**TR 141:2025**
(ICS 91.140.30)

**TECHNICAL REFERENCE**

# Hybrid cooling system for air-conditioning

Singapore Standards Council

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## Contents

## Foreword

This Technical Reference (TR) was prepared by the Working Group on Hybrid Cooling System for Air-conditioning set up by the Technical Committee on Building Maintenance and Management under the purview of the Building and Construction Standards Committee.

This TR introduces the design and operation of hybrid cooling systems as an alternative cooling approach. A hybrid cooling system is designed to maintain indoor environments at a higher set-point temperature, supplemented by elevated air speeds to achieve occupant thermal comfort. The aim of the TR is to accelerate its adoption by designers and users in the industry.

This TR is a provisional standard made available for application over a period of three years. The aim is to use the experience gained to update the TR so that it can be adopted as a Singapore Standard. Users of the TR are invited to provide feedback on its technical content, clarity and ease of use. Feedback can be submitted using the form provided in the TR. At the end of the three years, the TR will be reviewed, taking into account any feedback or other considerations, to further its development into a Singapore Standard if found suitable.

In preparing this TR, reference was made to the following publications:

1. ANSI/ASHRAE Standard 55:2023 Thermal environmental conditions for human occupancy

2. ANSI/ASHRAE Standard 216:2020 Methods of test for determining application data of overhead circulator fans

3. ANSI/AMCA Standard 230:23 Laboratory methods of testing air circulating fans for rating and certification

4. ISO/IEC 27002:2022 Information security, cybersecurity and privacy protection – Information security control

5. TR 111:2023 Securing cyber-physical systems for buildings

6. Center for the Built Environment, University of California, Berkeley – Fans for cooling people guidebook

7. Design for Maintainability Guide – Non-residential (Version 2.0)

8. Green Mark 2021

Permission has been sought from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to reproduce the definition of 'thermal comfort' into this TR. ©ASHRAE, www.ashrae.org. (2023) ANSI/ASHRAE Standard-55, 'Thermal environmental conditions for human occupancy'.

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

Attention is drawn to the possibility that some of the elements of this TR may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

**NOTE**

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "mature standards". Mature standards will not be subject to further review unless there are requests to review such standards.*

2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*

3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

# Hybrid cooling system for air-conditioning

## 1 Scope

This Technical Reference (TR) sets out provisions for the design, performance, installation and maintenance of a hybrid cooling system.

This TR is intended for application across various building types, including commercial and office buildings, whether new or undergoing retrofitting.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

| | |
|---|---|
| ANSI/ASHRAE Standard 55:2023 | Thermal environmental conditions for human occupancy |
| IEC 61672-1 | Electroacoustics − Sound level meters − Part 1: Specifications |
| SS 530 | Code of practice for energy efficiency for building services and equipment |
| SS 531-1 | Code of practice for lighting of work places – Part 1: Indoor |
| SS 553 | Code of practice for air-conditioning and mechanical ventilation in buildings |

## 3 Terms and definitions

For the purpose of this Technical Reference, the following terms and definitions apply.

### 3.1 Building management system (BMS)

A system with capabilities beyond basic operational task automation.

Note 1 to entry: An example of a BMS is a system that provides a dashboard to enable integrated operations, such as a surveillance system integrated with smart lighting, or management of multiple sites within a building.

### 3.2 Ceiling fan

A non-portable device suspended from a ceiling or false ceiling, designed to circulate air through the rotation of fan blades.

### 3.3 Cooling effect

Differences in standard effective temperature (SET) between calm condition and elevated air speed.

### 3.4 Hybrid cooling system

A cooling system where the design and operational indoor set-point temperature of the air-conditioning system is increased and supplemented with elevated air speed to achieve acceptable occupants' thermal comfort.