IEC 62381

Edition 2.0   2012-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Automation systems in the process industry – Factory acceptance test (FAT), site acceptance test (SAT), and site integration test (SIT)

Systèmes d'automatisation pour les procédés industriels – Essais d'acceptation en usine (FAT), essais d'acceptation sur site (SAT) et essais d'intégration sur site (SIT)

IEC 62381:2012

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AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT), AND SITE INTEGRATION TEST (SIT)

FOREWORD

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International Standard IEC 62381 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2006. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

– The definition of the documents mentioned in this standard is in accordance with future IEC 62708[1].

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1   To be published.

The text of this standard is based on the following documents:

FDIS	Report on voting
65E/222/FDIS	65E/227/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

There is an increasing trend in the process industry to shorten the time period for project execution. At the same time, the complexity of automation systems is being increased due to the number of connected systems and the use of new technologies, for example, fieldbus systems.

Experience has shown that the owner, the contractor and the vendor have long and extensive discussions to unambiguously lay down the scope of activities and responsibilities in order to achieve a timely delivery and acceptance of automation systems.

This standard is intended to lead to an improvement and acceleration of the negotiation phase and to a mutual understanding about the scope of activities of each party

The annexes of this standard contain forms which may be used in the test procedures. Buyers of this standard may copy these forms for their own purposes only in the required amount.

AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT), AND SITE INTEGRATION TEST (SIT)

1 Scope

This International Standard defines procedures and specifications for the Factory Acceptance Test (FAT), the Site Acceptance Test (SAT), and the Site Integration Test (SIT). These tests are carried out to prove that the automation system is in accordance with the specification.

Engineering and manufacturing activities prior to these tests are not covered by this standard.

For application in the pharmaceutical or other highly specialized industries, additional guidelines (for example, Good Automated Manufacturing Practice (GAMP)), definitions and stipulations should apply in accordance with existing standards, for example, for GMP Compliance 21 CFR (FDA) and the Standard Operating Procedure of the European Medicines Agency (SOP/INSP/2003).

The description of activities given in this standard can be taken as a guideline and adapted to the specific requirements of the process, plant or equipment. A typical sequence of activities and events is shown in Figure 1, and their relationship are shown in Figures 2 and Figure 3.

IEC   136/12

Prerequisite for FAT
- SW complete
- System hooked up
- Vendor in-house test completed

Prerequisite for SAT
- Shipment of system to site
- Proper installation
- System start-up

Prerequisite for SIT
- Systems properly connected
- SAT complete
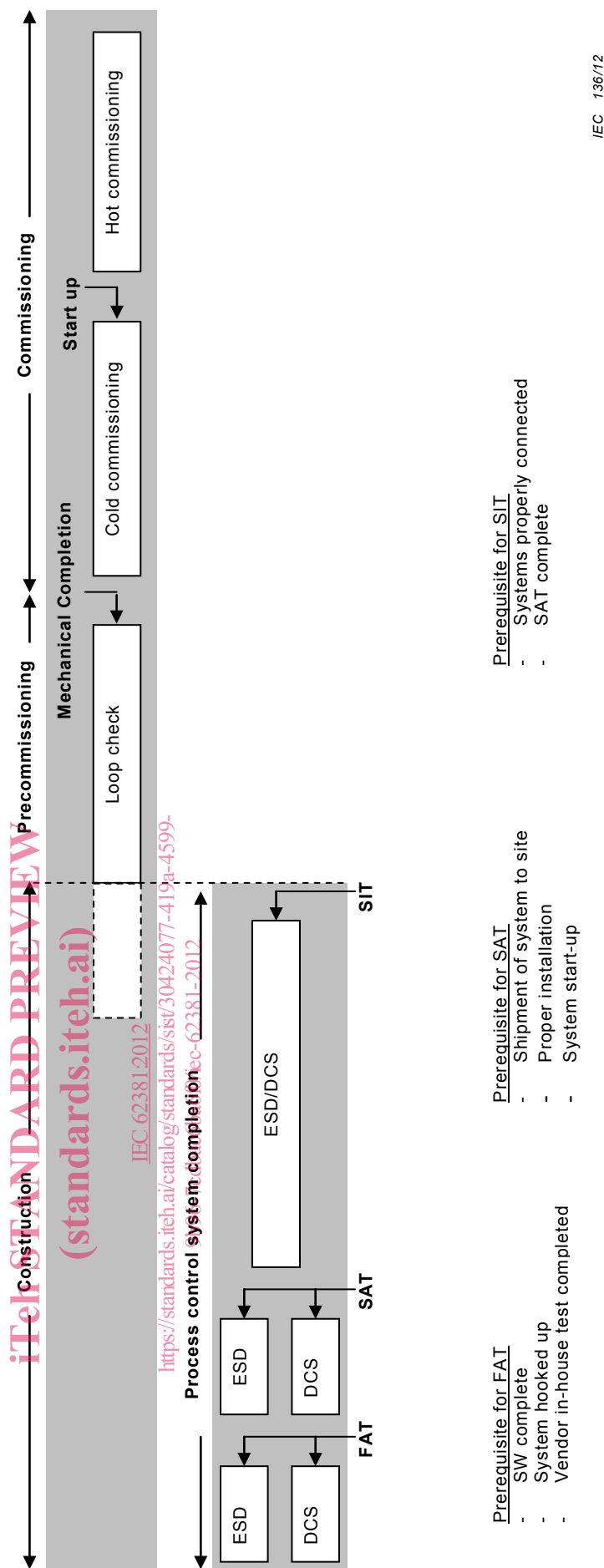
NOTE   The loop check can actually be started during the construction phase once the required infrastructure has been installed.

Figure 1 – Diagram depicting typical sequence of events for FAT, SAT and SIT with respect to the project milestones
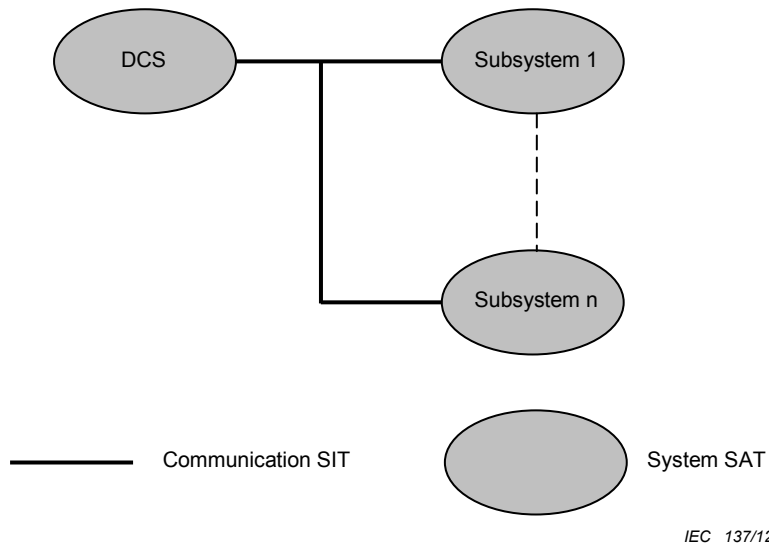
Figure 2 – Diagram depicting the relationship for the SAT and SIT
between the DCS and subsystems

Figure 3 – Diagram depicting the relationship between the FAT, SAT and SIT
with the relevant plant levels

2   Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

None

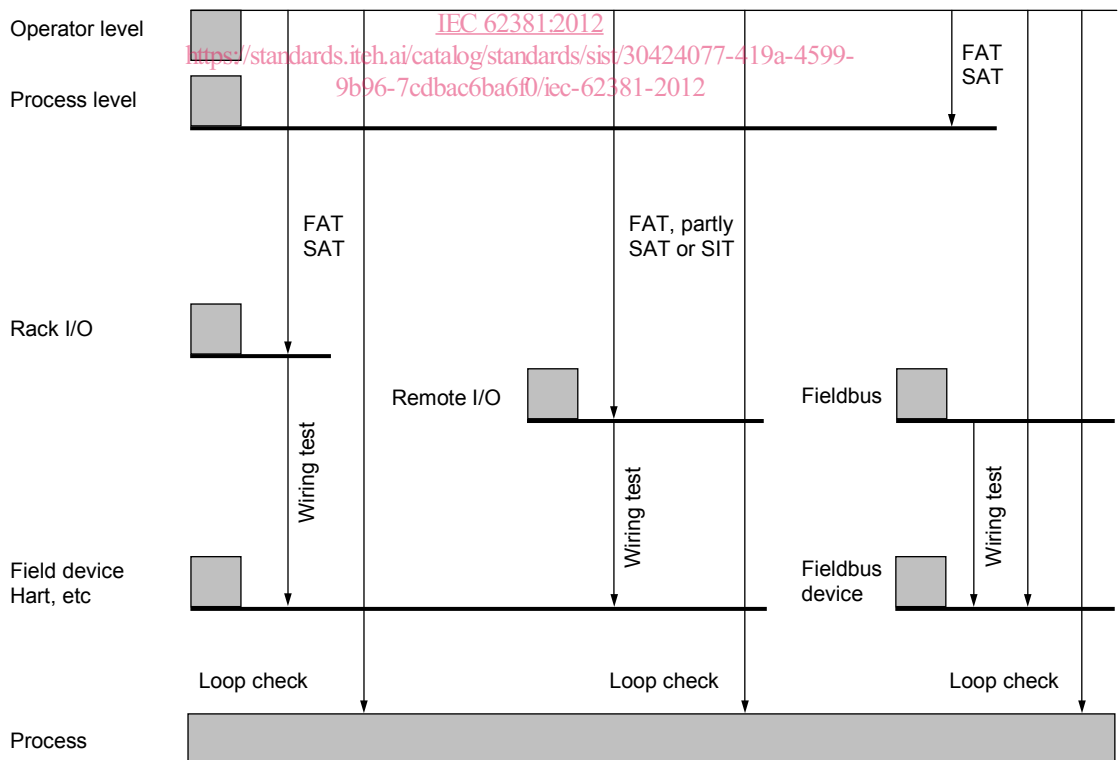## 3   Terms, definitions and abbreviated terms

3.1   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
automation system
DCS- or PLC-based system for the monitoring and controlling of production facilities in the process industry, including control systems based on fieldbus technologies

3.1.2
tag
unambiguous alphanumerical descriptor which identifies a sensor or actuator

3.1.3
factory acceptance test
activity to demonstrate that the vendor system and additionally supplied systems are in accordance with the specification

3.1.4
site acceptance test
activity to demonstrate that the installation of the various vendor systems are in accordance with the applicable specifications and installation instructions

3.1.5
site integration test
activity to demonstrate that the merging of the various systems to one overall system is completed and that all components work together as specified

3.1.6
buyer
company which is functionally responsible for the automation system purchased from vendor, i.e. either the owner or the contractor

3.1.7
owner
company that hired a contractor to build a chemical plant, petrochemical plant, etc.

3.1.8
contractor
company which is hired by the owner to design and build a chemical plant, petrochemical plant, etc.

NOTE   The function of contractor can be fulfilled by the owner.

3.1.9
vendor
manufacturer or distributor of the automation system

3.1.10
process industry
industry that uses chemical reactions, separations, or mixing techniques in order to create new products, modify existing products or treat waste and includes the following types of industries: chemical, petrochemical, waste treatment, paper, cement, etc. It does not include such industries as equipment/machine manufacturing or other similar industries. Industries which are subject to special requirements and or validation, etc. are also not included.

3.1.11
vendor documentation
product describing documents

EXAMPLE   Datasheets, handbooks, operating manuals and spare part lists of supplied devices or systems.

3.1.12
test report
documentation of test sequence and results

3.1.13
test plan
overview of tests as provided in the contract

3.1.14
punch list
list of all open tasks

3.1.15
loop list
tabulated list of all E&I tags with tagging, function and PID references

3.1.16
loop sheet
data sheet with essential E&I data concerning tagging, function, description, measuring range, location, process data, instrument data, etc.

3.1.17
cabinet layout drawing
drawing to scale of equipment, terminal strips, cable trays etc. in cabinets, consoles and similar

3.1.18
function diagram or logic diagram
description of the E&I functions according to the IEC 61131 series. Use of this term/such a diagram is limited to digital signal processing only

3.1.19
cause & effect matrix
actuators and sensors assigned to columns and rows according to their function, including their related switching and/or alarm function and their safety integrity level (SIL)

3.1.20
user requirement specification
rough user specification in view of the customer to be detailed by the requirement specification

3.1.21
requirement specification
complete description of all requirements for the realisation (e.g. of an automation system)

3.1.22
control loop description
description of task, function and operator interface of complex continous control loops

3.1.23
HMI specification
specification containing detailed graphic standards and hierarchy of the human machine interface e.g. group-, trend-, alarm- and operator display

3.1.24
trip point list & configuration parameter list
tabulated list of all variable parameter for E&I equipment

3.1.25
structure diagram DCS/PLC/SIS
simplified schematic drawing of control systems and their network topology by graphical symbols, not showing any secondary wiring

3.1.26
safety requirement specification
complete description of all tasks and equipment of the safety instrumented functions, including their check procedures

3.2 Abbreviated terms

C&E	Cause and effect matrix
DCS	Distributed control system
ESD	Emergency shut-down system
EX-i	Intrinsic safety
FAT	Factory acceptance testing
FUP	Function or logic diagram
HMI	Human machine interface
HW	Hardware
MC	Mechanical completion
PLC	Programmable logic controller
SAT	Site acceptance test
SIF	Safety instrumented function (safety loop)
SIS	Safety instrumented system
SIL	Safety integrity level
SIT	Site integration test
SRS	Safety requirement specification
SW	Software

4 General preparation before conducting the FAT

4.1 Overview

Prior to commencing the FAT, the vendor shall complete full in-house testing. Test reports shall be available for inspection.

All relevant documents shall be prepared for use during the FAT. The following list shows documents typically used. The list should be adapted to be project specific.

4.2 Documents typically prepared by owner/contractor

For example, the following documents:

- User requirement specification:
- Preceding agreement(s):
- Function or logic diagrams:
- Cause and effect matrix:
- Sketches of operator displays and relevant text:
- Control loop description:
- Loop list;
- HMI specification;
- Loop sheet;
- Trip point list & configuration parameter list.
- Safety manuals
- Test procedures for all safety instrumented functions
- Classification for each safety instrumented function into the levels SIL1, or SIL 2; or SIL3, or none.

4.3 Documents typically prepared by vendor

For example, the following documents:

- Requirement specification;
- Vendor documents, operating manual, certificates;
- Structural diagram DCS/PLC, SIS;
- Cabinet layout drawings;
- I/O list;
- Graphic printouts;
- Configuration printout;
- In-house test reports;
- Test plan.

5 Factory acceptance test

5.1 General

The FAT shall be performed by the vendor. The buyer should witness the test activities. There may be buyers who want to carry out some parts of the FAT themselves. This has to be laid down on a project-related basis.

The FAT shall comprise the following areas:

- project-relevant scope of supply;
- application-related functions of the automation system from signal source;
- system-related functions;
- adequate infrastructure shall be provided by the vendor.

The FAT shall be conducted using the test report given in Annex A.

With respect to the specification, any incomplete work or nonconformances detected during the FAT shall be recorded on a punch list (Annex H).

Punch list items will be categorized as follows:

• to be cleared on the spot, FAT to continue after rectification;

• on-going rectification during FAT;

• FAT to be repeated;

• modifications to be made after FAT, before the system is shipped to the site;

• remaining work to be rectified, i.e. at site.

The FAT shall be considered complete when the vendor has successfully proven all necessary functions according to the FAT procedures and specifications, with the exception of the mutually agreed remaining items of the punch-list.

Upon successful completion of the FAT, authorized representatives of the buyer and the vendor shall sign the FAT certificate (for an example, see Annex D).

5.2   FAT test plan

A test plan (activities and time-schedule) shall be mutually agreed upon between the buyer and the vendor. The schedule shall include, but is not limited to, the following activities:

Item	Description
1	Start-up meeting (document review, schedule, etc.)
2	Vendor documentation (including in-house test reports) check
3	HW and SW inventory check
4	Mechanical inspection
5	Wiring and termination inspection
6	Start-up test
7	General system functions including hardware redundancy and diagnostic check
8	Visualization/operation
9	Test of functionality against all documents mentioned in Clause 3
10	Complex functionality and operation modes (for example, batch, sequence control)
11	Subsystem interface test
12	FAT rework, punch list for onsite (SAT) work
13	FAT close-out meeting

5.3   Test procedure

5.3.1   Test set-up

5.3.1.1   Rack/remote I/O

According to one or more of the following typical scenarios, a complete test shall be carried out.

The following scenario is customary.

• Forcing of rack/remote I/O by means of simulation devices hooked up at I/O modules.