

Our Ref: APPBCA-2023-06

Environmental Sustainability Group

1 March 2023

See Distribution List

Dear Sir/ Madam

CIRCULAR TO PROFESSIONAL INSTITUTES/ ASSOCIATIONS

ADOPTION OF THE CODE ON PERIODIC ENERGY AUDIT OF BUILDING COOLING SYSTEM (EDITION 4.0)

Aim

1 This circular is to inform the industry on the adoption of the Code on Periodic Energy Audit of Building Cooling System (Edition 4.0) (the “**Energy Audit Code**”) under the Building Control (Environmental Sustainability Measures for Existing Buildings) Regulation 2013.

Background

2 Under 22FF of the Building Control Act, building owners will be served a Notice to conduct an energy audit on their building cooling systems. The energy audit shall be carried out by a Professional Engineer (Mechanical) or an energy auditor registered with BCA and to be conducted in the prescribed manner specified in the Energy Audit Code.

3 The objective of the energy audit requirement is to ensure that the building cooling systems installed continue to operate as efficiently as designed. The level of operating system efficiency (OSE) of these systems must minimally meet the prescribed energy performance standard stipulated in the Codes and Green Mark Certification Standard referred to in the Building Control (Environmental Sustainability) Regulations 2008 (the “**ES Regulations 2008**”) and the Building Control (Environmental Sustainability Measures for Existing Buildings) Regulations 2013 (the “**ESM Regulations 2013**”).

Adoption of the Energy Audit Code

4 The Energy Audit Code is revised to align with the recent changes to the prescribed minimum energy performance standards spelled out in the following Codes and Standards namely :

- (a) Code for Environmental Sustainability of Buildings (Edition 4.0);
- (b) Code for Environmental Sustainability Measures for Existing Buildings (Edition 3.0); and
- (c) Green Mark Certification Standard 2021

5 The energy audit report submission template provided in the Energy Audit Code is also updated to include data required in relation to the total cooling system efficiency as well as the verification check requirement as part of the energy audit process.

6 The [Energy Audit Code](#) will apply to all energy audit reports submitted on or after 1 June 2023. The summary of key changes is detailed in Annex A for reference.

For Clarification

7. We would appreciate if you could convey the contents of this circular to members of your organisation. For clarification, please submit your enquiry through [BCA's Online Feedback Form](#) or call us at 1800 342 5222.

Thank you.

Yours faithfully



ANG KIAN SENG
GROUP DIRECTOR
ENVIRONMENTAL SUSTAINABILITY GROUP
BUILDING AND CONSTRUCTION AUTHORITY
for COMMISSIONER OF BUILDING CONTROL

DISTRIBUTION (via e-mail):

President
Real Estate Developer Association of Singapore (REDAS)
190 Clemenceau Avenue
#07-01 Singapore Shopping Centre
Singapore 239924

President
Singapore Institute of Architects (SIA)
79 Neil Road
Singapore 088904

President
The Institution of Engineers, Singapore (IES)
70, Bukit Tinggi Road
Singapore 289758

President
Association of Consulting Engineers Singapore (ACES)
18 Sin Ming Lane
#06-01 Midview City
Singapore 573960

President
Singapore Contractors Association Limited (SCAL)
1 Bukit Merah Lane 2
Construction House
Singapore 159760

President
Specialists Trade Alliance of Singapore
24 Peck Seah Street
#07-11 Nehsons Building
Singapore 079314

President
Society of Project Managers (SPM)
200 Braddell Road, BCA Academy,
Block H, Level 2, Singapore 579700

President
Singapore Institute of Building Limited (SIBL)
No. 9 Ah Hood Road,
#02-04, Singapore 329975

President
Singapore Institute of Surveyors & Valuers (SISV)
110 Middle Road
#09-00 Chiat Hong Building
Singapore 188968

President
Singapore Institute of Planners
(c/o Singapore Professional Center)
93 Toa Payoh Central #05-01
Toa Payoh Central Community Building
Singapore 319194

President
Association of Property & Facility Managers (APFM)
110 Middle Road
#09-00 Chiat Hong Building
Singapore 188968

President
Singapore International Facility Management Association (SIFMA)
200H Braddell Road
#01-03, BCA Braddell Campus
Singapore 579700

President
Singapore Green Building Council (SGBC)
Block H, #02-04
BCA Braddell Campus
200 Braddell Road
Singapore 579700

Chairman
Sustainable Energy Association of Singapore (SEAS)
180 Kitchener Road
#06-10 City Square Mall
Singapore 208539

Registrar
Board of Architects (BOA)
5 Maxwell Road
#01-03 Tower Block
MND Complex
Singapore 069110

Registrar
Professional Engineers Board, Singapore
52 Jurong Gateway Road
#07-03 Singapore 608550

Group Director
Land Sales Administration Group
Urban Redevelopment Authority (URA)
45 Maxwell Road
The URA Centre
Singapore 069110

Group Director
Development Group
Land Planning & Redevelopment
JTC Corporation
The JTC Summit
8 Jurong Town Hall Road
Singapore 609434

Director
Technical Services Division
JTC Corporation
The JTC Summit
8 Jurong Town Hall Road
Singapore 609434

Group Director
Properties and Land Group
Housing Development Board (HDB)
HDB Hub
480 Lorong 6 Toa Payoh
Singapore 310480

Director
Land Operation
Land Transfer & Land Sale Division
Singapore Land Authority (SLA)
55 Newton Road
#12-01 Revenue House
Singapore 307987

All CORENET e-Info subscribers

All BCA Registered Energy Auditors

Annex A – Amendments to the Energy Audit Code

Items	Requirements																																																										
Minimum Operating System Efficiency (OSE)Standard - ESM Reg 2013 - ES Reg 2008	Minimum OSE standards applicable for buildings for which the design score submission under the ESM Regulations 2013 were made on or after 1 June 2022. <table><tr><th colspan="7">Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)</th></tr><tr><td>Existing Building with Major Energy-Use Change</td><td colspan="6">0.9 kW/RT</td></tr><tr><td colspan="7">where TSE refers to combined system efficiency of the chiller plant and air distribution systems and the minimum requirement on water-side component efficiency will be based on the chilled water supply temperature and as follows:</td></tr><tr><th colspan="7">Minimum Water-Cooled Chilled Water Plant Efficiency</th></tr><tr><td>Chilled Water Supply Temp (°C)</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td rowspan="2">For chilled water supply temp above 10°C, the threshold will be adjusted from 0.64kW/RT for every 1°C increase in chilled water temperature</td></tr><tr><td>Water-Cooled Chiller System Efficiency (kW/RT)</td><td>0.68</td><td>0.67</td><td>0.66</td><td>0.65</td><td>0.64</td></tr></table> <table><tr><th colspan="2">Total System Efficiency (TSE) for Air-Cooled Building Cooling System (kW/RT)</th></tr><tr><td>Existing building with Major Energy-Use Change</td><td>1.0 kW/RT</td></tr><tr><td colspan="2">where the minimum water-side component efficiency for air-cooled chilled water plant is 0.85 kW/RT</td></tr></table> Minimum OSE standards applicable for buildings on land sold on or after 1 June 2022 under the Government Land Sales Programme and subject to ES Regulations 2008. <table><tr><th colspan="3">Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)</th></tr><tr><th rowspan="2">Green Mark Certification Standard</th><th colspan="2">Building Type</th></tr><tr><th>Office/ Retail/ Hotel/ IHL</th><th>Other Building Types</th></tr><tr><td>Green Mark Platinum Super Low Energy (SLE)</td><td>0.68 kW/RT</td><td>0.7 kW/RT</td></tr></table>	Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)							Existing Building with Major Energy-Use Change	0.9 kW/RT						where TSE refers to combined system efficiency of the chiller plant and air distribution systems and the minimum requirement on water-side component efficiency will be based on the chilled water supply temperature and as follows:							Minimum Water-Cooled Chilled Water Plant Efficiency							Chilled Water Supply Temp (°C)	6	7	8	9	10	For chilled water supply temp above 10°C, the threshold will be adjusted from 0.64kW/RT for every 1°C increase in chilled water temperature	Water-Cooled Chiller System Efficiency (kW/RT)	0.68	0.67	0.66	0.65	0.64	Total System Efficiency (TSE) for Air-Cooled Building Cooling System (kW/RT)		Existing building with Major Energy-Use Change	1.0 kW/RT	where the minimum water-side component efficiency for air-cooled chilled water plant is 0.85 kW/RT		Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)			Green Mark Certification Standard	Building Type		Office/ Retail/ Hotel/ IHL	Other Building Types	Green Mark Platinum Super Low Energy (SLE)	0.68 kW/RT	0.7 kW/RT
	Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)																																																										
	Existing Building with Major Energy-Use Change	0.9 kW/RT																																																									
	where TSE refers to combined system efficiency of the chiller plant and air distribution systems and the minimum requirement on water-side component efficiency will be based on the chilled water supply temperature and as follows:																																																										
	Minimum Water-Cooled Chilled Water Plant Efficiency																																																										
	Chilled Water Supply Temp (°C)	6	7	8	9	10	For chilled water supply temp above 10°C, the threshold will be adjusted from 0.64kW/RT for every 1°C increase in chilled water temperature																																																				
	Water-Cooled Chiller System Efficiency (kW/RT)	0.68	0.67	0.66	0.65	0.64																																																					
	Total System Efficiency (TSE) for Air-Cooled Building Cooling System (kW/RT)																																																										
	Existing building with Major Energy-Use Change	1.0 kW/RT																																																									
	where the minimum water-side component efficiency for air-cooled chilled water plant is 0.85 kW/RT																																																										
Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)																																																											
Green Mark Certification Standard	Building Type																																																										
	Office/ Retail/ Hotel/ IHL	Other Building Types																																																									
Green Mark Platinum Super Low Energy (SLE)	0.68 kW/RT	0.7 kW/RT																																																									

- Minimum OSE standards applicable to buildings where the applications for planning permission were submitted to the competent authority under the Planning Act 1998 on or after 1 Dec 2021 under the ES Regulations 2008.

Total System Efficiency (TSE) for Water-Cooled Building Cooling System (kW/RT)							
New Buildings <i>(based on classification under the Code for Environmental Sustainability of Building (Edition 4.0))</i>				Existing Buildings undergoing Major Retrofitting/ Additions & Alterations			
0.85 kW/RT				0.9 kW/RT			
where the minimum water-side component efficiency for commercial building development shall not be more than 0.63 kW/RT. As for other building developments, the minimum water-side component efficiency will be based on the chilled water supply temperature and as follows:							
Minimum Water-Cooled Chilled Water Plant Efficiency (KW/RT)							
Commercial Building	Other Building Developments						For chilled water supply temp above 10°C, the threshold will be adjusted from 0.64kW/RT for every 1°C increase in chilled water temperature
	Chilled Water Supply Temp (°C)	6	7	8	9	10	
0.63 kW/RT	Water-Cooled Chiller System Efficiency (kW/RT)	0.68	0.67	0.66	0.65	0.64	

Total System Efficiency (TSE) for Air-Cooled Building Cooling System (kW/RT)	
All buildings including existing buildings undergoing Major Retrofitting / Major Additions and Alterations	1.0 kW/RT
where the minimum water-side component efficiency for air-cooled chilled water plant is 0.85 kW/RT	

Verification Check by appointed Qualified Professionals PE(Mech) or Energy Auditor (EA)	<table><tr><td>BMS Check</td></tr><tr><td>1. Temperature sensors' ABC coefficient constants input as reflected in the calibration certificates</td></tr><tr><td>Power Meter (Consistency Check)</td></tr><tr><td>2. Check power meter reading and BMS reading are same</td></tr><tr><td>3. Check power meter reading and chiller panel or pump VSD display reading is $\leq 3\%$</td></tr><tr><td>4. Check the Current Transformer ratio tallies with power meter setting</td></tr><tr><td>Flow Meter</td></tr><tr><td>5. Check sum of flow meter branches tallies with flow meter header reading (if there are flowmeters at header and individual chillers)</td></tr><tr><td>6. Check flowmeter reading and BMS reading are same</td></tr><tr><td>7. Check flowmeter do not have any correction factor or off-set factor input</td></tr><tr><td>Verified Temperature Sensor Accuracy</td></tr><tr><td>8. Use calibrated reference temperature sensor with end-to-end uncertainty of owners of buildings with poor energy performance $\leq 0.05\text{ }^{\circ}\text{C}$</td></tr><tr><td>9. Synchronise the reference temperature sensor device timing with BMS</td></tr><tr><td>10. Collect at least 20 sets of reading from reference temperature sensor device (after insertion into spare test plug) and BMS</td></tr><tr><td>11. Compare the difference between both set of readings, with average of absolute difference to be $\leq 0.07\text{ }^{\circ}\text{C}$</td></tr></table>	BMS Check	1. Temperature sensors' ABC coefficient constants input as reflected in the calibration certificates	Power Meter (Consistency Check)	2. Check power meter reading and BMS reading are same	3. Check power meter reading and chiller panel or pump VSD display reading is $\leq 3\%$	4. Check the Current Transformer ratio tallies with power meter setting	Flow Meter	5. Check sum of flow meter branches tallies with flow meter header reading (if there are flowmeters at header and individual chillers)	6. Check flowmeter reading and BMS reading are same	7. Check flowmeter do not have any correction factor or off-set factor input	Verified Temperature Sensor Accuracy	8. Use calibrated reference temperature sensor with end-to-end uncertainty of owners of buildings with poor energy performance $\leq 0.05\text{ }^{\circ}\text{C}$	9. Synchronise the reference temperature sensor device timing with BMS	10. Collect at least 20 sets of reading from reference temperature sensor device (after insertion into spare test plug) and BMS	11. Compare the difference between both set of readings, with average of absolute difference to be $\leq 0.07\text{ }^{\circ}\text{C}$
BMS Check																
1. Temperature sensors' ABC coefficient constants input as reflected in the calibration certificates																
Power Meter (Consistency Check)																
2. Check power meter reading and BMS reading are same																
3. Check power meter reading and chiller panel or pump VSD display reading is $\leq 3\%$																
4. Check the Current Transformer ratio tallies with power meter setting																
Flow Meter																
5. Check sum of flow meter branches tallies with flow meter header reading (if there are flowmeters at header and individual chillers)																
6. Check flowmeter reading and BMS reading are same																
7. Check flowmeter do not have any correction factor or off-set factor input																
Verified Temperature Sensor Accuracy																
8. Use calibrated reference temperature sensor with end-to-end uncertainty of owners of buildings with poor energy performance $\leq 0.05\text{ }^{\circ}\text{C}$																
9. Synchronise the reference temperature sensor device timing with BMS																
10. Collect at least 20 sets of reading from reference temperature sensor device (after insertion into spare test plug) and BMS																
11. Compare the difference between both set of readings, with average of absolute difference to be $\leq 0.07\text{ }^{\circ}\text{C}$																
Total building cooling system efficiency to include airside component	- Changes to incorporate in Appendix C of the Energy Audit Report Template (provided in Annex A of the Energy Audit Code) - The super-imposed plot of daily total cooling system efficiency (kW/RT) to be provided as illustrated in Figure 21.															