SANT'AMBROGIO NEWSLETTERS 1999-2015
Foreword

In this document I have collected all the articles published in our European newsletters in the years starting from 1999 up to 2015. I decided to make them downloadable from our web site because many European friends have asked me for them, and also because they are referred to a period of time in which the Pressure Equipment Directive and the relevant harmonized standards were coming into force, and therefore they might have a historical value for our profession. I apologize albeit late) if in any of those articles I found myself criticizing some national or European authority. The present legislative situation, although more stable than in those years, is still evolving: therefore in the future I will try to keep all the interested people up to date, by means of the technical articles that you will find in our web site under the heading "Editorials"

F. Lidonnici

SANT'AMBROGIO Newsletter - June 1999

The new European Directive 97/23 "Pressure Equipment" (PED)

Since years this subject has been dealt with in conferences, papers and meetings: however, in spite of the fact that this directive is now expected to come into force for November 29th, 1999, there is still somebody who knows very little (better to say: nothing!) about it. Very often in fact some of our licensees is asking us questions like: "What will be changed in the new rules? Are you preparing new computer programs for calculations in accordance with the Directive? And what will happen with the existing codes like AD Merkblätter, BS 5500, CODAP, Stoomwezen and VSR?". I think that some clarifications are necessary to properly answer all these questions; however one thing is absolutely true: in our small word, made up of shells, heads, nozzles, flanges and tubesheets, very shortly everything will change.

First: to which products does the PED apply? Answer: to any mechanical system where the "pressure" risk is deciding: therefore the PED will apply not only to pressure vessels and steam generators, and not only to systems containing vapours, gases or superheated liquids (like it is now provided in the majority of the national legislations); it will apply to any pressure containing or pressure controlling equipment or device, including vessels or piping containing liquids (even if not superheated). Simple Pressure Vessels (air tanks and receivers already covered by Directive 87/404) are however excluded; also excluded are transportable pressure vessels, machines, and those piping systems which are located outside industrial plants. In spite of these exclusions, it is clear that a lot of products for which previously nothing was provided in the national legislations are now subject to the legal requirements of the PED (for example pressure cookers, oleopneumatic systems, piping, valves, pressure measuring and pressure controlling devices); the minimum pressure limit of 0,5 bar already provided by the old "Framework Directive" 76/767 still apply, however volume limits are now much lower: for example, all vessels containing a gaseous fluid classified as "dangerous" are subject to the PED if their PS x V (pressure in bar x volume in litre) product is above 25 and if their volume is greater than 1 litre; boilers are subject to the PED starting from a volume of 2 litres, while piping containing dangerous gases are subject starting from ND 25.

Second: which are the standards to be used? This question is well justified if we take into account that also the PED (like the Machine Directive and all other technical directives recently approved by the Commission) is based on the so-called "New Approach": i.e. they do not contain detailed regulations, but only Essential Safety Requirements: general statements like "materials sufficiently ductile and tough" or "appropriate safety coefficients", and so on. But who is responsible for the translation into precise figures of these general statements? The PED gives this task to the

so-called “Harmonized Standards”, which are now being prepared by CEN (the European federation of the national Standard Organizations of the European countries): AFNOR, BSI, DIN, UNI etc.): the use of the harmonized standard gives to the product the “Presumption of Conformity”; in other words any product made in accordance with a harmonized CEN standard shall be automatically presumed to be in compliance with the PED. This doesn’t mean that a different (non-harmonized, and possibly also non-European) standard may not be used in the construction of that product: in this case however the manufacturer has to prove that the use of that standard also gives conformity to the PED. A very nice theory, like all the theories found by politicians: it is really a pity that most of these harmonized standards are not yet ready: particularly the Unfired Pressure Vessel Standard (PrEN - Draft European Standard - 13445) is still very far from its formal approval. Therefore the PED will come into force **without** the most important harmonized standards, and this will start a real war among the still existing national Codes: in fact each Member Country is now trying to prove the conformity with the PED of its national Codes for Vessels and Boilers, for the simple reason that these Codes, which could be formerly used only for the internal market, after the coming into force of the PED (if specific customer’s requirements are missing and if conformity to PED has been proven) may also be used for the European export market, which of course will be an advantage for the national manufacturers. Note that this exercise may be difficult for some well-known Pressure Vessel Codes (example: AD Merkblätter has no safety factor for tensile strength, while both BS5500 and Stoomwezen have no joint efficiencies).

Third: who has to certify the product, and according to which procedures? The so-called “Notified Bodies”, appointed in each Member Country by the relevant Minister of Industry, will have the task to certify the products according to the various certification procedures provided in the PED: once appointed by a Member Country, each notified body will have the right to work in the entire Union. The experience with the Simple Pressure Vessel Directive has shown that this situation together with the a.m. normative confusion will involve the risk of an extreme competition among notified bodies: “Come with me, nice Pressure Equipment manufacturer, and I’ll show you the more favourable standard to be used in your case!”. In all cases where the client has no particular requirements, the manufacturer is in fact free to use any standard complying with the PED, provided his notified body (who at the end is responsible only for the Essential Safety Requirements and not for all the details of the manufacturing standard) is willing to accept it. Moreover, the certification procedures (so-called Modules) are less stringent for products with lower PS x V products, so that many products will simply require a module A (self-certification of compliance issued by the manufacturer), while for higher risk categories quality assurance modules (based on manufacturer’s qualification by a notified body) are always available as an alternative to modules involving full product checking. Therefore many of the existing governmental inspection organizations (like ISPESL in Italy and Service de l’Industrie in France) will close their “police-like” activity among manufacturers, and will be probably displaced to carry out market surveillance. Of course this means that European manufacturers are considered reliable people: once they have got from a notified body a beautiful QA certificate in a golden frame, there are good reasons to think that their behaviour will be in full conformity with their officially approved QA manuals. Is this so sure? And is it so logic that this “presumption of reliability” is also given to many non-European manufacturers? Whoever has an experience in pressure vessels has, in my opinion, very good reasons to be very careful on this matter.

Fourth: will all the countries be ready to start the PED at the 29th of November 1999? Many countries have set up special Committees to deal with this: however the matter is not so easy, because many times national laws take into consideration in the same rules both inspection during manufacturing (which will be ruled by the PED) and subsequent in-service inspection (which will not be affected by the PED); moreover, for the first 30 months of application, the PED will be optional, not compulsory. In spite of the fact that many people is working hard to update all these national rules, it is very well possible that in the first months there will be a lot of confusion, particularly if some of the Member Countries will be late in the approval of the PED and in the clarification of their national legislation (please, don’t ask me the names...)

F.Lidonnici

SANT'AMBROGIO Newsletter - December 1999

The new millennium is starting…

…and will bring with it a lot of new things: on the 29th of November the Pressure Equipment Directive (CE Directive 97/23, the so called PED) has finally come into force (although the old national legislations concerning Pressure Equipment manufacture and certification will still remain, as an alternative to the PED, up to the 29th of May 2002, at which date the PED will become binding for everybody). But are we really ready in Europe to face the consequences of this? First of all, not all the European countries have recognized the PED, although most of them have notified one or more inspection bodies in accordance with it. Secondly, the PED concerns manufacturing only, not service inspection, for which national practice will remain unchanged. Thirdly, the most important "harmonized" CEN standards are not yet ready, and therefore some other standard (i.e. the existing national Pressure Vessel and Boiler codes) shall be used to prove compliance with the PED.

This means that in Europe there is already a structure which is able to issue certificates in accordance with the PED, although national standards are still needed to issue such certifications: the doubt is however, whether in Europe (or in some country of the European Union) there is a structure capable of accepting products made in accordance with the PED, at least until the national legislations concerning installation or in-service inspection will be properly "interfaced" with the PED at the national level.

In order to clarify the problem, let's make a small example: in Italy the official governmental inspection Authority (ISPESL) is charged of the inspection during fabrication of any pressure vessel or boiler at the manufacturer's shop; when the inspector of the ISPESL department competent for the manufacturer's location stamps a finished product in accordance with the Italian law, he also prepares the so called "libretto": a booklet which contains the main features of the unit, its ISPESL serial number and the results of the testing at the manufacturer's shop; the "libretto" will accompany the vessel during its entire life, and therefore it is necessary either for the installation (to be carried out by the local ISPESL department competent for the user's location), or for the future in-service inspections; the results of all these visits, as well as the possible problems, damages and repairs of the vessel shall be marked on the libretto. Well, a CE marked unit has no libretto, because it is not required by the PED; however somebody must decide who has to prepare it, otherwise the installation and the future inspections cannot take place, and the user will not be authorized to start the plant where the vessel or boiler will have been installed; but how decisions like this can be taken, if the PED has not been implemented into the Italian legislation?

Of course each national government is fully responsible of recognizing the PED by amending the relevant national legislation; if a national government has not yet recognized the PED, and this is causing troubles or damages to anybody, the matter can be brought to the attention of the Commission, which is able to take all the necessary measures against that government: and at the end (certainly not in one day) somebody will pay the damages. But pressure equipment users (as well as pressure equipment manufacturers) have a very strong inclination to avoid problems: why should they use the PED with possible installation problems, while the old national legislation can still be applied without them? And even if they are willing to apply the PED, why they should consider standards different from the old national Pressure Vessel and Boiler codes, if using these codes (which are also more or less conforming to the Essential Safety Requirements of the PED) there is a better possibility of avoiding troubles?

Poor European people, how long will you be obliged to speak so many different technical languages? But don't worry, somebody (or some notified Body?) is coming out with a solution. In fact the more qualified European Pressure Vessel and Boiler manufacturers are holders of an ASME stamp, i.e. they are accustomed to apply the ASME code as well as their national code (only in Italy we have 120 ASME stamp holders): therefore, since also the ASME code gives

presumption of conformity (somebody, or some Body, says) with the PED, why not to use the ASME code in place of the harmonized standards that those stupid experts of CEN have not been able to prepare in due time? This opinion is brought forward not by President Clinton, but by some European notified Bodies, who are also authorized by the American National Board of Boiler and Pressure Vessel Inspectors to qualify and assist ASME stamp holders. If this will really happen, the commercial advantage of these Bodies is evident: an ASME QC Manual can become, with slight modifications, a Pressure Equipment QA Manual conforming to ISO 9000, as required by the PED for all quality assurance modules, and this will of course reduce the cost of the qualification: therefore a Manufacturer with an ASME stamp will find more convenient to get his qualification for the PED from the same organization which assists him for the ASME.

But the partisans of the ASME code generally forget a couple of small things: first of all, the ASME code is far more conservative than any European code: to use it in a context where other (less conservative and therefore more economic) codes may also be applied is of course a loss of competitiveness for the manufacturer; secondly, the ASME procedure is not equivalent to the quality assurance modules of the PED, because it provides in all cases an intervention of the authorized inspector on all stamped products, and this means a greater cost for the manufacturer. But, in my opinion, there is a third point that should be made clear: the real beneficiaries of a generalized adoption of the ASME code in Europe will be not the European manufacturers or users, but only the American engineering and process companies. Up to know all these companies have offered chemical and petrochemical plants all over the world always using American standards for everything, and the ASME code for Pressure Vessels (which are more than 50% of the total cost of such plants); up to now their European competitors where never able to supply plants made with an equivalent standardization system, having the same degree of coherence and completeness. But what would happen if CEN were really in the position of providing in due time harmonized standards for materials, piping, vessels and boilers based on more modern and more economic criteria than the American standards? The answer is easy: the European industry would become more competitive; and the only way to avoid this is to kill the system before it can be born, just convincing the European industry that ASME, ANSI, ASTM and ASNT, which exist since years, are always better than those confuse CEN draft standards that have not yet found their way out in the labyrinth of a bureaucratic system, where everything has to be translated into three official languages, launched to a six months inquiry, amended, formally voted, and then translated again into other eight or nine languages (by the way, if we really want to take some kind of standards from U.S.A., why not to take the English language, at least for the CEN TC meetings, where one is obliged to hear three times - one for each official language - the same things?).

Please, do not misunderstand me: I have nothing against U.S.A. and their standardization system, which is really complete and based on dozens of years of sound practical experience, although its philosophy gives priority to the weight of the product more than to calculations and testing: at the end Sant'Ambrogio is able to supply computer programs in accordance with both ASME VIII division 1 and division 2 because these codes exist and are regularly used and updated, while software to Pr En 13445 – the CEN draft standard for Unfired Pressure Vessels – can only be still in preparation, like the entire European standardization system. Moreover, a commercial competition among different countries is always positive, because one is able to learn – using somebody else's experience – the best way of doing things (do you remember the American cars – huge and highly polluting - of the fifties and the sixties? Looking at the present models, no one can deny that American were able to learn something from Europe and Japan on the subject). Well, I personally thing, having served ten years as convenor in the WG Design of CEN TC54 (Unfired Pressure Vessels) that a big effort was made in Europe to harmonize many different national philosophies in Pressure Vessel design, materials, fabrication and inspection, and that the result of this effort, PrEN 13445, if regularly maintained and updated, will become a valuable tool to achieve at the same time safety and economy; I am fairly convinced that this standard, as well as the other harmonized CEN standards on pressure equipment, if adopted and generally used, will influence also the ASME code (the reduction of the safety coefficient on tensile strength – from 4 to 3,5 – effective starting with Addenda 1999, is already a symptom).

But unfortunately the coming into force of the PED when the relevant harmonized standards are not yet ready (and when also many European countries are not prepared to it) obliges the industry to come back to the old national Pressure Vessel codes, with the risk that all the efforts made up to now by many people in the CEN committees are wasted. Well, let me make a proposal, to be addressed to all people that usually work as experts in the national committees which regularly amend and update the national codes (and I know that most of these people are also the CEN national experts that are preparing the harmonized standards): please, gentlemen, in doing your work, do not forget what you have done in the CEN TCs: if possible, try to use that material in amending your own Pressure Vessel or Boiler code: if possible, instead of amending a clause, just take the relevant clause of the corresponding CEN standard. And if someone of the users discovers a mistake, don't worry: just correct it in your national standard, but advise your WG or TC that this mistake exists, and shall be corrected also in the CEN draft. If, on the contrary, someone of the users says that the method cannot be applied, because it leads to unlogic results, bring the matter a.s.a.p. to the attention of your CEN TC or WG, and try to work out a proposed solution in collaboration with them.

What is the advantage of such a proposal? Well, in doing so the European codes should automatically converge into the direction of the harmonized standards: in a few years, even if they will not necessarily become equal to the harmonized standards, the differences will be greatly reduced. Somebody could object that this kind of exercise is useless, because when the harmonized standards are adopted, they shall automatically replace the corresponding national standard: pay attention, this is not true, because most of the European Pressure Vessel and Boiler codes are not prepared by the national standardization body (for example, the French code is prepared by the manufacturers' association, while the Italian code is prepared by ISPESL); therefore, even if the national standardization body which is member of CEN is obliged to publish it as a national standard, no one can oblige other organizations to withdraw a document which is generally accepted as standard by the national industry, and generally recognized to be in conformity with the PED.

Any alternative: yes, there is an alternative: just take all the European experts that are now working for the CEN harmonized Pressure Equipment standards and put them under a different organization: for example, an organization like the American PVRC, whose members are officially charged to discuss and amend the ASME code, and that can be consulted in order to clarify all possible cases arising in its use, not being subject to translations into three official languages, official inquiries and formal votes: they are experts, and therefore are reliable people. Only in this way this small group, having a continuous feed-back from the users, will be able to quickly discover mistakes and correct them through periodical reprints of the standards (once a year at least, like the ASME code). But, of course, considering the financial agreements made between the Commission and CEN, and the implications that the transfer of this agreement to a different organization would involve, this is only a dream.

F.Lidonnici

SANT'AMBROGIO Newsletter– June 2000

The PED: a directive still unknown to most people

In March all of us were excited for the recent recognition in Italy of the PED (for those who are not familiar with it, PED stays for Pressure Equipment Directive). Today, more than 3 months later, what has changed? Almost nothing I would say: no appointment of notified bodies different from ISPESL has been made; no extensive examination of the Italian legislation in order to bring it in line with the Directive and no examination of the relevant Italian norms in order to determine what should be reasonable to modify for assuring the compliance with the PED are in course.

From time to time somebody contacts us and asks us to carry out a calculation in accordance with the PED, and we have to explain him the same old story: the PED doesn't contain calculation rules, only essential safety requirements, so that, until the harmonized standards (which would give the so called 'conformity presumption') are ready, there is no other choice than to use the national codes (also our ISPESL norms), taking into account also a few simple requirements, which are necessary to bring them in line with the PED, all of this assuming that the customer, its customer and the national body charged with the market surveillance agree with it.

At the end it turns out that in order to export to France it's still necessary to use CODAP and it is advisable to work with a French body; in order to export to Germany it's still necessary to use AD Merkblätter and it is advisable to work with a German body, and by the way how not to advise a foreign customer who wants to export to Italy to use ISPESL norms? Well, a lot of circular letters were issued where (at least theoretically) all necessary prescriptions for putting into service a CE marked equipment are given (also the € mark could be used, i.e the symbol of the single European Currency, the one which would flow in the purse of the constructors and users, if only they would succeed in getting rid of the technical barriers which still hinder them); in Germany however many local TÜV have given instructions that CE marked equipment is put into service without problems, but provided that during operation it is controlled by one of their inspectors much more frequently than the equipment fabricated in accordance with the German regulations; keeping into account that up to 29/5/2002 the PED is not compulsory, but is only an alternative to national norms, who should take the trouble to order a CE marked unit in Germany?

Even if we cannot but blame the ones who offer prejudiced resistance with all means, on the other hand we have to admit that there are still some shortcomings in the PED which have to be overcome: first of all the fact that a sound harmonized norm on pressure vessels (which should be regularly updated basing on the comments of those who use it, i.e constructors, users or inspection authorities) is still missing; if this will not be achieved (and there are many doubts that this can be achieved through CEN with its rigid structure and its highly bureaucratic procedures entailing translations into 3 languages, public inquiries, formal votes, comments which must be officially answered), the harmonized standard will be killed before being born, and this because the little world of pressure vessels and boilers always ruled upon its norms at national level, without having to justify to anybody the reason why the minimum thickness of a shell is obtained multiplying p by D divided by two f z minus p, or why the notch of the specimens for the impact test must be V-shaped instead of U-shaped; this sort of self-government must be now transferred to the European level, but without the bureaucratic hobbles of CEN: what's the use of a public inquiry on a standard issued by experts who argue on Gross Plastic Deformation or on Limit Analysis as if they would talk of their favourite football team? What's the use of giving a written answer to those (less expert) who ask why the new European standard says something different from their national norm? Why is it necessary to translate everything into 3 languages now, when thanks to Internet the English language is within reach even of children fond of videogames?

But there are still other weak points that sooner or later will have to be faced: how is it possible to provide for a great number of inspection bodies when a single body which establishes their rules of activity on the European level, defining what is acceptable and what is not acceptable, is still missing? How is it possible that the said bodies are responsible only for the essential safety requirements and not for the observance of precise and detailed rules, so that their work can be correctly evaluated? How is it possible to grant the fabricators of pressure vessels and boilers an authorisation to work under Quality Assurance without any control on products in a field where competition is such that the removal of a prescription can make the difference between high profits and bankruptcy? These are the questions that somebody at the Commission will have to answer sooner or later, in order to avoid that some member country would be tempted to ask for a delay of the coming into force of PED, that would mean a definitive abandonment of the Directive.

F. Lidonnici

SANT'AMBROGIO Newsletter– December 2000

Who has seen the PED?

At the end of November I was invited to a conference on the PED in Mannheim, Germany (for those who still do not know anything about it, PED means Pressure Equipment Directive, the wonderful tool devised by the European Commission in order to get rid of the technical barriers to trade on Pressure Vessels, Boilers, Piping and all other kinds of Pressure Equipment in Europe): and there I was able to see that the German situation on the practical application of the PED is not very much different from the situation existing in Italy: in fact, in Germany and in Italy, nobody is willing to use the PED, even if this happens for different reasons.

Just to clarify the problem, we are now in the transitional period, where the PED may be applied as an alternative to the existing legislation; this period will expire on the 29th of May 2002; after this date the PED must be applied, and all the different national legislations will be superseded. Who decides, before this fatal date, whether a specific pressure vessel or boiler shall be fabricated according to the PED or to the old national rules? In theory, the manufacturer; in practice, this happens only when he is allowed to do so, i.e. when his customer, His Majesty the User, agrees. Well, in Italy the qualified users (i.e. all the big Companies working for the Energy and the Chemical/Petrochemical Industry) do not want equipment conforming to the PED because the acceptance of the PED by the Italian Government (Law 93 of February 25th, 2000) is still not complete: the term of 90 days given to the Ministry in order to issue detailed rules for the notification of inspection bodies has already expired, and the rules were not issued (so that ISPESL is still the only Italian Notified Body); the term of one year given to the Ministry in order to update all the existing legislation is also nearly expired, and nothing has happened, so that all the local authorities (ISPESL and the ASLs) charged for installation and in service inspection still do not know which part of the rules remains valid for a CE-marked vessel: in fact the PED has changed only the procedures concerning the construction, not those concerning in service inspections (which remain unchanged); however the security system designed by the Italian legislators doesn't make a clear distinction between these two activities (and the same happens in most of the other European countries), so that without detailed rules it is not possible to put into service a CE-marked item without running the risk of having problems with the local authorities (which, of course, the big companies wish to avoid).

Well, in Germany, the reasons are different, but the results are the same: the users do not want CE marked vessels, because most TÜVs require shorter intervals between two consecutive in service inspections for CE-marked vessels and boilers; and this happens because, after a careful examination of the PED, they came to the conclusion that such vessels and boilers may be less safe than the corresponding equipment made in accordance with the old German legislation. This opinion is based on the following:

1) a CE-marked unit conforming to the PED may be fabricated in accordance with any Code, because the Essential Safety Requirements of the PED are considered by nearly all the modern national Pressure Vessel and Boiler codes or standards; the so-called "harmonized standards", which should give the presumption of conformity with the PED, still do not exist, or, if they exist, they are not compulsory;

2) a CE-marked unit may be certified and inspected by any one of the inspection bodies notified by each one of the Member Countries; however it is not guaranteed that all Member Countries are using the same criteria in the notification of these organizations, and it is also not guaranteed that such organizations are using the same criteria in the surveillance on manufacturers;

3) the CE mark doesn't guarantee that a given unit has been fabricated under the direct

surveillance of an inspection body (notified or not): in fact for some pressure equipment classes the PED allows self-certification procedures, without any intervention of the inspection body, while for all the categories with higher risk direct inspection procedures may be replaced by quality assurance procedures; in other words, the notified body will check the manufacturer and his organization, in order to be sure that he is able to perform by himself all the required inspection activities; in this way the presence of the notified body at the product's inspection may be waived; which is a very nice thing for small units fabricated in series, but what is the degree of quality assurance in case of large single units with a very high value? Are we sure that the manufacturer is willing, in the name of Quality, to scrap or at least to delay the delivery of a large pressure vessel which may cost 1 million € or even more? Just try to imagine the scene: the Quality Assurance Manager, standing like a rock on the main workshop gate, ordering to the workers to bring back into the shop a huge 50 tons piece of equipment, all made of titanium, zirconium and other special materials; in front of him, weeping and tearing his hair, the poor Production Manager, who was responsible for a couple of small (or large?) weld defects which determined the non-conformity report, and which will need at least one month in order to be properly repaired; not very far from him, the Financial Manager is slowly and carefully charging his 6 shots revolver, by which he intends to shoot himself, knowing very well that failure to deliver on schedule that piece of equipment means failure to pay workers, employees, sub-suppliers and banks, and also to close with a considerable loss the current financial year; in the shadow also the Owner of the Company may be seen, with a gloomy but calm attitude, whispering with a very low voice: "Well, nobody will ever say that our Company has not honoured its Quality Assurance Manual!".

Considering all the above, the Ministers of Work of many German Länder have issued regional laws which provide for shorter intervals between two consecutive in service inspection visits for vessels fabricated in accordance with the PED (one visit every year, instead of every three years, as it happens for vessels conforming to the German legislation). This is possible, because every Member Country has the right to organize pressure equipment inspection according to its own ideas.

At this stage a very stupid question may be asked: was this the only way to get rid of technical barriers? Is it really clear to all the responsible persons in the Commission that the PED, which was expected to give a final, logical and uniform assessment to the safety system on Pressure Equipment in the whole European Union has on the contrary failed to give any kind of certitude to anybody? Look at the present situation: those who are manufacturing and selling pressure vessels do not know which standards and which notified bodies have to be used in order to avoid problems in the country of destination; those who are purchasing them do not know what they are really buying, because the CE mark by itself is not a precise identification either of the standard to which the product is conforming, or of the procedures followed for its inspection and certification; those who carry out certifications in accordance with the PED, are obliged to give proper consideration to all national legislations concerning service, that may cause additional constraints to the product.

According to logic and common sense, the idea to give rules only on one half of the problem (the construction) and not on the other half (the service) is stupid, and this is proved by the fact that in all industrial countries the national safety systems on pressure vessels and boilers take into account both aspects at the same time; therefore, knowing that directives are prepared by different DGs (DGIII, who prepared the PED, is responsible for Technical Barriers only), why not to coordinate the work among different DGs, so that also a directive concerning in service inspections could have come into force at the same time? Amendment of national legislations could have been much easier, just throwing away all the existing national rules, and replacing them by the same consistent system in the entire European Union. According to logic and common sense the idea of Quality Assurance should have been interpreted, as, for example, it has been interpreted in the United States, where the certification procedure for boilers and pressure vessels (the so-called ASME stamp) leaves a lot of responsibility to the manufacturer with an approved Quality Control Manual, while the Authorized Inspector has always the right to decide (according to the confidence

he has in the Manufacturer) which are the hold points in the construction he intends to witness. Finally, something should have been done for a European coordination of all the notified bodies, so that reasonable assurance of a uniform application of the Essential Safety Requirements of the PED could be given to everybody. Will it be possible to correct these mistakes before the coming into force of the PED, on the 29th May 2002?

F. Lidonnici

SANT'AMBROGIO Newsletter – June 2001

What has happened to the Harmonized Standards?

The fatal deadline of 29th May 2002 is getting closer: on that day all national legislations on the fabrication of products which are covered by the PED (Pressure Equipment Directive) will not be applicable anymore and it will become mandatory to comply with the Directive (which at present can be used as an alternative option to the national legislations). I would like to remind you once again that as a matter of fact the PED is an empty box: the idea of the Essential Safety Requirements is something that is maybe valuable for politicians, but from a technical point of view, if it isn't translated in numbers, formulas and precise provisions it becomes practically inapplicable: it is as if somebody should lay down road regulations by simply stating that drivers have to be cautious under any circumstances, that cars have to be adequately fabricated and equipped with suitable breaking, signalling & lighting devices and that suitable warning and indication signs have to be placed on the roads, but without fixing neither the speed limits nor the characteristics of the said devices and signs.

Who is in charge with defining the details? The idea of the Brussels law-makers is that details shouldn't be part of the law, but they should be contained in application standards to be prepared by Standardisation Bodies associated in CEN; once the standards are ready they are published in the Official Journal of the European Communities: after that they acquire the status of Harmonised Standards; complying to these standards means to be automatically sure of the compliance with the Directive too (this is the so-called "presumption of conformity"); this doesn't mean that the Harmonized Standards are mandatory, because constructors are still free to fabricate their products in accordance with standards other than the harmonised ones but which in their opinion (and in the opinion of the Notified Body charged with the product certification) guarantee the conformity with the Essential Safety Requirements of the Directive.

This is the theory: it would be a fine one too, if the Harmonised Standards, although not mandatory by law, would become such in the practice: in other words, the use of other norms as alternative to the harmonised ones should be allowed only for serious and justified reasons (for instance for constructions which do not fall within the application limits of the norm, for shapes which are not covered by the code, for special materials or peculiar welding procedures); this is an idea that the Notified Bodies (which are in constant and ruthless competition the ones with the others) take good care not to apply: the norm to be used seems on the contrary one of the main issues of competition among bodies, which tend to use and to promote the use of their national code or of a code which permits to lower as much as possible the product cost; all this results in many cases in a hectic race to save money which, in the present state of extreme competition among fabricators cannot but affect product safety.

It is clear to everybody that if a competitor uses the Code of the Land of Cockaigne under the Surveillance of the Confraternity of Good Death (Notified Body of the Banana Republic) and by doing so, succeeds in selling its product at a price which is one thousand lire (beg your pardon I should say half Euro) cheaper than mine, I will be forced to use the Code of the Land of Cockaigne too, if I want to remain competitive, while I could still apply to more reliable bodies for certification (but at this stage they too would be forced to act as the said Confraternity of Good Death, if they want to remain competitive).

However, just to say a word in favour of those Notified Bodies which do their best to monitor and guarantee something, the main problem is due to the fact that Harmonised Standards still don't exist. With regard to this a distinction should be made between the standards relating to steam generators (which have already been approved and only have to be published) and the ones relating to unfired pressure vessels, for which the so called Public Inquiry has already taken place and the thousands of comments made during the inquiry or, to be more precise, the necessity of giving a reason for all rejected comments is exactly what is delaying a standard which

is vital for most products which are covered by the Directive. As I have been for the past 11 years, and I still am, the Convenor of Working Group C (Design) of Technical Committee 54 (Unfired Pressure Vessels) of CEN I kept on complaining about the excess of bureaucracy in this body, a circumstance which together with other inconveniences leads to neglect the technical content of complex norms as the ones which concern pressure vessels necessarily are; now, thank God, I am glad to admit that something is moving at CEN: for the EN 13445 Project (Unfired Pressure Vessels) a special urgency approach has been provided for which should lead to the publication of the standard by June 2002 (assuming of course that it is approved in the final voting); after that, quicker procedures should make subsequent updates easier.

At this stage the big doubt is how the Notified Bodies will behave in presence of a Harmonised Standard which embodies the experience of all EC countries: will they be prepared to give up the dangerous game of looking for alternative standards to the sole purpose of reducing the product price? The answer to this question is of utmost importance not only for the competition among fabricators, but above all for product safety. I believe that it is up to the Commission, not only to national governments, to see that this result is achieved and I believe also that in case of doubts it would be better to postpone the date of coming into force of the Directive (I know that many do not like this idea) and wait until a uniformity of behaviour among bodies is guaranteed; this is necessary in any system (see United States of America) where several inspection bodies are in competition among themselves.

F. Lidonnici

SANT'AMBROGIO Newsletter – December 2001

The new Italian notified bodies

In the last 3 months the Italian Ministry of Industry, Trade and Handicrafts has finally proceeded to notifying new Italian bodies entitled to certify in accordance with the 97/23/EC Directive (the so-called PED - Pressure Equipment Directive), which on the 29th May 2002 will become law in the whole European Union. To this regard we are proud to announce to all our customers and to all companies who could be interested in it, that a decree authorizing **CEC (Consorzio Europeo Certificazione)** to issue CE certifications for all products falling under the PED both in Italy and in all other countries of the European Union has been published in the Italian Official Journal (Gazzetta Ufficiale) of the 11th January 2002. We remind you that in addition to **Sant'Ambrogio**, the other partners constituting CEC are **ANCCP** (Agenzia Nazionale Componenti e Prodotti), **Istituto Italiano della Saldatura** and **RWTÜV-Italian Branch**. CEC, which, since its creation in March 2000, has been operating all over Italy thanks to the coverage provided by the local offices of the partners, can now issue certifications in its own name (up to now at the end of the certification activity a certificate by RWTÜV Essen was issued).

But what will happen to the old national norms after the 29th May 2002? Similarly to what is happening in these days to our lire, to the German marks, the French francs, the pesetas and so on, which are being set aside under the powerful surge of the new European currency, so it should happen to the old national safety regulations for pressure vessels and boilers: the ISPESL stars, the TÜV stamps and the little horses of DRIR should give way to CE marks, which should be affixed under the surveillance of the new notified bodies: the double circulation wil not be allowed anymore starting from the 29th May. To this regard we have been informed by ISPESL that any pressure vessel or steam generator on which the ISPESL stamp has already been affixed before the 29th May 2002 can be put into operation also after that date; if however it shouldn't be possible to carry out the final inspection in accordance with ISPESL rules by the 29th May, for instance as a consequence of a delay in the construction, the only possible solution will be to restart the whole procedure as PED certification, applying to any Italian or foreign body present on the market. In particular, since also ISPESL is a notified body for the PED, the fabricator who intends to conclude the certification procedure with ISPESL will have to deliver to them the additional documents required by the PED (risk analysis, operating manual, calculations in all conditions, i.e. operation, test, transport, erection and maintenance); this of course applies only if the vessel or boiler falls under a risk category for which the intervention of a notified body is required. It is already taken for granted that calculations to VSR or VSG which have already been submitted and approved are valid for the PED too, since both VSR and VSG meet the essential safety requirements of the PED.

But is this true also for the other national codes (AD Merkblätter, CODAP, PD 5500, Stoomwezen, etc.)? And what will be the use of the well-known harmonised standards? In the past we have already pointed out that the PED can actually be used with any national (European or extra-European) norm or code which, in the opinion of the manufacturer and of the notified body, guarantees the compliance with the essential safety requirements: the advantage of the harmonised standards is that they give automatically (i.e. without need of additional checks) the so-called "presumption of conformity" to the said requirements. The problem is however that up to now, as the bureaucratic procedure for the publication of the most important harmonised standards (the ones relating to unfired pressure vessels and the ones regarding steam generators) hasn't yet been completed, the most qualified users insist on specifying the compliance with the existing national construction codes (perhaps revised and corrected in order to adapt to the PED, as AD 2000 in Germany, CODAP 2000 in France etc.), when placing orders to manufacturers .

But then what is going to happen to the single regulation enforced by the PED? And how can we get used to think in terms of Euronorms, if nobody wants to give up his national norms? The only possible solution will be that the compliance with the PED is required by the customers, assuming that they are ready to abandon the old road and throw themselves entirely on the new

one, with all the risks and problems that this necessarily entails, since the harmonised standards which have already been approved or are in course of approval at CEN are not and cannot be perfect: it is not possible to issue such complex construction codes without making mistakes, and these can be discovered and corrected only when the first comments from the users, the manufacturers and the inspection bodies start to arrive. To this regard CECT (nothing to do with the CEC: CECT is the European Association of Pressure Vessels, Boilers and Piping manufacturers , which comprises the different national federations: FDBR for Germany, SNCT for France, UCC/ANIMA for Italy and so on) is going to submit a proposal that should promote the use of harmonised standards: it would just suffice to identify with an additional mark, i.e. the CECT mark, to be affixed side by side with the CE mark, all products which not only meet the requirements of the PED, but are also in compliance with the relevant harmonised standards (as soon as they are available); the CECT mark (reserved to the manufacturers which have joined the said federations) would also give additional guarantees, to be checked by the federations themselves, which would turn the CECT mark into a real quality mark, as the ASME stamp.

But let's not run too much: a bunch of willing small 'beavers' is presently working at this problem: if the users understand, if the notified bodies help, if the Commission doesn't put obstacles in the way, but above all if CEN proves to be capable to prepare and modify norms in real time, it may be possible to "kill two birds with one stone" where the stone is clearly the CECT mark, while the first target is to achieve that the harmonised standard really becomes the market standard, the state of the art, the banner of European industry; the second one is to avoid that, in all cases where the lack of minimum requirements from the customers would allow it, products bearing a CE mark would start to circulate, which in spite of the said mark are potentially dangerous, because they are fabricated in accordance with who knows which norms, by who knows which manufacturers under the surveillance of who knows which bodies.

And this is more so, because if on one side there are industries (as the chemical and petrochemical industry) which, dealing with high-risk plants, are accustomed to consider safety as a basic requirement of their equipments, there are also pressure vessels which are produced for industries where the potential burst risk involved in their operation is not even suspected; I refer for instance to the cylinders for the paper industry (heated by steam at let's say 20 or 25 bar), to the refrigeration plants filled with Freon under pressure, to all the processes (from sterilization to industrial autoclaves) where steam under pressure is regularly used for heating: these are the fields where uncontrolled import of low-cost products from extra-European countries (and from European ones too) will occur; for such products in fact a Notified Body prepared to issue, so much a kilo, ISO 9000 certificates on glossy paper, particularly suitable to embellish the meeting rooms where key clients are received, will always be found.

But let's not start complaining when things are still moving: let the 'beavers' work, and let's see if these little, hard-working animals are really capable to build their quality dam. We should never forget that if we want the European Union to really become effective, we need not only a single currency, but also a single legislation (on sweets, on taxes, on work, on international rogatory letters, and also on Pressure Vessels).

F. Lidonnici

SANT'AMBROGIO Newsletter – September 2002

PED or not PED: lights and shadows.

On the 30th of May the PED (Pressure Equipment Directive) has finally become Law in all the European Countries. For our small world of Pressure Vessels, Boilers and other Pressure Equipment this is a real revolution: the theory is that now any manufacturer of these funny objects (never tried to explain to normal people what a pressure vessel is? never got back this kind of embarrassed smile which generally means something like "sorry, I do not understand, but doesn't matter, it is not very important"?) should be free to export his products without having to use foreign standards and foreign Inspection Bodies.

But it is really so? We are working for Italian manufacturers that have to deliver PED vessels to one European country that we will simply call Happyland, because we do not want to make problems to anybody: but their Happilandish customer has specified that they are to be calculated, manufactured and tested in full compliance with the Happyland Pressure Vessel Code (plus possible additional PED requirements), because otherwise the Happyland National Inspectorate (which is a Notified Body, but also the national authority responsible for the in service inspections) could make a lot of problems; we have met another Italian boiler manufacturer that had severe problems in the installation of a serially made firetube boiler in another European country (that, for the same reasons, we will simply call Nicecountry) because the Nicecountrian inspector did not wanted to accept the module H certificate, unless the Italian Notified Body was willing to certify that they had personally witnessed the pressure test of that particular vessel: "I will never allow the service in Nicecountry of a Boiler which was not tested in the presence of an inspector!" was the hard reply to the complaints of the poor manufacturer; and so the only solution was to ship to Nicecountry the inspector of the Notified Body in order to repeat in his presence the pressure test that the manufacturer, proud of his Q.A. certificate, had already made by himself.

A couple of words also about the Italian situation: I will simply say that in Italy we are working according to the PED, still waiting for the new rules for installation and in service inspection of Pressure Equipment (a draft was prepared and approved, but our Minister of Industry has a lot of more important things to do); for the time being the installation visits can only be made by the local ISPESL Departments, and the periodic inspections by ASLs (Aziende Sanitarie Locali), while according to the draft also private organisations should be allowed to carry out these activities; the draft also specifies what the inspectors have to do for the installation of the various kinds of Pressure Equipment, in order to avoid repetition of tests and inspections that have been already carried out by the Notified Body (or by the Manufacturer, when a Q.A, module has been used). However nobody has still withdrawn the old Laws concerning construction (such as Regio Decreto 12/5/1927 n.824 and a lot of connected laws and circular letters) which should be superseded by the PED; our lawyers say that it is not necessary to withdraw the old national legislation superseded by European directives, because according to the European Right it is automatically cancelled by their coming into force; however I wouldn't like to convince a governmental officer that anything written in a Law, which he has applied without exceptions in the last twenty years, shall not be considered anymore because there is some European directive that automatically supersedes it. That's the reason why our advice to foreign manufacturers is still to pay attention to those Italian rules (particularly the rules of Raccolte E, R and H, i.e. everything concerning safety valves, quick actuating closures and other safety devices, like expansion vessels, level indicators and pressure gauges, and everything concerning boilers and hot or superheated water systems) that are generally verified by ISPESL during the installation visit. Certainly nobody will make problems about the construction rules used in a CE marked vessel or boiler, because the CE mark is clearly recognized by our Law 93 of 25.02.2000; however the possibility of having problems on the a.m. subjects still exists.

I also wish to advise all the manufacturers that also in Italy we have updated the Italian fabrication rules contained in the so called Raccolte ISPESL (VSR for Vessel Design, VSG for

Boiler Design, M for Materials and S for Welding) in order to take into account the requirements of the PED; the update was made in the form of a booklet (prepared by CTI – Comitato Termotecnico Italiano) which lists all the amendments and additions that are to be considered when using the Raccolte (particularly concerning the test pressure, the nominal design stresses and the use of EN and non-EN materials). By mutual agreement among all the Italian Notified Bodies (including ISPESL), the use of the Raccolte implemented by the CTI Recommendations guarantees conformity with the PED; this, of course, waiting for the publication of the harmonised standards (provided the most important users are willing to specify them).

In our preceding newsletter I had spoken about the work which was being carried out within CECT (European Committee of Pressure Vessel, Boiler and Piping manufacturers) about the possibility of establishing additional rules to the PED, contained in a procedure called CECT Mark (similar to the American ASME Stamp); the idea is that each product bearing this mark is to be made in accordance with all the applicable harmonised standards, and that its manufacturer is to be qualified by his national Association. Unfortunately, it seems that most of the European federations which are members of CECT are not willing to go on with this idea any more. One of them wrote me a letter telling, more or less, that the PED is already a big trouble for the manufacturers by itself, why we should add additional troubles? May be they are right, better to go on with the actual mess: better to use old national codes (and in this match of codes ASME will be certainly the winner, no matter if we have spent 12 years in making garbled European rules that nobody will ever apply); better not to have qualified European manufacturers, non European manufacturers will be happy, and happy will also be all those important European Notified Bodies that are opening offices all over the world, in order to help non-European manufacturers to export their products into the European Union (was this really the purpose of the PED?). At the end, it seems that also CECT is not willing to exist anymore: the 2002 General Assembly had to be cancelled, due to lack of participants. European Manufacturers, don't worry: simply consider the possibility of changing business.

F. Lidonnici

SANT'AMBROGIO Newsletter – December 2002

Are there other EU Directives in course of preparation?

A good friend of mine, who has very good relationships with the European Commission in Brussels, told me that after the PED (the well-known Pressure Equipment Directive) other EU Directives are now in course of preparation. Like all the latest EU technical directives, the purpose of these new directives is to eliminate the so-called "technical barriers" to the trade of some specific products, for which no rules exist in the present European legislation: among them there are the rubbish containers, the water closets and the shovels for collecting dog excrement; the use of such shovels will shortly be made compulsory within the entire European Union. However the relevant EU draft directive is now causing a lot of discussions among the delegates of the Member Countries at the European Council: in fact they all agree that the solution of the problem of dog excrement, widely present on all the pavements of European cities, towns and villages, cannot be postponed any further; this for both hygienic and aesthetic reasons. The situation is worsening every year, because the number of four legged animals is increasing, while (with more or less the same speed) the number of two legged children is decreasing: in fact animals cost much less than children, particularly because they do not need neither a fixed monthly salary proportional to their registry age, nor University fees up to their 40th year; moreover, animals like dogs, cats, birds and similar can hardly live for more than 20 years, which also contributes to reduce the costs.

Certainly the decreasing birth rate is causing other problems too, like the greater need for import of manpower from extra-European countries, or the risk of bankrupt for the Social Security Institutions of the Member Countries, due to the always more unfavourable ratio between workers who pay contributions and ex-workers who get pensions; nevertheless, after hearing the Social Parties (Trade Unions and Industrial Federations), it seems that a consensus was finally found on a draft directive to be modelled on the PED (Pressure Equipment Directive), which will be most probably named DED (Dog Excrement Directive). However the Commission is very concerned about the present situation of the PED, and fears that the future DED could cause similar problems: certainly neither from the point of view of the ESRs (Essential Safety Requirements) of the shovels, nor for the establishment of suitable certification procedures; but the qualification of suitable Notified Bodies will certainly cause more difficulties, and the same will happen for the periodical in-service inspections, and also for the market surveillance.

From the design point of view, it is evident that shovels for collecting dog excrement shall be dimensioned for the worst conditions that they have to withstand during service and testing (probably transport and maintenance will not influence so much the design); however strong disagreements exist among the Member Countries: some of them would like to express the maximum load to be withstood by a shovel using a fixed figure (probably 5 kg, or, using force instead of mass, 49 N); other Countries on the contrary are in favour of using a less constraining definition, for example "maximum weight of the product that the dog could reasonably put down"; of course the technical details should be provided by a suitable harmonised CEN standard, as it happens with the PED; the shovel Manufacturer will be responsible to prepare a suitable Risk Analysis, which should consider all the possible risks that are reasonably foreseeable (loss of the shovel content, operator's protection from getting in contact with it, etc.). The difficulties in the theoretical calculation of the shovel cannot be ignored; therefore, it seems that DBA (Design by Analysis) will also be allowed, in parallel with DBF (Design by Formulae); doubts still exist on the Design by Experimental Methods, because shovel designers generally do not like to make experimental design.

But, as it was said before, the greatest concern of the Commission is the competition among the most important and internationally recognised Inspection Organisations, which will of course try, by all possible means, to be appointed by their national governments as Notified Bodies for the DED: if the use of dog excrement shovels will become compulsory, and therefore certified (CE-marked) shovels are to be bought by all dog owners in Europe in a very short delay, the business

for the Notified Bodies is assured. Of course, like in the case of the PED, notified bodies will be only responsible to certify compliance with the Essential Safety Requirements (for example, speaking about Design, and supposing that the idea of a fixed figure for the weight will not be accepted, the NB has to certify that the weight of product used by the Manufacturer in his design calculations is reasonable); considering that dog excrement shovels are serially made products, the NB will have probably to adopt a module B (Type Examination), coupled with a module F (testing of the entire production – of the shovels, not of the excrement); of course corresponding QA (Qualty Assurance) modules could also be used (probably D or E); no agreement was found on module H, because with this module the Manufacturer (having obtained his QA certificate related to the specific product) would be free to test his products by himself (again, I mean to test the shovels, not the content), without any intervention of the NB. There is also a proposal for a completely new module, that no other directive has considered yet: module S (to be named M in latin speaking countries).

It is a fact that all the most important British, French and German inspection organisations are warning their peripheral offices in Eastern Europe and in the Far East, because the great majority of the CE marked products concerned by the DED will be probably coming from those areas; for the same reason in many Member Countries the Ministries for Industry are carefully studying the most appropriate systems for the Market Surveillance, because the experience with the PED has proven that the more serious Inspection Organisations tend to become less serious when they are only responsible for the Essential Safety Requirements (that is, in the case of the DED, to be responsible for the right weight of the excrement).

Considering the experience made with the PED, the Commission is afraid that for the DED in some Member Countries the same problems will have to be expected: for example in Germany there is a very good possibility that someone of the Länder will issue rules for in service inspections which might give a penalty (in terms of more frequent inspections) to the products not made in strict conformity with the German rules; it is in fact clear that the DED, like the PED, being a directive made with the purpose of eliminating technical barriers to trade, will only give rules for fabrication: each Member Country will be left free to organise periodical inspections according to its needs and its traditions.

In Italy, where in the past no particular inspection was ever considered for dog excrement shovels, the Italian Ministry for Industry is preparing a draft: according to this draft, the products bearing the CE-mark in accordance with the DED will be probably inspected (like cars) every two years; however it is not yet decided who will have to carry our these inspections: of course ISPESL and ASLs are the most suitable candidates, but many private organisations are pushing in order to be considered; informed people say that the corresponding draft for in service inspections of PED products, which is now ready since many months, and which also opens to private organisations, will be issued only after the approval of the DED; in this way ISPESL and ASLs could be compensated for the considerable loss of work on PED products. However ISPESL, as for PED products, will also act as Notified Body for the construction of DED products: of course this will assure to this organisation a reasonable turnover, particularly considering that ISPESL is a fully governmental organisation, not subject to budget constraints: in other words, its prices can be fairly competitive with the prices of the other private NBs, which, on the contrary, are not allowed to spend more money than they earn.

No problem seems to exist for putting into service DED products: a written declaration of the user, to be sent to the local ISPESL department, will be required in order to register the shovel for future in-service inspections; of course, the declaration must be completed with the Manufacturer's certificate and other related documents.

Nothing, for the time being, has been provided in Italy from the point of view of market surveillance, neither for the PED nor for the DED; of course this is a minor problem, defective pressure equipment, like dog excrement falling down from defective shovels, in the opinion of the Italian Ministry, are not likely to cause important damages.

This, at least, is what I was told by that friend of mine, who is very conversant with Commission's matters. Well, I must admit that sometimes what he says is hard to believe, so you can never be sure whether he is serious or not.

F. Lidonnici

SANT'AMBROGIO Newsletter – June 2003

The Children's Corner

Once upon a time in the World of Animals there was a country called Euforbia. Euforbia was not a real country: it was merely a federation composed by various Animal Kingdoms, whose Kings, after many years spent to fight against each other, one day decided that they would not have survived in that way. However nobody of them was really ready to leave all his power to a Central Government: therefore they decided for a compromise solution. Of course one of the first things they did was to create a Euforbian Parliament and a Euforbian Council, composed by the most respectable and authoritative Euforbian animals; moreover, they decided to nominate a Euforbian Commission, where they sent all the politicians who could create problems at home; but neither the Parliament, nor the Council, nor the Commission had any real power on important things: therefore the first Animals who became members of the new institutions decided to start dealing with those matters which their national governments considered less important, like eliminating customs and technical barriers, harmonizing national legislations, using a common currency unit, and so on: of course this would have brought money and economic advantages to everybody; because it is well possible for Lions to make good business with Foxes, and for Pigs to make good business with Frogs; on the contrary it is very unlikely that Lions are willing to delegate their power to Pigs, and Foxes accept to be governed by Frogs.

The main concern of the respectable and authoritative Animals of the new Euforbian institutions was to issue Technical Directives, in order to eliminate technical barriers to trade caused by the differences in technical rules existing in the different Kingdoms; the Animals which were members of the Euforbian Commission were particularly severe against those Kingdoms which refused to conform their legislations to the new Euforbian Technical Directives.

But even in technical matters nobody was willing to change his mind; therefore, in order to make these new Directives acceptable to Lions, Foxes, Frogs, Pigs and other flying, swimming and walking animals, the King of the Foxes had a wonderful idea: the new Directives would not have considered (as the old Animals' legislations) all the technical details of a given product, but merely the so-called Essential Safety Requirements. These words were very nice, also because everybody had the possibility of interpreting them according to his own ideas: which in Euforbia was considered of outermost importance. But since the Essential Safety Requirements alone were not actually sufficient to design and fabricate a given product, the Animals' Commission decided to make a contract with EFAS (Euforbian Federation of Animal Standards) in order to produce a great quantity of EHAS (Euforbian Harmonised Animal Standards) who should give the detailed rules which had to be the translation into details of the Essential Safety Requirements. It was clarified by the Animals' Commission however that the EHAS should simply give the so called "Presumption of Conformity" with the relevant Directive, but they should not be considered compulsory.

Therefore the production of technical directives started with great emphasis: every technical device which was in use among the Euforbian Animals was the subject of a particular Directive, so that a lot of things had to be stamped with the EAC (Euforbian Animals' Community) mark. The production of EHAS started as well, because the various Technical Committees of EFAS were very happy to receive money from the Euforbian Animals' Commission.

However there were devices for which each animal kingdom had independently developed very complicated and peculiar rules; this was the case of Pressure Equipment. Pressure Equipment in general, and Pressure Vessels in particular, were completely unknown to the majority of Euforbian Animals; only a small minority was familiar with them, and could understand the risk of having Pressure Vessels not properly designed and manufactured; which, in their opinion, could only happen when their particular Animal Legislation was used: in other words, the Lions could not accept Pressure Vessels designed and Manufactured according to the Frogs' rules, because they thought that only the Lions' rules were safe enough; and the Pigs could not accept Pressure

Vessels to the Foxes' rules, because in the Pigs' world these rules were considered too foxy.

But the coming into force of the Pressure Equipment Directive obliged each one of the Animal Kingdoms to cancel its old legislation on Pressure Equipment and to replace it with the Directive. Many animals of this experts' minority were members of the EFAS Technical Committees, and had taken part to the development of the EHAS; many of them were sincerely convinced that the work done for EFAS was a good work; but other animals of the same minority were particularly reluctant to leave the old technical rules on Pressure Equipment in favour of the new EHAS. Therefore in each one of the different Animals' Kingdoms some kind of trick was found in order to save the old technical rules on Pressure Vessels: in one of them it was decided to shorten the interval between two subsequent inspections for all products which were not made in conformity with the old national rules; in another one it was decided to change the name of the old national standard in order not to replace it automatically with the new EHAS; and many other foxy tricks of this kind.

The Animals' Commission was very concerned about the unfair behaviour of some Kingdom; but since Euforbian Directives dealt with construction and not with service, and since the new EHAS were not compulsory, considering also that the great majority of the animals didn't know anything about Pressure Equipment, they preferred to growl, grunt, grumble and croak a little bit; but no roars whatsoever came from the Commission.

Of course, this is a only tale, with absolutely no reference to the real world, which is composed by Men, not by Animals; whoever wants to establish any relationships between this Euforbian tale and the European reality is wrong, absolutely wrong; because Men are much more clever than Lions, Foxes, Pigs and Frogs, or any other flying, walking or swimming animal.

F. Lidonnici

SANT'AMBROGIO Newsletter – March 2004

The new Harmonized Unfired Pressure Vessel Standard EN 13445: was it a waste of time?

It took more than 12 years to CEN TC54 to issue the first version of **EN 13445 (Unfired Pressure Vessels): the most important harmonized standard to be used with the PED**, the Pressure Equipment Directive. A team of selected European experts has spent a lot of man-hours in preparing and discussing the standard, and a lot of travel hours in going around Europe to the different cities where the meetings of their working groups were organized; they still meet regularly in order to improve the standard, to correct mistakes, to complete it with new clauses and annexes. Was it worthwhile doing this tremendous effort?

From the merely technical point of view, **EN 13445 is certainly one of the most advanced Pressure Vessel standards in the world**: new original methods have been developed for Design by Analysis, and the same methods have been used for Design by Formulae of complicated items, such as Flanges, Tubesheets and Saddle Supports. But pressure vessels are certainly the items with the greatest influence in the cost of any chemical and petrochemical plant: therefore Pressure Vessel standards must not only be technically advanced, they must also be competitive. Moreover, pressure vessels are also dangerous, if they are not correctly designed, manufactured and tested: therefore pressure vessel standards must also be safe and reliable. **Are we sure that EN 13445 is not only technically advanced, but also safe, reliable and competitive?**

As probably all pressure vessel engineers know, **the PED doesn't prescribe the use of a specific standard**, neither for vessels nor for any other piece of equipment: pressure vessel manufacturers are therefore free to choose any standard that in their opinion (or in the opinion of their customers) is in compliance with the Directive. **What is then the advantage of using a harmonized standard**, that is, a standard that the Commission has officially commissioned to the Federation of European standard organizations (CEN) and that was officially published on the Official Journal?

The idea which was at the root of the New Approach (the new way of writing European Technical Directives) was very simple: let's make simple laws (the directives) which contain only essential (and binding) safety requirements, and let's give to CEN the task of preparing harmonized standards, which contain all the complex technical details needed in order to convert the ESRs into precise figures and concrete technical measures: **the advantage of using the harmonized standard instead of any other possibly applicable national or international standard will be the presumption of conformity**: a given product is made in conformity with a harmonized standard, therefore it must be presumed to be also in conformity with all the applicable directives; on the contrary, whoever will use non harmonized standards will have the obligation to prove compliance of his product with the directive.

A further idea of the New Approach was that **the harmonized standards of a given European directive would replace all the existing national standards**, which would automatically disappear after the issue of the EN: this because all the national standard organizations (DIN, AFNOR, BSI, UNI, etc.) which are members of CEN are automatically obliged by the CEN rules to replace all the existing national standards on a given subject with the mutually agreed EN standard as soon as a new EN on the same subject is approved and published.

I really do not know for how many European directives the system has really worked in this way; but everybody can see that for Unfired Pressure Vessels the situation is different from the one that the European legislators had imagined.

First of all, the presumption of conformity to be given to EN 13445 is nothing but a nice tale for children: all European manufacturers who usually export unfired pressure vessels into other

European countries know very well that **in Germany the presumption of conformity is given only to AD 2000, in France to CODAP 2000, in the United Kingdom to PD5500 and in Italy to the post-PED update of the Raccolte ISPESL; in some of these countries a certain presumption of conformity is also given to the American Unfired Pressure Vessel standards (ASME Section VIII, division 1 and 2)**, which are widely used for export outside Europe; the American Society of Mechanical Engineers is now trying, with the help of some interested notified body, to prove that a vessel manufactured to its standards automatically (or almost automatically) complies with the PED. In all these countries (which, by the way, are the ones that invested more money to send their experts around Europe for the preparation of the new EN) nobody wants to leave the national standards, even if sometimes they are less competitive than the EN; the fact is that **in the a.m. countries the EN is considered less safe and reliable than the national standard** (in Germany, for example, TÜV inspectors usually require shorter inspection intervals for all vessels which have not been manufactured to AD 2000). Only the countries in which no national standard existed before the PED (or where the national standard was not so widely used as in Germany, France, Italy and United Kingdom) seem to find the new EN acceptable.

But how is this possible, if the National standard should disappear after the publication of the corresponding EN? The problem is that this should really be true only for those Pressure Vessel standards which are published by the national standard organizations: while in Germany the AD 2000 are prepared by the professional associations concerned and published by **VdTÜV**; in France CODAP 2000 is prepared and published by **SNCT** (the French association of Manufacturers); in Italy the Raccolte are prepared by the official governmental inspection body **ISPESL**; and **all these organizations are not obliged to withdraw the national standard when the corresponding EN is published**. In the only country (United Kingdom) where the Unfired Pressure Vessel standard (BS 5500) was really published by the national standardization body (BSI), somebody was clever enough to find the way to **keep the British standard in life simply changing its name: PD 5500 (where PD stays for Published Document) instead of BS 5500** (Neapolitans, who are worldwide famous for this kind of tricks, would not have been able to make it better).

Probably those people (among notified bodies and users' companies, certainly not among manufacturers) who are fighting to defend the old national standards understand very well that **standardization is a political philosophy whose goal is to defend the economic interests of the country where the standards are made**; they probably think that the national industry will have an advantage if the national Pressure Vessel code will survive: who is able to impose his standards to other people makes the interest of his national industry, which using its own standards can fabricate at lower costs. The Americans know this very well, and in fact they were able to build the most coherent and comprehensive standardization system in the World: looking at Pressure Equipment, the ASME Code is complemented by ASTM/ASME material standards, ASNT standards for testing, ANSI standards for flanges, bolting, etc. Every one of these documents makes reference to the other ones, so that the entire system is self-supporting, and doesn't need further references. **What the enemies of the harmonized standards probably do not understand, is that no one of the national standardization systems of the various European countries was able up to now to compete with the American system**, and that **only a common European system made of advanced technical rules is able to get the same international acceptance level of the American one**, particularly if the use of the new ENs will be able to reduce the costs, without decreasing the overall degree of safety of the products; this is so true, that now the Americans are changing their standards looking at our new ENs (many ideas in the draft of the new division 2 of ASME Section VIII have been taken from EN 13445). In other words, the defenders of the old national Pressure Vessel standards are short-sighted: they think to defend the national industry, but in the reality they are penalizing the entire European industry, which would get big advantages from the adoption of a common European standards.

Some advice for the Commission? **Do every effort to promote the use of EN 13445**, and to discourage the use of the old national codes: the users must understand that **the new EN is safe and reliable**, in some case more reliable than these codes; punish all behaviours which try to limit

the use of the EN in any one of the European countries (particularly when these behaviours come from public authorities and notified bodies); and finally, **try to change your rules for financing the preparation of harmonized standards**. Pressure Vessel standardization requires big efforts: it is not possible to say that Commission's financial contributions are only for the administrative work while the time of the experts is not paid; it is not possible to say that these contributions are only for the so called new Work Items, while every modification to already approved rules is not financed; in this way the poor standard-writers shall starve, while the secretariats of Standard organizations, TCs and WGs will become rich and powerful; and if standard-writers die, we will loose the only people who are able to find out always new Work Items to finance the system.

The reality of all the industrialized countries is that **Pressure Vessel standards are living standards, regularly updated on the basis of the progress of technology and of the feedback of users, manufacturers and inspection bodies**; for this purpose in every country there are **permanent technical Committees**, which meet regularly to issue **periodic amendments** and **code cases**. Therefore, in order to create a similar European system, TC54 and its Working Groups (as probably also other TCs and WGs which prepare harmonized standards for other types of pressure equipment) should become permanent committees: now, everybody can see that the presences (particularly manufacturers' presences) are decreasing, because **industry cannot afford to supply the man-hours of qualified experts for nothing**; if this tendency goes on, the entire process of preparing the standards will be slowed, the standards will become over conservative, which will put them automatically out of the market. Consider the possibility of simply reimbursing the travel expenses of the experts, plus a small fixed sum for their daily presence at the meeting, which covers at least the time they are spending outside their companies or organizations. Of course a method like this should be coupled to a practical evaluation of the results, in order to be sure that the time of the experts is actually spent to make and update standards, not to play videogames with their laptops during the meetings.

F. Lidonnici

SANT'AMBROGIO Newsletter – November 2004

The new Harmonized Unfired Pressure Vessel Standard EN 13445: a competitive alternative to the existing national standards

I have already mentioned in our newsletters the **difficulties encountered by the new harmonized European standards to get universal acceptance** among their possible users: this is particularly true for the Unfired Pressure Vessel standard EN 13445. The main problem is that **the old national standards have now got, in the relevant country of origin, the same degree of "presumption of conformity" with the Pressure Equipment Directive that the harmonized standard should get:** all the technical committees officially charged for the maintenance of such national standards have in fact spent a lot of work in order to **amend and update** these documents **to bring them in full conformity with the PED**; moreover, the **positive experience of use** and the **great amount of technical specifications written by the main engineering companies** in each Country and based on the national Pressure Vessel standard, make these important users particularly reluctant to leave the old route in favour of the new one.

In fact **the main problem in the so called "New Approach"**, that is in the new European way to make (through a substantial **deregulation)** the European technical directives acceptable to everybody, **is the fact that no standards, not even the harmonized ones, are compulsory**; therefore, even if **EN 13445 is certainly one of the most advanced Pressure Vessel standards in the world**, before it can be accepted by the Industry it should be made first of all clear that it is **competitive**, and secondly that it is **regularly maintained, updated and developed**.

The **European Commission and CEN** (the European standardization body) are really putting **a lot of efforts in the maintenance and update of this standard**: the **MHD (Migration Help Desk)** in Paris, composed by experts nominated by all the main European countries, is working hard to issue **amendments based on the comments** received by all the interested parties: its task is to **give interpretations and to correct obvious errors**, sending to the relevant **CEN/TC54 Working Groups or Task Groups the comments which require more substantial modifications**; on the other side, **CEN/TC 54** (chaired by BSI) is coordinating the work of the same Groups on the so called "**new work items**", that is the items not yet considered in the standard or the ones that need important revisions; and even if the Commission's rules for the financing of this work are sometimes questionable, **EN 13445 is certainly one of the European standard on which more activity is now in course**.

In this way **the possible users can be sure that EN 13445 will not become obsolete**; but **how can they be sure that it is competitive** with the still existing (and hard to die) corresponding national standards?

Just to make some example, the following tables give you an idea of the competitiveness of the new standard in the design of tubesheets of **shell and tube exchangers**.

TABLE 1 – GEOMETRY AND DESIGN CONDITIONS

CASE	H.E.TYPE (TEMA)	SHELL SIDE PRESSURE (bar)	TUBE SIDE PRESSURE (bar)	SHELL SIDE TEMP. (°C)	TUBE SIDE TEMP. (°C)	SHELL I.D. (mm)	CHANNEL THCKS. (mm)	SHELL THCKS. (mm)
AU_1	DEU	40	200	300	300	1500	126	22
AU_2	BEU	15	30	250	250	1500	-	-
AF_1	AES	15	30	250	250	1500	-	-
AX_1	NEN	15	30	250	250	1500	16	10
AX_2	BEM+EXP.JOINT	10	6	200	150	1500	-	10
AX_3	BEM	10	6	200	150	1500	-	10

CASE	TUBE O.D., THCKS, LENGTH (mm)	TUBE PITCH (mm) AND PITCH TYPE	TUBE NUMBER	FREE BAFFLE/BAFFLE LENGTH (mm)	SHELL WALL TEMP. (°C)	TUBE WALL TEMP. (°C)	TUBE-TO-TUBESH. JOINT	Material
AU_1	16 x 2 x 6000	21 TR.	2105 U	1000	-	-	EXP+W	CS
AU_2	19,05 x 2,11 x 6000	25,4 SQ.	1198 U	1000	-	-	EXP	CS
AF_1	19,05 x 2,11 x 6096	25,4 SQ.	2385	1000	-	-	EXP	CS
AX_1	19,05 x 2,11 x 6096	23,81 TR.	3260	1000	110	75	EXP	CS
AX_2	25,4 x 1,65 x 4200	31,75 TR.	1849	1000	145	50	WELDED	SS
AX_3	25,4 x 1,65 x 4200	31,75 TR.	1849	1000	145	110	WELDED	SS

TABLE 2 – TUBESHEET THICKNESS OBTAINED WITH DIFFERENT STANDARDS

CASE	ASME VIII division 1	TEMA	EN 13445.3 (Cl. 13)	EN 13445.3 (Annex J) 1000 Cycles	EN 13445.3 (Annex J) 10000 Cycles	EN 13445.3 (Annex J) 100000 Cycles
AU_1	302	299	302(1)(2)	308		
AU_2	148	127	147	147		
AF_1	98	106	67	74		
AX_1	76 (3)	108	59	16	26	68
AX_2	65	75	40	57		
AX_3	45	75	34	31	31	55

(1) Clause 13 thickness only possible with 163 mm channel thickness and 30 mm shell thickness
(2) Clause 13 thickness increased to 405 mm if channel thickness is increased to 150 mm only
(3) ASME Thickness only possible with 30 mm channel thickness

The exchangers selected for the test are all made with **a common diameter of 1500 mm**, however with **different arrangements** (2 “U” tube, 1 Floating Head, 2 Fixed Tubesheets with Bellows, 1 Fixed Tubesheet without Bellows); the codes used for the comparison are the **American codes TEMA and ASME Section VIII division 1** (note that TEMA rules on tubesheets will be discontinued, since the new ASME method is now mandatory). The **yellow fields indicate the lowest thickness obtained**. It has to be noted that while for the “U” tube exchangers (where the tubesheet is practically a flat cover with holes) **the new standard gives results equivalent to ASME, in Floating Head and Fixed Tubesheets with Bellows the advantage in thickness is around 35%**; but particularly **remarkable is the advantage of the alternative method contained in Annex J** (based on limit analysis) **for the design of plain Fixed Tubesheet exchangers,** where **the thicknesses can be greatly reduced** (even by **70%**!), particularly in exchangers with relatively low specified number of cycles. Note that the advantage depends on **a better evaluation of the real behaviour of a fixed tubesheet exchanger**: all the existing methods (based on the Gardner’s theory, developed in U.S.A. about 40 years ago) consider the **differential thermal expansion** between tubes and shell as an **additional pressure on the tubesheets**, thus causing an increase of their thickness; while Annex J, considering the experience of the very thin (and flexible!) tubesheets normally used in fire tube boilers (which are also fixed tubesheet exchangers), **takes into account the thermal stresses for the calculation of the allowable number of cycles only**. In other words, **the differential thermal expansion of the tubes doesn’t affect the safety of a fixed tubesheet exchanger**, provided its specified number of cycles is reasonably low (which i**s the case of almost all the units in service at chemical and petrochemical plants**,

that are always in **continuous service**, except that they are stopped for maintenance with very long intervals, generally every three year)

The above examples have been presented in July at the **International Welding Institute in Osaka**; the research has been **limited to American standards**, but using **our software (which is particularly oriented to design)** is very easy to obtain a comparison also with **AD 2000** (German) and **VSR** (Italian) rules. It has to be noted that **also AD B5 allows very thin tubesheets**, because the calculation of fixed tubesheet exchangers is made with the same formula of fire tube boilers, which only considers the local bending of a flat tubesheet area within the tube layout; however **Annex J** (which, by the way, was also elaborated by a German expert, **Dr. Joachim Wölfel**) **is based on a much better theoretical** approach than AD B5, because it points out the real problem of thermal stresses in fixed tubesheet exchangers.

To **similar conclusions** one could come after examining **a similar table for flanges**, where the **alternative method of Annex G allows substantial advantages in thicknesses in relationship to standards based on the old Taylor Forge method** (such as ASME Section VIII division 1 and 2, PD 5500, CODAP, VSR); again, flanges calculated according to **DIN 2505** (or to **AD B7/B8**) **may be even thinner, however Annex G is based on a better theoretical approach**.

Fernando Lidonnici

SANT'AMBROGIO Newsletter – July 2005

The new Harmonized Unfired Pressure Vessel Standard EN 13445: the alternative design method for Flanges.

At the end, it seems that something is moving! There are European users (mainly in the field of energy) that are specifying in their purchase orders to Pressure Vessel Manufacturers the use of **EN 13445, as an alternative to the old national codes**; as we have already mentioned in our preceding newsletters, three years after the coming into force of the Pressure Equipment Directive **these codes are still alive in the major European countries** (France, Germany, Italy and U.K.); this is due to the **reluctance of the most important users** (particularly the chemical and petrochemical companies) **to change their specifications**, which are based on the old national regulations; so that it can be easily said that such regulations, in the relevant country of origin, are giving the same presumption of conformity to the P.E.D. of the harmonised standard EN 13445.

This **presumption of conformity is generally given also to the ASME code**, which has always been widely used in chemical and petrochemical plants, and which many international Notified Bodies are willing to consider as satisfying the Essential Safety Requirements of the P.E.D. (which might also be right, provided some additional prescriptions are considered).

Now, **the global European market is speeding up the change**: if EN 13445 starts to be specified at least for one plant, a lot of European Manufacturers, located in all European countries, will receive inquiries asking for vessels designed to that standard; and engineering companies like ours, that are able to supply **either the software, or the design calculations and the drawings**, will start receiving calls or e-mails from national and foreign customers, with questions like the following ones: "**How is the new standard? Is it more or less severe than AD 2000, CODAP 2000, ASME VIII division 1 and 2, PD 5500, VSR**? If I make my quotation using one of these standards, what is the possibility of obtaining the same cost as with EN 13445? What is the cost of your software? How much time do we need to learn to use it?"

What is really remarkable in these questions is that **nobody has really read the text of the standard**, not even in the countries where a version written in the national language already exists; this probably happens because **people are so accustomed to use a software for their calculations, that they have lost the idea of reading** a book in order to get the necessary "know-how"; this is something belonging to our ancestors, young people have no time to read and to understand: let the software writers do this, we will profit from their experience when using their software. Well, at the end **it is not reasonable to fill one's head with dozens of equations when the same are automatically solved by a computer; but sometimes reading a book may help to understand things better**. Nevertheless, for the benefit of those who hate reading books, but are still willing to read our newsletters, we will try to offer some cross comparison between the old standards and the new one.

Last time we had already shown something about **Tubesheets**; now we would like to show something about **Flanges**, considering that **in EN 13445 there are two different calculations methods for Flanges**: the traditional **Taylor Forge** method (which is now almost 60 years old), contained in Clause 11, and **the new method of Annex G**, based on limit analysis, which was published for the first time in EN 1591. Note that **Flanges are generally made from forgings, and forgings are more expensive than plates**: therefore the advantage in using a more competitive calculation method for Flanges may be important, particularly for **Shell and Tube Heat Exchangers** with removable tube bundle, which may have a considerable number of flanges.

The following examples have been derived from the **research project ENVELOPS**, which was completed four years ago and was coordinated by Sant'Ambrogio: nine different "Welding Neck" flanges, of different sizes and design conditions, have been studied with **three different procedures: ASME VIII division 1, EN 13445.3 Clause 13 and EN 13445.3 Annex G**. The

design (design, not checking!) calculations were made using **Sant'Ambrogio software** in all cases; the materials are those which are normally used with each standard (SA materials for ASME, EN materials for EN), however using for each example materials that are substantially equivalent; the procedure consists in **optimizing first the bolt area**, and **then the flange weight**, starting from **hub proportions** that have also been optimized according to reasonable design criteria intended to **reduce both the cost of raw material purchase and the cost of machining**; this design procedure (which can be used with any flange design method) was developed for the first time in our software and has now 17 years of positive experience.

CASE	CODE	FLANGE MATERIAL	BOLTING MATERIAL	PS (bar)	TS (°C)	SHELL ID x THICKNESS (mm)
WN1	ASME	SA 336 F 22	SA 193 B16	150	400	1500 x 110
	EN	11CrMo9-10	40CrMoV4-6			
WN2	ASME	SA 266 3	SA 193 B7	100	100	1500 x 42
	EN	P355QH1	25CrMo4			
WN3	ASME	SA 266 2	SA 193 B7	10	200	500 x 3
	EN	P305GH	25CrMo4			
WN4	ASME	SA 266 2	SA 193 B7	10	200	1000 x 6
	EN	P305GH	25CrMo4			
WN5	ASME	SA 266 2	SA 193 B7	25	200	1500 x 14
	EN	P305GH	25CrMo4			
WN6	ASME	SA 266 2	SA 193 B7	25	200	2000 x 18
	EN	P305GH	25CrMo4			
WN7	ASME	SA 266 2	SA 193 B7	25	200	3000 x 28
	EN	P305GH	25CrMo4			
WN8	ASME	SA 182 F 304	SA 193 B8 cl.1	5	200	1500 x 5
	EN	X5CrNi1810	X5CrNi1810			
WN9	ASME	SA 182 F 304	SA 193 B8 cl.1	10	200	1500 x 9
	EN	X5CrNi1810	X5CrNi1810			

CASE	Required Bolting (Clause11)	Required Bolting (Annex G)	Required Bolting (ASME VIII-1)	Bolt Tensioning device
WN1	36 M85 x 6	36 M76 x 6	32 M95 x 6	Hydraulic bolt tens.
WN2	32 M80 x 6	36 M72 x 6	32 M85 x 6	Hydraulic bolt tens.
WN3	12 M16	16 M16	12 M16	Impact wrench
WN4	44 M16	40 M16	40 M16	Impact wrench
WN5	88 M27	92 M24	76 M27	Impact wrench
WN6	72 M39	108 M30	88 M33	Impact wrench
WN7	88 M52	104 M45	108 M42	Impact wrench
WN8	64 M20	80 M20	68 M20	Impact wrench
WN9	92 M20	88 M27	104 M20	Impact wrench

CASE	FLANGE WEIGHT kg (Clause 11)	FLANGE WEIGHT Kg (Annex G)	FLANGE WEIGHT Kg (ASME VIII-1)
WN1	4673	4395	4646
WN2	2383	2013	2781
WN3	22	22	26
WN4	75	61	98
WN5	411	327	444
WN6	1125	676	974
WN7	3213	2301	2773
WN8	200	139	231
WN9	262	237	257

Note that **the method of Annex G requires the knowledge of the bolt tightening device** used for bolting-up (either in the shop or in the field); an impact wrench has always been considered, except for the high pressure flanges (for which a hydraulic bolt tensioner is normally used).

Examining the results, we can see that **Annex G gives the lowest bolt area in 5 cases over 9**, while it **gives the lowest flange weight in all 9 cases** (the cells coloured in yellow indicate the less conservative results); at the end, **flanges designed to Annex G have a weight which is 20% less than the corresponding weight obtained with the other methods**; and this with the additional advantage of **a much better theoretical analysis, which guarantees, if the bolts are properly tightened with the load selected at the design stage, the leak tightness of the assembly**.

Note also that the r**esults obtained with Clause 11 are substantially equivalent to those obtained with ASME**, although Clause 11 provides higher nominal design stresses for bolts than the ASME code (for bolts in heat treated Cr-Mo steel, at not particularly high temperatures, Clause 11 prescribes the tensile strength at 20°C divided by 4, while ASME VIII division 1 prescribes the same characteristic divided by 5); however **EN bolting materials have mechanical characteristics much lower than the corresponding ASME materials**, which sometime cancels the advantage given by the lower safety factor.

The only problem in the use of Annex G is the l**ack of data about the required gasket characteristics for a certain number of materials**; a Work Item for the amendment of Annex G is now being finalized by WG'C' (Design) of CEN TC54, which should solve the problem and make the method much easier to use.

In the context of a series of **courses on Pressure Vessel design**, organised in Milano by Sant'Ambrogio in collaboration with **UCC/ANIMA** (the Italian Association of Pressure Equipment Manufacturers), **we are carrying out a lot of work on cross comparisons among different standards**; in the next issue of this newsletter we will keep you informed about the competitiveness of EN 13445 for the design of other pressure vessel components.

F. Lidonnici

SANT'AMBROGIO Newsletter – September 2006

The new Harmonized Unfired Pressure Vessel Standard EN 13445: do we really need it?

Try to ask this question to some important European user (for example, one of the companies belonging to the wide field of the chemical and petrochemical industry). Very easily the answer will be: "We have already an **ASME Code**, which is known by everybody in the world. And there are **plenty of national Pressure Vessel codes** in Europe. And **the Pressure Equipment Directive (PED) may be used with any one of them**. Why should we use another one?"

If you insist in trying to prove that vessels designed to **EN 13445** may be **10% to 15% less expensive** than the corresponding vessels designed to ASME, you will probably get the comment that EN 13445 is not yet sufficiently known, that they should modify all their specifications based either on ASME or on their own national codes, that their Arab customers willing to build an oil refinery in the Middle East would hardly accept something different from the ASME code for the pressure vessels, and so on. It is funny, but it seems that the only part of the American culture easily accepted without problems in the Middle East is the American standardization system on Pressure Equipment.

Well, this might also be justified for plants to be built outside Europe. But **it is very hard to understand why EN 13445 is not used in Europe**, particularly in the most important industrial countries, like **France, Germany, Italy and United Kingdom**. At the end, **these countries gave the most important contribution** to the standard in terms of number of experts (and in terms of man hours spent by the same experts in 16 years of work: the first WG meetings of CEN TC54 started in 1990). In each one of these countries somebody (sometimes the same experts who worked for the EN!) is **still working at the further development of the old national standards**. So in France we have now **CODAP 2000**, in Germany we have **AD 2000**, in UK we have **PD 5500** (instead of BS 5500), in Italy we have the "**Raccomandazioni**" for the use of the old **"Raccolte" ISPESL** in the context of the Pressure Equipment Directive (even ASME has issued a Guide for the use of ASME Section VIII division 1 in the context of the PED!). How is this possible? And is it really true that the resistance against the use of the new EN 13445 comes from the users only and not also from the Manufacturers' Associations, Standard Organizations or Notified Bodies? And what kind of interest might have all these people to go on with the old national codes?

Speaking about Manufacturers' Association, it has to be noted that the French Association **SNCT** is regularly developing, updating and publishing in France the national Pressure Vessel code CODAP 2000 (price for non-members: € 3.000,00 plus taxes). Well, somebody could think that the Financial Manager of SNCT would not be happy if EN 13445 (published by **AFNOR** in France at less than ¼ of this price) should replace CODAP 2000 on the French Pressure Vessel market.

Speaking about Standard Organizations, **BSI** (the British Standard organization), being member of **CEN**, according to the CEN statute should have been obliged to replace **BS 5500** with the new EN. On the contrary, they preferred to change the nature of this British Standard, transforming it into a **Published Document** (PD instead of BS – human fantasy has really no limits!), regularly developed, updated and sold to non-members at £1.150,00 (~ € 1.680,00), a little bit more than the £ 880,00 (~ € 1.290,00) required for EN 13445. Of course a PD may be sold also to foreign customers, while the same foreign customers would hardly buy in UK an EN sold (possibly at a lower price) also by their own national standard organization. So, also in this case, somebody could think that the Financial Manager of BSI would not be happy if EN 13445 should replace PD5500.

And what about **AD 2000** in Germany, which is regularly developed, updated and published by **VdTÜV**? The cost of the complete AD 2000 Handbook is only € 280,00. With a price so small

(compared to the other national standards), is it possible that the Financial Manager of VdTÜV would really be worried about a possible loss of money? Of course the Financial Manager of **DIN** should be worried about the profits he cannot make selling EN 13445 at the official price of € 544,60…

The Italian "**Raccolte ISPESL**" (issue 1999, no further development was made after that date, except for an "errata corrige" of VSR and VSG issued in 2003) are actually sold at an official price (including taxes) of € 59,64 (these books are available in Italian language only). Since they are not fully in line with the PED, **CTI** (Comitato Termotecnico Italiano, the Italian Committee supporting **UNI** – the Italian standardization body - for all matters related to Pressure Equipment) has issued a set of recommendations for their use in the context of the PED (also in Italian language only, however freely downloadable from the web site of CTI). Therefore I do not think that the Financial Managers of ISPESL or CTI will kill themselves if the Italian code will disappear. However there are in Italy many peripheral offices of important **Notified Bodies** (mainly working with ASME) that are trying to show to Italian Manufacturers all the advantages of replacing the old ISPESL rules with the **ASME Code** (in this job they have the unconditioned support of many important users and engineering companies, that are already accustomed to use this Code everywhere). For them, as for the said users, this means to use experience, specifications and software that they already own, thus avoiding a lot of troubles to their relevant Financial Managers. And probably the Financial Manager of UNI, which sells a CD containing the English edition of EN 13445 for € 119,00 (plus 20% TVA) only, will not feel himself particularly unhappy, provided nobody will oblige him to make a translation of the standard into Italian, which would involve – so I have heard – tremendous costs and questionable results.

But **who or what is really deciding in this stupid war among the old European codes, ASME and the new EN?** Financial Managers may be very strong, but at the end they are not necessarily decision-makers. Maybe **somebody is afraid to leave an existing standard successfully used for many years**, while the new EN doesn't give sufficient guarantees. Maybe the customers are always the boss, and therefore entitled to impose to their subcontractors the standard, and possibly also the Notified Body, as it always happens with big users of the Chemical Industry. Maybe there is **a sort of national pride**, still existing in the most important European countries, which prevents the creation of a corresponding **European pride**: so that **the same experts, in many countries, are working at the same time to develop and update the new EN and their old national Codes**. Is this behaviour really reasonable? Or is it a shame for all the European industry, which could only have advantages if a coherent and comprehensive system of harmonized standards supporting the corresponding European directives is built in Europe?

Note: owners and prices of the different standards in the various countries have been taken from the internet. Sometimes it is not completely clear what is included or excluded from these prices (taxes, updates, etc.). I apologize for any incorrect information that I might have communicated because of errors existing in the relevant web sites.

F. Lidonnici

SANT'AMBROGIO Newsletter – April 2007

Should we delete EN 13445 from the list of the harmonised standard?

Well, somebody in Europe seems to share this opinion. As you know, **Technical Committee 54 (Unfired Pressure Vessels) of CEN is carrying out the 5 years systematic review of all its standards**. Among them, the one which required more efforts is no doubt **EN 13445**, **the Unfired Pressure Vessel Standard**, published for the first time in 2002 and therefore candidate for the 5 years systematic review. In our newsletters I have spoken many times of this standard, trying to explain the reasons why **it has still to face the strong competition of many famous corresponding national Pressure Vessel standards**, although from the purely technical point of view it is certainly the most advanced Pressure Vessel standard in the world.

Well, it's true, I have worked for its preparation, I am still working for its maintenance and updates, so my opinion could be in some way influenced by this situation. Certainly it is not influenced by the fact that my company is selling software for the calculations in accordance with EN 13445, because **we also sell software in accordance with the ASME Code** (divisions 1 and 2), **with the German Code AD 2000**, **with the Italian ISPESL codes VSR and VSG**: until the number of standards to be used with the Pressure Equipment Directive will remain high, every Manufacturer will have to buy and keep up to date software licenses in accordance with all the possible standards, not only with one of them, which of course means a greater turnover for my company. In any case, if you don't share my opinion about EN 13445, **can you tell me the reason why the Americans, in the new coming issue of their ASME Section VIII division 2, have taken so many ideas from that standard**? I would only mention one of them, a very simple one: the **reduction of the safety factor on the tensile strength from 3 to 2,4** (by the way, with the "Design by Formula Amendment", EN 13445 has gone still further, allowing a reduction from 2,4 to 1,875, provided addition safety measures are met).

Funny situation: 12 years to prepare a European standard on Pressure Vessels, plus 5 years of maintenance and updates (the Migration Help Desk has just issued the 24th amendment of the standard), **a lot of money coming from the European Commission** (our money at the end, because the European Commission is financed by the European citizens: Belgian, British, Dutch, French, German, Italian, Portuguese, Spanish citizens are all European citizens, even if many of them have still some doubt about this kind of double identity: probably more doubts than the new European citizens coming from the Eastern European countries). And this **just to help our American friends to improve their national Pressure Vessel code**. Well, at the end it's all right: **for years the European Pressure Vessel codes have taken ideas from ASME or from other American sources:** just to make an example, **the Taylor Forge method for Flanges**, which was thoroughly copied in the French CODAP, in the British PD 5500 and in the Italian VSR. Or **the Tubesheet design method**, taken from a series of papers (1948-1960) of **K.A. Gardner**, which was the basis not only of the American TEMA and (later) ASME method, but also of the French CODAP, of the British PD 5500, of the Dutch rules for Pressure Vessels and of the Italian VSR. Not to mention the **Welding Research Council Bulletins for Local Loads**, the **Zick's method for horizontal vessels on saddle supports**, and the entire philosophy of **the Stress Categorization in the rules for Design by Analysis** (these latter transferred from the ASME code into all the main European pressure vessel standards). Even **EN 13445 still takes into consideration some of these methods as a basic solution** (Flanges in Clause 11, Tubesheets in Clause 13, Design by Analysis in Annex C), while, on the other end, it provides **more modern methods (based on limit analysis) as an alternative** (Flanges in Annex G, Tubesheets in Annex J, Design by Analysis in Annex B). Therefore to make problems because the trend is now going (for the first time in the history of Pressure Vessel Technology) into the opposite direction, from Europe to the United States and not vice versa, is, in my opinion, absolutely silly.

In our latest newsletter (made in September 2006) I tried to analyse **the reasons why the**

European national Pressure Vessel standards are always so vital, although so many efforts have been spent in the preparation of a modern European CEN standard. My conclusion (which up to now has not been opposed by anybody) was that **in certain countries there might be some peculiar interest of the Organization publishing the national code**, which is sometimes different from the national standard organization associated to CEN, and therefore **is not obliged by the CEN rules to withdraw the publication of the corresponding national standard when a CEN standard is approved**. I also mentioned **the case of UK**, the only European country where, on the contrary, **the Pressure Vessel standard (BS 5500) was published by the national standard organisation (BSI) and not by another entity**: well, even in this case the national Pressure Vessel is surviving, regularly maintained and updated by a team of qualified experts. How is this possible? With **the simple trick of changing its name in PD 550**0, where PD stands for **Published Document**. Of course a PD is not a BS (British Standard), and therefore there was no obligation to withdraw PD 5500 after the publication of EN 13445.

Funny, isn't it? Particularly if you consider that **BSI has the chairmanship of the CEN Technical Committee (54) which has prepared EN 13445**, and is therefore responsible for its update and continuous development. It is true that now **the great majority of projects concerning EN 13445 is carried out by the most important Working groups**: A (General), B (Materials), C (Design), D (Fabrication), E (Inspection), and no one of them is chaired by BSI. Also the **MHD** (Migration Help Desk, responsible for the **interpretation and correction of errors**), is chaired by AFNOR, not by BSI. Therefore is not surprising to read the **comments made by BSI about a possible new edition of EN 13445:**

"This is a mature industry with a high profile safety focus, currently under severe financial constraint. As currently presented, there is no commercial incentive to use the multi-part EN 13445. We strongly recommend that before progressing too far with the proposed new edition, CEN should discuss this with the industry operators responsible for making the decisions that govern the selection of standards. Whilst it is accepted that the proposals for amendment, currently in process will improve the viability of application, the usability issue, engendered by the multi-part structure will remain and requires positive action".

Trying to give an interpretation: ***"Why the Pressure Vessel industry should use EN 13445? There are so many nice national codes (particularly PD 5500, Published Document sold by BSI only) that are certainly better known! So, boys, don't be silly, forget a possible new edition of EN 13445, better to throw everything into the basket! At least, once the Commission gave us some money: now, that access to funding has become more difficult, there is no reason why we should overstress ourselves"***. (I repeat, **this is only my personal interpretation**: I would be obliged to anybody capable of giving me a better one, also explaining which are the "**usability problems**" caused by the **multi-part structure**).

Well, **I don't want to say that EN 13445 is perfect**. Many things are still to be improved. I find more constructive and worth to be considered the **comments made by Belgium**, particularly on **part 5 (Inspection),** whose prescriptions are sometimes **more stringent than the corresponding prescriptions of other Pressure Vessel standards**. But, of course, improvements can only be carried out by people who believe in them.

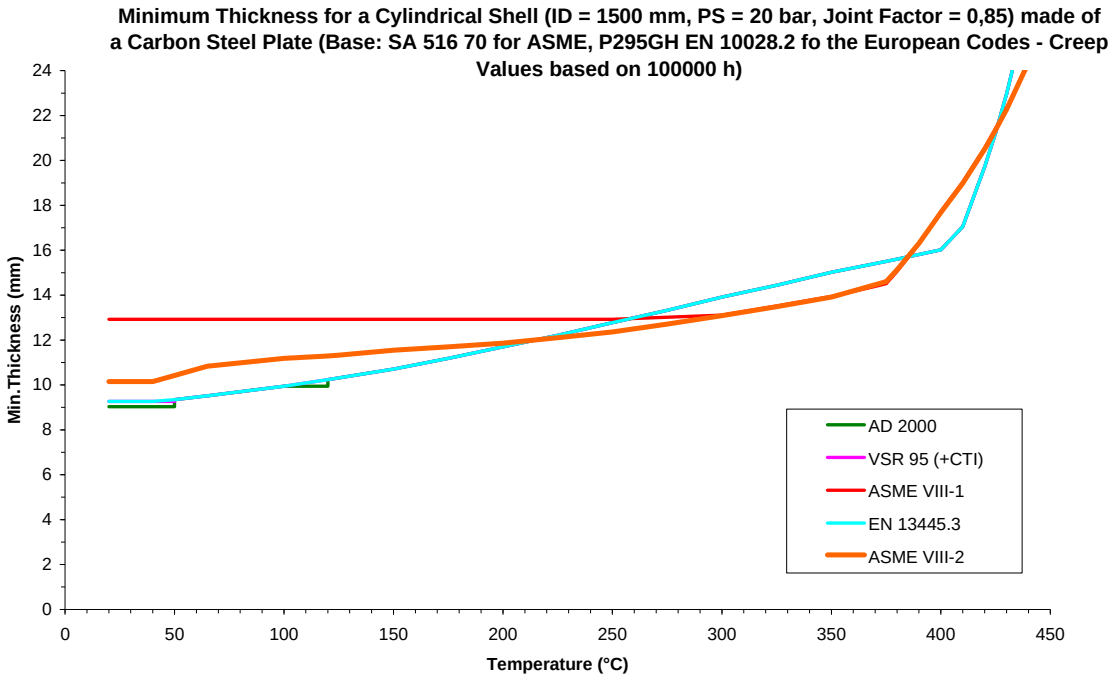
By the way, **on June 11th Sant'Ambrogio is organizing a conference in Brussels, at the CEN Meeting Centre, on EN 13445**. The conference will be **mainly focused on part 3**, but my friend **Piet Verbesselt will also deal with the other parts** (particularly 2, 4 and 5). Hoping to convince European people that European standards have been made for them, even if they can be useful also for the Americans.

F. Lidonnici

SANT'AMBROGIO Newsletter – July 2008

The new edition of ASME Section VIII Division 2

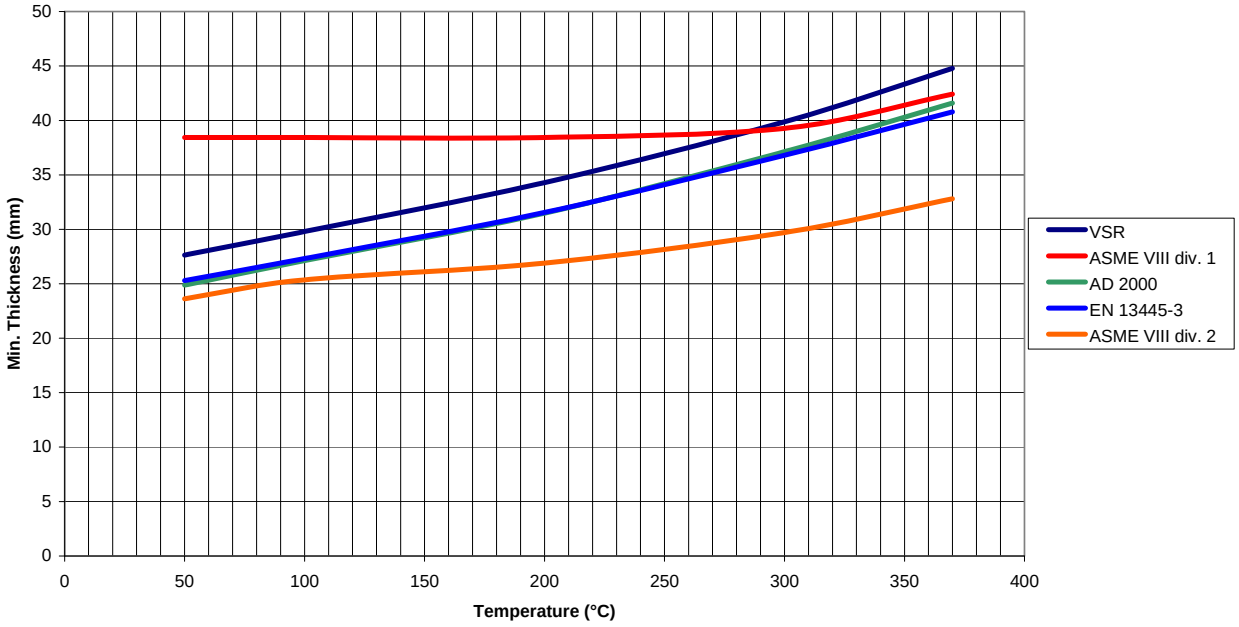
In the month of July 2007 **the new edition 2007 of the American Pressure Vessel Code ASME Section VIII, Division 2** has finally been published. This brand new Unfired Pressure Vessel Code contains a lot of innovation in respect of the previous 2004 edition. **The allowable stresses of Carbon and Low 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 performed, 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**.

F. Lidonnici

SANT'AMBROGIO Newsletter – February 2009

Is the European Commission really interested in the creation of a European standardisation system?

A few days ago we have received from CEN (the European Federation of the National Standard Organisations) the communication that **the European Commission is refusing to pay the contributions already agreed for the work done after 2003 (and completed 3-4 years later) on EN 13445 (the Unfired Pressure Vessel standard) part 3 (Design)**. Just to explain the problem to people that are not familiar with the procedures of the European standardisation (and of the European bureaucracy), we will tell you that after 1990 **Sant'Ambrogio had always assured Convenorship and Secretariat of WG'C' (Design) / CEN TC54**, the group who has in charge the update and development of EN 13445 part 3. From 1990 to 1995 this work was done on the basis of a financial agreement between Sant'Ambrogio and UCC/ANIMA, the Italian association of Pressure Vessel manufacturers. **After 1995 the Commission decided to provide a financial support (50% of the man hours and the travel expenses) to CEN** for the preparation of the most important harmonised standard of the Pressure Equipment Directive: but the **European contributions were given only to the national standard organisations** who had the responsibility of the Technical Committees, Working Groups and Subgroup where the work had to take place. For this reason after 1995 our work was paid by **UNI (the Italian standard body)**, using these contributions. But **after the first issue of EN 13445 in 2002 it became always more difficult to obtain the agreement of the Commission for further amendments and additions** which were logically suggested by the first experiences of the users. However a certain number of "work items" were approved, although after a long series of discussions. These work items permitted **substantial improvements of the standard**: for example, the extension to materials other than steel, the extension to temperatures in the creep range, the experimental tests, etc. **After 2006 it became practically impossible to obtain the Commission's approval of new work items on EN 13445**, so that we were obliged to give back to UCC/ANIMA the task of assuring the Secretariat of WG'C', while Sant'Ambrogio was still assuring the Convenorship, upon reimbursement of the Convenor's travel expenses only. At the same time, **the contributions already due were greatly delayed**, while the Commission was asking more and more justifications about the man hours spent on each specific work item. **Now, after completing the inquiry about the correctness of all the papers supplied, UNI has received the Communication that the Commission is not willing to pay**. And this in spite of the fact that UNI got from CEN a regular "order voucher" and that the various amendments of EN 13445 part 3 (Design) had been all regularly approved and published. **Other experts and institutions who worked together with us for part 3 (Design) and also for the other parts of EN 13445, have also received a similar communication**. Moreover, it seems that there is a very good possibility that the Commission **will ask the reimbursement of the contributions already given in the past**. For somebody, like myself, who has been working 19 years for the European standardisation of Pressure Equipment it is certainly not encouraging. I enclose the **open letter that I sent to the Commission and to CEN** on this subject. In this letter I am explaining **the excuses found by our Eurocrates in order to spare some money** and I try to figure out what can be **the future of the harmonised standards of the PED**, also considering the **actual situation of the old national Pressure Vessel standards** (that I have already described many times in our newsletters).

F. Lidonnici

Open letter to the European Commission:

SANT'AMBROGIO SERVIZI INDUSTRIALI S.R.L.
PIAZZA CARLO DONEGANI 8 - I 20133 MILANO, ITALY
tel.: +39.02.70603113 fax : +39.02.2663546
e-mail: *santambrogio@sant-ambrogio.it*

Mr. Hans Dhooge
European Commission
Rue Belliard 100
B 1049 Brussels

c.c. Mr Gaston Michaud
CEN
Rue de Stassart 36
B 1050 Brussels

c.c. Mr. Ruggero Lensi
UNI
Via Sannio 2
I 20137 Milano

Milano, February 11th, 2009

Subject: EC/EFTA contributions on Order Voucher 03/07 (several work items concerning EN 13445 part 3 – Unfired Pressure Vessels – under the responsibility of CEN TC54).

Dear Mr. Dhooge,

Although I never had the pleasure to meet you in the past, I take the liberty of applying to you personally, as Administrator of Unit I/5 (Construction and Pressure Equipment).

Since 1990 I am the Convenor of WG'C' (Design) of CEN TC 54; I was consultant of the Commission for the preparation of the Pressure Equipment Directive in the years 1993-1998; my company (Sant'Ambrogio Servizi Industriali) took part in several Research Projects financed by the Commission, all of them in support of the standardisation work.

You certainly know that EN 13445, the European standard for Unfired Pressure Vessels, is by far the most important harmonised standard of EC Directive 97/23, the so called PED (Pressure Equipment Directive). 12 years of discussions (1990-2002) among several experts coming from all the European countries were needed for the preparation of this standard, due to the big differences in the technical principles used by the various European national standards, regulations and laws. But at the end, thanks to the good will, the hard work and the joint efforts of all these experts, it was possible to find a consensus, which led to the creation of a common European technical philosophy in Pressure Vessel Design and Fabrication. EN 13445 is now an example for every similar national standard also outside Europe, as it is proved by the latest edition, i.e. 2007 edition, of the American Unfired Pressure Vessel Code ASME Section VIII division 2, which took several ideas from EN 13445 and also from the Pressure Equipment Directive itself.

Certainly one of the main reasons of this success was the financial support given by the Commission to CEN, and through CEN to the national standard organisations (BSI, AFNOR, DIN, UNI, etc.) which held the Convenorship and the Secretariat of TC54 and of its various groups and subgroups. This support, which started in 1995, was continued at least up to 2005. After this date, the rules to obtain the contributions for further work items became so stringent, that it was practically impossible to obtain the necessary approvals (at least this was the opinion of the TC54 Secretariat). And the situation is worsening, because it seems now that also the contributions given in the past should not have been given. But let's make one step at a time.

Of course I am well aware that the Commission cannot give financial contributions to a given standard for ever, even to a standard like EN 13445 which is so deeply innovative. It is logic to expect that European standardisation, which is made in the interest of European industry, has to be supported by the European national industrial associations concerned by the standard. However, for reasons that are possibly different in each specific case, in the most important

European countries (France, Germany, United Kingdom and Italy) the old national Pressure Vessel standards which were used before the coming into force of the PED are still preferred by the most important Users. It would take too long to investigate the reasons of this phenomenon: the only thing that can be told is that these reasons have almost nothing to do with Pressure Vessel technology and much more to do with the particular interests of somebody. In any case it is a fact that in France, in Germany and UK (which by the way are the countries which gave the greatest contribution of experts to the preparation of EN 13445) there are still groups of experts which are paid by the industrial associations for maintaining and updating the old national standards, while the same associations are not willing to send them to the meetings of TC54 and its working groups. In other words, in these countries manufacturers, users and notified bodies are giving to the old national standards (already brought in conformity with the PED) the same "Presumption of Conformity" which, according to the PED, should only be given to the harmonised EN standards.

This situation is the main obstacle to the further development of EN 13445, and tends to reduce the value of the investment made by the Commission in the years between 1995 and 2005 not only for the Unfired Pressure Vessel standard, but also for all the other harmonised standards concerning Pressure Equipment. In fact Users and Engineering companies would have a strong interest in developing a coherent and consistent European standardisation system to be used for chemical, petrochemical end energy plants, as a more competitive alternative to the American system. But since 70-80% of the cost of such plants is given by Unfired Pressure Vessels, it is clear that failure to specify EN 13445 for the Vessels would make impossible also to use the harmonised EN standards for Boilers, for Piping, for Valves, etc. In other words, until the European experts will be working to develop the old national Pressure Vessel standards, the entire set of harmonised EN standards of the PED will be jeopardized, and the money spent by the Commission will be lost.

I don't know how much the Commission and CEN are aware of the problem: it is true that many experts of TC54 (including myself) have been invited many times in the past by the Commission to international meetings aimed at the promotion of the European harmonised standards. I know also that EN 13445 is now taken in good consideration in the new Eastern European member countries, where no strong national rule or standard existed before the PED. But the most important contractors are in Western Europe, and the Manufacturers must follow the standard specified by them.

In this respect the Italian situation is particularly remarkable: In fact Italy is probably the European country where Pressure Vessel manufacturing is still extensively taking place, while the great majority of French and German workshops have been moved towards countries having lower man hour costs. In Italy no maintenance and update of the old ISPESL rules is carried out: however the influence of the American process companies on many important Italian users working for the chemical and petrochemical industry is very strong, so that manufacturers very often receive orders for plants to be built in Italy (or elsewhere in Europe) where the ASME Code and not the European standard is imposed by the customer.

In other words, if CEN and the Commission will not develop a joint action to change the situation, sooner or later the American system (whose compliance with the P.E.D. is questionable, although it must be recognized that ASME is doing a big effort to update its standards in this direction) will automatically prevail. May be this is the real intent of the Commission: in this case the idea of trying to recover also the money already spent up to now in favour of the building of a sound European standardisation system based on the New Approach technical directives may be justified.

It seems in fact that the European Commission is now putting all its efforts to punish and discourage the people who have spent a big part of their professional life in working for the European Pressure Vessel standards. And this is done with a very simple method: refusing to pay them the amount of money originally approved for work already carried out some years ago, and possibly finding a way to recover also the money which was already given in the past.

And now I come to the point. A few days ago I was informed by UNI, which after 1995 has subcontracted to my company all the work concerning chairmanship and secretariat of the Working Group "C" (Design) of CEN TC 54, the Technical Committee responsible for EN 13445, that the invoices we made for the latest work items were rejected by the Commission. Note that these work items, concerning a series of amendments and improvements to part 3 of EN 13445 carried out in the years 2003-2007, had been regularly approved by CEN and by the Commission.

These invoices, as usual, covered only 50% of the time spent to bring the amendments to a positive conclusion. And the conclusion was certainly positive, since they had been all regularly approved in Public Inquiries followed by Formal Votes or in UAP Ballots (simplified voting procedures). All of them have been already published: EN 13445.3 is now arrived at its 35th issue, and a meeting in Paris has already been scheduled in order to discuss the publication of the 2009 edition of the standard.

It is also interesting to note that the rejection came after an endless series of clarifications requested by the Commission concerning exact dates and times of the meetings where the different work items were discussed, so that we and UNI had to spend a considerable amount of hours to look into old documents in order to present to the Commission the

required data. Nevertheless, our invoices were rejected. But what is really ridiculous is the reason of this rejection: UNI, according to the Commission's rules, should not be entitled to subcontract entirely the work to a private company like Sant'Ambrogio! Funny to discover this after so many years, isn't it? Particularly knowing that Pressure Vessels are such a peculiar subject, that chairmanship and secretariat of any group working for their standardisation must necessarily be assured by an expert. And knowing also that the world of Pressure Equipment experts is so restricted, that it is particularly difficult to find people who have time enough to spend in favour of the European standardisation. And knowing also that we are an engineering company specialised in Pressure Vessel Design, that we have worked for years for Pressure Vessel manufacturers all over Europe, that we were for years consultants of the European Commission (the latest contract between Sant'Ambrogio and the former DGIII bears the number PRS/95/A01178/83818). All this in the years where my work for TC54 was still financed by UCC/ANIMA (the Italian association of Pressure Vessel Manufacturers, which, by the way, is now paying at least my travel expenses when I work for WG'C' and CEN TC54). And knowing also the active part had by the former Commission's official Mr. Nikolaus Steininger and by the CEN Pressure Equipment coordinator Mr. Hakimi Noureddine in the discussions held in Brussels in September 2003, where the distribution of the funding for the contested work items was discussed: may be everybody thought at that time that I was an employee of UNI, otherwise somebody would have protested, would have told me "Go away! You have not the right to sit here with us!": or, may be, something softer, like "Well, if you like to carry out some kind of work for us you are free to do it, but please consider that nobody will ever give you an Euro cent for this!"

But nobody had protested, so I was really convinced that at least 50% of the time spent for CEN could receive some kind of reward.

Only now I have learnt that, according to the rules of the European bureaucracy, a national standardisation body should employee a sufficient number of technical officers having experience and ability to follow the harmonised standards for Pressure Vessels, Boilers, Piping, Lifts, Refrigerators, Buildings, Bicycles, Electrical Devices… should I add something else? Or, better, it should have people having sufficient experience to follow, may be, 10% of the meetings, while the remaining 90% can be subcontracted to somebody else? Do you think that is a reasonable way to coordinate a group of experts?

The amount of money? Well, nothing special, something around 21.000 Euro: Sant'Ambrogio can of course survive. May be we can also go on giving my time free of charge, while, as I told before, somebody else is paying at least the travel expenses: this is exactly the way we are now using in order to carry out, as far as possible, the new work items on EN 13445 agreed in TC54. For these work items everybody knows that there will be no support from anybody, neither from the Commission, nor from the industrial Associations: and at the end they are all stupid topics like Non Pressure Loads (Wind and Earthquake calculations), Heat Exchanger Tubesheets, Fatigue and so on. But the problem is that there are very few people willing to take the task of chairing the relevant Subgroups: old guys (like myself and a few other) are disappearing, younger guys are probably available (upon suitable payment to be made to the companies which they work for) only for the national Pressure Vessel standards: for the EN, the situation is the same as in a well known TV spot played by George Clooney, where the actor opens the door, comes in and says to the party's guests: "No Martini, no party"; and takes away the bottle of Martini, leaving all of them in the deepest sorrow.

Well, Mr. Dhooge, the Commission has taken away my personal bottle of Martini: to other old guys like myself you have taken away also more than one bottle. Of course that is a good starting point if the intent is to destroy everything we have built in almost 20 years of work. May be you will be able in this way to convince myself and the other people that working for free in the European standardization is a stupid exercise. At the next ASME PVP conference, which will be held in Prague in the month of July, I have to present a paper, which deals with a cross comparison of the American and European Pressure Vessel standards (including EN 13445): well, also this time, as in all the preceding occasions (last time it was two years ago in Bucharest, where I have been invited by Mrs. Dakai of the Commission), I will assure the audience than EN 13445 is the most advanced and innovative Pressure Vessel standard in the world: but you can be sure that I will do this with much less enthusiasm than before.

The other thing that the Commission must really do if they really want to throw completely into the basket the harmonized standards of the PED is the one you are already doing (or not doing): that is, doing nothing to stop the continuous development of the old national codes in France, Germany and UK. But please, don't tell me that this is outside the scope of your work, that the Commission cannot stop the production of private publications (Published Documents!) on Pressure Vessels like these national standards are considered: if the Commission is able to find excuses in order to avoid payments for works successfully completed some years ago, it should also be able to find excuses to avoid this kind of exercises, which are certainly against the interest of the European industry. Because if your intention is to go on in doing absolutely nothing in order to stop the work on such Published Documents, my company could possibly face the temptation to make also a Published Document: the Sant'Ambrogio Boiler and Pressure Vessel Code, based not only on our long experience in Pressure Vessel Design and Fabrication, but possibly also on the experience of someone of my European friends that the Commission is also refusing to pay: I am sure that I am able to convince

plenty of them, without Commission's and CEN's rules we will do a very good work, then we will sell the new standard and share the profits.

Well, of course this was a joke. In any case I wish to assure the Commission and the CEN Management (as I have already done with UNI) that I will do my best in order to recover the money due for the positive conclusion of the a.m. Order Voucher: I have received an order, I have done my duty, please give me my money, I have earned it.

And if somebody is still refusing, as I have always done in my work of Convenor, I will first try to convince people by speaking and writing, possibly smiling a little bit, as I am doing now.

By the way, forgive me if this letter will be sent not only to you and the CEN management, but also (through our periodic Newsletter) to all Sant'Ambrogio customers and friends: at the end after 19 years of work in CEN I think I have the right (and 21.000 good reasons) to do so. In any case this could also be helpful for the greater diffusion of the harmonised CEN standards.

Be sure that any answer received from the Commission and from CEN will also be brought to the attention of the same people, using the same channel. And be sure also that I look forward to receiving an answer.

Very truly yours

(Dr. Eng. Fernando Lidonnici)

Convenor of WG"C" (Design) of CEN TC54

SANT'AMBROGIO Newsletter – November 2009

The importance of European standardisation for the Industry of all the world.

All manufacturing activities concerning Pressure Vessels are slowly moving from Western Europe to Eastern Europe and the Emerging Countries (mainly **China** and **India**). This tendency is particularly relevant in France and Germany, where well known manufacturers (particularly of Steam Generators) have closed their home manufacturing facilities and bought manufacturing shops in countries with lower price of man hours, leaving at home only their Engineering and Commercial departments. Also Italy has been affected by this tendency, although several qualified Italian manufacturers are still on the market, particularly manufacturers of vessels made of special materials, or more generally of products where the cost of man hour has a lower importance in the definition of the final cost.

The world economic crisis, mainly due to financial reasons and not to real problems of the industry, **is now at its end**, and **the market outlooks for Pressure Vessels (in Europe and outside Europe) are certainly positive**. This is particularly true in the field of Pressure Vessels for chemical, petrochemical and energy plants, because the start of the economic recovery will certainly lead to an increase on the demand of oil products, bio fuels, alternative energy sources (mainly of nuclear energy): in all these activities Pressure Vessels play a key role. An industrial world where 1,600,000,000 Chinese and 1,200,000,000 Indians are now entering not only as workers, but also as consumers, will of course require food and bicycles, but also the demand of cars, planes, electric appliances and many other products will necessarily increase. And this is the best guarantee for the survival and further development of the Mechanical (and Pressure Vessel) Industry also in Europe and in U.S.A.

However we should expect that **the qualification of the new competitors coming from the East into the Pressure Vessel market will be progressively growing**, so that in a few years they will also be capable to supply pressure vessels made of special materials with the same quality level of the Western manufacturers. **What kind of standardisation is the best one in order to help this process for the mutual advantage of all the involved countries**?

The standardisation system which is now almost universally used in all the emerging countries is the **American system**, made of **ASME codes and standard**s for Vessels, Boilers and Piping, **TEMA standards** for Shell & Tube Heat Exchangers, **AWS standards** for Welding, **ASNT standards** for NDT Testing, **SA/ASTM Standards** for materials. The main advantage of this system is that it covers all the components of any pressure assembly, whatever is the kind of industry (chemical, energy, food, refrigeration, etc.) for which it has to be designed. **All these standards are coherent within themselves**, that is they have been prepared considering all the requirements of the other American standards concerning the same piece of equipment. Moreover, **their use is very simple**: you need only to read very carefully the customer's specifications and to apply in detail all the prescriptions of the applicable standards, and then you will be able to build a product which is properly designed, fabricated and inspected. Just to make an example, many pressure components (nozzle flanges, valves, etc.) are simply designed on the basis of a rating table, which gives you the allowable pressure on the basis of the temperature and of the material type. Of course the pressure is not the only existing load, although it is generally the one which is determinant for the design; but allowances have been made in the standard in order to guarantee that the component is able to withstand also the other logically existing loads: this is the reason why, in the case of standard nozzle flanges, bolting areas are much larger than the bolting areas required by pressure. In this way no calculation is needed, neither for the pressure nor for the local loads (except, of course, for the most pedantic customers). **It is clear that a system like this is the best one for new manufacturers that have no previous experience**: you have just to follow the rules, then your product is accepted because strict compliance with the rules is considered to be the best guarantee of safety.

But what are the disadvantages of this system? Well, **in all the American standards there is a general tendency to cut the design costs by increasing the weights**: very **low allowable stresses** (in ASME Section VIII division 1 – Unfired Pressure Vessels - and in Section I – Power Boilers - the allowable stress on Carbon and Low Alloy steel is limited by a safety factor of 3,5 on the tensile strength), high **minimum thicknesses** (ASME Valves, TEMA heat exchangers), formulae and rules relatively simple and conservative. **In all the European standards the tendency is exactly opposite**: to **refine as much as possible the calculations**, starting from a **specific risk analysis** which takes into account the particular features of each pressure component (by the way, this is basis of all the European technical directives) and increasing as much as possible the allowable design stresses; **to increase the amount of NDT** on the final product **and the amount of testing on the materials** used for fabrication (the Pressure Equipment Directive requires the guarantee of the material manufacturer on the hot tensile and creep properties, and a greater amount of testing for low temperature service). **The use of a system like this is of course more difficult**, and it requires more qualified personnel, particularly at the design stage. But **at the end the final cost of the product will be lower**.

However the creation **of the European system has still to be finalised**: in the context of the PED we have made very good and advanced standards (like **EN 13445, the Unfired Pressure Vessel standard**) made by CEN TC54. However **the criteria used for this standard do not always match with the criteria followed by the other CEN TCs** dealing with Pressure products (Boilers, Piping, Flanges etc.). These criteria are sometimes determined by the nationality of the experts which gave the greater contribution for the preparation of each specific standard in each specific TC. That is the reason why the European standardisation system, although more modern than the American system, is still behind from the point of view of the mutual harmonisation of the standards within themselves: and unfortunately the **terrific bureaucracy existing in CEN** (due also to the very heavy procedures provided in order to get the approval of so many different countries with different technical backgrounds) doesn't help very much to solve the problem.

Unfortunately also the **European Commission is not helping very much**: and not only because **the financial support to standardisation in the field of pressure systems has been completely withdrawn**. There are other problems, that I have mentioned many times on our newsletters: for example the **survival in France, Germany and UK of the old national Pressure Vessel standards** (CODAP, AD and PD 5500). These standards are still accurately maintained by the experts of the relevant national committees, with the financial support of the local industry. Is it really possible that some people in France, Germany and UK are really convinced that the interest of their countries relies on the survival of the old national Pressure Vessel standards? The reality is that **this situation is only subtracting resources to the European standardisation system**, thus delaying its finalisation, that can only be made when the EN standards will be generally used by all the European industry. **A problem like this can only be solved at the Commission's level**; provided somebody is really willing to take care of it.

The creation of a **European standardisation system** is also important for another reason: for the **positive influence that it could have on the modernisation of the American system**. Many American experts share the opinion that new less conservative standards are necessary. A very good example of a standard like this is the **2007 edition of ASME Section VIII division 2**. The **influence of EN 13445** on that (completely new) code is evident for everybody: **same safety factors** for Carbon and Low alloy steels, **same values for the hydrostatic test pressure**, **similar criteria for fatigue** in welded and unwelded components, **new Design by Analysis methods explicitly based on limit analysis** used as an alternative to the traditional methods based on elastic analysis. However **the contacts among the experts from both sides of the Atlantic Ocean are very few**: it seems that some important reason exists why the American experts are not allowed to take part as observers in the CEN TC or WG meetings, while the same thing happens for the European experts in the PVRC meetings: just to make an example, a lot of research work has been made on both sides on specific subjects (like leak tightness of gaskets),

but up to now a common discussion of the results in view of the possible creation of a more modern flange design method has not been started.

Of course **discussions and exchange of experiences are not easy, considering the difference in technical philosophies**: the American philosophy based on the complete acceptance of all the details of a specific code or standard in order to assure safety, the European philosophy based on the need of performing an accurate risk analysis for each specific case, because the particular standard used (even a harmonised EN standard) is not sufficient by itself to assure the same. Nevertheless, after 19 years of work in the European standardisation, I have seen that **when engineers of different countries, schools and opinions meet around the same table they may have very hard discussions at the beginning, but at the end they will find a solution** (unfortunately this is probably true for engineers only, certainly not for politicians).

Many years of work are probably needed before the European system made of harmonised CEN standards and of compulsory technical directives will have the same degree of coherence and completeness of the American system. But **if the Europeans are all willing to build and to use a system like this**, if they are willing to **share their experiences also with experts outside Europe**, this will be probably **positive for the industry of the whole world**. Of course, in order to do so, they should start to feel themselves Europeans: will ever this be possible?

F. Lidonnici

SANT'AMBROGIO Newsletter – October 2010

The European Pressure Vessel standard: the most advanced Pressure Vessel standard in the world or a stupid waste of money?

In our preceding Newsletter (November 2009) I tried to prove that **the interest of all the European industry (manufacturers and users of pressure vessels)** should be the **adoption of a single European Pressure Vessel standard**. In all the other industrial compartments European standards are in fact progressively replacing the old national standards: so that in France, UK, Germany and Italy the old NF, BS, DIN, UNI… standards are now replaced by European standards designated as NF EN, BS EN, DIN EN, UNI EN… In fact AFNOR, BSI, DIN, UNI, etc. are all members of **CEN, the European Federation of the national standard organisations**. According to the CEN statute, the new ENs, prepared by CEN Technical Committees and Working Groups, are approved by weighted majority in a specific Public Inquiry. **When a CEN standard is approved, all the CEN members are obliged to adopt it withdrawing the existing national standards dealing with the same subject**. This is the reason why CEN was officially charged by the European Commission to prepare the **"Harmonised Standards"**, which should give the so called **"Presumption of Conformity"** to all the **industrial products covered by the "New Approach" technical European directives**. A specific **"framework agreement"** was established between CEN and the Commission, providing a financial support for the preparation of the harmonised standards. **Detailed contracts** were then signed for each specific **"work item"** dealing with the preparation of a new standard or for the relevant amendments and additions.

In fact a European Pressure Vessel standard already exists**: EN 13445,** prepared by **CEN TC54** (chairmanship assured by BSI) and by its **Working Groups** dealing with **Materials**, **Design**, **Fabrication**, **Inspection**, etc. Each WG has a different Convenor, and its work is organised and directed by one of the CEN members. The **first edition of EN 13445** was first published in **2002**, the second one (already arrived at its second issue) was published at the end of last year. It has required **20 years of efforts of many European experts** working for manufacturers, users, engineering companies, notified bodies and standardization bodies. It is **one of the most advanced pressure vessel standard in the world**, in the sense that its use allows a **substantial reduction in thicknesses, weights and costs** of the vessels without decreasing their overall degree of safety and always assuring compliance **with the Essential Safety Requirements of the European Pressure Equipment Directive (PED)**. Of course compliance with the ESRs of the PED may also be achieved using other standards: EN 13445 is therefore **not at all compulsory**, and this is the main reason why it has to face the **competition of other European and American Pressure Vessel standards** (on which, by the way, it had also a strong influence, as I will show later on).

Unfortunately, EN 13445 has **many enemies**, who are trying in all possible ways **to stop its use and its further development**. Let's try to see who these enemies are, and which arguments against it they have.

The first enemy is no doubt the European Commission. Surprising, isn't it? Particularly if you think of the **terrific amount of money** (some million Euros) that the Commission spent in the past to finance the creation and the development of the standard. However absolutely normal, if you consider that **the Commission's employees**, well aware of the Christian matrix of Europe, are simply **applying the Gospel**: and the Gospel says **"don't let your left hand know what your right hand is doing"**. Considering this rule it is possible to understand the actual situation: **the right (operating) hand of the Commission**, the same that has given in the past so much money for the financing of EN 13445 and which is still responsible for financing the European standardization system, **is now trying to promote this standard** through questionnaires and meetings; at the same time **the left (bureaucratic) hand of the Commission**, completely ignoring what the right hand is doing, **is trying with all possible excuses to recover some of the money**

already spent in the past. This is done not only by **refusing to make payments already agreed** for specific work items on EN 13445 completed some years ago, but also **requiring reimbursement of payments already made for much older work items**. The amount of money involved is considerable, some hundred thousand Euros: the excuses for this are that the **Commission's rules** (modified some years ago) forbid subcontracting, unless the standardization body involved can prove that a suitable inquiry had been made for the work item concerned, and that the lowest bidder had got the order. I have already mentioned in a preceding newsletter the fact that **Sant'Ambrogio, which since 1995 by agreement with UNI assured convenorship and secretariat of WG "Design" of CEN TC54,** owing to this pedantic excuses has lost about **21000 Euros**. **UNI,** at its turn, received the request to give back **almost 3 times this amount**, while it seems **much higher figures were requested from BSI**. It is really a pity that this sad history was not discovered at the beginning, but only at the end of the work (at that time we had continuous contacts with the Commission, unfortunately only with the right operating hand, not with the left bureaucratic one – next time before signing a contract we will read carefully the Gospel, or wait until Turkey will become part of the European Union). **Nevertheless, we are going on**: **UCC-ANIMA, the Italian Association of Pressure Vessel Manufacturers**, is now assuring the secretariat and the payment of my travel expenses, as well as the travel expenses of other experts. But, as you can easily imagine, **the attendance of experts is greatly reduced**, and **no one of the standardisation bodies involved is even willing to try to set up new financial requests to the Commission** on any new work item, although **we still need to work on several important items in order to complete or improve the standard**. In the specific case of Italy, **UNI is also refusing to make the translation into Italian of the standard** (available only in English, French and German, the three official languages of CEN), even considering that the Commission has provisions for financing the translation of standards into the various national languages: they fear (and nobody can blame them for this) that **the right hand will sign an agreement at the beginning, while the left hand will refuse payment at the end**. I really do not know whether somebody in the Commission is realizing that **their behaviour risks to bring EN 13445 to a complete stop**, **thus throwing into the basket all the money spent up to now.**

A **second category of enemies** are all the **industrial associations** that in **France, Germany and UK are still publishing the old national Pressure Vessel standards**, sometimes with the help of the same experts who once had worked at the preparation of EN 13445. In fact these **experts are the last individuals of a species which is becoming extinct**: generally old retired engineers, fond of their profession, looking for a natural habitat where they are able to go on working, rounding up a little bit their pension if possible. **Of course a more favourable habitat is offered to them by these associations**, which in the past were able to promote the use of their standards also outside the borders of their countries of origin, and therefore **are now reluctant to give up the profits made by selling the new editions** (generally at prices much higher than the prices requested by the standardization bodies for EN 13445). For these reason **national committees still exist in France, Germany and UK which meet regularly for the further update of the relevant national codes.** But if in these countries the industry has to finance this work, and if the situation with the European Commission is the one I have described above, it is clear that **there are no resources left for financing the European Pressure Vessel standard**. If you ask somebody in these associations, he will swear that his national Pressure Vessel code is the best one in the world, that EN 13445 has not yet a sufficient experience of use, and that in his country everybody still prefers to use the national code only for the sake of safety (all comments are left to the reader).

Another category of enemies are **many important notified bodies**, particularly the bigger ones of them, having local offices outside their country of origin. Of course at home they prefer and promote the use of their national Pressure Vessel code: but in many cases their foreign local offices show **a definite preference toward the ASME code** (particularly Section VIII division 1) more than towards the harmonized standard. Even if many of them are also authorized **ASME inspection agencies**, and therefore they are normally using the ASME Code for vessels directed outside Europe, in Europe they are notified for vessels conforming to the PED. Therefore it is less understandable **why they consider the American Pressure Vessel code as being more in line**

with the PED than the harmonised standard. It is true that the choice of the code is generally made by the user, particularly in the case of **Italy**, the European country where there is probably the greatest concentration of manufacturing shops, and where **no national committee is working any more at the maintenance of the old local Pressure Vessel standard** (the **ISPESL "Raccolte"**). The result is that the ISPESL "Raccolte" are still in use for the local market, while for export to Europe ASME VIII division 1 is becoming the most popular code, and the use of EN 13445 is limited to a small number of products.

But let's come now to ASME**, the American Society of Mechanical Engineers**: I cannot really designate this association as an "enemy" of EN 13445, for two very important reasons: first of all, because I am a member of ASME since 24 years; the second one is that, at the end, although in many public occasions ASME has tried to prove that the use of the ASME Code is giving to products the same presumption of conformity as the harmonised standard, **in practice they are giving a lot of attention to the work that we have done in TC54**. Starting from 2007, **ASME VIII division 2 is considering for carbon and low alloy steels the same allowable stresses** as the harmonised standard. This is also true for the **hydraulic pressure** (same rule as the harmonised standard), for **Design by Analysis**, where now also plastic analysis has been considered as an alternative to the traditional elastic analysis, for **Fatigue**, where now there is a clear distinction between fatigue on welded and fatigue on unwelded components, like in EN 13445.3. So that **the difference in weight and costs between vessels fabricated in accordance with EN 13445 and vessels fabricated in accordance with division 2 are much smaller than with the previous 2004 edition**, although **considerable differences still exist for division 1** (differences in the range **15 to 30%** are normal for **large pressure vessels**, while **division 1 can give some advantage for small vessels,** where the greater amount of testing required by EN 13445.5 may penalize the European standard in comparison with division 1). At the end, until the entire European standardisation system will not achieve the same degree of completeness and coherence of the American system, **the ASME Boiler and Pressure Vessel Code will remain the Pressure Vessel standard more used in the world**, also for contracts outside U.S.A. **What however cannot be said, is that the ASME Code gives presumption of conformity with the European PED**: **the American and European safety systems on pressure equipment are basically different** (the first one based on strict conformity of all products with the applicable Code, the second one requiring a detailed "risk analysis" that considers each product as a single specific case - I have better explained these differences in the paper that I presented at the **PVP conference of last year in Prague – PVP 2009 77273 "Cross comparison of European and American Pressure Vessel Standards in the Design of the Main Pressure Vessel Components"**).

At the end, considering the actual situation, **what kind of future can we imagine for our European Pressure Vessel standard?** I hope to receive an answer from whoever is willing to give his contribution.

F. Lidonnici

SANT'AMBROGIO Newsletter – January 2012

The European Pressure Equipment standardisation system: state of the art

Following to the remarks made by many different sources, I was recently involved in a **comparison among the different EN standards dealing with Pressure Equipment** in order to identify possible differences. Among the topics in which the main harmonised standards (**EN 12952 – Water Tube Boilers, EN 12953 – Shell Boilers, EN 13445 – Unfired Pressure Vessels, EN 13480 – Piping**) show remarkable differences, I have selected **the method for high temperature design** (in the so called **"creep range"**, where materials start behaving like liquids, increasing their strain under constant stress) and the **hydrostatic test pressure** (the value of the test pressure is prescribed, or at least recommended, in the Pressure Equipment Directive, however the prescriptions are not completely clear and may give raise to different interpretations). Without going too much into details about the reasons of the differences, I will only mention the most significant results of these comparisons.

Example 1 - Thicknesses (mm) of a cylindrical shell having an I.D. = 1000 mm, made of Low Alloy steel 2,5Cr-1Mo at 100 bar and 500°C

Standard	EN 12952.3		EN 13445.3		EN 13480.3	
Lifetime (hours)	100000	200000	100000	200000	100000	200000
Monitoring in service required	49	55	49	55	59	55
Monitoring in service not required	49	55	59	67	59	55

Example 2 - Thicknesses (mm) of a cylindrical shell having an I.D. = 1000 mm made of Austenitic Stainless Steel ASME SA 240 304 at 100 bar and 600°C (1)

Standard	EN 12952.3	EN 13445.3	EN 13480.3
Lifetime (hours)	100000	100000	100000
Monitoring in service required	84 mm	69 mm	84 mm
Monitoring in service not required	84 mm	84 mm	84 mm

(1) The equivalent EN steel has no tabulated value of high temperature creep characteristics

From the two examples presented above, it is evident that **the thickness of the same cylindrical shell operating in the creep range (at 100000 or at 200000 hours) is not the same when it is part of a water tube boiler, of a pressure vessel or of a piping system**. In example 1, with a service life of 100000 hours (11 years), the boiler standard is the one which gives the minimum thickness (49 mm), while the maximum thickness (59 mm) is obtained with the piping standard. In example 2, for the same service life, the minimum thickness (69 mm) is for a pressure vessel (provided it is monitored in service!), all other standards give 84 mm. Well, let's hope that cylindrical shells for high temperature applications are clever enough to understand to which kind of pressure equipment they are belonging, and possibly to make a reasonable forecast about the designer's ideas about future monitoring in service: in this way they will be able to develop the necessary strength characteristics! I personally must confess that I am not clever enough to understand why a piece of piping working at 100 bar and 500°C may be thinner when its lifetime is 200000 hours (22 years) than in the case of a shorter lifetime (100000 hours = 11 years). If this were true, it could be extremely dangerous to interrupt after 11 years the life of a pipe originally designed for a lifetime of 22 years!

Dealing with the **hydrostatic test pressure**, I have considered 3 different examples:

Example 1: cylindrical shell, 1 m inside diameter, 40 mm thickness, joint efficiency 100%, corrosion allowance 1 mm, material **fine grained carbon steel P355 NH EN 10028.3**, **design pressure 100 bar, design temperature 350°C.**

Example 2: cylindrical shell, 1 m inside diameter, 20 mm thickness, joint efficiency 100%, no corrosion allowance, material **austenitic stainless steel 1.4571 EN 10028.7**, **design pressure 50 bar**, **design temperature 200°C**.

Example 3: cylindrical shell, 1 m inside diameter, 8 mm thickness, joint efficiency 85%, corrosion allowance 1 mm, material **carbon steel P355 GH EN 10028.2, design pressure 10 bar**, **design temperature 200°C**. The shell is closed by an elliptical end, 5 mm thick, with no corrosion allowance, material **austenitic stainless steel 1.4571 EN 10028.7.**

For all the three cases I have calculated the hydrostatic test pressure according to the prescriptions of the harmonised standards for pressure equipment mentioned above (note **that a harmonised standard, by definition, should be a standard giving the so called "presumption of conformity"** with the reference directive, in our case the Pressure Equipment Directive). **It is surprising to see the amount of disagreement about the interpretation of the same PED requirement among the different EN standards**, prepared of course by different CEN Technical Committees. By the way, in the comparison I have also included the values of the test pressures which should be reasonably obtained if we try to give the same interpretation of the PED with the use of a different (non harmonised) standard (ASME Section VIII division 1).

Test Pressure Summary for the 3 different examples

	DESIGN PRESSURE	EN 13445	EN 12952	EN 12953	EN 13480	ASME VIII div. 1
EXAMPLE 1	100	184,7	207,3	207,3 (1)	184,7	143
EXAMPLE 2	50	82,9	71,5	N.A.	82,9	71,5
EXAMPLE 3	10	14,5	16,1	N.A.	17,2	17,4 (2)

NOTES: (1) limited to 143 bar if tubes are expanded only (2) imposed by ASME, PED would require 14,3 bar only

At the end I must say that **the situation of EN standards for Pressure Equipment is an excellent mirror of the actual political situation of the European Union: everyone is trying to bring forward his own ideas, without looking too much at other people's ideas, and possibly ignoring the final goal of the work**. But please, **do not blame too much European standardisers**: differently from European politicians, **they are not paid at all** (moreover, **they have to pay some contribution to their relevant standard bodies** in order to have the great honour to work for CEN). However, if you look at the mess European politicians are now doing with the Euro, you will have to recognize that **possible problems concerning the stability of pressure equipment are certainly negligible if compared to problems concerning the future financial stability of Europe**.

F. Lidonnici

SANT'AMBROGIO Newsletter – October 2013

Europe and the European Standardization System: Lights and Shadows

When **some European countries decided to withdraw their national currency and to replace it with the Euro**, they certainly decided to **give up much of their national sovereignty**. Well, at that time the economy was doing well, it was certainly a big advantage for everybody to use a single very stable currency, which could be borrowed at very low interest rates: so, **at the beginning of the Euro Era everybody was happy**. But then the economic situation worsened: **some banks and financial organizations thought they had found the way to exploit this stability in order to make money without creating wealth**. As a result of this basic mistake, they started having **serious financial problems**, problems that were **quickly transferred to the industries**, thus undermining their ability to create new wealth. Also **the single national European governments, particularly the ones with a consistent sovereign debt, realized that waiving their ability to print money was causing a raise in the interest rates they were obliged to pay on their debt**: and these additional costs had of course to be charged on their citizens and their industries, thus **increasing the differences among the countries** of the European Union. With the further problem that there is no guarantee for these countries that they will even find a buyer for their bonds; in other words, there is the risk that they are going bankrupt, which in the case of a country is called a **default**. It's hard to imagine the meaning of this: **no money to pay pensioners, public employees, policemen, soldiers, no money to buy medical services and medicines**, not even the money to pay goods coming from abroad, even from the other partners of the Single Currency Area. This phenomenon, of course, risks to be turned into **a kind of cancer that sooner or later will infect all the countries in the world**: a lot of companies will go bankrupt, workers and employees will lose their jobs, not only in the Single Currency area, not only in Europe, but also in those countries for which Europe is an important export market… **unless somebody will realize that a single currency has a meaning only if behind it there is also a single country**, or at least a real federation of countries determined **to help each other**. Failure to understand this will simply mean that in Europe **the "spread" between the interest rates will generate a spread between the economies** of the different European countries, and this at the end will cause problems everywhere in Europe. **Only the mutual help among all the partners of the European Union will be able to solve the problem**: what would have happened in the former DDR if western Germans had not paid the cost of supporting their eastern fellows? And what would have happened in Italy if the northern Italians would have refused to support their southern fellows? The cost of this lack of support would have been probably much higher than the cost of the support itself. But in order to share this behavior **British, French, Germans, Italians, Spaniards etc. must first understand that Europe is now only a very small piece of a globalized world** where new strong economic powers have made their appearance. Therefore **the only way in which we can survive** and save the historical background of our civilization is **to start behaving as Europeans**, that is as **citizens of a single country, ready to help each other for the sake of assuring a common future to everybody**.

Is this pure philosophy? May be. However it has to be recognized that **the European institutions do not seem to have been designed in order to support this idea**. What is remarkable is the **incredible level of bureaucracy** that one has to face each time he has something to do with these institutions. Let's take for example **CEN, the European Standardization Committee**. Standards are important for the industry: **to use the same standards is of a big economic advantage not only for the European industry, but certainly for all the European citizens**. Unfortunately Europeans do not speak all the same language, as, for example, Americans, although nowadays most of them speak or at least understand English. Well, some European politicians feel so proud of their national languages, that they will never be willing to follow **the example of India** (where the problem of **more than 40 different languages** – in the European Union we have only 20! – has been solved with **the use of the English language in all the official documents**). Therefore, first problem: **which language has to be used in the preparation of the standards?** The CEN constitution provides the use of **three Official languages: English, French and German**. Have

you got an idea about the **cost of the translations**? And about the problems caused by the **different interpretations of the original text** (generally in English) when translated into the other two languages? Many years ago, when I started my work as Convenor of WG"Design" of CEN TC54, in our meetings at BSI in London **there were two nice ladies charged of the consecutive translations** of each intervention into the other 2 languages: apart from the **unavoidable misinterpretations** (despite their experience and good will, those two ladies had probably no idea about the **mysterious objects concealed behind funny names like flanges, shells and tubesheets**), the need for a consecutive double translation involved the need of multiplying at least by three the duration of the meetings. After several years **it was finally decided to eliminate the consecutive translations** and start using, at least as spoken language for the meetings, the English language only, like it was made in the Working Groups from the beginning. But **having solved the problem of languages** (at least for the purpose of understanding each other in the technical discussions), **the overall bureaucratic spirit of CEN asked for a compensation**. Therefore the rules became more and more stringent. Of course it is easily understandable that **all the standards are to be made with the same style, using the same size and type of characters, and using the same word processors and graphic programs**: a little bit less understandable is the fact that, in order to do any kind of work on a specific subject, you have **first of all to open a Work Item** and then fix **binding target dates** (with severe punishments if you do not respect them) for the presentation and the **approval at the TC level**, for the **Public Inquiry** and for the **Formal Vote**. In order to start the Public Inquiry you have of course to make the translations of the original English text into German and French, hoping that the translators will be able to do their work correctly, without introducing into the text unwanted modifications. But what is really a Public Inquiry? Easy, it is **an occasion in which all the people who never took part at the preparation of the standard will start asking funny questions, that you are obliged to answer if you want to arrive at its approval**. In fact **all the modifications proposed during the Public Inquiry, unless you are willing to accept them, should receive a written answer in which you must explain the reasons for rejection**. The only problem is that, dealing with standards for design and calculation of something, you will surely find **a lot of people ready to ask questions and propose modifications**, but **very few people ready to test the standard** by using it for a **sample calculation**: so that **the majority of mistakes (sometimes not merely misprints) will be discovered when the standard will come into force**. Therefore the Formal Vote (like the name itself says) is a mere formality: the vote is generally given by people who have never used the standard, and therefore can only make an evaluation on the basis of their familiarity with the methods used.

Taking into account the difficulties involved in the above procedures, **you will probably think that the experts working for the preparation of the standards are earning a lot of money**. Well, you are wrong. In the majority of cases they are **volunteers**, who have their own job at home, and **can dedicate to standardization only remnants of their time**. Moreover, in order to have the great honor to be a standardizer **you have (or your organization has) to pay**: in fact CEN is the federation of the various European national standard organizations, you are not allowed to work in the CEN TCs or WGs if you do not pay a fee to your nominating standard organization; unless, of course, you are an employee of this organization.

Well, some time ago this was not completely true: **at the beginning of our work on the new harmonized standard EN 13445**, there was an **agreement between CEN and the European Commission**: on the basis of this agreement **the experts working for the harmonized standards** of the Pressure Equipment Directive **did receive money for their services**. But **after about 10 years**, for reasons that it would be very long to explain, **this financial support** (although in theory it could still be required today by the CEN members) **was terminated** in the worst possible way, that is withdrawing the payment of the experts for the work they had already done, and asking back the money which was already given to them (I have already told this very sad story in another newsletter, so I will not repeat it now).

Well, **this is not exactly the way of making standards used elsewhere in the world**. This summer I was in Paris for the **Pressure Vessel and Piping conference organized by ASME**, the American Society of Mechanical Engineers. At the end of the Conference, after the Official Conference Lunch, there was a **distribution of prizes and honors to the people working in the**

ASME Committees for the development of the ASME standards. The experts who worked many years for such Committees received a **medal**, a **certification**, and a **check** (500$, 1000$ or even more, depending on the years they had spent in such committees). But **the nicest thing was not the money** (in any case not enough to be considered as a payment for their services): it was **being called on stage to receive an award from the President**, while all present applauded. And it was really a pleasure to see **all these people coming back to their tables with a big smile depicted on their faces**, and with a feeling that **there was somebody in the world who could appreciate their work**: maybe **a usual feeling among actors, singers, doctors, saints, poets and painters, certainly not among the experts of Pressure Equipment standards**. By the way, I do not know how many experts of CEN have ever received at least a letter from the CEN management saying **"Thank you good man, so go ahead"**. Well, although I am not in the CEN management, this is exactly the message that I would like to send to all the friends of my WG. I know that it is neither a medal, nor a certification, and certainly it is not a check, but it is probably the maximum reward that they will receive from CEN for the work they are doing.

Dr. Fernando Lidonnici
Convenor of WG53/CEN TC54

SANT'AMBROGIO Newsletter – March 2014

The dissolution of EPERC, the European Pressure Equipment Research Council

I have just received from **UCC/ANIMA** (**Unione Costruttori Caldareria**, the Italian Pressure Equipment Manufacturers' Association of the ANIMA federation, the actual operating agent of **EPERC-AISBL**) the agenda of the next meeting of this association, to be held in Milan on April 3rd 2014. One of the points on the agenda is the following: "**Dissolution of the Association EPERC-AISBL**". Well, when an association is completely useless, the best thing to do is to dissolute it (you could possibly use less gentle words: to disband, to delete, to eliminate, to kill, possibly with the relevant elimination - dissolution – cancellation - assassination of all responsible people, starting with the President, the board of directors, the secretary, and all the employees and workers, if any). Then you can collect all the documents concerned (letters, technical bulletins, conference reports, meeting agendas), bring them to the proper disposal facilities and proceed to disrupt - destroy – eliminate them, so that also the memory of EPERC-AISBL is dissolved – cancelled – disrupted – destroyed, and no one in the world will ever remember anything concerning this stupid and useless association.

But why the said stupid and useless association was created? Just to copy the Americans with their **Pressure Vessel Research Council** and the Japanese with their **Japan Pressure Vessel Research Council**? Looking in the Statute of EPERC-AISBL we read:

"The main objective of the Association is to develop the European Industry of pressure equipment (manufacturers and users) through research. Other objective of the Association are:

- *promoting the role and importance of the pressure equipment industry in Europe;*
- *promoting and encouraging under respect of the applicable law, cooperation among the manufacturers and users of pressure equipment;*
- *safeguarding the interests of the industry, particularly economic policy issues;*
- *encouraging technical progress, protection of environment and safety at work in the field of pressure equipment;*
- *harmonization of legislation and standardisation as well as acceptance tests at international and European levels in order to facilitate the exchange of goods across borders;*
- *the promotion of competitive methods for in-service inspection and their recognition in standardization and European legislation;*
- *assisting and advising authorities involved in questions concerning pressure equipment at European level.*

Its mission is to coordinate and promote the common technical interests and strategies of the European pressure equipment and related industry in relation to European institutions and the international community"

This was more or less the same program of work of the old EPERC (not yet –AISBL): certainly an ambitious one. But let's look at some historical data. **Founded in 1995** under the auspices of the **European Commission**, the former EPERC in the year 2000 was organised in several task forces:

TTF1 Fatigue Design

TTF2 High Strength Steels

TTF3 Harmonisation of Inspection Programming in Europe

TTF4 Flanges and Gaskets

TTF5 Service Integrity and Life Extension

TTF6 Tanks for Alternative Fuels

TTF7 Hydrogen Damage

At that time EPERC was only a "de facto" association, and its operating agent was the **Joint Research Centre of the European Commission**. In 2003 EPERC had **more than 300 members** (individuals or organisations). Several technical documents (Bulletins) have been produced in those years, on **Flanges**, **High Strength Steels**, etc. Obviously the entry into force of the Pressure Equipment Directive (2002) has decreased the interest of the Commission in supporting EPERC. Having thus lost also the support of JRC, EPERC was obliged to find volunteers to act as operating agents: the last operating agent of the former EPERC was UCC/ANIMA, who is also the actual operating agent of EPERC-AISBL. **In the general Assembly of December 2007 it was finally decided to transform EPERC from a "de facto" organisation in a "de jure" organisation**, thus creating **EPERC-AISBL (Association Internationale Sans But Lucratif** according to the Belgian legislation**)**, with a better possibility to manage research projects using the funding provided by the Commission for research activities. This decision was further confirmed in 2009 at Budapest. However no one knows why it took UCC/ANIMA so many years to obtain the recognition of EPERC-AISBL as a legal Belgian entity, which happened officially only in **2011** with the **Royal Decree of October 27th.** Certainly the 3-4 years stop of any activity has caused a fall of interest in many of the original more than 300 members, so that the actual members of EPERC-AISBL (who actually paid the association fee for the first year) are a little bit more than 10 individuals and/or organisations. This fall of interest became evident at the time of the **general assembly of November 2011**, **which never took place**, because almost no one of the members was willing to participate. No further date was fixed for this assembly, no promotional activity was carried out by UCC/ANIMA, no one dared even to ask the members for the payment of the subsequent yearly association fees. So **the first general assembly of EPERC-AISBL, scheduled for the next month of April, will also be the last one**. In this general assembly at the first point of the agenda the members will have to approve the financial statements for the year 2012 (result: loss of 29,83 Euro) and for the year 2013 (result: loss of 29,84 Euro), as well as the budget for 2014 (result: loss of 364,70 Euro, having spent all the amount of the original association fees to pay first the constitution, and then the dissolution of EPERC-AISBL). In other words: sorry gentlemen, it was only a joke.

Who is responsible for this? The actual President Dr. Franco Tartaglino? The 6 directors (including myself)? The President of UCC? The President of ANIMA? The European Commission? The original 300 members? The world crisis? Or it is the fault of the cynical and cheat fate, just to recall a famous sentence of Benito Mussolini?

Well, let's try to be realistic**. The pressure equipment industry** (at least the manufacturing industry) **is quickly moving outside Europe**: even if many important French, German and Italian Pressure Vessel and Boiler makers still exist, many of them have transferred all their manufacturing activities towards countries like India, Saudi Arabia, Kazakhstan, Turkey, etc. Only a few European manufacturers, which make qualified vessels of very peculiar and expensive materials, are insisting in keeping their facilities open. May be we have in Europe still **some important users**, big oil, gas and power generation companies: but how can you pretend that these poor guys are still interested in developing the Pressure Equipment industry in Europe? How can you pretend that they are interested in the research on pressure equipment? And why they should subcontract their relationships with the European Union to an Association like EPERC-AISBL? Each one of them has already very good links with the European Union. At the end, why they should collaborate with European Institutions and Organisations for the growth of the Pressure Equipment sector, having clarified that in this sector in Europe there is no growth at all? And why they should present to the Commission some stupid research project and ask them for funding? Let other countries make their own research projects and let find themselves the proper

funding! In Europe we have already **ORGALIME, the European Federation of the Mechanical Industry**, which assures the proper contacts with the Commission. Moreover, we have already **several CEN Technical Committees**, where some experts are amusing themselves in writing the proper EN standards needed for the application of the European Directives (at a really negligible cost, since they are all working for fun). Of course these guys are always complaining that **some kind of theoretical or experimental work in support of the standardization would be needed**, but at the end they will certainly realize that the best thing to do is to go on copying somebody else's standards, leaving the European Commission the possibility of using the money of the European tax payers for more important business.

Of course there is also the possibility that some one of the actual members will come to the assembly to say that he doesn't agree with the dissolution of EPERC-AISBL, may be also proposing a change in the board of directors and a change of the operating agent; or **may be some one of the members of the former EPERC will have some reasonable proposal to keep this organisation alive**. Well, if this is the case, please do something.

Dr. Fernando Lidonnici
Convenor of WG53/CEN TC54

SANT'AMBROGIO Newsletter – May 2015

How to design a pressure vessel considering loads other than Pressure.

Many years ago, when the first boilers and pressure vessels were put into service, and when people realized the danger involved in their operation, the national governments of the main industrial countries started to issue rules for their design, fabrication and inspection. Of course the most important problem at that time was to avoid an explosion caused by internal pressure, also considering the change in material properties due to high temperature.

If we look at any one of the national standards existing 50 years ago, their size was certainly much smaller than the actual editions of the same standards. About Pressure Vessel Design, there were only some simple formulae for the calculation of cylindrical shells and domed ends, while very few of them considered more complex components like main flanges and heat exchanger tubesheets. Although some of them warned the user about the need to consider in the design also loads other than pressure, very few of them gave practical rules to take these loads into account.

Of course the evolution of all these regulations was aimed to **increase safety** on one side, and to **reduce costs** on the other side. To achieve this goal different directions were followed: to **improve material technology**, in order to have a better control on material properties; to **develop new materials with higher characteristics**; to **improve NDT controls** on welds, in order to increase reliability of all pressure vessel joints; and finally to **make more precise calculations**, refining the engineering approach in order to improve the calculation models and to consider **all the possible loading situations**, caused by pressure and by other loads, thus having the possibility to reduce the safety factors and, as a consequence, the thicknesses and the weights. Although the national Pressure Equipment standards existing in the different countries have given a different priority to these directions (American standards relying more on weight and thickness, European standards relying more on a greater amount of NDT and welding qualifications), the evolution of all the pressure equipment rules was similar in all the industrialized countries.

An important contribution to this process was given in Europe by the coming into force (2002) of the **PED** (=**Pressure Equipment Directive**). From a superficial examination of this document one should come to the conclusion that its basic philosophy (to consider as binding Only the **Essential Safety Requirements** and not the detailed standards used to translate them into more precise prescriptions) is a sort of deregulation: all standards are acceptable (with a slight preference given to the **Harmonized EN Standards**, which should guarantee a certain **“Presumption of Conformity”** to the **PED** of the pressure equipment concerned). But the reality is completely different: in fact the basis of the PED is the **Risk Analysis**, which the Manufacturer is obliged to carry out for any kind of pressure equipment, and for which he is fully responsible. In other words, according to the PED **there is no detailed standard which can relieve the Manufacturer’s responsibility to design and fabricate his product considering all the possible situations to which it could reasonably be subject during its foreseeable lifetime**: therefore all the possible loads, not only pressure, but also weight, wind, snow, earthquake, thermal stresses, loads transmitted from adjoining structures and so on. But this new approach is causing a series of practical problems, that we will try to explain in the following.

Many of the loads other than pressure have been dealt with in other regulations: **own weight, "live" weight** (that is the weight that might also be present, however not necessarily, or not necessarily at its maximum possible value: for example, the weight of workers walking on a platform); the weight of the **snow** (that may be there in Winter time, but certainly not in

Summer); the force caused by **wind pressure** (that is occasionally present); the **seismic acceleration** (only exceptionally present), etc. These loads have been extensively dealt with in the rules for **civil structures** (buildings), which also were subject to continuous improvements and modifications. In fact, before the PED, another directive came into force in Europe: the Directive about **Construction Products**. Also this directive, as the PED, has generated a series of harmonized standards, the so called "**Eurocodes**" (EN 1990 to EN 1998). However the philosophy on which the Eurocodes are based (differently from what happened for the pressure equipment rules) is not the same in Europe and in the United States: in fact in USA either the **ASCE** (=American Society of Civil Engineers) or the **IBC** (=International Building Code) standards consider the traditional approach of Structural Engineering (comparison between an actual stress and an allowable stress), while the Eurocodes use the method of the "**partial safety factors**", that is to split the safety factor into two different components: the first one to be applied to the design load (different for each load category), the second one to be applied to a significant material property (different for the different materials).

Therefore the first problem that we have in Europe is to **combine the philosophy normally used by all the Pressure Equipment standards with the philosophy normally used by the standards dealing with building and structures**. The problem is further complicated by the presence in many European countries of different **national Annexes** of the Eurocodes, which in many cases are also binding by law: these national rules sometimes give an interpretation of the Eurocodes which may be slightly different in the different countries. An attempt to integrate the Eurocodes with EN Pressure Equipment standards is the one contained in the **Unfired Pressure Vessel standard EN 13445 part 3, Annex B** (Design by Analysis using the so called **"Alternative Route"**, i.e. the limit analysis). The philosophy of Annex B is the same of the Eurocodes, therefore based on the method of the partial safety factors: however the corresponding values are not always in compliance with the values given by the Eurocodes. The same philosophy of Annex B has recently been considered also in the new **Clause 22 ("Tall vertical Vessels")** of the same standard, issued, for the first time, in the 2014 edition of EN 13445.3.

A second problem is given by the need to **combine with each other the different loads**. This problem (never considered in the Pressure Equipment standards, which are usually dealing with the pressure load only) becomes important when also other loads are acting together with pressure, particularly (as already explained above) when these loads may or may not be present, or may be present with variable values. **The presence and the intensity of the variable loads must therefore be considered with a probabilistic approach**: if one of them is present with the maximum possible intensity, the probability to have also the contemporary presence of the other variable loads at their maximum possible intensity is certainly negligible. Just to make an example, if a distillation tower has a platform with a nominal loading capacity of 250 kg/m^2 and is located in an area where the maximum wind pressure is 1400 N/m^2, it is not reasonable to consider the possibility of the contemporary presence of the maximum allowable inside pressure, of a load on the platform equal to its full capacity and of the maximum possible wind pressure. On the contrary, if we really want to take into account the possibility of a platform loaded at 100% of its capacity, it will be necessary to define the **"combination coefficients"** (values between 0 and 1) for the other variable loads: in other words, **the reduction to be attributed to the maximum possible values of the other variable loads**, which of course cannot be present at their maximum possible intensity when the load on the platform is at its maximum design value. In the Eurocodes there are tables giving the combination coefficients to be used in the different cases.

In the specific case of Pressure Equipment there is another non pressure load category which may lead to a still worse situation: these are the **Local Nozzle Loads**. In fact the engineering companies responsible for the piping design usually make the piping calculations after

purchasing the vessels: in order to avoid problems when the vessel is built, at the beginning they simply give to the vessel manufacturers a table with the maximum possible values of some load components (usually the axial load and the bending moment, based on the nozzle diameter), however without specifying the direction. Well, if we now imagine that the distillation tower of the previous example may have about 50 nozzles, and that on each one of them the bending moments and the axial loads are present at their maximum values and are oriented towards the same direction, even supposing that the local stresses at the nozzle connections are acceptable, the total load on the column supports would be totally unrealistic.

Moreover, someone of the loads other than pressure **might have a favourable effect** when combined with the other loads: a tower subject to wind is practically loaded by the wind pressure as a cantilever beam subjected to a distributed load and having each cross section shaped as a circular crown: if the cantilever beam is fixed at its base, on each cross section there will be an overall bending moment (decreasing with the height) causing longitudinal tensile stresses on the upwind side (with the risk of gross plastic deformations) and longitudinal compressive stresses (with the risk of buckling) in the downwind side. If we algebraically add these stresses to the longitudinal tensile stresses caused by the inside pressure, the situation upwind will be worse (increase of tensile stresses), but the situation downwind will be better (compressive stresses will decrease or even disappear, thus reducing the risk of buckling): in the first case it is reasonable to give to the inside design pressure its maximum allowable value, while in the second one this value should be reduced, or may be also set to 0.

A particular case of variable loads are those usually defined as **“exceptional”**, particularly **seismic loads**, that is, those loads that have a **very low (however well defined) probability to be present in a reference (conveniently long) “return period”**. In case such loads should be present, there should however be the guarantee that they will not affect the stability of the structure in respect of its **“ultimate limit state”** (one of the new ideas contained in the Eurocodes is the design of a structure in respect of more than one **“limit state”**). Such limit states are usually considered in the buildings, where reference is made either to **“ultimate limit states”** (states causing the collapse of a structure) or to **“damage limitation states”** (limit states which do not cause the collapse of a structure, but simply a damage condition involving serious limitations of its service capability). In the case of Pressure Vessels, damage limitation states are not generally relevant, therefore only ultimate limit states shall be considered. With reference to the example of a distillation tower containing a dangerous fluid, the seismic design for an ultimate limit state is based on a seismic event which has 5% probability to happen in a return period of 1472 years.

According to EN 1990 (Eurocode 0), in a carbon steel vessel a normal operating condition where only the internal design pressure and the weight are present should be evaluated with a partial safety factor of 1,35 applied to both loads, while the partial safety factor to be applied to the material limit property should be 1,00 (1,25 only for the case of fasteners); Annex B of EN 13445.3 gives 1,2 for the load and 1,25 for the material. At the end, this gives a total safety factor of 1,2 x 1,25 = 1,5, that is the customary safety coefficient on the elastic limit at design temperature always used by the great majority of the Pressure Vessel standards, therefore more conservative than the total coefficient obtained with the Eurocode 0 (1,35 x 1,00 = 1,35). For an exceptional (or seismic) condition the combined safety factor of Eurocode 0 is 1,00 x 1,00 = 1,00, while Annex B gives 1,00 x 1,05 = 1,05.

The method of the partial safety factors used in the Eurocodes may cause a little bit of confusion for those who are accustomed to use the traditional approach of structural engineering, that is to consider a single safety factor on the material property, thus obtaining an **allowable stress** (better defined as a **nominal design stress** in all the European standards) to be compared with the actual stress caused by the design loads. Of course a

decrease of the safety factor on the material characteristic with a corresponding increase of the safety factor on the design loads doesn't make a lot of difference when the behaviour of the structure is fully elastic (all stresses directly proportional to the design loads); however this situation may change when the limit analysis is used.

Moreover, an additional remark should be made for the cases where the designer has to **consider Non Pressure Loads (such as wind and earthquake) in the context of a specific Pressure Vessel standard**: in this case he might have the freedom (particularly for deliveries outside Europe or USA) to choose (or interpret) the standards for civil structures needed in order to take into account the additional loads. Well, it has to be noted that it is **absolutely dangerous to mix different standards together**. In other words, **all the standards used should be considered in their entirety**, avoiding the mixture between loads calculated according to one standard with the nominal design stresses given by another standard: this because in each standard the probabilistic considerations used for the definition of the loads are generally tied to the safety factors and the nominal design stresses: a mixture would involve the risk either to be too much on the safe side, or (which is worse) to give raise to an unsafe structure.

But now let's stop, without coming too much into details. The logical conclusion is that **in Pressure Vessel design considering Pressure together with Non Pressure loads is a critical process, which requires a careful examination particularly for the preparation of the design specifications to be given to the Manufacturer**; who, at his turn, must not forget that **according to the PED (and this is the main difference with the American philosophy!) he will be fully responsible** also for the case where such specifications are prepared by somebody else.

Dr. Fernando Lidonnici
Convenor of WG53/CEN TC54