PED Re-certification

Engineering and Validation Program

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1. Introduction

1.1. European Regulation (PED) and consequences

The essential safety requirements laid down in this Directive [1] are **mandatory**. The obligations following from those essential safety requirements apply only if the corresponding hazard exists for the pressure equipment in question when it is used under conditions which are "reasonably foreseeable" by the manufacturer.
The manufacturer is under an obligation to analyze the hazards and risks in order to identify those which apply to his equipment on account of pressure; he shall then design and construct it taking account of his risk analysis.
Pressure Equipment shall be designed for adequate strength associated to pressure loads and for loadings appropriate to its intended use and other reasonably foreseeable operating conditions. In particular, different degradation mechanisms shall be taken into account, as: fatigue, ratcheting, creep-fatigue, corrosion and erosion…
Consequently:

- some margins have to be justified in front of the basic pressure equipment failure modes, as: plastic collapse, plastic instability, local failure without crack, buckling, creep…
- potential degradation that can affect the pressure boundary has to be considered at the design stage: no thinning, no loss of material properties (material strength and toughness), no cracks, associated to do different degradation mechanisms, as fatigue, plastic shakedown, corrosions or thermal ageing….
- in some cases, the "flaw tolerance" of the pressure equipment has to be evaluated at design level to assure safe operation life of the equipment

1.2. Needs of EN standards

- assure "easy to use" Standards, sufficiently explain, justified, at the state of the art technical level
- assure "competitiveness" with similar international standard to assure relevance of the European pressure equipment designs: security and cost of Construction (Design, Fabrication, Protection, Tests)
- anticipate "specific or future needs" of European Pressure Equipment industry on the future Clean Energy market and other innovative Pressure Equipment application.

2. Major Objectives of EPERC TG12

- help all the users of EN Standards on Pressure Equipment: EN 12952-12953 for Boilers, EN 13445 for Vessels and EN 13480 for Piping to meet the essential safety requirements for pressure equipments originally designed according to the National Codes & Standards (C&S), submitted to major modification after the introduction of the PED in the member States
- review format and content of EN 12952-12953, EN 13445, EN 13480
- compare EN Standards with similar other International C&S, as: ASME BPVC Section VIII-Division 1-2-3 and ASME-B31, API682, KTA/ADM, BS, Japan, Korea… and ISO Standards
- collect all the references that support and justify all the proposal available inside the standards
- identified gaps and needs to remain competitive at the State Of the Art Level and new needs associated to relevant modifications, in connection with CEN-TC 54 and CEN-TC 269 Business Plans
- analyze all the uncertainties associated to the former use of National C&S
- propose a set of typical Benchmarks to assure applicability of the new rules
- prepare some recommended practice proposals of parts of EN 12952-12953 [6], EN13445 [7], EN13480 [8]
- develop a set of practical examples on typical cases for the more complex rules
- develop a proposal for a PED amendment related to the modification of pressure equipments originally designed according to the National C&S
- develop a dedicated Road Map for regular reviews of Project and Tasks advancement
- Reports and knowledge dissemination closely connected.

3. Potential EU Research Support

A dedicated Report has been proposed by CEN-CENELEC:

- "How to Link Standardization with EU research projects" [2] can be found on www.cencenelec.eu/research .
- "Horizon 2020" December 2019 [3] on https://ec.europa.eu/programmes/horizon2020/en/background-material
- "Strategic Plan" December 2019 [4] on https://ec.europa.eu/info/files/strategic-planning-process-and-strategic-plan_en

3.1. Standardization and Research Projects

3.1.1. A guide for the reader

This document addresses those NSBs/NCs that wish to establish, increase or further develop interaction with the research community, including private and public organizations that perform or support research, development and innovation.
Throughout the document, the term “standard” refers to all types of documents published by formal standardization organizations, irrespective of the level of consensus within the standardization process. Those include both “formal” standards (e.g. EN, ISO and National Standards) and other standardization documents (e.g. TS, TR, CWA): https://www.cen.eu/work/products/cwa/pages/default.aspx
This document is written for all NSBs/NCs, regardless of their level of experience in terms of cooperating with the research community. It offers advice on how best to approach participation in research projects, how to develop a strategy for research, set up a communication strategy, and find and participate in research projects.
The primary focus is on Horizon 2020, the EC’s current framework program for research and innovation, but other research and funding programs are available at the national and European levels.
This document consists of four chapters and three annexes, each of which can be read independently of the others.
However, if you are new to the area of research and innovation, or if you have little experience in cooperating with the research community and participating in research projects, it could be to your advantage to read the chapters in order.

3.1.2. Summary of the content of CEN Report

3.1.2.1. Why link research and standardization? (**Chapter 1**)

The first chapter introduces the role of NSBs/NCs in linking standardization and research and provides information on initiatives linking standardization with research, including the “Integrated Approach”, a method developed by the CEN and CENELEC Joint Working Group on “Standardization, Innovation and Research” (STAIR).

3.1.2.2. Getting organized (**Chapter 2**)

The experience of a number of NSBs/NCs has shown that to ensure a well-organized approach to activities related to research projects, two crucial factors need to be taken into account: the definition of your strategy and the development of your organizational capability. Chapter 2 will give you an understanding of these factors and inspire you in your first steps towards successful participation in research projects.

3.1.2.3. Engaging your stakeholders (**Chapter 3**)

The third chapter focuses on how to define and engage with stakeholders in the research community. Experience shows that many people involved in research have little or no knowledge about standardization. In this chapter you will find tips and recommendations to help you ensure a successful engagement.

3.1.2.4. Participating in research projects (**Chapter 4**)

The final chapter offers NSBs/NCs guidance with regard to their participation in research projects. Here you can find information on what your role could be in research projects, how to identify relevant projects and how to participate in research projects. While the primary focus is on research projects at the European level, especially in Horizon 2020, it is possible to draw parallels with other European and national research initiatives.

3.1.2.5. Success stories (**Annex A**)

The first annex contains stories of how standardization played a crucial role in the success of research projects funded under the EU´s Seventh Framework Programme for Research (FP7).

3.1.2.6. CEN and CENELEC Policy on Participation in Research Project Consortia (Annex B)

Annex B presents the CEN and CENELEC policy on participation in research consortia.

3.1.2.7. Useful links (**Annex C**)

Annex C offers links to help you find information on different aspects of participating in research projects.
Figure 1 illustrates the contents of this document and the interrelation of its elements.

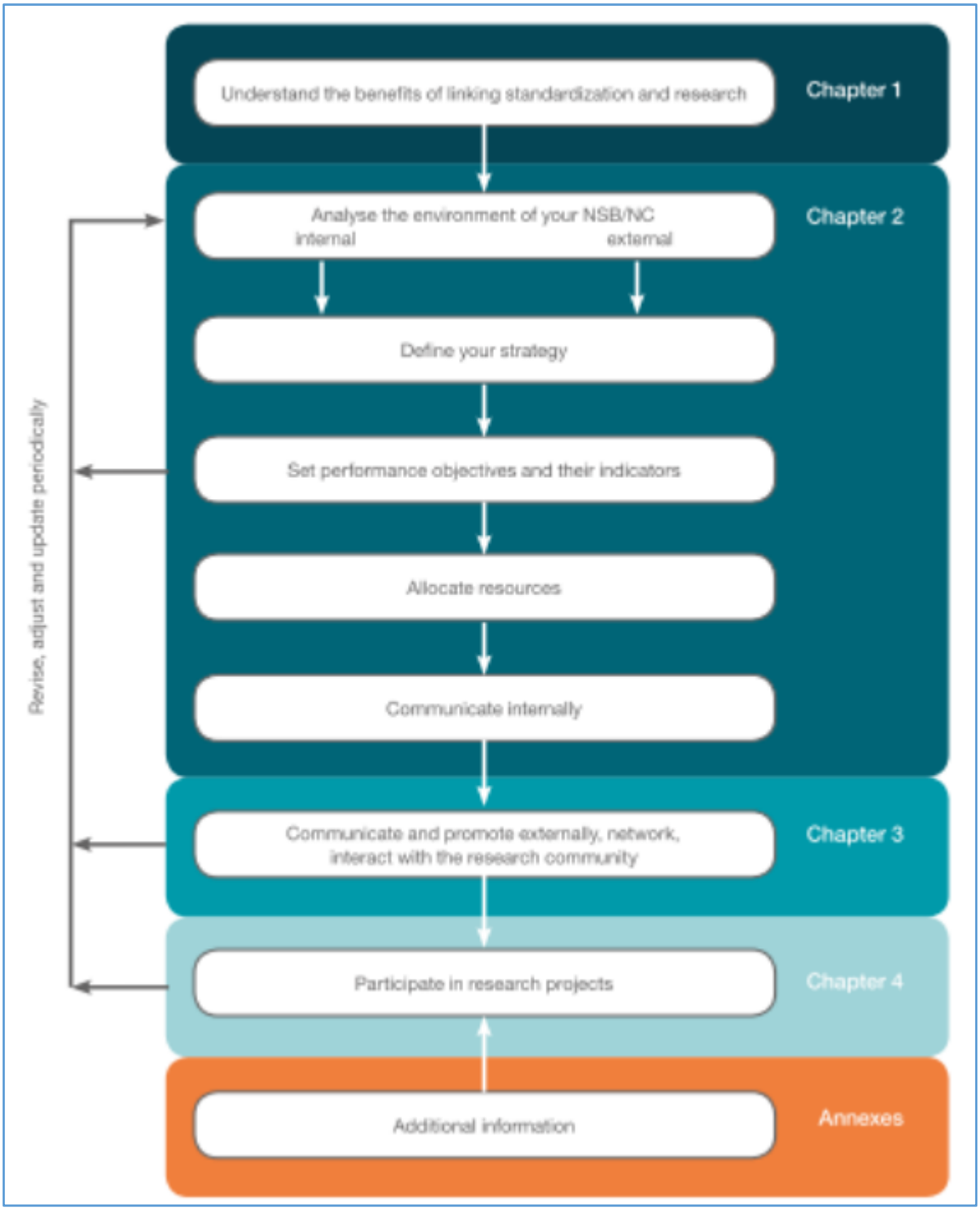

Figure 1: Content of the Report and Interaction between its elements

3.1.3. Target Group

Standards play an important role for every stakeholder in the research community. While there may be significant differences between countries in this respect, it is always important to consider the following groups of stakeholders:

- **Researchers**

These are individuals who perform the research activities. They can be publicly or privately funded and they might work at universities, research institutions or research departments in companies.

- **Policymakers**

These are national, regional or local authorities who have some level of responsibility in the planning, organization or funding of research.

- **National Contact Points (NCPs)**

These are the formally appointed points of connection between the EC and the national project coordinators. There may be one or more Work Package-specific NCPs and those can be part of one or several different organizations depending on the structure of NCPs in your country. They play a strong role as information providers for consortia, proposers, potential participants, etc.

- **Intermediate organizations**

These include sector associations, research platforms, and clusters. Often they facilitate consortia creation and composition as well as idea generation and they are willing to provide information to their members or associates.

As a first step, you should identify these categories of stakeholders in your project to have a target list as a basis for building communication plans to link between research and standardization.

Technical Committees will also be an interested party if researchers are willing to get involved in standardization activities or if a new standardization proposal arises from a research project. It is also smart to do some communication and awareness work with them as well, so they can be more supportive of this kind of activity.

3.1.4. How to Communicate?

- Creating a dedicated webpage
- Distributing brochures and flyers
- Giving presentations at external events
- Providing information to technical committees
- Organizing dedicated events
- Holding face-to-face meetings

3.1.5. Participation in European Research Projects

3.1.5.1. Some advice before you start

Before thinking about participating in research projects, you should consider the following:

- An average of 10 – 12% of all proposals is selected by European Commission for funding.
- The development stage of your proposal will not be funded by the European Commission.
- Your contributions to proposals may be required at short notice.

However, if the proposal is well prepared and well-structured with good project management, your project is more likely to get funded.

You can increase your efficiency in various ways:

- by having a repository of administrative information (e.g. administrative data, a description of your NSB/NC, CVs, a generic description of your potential activities, considerations for budgeting)
- by remaining available until the deadline of the call, because contributions (activities, texts and budgets modifications and adjustments) may be required at any time until then
- by carefully reading the chapters below

3.1.5.2. Participation

NSBs/NCs can participate in Horizon 2020 projects in different ways, depending on the project characteristics or the NSBs'/NCs' own strategies and preferences:

- **Partner**: As a partner you are a regular consortium member. Partners are expected to be active in one or more of the "work packages" (WPs) of the project and to contribute knowledge and expertise; in case of an NSB/NC this could be information on e.g. existing standards and standardization

Being a partner involves reporting, including financial and technical justifications, and voting in project decision-making, in addition to participating in project meetings. The latter provides you with many options

for interacting with the project partners as well as with contacts outside the project with the goal of interesting them in the world of standardization. Partnership also provides full access to information in the project.
As a partner you can also take over one or several of the following roles in the project:

- **Task leader (TL)**: a task leader may be appointed to coordinate a specific task of a WP. His or her responsibilities are similar to those of a WPL (see below). If standardization has been allocated to a WP instead of forming a WP itself, the NSB/NC would be the task leader within the WP handling standardization as a task.
- **Work package leader (WPL)**: a WPL is fully responsible for one or more of the WPs of the project. An NSB will thus usually be responsible for the WP related to standardization activities, if foreseen as such. Being WPL requires some effort, specifically regarding coordination, delegation and organization of work, reporting on progress and results and attendance of meetings at WP and overall project levels.
- **Project coordinator (PC)**: Being coordinator of a project requires a large effort and should be based on a strategic decision of the NSB/NC, e.g. if the project is directly focusing standardization (e.g. a CSA, Coordination and Support Action). Being the project coordinator requires sound management expertise and skills, having sufficient resources allocated to coordination, planning and reporting, and having the overall responsibility for setting up and submitting the proposal and implementing the project, including the financial coordination and reporting, until closure of the project.

- **Subcontractor:** As a subcontractor you are contracted by the coordinator or one of the partners to develop the standardization activities planned for the project. You do not need to justify your expenditures according to the rules for participants, which allows you to request reimbursement of your full costs; you might not be invited to all project meetings and do not have any voting rights. This kind of participation allows less involvement and influence in proposal writing and project implementation. Note: If you wish to take the role of subcontractor, this should be agreed by the project coordinator during the proposal phase so that you can deliver the input needed to accurately describe your role and standardization activities. If you are contracted at a later stage, your range of activities might be very limited due to financial constraints at that time.
- **External advisor**: NSBs/NCs are often contacted by project consortia to provide letters of support at the proposal stage or to participate in advisory boards during the project development. These boards provide support by means of information and advice. They are requested to comment on project deliverables and may need to attend some meetings. No funding is available to cover the work to be done, but travel costs to the meetings are very commonly covered by the project.

3.1.6. Drafting a project proposal

- Consideration
- Presenting your capability of joining a project
- Developing and scheduling your project activities
- Budgeting

3.1.7. Submitting the proposal

Any formal step in proposal preparation (as well as any other step related to a research project under Horizon 2020) is to be done and stored in the Participant Portal.
Registration procedures to gain access are explained in the Horizon 2020 Online Manual (http://ec.europa.eu/research/participants/docs/h2020-funding-guide/index_en.htm) .
All organizations that are planning to participate in Research Framework Programmes need a Participant Identification Code (PIC).
To find out if your organization already has a PIC or still needs to register, see http://ec.europa.eu/research/participants/portal/desktop/en/organisations/register.html .

3.1.8. Agreeing on contractual aspects

Once a proposal has been selected for funding, the EC will set up the overall Grant Agreement (GA) for the funding, while the project partners will negotiate a Consortium Agreement (CA) among themselves. Within the Consortium Agreement you should carefully read the chapters on “Background” (e.g. access to standards vs. access to information on standards) and “Results” (outcomes of the project; i.e. related to standardization deliverables). Regarding the results, the Consortium Agreement will need to include a statement that the copyright of any published standardization deliverable shall remain with the respective standards body

3.1.9. Implementing the Research Project

About eight months after the deadline for the submission of the proposal, the project will start the implementation according to the Description of Action (DoA) if the project has been selected for funding. Any subsequent deviations will need to be negotiated among partners and in some case (e.g. financial issues) with the EC.

The GA defines the reporting periods in which financial and technical reports have to be delivered. It is essential to keep records of all costs and to be able to link them to specific activities. This will allow you to quickly provide a complete justification for your expenditures.

Technical reviews by independent experts can be commissioned by the EC. Project advisers will support the consortium and the project officer of the EC in technical aspects of the project.

The EC can audit any project up to two years after its completion and can return to any given project to assess the sustainability of results in comparison to the planning of the project.

Figure 2 illustrates the overall process from finding a project to the actual start of a project.

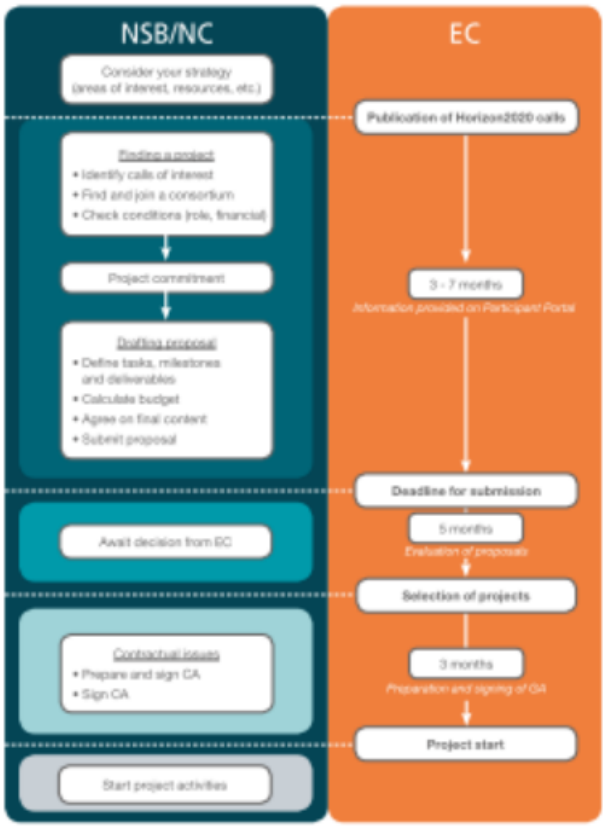

Figure 2: Processes from project initiation to the start of a project

3.2. Horizon 2020

3.2.1. Introduction

Horizon 2020 is the biggest EU research and innovation programme ever. Almost €77 billion of funding is available over seven years (2014 to 2020) – in addition to the private and national public investment that this money will attract.
Horizon 2020 will help to achieve smart, sustainable and inclusive economic growth. The goal is to ensure Europe produces world-class science and technology, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering solutions to big challenges facing our society.
The major content organization is:

- What is Horizon 2020
- Find your area
- How to get founding?
- News, events & Publications
- Projects
- The next Framework Programme

3.2.2. The next Framework Programme

Following the political agreement, the Commission has begun a strategic planning process.
The result of the process will be set out in a multiannual Strategic Plan to prepare the content in the work programmes and calls for proposal for the first 4 years of Horizon Europe.
The strategic planning process will focus in particular on the Global Challenges and European Industrial Competitiveness pillar of Horizon Europe. It will also cover the Widening Participation and Strengthening the European Research Area part of the programme as well as relevant activities in other pillars.

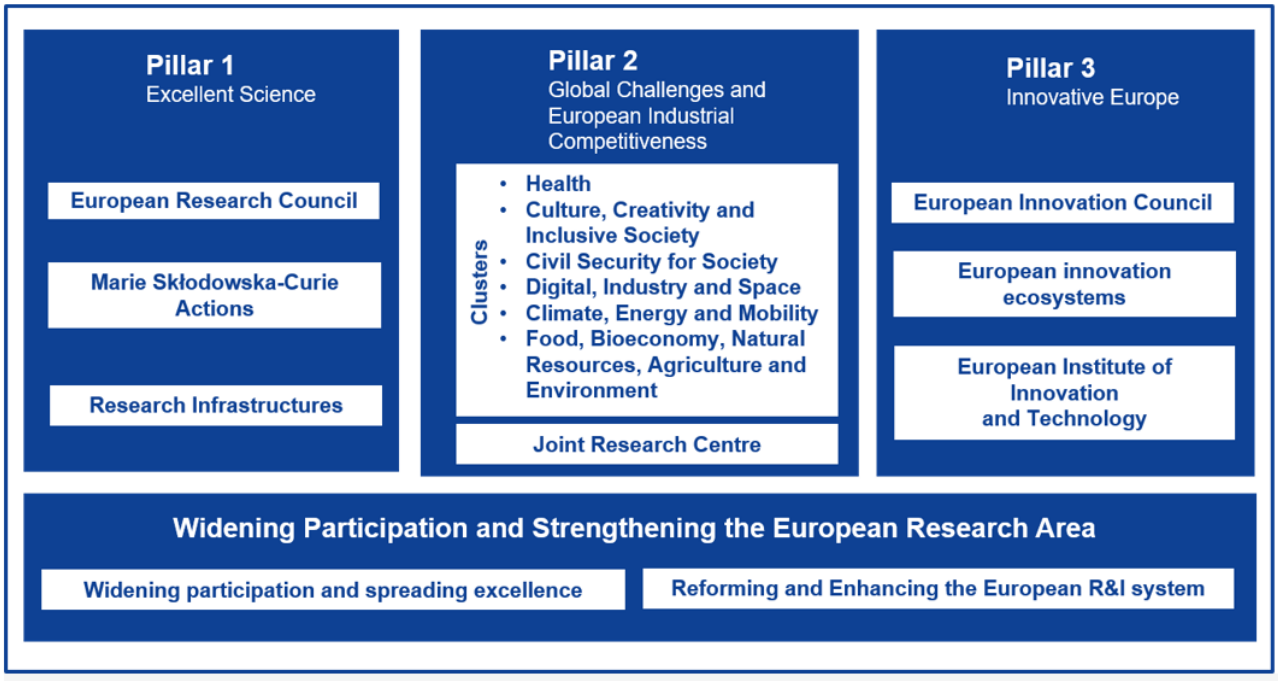

Figure 3: Preliminary structure of Horizon Europe

The process will identify, among other things key areas for research and innovation support and their targeted impact European partnerships missions areas of international cooperation
The strategic planning process includes a co-design process that took place over the summer and autumn 2019 in view of preparing the first Strategic Plan for Horizon Europe.
The views and ideas of more than 7,000 respondents were collected through web-based surveys and close to 4,000 participants engaged in in-depth debates at the European Research and Innovation Days, which took place in Brussels on 24 - 26 September 2019.
The results of the co-design process are summarized in the document Orientations towards the first Strategic Plan for Horizon Europe.

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The results of the co-design process are summarized in the document:
Orientations towards the first Strategic Plan for Horizon Europe .

3.2.3. Missions in Horizon Europe

Horizon Europe will incorporate research and innovation missions to increase the effectiveness of funding by pursuing clearly defined targets.
The Commission has engaged policy experts to develop studies, case studies and reports on how a mission-oriented policy approach will work.
Read more about the Commission's mission-oriented approach and download the studies that shaped it

3.2.4. European partnerships in Horizon Europe

Horizon Europe will support European partnerships with EU countries, the private sector, foundations and other stakeholders. The aim is to deliver on global challenges and industrial modernisation through concerted research and innovation efforts.
The Horizon Europe proposal lays down the conditions and principles for establishing European Partnerships. 3 types are proposed.

3.2.4.1. Co-programmed European Partnerships

Between the Commission and private and/or public partners. Based on memoranda of understanding and/ or contractual arrangements

3.2.4.2. Co-funded European Partnerships using a programme co-fund action

Partnerships involving EU countries, with research funders and other public authorities at the core of the consortium.

3.2.4.3. Institutionalized European Partnerships

These are partnerships where the EU participates in research and innovation funding programmes that are undertaken by a number of EU countries. They are based on article 185 of the Treaty on the Functioning of the European Union (TFEU) which allows the EU to participate in such programmes.
These can also be public-private partnerships established under Article 187 TFEU, such as joint undertakings or EIT Knowledge and Innovation Communities.
These partnerships will only be implemented where other parts of the Horizon Europe programme would not achieve the objectives desired or expected impacts.

3.2.5. Adoption timeline:

- 2 May 2018
  - The Commission adopts its proposal for the next EU long-term budget (MFF)
- 7 June 2018
  - The Commission adopts its proposal for Horizon Europe
- **2019-2020**
  - The Council and European Parliament negotiate and subsequently adopt the programme
- **1 January 2021**
  - Horizon Europe is launched

4. EPERC TG12- Detailed Proposed Working Program

4.1. Project Introduction

The modification interventions require the submission of the equipment to be modified to a conformity assessment procedure in accordance with Directive 97/23 / CE - PED, whatever its original construction code was. This procedure requires the re-assessment of the entire pressure equipment according to the PED.
Main problems are the conformity assessment in the case of ex-service damage and defects, occurred incidents and accidents during previous use of the pressure equipment; the manufacturing code is generally different from the codes for PED. The original manufacturing file can be lost.
The contents of PED Guideline A.03 (1-3) are essential for this scope: *are replacements, repairs or modifications of pressure equipment in use covered by the Pressure Equipment Directive (PED)? Pressure equipment which has been subject to important modifications that change its original characteristics, purpose and/or type after it has been put into service has to be considered as a new product covered by the directive. This has to be assessed on a case by case basis.*
The assessment of the PE status, the history and the documentation analysis are essential steps that must precede the conformity assessment. The conformity assessment procedure should be establish on the basis of the results of the above mentioned steps. None of the existing conformity assessment procedures are suitable for the used PE, manufactured according to the National legislations or according PED.
The new working conditions can be completely different from the previous one, resulting in an increased risk. There is the need to address all kind of hazards, including hazards that where not addressed because they were not required by the original manufacturing code (main reason for which the EC required the PED conformity assessment for modifications).
Before the PED, the manufacturing file, including the certificates and their annexes were provided by official bodies, appointed by the local authorities. Official papers were provided, including all relevant information.
All in-service inspection activities should be collected and delivered to the PED manufacturer for the recertification, including creep and fatigue assessments.
A detailed NDE program should be issued by the manufacturer appointed for the conformity assessment of the used PE, according to the PED. New drawings and calculations should be provided, taking into account the results of the NDE and other relevant issues (residual thickness, etc..). Rules for in series production and conformity assessment should be provided, establishing where the PED quality assurance modules can be appropriate.
Some other issues:

- Material ageing
- Material embrittlement
- Sigma phase precipitates
- High temperature embrittlement
- Welding procedure qualification
- Welders qualification
- PMA
- Pressure test limitations.

4.2. List of Work Packages and Tasks covered in the Project

4.2.1. Work Package 1: Overview of existing International Standards

- Task 1.1: General Introduction
- Task 1.2: Design Rules and historical background
- Task 1.3: Manufacturing
- Task 1.4: Welds
- Task 1.5: Materials

4.2.2. Work Package 2: Gaps and Needs evaluation

- Task 2.1: Design analyses: engineering rules and detailed analysis
- Task 2.2: Material properties
- Task 2.3: Welding qualification

- Task 2.4: Non Destructive Testing
- Task 2.5: Final test and destructive tests

4.2.3. Work Package 3: Overview of National Codes & Standards

- Task 3.1: Design Rules
- Task 3.2: Manufacturing
- Task 3.3: Welds
- Task 3.4: Materials

4.2.4. Work Package 4: R&D Test Program

- Task 4.1: PE qualification
- Task 4.2: PE Tests integration
- Task 4.3: Pre-test analyses
- Task 4.4: Post-test analyses
- Task 4.3: PED loading conditions

4.2.5. Work Package 5: Benchmarks

4.2.6. Work Package 6: Recommended Practices

- Task 5.1: Design Rules
- Task 5.2: Manufacturing
- Task 5.3: Welds
- Task 5.4: Materials
- Task 5.5: Innovative applications and new operating conditions

4.2.7. Work Package 7: Practical Cases

4.2.8. Work Package 8: Project Synthesis and Conclusion

- Knowledge transfer
- Project Synthesis
- Project Conclusion

4.3. Final Reports and Conclusion

Topics to be covered through contribution of different Work Packages:

1. Introduction and Definition
2. Existing Codified Rules
3. Detailed Design Rules
4. Experimental Program: definition, performance, pre- and post-test analyses
5. Benchmarking
6. Code Case Proposal
7. Practical Examples
8. Knowledge Transfer
9. List of Document produced in the Task

4.4. Management, Synthesis and Conclusion of the Project

- Chairman and list of members
- Detailed program of each task
- Periodic updated Planning and Roadmap review
- Report: review by Project members and selected International Key Actors of the domain
- All the documents of each Work Package will be released to: all the sponsors and EPERC TG12 members

5. Detailed Work Package Developments

To be filled up with TG12 members or potential members contributions

5.1. Work Package 1: Overview of existing International Standards

5.2. Work Package 2: Gaps and Needs evaluation

5.3. Work Package 3: Overview of National Codes & Standards

5.4. Work Package 4: R&D Test Program

5.5. Work Package 5: Benchmarks

5.6. Work Package 6: Recommended Practices and Code Cases

5.7. Work Package 7: Practical Examples

5.8. Work Package 8: Knowledge Transfer, Synthesis, Conclusion

6. Deliverables, planning and meetings

All duration, delays, costs… as examples to be discussed with EPERC TG12 and participants to the Project…

6.1. Planning

- project duration: 36 months

6.2. Planned Reports

To be defined later with Chairman and Work Package responsible.

6.3. Project Management

To be defined later with Chairman and Work Package responsible.

7. Preliminary Budget

All duration, delays, costs… as examples to be discussed with EPERC TG12 and participants to the Project…

7.1. Technical Tasks of each Work Package

- Project management:
  - WP 1 5*8 hours = 40 hours
  - WP 2 …
  - WP 3 …
  - WP 4 …
  - WP 5 …
  - WP 6 …
  - WP 7 …
  - WP 8 …
- Technical Reports
  - WP 1 10*8 hours = 80 hours

  - WP 2 …
  - WP 3 …
- WP 4: Experimental Programs
  - Program Definition 20*8 hours = 160 hours
  - Mock-ups and Facility cost xxxx €
  - Program Performance and Results 120*8 hours = 960 hours
  - Pre and Post Test Analyses 20* 8 hours = 160 hours
- WP 5: Benchmarking
  - Definition / Performance / Synthesis 2* 5 * 8 hours= 80 hours
- WP 6: Recommended Practice 10*8 hours = 80 hours
- WP 7: Practical Examples 2* 5 * 8 hours= 80 hours
- WP 8: Project Synthesis and Conclusion 20*8 hours = 160 hours

7.2. Meetings

- 1 meeting every 6 months in different European Countries with EPERC Task Group 12
- 1 final 3 days workshop to present the results (not included in the budget)

- Intermediate meeting with EPERC Task Group 12:	3*2*8 hours	=	24	hours
- 3 Trips and subsistence (based on Receipts)	3*800 €	=	2400	€

7.3. Total Budget for TG12

- later

8. EPERC TG12 Development

- All members or potential members have to review the proposal and send their remarks for improvements to TG12 "preliminary" Chairman (a.tonti@inail.it)
- All members and potential members have to confirm their interest to join EPERC TGX:
  - To review any TG12 documents
  - To develop totally or partially TG12 reports
  - To contribute to pre-test or post-test analyses of R&D program
  - To launch Experimental R&D program
  - To define or contribute to Benchmarks or Practical cases example
  - To contribute to Recommended Practices and Project Synthesis
  - To define the TG12 proposal for EC support

9. References

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