda, and supplements) unless stated otherwise.

Saudi Aramco Engineering Procedures

[SAEP-16](#)

Project Execution Guide for Process Automation Systems

[SAEP-302](#)

Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement

[SAEP-1628](#)

*Preparation of Integration Specifications
Document*

4 Instructions

- 4.1 After developing the Integration Specification Document (ISD) per [SAEP-1628](#), the integration test is conducted to verify that the IPAS performs as stated in the ISD to meet project requirements.
- 4.2 The purpose of the integration test is to verify that PAS Integrator's philosophy, strategy, and methods provide compatibility of integrated system components. The PAS Integrator shall ensure reliability, integrity, and robustness of the integrated technologies between integration system components with their systems and applications.
- 4.3 The Integration Test Procedure shall describe in detail the important testing issues, testing scenarios, testing locations, testing strategies, testing resources, and the specific testing methods. PAS Integrator shall use this procedure to demonstrate the correctness, reliability, integrity, and robustness of the integrated system.
- 4.4 Appendix 1 provides the guidelines for the format and contents of the Integration Test Procedure. Sections shown are the minimum that shall be included in the procedure. Other sections could be included as required by the FSD or PAS Integrator.

5 Responsibilities

The SAPMT has overall responsibility for the development of the Integration Test Procedure per [SAEP-16](#) and Job Specification requirements. The procedure is to be delivered with 601 NMRs and 602 NMRs. P&CSD may be requested to review the procedure at any time.

6 Acronyms and Definitions

6.1 Acronyms

DCS	- Distributed Control System
ESD	- Emergency Shutdown System
FSD	- Functional Specification Document
IPAS	- Integrated Process Automation System
ISD	- Integration Specification Document
MIS	- Management Information System
OO	- Operating Organization
P&CSD	- Process & Control Systems Department

PAS	- Process Automation System
PLC	- Programmable Logic Controller
SAEP	- Saudi Aramco Engineering Procedure
SAMSS	- Saudi Aramco Materials System Specification
SAPMT	- Saudi Aramco Project Management Team
SCADA	- Supervisory Control and Data Acquisition systems

6.2 Definitions

Integrated Process Automation System: Two or more Process Automation Systems (PAS) linked via a common backbone or a wide-area network. Examples of IPAS are DCS/MIS, SCADA/MIS, and DCS/SCADA. Systems connected by serial interfaces do not fall under the category of IPAS.

Integration Specifications Document: A document prepared by the PAS integrator that provides the technical specifications for all the different systems and sub-systems hardware interfaces, applications interfaces and data communications requirements.

Non-Material Requirements: The complete set of documentation required from PAS Integrator during the design and development phase of the project. There are three categories of NMRs:

601 NMRs	Preliminary drawings for review and approval
602 NMRs	Certified drawings, literature, photographs, and parts data/requirements
603 NMRs	Operations, maintenance manuals, installation instructions, test certificates, etc.

Operating Organization: The department responsible for operating the facility sometimes called Proponent.

PAS Integrator: The party responsible for the design and integration of the IPAS. The integrator may be a vendor, a contractor, or a Saudi Aramco organization.

Process Automation System: A network of computer-based or microprocessor-based modules whose primary purpose is process automation. The functions of a PAS may include process control, safety, data acquisition, advanced control and optimization, historical archiving, and decision support. Examples of process automation systems are DCS, SCADA, MIS, ESD, PC and PLC-based systems.

Revision Summary

Document Responsibility: Process Control
Issue Date: 28 February 2005
Next Planned Update: 1 February 2007

SAEP-1630
Preparation of Integration
Test Procedure Document

28 February 2005	Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with no other changes.
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Appendix 1 – Required Integration Test Procedure Contents

1. Introduction

1.1 Scope

This section shall introduce the test procedure, describing the content and how it is to be used.

1.2 Applicable Documents

All documents referenced in the procedure shall be listed.

1.3 Terms and Abbreviations

Definitions of all acronyms, mnemonics, and special terms used in the Plan shall be provided.

2. Overview

A concise summary of the test scenario and plan shall be presented in this section.

3. Prerequisites

All conditions and requirements that must be met or completed before initiation of the integration test shall be listed and described. Examples of such prerequisites could be:

3.1 Documentation

The section shall list any system and configuration documents of systems to be tested. Specific items typically include User's Manuals, configuration drawings, connection drawings, integration and shared database listings, etc.

3.2 Inspections and Testing

All inspections and testing records that must be completed before the integration test initiation shall be specified. Methods to document completion of inspections and pre-testing shall be specified.

3.3 Test Equipment

All test equipment needed for all aspects of integration test shall be identified. The test might require third party application which diagnoses or monitors system integration.

4. Personnel Requirements

All personnel required during the Integration Test shall be specified. Specific items to be addressed include:

- Contractor personnel requirements and responsibilities
- Company personnel requirements and responsibilities
- Special personnel qualifications (network, systems, electrician, technician, etc.).

5. Test Configuration

Deviations from the system configurations are allowed for only those items that cannot be tested without a system modification.

If this configuration is changed for the integration test, the modified system configuration shall be described in sufficient detail such that the effects on the system's functional requirements may be determined.

6. Simulation

All items that must be simulated for the integration test shall be described, including hardware, software, and applications. This description shall be of sufficient detail to determine the simulation's effect on each system.

7. Untestable Items

All items that are impossible to test or simulate during the integration test shall be described in this section. Provisions for testing these items during operational or performance test shall be stated, and a reference to such tests given.

8. Testing Schedule

The integration test schedule shall provide a day-by-day schedule of the chronological structured tests. This schedule shall reflect the following:

- Time required for each test
- Day-by-day planned structured tests.

9. Mandatory Tests

The following are mandatory integration tests. Test procedures shall specify whether all modules (or system components) shall be tested or only representative samples of each module type shall be tested.

9.1 Test of Physical Architecture

The purpose of this section is to provide a test procedure of physical resource connections to each other and external data-sources.

9.2 Logical Architecture

The purpose of this section is to insure that IPAS have implemented integration requirements stated in the ISD for integration of applications and external data sources.

9.3 Integration Protocols

The purpose of this test section is to insure compatibility of communication protocols and protocol domains in the system(s) provided by the Project.

PAS Integrator shall identify all protocols to be employed in the integration. These shall include protocols for all levels, physical through application (taking the Open Systems Interconnect (OSI) as a descriptive model). Where more than a single protocol will be applied for a given level, PAS Integrator shall specifically cite domains for each protocol.

9.4 Proprietary Integration test

The purpose of this section is to list all proprietary integration tests required verifying functionality of IPAS. PAS Integrator shall identify all proprietary content in the integration. PAS Integrator shall detail any tests of the proprietary protocols.

9.5 Security

The purpose of this section is to test IPAS integration design to assure security of data and networks. The test shall include redundancy or fault tolerance and fail-over integration operation.

10. Test Documentation

The documentation to be generated during the Integration Test shall be described. The test results shall be documented sufficiently such that re-tests or any further on-site test results can be compared.

10.1 Test Log

A procedure for maintaining a chronological test activity log during the test shall be described.

10.2 Test Results

The test result documentation to be produced during testing shall be described. Specific items include:

- System generated hard copy reports and logs
- Manually completed forms

10.3 Test Discrepancies / Corrections

The procedure for documenting and reporting discrepancies and corrections during testing shall be described. Specific items include:

- Discrepancy/correction report format
 - Discrepancy/correction reporting procedure
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- Problem Resolution
- The actions to be taken during the test in the event discrepancies are detected shall be defined.

10.4 Resolution during Testing

Actions to be taken by the PAS integrator during the test to resolve minor problems shall be defined. Items to be addressed include:

- Maximum time allowable for problem resolution during the integration tests
- Scheduling of problem resolution time.

11. Integration Test Report

The test report shall be written such that, when approved by Company, it may be used as the certification that the Integration Test has been successfully completed and as the documentation of all activities and results of the test. The report shall meet the following minimum specific requirements:

- Identify all tested Systems (including system version)
- Include certification statement
- Test location, start date, completion date
- Configuration identification at the test completion
- PAS Integrator representative signature
- Company representative signature
- An official copy of the Integration Test Procedure
- All test documentation defined in Section 9