KASA Redberg

Engineers & Technical Trainers

Pressure Vessels & Pressure Piping -

Essential Knowledge for End Users

A practical and interactive 3 day course

Pressure Vessels Essential Knowledge

Introduction

The intent of this course is to provide knowledge to site-based engineers (e.g. Plant Engineers, Maintenance Engineers and Operations Engineers) which is essential for ensuring that pressure vessels and pressure piping systems are safe to operate and maintain (i) on an ongoing basis, or (ii) after modification to the equipment/system itself or the process it is located in.

Upon completion of this course, the attendee should be well placed to liaise with vessel/piping system designers, perform some design work themselves or to determine fundamental "fitness-for-service" and remaining life assessments.

Who Should Attend

Engineers (i) who are required to ensure the safe ongoing operation of pressure vessels and pressure piping, or (ii) are required to design pressure vessels or piping systems to *ASME B31.3, AS 4041* or *AS 1210* as appropriate, or (iii) who have to perform process safety, plant maintenance/reliability engineering or "fitness-for-service" roles. This course is ideally suited to Junior/Graduate Engineers or those new to the field of piping and pressure vessels who have roles in end-user organisations rather than in design consultancies.

Delegate Pre-Requisites

As this course includes numerous calculations, it is recommended that each attendee is degree or diploma qualified in a relevant technical discipline (e.g. mechanical, chemical or structural engineering).

For the maximum benefit to be obtained, it is recommended that each attendee:

- Is familiar with basic hydraulics theory.
- Has had some previous exposure to pressure vessels and piping systems.

Those who have previously attended KASA's "*Liquid Piping Systems Fundamentals*" course should also be well placed to derive maximum benefit from this course.

Overlap With Other KASA Courses

This course is an alternative to completing both of KASA's *Piping Design to AS 4041 & ASME B31.3* and *Pressure Vessel Design to AS 1210* courses (which are primarily for designers rather than end-users).

Course Objectives

The following primary learning objectives have been designed so that each attendee can:

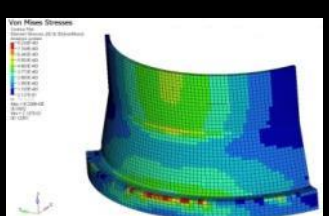
- Determine the pressure vessel registration, inspection and testing requirements that apply in their state/territory upon initial vessel purchase as well as for ongoing operation.
- Determine the hazard level in accordance with *AS 4343* for both pressure piping and pressure vessels so that appropriate design, fabrication and testing methods are applied throughout the asset lifecycle.
- Understand the intent of *AS4041, ASME B31.3* and *AS 1210* and how the design process should proceed so as to ensure compliance with these codes.
- Design (or modify) simple pressure piping installations for compliance with either *AS 4041* or *ASME B31.3*.
- Perform "remaining life" calculations for pressure vessels and pressure piping using the thickness equations located in *AS 1210, AS 4041* or *ASME B31.3* as appropriate.
- Understand piping and pressure vessel failure modes and what inspection and testing methods are appropriate to obtain early warning of impending failure.
- Understand what safety and relief devices are required for pressure vessels and pressure piping and what testing and inspection requirements apply for ongoing operation.
- Appreciate the key in-service inspection requirements detailed in *AS/NZS 3788* and how to comply with these requirements.

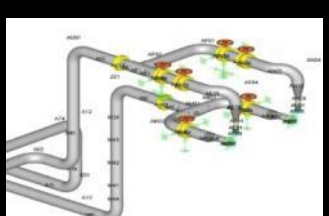
Training Course Materials

All delegates receive:

- **A Detailed Course Manual** – Which provides a reference text of all of the material presented during the course. Note: This manual is written as a textbook which allows it to be more useful as a future design reference.
- **Certificate of Attendance** – Which states the number of hours of training and serves as documentary proof of attendance.

Note: KASA does not supply copies of any standard or code. It is not absolutely necessary to have a copy during the course but attendees may wish bring their own copies of these standards/codes for easy referencing.





and Pressure Piping – for End Users

Course Synopsis

DAY 1

BACKGROUND INFORMATION
- Terms and definitions.
- Stress, strain, allowable stresses and safety factors.
- Principle and secondary stresses.
- Combined bending, torsion and pressure loading.
- Failure theories used in design codes.
- Stresses and deflections due to temperature.
- Cyclic loading and creep.
- Loss of ductility – low temperatures
- Australian (and US) pressure equipment standards
- Hazard levels – *AS 4343*
- Worked example problems.

PRESSURE VESSELS – OWNER OBLIGATIONS
- Theory – pressure, stresses and stored energy
- Design Pressure, MAWP and relief settings
- Bursting discs, safety valves and relief valves
- The law, vessel registration and regulatory requirements
- Inspection and testing – *AS/NZS 3788* overview
- Failure modes and vessel safety

DAY 2

PRESSURE PIPING – *AS 4041* VERSUS *ASME B31.3*
- A "walk through" of *AS 4041 Pressure Piping*
- A "walk through" of *ASME B31.3 Process Piping*

PRESSURE DESIGN AND COMBINED LOADS
- Design temperature, design pressure
- Allowable movements
- Pipe – internal and external pressure
- Design of fittings
- Pipe and vessels – branch connections
- Pipe – Longitudinal stresses
- Pipe – Support spacings

PRESSURE PIPING – THERMAL CYCLING
- Self-limiting and elastic stress
- Allowable stress range for thermal expansion
- Flexibility analysis and flexibility stresses

DAY 3

FABRICATION, INSTALLATION AND TESTING
- Hydrostatic, pneumatic and in-service leak testing
- Non-destructive test methods
- Pipe testing requirements
- Pressure vessel testing requirements

INSPECTION BODIES AND PERSONNEL
- The "competent person"
- Welder and welding inspector qualifications

IN-SERVICE INSPECTION
- Standards and codes: *AS/NZS 3788, API 510, API 570, API 572, API 574*
- *AS/NZS 3788* – detailed inspection requirements
- Risk-based inspection

FITNESS FOR SERVICE
- Defects and potential repair methods
- Wall thickness calculations
- Remaining life assessment
- De-rating and re-rating

SUMMARY AND WRAP-UP
- Summary of key points
- Open discussion – question and answer session



About KASA Redberg

KASA Redberg is a technical training and engineering consulting group.

We have core competencies in pumping systems, piping systems, pipelines, pressure vessels and slurry handling systems. We also act as independent HAZOP workshop facilitators and Safety-in-Design workshop facilitators.

Our portfolio of services includes:

•Tank and vessel design.
•Chemicals plant design.
•Water treatment plant design.
•Pumping and piping systems design.
•Pump station and pipeline design
•Mine dewatering and water supply systems design.
•Pipe stress analysis
•Pipeline hydraulic modelling
•Water hammer analysis
•Slurry piping systems design and slurry pump selection.
•On-site troubleshooting of pumps and piping systems.
•Operator training courses
•HAZOP workshop facilitation
•Safety-in-Design workshop facilitation

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