

Safety Lines

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Pressure Equipment and the Borderless Market

The following article was contributed by Bryn George, Senior Safety Engineer, Occupational Safety and Health Service, Wellington and John Stark, Engineering Consultant, Wellington.

In recent years, changes have taken place which require suppliers and purchasers of pressure equipment to order carefully if the equipment they obtain is to perform and behave in the same manner as that which has been supplied from local sources in the past.

The regulatory authorities are placing the responsibility on purchasers and owners to ensure that pressure equipment remains in a safe operating condition. With the opening up of trade, a product should not be assumed as always being of a certain quality without knowledge of its origins and the standards to which it complies.

Many standards are becoming available which are capable of providing a safe product but, in some cases, the useful life of equipment may be less than expected.

Standards produced by Standards Australia and Standards New Zealand, either separately or jointly, give good guidance on specifications and practices for design, construction, operation and in-service inspection, resulting in products, that with proper care, will give good performance and have a reasonable life.

There are many other overseas codes and standards around that may be satisfactory but are very difficult to

evaluate as they may not all be available in the English language. Suppliers of pressure equipment have responsibilities in this matter and they should ensure that such standards are evaluated and accepted before they are used as the basis for purchase and supply.

Suppliers need to be aware that they are responsible for the equipment they supply. In certain cases if the product proves unsafe in service through unsatisfactory design or construction, purchasers could be instructed to withdraw that equipment from service and the suppliers made, at their expense, to initiate a product recall and remedy deficiencies.

Purchasers need to specify carefully what it is they require in a pressure equipment product. If they are not sure, sound and reliable guidance should be obtained.

The following page contains a list of pressure equipment related standards from AS/NZS 1200 including full title. When using these standards, it is important that they be the latest issue and that all amendments, case studies etc., be available and taken into consideration.

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Primary Applicable Standards (Other Than Australian Standards) Listed in AS/NZS 1200 As Specific New Zealand Requirements

Identifier	Title
BS 806	<i>Design and construction of ferrous piping systems for, and in conjunction with, land boilers.</i>
BS 853	<i>Calorifiers and storage vessels for central heating and hot water supply.</i>
BS 855	<i>Welded steel boilers for central heating and indirect hot water supply (rated output 44 kW to 3 MW).</i>
BS 1113	<i>Design and manufacture of water-tube steam-generating plant (including superheaters, reheaters and steel tube economisers).</i>
BS 2790	<i>Design and manufacture of shell boilers of welded construction.</i>
BS 3970	<i>Sterilising and disinfecting equipment for medical products (Parts 1-6).</i>
BS 5169	<i>Fusion welded air receivers.</i>
BS 5500	<i>Unfired fusion welded pressure vessels.</i>
BS/EN 286	<i>Simple unfired pressure vessels designed to contain air or nitrogen (Parts 1-4).</i>
BS EN 287	<i>Approval tests of welders for fusion welding (Parts 1 and 2).</i>
BS EN 288	<i>Specification and approval of welding procedures for metallic materials (Parts 1-8).</i>
ANSI/ASME, Section I	<i>Power boilers (Approved for water tube boilers only).</i>
ANSI/ASME, Section VIII, Div. 1	<i>Rules for the construction of pressure vessels.</i>
ANSI/ASME, Section VIII, Div. 2	<i>Rules for the construction of pressure vessels - alternative rules.</i>
ANSI/ASME B31.1	<i>Power piping.</i>
ANSI/ASME B31.3	<i>Chemical plant and petroleum refinery piping.</i>

Design Verifier Certification

Continuing our policy of informing readers of individuals who have achieved or extended their certification as a design verifier, Engineering Safety advise that the following person has added pressure piping to their portfolio.

The specific categories* of certification now held and other relevant details are as follows:

Design Verifier	Inspection Body	IPENZ Cert. No	Category	Validity
M W Parsons	SGS New Zealand	1001	Piping Part A	22/12/97-22/12/00
			Unfired pressure vessels	01/08/95-31/07/98

* Refer to *Safety Lines* No. 23 for an explanation of the equipment category.

Air Compressing Plant

The following article was contributed by an equipment inspector concerned about the general standard of housekeeping and maintenance of air compressing equipment and, in particular, air receivers. In addition to the inspector's comments noted below, data on the design, operation and maintenance of air compressing systems is available from equipment suppliers. Contact Engineering Safety for more information. *Ed.*

The potentially hazardous situations that have been noted during inspection work, the problems that can arise from these hazards, and the steps that can be taken to improve safety are summarised below.

- The storage of material around air receivers.
The equipment may be hidden from inspection. Any deterioration in its condition or other unsatisfactory development could go unnoticed. Barriers should be placed around equipment so that it is always readily accessible for inspection and maintenance. Better still, locate air-compressing plant in its own secure area.
- Contamination of safety relief valves with materials such as wood shavings, sand, etc.
The safety valve may not operate causing over pressure of the air-compressing system. The environment around the air-compressing plant must be kept clean and regular inspections of the system, including safety valves, carried out.
- External corrosion of receiver.
This may cause pitting and a general reduction in shell thickness. This will result in downrating of pressure capacity and eventual withdrawal of the receiver from service. Protective surface coatings must be regularly inspected and maintained.
- Unsatisfactory support, guiding and anchoring of compressed air piping.
This can cause piping systems to fail as a result of over stress from displacement forces due to expansion, contraction and seismic disturbance. Excessive vibration may result in fatigue and/or gasket failure. Supports, guides and anchors should be properly designed. They should be regularly

inspected and maintained to ensure that all parts are secure and in good order.

- Excessive oil carry over to the receiver from the compressor.
This can result in sludge buildup in the receiver, fouling of air traps and spontaneous fires. Oil carryover should be minimised through proper maintenance of air-compressing plant. Where excessive oil carryover is unavoidable the drainage system should be designed accordingly and air traps regularly cleaned.
 - Accumulation of water in the receiver.
This can result in excessive stopping and starting of the compressor; reduced capacity of the air compressing system; internal corrosion of the receiver and carryover of water to the downstream process. Any intercoolers or aftercoolers fitted to a compressor should be regularly inspected and kept in good operating condition. Automatic air traps fitted to air receivers should be maintained in good operating condition or, where there is no automatic trap, the air receiver should be manually drained at regular intervals.
 - Horizontal receiver mounted with gradient falling from drain point.
This will cause drainage problems for the receiver. This may cause internal corrosion leading to a reduction in shell thickness, a downgrade in pressure capacity and eventual withdrawal from service. Ensure air receivers are mounted so that internal surfaces will freely drain and water will not accumulate.
 - Lack of monitoring for internal corrosion of receivers.
Internal corrosion may occur with the consequences noted above. Suitable provision should be made for inspection and cleaning of internal surfaces of air receivers. Regular inspections of internal surfaces must be carried out.
 - Unsatisfactory maintenance of air receivers.
This may result in flooding, sludge build up and corrosion of air receivers with the consequences noted above.
- In conclusion, looking after air compressing plant through regular inspection and maintenance will optimise plant performance and improve safety.

Safety Lines welcomes readers' contributions. If you have any matters, coming within the scope of the pending Pressure Equipment, Cranes and Passenger Ropeways Regulations, which you think should be publicised, please contact Engineering Safety. *Ed.*

Trainee Equipment Inspectors

Engineering Safety has been asked to comment on the training and supervision of trainee inspectors and the level of qualification required to carry out inspection tasks.

The following principles are pertinent to inspector training and are in keeping with the provisions of the draft Pressure Equipment Cranes and Passenger Ropeways Regulations.

- An inspection body should only appoint persons as trainee equipment inspectors who satisfy the prerequisite training and qualification criteria for the relevant CBIP certification.
- An inspection body must maintain, under its quality management system, training procedures and records for its equipment inspectors.
- Trainee inspectors must work under the supervision of an inspector who has the qualifications, skills and experience appropriate for this role.
- Trainee inspectors must undertake study for the CBIP qualification relevant to any 'hands on' training being received. They must qualify within a reasonable period from commencement of training and cannot indefinitely retain training status for any category of equipment.
- Trainee equipment inspectors may only inspect equipment for which they have been adequately trained.
- Trainees may only undertake inspection work in accordance with technical procedures issued under an inspection bodies quality management system.
- Training procedures and records will be audited during accreditation and surveillance audits.

The practical application of these principles requires inspection bodies, inspectors and trainees to comply with the requirements outlined below.

Training Modules

Inspection bodies must maintain appropriate training modules, under their quality management system, for each category of equipment for which training is provided. These modules should each cover a discrete element of 'hands on' training relevant to a category of equipment for which training is provided.

Training Records

Inspection bodies must maintain training records, under their quality management system, for all equipment inspectors and trainees. These must cover all categories of equipment coming within the scope of the PECPR regulations and the inspection bodies accreditation.

Each training module and a training record for a particular category of equipment with which the trainee has been involved, must be signed off by the trainee and the supervising inspector, once training has been satisfactorily completed. The trainee is to sign off the training record as having received the training. The supervisor is to sign off the training record as confirmation that training has been delivered and that the trainee is competent to inspect the equipment described in the training record.

Until a training record has been signed off by both parties, the trainee shall not perform inspection of that particular category of equipment, except in the company of the supervising inspector.

Report Preparation and Certificates of Inspection

Once 'hands on' training, in accordance with the documented training procedure, has been completed and signed off for a particular category of equipment, the trainee may inspect such equipment unaccompanied by the supervising inspector. The trainee may then prepare inspection reports which must be submitted to the supervising inspector for approval. Following approval of an inspection report, the supervising inspector may recommend to the inspection body the issue of any relevant certificates of inspection, non-conformance reports etc.



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Trainee Equipment Inspectors

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Supervising Equipment Inspector

The inspector responsible for supervising a trainee must have appropriate skills and experience and:

1. For pressure equipment, hold CBIP level 2/level 3 qualification and,
2. For cranes and passenger ropeways hold the appropriate category of CBIP qualification.

CBIP Certification

Trainee equipment inspectors must, in parallel with 'hands on' training, be undertaking study leading to a relevant CBIP qualification(s). The onus is on the trainee to make appropriate arrangements for study in accordance with the CBIP syllabus.

A trainee would be expected to qualify within two years of commencing 'hands on' training. If this is not achieved then the trainee's position should be reviewed by the inspection body. A trainee equipment inspector cannot be indefinitely employed on duties for which they do not hold appropriate CBIP certification.

Equipment Inspection

For pressure equipment, the inspection work that an inspector or trainee may perform is dependent on training, qualifications and the equipment hazard level (Determined in accordance with AS 3920.1).

For inspectors (and trainees) who have completed relevant training, the relationship between hazard level

of equipment and the inspection work they may undertake, is as follows:

- | | |
|-----------------|--|
| Hazard level A. | Level 2/level 3 qualification. |
| Hazard level B. | Level 2/level 3 qualification or, level 1 (or CWI for pipework) qualification, provided relevant 'hands on' training completed.* |
| Hazard level C. | Level 1 or level 2/level 3 qualification or CWI, provided relevant 'hands on' training completed.* |

* The supervising inspector is responsible for approving inspection reports and recommending issue of certificates of inspection and non-conformance reports.

For cranes and passenger ropeways the inspection work that an inspector or trainee may perform is dependent on experience, training and qualifications.

Inspectors who have completed relevant training may inspect passenger ropeways and cranes of any category provided they hold the appropriate CBIP qualification.

Trainee equipment inspectors may inspect cranes and passenger ropeways of any category for which they have completed training. When assigning work to a trainee equipment inspector the supervising inspector must, because of the diversity of passenger ropeways and cranes within any particular category, consider whether the training given has been adequate.

It is the supervising inspector's responsibility to ensure that the training a trainee has completed is appropriate for the capacity and constructional/structural design of the equipment the trainee is to inspect.

Fabrication Hold Points and Equipment Inspection

Engineering Safety reminds readers that fabrication work coming within the scope of the draft Pressure Equipment, Cranes and Passenger Ropeways Regulations will normally require inspection and testing at various hold points during manufacture.

The participation of the equipment inspector at most of these hold points is mandatory.

These hold points on larger jobs should normally be specified by the designer on an inspection and test plan. However, on smaller jobs, inspection and test requirements may be agreed between the inspection body and the fabricator. In both cases the fabricator must consult their inspection body, prior to commencing manufacture, and obtain agreement on those points at which attendance of the equipment inspector is required.

The following is an extract from BS 5500 which describes the stages at which participation of the equipment inspector is mandatory. This is also typical of the requirements of other manufacturing codes used for pressure equipment manufacture in New Zealand:

Inspection Stage	Remarks
Correlation of material certificates with materials and check for conformity with material specification.	The manufacturer is required to make the certificates available to the Inspecting Authority for independent checking.
Identification of material and witnessing of transfer of identification marks in manufacturer's works.	Origin of material to be demonstrated from available records to the satisfaction of the Inspecting Authority. Any transfer of identification marks to be witnessed by the manufacturer's inspection department. *
Examination of material cut edges and heat-affected zones	The Inspecting Authority is required to carry out this examination in the case of all category 3 components.
Approval of weld procedures.	The Inspecting Authority is required to witness tests unless the procedures are already approved.
Approval of welders and operators	The Inspecting Authority is required to witness tests unless the welders and operators are already approved.
Examination of setup of seams for welding including dimensional check, examination of weld preparations, tack welds, etc.	The Inspecting Authority is required to carry out an independent examination in the case of all category 3 components.
Inspection of second side of weld preparations after first side is completed and root cleaned.	The Inspecting Authority is required to carry out an independent examination in the case of all category 3 components.
Examine non-destructive test reports and check compliance with agreed procedure and acceptability of any defects.	The manufacturer is required to make the reports available to the Inspecting Authority for independent checking.
Examine heat treatment records and check compliance with agreed procedure.	The manufacturer is required to make the reports available to the Inspecting Authority for independent checking.
Witness the pressure test and, where necessary, record the amount of permanent set.	On all categories.
Examine the completed vessel before despatch. Check marking.	On all categories.

* In New Zealand, the inspection department must operate under a recognised ISO 9000 QMS and must employ inspectors holding CWI qualification, otherwise this function must be performed by an inspection body.

In addition to the above 'hold points', inspection bodies may also participate in inspection and testing at other points in the manufacturing process. These include:

- Visual examination of material for flaws, laminations, etc.
- Thickness checking
- Witnessing of production weld tests
- Examination of welded joints after forming
- Examination of plates after forming

The inspector may also participate in any other inspection at the purchaser's request and by arrangement with the other parties concerned.

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