BS EN 62381:2012

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN 62381:2012. It is identical to IEC 62381:2012. It supersedes BS EN 62381:2007 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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EN 62381

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English version

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

(IEC 62381:2012)

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) (CEI 62381:2012)

Automatisierungssysteme in der vefahrenstechnischen Industrie - Werksabnahme (FAT), Abnahme der installierten Anlage (SAT) und Integrationstest (SIT) (IEC 62381:2012)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 65E/222/FDIS, future edition 2 of IEC 62381, prepared by SC 65E, "Devices and integration in enterprise systems", of IEC TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62381:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-12-28
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-03-28

This document supersedes EN 62381:2007.

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Endorsement notice

The text of the International Standard IEC 62381:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61331 series	NOTE	Harmonized in EN 61331 series.
IEC 62337	NOTE	Harmonized as EN 62337.

CONTENTS

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)

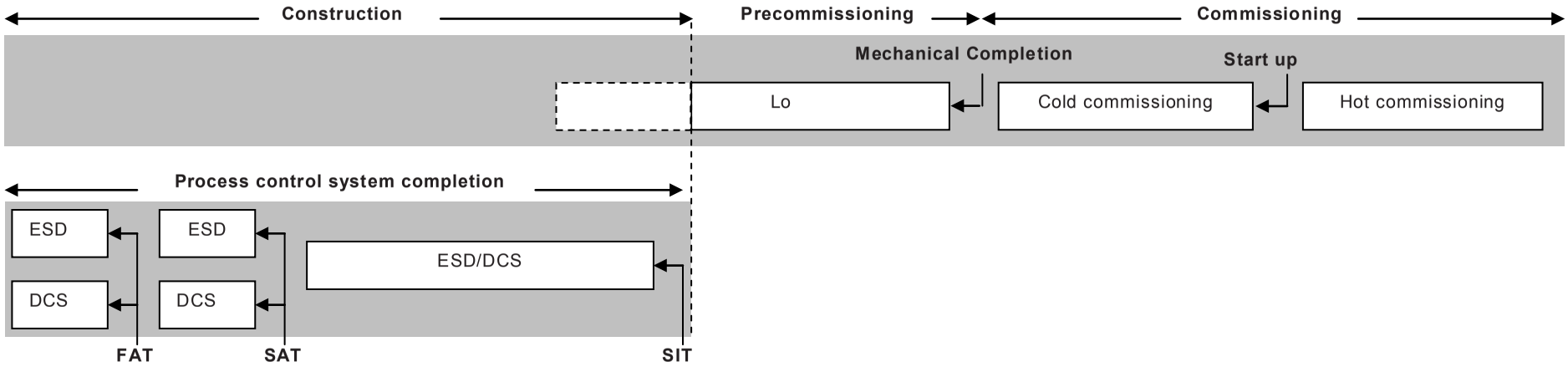
1 Scope

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.



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

IEC 136/12

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

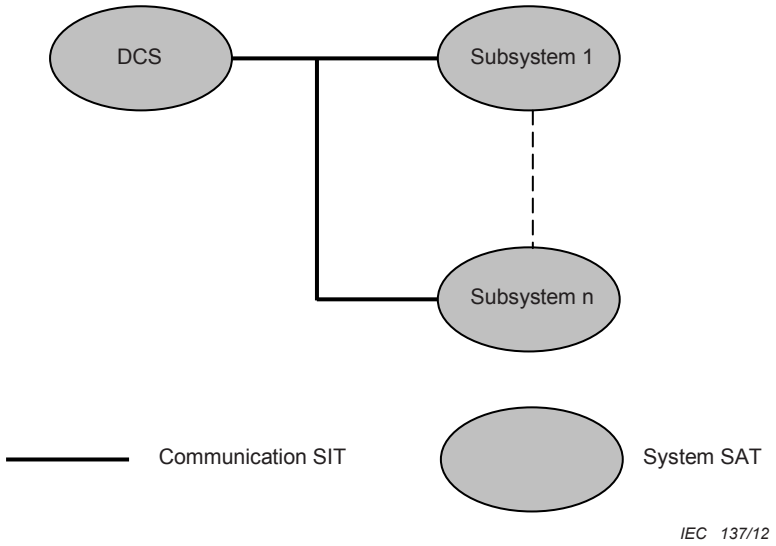


Figure 2 – Diagram depicting the relationship for the SAT and SIT between the DCS and subsystems

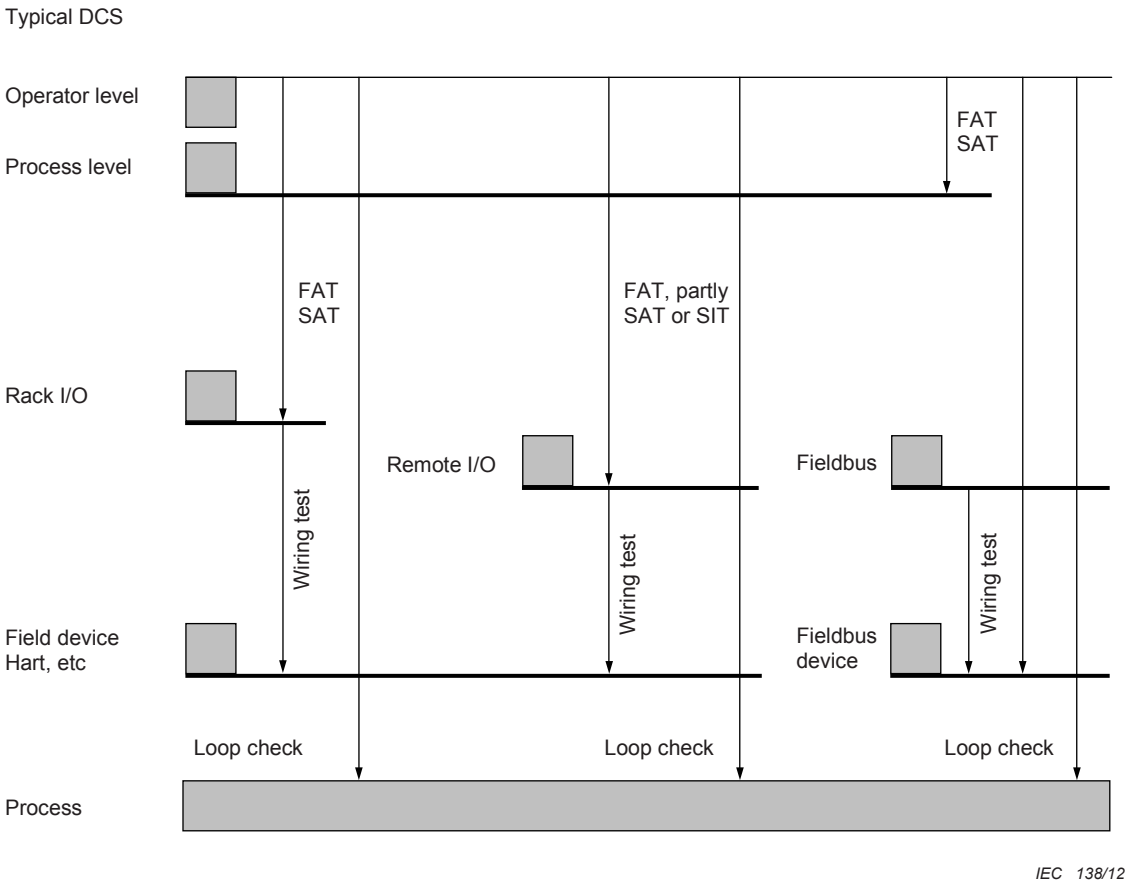


Figure 3 – Diagram depicting the relationship between the FAT, SAT and SIT with the relevant plant levels

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.

The scenarios listed below depend upon contract/specification requirements.

- Forcing of I/O by means of SW simulation on processor level.
- Forcing of I/O by means of SW simulation on the I/O modules.
- Forcing of I/O by means of simulation devices hooked up at field terminals (thus test inclusive marshalling, process interface (Ex), cross-wiring, system cabling, and I/O modules).

5.3.1.2 Bus interfaces

A generic test shall be carried out for each specified type of field device which is compliant to the relevant standard. This test shall cover the interoperability of the automation system and the device.

- One segment shall be built up and tested with all associated devices linked to it. Selection of the segment shall be mutually agreed upon.
- In the case of distributed control functionality, all concerned segments shall be tested.
- Signals related to segments not built up shall be simulated.
- All relevant documents, data sheets, figures (load, cycle time, architecture) shall be reviewed for all segments.

5.3.1.3 Subsystem connection

The following scenario is customary.

The test of the link itself and selected loops should be performed by means of a subsystem simulation device. The value of the signal is forced/monitored in the simulation device/automation system. The specified architecture, for example, redundancy, medium of link, glass-fiber or copper cable connection, etc. should be provided as far as practicable.

Other scenarios such as listed below depend upon contract/specification requirements.

- Subsystem is emulated in the automation system; the signals are forced/monitored in the automation system.
- Subsystem with limited configuration (processor and link devices only) are available to check real communication and the signals are simulated in the subsystem.
- Complete subsystem, link devices and automation system are available, forcing/monitoring of I/O at the subsystem/automation system.

The manner of testing shall be defined for each subsystem individually and after consideration of the project requirements.

5.3.2 Conducting of test

5.3.2.1 Overview

The test activities can be divided into the three following steps:

- Check of system features;
- Project-related scope of supply; and
- Application.

For test report, see Annex A.

5.3.2.2 Test report for the test of system features

This report covers the following.

- Start-up test;
- General system functions including hardware redundancy and diagnostic check.

5.3.2.3 Test report for project-related scope of supply

This report covers the following.

- Documentation check;
- HW and SW inventory check;
- Mechanical inspection;
- Wiring and termination inspection.

5.3.2.4 Reference documents

The documents listed in Clause 4 shall serve as the basis for the functionality test. Completed tags shall be marked and the resulting documents shall be considered as FAT record.

5.3.3 Application check procedures

5.3.3.1 Check of HMI displays

Prior to the loop-oriented test, the static parts of the HMI displays shall be tested.

The following display functionality (static) shall be verified.

- Symbols for vessels, process lines, valves, transmitters, motors, pumps, etc.
- Colours for static items, for example, hand valves, process lines, etc.
- Process flow direction and path, i.e., process line arrows, shall be verified.
- Correct linking of split range control schemes shall be verified.
- Hierarchies and linking of displays shall be verified.
- The dynamic changes of colours, subpictures and data entry points shall be verified.

5.3.3.2 Tag-oriented test

A master document shall be identified prior to the FAT to ensure complete coverage of all tags. The loop list including all tags connected to DCS and all subsystems visible on DCS (ESD, PLC, unit controllers, analyser subsystems, etc.) is the preferred master document.

All tags shall be tested as follows.

- The faceplate, for example, functionality, service text, range, units, etc., shall be checked;
- Link to I/O level;
- Related group display;
- Related trends;
- It shall be verified that the tag target on the graphic is in the correct location and that the colour changes for dynamic targets, for example, valves, motors, bar graphs, etc. are correct;
- Check of alarm assignments – Sorting criteria (priority, plant area, etc.);
- Check of user log-on level for operation and control.

5.3.3.3 Check of complex functionality and interlocks

The test of complex functionality and interlocks shall be carried out after the tag-oriented test for the related tags.

5.3.3.4 Additional functionality (reporting)

To be defined by the project.

5.3.3.5 Test of communication links to subsystems

The simulation of signals shall be carried out according to the chosen scenario.

The related functions shall be checked according to the tag-oriented test specification.

In addition to the application-related test, system features such as:

- recovery from failure;
- redundancy;
- alternative modes of operation, shall be checked

5.3.3.6 Check of system functionalities

In addition to the application-related test, system features such as:

- recovery from failure;
- redundancy;
- log-on strategy and levels;
- alarm processing strategy and acknowledgement;
- guaranteed system performance (refresh rate, etc.), shall be checked.

5.4 FAT rework

All rectification and subsequent re-check should be executed during the FAT. If this is not possible, it should be undertaken after the FAT on the basis of a mutual agreement, including the following points:

- Identification of re-work;
- Action plan/time schedule;
- Execution of re-work;
- Re-check;
- Notification of completion.

5.5 Documentation of FAT in accordance with Annex A

Documentation of FAT in accordance with Annex A includes the following:

a) Print and sign the tested function plans.
b) Date and sign all other documents generated during the FAT.
c) Review the punch list
d) Document the actual HW and SW tested, prepare the complete system and application SW back-up.
e) Document spare and system load.
f) Provide an index and color copies of all applicable graphic displays.

6 Site acceptance test

6.1 General

The SAT shall be performed after the delivery/installation of the system at the buyer's site.

The SAT is performed to prove the functionality of the system after delivery and installation.

Prior to conducting the SAT, the relevant HW/SW components shall be delivered to the site and properly installed. The following actions shall be completed during the installation of the DCS/PLC before the SAT can be carried out:

- HW installation (controllers, I/O cards, marshalling racks, operating/engineering stations);
- Power supply installed for the relevant HW being tested;
- Grounding system installed for the relevant HW being tested;
- Network communications installed (for example, hubs, switches, fibre optics, Ethernet).

A check list for the activities carried out during the SAT is included in Annex B.

6.2 SAT 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 check
3	HW and SW inventory check
4	Mechanical inspection (grounding system, power supply, network connections, etc.)
5	Start-up/diagnostic check (turn on power supply, initialize/commission controllers, perform diagnostic check)
6	Download SW

7 Site integration test

7.1 General

The SIT shall be performed by the buyer after the SAT for each system that has been successfully completed.

The SIT is performed to test the combination of two or more independent systems that have been combined in order to obtain the functionality desired by the project control philosophy. For example, SITs can and should be carried out when integrating the following types of systems:

- Package units having their own DCS/PLC or unit controller;
- Analyser systems that communicate with DCS/PLCs using non-conventional I/O signals.
- ESD systems;
- Combining DCS/PLCs from several manufacturers;
- Integration of DCS into higher structure factory network;
- Other combinations of systems requiring a SIT can also exist.

The SIT should ensure that both systems function together in order to achieve the results based on the control philosophy. The SIT basically consists of testing the communication and interaction between the automation system and the subsystem to ensure properly and sufficiently performed function.

A check list for the basic activities carried out during the SIT is included in Annex C.

7.2 SIT 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 check
4	Mechanical inspection (communication link between systems)
5	Diagnostic check (inspect communication between systems, baud rate, etc.)
6	Download SW (if applicable)

Annex A
(informative)

FAT test report

A.1 Documentation check

Purpose

To review all FAT relevant documents.

Item	Verify document	Test result	Remarks
1	.....	☐ P ☐ F ☐ NA	

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.2 HW and SW inventory check

Purpose

To verify that HW architecture, quantities, dimensions, painting, etc. are in accordance with the relevant documents. Furthermore, SW licences, spares and consumables shall be checked.

Reference documents

- Approved vendor cabinet layout drawings
- Order

Note

Recommendation: copies of the relevant drawings shall be checked off and signed by the customer and user to serve as proof.

Item	Description	Test result
1	HW check	☐ P ☐ F ☐ NA
2	Check of SW licenses /versions including firmware	☐ P ☐ F ☐ NA
3	Spares, consumables, and tools	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.3 Mechanical inspection

Purpose

To inspect HW architecture and layout against the approved documents.

Reference documents

- Approved vendor cabinet layout drawings
- Requirement specification
- Applicable standards and codes

Note

Items under 4 will be randomly selected for the test.

Item	Description	Test result
1	Cable entry, support bars and accessories (cable clamps, glands, etc.)	☐ P ☐ F ☐ NA
2	Labelling, tagging	☐ P ☐ F ☐ NA
3	Mounting of components and modules	☐ P ☐ F ☐ NA
4	Screwed connections, terminal connections	☐ P ☐ F ☐ NA
5	Earthing, equipotential bonding	☐ P ☐ F ☐ NA
6	Electric shock protection, warning labels	☐ P ☐ F ☐ NA
7	Maintainability of cabinet fans, construction of cabinets	☐ P ☐ F ☐ NA
8	Spare capacity	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.4 Wiring and termination inspection

Purpose

To verify that the wiring is in accordance with the guidelines given by the requirement specification and that the approved HW documents and workmanship are in compliance with industry standards.

Reference documents

- Approved vendor cabinet layout drawings
- Requirement specification
- Applicable standards and codes

Note

Items 5 and 6 will be randomly selected for test.

Item	Description	Test result
1	Wiring and cabling, cabling of internal circuits	☐ P ☐ F ☐ NA
2	Fusing, circuit-breakers	☐ P ☐ F ☐ NA
3	Tagging, labelling	☐ P ☐ F ☐ NA
4	Segregation of lines, colours, cross-section, voltages, Ex-i	☐ P ☐ F ☐ NA
5	Wire crimp inspection	☐ P ☐ F ☐ NA
6	Manual wire crimp pull test	☐ P ☐ F ☐ NA
7	Cable duct loading	☐ P ☐ F ☐ NA
8	I/O wiring to terminals and connector labeling	☐ P ☐ F ☐ NA
9	System cable plug orientation	☐ P ☐ F ☐ NA
10	System voltage insulation test	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.5 Start-up text and general system functions

Purpose

To verify that the system has no problems to start up, recover from a power failure and perform on-line loading. Furthermore, it shall be verified that the system is operating within the given limits.

Reference documents

- Relevant vendor documentation
- Requirement specification (specified system limits)

Item	Description	Test result
1	New start (start from zero point[a], stop/start)	☐ P ☐ F ☐ NA
2	On-line change	☐ P ☐ F ☐ NA
3	Controller cycle time	☐ P ☐ F ☐ NA
4	Display call-up time	☐ P ☐ F ☐ NA
5	Value update time	☐ P ☐ F ☐ NA
6	System load (memory capacity, storage capacity, etc.)	☐ P ☐ F ☐ NA
7	Log-on strategy and level	☐ P ☐ F ☐ NA
8	Alarm processing strategy and acknowledgement	☐ P ☐ F ☐ NA
[a] New disc and controller back-up batteries removed.		

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.6 System alarm test

Purpose

To verify the announcement of system-related failures, cabinet alarms and system-generated alarms to appear on system.

Reference documents

- Vendor documentation
- HMI specification

Item	Description	Test result
1	Power-supply failure, UPS monitoring	☐ P ☐ F ☐ NA
2	Fuse, breaker monitoring	☐ P ☐ F ☐ NA
3	Cooling fans	☐ P ☐ F ☐ NA
4	Communication, network monitoring	☐ P ☐ F ☐ NA
5	Short circuit, wire break, out of range, earth fault	☐ P ☐ F ☐ NA
6	Watchdog, if any	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.7 Hardware redundancy and diagnostic test

Purpose

To ensure proper operation and monitoring of redundant components.

Reference documents

Vendor relevant documentation

Note

No single action shall effect the operation of the overall system.

Item	Description	Test result
1	Redundant operation and monitoring of controllers	☐ P ☐ F ☐ NA
2	Redundant operation and monitoring of communication and networks	☐ P ☐ F ☐ NA
3	Redundant operation and monitoring of power supplies	☐ P ☐ F ☐ NA
4	Redundant operation and monitoring of operator stations	☐ P ☐ F ☐ NA
5	Redundant operation and monitoring of I/Os, if any	☐ P ☐ F ☐ NA
6	Redundant operation and monitoring of all other devices not mentioned before	☐ P ☐ F ☐ NA

Comments:

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not Applicable

Signature:

A.8 Visualization and operation

Purpose

To verify the functionality of standard and graphic display arrangements in accordance with the specification.

Reference documents

- Relevant vendor documentation
- HMI specification

Note

This item covers the static part of the display only. The dynamic part will be tested later, together with the configuration functions.

Recommendation: The graphic design shall be agreed upon with the end-user well in advance.

Item	Description	Test result
1	Colours of background and colour changes	☐ P ☐ F ☐ NA
2	Symbols	☐ P ☐ F ☐ NA
3	Static text and dynamic changes	☐ P ☐ F ☐ NA
4	Organization (jumps, transitions, subpictures)	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.9 Test of functionality against functional diagram or logic diagram and functional description

Purpose

To verify the functionality of the system according to the given documents.

Reference documents

Project relevant documents, for example:

- Functional description
- Functional diagram or logic diagram
- Cause & effect matrix (C&E)
- Pre-defined typical

Note

Test as defined in the specification, for example, 100 %, spot check, etc.

Below is a list of the items that need to be tested for the system. A project-specific detailed test report should be developed and used to evaluate the individual loops. An example test report is provided in the next page.

Item	Description	Test result
1	Identification and labelling of the loop/function	☐ P ☐ F ☐ NA
2	Test relevant I/O up to the display	☐ P ☐ F ☐ NA
3	Check of functionality in detail with all related interlocks, alarms, messages, displays, trends, signal updating on graphics and face plates	☐ P ☐ F ☐ NA
4	Operation of tags, trend archiving functions (internal and external)	☐ P ☐ F ☐ NA
5	Priority of alarm texts	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

EXAMPLE A test sheet for individual loop evaluation is shown in this page.

LOOP

FUNCTION: LIRCA+-
DCS/PLC: Controller 12
Loop Signal Type: Analog Input
HW Loop: V0108 AB86 L001

Measurement Range: 0 – 800
Measurement Units: mbar

Alarm/Switch Setpoints (mbar):

S+	A+	712
S++	A++	
S+++	A+++	
S-	A-	152
S--	A--	
S---	A---	

Operation:
Local
DCS/PLC X
Other

DCS Input		DCS Output	
Analog	1	Analog	1
Binary	0	Binary	1

Measurement Technique: Diff. Pressure Trsmtr
Device Manufacturer: XXXX
Device Type: XXXX

TEST RESULTS

	OK	Not OK
Loop Text:	☐	☐
Interlocks:	☐	☐
Location in software display:	☐	☐
Alarm settings/switchpoints:	☐	☐
Loop signal to DCS:	☐	☐
Display dynamics/color settings:	☐	☐

Comments when not OK

Signature:

A.10 Complex functionality and operation modes

Purpose

To verify the functionality of the system according to the given documents.

Reference documents

Examples of project relevant documents are:

- Functional description
- Function or logic diagram
- Cause & effect matrix (C&E)
- Pre-defined typical

Note

Complex in this context means large sequence controls, recipes, advanced controls, meshed loops, etc.

Item	Description	Test result
1	Check of functionality in detail with all related alarms, messages, displays, trends, signal updating on graphics and face plates	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

A.11 Integration of subsystems

Purpose

To verify the interoperability of the systems considered.

Reference documents

- I/O list for relevant signals
- Relevant function diagram or logic diagram, C&E, etc.

Note

The majority are serial links (soft I/O). Test shall be performed as with hardwired I/O after consideration of the side condition of serial links, for example, transmission time.

Item	Description	Test result
1	Check of functionality in detail with all related alarms, messages, displays, trends, signal updating on graphics and face plates	☐ P ☐ F ☐ NA

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

Annex B
(informative)

SAT check list

Purpose

To review all SAT relevant items

Reference documents

- Vendor documentation
- FAT test report documents
- Licensing information
  - Purchased/installed software/firmware version information
  - Available or new software/firmware releases or patches

Item	Description	Test result	Remarks
1	Control system documentation check	☐ P ☐ F ☐ NA	
2	HW inventory check	☐ P ☐ F ☐ NA	
3	SW inventory check (correct SW/Firmware release version, etc.)	☐ P ☐ F ☐ NA	
4	Mechanical inspection check Grounding system properly connected Power supply properly connected Network connections properly connected	 ☐ P ☐ F ☐ NA ☐ P ☐ F ☐ NA ☐ P ☐ F ☐ NA	
5	Start-up/Diagnostic check Turn on power supply for relevant HW Commission/initialize relevant HW and perform diagnostic check	 ☐ P ☐ F ☐ NA ☐ P ☐ F ☐ NA	
6	Download SW	☐ P ☐ F ☐ NA	
7	SAT certificate complete	☐ P ☐ F ☐ NA	

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

Annex C
(informative)

SIT check list

Purpose

To review all SIT relevant items

Reference documents

- Vendor documentation
- System index list for project

Systems being tested

Main system _____

Subsystem _____

Item	Description	Test result	Remarks
1	Control system documentation check	☐ P ☐ F ☐ NA	
2	Mechanical inspection check Connection between systems properly installed (serial connection, Ethernet, fibre optics, etc.) Baud rate for communication properly set (dip switches on HW, software settings, etc.)	☐ P ☐ F ☐ NA ☐ P ☐ F ☐ NA	
3	Verify communication between systems I/O signals between systems function properly	☐ P ☐ F ☐ NA	
4	Visualization of subsystem within the automation system set up according to the specification	☐ P ☐ F ☐ NA	

Comments

Nonconformity to be recorded in the punch list, categorized and treated as agreed in the start-up meeting.

P = Pass
F = Fail
NA = Not applicable

Signature:

Annex D
(informative)

FAT certificate

ACCEPTED ☐ **NOT ACCEPTED** ☐

CUSTOMER			
PROJECT		PROJECT N°	
PLANT/UNIT			
VENUE OF FAT		FAT FINISHED ON	

PERSON IN CHARGE/ Signatures:

Customer		DEP.	
Vendor		DEP.	

SPECIAL REQUIREMENTS	
NO PUNCH LIST ITEMS WERE FOUND ☐	
PUNCH LIST ITEMS WERE FOUND ☐	SEE REMARKS BELOW OR LIST ATTACHED
RE-CHECK NECESSARY ☐	NOT NECESSARY ☐
System ready for shipment ☐	
Release note for shipment to be given to:	
REMARKS	

Annex E
(informative)

SAT certificate

ACCEPTED ☐ **NOT ACCEPTED** ☐

CUSTOMER			
PROJECT		PROJECT N°	
SYSTEM BEING TESTED			
PLANT/UNIT			
VENUE OF SAT		SAT FINISHED ON	

PERSON IN CHARGE/ Signatures:

Customer		DEP.	
Vendor		DEP.	

Annex F
(informative)

SIT certificate

ACCEPTED ☐ **NOT ACCEPTED** ☐

CUSTOMER			
PROJECT		PROJECT N°	
PLANT/UNIT			
MAIN SYSTEM BEING INTEGRATED			
SUBSYSTEM BEING INTEGRATED			
VENUE OF SIT		SIT FINISHED ON	

PERSON IN CHARGE/ Signatures:

Customer		DEP.	
Vendor		DEP.	

Annex G
(informative)

Automation system acceptance certificate

ACCEPTED ☐ **NOT ACCEPTED** ☐

CUSTOMER			
PROJECT		PROJECT N°	
PLANT/UNIT			
SYSTEMS BEING INTEGRATED			
FAT (FATS) COMPLETE ☐		FAT COMPLETED ON	
SAT (SATS) COMPLETE ☐		SAT COMPLETED ON	
SIT (SITS) COMPLETE ☐		SIT COMPLETED ON	

PERSON IN CHARGE

Customer		DEP.	
Vendor		DEP.	

THE UNDERSIGNED CONFIRMS THAT THE AUTOMATION SYSTEM HAS PASSED THE FAT, SAT AND SIT ACCORDING TO THE SPECIFICATION

PLACE			
DATE			
Signature		DEP	

Annex H
(informative)

FAT punch list

Participants

FAT PUNCH LIST

Any incomplete work or nonconformities shall be recorded on the FAT punch list and categorized as follows:

a) to be cleared on the spot, FAT to continue after rectification;
b) ongoing rectification during FAT;
c) FAT to be repeated;
d) modifications to be made after FAT, before the system/cabinet/controllers are shipped to site;
e) remaining work to be rectified i.e. at site.

Note

ITEM	DESCRIPTION	RESPONSIBLE	TYPE	COMPLETE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				

Annex I
(informative)

SAT punch list

Participants

SAT PUNCH LIST

Any incomplete work or non-conformances shall be recorded on the SAT punch list and categorized as follows:

a) to be cleared on the spot, SAT to continue after rectification;
b) ongoing rectification during SAT;
c) SAT to be repeated;
d) modifications to be made after SAT.

Note

ITEM	DESCRIPTION	RESPONSIBLE	TYPE	COMPLETE
1				
2				
3				
4				
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16				
17				
18				
19				

Annex J
(informative)

SIT punch list

Participants

SIT PUNCH LIST

Any incomplete work or nonconformities shall be recorded on the SIT punch list and categorized as follows:

a) to be cleared on the spot, SIT to continue after rectification;
b) ongoing rectification during SIT;
c) SIT to be repeated;
d) modifications to be made after SIT.

Note

ITEM	DESCRIPTION	RESPONSIBLE	TYPE	COMPLETE
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Bibliography

IEC 61131(all parts), *Programmable controllers*

IEC 62337, *Commissioning of electrical, instrumentation and control systems in the process industry – Specific phases and milestones*

IEC 62708, *Documents for electrical and instrumentation projects in the process industry*[2]

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2 To be published.

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