BS EN 62382:2013

BSI Standards Publication

# Control systems in the process industry — Electrical and instrumentation loop check

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## National foreword

This British Standard is the UK implementation of EN 62382:2013. It is identical to IEC 62382:2012. It supersedes BS EN 62382:2007 which is withdrawn.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.

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**Compliance with a British Standard cannot confer immunity from legal obligations.**

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|---|---|---|

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 62382

March 2013

ICS 25.040.40

Supersedes EN 62382:2007

English version

# Control systems in the process industry - Electrical and instrumentation loop check

(IEC 62382:2012)

Systèmes de commande pour les procédés industriels - Contrôle de boucle des circuits électriques et des appareillages (CEI 62382:2012)

Leittechnische Systeme in der verfahrenstechnischen Industrie - PLT-Stellenprüfung (IEC 62382:2012)

This European Standard was approved by CENELEC on 2012-12-13. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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/271/FDIS, future edition 2 of IEC 62382, 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 62382:2013.

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) | 2013-09-13 |
| • latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2015-12-13 |

This document supersedes EN 62382:2007.

EN 62382:2013 includes the following significant technical changes with respect to EN 62382:2007:

- The definition of the documents mentioned in the standards is in accordance with EN 62708 [1)]: *Documents for electrical and instrumentation projects in the process industry*.
- Subclause 6.3 has been revised.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 62382:2012 was approved by CENELEC as a European Standard without any modification.

1) Under consideration.

# Annex ZA
(normative)

## Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| Publication | Year | Title | EN/HD | Year |
|---|---|---|---|---|
| IEC 61131 | Series | Programmable controllers | EN 61131 | Series |
| IEC 62337 | - | Commissioning of electrical, instrumentation and control systems in the process industry - Specific phases and milestones | EN 62337 | - |
| IEC 62424 | - | Representation of process control engineering - Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools | EN 62424 | - |
| IEC 62708 [1)] | - | Documents for electrical and instrumentation projects in the process industry | prEN 62708 | - |

[1)] Under consideration.

CONTENTS

# INTRODUCTION

The inspection and verification of the individual measurements and controls in conjunction with the control systems used to monitor these devices (DCS, PLC, etc.) is referred to as loop check. In industry, numerous methods and philosophies are used to check the instrumentation and controls after mechanical installation within projects for modified or new facilities.

This standard was created to provide a better understanding of what loop check consists of and also to provide a standard methodology for executing a loop check.

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

# CONTROL SYSTEMS IN THE PROCESS INDUSTRY – ELECTRICAL AND INSTRUMENTATION LOOP CHECK

## 1 Scope

This International Standard describes the steps recommended to complete a loop check, which comprises the activities between the completion of the loop construction (including installation and point-to-point checks) and the start-up of cold commissioning. This standard is applicable for the construction of new plants and for expansion/retrofits (i.e. revamping) of E&I installations in existing plants (including PLC, BAS, DCS, panel-mounted and field instrumentation). It does not include a detailed checkout of power distribution systems, except as they relate to the loops being checked (i.e. a motor starter or a power supply to a four-wire transmitter).

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).

## 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.

IEC 61131 (all parts), *Programmable controllers*

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

IEC 62424,*Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools*

IEC 62708, *Documents for Electrical and Instrumentation Projects in the Process Industry*[1]

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

EXAMPLE Please refer to the annexes.

---

1 This standard is under consideration.

**3.1.2**
**mechanical completion**
milestone, which is achieved when the plant, or any part thereof, has been erected and tested in accordance with drawings, specifications, instructions, and applicable codes and regulations to the extent necessary to permit cold commissioning

Note 1 to entry: This includes completion of all necessary electrical and instrumentation work. This is a milestone marking the end of the precommissioning activities.

**3.1.3**
**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

**3.1.4**
**start-up**
milestone marking the end of cold commissioning

Note 1 to entry: At this stage, the operating range of every instrument loop is already adjusted to reflect the actual working condition.

**3.1.5**
**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

**3.1.6**
**start of production**
milestone marking the end of hot commissioning

Note 1 to entry: At this stage, the plant is ready for full and continuous operation.

**3.1.7**
**performance test**
milestone at which the production plant runs to its design capacity

Note 1 to entry: This test, carried out by the owner's personnel with the help and supervision of the contractor, should demonstrate the contractor's process performance and consumption guarantees as specified in the contract.

**3.1.8**
**acceptance of plant**
milestone at which the plant is formally turned over from the contractor to the owner

**3.1.9**
**basic software**
software which, at a minimum, contains the graphic faceplates, base-level alarms and switch points, basic interlocking and analogue control. In the case of safety loops, any safety switch point should be included if it is not in the basic database

**3.1.10**
**loop list**
tabulated list of all E&I tags with tagging, function and PID reference

**3.1.11**
**loop diagram**
representation of hardware and/or basic software functions of a control loop with graphical symbols e.g. according to IEC 62424. It shows equipment in its topological order and wiring including the terminals

**3.1.12**
**loop sheet**
data sheet with all essential E&I data concerning tagging, function, description, measuring range, location, process data, instrument data, etc

**3.1.13**
**function diagram or logic diagram**
description of the E&I functions according to IEC 61131. Use of this term/such a diagram is limited to digital signal processing only.

**3.1.14**
**cause and effect matrix**
actuators and sensors assigned to coloums and rows according their function, including their related switching and/or alarm function

**3.1.15**
**user requirement specification**
rough user specification in view of the customer to be detailed by the requirement specification

**3.1.16**
**requirement specification**
complete description of all requirements for the realisation (e.g. of an automation system)

**3.1.17**
**trip point list and configuration parameter list**
tabulated list of all variable parameter for E&I equipment

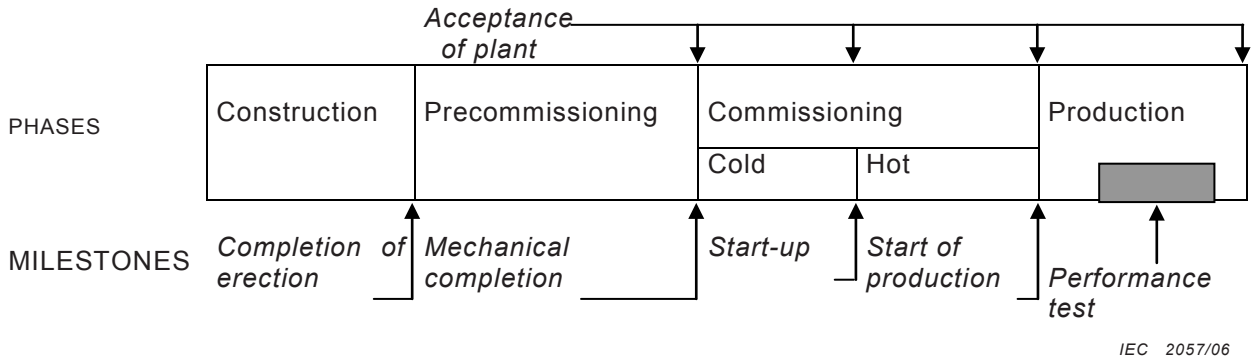
### 3.2 Abbreviated terms

| | |
|---|---|
| BAS | Building automation systems |
| C&E | Cause & effect matrix |
| DCS | Distributed control system |
| E&I | Electrical and instrumentation and control systems |
| ESD | Emergency shut-down system |
| FAT | Factory acceptance testing |
| FUP | Functional or logic diagram |
| HMI | Human machine interface |
| HW | Hardware |
| MC | Mechanical completion |
| MCC | Motor control centre |
| PLC | Programmable logic controller |
| SAT | Site acceptance test |
| SIT | Site integration test |
| SW | Software |

## 4 Order of loop check and cold commissioning in the project schedule

The loop checks will ideally occur in the precommissioning phase of the schedule shown in Figure 1.

However, normal occurrence is that the loop checks begin when any specific loop is completed and turned over to the checkout crew even if it is during the "construction" phase. The loop check could substantially overlap the "construction" phase.




NOTE Construction and precommissioning activities could be overlapping.

**Figure 1 – Definition of phases and milestones**

The loop check has the following characteristics:

- it follows the E&I construction phase and FAT of the DCS in a project;
- it is the last systematic check before mechanical completion to ensure that:
- all E&I documents (loop sheets, etc.) are available and correspond to their latest revision;
- all instrumentation and equipment is delivered according to the design specifications if not already verified during FAT or quality check during equipment receiving;
- installation has occurred in accordance to engineering documents, applicable codes and local regulations;
- loop functionality is correct.

This provides that:

- in a project, the quality check for E&I engineering, and for the delivered instrumentation and equipment and their installation;
- the base for the commissioning phase which consists of the following phases:

  a) cold commissioning

     phase during which functional testing of equipment and facilities, using test media such as water or inert substances, takes place;

  b) hot commissioning (chemical start-up)

     phase during which activities associated with the testing and operation of equipment using the actual process chemicals (initial start-up of process) are performed.

  The main activities in the cold and hot commissioning phases are system verification tuning of loops and instruments and control schemes.

## 5 Loop check content

### 5.1 Included activities

The loop check includes the following elements of a "single loop" (sensor and/or actuator).

- Hardware components:
  – the installed instruments or components in the field or in their final destination;

  - the equipment in E&I rooms;
  - hard wired functionality between sensor and actuator loops (if applicable);
  - the input and output (if applicable) cards of process control systems.
- The basic software components (including the graphic faceplates, base level alarms and switch points, basic interlocking and basic analogue control) to test the field devices. The loop check uses the basic graphics/faceplates of the control system (see Figure 2). Note that primary inputs and outputs may be connected not only to DCS but also to ESD, PLC, unit controllers and other subsystems. They all are visualized on DCS.

The actual loop check involves the three following phases (see details in Clause 6):

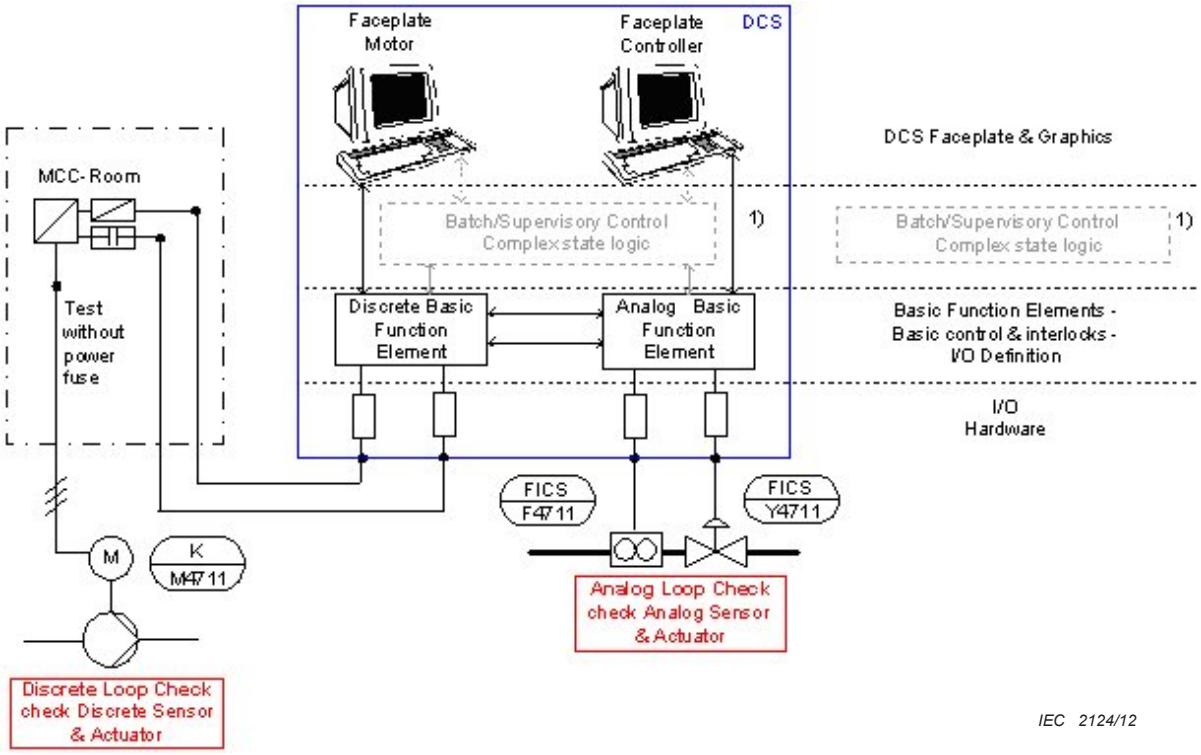
a) Documentation checkout

Check for the completeness and consistency of loop documents, including any documents from the installation or FAT.

b) Visual inspection of loop devices for correct installation and tagging.

c) Function check

A testing device is used to exercise all the components of the loop (including hardware, wiring and software). It checks that all the components function correctly and that the DCS or panel readouts are accurate.




[1] Check of the operational configuration is completed during cold commissioning or hot commissioning.

**Figure 2 – Loop components**

During the loop check the following three types of deficiencies can be found:

d) Installation failures

Installation failures are discrepancies with the specified hardware or the method of installation (wrong installation, wrong instruments, etc.). The construction contractor should fix these problems.

e) Configuration failures

Configuration failures are discrepancies with the original software specification. The programming contractor or E&I engineering should fix these problems.

f) E&I engineering failures

Engineering failures are to be suspected when, despite good installation of the right instruments, the desired functionality cannot be realized (for example, fault in wiring diagram; etc.) These problems should be corrected by E&I engineering.

Additional deficiencies might be in the process design, but this can only be determined after process start-up.

### 5.2 Activities excluded

The loop check does not consist of:

- test activities possible without construction being completed:
- software testing using simulation tools;
- other factory acceptance tests performed at the contractor or vendor's factories;
- other software checkout activities (FAT,etc.);
- detailed construction and mechanical inspections performed during the construction phase:
- cable testing during construction (Hipot, Meggering, etc.);
- point-to-point wiring checks;
- the testing of the internal workings of package units (i.e. process subunits, machinery, complex analysers, etc.) is excluded; only the I/O testing of this equipment is included in the loop check;
- activities belonging to the commissioning phase: tuning of loops, instruments and control schemes (for example, calibrating of level transmitters by filling tanks; verification of complex control schemes; tuning of continuous control schemes; etc.).

## 6 Loop check procedure

### 6.1 Documentation check

The documentation check consists of the following activities.

- The checkout of the loop should first establish that all documentation pertaining to that loop is available, consistent and correctly labelled if the loop is a safety, quality or environmental loop.
- The pertinent documentation shall, as a minimum, contain a loop diagram and a specification containing all calibration and functional data necessary to verify the correct operation of the loop (loop sheet).

### 6.2 Visual inspection

The visual inspection consists of the following activities.

- The installation should be visually checked against the documents to ensure that the correct instruments were installed and that the installation is in accordance with the hardware specifications and loop diagrams/circuit diagrams.
- Valves and flowmeters are checked for correct installation with the direction of flow.
- Can local instrumentation be easily read?
- Are all the elements of the loop available, accessible, labelled and installed in a clean and neat manner (including junction boxes, panels, cabinets, racks)?
- Is the tagging clear and unambiguous (no danger of false interpretation)?

- Are the field elements adequately protected from mechanical or environmental damage?

### 6.3 Function check

#### 6.3.1 General

The function checks concerning field devices are ideally performed in well defined blocks (related technical blocks like process units or related racks in E&I rooms). The actual method and order of checkout should be defined by the project team prior to starting the loop check.

The purpose of the function check is to exercise all components of a loop during one test and measure their accuracy. Checking out a loop in pieces does not qualify as a function check and shall not substitute for the function check.

Detailed checks have to be done according following list. Simulations could be done in different ways depending on the type of device (4 – 20 mA, HART or fieldbus).

#### 6.3.2 Sensors

Functional checking of sensors is as follows.

- Checking of tag number and parameters.
- Simulation of transmitter signal in increments to full span to ensure that the DCS or panel readout follows the input.
- Simulation of transmitter signal out of DCS range (high and low), checking of substitute value and failure reaction in DCS.
- Simulation of a sensor failure to verify the correct failure reaction.
- Disconnection of the sensor, checking of the failure reaction in DCS.
- Reconnection of the sensor, checking if device is correctly and automatically initiated (fieldbus); checking of behaviour of the live list (fieldbus).

#### 6.3.3 Actuators

Functional checking of actuators is as follows.

- Checking of tag number and parameters.
- If the loop has an analogue output, the actuator should be observed to verify that it follows the incremental output changes within a specified tolerance.
- Simulation of an actuator failure to verify the correct failure reaction.
- Simulation of a limit switch failure, checking of failure reaction in DCS.
- Disconnection of actuator, checking of the failsafe position and the failure reaction in DCS.
- Reconnection of actuator, checking if device is correctly and automatically initiated; checking of behaviour of the live list (fieldbus).
- Disconnection of air supply and checking of failsafe behaviour.

#### 6.3.4 Motor loops

Functional checking of motor loops is as follows.

- Checking of parameters in motor protection device, compare with motor data
- Simulation of motor protection device signals to verify correct readout in DCS.
- Simulation of motor protection device failure and checking of correct reaction in DCS.
- Checking of correct operation with motor protection device in test mode and removed motor fuses
- Checking of correct function of local ON/OFF switches

### 6.3.5 Inter-loops

The check of inter-loop functionality (like analogue control loops or interlock functions) is preferably done for integrated units after a successful checkout of the separate sensor and actuator loop. This is most effectively completed during cold commissioning.

IMPORTANT A recheck is required for E&I loops that have been modified or disconnected after successful checkout has been completed.

### 6.3.6 Interlocks

Verification of interlocks according to logic diagrams is only based on static signals and not on dynamic process information.

### 6.3.7 Quality loops

These loops should be checked similar to standard loops. However the accuracy of the field device should be verified. This could be done by testing the device by the manufacturer, and should be documented with a test certificate. The procedure of the initial and the periodical checks has to be defined and documented.

### 6.3.8 Safety loops

In a first step these loops should be checked similar to standard loops. The additional validation of safety loops is following a dedicated procedure, which is not described here.

## 6.4 Checkout of E&I Infrastructure and E&I concepts

Prior to, or during, loop checkout, E&I infrastructure should be checked for mechanical completion and full functionality. This covers a checklist on the overall condition of E&I rooms, field installations, energy supplies, grounding systems and cabinet equipment.

During the function check of loops, it is good practice to checkout E&I fundamentals and concepts.

- Check of loop reaction during a failure or malfunction
- Check of the "fail-safe" action – does the loop go to a safe state when a component malfunctions?
- What happens when the span limits are exceeded – do the readings and alarms conform to manufacturers specifications or desired actions?
- If the DCS malfunctions, do the final element’s actions conform to the specifications?
- Check of the function of redundant controls or power supplies:
- Does the redundancy function works as specified during the failure of the primary element? Does it switch back correctly?

The loop-related concept checkout results are to be recorded on the loop test report. Loop-related concept checkout is performed for each loop typical and for all safety and quality loops. For non-safety loops, these tests are performed only frequently enough so that each concept is checked.

Results of infrastructure concept checkout are recorded on the E&I general infrastructure test report.

## 6.5 Additional tests – Quality and safety relevant loops

All quality-relevant and safety-measure-relevant tags are to be rechecked after successful completion of the loop check.

For safety measures it is important that the functionality of the entire E&I measurement as a whole is verified (sensor loop + binary control loop, or, interlock + actuator loop).

These specific additional checks are to be verified by a second E&I checkout crew or specifically tested during cold commissioning.

## 7 Documents and test sheets

### 7.1 Input documents

The prepared documentation set according to the process unit contains the following:

a) loop list;

b) loop sheet;

c) loop diagram;

function or logic diagram

d) trip point list and configuration parameter list;

e) test reports;

f) calculation and documents (i.e., intrinsic safety);

g) certificates, if any (i.e., motor megger checks or point-to-point checks) from the construction phase are available, should also be included as part of the documentation package.

All project, safety, code, local regulations/law-related documents as required by the specific project should be available.

### 7.2 Test sheets

The following annexes or PC tools (Excel files) contain examples of test reports per loop type.

- Test report for analogue input loop Annex A
- Test report for binary input loop Annex B
- Test report for analogue output loop (control valve) Annex C
- Test report for binary output loop (on/off valve) Annex D
- Test report for motors and variable frequency drives Annex E

### 7.3 Documents generated upon completion of loop check

The following documents shall be generated.

- Marked-up E&I documentation to reflect as-built condition.
- Loop test report: signed and completed with loop check results.

### 7.4 Loop check results

The results of the loop checks shall be indicated as follows:

P = Pass (correct when checked)

F = Fail (not passed when checked; shall include a clear problem description; may require engineering involvement)

PR = Pass after repair (repair action by checkout/repair crew required)

## 8 Quality assurance

The test reports are drafted in such a way that all relevant items are covered at least once.

Quality is guaranteed by the following measures:

- The loop check is always performed in the same manner (independent of the particular tester).
- Test reports are updated with the latest information.
- The testers confirm with their signature that a complete loop check agrees with the test procedures.

## 9 Safety aspects

For safety installations, extra checklists and working plans are set up in addition to the normal loop-check procedure. These documents typically describe a very detailed check procedure and are periodically repeated after production start-up.

# Annex A
(informative)

## Test report for analogue input loop

**Instrument type:**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | **Results** | |
| **1. Documentation check *(Italics denote: normally not present)*** | | | | | | | | | | | |
| | Loop documentation complete? Cable test - point-to-point connection test complete | | | | | | | | | P | PR | F |
| | | | | | | | | | | Date | | |
| PCS specification HW present | | | | | Wiring diagram present | | | | | Name | | |
| *Instrument certificates present* | | | | | *Test sheet SW-FAT present* | | | | | Signature | | |
| Release of construction present | | | | | *PCS Specification SW present* | | | | | | | |
| **2. Visual inspection** | | | | | | | | | | | |
| | Are the elements of the loop complete, coded, installed in a clean and neat manner? | | | | | | | | | P | PR | F |
| Cable glands and connections tight? | | | | | Construction/flow direction OK | | | | | Date | | |
| All cards and nests installed and properly labeled? | | | | | | | | | | Name | | |
| Do the instruments conform to the circuit diagrams (loop diagram) and specification sheets? | | | | | | | | | | Signature | | |
| Individual configuration of cards, transmitters, etc. complete (e.g. dip switches properly set)? | | | | | | | | | | | | |
| **3. Function check** | | | | | | | | | | | |
| | | | | | Function of PCS loop successful? | | | | | P | PR | F |
| | | | | | | | | | | Date | | |
| | | | | | Fuses placed in system | | | | | Name | | |
| | | | | | Cards, nests and instruments operational? | | | | | Signature | | |
| Accept. error of span % | | | | | | | | | | | | |
| Accept. error of meas. % | | 1.5 | | Span | -30 | | 200 | °C | | | | |
| **Calibration device** | **Value** | **Accepted error** | | **Indicator** | | | | | | | | |
| | | | | **Field /PU** | **DCS** | | **Panel** | **Rec./other** | **Results** | | | |
| 3,5 mA | **False measurement** | | | | | | | | | | | |
| 4 mA | -30 | 0.45 | | | | | | | | | | |
| 12 mA | 85 | 1.5 | | | | | | | | | | |
| 20 mA | 200 | 3 | | | | | | | | | | |
| 22 mA | **False measurement** | | | | | | | | | | | |
| Open circuit | | | | | | | | | | | | |
| | | | Span and units on read out OK? | | | | | | | | | |
| | | | SW/Spec: alarm and switch levels OK? | | | | | | | No check due to operational reasons? | | |
| | | | Loop brought back ready for commissioning? | | | | | | | | | |

| Explanation: | |
|---|---|
| P | Pass |
| PR | Pass after repair |
| F | Fail |

| **Status:** | **Date** |
|---|---|
| Issued to checkout crew | |
| Issued to repair crew | |
| Issued to constr. for repair | |
| Issued to progr. for repair | |
| Issued to engineering | |
| Loop filed and complete | |

| Name | Date | Signature |
|---|---|---|
| | | |

# Annex B
(informative)

## Test report for binary input loop

**Test report** for binary input loop — January 2002

| Complex | Process area | Subprocess | Techn. item | Business unit | Building | xyz-coord | **L0001** |
|---|---|---|---|---|---|---|---|
| **ANTPCS6** | **V401** | **TA10** | | **KU** | **80** | **317** | Tag-description |
| Function **LSA** | | | Purpose Loop check after installation | | Phase Precommissioning | | Min. Level BA001 |

**Remark:** This check is performed/documented after successful point-to-point wiring check and base software implementation.
Changes in installation or software functionality require recheck.
Irrelevant boxes are crossed out or filled in with N/A (not applicable).

**Instrument type:** Liquiphant

**Results**

**1. Documentation check *(Italics denote: normally not present)***

| Loop documentation complete? Cable test - point to point connection test complete | P | PR | F |
|---|---|---|---|

| | | | |
|---|---|---|---|
| PCS specification HW present | | Wiring diagram present | |
| *Instrument certificates present* | | *Test sheet SW-FAT present* | |
| Release of construction present | | *PCS specification SW present* | |

Date / Name / Signature

**2. Visual inspection**

| Are the elements of the loop complete, coded, installed in a clean and neat manner? | P | PR | F |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Cable glands and connections tight? | | Construction/flow direction OK | |
| All cards & nests installed and properly labeled? | | | |
| Do the instruments conform to the circuit diagrams (loop diagram) and specification sheets? | | | |
| Individual configuration of cards, transmitters, etc. complete (e.g. dip switches properly set)? | | | |

Date / Name / Signature

**3. Function check**

| Function of PCS loop successful? | P | PR | F |
|---|---|---|---|

| | |
|---|---|
| Fuses placed in system | |
| Cards, nests and instruments operational? | |

Date / Name / Signature

| **Calibration device** | **Value** | **Indicator** | | | | |
|---|---|---|---|---|---|---|
| | | **Field /PU** | **DCS** | **Panel** | **Rec./other** | **Result** |
| 0/0 V | | | | | | |
| 1/24 V | | | | | | |
| Device alarm | | | | | | |
| Open circuit | | | | | | |

No check due to operational reasons?

| SW/Spec: alarm and switch levels OK? | |
|---|---|
| Loop brought back ready for commissioning? | |

| Explanation: | |
|---|---|
| P | Pass |
| PR | Pass after repair |
| F | Fail |

Description of failure (use other side)

| **Status:** | **Date** |
|---|---|
| Issued to checkout crew | |
| Issued to repair crew | |
| Issued to constr. for repair | |
| Issued to progr. for repair | |
| Issued to engineering | |
| Loop filed and complete | |

Description of repair (use other side)

| Name | Date | Signature |
|---|---|---|
| | | |

# Annex C
(informative)

## Test report for analogue output loop

**Test report** for analogue output loop (control valve) — Janaury 2002

| Complex | Process area | Subprocess | Techn. item | Business unit | Building | xyz-coord | **Y0001** |
|---|---|---|---|---|---|---|---|
| **ANTPCS6** | **V401** | **TA10** | | **KU** | **80** | **115.2** | Tag-description |
| Function **YCOS** | | | Purpose Loop check after installation | | Phase Precommissioning | | Product out BA001 |

**Remark:** This check is performed/documented after successful point-to-point wiring check and base software implementation.
Changes in installation or software functionality require recheck.
Irrelevant boxes are crossed out or filled in with N/A (not applicable).

**Instrument type:** Control membranevalve CT

**Results**

**1. Documentation check** ***(Italics denote: normally not present)***

Loop documentation complete? Cable test - point-to-point connection test complete — P / PR / F

| | | | |
|---|---|---|---|
| PCS specification HW present | | Wiring diagram present | |
| *Instrument certificates present* | | *PCS specification SW present* | |
| Release of construction present | | *Test sheet SW-FAT present* | |

Date / Name / Signature

**2. Visual inspection**

Are the elements of the loop complete, coded, installed in a clean and neat manner? — P / PR / F

| | | | |
|---|---|---|---|
| Cable glands and connections tight? | | Construction/flow direction OK | |
| All cards and nests installed and properly labelled? | | | |
| Do the instruments conform to the circuit diagrams (loop diagram) and specification sheets? | | | |
| Individual configuration of cards, transmitters, etc. complete (e.g. dip switches properly set)? | | | |

Date / Name / Signature

**3. Function check**

Function of PCS loop successful? — P / PR / F

| | |
|---|---|
| Fuses placed in system | |
| Instrument air open | |
| Cards, nests and instruments operational? | |

Date / Name / Signature

| | **Indication limit switches** | | | | |
|---|---|---|---|---|---|
| **Setpoint** | **Field /PU** | **DCS** | **Panel** | **Recorder/other** | **Results** |
| OPEN | | | | | |
| CLOSE | | | | | |

| **Setpoint device** | **Analog output** | | **Indication analog output** | | | | |
|---|---|---|---|---|---|---|---|
| | **Air to open** | **Air to close** | **Field /PU** | **DCS** | **Panel** | **Recorder/other** | **Results** |
| 3,5 mA | **False value** | | | | | | |
| 0% | 4,0 mA | 20,0 mA | | | | | |
| 10% | 5,6 mA | 18,4 mA | | | | | |
| 50% | 12,0 mA | 12,0 mA | | | | | |
| 100% | 20,0 mA | 4,0 mA | | | | | |
| 22 mA | **False value** | | | | | | |

| | | | |
|---|---|---|---|
| SW/Spec: control functions OK? | | SW/Spec: interlock functions OK? | |
| Solenoid forced? | | Valve operation as specified? | |
| Air fail position | **CLOSE** | of valve OK? | |
| DCS malfunctioning: action final element (valve) conform to specification? | | | |
| Loop brought back ready for commissioning? | | | |

No check due to operational reasons?

Description of failure (use other side)

| Explanation: | |
|---|---|
| P | Pass |
| PR | Pass after repair |
| F | Fail |

Description of repair (use other side)

| Status: | Date |
|---|---|
| Issued to checkout crew | |
| Issued to repair crew | |
| Issued to constr. for repair | |
| Issued to progr. for repair | |
| Issued to engineering | |
| Loop filed and complete | |

| Name | Date | Signature |
|---|---|---|
| | | |

# Annex D
(informative)

## Test report for binary output loop

**Test report** for binary output loop (On/off valve, ...) January 2002

| Complex | Process area | Subprocess | Techn. item | Business unit | Building | xyz-coord | **Y0029** |
|---|---|---|---|---|---|---|---|
| **ANTPCS6** | **V401** | **TA10** | | **KU** | **80** | | Tag-description |
| Function | | | Purpose | | Phase | | Input to BA001 |
| **YOS** | | | Loop check after installation | | Precommissioning | | |

**Remark:** This check is performed/documented after successful point-to-point wiring check and base software implementation.
Changes in installation or software functionality require recheck.
Irrelevant boxes are crossed out or filled in with N/A (not applicable).

**Instrument type:** Ball valve

**Results**

**1. Documentation check** ***(Italics denote: normally not present)***

| Loop documentation complete? Cable test - point-to-point connection test complete | P | PR | F |
|---|---|---|---|
| | Date | | |
| | Name | | |
| | Signature | | |

| | | | |
|---|---|---|---|
| PCS specification HW present | | Wiring diagram present | |
| *Instrument certificates present* | | *PCS specification SW present* | |
| Release of construction present | | *Test sheet SW-FAT present* | |

**2. Visual inspection**

| Are the elements of the loop complete, coded, installed in a clean and neat manner? | P | PR | F |
|---|---|---|---|
| | Date | | |
| | Name | | |
| | Signature | | |

| | | | |
|---|---|---|---|
| Cable glands and connections tight? | | Construction/flow direction OK | |
| All cards and nests installed and properly labelled? | | | |
| Do the instruments conform to the circuit diagrams (loop diagram) and specification sheets? | | | |
| Individual configuration of cards, transmitters, etc. complete (e.g. dip switches properly set)? | | | |

**3. Function check**

| Function of PCS loop successful? | P | PR | F |
|---|---|---|---|
| | Date | | |
| | Name | | |
| | Signature | | |

| | |
|---|---|
| Fuses placed in system | |
| Instrument air open | |
| Cards, nests and instruments operational? | |

| **Set on DCS** | **Indication limit switches** | | | | |
|---|---|---|---|---|---|
| | **Field /PU** | **DCS** | **Panel** | **Rec./other** | **Results** |
| OPEN | | | | | |
| CLOSE | | | | | |

| | | | |
|---|---|---|---|
| Air fail position | **CLOSE** | of valve OK? | |
| SW/Spec: interlock functions OK? | | | |
| DCS malfunctioning: action final element (valve) conform to specification? | | | |
| Loop brought back ready for commissioning? | | | |

No check due to operational reasons?

| Explanation: | |
|---|---|
| P | Pass |
| PR | Pass after repair |
| F | Fail |

Description of failure (use other side)

| Status: | Date |
|---|---|
| Issued to checkout crew | |
| Issued to repair crew | |
| Issued to constr. for repair | |
| Issued to progr. for repair | |
| Issued to engineering | |
| Loop filed and complete | |

Description of repair (use other side)

| Name | Date | Signature |
|---|---|---|
| | | |

# Annex E
(informative)

## Test report for motors and variable frequency drives

Test report for motor var. freq. drive — January 2002

| Complex | Process area | Subprocess | Techn. item | Business unit | Building | xyz-coord | **M0001** |
|---|---|---|---|---|---|---|---|
| **ANTPCS6** | **V401** | **TA10** | | **KU** | **80** | | Tag-description |
| Function | | | Purpose | | Phase | | Mixer BA001 |
| **MCOS** | | | Loop check after installation | | Precommissioning | | |

**Remark:** This check is performed/documented after successful point-to-point wiring check and base software implementation.
Changes in installation or software functionality require recheck.
Irrelevant boxes are crossed out or filled in with N/A (not applicable).

**Instrument type:** F&G CD100L1/4

**1. Documentation check** ***(Italics denote: normally not present)***

| Loop documentation complete? Cable test - point-to-point connection test complete | P | PR | F |
|---|---|---|---|
| | Date | | |
| | Name | | |
| | Signature | | |

| | | | |
|---|---|---|---|
| PCS specification HW present | | Wiring diagram present | |
| *Instrument certificates present* | | *PCS specification SW present* | |
| Release of construction present | | *Test sheet SW-FAT present* | |

**2. Visual inspection**

| Are the elements of the loop complete, coded, installed in a clean and neat manner? | P | PR | F |
|---|---|---|---|
| | Date | | |
| | Name | | |
| | Signature | | |

| | | | |
|---|---|---|---|
| Cable glands and connections tight? | | Construction/flow direction OK | |
| All cards and nests installed and properly labeled? | | | |
| Do the instruments conform to the circuit diagrams (loop diagram) and specification sheets? | | | |
| Individual configuration of cards, transmitters, etc. complete (e.g. dip switches properly set)? | | | |

**3. Function check**

| | | Function of PCS loop successful? | P | PR | F |
|---|---|---|---|---|---|
| Power fuses removed | | | Date | | |
| Control fuses installed | | | Name | | |
| Cards, nests and instruments operational | | | Signature | | |
| Field repair disconnect - closed | | | | | |

| **Operation/ indication at** | **Field** | **PU** | **DCS** | **Panel** | **Other** | **Result** |
|---|---|---|---|---|---|---|
| Mode | Manual/Auto | Manual/Auto | Manual/Auto | Manual/Auto | Manual/Auto | |
| Operation | / | / | / **AUTO** | / | / | |
| On | / | / | / | / | / | |
| Off | / | / | / | / | / | |
| Disturbance | / | / | / | / | / | |

| **Setpoint device** | **Setpoint RPM** | **Analogue output** | **Indication at var. freq. drive S313 K706 E01.1** | **Result** |
|---|---|---|---|---|
| 0% | 0 | 4 mA | | |
| 50% | 710 | 12 mA | | |
| 100% | 1420 | 20 mA | | |

| | | | | | |
|---|---|---|---|---|---|
| Overtemp. | | | | Thermal overloads | |
| Run dry prot. | | Power monitor | | Overload lockout | |
| Repair disc. | | | | | |

| | | | | |
|---|---|---|---|---|
| SW/spec: control functions OK? | | Span and units on readout OK? | | No check due to operational reasons? |
| SW/spec: interlock functions OK? | | | | |
| DCS malfunctioning: action final element (motor) conform to specification? | | | | |
| | Loop brought back ready for commissioning? | | | |

Description of Failure (use other side)

| Explanation: | |
|---|---|
| P | Pass |
| PR | Pass after repair |
| F | Fail |

Description of Repair (use other side)

| Status: | Date |
|---|---|
| Issued to checkout crew | |
| Issued to repair crew | |
| Issued to constr. for repair | |
| Issued to progr. for repair | |
| Issued to Engineering | |
| Loop filed and complete | |

| Name | Date | Signature |
|---|---|---|
| | | |

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