

## **COST SAVINGS THROUGH QUALITY INSTALLATIONS**

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### **ABSTRACT**

Always important, but especially relevant in these times of cost cuttings, is to be aware of and to take into account all costs related to our activity. This paper discloses the contribution of the plastic pipes installation quality in the cost savings for our industry and customers.

Generally, our clients only consider the initial cost of pipeline's products or elements, without considering that those products are part of a network expected to have a long service lifetime which can only be achieved by a correct installation of the elements.

A deficient installation may contribute to the appearance of breakages, as well as infiltrations and leaks, with the consequent increase of network management costs (water loses, failure detection, repairing costs...).

These failures also affect the manufacturer that has to invest time, money and resources to manage the received complaints which in many cases are due to a non-proper installation of the plastic pipes or wrong execution of the jointing procedure.

Ten years ago, AseTUB (the Spanish association of plastics pipes and fittings manufacturers) implemented in Spain a training scheme to qualify installers for the correct installation of plastics pipes in water supply, sewage and irrigation systems.

The aim of this paper is to present: the AseTUB's training scheme, the 10-year experience and results, benefits and effects of this qualification and cost savings for water companies and plastic pipes manufacturers.

### **INTRODUCTION**

Optimization of all costs related to the water cycle management is essential in our time. This analysis should be conducted from a long-term perspective, only then the lifetime and the performance of the different piping elements will be taken into account and so maintenance needs, repairing costs... involved during their use.

It is clear that the choice and use of quality certified products, and their proper installation is important to guarantee, during the whole lifetime, the good performance of water piping networks and to avoid incurring increased costs for possible later reparation needs.

Several factors contribute to repairing costs: pipe dimension, depth of the network, type of pavement and place (rural area, city...), and on top of these, there is also of course the water loses cost. However to get a global analysis of the real repairing cost many other factor have to be considered. Some of the most important ones are shown in table 1.

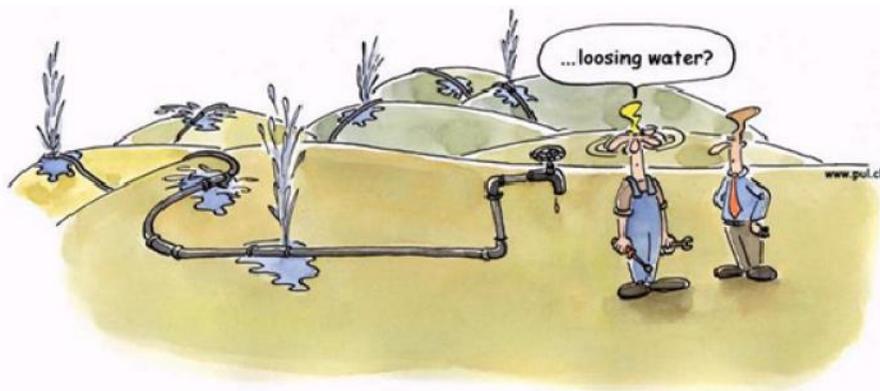
**Table I: Aspects to be considered in the repairing cost**

Repairing works	Water	Society
Leak or break detection and finding	Loss of valuable resource	Environmental damage
Pavement pulling up	Non billed water	Failure of water supply
Excavation	Cut of water service	Deprivation of a basic right
Repairing (execution, element removal and replacement...)	Non consumed water	Public and private property damage
Cleaning and disinfection	Flushing water for cleaning and disinfection	Claims and complaints
Paving		Potential damage of company or municipality image
Landfill debris disposal		

In many cases when a leak or break occurs in a water main, the pipe and/or fitting manufacturer is contacted to be held responsible for it; but firstly, the cause of the problem: a non-quality product, incorrect installation, design or use...should be found out.

It is well-known that the majority of the complaints or problems in the piping networks are either caused by in-site work affection or by a non-proper installation of the plastic pipes or wrong execution of the jointing procedure, and in only few cases due to the quality of the products.

As a result, manufacturers invest time, money and resources to manage the received complaints and to demonstrate the cause of the problem is not under their responsibility.



All in all, the proper knowledge and skill of the pipe installer becomes a must. Plastic pipe industry committed to offer quality products should therefor actively work to transmit its knowhow on the right handling, jointing and installing of the products, and this commitment to quality, to the next link in the chain, the pipe installer.

## **QUALITY: FROM PRODUCTS TO THE INSTALLATION**

Plastic pipes industry is a modern, innovative and high-tech industry that offers integral piping solutions made of different plastic materials. The commitment to the quality of manufacturing and products has long been demonstrated.

A production quality system is implemented in manufacturing plans and products are subjected to a rigorous third-party testing program to guarantee the compliance with very stringent performance requirements established in the standards. The quality of the plastic pipes, fittings, joints, valves... is therefore well-recognized.

However, to gain the complete satisfaction of our clients and the end users, these quality products should be correctly installed. This is the only way to prove the excellent performance and reliability of plastic piping systems as well as the advantages they offer in the water network management.

The Spanish association of plastic pipes and fittings manufacturers, AseTUB, is a professional non-profit trade association, founded in 1978, which groups the most important plastic pipes manufacturers in Spain. The fundamental aim of the association is to promote the advance and the expansion of this industry, and to uphold the highest quality standards of performance of the plastic piping systems in their different applications.

AseTUB's commitment to quality is supported by the fact that it's a requirement for a company to be a member of the association, the third-party certification of its products (AENOR's N product quality mark).

Moreover, AseTUB conscious of the importance of the correct installation of the plastic piping systems, and due to the lack of a specific qualification in Spain, decided to work on the implementation of an installer training scheme addressed to operators working at water pipeline construction sites.

Since 2004, specialized hands-on courses are being conducted in recognized training centers and implemented in collaboration with the main water companies in Spain. The aim of these practical training courses is to provide with skilled-workers and so to improve the quality in the installation of plastic pipes systems in water supply, sewage and irrigation networks.

## **SPECIALISED TRAINING SCHEME**

When elaborating the content of the training and listing the skills the installer should have we realized that jointing is just one step of the installation process. In the underground pipeline networks there are other important factors affecting the performance of the piping system (bedding, backfilling...) that they also have to be executed correctly.

So, the didactic program covers a comprehensive training on all aspects related to a proper installation of plastic pipes, from the reception of the material, the laying in the trench, the correct execution of different jointing techniques and up to the field testing and commissioning of the pipeline.

The national legislation, reference standards [1], AseTUB technical publications [2] and the experience of the manufacturers have been taking into account in the preparation of the educational program, the contents of the theoretical and practical classes and in the elaboration of the installation handbook.

This technical handbook is a comprehensive and user-friendly document published by AseTUB. The handbook contains the knowledge we consider the installer should have to execute a correct installation of the different underground plastic piping systems such as PVC-U, PVC-O, PE, PP and GRP pipes for water supply, irrigation and sewage networks.

With the aim of being an easy reading and consultation document, its content has been split in 14 chapters with a total of nearly 250 pages. The handbook, given to installers attending the course, is full of pictures, detailed jointing steps explanations, graphs and it is written with a simple and familiar wording.

**Table II: Content of the plastic piping systems installation handbook**

Chapter 1	Introduction
Chapter 2	Plastic piping systems
Chapter 3	Basic hydraulics and plan interpretation
Chapter 4	Standardisation, testing and product certification
Chapter 5	PVC-U piping systems
Chapter 6	PVC-O piping systems
Chapter 7	PE piping systems
Chapter 8	Structured-wall piping systems (PVC, PE, PP)
Chapter 9	GRP piping systems
Chapter 10	Other elements: valves, manholes...
Chapter 11	Installation (buried and above ground)
Chapter 12	Field testing and commissioning
Chapter 13	Repairing operations
Chapter 14	Professional commitment

The training starts providing a general knowledge on plastic materials, hydraulics, and standardization and certification of products.

Details of the different plastic pipes, fittings, reference standards and jointing techniques are taught to ensure the installer acquires the knowledge and the practice for the right jointing of the elements. This is a very important part of the training. Common installation defects are presented and explained to be avoided in the future.

All different jointing techniques (solvent cement, elastomeric ring, electro fusion, butt fusion, compression and mechanical jointing) are performed on pipes and fittings, as well as connections to valves, manholes and new inlets from the mains.

Most of the water plastic piping systems are installed underground. Guidelines for best practices are an essential part of the training. This part covers:

- transport, handling, storage at depots and site
- trench types, width, depth and bedding
- pipe laying, jointing and anchoring
- backfilling and compacting
- field testing and commissioning

A trench is a confined space with many special problems and risks. Sometimes time pressure could lead to work without taking safety measures. Operators are also trained on safe working practices.

At the end of the course the trained installer is more conscious and concerned that his professional commitment makes him responsible for his work and for ensuring the quality of the installation done.

## **TRAINING CENTRES AND WATER MANAGEMENT ENTITIES**

For the development of the courses, AseTUB has signed collaboration agreements with recognized training centers and water management entities.

Training program and its concept is property of AseTUB and is freely handed over as well as the training of the teachers and the material used during the course (pipe, fittings, machinery, adhesives...) which is provided by AseTUB member companies.

A close relationship between all parties is established in order to keep the training and trainers up-to-date.

## Training centers

The course takes place at recognized training centers which are in charge of the calendar of the courses, the registration fees and the training and qualification of the installers.

The course is carried out by professional teachers. Their training is given by AseTUB and consists in different production plants visits, meetings with manufacturers and a special training session carried out by AseTUB technical experts.

With the aim to achieve the best professional training and considering the installers' profile the course is very practical. Nearly 2/3 of the training take place in a workshop and in a trench.

Centers are fully prepared for the development of the course in terms of facilities, equipment and have a civil liability cover, to insure the trainees.



**Image I: Classroom, workshop and training trench**

Before launching the first course in a training center, AseTUB supervises the installations, the material, documentation and all the requirements to guarantee the quality of the training.

## Water management entities

The collaboration of the water entities has contributed to the success of this initiative. Water companies have seen clearly the benefits of having pipeline works done by professional and skilled operators. Therefore their own personnel are trained and this qualification is requested to other external workers.

In many cases, the water entity takes an active role in the training program. Own technical personnel act as teachers in these courses.

## Training places

The first courses took place in 2004 in Madrid and Seville. Nowadays, seven centers offer this type of training all over Spain and two more are being prepared to join quite soon.

The course can take place not only at the training centers endorsed by AseTUB, but also on demand, at the client facilities on condition that the course is completely developed as in the training center and the same education quality is maintained.

These courses are under the scope of the educational program of the *Spanish tripartite foundation for training in employment*. Therefore the course attendees can have defrayed the attendance fee.



Image II: Training entities and place where courses have been organized

## Duration

The duration of the training course is 36 hours generally divided in 5 days. But to facilitate the attendance of employed workers some courses are on demand split in more days in afternoon shift.

In order to guarantee the quality of the training and a closer monitoring, the number of attendees is also fixed to a maximum of 12 people.

## Qualification tests

At the end of the course, the installer should pass 2 tests (theoretical and practical) to demonstrate he has gained the proper theoretical knowledge and practical skill.

The installer's knowledge of the practical working rules is evaluated in the theoretical test. To pass the exam, the operator must answer correctly a minimum of 21 questions of a 30 multiple-choice question test.

In the practical test the installer must show his skills by executing correctly 2 jointing practices (electro fusion and solvent cement welding or butt fusion welding and elastomeric seal jointing).

Tests are supervised and evaluated by the training teachers. The result of the qualification test is communicated to AseTUB. Only by passing both tests (theoretical and practical) the installer will be entitled to obtain his AseTUB specialized installer card.

### Installer's card

The installer, who has passed the corresponding examinations, will be accredited as specialized plastic piping systems installer and AseTUB will issue his operator's card.

The card guarantees that the holder has the knowledge and skills for the correct handling and installation of PVC-U, PVC-O, PE, PP and GRP piping systems for water supply, irrigation and sewage.



Image III: AseTUB's installer card. Front and backside (example)

**Front side:** Picture. Installer full name. Card number. Validity

**Back side:** Materials. Applications. AseTUB and training entities' logo(s). Bar code.

The backside of the card includes the logos of the training/water entities where the installer was trained. Since 2011 all the operator's badge include a bar code conforming the ISO 12176-3 standard, so it can be read by fusion-jointing PE system equipment contributing to traceability. This bar code includes the following encoded data fields: entrance code, operator's card number, expiry date, country, competent organization, skill, language and identifier.

A complete list of qualified plastic pipes installers can be found in AseTUB website. A searching engine by name, card number or province provides the contact details of specialized installers.

### Period of validity and card renewal

The validity of the installer's card begins from the date of the qualification test was passed. This qualification remains valid for a period of 5 years. During this time, the installer should register in the RIR (Installation record booklet) all the works done. Each report includes the following data: work identification name, place and date, duration, pipe material, DN, meters, PN/SN, jointing method, and it has to be signed by the installer and the contractor.



Image IV: Installation record booklet (RIR)

Before the end of the 5 year validity period, the installer can request the renewal of the card by sending the proper form and the RIR to AseTUB. The work experience registered in the RIR is evaluated by the Evaluation and Monitoring Committee.

There is an automatic renewal if the installer's skills and knowledge are unquestioned and proven by a number enough of works with different plastic materials. Otherwise the requalification of the installer is required for the renewal of his card.

### THE TRAINING ON IMAGES



## 10 YEARS OF THE AseTUB SPECIALISED INSTALLER'S CARD

This initiative gave birth in 2004. The beginnings required strong support from the national plastic pipes industry (AseTUB) to establish and promote the training courses.

Only 2 years later, most important water companies in Spain contacted AseTUB to initiate a collaboration to establish this training program in their region, and more and more entities are interested in getting involved.

Nowadays, more than 140 courses have been conducted and over 1.400 professionals hold the AseTUB specialized installer card.

Despite of being a voluntary qualification, many entities (councils, water management entities, construction companies...) are requiring AseTUB installer card to operators working on their piping networks.

AseTUB believes in the relevance of this initiative and the importance of transmitting to the installers the right handling, jointing and installation practices of our plastic pipes. Every promotion of the plastic piping systems and their benefits and quality is always accompanied by the promotion of this training and qualified plastic pipes specialized installers.

Although this course is designed for pipe installers, some head of network maintenance, site managers, work inspectors, project managers... have come to the courses to know more details about plastic piping systems and their correct installation.

And besides, the courses involve an extra benefit for the plastic pipes industry, since they are a very powerful promotional platform to show our products and for the introduction of new solutions, especially useful for a continuously developing industry.

The experience collected during this first decade has demonstrated that:

**Water entities** highly value this accreditation because they realize the benefits from having skilled and trained operators working in their pipeline networks.

The installer's card is a perfect tool to distinguish and select best prepared and skilled operators; to guarantee the quality of the labor and the safety at work.

Since water companies request this accreditation, they have already experienced a significantly decreased of the number of failures and water losses with the consequent savings in water, repairing costs and users complains.

For the **installer**, this card is a way to accredit his skill, knowledge, professionalism and his commitment to the quality of the work they execute.

And for the **plastic piping industry** this training is a duty. Plastic pipe manufacturers are committed to quality of their manufacturing processes and products, and accordingly, AseTUB and national associations can foster the quality of installations by transmitting the knowhow of the sector, especially to installers. In this way, the number of incidents in plastic piping networks due to a poor installation has been reduced and consequently, the time, cost and resources dedicated to deal with the complaints.

All in all contributes to increase the knowledge and confidence on our products.

## CONCLUSIONS

A quality certified plastic piping system installed by a qualified professional offers a valuable guarantee for the contractor and contributes to a more effective management of the networks, reducing their maintenance and repairing cost and consequently increasing the confidence and satisfaction of our clients.

The success of the AseTUB plastic pipes installer accreditation and training scheme put in place in Spain reflects the need and the importance of knowledge transfer in the correct handling and installation of plastic piping systems. It also shows the key role national associations can play to contribute to the quality of plastic pipes networks.

Since the presentation of this pioneering initiative at the Plastic Pipe XVI Conference (Barcelona - Spain, 2012) many countries all over the world have expressed great interest in the possibility of adopting a similar training scheme.

This initiative contributes to improve the image of plastic piping systems, to gain knowledge and confidence on our products and to reduce costs through quality installations.

Adapting the popular English saying “one apple a day keeps the doctor away” we would say “*one installation OK keeps the problems away*”.

## REFERENCES

[1] CEN/TR 1046, CEN/TS 14578, EN 805, EN 1610, UNE 53394 IN and product/system standards.

[2] “PVC-U piping systems technical handbook”, AseTUB, 2007 edition.  
“PE piping systems technical handbook”, AseTUB, 2008 edition.  
“GRP piping systems technical guide”, AseTUB, 2008 edition.