



Guideline
Eligibility Criteria and Procedure for Recognition in
the Specific Area of Practice
**Pressure Equipment Design
Verification**

1. Introduction

This document provides the criteria to be used for assessing applicants seeking to gain certification as pressure equipment design verifiers on the National Professional Engineers Register (NPER) or the National Engineering Technologists Register (NETR). The guideline refers to competencies that are consistent with AS/NZS 4481:1997 “Pressure equipment – Competencies of inspectors” and with other relevant standards that refer to design verification responsibilities. It also sets down a certification system that is consistent with the requirements of EN45013 “General criteria for certification bodies operating certification of personnel”.

Certification as a pressure equipment design verifier requires that applicants:

- have an acceptable qualification and sufficient experience

either to satisfy the Australian Engineering Competency Standards for Professional Engineers at Stage 2 and be registered in a general area of practice on NPER

or to satisfy the Australian Engineering Competency Standards for Engineering Technologists at Stage 2 in the area of pressure equipment design and/or design verification

- practise as a pressure equipment design verifiers as a significant component of their professional employment or practice
- can show they have capability in a satisfactory range of design verification competencies (section 3)

Administration of the registration scheme is the responsibility of the Associate Director Registration, Engineers Australia.

2. Background to Pressure Equipment Design Verification

2.1 Evolution of a Pressure Equipment Design

The pressure equipment design process consists of the following basic steps, defined below for reference:

- A. The designer receives a statement of the design and operating conditions, including a sketch of the approximate final form, the design specification and data sheets giving diameter, number of nozzles, volume and other relevant information. The design process then produces a completed design.
- B. The designer or a colleague checks the design, which involves checking all calculations, eliminating arithmetic errors, checking documentation requirements, and, most importantly, ensuring that the design being manufactured will work in service.
- C. The design verifier, normally independent of the designer, verifies the design. The verifier works within an agreed scope to systematically verify the design, taking into account all matters that are important to safety and ensuring that the designer has not made unsupportable assumptions or applied incorrect logic.

2.2 Scope of Design Verification

Pressure equipment design verification is the process which assures the integrity of the equipment for the stated design and operating conditions. As a minimum, this must ensure compliance with the relevant equipment Standards as well as any additional requirements deemed necessary to ensure the equipment integrity. Design verification is not concerned with functionality but is concerned with the equipment safety.

The design verifier then issues a certificate of design verification which includes a brief description of the equipment, its relevant design and operating conditions, principal design parameters such as maximum pressure and temperature, safe working loads, limiting wind and seismic conditions and the fluid to be contained. The certificate lists the document numbers of calculations, drawings and applicable design code(s), and includes a declaration that the verifier believes the equipment complies with the design specification and standards for the stated conditions, subject to any required modifications or observations.

2.3 Pressure Equipment Design Verifiers

All applicants must show they have practised competently as design verifiers. They must demonstrate competencies consistent with AS/NZS 4481:1997 and other relevant standards. They can claim competency as a design verifier in respect of one or more of the following broad categories of pressure equipment:

- a. Pressure vessels
- b. Boilers
- c. Pressure piping
- d. Gas cylinders

3. Competencies for Pressure Equipment Design Verifiers

All applicants must demonstrate that they possess the required knowledge and have worked competently in all of the mandatory areas and in at least three of the optional areas listed below, selected appropriately for the category of pressure equipment they have ticked on the application form at PE3 (page 5).

MANDATORY AREAS OF COMPETENCE

1. *Legal framework*
Legal liabilities and responsibilities, verification requirements, design verification inspection bodies
2. *Engineers Australia Code of Ethics*
Personal integrity to act ethically, within limits of professional practice
3. *Codes and Standards*
New Zealand and Australian codes (as appropriate), terminology, permissible stress and derivation
4. *Shells, ends and openings*
Membrane stresses (longitudinal and circumferential), internal and external pressures, dished ends, semielliptical, spherical and torispherical ends, openings and reinforcement
5. *Fabrication and welding*
Limits of cold working, welding procedures, weld details, classes of vessel and heat treatment
6. *Material*
Allowable types, properties, design stresses, suitability against various modes of failure (corrosion, creep, fatigue, brittle fracture) and testing (Charpy, tensile, bend and other tests)
7. *Hazards and risk*
Main hazards and hazard levels to AS 4343 including basic risk assessment
8. *Testing and NDE*

Hydrostatic tests, pneumatic tests and their hazards, liquid penetrant methods, radiography, magnetic particle techniques and ultrasonic methods. Calculations must be verified if they are submitted.

9. *Pressure and temperature relief devices*
Suitability and capacity

OPTIONAL AREAS OF COMPETENCE

10. *Boiler headers*
(**mandatory** if you tick Boilers at **PE3**)
Ligament design, tube bundles, constructability
11. *Tubeplates*
TEMA methods, AS 3857 method, tube attachment methods
12. *Flat plates*
Unstayed flat plates - circular and non-circular, stayed flat plates
13. *Threaded and flanged joints*
Standard fittings and flanges, designed flanges - low and high pressure, gasket types, bolt tensioning, sealants
14. *Local loads and supports*
WRC 107 & 297 methods, Zick saddle methods, skirts for tall vessels, local bending stresses, piping loads, stress intensities at openings
15. *Wind, seismic, vibration and shock loads*
Wind loads for tall vessels, seismic loads, impact and shock loads, resonance in vibration loads, hydraulic hammer loads and soil loading
16. *Fatigue design*
Fatigue crack initiation and propagation, fatigue cycle life and Miner's law, statistical analysis of load life times, stress concentration, fatigue performance of joint details, fatigue endurance limit, high temperature creep and stress analysis with time dependent properties
17. *Thermal stresses*
Temperature distribution in boilers and thermal stresses from through-wall temperatures
18. *Piping flexibility*
(**mandatory**, if you tick Pressure Piping at **PE3**)
Flexibility in piping to allow for expansion and/or contraction due to variation in pressure and/or temperature without causing excessive stresses
19. *Fracture mechanics*
Assessment of planar defects stress and property combination, flaws in fusion welded vessels, crack propagation and equipment life expectancy
20. *Vessels with non-circular cross section*

Pressure vessels with rectangular or obround cross section, including openings which extend to more than half the width of the vessel

21. *Transportable vessels*

Transportable pressure vessels permanently mounted on, or forming an integral part of a vehicle tanker, portable vessel or shipping tank container

22. *Design by analysis*

Combination of stresses in vessel and integral parts including definition and differentiation of primary, secondary, and peak stress classification and application

23. *Buried or mounded vessels*

Buried or mounded vessels subjected to soil loads, including support systems and specialised openings and connections, and adequate cathodic protection

24. *Pressure relief devices*

Design and selection of suitable pressure relief systems, including over-temperature relief systems

25. *Special materials*

Use of special materials such as non-metallic materials, glass fibre reinforced plastic, graphite, unreinforced polymers and borosilicate glass with attention to joining requirements.

26. *Pressure equipment research and testing.*

4. The Application and Assessment Process

4.1 Making an application

The following sections indicate the action you must take to register and to gain certification as a pressure equipment design verifier.

You do not need to join the Engineers Australia to register on NPER and NETR.

4.2 Registration in a general area of practice

If you are a Chartered Professional Engineer (CPEng):

- 4.2.1. you must apply for NPER in an appropriate general area of practice using the [Application for Registration on NPER](#) (www.nerb.org.au under the *applying* tab). You must submit a Statement of Experience and evidence of how you have kept up to date in your practice, as explained on the form.

You must also meet the requirements of 4.3.1 to 4.3.6 below.

If you are a Professional Engineer who is not CPEng:

- 4.2.2. If you have a professional engineering qualification but are not a CPEng, you must follow guidelines in the [Chartered Status Applicant's Handbook](#), (www.engineersaustralia.org.au >education >chartered status) (even if you do not intend to join Engineers Australia). You must use the application form in the Handbook to apply for NPER in an appropriate general area of practice such as Mechanical or Structural. [The same process will also allow you to obtain Chartered Membership (CPEng) if you wish.]

You must also meet the requirements of 4.3.1 to 4.3.6 below.

If you are an Engineering Technologist:

- 4.2.3. If you are an engineering technologist with an accredited engineering technologist qualification or recognised equivalent, you must follow guidelines in the [Chartered Status Applicant's Handbook](#), (www.engineersaustralia.org.au >education >chartered status) to register on NETR (even if you do not intend to join Engineers Australia).

You must also meet the requirements of 4.3.1 to 4.3.6 below.

4.3 Registration in the specific area of practice

- 4.3.1. You must provide a statement summarising recent responsibilities for the design verification of pressure equipment. Experience with design of pressure equipment can also be included in your statement and will be taken into account when assessing design verification competencies.
- 4.3.2. Your statement of experience must clearly show that you have the competencies listed in section 3 above and a working knowledge of the practice of design verification, including any requirements for installation, maintenance and inspection and reliability of appropriate pressure relief systems and support structures.
- 4.3.3. You must submit at least one example of design verification from each category of equipment selected from section 2.3 and a total of at least two examples (e.g. two vessels or one vessel and one pipe). Include, for each example, the design verification calculation, the main drawing (A4 or A3 size) and the certificate of design verification provided. Where you have used computer

programs, you must provide the design input, design printout and a summary of the assumptions and limitations of the computer modelling techniques used. Your examples must show a systematic approach to design verification and your capacity to question the material supplied by the designer and to understand what is important to safety.

- 4.3.4. Where new equipment or a new material has been encountered, you must show how additional specialised competencies have been gained to suit the specific case. A Continuing Development (CPD) record sheet should be used to submit records of relevant CPD and is included on the NPER application form.
- 4.3.5. You must have your documents reviewed by an experienced professional engineer and endorsed as being a true representation of your work as a design verifier. Please ask your Referee to complete the statement provided on the NPER application form.
- 4.3.6. Include with your application the names and contact details of three people who can substantiate your involvement in design verification. Your Referee may be one of these.
- 4.3.7. Finally, you must complete and sign an application for certification as a pressure equipment design verifier (attached).

5. Assessment

Your application, Statement of Experience and examples of completed design verifications will be analysed for evidence that you have exercised the competencies of a pressure equipment design verifier. An Assessment Panel will examine the submitted examples and review your statement of experience. Where competency is not evident, your application will be returned to you for further work and substantiation.

If your application is made in accordance with sections 4.2.2 or 4.2.3, the assessment will be based on the Australian Engineering Competency Standards and will normally include a professional interview conducted by an assessment panel having expertise in pressure equipment design verification. At the discretion of the Assessment Panel, interviews may also be conducted if the applicant is already a Chartered Member or registered in a general area of practice.

The interview enables a quality assurance check of the educational and professional experience detailed in your application and may include some technical questions on the examples you submitted.

Your application for recognition in the Pressure Equipment Design Verification specific area of practice, together with appropriate attachments and fees, must be forwarded to: Associate Director Registration, Engineers Australia, 11 National Circuit, Barton ACT 2600

APPLICATION FOR CERTIFICATION AS A PRESSURE EQUIPMENT DESIGN VERIFIER

Applicant's Name Membership/Registration No

If applying for registration in this area on NPER, attach this form to the NPER application form (Section 4.2.1 & 4.2.2).
 If applying for registration in this area on NETR, attach this form to the form in the handbook (see Section 4.2.3).
 All applicants must provide a summary of their Statement of Experience in **PE1** below.

PE1. Demonstrated Responsibility in Pressure Equipment Design Verification

I have provided professional services, independently or under general direction, in pressure equipment design or design verification in the following positions:

.....

[Provide, in your statement of experience, dates and a list of responsibilities accepted and functions performed for these positions]

PE2. Professional Practice in Pressure Equipment Design Verification

My involvement in Pressure Equipment Design Verification has included activities ticked below:

- | | | |
|--|--|--|
| <input type="checkbox"/> Legal framework | <input type="checkbox"/> Code of ethics | <input type="checkbox"/> Codes and standards |
| <input type="checkbox"/> Shells, ends and openings | <input type="checkbox"/> Fabrication and welding | <input type="checkbox"/> Material |
| <input type="checkbox"/> Hazards and risks | <input type="checkbox"/> Testing and NDE | <input type="checkbox"/> Pressure and temperature relief devices |
-
- | | | |
|--|---|--|
| <input type="checkbox"/> Boiler headers | <input type="checkbox"/> Tubeplates | <input type="checkbox"/> Flat plates |
| <input type="checkbox"/> Threaded and flanged joints | <input type="checkbox"/> Local loads and supports | <input type="checkbox"/> Wind/seismic/vibration/shock loads |
| <input type="checkbox"/> Fatigue design | <input type="checkbox"/> Thermal stresses | <input type="checkbox"/> Piping flexibility |
| <input type="checkbox"/> Fracture mechanics | <input type="checkbox"/> Non-circular cross section | <input type="checkbox"/> Transportable vessels |
| <input type="checkbox"/> Design by analysis | <input type="checkbox"/> Buried or mounded vessels | <input type="checkbox"/> Pressure relief devices |
| | <input type="checkbox"/> Special materials | <input type="checkbox"/> Pressure equipment research and testing |

PE3. Indicate the categories of Pressure Equipment (see Section 2.3)

I am applying for certification in the categories indicated (please 3)

<input type="checkbox"/> a. Pressure vessels	<input type="checkbox"/> b. Boilers
<input type="checkbox"/> c. Pressure piping	<input type="checkbox"/> d. Gas cylinders

This summary of my involvement in pressure equipment design verification and the details reported in my statement of experience are correct. Examples of design verifications or published papers, submitted in support of my application, are my own work. While I am registered on NPER or NETR or a member of Engineers Australia, I remain subject to the Engineers Australia Code of Ethics and Disciplinary Regulations in respect of my actions as a design verifier. I agree to offer services as a design verifier only in categories of equipment for which I am approved.

Signed Date/...../.....

