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IEC 62381

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2006-11

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



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International Electrotechnical Commission
Международная Электротехническая Комиссия

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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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International Standard IEC 62381 has been prepared by IEC technical committee 65: Industrial-process measurement and control.

This standard cancels and replaces IEC/PAS 62381 published in 2004. This first edition constitutes a technical revision.

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

FDIS	Report on voting
65/385/FDIS	65/394/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 maintenance result 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- withdrawn,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.

A bilingual version of this publication may be issued at a later date.

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 should 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.

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).

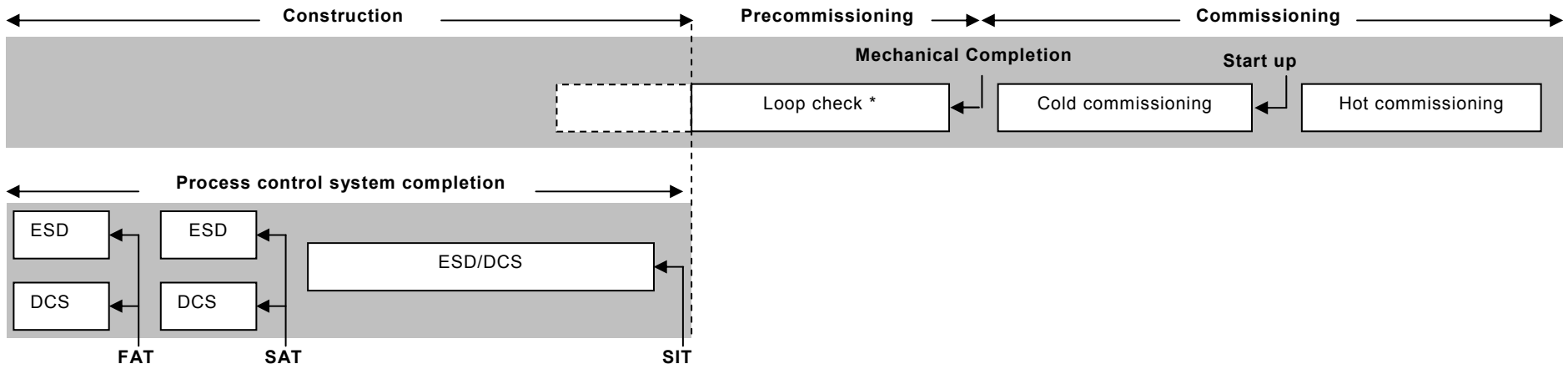
AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT), AND SITE INTEGRATION TEST (SIT)

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.

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



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

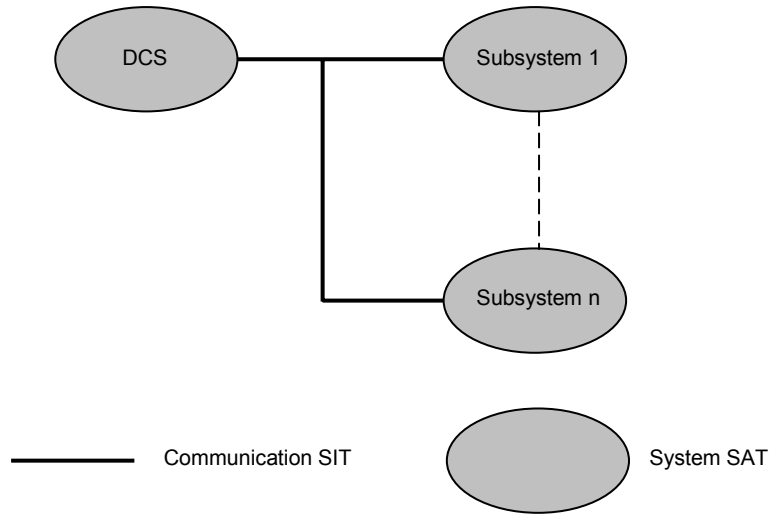
- Prerequisite for SAT
- Shipment of system to site
 - Proper installation
 - System start-up

- Prerequisite for SIT
- Systems properly connected
 - SAT complete

IEC 2059/06

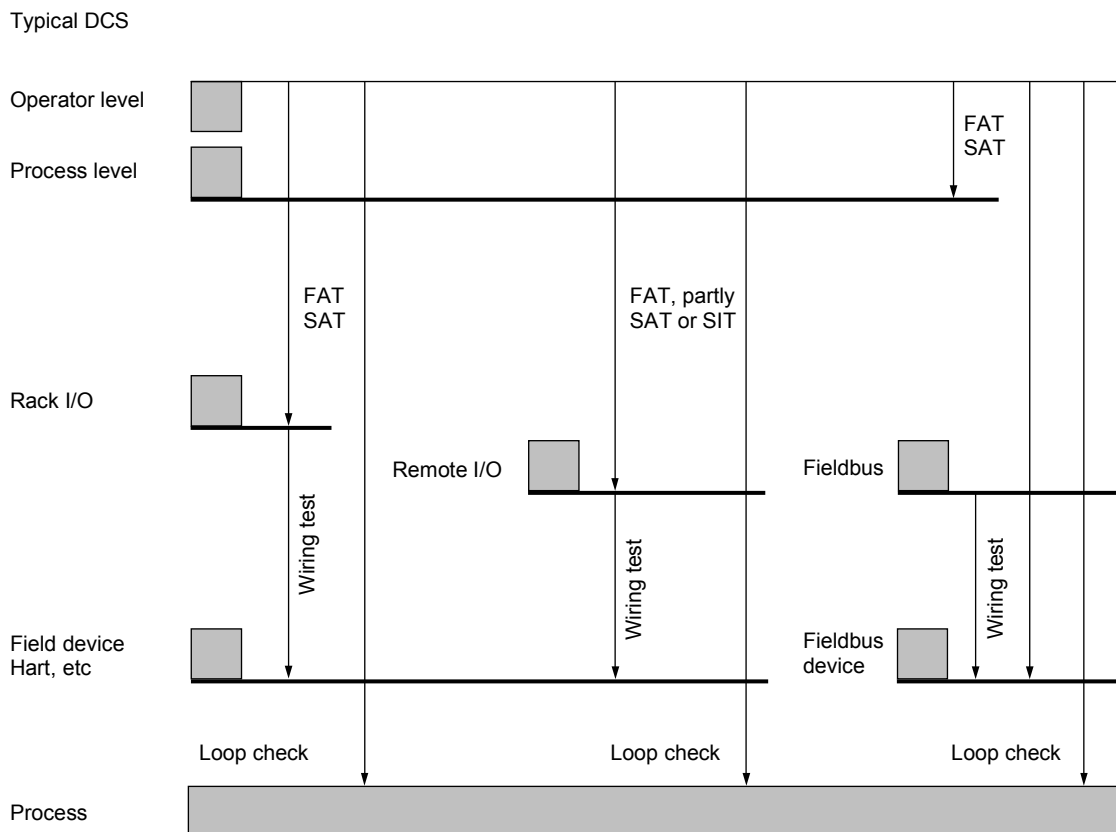
*The loop check can actually be started during the construction phase once the required infrastructure has been installed

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



IEC 2060/06

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



IEC 2061/06

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

2 Terms and definitions

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

2.1

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

2.2

tag

unambiguous alphanumeric descriptor which identifies a sensor or actuator

2.3

factory acceptance test

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

2.4

site acceptance test

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

2.5

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

2.6

buyer

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

2.7

owner

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

2.8

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.

2.9

vendor

manufacturer or distributor of the automation system.

2.10

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

2.11

project design specification

PDS

document that defines detailed information needed to implement the functionality described in the PFS

2.12

project functional specification

PFS

document that contains the vendor's response to the requirements the buyer stipulated prior to starting the project with the vendor

3 Abbreviations

C&E	Cause and effect diagram
DCS	Distributed control system
ESD	Emergency shut-down system
FAT	Factory acceptance testing
FBD	Functional block diagram
FUP	Function plan
HMI	Human machine interface
HW	Hardware

MC	Mechanical completion
PDS	Project design specifications
PFS	Project functional specification
PLC	Programmable logic controller
SAT	Site acceptance test
SIT	Site integration test
SW	Software

4 General preparation before conducting the FAT

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 specific project.

4.1 Documents typically prepared by OWNER/CONTRACTOR

- Specifications
- Preceding agreement(s)
- Function plans
- Cause and effect diagrams
- Sequential functional charts
- Sketches of operator displays and relevant text
- Control narratives
- Instrument index, for example, TAG – service text – I/O type – scaling – units
- Alarm message list, for example, TAG – type of alarm – sorting criteria (priority, plant area)
- Setpoint, control, effect and safety directions
- Interlock list, for example, interlocks assigned to each sensor/actuator, software (DCS) and hardware (ESD)

4.2 Documents typically prepared by vendor

- System documentation
- Manuals, system data sheets, certificates
- System layout
- Hardware layout
- Description of interfaces
- I/O list and tag name conventions
- Graphic printouts
- Configuration printout
- In-house test reports
- Loop typicals (hardware and software) list of deliveries (hardware, software, application and licenses)
- 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 vendor.

The FAT shall be conducted using the checklists 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 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 punch-list items.

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 schedule

A test schedule (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 4
10	Complex functionality and operation modes (for example, batch, sequence control)

Item Description

- | | |
|----|--|
| 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, for example, glass-fibre 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

The test activities can be divided into check of system features, project-related scope of supply and application. For checklists, see Annex A.

5.3.2.1 Checklists for the test of system features

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

5.3.2.2 Checklists for project-related scope of supply

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

5.3.2.3 Reference documents

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

- P&ID
- Function plan
- Control narrative
- Cause and effects, interlock lists
- Function logic diagrams
- Complex control schemes
- Interface documents
- Colour coding information (process stream colours, block status colours, etc.)
- Definition of plant units and alarm philosophy
- Assignment of plant units to operator workstations
- Operating philosophy (access from graphic displays, group displays or faceplates)
- History collection definition

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 instrument index including all tags connected to DCS and all subsystems visible on DCS (ESD, PLC, unit controllers, analyser subsystems, etc.) is the preferred master.

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.).

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.

- 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

- 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 items 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 checklist for the activities carried out during the SAT is included in Annex B.

6.2 SAT test schedule

A test schedule (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.)

Item	Description
-------------	--------------------

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 checklist for the basic activities carried out during the SIT is included in Annex C.

7.2 SIT test schedule

A test schedule (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 checklists

A.1 Documentation check

Purpose

To review all FAT relevant documents.

Item	Verify document	Test result	Remarks
1	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 HW 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	Check of SW licences/versions including firmware	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Spares, consumables, and tools	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 as against the approved documents.

Reference documents

- Approved vendor HW drawings
- Project specification
- Applicable standards and codes

Note

Items under 4 will be randomly selected for test.

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

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A.4 Wiring and termination inspection

Purpose

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

Reference documents

- Approved vendor HW drawings
- Project 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	Fusing, circuit-breakers	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Tagging, labelling	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
4	Segregation of lines, colours, cross-section, voltages, Exi	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
5	Wire crimp inspection	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
6	Manual wire crimp pull test	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
7	Cable duct loading	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
8	I/O wiring to terminals and connector labelling	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
9	System cable plug orientation	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
10	System voltage insulation test	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 product documentation
- Specified system limits

Item	Description	Test result
1	New start (start from zero point ^a , stop/start)	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	On-line change	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Controller cycle time	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
4	Display call-up time	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
5	Value update time	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
6	System load (memory capacity, storage capacity, etc.)	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
7	Log-on strategy and level	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
8	Alarm processing strategy and acknowledgement	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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

Product relevant documentation

- Alarm message list

Item	Description	Test result
1	Power-supply failure, UPS monitoring	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	Fuse, breaker monitoring	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Cooling fans	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
4	Communication, network monitoring	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
5	Short circuit, wire break, out of range, earth fault	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
6	Watchdog, if any	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 check

Purpose

To ensure proper operation and monitoring of redundant components.

Reference documents

Product 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	Redundant operation and monitoring of communication and networks	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Redundant operation and monitoring of power supplies	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
4	Redundant operation and monitoring of operator stations	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
5	Redundant operation and monitoring of I/Os, if any	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
6	Redundant operation and monitoring of all other devices not mentioned before	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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/Operation

Purpose

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

Reference documents

- Relevant product information
- Handed over sketches

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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
2	Symbols	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
3	Static text and dynamic changes	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA
4	Organization (jumps, transitions, subpictures)	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 FBD, FUP, etc.

Purpose

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

Reference documents

Project relevant documents, for example:

- FBD(s)
- FUP(s)
- C&E(s)
- Interlocks
- Narrative(s)
- 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 checklist should be developed and used to evaluate the individual loops. An example test sheet is provided on the following page.

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

<u>LOOP</u>	<u>TEST RESULTS</u>																																													
<p>FUNCTION: LIRCA+- DCS/PLC: Controller 12 Loop Signal Type: Analog Input HW Loop: V0108 AB86 L001</p> <p>Measurement Range: 0 – 800 Measurement Units: mbar</p> <p>Alarm/Switch Setpoints (mbar):</p> <table style="margin-left: 20px;"> <tr><td>S+</td><td>A+</td><td>712</td></tr> <tr><td>S++</td><td>A++</td><td></td></tr> <tr><td>S+++</td><td>A+++</td><td></td></tr> <tr><td>S-</td><td>A-</td><td>152</td></tr> <tr><td>S--</td><td>A--</td><td></td></tr> <tr><td>S---</td><td>A---</td><td></td></tr> </table> <p>Operation: Local DCS/PLC X Other</p> <table style="width: 100%;"> <tr> <td style="width: 50%;">DCS Input</td> <td style="width: 50%;">DCS Output</td> </tr> <tr> <td>Analog 1</td> <td>Analog 1</td> </tr> <tr> <td>Binary 0</td> <td>Binary 1</td> </tr> </table> <p>Measurement Technique: Diff. Pressure Trsmtr Device Manufacturer: XXXX Device Type: XXXX</p>	S+	A+	712	S++	A++		S+++	A+++		S-	A-	152	S--	A--		S---	A---		DCS Input	DCS Output	Analog 1	Analog 1	Binary 0	Binary 1	<table style="width: 100%;"> <tr> <td style="width: 80%;"></td> <td style="width: 10%; text-align: center;">OK</td> <td style="width: 10%; text-align: center;">Not</td> </tr> <tr> <td>Loop Text:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Interlocks:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Location in software display:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Alarm settings/switchpoints:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Loop signal to DCS:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Display dynamics/color settings:</td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table> <p>Comments when not OK</p> <div style="border: 1px solid black; height: 150px; width: 100%;"></div>		OK	Not	Loop Text:	<input type="checkbox"/>	<input type="checkbox"/>	Interlocks:	<input type="checkbox"/>	<input type="checkbox"/>	Location in software display:	<input type="checkbox"/>	<input type="checkbox"/>	Alarm settings/switchpoints:	<input type="checkbox"/>	<input type="checkbox"/>	Loop signal to DCS:	<input type="checkbox"/>	<input type="checkbox"/>	Display dynamics/color settings:	<input type="checkbox"/>	<input type="checkbox"/>
S+	A+	712																																												
S++	A++																																													
S+++	A+++																																													
S-	A-	152																																												
S--	A--																																													
S---	A---																																													
DCS Input	DCS Output																																													
Analog 1	Analog 1																																													
Binary 0	Binary 1																																													
	OK	Not																																												
Loop Text:	<input type="checkbox"/>	<input type="checkbox"/>																																												
Interlocks:	<input type="checkbox"/>	<input type="checkbox"/>																																												
Location in software display:	<input type="checkbox"/>	<input type="checkbox"/>																																												
Alarm settings/switchpoints:	<input type="checkbox"/>	<input type="checkbox"/>																																												
Loop signal to DCS:	<input type="checkbox"/>	<input type="checkbox"/>																																												
Display dynamics/color settings:	<input type="checkbox"/>	<input type="checkbox"/>																																												

Signature:

A.10 Complex functionality and operation modes

Purpose

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

Reference documents

Project relevant documents, for example:

- FBD(s)
- FUP(s)
- C&E(s)
- Interlocks
- Narrative(s)
- 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 FBD, 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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 checklist

Purpose

To review all SAT relevant items

Reference documents

- Installation documentation
- Manufacturer documentation for system
- System user manual
- FAT 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	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
2	HW inventory check	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
3	SW inventory check (correct SW/Firmware release version, etc.)	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
4	Mechanical inspection check Grounding system properly connected Power supply properly connected Network connections properly connected	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA <input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA <input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
5	Start-up/Diagnostic check Turn on power supply for relevant HW Commission/initialize relevant HW and perform diagnostic check	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA <input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
6	Download SW	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
7	SAT certificate complete	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	

Comments

- P = Pass
F = Fail
NA = Not applicable

Signature:

Annex C (informative)

SIT checklist

Purpose

To review all SIT relevant items

Reference documents

- Installation documentation
- Manufacturer documentation for system
- System user manual
- System index list for project

Systems being tested

Main system _____

Subsystem _____

Item	Description	Test result	Remarks
1	Control system documentation check	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> 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.)	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA <input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
3	Verify communication between systems I/O signals between systems function properly	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	
4	Visualization of subsystem within the automation system set up according to the specification	<input type="checkbox"/> P <input type="checkbox"/> F <input type="checkbox"/> NA	

Comments

P = Pass
F = Fail
NA = Not applicable

Signature:

Annex D
(informative)

FAT certificate

ACCEPTED

NOT ACCEPTED

CUSTOMER			
PROJECT		PROJECT NO	
PLANT/UNIT			
VENUE OF FAT		FAT FINISHED ON	

PERSON IN CHARGE/ Signatures:

Customer		DEP.	
Vendor		DEP.	

SPECIAL REQUIREMENTS	
NO PUNCH LIST ITEMS WERE FOUND	<input type="checkbox"/>
PUNCH LIST ITEMS WERE FOUND	<input type="checkbox"/> SEE REMARKS BELOW OR LIST ATTACHED
RE-CHECK NECESSARY <input type="checkbox"/>	NOT NECESSARY <input type="checkbox"/>
System ready for shipment <input type="checkbox"/>	
Release note for shipment to be given to:	
REMARKS	

Annex E
(informative)

SAT certificate

ACCEPTED**NOT ACCEPTED**

CUSTOMER			
PROJECT		PROJECT NO	
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 NO	
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 NO	
PLANT/UNIT			
SYSTEMS BEING INTEGRATED			
FAT (FATs) COMPLETE	<input type="checkbox"/>	FAT COMPLETED ON	
SAT (SATs) COMPLETE	<input type="checkbox"/>	SAT COMPLETED ON	
SIT (SITs) COMPLETE	<input type="checkbox"/>	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				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
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				



Standards Survey

The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!

Customer Service Centre (CSC)

International Electrotechnical Commission

3, rue de Varembé
1211 Genève 20
Switzerland

or

Fax to: **IEC/CSC** at +41 22 919 03 00

Thank you for your contribution to the standards-making process.

A Prioritaire

Nicht frankieren
Ne pas affranchir



Non affrancare
No stamp required

RÉPONSE PAYÉE

SUISSE

Customer Service Centre (CSC)
International Electrotechnical Commission
3, rue de Varembé
1211 GENEVA 20
Switzerland



Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: (e.g. 60601-1-1)

.....

Q2 Please tell us in what capacity(ies) you bought the standard (tick all that apply). I am the/a:

- purchasing agent
- librarian
- researcher
- design engineer
- safety engineer
- testing engineer
- marketing specialist
- other.....

Q3 I work for/in/as a: (tick all that apply)

- manufacturing
- consultant
- government
- test/certification facility
- public utility
- education
- military
- other.....

Q4 This standard will be used for: (tick all that apply)

- general reference
- product research
- product design/development
- specifications
- tenders
- quality assessment
- certification
- technical documentation
- thesis
- manufacturing
- other.....

Q5 This standard meets my needs: (tick one)

- not at all
- nearly
- fairly well
- exactly

Q6 If you ticked NOT AT ALL in Question 5 the reason is: (tick all that apply)

- standard is out of date
- standard is incomplete
- standard is too academic
- standard is too superficial
- title is misleading
- I made the wrong choice
- other

Q7 Please assess the standard in the following categories, using the numbers:

- (1) unacceptable,
- (2) below average,
- (3) average,
- (4) above average,
- (5) exceptional,
- (6) not applicable

- timeliness.....
- quality of writing.....
- technical contents.....
- logic of arrangement of contents
- tables, charts, graphs, figures.....
- other

Q8 I read/use the: (tick one)

- French text only
- English text only
- both English and French texts

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

.....



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