

## INNOVATIVE SOLUTIONS IN INDUSTRY USING PEX

The first use of POLIDAN TUX 100 – based ChemPEX piping system, for an industrial application. A safe, easy to install and highly economical solution, for the transportation of chemicals at high temperatures and pressures.

### INTRODUCTION.

SGIM (Societa Generali Italiana Magnesia) is Company of the SOLVAY group, manufacturing calcium and magnesium based compounds.

The Company manufactures  $\text{CaCO}_3$  (calcium carbonate) through a precipitation reaction that takes place with  $\text{CO}_2$  and water.

### THE ORIGINAL PIPES

Conduits manufactured from Carbon steel and comprised of 2 vertical segments (1 ascending and 1 descending) and a horizontal one, connected by elbows and attached to the reactor and an external manifold. Each conduit is approximately 4.5M long, weighing about 150kg.

### PRODUCT BEING CONVEYED.

Aqueous vapour gas and  $\text{CO}_2$  carrying highly fouling  $\text{CaCO}_3$  powders.

The service conditions

Operating temperature 65 – 70°C, pressure 0.3 bar.

### THE SITUATION AS OF JUNE 1999

The persistent fouling action of the gas, continually reduced the 12 conduits efficiency and required de-scaling operations every 25-30 days. The total weight of each exhaust conduit, with the addition of about 20-25kg of deposits, made it necessary for a 5-man team who, (with a hoist and supporting poles), removed the conduit cleaned it and put it back in place.



The whole operation took about 2 hours for each reactor. This had an adverse effect on the maintenance costs and in addition, the amount of down-time made it very difficult for all 12 reactors to function simultaneously at any given time.

### THE PEX ALTERNATIVE

SGIM decided to test alternative materials for one of its production units.

In July 1999, Nupi spa (Industrial Division) initiated the study. The piping system immediately chosen was TUX 100-based ChemPEX, since the mechanical, physical and chemical features of this material are very well suited for the particular application. Furthermore, since the product has a significant water cut, the ChemPEX piping system could be cross-linked in situ, thus ensuring right from the start of the operation that the full benefits of this high performance engineering thermoplastic material were being utilised.

Nupi spa, initially developed and manufactured a prototype of the vertical segment of the conduit which was immediately installed. The project included the design and manufacture of a 90° fabricated bend to connect the prototype to the horizontal steel segment. The prototype was to assess the application related installation and removal procedures.

### THE TRIAL

The installation of the Nupi spa's prototype took 20 minutes and involved two of the five men who had previously disconnected the vertical steel element. The prototype weighed about 20kg and required no hoist or any tool except a wrench to tighten the flange bolts onto the reactor and steel pipes.

SGIM's technical personnel removed and re-installed the prototype conduit after 30, 60 and 160 days. In the course

of the assessment operations, no deposits or scaling were found on the pipe's internal walls and each removal/installation was performed in a matter of minutes, with a truly negligible down time for the line.



### ...AND FINALLY

In March 2000 SGIM decided to purchase the ChemPEX system, using POLIDAN TUX 100, cross-linkable Sioplas type HDPE compound.

The internal surfaces of the fabricated bends were specially treated to make them perfectly smooth, in order not to impeded the pipes mirror-like surface. In fact it's the smoothness that accounts for the absence of deposits, since the vapour droplets containing  $\text{CaCO}_3$  cannot adhere to the walls, as they do on the much rougher steel surfaces. The values of superficial roughness for POLIDAN TUX 100 and carbon steel are respectively,  $4 \times 10^{-6}$  and  $1 \times 10^{-4}$ (m).



### THE BENEFITS FOR THE CUSTOMER

The intrinsic design of POLIDAN TUX 100 ensures that the conduits will maintain their high performance profile with no deterioration caused by chemical aggression and temperature or by corrosion and scaling which (besides impairing the operation of the line) could foster long term bacterial aggression.

From a maintenance point of view, it is interesting to note that the frequency of each operation is now reduced to just 90 days and requires less time. As well as reducing costs, there are improved personal safety aspects using this new material, since each of the POLIDAN TUX 100 conduits has an overall weight equalling 1/3 of its non scaled steel equivalent, which cuts the risks involved in handling vertical and aerial pipes to almost zero. Furthermore, exposure to vapours containing  $\text{CO}_2$  is limited to a few minutes and to two workers per reactor.

Application-related and technical literature is available on the internet at [www.padanplast.com](http://www.padanplast.com) and [www.chempex.net](http://www.chempex.net) POLIDAN TUX 100 system's expected operating lifetime is 10 years as required by SGIM's design specifications.

Nupi ID manufactured the ChemPEX conduits at its Imola (Bologna) plant and the fabricated bends at its Busto Arsizio (Varese) plant.

Solvay Padanplast manufactured POLIDAN TUX 100 compound in its Roccabianca (Parma) plant



# Harmonised Euronormes and the CE Mark

## WHAT DOES THIS MEAN FOR PEX?



The PE-X pipe and fittings system standard for Hot and Cold water applications was finally published in 2004, EN ISO 15875 (1). This European and International standard is the result of harmonisation of standards from several European countries and other countries worldwide. It is now being implemented as a replacement for national standards when applicable.

In Europe, manufacturers usually use voluntary third party certification against product standards to gain a quality mark to promote their products and satisfy customer requirements. The CE mark is used to indicate that the product is produced to a relevant performance specification related to the application. For the purpose of CE marking, harmonised Euronormes referred to as hENs are to be used in parallel with product standards following a decision made by CEN TC 155 Plastics Pipes and Fittings.

The hEN for plastics products for Hot and Cold water applications specifying the relevant 'performance requirements' will be EN 15015 (2). Following a negative vote in the first UAP unique acceptance procedure, the document will go out for a second 3 month UAP vote later this year. It is expected to be published early in 2006 and will allow conforming products to be CE marked from that date. Most European countries have a legal obligation for products to be CE marked.

In accordance with Guidance Paper D (3), it is stated that 'the CE marking indicates that the product complies with the relevant national standards

transposing the harmonised standards, or a European technical approval, or one of the national technical specifications referred to in Article 4 (2.c) and that the system of attestation of conformity laid down in the Commission Decision relating to the product has been applied.' It categorically states that 'The CE marking is neither a mark of origin, indicating made in the "EEA", nor a quality mark'.

'Once all obligations arising from EC law (directives, Treaty provisions etc) have been respected, a producer may also affix different marks to a product, such as a voluntary quality mark or a voluntary standardisation mark, on condition that the visibility and legibility of the CE marking are not reduced, and provided that such marks are not likely to deceive third parties as to the meaning and form of the CE marking. A producer remains entitled, on a voluntary basis, to go beyond the strictly legal requirements, for commercial or marketing reasons, allowing a product to be positioned on the market in the normal way.'

(1) EN ISO 15875 Plastics piping systems for hot and cold water installations – Cross linked polyethylene (PE-X) Parts 1/2/3/5/7

(2) EN 15015 Plastics piping systems - Systems for hot and cold water not intended for human consumption - Performance characteristics for pipes, fittings and their joints

(3) Guidance Paper D: CE marking under the Construction Products Directive (version May 2004) CEN TC 155 document N2785.

## Some **PEX** facts

PEX is one of the most versatile, performing and cost-efficient systems for the transport of water, chemicals and gas under elevated pressure and temperature conditions.

- Cross-linked polyethylene (PE-X) pipes have been installed in European houses for more than 25 years.
- Over the last ten years, PE-X was amongst the fastest growing materials for plastic pipe installations and today more than 5 billion meters of installed PE-X pipes serve European consumers.
- PE-X pipes have demonstrated an outstanding safety record across plumbing, heating and drinking water installations, also as a result of their unmatched performance and in-service costs.

# PEX INJECTION MOULDING

## Chemically Crosslinkable High Density Polyethylene for Injection Moulding

PE-X b Injection Moulding compounds are able to satisfy the demands of applications historically reserved for other 'Engineering Plastics'. PE-X b performance characteristics of high & low end use temperature, excellent chemical & abrasion resistance, good dimensional & hydrolytic stability, good creep & environmental stress cracking resistance & high strength & toughness have conferred a broad property attractiveness to the engineering

compounds market. Expensive 'Engineering Plastics' are frequently over specified & in such cases PE-X b compounds can provide a more cost effective solution.

The excellent processability of the PE-X b products is similar to that for standard thermoplastic PE compounds, giving a wide process window & high productivity.

PE-X b compounds, require a post moulding treatment to complete crosslinking, not unlike other post treatments, annealing etc, required for some engineering materials.

PE-X compounds have competed successfully with polysulphone, polyketone, polyacetal & metal for injection moulded pipe fittings for pressure hot & cold water systems, fully satisfying all performance requirements. Considerable cost benefits can be achieved by factors of up to 8 times.

PE-X pipe fittings are compatible for use with other pipe materials such as polyethylene, polybutylene & copper.

The table below compares the properties & cost relationship for engineering materials used for pipe fittings.

	PE-X b	A	B	C	D
<b>Tensile strength MPa</b>	26	36	55	60	70
<b>Elongation at break %</b>	450	340	300	30	75
<b>Density</b>	0.95	0.94	1.24	1.42	1.24
<b>Density</b>	0.95	0.94	1.24	1.42	1.24
<b>Heat Deflection Temp °C (0.45MPa)</b>	116	na	210	160	1.74 (1.8 MPa)
<b>Vicat Softening Point °C</b>	131	120	210	157	188
<b>Flexural Modulus MPa</b>	1350	450	1400	2700	2700
<b>Mould shrinkage %</b>	3	2.5	2.5	2	0.7
<b>Relative Material cost</b>	1	1.5	4	1.5	8