



CONSTRUCTION INDUSTRY COUNCIL

CIC GREEN PRODUCT CERTIFICATION

CHILLER

(Version 1.1)

Assessment Standard

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CHILLER

Summary of Assessment Criteria

CORE CRITERIA

<i>Criteria</i>	<i>Requirements</i>	<i>Verification</i>	<i>Points</i>		<i>Index</i>																				
			<i>Basic</i>	<i>+Bonus</i>																					
Energy Efficiency	<p><u>Electrical</u> Shall exceed the minimum COP at full load as specified in BEC/BEE0 by 3% OR IPLV under Path B specified in Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2010 (SI Edition) by 3% [basic];</p> <p><u>Absorption</u> Shall exceed the minimum COP at full load OR IPLV specified in Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2010 (SI Edition) by 3% [basic];</p> <p>Up to 20 bonus points will be awarded if Full Load COP is more than BEC/BEE0 requirement as follows:</p> <table border="1" style="margin-left: 20px;"> <tr> <td>COP</td> <td>+8%</td> <td>+13%</td> <td>+17%</td> <td>+20%</td> </tr> <tr> <td>Bonus Points</td> <td>+5</td> <td>+10</td> <td>+15</td> <td>+20</td> </tr> </table> <p><u>OR</u></p> <p>Up to 20 bonus points will be awarded if IPLV (Path B for electrical; Path A for absorption) is more than Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2013 (SI Edition) as follows:</p> <table border="1" style="margin-left: 20px;"> <tr> <td>IPLV</td> <td>+8%</td> <td>+13%</td> <td>+17%</td> <td>+20%</td> </tr> <tr> <td>Bonus Points</td> <td>+5</td> <td>+10</td> <td>+15</td> <td>+20</td> </tr> </table>	COP	+8%	+13%	+17%	+20%	Bonus Points	+5	+10	+15	+20	IPLV	+8%	+13%	+17%	+20%	Bonus Points	+5	+10	+15	+20	Relevant documentation in compliance with BEC, BEE0 and ASHRAE Compliance Form	20	+5 / +10 / +15 / +20	4.2.1 (page 4)
COP	+8%	+13%	+17%	+20%																					
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IPLV	+8%	+13%	+17%	+20%																					
Bonus Points	+5	+10	+15	+20																					
Operating Noise	<ul style="list-style-type: none"> ○ Shall meet the noise level: ≤ 90 dBA [basic]; ○ + 5 bonus points if <ul style="list-style-type: none"> ▪ ≤ 80 dBA for air-cooled chillers ▪ ≤ 85 dBA for water-cooled chillers 	Detailed report(s) of the operating noise	10	+5	4.3.1 (page 5)																				
Eco-friendly Refrigerant	<ul style="list-style-type: none"> ○ Shall have no ozone depletion potential or have a global warming potential of < 150. ○ Refrigerant shall also be complied the following requirement: 	Laboratory test report(s) and any documentation on the refrigerant used	15		4.4.1 (page 6)																				

	<p>i. Safety group of the refrigerant must be A1 and A2L according to ASHRAE 34-2013</p> <p>Or</p> <p>ii. Safety group of the refrigerant could be B1 and B2L according to ASHRAE 34-2013 if the refrigerant leakage rate is equal to or less than 0.5%</p>				
Refrigerant Leakage Rate	<p>o Product shall conduct the leakage testing and the refrigerant leakage shall be equal to or less than 1.0% of full refrigerant charge. Manufacturer shall provide a factory testing report including the information of testing methodology and all calculation details leading to the end result of refrigerant leakage rate. [basic]</p> <p>o Product shall be incorporated a leak detection system and send the alert to the Building Management System (BMS) for the leakage. The leakage detection system shall be able to communicate with Building Management System (BMS) via an open standard communication interface including but not limited to BACnet, ZigBee and LonWorks. [bonus]</p>	Laboratory test report(s) and documentation on the refrigerant leakage rate, loss and charge	5	+5	4.4.2 (page 7)
Subtotal:			50	+30	

NON-CORE CRITERIA

<i>Criteria</i>	<i>Requirements</i>	<i>Verification</i>	<i>Points</i>	<i>Index</i>
			<i>+Bonus</i>	
Environmental Management System	<p>o Valid certification of ISO14001 or the EU Eco-Management and Audit Scheme (EMAS)</p>	ISO14001 or EMAS certificate issued by accredited certification body	+5	4.1.1 (page 4)
Paint Used	<p>o Paints used on the products shall not contain the following heavy metals or their compounds.</p> <p>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.</p> <ul style="list-style-type: none"> •Cadmium •Lead 	Laboratory test report(s) and any documentation on the paint used	+5	4.3.2 (page 6)

	<ul style="list-style-type: none"> •Chromium VI •Mercury <p>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.</p> <ul style="list-style-type: none"> ○ Volatile organic compound content of the paint used on the products shall be equal to or less than 500g/L minus water. 			
Identification of Lubricating Oil	<ul style="list-style-type: none"> ○ The manufacturer shall indicate either one of the followings: <ul style="list-style-type: none"> ▪ the correct lubricant for the type of refrigerant used in the chiller operating instructions OR ▪ oil free compressor is used 	Documentation related to the lubricant used and relevant information	+5	4.3.3 (page 6)
Recyclability	<ul style="list-style-type: none"> ○ Shall develop a recycling programme for electronic components, including end-of-life advice and recommendations for typical deconstruction procedures for the chillers ○ Shall declared options for re-use, recycling, recovery and disposal of the product 	Documentation related to the deconstruction procedures and relevant information	+5	4.4.3 (page 8)
Subtotal:			+20	

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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 as the “Standard”) sets out the assessment criteria and their benchmarks for chillers 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

Air conditioning system contributes about 40% of the total energy consumption in buildings in subtropical climatic condition such as Hong Kong. Chiller is one of the most energy intensive components in the centralised cooling system. Another major environmental concern about chiller is the use of refrigerant. It is the working fluid inside a refrigerative chiller, which could cause significant damage to the earth’s protective ozone layer if they are released into the atmosphere. The refrigerant and its type as well as its charge, as well as the energy efficiency are often considered in most of the environmental studies regarding the air conditioning systems.

The purposes of the assessment criteria developed for chillers are, therefore, to conserve resources and energy consumption, to reduce the environmental impact of refrigerants, to minimise the use of hazardous substances, and to encourage reuse, recycling and responsible disposal of the product.

2. SCOPE

The types of chillers covered by this Standard include air-cooled, water-cooled and absorption chillers which can be driven by electric motor or other means. Evaporative chiller is excluded from this Standard.

The types of cooling, compressor, and refrigerants shall be specified clearly in each application. **ONE** application is only for **ONE** product series with same serial number up to **5 (FIVE)** models (e.g. different cooling capacity). All the related products have to be listed on the submitted documents.

E.g. water-cooled – centrifugal –134a (model e.g. ABC-D-134) is regarded as one application.

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

Each subsequent application shall include **5 (FIVE)** models, while maximum **5 (FIVE)** subsequent application per each application.

3. DEFINITIONS

Applicant: Organisations which apply for the label of the CIC Green Product Certification of the Construction Industry Council

ARI / AHRI: Air Conditioning and Refrigeration Institute. In 2007, the organisation added the letter “H” to their name. AHRI stands for Air Conditioning, Heating and Refrigeration Institute

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers

Air-conditioning: The process of treating air to control simultaneously its temperature, humidity and distribution to meet the comfort requirements of the occupants of the conditioned spaces

BEC: Building Energy Code

BEEO: Buildings Energy Efficiency Ordinance

CIC: Construction Industry Council

CNAS: China National Accreditation Service for Conformity Assessment

Cooling capacity: The rated ability of the chiller to cool, measured in tons. One ton of cooling is equal to the amount of cooling provided by one ton (2,000 lbs) of melting ice in one day (12,000 Btu/h)

Coefficient of performance (COP): A ratio of the cooling capacity in watts (W) to the total power input, in watts (W) at any specified set of standard rating conditions, expressed in watts / watts (W/W)

Energy management programme: A programme to achieve and sustain efficient and effective use of energy including policies, practices, planning activities, responsibilities and resources that affect the organisation's performance for achieving the objectives and targets of the energy policy

Global warming potential (GWP): The ratio of the warming of atmosphere caused by one substance to that caused by a similar mass of carbon dioxide

HKAS: Hong Kong Accreditation Service

HKGBC: The Hong Kong Green Building Council Limited

HOKLAS: The Hong Kong Laboratory Accreditation Scheme

IARC: International Agency for Research on Cancer

ISO: International Organisation for Standardisation

MSDS: Material safety data sheet. To qualify as suitable, the MSDS and information therein must not be more than 5-years old

Integrated part load value (IPLV): This is a performance characteristic developed by the AHRI, which is most commonly used to describe the performance of a chiller capable of capacity modulation

Ozone depleting potential (ODP): The ratio of the ability of a molecule to react with the ozone contained in the Earth's stratosphere compared to a CFC-12 molecule, as determined by the US Environmental Protection Agency (EPA)

Ozone depletion substances: The chemical compounds defined by the 1990 Clean Air Act Amendments as ozone depletion substances

Refrigerant: The working fluid of a vapour-compression heat transferring system. The refrigerant transfers heat from one location to another by boiling and condensing

Third-party: An entity without any financial interest or stake in the sales of the product or service being evaluated or other conflict of interest

VOC: Volatile organic compounds. Any organic compound (compound which contains carbon) with either a boiling point below 250°C measured at 101.3 kPa or a vapour pressure of more than 0.1 mm Hg measured at 25°C

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 submission 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 certification, laboratory report and documentation must be valid during the assessment process and labelling period. The validity of all laboratory report and documentation shall be 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.

4.1 GENERAL REQUIREMENTS

4.1.1 Environmental Management System

5 Points (Non-Core Criterion)

Manufacturer of the products shall possess valid certificate of ISO14001 or the EU Eco-Management and Audit Scheme (EMAS). Targets shall be set to reduce the environmental impacts during the manufacturing process which include but not limited to the reduction of hazardous substance emissions, energy consumption, CO₂ emissions, secondary environmental load, waste management, water management, etc.

Verification

A valid ISO14001 or EMAS Certificate issued by local or overseas accredited certification bodies.

4.2 RESOURCE CONSUMPTION

4.2.1 Energy Efficiency

20 Basic + 5 / 10 / 15 / 20 Bonus Points (Core Criterion)

Electrical

The product shall exceed the minimum coefficient of performance (COP) at full load as specified in the Building Energy Code (BEC) / Buildings Energy Efficiency Ordinance (BEEO) by 3% or integrated part load value (IPLV) under Path B specified in Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2010 (SI Edition) by 3%.

Absorption

Shall exceed the minimum COP at full load OR IPLV specified in Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2010 (SI Edition) by 3% [basic];

Up to 20 bonus points will be awarded if COP at full load is higher than the minimum requirement in BEC/BEE0, as shown in Table 1.

Table 1: Points awarded for coefficient of performance

COP	+3%	+8%	+13%	+17%	+20%
Basic Points	20				
Bonus Points		+5	+10	+15	+20

OR

Up to 20 bonus points will be awarded, if IPLV (Path B for electrical; Path A for absorption) of Table 6.8.1C of ANSI/ASHRAE Standard 90.1-2010 (SI Edition) exceeds the requirement as shown in Table 2.

Table 2: Points awarded for integrated part load value

IPLV	+3%	+8%	+13%	+17%	+20%
Basic Points	20				
Bonus Points		+5	+10	+15	+20

Verification

Relevant documentation and data in compliance with the efficiency requirements of BEC and/or ASHRAE.

4.3 HUMAN TOXICITY

4.3.1 Operating Noise

10 Basic + 5 Bonus Points (Core Criterion)

The product shall meet the noise level: ≤ 90 dBA.

5 bonus points will be awarded if operating noise level can fulfil the requirements as shown in Table 3.

Table 3: Requirements of operating noise for chillers

Product Type	Operating noise level (dBA)	Points
Air-cooled Chillers	≤ 90	10 [basic]
	≤ 80	+5 (bonus)
Water-cooled Chillers	≤ 90	10 [basic]
	≤ 85	+5 (bonus)

Verification

Detail report(s) on noise evaluation shall be conducted in accordance with the AHRI Standard 575 - 94, Method of Measuring Machinery Sound within Equipment Rooms.

4.3.2 *Paint Used*

5 Points (Non-Core Criterion)

Paints used on the products 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.

Verification

Laboratory test report(s) and relevant documentation on the paint used.

4.3.3 *Identification of Lubricating Oil*

5 Points (Non-Core Criterion)

The manufacturer shall indicate the correct lubricant for the type of refrigerant used in the chiller operating instructions or use oil free compressor.

Verification

Documentation related to the lubricant used and relevant information as stated above.

4.4 ECOSYSTEM IMPACT

4.4.1 *Eco-friendly Refrigerant*

15 Points (Core Criterion)

- The refrigerant used shall have no ozone depletion potentials (ODP) or have a global warming potential (GWP) of lower than 150 as determined by the US Environmental Protection Agency (EPA).
- Refrigerant shall also be complied the following requirement:
 - i. Safety group of the refrigerant must be A1 and A2L according to ASHRAE 34-2013;
 - or
 - ii. Safety group of the refrigerant could be B1 and B2L according to ASHRAE 34-2013 if the refrigerant leakage rate is equal to or less than 0.5%.

Verification

Laboratory test report(s) and any relevant documentation on the refrigerant used, refrigerant leakage rate, loss and charge. The leak testing method(s) shall be selected in accordance with the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guideline 3-1990 (Reducing Emissions of Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications), Section 6.4.2.

4.4.2 Refrigerant Leakage Rate

5 Basic + 5 Bonus Points (Non-Core Criterion)

Product shall conduct the leakage testing and the refrigerant leakage shall be equal to or less than 1.0% of full refrigerant charge. Manufacturer shall provide a factory testing report including the information of testing methodology and all calculation details leading to the end result of refrigerant leakage rate.

Bonus points will be award if the product shall be incorporated a leak detection system and send the alert to the Building Management System (BMS) for the leakage. The leakage detection system shall be able to communicate with Building Management System (BMS) via an open standard communication interface including but not limited to BACnet, ZigBee and LonWorks.

Verification

Laboratory test report(s) and any relevant documentation on the refrigerant used, refrigerant leakage rate, loss and charge. The leak testing method(s) shall be selected in accordance with the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guideline 3-1990 (Reducing Emissions of Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications), Section 6.4.2. Documentation related to the leak detection system and relevant information as stated above.

4.4.3 *Recyclability*

5 Points (Non-Core Criterion)

The manufacturer shall build up a recycling programme for electronic components of chiller. The end-of-life advice and recommendations for typical deconstruction procedures for the chillers shall be given.

Options for re-use, recycling, recovery and disposal of the products / materials shall be declared. The manufacturer is encouraged to adopt recycling-oriented product design and manufacturing.

Verification

Documentation related to the deconstruction procedures and relevant information as stated above.

5. SCORING AND GRADING

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

Table 4: Points to be awarded under the assessment criteria of this Standard

<i>Evaluation criteria</i>	<i>Points</i>	
	<i>Basic</i>	<i>+Bonus</i>
4.1.1 Environmental Management System		+5
4.2.1 Energy Efficiency [CORE]	20	+5 / +10 / +15 / + 20
4.3.1 Operating Noise [CORE]	10	+5
4.3.2 Paint Used		+5
4.3.3 Identification of Lubricating Oil		+5
4.4.1 Eco-friendly Refrigerant [CORE]	15	
4.4.2 Refrigerant Leakage Rate[CORE]	5	+5
4.4.3 Recyclability		+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 5: Benchmarks for grading chillers

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