

MORTAR & GROUT ADMIXTURES FOR IMPROVED FRESH & MECHANICAL PROPERTIES

batimix[®]



Company Overview

Holderchem Building Chemicals S.A.L. was founded in 1994 as a joint venture with Holcim, the world's leading Portland cement producer. It has since developed by virtue of technically innovative ideas, dedicated customer service, and highly skilled staff to become a main independent supplier to the cement and construction industries in Lebanon as well as Middle East and Gulf countries.

A wide and full range of products is available at Holderchem Building Chemicals S.A.L. meeting the most challenging requirements of modern construction. This includes concrete admixtures, masonry binders, ready-to-use mortars, tile adhesives, curing and sealing compounds, epoxy adhesives, injection grouts, concrete repair and waterproofing products, protective coatings, and miscellaneous other specialty construction materials. Holderchem Building Chemicals S.A.L. provides complete laboratory support and specification assistance as well as on-site service for proper usage and application of all supplied products.

Introduction

Commonly used materials in the construction industry include mortars resulting from the intimate mixture of cementitious-based binders, sand grains, and water. Throughout the years, engineers and architects have successfully specified mortars to their simplest and most challenging design works which may vary from laying of masonry blocks to the repair, injection, or rehabilitation of structural load-bearing elements. Mortars remain unmatched materials of choice for a number of reasons including availability, economy, attractive appearance, minimum maintenance, safety, durability, and sustainability.

Nowadays, admixtures of various chemical basis are essential ingredients that are specified for the design of mortar and grout mixtures. For example, plasticizers are used to improve the mortar's board life and water retentivity during construction. On the other hand, set-modifiers are introduced to adjust the stiffness ratios in hot or cold weather climates. Additionally, a wide variety of admixtures exist to enhance specific property such as resistance to shrinkage, efflorescence, carbonation, and water penetration.

Products range

Holderchem Building Chemicals S.A.L. offers a full line of **balimix**, chemical admixtures for use when producing mortars and grouts (TABLE 1). The products are formulated according to relevant EN and ASTM standards to physically

or chemically enhance one or more desirable properties in the fresh and hardened states. A wide range of specialty mortars and grouts may thus be produced for various types of applications such as injection, structural, repair, pointing, rendering, and architectural.

TABLE 1

Product categories and use of balimix admixtures for mortars and grouts

MP and MSP	Water reducers to improve plastic properties and/or reduce water content and increase adhesion strength. Mortars modified with such products result in increased board lives and higher levels of water retention.
MAE	Air entrainer for increased resistance against freeze/thaw cycles together with enhanced workability and water retention.
MR and MAC	Set-retarders and set-accelerators for adjusting the mortars rheological properties over time, particularly recommended in extreme temperatures.
Special purpose admixtures	Chemicals used to enhance specific properties such as water repellency, cohesiveness, volume stability, shrinkage, corrosion resistance, and frost attack.
Mortar and grout additives	Products incorporated for coloring cement-based materials, reducing potentials to efflorescence and cracking, and increasing durability.
Surface quality coatings	Products used for increased adhesion, reduced absorptivity and carbonation over time, and for limited level of water evaporation after mortar application.

batimix® water reducers, air entrainers, and set-modifiers

I – WATER REDUCING ADMIXTURES

The nomenclature of the **batimix** water reducers, specific properties, and description are summarized in TABLE 2.

The water soluble polymeric products improve cement dispersion through two different mechanisms. The lignosulphonate and naphthalene-sulphonate admixtures act essentially by molecule adsorption and electrostatic repulsion between neighboring cement particles, thus promoting increased deflocculation and dispersion of these particles. On the other hand, polycarboxylic-based admixtures generate powerful deflocculation due to steric hindrance of short-range particle repulsion.

In cold or hot weather conditions, **batimix** water reducers can be supplied blended with carefully selected chloride-free set-modifiers, which save masons the time and hassle of mixing several admixtures on site. The optimum dosage rates are best determined using the actual mix design under site conditions. Such admixtures are generally added to the mortar mix towards the end mixing, i.e. after incorporating around 2/3 of the mixing water.

TABLE 2

Specific properties and description of batimix water reducers

	Specific gravity	Dosage rates, % c.w.	Overall description
MP 100	1.13	0.2 to 1.4	Lignosulphonate-based plasticizers for commonly used mortars of normal strength requirements. Allow up to 15% reduction in the free water content, and offer good levels of workability, board life, and water retention.
MP 100-S	1.14	0.2 to 1.2	
MP 100-A	1.14	0.2 to 1.5	
MP 200	1.15	0.3 to 1.6	Mid-range water reducers with optimized combinations of naphthalene-sulphonate and lignosulphonate polymers. Allow up to 20% reduction in the free water content with adequate levels of workability, water retention, and cohesion.
MP 200-S	1.16	0.3 to 1.4	
MP 200-A	1.16	0.3 to 1.8	
MSP 300	1.19	0.4 to 2.0	Naphthalene-based superplasticizers for high workability and strength requirements. Allow up to 25% reduction in the free water, and offer high levels of water retention, cohesion, and flow adhesion.
MSP 300-S	1.20	0.4 to 1.6	
MSP 300-A	1.20	0.4 to 2.4	
MSP 400	1.11	0.2 to 1.4	Polycarboxylate-acid superplasticizers for high workability and strength requirements. Allow up to 30% reduction in the free water, and offer high levels of board life, water retention, cohesion, and flow adhesion.
MSP 400-S	1.11	0.2 to 1.2	
MSP 400-A	1.12	0.2 to 1.5	

The "S" letter is used when admixtures are blended with set-retarders to improve board life and/or for use in hot climates; whereas the "A" letter is used when admixtures are blended with set-accelerators to shorten setting times, suitable in cold weather temperatures.

Selection of **balimix** water reducers

Selecting the appropriate water reducer is crucial to ensure that the produced mortar matches the plastic and hardened construction requirements as well as the application techniques. For example, water reducers made of lignosulphonate polymers can be used in ordinary mortars for common applications, i.e. masonry, rendering. In

case highly flowable grouts are needed for injection of small holes or prestressing tendons, naphthalene-sulphonate or polycarboxylate-acid superplasticizers are recommended. Users may consult Holderchem representatives for technical assistance and proper products use. Typical properties of mortars made with 25% cement and various types of water reducers are presented in TABLE 3.

TABLE 3

Typical mortar properties made with **balimix** water reducers

	W/C	Dosage, % of c.w.	Mortar properties at 20°C and 60% R.H.					
			Initial flow and after 60 min, mm		Compressive and pull-off strengths after 28 days, MPa			
Reference	0.65	N/A	170	-	145	25.5	-	0.32
MP 100	0.55	0.5	165	-	150	29.7	-	0.46
MP 100-S	0.55	0.5	170	-	160	30.1	-	0.45
MP 100-A	0.55	0.5	160	-	135	29.5	-	0.47
MP 200	0.50	0.8	165	-	150	33.5	-	0.51
MSP 300	0.45	1.4	155	-	135	36.7	-	0.58
MSP 400	0.45	0.7	160	-	155	36.4	-	0.59

II – AIR ENTRAINING ADMIXTURES

Air entrainers are generally added in mortars to improve ease of spread and resistance against freeze/thaw cycles. Generally, it is important to control the level of air content to less than 16% as highly entrained air mortars possess good workability and water retention but relatively low compressive and bond strengths. Those made without any air entrainment possess good hardened properties but are difficult to handle by the mason.

balimix.MAE 500 is an aqueous solution of modified resins and naturally occurring surfactants. It acts at the interference between the mixing water and cement/sand particles to produce microscopic air bubbles dispersed evenly throughout the mass mortar. Among this chemical's features:

- ease of spread and workability, as air bubbles reduce internal friction
- reduced water absorptivity, as microscopic air can act as "air plugs"
- limitation of progressive cracks, as air-bubbles dissipate energy at their tips
- improved durability against freezing and thawing cycles

balimix.MAE 500 has a specific gravity of 1.01 and is generally added at a dosage of 0.05% to 0.4% of cement weight. For indication purposes, the addition of 0.15% of this product exhibits 16% air content in mortars made with 25% Type I Portland cement and 75% of well-graded sand. To enhance its air-entraining efficiency, the admixture should be added prior to cement, i.e. after the fine aggregates and 1/3 of mixing water.

During construction, mortar mixes must be tested regularly to ensure that the specified air content is achieved. It is to be noted that a large number of factors can affect the degree of air entrainment including the nature and grading of fine aggregate, cement fineness and content, W/C, temperature, and mixing equipment.

III – SET-MODIFYING ADMIXTURES

balimix. set-modifiers nomenclature, main purpose, and specific properties are presented in TABLE 4. Set-retarders are generally added in hot temperatures to slow down the rate of cement hydration,

thus prolonging the mortar's trowability and board life over time. To the opposite end of the spectrum, set-accelerators are used in cold temperatures to speed up the rate of mortar's strength development, thus preventing any delays that could occur during construction.

Products from the **balimix.** MR series are liquid solutions based on modified gluconate chemicals. They cover cement particles with a thin layer that neutralizes and temporarily blocks the hydration of C_3S and C_3A , thus delaying the precipitation of $Ca(OH)_2$. When the entire admixture has been combined, hydration reactions can then start normally leading to similar or greater 28-day strength.

Products from the **balimix.** MAC series are synthetically produced liquid solutions based on modified set-accelerator organic polymers. When introduced in cement pastes, they favor the hydration of the various cement chemical compounds and result in faster setting and hardening times.

Holderchem Building Chemicals S.A.L. set-modifiers are compatible with all types of Portland cement and other admixtures. They should be added after the fine aggregates, cement, and 2/3 of the mixing water; but prior to other chemicals such as water reducers. For additional technical and safety information, kindly refer to the Technical Data Sheet and MSDS.

TABLE 4

Specific properties and description of balimix. set-modifiers

	Specific gravity	Dosage, % of c.w.	Description of the product
MR 600	1.12	0.3 to 1.2	General purpose set-retarder, recommended for mixtures produced in hot weather climates.
MR 630	1.16	0.3 to 1.0	Concentrated set-retarder blended with plasticizing polymers for improved board life.
MR 660	1.18	0.6 to 1.4	Set-regulating admixture suited for producing extended-life mortars conforming to ASTM C 1142.
MAC 700	1.21	1 to 5	Calcium chloride-based set-accelerator, recommended for plain mortars.
MAC 730	1.15	1 to 5	Chloride-free, general purpose set-accelerator to speed up cement hydration in cold weather.
MAC 760	1.17	1 to 4	Chloride-free, set-accelerator blended with plasticizing polymers for improved plasticity.

batimix[®] specialty chemical admixtures

Holderchem Building Chemicals S.A.L. offers a wide variety of specialty admixtures to enhance specific properties of cementitious-based mortars and grouts. Products nomenclature, description, and dosage rates are summarized in TABLE 5.

TABLE 5 Specialty batimix products for specific uses

	Specific gravity	Dosages rates*	Overall description
IWR M-800	0.98	0.2 to 1.2	Liquid integral water-repellent for reduced water absorption (also available in powder form)
Thixo M-810	1.01	0.15 to 0.8	Thixotropic, viscosity-enhancing, and water-retaining admixture for injection and repair works
Expansion M-820	0.7 (dry)	0.05 to 0.5	Powder, expansive agent to control volume stability and reduce surface cracks
Anti-Shrink M-830	1.03	0.5 to 2.5	Reducer of shrinkage that occurs during the mortar drying process
Anti-Corrosion M-840	1.21	1 to 5	Corrosion inhibitor for superior protection of embedded steel in repair and structural works
Anti-Frost M-850	1.25	2 to 5	Frost reducer that favors cement hydration and setting in very cold climates
Color M-860	0.52 (dry)	0.2 to 1	Powder, concentrated pigment for colored architectural mortars and grouts
Anti-Efflorescence M-870	0.97	0.3 to 1.4	Efflorescence reducer that improves and maintains color facades integrity and uniformity
Fiber M-880	0.92 (dry)	0.3 to 0.8	Polypropylene fibers for increased toughness and mechanical / flexural properties
Silica Fume M-890	0.37 (dry)	5 to 12	Powder, silica fume to create denser and more durable mortars and grouts
SBR Latex M-900	1.01	Various	Latex-based bonding admixture for increased adhesion properties on substrates
CWR M-910	0.7	5 to 12 m ² /kg	Siloxane-based water repellent coating for reduced water permeability of old/new substrates
Anti-Carbonation M-920	1.16	4 to 10 m ² /kg	Acrylic-based protective paint applied on old/new cement-based substrates
Cure M-930	0.96	2 to 5 m ² /kg	Paraffin wax curing agent for reduced water evaporation after mortar application

* Dosage rates are given in percent of cement weight, except for products # 910, 920, and 930.

I – SPECIAL PURPOSE ADMIXTURES

balimix. IWR M-800 is an integral water-repellent admixture for use in all types of mortar and grout mixtures to reduce absorptivity and water penetration from the surrounding environment. It is formulated from carefully selected water insoluble stearate raw materials.

This product reacts with the cement hydrating compounds to form hydrophobic “water-repellent” coatings in the mortar pores and voids. A reduction in the absorption rate from 3% to 0.9% can be measured when using this product at a dosage of 0.8% in mortars prepared with 25% Portland cement, 75% sand, and W/C of 0.50. Primary features include:

- reduced water permeability, capillary suction, and moisture transfer
- no negative influence on drinking water in storage tank structures
- no detrimental effect on setting, strength, or adhesion against substrates
- reduced potential for efflorescence and rebar corrosion
- improved durability and protection against aggressive chemicals

balimix. Thixo M-810 is a liquid viscosity-enhancing admixture used to modify viscosity of fresh mortars. When used in conjunction with superplasticizers, highly flowable mixtures can be produced without bleeding or segregation. Upon request, it can be supplied in powder form.

The water-soluble polymers of this product are characterized by their long-chains of complex forms that adhere to the periphery of mixing water in a cement paste. The chains can intertwine and develop attractive forces through hydrogen bonds and polymer entanglements, resulting in increased plastic viscosity and yield stress even in mixtures with high W/C. Primary features include:

- greatly reduced level of bleeding and segregation of solid particles
- increased cohesiveness with less risks of mix separation and washout
- improved stability of fresh mortars during casting and thereafter until setting
- thixotropic action, providing enhanced homogeneity and viscosity
- better resistance against sagging in shotcrete mortars

balimix. Expansion M-820 is a powder admixture designed to produce a slow and controlled gaseous expansion prior to the hardening of mortars and grouts, thus forcing the mixture to come in close contact with the surrounding surfaces. A volume increase for a mortar prepared with 25% cement, 0.50 W/C, and 0.15 % of this product can be around triple that obtained from a similar mortar made without such admixture. The resulting mortars are characterized by a reduced crack occurrence, increased joint spacing in pavements and walls, and improved surface quality.

balimix. Anti-Shrink M-830 is a liquid admixture designed to significantly reduce cracks on mortar and grout surfaces due to drying shrinkage. It is designed from selected glycols to dramatically reduce the tensile strength developed within the menisci and angle of contact with capillary pores. It does not contain expansive materials, but rather acts chemically to reduce the surface tension of water in the mixture pores. Applications using this product include all types of mortars used for masonry and repair such as plastering, patching, and pointing.

balimix. Anti-Corrosion M-840 is a calcium nitrite-based admixture for use in repair mortars to inhibit corrosion of steel reinforcements. It chemically oxidizes the steel to prevent ferrous chloride complex formations which may result in cracking, spalling, and failure of structural elements. When designing mixes with this product, it is necessary to reduce the free water content to maintain constant W/C. This product is blended with set-retarding chemicals to offset any set-acceleration that may occur due to calcium nitrite.

balimix. Anti-Frost M-850 is a chloride-free admixture designed to reduce/eliminate frost attacks in mortars and grouts during cold weather works. Depending on the dosage used, it increases early strength development by promoting cement hydration, thus reducing construction delays and cold weather protective measures. The optimum dosage of this product should better be determined by trials using the actual mix formulation under field conditions. It is to be noted that entraining air up to 12% is crucial to ensure long service life of mortars and grouts exposed to moisture and freezing temperatures.

II - MORTAR AND GROUT ADDITIVES

batimix. Color M-860 is a free-flowing powder pigment made from the finest raw materials with a sulfate content not exceeding 3%. Available in various colors and premeasured quantities, it allows accurate dispersion of color throughout the mixture to produce integrally colored concrete, mortar, or grout.

Generally, test batches are recommended to evaluate color prior to beginning of work as well as when variations in local cement and aggregates occur. To improve color uniformity, this product should be mixed with the dry cement and sand before adding water. Furthermore, care should be taken to keep quantities of sand, fillers, water etc. constant from batch to batch.

batimix. Anti-Efflorescence M-870 is a balanced blend of stearate water repellents and other chemicals which, when used as an admixture, reduces the formation of whitish crystalline deposits on masonry surfaces. The mechanism of efflorescence is directly related to the quantity of water-soluble compounds that may exist in masonry units and mortar components, and to the quantity of water exposed to these compounds. Therefore, when an amount of water penetrates the wall, it will dissolve the water-soluble compounds and deposit them on the exterior wall surface when water migrates through evaporation.

Depending on the expected level of water-soluble compounds, this product is used at various dosage rates to minimize efflorescence without affecting other properties such as trowability and bonding. Applications include all types of architectural and masonry works such as plastering, rendering, patching, and pointing.

batimix. Fiber M-880 is made of propylene fiber monofilaments that totally disperse into the mortar mix. Available in various lengths, it is compatible with the normally alkaline environment within the cement paste and highly resistant to moisture and service conditions. It exhibits in masonry and repair applications optimum strength compared to reference mixtures with improved resistance to cracking and long-term durability (TABLE 6).

batimix. Silica Fume M-890 is a powder microsilica raw material conforming to ASTM C 1240. When added in a mortar or grout mix, it reacts chemically with the calcium hydroxide of the cement paste and leads to the formation of greater amount and stronger C-S-H gel. This product generates increases in strength (TABLE 6) together with improved particle packing and resistance against water permeability, corrosion, and chemical attack.

TABLE 6 **Fiber and silica fume effect (Mortar with 25% cement & 0.55 W/C)**

	Plain reference mortar	Mortar with 0.5% Fiber M-880	Mortar with 10% Silica Fume M-890
Compressive strength, MPa (EN 1015-11)	28.5	29.3	34.7
Flexural strength, MPa (EN 1015-11)	5.5	7.3	6.8
Pull-off strength, MPa (EN 1015-12)	0.43	0.47	0.56

III – COATINGS FOR ENHANCED SURFACE QUALITY

balimix. SBR Latex M-900 is a water-based styrene-butadiene polymer latex with high adhesive characteristics. It can be used for various applications, including:

- Bond coating on concrete, masonry, or brick surfaces to enhance bond/adhesion of newly applied cementitious renders, screeds, or repairs. Bond coats remain “tacky” around 20 minutes depending on ambient temperature
- Adhesive bonding mortars for fixing bricks, tiles, and mosaics as well as for grouting and pointing mortars with improved chemical resistance
- Waterproof mortars with increased adhesion and reduced water absorptivity (water tanks, basements, foundations, etc.)
- Screeds for leveling uneven floors, reinstatement/repair of old substrates, and patching of large surface areas with enhanced resistance to abrasion and mechanical wear

balimix. CWR M-910 is a siloxane solvent-based water repellent coating used to block capillaries and pores in concrete and masonry structures. This allows the formation of a water repellent barrier which limits the growth of moss, controls efflorescence, prevents water penetration without affecting breathability, and reduces cleaning costs.

balimix. Anti-Carbonation M-920 is an acrylic-based protective coating in grey or white colors. It provides optimum barrier for structures atmospherically exposed to humidity, carbon dioxide, sulphate, and chlorides. It forms an extremely durable and breathable coating allowing moisture vapor to escape from the structure.

balimix. Cure M-930 is a water-based paraffin wax emulsion used as curing agent to reduce water evaporation in concrete and mortar applications. It perfectly suits all types of plain or reinforced repair and patching applications. Other solvent-based products may also be supplied, upon request.

TABLE 7

Typical effects on mortar properties and surface performance

Comparison to reference mixtures

SBR Latex M-900	When used as mixing water, mortars and grouts prepared with this product exhibit up to 50% increase in pull-off adhesion strength (EN 1015-12)
CWR M-910	A 10-folds reduction in the rate of water absorption can be measured (ASTM C 1403) when applying this product at 6 m ² /kg on existing substrates
Anti-Carbonation M-920	The depth of carbon dioxide penetration is less than 0.5 mm after 8 days exposure (NT Build 372) when applying this product at a rate of 5 m ² /kg
Cure M-930	When sprayed onto newly applied mortar surfaces at a rate of 4 m ² /kg, this product restricts the loss of water to around 0.4 kg/m ² after 72 hours (ASTM C 156)

Referenced EN & ASTM standards

EN 934-3 Admixtures for concrete, mortar and grout - Part 3: Admixtures for masonry mortars - Definitions, requirements, conformity, marking and labeling
EN 934-4 Admixtures for concrete, mortar and grout - Part 4: Admixtures for grout for pre-stressing tendons - Definitions, requirements, conformity, marking and labeling
ASTM C 270 Standard specification for mortar for unit masonry
ASTM C 1142 Standard specification for extended life mortar for unit masonry
ASTM C 1240 Standard specification for use of silica fume as a mineral admixture in hydraulic-cement concrete, mortar, and grout
ASTM C 1384 Standard specification for admixtures for masonry mortars

Important notes

- For proper use of any specific product, users may consult the corresponding “Technical Data Sheet” by visiting our website at www.holderchem.net.
- All of the reported values in this brochure are given for indication purposes only. They are averages of several tests under laboratory conditions. In practice, these values may be significantly affected by the characteristics of raw materials and mixing conditions.

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