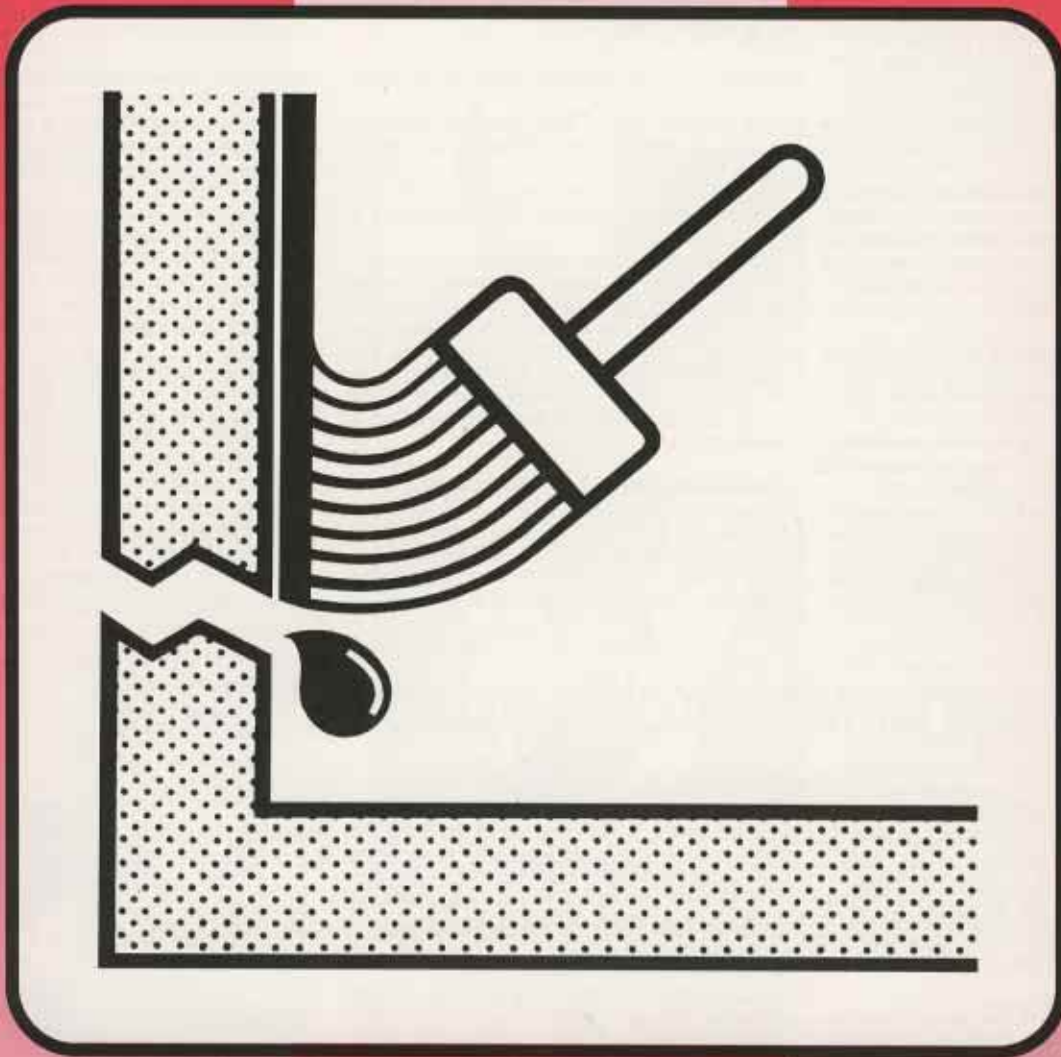




4<sup>th</sup> Division: damp-proofing plasters for refurbishment and restoration. Water-proofing cements. Shrink - resistant mortars, paints, protective, water-proofing and epoxy coating, water repellent treatments, additives for improved bonding, sealants for joints, adhesives for tiles.



# WATERPROOFING

WITH  
VAPOUR PERMEABLE CEMENTS

TECHNICAL SPECIFICATION

**index**»»»



# Problems

The growing need to increase living space, to renovate warehouses and garages, and to generally restore existing structures at an affordable cost has led to the development of new techniques designed to make habitable various specific areas, particularly those which are underground, and make them fit for use.

The characteristic effect of the presence of water underground when in direct contact with a structure which has not been waterproofed is: excessive moisture present in the structure which is identifiable at the start of degradation and then mould and efflorescence due to the inaccessibility of the fault.

The high rate of dampness present in these places involves greater heating cost due to greater thermal loss through the walls, contributing towards increased living costs.

The necessity to adequately waterproof structures has pushed planners and technicians to consider new waterproofing techniques.

The aim of this specification is the presentation of **INDEX** technology in order to anticipate structural waterproofing needs, especially underground, with alternative products or products which are complementary to polymer-

bitumen membranes to allow a radical solution of the problem.

## WATER ACTION IN UNDERGROUND PLACES

The principal source of degradation of underground or partially underground spaces is water entering by infiltration, from an underground stream or from normal humidity present in the earth on which the groundwork is laid.

In the most serious cases, where an underground stream is present, the water is pushed by hydrostatic pressure and tends to reach the same height on the inside as the outside level through fissures or empty capillaries. The water from infiltration can only be blocked by making the holding structure waterproof. This must be strong enough to support the hydrostatic thrust.

## WATERPROOFING - FOUNDATIONS

So as not to incur costly restoration, the waterproofing of underground works must be planned and carried out with special care.

The choice of materials will depend on requirements of cost, or simplicity of application and

on the type of intervention.

This should take into account the different characteristics relating to waterproofing, to vapour, to rot and mechanical resistance. In particular situations where land is sufficiently drained or where there is a deep water table and in places which are not underground, it may be sufficient to waterproof by means of a **DAMP COURSE**.

When building in areas where there are possible accumulations of water, it may be advisable to provide adequate waterproofing of all underground surfaces; while in the presence of the water table, waterproofing will be total and include vertical and horizontal surfaces.

The waterproofing covering may be applied to the exterior or interior of the foundations, or in the case of homogenous foundations in concrete, additives may be used which will make it impermeable to water. Protection relating to all the underground parts of the building (walls and floor) will be defined as «Total Protection» while that which relates only to the walls will be called «Partial Protection». In the following chapter the products and relative applications are listed.

# System in use for waterproofing underground spaces

## POLYMER BITUMEN MEMBRANES

These are widely used and recommended for this type of intervention. The **INDEX** Company, producers of polymer bitumen membranes, illustrate the type and the way to use them in Technical Specification No. 5 «Foundations».

## LIQUID PRODUCTS

These are advisable for the external protection of basement walls built on sufficiently drained land in not too difficult a situation. **INDEX** product type:

**INDEMASTIC** is a cold applied bitumen emulsion which when diluted with water is applied in a pasty consistency onto the surface to be waterproofed. Once dried it forms a waterproof film which is resistant to water infiltration.

This system is advised for non underground situations and for its ease of application as well as low cost.

**INDESOL** is a cold applied solvent based bituminous mastic which, unlike **INDEMASTIC**, cannot be damaged by frost and also dries more quickly. It sets the solution by means of evaporation and, once dried, forms a tough waterproofing film which will not drip at high temperatures or crack at low temperatures. Low in cost, it must be applied only on perfectly dry surfaces.

## SODIUM BENTONITE CONTAINED IN A PANEL

This type of waterproofing appeared on the market only a few years ago and is used both for external walls and sub-floors.

When in contact with water the bentonite expands and stops any water movement.

## WATERPROOFING WITH DAMP PROOFING CEMENTS

These are recommended for waterproofing concrete walls, especially internal walls.

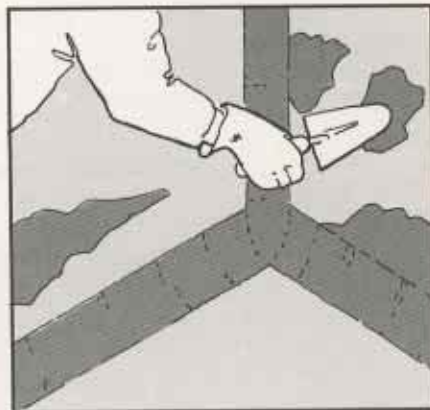
**INDEX** produce **OSMOSEAL** for interior waterproofing of underground areas in the presence of a continuously high water table, and **BENTORAPID** quick-setting waterproofing cement, and these will be the subject of technical specifications described below.

## SYNTHETIC MEMBRANES

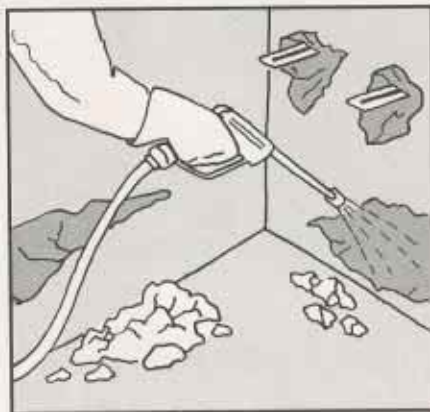
The synthetic membranes which may be used are of a different nature (PVC, EPDM, ECB, etc.). The type most used is PVC which generally is not bonded to the structure.

## CHEMICAL ADDITIVES FOR CONCRETE

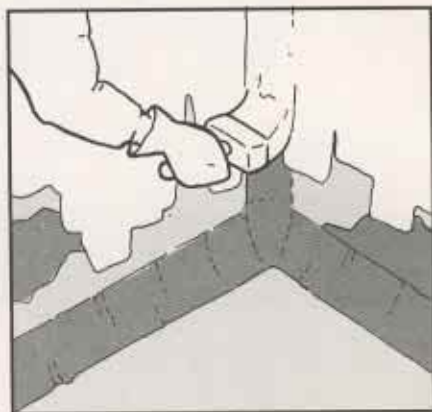
These products form part of the category called «**MASS WATERPROOFING**» or «**MASS DAMP-PROOFING**» and are added to the mix during the mixing stage. **INDEX** produces damp-proofing **SATURFIX** and super fluidiser **FLUXAN**. The use of these additives will be discussed in specification D which follows.



Restoration of walls and formation of fillets



Surface cleaning by chiselling and high pressure water cleansing



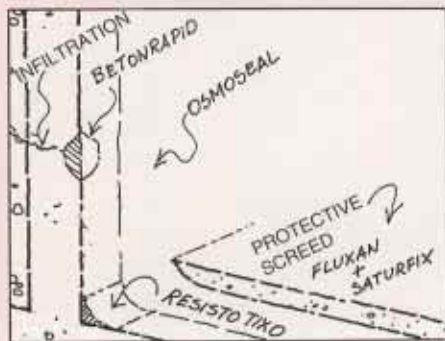
Osmoseal application



# Technical Specification

**INTERIOR WATERPROOFING OF BASEMENTS, UNDERGROUND GARAGES, LIFT SHAFTS, UNDERGROUND WAREHOUSES, WHICH ALL LACK ADEQUATE EXTERIOR WATERPROOFING AND ARE IN THE PERMANENT PRESENCE OF A WATER TABLE AND INFILTRATION WATER.**

## A TECHNICAL SPECIFICATION



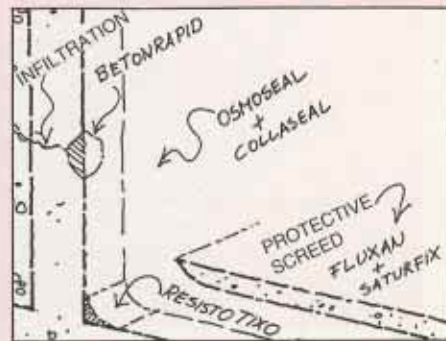
- Remove any remaining old plaster or rendering until the concrete surface is found. Clean off any incrustations, thin coverings of mortar, oils, release agents, crumbling and dusty areas by chiselling, brushing or by high pressure water cleansing.
- Remove any nails and plugs and cut deeply around distancing steelwork, chiselling the surrounding area.
- Open and seal re-start castings, gravel nests, and all chiselled areas using RESISTO UNIFIX shrink-resistant mortar.
- Block possible water infiltration with BETONRAPID quick setting waterproof cement (see description is "Preliminary work").
- Form angle fillets between floor-walls with RESISTO TIXO shrink-resistant mortar.
- Bathe the surfaces with water before applying OSMOSEAL, avoid a surface film of water.
- Any localised water seepage must already have been blocked by mixing OSMOSEAL with BETONRAPID in the ratio 3:1.

OSMOSEAL is prepared by diluting the dry product with 28% of clean water (7 litres of water to each 25 kg bag) taking care to mix the product well to avoid the formation of lumps, until a smooth mortar consistency is reached.

- Apply OSMOSEAL in 2 interlacing covering coats, fresh on fresh, using a bristle brush to achieve a total minimum consumption of 3 Kg/m<sup>2</sup>.
- The waterproofing will then be completely protected by a cement screed/render to which has been added FLUXAN superfluidiser and SATURFIX water repellent; the water cement ratio should be  $\leq 0.45$ . The protective layer will be applied to both floor and walls to achieve total protection.

**INTERIOR WATERPROOFING OF BASEMENTS, UNDERGROUND GARAGES, LIFT SHAFTS, UNDERGROUND WAREHOUSES, WHICH ALL LACK ADEQUATE EXTERIOR WATERPROOFING AND ARE IN THE PERMANENT PRESENCE OF A WATER TABLE**

## B TECHNICAL SPECIFICATION



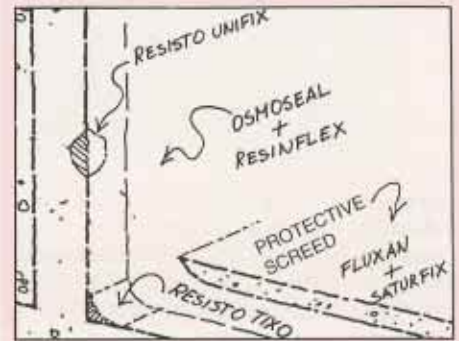
- Remove any remaining old plaster or rendering until the concrete surface is found. Clean off any incrustations, thin coverings of mortar, oils, release agents, crumbling and dusty areas by chiselling, brushing or by high pressure water cleansing.
- Remove any nails and plugs and cut deeply around distancing steelwork, chiselling the surrounding area.
- Open and seal re-start castings, gravel nests, and all chiselled areas using RESISTO UNIFIX shrink-resistant mortar.
- Block possible water infiltration with BETONRAPID quick setting waterproof cement (see description is "Preliminary work").
- Form angle fillets between floor-walls with RESISTO TIXO shrink-resistant mortar.
- Bathe the surfaces with water before applying OSMOSEAL, avoid a surface film of water.
- Any localised water seepage must already have been blocked by mixing OSMOSEAL with BETONRAPID in the ratio 3:1.

OSMOSEAL is prepared by diluting the dry product at 28% using water and COLLASEAL in the following proportions for each 25 Kg bag: 4 litres of water with 3 litres of COLLASEAL. Mix the water with COLLASEAL before adding Osmoseal which will then be mixed until a smooth mortar consistency is reached.

- Apply OSMOSEAL in 2 interlacing covering coats, fresh on fresh, using a bristle brush for a total minimum consumption of 3 Kg/m<sup>2</sup>.
- The waterproofing will then be completely protected by a cement screed/render to which has been added FLUXAN superfluidiser and SATURFIX water repellent; the water cement ratio should be  $\leq 0.45$ . The protective layer will be applied to both floor and walls to achieve total protection.

**EXTERIOR AND INTERIOR WATERPROOFING OF UNDERGROUND BASEMENTS, UNDERGROUND GARAGES, LIFT SHAFTS, IN THE PERMANENT PRESENCE OF A WATER TABLE OR WHERE MASONRY IS SUBJECT TO STRONG NEGATIVE WATER THRUST AND STRUCTURAL VIBRATIONS.**

## C TECHNICAL SPECIFICATION



- Remove any remaining old plaster or rendering until the concrete surface is found. Clean off any incrustations, thin covering of mortar oils, release agents, crumbling and dusty areas by chiselling, brushing or by high pressure water cleansing.
- Remove any nails and plugs and cut deeply around distancing steelwork, chiselling the surrounding area.
- Open and seal re-start castings, gravel nests, and all chiselled areas using RESISTO UNIFIX shrink-resistant mortar.

- Form angle fillets between floor-walls with RESISTO TIXO shrink-resistant mortar.

- Bathe the surfaces with water before applying OSMOSEAL, avoid a surface film of water.

- OSMOSEAL is prepared by diluting the dry product at 30% using water and RESINFLEX flexible acrylic resin in the following proportions for each 25 Kg bag of OSMOSEAL: 4 litres of water with 3,5 litres of RESINFLEX. Mix the water with RESINFLEX before adding OSMOSEAL which will then be mixed until a smooth mortar consistency is reached.

- Apply OSMOSEAL in 2 interlacing covering coats, fresh on fresh, using a bristle brush for a total minimum consumption of 3 Kg/m<sup>2</sup>.

- The internal waterproofing will then be completely protected by a cement screed/render to which has been added FLUXAN superfluidiser and SATURFIX water repellent; the water cement ratio should be  $\leq 0.45$ . The protective layer will be applied to both floor and walls to achieve total protection.

## CONCRETE IMPERMEABILITY

The limited impermeability of concrete is well known; it depends not only on the use of good quality materials or the use of suitable additives but also on the manufacturing process in the factory. It is well that concrete is poured into the moulds in a semi-liquid state where steel reinforcement has been put into place in advance. During this stage air forms in the mix which must be forced out with the help of vibrators. If this last operation is not carried out in the proper manner, once the concrete has hardened holes will be found inside the concrete mass which will negatively influence resistance. The problem of the correct rate of water evaporation also exists; in fact if this happens too rapidly, cavities and superficial porosity will be created in the concrete. The water/cement ratio is also of great relevance because if more water than necessary is added, the concrete becomes too porous with a resulting loss of mechanical resistance.

The durability of concrete depends in the main on the permeability of the material. If this is made impermeable to water, the aggressive agents dissolved in it cannot penetrate the material and so concrete durability will be greater. The permeability and therefore the durability of concrete is affected by the type of cavities present. With numerous cavities connected to each other, continuous porosity inside the material can be established which makes the concrete permeable and therefore degradable in aggressive surroundings. The problem of making concrete impermeable and long-lasting consists of achieving an interrupted porosity which will not allow aggressive agents to permeate the material. In addition to a thorough vibration of the concrete mix so as to reduce porosity, one must try to obtain a small number of capillary pores. To obtain this it is necessary to work on the water/cement ratios and on the seasoning times needed to reach these conditions. The first aspect may be achieved by limiting the water/cement ratio by adding superfluidisers because then the distance between the cement granules is less, therefore the less the distance the more dense and less porous the microstructure will be due to the intermingling of the fibrous crystals produced by the drying of the cement.

## FLUXAN SUPERFLUIDISER AND SATURFIX WATER-REPELLENT ADDED TO CONCRETE

**FLUXAN** and **SATURFIX** additives are used to obtain a concrete mix with the excellent characteristics mentioned which are: permeability, low water cement ratio and excellent handling.

The main function, of the superfluidiser **FLUXAN** is in fact to allow a noticeable reduction of the water used, without jeopardising consistency values, and to greatly improve mechanical resistance. With the addition of 1,5% **FLUXAN**, the appearance, the ability to compact, impermeability, bending to steelwork - all will be improved (with a significant increase in workability to equal water/cement ratio without separation of the individual constituents).

By mixing **FLUXAN** in the ratio of 1 - 1,5 kg per 100 kg cement, the superfluid concrete will obtain **SLUMP** of 220 mm whereas normal concrete will only achieve slump of 20/30 mm. The action of the additive is particularly evident in self-levelling concrete preparation, where with the same quantity of water used for normal concrete (at 2/3 cm **SLUMP**) the addition of **FLUXAN** will provide a mix which will give good pumping, higher operation speed and reduced vibration time.

**The function of SATURFIX is to obtain concrete with improved permeability whilst not altering the cement setting time nor the mechanical resistance of the concrete. SATURFIX additive blocks the capillary pores of the concrete mix. It is an additive where the base material reacts with hydrolytic lime in the cement, forming insoluble calcium salts in the mix which hasten blocking of the pores.** With the addition of 2% **SATURFIX** to cement, a good water-repellent concrete will be obtained.

## CONCRETE COMPOUND FOR WATER-PROOFING FOUNDATION CASTINGS AND PROTECTIVE SCREED/RENDER

### TECHNICAL SPECIFICATION

Concrete for waterproofing foundations must be formed from cement of low hydration heat with the cement content equal to or greater than 350 kg/m<sup>3</sup> and from perfectly granulated sand (UNI 7163), with fine parts (0,2 mm) which should equal at least 5% of total weight of sand. The water/cement ratio must be maintained at equal values and less than 0,45.

The concrete will be obtained by adding superfluidizer **FLUXAN** at 1,5% of cement weight and water-repellent additive **SATURFIX** at the rate of 2% cement weight. The additives will be incorporated in the required quantity, immediately after the cement has been made, taking care to blend the added mixture for another three minutes.

During the mixing stage do not prolong vibration time as this can result in a separation of the various elements of the concrete mix with the resultant reduction in quantity and density.

Care should be taken to ensure thorough seasoning of cast concrete. In case of high evaporation of the water content, cover with dampened cloth or paper bags. Steps must be taken to spray the casting as soon as it has been completed. (curing agents)

**FLUXAN** additive must have the following characteristics and properties: **product density 1,15 ± 1,01 kg/ltr; mass percentage of dry substance in accordance with UNI rules 7111-72 - 32%; Superficial tension of the product in watery solution in water/cement ratio - 0,5 in accordance with UNI 7117-72: 0,078 N/m; water quantity to obtain normal paste (in accordance with DM 3/6/86 Article 11, section 1, article 7): cc 120; water reduction in the paste which has had 1,5% **FLUXAN** added to the cement mass: 15%. **SATURFIX** additive must have the following characteristics: **product density at 20 C 1,03 ± 0,01 kg/ltr; PH value 9.****



# Preliminary work and warning

## PRELIMINARY WORK

### LOWERING THE WATER BEARING STRATA LEVEL

When working in places affected by a high water table, steps must be taken to lower the water level for the time necessary to carry out the waterproofing.

To maintain the water level below the working level, two systems may be adopted depending on the type of ground.

### SANDY SOIL - WELLPOINT SYSTEM

This system allows work to be carried out in dry conditions by way of a series of draining tubes positioned in the ground around the perimeter of the site. These are connected to a draining ditch at a pumping station from where the water is pumped out to maintain the level below the working area.

### CLAY SOIL - IMMERSION PUMP SYSTEMS

The water is collected by means of drainage canals into suitable tanks/reservoirs which are fitted with immersion pumps. The water is continuously sucked out from the interior thus maintaining the desired level. Pumps must be provided with emergency power supply which will guarantee continuous functioning even during accidental interruption of the electricity supply.

Once the waterproofing has been carried out the tanks/reservoir are hermetically sealed and bolted with metallic covers.

### PLUGGING ESCAPING WATER WITH BETONRAPID

Waterproofing of underground works requires an extremely diversified and complex series of interventions. The first operation to be accomplished is to stop water infiltration.

The water routes are opened and cleaned and then closed by means of **BETONRAPID** quick-setting cement. When water infiltration is located on points on a wall, it is advisable to use flexible P.V.C plastic tubes which are introduced into the cleaned out hole for drainage purposes. The **BETONRAPID** will then be applied into the hole around the tube and a slight pressure will be applied until the **BETONRAPID** has fully hardened. When the tube has been positioned the water will begin to flow and may be channelled towards the exterior of the building. The surrounding area may then be waterproofed with **OSMOSEAL** damp-proof cement described as under. The small tubes should be removed when the waterproofed structure is completely dry and sufficiently hardened to resist water under pressure. After extracting the plastic tube the opening must be closed immediately using a small ball of **BETONRAPID**.

See design sequence →



Surface preparation by chiselling



Wear gloves to mix



Betonrapid application

### PREPARATION OF THE CONCRETE BASE

After dealing with the escaping water it is necessary to prepare the concrete surface to be waterproofed adopting a suitable cleansing treatment such as sanding or water cleansing. The surface to be treated will be coated with shrink proof mortar **RESISTO** paying attention to gravel nests, casting breakdown, static damage, fillets and cavities which may be present.

Steelwork which becomes exposed must be cut and hammered inside a purpose made dovetail joint which is then plastered.

Special care must be taken to make the concrete surface wet so as to create the correct conditions for the **OSMOSEAL** to absorb all the water necessary both for the damp-proofing process and for the chemical hardening reaction. Any excess water must be removed from the surface with sponges.

At this point the waterproof treatment takes place applying **OSMOSEAL** thin mortar of a smooth consistency using a bristle brush starting at the top working towards the bottom and starting with the walls and finishing with the floor. If applied to the exterior, the waterproofing must be protected from the sun or the frost with nylon cloth so that it does not burn or freeze during the hardening stage. In climatic conditions of very hot sun and in windy areas the waterproofing must be kept damp during the first 24 hours after application by spraying a water mist but avoiding directly bathing with the water jet.

Waterproofing may be extended on brick surfaces, tufa and stone on condition that a suitable support of reinforced concrete is created to resist possible negative thrust of seasonal water table and this must be integrated with and anchored to the surrounding structures.

## INSTRUCTIONS

Corners between floor and wall must be coated with a bonding base layer of **STRATO 4900** and **OSMOSEAL** thin mortar and must be connected by means of fillets formed using **RESISTO TIXO** shrink-resistant mortar. Water venting tubes must be sealed with polyurethane mastic along all the circumference in contact with concrete to avoid exit of water.

It is not advisable to apply **OSMOSEAL** on surfaces treated with release agents containing mineral oils without cleaning first.

To achieve good bonding on inconsistent, crumbling masonry, it is necessary, in addition to the normal superficial cleaning, that a render reinforced with a galvanised steel mesh be used, suitably fixed to the wall.

The walking surface which has been waterproofed with **OSMOSEAL** must be protected from wear and tear and continuous traffic by a cement screed which has a minimum thickness of 5 centimetres. This will also serve as a prepared surface for floor tiles. The walls too may be finished either with damp-proofing plaster or cement mortar **without however interrupting and prejudicing the waterproofing with plugs or perforations.**



# The Products

## OSMOSEAL

**OSMOSEAL** is ready mixed in powder form containing high resistance water activated bonding agents, water-repellent additives and selected inert material. It is produced in powder form to be mixed with water prior to use. **OSMOSEAL** is reactive to calcium hydroxide, forming stable and insoluble compounds. These crystallising salts guarantee perfect integration with the surface, creating an insoluble crystallisation which fills up the capillaries osmotically. The presence of special additives creates with the cement a double layer which is impermeable to water.

## RESINFLEX

**RESINFLEX** is a modifier which helps to create mortars with characteristics of flexibility, resistance and adhesion which is superior to traditional material. It is a co-polymer of acrylic acid esters - the resins are dispersed in water.

## BETONRAPID

**BETONRAPID** is a rapid setting waterproofing cement which is mixed with water and is then ready to use. It has shrink-proof characteristics and bonds perfectly to the surface, forming one body with the structure. **BETONRAPID** seals and blocks water infiltration instantly even when under strong pressure and thus makes total waterproofing with **OSMOSEAL** possible.

## SATURFIX

**SATURFIX** is a liquid additive which is used as a waterproofing additive for the preparation of renders and cast concrete. **SATURFIX** must always be diluted in the water mix in constant proportion to the cement weight. It reduces porosity, noticeably improving mortar and concrete impermeability. It will be damaged by frost so during the winter period it is advisable to use **IDROBETON** which is in powder form (see technical sheet).

## COLLASEAL

**COLLASEAL** is a modifier containing vinyl polymer resins dispersed in water, to be added to the water when mixing to achieve mortars with characteristics of elasticity, mechanical resistance and superior adhesion to traditional material.

## FLUXAN

**FLUXAN** is an additive obtained by synthesis of polycondensing resins. It is packaged as a brownish liquid which is water soluble. **FLUXAN** is free from chlorides and does not influence the start or finish of cement setting times. **FLUXAN** displays two important actions on the fresh, hardened concrete with evident improving effects.

- It improves fluidity of the concrete mix without causing segregation and bleeding through the lubricating effect which it carries out towards mineral charges.
- It improves concrete handling, even with low water/cement ratio, and therefore improves impermeability, compactness, adhesion and mechanical resistance.



For problems concerning Restoration and Refurbishment, we refer you to INDEX specific Technical Specifications



WATERPROOFING WITH LIQUID PRODUCTS



RESTORATION OF DAMP MASONRY BRICKWORK USING DAMP-PROOFING RENDERS



CONCRETE REFRUBISHMENT

# index

advanced waterproofing systems, insulations and refurbishment