

Leonardo Da Vinci Programme European Training Programme for the Qualification of NDT Personnel

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Abstract: The qualification of NDT personnel is sanctioned through their certification.

The different standards to certify personnel call for minimum training requirements previous to the examination and establish training programmes.

Thus, the ISO 9712 and EN 473 standards recommend a programme prepared by de ICNDT. On the other hand, the CEN, knowing this necessity, has designed technical recommendations with the syllabuses to impart in the different methods.

Therefore, the Centro Nacional de Formación Profesional Ocupacional (CNFPO) of Cartagena (Spain) persuaded of the importance of the personnel training in the main objective, knowledge acquisition, as well as certification obtaining, has proposed the following project:

EUROPEAN TRAINING PROGRAMME FOR THE QUALIFICATION OF PERSONNEL PERFORMING NDT.

Introduction

The European standard EN 473 devoted to the qualification and certification of personnel performing NDT was issued in 1993. After the review done in 2000, it is a harmonised standard for the application of the essential requirements included in the European Directive on Pressure Equipments 97/23/CE. This standard establishes that the certification must be done by independent bodies and has been adopted by the majority of the European Union countries.

In this way the action to develop the certification tests for the personnel performing NDT is defined and harmonised for all the UE countries; however, it is necessary to give an answer to the lack of methodology as well as unified texts that develop the minimum required programme recommended in the EN 473 and ISO 9712 standards, as well as to provide to the bodies, teachers and candidates an uniform material integrated with the norms and recommendations of the UE.

These lacks have been detected thanks to the continuous participation in the different international forums of the partners. As it will be explained afterwards, the partners of this project are, in each of the respective countries, the person in charge of the personnel certification, and therefore, without any doubt, they are the ones that have a more exact knowledge about the training in this sector.

The project constitutes a fundamental advance in the professional training of the NDT technicians in different education fields (ruled, occupational, continuous) and implies an innovation in diverse aspects. On the one hand, every training centre has prepared their

texts in a isolated way; so, it is a question of developing among all the partners, educational tools for the NDT operators, with the consensus and acceptance of all, what will make easy the acknowledgement, the transfer and the acceptance of the operators training among the various countries and, on the other hand, will strengthen the relationships and the information exchange among the bodies that certify NDT operators. As a practical example, a worker, that had performed his NDT training in Spain, will be able to apply to be examined in other of the participant countries.

To prepare the material that set up the final product of the project we count on:

The partners experience in the preparation of European norms and standards.

The documents, standards and technical recommendations on qualification and certification in the CEN.

The Promoter

The CNFPO (National Centre of Occupational Professional Training) of Cartagena (Spain) is a training centre Depending on the Servicio Regional de Empleo y Formación of the Autonomous Community of the Murcia Region. It seeks, as project promoter, to furnish its experience in the starting and development of European projects, coordinating all their phases but, at the same time, as well as its experience in the NDT field as Cento Nacional de Control de Calidad (National Centre of Quality Control), and in the preparation of didactics means under methodologies related with the professional training.

The Cartagena centre belongs to the occupational training national centres network in Spain and it is considered as National Centre for Chemical Industries and Enterprises Services (among them NDT include in Quality Control area). Among its functions are the unemployed training in different areas (chemistry, NDT, welding, informatics), training of trainers, preparation of programmes for courses to obtain the professional certificates in the areas above mentioned, and so on. It has been successful promoter in different European projects of the Eurotecneq and Leonardo da Vinci (two projects numbers 116.294 and 116.782 and a pilot project number 115.404) programmes, this experience will be useful for a good coordination and development of the project.

The Partners

The association created for this project is composed by AEND (Spain), COFREND (France), BINDT (United Kingdom) and DGZfP (Germany) that represent in the respective countries the maximal authority in all aspects related with the END; Among their activities is the certification of the operators that work in this tests sector. All of these entities are valid speakers to represent their country in the international forums and European committees in which are discussed topics related with the NDT and, in the same way, they participate in the preparation of standards, specially the ones related with the certification requirements and training programmes recommended for the END.

PARTICIPANT PARTNERS

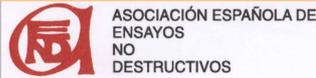
PROMOTER



CNFPO National Centre of Vocational Training
Cartagena (Murcia) – Spain

PENETRANT TESTING

PARTNER



Spanish Society for Non Destructive Testing
Madrid – Spain



MAGNETIC PARTICLE TESTING

German Society for Non Destructive Testing
Berlín – Germany



RADIOGRAPHIC TESTING

British Society for Non Destructive Testing
Northampton – United Kingdom



ULTRASONIC TESTING

French Society for Non Destructive Testing
Paris – France

EDDY CURRENT TESTING

Objective

The project objective is the preparation of a European programme for training of professionals that perform NDT in the levels 1, 2 and 3 in the test methods included in the table above, and that accomplish with the requirements demanded in the certification.

After a study of the state of the art in the countries of the partners, it is sought the preparation of didactic materials for students and teachers, the same for all the participating countries, issued in every one of the languages. As basic documents to start are:

EN 473 Qualification and certification of personnel performing END. General principles.

CEN ISO/TR 25107 Non destructive testing. Guidelines for NDT training syllabuses.

Once finalised the project it will be at disposal a model of uniform training in 5 methods and in the 3 qualification levels mentioned in the standards of personnel certification.

This model will be composed of:

- A didactic guide for each method, in the three levels.
- Student manual for each method and level.
- Teacher manual.

The methods contained in the project are:

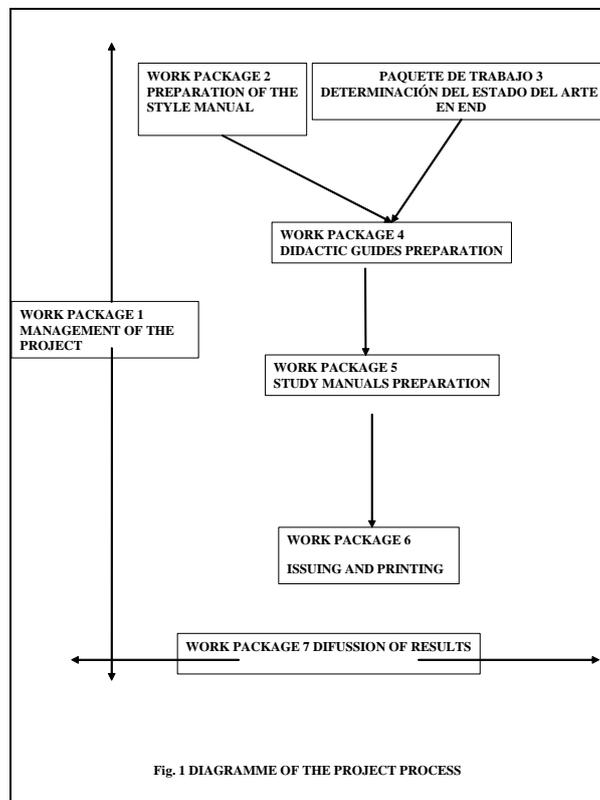
- Ultrasonics.
- Industrial radiography.
- Penetrants.
- Magnetic particles.
- Eddy currents.

Development

The structure of the project is shown in the Fig. 1 and it is divided in the following work packages:

Work Package 1: Project Management.

It comprises the leadership, coordination and continuous monitoring of the project during the whole execution period. In it, are established the type and number of evaluations needed to ensure the fulfilment of the marked objectives, implementing a quality management of the project.



Objectives

- To prepare the methodology to be used along the project.
- To determine the way for approving the different documents performed.
- To establish the scope and the documental scheme of reference.
- To analyse the right performance of the project watching over the implication of all partners.
- To establish the project quality management plan.
- To perform activities of evaluation and forwarding.
- To assure the quality of the resulting products as well as their applicability to the addressees.

Working methods and techniques

During the project development meetings will be held to analyse the performed works, besides the promoter will establish the appropriate activities to verify the correct fulfilment of the foreseen programme regarding contents and timetables.

In the working methodology is included the quality management plan, that identify deviations, propose corrective actions and look after its performance.

This plan includes the quality control activities that consider three important aspects:

- To verify that the obtained results meet the needs of the users.
- To verify that the contents fit the standards and documents generally accepted.
- To verify that the rules marked on the style manual are followed.

Work Package 2: Preparation Of The Style Manual.

It includes the preparation of a style manual where are collected the writing rules, including terminology, symbols, abbreviations, typography, and so on. Its use is mandatory for all the partners and therefore any document generated must be adapted to it.

Objectives

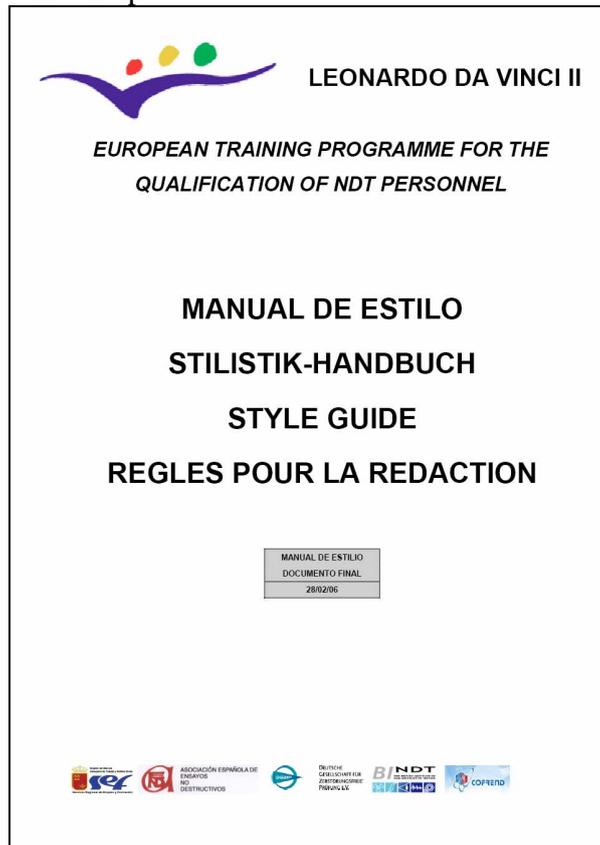
- To establish the mandatory norms for the issue of all the writing material.
- To collect the reference documentation for the issue of the texts.
- To suggest rules related to the terminology, typography, design, abbreviations, symbols, and so on.

Working methods and techniques

In the *style manual*, are described the norms to avoid mistakes in writing, giving uniformity to the texts and avoiding uncertainties. The style manual is a document that answers the established objectives, taking into account the linguistic particularities of the partners. The style manual include recommendations with respect to the writing style, taking into

account the addressees as well as the project final objective, that is to obtain study manuals useful as material to be utilised in the process of training in the NDT field. It solves, among other, the following questions:

- Titles.
- Typographic elements.
- Names and terms.
- Abbreviations, numbers and symbols.
- Orthographic signs.
- Grammatical norms.
- Figures, graphics, tables,...
- Design, materials and mock-up.



The international standards on terminology are referenced in the style manual. The terms not included in the standards are also considered, to reach agreement among the authors that are of different nationalities.

Work Package 3: Knowledge Of The State Of The Art

Introduction

Leaving of an unique questionnaire for the collection of data for each one of the partners, a final document of conclusions has been elaborated that allows us to know the state of the art regarding the training in non destructive (NDT) testing as for the didactic existent means and the necessities of the same ones in each participant country in the project, and that will

serve as departure for the realization of the works included in the packages of work 4 and 5 of the project, establishing the reach of each one of them.

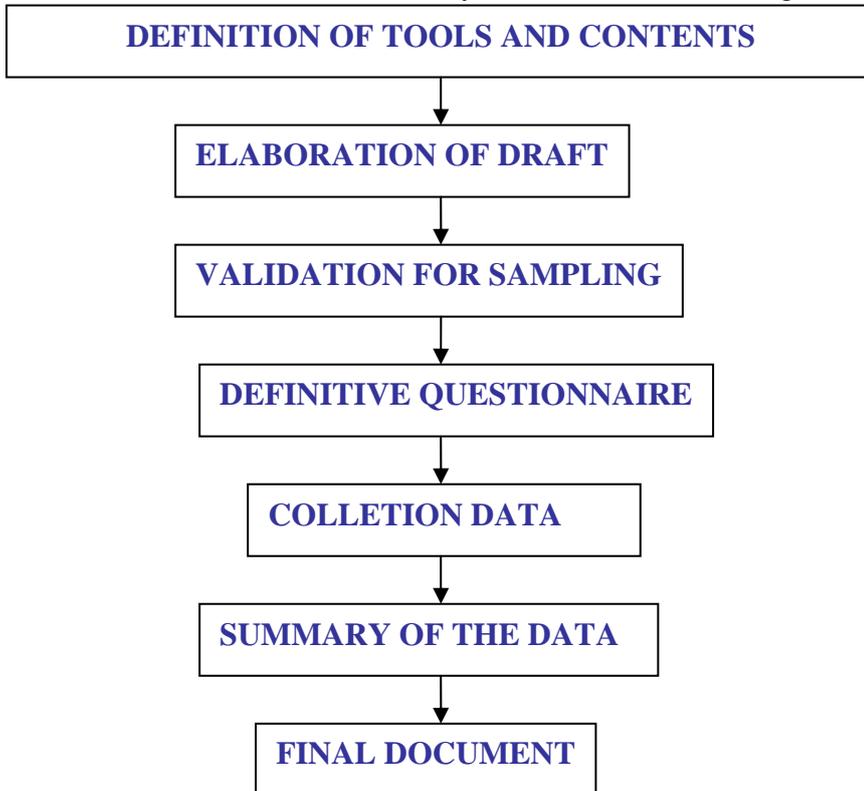
Aims

The objectives pursued by study of the art are

- To generate a tool of collection of data
- To establish the data to gather.
- To identify the population to which is applicable
- To know the didactic means and the programs continued in the formation.
- To gather the bibliography (books, norms, manuals, publications) about NDT.

Process of work

The process of followed work for the analysis follows the following outline:



Definition of tool and contents

In the course of the first meeting of launching of the project it was showed up the contents to analyze and it was defined as tool to make it a questionnaire that would be distributed in each country by the corresponding partner taking charge of gathering the results to send them finally to the Spanish Association of Non Destructive (AEND) Testing.

Also the interested agents were identified among which should be carried out the survey:

Formation entities.

Companies of non destructive testing.

Trade Unions.

Employer.

Public administrations.

Professional schools.

Academic education.

Occupational training.

Continuous education.

Companies receiving training.

Companies or professionals devoted to training

Certifying organisms

Elaboration of draft

The Spanish Association of Non Destructive Testing has taken charge of elaborating a questionnaire for the collection of data in which the different aspects are reflected to analyze.

Validation for sampling

For the validation of the questionnaire a meeting was carried out, to which interested different agents' representatives implied in the training of NDT attended. The assisting entities to the mentioned meeting corresponded to the following types

- Private Company
- Occupational training Centre
- Company that lends training services
- Centre of academic education. University
- Professional association
- Certifying organism
- Independent trainer

Once celebrated this meeting and taken in consideration the points of view expressed, and with the comments received by the partners the definitive questionnaire was elaborated.

Collection of data

For the collection of the data each partner was responsible of the distribution of the questionnaires among the interested agents of their country, forwarding the data received to AEND who would take charge of to process them and to elaborate the report of the same ones.

Elaboration of results

For the treatment of the received data a database has been elaborated that picks up the received data in a way contained according to the sections that the questionnaire had, being shown the results in the point 4 of the present document.

Results

The responded questionnaires are shown in the Chart I, a priori they are scarce and not very representative.

	RECEIVED SURVEY	ANSWER PORCENTAGE	SENDED SURVEY
SPAIN	15	6,64%	226
GERMANY	2		
UNITED KINGDOM	24		
FRANCE	2		
	ONE OF THEM FREELANCE		

Chart I received questionnaires

As we can appreciate in the Chart II the number of students that embrace the received surveys make that the obtained results are taken as representative when approaching the number of students to the number of people certified in each one of the countries, except for the case of France that cannot be had as representative by their shortage of data.

	STUDENT	AVERAGE PER COURSE	COURSE PER YEAR
SPAIN	871	13	67
GERMANY	4400	11	400
UNITED KINGDOM	3600	8	450
FRANCE	600	6	100
TOTAL	9471	9,31	1017

Chart II Population

Profile of the centres and types of training.

The results come from different organizations being their distribution the one shown next:

- 19 private Companies that, among their activities, impart training.
- 10 public or private organizations, like training centres, associations, universities, etc.
- 1 independent professional that lends their services like professor.

The type of training imparted by these organizations is the following one:

- 3 Academic: They are those entities that impart ruled training/education guided to the obtaining of an academic title of any grade.
- 4 Occupational: The occupational training is that that has as objective to endow to the student of the knowledge and necessary dexterity to be able to insert them in the labour world, since this is directed to unemployed.
- 23 Continuous: The continuous training is guided to the workers' professional improvement, this is to employed people.

Profile of the students

The study has been centred in three characteristics: age, academic training/education and gender, with the following results:

		LESS THAN 18	18 TO 25	25 TO 40	MORE THAN 40
SPAIN		0,34%	13,32%	55,91%	30,42%
GERMANY		0,00%	9,55%	40,45%	50,00%
UNITED KINGDOM			30,00%	55,00%	12,00%
FRANCE		NA	NA	NA	NA

Chart III Students' age

	ELEMENTARY	HIGH SCHOOL	PROF. TRAINING	UNIVERSITY	POST GRADUATE
SPAIN	28	77	291	475	
GERMANY	60	260	3200	880	
UNITED KINGDOM		the majority of the students			
FRANCE			600		

Chart IV Academic education/training

	FEMALES	MALES	FEMALES	MALES
SPAIN	111	760	12,74%	87,26%
GERMANY	160	4240	3,64%	96,36%
UNITED KINGDOM	360	3240	10,00%	90,00%
FRANCE	NA	NA		

Chart V Gender

Teaching modality.

The modalities of teaching studied obey to the following types, showing the results obtained in the Chart VI:

- Present teaching The teaching of all school hours, as much the theory as the practices are carried out with continuous attendance to class.
- Semi-present teaching In this case the acquisition of theoretical knowledge is carried out at distance with the attendance of a professor to consult doubts and evaluation exercises that allow the professor to verify the acquisition of theoretical knowledge that allow the student the access to the realization in present modality of the practices and proficiency tests.
- On-line It is about those courses that are imparted with the aid of multimedia, being the contents of the same accessible for the students through Web.

		CLASSROOM	SEMI-CLASSROOM	ON-LINE
SPAIN		767	104	0
GERMANY		4400		0
UNITED KINGDOM		3600		0
FRANCE		600		0
TOTAL		9367		

Chart VI Teaching modality.

Types of courses.

In this section the different variables were studied to discover how the courses were imparted, being the parameters observables:

- Method
- Level
- Hours of theory
- Hours of practice
- Total of imparted hours
- Recommended program
- Material given to the student
- Used equipment

Bibliography

This aspect of the study sought to gather the bibliography used in the formation, as well as the complementary existent bibliography in the different participant countries in the project.

Conclusions

Of all that exposed we can establish the student type that attends the non destructive testing courses of training, this student is characterized by that exposed next: Man with age understood among those 25 and those 40 with an academic education/training of High (Secondary) school, these two characteristics make that in the training is necessary to think of people that between their academic studies and the formation in NDT there is a time that they have left the studies.

As for the type of imparted training it is observed that there is not implemented the education/training On - line, and that the semi-presencial teaching is only observed its use in Spain, being majority the present training. The teaching runs to private companies that impart the training to their own workers or that among their activities they lend training services.

From among the existent programs of subjects used in the training is the recommendations of ICNDT and those published by CEN

The material used by the training centres that is surrendered to the students is elaborated by each training centre in a specific form, although they exist a series of bibliography of advisable, reading besides the norms that are published with general character, see series of norms EN, ISO, and others of widespread use as ASTM, ASME. Data have not been obtained as for program of practices neither as for means, which makes to think that we will have to focalize this aspect in the realization of the didactic guides as in the elaboration of the study materials.

Work Package 4: Didactic Guides Preparation.

Didactic guidelines for every one of the methods and levels have to be prepared. The starting point will be the document obtained as result of the work package 3. These guides will contain general orientations, the description of every didactic unit and the evaluation tools.

Objectives

- To draft a didactic guide for every method.
- To provide the specifications of every method and level.
- To include all elements participating in the training-learning process.

Work methods and techniques

To prepare the didactic guides, one for each method, have to be used the state of the art results obtained in the previous work package, taking into account the recommendations that appear in the following documents:

EN 473 *Non destructive testing-Qualification and certification of NDT personnel- General principles*

ICNDT-WH-85 *Requirements of Technical Knowledge of NDT-Personnel.*

CEN ISO/TR 25107. 2006 *Non destructive testing. Guidelines for NDT training Syllabuses.*

ISO 9712 *Non destructive testing Qualification and certification of NDT personnel.*

This document will be a novel advance very important in the harmonization of the personnel qualification and certification, since it gives general orientations to prepare the study manuals contents as well as the didactic helps to impart courses.

They are structured in:

General orientations, didactic units and evaluation.

The general orientations consist in:

Objectives. Student requirements. Courses requirements. Subjects. Courses timetable.

Facilities. Equipments and materials. Bibliography.

Every didactic unit consists in:

General objectives. Operative objectives. Pedagogic orientations. Didactic aids. Equipment and materials. Theoretic knowledges. Practical knowledges.

The evaluation part is divided in:

Observation keys. Evaluation tests.

Every partner has to prepare the didactic guide of the assigned method.

Work Package 5: Study Manuals Preparation.

Starting from the directives collected in the didactic guides performed in the work package 4, to prepare study manuals that meet all the contents for the methods and levels that are object of the project.

Objectives

- To develop the contents included in the didactic guides.
- To prepare the student study manuals.

Work methods and techniques

Every partner will write the assigned study manual, developing the contents included in the didactic guides and accomplishing the marked objectives. At the same time, will furnish the described evaluation tools.

It has been established that the contents corresponding to the levels 1 and 2 will be included in one book, making the difference in the texts for the level 2 with a weft of 10%.

The study manual corresponding to the level 3 will be wrote in other document.

Work Package 6: Issuing And Printing.

Every partner will prepare the corresponding material in his own language, afterwards every one of the other partners will translate this material to his own language, taking in charge its issuing and printing using the means previously determined.

Objectives

- To adapt the contents to the style manual.
- To translate the different materials to the participating countries languages.
- To issue and mock-up the contents following the indications of the style manual.
- To print and deliver the resulting materials. (study manuals, triptychs,etc).

Work methods and techniques

Once issued the study manuals, fitted with the style manual and translated to the four languages (Spanish, German, French and English) a last international meeting will be held to definitively approve the complete material before to be sent to print.