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English version

# Non-destructive testing - Generic NDE data format model

This CEN Report was approved by CEN on 26 May 2000. It has been drawn up by the Technical Committee CEN/TC 138.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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# Contents

## Foreword

This CEN Report has been prepared by Technical Committee CEN/TC 138 « Non-destructive testing », the secretariat of which is held by AFNOR.

Taking into account the specific character of this CEN report, it was decided to give some explanations in an introduction given in the 3 languages.

# Introduction

This CR assumes knowledge of the Object Modelling Technique (OMT) and of NDE.

There is a growing interest to manage the results of non-destructive testing (NDT) by the use of computers with data in a digital form. As a result, the NDT activities are undergoing an evolution which makes them face new needs, such as the handling of huge volumes of digital data and the growing complexity of analysis processes, involving, in many cases, multitechnique procedures.

The NDT service business is evolving towards a more open market, in which the prime contractor requires transparent access to the data provided by the supplier, in order to ensure the comparison of data obtained from different sources and at different periods of time. Existing formats are often proprietary formats released by instrument manufacturers, generally dealing with a unique NDT method and not including complementary information on acquisition : consequently, they often fail to meet emerging requirements.

It is a natural evolution to express the need of a standard format model for the exchange of non-destructive examination (NDE) data, which can be recognized by all involved in the main NDT methods.

The expected characteristics of such a format are the following :

— exchange : the format can be used mainly for data exchange, but could be used for real-time data processing ;

— multitechnique : the format must take into account the different forms taken by the data (e.g. time/amplitude vectors for ultrasonics A-scans, complex values for eddy currents, 2-D images for radiography) ;

— traceability : the format must include all the relevant complementary information on the acquisition (e.g. date of the acquisition, component name, procedure identification, list of NDT equipment, ...) ;

— reproducibility : the format must contain all information allowing the reproduction of the acquisition (e.g. set-up parameters) ;

— completeness : the format must contain all information necessary for data analysis (e.g. probe position) ;

— compatibility with NDT standards.

The objective of this technical report is to define a format model for the organisation of NDE data for exchange (transmission, comparison, remote computer-processing) and computer-processing (traceability, archiving, retrieval, signal processing, comparative analysis). The format described is independent of the system and method used. It applies to digital data issued from the NDE methods on which general standards are being defined in CEN/TC138 working groups, i.e. radiology, ultrasonics, eddy currents, penetrant testing, magnetic particle testing, leak testing, acoustic emission, visual inspection. However, other methods (thermography, Barkhausen noise, shearography, microwave testing,...) may comply with this organisation with additional definitions required to ensure satisfactory performance. Interpretation of data is outside the scope of the technical report.

Digital data can be obtained in each of the main NDT methods in the following ways :

| | |
|---|---|
| Radiography | Computed radiography<br>Computed tomography<br>Digitised film radiography<br>Radioscopy |
| Ultrasonics | Digital equipment |
| Eddy currents | Digital equipment |
| Penetrant testing | Digital camera |
| Magnetic particle testing | Digital camera |
| Leak Testing | Digital recording device |
| Acoustic emission | Digital equipment |
| Visual inspection | Digital camera |

It is important to note that this technical report proposes a format model. It can be implemented practically in many ways. To do so, a standard or a document describing the application programming interfaces is necessary.

The examination data is described as an integration of acquisition data (made of the NDE data and of setting and positionning data) and of complementary data, which are all the other data relevant to the examination, e.g. the data necessary to identify the inspection conditions, the examination object or the testing equipment.

The working method used in this report is the Object Modelling Technique (OMT), a recognised object modelling approach.

This technical report :

— defines the objects : one must be very careful, during the interpretation of the document, to distinguish between the object names and the actual terms used in the definitions ; some ambiguities may arise from the fact that these names are sometimes identical ; to avoid that, a specific typology has been adopted throughout the document ;

— defines the relationships between objects ;

— defines the attributes of the objects (dictionary).

A generic overview of the model can be seen on Figure I.1. This representation gathers the objects in object groups and gives a global view of the model. It can be observed that a set of data on which the format is applied relates to a single examination. A different examination will then create a different data set.

The examination is made on an object (i.e. the volume of the component on which NDE information is required), using a procedure and a data organisation (i.e. the definition of the structure of acquisition data). The procedure defines the equipment. The acquisition data is produced by the equipment and arranged according to the data organisation related to the equipment.

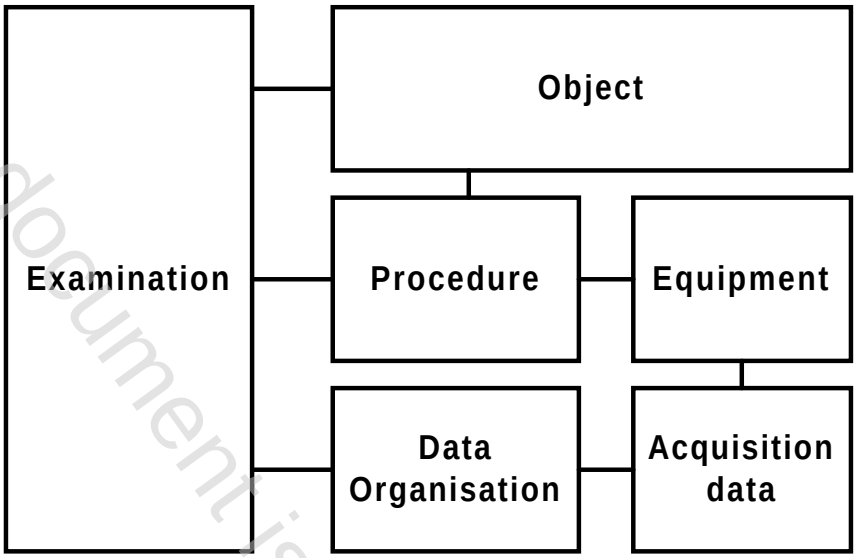


**Figure I.1 — Generic overview of the model**

Figure I.2 represents the main view of the model, including all the objects and relationships, the detailed definition of which is given in paragraph 8.2.1. The object groups of Figure I.1 have also been represented on Figure I.2, for easier comprehension. This main view is common to all the NDT methods.

The characteristics specific to each method are included in the DEVICE object. A DEVICE is an element of a NDT equipment. The technical report aims to define standard DEVICE objects for the standardised NDT methods. This model intends to be open to new techniques or to the evolution of conventional techniques, and the possibility is given to define "non-standard devices", under restrictions which are given in the document ("general rules for use").

Finally, this report provides a detailed model of the acquisition data, which describes all the possible forms which can be taken by NDE data : 0D (scalar or complex), 1D (sampled - cf. ultrasonics A-scans - or unsampled - cf. ultrasonics time/amplitude data), 2D (images) or 3D (volumes).

In annex B, a formal description of the model can be found, using the Express language, based on the STEP (STandard for the Exchange of Product model data) standardised approach (ISO 10303).

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If this report is translated, the Object Modelling Technique (OMT) terminology (written in capitals) shall remain in English.

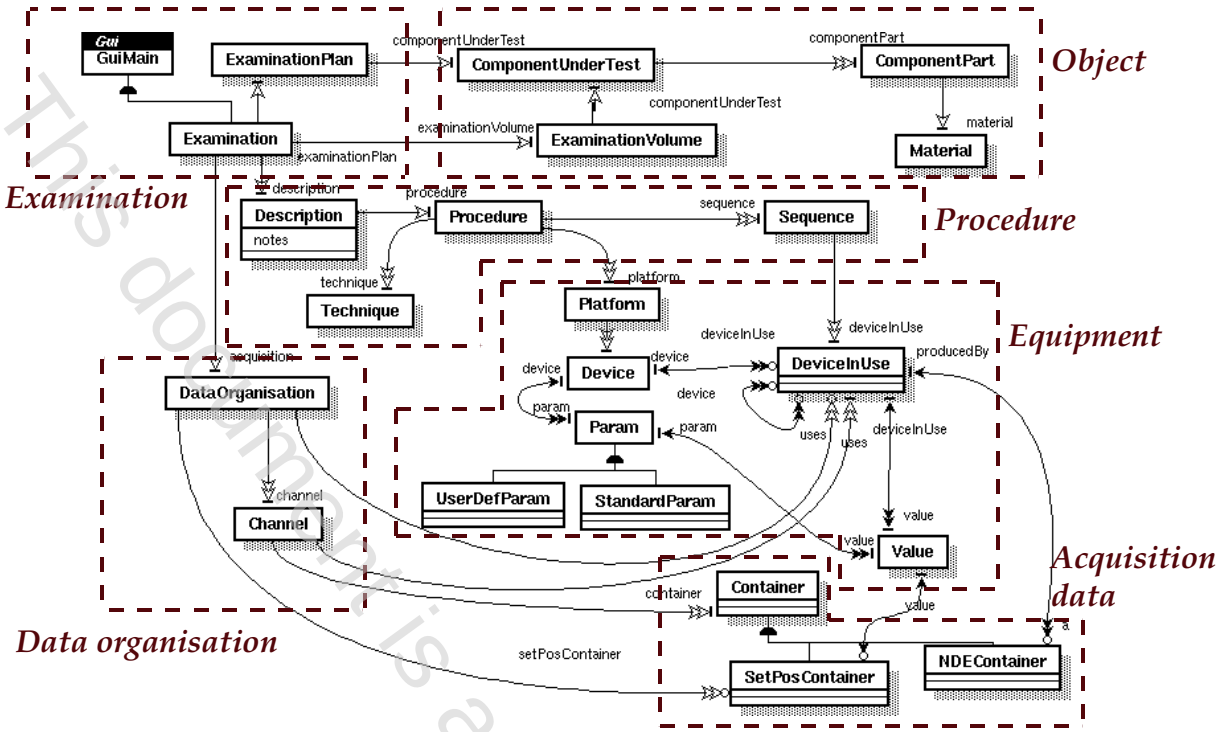


**Figure I.2 — Main view of the model (DOM representation)**

## 1 SCOPE

So far, existing formats for non-destructive examination (NDE) data are specific to a given system and method, and do not include all the necessary information to allow an exchange of the data.

This technical report defines a format model for NDE data organisation, in order for them to be exchanged (transmission, comparison, remote computer-processing) and computer-processed (traceability, archiving, retrieval, signal processing, comparative analysis). This format is independent of the used system and method. It applies to digital data issued from the following NDE methods : radiology, ultrasonics, eddy currents, penetrant testing, magnetic particle testing, leak testing, acoustic emission, visual inspection. Other methods (thermography, Barkhausen noise, shearography, microwave testing, ...) may comply with this model with additional definitions required to ensure satisfactory performance.

Interpretation of data is outside the scope of this technical report.

## 2 REFERENCES

This CEN Report incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this CEN Report only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 10303, *Industrial automation systems and integration – Production data representation and exchange, (STEP : STandard for the Exchange of Product model data)*

EN 462-1, *Non-destructive testing – Image quality of radiographs – Part 1: Image quality indicators (wire type) - Determination of image quality value*

EN 462-2, *Non-destructive testing – Image quality of radiographs – Part 2: Image quality indicators (step/hole type) - Determination of image quality value*

EN 462-5, *Non-destructive testing – Image quality of radiographs – Part 5: Image quality indicators (duplex wire type), determination of image unsharpness value*

EN 12543-2, *Non-destructive testing – Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 2: Pinhole camera radiographic method*

EN 12679, *Non-destructive testing – Determination of the size of industrial radiographic sources – Radiographic method*

## 3 DEFINITIONS RELATED TO THE MODELLING METHOD

**STEP :** STandard for the Exchange of Product model data (ISO 10303) bearing on the representation and exchange of the product data, aiming to integrate conception and development processes.

**Domain :** in the STEP methodology, the domain describes what is inside the limits of application of the model.

**Analysis model :** the definition of the objects constituting the domain and of the relationships between them.

## 4 CONVENTIONS AND SYMBOLS

SMALL CAPITALS are used in this document to refer to model objects, as defined in the OMT (Object Modeling Technique) formalism. UNDERSCORED SMALL CAPITALS refer to object groups.