

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 dans l'industrie de transformation –
Essais d'acceptation en usine (FAT), essais d'acceptation sur site (SAT) et
essais d'intégration sur site (SIT)**

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IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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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. It is an International Standard.

This third edition cancels and replaces the second edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) General re-organization of the standard;
- b) Current technology incorporated;
- c) Optional factory integration test (FIT) added;

- d) Replaced the forms in the annexes with detailed checklists of activities which can be used to develop project-specific test plans; and
- e) Provided additional references to other applicable standards.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/1080/FDIS	65E/1092/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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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, wired and wireless field sensor networks.

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

This document provides requirements and guidance on acceptance testing of control system installations, which can lead to a mutual understanding about the scope of activities of each party.

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

1 Scope

1.1 General applicability

This International Standard defines requirements and checklists for the factory acceptance test (FAT), the factory integration test (FIT), the site acceptance test (SAT), and the site integration test (SIT). These tests are carried out to demonstrate that the automation system meets the requirements of the applicable specification.

This document provides a means for all parties, including the owner, the buyer, and the vendor, to clearly establish and agree on the scope of activities and responsibilities involved in performing these tests in order to achieve a timely delivery and acceptance of the automation system. The activities specified in this document can be used to develop test plans adapted to the specific requirements of the process/plant/equipment.

The annexes of this document contain checklists which are available for consideration when preparing specific test procedures and documentation for a specific automation system.

1.2 Exclusions

1.2.1 Prior- and post-test activities

Engineering and manufacturing activities prior to or after the FAT, FIT, SAT and SIT, such as loop checks and commissioning, are not covered by this document.

1.2.2 Regulated industries

For applications in the pharmaceutical or other highly specialized industries, additional guidelines (for example, good automated manufacturing practice (GAMP)), definitions and stipulations apply in accordance with other applicable existing standards.

1.2.3 Safety instrumented systems

The user can utilize this document to develop necessary testing for basic checks of a safety system, however, this document does not cover validation of a safety system. IEC 61511 provides requirements for checks and validation of safety instrumented systems.

1.2.4 Manufacturing execution systems

Testing and verification of manufacturing execution systems (MES) is not covered by this document.

1.2.5 Advanced process control

Testing and verification of advanced process control (APC) is not covered by this document.

1.2.6 Security for industrial automation and control systems

Although this document includes a limited number of network checks, it does not cover complete network and system security. IEC 62443 provides requirements for automation and control systems cyber security.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62382, *Control systems in the process industry – Electrical and instrumentation loop check*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

advanced process control

APC

several tools and techniques whose common characteristic is taking process automation beyond the limits of single-loop control

Note 1 to entry: APC includes model-based software that is used to direct the process operation and is commonly referred to as multivariable predictive control or model predictive control.

3.1.2

automation system

complete system for the monitoring and control of production facilities

Note 1 to entry: An automation system can include a BPCS and can also include a SIS and other subsystems.

3.1.3

basic process control system

BPCS

system which responds to input signals from the process, its associated equipment, other programmable systems and/or operators and generates output signals causing the process and its associated equipment to operate in the desired manner but which does not perform any SIF

Note 1 to entry: A BPCS includes all of the devices necessary to ensure that the process operates in the desired manner.

Note 2 to entry: A BPCS typically can implement various functions such as process control functions, monitoring, and alarms.

[SOURCE: IEC 61511-1:2016, 3.2.3]

3.1.4

buyer

company purchasing the equipment or control system from the vendor

Note 1 to entry: The buyer can be the owner of the equipment or control system, or the buyer can be another company.

3.1.5**cold commissioning**

phase, during which the activities associated with the testing and operation of equipment or facilities using test media such as water or inert substances prior to introducing any chemical in the system take place

3.1.6**control system**

system which responds to input signals from the process and/or from an operator and generates output signals causing the process to operate in the desired manner

Note 1 to entry: The control system includes sensors and final elements and can be either a BPCS or a SIS or a combination of the two.

[SOURCE: IEC 61511-1:2016, 3.2.10]

3.1.7**detailed design specification**

separate document that shows how the system functions and meets the requirements established in the functional requirements specification

3.1.8**factory acceptance test****FAT**

activity, including inspection and testing, to demonstrate that the automation system, subsystem, or component is in accordance with the specification and is typically conducted at the vendor's facility

3.1.9**factory integration test****FIT**

activity, including inspection and testing, conducted at the vendor's facility to demonstrate that the merging of some or all of the various subsystems and components into one overall automation system functions in accordance with the specification

3.1.10**functional requirements specification****FRS**

specification listing the detailed operational requirements for a control system (i.e., what the system does, not how it does it)

3.1.11**hot commissioning**

phase during which the activities associated with the testing and operation of equipment or facilities using the actual chemical process prior to making an actual production run take place

3.1.12**manufacturing execution system****MES**

computerized system used in manufacturing to track and document the transformation of raw materials to finished goods

3.1.13**owner**

company that operates the production facilities where the automation system is or will be installed

3.1.14**precommissioning**

phase during which the activities of non-operating adjustments, cold alignment checks, cleaning, and testing of machinery take place

3.1.15**process industry**

industry that has a continuous or batch flow and 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, water and wastewater treatment, paper, cement, etc.

Note 1 to entry: Process industry does not include such industries as equipment/machine manufacturing or other similar industries. It does not include industries which are subject to regulations which have specialized validation requirements.

3.1.16**punch list**

list of all problems found, the corrective action to be taken, party responsible and date completed

Note 1 to entry: Other information categories can be added as required.

3.1.17**safety instrumented function****SIF**

safety function to be implemented by a safety instrumented system (SIS)

[SOURCE: IEC 61511-1:2016, 3.2.66]

3.1.18**safety instrumented system****SIS**

instrumented system used to implement one or more SIFs

Note 1 to entry: A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s) (e.g., see Figure 6 of IEC 61511:2016). It also includes communication and ancillary equipment (e.g., cables, tubing, power supply, impulse lines, heat tracing).

Note 2 to entry: A SIS can include software.

Note 3 to entry: A SIS can include human action as part of a SIF.

[SOURCE: IEC 61511-1:2016, 3.2.67, modified – Figure 6 and reference to ISA TR84.00.04:2015 part 1 have been omitted.]

3.1.19**site acceptance test****SAT**

activity, including inspection and testing, conducted at the site of the installation, to demonstrate that the installation of the automation system, any subsystem, or any component is in accordance with the applicable standards, codes, specifications, and installation instructions

3.1.20**site integration test****SIT**

activity, including inspection and testing, conducted at the site of the installation, to demonstrate that the merging of the various subsystems and components into one overall automation system is completed and that all components work together in accordance with the specification