BUILDING TRUST

PRODUCT DATA SHEET

King® RS-D2

RAPID STRENGTH SHOTCRETE MATERIAL FOR DRY-MIX PROCESS FOR UNDERGROUND APPLICATIONS

PRODUCT DESCRIPTION

King® RS-D2 is a rapid hardening, pre-blended, and pre-packaged shotcrete material formulated for dry-mix underground applications, powered by Rapid Set® technology. It contains blended aggregates and other carefully selected components. It has greatly enhanced shooting characteristics and physical properties, greatly reduced setting times, along with very rapid strength development.

USES

- 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

- Very rapid early age strength development
- 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
- Low shrinkage

OPTIONAL FEATURES & BENEFITS

Micro-Synthetic Fiber (SY)

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

Macro-Synthetic Fibers (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 fibers
- Ideal for use in man-ways or other areas where people may come in contact with the shotcrete surface
- Reduced cracking due to drying shrinkage
- Very rapid early-age strength development
- Improved adhesive and cohesive plastic properties

Product	Dosage of fibers
King® RS-D2 MFB	High
King® RS-D2 MFC	Medium
King® RS-D2 MFD	Low

Steel Fibers (ST)
Different grades of King® RS-D2 ST with higher and lower dosage of Steel fibers are available upon request.
- Significantly increased load carrying capacity
- Significantly increased energy absorbing capacity (toughness)
- Significantly increased impact resistance

Gradation
- By default King® RS-D2, King® RS-D2 MF and King® RS-D2 ST are blended to meet ACI 506 "*Guide to Shotcrete", Table 1.1, Gradation No. 2* (No Added Abbreviation)

Examples:
- For King® RS-D2 with steel fibers and gradation No. 1, the name of the product would be:
  King® RS-D2 ST G1.
- For King® RS-D2 with a high dosage of macro-synthetic fibers, and gradation No. 2, the name of the product would be:
  King® RS-D2 MFB.
- For King® RS-D2 with gradation No. 1, the name of the product would be:
  King® RS-D2 G1.

PRODUCT INFORMATION

Packaging	2205 lb (1000 kg) FIBC* Products containing Macro-Synthetic fibers (MF) or Steel fibers (ST) can only be packaged in FIBC* Custom packaging is available to suit specific project requirements **Flexible Intermediate Bulk Container*
Shelf Life	12 months in original, unopened packaging
Storage Conditions	Store in a dry, covered area, protected from the elements between 40°F - 95°F (5°C - 35°C) Physical properties may be adversely affected if material is stored in temperatures below 40°F (5°C) and should be allowed to warm to ambient underground temperatures before application

TECHNICAL INFORMATION

Compressive Strength

	ASTM C116 (MODIFIED)
2 hours	3000 psi (21 MPa)

	ASTM C1604
1 day	4350 psi (30 MPa)
7 days	5800 psi (40 MPa)
28 days	7250 psi (50 MPa)

Flexural Strength

			ASTM C78
	King® RS-D2	King® RS-D2 ST	King® RS-D2 MF
7 days	800 psi (5.5 MPa)	-	-
28 days	870 psi (6.0 MPa)	785 psi (5.4 MPa)	785 psi (5.4 MPa)

Flexural toughness

MACRO-SYNTHETIC FIBER — **ASTM C1550**

King® RS-D2 MFB

	Peak load applied	Toughness at 40 mm
1 day	4495 lbf (20 kN)	> 350 J
28 day	5620 lbf (25 kN)	> 400 J

King® RS-D2 MFC

	Peak load applied	Toughness at 40 mm
1 day	3370 lbf (15 kN)	> 325 J
28 day	4485 lbf (20 kN)	> 350 J

King® RS-D2 MFD

	Peak load applied	Toughness at 40 mm
1 day	2245 lbf (10 kN)	> 250 J
28 day	3370 lbf (15 kN)	> 275 J

STEEL FIBER — **ASTM C1550**

Peak applied load	Toughness a function of flexure				
1 day	**5 mm**	**10 mm**	**20 mm**	**30 mm**	**40 mm**
3821 lbf (17 kN)	> 75 J	> 140 J	> 230 J	> 250 J	> 300 J
28 days	**5 mm**	**10 mm**	**20 mm**	**30 mm**	**40 mm**
6070 lbf (27 kN)	> 100 J	> 200 J	> 300 J	> 350 J	> 400 J

Porosity

BOILED ABSORPTION — **ASTM C642**

7.0 %

MAXIMUM OF PERMEABLE VOIDS — **ASTM C642**

King® RS-D2	15.0 %
King® RS-D2 MF	14.0 %

APPLICATION INFORMATION

Coverage

Approx. 16.5 ft^3 per 2205 lb FIBC (0.45 m^3 per 1000 kg FIBC)

Set Time — **ASTM C1117**

Initial	5 minutes
Final	10 minutes

BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

The following data was obtained under controlled conditions with material and ambient temperatures of 70 °F (21 °C). Higher or lower temperatures can respectively accelerate or delay setting time and early-age compressive strength gain.

AVAILABILITY/WARRANTY

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 descriptors / features.

Descriptors / Features of fiber dosages:	
Steel Fibers	ST
Micro-Synthetic Fibers	SY
Macro-Synthetic Fibers	MFB - High MFC - Medium MFD - Low

Descriptors / Features of other technologies:	
Air-Entrained	E

ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

APPLICATION INSTRUCTIONS

EQUIPMENT

Special precautions needed when using predampeners with dry blended powdered accelerated shotcrete.

Contact your Sika STM Technical Representative for more information.

SURFACE PREPARATION

All surfaces to be in contact with product 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 King® RS-D2 in accordance with the ACI 506 *"Guide to Shotcrete"* publication.

Performance of in-place shotcrete relies heavily upon application techniques. The shotcrete material, equipment and key personnel should be pre-qualified prior to project start-up to ensure optimum quality of in-place shotcrete.

OPTIMUM PERFORMANCE

- King® RS-D2 physical properties may be adversely affected if material is stored in temperatures below 40 °F (5 °C).
- Material should be allowed to warm to at least 60 °F (15 °C) prior to shooting in order to optimize early age compressive strength results.
- King® RS-D2 MF and King® RS-D2 ST should not be applied when ambient, substrate, and material temperatures are below 40 °F (5 °C).
- For adverse temperatures, follow ACI recommendations for Cold / Hot Weather Concreting.
- King® RS-D2 MF and King® RS-D2 ST recommended minimum inside diameter of shotcrete hoses should be 2 in (50 mm).

Contact your Sika STM Technical Representative for more information.

CURING TREATMENT

Good curing conditions are beneficial to optimizing the physical properties. 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*".

CLEANING OF TOOLS

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

OTHER RESTRICTIONS

See Legal Disclaimer.

LEGAL DISCLAIMER

- **KEEP CONTAINER TIGHTLY CLOSED**
- **KEEP OUT OF REACH OF CHILDREN**
- **NOT FOR INTERNAL CONSUMPTION**
- **FOR INDUSTRIAL USE ONLY**
- **FOR PROFESSIONAL USE ONLY**

Prior to each use of any product of Sika Corporation, its subsidiaries or affiliates ("SIKA"), the user must always read and follow the warnings and instructions on the product's most current product label, Product Data Sheet and Safety Data Sheet which are available at usa.sika.com or by calling SIKA's Technical Service Department at 1-800-933-7452. Nothing contained in any SIKA literature or materials relieves the user of the obligation to read and follow the warnings and instructions for each SIKA product as set forth in the current product label, Product Data Sheet and Safety Data Sheet prior to use of the SIKA product.

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