

# SLAGCEM GGBS

GROUND GRANULATED BLAST FURNACE SLAG



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The information given is of general nature and does not address the specific circumstances of any particular situation. The guidance is given with the best intention, however, nothing in this brochure shall create or be deemed to create any obligations, whether expressed or implied on YTL Cement Marketing Sdn Bhd. Users are advised to carry out their own tests in order to ascertain the performance and suitability of the product for their particular project.

# SLAGCEM GGBS

GROUND GRANULATED BLAST FURNACE SLAG



SLAGCEM GGBS is the brand name of a high quality Ground Granulated Blast Furnace Slag (GGBS) produced by grinding granulated blast furnace slag using vertical roller mill.

## CERTIFICATION

SLAGCEM GGBS is certified to MS EN 15167-1 : 2010.



## APPLICATIONS

SLAGCEM GGBS is suitable for applications in marine environment, mass concreting, sulfate environment, water retaining structures, basement and other structures which require low heat of hydration.



## BENEFITS AND SELECTION OF SLAGCEM GGBS BASED ON RECOMMENDATIONS OF THE BRITISH STANDARD

BS 8500-1:2015, TABLE A.4 DURABILITY FOR REINFORCED OR PRESTRESSED ELEMENTS WITH INTENDED WORKING LIFE OF AT LEAST 50 YEARS (EXTRACTS)

Exposure Class	Nominal cover mm	Compressive Strength Class	Maximum w/c ratio	Minimum cement or combination content	Cement / Combination	
XS3	80 + $\Delta$ C	C55	0.35	380	CEM I, IIA, IIB-S	
		C30			IIIA	
	70 + $\Delta$ C	C30	0.55	320	IIIA $\geq$ 46% GGBS	
		C25			IIB	
	50 + $\Delta$ C	C50	0.35	380	IIIA	
		C40			IIIA $\geq$ 46% GGBS	
		45 + $\Delta$ C	C35	0.45	360	IIB
			C50			IIIA $\geq$ 46% GGBS
	45 + $\Delta$ C	C45	0.35	380	IIIB	
		C45			IIIB	

1.  $\Delta$ C, to accommodate fixing precision (nominally at 5mm to 15mm).

2. OPC concrete is ONLY allowed for nominal cover of 80mm + $\Delta$ C. Cement with higher GGBS content ( $\geq$ 46%) are recommended for marine structures in XS3 exposure class.

3. XS3 = Tidal, splash and spray zones.

## BS 8500-1:2015, Table A.12 LIMITING VALUES OF COMPOSITION AND PROPERTIES FOR CONCRETE WHERE A DC-CLASS IS SPECIFIED (EXTRACTS)

* DC-class	Max. w/c ratio	Min. cement or combination content (kg/m <sup>3</sup> ) for max. 20mm aggregate size	Cement and combination types
DC-2	0.55	320	IIB-V+SR, IIIA+SR, <b>IIIB+SR</b> , IVB-V
	0.50	340	CEM I, IIA-S, IIA-V, IIB-S, IIB-V, IIIA, IIIB
	0.45	360	IIA-L - 42.5
	0.40	380	IIA-L - 32.5
DC-3	0.50	340	<b>IIIB+SR</b>
	0.45	360	IVB-V
	0.40	380	IIB-V+SR, IIIA+SR
DC-4	0.45	360	<b>IIIB+SR</b>
	0.40	380	IVB-V
	0.35	380	IIB-V+SR, IIIA+SR
DC-4m	0.45	360	<b>IIIB+SR</b>

1. Please refer to BS 8500-1:2015, Table A.2 and Table A.10 for details on selection of DC classes.

2. \*DC-class stands for Design Chemical class.

3. CEM IIIB+SR (Sulfate Resisting) is cost effective cement for concrete under chemical attack.



SLAGCEM GGBS for High Rise Building



SLAGCEM GGBS for Flowing Concrete



SLAGCEM GGBS for Lighter Colour



SLAGCEM GGBS for Precast Product



SLAGCEM GGBS for Green Label Certified Pavers



SLAGCEM GGBS for Marine Works

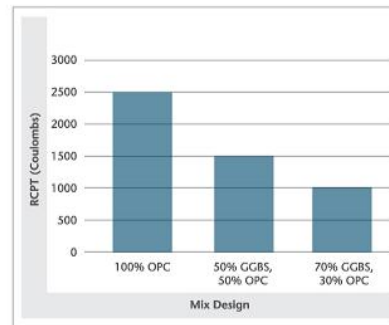


**PROPERTIES**

Tests	Units	Specification	Test Results
		MS EN 15167-1:2010	
<b>Properties of GGBS</b>			
Specific Surface Area	m <sup>2</sup> /kg	275 min.	435
Setting Time - Initial	mins	-	255
- Ratio (GGBS / Test Cement)	-	2 max.	1.4
Soundness	mm	-	<1
Compressive Strength Mortar Prisms	7 days	MPa	27.1
	28 days	MPa	50.0
Activity Index	7 days	%	61
	28 days	%	92
Chloride (Cl <sup>-</sup> )	%	0.10 max.	0.01

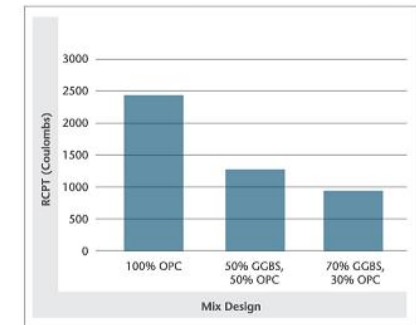


RCPT Results @ 28D (Binder Content = 500kg)



• RCPT – Rapid Chloride Permeability Test

RCPT Results @ 56D (Binder Content = 500kg)



• RCPT – Rapid Chloride Permeability Test

**HEALTH AND SAFETY**

Skin contact with wet cement, fresh concrete or mortar may cause irritation dermatitis or burns. It is recommended to use Personal Protective Equipments which include eye, hand, skin protection and dust masks. First aid treatment should involve the immediate bathing of the affected area with water.



**ENVIRONMENTAL BENEFITS**

SLAGCEM GGBS is produced by grinding granulated blast furnace slag which is a by-product from the steel manufacturing process. By using GGBS to replace cement, significant amount of CO<sub>2</sub> emission will be eliminated.



Certification nos.  
022-037 & 022-039

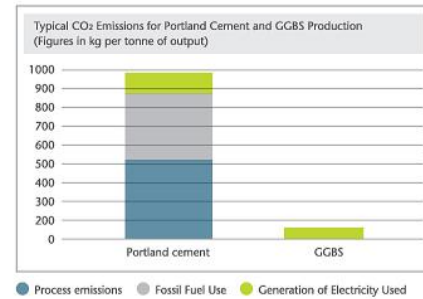


SIRIM  
Eco-Label nos.  
EL000002 & EL000005

**GREEN LABEL SINGAPORE / SIRIM ECO-LABEL**

SLAGCEM GGBS is certified as eco-friendly cement by the Singapore Environment Council and SIRIM QAS International Sdn. Bhd.

CO<sub>2</sub> emissions for GGBS and cement production



**AVAILABILITY**

SLAGCEM GGBS is available in bulk from YTL Westport & Pasir Gudang cement plants.

**QUALITY ASSURANCE**

SLAGCEM GGBS is produced under stringent quality assurance, environmental management, health & safety and energy management systems. It is certified to MS ISO 9001, MS ISO 14001, OHSAS 18001 & MS ISO 50001.

**TYPICAL SPECIFICATIONS FOR MARINE WORKS**

Requirement	Reinforced Concrete
Intended working life of structure	120 years
Minimum cover to reinforcement	External faces 40mm / Internal faces 25mm
Applicable exposure classes (excluding DC-class) as defined in BS 8500-1	XS3
Minimum cement content (kg/m <sup>3</sup> )	380 kg/m <sup>3</sup>
Maximum free water/cement ratio	0.40
Permitted group or type and class of cement or combination	Type III/A and III/B Blast furnace cement with 36% to 65% GGBS (CEM III/A) or with 66% to 80% GGBS (CEM III/B)
Consistence class	S3 (Slump = 80 - 170mm)



**REQUIREMENTS FOR TEMPERATURE CONTROL AS PER BS 8500-1 : 2015**

Clause A.8.2  
**Delayed Ettringite Formation**

Where the heat of hydration or accelerated curing is likely to take the concrete temperature above 70°C, the potential for Delayed Ettringite Formation should be considered.



**LAND TRANSPORT AUTHORITY (LTA) SINGAPORE, SPECIFICATION FOR CONCRETE**

Clause 11.11  
**Concreting of thick sections**

1. Maximum temperature shall not exceed 70°C.
2. When GGBS is used at not less than 60%, maximum temperature shall not exceed 75°C.

**SUGGESTED SLAG REPLACEMENT LEVELS**

Applications	% Slag
Concrete slabs / floors / basement walls / beams / columns	25% - 50%
Marine works / sulfate resistance / mass concrete	50% - 70%
Precast concrete	20% - 50%

**SPECIFICATIONS ON TEMPERATURE OF CONCRETE FOR A DAM PROJECT**

1. For normal structural concrete, the maximum temperature in the core after placing shall not exceed 65°C. The temperature differential between the surface and core of any section after placing shall not exceed 30°C.
2. For massive concrete placements, the maximum temperature in the core after placing shall not exceed 50°C. The temperature differential between surface and core of any section after placing shall not exceed 20°C.

**BENEFITS OF SLAGCEM GGBS FOR TEMPERATURE RISE**

TEMP RISE/100KG BINDER (SEMI ADIABATIC)

