English Indian Clays Limited
[AN **ISO 9001 : 2000** COMPANY]

Metacon Metakaolin

KP111/428 Veli, Thiruvanthapuram – 695021, Kerala, India
Phone 91 471 274 1133 | Fax 91 471 274 2233

Technical Data Sheet

DESCRIPTION:

METACON METAKAOLIN is a high reactivity, silica based pozzolona which complies with the requirements of ASTM C 618N. It is manufactured by the processing of specially selected pozzolanic ingredients under controlled conditions. It reacts with free lime produced during the hydration process of cement to form additional cementitious products.

BENEFITS:

- Economic and superior manufactured alternative to Microsilica
- Reduces permeability and the penetration of chloride ions.
- Achieves very low RCP results
- Increases chemical resistance
- Prevents of alkali-silica reactivity
- Reduces efflorescence
- Reduces drying shrinkage
- Improves strength and toughness
- Improves colour and appearance
- Can be used in conjunction with white cement without affecting colour of finished product.

RECOMMENDED USAGE:

- In pre-cast and architectural elements
- In high performance concrete
- In concrete for marine structures
- In concrete for use in aggressive environments

METACON METAKAOLIN can be used as either an alternative to microsilica or as a supplemental cementitious material depending on the desired properties of the hardened concrete mix.

The normal usage levels are as follows:

3-5 % for use in triple blend mixes

5-8 % optimum replacement for achieving low RCP, water penetration and absorption results.

8-20 % of cement content – for optimum chemical resistance and efflorescence control

PHYSICAL ANALYSIS:

Appearance:	Off-white
Loss on Ignition:	0.5 – 1.5%
Lime Reactivity (Chapelle Test):	740 – 1,000 mg/gm
pH (10% solids):	4.0 – 5.0
Specific Gravity:	2.6
Bulk Density, kg/lt:	0.4 – 0.5
Blaine value (cm^2/g):	22,000 – 25,000

CHEMICAL ANALYSIS (Mass %):

Characteristics	Results
SiO_2	52.0 – 54.0
Al_2O_3	44.0 – 46.0
Fe_2O_3	0.60 – 1.20
TiO_2 (max)	0.65
CaO (max)	0.09
MgO (max)	0.03
Na_2O (max)	0.10
K_2O (max)	0.03

PACKAGING:

METACON METAKAOLIN is supplied in 25 kg and 650 kg jumbo bags and bulk.

STORAGE:

When supplied in bags store in original closed bags and in a dry ventilated area. When supplied in bulk, store in closed bulk silos.

METACON METAKAOLIN has a shelf life of not less than 12 months when stored correctly.

TECHNICAL ADVICE:

The Technical Department is available to assist you in the correct use of our products and its resources are at your disposal entirely without obligation.

SAFETY PRECAUTIONS:

Refer to the Material Safety Data Sheet (MSDS) for Metacon Metakaolin.

GULF CONCRETING PRODUCTS
P.O. Box 43010 Abu Dhabi ; 50012 Fujairah, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: info@gcpuae.ae | Website: www.gcpuae.com

CROWN CONCRETING PRODUCTS LLC
P.O. Box 43010 Abu Dhabi, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: crown@gcpuae.ae

ABOUT THE COMPANY

English Indian Clays Limited (EICL) is part of USD 1 billion THAPAR GROUP of companies, one of the largest business houses in India having varied interests in Paper, Chemicals, Textiles, Engineering, etc. The company was established in 1965 by ECC Plc as a JV with a local group but has been subsequently become an independent unit in late 80's. The company is an ISO 9002 certified company since 1995 and the certification has been upgraded to **ISO 9001 : 2000.**

The Capacity

EICL is the largest producer of China clay (Kaolin) and Calcined Clay in the region with a 200,000 Tons per annum capacity. The company has two production units in Trivandrum, Kerala, South India.

- Calcined Clay - 25000 (Unit I), 5000 (Unit II).
- Hydrous Clay -120000 (Unit I), 50000 (Unit II).

The Mines

EICL clay deposits are considered to be among the best in the world with 96% kaolin content. Mining activity is fully mechanized and is done throughout the year. Prospecting and buying of new land is managed by an in-house mining and geology team. The company has a policy of maintaining 25 years minable land stock at any point of time. Mining department undertakes replanting of all mined out land as part of our environmental policy.

R & D and Application support

EICL R & D is a well-equipped facility that co-ordinates all development work. It is one of the few industry laboratories recognized by Department of Science and Technology, Government of India. Under R&D, we have Application labs which have application specific teams in Paper, Paint, Ceramics, Rubber, Plastic & Concrete, who undertake trials for customers in strict confidentiality to meet customer specific requirements.

Logistics Support

The major Indian Arabian Sea port of Cochin is only 220 kms from our works. Regular connections to all major ports in the world are available from Cochin. A new port at Tuticorin, managed by Singapore Port Authority has come up in a major way to the East in Bay of Bengal. This port is 200 kms from our works and major shipping lines have started calling here. These two Ports together ensure minimum lead time for our cargo to be shipped out of India to destinations all over the world.

Packaging Options

EICL products are available in 25 kg bags palletized and shrink-wrapped. We also offer special packing options in 650 kg/1000 kg Jumbo bags and 50 kg bags wherever required.

Metacon Metakaolin

KP111/428 Veli, Thiruvanthapuram – 695021, Kerala, India
Phone 91 471 274 1133 | Fax 91 471 274 2233

Material Safety Data Sheet

1. Identification of the Substance and Company

Product Name	:	METACON METAKAOLIN
Product Application	:	Cementitious systems
Address/Phone No.	:	English Indian Clays Limited P111/428 Veli Thiruvananthapuram – 695021 Kerala, India
Emergency Phone	:	0091 471 2741133

2. Composition/Information on Ingredients

Synonyms	:	Refined Kaolin [China Clay]
CAS No.	:	1332-58-7
Symbol	:	None
R-phrases	:	None
S-phrases	:	None

3. Hazards Identification

Metacon Metakaolin is classed as Non Hazardous and is unlikely to cause harmful effects when handled and stored as advised. See section 7.

4. First Aid Measures

Inhalation	:	Remove exposed person from dusty area. Bring to fresh air.
Skin contact	:	Wash contaminated skin with water and/or a mild detergent.
Eye contact	:	Rinse eyes with water/saline solution. If discomfort persists, obtain medical attention.
Ingestion	:	Not applicable.

5. Fire Fighting Measures

Metacon Metakaolin is not combustible and the dust entails no danger of explosion.

Extinguishing Media	:	No applicable

6. Accidental Release Measures

Avoid exposure to dust of Metacon Metakaolin.
Released material should be collected in suitable containers.

7. Handling and storage

Handling	:	Avoid dust generation. See section 8.
Storage	:	Keep in a dry place. When handled pneumatically use standard dust filters on vehicles and silos.

8. Exposure Controls/Personal Protection

Occupational exposure controls:

Avoid inhalation of dust. Ensure good dust ventilation during use. Wear a CE-marked respirator according to EN 149 FFP 2S/3S during dust generating operations. Use protective gloves and eye protection. Facilities for eye flushing should be available.

9. Physical and Chemical properties

Colour	:	Off white
Odour	:	Odourless
Solubility (water)	:	Insoluble/slightly soluble
Solubility (Organic Solvents)	:	Insoluble/slightly soluble
Specific Gravity	:	2.5 to 2.7 g/cm^3
Bulk Density (kg/lt) approx	:	0.4 to 0.5
Specific Surface Area (cm^2/g)	:	22,000 – 25,000

10. Toxicological Information

Acute Effects:

INGESTION	:	Finely divided dust may cause irritation and dehydration of mucous membranes.
INHALATION	:	Finely divided dust may cause irritation and dehydration of mucous membranes.
SKIN CONTACT	:	Finely divided dust may cause irritation and dehydration.
EYE CONTACT	:	Finely divided dust may cause irritation and dehydration

Chronic Effects:

Inhalation of Metacon Metakaolin is considered to entail minimal risk of pulmonary fibrosis (silicosis). However, chronic obstructive lung disease is suspected following long term exposure (years) for concentrations above recommended occupational exposure limits.

11. Disposal Considerations

The material should be recovered for recycling if possible.
This material is not classified as hazardous waste according to Commission Decision 2000/532/EC and 2001/118/EC. Prior to disposal of large quantities of this material advice should be sought from the relevant Waste Regulation Authority.

12. Transport Information

UN	-
IMDG/IMO	Not subject to classification
ADR/RID	Not subject to classification
ICAO/IATA	Not subject to classification

13. Regulatory Information

Product classification and labeling:

Symbol	:	Not subject to classification
R-Phrases	:	None
S-phrases	:	None

14. Other Information

Literature references are available upon application to the manufacturer.

The provision of this information should not be construed as a recommendation to use this product in violation of any patent rights or in breach of any state or regulation. Users are advised to make their own determination as to the suitability of this information in relation to their particular purposes and specific circumstances. Users should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace and in conjunction with other substances or products.

Metacon Metakaolin is marketed in the Gulf Region by:

GULF CONCRETING PRODUCTS
P.O. Box 43010 Abu Dhabi ; 50012 Fujairah, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: info@gcpuae.ae | Website: www.gcpuae.com

CROWN CONCRETING PRODUCTS LLC
P.O. Box 43010 Abu Dhabi, UAE
Tel. No. +971 2 6273998 | Fax No. +971 2 6273994
Email: crown@gcpuae.ae

GENERAL GUIDE FOR SPECIFICATION FOR ALL STRUCTURAL CONCRETE INCORPORATING HIGH PERFORMANCE METACON METAKAOLIN

Prescription Method:

1. Provide High Performance Metakaolin admixture Metacon as manufactured by English Indian Clays Limited and which complies with the requirements of ASTM C618N.

2. High Performance Metakaolin shall be added at a rate of 5% TO 10% by weight of cement depending on the RCP and strength requirement per cubic meter of concrete.

3. Comprehensive strength shall be a minimum of ___ MPA at 28 days as measured using 150 mm cube specimens.

4. A maximum water-to-cementitious ratio of ___ is required.

5. High Performance Metakaolin to be deemed as a cementitious material in calculations.

6. Add High Performance Metakaolin to the concrete mixer at the same time as the other cementitious materials.

Performance Method:

1. Provide High Performance Metakaolin admixture Metacon as manufactured by English Indian Clays Limited and which complies with the requirements of ASTM C618N.

2. High Performance Metakaolin shall be added at a rate of ___ by weight of cement per cubic meter of concrete.

3. Concrete incorporating Metakaolin shall have a minimum strength of ___at 28 days as measured using 150 mm cube specimens.

4. The Permeability of High Performance Metakaolin concrete shall be tested by ASTM C 1202. Result of tests shall be expressed in electrical units of coulombs. Coulomb test shall be made on two (4" x 8") (100 mm x 200 mm) representative samples, moist cured for 56 days. Test cylinders shall be made according to ASTM C 31. Coulomb requirement shall be 1,200 coulombs or less at 28 days. ASTM C 1202 testing shall be used as an indicator of concrete permeability at mix design submittal only.

5. A maximum water-to-cementitious ratio of ___ is required.

6. High Performance Metakaolin to be deemed as a cementitious material in calculations.

7. Add High Performance Metakaolin at the same time as all other raw materials of the concrete mix.

The admixture High Performance Metacon Metakaolin as manufactured by English Indian Clays Ltd. Shall be supplied by Gulf Concreting Products (GCP) or Crown Concreting Products (CCP)• P.O. Box 43010 Abu Dhabi, UAE • Tel. No. 02 6273998 • Fax No. 02 6273994.

GENERAL GUIDE FOR SPECIFICATION FOR ALL STRUCTURAL CONCRETE INCORPORATING HIGH PERFORMANCE METACON METAKAOLIN

Prescription Method:

1. Provide High Performance Metakaolin admixture which complies with the requirements of ASTM C618N.
2. High Performance Metakaolin shall be added at a rate of 5% TO 10% by weight of cement depending on the RCP and strength requirement per cubic meter of concrete.
3. Comprehensive strength shall be a minimum of ___ MPA at 28 days as measured using 150 mm cube specimens.
4. A maximum water-to-cementitious ratio of ___ is required.
5. High Performance Metakaolin to be deemed as a cementitious material in calculations.
6. Add High Performance Metakaolin to the concrete mixer at the same time as the other cementitious materials.

Performance Method:

1. Provide High Performance Metakaolin admixture which complies with the requirements of ASTM C618N.
2. High Performance Metakaolin shall be added at a rate of ___ by weight of cement per cubic meter of concrete.
3. Concrete incorporating Metakaolin shall have a minimum strength of ___at 28 days as measured using 150 mm cube specimens.
4. The permeability of High Performance Metakaolin concrete shall be tested by ASTM C 1202. Result of tests shall be expressed in electrical units of coulombs. Coulomb test shall be made on two (4" x 8") (100 mm x 200 mm) representative samples, moist cured for 56 days. Test cylinders shall be made according to ASTM C 31. Coulomb requirement shall be 1,200 coulombs or less at 28 days. ASTM C 1202 testing shall be used as an indicator of concrete permeability at mix design submittal only.
5. A maximum water-to-cementitious ratio of ___ is required.
6. High Performance Metakaolin to be deemed as a cementitious material in calculations.
7. Add High Performance Metakaolin at the same time as all other raw materials of the concrete mix.

REPORT ON TRIAL MIXES

Lab References:

Report No.	: RC07-48042	Report Date	: 16/04/2007
Request No.	: QC07-38117	Sample No.	: SC07-38117
Date Tested	: 12/03/2007-13/04/2007		
Tested by	: RES/TTP/SPA		

Client References:

Project No.	: Not Given
Project Name	: Quality Control Performance
Client	: Gulf Concreting Products FZC
Consultant	: No Specific Consultant
Contractor	: No Specific Contractor
Location	: GTL
Senders Ref No.	: Not Given

1. Introduction

Further to the instruction received from M/s Gulf Concreting Products FZC through test requisition, GTL has carried out trial mixes using Metacon Metakaolin submitted by the client and studied the properties of the concrete with a reference mix. The following properties were determined and reported.

Slump	:	BS 1881 Part 102:1983
Initial & Final Setting Time	:	ASTM C 403 M: 99
Compressive Strength	:	BS 1881 Part 116: 1983
Water Permeability	:	BSEN 12390 Part 8: 2000
Water Absorption	:	BS 1881 Part 122:1983
Rapid Chloride Permeability	:	ASTMC 1202: 1997

مختبر علوم التربة لفحص المواد GTL GEOSCIENCE TESTING LABORATORY

SUNNY PAILY
TECHNICAL SUPERVISOR
For GEOSCIENCE TESTING LABORATORY

Main Office:- Dubai
P.O. Box : 61670 - Dubai
Sharjah
P.O. Box : 64800 - Sharjah
Abu Dhabi
P.O. Box : 38442 - Abu Dhabi

2. Reference mix

Material description	Type	20 mm crushed	10 mm crushed	5 mm crushed	Dune sand			cement (OPC)		Super Plasticizer	Water
	Source	Al Shoula Siji	Al Shoula Siji	Al Shoula Siji	Al Ain			U.C.C R.AK		RB-857	DEWA
Quantity,Kg/m^3		706	316	595	242			440		6.6	158
Specific Gravity		2.76	2.77	2.65	2.63			3.15		1.2	1.0
Absolute Volume,litre		255.95	114.09	224.48	91.89			139.68		5.5	158.40
Water Absorption%		0.6	0.7	1.7	0.9			-		-	-
Moisture content%		0	0	0	0			-		-	-
Moisture correction,kg/m^3		4.24	2.21	10.11	2.18			-		-	18.7
Corrected quantity,kg/m^3		700	310	580	240			440		6.6	177

Mix with 7% Metacon Metakaolin

Material description	Type	20 mm crushed	10 mm crushed	5 mm crushed	Dune sand	Metakaolin 7%	cement (OPC)	Super Plasticizer	Water
	Source	Al Shoula Siji	Al Shoula Siji	Al Shoula Siji	Al Ain	MetaCon Metakaolin	U.C.C R.AK	RB-857	DEWA
Quantity,Kg/m^3		702	314	591	240	31	409	6.6	158
Specific Gravity		2.76	2.77	2.65	2.63	2.2	3.15	1.2	1.0
Absolute Volume,litre		254.37	113.38	223.09	91.32	14.09	129.84	5.5	158.40
Water Absorption%		0.6	0.7	1.7	0.9	-	-	-	-
Moisture content%		0	0	0	0	-	-	-	-
Moisture correction,kg/m^3		4.21	2.20	10.05	2.16	-	-	-	18.6
Corrected quantity,kg/m^3		700	310	580	240	31	409	6.6	177

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Issue No. : Rev. No. :
Issue Dt. : Rev. Dt. :
GTL
GEOSCIENCE TESTING LABORATORY

SUNNY PAILY
TECHNICAL SUPERVISOR

For GEOSCIENCE TESTING LABORATORY

Reference mix

1. Slump & Temperature

Date & Time of Production of Concrete: 12/03/2007, 1055 Hrs

SAMPLE ID	THE SAMPLING COMPLETED	TEMPARATURE OF SAMPLE (°C)	THE TEST STARTED	THE TEST COMPLETED	MESSURED SLUMP (mm)	FORM OF SLUMP
1	1101 Hrs	28.0	1102 Hrs	1103 Hrs	200	Collapse
2	1131 Hrs	28.0	1132 Hrs	1133 Hrs	190	Collapse
3	1201 Hrs	29.2	1202 Hrs	1203 Hrs	160	Shear

2. Initial & Final Setting Time

Setting Time	Initial	Final
	12 Hrs 50 Min	15 Hrs 00 Min

Mix with 7% Metacon Metakaolin

1. Slump & Temperature

Date & Time of Production of Concrete : 12/03/2007, 1610 Hrs

SAMPLE ID	THE SAMPLING COMPLETED	TEMPARATURE OF SAMPLE (°C)	THE TEST STARTED	THE TEST COMPLETED	MESSURED SLUMP (mm)	FORM OF SLUMP
1	1611 Hrs	31.0	1612 Hrs	1613 Hrs	200	Collapse
2	1641 Hrs	32.0	1642 Hrs	1643 Hrs	160	Collapse
3	1711 Hrs	32.0	1712 Hrs	1713 Hrs	100	Shear

02. Initial & Final Setting Time

Setting Time	Initial	Final
	13 Hrs 00 Min	14 Hrs 50 Min

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For GEOSCIENCE TESTING LABORATORY

SUNNY PAILY
TECHNICAL SUPERVISOR

Main Office:- Dubai
P.O. Box : 61670 - Dubai
Sharjah
P.O. Box : 64800 - Sharjah
Abu Dhabi
P.O. Box : 38442 - Abu Dhabi

Reference mix

03. Compressive Strength

Sample ID	Date of Test	Age of Test	Compressive Strength(N/mm^2)
1	13/03/2007	01 Day	24.0
2	15/03/2007	03 Days	40.5
3	19/03/2007	07 Days	53.5
4	09/04/2007	28 Days	57.5

Durability Results

Test Description	Observation	Results	
Water Permeability	Depth of penetration of Water (mm)	12	14
R C P	Total Charge Passed in Six Hour(Coulombs)	3817	4347
Water Absorption	Corrected Absorption (%)	1.8	2.0

Mix with 7% Metacon Metakaolin

Compressive Strength

Sample ID	Date of Test	Age of Test	Compressive Strength(N/mm^2)
1	13/03/2007	01 Day	19.0
2	15/03/2007	03 Days	41.0
3	19/03/2007	07 Days	55.5
4	09/04/2007	28 Days	69.5

Durability Results

Test Description	Observation	Results	
Water Permeability	Depth of penetration of Water (mm)	08	07
R C P	Total Charge Passed in Six Hour(Coulombs)	820	898
Water Absorption	Corrected Absorption (%)	1.6	1.5

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SUNNY PAILY
TECHNICAL SUPERVISOR

For GEOSCIENCE TESTING LABORATORY

REPORT OF TESTS

Description	Laboratory Trial Mix		
Tested for	Gulf Concreting Products, P.O.Box: 43010, Abu Dhabi, U.A.E.		
Lab Ref. No.	WR06-03298 (Page 1 of 5)	Request No.	WQ05-14043
Date Received	21.12.2005	Date Reported	26.04.2006

Client's ref : Requisition dated 03.12.2005
AFBMTS Sample No. : W05-014043/1 - 2

1.0 Introduction

Further to the instructions received from M/s. Gulf Concreting Products – Abu Dhabi, dated 03.12.2005, Al Futtaim Bodycote Materials Testing Services have been conducted three trial mixes as follows:

1. Control
2. Microsilica supplied by GCP
3. Metacon supplied by GCP

The purpose of the trial mix was to establish different fresh and hardened concrete properties subsequent to addition of the above cementitious materials in concrete. A control mix also runs along with the test mixes to compare the properties. The following fresh and hardened properties were conducted.

1.1	Workability (Slump)	:	BS 1881 : Part 102 : 1983
1.2	Temperature	:	ASTM C 1064 : 86
1.3	Setting Time	:	ASTM C403/C403M – 97
1.4	Compressive strength	:	BS 1881 : Part 116 : 1983
1.5	Water Absorption	:	BS 1881 : Part 122 : 1983
1.6	Water Penetration	:	BS EN 12390 : Part 8 : 2000
1.7	Rapid Chloride Permeability	:	ASTM C 1202 : 97
1.8	Length Change	:	ASTM C 157 : 93

2.0 Material

The following individual materials were used for the trial mix. The mixing process was conducted in accordance with the UK Department of the Environment "Design of Normal Concrete Mixes"

Materials	Source	Batch Weight		
		Control	Microsilica	Metacon
20mm Aggregates	Fujairah	650 kg/m^3	650 kg/m^3	650 kg/m^3
10mm Aggregates	Fujairah	320 kg/m^3	320 kg/m^3	320 kg/m^3
0- 5mm Crushed Sand	Fujairah	562 kg/m^3	562 kg/m^3	562 kg/m^3
Dune Sand	Al Ain	334 kg/m^3	320 kg/m^3	330 kg/m^3
Cement (OPC)	Sharjah Cement Factory	400 kg/m^3	360 kg/m^3	360 kg/m^3
Water	DEWA	175 L/m^3	175 L/m^3	175 L/m^3
Microsilica	Gulf Concrete Products	-	40kg/m^3	-
Metakaolin	Gulf Concrete Products	-	-	40kg/m^3
Admixture SP335	Al Gurg Fosroc	6.7 kg/m^3	6.7 kg/m^3	6.7 kg/m^3

3.0 Preparation & Analysis of Fresh Concrete

The concrete was prepared using a "Crettangle" laboratory mixer. Concrete temperature, workability, initial and final setting time were determined on the fresh concrete.

4.0 Testing of Hardened Concrete

150 x 150 x 150mm cubes were prepared from the mix (Test and control) for compressive Strength, Water Absorption, Water penetration and Rapid Chloride Permeability test.

5.0 Results

5. 1 Fresh Concrete Tests

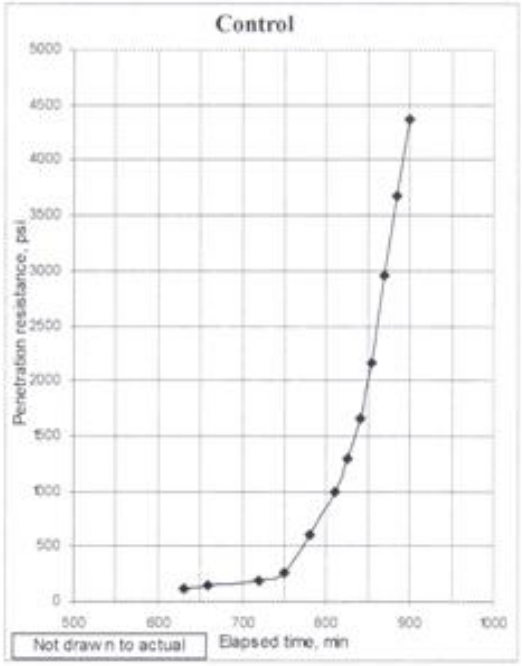
5.1.1 Workability (Slump) , Temperature, Density & Air content

Test Method: Slump : BS 1881 Part 102 : 1983
Temperature : ASTM C 1064 : 1986

Tests		Workability (Slump) (mm)	Concrete Temperature (°C)	Density (kg/m³)	Air Content (%)
Control	Initial	150	22.5	2430	1.8
	@ 30 Mins	110	22.5		
Microsilica	Initial	145	23.0	2410	1.5
	@ 30 Mins	120	23.0		
Metacon	Initial	115	23.0	2430	1.4
	@ 30 Mins	95	23.0		

5.1.2 Setting Time

Test Method: ASTM C403/C403M – 97

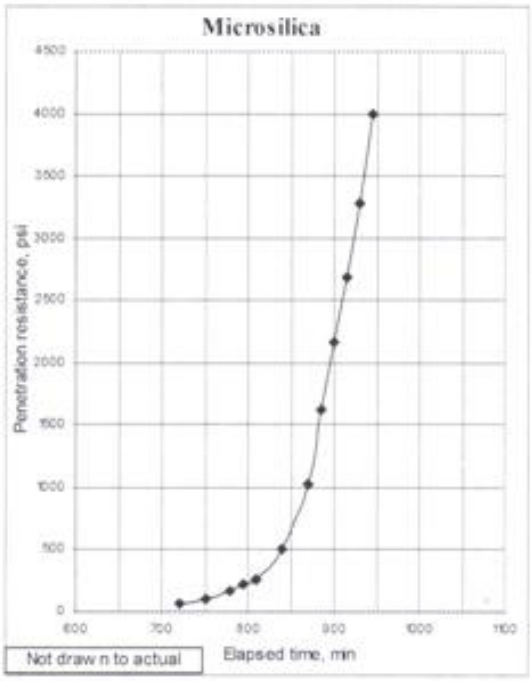


Initial Setting Time
12 Hours 45 minutes

Final Setting Time
14 Hours 50 minutes

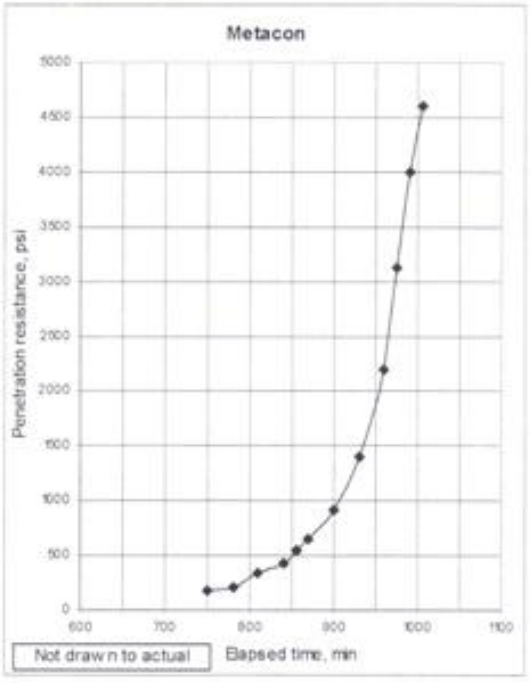
Bodycote MATERIALS TESTING SERVICES
باديكوت ماتيريال تيستينج سيرفيسز
P.O. Box: 34924 - DUBAI - U.A.E.

Setting Time (Contd.)



Initial Setting Time
14 Hours

Final Setting Time
15 Hours 45 minutes



Initial Setting Time
14 Hours 10 Minutes

Final Setting Time
16 Hours 30 minutes

Al-Futtaim الفطيم Bodycote MATERIALS TESTING SERVICES باديكوت ماتيريال تيستينغ سيرفيسز
P.O. Box: 34924 - DUBAI - U.A.E.

5.2 Testing of Hardened Concrete

5.2.1 Compressive Strength

Test Method: 150 mm nominal cubes were cast for compressive strength in accordance with BS 1811 Part 116: 1983. The specimens were water cured at laboratory conditions.

Sample Identification		Control	Microsilica	Metacon
Test ref.	Test Age	Compressive Strength (N/mm^2)		
1	7 days	46.5	54.0	56.5
2		45.5	53.0	57.0
3		47.0	53.5	57.5
Average		**46.5**	**53.5**	**57.0**
4	28 days	67.0	68.0	65.5
5		62.0	66.5	68.5
6		61.5	67.5	67.0
Average		**63.5**	**67.5**	**67.0**

5.2.2 Water Absorption

Test Method: The test was carried out in accordance with BS 1881 Part 122 1983. The specimens were water cured in the laboratory condition for 28 days.

Test	Test ref.	Water Absorption (%)		
		Control	Microsilica	Metacon
Water Absorption	7	2.1	1.8	1.6
	8	2.3	1.8	1.7
	9	2.2	1.7	1.8

5.2.3 Water Penetration

Test Method: The test was carried out in accordance with BS EN 12390 Part 8: 2000. The specimens were water cured in the laboratory condition for 28 days.

Test	Test Ref.	Maximum depth of water penetration (mm)		
		Control	Microsilica	Metacon
Depth of water penetration	10	13	3	4
	11	15	Nil	3
	12	12	4	3

5.2.4 Rapid Chloride Permeability

Test Method: The test was carried out in accordance with ASTM C 1202: 97. The specimens were water cured in the laboratory condition for 28 days.

Test	Test Ref.	Control		Microsilica		Metacon	
		Coulombs	Chloride Penetration	Coulombs	Chloride Penetration	Coulombs	Chloride Penetration
Rapid Chloride Permeability	13	2375	Moderate	705	Very low	564	Very low
	14	2468	Moderate	733	Very low	667	Very low
	15	2511	Moderate	861	Very low	742	Very low

5.2.5 Length Change

Specimens having nominal dimension 75 x 75 x 285 mm were cast and tested for shrinkage in accordance with ASTM C 157 : 93

Specimen No.	Age of test	Control	Microsilica	Metacon
		Length Change (%)		
A – 1	28	-0.035	-0.025	-0.022
B – 1		-0.034	-0.024	-0.021
C – 1		-0.037	-0.024	-0.022
Average		**-0.035**	**-0.024**	**-0.022**

Remarks: - ve Shrinkage/+ve Expansion

Al-Futtaim Bodycote MATERIALS TESTING SERVICES
P.O. Box: 34924 - DUBAI - U.A.E.

For and on behalf of Al Futtaim Bodycote
Materials Testing Services (L.L.C)
Tested by: MSO/RBT/AVS/MK/SSL/DC/PB Date tested: 03.01.2006 - 05.03.2006

A. Umar Farook
Civils Laboratory Manager

Annex 1

Occupational Exposure Limit Values in mg/m³ (respirable fraction)

for the 27 EU member states (excluding Latvia) + Norway & Switzerland

Country	Non specified dust	Quartz	Cristobalite	Tridymite	Amorphous silica	Kaolin	Mica
Austria	6	0.15	0.15	0.15			
Belgium	3	0.1	0.05	0.05	2	2	3
Bulgaria	4	0.07	0.07	0.07			
Czech Republic		0.1	0.1	0.1			2
Cyprus		10*K/Q [a]			2		
Denmark	5	0.1	0.05	0.05		2	
Estonia		0.1	0.05	0.05	2		
Finland		0.2	0.1	0.1			
France [b]		25*K/Q [c] or 5 [d]					
France [e]	5	0.1	0.05	0.05		10 [f]	
Germany	3	[g]	0.15	0.15			
Greece	5	0.1	0.05	0.05			
Hungary		0.15	0.1	0.15			
Ireland	4	0.05	0.05	0.05	2.4	2	0.8
Italy	3	0.05	0.05	0.05		2	3
Lithuania	10	0.1	0.05	0.05			
Luxembourg	6	0.15	0.15	0.15			
Malta [h]							
Netherlands	5	0.075	0.075	0.075			
Norway	5	0.1	0.05	0.05	1.5		3
Poland		0.3	0.3	0.3			
Portugal	5	0.05	0.05	0.05		2	3
Romania	10	0.1	0.05	0.05		2	3
Slovakia		0.1	0.1	0.1	2		2
Slovenia		0.15	0.15	0.15			
Spain	3	0.1	0.05	0.05		2	3
Sweden	5	0.1	0.05	0.05			
Switzerland	6	0.15	0.15	0.15	0.3	3	3
United Kingdom	4	0.1	0.1	0.1	2.4	2	0.8

[a] K = 1 – Q = quartz percentage
[b] Empoussiérage de référence (Ministère de l'Industrie (RGIE))
[c] K = 1 – Q = quartz percentage
[d] Lowest of the two values.
[e] Valeur limite de moyenne d'exposition (Ministère du Travail)
[f] Inhalable fraction
[g] Germany has no OEL for quartz. Employers are obliged to minimise exposure as much as possible and to follow certain protective measures.
[h] When needed, Maltese authorities refer to United Kingdom values for OELVs which do not exist in Maltese legislation.