MS-D1

A SIKA COMPANY

MS-D1 is a silica fume enhanced, pre-packaged shotcrete material for dry-process applications. This product is a pre-blended, pre-packaged, dry-process shotcrete material containing Portland cement, silica fume, air-entraining admixture, blended aggregates and other carefully selected components. It has greatly enhanced shooting characteristics and physical properties.

FEATURES & BENEFITS

- 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
- Improved resistance to water wash-out
- Improved resistance to sulphate attack
- Very low permeability
- Low shrinkage
- Compatible with integral, pre-applied and/or post-applied corrosion inhibitors*
- Designed with natural normal-density non-reactive aggregates to eliminate potential alkali-aggregate reactivity (AAR)
- All KING products are manufactured using ISO 9001:2015 Certified Processes

*For more information regarding the use of a corrosion inhibitor in conjunction with MS-D1, please contact your KING Technical Representative.

OPTIONAL FEATURES & BENEFITS

ACCELERATOR LEVEL/SET-TIME/STRENGTH GAIN

- Improved performance in presence of running water
- Superior ability to build greater thicknesses in a single pass in both vertical and overhead orientations
- Allows for earlier re-opening of traffic lanes on bridges and in subway tunnels

MS-D1 does not contain accelerator.
MS-D1 X contains a level 1 dosage of accelerator.
MS-D1 X2 contains a level 2 dosage of accelerator.
MS-D1 X3 contains a level 3 dosage of accelerator.

See the Technical Data section for more detailed information.

SYNTHETIC FIBER
MS-D1 SY

- Synthetic fibers reduce cracking caused by intrinsic stresses
- Type III synthetic fiber in accordance with ASTM C 1116
- Grade FR Class I shotcrete in accordance with ASTM C 1480

CORROSION INHIBITOR
MS-D1 CI

- Corrosion inhibitor protects steel reinforcing and other metals embedded in concrete from corrosion induced by carbonation or chlorides
- Pre-blended corrosion inhibitor provides the correct dosage to enhance corrosion protection

POTABLE WATER APPLICATION
MS-D1 NSF-61

- Product meets the requirements of NSF/ANSI 61

GRADATION

- By default MS-D1 is blended to meet ACI 506 “Guide to Shotcrete”, Table 1.1, Gradation No. 1
- MS-D1 G2 is blended to meet ACI 506 “Guide to Shotcrete”, Table 1.1, Gradation No. 2

EXAMPLE:
For MS-D1 with a level 3 dosage of accelerator, with synthetic fibers and Gradation No. 2, the name of the product would be MS-D1 X3 SY G2.

USES

- Rehabilitation of concrete bridges, dams, reservoirs, subway tunnels, marine structures and parking ramps.
- Lining and rehabilitation of sewers and watermains.
- New construction including slope stabilization, soil-nailing, shaft and tunnel linings, pools and other concrete structures.
- Use of a predampener in conjunction with dry-process, accelerated shotcrete is not recommended. Contact your KING Technical Representative for more information.

PROCEDURES

Surface Preparation (Repair or Rehabilitation): All surfaces to be in contact with MS-D1 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 concrete providing a roughened surface and a minimum of 25 mm (1 inch) clearance behind any corroded reinforcing steel. The perimeter of the repair area should be saw-cut a minimum of 20 mm (¾ inch). Clean the area to be repaired with potable water, leaving the concrete saturated but free of standing water (SSD).

Application: Apply MS-D1 in accordance with the ACI 506 “Guide to Shotcrete” publication.

CURING

Curing is essential to optimize physical properties of the shotcrete and minimize plastic shrinkage. MS-D1 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 7 days. Alternatively, moist cure for a minimum period of 24 hours and apply a curing compound that complies with ASTM C 309. Curing is particularly critical in rapid moisture loss conditions such as high temperatures, high winds and low humidity.

TECHNICAL DATA

The following data is representative of typical values achievable using proper application techniques as outlined in the ACI 506 “Guide to Shotcrete” publication. The data was obtained during project field tests and in-house shotcrete studies.

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ACCELERATOR LEVEL

	MS-D1	MS-D1 X	MS-D1 X2	MS-D1 X3
SET TIME* ASTM C 1117				
Initial	4 hours	60 minutes	20 minutes	5 minutes
Final	6 hours	1 hour, 10 minutes	30 minutes	10 minutes
COMPRESSIVE STRENGTH* ASTM C 116 (MODIFIED)				
4 Hour	-	-	1 MPa (150 psi)	5 MPa (725 psi)
8 Hour	-	5 MPa (725 psi)	6 MPa (870 psi)	8 MPa (1150 psi)
12 Hour	-	7 MPa (1015 psi)	8 MPa (1150 psi)	10 MPa (1500 psi)
COMPRESSIVE STRENGTH* ASTM C 1604				
1 Day	15 MPa (2175 psi)	21 MPa (3000 psi)	21 MPa (3000 psi)	21 MPa (3000 psi)
3 Day	28 MPa (4060 psi)	28 MPa (4060 psi)	28 MPa (4060 psi)	28 MPa (4060 psi)
7 Day	32 MPa (4640 psi)	32 MPa (4640 psi)	32 MPa (4640 psi)	32 MPa (4640 psi)
28 Day	42 MPa (6000 psi)	42 MPa (6000 psi)	42 MPa (6000 psi)	42 MPa (6000 psi)
FLEXURAL STRENGTH ASTM C 78				
7 Day	6.5 MPa (940 psi)	6.0 MPa (870 psi)	6.0 MPa (870 psi)	6.0 MPa (870 psi)
28 Day	7.5 MPa (1085 psi)	7.0 MPa (1015 psi)	7.0 MPa (1015 psi)	7.0 MPa (1015 psi)
UNIAXIAL DRYING SHRINKAGE ASTM C 157				
28 Day	500 µm/m	600 µm/m	600 µm/m	600 µm/m
56 Day	580 µm/m	650 µm/m	650 µm/m	650 µm/m
FREEZE-THAW RESISTANCE ASTM C 666	100% (Excellent durability factor)	96% (Excellent durability factor)	96% (Excellent durability factor)	96% (Excellent durability factor)
SALT-SCALING RESISTANCE ASTM C 672	0.2 kg/m^2 (0.04 lb/ft^2)	1.2 kg/m^2 (0.24 lb/ft^2)	1.2 kg/m^2 (0.24 lb/ft^2)	1.2 kg/m^2 (0.24 lb/ft^2)

MODULUS OF ELASTICITY**
ASTM C 469
7 Day 26.6 GPa (3.9 x 10^6 psi)
28 Day 29.0 GPa (4.2 x 10^6 psi)

COEFFICIENT OF THERMAL EXPANSION**
CRD-C 39
28 Day 11.7 x 10^{-6}/°C (6.5 x 10^{-6}/°F)

SPLITTING TENSILE STRENGTH**
ASTM C 496
7 Day 3.8 MPa (550 psi)
28 Day 4.5 MPa (650 psi)

BOND STRENGTH BY SLANT SHEAR (MODIFIED)**
ASTM C 882
7 Day 21.1 MPa (3060 psi)
28 Day 23.0 MPa (3335 psi)

TENSILE BOND STRENGTH**
ASTM C 1583
7 Day 2.2 MPa (320 psi)
28 Day 2.9 MPa (420 psi)

AIR CONTENT**
ASTM C 457
6% ± 2%

MAXIMUM AIR VOID SPACING FACTOR**
ASTM C 457
300 µm

BOILED ABSORPTION**
ASTM C 642
6.0%

MAXIMUM VOLUME OF PERMEABLE VOIDS**
ASTM C 642
15.0%

CHLORIDE ION PENETRABILITY**
ASTM C 1202
700 Coulombs

*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.

**The following data is not affected by accelerator dosage and is applicable for all accelerator levels.

Head Office
601, avenue Delmar
Pointe-Claire (Québec) H9R 4A9

Other Sites:
Boisbriand, Qc
Brantford; Cambridge; Sudbury; Toronto(ON)
Edmonton (Alberta)
Surrey (British Columbia)

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OPTIMUM PERFORMANCE

- MS-D1 should not be applied when ambient substrate and material termperatures are below 5 °C (40 °F) or above 35 °C (95 °F).
- For adverse temperatures, follow ACI recommendations for Cold/ Hot Weather Concreting.
- For cold temperature applications, use MS-D3 X2 or MS-D3 X3.
- 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.

YIELD

- 30 KG (66 lb) bag contains approximately 0.014 m^3 (0.5 ft^3)
- 1000 KG (2205 lb) bag contains approximately 0.45 m^3 (16.5 ft^3)

PACKAGING

MS-D1 is normally packaged in 30 KG (66 lb) triple-lined bags or 1000 KG (2205 lb) bulk bags and polywrapped on wooden pallets. All KING products can be custom packaged to suit specific job requirements.

STORAGE AND SHELF LIFE

Material should be stored in a dry, covered area, protected from the elements. Unopened bags have a shelf life of 12 months.

SAFETY PROCEDURES

MS-D1 contains Portland cement. Normal safety-wear such as rubber gloves, dust mask and safety glasses used to handle conventional cement based products should be worn. Safety Data Sheets are available upon request.

Drinking Water
NSF/ANSI 61

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