SANT'AMBROGIO Newsletter – July 2008

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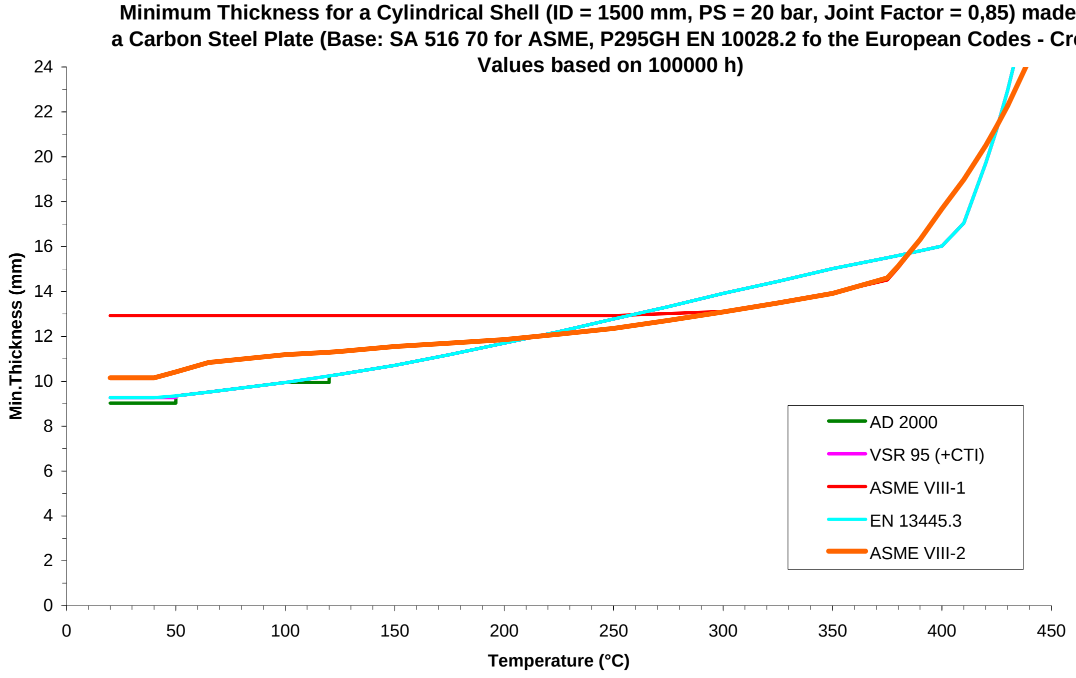
The new edition of ASME Section VIII Division 2

In the month of July 2007 **the new edition 2007 of the American Pressure Vessel Code ASME Section VIII, Division 2** has finally been published. This brand new Unfired Pressure Vessel Code contains a lot of innovation in respect of the previous 2004 edition. **The allowable stresses of Carbon and Low Alloy steels** have been completely revised: for Carbon and Low Alloy Steel materials other than bolting, at temperatures below the creep range, the allowable stresses **are now based on the nominal design stresses given by the EC Pressure Equipment Directive and by its harmonised Unfired Pressure Vessel Standard EN 13445.3**: the **safety factor on the tensile strength has in fact been lowered from 3 to 2,4**, thus following the trend started some years ago with Division 1 of the same Section VIII, when the safety factor on the tensile strength had been lowered from 4 to 3,5. By the way, it has to be noted that to keep high safety factors on the tensile strength at room temperature, while considering a value of 1,5 on the yield strength at the design temperature, means to get the same thickness at 20°C and at 250°C (look at the consequences

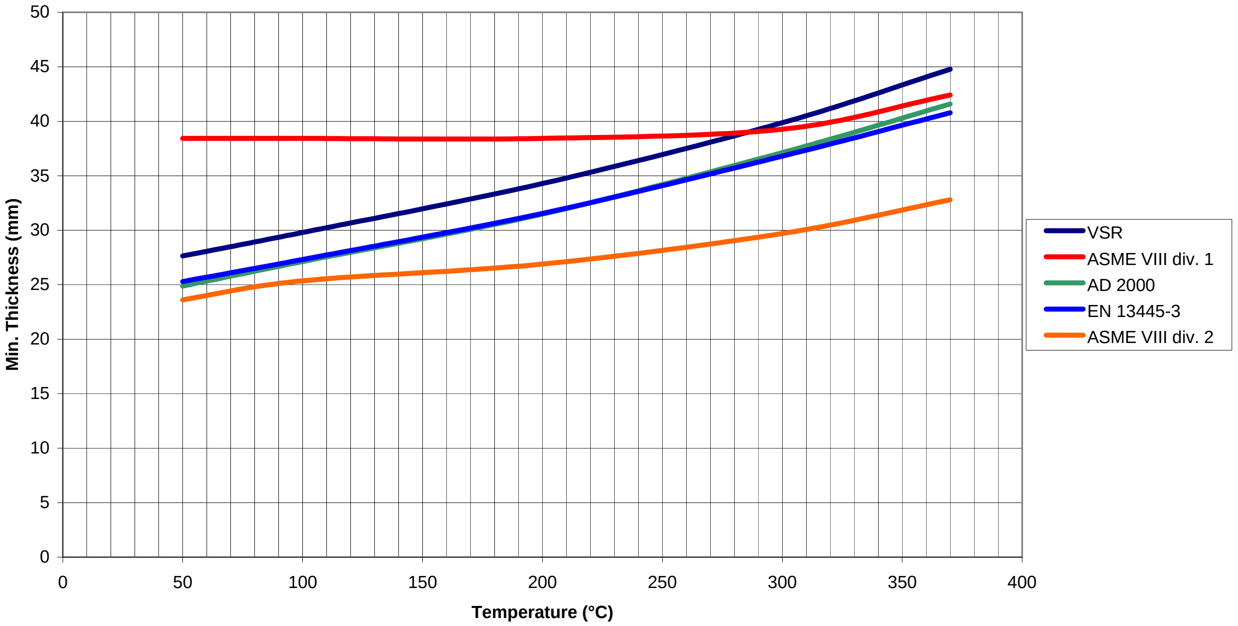


In the graph, which shows the minimum required thickness of a cylindrical shell at different temperatures using different pressure vessel codes). It has also to be noted that **the new Division 2 can now be used also in the creep range** (the creep values are the same of Division 1).

The new formulae for **Shells, Domed Ends and Cones under internal pressure** include now also the case of **thick walls**. The figure of next page shows the comparison among the minimum required thicknesses given by the same pressure vessel codes of the preceding example for another design case. This time a typical torispherical end (2:1) has been considered (however at temperatures below the creep range): note that **the two divisions of Section VIII place themselves at the lower and upper borders of the graphs, with Division 1 giving the higher**

thicknesses and Division 2 giving the lower ones. In this case the problem is not only the allowable stress of the material, but **the different consideration given by the different standards to the high compressive stresses which exist in the knuckle region of the domed ends**.

Minimum thickness of a Torispherical Head with ID = 2000 mm, R=0.8 ID, r=0.154 ID, PS=50 bar, material CS (SA 516 70 for ASME, P295GH for the European codes)



A **new method for opening reinforcement** has also been developed: this method is similar to the **area replacement method** used by many European standards, such as **EN 13445, CODAP 2000, AD 2000, VSR**, etc. However it has the advantage of giving in any case a calculated local stress due to pressure, to be algebraically added to the stresses caused by local loads on nozzles, calculated with the well known **WRC method (Welding Research Council Bulletins 107 e 297)**: an explicit reference to WRC has now been made in the Code. This seems to be a quite reasonable solution to the problem of calculating the stresses due to combined loading in nozzles (pressure plus local loads), which up to now was one of the main problems in the use of WRC.

There is also **a new method for the calculation of local stresses at cone-to-cylinder junctions** (based on **Code Case 2286-1**). The method seems to be overconservative, much more conservative than the method of Section VIII Division 1. It is possible that there was some misinterpretation about the allowable compressive stresses given by this method: we hope that the 2008 Addenda will modify this point.

For **Heat Exchanger Tubesheets** (previously considered only in Design by Analysis) the method has been taken from Division1 of the same Section VIII.

Nothing new for **Flat Covers** (same rules as in Division 1) and **Flanges**, which are **still calculated using the old Taylor Forge method** (the same method of Division 1, PD 5500, CODAP 2000, VSR and even of Clause 11 of EN 13445.3, although this standard contains a more advanced alternative method).

But the most innovative subject of the new standard is the **Design by Analysis (DBA)**, which is now contained in **a specific part (5)** and not in an Appendix. The meaning is that **DBA has to be regarded as a normal design procedure**, not as an exception: in fact it is stated that DBA is an alternative to DBF, and therefore, **when a DBA has been preformed, there is no need to perform also DBF calculations**, as it was provided by the previous edition of the standard. Moreover, there are now three different methods for DBA: the classic method based on an **Elastic Analysis** followed by an evaluation of stresses made through their **categorization** (primary membrane, primary bending, primary local, secondary, etc.) has now been supplemented by a second method based on a **Limit Analysis** and by a third method based on an **Elastic-plastic Analysis**. New is also the **Fatigue Analysis**, where some ideas have been taken from the European standards, particularly the idea of making a **difference between the fatigue evaluation in welded components and unwelded components**: in the first case only the **structural stresses** are relevant (that is, the stresses calculated without considering the stress concentrations), while in the second one the **total stresses** have to be considered. Of course the fatigue curves used for the evaluation of the number of cycles are different in the two cases.

The **Hydrostatic Test Pressure** is now **very similar to the one provided by the Pressure Equipment Directive** (the only difference is that in the Directive the test pressure is based on the **Design Pressure PS**, while in the new standard it is based on the **Maximum Allowable Working Pressure)**

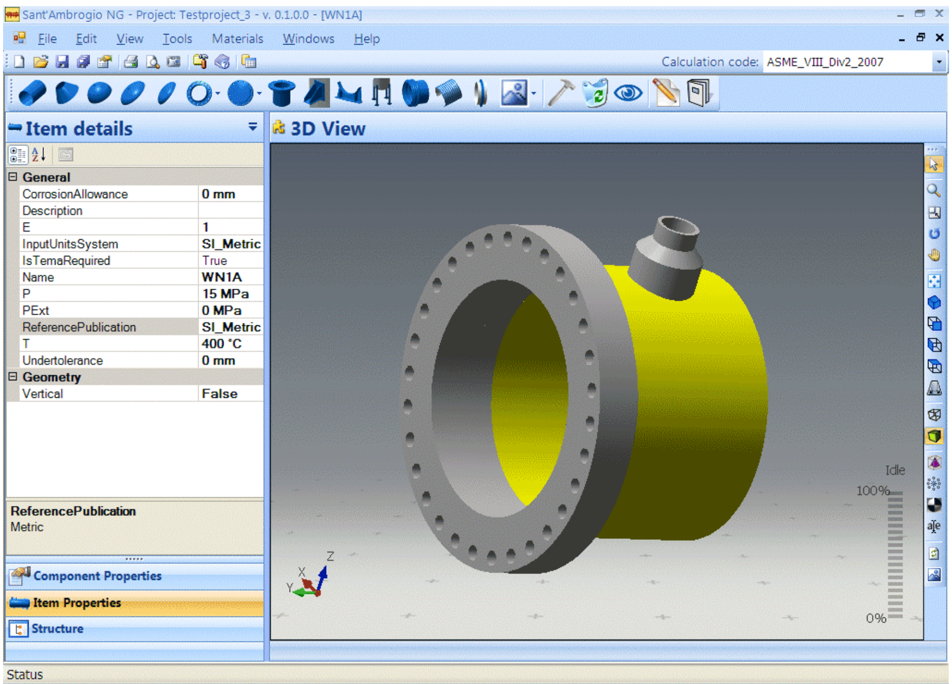
Due to the **great amount of innovation contained in this new Division 2** (to be used only for very special and technologically advanced vessels as an alternative to the more traditional and conservative Division 1 of the same Section VIII), a **specific ASME case has been approved in order to extend by 18 months the use of the previous edition** of the standard: in other words, the coming into force of the new Division 2 will take place 12 months after the issue of the 2008 Addenda, where probably most of the identified mistakes contained in the first edition will have been corrected.

Nevertheless, one must recognize that with the new Division 2 **the Americans have made a very big step forward into the direction already indicated by the European Harmonised Pressure Vessel Standard EN 13445**.

Fernando Lidonnici

What's being cooked up?

The new software (called **"Next Generation"**) according to the **2007 Edition of ASME Section**



VIII Division 2 is now being distributed among the licensees of the previous Edition. **The new software shares with the new standard the same degree of innovation**. First of all, the new **graphical interface**, which allows the complete graphical construction of the pressure vessel to be designed. Secondly, the **new material data base,** which now contains **all the ASME ferrous and non ferrous materials** considered in Section II, part D of the Code; then all the other data bases (**standard pipes**, **standard flanges**, **gaskets**, etc.) which are needed for the design have been included into the software. Finally, a **complete report**, containing **all the main formulae** used for calculation, which can be printed or stored as a .pdf file. All calculations are automatically made for the **design** and for the **test condition** (a **hydrostatic test** or a **pneumatic test**, or **both of them,** may be selected). The **Maximum Allowable Working Pressure** is automatically calculated for all components either in corroded conditions at the design temperature, or in uncorroded conditions at room temperature. The test pressure is also automatically calculated, taking into account all the components of the vessel with their materials and calculation temperatures.

For the time being, the Pressure Vessel module is ready, while we expect to complete also the Heat Exchanger module for the end of the year.

The **graphical interface** developed for this new software will later be used also for all the other software packages supplied by Sant'Ambrogio.

Our software in accordance with **Section VIII Division 1** has recently been updated with the **automatic calculation of the Minimum Design Metal Temperature**. We are now working to a further issue of this software, which will provide also an assessment of the vessel for testing conditions. Note that in Division 1 there are no indications about the allowable stresses to be used for testing conditions: there is however a general rule, considering the **"basis for calculated test pressure"** as the design pressure which, if applied at room temperature in uncorroded conditions, would justify a test pressure 1,3 times higher than the basis (differences in static heads in design and test conditions are to be properly considered). Using this rule it is possible to reduce a calculation for testing condition to a calculation for design condition.

EN 13445 is now arrived at its **31st issue**: a **totally new edition of this standard is expected for the end of the year**. We have now updated the software up to the 30th issue: the **rules for Creep** have been included, the new **Annex GA** (a further development of the alternative method for Flanges contained in Annex G) is also available. Note that **Annex GA is an informative Annex**, but can be used in all cases where the **risk of leaks with gaseous fluids** is particularly high. In fact Annex GA should have replaced the existing Annex G: for many reasons (some of them technical, some others of merely political nature) it was decided to publish it as a further alternative to the main rules of Clause 11 (which is still the old Taylor Forge method). **We are ready to support all our licensees that need help on the choice of the best method to be used for Flange Design** according to EN 13445.3.

We welcome our new licensees:

ARCOMSPA Sas – Gessate (Milano) - **ITALY**
ATHANASIOS KOYTSOYKOS Process Chemical Unit – Volos - **GREECE**
ATLAS COPCO AIRPOWER – Wilrijk - **BELGIUM**
COLOMBI Carpenterie – Ospitaletto (Brescia) - **ITALY**
Components Stability Assessment Srl – Milano - **ITALY**
DBF Srl – Melito di Napoli (Napoli) - **ITALY**
DORA ACCIAI sas – Serravalle (Ferrara) - **ITALY**
FASTECH Srl - Seregno (Milano) - **ITALY**
FILTREC SpA – Cazzago S.Martino (Brescia) - **ITALY**
FRASSI & DE FERRARI – Sant'Olcese (Genova) - **ITALY**

GLATT-PHARMA – Hradec Kralové - **CZECH REPUBLIC**
HYDROFIN Srl – Soresina (Cremona) - **ITALY**
IDROCONSULTING Srl – Gessate (Milano) - **ITALY**
IMA SPA – Castenaso (Bologna) - **ITALY**
Impresa OSSOLANA SRL – Verbania Fondotoce (Verbania) - **ITALY**
IPIP S.A. - Ploiesti - **ROMANIA**
ISG SPA – Baranzate (Milano) - **ITALY**
K 10 – Gratot - **FRANCE**
LED ITALIA Srl – Zoppola (Pordenone) - **ITALY**
MORA Group Srl - S.Maria Maddalena (Rovigo) - **ITALY**
POLARTEST OY – Vantaa - **FINLAND**
POZZI LEOPOLDO SpA – Carate Brianza (Milano) - **ITALY**
REMOIN Srl – Artena (Roma) - **ITALY**
RTM BREDA Srl – Cormano (Milano) - **ITALY**
SA Srl – Saponara M. (Messina) - **ITALY**
SEA CZ – Kolin - **CZECH REPUBLIC**
SGS Shangai - **CHINA**
TAIM SRL - Atessa (Chieti) - **ITALY**
TECNIMONT Brindisi - **ITALY**
TEMA SISTEMI SpA – Taranto - **ITALY**
TÜV Rheinland Italia Srl - Medolago (Bergamo) - **ITALY**
VELO SPA – Altivole (Treviso) - **ITALY**
VUT UNIVERSITY - Brno - **CZECH REPUBLIC**

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