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**Electrical and pneumatic analogue
chart recorders for use in industrial
process control systems –**

**Part 2:
Guidance for inspection
and routine testing**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL AND PNEUMATIC ANALOGUE CHART RECORDERS
FOR USE IN INDUSTRIAL PROCESS CONTROL SYSTEMS –**

Part 2: Guidance for inspection and routine testing

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International Standard IEC 60873-2 has been prepared by subcommittee 65B: Devices, of IEC technical committee 65: Industrial-process measurement and control.

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

FDIS	Report on voting
65B/513/FDIS	65B/520/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 2009. At this date, the publication will be

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- withdrawn;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

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ELECTRICAL AND PNEUMATIC ANALOGUE CHART RECORDERS FOR USE IN INDUSTRIAL PROCESS CONTROL SYSTEMS –

Part 2: Guidance for inspection and routine testing

1 Scope and object

This part of IEC 60873 applies to electrical and pneumatic analogue chart recorders (for use in industrial-process control systems), operating from a standardized signal which may be used in process control. It is intended that continuous and dotted line traces, and multiple pen and multiple-channel instruments should be covered. Some tests may not apply to all instruments and additional tests may be required for certain types of recorders.

The object of this standard is to provide technical guidance for inspection and routine testing of electrical and pneumatic analogue chart recorders, for instance, as acceptance tests or after repair. For a full evaluation, or where a recorder is to be used under arduous conditions, (for example, high temperatures), IEC 60873-1 should be used. Whenever possible any tests carried out are to be in accordance with IEC 61298, and the person carrying out the tests needs to have a copy of it to hand and be familiar with it.

Quantitative criteria for acceptable performance should be established by agreement between manufacturer and user, and the report on the tests shall make clear which tests were carried out. The requirements of this standard shall be effective when agreed by the manufacturer and the user.

2 Normative references

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

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*

IEC 60873-1, *Electrical and pneumatic analogue chart recorders for use in industrial-process control systems – Part 1: Methods for performance evaluation*¹

IEC 61010-1:2001, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61298 (all parts), *Process measurement and control devices – General methods and procedures for evaluating performance*

¹ To be published.

3 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 60873-1, together with the following, apply.

3.1

acceptance test

test which intends to prove to the user that the device complies with certain conditions of its requirements as they appear in the contract

4 Sampling for test

If, by agreement between user and manufacturer, tests are to be performed on a sample lot, it is recommended that a sampling method such as that presented in IEC 60410 be selected.

When sampling is used, recorders to be tested may be chosen by the user's inspector.

5 Performance test

Environmental conditions at the location of testing shall be recorded (see 5.1 of IEC 60873-1).

Adjustments: For zero, span and damping, the routine tests shall be carried out with the final manufacturing adjustments (for example, as an acceptance test) or with the adjustments determined by the user (for example, after repair).

The following tests shall be performed unless another series of tests is agreed between user and manufacturer.

NOTE Ink and paper should be in accordance with the manufacturer's specifications. A chart speed of approximately 20 mm/h should preferably be used.

5.1 Measured error and hysteresis (see Clause 6 of IEC 60873-1)

Prior to recording observations, the device under test shall be exercised by three full-range traverses in each direction. The input-output characteristic under reference conditions shall be measured in one measurement cycle traversing full range in each direction. For this, at least five points of measurements should be distributed over the range, for example, in steps of 25 % from 0 % to 100 % and then from 100 % to 0 %. Tapping or vibrating the instrument under test is not allowed, unless otherwise stated.

Adjust the input to bring the output to the required value. Measure the input at this level and determine the difference between this input and the specified input to give this output value. As the result, report the difference as "measured error including hysteresis" expressed in per cent of input span.

NOTE For this test, measured error is defined as the greatest positive or negative error in the measuring cycle. Hysteresis (including deadband) is defined as the greatest difference between upscale and downscale readings which are determined at each value of output.

5.2 Effects of influence quantities

5.2.1 Power supply variations (see 12.1 of IEC 61298-3)

Adjust the input signal to bring the output to approximately 95 % of span. Measure and report the change of input that is necessary to bring the output level to its original value in % of span at the following variations in power supply or at the manufacturer's stated limits, if smaller:

- voltage variation = +10 %, –15 % of nominal a.c. or +20 %, –15 % of nominal d.c. voltage;
- supply pressure variation = +10 % –15 % of nominal supply pressure (see 12.8 of IEC 61298-3)

5.2.2 Over-range (see Clause 10 of IEC 61298-3)

With the input adjusted to bring the output first to approximately 5 % and then to approximately 95 % span, note the input levels.

The input shall then be increased gradually to the maximum overrange specified by the manufacturer. After the over-range has been applied for 1 min, the input shall be reduced to the nominal lower range value. After a further 5 min have elapsed, using the same output values as before, determine the changes required in input values to bring the output back to the originally used values.

The changes in input determined after over-ranging shall be reported, expressed as per cent input span.

NOTE If over-ranging produces significant thermal effects, the duration of application should be increased accordingly.

5.3 Recording quality

The instrument shall be connected as for normal operation and an alternating input applied with a peak-to-peak amplitude equal to half the span and centred at the mean of the upper and lower range input values. The frequency selected shall be such that all recorded traces can be clearly distinguished (not more than 1 cycle per millimeter chart travel).

After an appropriate number of traverses it shall be noted

- a) whether all traces are without interruption of the ink flow;
- b) whether the widths of the recorded lines change during the test;
- c) for multi-channel recorders, whether the ink colours change over a longer distance than 5 mm after crossing different colour traces.

5.4 Paper speed

With the chart-drive operating as normal, check by observing over a suitable period of time that the paper speed is within specification.

5.5 Step response

With the chart being driven at its fastest selectable speed, apply a suitably large step change of input signal and check that the step response of the pen mechanism is within specification.

6 Safety

The instrument shall be checked against the requirements of IEC 61010-1.
