CONSTRUCTION INDUSTRY COUNCIL

CIC GREEN PRODUCT CERTIFICATION

Cooling Tower

Assessment Standard

(Version 2.0)

Last updated: 26 July 2021

Cooling Tower

Summary of Assessment Criteria

CORE CRITERIA

Criteria	*Requirements*	*Verification*	*Points*		*Index*
			Basic	*+Bonus*	
Product Information	Applicant shall provide the following product information for compliance: • Basic product specifications • The intended use of the product • Instructions for correct use and storage to maximise the lifetime of the product • Recommended operating conditions • Recommended maintenance instructions for the product • Installation method • Instructions for consumer product disposal • Country of origin • Operation & Maintenance Manual	Documentation including but not limited to product label, product catalogue, MSDS, and written declaration with date-stamped photographs.	5		*4.1.2 (page 4)*
Noise Level	Product should not exceed the limits as stated in Table 4.2.2a and 4.2.2b.	Documentation including but not limited to product catalogue, MSDS and test report	10		*4.2.2 (page 5)*
Water Efficiency	Evaporation loss and drift loss shall not exceed 1% and 0.005% of water circulation rate respectively, under maximum air flow and maximum water flow.	Documentation including but not limited to product catalogue, MSDS and test report	10		*4.3.1 (page 7)*

<table>
<tr><th rowspan="2">Criteria</th><th rowspan="2">Requirements</th><th rowspan="2">Verification</th><th colspan="2">Points</th><th rowspan="2">Index</th></tr>
<tr><th>Basic</th><th>+Bonus</th></tr>
<tr><td>Energy Efficiency</td><td>Cooling towers shall be awarded if they meet the requirement of efficiency as stated below:
<table><tr><th>Efficiency levels</th><th>Points</th></tr><tr><td>Baseline efficiency</td><td>15 Basic Points</td></tr><tr><td>Exceed the baseline efficiency in Table 4.3.3b by 10%</td><td>5 Bonus Points</td></tr><tr><td>Exceed the baseline efficiency in Table 4.3.3b by 15%</td><td>10 Bonus Points</td></tr></table></td><td>Documentation including but not limited to product catalogue, MSDS and test report</td><td>15</td><td>+5/ +10</td><td>4.3.3 (page 7)</td></tr>
<tr><td>Thermal Performance</td><td>Under specific operating conditions as stated in Table 4.3.4, the percentage of the measured cooling capacity and the designed cooling capacity shall not be less than the following limits:
• ≥ 90% (10 Basic Points)
• ≥ 95% (+5 Bonus Points)</td><td>Documentation including but not limited to product catalogue, MSDS and test report</td><td>10</td><td>+5</td><td>4.3.4 (page 8)</td></tr>
<tr><td></td><td></td><td>Subtotal:</td><td>50</td><td>+15</td><td></td></tr>
</table>

NON-CORE CRITERIA

Criteria	*Requirements*	*Verification*	*Points* *+Bonus*	*Index*
Environmental Management System	Manufacturers shall possess valid certificates of ISO 14001, EU Eco-Management and Audit Scheme (EMAS) or Cradle-to-Cradle.	A valid certificate issued by local or overseas accredited certification bodies	+5	*4.1.1 (page 3)*
Hazardous Substance	**Paint Used** Paints used on the products including but not limited to the corrosion resistant coatings and protective coatings shall not contain the following heavy metals or their compounds. If the paints used on the products contain the following heavy metal or their compounds, the concentration shall be less than 0.01% by weight of the product. • Cadmium • Lead • Chromium VI • Mercury If the paints used on the products contain the barium (excluding barium sulfate) or its compounds, the concentration shall be less than 0.1% by weight of the product. Volatile organic compound content of the paint used on the products shall be equal to or less than 500g/L minus water. **Flame Retardant** Concentration of the flame-retardants in the product shall be below 0.1% by weight of the product. The restricted fire retardants including the following types: • Polybrominated diphenyl ether • Polybrominated biphenyls • Short-chained chlorinated paraffin • Halogenated organic compound • Hexabromocyclododecane	Laboratory test report(s), MSDS, self-declaration letter and production documentation	+5	*4.2.1 (page 4)*

Criteria	***Requirements***	***Verification***	***Points +Bonus***	***Index***
Variable Speed Drives	Variable Speed Drives shall be added to the cooling tower fans.	Documentation including but not limited to product label, product catalogue, MSDS, and written declaration with date-stamped photographs	+5	*4.3.2 (page 7)*
Waste Management	Manufacturers shall implement effective waste management policies, procedures and/or a waste management programs covering manufacturing operations. Documentation should include but not limited to the following information: • Initiatives taken to reduce waste generation and improve recovery/recycling of waste; • Initiatives implemented for recovery of post-consumer and/or pre-consumer waste that can be re-introduced into the manufacturing process; and • Other environmental benefits or constraints associated with waste minimisation objectives and processes.	Documentation including but not limited to detailed plan and report	+5	*4.3.5 (page 9)*
Energy Management	Manufacturers shall implement effective energy management policies and procedures and / or an energy management programme, including but not limited to the following items: • Initiatives taken to reduce energy use and improve energy efficiency; and • Initiatives or requirements for suppliers or contract manufacturers.	Documentation including but not limited to detailed plan and report	+5	*4.3.6 (page 9)*

Criteria	***Requirements***	***Verification***	***Points +Bonus***	***Index***
Packaging Requirement	• All packaging shall be able to be reused/recycled in the country. • All plastic packaging (if applicable) shall be included plastic identification symbol and shall not contain halogenated plastics. • Packaging shall not be impregnated, labeled, coated or otherwise treated in a manner, which would prevent or significantly limit recycling (i.e. metallic labels).	Documentation including but not limited to written declaration with date-stamped photographs	+5	*4.4.1 (page 9)*
MiMEP Impact	Products shall be able to adopt with Multi-trade Integrated MEP (MiMEP) via technologies to facilitate including but not limited to BIM, Virtual Reality. RFID and Augmented Realty for improving efficiency and streamline manufacturing processes from MiMEP.	Documentation including but not limited to product catalogue, MSDS	**+5**	*4.5.1 (page.9)*
		Subtotal:	**+35**	

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1. INTRODUCTION

1.1 PURPOSE

The CIC Green Product Certification (formerly known as HKGBC Green Product Accreditation and Standards [HK G-PASS]) (herein after referred as the "Scheme") is an environmental labelling scheme owned by the Construction Industry Council (CIC) and implemented by the Hong Kong Green Building Council (HKGBC) which aims to help consumers, building professionals and policy makers identify environmentally preferable building materials and products. This Assessment Standard (hereafter referred to as the "Standard") sets out the assessment criteria and their benchmarks for cooling tower to govern the application and award of a label under the Scheme. The Standard also defines the verification methods to determine which labelling grade should be awarded to the product according to the assessment criteria.

This Standard neither modifies nor supersedes laws and regulations. Compliance with this Standard is not a substitute for, and does not assure, compliance with any applicable laws or regulations. Compliance with all applicable laws and regulations is a prerequisite for the manufacturing and marketing of the product.

1.2 BACKGROUND

Cooling tower is a device for lowering the temperature of water by evaporative cooling in which ambient air is in contact with falling water, thereby exchanging heat. Devices incorporating water refrigerant or water-water heat exchanger (evaporative condenser or closed circuit cooling tower) are also included. "Evaporative" is used to term the type of heat rejection in a cooling tower because a small portion of water being cooled evaporates into a moving air stream to provide significant cooling to the rest of that water stream. The heat transferred from the water stream to the air stream raises the air temperature and its relative humidity to 100%, which is then discharged to the atmosphere.

Cooling tower can place a significant burden on the environment. With increasing environmental claims of cooling tower in the market, a more comprehensive and systematic approach to assess the environmental impacts of the cooling tower shall be developed. The aim of this Standard is to help designers and end-users choosing greener products by conserving resources, reducing the amount of waste disposal in landfills and reducing the impact to human health throughout the life cycle of air handling unit. The development of the assessment criteria in this Standard has made references to worldwide relevant eco-labelling schemes and some existing life cycle assessment (LCA) studies.

2. SCOPE

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ONE application is only eligible for ONE product series. All the related products have to be listed on the submitted documents

Subsequent application is available for similar products of a labelled product series, which is only eligible for applying within the validity period of the label.

Note:
Each application should specify the product code / serial number.

The CIC or an appointed third party would conduct a random check of the labelled product during the validity period of the label. One of the laboratory tests listed below will be selected and performed to verify the compliancy of the product with the criteria stated in the Assessment Standard. Applicant has to be responsible for the cost of the laboratory test.

3. DEFINITIONS

Applicant:	Organisation which apply for the label under the CIC Green Product Certification of the Construction Industry Council
ASTM:	American Society for Testing and Materials
GB:	Chinese National Standards
BS:	British Standards
CIC:	Construction Industry Council
CNAS:	China National Accreditation Service for Conformity Assessment
HKAS:	Hong Kong Accreditation Service
HKGBC:	Hong Kong Green Building Council
HOKLAS:	The Hong Kong Laboratory Accreditation Scheme
ISO:	International Organisation for Standardisation

MSDS: Material Safety Data Sheet. To qualify as suitable, MSDS and information therein must not be more than 5-years old

4. EVALUATION CRITERIA

A product to be assessed shall meet all the minimum requirements of the "Core Criteria" in order to be awarded a "Green" (i.e. a "pass" grade) Label under the Scheme. Bonus points may be awarded if the product meets the "Non-core Criteria" and a "Bronze", "Silver", "Gold" or "Platinum" Label will be awarded according to the total points accumulated (see Section 5 for details). All submissions and documentation shall be endorsed by the Chief Executive Officer or other authorised persons of the Applicant to demonstrate conformance to the assessment criteria. All certifications, laboratory reports and documentations must be valid during the assessment process and labelling period. All laboratory reports and documentation shall be within 5 years from the date of issue. The chemical tests should be conducted by either a third party or the manufacturer who has received the ISO17025 certification or relevant national accreditation systems, e.g. HOKLAS, CNAS, etc. CIC or an appointed third party would conduct a random check of the labelled product during the period of validity of the label, through laboratory test to verify the compliance with the criteria as stated in the Standard. Applicant has to be bear the cost of the laboratory test.

4.1 GENERAL REQUIREMENTS

4.1.1 Environmental Management System

5 Points (Non-core Criterion)
Manufactures shall possess valid certificates of ISO 14001, EU Eco-Management and Audit Scheme (EMAS) or Cradle-to-Cradle.

Note:
BS EN ISO 14001 is the international standard which provides an outline of how to meet the environmental policy and objectives for the business of the applicant.

Eco-Management and Audit Scheme (EMAS) is an environmental management tool which enables organizations to assess, manage and continuously improve their environmental performance

Cradle to Cradle design is a biomimetic approach to the design of products and systems. It models human industry on nature's processes viewing materials as nutrients circulating in healthy, safe metabolisms.

Verification
A valid certificate issued by local or overseas accredited certification bodies.

4.1.2 Product Information

5 Points (Core Criterion)
Applicant shall provide the following product information for compliance:

- Basic product specifications
- The intended use of the product
- Instructions for correct use and storage to maximise the lifetime of the product
- Recommended operating conditions
- Recommended maintenance instructions for the product
- Installation method
- Instructions for consumer product disposal
- Country of origin

Verification
Documentation including but not limited to product label, product catalogue, MSDS, and written declaration with date-stamped photographs.

4.2 HUMAN TOXICITY

4.2.1 Hazardous Substance

5 Points (Non-core Criterion)
Paint Used
Paints used on the products including but not limited to the corrosion resistant coatings and protective coatings shall not contain the following heavy metals or their compounds.

If the paints used on the products contain the following heavy metal or their compounds, the concentration shall be less than 0.01% by weight of the product.

- Cadmium
- Lead
- Chromium VI
- Mercury

If the paints used on the products contain the barium (excluding barium sulfate) or its compounds, the concentration shall be less than 0.1% by weight of the product.

Volatile organic compound content of the paint used on the products shall be equal to

or less than 500g/L minus water.

Flame Retardant

Concentration of the flame-retardants in the product shall be below 0.1% by weight of the product. The restricted fire retardants including the following types:

- Polybrominated diphenyl ether
- Polybrominated biphenyls
- Short-chained chlorinated paraffin
- Halogenated organic compound
- Hexabromocyclododecane

Products shall be tested based on the requirement as stated in BS 62321:2009 (or latest version); other related testing methods are also acceptable with justification provided by the applicant.

Note:

BS EN 62321:2009 specifies the determination of the levels of brominated flame retardants, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) contained in electrotechnical products.

Verification

Laboratory test report(s), MSDS, self-declaration letter and production documentation.

4.2.2 Noise Level

10 Points (Core Criterion)

Product should not exceed the limits shown in Table 4.2.2a and 4.2.2b. Products shall be tested based on the requirement as stated in GB/T 7190.1:2008 and GB/T 7190.2008 (or latest version); other related testing methods are also acceptable with justification provided by the applicant.

Table 4.2.2a Noise levels of cooling towers with cooling water capacity < 1,000m^3/h

Nominal cooling water capacity/(m^3/h)	Noise levels /dB (A)			
	Ordinary type	Low noise type	Ultra-low noise type	Industrial type
8	66.0	60.0	55.0	70.0
15	67.0	60.0	55.0	70.0
30	68.0	60.0	55.0	70.0
50	68.0	60.0	55.0	70.0
75	68.0	62.0	57.0	70.0
100	69.0	63.0	58.0	75.0
150	70.0	63.0	58.0	75.0
200	71.0	65.0	60.0	75.0
300	72.0	66.0	61.0	75.0
400	72.0	66.0	62.0	75.0
500	73.0	68.0	62.0	78.0
700	73.0	69.0	64.0	78.0
800	74.0	70.0	67.0	78.0
900	75.0	71.0	68.0	78.0
1,000	75.0	71.0	68.0	78.0

Table 4.2.2b Noise levels of cooling towers with cooling water capacity ≥ 1000m^3/h

Types	Nominal cooling water capacity Q/ (m^3/h)	Noise levels/ db(A)
Counterflow	1,000 ≤ Q < 2,000	78.0
	2,000 ≤ Q < 3,000	79.0
	3,000 ≤ Q	80.0
Crossflow	1,000 ≤ Q < 2,000	74.0
	2,000 ≤ Q < 3,000	75.0
	3,000 ≤ Q	76.0

Note:

GB/T 7190.1:2008 specifies the classification of small and medium cooling tower products, technical requirements, test methods, inspection rules, signs, packaging, transport, storage and others. This section applies to a single tower cooling water is less than 1000m^3/h, mechanical draft, equipped with water spray filler mixed structure open cooling tower. Noise measuring point shall refer to standard point L2 as per GB/T 7190.1: 2018.

GB/T 7190.2:2008 specifies the large cooling towers Products, technical requirements, test methods, inspection rules, signs, packaging, transport, storage and others. This section applies to the cooling water flow rate of not less than 1000m^3/h of mechanical draft cooling tower industry. Noise measuring point shall refer to standard point L2 as per GB/T 7190.1: 2018.

Verification

Documentation including but not limited to product catalogue, MSDS and test report issued by third party or the manufacturer who has received the ISO17025 certification or relevant national accreditation systems, e.g. HOKLAS, CNAS, etc.

4.3 RESOURCE CONSUMPTION

4.3.1 Water Efficiency

10 Basic Points (Core Criterion)
Evaporation loss and drift loss shall not exceed 1% and 0.005% of water circulation rate respectively, under maximum air flow and maximum water flow.

Verification
Documentation including but not limited to product catalogue, MSDS and test report issued by third party or the manufacturer who has received the ISO17025 certification or relevant national accreditation systems, e.g. HOKLAS, CNAS, etc.

4.3.2 Variable Speed Drives

5Points (Non-core Criterion)
Variable Speed Drives shall be added to the cooling tower fans.

Verification
Documentation including but not limited to product label, product catalogue, MSDS, and written declaration with date-stamped photographs.

4.3.3 Energy Efficiency

15 Basic Points + 10 Bonus Points (Core Criterion)
Cooling towers will be awarded if they meet the following efficiencies:

Table 4.3.3a Efficiency levels

Efficiency levels	Points
Baseline efficiency	15 Basic Points
Exceed the baseline efficiency in the Table 4.3.3b by 10%	5 Bonus Points
Exceed the baseline efficiency in Table 4.3.3b by 15%	10 Bonus Points

Table 4.3.3b Performance requirements (Ref: ASHRAE 90.1-TABLE 6.8.1 G)

Equipment type	Total system heat rejection capacity at rated conditions	Rating condition	Performance required	Test procedure
• Propeller type • Axial fan open circuit type	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wet bulb	≥ 3.23 L/s.kW	CTI ATC-105 CTI STD-201
• Centrifugal fan open circuit	All	35.0°C entering water 29.4°C leaving water 23.9°C entering wet bulb	≥ 1.70 L/s.kW	CTI ATC-105 CTI STD-201
• Propeller type • Axial fan closed circuit	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wet-bulb	≥ 1.18 L/s.kW	CTI ATC-105S CTI STD-201
• Centrifugal fan closed circuit type	All	38.9°C entering water 32.2°C leaving water 23.9°C entering wet-bulb	≥ 0.59 L/s.kW	CTI ATC-105S CTI STD-201

For SI: °C = [(°F) - 32]/1.8, L/s • kW = (gpm/hp)/ (11.83)

Verification

Documentation including but not limited to product catalogue, MSDS and test report issued by third party or the manufacturer who has received the ISO17025 certification or relevant national accreditation systems, e.g. HOKLAS, CNAS, etc.

4.3.4 Thermal Performance

10 Basic Points + 5 Bonus Points (Core Criterion)

Under the following specific operating conditions as stated in Table 4.3.4, the percentage of the measured cooling capacity and the designed cooling capacity shall not be less than the following limit:

- Basic (10 points): ≥ 90%
- Bonus (5 points): ≥ 95%

Table 4.3.4 Standard Rating Condition

Operating Conditions	Types of cooling tower		
	Open Circuit Cooling Tower	Closed Circuit Cooling Tower	Evaporative Refrigerant Condenser
Fluid	Water	Water	Ammonia
Inlet Fluid temperature/°C	35.0	38.9	-
Outlet Fluid Temperature/°C	29.4	32.2	35.7

Wet bulb temperature/°C	25.6	25.6	25.6

Products shall be tested based on the requirement as stated in CTI STD 201; other related testing methods are also acceptable with justification provided by the applicant.

Note:
CTI STD 201 specifies the performance rating of evaporative heat rejection equipment.

Verification
Documentation including but not limited to product catalogue, MSDS and test report issued by third party or the manufacturer who has received the ISO17025 certification or relevant national accreditation systems, e.g. HOKLAS, CNAS, etc.

4.3.5 Waste Management

5 Points (Non-core Criterion)
Manufacturer shall implement effective waste management policies, procedures and/or a waste management programs covering manufacturing operations. Documentation should include but not limited to the following information:

- Initiatives taken to reduce waste generation and improve recovery/recycling of waste;
- Initiatives implemented for recovery of post-consumer and/or pre-consumer waste that can be re-introduced into the manufacturing process; and
- Other environmental benefits or constraints associated with waste minimisation objectives and processes.

Verification
Documentation including but not limited to detailed plan and report.

4.3.6 Energy Management

5 Points (Non-core Criterion)
Manufacturer shall implement effective energy management policies and procedures and / or an energy management programme, including but not limited to the following items:

- Initiatives taken to reduce energy use and improve energy efficiency; and
- Initiatives or requirements for suppliers or contract manufacturers.

Verification
Documentation including but not limited to detailed plan and report.

4.4 ECOSYSTEM IMPACT

4.4.1 Packaging Requirement

5 Points (Non-core Criterion)

- All packaging shall be able to be reused/recycled in the country.
- All plastic packaging (if applicable) shall be included plastic identification symbol and shall not contain halogenated plastics.
- Packaging shall not be impregnated, labeled, coated or otherwise treated in a manner, which would prevent or significantly limit recycling (i.e. metallic labels).

Verification

Documentation including but not limited to written declaration with date-stamped photographs.

4.5 MiMEP Impacat

4.5.1 Modular for Cooling Tower

5 Points (Non-core Criterion)

Products shall be able to adopt with Multi-trade Integrated MEP (MiMEP) via difference kind of technologies for enhanced a higher efficiency in manufacturing processes including but not limited to BIM, Virtual Reality. RFID and Augmented Realty from MiMEP.

Verification

Documentation including but not limited to product catalogue.

5. SCORING AND GRADING

The points for meeting each criterion stated in Section 4 are summarised in Table 1.

Table 1: Points to be awarded under the assessment criteria of this Standard

Evaluation criteria	***Points***	
	Basic	***+Bonus***
4.1.1 Environmental Management System		+5
4.1.2 Product Information [CORE]	5	
4.2.1 Hazardous Substance		+5
4.2.2 Noise Level [CORE]	10	
4.3.1 Water Efficiency [CORE]	10	
4.3.2 Variable Speed Control		+5

4.3.3 Energy Efficiency [CORE]	15	+5 / +10
4.3.4 Thermal Performance [CORE]	10	+5
4.3.5 Waste Management		+5
4.4.1 Energy Management		+5
4.4.5 Packaging Requirement		+5
4.5.1 Modular for Cooling Tower		+5
	50	**+50**
Total:	**100**	

The minimum requirement to be awarded a "Green" Label under this product category is to obtain 50 points by meeting all minimum requirements laid down in the "Core Criteria".

Table 2: Benchmarks for grading

Grade to be awarded	***Points required***
Platinum	90 or above
Gold	80 – 89
Silver	70 – 79
Bronze	60 – 69
Green	50 – 59
No Label	Below 50