TECHNICAL BULLETIN

Storage

Plaster Master can be stored for 12 months in closed, unopened original drums or storage vessels, provided the temperature does not fall below 5°C or exceed 40°C.

Mixing with Plaster Master

Mixing procedure for mortars or concretes containing Plaster Master is similar to that used for conventional compositions, gauging water being partly or completely replaced by Plaster Master.

The quantity of Plaster Master recommended will depend upon the application and is normally from 9 to 18 litres per 50 kgs of cement. The higher level of latex addition is used for thin screeds where maximum performance is required; levels lower or higher than those quoted may be used in special circumstances. The colour of latex-modified compositions may be a little darker than that of ordinary compositions; if this is undesirable it can be simply remedied by including a proportion of white cement.

Typical examples of mortars are given in the appendix.

Portland, High Alumina and certain fast setting cements are compatible with Plaster Master and have been successfully used.

- **Water/cement ratio**
  Mortars containing Plaster Master will have a water/cement ratio slightly lower than that for conventional mortars.
- **Aggregate**
  Washed sharp sand, free from excessive fibres, should always be used in latex-modified cement mortars. Where a very smooth surface is required fine sand may be used, but it is important to ensure that there are no very fine clay-like particles present. Many types of aggregate have been successfully used in Plaster Master modified compositions; typical examples are those conforming to the SABS 1090 - 1976 “Sand for plaster and mortar” as well as granite chippings used in heavy duty flooring.
- **Workability**
  The workability time is generally slightly increased by the addition of Plaster Master. In cold weather conditions (i.e. below 10º C) especially when it is also damp, it is desirable to use rapid or extra-rapid hardening cement. Alternatively, ordinary Portland cement may be used in conjunction with 2% - 4% of calcium chloride (expressed on cement weight); the calcium chloride should be added as a 50% solution in water to the mortar mix.
- **Additives**
  Workability additives such as fly ash and lime are not necessary as Plaster Master exerts a considerable plasticizing effect of its own. Air entraining agents should not be used without adequate testing.

Application of Plaster Master

The next section of this bulletin gives detailed information describing the use of Plaster Master modified compositions for walls and floors. Also included are some recommendations for water-resistant treatments, patching and heavy-duty floorings. We have extensive knowledge of the use of Plaster Master in a host of specialized applications, and we are always pleased to make recommendations for individual requirements. Test results obtained on Plaster Master are given in separate test data sheets.

Wall Renderings

- **Preparation**

  It is necessary to ensure that the wall surface is free from crumbly or other unsound areas. Dusty patches and old paint should also be removed. It is usually sufficient to prepare the wall with a wire brush. All surfaces should be dampened an hour or so before priming.

- **Priming**

  The application of a priming coat is normally recommended to obtain maximum adhesion of the subsequently applied rendering. The priming coat, consisting of 2 parts or ordinary Portland cement slurried with 1 part of Plaster Master, should be thoroughly brushed on to the prepared wall surface. The rendering is applied whilst the priming coat is still wet.

- **Mixing**

  A general purpose rendering compositions is as follows:-

  - SABS 1090 - 1976 “plaster sand” 100kg
  - ordinary Portland cement * 33kg
  - Plaster Master 6 litres water as required to adjust consistency

  NOTE: Although fine sand may be used, especially where a very smooth surface is required, it is essential that there should be no ultrafine clay-like material present in the sand.

  Mixing should preferably be carried out in a concrete mixer, although hand mixing is permissible where the total weight of the dry batch does not exceed 50kg. The usual procedure is to quickly premix the sand and cement in a mixer, pour in the Plaster Master, mix for 2-3 minutes and finally cautiously add water little by little until the required consistency is achieved over addition of water causes rapid thinning of latex modified mortars owing to the plasticizing effect of the latex.

- **Application**

  The thickness of latex-modified renderings should be restricted to not more than approximately 6mm for each coat. Greater thickness tends to cause sagging or, in the case of soffits, actual fall off of the unset renderings. However, several coats may be applied in fairly rapid succession; it is sufficient to allow each coat time to set-off adequately to receive the subsequent coating. The time required between coats will vary according to conditions but is typically 15 - 30 minutes. A single trowelling operation is usually sufficient to achieve a moderately smooth finish. If a smoother surface is required, the rendering should be floated using a clean steel or preferably wooden float after a suitable interval has elapsed. This interval is usually about ½ to 1 hour, but is best found by experience.

Water Resistant Rendering

Where the main requirement of the rendering is improved water resistance, a modified application technique is recommended. After preparing the substrate as described above, two sealing coats consisting of approximately two parts of Portland cement slurried with 1 part of Plaster Master should be thoroughly brushed on to the surface. The second sealing coat may be applied as soon as the first coat is touch dry, i.e. after 20 to 30 minutes. Ideally, the sealing coats should be applied at right angles across each other, thus ensuring complete coverage of the substrate. It is emphasized that the thickness of each sealing coat should not exceed 1.6 mm otherwise crazing may occur. Before proceeding further, the double sealing coat system must dry out completely for a period of at least 48 hours.

After the sealing coats have dried thoroughly, a tack coat consisting of two parts Portland cement slurried with one part of Plaster Master should be applied. The renderings should then be applied whilst the tack coat is still wet.

The amount of Plaster Master required in the rendering composition depends upon the degree of water resistance required and the conditions prevailing during application, but the addition of 14 litres of Plaster

Master per 50kg of cement is usually satisfactory. Where high hydrostatic pressures are anticipated, the level of Plaster Master normally recommended is 20 litres per 50kg of cement.
Because the application of water-resistance rendering is a specialized procedure, we advise each customer to consult us for recommendations appropriate to his individual requirements.

Floor Screeds

- **Preparation**

  Where the existing floor is old or dirty, it is essential to remove all contaminant such as oil, grease, paint etc to ensure adequate development of bond when the topping is applied. Any unsound crumbly concrete must also be removed.

  An efficient way of preparing an old floor is to use a mechanical scabbler to remove all unsound materials. If the concrete is in reasonably good order light scabbling will suffice, eg to a depth of about 2 - 4 mm.

  For new floors, to which for example a levelling screed needs to be laid, it may still be desirable to remove the upper surface to ensure that weak surface latencies is not present. Light scabbling to a depth of up to 4mm will normally suffice. Alternatively good results can often be obtained by etching either new or old concrete floors with hydrochloric acid (1 part of concentrated acid diluted with 2 parts of water) followed by a thorough washing to remove all traces of acid.

  If screed bars are to be used to define thickness of the screed, these should be positioned after the above preparation.

- **Priming**

  The application of a priming coat is normally recommended to obtain maximum adhesion of the subsequently applied screed. The prepared floor should be thoroughly dampened with water, hosing is suggested, followed by removal of excess standing water. A priming coat, consisting of 2 parts of ordinary Portland cement slurried with 1 part of Plaster Master, would then be thoroughly brushed into the floor using a stiff broom. The topping is applied whilst the priming coat is still wet.

  For general-purpose topping, the following composition is suggested:-

  - SABS 1090 - 1976 “mortar sand” 100kg
  - Ordinary Portland cement 33kg
  - Plaster Master 6 litres

  Water as required to adjust consistency

  The mixing procedure is straight forward, and is as described in the section dealing with wall renderings.

- **Application of topping**

  Screeds based on the above composition can be laid to any thickness, down to a featheredge if necessary, providing that a sufficiently find grade of sand is used. However, it is essential that there should be no ultrafine clay-like material present in the sand.

  Because Plaster Master allows “feather-edging” of suitable mortar compositions, it is therefore possible to patch up only the damaged portions of existing concrete floors. These portions must, of course, be prepared and primed as previously described.

  After mixing the Plaster Master, mortar should be poured over the still wet priming coat and struck off. It may then be trowelled to the required finish. An experienced floor layer will readily achieve a finish of satisfactory smoothness without having to do any further trowelling. However, as an alternative procedure it is possible with care to carry out further trowelling after a suitable interval, when initial stiffening of the mortar has commenced. A clean steel trowel is recommended for this operation.

  With a little experience, the correct timing at which this re-trowelling should be carried out will be properly judged. If insufficient time has been allowed to elapse, a thin surface skin will be present over

soft unset material and the skin will be torn giving surface cracking. Too great a time interval on the other hand would result in the mortar having set too much to be smoothed. The whole surface should be trowelled, not just sections of it to avoid variations in shade, texture, etc.

- **Heavy duty flooring**

  Plaster Master may be used with advantage in heavy duty flooring compositions. The procedures for preparing and priming the existing floor and for mixing and application is as described for general purpose floor screeds.

  Plaster Master modified heavy-duty floorings are normally laid as 12 mm toppings. An exception to this is the iron aggregate flooring, which we recommended laying as a 6 mm topping.

  A typical heavy-duty composition is as follows:-

  - Portland cement 100kg
  - SABS 1090 - 1976 “mortar sand” 125kg
  - 3mm granite chippings 125kg
  - Plaster Master 18 litres
  - Water as required to adjust consistency

APPENDIX 1

Practical examples of formulations using different sands

(See 2 for grading analysis)

1. Using Witbank plastering sand

Cement	Sand	Plaster Master	Total Water	Consistency using flowtable ASTM C2 30 (MM)
1	3	0,085	0.48	162
1	4	0,085	0.65	171
1	6	0,085	0.87	163
1	3	0,190	0.41	168
1	4	0,190	0.49	161
1	6	0,190	0.73	162

2. b. Using Pro-sand

Cement	Sand	Plaster Master	Total Water	Consistency using flowtable ASTM C2 30 (MM)
1	3	0,085	0.35	162
1	4	0,085	0.39	163
1	6	0,085	0.62	168
1	3	0,190	0.30	182
1	4	0,190	0.31	163
1	6	0,190	0.41	148

3. Using a blend of Prosand 60% with TMS pit 40%

Cement	Sand	Plaster Master	Total Water	Consistency using flowtable ASTM C2 30 (MM)
1	3	0,085	0.44	193
1	4	0,085	0.52	182
1	6	0,085	0.62	188
1	3	0,190	0.36	195
1	4	0,190	0.41	171
1	6	0,190	0.62	184

Summary of results

The control samples had adhesion values between 0 and 350 kp depending upon test conditions.
Incorporation of Plaster Master markedly improved adhesion to concrete, even at low levels of addition the advantage of using this latex under both dry and wet conditions are clearly illustrated.
These results give definite indication of the benefit of using Plaster Master as an admixture to cement for flooring screeds, wall renderings and adhesive layers.

APPENDIX 2

SAMPLE DESCRIPTION	PROSAND	TMS PIT	PLASTERING SAND
Relative density	2,66	2,60	2,65
Bulk density : loose (air dry) kg/m3 Consolidated (air dry) kg/m3	1570 1710	1360 1570	1240 1470
SCREEN ANALYSIS		% passing (by mass)	
SABS screens			
4 750 um	100	100	
2 360 "	99	99	
1 180 "	91	95	100
600 "	59	83	98
300 "	21	58	68
150 "	1	22	21
75 "	0.1	8.5	4.5
AVERAGE PARTICLE SIZE FM	**2.30**	**1.43**	**1.14**

Test data sheet no 1
Tensile strength and flexural strength of cement mortar compositions - effect of latex admixtures.
Test data sheet no 2
Adhesion to concrete and adhesion to steel of cement mortar compositions - effect of latex admixtures.
Test data sheet no 3
Adhesion to concrete - the effect of adding various levels of Plaster Master to cement mortars.
Test data sheet no 4
Shrinkage of cement mortars during the drying process - effect of latex admixtures.
Test data sheet no 5
Effect of heat ageing upon physical properties of cement mortars.
Test data sheet no 6
Resistance to water penetration of cement mortars containing Plaster Master.

PLASTER MASTER TEST DATA SHEET NUMBER 1

TENSILE STRENGTH & FLEXURAL STRENGTH OF CEMENT MORTAR COMPOSITIONS - EFFECT OF LATEX ADMIXTURES

Test method

Mortar compositions based on 3 parts BS 12 sand to 1 part Portland cement were prepared. The following samples were compared in wet and dry tests on tensile and flexural strengths:-

Control	no admixture
Plaster Master	as admixture at 40 parts per 100 parts cement by weight
Vinyl acetate copolymer	as admixture at 40 parts per 100 parts cement by weight

Treatment of the test pieces prior to testing were as follows:-

Dry testing

1 day drying + 6 days immersion in water + 21 days drying.

Wet testing

1 day drying + 6 days immersion in water + 14 days drying + 7 days immersion in water.

RESULTS

Test Method	Unmodified Mortar (contol)	Mortar modified with Plaster Master	Mortar modified with Vinyl Acetate Copolymer
Test conditions	**kPa**	**KPa**	**kPa**
tensile strength			
dry	3050	4350	3300
wet	1800	7950	175
flexural strength			
dry	7100	10600	11300
wet	5800	9600	1050

Summary of results

Plaster Master gives marked improvement in both tensile and flexural strengths in comparison with the control.

Plaster Master has special advantages under wet conditions. In this respect, it is much better than the vinyl acetate copolymer.

PLASTER MASTER TEST DATA SHEET NUMBER 2

ADHESION TO CONCRETE & ADHESION TO STEEL OF CEMENT MORTAR COMPOSITIONS - EFFECT OF LATEX ADMIXTURES

Test method

Mortar compositions based on 3 parts BS 12 sand to 1 part Portland cement were prepared. The following samples were compared in wet and dry tests to adhesion to concrete and to steel:-

Control	no admixture
Plaster Master	as admixture at 40 parts per 100 parts cement by weight
Vinyl acetate copolymer	as admixture at 40 parts per 100 parts cement by weight

The tests were carried out on “air-cured” samples because wet-curing can lead to unreliable results in tests of this nature. Treatment prior to testing was as follows:-

Dry testing

28 days air-drying.

Wet testing

21 days air-drying + 7 days immersion in water.

Test Method	Unmodified Mortar (contol)	Mortar modified with Plaster Master	Mortar modified with Vinyl Acetate Copolymer
Test conditions	**kPa**	**kPa**	**kPa**
Adhesion dry	70	3450	2140
Concrete wet	310	1380	480
Adhesion dry	0	1590	1170
Concrete wet	0	1310	0

Summary of results

Plaster Master gives excellent adhesion to concrete and to steel under both dry and wet conditions. It offers particular advantages over the vinyl acetate copolymer under wet conditions.

PLASTER MASTER TEST DATA SHEET NUMBER 3

SHRINKAGE OF CEMENT MORTARS DURING THE DRYING PROCESS - EFFECT OF LATEX ADMIXTURES

Test method

To test for shrinkage on setting, a mild steel mould 25 cm long x 2,5 cm wide x 2,5 cm deep was used, and the inner surfaces of the mould were lightly smeared with petroleum jelly before filling with mortar.

The mortars under test were tamped down, levelled and left to dry for 28 days at room temperature.

The longitudinal shrinkage of the mortars was measured at the end of this period using a traveling microscope.

All mortars testes were based on 3 parts BS 12 sand and 1 part Portland cement. Control samples without admixture were compared with mortars containing various levels of Plaster Master

Results

Control	Amount of Latex added (Parts per 100 Parts of cement)	Water / Cement Ratio	Shrinkage (%)
	NONE	**0.40**	**0.07**
Plaster Master	20	0.34	0.02
	30	0.34	0.01
	40	0.30	0.01

Summary of results

In formulating Plaster Master for admixture to cement, one of the properties, which have been optimized, is resistance to shrinkage during setting of the modified cement. The above test results show that Plaster Master gives a great improvement in resistance to shrinkage - this is in accordance with qualitative observations on large areas.

PLASTER MASTER TEST DATA SHEET NUMBER 4

EFFECT OF HEAT AGEING UPON PHYSICAL PROPERTIES OF CEMENT MORTARS

Introduction

Heat ageing tests are employed to obtain data, which have a bearing on long-term performance. A general guide used in the rubber industry is that one week at 70ºC approximates to 5 years of normal service life.

Test method

Cement mortars were prepared based on 3 parts BS 12 sand and 1 part of Portland cement.

Control	no admixture
Plaster master	as admixture at 40 parts per 100 parts cement by weight
All acrylic	as admixture at 40 parts per 100 parts cement by weight

Flexural strength was evaluated on "wet-cured" test pieces which had been treated as follows:-
1 day drying + 6 days immersion in water + 21 days drying, prior to ageing.

Adhesion to concrete was measured on "dry-cured" samples because wet curing can lead to unreliable results in this test. The test samples were simply dried for 28 days before ageing and testing.

RESULTS

Heat ageing at 70ºC

FLEXURAL STRENGTH (kPa)

	Initial	1 Month	3 Months	12 Months
Control	7100	4800	5500	5200
Plaster Master	10600	15700	14800	14400
All Acrylic	11900	43000	18500	10100

ADHESION TO CONCRETE (kPa)

	Initial	1 Month	3 Months	12 Months
Control	70	NIL	NIL	NIL
Plaster Master	3450	2690	1790	2550
All Acrylic	2920	2830	2480	2280

Summary of results

The tests show that Plaster Master retains its effectiveness in cement mortar compositions over long periods of heat ageing, showing marked improvements over unmodified samples. It compares favourably with the all-acrylic polymer. Plaster Master may therefore be expected to remain effective throughout the normal service life of cement compositions treated with it.

PLASTER MASTER TEST DATA SHEET NUMBER 5

RESISTANCE TO WATER PENETRATION OF CEMENT COMPOSITIONS CONTAINING PLASTER MASTER

Scope

Two distinct water-resistant treatments using Plaster Master were evaluated viz:-

1. Plaster Master/cement slurry sealing coat system sandwiched between two layers of conventional cement mortar.
2. Cement mortar, based on 3 parts of sharp sand to 1 part of Portland cement, using various levels of Plaster Master as admixture.

Test method:

Preparation of samples

Annular, mild steel bands (85mm internal diameter and 15mm depth) were used as moulds for the mortar test samples. Methods of preparation of the two sets of samples are described below:-

1. Plaster Master/cement sealing coats as a water-resistant treatment
   Moulds were filled to half depth with a conventional cement mortar (3 parts of sharp sand to 1 part of Portland cement) and left to dry for 3 days at 20ºC.
   After 3 days, a sealing coat consisting of 2 parts of Portland cement slurried with 1 part of Plaster Master was brushed on to the upper surface of the dry mortar, ensuring that all brush stroked were made in the same direction. After 1 hour, a second sealing coat was applied with brush strokes at right angles across the strokes of the first coat.
   The coated test pieces were allowed to dry for various periods of time: 24, 48 and 72 hours.
   A third coat of fresh slurry was then applied as an adhesive tack coat. Whilst the third coat was still wet and tacky, a conventional mortar (3 parts of sharp sand to 1 part of Portland cement) was placed on the tack coat, filling the remaining half of the mould. The "sandwich" test pieces thus obtained were allowed to dry for 7 days at 20ºC prior to testing.
2. Plaster Master as a water-resistant admixture in the mortar
   Cement mortars, based on 3 parts of sharp sand to 1 part of Portland cement, containing respectively 0, 20, 30 and 40 parts of per 100 parts of cement were prepared. Annular moulds, as described above, were completely filled with each composition.
   The mortars were allowed to dry for 7 days at 20ºC prior to testing.

Testing

Each mortar disc, retained in its mild steel band, was clamped into a test apparatus designed to apply water pressure, equivalent to a 30 metre head of water, to one face of the disc. The other face (i.e. the underside) of the disc was open to the atmosphere.

Throughout the test, a constant water pressure was maintained, and the water pressure gauge monitored for any reduction in pressure. Pressure drop, which in this test indicated sample failure, was corrected where necessary. Any water which did pass through was collected in a measuring cylinder and the volume recorded.

Testing was continued until either a measurable volume of water passed through the sample, or where no water penetrated, for a period of 3 weeks. On completion of the test, the underside of each sample which withstood 3 weeks testing was carefully examined to ensure that there was no sign of water penetration.

Results

Results, expressed in ml of water passing through the samples, are shown in the following tables:-

1. **Plaster Master/cement sealing coats as a water-resistant treatment**

   Volume of water passing through sample (mls)

Drying time of Sealing Coat System (Hrs)	**3 Hrs**	**3 Days**	**3 Weeks**
24	5	28	-
48	Nil	Nil	Nil
72	Nil	Nil	Nil

   Note

   The conventional cement mortar compositions used to "sandwich" the Plaster master/cement sealing coats tested above were based on BS 882 Zone 2 sand.
   Another conventional mortar composition, based on BS 12 sand, was also used in these experiments.

Here, the sealing coat system was tested after 72 hours drying only. Again, no water penetrated after 3 weeks.

2. **Plaster Master as a water-resistant admixture in the mortar**
   Volume of water passing through sample (mls)

Level of Plaster Master added (Parts per 100 Parts of Cement by weights)	**3 HRS**	**3 DAYS**	**3 WEEKS**
0	71	-	-
20	23	-	-
30	Nil	Nil	Nil
40	Nil	Nil	Nil

   Note
   These mortar compositions were prepared using BS 882 zone 2 sand. Another composition, based on BS 12 sand and containing 40 parts of Plaster Master per 100 parts of cement was also tested.
   No water penetrated after 3 weeks.

Summary of results

The results of these tests show that the following treatments provide effective water resistance for cement mortars:-

1. Two sealing coats plus one tack coat using Plaster Master /cement slurry
   Portland cement (2 parts) is slurried with Plaster Master (1 part) and two coats of the slurry are applied at right angles across each other on the surface to be treated.
   Following this, at least 48 hours drying is allowed, and then a fresh slurry of cement and Plaster Master is applied at a tack coat for the surfacing mortar.
2. Mortar modified with Plaster Master
   40 parts of Plaster Master per 100 parts of cement gives a water-resistant mortar (3 parts sand to 1 part of cement) using a suitable sand.
   For optimum results, the system of two sealing coats plus one tack coat of Plaster Master/cement slurry (1) may be combined with the Plaster Master modified mortar (2)