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**SECTION SP43 CEMENTITIOUS MATERIALS FOR CONCRETE**

**1 GENERAL**

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**1.1 CONTENTS**

**OUTLINE:** This Section sets out the technical requirements for the manufacture and supply of cementitious materials (ie: cement or hydraulic cement), consisting of portland cement, or of mixtures of portland cement and one or more of fly ash, ground granulated iron blast-furnace slag (slag) and amorphous silica, for use in special class concrete, grouts, mortars for all types of durable infrastructure, including risk limitation from both salinity and alkali-silica reactive (ASR) aggregates. This Section may also be used for normal class concretes.

[Note: Not applicable for bagged special mortars, grouts and repair products.]

**1.2 STANDARDS**

**MANUFACTURE:** Portland and blended cements to AS 3972, and where in combination with one or more supplementary cementitious materials (SCM), that is fly ash, slag and amorphous silica (includes silica fume), to AS 3582 Parts 1 and 2, and AS/NZS 3582 Part 3, respectively (also referred to herein as the ‘AS 3582 Series’).

**1.3 PACKAGING, STORAGE AND TRANSPORT**

**REQUIREMENT:** At all times, all cementitious materials to be protected from contact with water, free from contamination and be accessible for inspection, sampling and identification purposes. Prior to use, all materials manufactured 3 months or more before, to be retested at the supplier’s expense. Use in chronological order and reject any materials containing lumps or signs of moisture absorption.

**1.4 DEFINITION**

**DESIGN & DEVELOPMENT:** Application of AS 3582 Parts 1 and 2, AS/NZS 3582 Part 3, and/or AS 3972 for determining cement performance parameters, the criteria required to yield the desired performance, their interpretation and the test methods determining compliance with these criteria.

**AUSTRALIAN DISTRIBUTOR:** An entity (corporation or otherwise) based in Australia, including but not limited to an Australian manufacturer, overseas manufacturer’s local representative, importer or contractor, which has the responsibility for verifying that the products comply with Section SP43.

**1.5 TERMINOLOGY**

**BLENDED CEMENTS:** Hydraulic cement containing portland cement and one or more of the SCMs of fly ash, slag and/or amorphous silica, to the proportions prescribed herein.

**SULFATE RESISTING CEMENTS:** A blended cement as prescribed in Clause 4.7. Clause 4.7 replaces the requirements and test methods for special purpose cement Type SR of AS 3972, Table 1.

**CONFORMITY:** General headings adopted from ISO/IEC Directives Part 2.

**2 CONFORMITY**

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**2.1 QUALITY MANAGEMENT SYSTEM**

**STANDARD:** To ISO 9001 and the following, with the certifier accredited or accepted by JAS-ANZ:

- Customer verification required (Clause 7.4.3).
- Service provision to include delivery (Clause 7.5.1f).
- Identification and traceability required (Clause 7.5.3).
- Scope of supply included in scope of certification.

## 2.2 PRODUCT CONFORMITY

**SAMPLING:** Portland & blended cement and slag to AS/NZS 2350.1. Fly ash and amorphous silica to AS 3582 Parts 1 and 2, and AS/NZS 3582 Part 3, respectively. Test samples to Appendix A. Also access required for independent sampling by customers, and for verification testing of registered products nominated in the Project Specifics.

**CEMENT TESTING:** To Appendix A and AS 3972.

**SCM TESTING:** To Appendix A and AS 3582 Parts 1 and 2, and AS/NZS 3582 Part 3.

## 2.3 CONFORMITY ASSESSMENT

**REQUIREMENT:** To AS 3972, AS 3582 Parts 1 and 2, AS/NZS 3582 Part 3, and Section SP43, with certifier accredited or accepted by JAS-ANZ.

OR

Pre-registered cementitious materials for concrete, to the requirements of Appendix A, and effective from 1 Oct 2006). The ATIC government agencies manage the Cementitious Materials Registration Scheme (CMRS) which is currently administered by RTA Materials Technology (RTA Lab). CMRS includes a Registered Products List posted on the Australian Procurement and Construction Council (APCC) website at [www.apcc.gov.au](http://www.apcc.gov.au) and a detailed description of the product types is shown in Clause 4.8.

**DESIGN, DEVELOPMENT & NEW PRODUCTS:** Certification to ISO 9001 from a cementitious materials product specialist or a Chartered Professional Engineer (CPEng) or other person providing equivalent evidence that they have the necessary qualifications and experience.

**LABORATORY COMPETENCE:** Accredited by NATA, or other internationally recognised accreditation body (ie: signatory to ILAC or APLAC), to AS ISO/IEC 17025 for relevant sampling and testing. (ILAC & APLAC: International & Asia Pacific Laboratory Accreditation Cooperation)

**AUDITORS:** Further to HB18.65 (AS ISO/IEC GUIDE 65), the minimum criteria for competence of personnel to include all the following:

- Tertiary qualifications
- At least three years in the manufacturing environment, with demonstrated competence in this particular product area, or particular product Standard/referenced standard.
- Experience in auditing quality management systems, or quality plans.
- At least one year actively involved in product assessment of this product, either in a laboratory or in production inspection.

## 3 CONSTITUENT MATERIALS

### 3.1 PORTLAND CEMENT

**REQUIREMENT:** Portland cement and portland cement clinker, to AS 3972 plus additional acceptance criteria herein.

### 3.2 FLY ASH

**REQUIREMENT:** Fine grade to AS 3582.1 plus additional acceptance criteria herein.

### 3.3 SLAG

**REQUIREMENT:** To AS 3582.2 plus additional acceptance criteria herein.

### 3.4 AMORPHOUS SILICA

REQUIREMENT: To AS/NZS 3582.3 plus additional acceptance criteria herein. For slurried and densified (ie: condensed or microsilica) amorphous silica, sample and test from the raw silica used to make these products.

### 3.5 OTHER POZZOLANS

REQUIREMENT: Not accepted.

### 3.6 LIMESTONE

REQUIREMENT: Calcium carbonate (CaCO<sub>3</sub>) content by mass, to be not less than 75%, and where less than 80%, comply with the following:

- Clay content to be less than 1.2% by mass, as determined by the methylene blue test of EN 933-9.
- Total organic carbon to not exceed 0.50% by mass, as determined by EN 13639.

### 3.7 CALCIUM SULFATE

REQUIREMENT: To AS 3972.

### 3.8 ADDITIONS

DEFINITION: Any material used and not included above.

REQUIREMENT: Full chemical analysis of additions and their proportions to be available from the manufacturer on request. [Process additions not to exceed 1% and mineral additions not to exceed 5%.] The properties of the cement, or concrete made from the cement, to be unimpaired by the additions (eg: reduced durability).

## 4 MANUFACTURE AND/OR PROCESSING

### 4.1 GENERAL

MATERIAL SELECTION: Appendix B tabulates specific cement blends for a variety of applications. Also some deemed-to-comply solutions are given for a range of environments.

Mixing: Blend cement either at the manufacturer's facilities and/or at the concrete batching plant. Powdered amorphous silica accepted only for concrete use in other than flat work.

Analysis: Full chemical analysis of each component material where supplied separately, and of the blended product where the components are supplied as a blend. For the latter case, the type, proportion and place of manufacture of each component, including sources of cement clinker, is also required. Other reportable properties and characteristics to AS 3972, Clause 6.2.

### 4.2 BLENDED CEMENTS WITH ONE SCM (BINARY)

REQUIREMENT: To Table 1 by % of total combined weight (portland cement portion not shown).

**TABLE 1: RANGE OF SCM %**

SCM	GENERAL (MIN TO MAX)
Fly Ash	20 to 40
Slag	30 to 70
Amorphous Silica	4 to 10

#### 4.3 BLENDED CEMENTS WITH TWO SCM (TERNARY)

REQUIREMENT: To Table 2 by % of total combined weight (portland cement portion not shown). The proportion of SCMs between Combination A and B, to be linearly interpolated.

**TABLE 2: RANGE OF SCM COMBINATIONS % \***

SCM I	SCM II	Combination A		Combination B	
		Max % of SCM I	Min % of SCM II	Min % of SCM I	Max % of SCM II
Fly Ash	Amorphous Silica	30	4	20	8
Slag	Amorphous Silica	50	4	30	8
Slag	Fly Ash	50	20	30	30

\* Sourced from BRC 27131

#### 4.4 BLENDED CEMENTS WITH THREE SCM (QUATERNARY)

REQUIREMENT: To the following:

- Portland cement content (ie: Type GP or SL) to be not less than 40% of the total cementitious material
- Creditable reference or test data for specific corrosive ions, showing proof of performance against concrete penetration, and
- A comparison with published data for binary, ternary and quaternary blends of similar materials.

#### 4.5 LOW HEAT CEMENTS

REQUIREMENT: Use portland and blended cements Type LH, to AS 3972.

#### 4.6 SHRINKAGE LIMITED CEMENTS

REQUIREMENT: Use portland and blended cement Type SL to AS 3972, and tested to AS 2350.13, with a maximum shrinkage limit of 750 microstrain at 28 days, and long term mean of 600 microstrain (see AS 3972), Clause A3.3.5.

#### 4.7 SULFATE RESISTING CEMENTS

REQUIREMENT: Use a blended cement with designation SRC to SP43, containing either: one SCM (ie: binary) conforming with Table 1 OR Two SCM (ternary) conforming with Table 2.

References & Solutions: Refer to BRC 27131, CSIRO/UTS CCC, ACI 201R-01, 232.2R-03, 233R-03 and 234R-96 or equivalent papers for data and proof of performance. Also refer to deemed-to-comply solutions included in Appendix B.

#### 4.8 REGISTERED PRODUCTS LIST

DESIGNATIONS: The following cementitious material designations may appear in the CMRS Registered Products List:

- AS 3972 Types: GP, SL, LH, HE
- AS 3582 Series Types: Fly Ash (FA) Fine and/or Special Grade, Slag, Amorphous Silica
- SP43 Designations: SRC (sulfate resisting cement), High Slag (> 55%), High FA (> 30%), Off-white, GB2 (binary general blend), GB3 (ternary general blend), GB4 (quaternary general blend)
- Combined Examples: (i) GB2, LH (ii) GB3, SRC (iii) GB2, LH, SRC (iv) GB2, High FA

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**5 SCHEDULES**

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**5.1 REFERENCED DOCUMENTS**

STANDARDS:

- AS 1199 - Sampling procedures for inspection by attributes
- AS/NZS 2350 - Methods of testing portland and blended cements
- AS/NZS 2350.1 - Methods of sampling portland and blended cement
- AS 2350.2 - Chemical composition of portland cement
- AS/NZS 2350.4 - Setting time of portland and blended cements
- AS/NZS 2350.5 - Determination of soundness of portland and blended cements
- AS 2350.7 - Determination of temperature rise during hydration of portland and blended cements
- AS/NZS 2350.8 - Fineness index of portland cement by air permeability
- AS 2350.9 - Fineness of portland fly ash cement by the 45 um sieve
- AS/NZS 2350.11 - Compressive strength of portland and blended cements
- AS 2350.12 - Preparation of a standard mortar and moulding of specimens
- AS 2350.13 - Determination of drying shrinkage of portland and blended cement mortars
- AS/NZS 2350.17 - Determination of soundness of masonry cements
- AS 3582 - Supplementary Cementitious materials for use with portland cement
- AS 3582.1 - Fly ash
- AS 3582.2 - Slag – Ground granulated iron blast-furnace
- AS/NZS 3582.3 - Amorphous silica
- AS 3583 - Methods of test for supplementary cementitious materials for use with portland cement
- AS 3583.2 - Method 2: Determination of moisture content
- AS 3583.3 - Method 3: Determination of loss of ignition
- AS 3583.5 - Method 5: Determination of relative density
- AS 3583.6 - Method 6: Determination of relative water requirement and relative strength
- AS 3583.8 - Method 8: Determination of sulfuric anhydride content
- AS 3583.12 - Method 12: Determination of available alkali
- AS 3583.13 - Method 13: Determination of chloride content
- AS 3600 - Concrete structures
- AS 3735 - Concrete structures retaining liquids
- AS 3942 - Quality control - Variables charts - Guide
- AS/NZS 3944 - Shewhart control charts
- AS 3972 - Portland and blended cements

## ATIC-SPEC

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- |                       |   |   |
|-----------------------|---|---|
| AS 3974               | - | Evaluation of uniformity of cement strength from a single source  |
| AS 4489.10.1          | - | Test methods for limes and limestones – Bulk density – Quicklime and hydrated lime                                    |
| AS 5100               | - | Bridge design   |
| AS/NZS<br>ISO 9001    | - | Quality management systems - Requirements   |
| AS ISO/IEC<br>17025   | - | General requirement for the competence of testing and calibration laboratories  |
| ASTM C 151            | - | Test method for autoclave expansion of portland cement  |
| ASTM C 1240           | - | Standard specification for use with silica fume as a mineral admixture in hydraulic cement concrete, mortar and grout |
| EN 197-1              | - | Cement – Composition, specifications and conformity criteria for common cements                                       |
| EN 933-9              | - | Test for geometrical properties of aggregates – Part 9: Assessment of fines – Methylene blue test                     |
| EN 13639              | - | Determination of total organic carbon content in limestone  |
| CSA A3000<br>Series   | - | Cementitious materials for use in concrete  |
| ISO 7870              | - | Control charts – General guide and introduction   |
| ISO/IEC<br>Directives | - | Part 2, Rules for the structure and drafting of International Standards (5 <sup>th</sup> ed), 2004                    |

### OTHER DOCUMENTS:

- |               |   |   |
|---------------|---|---|
| ACI 201.2R-01 | - | Guide to Durability Concrete  |
| ACI 232.2R-03 | - | Use of Fly Ash in Concrete  |
| ACI 233R-03   | - | Slag Cement in Concrete and Mortar  |
| ACI 234R-96   | - | Guide for the Use of Silica Fume in Concrete  |
| BRC 27131     | - | Properties of Fresh and Hardened Concrete with Ternary Binder System Containing Two Supplementary Cementitious Materials, 1998  |
| CSIRO/UTS CCC | - | Cao, H.T., Bucea, L., Ray, A. and Yozghatlian, S., 'The Effect of Cement Composition and pH of Environment on Sulfate Resistance of Portland Cements and Blended Cements', Cement and Concrete Composite 19 (1997), 161-171 |
| HB 18.28      | - | AS ISO/IEC GUIDE 28 – General rules for a model third-party certification system for products (ISO/IEC GUIDE 28)  |
| HB 18.65      | - | AS ISO/IEC GUIDE 65 – General requirements for bodies operating product certification systems (ISO/IEC GUIDE 65)  |
| HB 162        | - | Rules for the structure and drafting of Australian Standards  |

**5.2 PROJECT SPECIFICS**

[Note: To nominate the type of cementitious materials required for the various grades of concrete used in the project, select from or add to the following table, then insert in the project spec.]

CEMENTITIOUS MATERIALS TYPES: Use the nominated cementitious materials and proportions in the concrete grades, grouts, mortars as shown:

<b>APPLICATION DETAILS</b>	<b>REQUIRED CEMENTITIOUS MATERIALS</b>
<b>To Section SP45 (or nominate other)</b>	<b>To Section SP43</b>
Concrete mix type, grouts, mortars: (A) - Application: (eg: pre-stressed, reinforced or mass concrete) - Environment: (eg: see Appendix B) - Concrete type & grade: (eg: Sx, SFx, Nx or project code)	
Concrete mix type, grouts, mortars: (B) - Application: - Environment: - Concrete type & grade:	
Etc	

[Note: To specify the requirements for each of the cementitious materials above, select each heading in turn, with a copy of the table below, then select from or add to it, before inserting in the project spec.]

PORTLAND & BLENDED CEMENTS REQUIREMENTS: To Section SP43 and the following:

FLY ASH REQUIREMENTS: To Section SP43 and the following:

SLAG REQUIREMENTS: To Section SP43 and the following:

AMORPHOUS SILICA REQUIREMENTS: To Section SP43 and the following:

<b>ITEM</b>	<b>SP43</b>	<b>PROJECT REQUIREMENTS #</b>
Government registration details & contacts of manufacturer's nominated key liaison staff	-	Manufacturers without Product Certification to supply
Certificate for Design & Development	2.2	
Full chemical analysis of additions & proportion	3.8	
Chemical analysis results	4.1	
Agency requirements, both standard & additional	5.3	
Reportable properties & characteristics	App A	
Additional tests	App A	
Customer & nominated agency contacts	A3.9 & 10	
Low volume special blends for critical projects, required frequency for verification test	A3.16	
Certificate of Compliance to SP43	-	

# For premixed concrete, concrete manufacturer to arrange and supply certification as above.  
For direct purchase, cementitious material manufacturer to certify as above.

5.3 AGENCY PRACTICES

Agency	Requirement or Cement Types	Applications
All	Specialist advice required	Severe exposure environments
RTA & RailCorp (minor works)	Type SL (to ASTM Method C151, less than 0.8%) OR Type GB OR Type GB with all SCM(s) of Clauses 4.3 & 4.4	Concrete work for bridges and Shotcrete work (Specs B80 and B82)
	Type GP OR Type SL OR Type GB OR Type GB with all SCM(s) of Clauses 4.3 & 4.4	Lean concrete sub-base (Spec R82)
	Type SL OR Type GB OR Type GB with all SCM(s) of Clauses 4.3 & 4.4	Plain and continuously reinforced concrete base (Specs R83 & R84)
	Blended cement with 30% min FA or 65% min slag	For use in low heat concrete 30% min FA or 65% min slag
	Refer to RTA 263	Where aggregates are innocuous
VicRoads	Type GP Cement min 60% (refer to VicRoads Standard Specification, Section 610 "Structural Concrete")	For all types of work at moderate replacement levels refer to Clause 610.07(f)
	<ul style="list-style-type: none"> <li>▪ 90% GP/ 10% SF; OR</li> <li>▪ Higher replacement levels of:                             <ul style="list-style-type: none"> <li>- at least 30% FA; OR</li> <li>- 30%GP / 60% Slag / 10% SF; OR</li> <li>- 65% Slag / 35% GP</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Concrete structures in marine and other saline environments</li> <li>▪ Concrete structures subject to sulfate and chemical attack</li> </ul>
	90% GP / 10% SF; OR 80% GP / 20% FA (For precast members, eg: beams and crown units) [Note: SF = silica fume = amorphous silica]	<ul style="list-style-type: none"> <li>▪ Depending on concrete member and exposure classification, refer to Table 610.072.</li> </ul>
Qld DTMR	Type GP minimum 55% (refer MRS 11.70).	All types of work
	FA not to exceed 2.0% total alkali, & all mixes to have a minimum of 20% (refer MRS 11.70)	To control alkali silica reaction
	Slag & amorphous silica not to exceed 1.0% total alkali (refer MRS 11.70)	As specified
HWC	Fly ash blends OR Type GP (under review)	Water supply & sewerage
	Fly ash blends	Marine & saline areas
	Fly ash blends	Acid sulfate soils
NSW Public Works & SCA *	Fly ash blends OR high slag cement (refer SP45, under review)	Combined low heat & sulfate resistance
	Specialist advice required (refer SP45)	Chloride and other chemicals
SPA	Case by case basis	Major works

\* Includes all concrete and precast concrete strategic products

APPENDIX A

PRODUCT CONFORMITY AND CONFORMITY ASSESSMENT

**A1 SCOPE**

This Appendix sets out two means by which conformity assessment can be demonstrated by the manufacturer or supplier (see HB 162, Annex F, with ‘Normative’ replacing ‘Informative’):

- The use of a third party product certification scheme OR
- Other means of assessment, involving government registration and the use of a minimum sampling and testing frequency plan, combined with random verification testing from projects.

**A2 CONFORMITY ASSESSMENT, THIRD PARTY**

The purpose of product certification is to provide independent assurance of the claim by the manufacturer that products comply with the Standard(s).

The certification scheme shall meet the criteria described in HB18.28 (AS ISO/IEC GUIDE 28) in that, as well as full type testing from independently sampled production and subsequent verification of conformance, it requires the manufacturer to maintain effective planning to control production.

The certification scheme serves to indicate that the products consistently conform to the requirements of the Standard(s).

Product certification shall be conducted by a certification body accredited by the Joint Accreditation System for Australia and New Zealand (JAS-ANZ) or by another certification body that is acceptable to JAS-ANZ.

The frequency of the sampling and testing plan, as detailed in Tables A1 to A4, shall be used by the certifying body for product compliance auditing. However, where the manufacturer can demonstrate adequate process control to the certifying body, the frequency of sampling and testing nominated in the manufacturer’s quality plan and/or documented procedures shall take precedence for the purpose of product certification.

**A3 OTHER MEANS OF ASSESSMENT**

**A3.1 GENERAL:** Tables A1 to A4, set out the minimum sampling and testing frequency plans, for manufacturers to demonstrate product conformity to AS 3972, and AS 3582 Parts 1, 2 and 3, respectively. All tests conducted to these requirements shall be NATA certified. The plans are also designed to complement factory production control or the permanent internal quality control measures, as used by manufacturers for the continuous mass production of cementitious materials.

Product pre-registration confirmation to ATIC’s CMRS Scheme, can be obtained from the RTA Lab’s Laboratory Officer, on tel: (02) 8745-6038 or at Unit H, 75 St. Hilliers Rd., AUBURN NSW 2144.

**A3.2 PROVEN SOURCE:** A source for which the manufacturer presents 6 months minimum, verifiable data to demonstrate that the production of the cementitious material remains in statistical control using control charts procedures such as included in AS 3942, AS 3944 or ISO 7870 to criteria in this specification. Registered proven source manufacturers shall provide a monthly summary of results and other properties listed in Tables A1 to A4 to the RTA Lab, and on-going results to other nominated government agencies. Also from time to time, second party surveillance tests, audits and reviews may be carried out.

**A3.3 UNPROVEN SOURCE:** All sources, except those that are proven, including the following:

- Unproven sources have the option of continuing with the higher levels of testing or progressing to become a proven source.
- For one-off supply or spot sales on the open market, with limited source and production information, apply “unproven source” testing requirements.
- For new cementitious materials where the intention is to become a “proven source”, during the transition period the “unproven source” testing requirements may be progressively relaxed at the discretion of ATIC, as production records and other data becomes available.

**A3.4 CONFORMITY CRITERIA:** All product to meet the mechanical, physical, chemical and durability requirements of Tables A1 to A4, respectively.

**A3.5 REGISTRATION:** All cementitious materials to be registered, and each to be classified as being from either a “Proven” or “Unproven” Source. Products compliant with the requirements for the former, may initially be so registered, while all other product will be registered as “unproven source”.

**TABLE A1: PORTLAND & BLENDED CEMENTS TO AS 3972**

Characteristic	Clause	Requirement	Test Method	Source & Frequency	
<b>Type Tests</b>					
Material Properties & Performance		For registering or re-registering materials, use “Unproven Source” & other testing from last 6 months, to establish control limits and other data		At change of material source or production operation or interruption of production for 6 months	
<b>Process Control Monitoring or Lot Release Tests</b>				<b>Proven</b>	<b>Unproven (#)</b>
Materials	3	Nature & proportion of materials in the cement	-		
Specified Properties	6.1	Setting time	AS/NZS 2350.4	< 2,000 P 1/week  OR > 2,000 P & < 5,000 P, 1/week  OR > 5,000 P & <50,000 P, 2/week  OR >50,000 P, daily	If in shipments, either Lot or 1,000 tonne  OR If in continuous production, daily
		Soundness	AS/NZS 2350.5		
		SO <sub>3</sub> content	AS 2350.2		
		Compressive strength	AS/NZS 2350.11		
	Peak temp rise (Type LH)	AS 2350.7			
	Shrinkage (Type SL)	AS 2350.13			
	6.2	Chloride content ##	AS 2350.2		
-	Total alkali content (Na <sub>2</sub> O equiv) **	AS 2350.2			
Reportable Properties & Characteristics	6.2	Loss on ignition	AS 2350.2		
		Fineness or fineness index	AS 2350.9 AS/NZS 2350.8		
	Major oxide composition of the cement *	AS 2350.2			
	Shrinkage data	AS 2350.13			
	Time of peak temp. (Type LH)	AS 2350.7			
Additional Tests		Autoclave expansion to limits given in ASTM C 151 *	AS/NZS 2350.17 or AS 3583.4		

# Whichever is more frequent.

P = factory production, tonne/week/product

## Certificate to specify whether by test or by calculation from the portland cement and SCM reports. With compliance to:  $\mu \leq 0.05\%$  &  $\mu + 4.5\sigma \leq 0.10\%$ , where  $\mu$  is the mean value and  $\sigma$  is the standard deviation of the last 12 months production data, at the discretion of ATIC, a test frequency of 1/month may be accepted. But in the event of a single result value being  $\geq 0.07\%$ , the frequency will revert to that of Table A1, proven source.

\* When magnesia (MgO) > 4.5%, autoclave expansion test required

\*\* Reportable property for blended cements

**A3.6 DE-REGISTRATION:** Systemic failure OR a series of testing failures OR other evidence, including failure to advise of significant production changes, or loss of testing and traceability records or events that demonstrates the process is out of control, will result in de-registration of all registered product from that source, ineligible for use on any works covered by Section SP43.

**A3.7 RE-REGISTRATION:** Following de-registration, for re-registration, the extent of data required to be negotiated, to suit the classification of the material and the specific circumstances of the incident, at the discretion of ATIC.

**A3.8 RE-CLASSIFICATION:** The following to apply:

- Requests for change from an “unproven source” to a “proven source”, will be accepted on the provision of at least six (6) months compliant test results for the former.
- The opposite situation of “proven source” to “unproven source” occurs when there is either, a interruption of production for more than six (6) months OR a significant change to raw materials or production operation, that could significantly impact on product properties. Early advice to the RTA Lab of these events, will avoid un-necessary de-classification.
- Following de-classification, for re-classification, the extent of data required to be negotiated to suit the classification of the material and the specific circumstances of the incident, at the discretion of ATIC.

**TABLE A2: FLY ASH TO AS 3582.1**

Characteristic	Clause	Requirement	Test Method	Source & Frequency		
<b>Type Tests</b>						
Material Properties & Performance		For registering or re-registering materials, use “Unproven Source” & other testing from last 6 months, to establish control limits and other data		At change of material source or production operation (##) or interruption of production for 6 months		
<b>Process Control Monitoring or Lot Release Tests</b>				<b>Proven (#)</b>	<b>Unproven (#)</b>	
Specified Requirements	6.1	Fineness	AS 3583.1	500 tonne OR 6 hourly	###	
		Loss on ignition	AS 3583.3			
		Moisture content	AS 3583.2	Monthly	Lot** OR 3000 t OR weekly	
	6.2	Chloride ion content	AS 3583.13 *			
		Available alkali content	AS 3583.12			
	6.1	Sulfuric anhydride content SO <sub>3</sub>	AS 3583.8			
Reportable Properties	-	Total alkali content	AS 2350.2			500 tonne OR daily
	6.2	Relative density	AS 3583.5			
		Relative water requirement	AS 3583.6			
		Relative strength	AS 3583.6			
Additional test	-	Magnesia content ***	AS 3583.9		Lot** OR 3000 tonne OR weekly	

# Whichever is more frequent

t = tonne

## Includes change of power station or furnace operation, or method of ash collection and treatment.

### For a source having less than 3 months production record, for the first 4 weeks, increase to each lot or 100 tonne, then for the next 8 weeks, each 300 tonne

\* Fly ash may be optionally tested to AS 2350.2

\*\* Lot is applicable where source furnace is operated intermittently.

\*\*\* If unproven source magnesia testing, for a period not less than 6 months, shows content less than 3%, adopt proven source frequency.

**A3.9 SWAPPING OF PROVEN SOURCES:** Swapping of proven source materials may be accepted provided that the new product data has been reviewed by the manufacturer’s nominated product specialist for consistent material properties, and early advice given to the RTA Lab, customers and other parties nominated in the project specifics.

**A3.10 CHANGE OF RAW MATERIAL:** Changes of constituent raw materials for “proven sources” may be accepted provided that:

- Production records have been reviewed by the manufacturer’s nominated product specialist and are sufficient to demonstrate the process is in control and final product properties are not significantly different from the registered product
- Early advice given to the RTA Lab, customers and other parties nominated in the project specifics.

**A3.11 TEST SAMPLES:** The test sample shall be the amount of product necessary to provide material for the tests required for Section SP43, “which is representative of the product manufactured or of the individual identifiable lots sold or offered for sale”. [CSA A3001-03] Test samples to be taken individually and chosen randomly.

Composite samples are not accepted, the single exception being portland and blended cements for factory productions of less than 2,000 tonne/week/product. For small quantities of product (eg: amorphous silica), negotiation on a project by project basis may be considered.

**TABLE A3: SLAG TO AS 3582.2**

Characteristic	Clause	Requirement	Test Method	Source & Frequency	
<b>Type Tests</b>					
Material Properties & Performance		For registering or re-registering materials, use “Unproven Source” & other testing from last 6 months, to establish control limits and other data		At change of material source or production operation (##) or interruption of production for 6 months	
<b>Process Control Monitoring or Lot Release Tests</b>				<b>Proven (#)</b>	<b>Unproven (#)</b>
Specified Properties	7.1	Loss on ignition	AS 3583.3	3,000 tonne OR monthly	Lot OR 1,000 tonne
		Insoluble residue	AS 3583.14		
	7.2	Chloride ion (Cl) content	AS 3583.13 *		
		Available alkali content	AS 3583.12		
	7.1	Sulfide sulfur (S) content	AS 3583.7	20,000 tonne OR monthly	OR weekly
		Magnesia (MgO) content	AS 3583.9		
		Alumina (Al <sub>2</sub> O <sub>3</sub> ) content	AS 3583.10		
		Total iron (FeO) content	AS 3583.10		
	Manganese (MnO) content	AS 3583.11			
Reportable Properties & Characteristics	7.2	Fineness **	AS 3583.1	1,000 tonne OR daily	Lot OR 100 t OR 2 hourly
		Sulfuric anhydride (SO <sub>3</sub> ) content	AS 3583.8	3,000 tonne OR monthly	Lot OR 1,000 tonne OR weekly
		Relative water requirement	AS 3583.6		
		Relative strength	AS 3583.6		
	Total alkali content	AS 2350.2			
Other tests		Relative density	AS 3583.5		

\* Slag may be optionally tested to AS 2350.2 # Whichever is more frequent. t = tonne

\*\* Daily process control Blaine testing, to AS 2350.8, accepted in lieu

**A3.12 TESTING FAILURE:** In the event of a test failure, the manufacturer shall notify the RTA Lab, customers and other parties nominated in the project specifics.

**A3.13 LOT:** “An identifiable quantity of material, such as loads in trucks, rail cars, or boats, material in silo storage, or bagged material” [CSA A3001-03] from a single source.

**A3.14 ACCEPTANCE CRITERIA:** Production records from proven source manufacturers to demonstrate process is in-control and meets the criteria of AS 3972, and the AS 3582 Series, and additionally, unless otherwise specified, composition of:

- Portland cement not to exceed 0.6% total alkali content (Na<sub>2</sub>O equiv)
- Fly ash not to exceed 0.5% available alkali (Na<sub>2</sub>O equiv)
- Slag not to exceed 0.5% available alkali (Na<sub>2</sub>O equiv)
- Amorphous silica not to exceed 0.5% available alkali (Na<sub>2</sub>O equiv)
- For reinforced and prestressed concrete, unless otherwise specified, the mass of chloride ion in all cementitious materials not to exceed 0.05%, except amorphous silica not to exceed 0.20%.

**A3.15 BLEND VERIFICATION:** Adopt the following, to ± 3% proportions acceptance tolerance, for each of the nominated cementitious materials:

- Sampling and testing of blended SCM shall be as specified for its predominant SCM component. For a 50/50 blend, the sampling and testing shall be as specified for the component with the higher frequency of sampling and testing. [CSA A3004-03]
- For periodic low volume blends of “proven source” materials (eg: ‘dial-a-blend’), verify the process, using as a minimum, a weekly chemical composition test from a grab sample.
- For low volume special blends for critical projects, an increase in frequency of the verification test may be specified.

**TABLE A4: AMORPHOUS SILICA TO AS/NZS 3582.3**

Characteristic	Clause	Requirement	Test Method	Source & Frequency	
<b>Type Tests</b>					
Material Properties & Performance		For registering or re-registering materials, use “Unproven Source” & other testing from last 6 months, to establish control limits and other data		At change of material source or production operation or interruption of production for 6 months	
<b>Process Control Monitoring or Lot Release Tests ##</b>				<b>Proven (#)</b>	<b>Unproven (#)</b>
Specified Properties	5.1	Moisture content (slurry excluded)	AS 3582.2	500 tonne OR monthly	Weekly
		Loss on ignition	AS 3583.3		Lot OR 100 tonne (manufact'd or mined)
		Sulfuric anhydride content SO <sub>3</sub>	AS 3583.8		
		Total silica content SiO <sub>2</sub>	AS 2350.2		
	5.2	Available alkali content	AS 3583.12		
	Chloride ion content	AS 3583.13 *			
Reportable Properties & Characteristics	5.2	Surface area	AS 2879.4		Weekly
		Total alkali content	AS 2350.2		
		Relative strength	ASTM C1240		
		Bulk density, loose	AS 4489.10.1		
Additional Tests		Relative density	AS 3583.5		
		Fineness	Method & frequencies to be determined		

# Whichever is more frequent ## All tests are on undensified material or slurry, prior to processing.

\* Amorphous silica may be optionally tested to AS 2350.2

**A3.16 SAMPLING PLAN:** A specific plan which indicates the number of units of product to be inspected.

**A3.17 TYPE TESTING (TT):** Testing performed to prove that the product is capable of conforming to the requirements given in the relevant standard.

APPENDIX B

APPLICATIONS & ENVIRONMENTS

**B1 SPECIFIC CEMENT BLENDS WITH ONE SCM**

Table B1 contains a range of solutions for some typical environments or applications using a single SCM. The table is by % of total combined weight (portland cement portion not shown).

**TABLE B1: APPLICATIONS: SCM % (MIN TO MAX)**

SCM	GENERAL	* ALKALI SILICA REACTION	ACID SULFATE SOILS	SALINE & MARINE	WATER SUPPLY	SGE #
Fly Ash	20 to 40	20 to 30	20 to 30	20 to 40	20 to 40	20 to 30
Slag	30 to 50	50 to 70	50 to 70	50 to 70	50 to 70	50 to 70
Amorphous Silica	4 to 6	8 to 10	7 to 10	7 to 10	4 to 10	7 to 10

\* For ASR minimisation, if not using pre-blended cement, use 25% fly ash content

# Sewerage, for combined low heat and sulphate resistance

**B2 DEEMED-TO-COMPLY SOLUTIONS**

Table B4 shows more specific options for cement selection related to the level of aggressive ions present in the water surround. The nominated cement types are accepted as deemed-to-comply solutions, in soils of medium to high permeability and in static water. The classifications are similar, but not equal to those given in AS 3600, AS 3735 and AS 5100. Table B4 is for application with Section SP45 Concrete Supply Special Class [being revised to include durability] and AS 3600, as part of the total mix design for strength and durability.

**TABLE B2: EXPOSURE TO SULFATE # (CHLORIDE < 2,000 PPM)**

SULFATES (ppm) (IN WATER SURROUND)	4.5 < pH < 5.5	5.5 < pH < 6.5	pH > 6.5
< 400	3	2	1
400 to 1,500	4	3	2
1,500 to 3,000	4	3	3
3,000 to 6,000	X	4	4
> 6,000	X	X	4

# If magnesium ions (Mg<sup>2+</sup>) exceed 1000 ppm, assume an aggressivity of one higher class.

**TABLE B3: EXPOSURE TO SULFATES & CHLORIDES**

Cl <sup>-</sup> & SO <sub>4</sub> <sup>2-</sup> (ppm) (IN WATER SURROUND)	pH > 6.5		
	CHLORIDES (ppm)		
SULFATES (ppm)	< 2000	2,000 to 6,000	6,000 to 30,000
< 400	1	2	4
400 to 1,500	2	2	4
1,500 to 3,000	3	3	4
3,000 to 6,000	4	4	4

**TABLE B4: DEEMED-TO-COMPLY SOLUTIONS**

CLASSIFICATIONS	CEMENT TYPE	CEMENT BLEND #	
		PC/FA	PC/SLAG
1 (non-aggressive)	GP or GB	–	–
2 (mild)	GB	–	–
3 (moderate)	–	80/20 to 70/30	–
4A (severe) Cl <sup>-</sup> < 2,000 ppm	–	75/25 to 60/40	50/50 to 30/70
4B (severe) Cl <sup>-</sup> > 2,000 ppm	–	75/25 to 60/40	50/50 to 30/70
X	Expert advice required		

# Blend proportions “portland cement / fly ash” and “portland cement / slag”. Blends to have a known history of effective sulfate resistance.

Cl<sup>-</sup> = chlorides      SO<sub>4</sub><sup>2-</sup> = sulphates