

DrytechTM

Waterproofing System Engineering

DRYTECH[®] WHITE TANK SYSTEM UNDERGROUND WATERPROOFING WORKS



DRYTECH® WHITE TANK SYSTEM UNDERGROUND WATERPROOFING STRUCTURES

RATIONAL, QUICK, EFFECTIVE

The Drytech® White Tank System used for the waterproofing of underground structures against groundwater ingress is based on the construction of a single structure of watertight concrete and injection of an elastic acrylic resin into the cracks, joints and penetrations.

All details can be prepared for the waterproofing injection to suit the design and method of working using only the four products from the DRYset program in various combinations.

It is the most rational, practical and effective evolution of a development that first began in 1963.

960'000 M² OF WATERPROOFED STRUCTURES PER YEAR

The Drytech WTS of waterproofing is employed on approximately 1'000 new building across Europe every year.

This equates to over 960'000 m² lining to basements before the water table.

The Group has specialized in waterproofing since 1963 and is presently active in Switzerland, Germany, Italy, Denmark, Ireland, UK, Australia and South Korea.

Drytech's competence derived from decades of experience innovation: a key success factor for cost-optimized watertight structures.





**DESIGN WATERPROOFING:
EFFECTIVENESS AND SAVINGS**

The System introduces the concept of waterproofing design. This approach guarantees the waterproofing effectiveness, fast track construction and a reduction in the quantity of excavation and building materials.

ENGINEERING

The System is designed, co-ordinated and controlled by Drytech Engineering in co-operation with the structural engineer and the construction company from the moment the design commences.

Drytech specialisation and experience translate into proven solutions and sound advice to construction companies, enabling them to make maximum use of the full potential offered by the White Tank System in terms of reliability, speed and savings.

LONG TERM GUARANTEE

The main advantage is that the waterproofing cannot be damaged as it is located within the concrete lining itself, has the same thickness as the lining and is also watertight against aggressive water.

The System guarantees the real possibility to carry out preventative maintenance over time. Any repairs that need to be carried out can be easily undertaken by injection from the inside, without the need to expose the works, demolition or interruptions to the normal operations of the structure.

Drytech takes sole responsibility for the waterproofing of the structure, with a contractual and insurance guarantee.

**OPTIMIZATION OF THE
CONSTRUCTION FLOW**

Drytech waterproofing activities can be carried out in parallel with other site activities. In actual fact the time to install the Drytech® White Tank System can be totally deleted from the critical path of the construction schedule, as it no longer interferes with other construction activities.

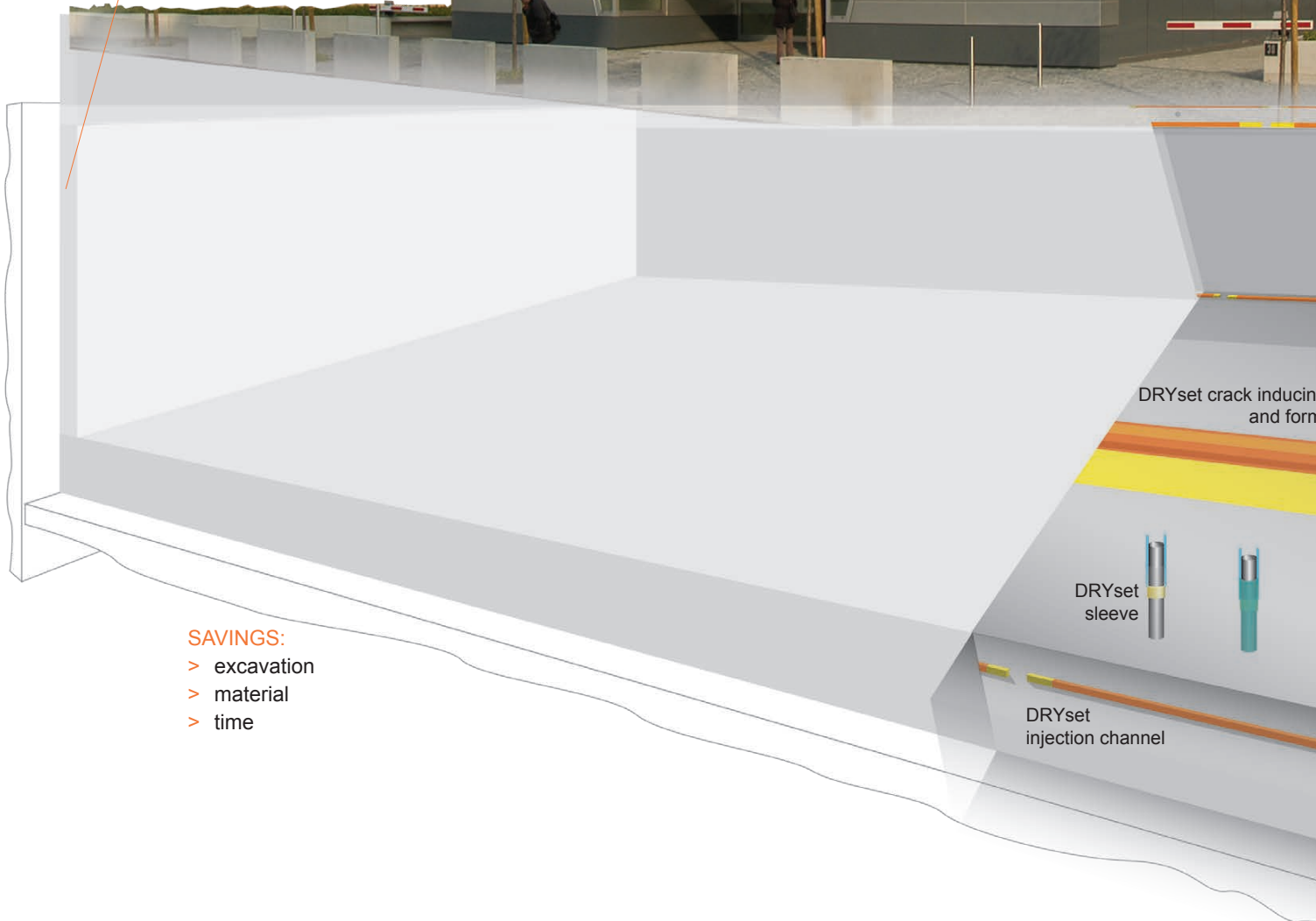
In addition, installation is not affected by environmental conditions.

Furthermore the DRYset crack inducing units for the concrete shrinkage control facilitate and accelerate the pours/pours (unlimited daily production) of floor slabs and walls. They can also be used as disposable therefore eliminating the need to remove the formwork.

RATIONAL QUICK EFFECTIVE

SINGLE MULTIFUNCTIONAL CONSTRUCTION

- > filling up
- > supporting
- > waterproofing



SAVINGS:

- > excavation
- > material
- > time

FROM THE WATERPROOFING TO THE WATERTIGHT STRUCTURE

The waterproofing of the Drytech® white tank system is not a further element of the structure: the structure itself is watertight.

Consequently:

- > the structure during the construction stage is not damageable;
- > time can be saved as the waterproofing is part of the structure (the waterproofing concrete);
- > maintenance activities are focussed, non invasive and easy verifiable as cause and effect are consistent.

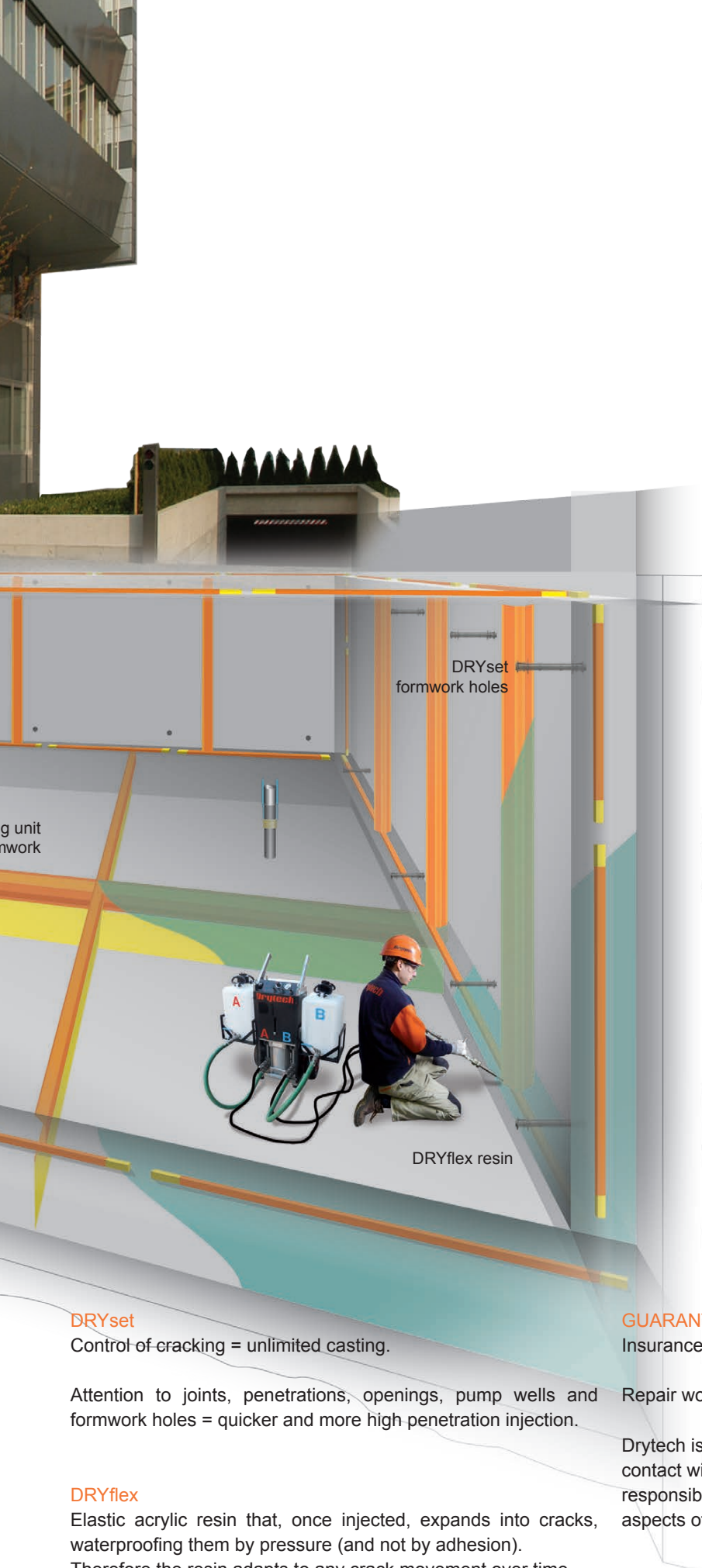
WATERPROOF CONCRETE

The EN 206-1 standard and the Drytech standard define concrete impermeability with a water penetration limit of no more than 30 mm.

The better the concrete and the higher the value induced by quality control on site for fresh concrete, the more durable it will be.

ENGINEERING

- > Definition of the waterproof concrete mix design.
- > Checking of the fresh concrete on site and tests on hardened concrete.
- > Checking of design drawings for steel reinforcement in relation to concrete shrinkage and strength.
- > Checking of the steel reinforcement installation on site.



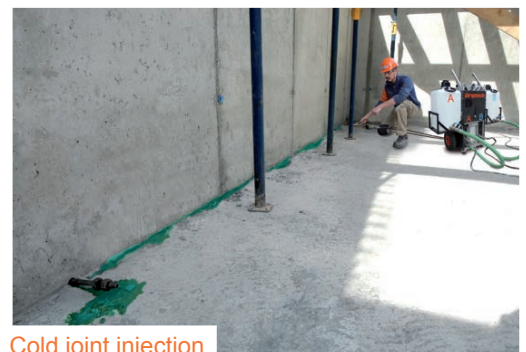
Joints



Shrinkage Control



Penetrations



Cold joint injection

DRYset

Control of cracking = unlimited casting.

Attention to joints, penetrations, openings, pump wells and formwork holes = quicker and more high penetration injection.

DRYflex

Elastic acrylic resin that, once injected, expands into cracks, waterproofing them by pressure (and not by adhesion). Therefore the resin adapts to any crack movement over time.

GUARANTEE

Insurance guarantee.

Repair work can be carried out from inside.

Drytech is the sole point of contact with overall responsibility for all aspects of waterproofing.



DRYSET CONTROL OF CONCRETE CRACKING UNLIMITED POURS

REDUCTION OF REINFORCEMENT STEEL, CONCRETE AND FORMWORK

Induced cracking of floor slabs and walls is achieved by subdividing the casting with DRYset Crack Inducing Units.

Good preparation of the steel reinforcement and control of cracking considerably reduces the risk of unwanted cracks and eliminates related repair costs.

The Drytech concrete mix design and the concrete shrinkage control offer considerable savings in the steel reinforcement material and the concrete costs.

The size of casting area is no longer subject to the concrete's physical and chemical properties, therefore daily production is unlimited.

The DRYset crack-Inducing Unit can also be used as disposable formwork. This means further savings in terms of time and costs.



ADVANTAGES

- > There is no limit to the length of wall that can be created with a single cast (unlimited daily production is possible).
- > Concrete bed and walls do not require shrinkage joints or temporary inserted formwork.
- > Reduction of cold joints.
- > Stop-end formwork units do not need to be removed. Therefore the expense and waste removal in terms of material and time of traditional stop-ends can be eliminated.
- > The trapezoidal crack inducing unit creates a joint between the cast sections guaranteeing shear stress transmission.
- > Installation is not affected by atmospheric conditions.



DRYSET SLEEVES FOR PENETRATIONS, OPENINGS AND TIE BOLT HOLES

COMPLEX DETAILS, SIMPLE SOLUTIONS

Penetrations, openings and tie bolt holes are the touchstone of any waterproofing company. Such detailed waterproofing systems require simple solutions.

In finding these solutions other systems are often complicated.

The Drytech® White Tank System provides a simple and efficient solution which in many cases may be the only applicable one.

This was the case at the new stage pit of the Teatro alla Scala opera house in Milan (below picture). The tie rods of the load-free floor slab have been waterproofed by employing the DRYset sleeves and injecting the DRYflex resin after pouring.

In this case a simple but unique solution.

All types of penetrations (e.g. pump sumps, drains, electrical conduits, etc.) are fitted with suitable DRYset sleeves to guarantee capillary diffusion of the waterproofing resin.

Advantages of DRYset:

- > The installation of additional sleeves becomes superfluous.
- > Any type of penetrating material can be employed (e.g. synthetic material, steel, chrome-plated steel, cast iron, concrete, etc.)

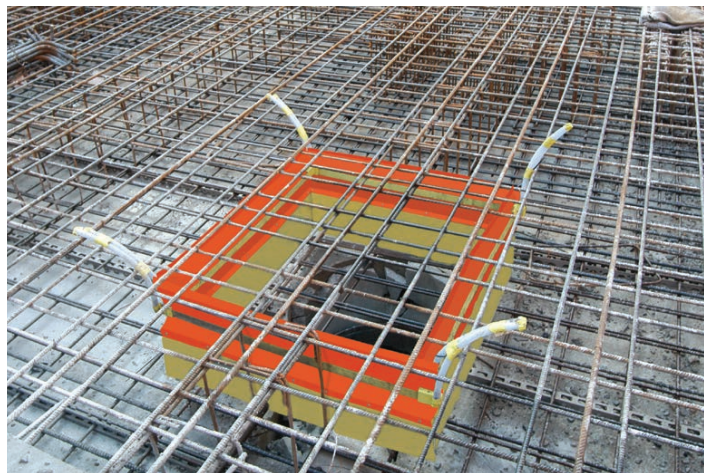
The seal remains safe as the waterproofing is not affected by movements caused by temperature variations of the multiple penetration elements.



The tie bold holes for formwork are cleaned with a brush or disk grinder and sealed by expandable plug and Hypalon tape with epoxy resin.

Openings can be waterproofed by two different techniques according to the respective situation of the constructions site:

- > The DRYset injection profile is fitted at the perimeter of the opening and the DRYset sleeve around it.
- > The DRYset crack-Inducing Unit can be used as disposable formwork between the steel reinforcement.



DRYSET COLD JOINTS



Joints are fitted with the DRYset Injection Channel to guarantee the fast distribution of the resin, which is injected on completion of casting. The channel is laid between the reinforcement bars and joints: floors slab/floor slab, floor slab/wall, wall/wall and wall/ suspended floor slab.

The joint injection profile with its applied foam enables a constant adhesion on the joint, even in the case of uneven surfaces.

The flexibility of the System permits joint preparation of any kind, form and place.

The installation made by Drytech specialists is not affected by atmospheric conditions.





RE-INJECTABLE DRYSET WATERSTOPS

Waterstop tapes have been used for many years to waterproof movement joints.

They are designed to obstruct water, extending its path by using a barrier positioned perpendicular to the joint.

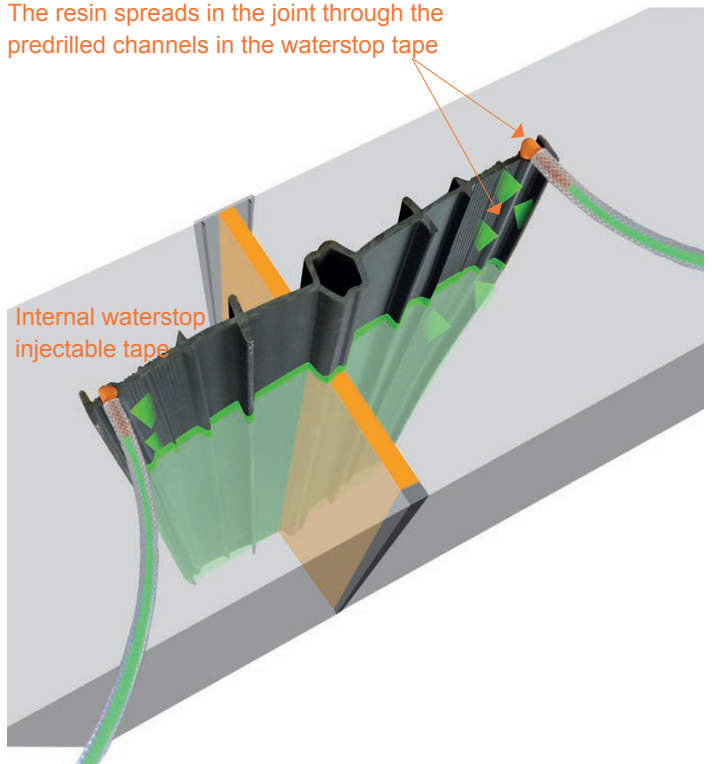
Traditional tapes are no longer effective when water pressure leads to the water going round them.

Drytech has overcome this problem by developing a new type of waterstop with predrilled channels along the whole length of the tape.

These channels allow DRYflex resin to be injected in the joint, ensuring the entire length of the joint is waterproof.

DRYset waterstop injectable tapes are available for both internal and external movement joints.

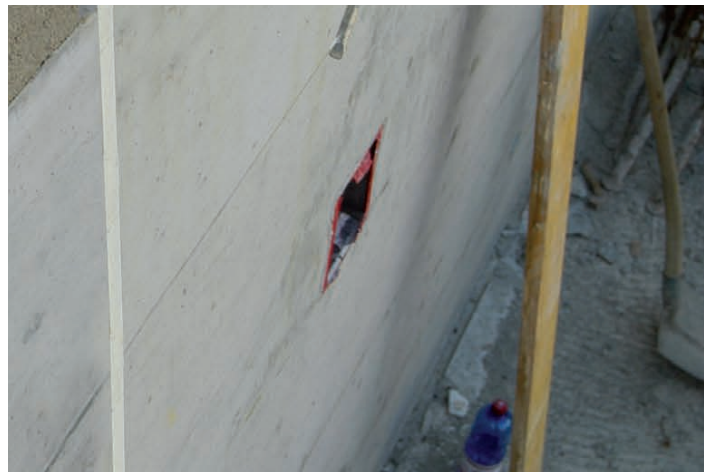
The resin spreads in the joint through the predrilled channels in the waterstop tape



Internal waterstop injectable tape

External waterstop injectable tape





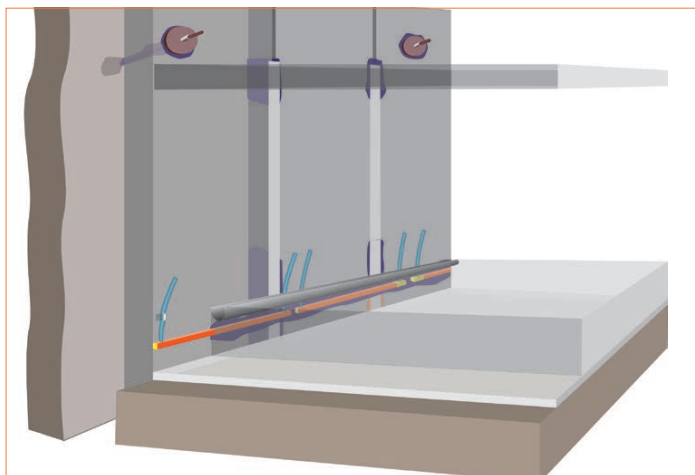
WATERTIGHT DIAPHRAGM WALLS

The Drytech® White Tank System provides a solution for all types of diaphragm walls.

WATERTIGHT DIAPHRAGM WALLS

The joints and cracks of the diaphragm wall are injected with the elastic DRYflex resin from the bottom of the excavated area to a level above the water table.

The diaphragm concrete slab/wall joint is fitted with a DRYset channel for injection. Where an absolute seal is not required, the concrete panel and floor slab can be designed with a drainage channel to collect and drain off acceptable minor infiltrations.



WATERTIGHT DIAPHRAGM WITH SHEET PILE

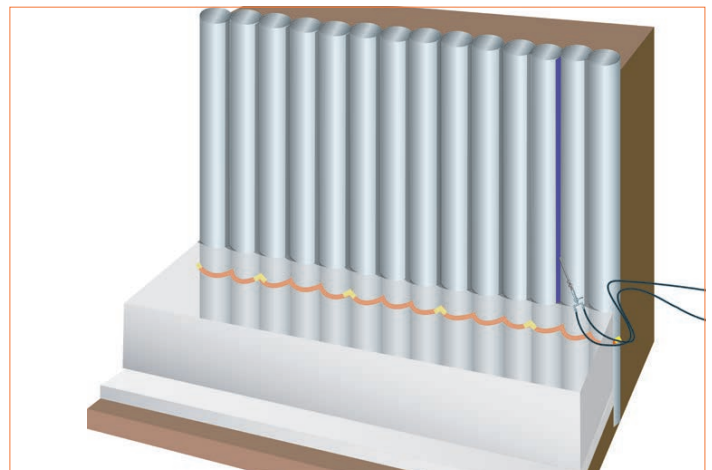
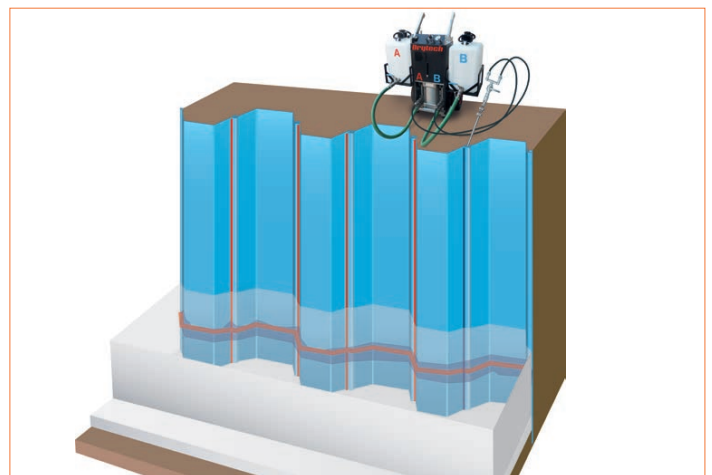
Sheet pile joints can be treated with hydroexpansive paste and waterproof welding.

Any gaps between the sheet pile can be repaired with DRYflex resin injections. The DRYset Injection channel is then fitted in the diaphragm concrete slab/wall joint, which will be injected with the DRYflex resin on completion of concrete casting.

WATERTIGHT DIAPHRAGM WITH MICROPILES

The joint between the micropiles and the concrete slab is fitted with a DRYset Injection channel and then injected.

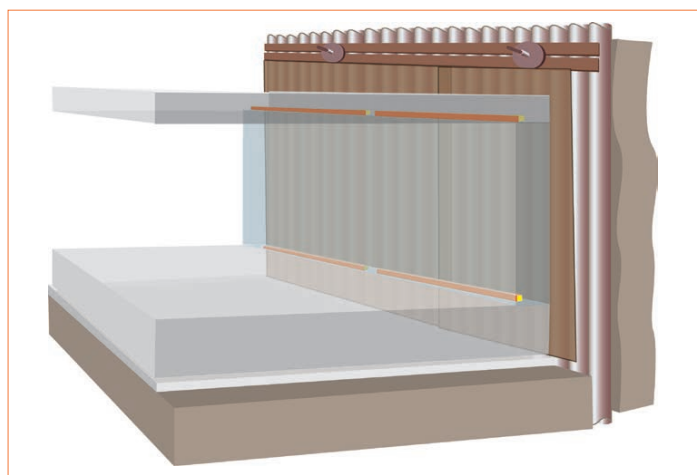
Again, any misalignment in the installation of the piles can easily be corrected by injecting DRYflex resin.



DRYTECH WHITE TANK DIAPHRAGM WALL

Waterproofing of diaphragm walls containing non-watertight components is carried out by casting the wall in waterproof concrete (Drytech® White Tank System for waterproofing of cracks, joints, etc.) directly against the diaphragm wall.

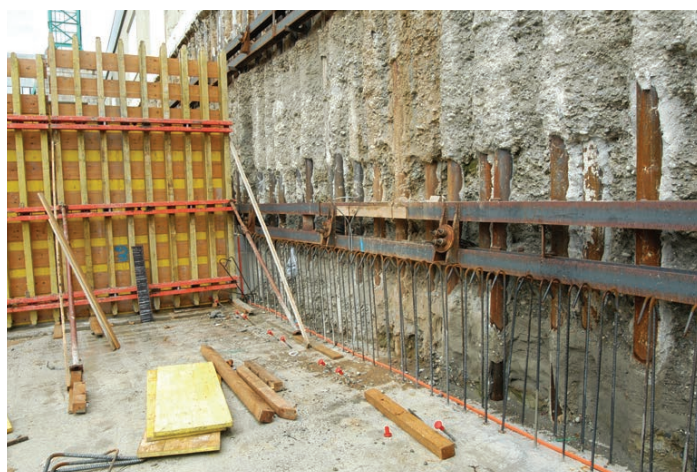
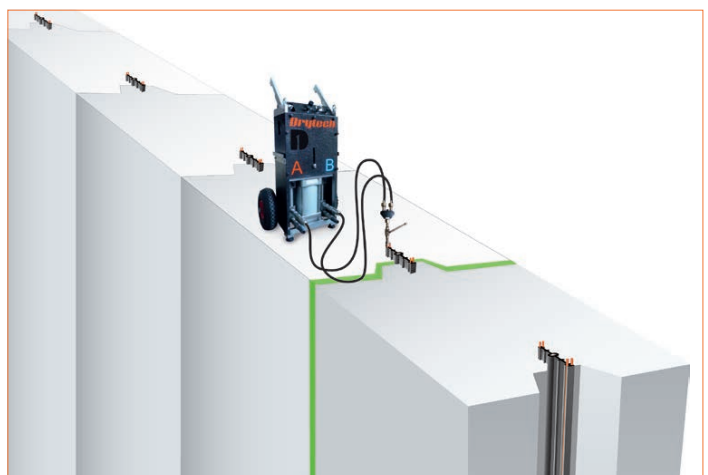
There must be no inflow of water during concrete casting. Water ingress is conveyed to the bottom of the excavation via half pipes to the drainage layers and/or sumps from which the water can be pumped.



WATERTIGHT DIAPHRAGM WALL WITH EMBEDDED WATERSTOP

This technique involves placing an injectable DRYset waterstop element half immersed into each of the adjacent diaphragm wall panels.

To provide protection against infiltration, the joint is injected with the waterproofing DRYflex resin through the two pipes provided for this purpose on the DRYset waterstop element.



WATERPROOF DRYFLEX INJECTIONS

INDESTRUCTIBLE WATERPROOFING

The Drytech® White Tank System exploits the properties of DRYflex elastic waterproofing acrylic resin, which is indestructible as it is injected into the lining of the concrete structure.

Moreover, the waterproofing has the same thickness of the structure which contributes to the sealing of the System and resistance to aggressive waters.

The resin has the same viscosity as the water during injection and therefore saturates the cracks, joints, cavities, gravel pockets and porosities in the concrete: even tens of centimetres away from the injection channel or the crack inducing unit, as shown in below.

WATERPROOFING BY PRESSURE

The resin forms an elastic gel within just a few minutes and, thanks to its self-expanding nature, forms a pressure-seal within the crack.

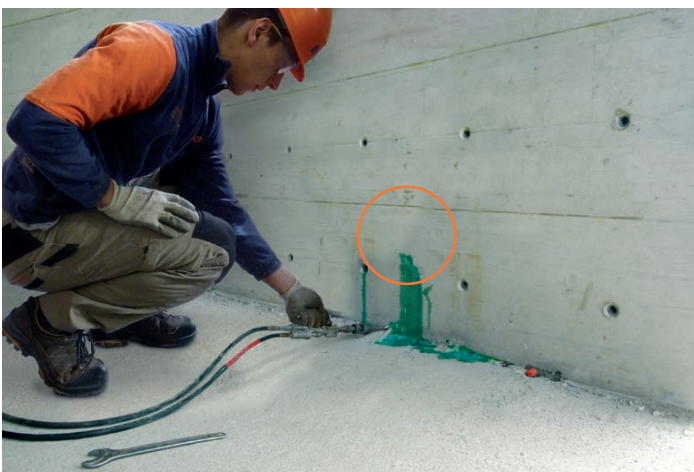
This reactive and reversible swelling remains constant over time*.

DRYflex resin is dyed to distinguish it from water during the injection operations. The colour disappears a few minutes after injection and the resin becomes colourless leaving no trace on the surface injected.

***Laboratory test:**
References:

100 transitions, equal to 20 working years.

The first applications date back to the 1960's and the resin injected at the time is still an effective waterproofing agent to this day.



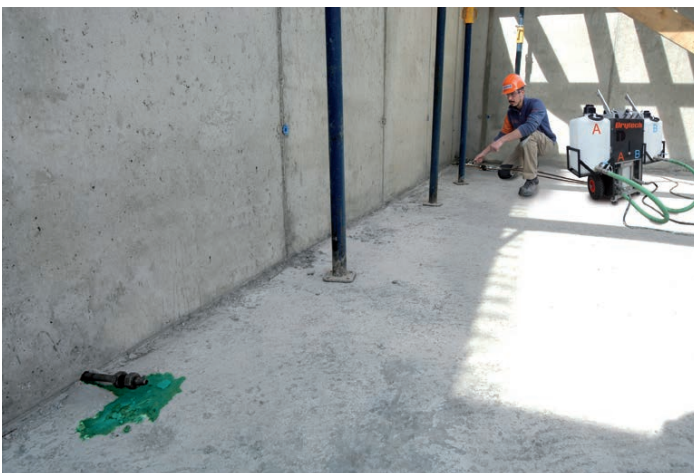
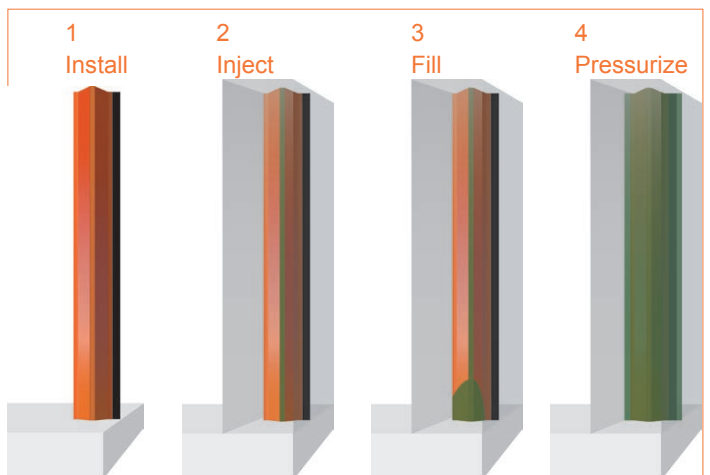
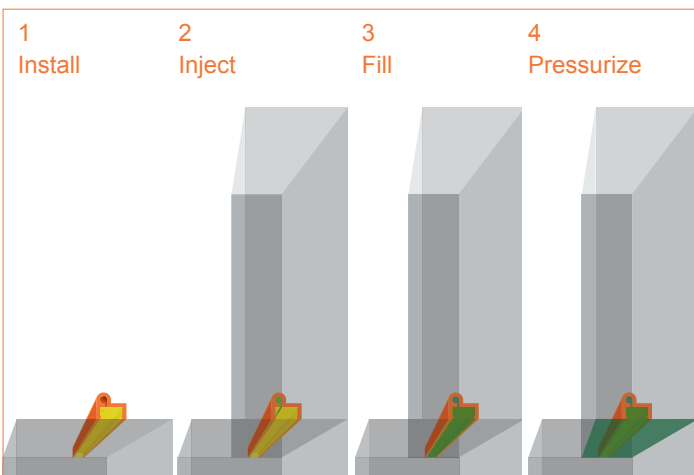
ENVIRONMENTAL PROTECTION

The waterproofing resin is solvent-free and, in its standard form, has no effect on the environment.

It can therefore also be used in drinking water applications.

The final, polymerized product can be disposed of in an incinerator as domestic waste.

In accordance with European transport rules currently in force, DRYflex resin is classed as a non-hazardous substance.



ENGINEERING WATERPROOFING DESIGN



THE EARLY AND GLOBAL APPROACH: EFFECTIVE WATERPROOFING IS A WHOLE EXPERIENCE

The System introduces the concept of waterproofing design. This approach guarantees the waterproofing efficiency, fast track construction and a reduction in the quantity of excavation and building materials.

The waterproofing is effective right from the beginning as all construction details are already specified during the phase of the waterproofing design.

The System is designed, co-ordinated and controlled by Drytech Engineering in co-operation with the structural engineer and the construction company from the moment the design commences.

Therefore a complete watertight structure as the basic concept of the Drytech® White Tank System is built.

During the construction stage of the underground structure, the Drytech Engineering Team works together with the structural engineer and the construction company enabling them to take advantage of the full potential offered by the System in terms of speed and linearity.

The System is simple and easy to use.

By planning the waterproofing requirements, the impermeability of underground spaces can be guaranteed. Usually the last aspect to be considered, from the moment infiltrations arise once the pumps have been switched off or after the first storm.



Design



Consultancy
On site control



DESIGN

- > Basement design advice.
- > Checking of design drawings for steel reinforcement related to anti-shrinkage.

PREQUALIFICATION

- > Concrete prequalification / Mix design.
Drytech defines the waterproof design mix peculiarities of the individual for the concrete structure.

CONTROLLING

- > Checking of fresh concrete casting.
- > Laboratory tests for concrete compression and tensile force.
- > Checking of steel reinforcement layouts and concrete casting.
- > Consultancy service for building contractor to ensure execution for high quality workmanship.

QUALITY

- > Quality dossier with test reports, photos and layout plans for DRYset systems.
After the completion of the construction Drytech provides a dossier with the detailed waterproof activities, controls and characteristics of the whole waterproofed structure.

These records help in case of maintenance work during the life cycle of the building.

YOUR PARTNER FOR WATERTIGHT STRUCTURES

Strong through broad and diffused experience Drytech does international research, perfections of the most modern waterproofing systems and gives advice to structural engineers, construction companies and private people.

The Drytech Group uses solely products in accordance to high standards for the protection of people and environment. Drytech promotes any compliance certificates and tests of their products. The corresponding conformity tests recognised and released by independent institutes and universities can be requested from Drytech at engineering@drytech.ch.

Drytech is ISO 9001:2008 certified for quality.

SAVINGS ACCELERATED CONSTRUCTION SCHEDULE

THE WATERPROOFING CAN BE DELETED OF THE GANTT DIAGRAM

Drytech waterproofing activities are carried out in parallel with site activities. In actual fact the time to install the Drytech® White Tank can be totally deleted from the critical path of the construction schedule, as it no longer interferes with other construction activities.

In addition, the waterproofing is not affected by atmospheric conditions. Therefore, the waterproofing can be deleted of the Gantt Diagram.

High quality materials, waterproofing experts, a logic and linear planing make sure that the waterproofing activities on site are efficient, save in time and guarantee a longlasting watertight structure.



SAVINGS

The savings of time, materials and resources produced by the White Tank during the whole construction path are multiple. In some cases they can even cover the waterproofing costs.

DESIGN OF CONCRETE CRACKING

Crack-inducing units permit up to 2.000 m³ continuous poured floor slab and 100 m wall per day which enables a 70% reduction in pouring stages.

WATERTIGHT CONCRETE

The Drytech watertight concrete offers cost savings of about 10.00 €/m³ and savings up to 30% of anti-shrinkage reinforcement steel.

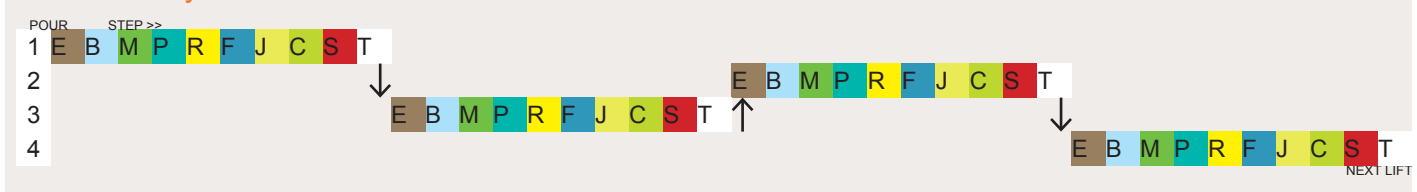
SINGLE STRUCTURE OF WATERTIGHT CONCRETE

Compared to other systems which require protective screed, retaining wall and refilling of certain diaphragm walls, the single structure of watertight concrete of the Drytech® White Tank System guarantees a reduction in the quantity of excavation and building materials as well as savings in time.

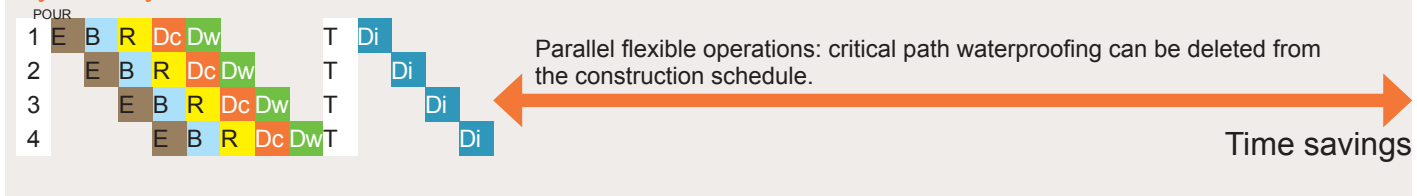
For example: In case of a diaphragm wall with micropiles the Drytech® White Tank System can realize the refilling, the walls and the waterproofing of the structure in a unique concrete pour.

- E Excavation
- B Blinding
- M Membrane
- P Protective screed
- R Reinforcement steel
- F Formwork erection
- J Traditional joints
- Dc DRYset crack inducing units
- C Normal concrete slab
- Dw Drytech watertight concrete slab
- S Strip formwork
- T Waiting time for shrinkage
- Di DRYflex joint injection

Traditional Systems



Drytech System



GUARANTEE

THE DIFFERENCE BETWEEN MAINTENANCE AND RESTORATION LAYS IN THE DETAIL

10 YEARS SYSTEM GUARANTEE

The waterproofing system guarantee of the construction is a key factor for the interest correspondence between client and Drytech.

The guaranteed waterproofing, long and short term, is a win-win situation for both: the client who desires an efficient and fast usable structure and Drytech, who employs a state-of-the-art waterproofing in order to avoid any guarantee ratings.



SINGLE STRUCTURE, PRACTICAL MAINTENANCE

The ability to sustain the watertightness of the structure is a key aspect.

The system guarantees the real possibility to carry out maintenance over time.

Any repairs can be easily undertaken by injection from the inside without the need to expose the works, demolition or interruptions to the normal operations of the structure.



PROCUREMENT AND REALITY

Maintenance costs are frequently under-estimated by the client during the tender process as these costs are not the responsibility of the new works contractor who is trying to submit the lowest bid. Anyway, for the client the real cost of a construction project still contain operation and maintenance activities.

Drytech guarantees the watertightness of the structure in time and agrees with the requirements of the client.

With the respective experience the normal maintenance activities can be quite exactly foreseen. It differs when coming to restoration and unusability of buildings, temporary or definitive.

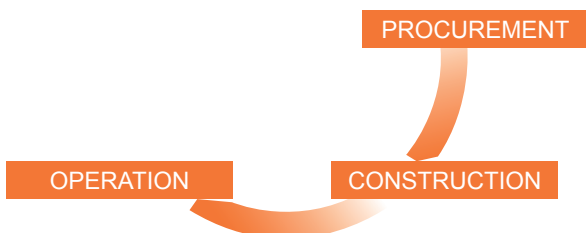
Through a lack of experience design faults or incomplete evaluations can generate high costs and in the worst case the unusability of a building.

The maintenance costs can therefore vary based on care and vision of the design.

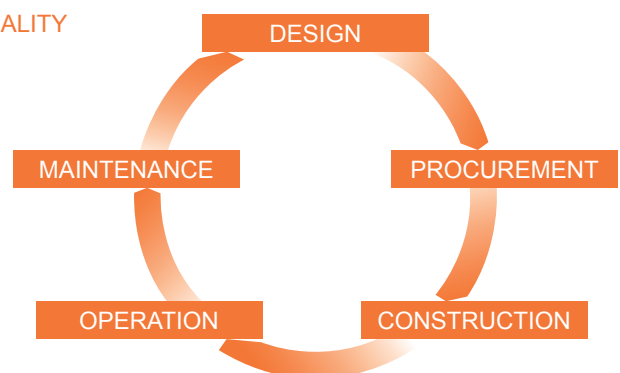
The same goes also for the usage, progressing rapidly in case of permanent contact with water.

Over 45 years of restoration activities have demonstrated that the difference of normal rentability and cost intensive emergencies lays in the construction details: even if they seem less important at the first sight.

PROCUREMENT



REALITY



APPLICATIONS UNDER GROUND UNDER WATER UNDER PRESSURE

Intesa SanPaolo Tower, Turin
Porta Nuova district, Milan
Isozaki Tower, Milan

BASEMENTS

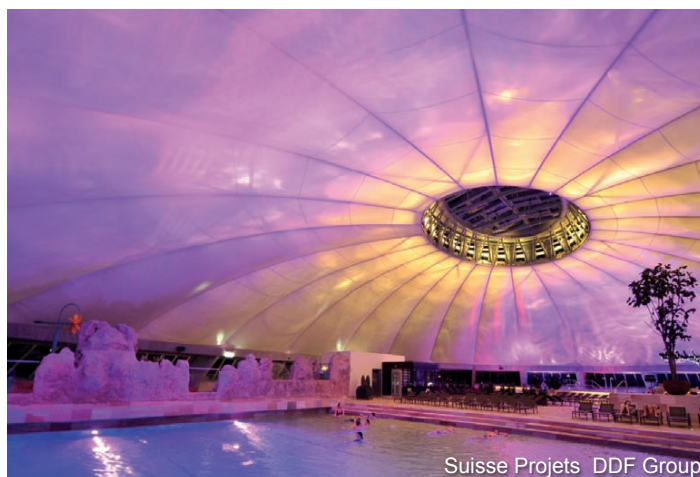


APPLICATIONS

- > Basements
- > Underground car parks
- > Dams and reservoirs
- > Water tanks/cisterns
- > Swimming pools
- > Sewers and pipelines
- > Waster water treatment plants
- > Marine structures
- > Utility adits
- > Road tunnels
- > Railway tunnels
- > Metros and underground stations
- > Immersed Tube Tunnels

Waste Water Treatment Plant, Birsfelden
 Splash Tamaro SPA, Rivera
 Industrial water clarifier, Genoa

HYDRAULIC PLANTS



Suisse Projets DDF Group



Control Tower and Service Tunnel for SBB AlpTransit, Pollegio
 Froloo Power Station, Therwil
 Railway Tunnel, Saronno

INFRASTRUCTURE



BASEMENTS

LE ALBERE, TRENTO

The new design of the area ex-Michelin in Trento created by the architect Renzo Piano foresees a variety of uses and enlarges the city center up to the Adige.

The river in its double function: on one side it connects the area with the new public park, on the other side it is used in its best technical functions, such as the irrigation, fire prevention and cooling system.

With the Drytech® White Tank System 90.000 m² have been waterproofed.



© RPBW

EXHIBITION TOWER, BASEL

28 floors in 28 weeks. The tower that has become a symbol of Basel's exhibition centre and also represents some of the most advanced construction techniques, including the Drytech Tank System. Due to the tower's rapid progress - one floor per week - the underground foundation level had to support the structural strain and settlement resulting from the rapid load changes. The Drytech® Tank System was also adopted thanks to the particular characteristic of the resin i.e. its sealing capability due to the pressure exerted when the resin polymerises. The seal is capable of adapting to the movements of the joints and cracks, ensuring that the structure remains watertight.



TEATRO ALLA SCALA OPERA HOUSE, MILAN

As part of the extensive renovation of the famous Milanese opera house, the new stage pit (19 metres deep) was created using the White Tank System, whose single structure enabled a reduction in m³ of excavation, and the relative material to be disposed of, reducing the time required to complete the work by about 3 months. The pit houses two sophisticated stage machines, moving scenery for three different shows and taking just 6 minutes to change shows. The fact that any repairs can be carried out from the inside, without the need for demolition work and without interrupting the theatre's activities, was a decisive factor in choosing the Drytech Tank.

PALAZZO DONINI, LUGANO

Creation of the waterproof diaphragm of an automated underground car park, exposed to an 8-metre water head. Direct diaphragm waterproofing, without any other internal structures, has enabled the creation of two extra parking spaces, increasing the property value and producing greater sales revenue covering the investment made for waterproofing.



HYDRAULIC PLANTS

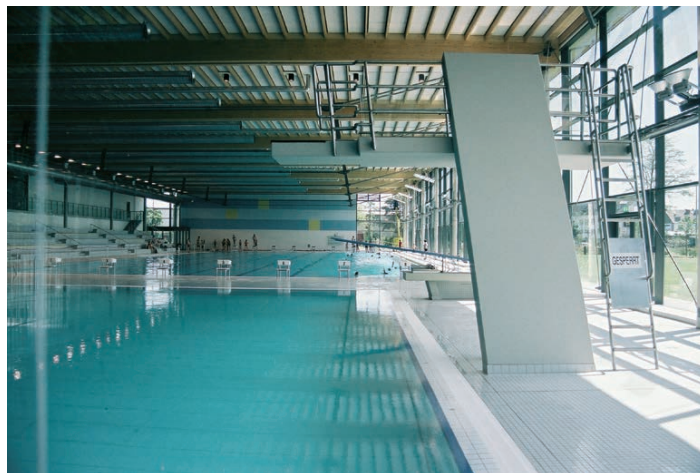
The System also finds application in any construction requiring to be waterproofed from the inside to the outside, such as: swimming and spa pools, drinking water tanks, river dikes and weirs, hydroelectric powerstations, industrial tanks.

On the right: Infinity pool encompassed within a garden pond.
Below: Hanging pool.



On the Right:
Infinity pool on terrasse, Lugano
Residential swimming pool, Brigels
Sereno Luxury Hotel, Como lake
Prefabricated and pre-waterproofed oil tanks, Loano

Below:
Olympic swimming pools, Mönchengladbach
Sewage treatment plant, Stans



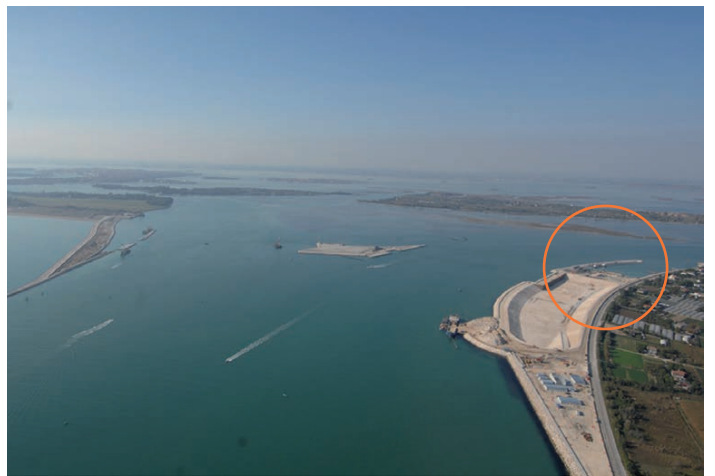
INFRASTRUCTURES

SEA LOCKS MOSE LAGUNA FLOOD PROTECTION SCHEME, VENICE

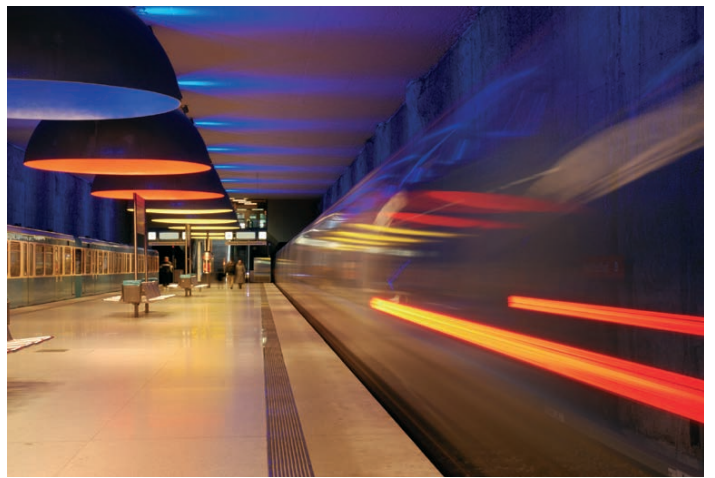
Drytech created the waterproof caissons 8 m under the sea level (at the centre of the circle in the photo) for the lock at the centre of the small harbour at the mouth of Lido Treporti in Venice.

The lock allows small boats to pass through when the MOSE floodgates are raised to counter the high water phenomenon afflicting Venice.

The walls of the caissons have been poured directly against the sheet pile wall, realizing in one stage the concrete filling and waterproofing of the walls.



Olympiapark-North Metro Station, Munich
Thames Lee Tunnel Aqueduct, London
North City Ring Motorway Tunnel N2, Basel



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