

PRODUCT DATA SHEET

King® MS-D1 FSR

Fire-spalling resistant shotcrete material for dry-mix process applications

PRODUCT DESCRIPTION

King® MS-D1 FSR is a pre-blended, pre-packaged, shotcrete mix formulated for dry-mix process applications and engineered to resist fire-induced spalling. It contains Portland cement, silica fume, air-entraining admixture, blended aggregates, along with other carefully selected components, including polypropylene microfibres specifically incorporated to provide fire-spalling resistance. King® MS-D1 FSR offers significantly improved shooting characteristics and enhanced physical properties.

WHERE TO USE

King® MS-D1 FSR can be used in the following applications, but is not limited to:

- New construction, such as shaft and tunnel linings, where high resistance to fire-induced spalling is required.
- Rehabilitation and repair of existing structures where the repair material must provide resistance to fire-induced spalling.

CHARACTERISTICS / ADVANTAGES

King® MS-D1 FSR provides the following characteristic and benefits:

- Polypropylene microfibers, specifically added to reduce fire-induced spalling, in accordance with ASTM C1116 (Type III)
- Air-entrainment provides superior resistance to freeze-thaw cycling and salt-scaling resistance

- Improved adhesive and cohesive plastic properties
- Significantly reduced rebound, resulting in lower material usage
- Improved ability to build greater thicknesses in a single pass in both vertical and overhead orientations
- Very low permeability
- Low shrinkage
- Designed with natural normal-density non-reactive aggregates to eliminate potential alkali-aggregate reactivity (AAR)

OPTIMAL FEATURES

Setting Accelerator (X)

- Allows earlier placement of successive shotcrete lifts
- Improves performance when applied in the presence of running water
- Enables earlier reopening of traffic lanes on bridges and in subway tunnels

Product	Setting Accelerator Dosage
King® MS-D1 FSR	-
King® MS-D1 FSR X	Level 1
King® MS-D1 FSR X2	Level 2

APPROVALS / CERTIFICATES

Gradation

- King® MS-D1 FSR is blended to meet ACI PRC-506 "Shotcrete - Guide", Table 1.1.1, Grading No. 2

PRODUCT INFORMATION

Packaging	▪ 30 kg (66 lb) bag ▪ 1000 kg (2205 lb) FIBC
Shelf Life	12 months in original, unopened packaging

Storage Conditions

Store in a dry, covered area, protected from the elements. For optimum performance, it is recommended to store the material at temperatures between 5 °C (41°F) and 35 °C (95 °F).

TECHNICAL INFORMATION

Compressive Strength		King® MS-D1 FSR	King® MS-D1 FSR X	King® MS-D1 FSR X2	(ASTM C1604)
	1 day	15 MPa (2175 psi)	21 MPa (3045 psi)	21 MPa (3045 psi)	
	7 days	32 MPa (4641 psi)	32 MPa (4641 psi)	32 MPa (4641 psi)	
	28 days	42 MPa (6091 psi)	42 MPa (6091 psi)	42 MPa (6091 psi)	
Resistance to Fire	HCM Fire Curve (Modified)	180 minutes 1300 °C (2372 °F)	Passed		(CETU Technical Guide; NF EN 13381 3)
Freeze Thaw De-Icing Salt Resistance		King® MS-D1 FSR	King® MS-D1 FSR X	King® MS-D1 FSR X2	(ASTM C672)
	56 cycles	0.10 kg/m² (0.02 lb/ft²)	0.17 kg/m² (0.03 lb/ft²)	0.20 kg/m² (0.04 lb/ft²)	
Electrical Resistivity	28 days	500 ohm-m (1 640 ohm-ft)			(CSA A23.2-26C)
Freeze thaw resistance		King® MS-D1 FSR	King® MS-D1 FSR X	King® MS-D1 FSR X2	(ASTM C666)
	300 cycles	100 %	96 %	96 %	
	Excellent durability factor				
Porosity	Air Content				(ASTM C457)
	6 % ± 2 %				
	Maximum Air Void Spacing Factor				
	300 µm (0.012 in)				
	Boiled Absorption				(ASTM C642)
	6.0 %				
	Maximum Volume of Permeable Voids				
	14.0 %				
Chloride Ion Diffusion Resistance	21 days	700 Coulombs			(ASTM C1202)
	Very low chloride ion penetrability				

BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control. The following data was obtained under controlled conditions with material and ambient temperatures of 21 °C (70 °F). Higher or lower temperatures can respectively accelerate or delay setting time and compressive strength gain.

LIMITATIONS

Performance of in-place shotcrete relies heavily upon application techniques. To ensure optimum quality of in-place shotcrete, the material, equipment and key

personnel should be pre-qualified prior to project start-up.

King® MS-D1 FSR should not be applied when ambient substrate and material temperatures are below 5 °C (41 °F) or above 35 °C (95 °F). For adverse temperatures, follow ACI recommendations for Cold/Hot Weather Concreting.

The use of a predampener in conjunction with dry-mix process, accelerated shotcrete material is not recommended. Contact your Sika technical representative for more information.

ENVIRONMENT, HEALTH & SAFETY

User must read the most recent corresponding Safety

PRODUCT DATA SHEET

King® MS-D1 FSR

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Data Sheets (SDS) before using any products. The SDS provides information and advice on the safe handling, storage and disposal of chemical products and contains physical, ecological, toxicological and other safety-related data.

APPLICATION INSTRUCTIONS

SUBSTRATE QUALITY

All surfaces that will come into contact with King® MS-D1 FSR must be structurally sound, clean and free of dust, oil, grease, and any other contaminants that could interfere with proper bonding.

SUBSTRATE PREPARATION

The area to be repaired must be cleaned with potable water, leaving the concrete in a saturated surface-dry (SSD) condition, free of standing water.

For any repair or rehabilitation:

Remove all loose or delaminated concrete to expose a sound, roughened substrate, ensuring a minimum clearance of 25 mm (1 in) behind any reinforcing steel. Saw-cut the perimeter of the area to be repaired to a minimum depth of 20 mm (¾ in).

APPLICATION

Apply in accordance with the ACI PRC-506 "Shotcrete - Guide" publication.

CURING TREATMENT

Curing is essential to optimize physical properties of the shotcrete and minimize plastic shrinkage. Curing is particularly critical in rapid moisture loss conditions such as high temperatures, high winds and low humidity.

King® MS-D1 FSR should be cured immediately after material has reached initial set in accordance with ACI 308 "Guide to Curing Concrete". Continuously moist cure the material for a minimum period of seven (7) days. Alternatively, moist cure for a minimum period of 24 hours and apply a curing compound that complies with ASTM C309.

Although the high relative humidity commonly found in underground environments provides for good curing conditions, additional curing is often appropriate and should be performed in accordance with ACI 308 "Guide to Curing Concrete".

CLEAN UP

Clean all tools and equipment after use with water. Once hardened, the product can only be removed mechanically.

LOCAL RESTRICTIONS

Note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Consult the local Product Data Sheet for exact product data and uses.

LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.