INDUSTRIAL NEW CONSTRUCTION (INC)

DESIGN REFERENCE GUIDE & SUBMISSION FORMAT

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www.greenbuildingindex.org

The Green Building Index is an environmental rating system for buildings developed by PAM (Pertubuhan Arkitek Malaysia / Malaysian Institute of Architects) and ACEM (the Association of Consulting Engineers Malaysia). The Green Building Index is Malaysia's first comprehensive rating system for evaluating the environmental design and performance of Malaysian buildings based on the six (6) main criterias of Energy Efficiency, Indoor Environment Quality, Sustainable Site Planning & Management, Materials & Resources, Water Efficiency, and Innovation. The Green Building Index is fundamentally derived from existing rating tools, including the Singapore Green Mark and the Australian Green Star system, but extensively modified for relevance to the Malaysian tropical weather, environmental context, cultural and social needs.

INDUSTRIAL NEW CONSTRUCTION (INC)

ASSESSMENT CRITERIA
OVERALL POINTS SCORE

PART	ITEM	MAXIMUM POINTS
1	Energy Efficiency (EE)	33
2	Indoor Environmental Quality (EQ)	22
3	Sustainable Site Planning & Management (SM)	18
4	Material & Resources (MR)	10
5	Water Efficiency (WE)	10
6	Innovation (IN)	7
	TOTAL SCORE	100

GREEN BUILDING INDEX CLASSIFICATION

POINTS	GBI RATING
86 to 100 points	Platinum
76 to 85 points	Gold
66 to 75 points	Silver
50 to 65 points	Certified

Overview of all credits and points, and those to which Jotun products may contribute:

PART	CRITERIA	ITEM	POINTS	Points to which Jotun products may contribute
	EE	ENERGY EFFICIENCY	33	0
	Design			
	EE1	Minimum EE Performance	1	
	EE2	Lighting Zoning	3	
	EE3	Electrical Sub-metering	1	
1	EE4	Renewable Energy & Onsite Energy Capture/Recovery	8	
	EE5	Advanced or Improved EE Performance - BEI and/or EUI	10	
	Commissioning			
	EE6	Enhanced Commissioning	4	
	EE7	On-going Post Occupancy Commissioning	2	
	Verification & Maintenance			
	EE8	EE Verification	2	
	EE9	Sustainable Maintenance	2	
	EQ	INDOOR ENVIRONMENTAL QUALITY	22	1
	Air Quality			
	EQ1	Minimum IAQ Performance	1	
	EQ2	Environmental Tobacco Smoke (ETS) Control	1	
	EQ3	Carbon Dioxide Monitoring and Control	1	
	EQ4	Indoor Air Pollutant & Industrial Chemical Exposure	3	1
	EQ5	Mould Prevention	1	
	Thermal Comfort E			
	Q6	Thermal Comfort: Design & Controllability of Systems	2	
2	EQ7	Air Change Effectiveness	1	
	EQ8	Breakout Spaces	1	
	Lighting, Visual & Acoustic Comfort			
	EQ9	Daylighting	2	
	EQ10	Daylight Glare Control	1	
	EQ11	Electric Lighting Levels	1	
	EQ12	High Frequency Ballasts	1	
	EQ13	External Views	2	
	EQ14	Internal Noise Levels	1	
	Verification			
	EQ15	IAQ Before & During Occupancy	2	
	EQ16	Post Occupancy Comfort Survey: Verification	1	
	SM	SUSTAINABLE SITE PLANNING & MANAGEMENT	18	2
	Site Planning			
	SM1	Site Selection	1	
	SM2	Brownfield Redevelopment	1	
	SM3	Development Density & Community Connectivity	2	

	SM4	Environment Management	2	
	SM5	Noise Pollution	1	
	Construction Management			
3	SM6	Earthworks - Construction Activity Pollution Control	1	
	SM7	QLASSIC	1	
	SM8	Workers Site Amenities	1	
	Transportation			
	SM9	Public Transportation Access & Transportation Plan	1	
	SM10	Green Vehicle Priority	1	
	SM11	Parking Capacity	1	
	SM12	Cargo Delivery Route and Proximity	1	
	Design			
	SM13	Stormwater Design - Quality & Quantity Control	1	
	SM14	Greenery & Roof	2	2
	SM15	Building User Manual	1	
	4 MR MATERIALS & RESOURCES		10	0
	Reused & Recycled Materials			
	MR1	Materials Reuse and Selection 2		
	MR2	Recycled Content Materials	2	
	Sustainable Resources			
4	MR3	Regional Materials	1	
	MR4	Sustainable Timber	1	
	Waste Management			
	MR5	Storage & Collection of Recyclables	1	
	MR6	Construction Waste Management	2	
	Green Products			
	MR6	Refrigerants & Clean Agents	1	
	WE	WATER EFFICIENCY	10	0
	Water Harvesting & Recycling			
	WE1	Rainwater Harvesting	2	
5	WE2	Water Recycling	2	
	Increased Efficiency			
	WE3	Water Efficient Irrigation/Landscaping	2	
	WE4	Water Reduction	2	
	WE5	Metering & Leak Detection System	2	
	IN	INNOVATION	7	1
6	IN1	Innovation & Environmental Design Initiatives	6	1
	IN2	Green Building Index Facilitator	1	
		TOTAL POINTS	100	4

INDOOR ENVIRONMENTAL QUALITY (EQ)

EQ4	INDOOR AIR POLLUTANTS & INDUSTRIAL CHEMICAL EXPOSURE	3 POINTS

INTENT To minimize detrimental impact on occupants' health from finishes that emits internal air pollutants and exposure to industrial chemicals.
DESCRIPTION Encourage the use and specification of healthy materials and finishes which contain low volatile organic compounds (VOC) and formaldehyde.
REQUIREMENTS 1 point:

- Use low VOC paint and coating throughout the building and plant area. Paints and Coatings to comply with requirements specified in international labelling schemes recognized by GBI, AND
- Use low VOC carpet or flooring throughout the building. Carpets to comply with requirements specified in international labelling schemes recognized by GBI. Other types of flooring to comply with requirements under FloorScore developed by Science Certification System or equivalent, AND Use low VOC adhesive and sealant or no adhesive or sealant used.

Accepted international labelling schemes recognized by GBI:

Paints/Coatings

Good Environmental Choice Australia
China Environmental United Certification Center
Environment and Development Foundation
Green Council
The Standards Institution of Israel
Japan Environment Association (JEA)
Korea Eco-Products Institute
SIRIM QAS International Sdn Bhd
The New Zealand Ecolabelling Trust
Nordic Ecolabelling Board
UL Environment
Green Seal Inc.
Philippine Center for Environmental Protection and Sustainable Development (PCEPSD)
Singapore Environment Council
Thailand Environment Institute
All Ukrainian NGO Living Planet

Jotun normally uses the VOC content limits of SIRIM QAS International Sdn Bhd Eco Label and Singapore Environment Council certificates. Both having more or less same test criteria, different by the acceptance limitation only.

GBI focuses on the VOC content as it's contribute to Indoor air quality and even accept LEED compliant products.

Malaysia SIRIM Eco-Label test

Item no.	Test	SIRIM Eco-label Criteria	Method detection limit
1	Formaldehyde content	<100mg/kg	10 mg/kg
2	Heavy metals : Mercury, Lead, Cadmium	Shall not contain in the formula	0.01%
3	VOC Content	*	2 g/L
4	Halogenated solvents	<0.01%	0.001%
5	Aromatic solvents	**	0.001%
6	Hexavalent Chromium	Shall not contain in the formula	0.01%

* For emulsion paints (<50g/L), for other water based varnishes (<100g/L).
For solvent based paint and varnishes (<300g/L)

** For emulsion paints (<0.1%), for other water based varnishes (<1%).
For solvent based paints and varnishes (<5%)

Method of test

1) Formaldehyde
    a. The sample was analysed by UV-Vis spectrophotometer using acetylacetone as reagent

2) Mercury, Lead, Cadmium
    a. The sample was digested in inorganic acid, followed by analysis using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)

3) Hexavalent Chromium
    a. The sample was analysed by UV-Vis spectrometer using 1,5-Diphenulcarbohydrazide as derivatizing agent

4) VOC
    a. By BS EN ISO 11890-2:2006, Paints and varnishes – Determination of volatile organic compound (VOC) content – Part 2 : Gas-chromatograph method

5) Halogenated solvents / Epichlorohydrin / Aromatic solvents
    a. By Gas Chromatograph – Mass Spectrometry (GC-MS)

Singapore Green Label (SGL)

Item no.	Test	GLS032 criteria	Method detection limit
1	Formaldehyde content	Not detected	0.01%
2	Heavy metals : Mercury, Lead, Cadmium, Chromium	Not detected	0.01%
3	Flash Point @ 61^{o}C	> 61^{o}C	-
4	VOC Content	**	2 g/L
5	Halogenated solvents	Not detected	0.1%
6	Epichlorohydrin	Not detected	0.1%
7	Aromatic solvents	Not detected	0.1%
8	N-methyl pyrrolidone	Not detected	0.1%
9	Alkyl Phenol Ethoxylates	Not detected	0.01%

** For water based coatings (Matt or Low sheen < 50g/L; Semi-gloss < 60 g/L; Gloss < 70g/L)
For solvent based coatings (Solvent paints and stains < 200g/L; Solvent varnishes < 250g/L)

Method of test

6) Formaldehyde
    a. The analysis was conducted based on the Vdl-RL 03 : Directive on the determination of the formaldehyde concentration of water dilutable emulsion paints and related products. VdL-RL 03 Clause 4.1 procedure – Free formaldehyde in sample was analysed by UV-Vis Spectrophotometer

7) Mercury, Lead, Cadmium and Chromium
    a. The sample was digested in inorganic acid, followed by analysis using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)

8) Flash point @ 61^{o}C
    a. By Seta flash

9) VOC
    a. By BS EN ISO 11890-2:2006, Paints and varnishes – Determination of volatile organic compound (VOC) content – Part 2 : Gas-chromatograph method

10) Halogenated solvents / Epichlorohydrin / Aromatic solvents
    a. By Gas Chromatograph – Mass Spectrometry (GC-MS)

11) N-methyl pyrrolidone
    a. By Gas Chromatography with Flame Ionization Detector (GC-FID)

12) Alkyl Phenol Ethoxylates

a. BS3762:1990 Analysis of formulated Detergent

SUSTAINABLE SITE PLANNING & MANAGEMENT (SM)

SM14	GREENERY & ROOF	2 POINTS

INTENT To reduce heat island effect (thermal gradient difference between developed and undeveloped areas) so as to minimize impact on microclimate and human and wildlife habitat.
DESCRIPTION
• Minimize impact on microclimate and human wildlife habitat.
• Reward for achieving any option. Roof application includes roofs over individual parking lots and roofs over parking structures.
• The use of greenery on rooftops can help alleviate urban heat island effects through shading and evaporative cooling. It also enhances aesthetics to the surrounding and provides a more pleasant working environment, which is also discussed in Indoor Environment Quality.

REQUIREMENTS
1 Point: Hardscape & Greenery Application

1) Provide any combination of the following strategies for 50% of the site hardscape (including sidewalks, courtyards, plazas and parking lots):
    a. • Shade (within 5 years of occupancy); •
    b. Paving materials with a Solar Index (SRI) of at least 29; •
    c. Open grid pavement system;
    d.

1 Point: Roof Application

1) Use roofing material with a Solar Reflectance Index (SRI) equal to or greater than the value in the table below for a minimum of 75% of the roof surface, OR
2) Install a vegetated roof for at least 50% of the roof area, OR
3) Install high albedo and vegetated roof surfaces that, in combination, meet the following criteria: (Area of SRI Roof / 0.75) + (Area of vegetated roof / 0.5) > Total Roof Area

Roof Type	Slope	SRI Value
Low-Sloped	< 2:12	78
Steep-Sloped	> 2:12	29

INNOVATION (IN)

IN1	INNOVATION & ENVIRONMENTAL DESIGN INITIATIVES	6 POINTS

INTENT To provide opportunity for the project to be awarded points for exceptional performance above the requirements set by GBI rating system.

DESCRIPTION Reward innovation and initiatives.

REQUIREMENTS Encourage project team to score points for exceptional performance above the requirements set by GBI rating system:
1 point for each approved innovation and environmental design initiative up to a maximum of 6 points, for innovative ideas such as, but not limited to:

- Self-cleaning façade

VOC requirements
The Swan:

Content of Volatile (VOC) and Semi-volatile Organic Compounds (SVOC) The maximum content of Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) shall not exceed the limits given in Table 6.

The content of VOCs and SVOCs shall be determined for the final product and shall include any recommended additions prior to application such as colourants and/or thinners. For tinting systems the content of VOCs and SVOCs shall be determined for the colour with most tinting paste and the base paint with highest content of VOC and SVOC.

The VOC and SVOC content shall be determined either by testing the final product or by calculation based on the raw materials*. * The test methods given in ISO 11890-2 shall be used. For the SVOC content, guidance given in appendix 4 regarding test method ISO 11890-2 shall be followed.

Instead of testing the SVOC content, the emission of Total Semi-Volatile Organic Compounds (TSVOC) can be tested for the final product with test method CEN/TS 16516, EN 16516, ISO 16000-6/-9/-10/-11 or EN 16402 all after 28 days, see table 6a.

AgBB, Indoor Air Comfort, Indoor Air Comfort Gold or Blue Angel certification are also accepted as documentation for the level of TSVOC emission. The test laboratory must fulfil the requirements in appendix 5.

Definitions of VOC and SVOC Volatile organic compounds (VOC) means any organic compounds having an initial boiling point less than or equal to 250 °C measured at a standard pressure of 101,3 kPa as defined in Directive 2004/42/EC and which, in a capillary column, are eluting up to and including n-Tetradecane (C14H30).

Semi volatile organic compounds (SVOCs) means any organic compound having a boiling point greater than 250 °C and less than 370 °C measured at a standard pressure of 101,3 kPa and which, in a capillary column are eluting with a retention range after n-Tetradecane (C14H30) and up to and including nDocosane (C22H46).

Products with the Nordic Swan Ecolabel may display the text ‘reduced VOC content’ and the VOC content in g/l next to the Ecolabel if they wish.

Table 6. VOC and SVOC content limits

Product description (with subcategory denotation according to Directive 2004/42/EC)	VOC limits (g/l including water)	SVOC limits** (g/l including water)	
		White paints and varnishes	Tinted paints and varnishes
a. Interior matt walls and ceilings (Gloss < 25@60°)	10	30	40
b. Interior glossy walls and ceilings (Gloss > 25@60°)	40	30	40
d. Interior trim and cladding paints for wood and metal	80	50	60
e. Interior trim varnishes and woodstains, including opaque woodstains	65	30	30
f. Interior minimal build woodstains	50	30	40
g. Primers	15	30	40
h. Binding primers	15	30	40
i. One-pack performance coatings	80	50	60
j. Two-pack reactive performance coatings for specific end use such as floors	80	50	60
l. Decorative effect coatings	80	50	60

****Table 6a. TSVOC emission limits from the final product (alternative to SVOC content requirement in table 6)**

	TSVOC limit (mg/m3 after 28 days)
All products	0.1

Declaration in line with Appendices 1 or 2 from the manufacturer of the product or the manufacturer of each raw material, respectively.

∗ Test report or calculation showing that the content level of VOC and SVOC in the final product in table 6 is fulfilled, based on test of the final product or on all ingoing raw materials using test methods given in ISO 11890-2. For the SVOC content, guidance given in appendix 4 regarding test method ISO 11890-2 shall be followed.

∗ If alternative for content of SVOC is used: Test report showing that the level of TSVOC emission from the final product in table 6a is fulfilled, based on test of the final product using methods given in CEN/TS 16516, EN 16516, ISO 16000-6/-9/- 10/-11 or EN 16402 all after 28 days. AgBB, Indoor Air Comfort, Indoor Air Comfort Gold or Blue Angel certification are also accepted as documentation for the level of TSVOC emission.

∗ Documentation for that the test laboratory fulfil the requirements in appendix 5.

O14 Volatile Aromatic Hydrocarbons - VAH Volatile aromatic hydrocarbons (VAH) must not be actively added to the product, but may occur as residuals to a total maximum of 100 ppm (0.01% w/w, 100

mg/kg) in the final product. Volatile aromatic hydrocarbons are volatile organic compounds where one or more benzene rings are contained within the molecule.

* Declaration in line with Appendices 1 and 2 from the manufacturer of the product and the manufacturer of each raw material.

* Calculation of the level of volatile aromatic hydrocarbons in the product (based on data for all ingoing raw materials)