

PRODUCT DATA SHEET

King® MS-D3 UG

HIGH EARLY SHOTCRETE MATERIAL FOR DRY-MIX PROCESS FOR UNDERGROUND APPLICATIONS

PRODUCT DESCRIPTION

King® MS-D3 UG is a preblended, prepackaged, dry-process, shotcrete material containing high early Portland cement, silica fume, set-time accelerator, blended aggregates and other carefully selected components. It has greatly enhanced shooting characteristics providing reduced setting times and rapid strength development.

WHERE TO USE

- Ground support applications for mining, tunneling and other underground openings.
- Construction of underground bulkheads, backfill barricades, pillars, ventilation walls and other underground concrete structures.

CHARACTERISTICS / ADVANTAGES

- Rapid early age strength development
- Improved performance in presence of running water
- Improved adhesive and cohesive plastic properties
- Significantly reduced rebound, resulting in lower material usage
- Superior ability to build greater thicknesses in a single pass in both vertical and overhead orientations
- Improved resistance to water wash-out
- Improved resistance to sulphate attack
- Low permeability
- Low shrinkage

OPTIONAL FEATURES & BENEFITS

ACCELERATOR LEVEL

Product	Dosage of accelerator
King® MS-D3 UG	level 1
King® MS-D3 UG2	level 2
King® MS-D3 UG3	level 3

LOW DUST (LD)

Low dust, which means the dust content has been reduced as per the CIPAC 5003/m MT 171.1 standard.

MICRO-SYNTHETIC FIBRE (SY)

- Synthetic fibres reduce cracking caused by intrinsic stresses
- Type III synthetic fibre in accordance with ASTM C1116
- Grade FR Class I shotcrete in accordance with ASTM C1480

MACRO-SYNTHETIC FIBRES (MF)

- Significantly increased load-carrying capacity
- Significantly increased energy absorbing capacity (toughness)
- Significantly increased impact resistance
- Significantly decreased wear on placing equipment and accessories when compared with steel fibres
- Ideal for use in man-ways or other areas where people may come in contact with the shotcrete surface
- Reduction of cracking due to drying shrinkage

Product	Dosage of fibres
King® MS-D3 UG MFB	high
King® MS-D3 UG MFC	medium
King® MS-D3 UG MFD	low

STEEL FIBRE (ST)

- Significantly increased load-carrying capacity
- Significantly increased energy absorbing capacity (toughness)
- Significantly increased impact resistance
- Reduction of cracking due to drying shrinkage

Product	Dosage of fibres
King® MS-D3 UG STA	high
King® MS-D3 UG STB	medium
King® MS-D3 UG STC	low
King® MS-D3 UG STD	very low

EXAMPLES:

- For King® MS-D3 UG with Gradation No. 1, the name of the product would be King® MS-D3 UG G1.
- For King® MS-D3 UG ST with a high dosage of steel fibre, a level 2 dosage of accelerator and Gradation No. 2, the name of the product would be King® MS-D3 UG2 STA.
- For King® MS-D3 UG MF with high dosage of macro-synthetic fibre, a level 2 dosage of accelerator and a Gradation No. 2, the name of the product would be King® MS-D3 UG2 MFB.

APPROVALS / CERTIFICATES**GRADATION**

- By default King® MS-D3 UG, King® MS-D3 UG ST and King® MS-D3 UG MF are blended to meet ACI 506 “Guide to Shotcrete”, Table 1.1, Gradation No. 2
- King® MS-D3 UG G1, King® MS-D3 UG ST G1 and King® MS-D3 UG MF G1 is blended to meet ACI 506 “Guide to Shotcrete”, Table 1.1, Gradation No. 1

PRODUCT INFORMATION**Packaging**

- 30 kg (66 lb) bags
- 1000 kg (2 205 lb) FIBC
- Products containing macro-synthetic fibres (MF) or steel fibres (ST) can only be packaged in bulk bags (FIBC).

*Custom packaging is available to suit specific project requirements

Shelf Life

12 months in original, unopened packaging

Storage Conditions

Material should be stored in a dry, covered area, protected from the elements. Physical properties may be adversely affected if material is stored in temperatures below 0 °C (32 °F). Material stored below these temperatures should be allowed to warm to ambient underground temperatures before shooting.

TECHNICAL INFORMATION**Compressive Strength****ASTM C 116(MODIFIED)**

	King® MS-D3 UG	King® MS-D3 UG2	King® MS-D3 UG3
4 hours	-	2 MPa (290 psi)	7 MPa (1015 psi)
8 hours	7 MPa (1015 psi)	8 MPa (1150 psi)	10 MPa (1500 psi)
12 hours	10 MPa (1500 psi)	12 MPa (1750 psi)	14 MPa (2030 psi)

ASTM C 1604

	King® MS-D3 UG	King® MS-D3 UG2	King® MS-D3 UG3
1 day	21 MPa (3000 psi)	25 Mpa (3625 psi)	25 MPa (3625 psi)
3 days	30 MPa (4350 psi)	30 Mpa (5075 psi)	30 MPa (5075 psi)
7 days	35 MPa (5075 psi)	35 MPa (5075 psi)	35 MPa (5075 psi)
28 days	42 MPa (6000 psi)	42 MPa (6000 psi)	42 MPa (6000 psi)

Tensile Strength in Flexure**ASTM C 78**

28 Days 6.8 MPa (985 psi)

King® MS-D3 UG MF and King® MS-D3 UG ST

28 Days 8.0 MPa (1160 psi)

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BUILDING TRUST
CONSTRUIRE LA CONFIANCE



MACRO SYNTHETIC FIBRES**King® MS-D3 UG MFB**

Peak applied Toughness as a function of flexure load

	10mm	20 mm	30 mm	40 mm
25 kN (5620 lbf)	> 150J	> 250J	> 350J	> 450J

King® MS-D3 UG MFC

Peak applied Toughness as a function of flexure load

	10mm	20 mm	30 mm	40 mm
20 kN (4495 lbf)	> 80J	> 125J	> 250J	> 350J

King® MS-D3 UG MFD

Peak applied Toughness as a function of flexure load

	10mm	20 mm	30 mm	40 mm
15 kN (3370 lbf)	> 50J	> 80J	> 150J	> 275J

STEEL FIBRE**King® MS-D3 UG STA**

Peak applied Toughness as a function of flexure load

	5 mm	10 mm	20 mm	30 mm	40 mm
40 Kn (8992 lbf)	> 100J	> 215J	> 350J	> 450J	> 500J

King® MS-D3 UG STB

Peak applied Toughness as a function of flexure load

	5 mm	10 mm	20 mm	30 mm	40 mm
25 Kn (5620 lbf)	> 100J	> 190J	> 300J	> 375J	> 425J

King® MS-D3 UG

Peak applied Toughness as a function of flexure load

	5 mm	10 mm	20 mm	30 mm	40 mm
20 Kn (4496 lbf)	> 100J	> 175J	> 270J	> 325J	> 370J

King® MS-D3 UG STD

Peak applied Toughness as a function of flexure load

	5 mm	10 mm	20 mm	30 mm	40 mm
20 Kn (4496 lbf)	> 40J	> 80J	> 125J	> 150J	> 175J

FLEXURAL PERFORMANCE

ASTM C 1609

Dosage	First peak strength	F ¹⁰⁰ ₆₀₀	F ¹⁰⁰ ₁₅₀
King® MS-D3 UG STA	6.25 MPa (906 psi)	5.50 MPa (797 psi)	4.50 MPa (652 psi)
King® MS-D3 UG STB	5.50 MPa (797 psi)	3.00 MPa (435 psi)	2.75 MPa (398 psi)
King® MS-D3 UG STC	4.00 MPa (580 psi)	2.50 MPa (362 psi)	1.00 MPa (145 psi)

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APPLICATION INFORMATION

Yield

- Approx. 0.014 m³ (0.5 ft³) / 30 kg (66 lb) bag
- Approx. 0.45 m³ (16.5 ft³) / 1000 kg (2 205 lb) bag

* Yield in service may slightly vary according to projects conditions

Setting Time

Set Time	King® MS-D3 UG	King® MS-D3 UG2	King® MS-D3 UG3	ASTM C 1117
Initial	10 minutes	5 minutes	3 minutes	
Final	45 minutes	20minutes	10 minutes	

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 early-age compressive strength gain.

OTHER DOCUMENTS

Each of the following descriptors / features have the possibility of being included in a specific mix design; Either on their own, or combined with any other descriptor / feature:

Level 2 dosage of accelerator (UG2)	Level 3 dosage of accelerator (UG3)	Corrosion inhibitor or (CI)
Gradation 1 (G1)	Crystalline Water-proofing (CW)	Air Entrained (E)

Descriptor /features of fibre dosages:

Micro synthetic fibres (SY)	SY
Macro-synthetic fibres (MF)	MFB, MFC, MFD
Steel fibres (ST)	STA, STB,STC,STD

LIMITATIONS

- Use of a predampener in conjunction with dry-process, accelerated shotcrete is not recommended. Contact your Sika Technical Representative for more information.
- 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

SURFACE PREPARATION

All surfaces to be in contact with King® MS-D3 UG and its variations must be free from dust, oil, grease or any other foreign substances that may interfere with the bond of the material. Remove all loose or delaminated rock. Clean the area with potable water, leaving the substrate saturated but free of standing water (SSD).

APPLICATION

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

OPTIMUM PERFORMANCE

- Should not be applied when ambient, substrate and material temperatures are below 5 °C (40 °F).

CURING TREATMENT

Good curing conditions are beneficial to optimizing physical properties of King® MS-D3 UG. 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.