Fosroc
application guide

Application of Renderoc SPXtra by the dry and wet spray process

Spray repairs with Renderoc SPXtra

Introduction

For repair applications where large volumes of material need to be placed, Renderoc SPXtra should be used. The spray techniques which are available for its application offer a number of significant advantages, namely :

i) Excellent bond to the substrate concrete.

ii) Excellent compaction of the mortar.

iii) Much higher build than can be achieved with hand or trowel applied mortars.

iv) Rapid placement of material.

Equipment

It is strongly recommended that a trial with the material and the proposed equipment should be performed prior to commencing a job. The type of equipment selected for a particular job will depend on availability, the amount of material to be applied and the location of the job.

Application

Spraying mortars - whether by wet spray or dry spray - is a skilled process and requires trained and experienced applicators to achieve good results. Operation of the nozzle and mixing of the mortar are key elements which the applicator must control, in order to ensure a good quality finish. It is, therefore, essential that only specialist, experienced applicators should be employed who are fully aware of the requirements and details of spray techniques.

Wherever possible it is recommended that trials are performed with the material and equipment, on elements which exhibit the same features as the job, to ensure the spraying technique employed is appropriate. The general guidelines presented here offer a starting point for these trials.

Surface preparation

The surface to accept the sprayed mortar should have been prepared to the required standard. To achieve good bond strengths, the surface must be free from all laitance, organic and inorganic deposits. The aggregate should be exposed to provide a rough surface finish which will act as a mechanical key for the mortar. Prior to spraying the mortar, the surface should be cleaned with a blast of air and water from the nozzle to remove any dust or debris. When the surface of the concrete starts to dry, application of the sprayed mortar can commence.

Priming

Any exposed steel reinforcement should be primed, using Nitoprime Zincrich in accordance with its current data sheet instructions.

Unless otherwise specified, priming of the substrate concrete is not normally necessary, provided the concrete is in a saturated surface dry condition immediately prior to the application of the sprayed mortar.

Thickness of application

Renderoc SPXtra should not be applied at a thickness of less than 10 mm. The material should be built up to the required thickness by applying wet on wet layers of material without allowing the previous layer to dry out. Typical thicknesses which can be achieved are as follows :

Overhead	150 - 250 mm
Vertical	200 - 300 mm
Horizontal	150 - 200 mm

The practical thickness which can be achieved on site will depend on the orientation of the substrate, the skill of the applicator, and the geometry of the repair area. In ***no*** circumstances should a thickness be reached where the material sags or slumps as this can affect the bond at the mortar/substrate interface. Should this occur, the material must be removed and replaced.

Area of application

The area which may be applied in one application will be dependent on a number of factors.

a) The temperature and prevailing environmental conditions control -

   i) the drying time of the mortar, thus limiting the time which may elapse between successive passes of the nozzle.

   ii) the setting time, which will determine whether application and finishing can proceed simultaneously.

b) The number of operatives control whether application and finishing can occur simultaneously.

Finishing

Renderoc SPX$_{tra}$ is finished by cutting to the required profile and closing with a steel float. Wooden or plastic floats, or damp sponges, may be used to achieve the desired surface texture. The complete surface should not be overworked. The surface will normally be finished immediately after spray application.

Curing

In common with all cementitious materials, Renderoc SPX$_{tra}$ must be cured immediately after finishing in accordance with good practice. The use of Rendercure**,** sprayed on to the finished surface in a continuous film, is recommended.

Large areas should be cured as trowelling progresses (0.5m^2 at a time) without waiting for completion of the entire area. In fast drying conditions, supplementary curing with polythene sheeting taped down at the edges must be used.

Hot weather working

It is suggested that, for temperatures above 35^{0}C, the following guidelines are adopted as good working practice:

(i) Store unmixed materials in a cool (air conditioned) environment, avoiding exposure to direct sunlight.

(ii) Keep equipment cool, arranging shade protection if necessary. It is especially important to keep cool those surfaces of the equipment which will come into direct contact with the material itself.

(iii) Avoid application during the hottest times of the day.

(iv) Make sufficient material, plant and labour available to ensure that application is a continuous process.

Overcoating with protective finishes

Following completion of repairs, it may be decided to overcoat the structure in order to maintain a consistent appearance.

The surrounding parts of the structure would also benefit from the application of a protective coating to limit the advance of chlorides and carbonation, thus bringing them up to the same level of protection as that already afforded to the repaired area.

Fosroc recommends the use of the Dekguard range of decorative, anti-chloride and anti-carbonation coatings. Dekguard products may be applied over the repair area without prior removal of Rendercure. Other curing membranes must be removed prior to the application of Dekguard products. These high performance coatings offer a wide range of performance capability, namely :

Dekguard S*	-	decorative coating with very low dirt pick-up, for areas subject to high uv exposure
Dekguard E2000/E6000*	-	elastomeric coatings with uv resistance plus excellent crack-bridging ability
Dekguard PU*	-	protective coating offering high degrees of chemical resistance, also suitable for overcoating epoxies and in submerged conditions

Safety

All necessary measures should be adopted in accordance with the requirements of local safety regulations, or other nationally recognised legislation. In particular, lighting, ventilation and protective clothing shall be adequate for the safe and proper execution of the work.

Before work commences, refer to the product data sheet and Material Safety Data Sheet (MSDS).

Further Information

For further information on spraying techniques and equipment, contact the local Fosroc office.

Dry spray application

Principles of operation

In the dry spray process (see Figure 1), the dry material is placed in a purpose made machine (1), known as the gun. This continuously feeds an even flow of dry material into a high velocity air stream from a compressor (2). The air carries the dry material through suitable flexible pressure hoses (3) to the discharge nozzle (4). At the nozzle, a finely dispersed spray of water is added to the stream of material from a pressurised water supply (5). The amount of water added is controlled by the nozzle operator using a valve arrangement. The material and the water are projected from the nozzle at a high velocity onto the repair area.

The equipment can be relatively small and easily manoeuvred, and is frequently electrically or air powered. To reduce dusting, a predamping box can be added to the equipment and liquid additives can be incorporated by either mixing with the water supply prior to its incorporation at the nozzle, or by a separate gauged supply.

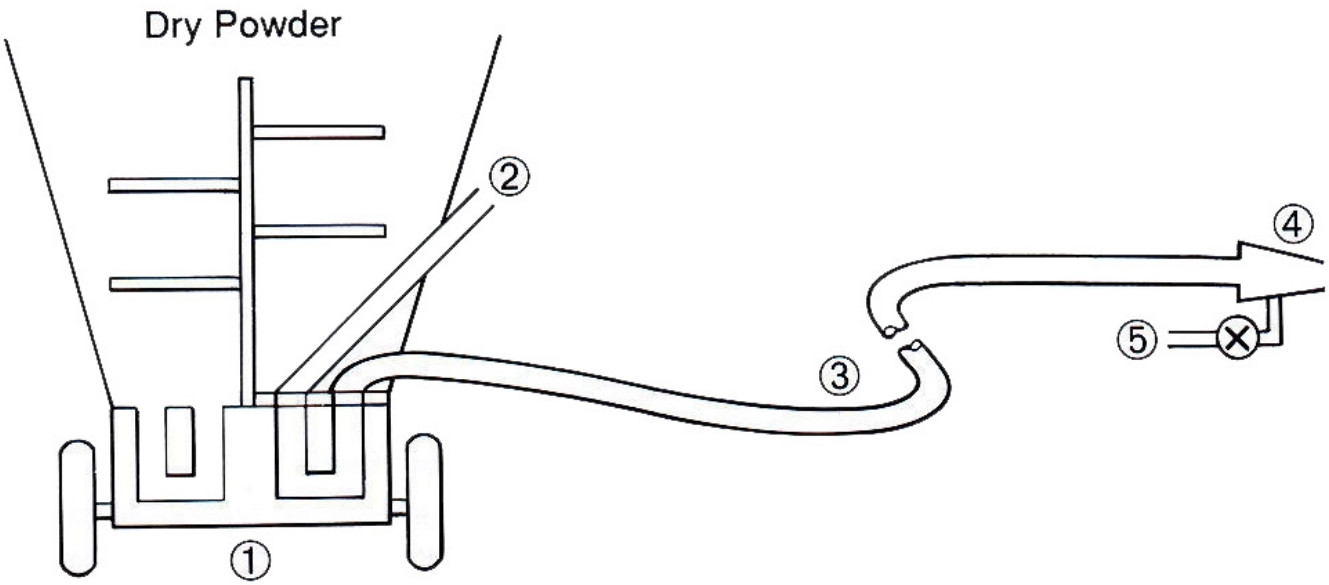
The rate of application of the material will be dependent upon the gun employed but should be in the order of 5-10 litres per minute.

Equipment

The gun and the hoses should be specifically designed for the dry spraying of mortars, and should be capable of delivering a continuous, even flow of material to the nozzle. All the equipment should be cleaned and inspected at least once a shift. The compressor should have sufficient capacity to power the gun and should be capable of providing a continuous supply of clean, oil-free compressed air to transport the material to the nozzle.

Delivery hoses should be inspected each shift to ensure they are clean and undamaged, with particular attention paid to the couplings. The couplings and seals should be clean and in good condition. If damaged they should be replaced prior to proceeding. The delivery hose should be laid out before work starts and all kinks and constrictions eliminated. The water supply line should be similarly laid out and inspected for damage. In the work area, the water hose should be attached to the delivery hose at regular intervals.

Figure 1 : Diagrammatic sketch of dry spray apparatus



Application

Prior to commencement of spraying, a final inspection should be made to ensure that the substrate has been properly prepared, and that any exposed reinforcement has been properly primed (see page 2).

Spray application should commence at the bottom of vertical or near vertical surfaces and the mortar built up to the required thickness by making several passes of the nozzle over the work area. The nozzle should at all times be held perpendicular to the work surface. In general, the distance of the nozzle from the application surface should be between 600 mm and 1500 mm, dependent on the orientation and geometry of the structure.

Care must be taken when spray applying material around exposed reinforcement and into corners. In these instances, the pressure may need to be reduced, the nozzle moved closer to the work and inclined to ensure complete encapsulation of the reinforcement and complete filling of the corners.

The material should emerge from the nozzle in a steady flow, free from pulsation. The dry spray application of mortars creates some dust and losses occur due to rebound from the surface. Care must be taken to ensure that none of the rebound, or other wastage, are incorporated into the work. It is important to remove any overspray, which may have resulted from a previous application, before more material is applied.

Where thick layers of mortar are required, care must be taken to ensure the material does not slump or sag, as this can break the bond to the substrate. If slumping does occur, the affected are must be cut out and replaced.

Greater thicknesses of mortar can be applied by allowing the first layer of material to stiffen before further layers are applied. The stiffening time will vary depending on the water content and the prevailing environmental conditions. Prior to the application of additional layers, any overspray must be removed.

The applied material may be cut and trowelled smooth to achieve an acceptable surface finish.

Suggested equipment

The following, suggested list of suitable equipment is based upon that which is typically available in the UK. For further advice and assistance regarding that which is available locally, contact the local Fosroc office (see page 8).

Rotary dry spray guns

Gunform (Equipment Supplies) Ltd
Reed SOVA
Air driven gun, output range 0.75 to 6.5 m^3/hr., 8 AM rotary vane motor, 18 pocket feed bowl, 125 to 365 cfm air consumption (relative to hose size and drive).

Reed SOVE
Electric driven gun, range 0.75 to 6.5 m^3/hr., 2 hp 3 phase electric motor, 18 pocket feed bowl 125 to 365 cfm air consumption (relative to hose size and drive).

Reed LOVA
Air driven gun, output range 0.75 to 9 m^3/hr., 8 AM or 16 AM rotary vane air model, 21 pocket feed bowl, 125 to 750 cfm air consumption (relative to hose size and drive).

Reed LOHE
Electric driven gun, output range 0.75 to 9 m^3/hr., 3 or 5 hp 3 phase, electric motor, 21 pocket feed bowl, 125 to 750 cfm air consumption (relative to hose size and drive).

Aliva Ltd
Model 240.5 air or electric driven gun, output up to 2 m^3/hr., 3 hp air driven or 2.2 kw 3 phase electric motor, 3.2 litre rotor structure.

Water pumps

Minimum water pressure at the nozzle should always exceed by 1 bar working pressure in conveying line.

Gunform (Equipment Supplies) Ltd
Model No. A04025 (100psi)

Aliva Ltd
Model No. AL M2

Compressors

The minimum compressor size should be 350 cfm/ 10 m^3/m. As distance from gun to nozzle increases, compressor size must increase. Minimum hose size between compressor and gun should be 38 mm (1½").

Wet spray application

Principles of operation

In the wet spray process (see Figure 2), the repair mortar is mixed in a forced-action mixer (1) to produce a material with the correct consistency for pumping. When thoroughly mixed, the material is placed into a hopper (2) containing a feed screw (3) which moves the material to the pump (4). The pump which is commonly a helical screw in a static jacket, but may in some cases be a positive displacement piston pump, forces the material along suitable pressure-rated delivery hoses (5) to the application nozzle (6). A jet of compressed air (7) is introduced to the mortar just prior to the end of the nozzle, causing the mortar to be broken into small particles and projected at relatively high speed to the repair area.

Much of the equipment currently available combines the mixer (1), hopper (2), feed screw (3), pump (4) and air compressor (8) in one electrically or diesel (9) powered unit.

Wherever possible, it is prudent to keep the pump unit close to the work area to prevent high pressures in the delivery hoses. Under good conditions, the mortar can be applied at a rate greater than 20 litre/minute.

Figure 2 : Diagrammatic sketch of wet spray apparatus

Figure 3 : Diagrammatic sketch of nozzle arrangements

Equipment

The mixer, pump and spray equipment should be specifically designed for spraying mortars or plasters and should be capable of delivering a continuous, even flow of material to the nozzle. The equipment should be inspected and cleaned at least twice a day. The compressor should be capable of supplying a continuous supply of clean, oil-free compressed air to the nozzle, sufficient to disperse the mortar and ensure an even spray distribution of material on to the substrate.

Delivery hoses should be inspected to ensure they are clean and undamaged, with particular attention paid to the couplings. The couplings and seals should be clean and in good condition. If damaged they should be replaced prior to proceeding. The delivery hoses should be laid out before work starts and all kinks and constrictions eliminated. The air line couplings should be similarly laid out and inspected for damage. In the work area, the air line should be attached to the delivery hose at regular intervals.

The pump delivery pressure should be tested by attaching a suitable pressure gauge to the outlet and operating the pump with clean water as the control material. If the pressure reading is too low, the pressure must be adjusted or, if necessary, the pump starter jacket replaced. When satisfactory, water must be pumped through the hoses, followed by a slurry of Portland cement and water, introduced into the hoses to act as a lubricant. Do ***not*** use a slurry of Renderoc SPX$_{tra}$.

Figure 2

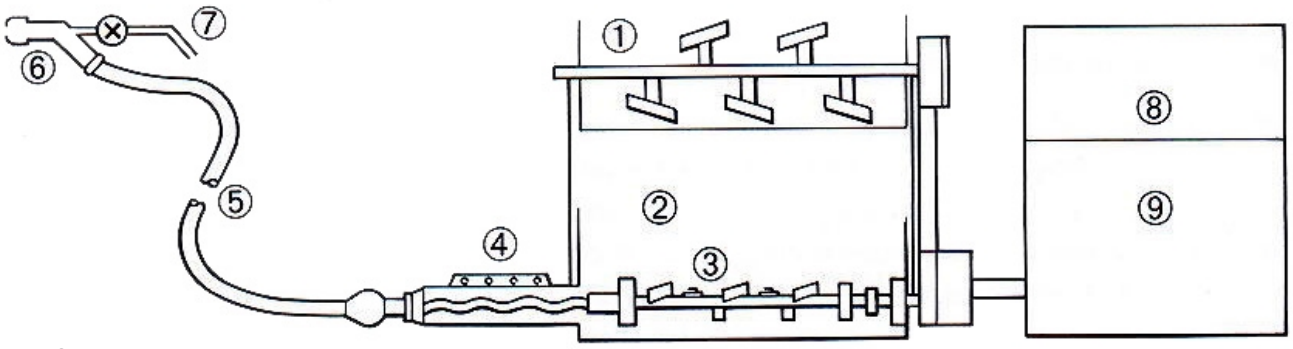
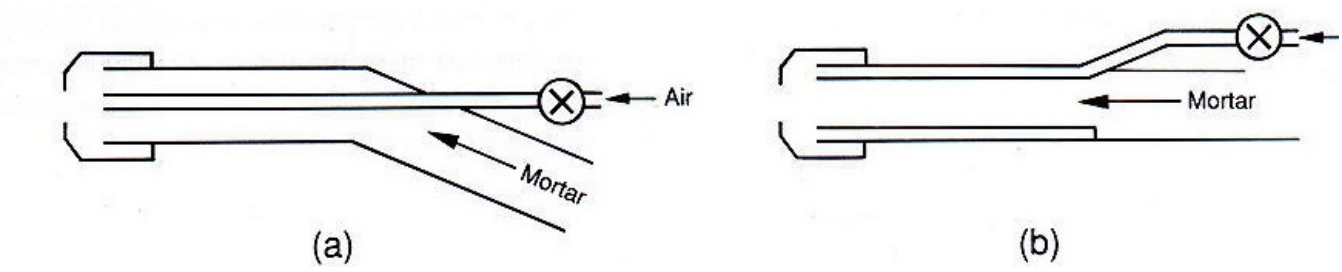


Figure 3



Pumps

Although many of the pumps have a compressor built in, this is frequently not adequate to ensure sufficient dispersion of the material and compaction on to the substrate. In general, a separate compressor is recommended.

Mixers

Renderoc SPXtra must be mixed in a forced-action mixer, and ***not*** in a free fall mixer. Many of the pumps available have forced-action mixers built into the single powered unit, which perform quite satisfactorily. Care must be exercised in controlling the water content. Please contact the local ***Fosroc*** office for guidance on suitability for this mixing process.

Hoses

The hoses for conveying the mortar should be pressure rated to at least twice the pressure capability of the pump. Typically the hose should be 35 mm diameter, with a minimum diameter of 25 mm. Care must be taken to ensure all the hose fittings are properly attached to the hose and are in good condition.

Nozzles

The compressed air for dispersing and projecting the mortar on to the substrate is introduced either through a central pipe or down an annulus - figures 3(a) and 3(b) respectively. The quality of the application is affected by the diameter of the exit aperture (this controls the size of the cone of sprayed mortar, the rate of flow and the degree of atomisation). Apertures of 10mm, 12mm and 14mm in steel and rubber caps have proved effective.

Equipment variables

When selecting the equipment to be employed for a particular application, consideration must be given to some variables.

Pump pressure

Most of the pumps provide some control over the delivery pressure of the mortars. The pressure must be sufficient to force the material along the hoses to the nozzle and overcome any hydrostatic head. Very high pressures will lead to rapid wear of the pump's component parts and may cause dewatering of the mortar, leading to blockage of the hoses. For a normal application, where the material is not pumped to a significant height (less than 5 metres), an operating pressure of 10 bar should prove adequate.

Rate of delivery

Some of the pumps have variable control over the rate of delivery of the mortar to the nozzle. Selection of an appropriate pump is important to ensure an adequate rate of delivery can be achieved.

Application

Prior to commencement of spraying, a final inspection should be made to ensure that the substrate has been properly prepared, and that any exposed reinforcement has been properly primed (see page 2).

Spray application should commence at the bottom of vertical or near vertical surfaces and the mortar built up to the required thickness by making several passes of the nozzle over the work area.

The nozzle should at all times be held perpendicular to the work surface. In general the distance of the nozzle from the application surface should be between 200 mm and 1000 mm dependent on the structure, air supply, mortar flow rate and application geometry.

Care must be taken when spray applying material around reinforcement and into corners. The nozzle should be held at an angle to the surface to ensure complete encapsulation of the reinforcement or complete filling of the corner.

The mortar should emerge from the nozzle in a steady flow, free from pulsation. With wet spray application of mortars, the amount of rebound should be minimal. However, care must be taken to prevent the incorporation of rebound, or other wastage, into the finished work.

Where thick layers are required, care must be taken to ensure the material does not slump or sag, as this can result in the breaking of the bond. If slumping does occur, the affected area must be cut out and replaced.

Greater thicknesses can be achieved by allowing the initial layer of mortar to stiffen before further layers are applied. The stiffening time will vary with the prevailing environmental conditions. Prior to the application of additional layers, any loose material or overspray must be removed.

The applied material may be trowelled smooth to achieve a specified surface finish. Care must be taken to ensure the bond line is not disturbed during trowelling.

Suggested equipment

The following, suggested list of suitable equipment is based upon that which is typically available in the UK. For further advice and assistance regarding that which is available locally, contact the local Fosroc office (see page 8).

Horizontal pumps

Putzmeister S5
Electric powered towable unit, 5 to 12.5 bar, 10 to 20 litres per minute.

Putzmeister P11
Diesel powered, towable unit, forced action mixer, compressor 5 to 12.5 bar, 10 to 20 litres per minute.

Turbosol T10
Diesel powered, towable unit, forced action mixer, compressor 5 to 12.5 bar.

Turbosol T20
Diesel powered, towable unit, forced action mixer, compressor 5 to 12.5 bar, variable speed 5 to 50 litres per minute.

Putzknecht S30
3 phase electric, 5 to 12.5 bar, variable speed 5 to 20 litres per minute (no compressor).

Vertical pumps

Putzmeister
3 phase electric, forced action mixer (cannot mix and pump simultaneously).

Putzknecht S58
3 phase electric, compressor, in line mixer.

Hopper fed gun

Premixed material from a small hopper feeds by gravity into an air stream. This is particularly useful for relatively small scale applications.

Mixers

Where mixers are built into the unit they have been utilised. In addition, the following mixers have been used successfully

Cretangle	electric/diesel
Pennine	110V electric
Putzknecht Estromat 404	3 phase electric
Mixall	electric/diesel

Compressors

In some instances, the mortar has been placed using the compressors built into the pump units. Experience has shown these to be insufficient to achieve good dispersion and compaction of the material.

It is recommended that an independent 100 cfm/3 m^3/m compressor is employed for wet spraying.

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Important note