



## Ammonia Piping Stress Analysis.

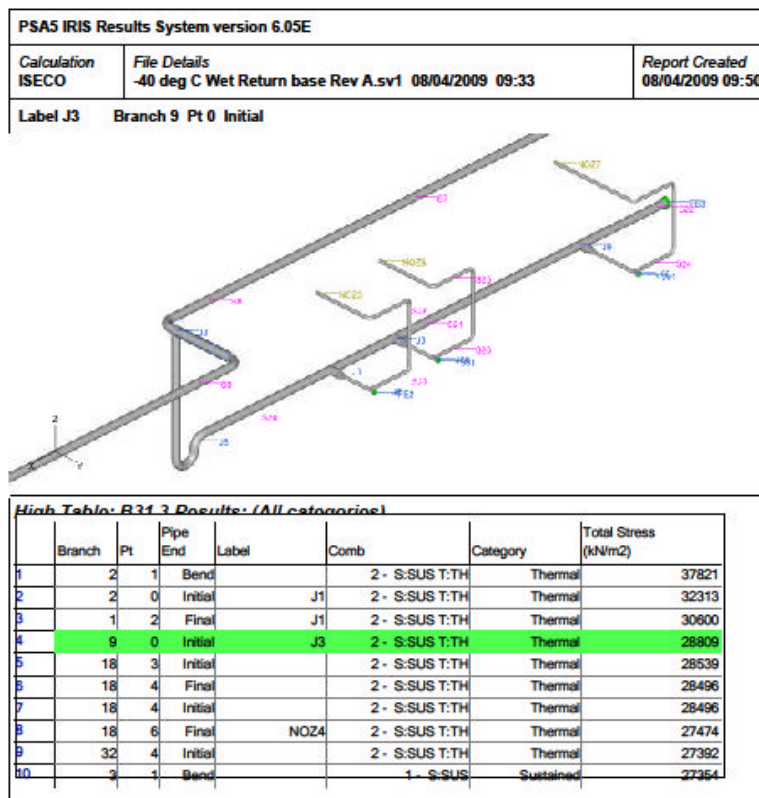
The following page sets out the compliance requirements for ammonia refrigeration piping installations.

This basically states that any ammonia refrigeration piping installation to be in compliance with the relevant standards, has to have pipe stress calculations carried out to certify the pipe grade and materials used are suitable for the service duty. The code also calls up that the piping system installation be to a designated class, this class designation nominates the welding, testing procedures and the supervision process.

For some time now ISECO has been carrying out independent piping stress analysis calculations nominating the piping class and issuing compliance reports including recommendations as may be necessary for compliance.

The programme used to carry out the stress calculations is PSA-5 this complies with ASME B31.3 Chemical piping and in turn ASME B31.5 Refrigeration piping both codes calling up identical rules for flexibility analysis.

As we have full user licence status this permits us to use the latest PSA-5 programme without restrictions, having this available we are able to extend the modelling process to provide our customers with complete and more cost effective solutions.





**REQUIREMENTS FOR AMMONIA PIPING DESIGN  
TO  
AS/NZS 1677.2:1998 Refrigerating Systems**

**ISECO Consulting Services Interpretation**

- AS 1677.2:1998 clause 3.6.1 states that piping and fittings shall comply with AS/NZS 1200. This also notes that AS/NZS 1200 references AS 4041 and also states other standards for piping. ASME B31.5 would be acceptable under the alternative provisions of AS/NZS 1200.
- AS/NZS 1200 "Pressure Equipment" is called up under Australian and New Zealand Legislation this in turn references AS 4041 "Pressure Piping" as well as many other Materials and Components standards and other design, fabrication, testing, inspection and assurance standards.
- It is our view this chain of references and standards make it mandatory that all ammonia systems piping design comply with AS 4041 – 1998 Pressure Piping.
- Sections of AS 4041 –1998 nominate the following with respect to design requirements: -
  - 1.1 (viii) Low temperature and refrigeration piping within the scope of AS 1677
  - 1.6 (c) Alternative Standard Piping for refrigeration plant ANSI/ASME B31.5
  - 3.27 Flexibility, Stress Analysis and Support Design.
  - 3.2.7.1 General, piping shall be installed in a way to, absorb thermal expansion, wind loading, dead weight, seismic effects and material stress limitations.
  - R8 Requirement for Flexibility Analysis, A flexibility analysis shall be made where the designer has doubt regarding the ability of the system to comply with the design. Where interpretation of a simplified analysis indicates that any of the effects listed in the design requirement may occur, a comprehensive analysis shall be made. Piping in low temperature service shall be subject to a flexibility analysis.

Based on this assessment listing the key points from the respective standards it is our view, that all ammonia refrigeration piping systems shall be subject to a flexibility analysis in order to determine the pipe grade used, class of piping installation and requirements for welding and testing so that the installation is in compliance with the relevant standards.

At ISECO we have developed a procedure for carrying out this process. From experience to date we have found the costs for compliance has often been off set by the savings in materials costs as in many cases the piping grade selected as suitable for the particular installation has been less expensive than the higher grades sometimes used.

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