WEB EARTH
Part of Ramboll

Punggol Digital District (PDD)

Green Lease Requirements

(CC1, CC2, CC3)

Ref: Web(E)/60/02/LWS

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Contents

1 Introduction

This document details the Green Lease requirements for tenants occupying the office units, retail and other units to meet the Green Mark Platinum rating for the PDD Development:

- CC1: Tower 1, 2, 3, 4
- CC2: Tower 5, 6, 7
- CC3: Tower 10

Tenants are required to comply with the Green Lease requirements with any green cost and performance bonds associated with it to ensure that the requirements are not compromised or forfeited.

Tenants are also required to compile and submit the documentary evidence where applicable

1.1 Codes and Standards

This document and the regulations contained herein have been carried out to all relevant local design codes and standards. The following codes have been applied and referenced throughout this document:

BCA Green Mark for Non-Residential Buildings NRB: 2015 revised in August 2018

SS531-1: 2006 (2019) Lux Levels

SS530: 2014 Lighting Power Density

SS 553: 2016 Thermal Comfort

SS 553: 2016 Ventilation rates

SS 554: 2016 IAQ Audit

1.2 Documentary Evidence

Documentary evidence is required for each of the following items, in form of the following for record:

- Tabulation
- Drawings
- Reports
- Certificates
- Product Catalogues
- Delivery Order or Invoices

Checklist and tabulation guidelines are provided in the Appendix.

2 ACMV System

The buildings air conditioning system should be designed to meet Green Mark Platinum standards, in terms of energy efficiency for Green Mark NRB: 2015, Updated August 2018.

Air conditioning systems shall use refrigerants with ozone depletion potential (ODP) of 0 or global warming potential (GWP) of less than 100.

The minimum design system efficiency of Condensing Units-VRF systems should be 30% more efficient than the minimum efficiency stated in Table 1B SS530 2014 where applicable.

Table 1B – Electrical operated variable refrigerant flow air-conditioning units – Minimum efficiency requirements

Equipment type	Cooling capacity	Minimum efficiency[a]	Test procedure
VRF air conditioners (air-cooled)	< 17.6 kW	Reference to MEPS Requirements by NEA, Singapore	
	≥ 17.6 kW and < 40 kW	3.28 COP 3.84 ICOP	AHRI 1230 ISO 5151 JIS B 8615-1 JIS B 8615-2
	≥ 40 kW and < 70 kW	3.22 COP 3.75 ICOP	
	≥ 70 kW	2.93 COP 3.40 ICOP	
VRF air conditioners (water-cooled)	< 19 kW	3.52 COP	AHRI 1230 (Rated condition at 30°C entering water)
	≥ 19 kW and < 40 kW	3.52 COP	
	≥ 40 kW	2.93 COP	

COP – Coefficient of Performance at full load capacity and is defined as the full load cooling capacity of the unit divided by the effective power input of a unit at the full load outdoor conditions according to the specified testing standards, expressed in W/W.

ICOP – A single number that is a cooling part load efficiency figure of merit equivalent to IEER calculated per the method described in ANSI/AHRI 340/360, ANSI/AHRI 1230 and ISO 5151.

[a] Both COP and ICOP shall be met or exceeded to comply with this standard.

2.1 Air Handling Units / Fan coil Units

All Air Handling Unit (AHU) and Fan coil Unit (FCU) fans installed on the project should meet the following fan system efficiencies (input power):

Fan system	Allowable Fan System efficiency (input Power)
Motor nameplate power < 4 kW	0.12 W/CMH
AHU/ FCU (constant flow) ≥ 4kW	0.29 W/CMH
AHU/ FCU (variable flow) ≥ 4kW	0.40 W/CMH

2.2 Mechanical Ventilation Fans

All mechanical ventilation fans installed on the project should meet the following fan system efficiencies (input power):

Fan system	Allowable Fan System efficiency (input Power)
Motor nameplate power < 4 kW	0.12 W/CMH
Fans ≥ 4kW (Constant air flow)	0.21 W/CMH
Fans ≥ 4kW (Variable air flow)	0.21 W/CMH

Fans ≥ 4kW (Variable air flow)	**Constant volume and variable volume**
Option 1: Fan system motor nameplate	Allowable nameplate motor < 0.245 W/CMH
Option 2: Fan system input	Allowable fan system input ≤ 0.21 W/CMH

Kitchen Exhaust Fans	**Constant volume and variable volume**
Option 1: Fan system motor nameplate	Allowable nameplate motor < 0.35 W/CMH
Option 2: Fan system input	Allowable fan system input ≤ 0.3 +A W/CMH (SS553 2016)

2.3 Thermal Comfort

The normal design dry-bulb temperature for comfort air-conditioning shall be within 24 degree Celsius – 26 degree Celsius, and resultant relative humidity ≤ 65% in accordance with SS 553: 2016 – Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings.

Air conditioning temperature shall meet the following parameters:

Dry-Bulb Temperature	24°C – 26°C
Relative Humidity	≤65%

2.4 Minimum Ventilation Rate

To ensure the health of the occupants, the building's air-conditioning and mechanical ventilation systems shall be designed to provide appropriate minimum quantum of outdoor air rates as stated in Table 1 and Table 5 of SS 553: 2016.

2.5 Acoustics

To demonstrate the acoustic performance of the internal partitions between adjoining spaces, the contractor shall follow the sound insulation requirements specified in the Acoustic Specifications.

Internal partitions between offices and existing AHU rooms are designed to be Rw 55 and to comply Green Mark NRB: 2015.

3 Artificial Lighting

3.1 Lighting

3.1.1 General

The tenant shall use the LED Luminaires certified under SGBP scheme in accordance the Architects/ Lighting consultant/ M&E engineers/ Landscape consultant light selection.

The quality of artificial lighting, used in occupied spaces shall be adhering to the following attributes:

- Good light-output over life with a minimum lifespan rating of L70>= 50,000 life hours.
- Lighting designed to avoid flicker and stroboscopic effects, by using high frequency ballasts for fluorescent luminaries and LED lighting with driver output frequency < 200 Hz and < 30% flicker.
- Meeting the minimum color rendering index (Ra or CRI) in clause of SS 531 – 1:2006 (2019)
- Only Persistent, Bioaccumulative and Toxic (PBT) free lighting luminaires are used for the Project.

3.1.2 Lighting Power Budget

The lighting power budget of the lighting designed should be at least 50% improvement over SS530: 2014 recommended baseline to conform to the required energy savings target.

Type of Usage	Maximum Lighting power budget (W/m²)
Tenanted Office spaces	≤ 6 W/m^2
Laboratories	≤ 8 W/m^2
Dining area and food preparation	≤ 5 W/m^2
Restaurants, lounges, bars	≤ 6 W/m^2
Retail: Clothes, cosmetics, accessories	≤ 17.5 W/m^2
Retail: Supermarket, hardware, stationary, pharmacy, sports, vehicles	≤ 10 W/m^2
Multi-purpose halls, conference halls	≤ 8 W/m^2
Toilets, changing rooms, laundries	≤ 5 W/m^2

The lighting lux levels to be achieved are to be complied with minimum lux levels recommended in SS531-1: 2006 (2019).

3.1.3 Smart Lighting Control

SMART sensors are provided throughout the development in various locations to control lighting function. The scope covers, but is not limited to, occupancy sensors, daylight sensor and temperature sensor.

4 Plug Loads

Limiting the plug load is essential to achieve Green Mark Platinum rating. The maximum plug load allowed for the offices and retail spaces is **16 W/m²**.

Type of Usage	Maximum Plug Load (W/m²)
Tenanted Office spaces	≤ 16 W/m²
Laboratories	≤ 22 W/m²
Data Centre	≤ 540 W/m²
Dining area and food preparation	≤ 16 W/m²
Restaurants, lounges, bars	≤ 16 W/m²
Retail: Clothes, cosmetics, accessories	≤ 16 W/m²
Retail: Supermarket, hardware, stationary, pharmacy, sports, vehicles	≤ 16 W/m²
Multi-purpose halls, conference halls	≤ 16 W/m²

5 Electrical Sub-Metering and Metering

Subsystem measurement devices with remote capability shall be provided, linked to a monitoring system and measure and trend energy consumption data of each tenant.

Tenants are required to provide separate digital power meter for lighting, AC system and plug load to meter the energy consumption of tenancy. They shall also be of billing grade that is capable of real-time data integration and transfer with JTC's Open Digital Platform using open standard protocols.

Tenants occupying a single unit, or multiple adjacent units on the same floor, shall provide at least a single set of Smart green lease meter that monitor the 3 different loads. Tenants taking up a single floor, multiple floors, or an entire tower block, shall minimally provide a single set of Smart green lease meter at every floor.

Smart Green Lease Meter Specifications:

- All digital power meter shall be verified by either tested and certification by a laboratory accredited by SAC-SINGLAS or recognized by SAC-SINGLAS.
- Records confirming the satisfactory testing of power meter required to be tested under sections 2.4.2 and 2.4.3 of Singapore Metering Code are to be produced when requested upon.
- The power meter accuracy shall comply to Singapore Metering Code 2.4.29 with accuracy class 0.5 or better. While the metering current transformers of accuracy class 0.5 with 5 amperes secondary current and 5VA burden. Refer to subsequent section on Current Transformer below.
- The meter memory shall be tamper-free and allow no resettable of kWh value.
- The data from the meter shall be collected via a pulse output, M-Bus or via built in communication interface Modbus RTU (RS485).
- Communication terminals shall be protected by suitable surge protective device.
- The kWh shall be applied in three-phase, four wired systems. In four-wire connection, the kWh meter shall utilize the circuit neutral common reference and not earth ground to provide metering accuracy.
- They shall be able to communicate with a smart energy analyser via M-Bus. The energy analyser shall have built-in web user interface via IP connection to allow remote monitoring. The user interface shall have configurable dashboards and graphical analysis functions (historical data, benchmark, instantaneous values, and consumption).

- Meters/devices connected via M-Bus/Modbus RS485 shall be limited to 8 nos. for maximum latency.

Only applicable for tenant providing energy for public facilities [Not applicable to retail tenants and hawker centre]

5.1 Energy Metering

Tenant to ensure sub-metering with remote metering capabilities for subsystems > 15kW or with electric loads > 100 kVA are provided for public facilities. Meters are to be logged and connected to district level energy monitoring.

5.2 Plan to Minimise Energy

Tenant to incorporate energy optimisation plan (i.e., for night operation, weekends when there is little occupancy) to ensure only the essential energy consuming devices are running.

6 Renewable Energy

[Not applicable to retail tenants and hawker centre]

The tenant shall provide a digital meter for Solar Photovoltaic (PV) system and ensure it is capable of logging data of the energy production. The tenant shall install solar PV in accordance with the architect's roof layout. Solar panel efficiency shall be 259 kWh/m^2 or higher.

The Tenant shall submit the following documents to the Landlord:

- Solar feasibility report acknowledged by QP or PV specialist and the Lead Consultant
- Reports of the installed system(s) including total capacity installed, area and location indication on plan.
- Technical product information of RE system and expected RE generated
- As-built drawings and on-site photographs of relevant design features and provisions for roof readiness
- As-built drawings and on-site photographs of the renewable energy source(s)
- Testing and commissioning report
- Logging data of the energy production and calculated energy replacement rate
- Purchase orders/delivery orders of the total capacity installed

7 Indoor Air Pollutants

During fit-out works, tenants should maintain indoor air quality by using materials that minimise airborne contaminants to promote a healthy indoor environment.

7.1 Non-Toxic materials

7.1.1 Volatile Organic Compounds

The use of products containing high levels of Volatile Organic Compounds (VOCs) is not permitted, as specified in the architect's schedule of finishes. Volatile Organic Compounds (VOCs) are defined as carbon compounds that participate in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metal carbides and carbonates, and ammonium carbonate). The compounds vaporize (become a gas) at normal room temperatures.

The contractor must use products certified SGBP Very Good or above.

Figure 1 SGBC certification of products to be 2 ticks above

7.1.2 Adhesives & Sealants

The following products as defined below are to be provided with low VOC content:

"Adhesive" - means any substance that is used to bond one surface to another surface by attachment. Adhesives include adhesive bonding primers, adhesive primers, adhesive primers for plastics, and any other primer.

"Aerosol Adhesive" - is any adhesive packaged as an aerosol product in which the spray mechanism is permanently housed in a non-refillable can designed for handheld application without the need for ancillary hoses or spray equipment. Aerosol adhesives include special purpose spray adhesives, mist spray adhesives and web spray adhesives.

"Indoor Adhesive, Sealant and/ or Sealant Primer" Products defined as adhesive or sealant applied on-site, inside the building's waterproofing system.

"Porous Sealant" is a substance used as a sealant on porous material. Porous materials have tiny openings, often microscopic, in which fluids may be absorbed or discharged. Such materials include, but are not limited to, wood, fabric, paper, corrugated paperboard and plastic foam.

"Primer" is a material applied to a substrate to improve adhesion of subsequently applied adhesive.

"Non-porous Sealant" is a substance used as a sealant on non-porous materials. Non-porous materials do not have openings in which fluids may be absorbed or discharged. Such materials include, but are not limited to, plastic and metal.

A "Sealant" is any material with adhesive properties that is formulated primarily to fill, seal, or waterproof gaps and joints between two surfaces. Sealants include sealant primers and caulks.

The contractor must use products certified SGBP Very Good or above.

7.1.3 Paints & coatings

The following products as defined below are to be provided with low VOC content:

"Paints –a pigmented liquid that is designed for application in single or multiple layers and forms an opaque, continuous film after application to decorate or protect a surface."

"Coatings - a pigmented resin that is converted to a solid adherent film after application to a substrate as a thin layer for decoration or protection of a surface."

The tenants must use products certified SGBP Very Good or above.

7.1.4 Urea Formaldehyde

The use of products containing added Urea Formaldehyde is not permitted, as specified in the architect's schedule of finishes.

No Added Urea Formaldehyde products are required throughout the interior of the building, defined as inside of the weatherproofing system.

The contractor is to submit details for the following to ensure no Urea Formaldehyde is used:

i. Composite wood products
ii. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies,
iii. Draperies
iv. Insulation

The following materials are classed as composite wood and agrifiber products:

i. Particleboard
ii. Medium density fibreboard (MDF)
iii. Plywood
iv. Wheat board
v. Strawboard
vi. Panel substrates
vii. Door cores

8 Water

8.1 Sanitary fittings & Finishes

All sanitary fittings installed on the project are to be WELS certified with an Excellent rating (3 Ticks).

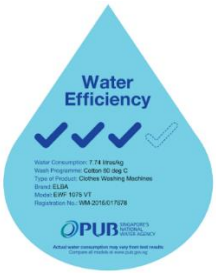

Figure 2 WELS Certification 3 ticks' example

This includes but is not limited to, the following applications:

i. Basin Taps & Mixers
ii. Sink/bib taps & mixers
iii. Urinals and Urinal flush valves
iv. Shower Taps and mixers or showerheads
v. Dual Flush low capacity Cisterns

The contractor shall submit the following to the Landlord (JTC):

- As-built drawings
- Water fitting schedules tabulated with the numbers, types and the WELS rating delivery order reference no, brands/ models of the installed fittings.

8.2 Water efficiency management

Only applicable for tenant providing water for public facilities [Not applicable to retail tenants and hawker centre]

Tenant to demonstrate plans to reduce demand of water by public facilities and in common areas, where applicable.

The buildings are to be provided with private meters and leak detection system to monitor major water consuming sources such as irrigation, water features and swimming pools.

Tenant to provide plan to improve water performance using water efficient strategies over the next 3 years.

9 Environmental Management Practice

As part of the environmental management practice for the buildings, the facilities provided for recycling bins which are provided for the collection and storage of different recyclable waste such as paper, glass, plastic food waste etc. are to be followed and used.

10 Waste management

10.1 Waste separation

The tenants are encouraged to segregate their waste properly. Waste are to be put in its appropriate chutes provided at every floor. Recycles waste chutes are provided in at every floor level.

Recyclables include paper, plastic, metal, aluminium and glass.

Only applicable for tenants handling waste from entire building/ buildings [Not applicable to retail tenants]

10.2 Monitoring of waste

Tenant to support monitoring of waste generated by the building through the centralised bin centre via pneumatic waste conveyance system. Waste generated includes domestic household waste, commercial waste, construction waste, etc.

10.3 Waste collection

Tenant to provide bins for segregation for recyclables (i.e., paper, plastic, glass etc.) and hazardous waste.

Tenant to provide litter receptacles with integrated recycle containers at public areas and public amenities.

11 Appendix

Checklist and tabulation guidelines are provided in this section to guide tenants and contractors with compliance.

Air Handling Units / Fan coil Units & Mechanical Ventilation Fans Tabulation

To indicate products purchased in the sample table below where applicable in tenanted space.

Products	Brand	Model	Motor nameplate power (kW)	Fan System efficiency (input Power) (W/CMH)	Refrigerant ODP	Refrigerant GWP	Compliant (Y/N)
Air Handling Unit							
Fan Coil Unit							
MV Fans							

VRF System Name	Brand	Efficiency (kW/RT)	Efficiency > 0.65kW/RT (Y/ N/ NA)

Please attach:

1. Relevant product specifications for each applicable item.
2. Purchase order/delivery order.

Minimum Ventilation Rate

Tabulation for the design ventilation rate for each space to follow a similar format as per the table below.

Space	Area	Occupancy Classification	L/s/m2 (SS553:2016)	Min Outdoor Air Flow rate (L/s) SS553	Designed Outdoor Air Flow rate (L/s)	Minimum Fan Capacity (L/s)	Minimum Fan Capacity (CMH)

Lighting Fitting Tabulation

For each space tabulate the Lighting Power Budget (LPB) and the achieved lux in the format below.

Area	Level	Floor Area (m^2)	Type of fitting	Power Per Fitting (Watts)	Quantity	SS531 Lux	Design Lux	SS530 LPB (W/m^2)	Design LPB (W/m^2)

Please attach:
1. SGBP Certificate of LED Luminaires.
2. Relevant product specifications for lighting fittings.
3. Purchase order/delivery order.

Plug Loads

For each space tabulate the AV and equipment based on the format below.
Note: Office spaces shall not exceed 16 W/m^2

Space	Area (m^2)	List of Equipment	Power (W)	Total Power (W)	Plug Load for Space (W/m^2)

Please attach:
1. Relevant product specifications for each applicable item.
2. Purchase order/delivery order.

Electric Submeters

Tenants are required provide separate a digital power meter to meter the total energy consumption of tenancy.

Electric Submeter	Installed (Y/N)
Lighting	
Air conditioning	
Plug loads	

Please attach:
1. Relevant product specifications for digital meter
2. Purchase order/delivery order

Volatile Organic Compounds Checklist

To indicate products purchased in the sample table below where applicable in tenanted space and the presence of volatile organic compounds (VOCs).

Products	Name of Product	Brand	SGBP Certification (Ticks)
Paints			
Coatings			
Primer			
Sealant			
Porous Sealant			
Non-porous Sealant			
Adhesive			
Aerosol Adhesive			
Indoor Adhesive, Sealant and/or Sealant Primer			

Please attach:

1. Relevant product specifications for each applicable item
2. SGBP Certificate
3. Purchase order/delivery order

Urea Formaldehyde Checklist

To indicate products purchased in the sample table below where applicable in tenanted space and the presence of urea formaldehyde.

Products	Name of Product	Brand	Urea Formaldehyde (Y /N / NA)
Composite wood products			
i. Particleboard			
ii. Medium density fibreboard (MDF)			
iii. Plywood,			
iv. Wheat board			
v. Strawboard			
vi. Panel substrates			
vii. Door cores			
Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies,			
Draperies			
Insulation			

Please attach:

1. Relevant product specifications for each applicable item.
2. Purchase order/delivery order.

Water Efficient Fittings Tabulation

Tabulation for any Water Efficient Fittings purchased to follow the following format.

Type of Water Fitting	Description	Applicable Areas	Brand	Model	Quantity of WELS Certified Water Fittings			Total
					3 Ticks Excellent	2 Ticks Very Good	Mandatory WELS	
Basin Taps & Mixers								
Flushing Cisterns								
Shower Taps, Mixers or Showerheads								
Sink Taps & Mixers								
Urinals and Urinal flush valve								
Bib Tap								

Please attach:

1. Relevant product specifications for each applicable item
2. WELS Certificate for each fitting
3. Purchase order/delivery order

Solar Photovoltaics

Location	Area (m^2)	Capacity (kWp)	Renewable energy generated (kWh/yr)

Please attach:

1. Relevant product specifications for applicable item
2. Solar feasibility report acknowledged by Qualified Person (QP) or PV specialist
3. Reports of the installed system(s) including total capacity installed, area and location indication on plan.
4. Technical product information of RE system and expected RE generated
5. As-built drawings and on-site photographs of relevant design features and provisions for roof readiness
6. As-built drawings and on-site photographs of the renewable energy source(s)
7. Testing and commissioning report
8. Logging data of the energy production and calculated energy replacement rate
9. Purchase orders/delivery orders of the total capacity installed