

# PRODUCT DATA SHEET

## King® MS-D1 STM

Dry-mix shotcrete for final lining applications

### PRODUCT DESCRIPTION

King® MS-D1 STM is a pre-blended, pre-packaged, shotcrete mix formulated for dry process applications. It contains Portland cement, silica fume, air-entraining admixture, blended aggregates, along with other carefully selected components, and presents greatly enhanced shooting characteristics and physical properties.

### WHERE TO USE

King® MS-D1 STM can be used in the following applications, but no limited to:

- Final lining for tunnels, underground structures, or any type of structure requiring a uniform surface
- Smoothing layer serving as surface preparation prior to the application of another lining

### CHARACTERISTICS / ADVANTAGES

King® MS-D1 STM provides the following characteristics and benefits:

- Air entrainment providing superior resistance to freeze-thaw cycling and salt-scaling
- Improved adhesive and cohesive plastic properties
- Significantly reduced rebound, resulting in lower material consumption
- Very low permeability
- Low shrinkage
- Formulated with natural normal-density non-reactive aggregates to eliminate any potential alkali-aggregate reactivity (AAR)

### PRODUCT INFORMATION

<b>Packaging</b>	<ul style="list-style-type: none"> <li>▪ 30 kg (66 lb) bag</li> <li>▪ 1000 kg (2205 lb) FIBC*</li> </ul> <small>*Flexible Intermediate Bulk Container</small>
<b>Shelf Life</b>	12 months in original, unopened packaging
<b>Storage Conditions</b>	Material should be stored above ground, in a dry, covered area, protected from the elements.

### TECHNICAL INFORMATION

<b>Compressive Strength</b>	3 days	28 MPa (4 060 psi)	<b>(ASTM C1604)</b>
	7 days	32 MPa (4 640 psi)	
	28 days	42 MPa (6 000 psi)	
<b>Modulus of Elasticity in Compression</b>	<b>Modulus of Elasticity</b>		<b>(ASTM C469)</b>
	7 days	26.6 GPa (3.9 x 10 <sup>6</sup> psi)	
	28 day	29.0 GPa (4.2 x 10 <sup>6</sup> psi)	

<b>Tensile Strength</b>	<b>Tensile Strength in Flexure</b> (ASTM C78)	
	7 days	6.5 MPa (940 psi)
	28 days	7.5 MPa (1085 psi)
	<b>Tensile Bond Strength</b> (ASTM C1583)	
	7 days	2.2 MPa (320 psi)
	28 days	2.9 MPa (420 psi)
<b>Shrinkage</b>	<b>Uniaxial Drying Shrinkage</b> (CSA A23.2-21C)	
	28 days	-0.040 %
	56 days	-0.050 %
<b>Coefficient of Thermal Expansion</b>	28 days	11.7 x 10 <sup>-6</sup> /°C (6.5 x 10 <sup>-6</sup> /°F) (CRD-C 39)
<b>Chloride Ion Diffusion Resistance</b>	<b>Chloride Ion Penetrability</b> (ASTM C1202)	
	28 days	< 1000 Coulombs
	Very low permeability	
<b>Shear Adhesion Strength</b>	<b>Bond Strength by Slant Shear (Modified)</b> (ASTM C882)	
	7 days	21.1 MPa (3 060 psi)
	28 days	23.0 MPa (3 335 psi)
<b>Freeze thaw resistance</b>	300 cycles	100 % (ASTM C666)
	Excellent durability factor	
<b>Porosity</b>	<b>Air Content</b>	6 % ± 2 % (ASTM C457)
	<b>Spacing Factor</b>	< 200 µm
	<b>Water Absorption</b>	≤ 6.0 % (ASTM C642)
	<b>Permeable Voids</b>	≤ 14.0 %
<b>Salt Resistance</b>	<b>Salt Scaling Resistance</b> (ASTM C672)	
	50 cycles	≤ 0.10 kg/m <sup>2</sup> (0.02 lb/ft <sup>2</sup> )
<b>Splitting Tensile Strength</b>	7 days	3.8 MPa (550 psi) (ASTM C496)
	28 days	4.5 MPa (650 psi)

## APPLICATION INFORMATION

<b>Yield</b>	<ul style="list-style-type: none"> <li>▪ ~ 0.014 m<sup>3</sup> (0.5 ft<sup>3</sup>) / 30 kg (66 lb) bag</li> <li>▪ ~ 0.45 m<sup>3</sup> (16.5 ft<sup>3</sup>) / 1000 kg (2205 lb) FIBC</li> </ul>	
<b>Setting Time</b>	Initial	4 hours (ASTM C1117)
	Final	6 hours

## 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.

## WHERE TO USE

- Product should not be applied when ambient substrate and material temperatures are below 5 °C (40 °F) or above 35 °C (95 °F). For adverse temperatures, follow ACI recommendations for Cold / Hot Weather Concreting.
- 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.

## ENVIRONMENT, HEALTH & SAFETY

User must read the most recent corresponding Safety 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

Surfaces must be clean and structurally sound.

### SURFACE PREPARATION

Remove all deteriorated concrete, dirt, dust, oil, grease, contaminants or any other foreign substances that may interfere with the bond of the material. Clean the area with potable water, leaving the substrate saturated but free of standing water (SSD). Ensure that any and all leaks are stopped prior to application.

### APPLICATION

Apply King® MS-D1 STM in accordance with the ACI PRC-506 "Guide to Shotcrete" publication.

### CURING TREATMENT

Curing is essential to optimize physical properties of the shotcrete and minimize plastic shrinkage. Product should be cured immediately after material has reached initial set in accordance with ACI 308 "Guide to Curing Concrete". Continuously moist cure 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. Curing is particularly critical in rapid moisture loss conditions such as high temperatures, high winds and low humidity.

Although the high relative humidity typically found in underground environments provides favorable 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.