CP 97-2:2004(2020)
(ICS 91.200)

SINGAPORE STANDARD

# Code of practice for construction electronic measurement standards (CEMS)

## – Part 2 : Standard method of measurement (SMM) for mechanical and electrical works

Confirmed and classified as a mature standard 2020

Singapore Standards Council

**CP 97-2:2004(2020)**
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# Code of practice for construction electronic measurement standards (CEMS)

– Part 2 : Standard method of measurement (SMM) for mechanical and electrical works

Published by Enterprise Singapore



ISBN 9971-67-950-7

This Singapore Standard was approved by the Information Technology (IT) Standards Committee on behalf of the Standards Council of Singapore on 20 January 2004.

First published, 2004

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The experts of the Working Group are nominated/recommended by the following organisations:

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*Dai Dan Co Ltd*
*Institution of Engineers Singapore*
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*Real Estate Developers Association of Singapore*

*Sanyo Engineering & Construction Inc*
*Singapore Contractors Association Limited*
*Singapore Institute of Architects*
*Singapore Institute of Surveyors and Valuers*
*Squire Mech Pte Ltd*

The Technical Committee acknowledges the contribution of the following consultants in preparing this standard:

1. Davis Langdon & Seah Singapore Pte Ltd - Mr Seah Choo Meng, Mr Amos Teo Ching Ming, Mr Eugene Seah, Mr Sunny Li and Ms Jasmine Yeo
2. KPK Quantity Surveyors Singapore Pte Ltd - Mr Billy Wong

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## Foreword

Since the introduction of the use of Bills of Quantities to the building trade in Singapore and Malaya from the early nineteen thirties, 'The Standard Method of Measurement of Building Works', as published in England by the Royal Institution of Chartered Surveyors, has been adopted as a broad basis for measuring building works.

The First Edition of the Standard Method of Measurement of Building Works (SMM, November 1959) aimed to standardise modifications that were made to suit individual requirements and the demands of local conditions and practice. The Second Edition (SMM2, September 1986) updated and improved provisions that were rendered obsolete by changing technology, improved methods of construction and the advent of new materials.

Continuing developments in the construction industry together with an increased awareness to improve productivity and quality, gave rise to a need to review the SMM2. Rapid advances in information technology in the last decade have made it possible for software programs to automatically extract quantities of various elements of a building or infrastructure works. The CEMS therefore defines the principles whereby the quantities should be extracted electronically and presented in an appropriate Bills of Quantities format.

This Singapore Standard was prepared by the Technical Committee on Construction IT Standards (CITC) under the direction of the Information Technology Standards Committee (ITSC). The Measure Work Group was appointed by the CITC to develop the CEMS as the national standard facilitating the development of Automated Quantity Taking-Off Systems (AQTS). The CEMS comprises 2 parts. Part 1 covers building works whilst Part 2 covers mechanical and electrical works.

The CEMS adopts the format of the 'Works section classification' of SS CP 80 : 1999 "Classification of construction cost information". In addition to the incorporation of Information Technology requirements for AQTS, one major change from the previous editions of the SMM is the presentation of measurement rules in classification tables as well as the parameters for SS CP 83 : 2000 series of standards on construction computer-aided design (CAD). This layout is appropriate for establishing the framework for AQTS development. Tabulated rules offer clarity of presentation, ease of use and encourage clear and consistent interpretation of the rules. This approach also prepares the way for the use of standard phraseology in the future. The measurement rules have also generally been simplified and the document brought up to date to keep abreast of modern practices.

Prior to the publication of this standard, every suggestion, observation and comment received has been carefully reviewed and considered in the context of current and future practices and CEMS objectives. Where appropriate, they have been incorporated in the CEMS.

The Singapore Standard was prepared with reference to the following publications:

1. Standard Method of Measurement of Building Works (Second Edition) by the Singapore Institute of Surveyors and Valuers

2. Singapore Standard CP 80 : 1999 Classification of construction cost information

3. Singapore Standard CP 83 : Code of practice for construction computer-aided design (CAD)

   Part 1 : 2000 Organisation and naming of CAD layers

   Part 2 : 2000 CAD symbols

4. Singapore Standard CP 93 : 2002 Classification of construction resources information

5. Singapore Standard CP 97 : 2002 Construction Electronic Measurement Standards (CEMS) – Part 1 : Standard method of measurement (SMM) for building works

6. National Productivity and Quality Specifications

7. A Code of Practice for Measurement of Building Works SMM7 Measurement Code Revised 1998 Incorporating Amendments 1 & 2 (UK)

8. Standard Method of Measurement of Building Works Seventh Edition Revised 1998 Incorporating Amendments 1 & 2 (UK)

9. Civil Engineering Standard Method of Measurement Third Edition Reprinted 1992 with corrections (UK)

10. Hong Kong Standard Method Measurement for Building Services, First Edition, May 1993

11. Standard of Method of Measurement of Building Works For The Philippines Second Edition 1999

12. The Australian Standard Method of Measurement of Building Works Fifth Edition

13. Malaysian Standard Method of Measurement for Building Works (SMM2)

14. Coordinated Project Information Series

15. Project Specification: A Code of procedure for building works

16. Nisa (Northcroft Lim Consultants Pte Ltd)

17. ATLES III (Davis Langdon & Seah Singapore Pte Ltd)

18. ATLES Pro (Davis Langdon & Seah Singapore Pte Ltd)

19. MasterFormat: Master list of numbers and titles for the construction industry by the Construction Specifications Institute (US) and Construction Specifications Canada, 6th printing, December 1996

20. Uniclass: Unified classification for the construction industry, First edition, 1997, published by RIBA Publications.

21. Building Cost Information Service of RICS

22. Reference materials, brochures, white papers, articles, specifications, handbooks and web information related to and derived from various CAD application software which are able to extract measurements and capture quantities.

Acknowledgement is made for the use of information from the above references.



**NOTE**

1. *Singapore Standards are subject to periodic review to keep abreast of technological changes and new technical developments. The changes in Singapore Standards are documented through the issue of either amendments or revisions.*

2. *Compliance with a Singapore Standard does not exempt users from legal obligations.*

# Code of practice for construction electronic measurement standards (CEMS) – Part 2 : Standard method of measurement (SMM) for mechanical and electrical works

## 0 Introduction

The Construction Electronic Measurement Standards (CEMS) provides a uniform basis for measuring mechanical and electrical works and preparing Bills of Quantities. The CEMS sets the rules by which the quantity and quality of the works to be carried out are to be measured and described.

It also aims to provide a common standard for the production of drawn information and the development of Automated Quantities Taking-Off Systems (AQTS) software applications. The rules of measurement are presented in a structured format suited for programmers to translate them into computer codes necessary for the development of AQTS software applications from CAD drawings, subject to the state of technology at its point of development.

Under the BCA's CORENET development framework, the procurement process has been identified as an area of much potential to derive vast productivity and quality gain through computerisation and automation. One of the key considerations of the CEMS is to improve the procurement process through definition of items and/or work sections that will facilitate contractors to source for labour and materials in their construction contracts.

The CEMS therefore serves the following objectives:

**0.1** Establishing the rules as standard methods of measurement for scheduling work items and measuring their quantities in a format that will facilitate the development of AQTS software applications for M&E works;

**0.2** Enabling easy exchange of data between CEMS, National Productivity and Quality Specifications (NPQS) and CAD drawings/objects through a data structure which supports an electronic model suitable for sharing data across applications;

**0.3** Improving the procurement process of contractors by the relational mapping of CEMS classifications against the SS CP 93 : 2002 to enable electronic procurement of construction products, materials and services.

## 1 Scope

This standard comprises:

**1.1** Guidance notes and general principles (rule 2 herein)

**1.2** Measurement rules for items related to mechanical and electrical works (sections 19000000 to 22000000)

The CEMS fulfills a bridging role by adapting current practices as well as defining the standards for future AQTS applications. As such, the items in the CEMS are both general and specific in terms of elemental breakdowns, work sections and measured items. The measurement rules in the CEMS are applicable to both general and specific items. For AQTS software development purposes, the CEMS provides attributes and operation templates for Object Oriented Modelling (OOM) but is by no means exhaustive as there are multiple permutations and terminologies for a single object model.

The users of this standard may include property developers, architects, mechanical and electrical engineers, civil and structural engineers, quantity surveyors and contractors.