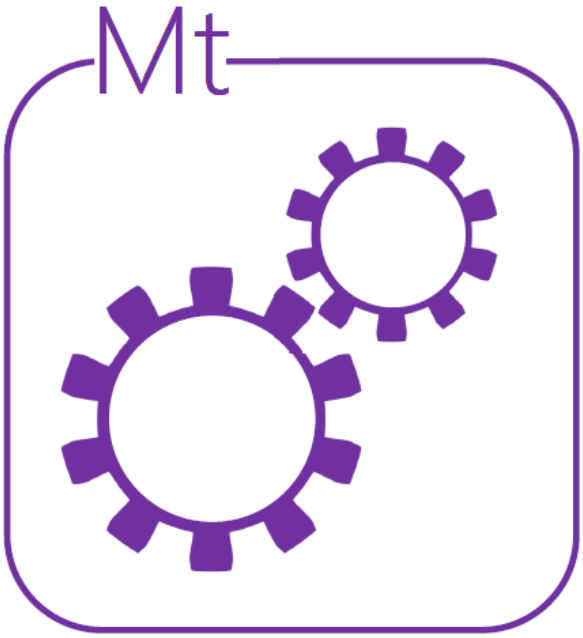

Green Mark 2021

Maintainability Framework

For Existing Non-Residential Buildings

Mt
Maintainability

Maintainability (Existing Non-residential Building) Revision Log

S/N	Brief description of changes	Effective date
01	First issue (Version 1.0)	01 Nov 2021
02	Second issue with minor updates (Version 1.1)	01 Nov 2021
03	Third issue with minor updates (Version 1.2)	01 Nov 2021
04	Fourth issue (Version 2.0) • Editorial changes across the framework for improved clarity. • Addition of criteria/ revision to existing criteria i. 2.3.3b (50mm raised partition) ii. 2.3.6c (open ceiling) iii. 3.1.2b (permanent sleeve to mount davit arm) iv. 3.6.2b (weatherproof fire-rated material) v. 5.1.1a (20m radius water points) vi. 5.2.1aii (shallow water body) • Deletion of former criteria i. 1.4.1a (efflorescence) ii. 2.2 (walls and partitions) iii. 2..5 (basement) iv. 3.5.1a (cleaning eyes with viewing panel) v. 3.6.1a (access to fire detectors) vi. 4.1.1a (access to light fixtures) vii. 5.5.1c (water absorption rate of engineered wood)	01 Jan 2024

CRITERIA			Points Allocation
Section 0 – GENERAL			
0	General Project Requirement		8.5
	Sub-total score for Section 0		8.5
Section 1 – ARCHITECTURAL EXTERIOR			
1.1	General Façade	Part A	2
	Part A: Subtotal of 1.1		*2*
1.2	Cladding – Tile / Stone / Metal / Others	Part B: Façade System	4
1.3	Curtain Wall		4
1.4	Masonry, Lightweight Concrete Panels, and Precast components		4
	Part B: Subtotal of 1.2 to 1.4		*4 (Max)*
1.5	Façade Features	Part C: Façade Ancillaries	3.5
1.6	Entrance lobby		3
1.7	Roof		2
	Part C: Subtotal of 1.6 to 1.7		8.5
	Sub-total score for Section 1 (Part A + Part B+ Part C)		14.5
Section 2 – ARCHITECTURAL INTERIOR			
2.1	Floors		2.5
2.2	Ceilings		5
2.3	Wet Rooms and Storage		8
2.4	Loading Bay/ Back of House Service Areas		3.5
	Sub-total score for Section 2		19

Section 3 – MECHANICAL			
3.1	Chiller Plant	Part A: Air Conditioning Plant Systems	13.5
3.2	Unitary Air Conditioning System – VRF System		1.5
	Part A: Subtotal for cooling systems (subtotal of apportioned 3.1 and 3.2)		13.5 (Max)
3.3	Air Distribution System	Part B	8
3.4	Domestic Water Supply		0.5
3.5	Sanitary System		1.5
3.6	Fire Protection System		3.5
	Part B: Subtotal of 3.3 to 3.6		13
	Sub-total score for Section 3 (Part A + Part B)		27
Section 4 – ELECTRICAL			
4.1	Lighting System		2
4.2	Power Distribution System		2.5
4.3	Extra Low Voltage (ELV) System		3.5
4.4	Lightning Protection System		1
4.5	Vertical Transportation System		1.5
	Sub-total score for Section 4		10.5
Section 5 – LANDSCAPE			
5.1	Softscape		2
5.2	Hardscape		3
5.3	Vertical Greenery		0.5
5.4	Roof, Sky Terraces, Planter boxes on building edge/facade		3
5.5	Standalone Structures		2
	Sub-total score for Section 5		10.5
Section 6 – SMART FM – Innovative Solutions			
6.1	Cybersecurity		1
6.2	Adoption of Smart FM solutions		10
	Sub-total score for Section 6		11

Section 7 – SMART FM – Building Management Systems			
7.1	Central Computer		2
7.2	Software Integration		4
7.3	Controllers		2.5
7.4	Integration with M&E systems		2
	Sub-total score for Section 7		10.5
Section 8 – SMART FM – FACILITIES MANAGEMENT SYSTEM			
8.1	Failure Analysis	Part A: Asset Management	1.5
8.2	Life Cycle Management		1.5
	Part A: Subtotal of 8.1 to 8.2		3
8.3	Service Management	Part B: Operations Management and Supply Chain Management	2.5
8.4	Maintenance Management		1.5
8.5	Other General Services		1
8.6	Supply Chain Management		4.5
	Part B: Subtotal of 8.3 to 8.7		9.5
	Sub-total score for Section 8 (Part A + Part B)		12.5
		Overall Maintainability Points	**124**

ASSESSMENT APPROACH

Category 1 (Cat 1)

Assessment: Full points for solutions only with 100% applicability in area of application or number of instances.

Category 2 (Cat 2)

Assessment:

a. Apportioned points for solutions with 15% to 85% coverage (partial or apportioning) in area of application or number of instances.

b. Full points for solutions with >85% coverage in area of application or number of instances.

c. No points for solutions with <15% coverage in area of application or number of instances.

o GENERAL

Design Factor	General Requirements		
Design Strategies & Collaboration	Promote inclusion of Design for Maintainability (DfM) during AEI stage (8.5 points)	Points Available	Points Scored
	a. Promote integrated design approach and stakeholder engagement at planning and key design stages during AEI work. i) Conduct at least 3 design charrettes during the detail design stage involving minimally 3 stakeholders from the following group: o Building owner/ representative o Facilities manager (FM)/operator o Design consultants (minimally one representative each from the various disciplines – architecture, civil & structural, mechanical and electrical, landscape, quantity surveyor, etc.) o Other specialist consultant / supplier (i.e. environmentally sustainable design, lighting specialist, material specialists, façade access consultant, etc.)	0.5 (Cat 1)	
	ii) Use of 5-step SMART process to evaluate building's potential to implement Smart FM, and to identify suitable solutions that will streamline FM maintenance process, improve productivity and service delivery.	1 (Cat 1)	
	iii) Design for maintainability report, as part of the O&M manual, outlining the key maintainability considerations and provisions.	1 (Cat 1)	
	b. Use of life cycle cost (LCC) approach to identify solutions with better maintainability benefit throughout the building life span. i) Undertake project-specific LCC analysis on adopted LCC-related solutions listed in this appraisal system. 0.5 points per LCC.	Up to 2 (Cat 1)	
LCC	c. Maintenance contract		

	Use of performance-based contracts and integrated facilities management (IFM) contracts to improve labour efficiency. i) Projects demonstrating performance-based / outcome-based maintenance contract for the following services: (1 point for each item, up to 2 points) • Chiller plant • Air distribution • Cleaning (toilets, waste management, etc.) • Landscape • Security ii) Projects demonstrating integrated facilities management (IFM) contracts for the following maintenance services: (1 point for 2 maintenance services, up to 2 points) • Building maintenance services • Mechanical and Electrical maintenance services • Security services • Cleaning services • Landscape services • Pest control services	Up to 4 (Cat 1)	

1 ARCHITECHTURAL EXTERIOR

Design Factor	1.1 General Façade (2 points)		
Detailing	1.1.1 to 1 Reduce risk of water ingress and streaking on façade (up point)	Points Available	Points Scored
	a. Design for drip edges/grooves to mitigate streaking on exterior soffits and vertical façade surfaces e.g. leading edge of flashing, sills, overhangs, or other horizontal projecting façade elements.	0.5 (Cat 1)	
	b. Design all top surface of walls to slope away from the external face of façade	0.5 (Cat 1)	
Detailing + Access	1.1.2 Access for maintenance of façade (0.5 point)	Points Available	Points Scored
LCC	a. Ensure entire façade is accessible for maintenance.	0.5 (Cat 1)	
Access	1.1.3 Access for maintenance to façade, soffit, and roof of enclosed sky bridges (0.5 point)	Points Available	Points Scored
	a. Ensure the roof, façade and soffit of skybridges are accessible for maintenance.	0.5 (Cat 1)	
	Part B: Façade Systems - Section 1.2 to 1.4 (For singular façade system, *points can be scored for 1.2, 1.3 or 1.4. In case project comprises multiple façade systems, points will be apportioned on an area basis)*		
Design Factor	1.2 Cladding – Tile / Stone / Metal / Others (4 points)		
Detailing + Material	1.2.1 Reduce risk of water ingress and streaking on façade (Up to 4 points)	Points Available	Points Scored
	a. For streaking: Specify metals of similar properties or separators between different metal components on the exposed face of the façade to mitigate risk of bi-metallic corrosion.	0.5 (Cat 1)	
LCC	b. For water ingress: Design for pressure-equalised (rain-screen) system, comprising of: i) Ventilation openings of adequate dimensions to ensure pressure-equalisation of the cladding cavity ii) Drainage system to positively drain out water iii) Air cavity with a fully sealed internal backing wall behind the cladding.	2.5 (Cat 1)	
	c. For water ingress – In face-sealed cladding: specify silicone or modified silicone sealant that is compatible and with adequate adhesion properties to the substrate.	1 (Cat 1)	

LCC	d. For streaking – specify sealant type with non-stain, non-bleed properties.	0.5 (Cat 1)	
	e. For water ingress – specify gasket type EPDM or TPE.	1 (Cat 1)	
	f. For water ingress - design for double layer protection at façade interfaces, coping, etc.	0.5 (Cat 2)	
	Advanced effort: For water ingress: Specify anti-carbonation coating or waterproofing layer onto the backing wall behind the cladding.	1 (Bonus) (Cat 1)	
Design Factor	1.3 Curtain Wall (4 points)		
Detailing + Material	1.3.1 Reduce risk of water ingress and streaking on façade (Up to 4 points)	Points Available	Points Scored
	a. For streaking: Specify metals of similar properties or separators between different metal components on the external face of façade to mitigate risk of bi-metallic corrosion.	0.5 (Cat 1)	
LCC	b. For water ingress – design for pressure-equalised system comprising of: i) Ventilation openings of adequate dimensions to ensure pressure-equalisation of the cavities ii) Drainage system to positively drain out water iii) Internal air-seal layer to pressurise internal cavities and minimise risk of water penetration	2 (Cat 1)	
LCC	c. For water ingress - specify silicone sealant that is compatible and with adequate adhesion properties to the substrate.	1 (Cat 1)	
LCC	d. For streaking – specify sealant type with non-stain, non-bleed properties.	0.5 (Cat 1)	
	e. For water ingress – specify gasket type EPDM or TPE.	1 (Cat 1)	
	f. For water ingress – design for double layer protection at façade interfaces, coping, etc..	0.5 (Cat 2)	
Design factor	1.4 Masonry, Lightweight Concrete Panels, and Precast components (4 points)		
Detailing	1.4.1 Reduce risk of water ingress and efflorescence formation (up to 3 points)	Points Available	Points Scored
	a. For water ingress: design movement joints in large continuous areas, or between adjacent/different building components, to minimise the risk of damage to façade, weather seal, and waterproofing joints.	0.5 (Cat 1)	
	b. For water ingress in precast joints – specify silicone or modified silicon sealant on exterior exposed joints, that is	1 (Cat 1)	

		compatible and with adequate adhesion properties to the substrate.		
LCC		c. For efflorescence: Specify clear coat with good resistance to water absorption on façade surface. E.g. fair-faced or pigmented concrete. (OR) Specify paint with good resistance to water absorption complying to SS500 or equivalent.	1.5 (Cat 1)	
Material	1.4.2	Reduce risk of façade flaking/peeling/cracking/blistering (1 point)	Points Available	Points Scored
LCC		a. Specify paint finish: Top coat: Paint with good resistance to water absorption complying to SS500 or equivalent *(OR)* Mineral paint	1 (Cat 2)	
Design Factor	1.5	Façade Features / other façade considerations (3.5 points)		
Access	1.5.1	Direct access to all protruding façade features, e.g. canopies, sunshades, niches, fins, ledges, BIPV, façade screens, etc. (0.5 point)	Points Available	Points Scored
		a. Ensure every part of all façade features is accessible for maintenance.	0.5 (Cat 1)	
Detailing	1.5.2	Reduce risk of corrosion of exposed steel structures (1 point)	Points Available	Points Scored
		a. Design to avoid direct contact of a steel base with the ground (at least 100mm above) to mitigate corrosion and entrapment of moisture and dirt.	1 (Cat 2)	
Detailing	1.5.3	Reduce risk of water ingress in open joint cladding (*i.e. cladding serving as a decorative feature and not as a water barrier*) (1 point)	Points Available	Points Scored
		a. For features such as open-joint cladding: provide flashings at regular intervals (not exceeding 3 floors) to positively drain out the cladding cavities and prevent the accumulation of water.	1 (Cat 1)	
Detailing	1.5.4	Reduce risk of tile/stone from detaching off façade (1 point)	Points Available	Points Scored
		a. Design for mechanically-fixed individual tile/stone panels with stainless steel fixings.	1 (Cat 1)	
Design Factor	1.6	Entrance Lobby (3 points)		

Detailing	1.6.1	Reduce risk of water ingress at entrances (Up to 3 points)	Points Available	Points Scored
LCC	a.	Design canopy/overhang (with minimum 1:50 slope) to shelter against wind-driven rain with canopy angled at least 45° to the entrance line and with drop panel if canopy/overhang does not shelter to entrance line.	2 (Cat 2)	
		Advanced efforts: Numerical simulation studies specific to location and context of surroundings of entrances	1 (Bonus) (Cat 1)	
LCC	b.	Design entrances with transition/buffer zone, e.g. vestibule design *(Solutions b & c work as an integrated system and are not mutually exclusive, i.e. both must be scored for.)*	2 (Cat 2)	
LCC	c.	Design for aluminium drain pan with walk-off mats. *(Solution c must be integrated with solution a or b to be eligible for scoring.)*	1 (Cat 2)	
Design Factor	1.7	Roof (2 points)		
Detailing	1.7.1	Reduce risk of water ponding on roofs (up to 1 point)	Points Available	Points Scored
	a.	For concrete flat roofs - design slope not gentler than 1:150 and with scupper drains/gutter.	0.5 (Cat 1)	
	b.	For metal sheet profiles: Design slope to manufacturer's specifications (*OR)* Design slope for different sheet profiles based on the roof pitch table (refer to table in technical guide). (*OR)* Design slope for different sheet profiles determined by rainwater drainage capacity calculation.	0.5 (Cat 1)	
Material + Detailing	1.7.2	Reduce risk of waterproofing failure/decay on concrete roofs (0.5 point)	Points Available	Points Scored
	a.	Specify bitumen / polymer elastomer preformed waterproofing membrane. *(*design for overlap and proper termination of waterproofing membrane*)* *(OR)* Specify water-based/solvent-based liquid applied waterproofing membrane.	0.5 (Cat 1)	

Material + Detailing	1.7.3	Reduce risk of corrosion on metal roofs (0.5 points)	Points Available	Points Scored
	a.	Specify metal of similar properties or separators between different materials to mitigate risk of bi-metallic corrosion between roof and other metal components or accessories.	0.5 (Cat 1)	

2 ARCHITECTURAL INTERIORS

Design Factor	2.1	Floors (2.5 points)		
Material	2.1.1	Reduce risk of damage to floors in common areas within the building (1.5 points)	Points Available	Points Scored
LCC	a.	Specify flooring materials with minimum Mohs hardness value of 7, in areas of high pedestrian traffic such as entrances, lobbies, corridors and connecting walkways.	1.5 (Cat 2)	
Material	2.1.2	Reduce maintenance works for floors in common areas within the building (1 point)	Points Available	Points Scored
LCC	a.	Specify flooring material – e.g. homogenous tiles – with water absorption rate not exceeding 0.5 % to reduce settling of stains in areas of high pedestrian traffic such as entrances, lobbies, corridors and connecting walkways.	1 (Cat 2)	
Design Factor	2.2	Ceilings (5 points)		
Access	2.2.1	Access to services within double slab areas for maintenance purposes (up to 2 points)	Points Available	Points Scored
	a.	Provide double slabs with minimum clear headroom of 1.8m	1 (Cat 2)	
	b.	Provide double slabs with minimum clear headroom of 2 m.	2 (Cat 2)	
Detailing	2.2.2	Access to services within the ceiling in non-tenanted indoor spaces (up to 1 point)	Points Available	Points Scored
	a.	Specify open ceiling design.	1 (Cat 2)	
LCC	b.	Specify suspended modular ceiling system that is easily demountable.	0.5 (Cat 2)	
Access	2.2.3	Access to ceiling for maintenance (1 point)	Points Available	Points Scored
	a.	Provide access to all parts of ceilings (including weather-exposed ceilings) or exposed soffit (where there are no ceilings) for general maintenance.	1 (Cat 1)	
Material	2.2.4	Reduce risk of warping/deterioration of ceiling panel system that are weather-exposed, e.g. sky terraces, entrance porches, corridors and canopies. (up to 1 point)	Points Available	Points Scored
LCC	a.	Specify suspended metal panel modular ceiling system, e.g. baffle metal panels and metal mesh panels.	1 (Cat 2)	

LCC	b. Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5 %.	1 (Cat 2)	
	c. Specify open ceiling design.	1 (Cat 2)	
Design Factor	2.3 Wet Rooms and Storage (8 points)		
Detailing	2.3.1 Provide permanent space to store cleaning tools and toilet supplies (up to 1 point)	Points Available	Points Scored
	a. Design for storage rooms for cleaning tools, carts, and supplies such as tissue rolls and soap refill for every male and female toilet cluster.	1 (Cat 1)	
	b. Design for at least one storage space within the male or female toilet clusters to store supplies such as tissue rolls and soap refill. (Point cannot be scored if already scored for solution a)	0.5 (Cat 1)	
Detailing + Material	2.3.2 Reduce risk of mould and fungus formation on walls in wet rooms (up to 1 point)	Points Available	Points Scored
LCC	Specify wall finishes with a. tiles e.g. glazed ceramic tiles or homogenous tiles. (1 point) b. anti-mould top-coat (0.5 point)	1 / 0.5 (Cat 2)	
Detailing + Material	2.3.3 Reduce risk of damage to toilet cubicle partitions and enable ease of cleaning (1 point)	Points Available	Points Scored
	a. Specify water-resistant, partition panels with water absorption rate not exceeding 5 %, e.g. phenolic panels.	0.5 (Cat 1)	
	b. Design for raised partition walls with minimum of 50mm gap from the finished floor level.	0.5 (Cat 1)	
Detailing	2.3.4 Reduce risk of water spill, and splashing and soap dripping on the counter and floor (up to 3.5 points)	Points Available	Points Scored
	a. Water spill on floor – Design for full vanity washbasin to slope away from the user.	1.5 (Cat 1)	
	b. Water spill on floor – Design for soap and tissue dispenser within arm's reach of each faucet. (Points can be scored only after scoring solution (a))	0.5 (Cat 1)	
	c. Soap dripping on counter/floor – Design of soap dispenser location to be vertically mounted directly above basin or integrated bin.	1 (Cat 1)	

	d. Water splash on counter/floor – Specify depth of basins to be minimally 175 mm to avoid excessive splashing.	0.5 (Cat 1)	
Detailing	2.3.5 Reduce the need to replace entire mirror glass pane when damaged (0.5 point)	Points Available	Points Scored
	a. Design for individual, modular mirror panes with standard sizes that are easy to replace.	0.5 (Cat 1)	
Material	2.3.6 Reduce degradation of false ceiling system in wet rooms (up to 1 point)	Points Available	Points Scored
LCC	a. Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5 %.	1 (Cat 2)	
LCC	b. Specify suspended metal panel modular ceiling system, e.g. baffle metal panels, aluminum trellis, and metal mesh.	1 (Cat 2)	
	c. Specify open ceiling design	1 (Cat 2)	
Design Factor	2.4 Loading Bay/Back of House Service Areas (3.5 points)		
Material	2.4.1 Reduce damage caused by impact on walls and columns in vehicular ramps, and loading bay areas (up to 1.5 points)	Points Available	Points Scored
LCC	a. Specify: i) wall bumpers (0.375 point) ii) column guards (0.375 point) iii) wheel stoppers (0.375 point) iv) bollards (0.375 point)	1.5 (Cat 1)	
Material	2.4.2 Reduce damage to walls, columns, and floors at back of house traffic delivery areas (up to 2 points)	Points Available	Points Scored
LCC	a. Specify column guards in service delivery areas.	0.5 (Cat 1)	
	b. Specify protective materials: i) for walls, e.g. chequered plate on walls (0.5 point) ii) for floors, e.g. epoxy flooring (0.5 point) iii) for doors, e.g. kickboards on doors (0.5 point)	1.5 (Cat 2)	

3 MECHANICAL

	Part A: Cooling Systems **(*Points can be scored for either 3.1 or 3.2. Points will be apportioned for projects having multiple types of cooling system and points in 3.1 will be prorated for projects with district cooling system)***		
Design Factor	3.1 Chiller Plant (13.5 points)		
Access	3.1.1 Access to chiller plant room for equipment replacement (1.5 point)	Points Available	Points Scored
	a. Chiller *(Require 100% compliance to all solutions listed below)* i) Provide minimum 1.5 m clear space to the back of the chiller to facilitate tube cleaning and general maintenance. *(OR)* Provide operable opening (i.e. roller shutter) to the back of chiller with minimum 2 m clear space upon opening of operable opening. The dimension of the operable opening shall be greater than the width and height of the chiller. ii) Provide minimum 1.2 m between the chillers (measured from plinth to plinth) for regular maintenance. iii) Provide minimum 1.5 m clear space above the chiller for overhaul or replacement including cable tray, trunking, sensors etc. *(OR)* Provide minimum 1m clear space above the chiller if the chiller plant has I-Beam to hoist heavy equipment's such as compressor.	0.5 (Cat 1)	
	b. Pump *(Require 100% compliance to all solutions listed below)* i) Provide minimum 600mm* clear space around the pump for regular maintenance. ii) Provide minimum 1 m clear headroom above the pump and motor to facilitate overhaul maintenance/replacement. iii) Provide clear and unobstructed access to chilled water pump for regular maintenance and replacement. Note: * excluding the sides with pipe connection	0.5 (Cat 1)	

	c. Locate all the measurement and verification (M&V) sensors < 3.0 m height from finished floor level (FFL). *(AND)* Provide unobstructed access to the M&V sensors for maintenance.	0.5 (Cat 1)	
Access	3.1.2 Access to equipment requiring frequent maintenance (5 points)	Points Available	Points Scored
	a. Provide catwalk to access ensure perimeter of the cooling tower (2 points) *(OR)* Provide Catwalk to access cooling tower fill area (1 point) Note: In addition to above requirements, cooling Tower entrance and cat ladder shall have direct access to perform regular maintenance	2 (Cat 1)	
LCC	b. Provide permanent sleeve to mount davit arm for all cooling towers and hand over of 1 davit arm for each cooling tower model to building owner.	1 (Cat 1)	
	c. Provide cat ladder with metal enclosure (cage) to access top of the equipment i.e. cooling tower etc.	0.5 (Cat 1)	
	d. Provide metal step-over platform at the main access leading to the plant rooms to avoid stepping on rooftop services (i.e. major ductwork, pipes above 100 mm diameter, trunking exceeding 200 mm in width etc.).	0.5 (Cat 1)	
	e. Provide minimum 1.2 m wide clear access route from the nearest lift lobby or staircase to the M&E plant rooms for regular maintenance (i.e. pump room, chiller plant room including cooling tower etc.).	0.5 (Cat 1)	
	f. Provide minimum 2m headroom from the top of cooling tower to objects such as trellis.	0.5 (Cat 1)	
Material + Detailing	3.1.3 Reduce risk of corrosion and dust invasion in cooling tower (Up to 1.5 points) *(Points can be scored for3.1.3a and either 3.1.3b or 3.1.3c, points will be apportioned for projects having both cross flow and counter flow cooling towers* *General requirement – applicable to both cross and counter flow cooling tower)*	Points Available	Points Scored
	a. All components in contact with condensing water or air stream shall be corrosion-protected. The construction material shall be either: i) FRP (fiberglass reinforced polyester with UV inhibitors). ii) 304 stainless steel. iii) For galvanized steel cooling tower, the zinc coating shall comply with the following: ○ Hot-dip galvanized steel shall comply with ASTM A123 (*OR*) G235 (*OR*) JIS H 8641 coating standards.	1 (Cat 1)	

	○ Continuous steel sheet shall comply with ASTM A653 zinc coating thickness.		
LCC	b. For cross flow cooling tower, provide basin cover to mitigate dust invasion and algal growth in the upper water basin.	0.5 (Cat 1)	
	c. For counter flow cooling tower, provide air intake louvres to avoid sun light from entering the cooling tower basin and thus reducing algae formation.	0.5 (Cat 1)	
Detailing	3.1.4 Reduce risk of oil/grease deposit on the cooling tower fins (1.5 point)	Points Available	Points Scored
	a. The kitchen exhaust outlet must be at least 5 m away from cooling tower air intake. *(AND)* The kitchen exhaust must be directed either perpendicular or opposite to the cooling tower air intake.	0.5 (Cat 1)	
	b. Provide kitchen air cleaning system (i.e. air scrubber, electrostatic precipitator filters etc.) to avoid grease deposits on the cooling towers.	1 (Cat 1)	
Detailing	3.1.5 Reduce risk of fouling issue and improve condenser water quality (2.5 points)	Points Available	Points Scored
LCC	a. Provide microprocessor based, automatic water quality monitoring and control system linked to Building Management System (BMS).	1.5 (Cat 1)	
LCC	b. Provide auto-tube cleaning for water cooled chillers.	1 (Cat 1)	
Detailing	3.1.6 Reduce risk of dust and debris settlement inside the cooling tower basin (up to 1.5 points)	Points Available	Points Scored
	a. Provide basin sweeper system (including side stream separator) to remove coarse to fine particles and silt deposit in the cooling tower basin. *Note: The basin sweeper system shall be provided for each cooling tower.* *(OR)*	1.5 (Cat 1)	
LCC	b. Provide side stream centrifugal separator or equivalent in condenser water loop to mitigate debris and dust accumulation.	1 (Cat 1)	
Design Factor	3.2 Unitary Air Conditioning System – Variable Refrigerant Flow (VRF) (1.5 points)		

Access	**3.2.1**	**Access to VRF outdoor units (Up to 0.5 point)**	**Points Available**	**Points Scored**
	a.	For single VRF outdoor unit installation: Note: Provide access space as specified in the Technical guide.	0.5 (Cat 1)	
	b.	For collective VRF outdoor unit installation: Note: Provide access space as specified in the Technical guide.	0.5 (Cat 1)	
	c.	For floor-by-floor VRF outdoor unit installation Note: Provide access space as specified in the Technical guide.	0.5 (Cat 1)	
Detailing	3.2.2	Avoid damage to the refrigerant pipe and insulation (1 point)	Points Available	Points Scored
	a.	Refrigerant pipe mounted outdoor (e.g. at roof level) must be mounted on inside raised trunking to avoid water ingress and damage to stepping/lateral impact.	1 (Cat 1)	
	Part B: Section 3.3 to 3.7			
Design Factor	3.3	Air Distribution System (8 points)		
Access	3.3.1	Access space for maintenance of air distribution system (up to 2 points). *Points can be scored for 3.3a, 3.3b, 3.3c and 3.3d points will be prorated for projects having all AHU, ceiling mounted AHU and FCU.*	Points Available	Points Scored
	a.	Floor mounted air handling unit (AHU) *Minimum 75% of the AHUs comply to below solutions = 0.5 point* *All AHUs (100%) comply to below solutions = 1 points* i) AHU access – Provide minimum 1 m clear space from the AHU room door entrance to the AHU for general maintenance. ii) Cooling coil pipe and filter access – Provide minimum 800 mm clear space after pipe connection to facilitate cooling coil cleaning and filter access. iii) Fan access – Provide minimum 800 mm clear space for fan/motor access and maintenance (if the access is not from cooling coil connection side). iv) Provide minimum 600 mm clear space to the side of AHU and 450mm to the back of AHU.	Up to 1 point (Cat 1)	

	b. Ceiling mounted air handling units (AHU) *Minimum 75% of the AHUs comply to below solutions = 0.5 point* *All AHUs (100%) comply to below solutions = 1 point* i) Cooling coil, filter and fan access – Provide minimum 600 mm clear space after pipe connection for cooling coil cleaning, filter access, and fan/motor access and maintenance. ii) AHU side and back clearance - Provide minimum 300 mm clear space to back of the AHU for general access. iii) For AHU's suspended at heights (≤ 3 m) – Provide minimum ground clearance of 1.5 m x 2.5 m to the mount scaffold. iv) For AHU's suspended at heights (> 3 m) – Provide permanent catwalk with structural platform (with handrails) around the AHU for periodic maintenance. The clear width of the catwalks shall not be less than 600 mm.		
	c. Fan coil units (FCU) *Minimum 75% of the FCUs comply to below solutions = 0.5 point* *All FCUs (100%) comply to below solutions = 1 point* i) Provide ceiling access panel with minimum 600 mm x 600 mm to access filter, cooling coil, and fan section for regular maintenance and replacement. ii) Cooling coil pipe connection access – Provide minimum 450 mm clear space after pipe connection from any obstacle. iii) FCU side clearance - Provide minimum 200 mm access space from any obstacle. iv) FCU and key components such as actuator control valve, local control panel (LCP) must be directly accessible and within maximum 600mm from the access panel.	Up to 1 point (Cat 1)	
	d. Access to FCU mounted at heights (i.e. atrium, lobby space) *Minimum 75% of the FCUs comply to below solutions = 0.5 point* *All FCUs (100%) comply to below solutions = 1 point* i) Access requirements stated in item 3.3.1c. (AND) either (dii), (diii) or (div).		

	ii) Provide clear access route for Mobile Elevated Work Platforms (MEWP) to reach the lobby, atrium space from the nearest door entrance. ○ Provide clear access with entrance door/ opening of 1.8 m width x 2.4 m height and working base of 1.8 m width x 2 m length if the mounting height is less than or equal to 10.5 m. ○ Provide clear access with entrance door/ opening of 2 m width x 2.8 m height and working base of 2 m width x 2 m length if the mounting height is greater than 10.5 m. iii) Provide alternative access (e.g. maintenance platform, access from top floors etc.) without having to access from the atrium floor. iv) Locate FCU less than 3 m from FFL for easy access and maintenance.		
Detailing	3.3.2 Reduce risk of water ponding and algae growth in the AHU room (1 point)	Points Available	Points Scored
	a. AHU drain pipe must be terminated directly above the floor trap to avoid any water spillage.	0.5 (Cat 1)	
	b. AHU room floor to be provided with epoxy coating to avoid algae and mould growth.	0.5 (Cat 1)	
Detailing	3.3.3 Reduce risk of choke of condensate drain pipes (1 point)	Points Available	Points Scored
	a. The horizontal drain pipes must have minimum slope of 1:100 for easy flow of condensate drain.	0.5 (Cat 1)	
	b. Provide T-joint before terminating the individual drain pipe from AHU to the main drain stack for periodic cleaning.	0.5 (Cat 1)	
Detailing	3.3.4 Reduce frequency of replacement for AHU filters (2 points)	Points Available	Points Scored
LCC	a. Provide differential pressure switch linked to BMS for real-time monitoring of filter choke condition. *Note: Differential pressure switch must be provided for both primary and secondary filter for PAHUs and AHUs.*	0.5 (Cat 1)	
LCC	b. Specify fibre glass filter media with average initial resistance not greater than 90 Pa for primary filter (MERV 8 and ISO ePM10 50%) and 145 Pa for secondary filter (MERV 14 and ISO ePM1 80%). *Note: Synthetic media with initial static charge is not acceptable*.	0.5 (Cat 1)	

LCC		c. Specify filters with better Life Cycle cost for increased service life and lower cost of ownership. LCC should capture the key parameters such as "Total cost of ownership, service life, Energy consumption details and Indoor Air Quality performance". *Note:* *i. Total cost of ownership must be in Singapore dollars* *ii. Energy consumption is based on S$0.20 / KWh* *iii. Filters must be complaint to ISO 16890 / ASHRAE 52.2:2017*	1 (Cat 1)	
Detailing	3.3.5	Avoid frequent re-alignment of fan parts i.e. pulley, bearings and belts (2 points)	Points Available	Points Scored
LCC		a. Specify AHU fan system with less moving parts (i.e. fans with direct drive system) for enhanced reliability and reduced downtime. *Note:* *Points will be prorated for buildings which are served predominantly (≥75%) by FCUs.*	2 (Cat 2)	
Design Factor	3.4	Domestic Water Supply (0.5 point)		
Access	3.4.1	Access space for maintenance of water tank (0.5 point)	Points Available	Points Scored
		a. Provide minimum clear width of 1.2 m access walkway to water tank from the nearest staircase or lift	0.5 (Cat 1)	
Design Factor	3.5	Sanitary System (1.5 points)		
Access + Detailing	3.5.1	Access provision and design detailing for sanitary pipes for ease of maintenance (1 point)	Points Available	Points Scored
		a. Specify hubless elbows for sanitary stacks with horizontal transfers.	1 (Cat 1)	
Detailing	3.5.2	Reduce risk of chokes in the sanitary pipe (0.5 point)	Points Available	Points Scored
		a. For buildings with food and beverage (F&B) units, the AHU condensate drain must not be linked to kitchen waste discharge pipes.	0.5 (Cat 1)	

Design Factor	3.6	Fire Protection System (3.5 points)		
Detailing	3.6.1	Prevent the lack of flexibility for maintenance and testing of sprinkler system (1.5 point)	Points Available	Points Scored
	a.	Locate the flow switch drain valve in rooms with floor trap (i.e. toilet, AHU room etc.).	0.5 (Cat 1)	
LCC	b.	Provide smart features such as the automatic flow switch testing system to automate the functional test for the fire sprinkler system.	1 (Cat 1)	
Material + Detailing	3.6.2	Reduce risk of damage and periodic replacement of fire-rated boards due to exposure to high humidity and water (2 points)	Points Available	Points Scored
	a.	Specify the use of weatherproof fire-rated materials for fire protection services such as wet/dry riser and hydrant pipes etc.	1 (Cat 1)	
	b.	Specify the use of weatherproof fire-rated materials for mechanical ventilation services such as kitchen exhaust ducts etc.	1 (Cat 1)	

4 ELECTRICAL

Design Factor	4.1 Lighting System (2 points)		
Access + Detailing	4.1.1 Reduce frequency of light replacement (1 point)	Points Available	Points Scored
LCC	a. Use reliable light fixtures such as LED light (LM80 B30 L70@ L50,000) which requires less maintenance.	1 (Cat 2)	
Material	4.1.2 Reduce risk of light flickering (0.5 point)	Points Available	Points Scored
	a. Specify constant DC output type LED driver complying with the following IEC standards to minimise flickering: i) IEC 62384. ii) IEC 61347 Part 1 and Part 2-13. b. For non-LED light fixtures, use electronic ballast to cut off power supply to mitigate flickering due to lamp failure.	0.5 (Cat 2)	
Material	4.1.3 Reduce risk of LED light colour shift (0.5 point)	Points Available	Points Scored
	a. Specify LEDs tested to ANSI/IES LM-79-19 and LM-80-15 to ensure the LED performance.	0.5 (Cat 2)	
Design Factor	4.2 Power Distribution (2.5 points)		
Detailing	4.2.1 Reduce risk of water Ingress into electrical room (0.5 point)	Points Available	Points Scored
	a. Electrical room must be raised by minimum 100 mm against the outside passageway. *(OR)* Provide minimum 100 mm plinth for floor mounted electrical switchboard.	0.5 (Cat 1)	
Detailing	4.2.2 Reduce risk of unnoticed failure of surge arrestor located in the LT main switchboard (1 point)	Points Available	Points Scored
	a. Use of surge arrestor with discharge indicator.	0.5 (Cat 1)	

	b.	Provide BMS monitoring for surge arrestor status.	0.5 (Cat 1)	
Detailing	4.2.3	Reduce risk of failure of main LT switchboard due to overheating (1 point)	Points Available	Points Scored
	a.	Install heat sensor in the main LT switchboard to alert any abnormal rise in temperature with audible/visual alarm.	0.5 (Cat 1)	
	b.	Integrate sensor to building BMS system for online monitoring of temperature data.	0.5 (Cat 1)	
Design Factor	4.3	Extra Low Voltage System (3.5 points)		
Access	4.3.1	Provide access for CCTV camera located at heights (1 point)	Points Available	Points Scored
	a. b.	Provide access to cameras located at heights (≥ 3m) i.e. foldable poles/arms; *(OR)* Provide clear access route for mobile elevated work platforms (MEWP) to reach the camera for maintenance.	1 (Cat 1)	
Detailing	4.3.2	Provide flexibility for future expansion for CCTV system (1.5 point)	Points Available	Points Scored
	a.	Provide minimum 20% spare capacity in network switch to cater for future expansion.	0.5 (Cat 1)	
	b.	Design that allows for future addition of data storage (either local or cloud base data storage).	1 (Cat 1)	
Detailing	4.3.3	Reduce risk of damage to outdoor camera and other equipment due to lightning surge (1 point)	Points Available	Points Scored
	a.	Provide surge arrestor to all outdoor cameras. *Note: The surge protection must be provided at power source (AND/OR) at network switch.*	1 (Cat 1)	
Design Factor	4.4	Lightning Protection System (1 point)		
Detailing	4.4.1	Reduce risk of damage of air termination tape at roof parapet wall due to operation of façade maintenance systems such as gondola (1 point)	Points Available	Points Scored

	a. Avoid damage to the lightning protection system by proper design and installation of facade maintenance system.	1 (Cat 1)	
Design Factor	4.5 Vertical Transportation (1.5 points)		
Access	4.5.1 Access to lift motor room for maintenance (0.5 point)	Points Available	Points Scored
	a. Provide permanent access (staircase with handrail) to the lift motor room.	0.5 (Cat 1)	
Detailing	4.5.2 Reduce lift downtime and enhance reliability (1 point)	Points Available	Points Scored
LCC	a. Provide lift predictive maintenance. Note: Monitor key parameters such as vibration, acceleration, levelling, door jams, gaps, noise, and jerk etc.	1 (Cat 1)	

5 LANDSCAPE

Design Factor	5.1	Softscape (2 points)		
Detailing + Material	5.1.1	Reduce labour-intensive irrigation for landscape (Up to 2 points)	Points Available	Points Scored
	a.	Design for water points with maximum 20 m radius from each point.	0.5 (Cat 1)	
LCC	b.	Specify rain sensor and auto-irrigation with timers.	1.5 (Cat 2)	
LCC	c.	Specify for auto-irrigation with timers. *(points cannot be scored if already scored in b)*	1 (Cat 2)	
		Advanced Efforts: Implement remote monitoring system for landscape irrigation along with water metering for irrigation. (+1 bonus point)	1 (bonus) (Cat 1)	
Design Factor	5.2	Hardscape (3 points)		
Detailing + Access	5.2.1	Access for maintenance of underwater lighting systems (1 point)	Points Available	Points Scored
LCC	a.	For shallow water bodies, design for easily replaceable lighting system along the inside perimeter of the structure, and i. above the waterline (1 point). ii. within a depth of 500mm below the waterline (calculate from base of light to finished floor level for in-ground water bodies/ to point of access for above-ground water bodies) (0.5 point) noted	1/0.5 (Cat 1)	
Material	5.2.2	Reduce risk of damage/degradation to outdoor fixed landscape furniture (up to 1 point)	Points Available	Points Scored
	a.	Specify for engineered wood with water absorption rate not exceeding 0.5%.	1 (Cat 2)	
	b.	Specify for anti-corrosion coating or stainless steel or aluminium for metal selections.	1 (Cat 2)	
Access	5.2.3	Ensure access for maintenance beneath decking (1 point)	Points Available	Points Scored

	a.	Design decks with demountable fixture system for maintenance of services beneath and for general cleaning.	1 (Cat 1)	
Design Factor	5.3	Vertical Greenery (0.5 point)		
Access	5.3.1	Access to all parts of vertical greenery for maintenance and replacement of perished plants (0.5 point)	Points Available	Points Scored
LCC	a.	Provide direct maintenance access to all vertical greenery both indoor and outdoor, e.g. catwalk, ladder, access corridor, MEWP, etc.	0.5 (Cat 1)	
Design Factor	5.4	Roof, Sky Terraces, Planter boxes on building edge/facade (3 points)		
Detailing + Access	5.4.1	Access for landscape on roof and sky terraces (2 points)	Points Available	Points Scored
	a.	Provide direct maintenance access to landscape on all roof and sky terraces.	0.5 (Cat 1)	
	b.	For planters more than 1.8 m wide, provide minimally 300 mm obstruction-free maintenance pathway inside the planter box.	0.5 (Cat 1)	
	c.	For trees: Provide 5 m clear pathway from building edge to tree trunk.	1 (Cat 2)	
Access	5.4.2	Access to planter boxes on building edge (up to 1 point)	Points Available	Points Scored
	a.	Provide minimally 600 mm access walkway to planter boxes for maintenance (1 point) *(OR)* Provide minimally 450 mm access walkway to planter boxes for maintenance (0.5 point)	1 (Cat 2)	
Design Factor	5.5	Standalone structures (2 points)		
Detailing + Material	5.5.1	Reduce water ponding and degradation of outdoor standalone structures, e.g. pavilions (up to 1point)	Points available	Points Scored
	a.	Design for outdoor standalone structure's roof slope to be not gentler than 15 degrees for efficient water run-off.	0.5 (Cat 1)	

	b. Design to avoid direct contact of steel base with the ground (raised at least 100mm) to prevent corrosion and entrapment of moisture and dirt. *(Point cannot be scored if already scored in solution 1.5.2)*	0.5 (Cat 1)	
Material	5.5.2 Reduce risk of warping/deterioration of ceiling panel system on standalone structure (up to 1 point)	Points available	Points scored
	a. Specify suspended modular metal panel, e.g. baffle metal panels and metal mesh panels	1 (Cat 2)	
	b. Specify moisture-resistant suspended non-metallic modular ceiling panels with water absorption rate not exceeding 5%	1 (Cat 2)	
	c. Specify open ceiling design	1 (Cat 2)	

6 SMART FM – INNOVATIVE SOLUTIONS

Design Factor	6.1	Cybersecurity (Applicable to both BMS and FMS System) (1 point)		
Detailing	6.1.1	Lack of cyber security leading to data theft and economic impact (Up to 1 point)	Points Available	Points Scored
		a. Implement a risk-based cyber security assessment conducted by building owner's IT department/cyber security consultant Building OT system i.e., BMS and FMS system must be governed by Information Security Management System ("ISMS"). These are some basic cyber security requirements that should be included in the ISMS; i) Minimum of two network tiers for BMS and FMS – web/application tier ("demilitarised zone or DMZ") and data tier separated by firewall that appropriately configured to block direct access to database from external network. ii) Up-to-date anti-virus software in all machines. iii) Firewalls to assess communication with 3rd-party services. iv) Encryption of critical data at rest (stored data) and data in transit (transmitted data); v) User access shall have Individual user authentication and multi-level grouping to regulate the access. The login authentication to be password protected. vi) Conducting of regular Vulnerability Assessment & Penetration Testing ("VAPT") and remediation of all critical, high and medium security issues; VAPT should minimally cover the latest OWASP Top 10 vulnerabilities. vii) System audit log or audit trail to record data changes and system access. viii) Install two-factor Authentication.	0.5 (Cat 1)	
		b. The organisation is assessed by an independent party and certified to comply with 1 of the following certifications; i) ISO 27001, the International Information Security Standard ii) SOC 2 certification, American Institute of Certified Public Accountants. iii) IEC 62443, Industrial communication networks - IT security for networks and systems.	1 (Cat 1)	

Design Factor	6.2	Adoption of Smart FM Solutions (10 points)		
Detailing	6.2.1	Adopt innovative technologies that improve FM labour efficiency and service delivery. (Up to 3 points)	Points Available	Points Scored
	a.	Type 1 – Use of digitised workflow automation to optimize the workflow, productivity and service delivery: (1 point each) Digitalized Workflow Automation: When triggered by a feedback or incident, automatically initiates a process that tracks, monitors, and closes the feedback or incident. Example applications are as follows: 1. Remote monitoring systems with sensors that which will alert FM team on soft FM (e.g. cleaning, pest control, etc.) 2. Video analytics with incident detection that would alert security team of any abnormalities 3. Application that allows for automated temperature adjustment in accordance to user feedback 4. Smart toilets 5. Smart bins 6. Smart monitoring system for fire extinguishers 7. Smart exit lights 8. Software platform for defects management 9. Software platform for handover of as-built drawings	Up to 3 (Cat 1)	
	b.	Type 2 – Use of data analytics and artificial intelligence for system optimization and predictive maintenance: (1 point each) i) Diagnostics AI: Able to identify system deviations and diagnose potential causes. ii) Predictive AI: Able to diagnose problems and predict future states of assets and systems. Example applications are as follows: 1. M&E equipment condition monitoring with sensors and analytics for preventive/conditional-based maintenance (e.g. monitoring of embedded sensors in chiller or VRF CU to predict mechanical wear and failure) 2. Fault detection diagnostics to find failed or improperly operating equipment (e.g. using abnormalities in IAQ readings or deviation from set points to relate equipment faults)		

Detailing	6.2.2 Advanced Smart FM – Integrated and aggregated Smart FM solutions that improve FM labour efficiency and service delivery (up to 4 points)	Points Available	Points Scored
	a. Type 3 – Integration across systems (1 point each): Integration across multiple systems/FM services to optimize resource deployment and utilization across multiple systems/FM services Example applications are as follows: 1. Use of lift traffic and carpark gantry data to forecast and streamline cleaning regimes 2. Integration of CCTV with access control system for intrusion detection 3. Integration between CCTV system and Fire Alarm System to promptly identify occurrences of false alarms	Up to 3 (Cat 1)	
	b. Aggregated Smart FM Solution Building owners can explore areas where economies of scale can be achieved through aggregation of FM solutions. Example applications are as follows: 1. For building owners with a portfolio of buildings, Smart FM solutions can be aggregated across the portfolio of buildings for a better overview and management of resources. 2. Building owners with a single development may explore aggregation through FM companies and solution providers through outcome-based contracts. FM companies and solution providers can better manage resources to meet service demands through the aggregation of buildings in a district.	1 (Cat 1)	

Detailing	6.2.3 Design for Robotics and Automation (R&A) (up to 3 points)	Points Available	Points Scored
	a. Building infrastructures should be designed to optimise robot capabilities such as their range of mobility, ease of completing tasks, and ability to navigate its work environment. (up to 3 points, 0.5 point for each R&A solution) Identifying the robots of interest to be deployed and recognising their corresponding level of autonomy is important in planning for suitable infrastructure that would cater to the robots. Example use of FM robots could include the following: • Cleaning robot e.g. façade, floor, window, toilet • Concierge robot • Facade inspection robot/drone • Landscape management robot e.g. lawn mowers • Pest management robot e.g. detection, monitoring, extermination • Security robot • Waste management robot	Up to 3 (Cat 1)	

7 BUILDING MANAGEMENT SYSTEM

Design Factor	7.1	Central Computer (up to 2 points)		
Detailing	7.1.1	Avoid data loss due to lack of redundancy (Up to 2 points)	Points Available	Points Scored
	a.	Provide cloned hard drive to back-up data points (0.5 point) Data backup include operation software (i.e., GUI, trend log), operation system (OS) etc. Note: Backup twice a year	Up to 1.5 (Cat 1)	
	b.	Provide cold stand-by as a back-up for primary server (1 point) *Note: A cold standby is a redundancy method that involves having one system as a backup for another identical primary system. The cold standby system is called upon only on failure of the primary system.*		
	c.	Provide hot stand-by for automatic switch-over from primary to back-up server. (1.5 point) Minimum uptime 99% https://www.quostar.com/blog/the-uptime-guarantee-explained/ *Note: Hot stand-by uses a backup server that receives regular updates and is standing by ready (on hot standby) to take over immediately in the event of a server failure.* (OR) Adopt Cloud-Based Building Management Technology for Over-the-cloud redundancy/high availability.		
	d.	Provide minimum 30 minutes UPS power back-up for central PC/ server.	0.5 (Cat 1)	
Design Factor	7.2	Software Integration (4 points)		
Detailing	7.2.1	Integration issues due to proprietary communication Protocol (0.5 point)	Points Available	Points Scored
	a.	Use open communication protocol (i.e. BACnet, Modbus, etc.)	0.5 (Cat 1)	
Detailing	7.2.2	Outdated operating system and lack of security features (Up to 2 points)	Points Available	Points Scored
	a. i)	Operating system Windows 10 (0.5 point)	Up to 1 (Cat 1)	

	ii) Windows Server 2019/ Linux Ubuntu server 20.04.2.0 LTS (1 point) (or) iii) Cloud/Virtual computing services (i.e. Microsoft Windows Azure, Google Chrome OS) Note: For cloud computing services, execution and processes of virtual machines / servers and virtual infrastructure, as well as the back-end hardware and software resources and security patches		
	b. Web access i) Internet Service Provider (ISP)/Mobile Data link-up (Example: Remote access, live viewing etc.)	1 (Cat 1)	
Detailing	7.2.3 Lack of interface with other services (1 point)	Points Available	Points Scored
	a. Provide IT infrastructure provision for high level integration with other services (0.5 point each) i. Provide minimum 20% spare IT port at individual switch level. ii. Provide minimum 20% spare band width for future expansion. Note: The normal usage should not exceed the cable limit (Ex: For a 10GB fiber optic cable, the usage should not exceed 8 GB).	1 (Cat 1)	
Detailing	7.2.4 Lack of notification system resulting in increased downtime (0.5 point)	Points Available	Points Scored
	a. Provide Short Messaging System (SMS) system *(OR)* Use of applications such as WhatsApp, Telegram, WeChat, etc. to notify the fault Example: Short messaging system to send message using local telco line to individual (operator or management) *(OR)* Provide email system. Example: Email system to send alarm notification in email (OR) Provide voice call system Example: Voice call system will call a direct number to notification the operator	0.5 (Cat 1)	

Design Factor	7.3 CONTROLLERS (2.5 points)		
Detailing	7.3.1 Lack of termination list (0.5 point)	Points Available	Points Scored
	a. Provide full terminal list (naming and tagging). Note: i) To be updated when building undertake A&A. ii) The termination list to have proper point description (equipment naming) and corresponding I/O points type and Interfacing Termination board (ITB) numbering. iii) Terminal list to be maintained in both hardcopy and softcopy to ensure up-to-date knowledge of system set-up.	0.5 (Cat 1)	
Access	7.3.2 Lack of access to DDC panels (0.5 point)	Points Available	Points Scored
	a. The top of the control panels shall be maximum 1.8m from the finished floor level (FFL) to facilitate direct access. (OR) b. The control panels located at heights shall have direct access from scaffolding, ladders etc. Provide minimum 800mm clear access space in front of the control panels.	0.5 (Cat 1)	
Detailing	7.3.3 Lack of reliable power supply to DDC controllers (up to 1.5 point)	Points Available	Points Scored
	a. Power Supply i) Provide minimum 30 minutes UPS power back-up for controllers serving critical infrastructure (i.e. Chiller plant, AHU's, PAHU's, HT/LT switch board) - 0.5 point ii) Provide minimum 30 minutes UPS power back-up for all controllers - 1 point	Up to 1 (Cat 1)	
	iii) Provide BMS monitoring for incoming power supply for UPS system to facilitate continuous operation – 0.5 point	0.5 (Cat 1)	

Design Factor	**7.4**	**Integration with M&E Systems (2 points)**		
Detailing	7.4.1	Lack of integration with Mechanical & Electrical systems (1.5 point)	Points Available	Points Scored
	a. ACMV system i) Monitor and control of chiller plant equipment's including chillers, cooling towers, chilled water pumps and condenser water pumps – 0.5 point Note: For buildings served by VRF, monitoring of VRF system is required. (AND/OR) ii) Monitor and control of Air distribution system including AHU, FCU and PAHU, main mechanical ventilation fans serving the common areas – 0.5 point b. Electrical systems i) Lighting system – 0.5 point Note: Lighting system monitor and control for the building common areas such as corridors, carpark and external lighting.		1.5 point (Cat 1)	
Detailing	7.4.2	Lack of integration with Solar PV systems (0.5 point)	Points Available	Points Scored
	a. Solar PV system Integration i) High level Integration of solar PV system with BMS for continued monitoring. Note: The monitoring should include energy yield, Panel temperature, current, voltage, Error messages etc.		0.5 (Cat 1)	

8 FACILITY MANAGEMENT SYSTEM

Design Factor	8.1	Asset Management – Failure Analysis (1.5 points)		
Detailing	8.1.1	Failure analysis not performed (1.5 point)	Points Available	Points Scored
	a.	Record all equipment or system failure, including downtime and description of fault. Note: The record should be in digital form.	0.5 (Cat 1)	
	b.	Define failure modes or fault codes and perform "Root Cause Failure Analysis (RCFA). Implement failure modelling (e.g. Weibull) for failure rate projection or perform reliability centred maintenance (RCM). Note: Fault codes allow you to perform analysis on occurrences of problems or defects in your building systems. Failure modelling allows you to model the failure patterns and predict future asset lifespan as well as failure rate.	1 (Cat 1)	
Design Factor	8.2	Asset Management – Lifecycle Management (1.5 points)		
Detailing	8.2.1	Lifecycle analysis not performed (Up to 1.5 point)	Points Available	Points Scored
	a.	Track life cycle cost (LCC) items (labour/ material, external services) including construction/ acquisition, operations and maintenance, and perform LCC analysis, such as repair/ overhaul/ replace analysis.	1.5 (Cat 1)	
Design Factor	8.3	Operations Management – Service Management (2.5 points)		
Detailing	8.3.1	Case management process is manually tracked or not tracked (2 points)	Points Available	Points Scored
	a.	Case management process (logging of new cases, dispatching cases, monitoring progress of case resolutions, closure of completed cases) is automated.	1 (Cat 1)	
	b.	Automated real-time dispatching of cases using SMS, mobile apps or other wireless mechanisms to field staff for acknowledgment and follow up	1 (Cat 1)	

Detailing	8.3.2	No customer care or self-service web portal or mobile app (0.5 point)	Points Available	Points Scored
	a.	Customer care or self-service web portal and / or mobile app available for customers to log new cases or review status of existing cases.	0.5 (Cat 1)	
Design Factor	8.4	Operations Management – Maintenance Management (1.5 points)		
Detailing	8.4.1	Work order process is ill-defined, manually tracked or not tracked (1 point)	Points Available	Points Scored
	a.	Work order process including application of permit to work for ad-hoc maintenance and scheduled work (e.g. corrective maintenance and preventive maintenance) are automated with FM software.	0.5 (Cat 1)	
	b.	Mobile devices and mobile apps are extensively used for work order management processes.	0.5 (Cat 1)	
Detailing	8.4.2	Work plans and checklists are not in digitalized format (0.5 point)	Points Available	Points Scored
	a.	Work plans and checklist in digitalized format (e.g. each checklist item is a record), e.g. in a spreadsheet or in a computer database (such as FMS system).	0.5 (Cat 1)	
Design Factor	8.5	Operations Management – Other General Services (1 point)		
Detailing	8.5.1	Service request forms and processes are managed manually (1 point)	Points Available	Points Scored
	a.	Service request forms and processes are digitalized and automated using FM or CRM software. Note: Examples of services are aircon or chilled water extension, meeting room booking, VIP visit arrangements, etc. Usually performed manually by a concierge.	0.5 (Cat 1)	
	b.	Customer care or self-service web portal available for customers to submit new service requests or review status of existing requests.	0.5 (Cat 1)	
Design Factor	8.6	Supply Chain Management – Inventory, Procurement and Contract Management (4.5 points)		
Detailing	8.6.1	Inventory tracked manually (or FM staff has no access to Finance Department Inventory Management System) (0.5 point)	Points Available	Points Scored
	a.	Keep an accurate inventory control register in a database.	0.5 (Cat 1)	

Detailing	8.6.2	Procurement process tracked manually (or FM staff has no access to Finance Department Procurement Management System) – Sourcing, purchasing, goods receipt. (0.5 point)	Points Available	Points Scored
	a.	Purchasing process (purchase order issuance) is automated including following key functions. i) Sourcing process (tendering, requesting for quotation) is automated with funds availability check. ii) Progress claims, goods receipt and invoicing processes are automated.	0.5 (Cat 1)	
Detailing	8.6.3	Expense budget management process tracked manually (or FM staff has no access to Finance Department Budget Management System). (0.5 point)	Points Available	Points Scored
	a.	Expense budget management processes (new budget approval, budget adjustment, budget reallocation/ virement) are automated.	0.5 (Cat 1)	
Detailing	8.6.4	Vendor pre-qualification and regular grading reviews performed manually or not performed (0.5 point)	Points Available	Points Scored
	a.	Automate vendor pre-qualification and regular grading reviews.	0.5 (Cat 1)	
Detailing	8.6.5	No vendor self-service web portal (1 point)	Points Available	Points Scored
	a.	Implement vendor self-service web portal with following functionality; i) Vendor portal for self-registration / pre-qualification. ii) Vendor portal for viewing procurement opportunities such as tenders. iii) Vendor portal for submission of bids proposals and receipt of Purchase Orders. iv) Vendor portal for submission of progress claims/ goods delivery or invoices.	1 (Cat 1)	
Detailing	8.6.6	Contracts are tracked manually (1 point)	Points Available	Points Scored
	a. b.	Contracts are in digitalized format and kept in central database (AND) Pro-active reminders or alerts on key contractual milestones (e.g. reminder for renewal).	1 (Cat 1)	
Detailing	8.6.7	Schedule of rates not in digitalized format (0.5 point)	Points Available	Points Scored
	a.	Schedule of rates for services in digitalized format and kept in central database.	0.5 (Cat 1)	