Briefing on the BEC 2015 and EAC 2015

In-House Training Sessions

23 Dec 2015
06 Jan 2016
13 Jan 2016

ENERGY SAVING FOR ALL 全民節能

Briefing on the BEC 2015 and EAC 2015

1. Lighting Installation
2. Electrical Installation
3. Air-conditioning Installation
4. Lift and Escalator Installation
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Briefing on the BEC 2015 and EAC 2015

(Session 1)

Lighting Installation

Electrical Installation

Lighting Installation

- **Lighting Power Density (W/m^2)**
- **Lighting Control Point**
- **Automatic Lighting Control**

Lighting Installation

Summary

- LPD requirement covers new spaces
- LPD requirement of certain spaces tightened
- Lighting control point to all spaces
- **Automatic lighting control** (new requirement)
- **Daylight responsive control** (new requirement)

Lighting Installation

Definition

Lighting Installation

lighting installation (照明裝置), in relation to a building, means a fixed electrical lighting system in the building including—

(a) general lighting that provides a substantially uniform level of illumination throughout an area; or

(b) maintained type emergency lighting,

but does not include non-maintained type emergency lighting;

Applicability

Schedule:	2	**BUILDING SERVICES INSTALLATIONS TO WHICH THIS ORDINANCE DOES NOT APPLY**

6. A lighting installation that is solely used for—

(a) illumination of an exhibit or product on display including special lighting for illuminating merchandise or art work;

(b) decoration including special lighting for architectural feature or festival decoration effect;

(c) visual production including special lighting for performance, entertainment or television broadcasting; or

(d) any combination of the purposes specified in paragraphs (a), (b) and (c).

Lighting Installation

Definition

Lighting Power Density

'**lighting power density** (LPD) (unit : W/m^2)' means the maximum circuit wattage consumed by fixed lighting installations per unit floor area of an illuminated space.

(In equation form, the definition of LPD is given by:

$$LPD = \frac{\text{Total circuit wattage of the fixed lighting installations}}{\text{Internal floor area of that space}}$$

,where the total circuit wattage should be taken at the full lighting output condition.)

Circuit wattage:

counting also the loss from driver, dimmer and step-down Tx.

Full lighting output:

Dim-and-fix ***not*** permissible.

Lighting Installation

Table 5.4
LPD Requirement Covers New Spaces

	BEC 2015
Type of space	LPD (W/m^2)
Computer Room / Data Centre	15
Court Room	15
Passenger Terminal Building	13 -18
Refuge Floor	11
School Hall	14

Lighting Installation

Table 5.4
LPD Requirement of Certain Spaces Tightened

Type of Space	BEC 2012 (Rev. 1) (W/m^2)	BEC 2015 (W/m^2)
Classroom / Training Rm	13	12
Loading & Unloading Area	10	8
Office	13	12 (>15 m^2) 13 (≤ 15 m^2)
Plant Room	11	10

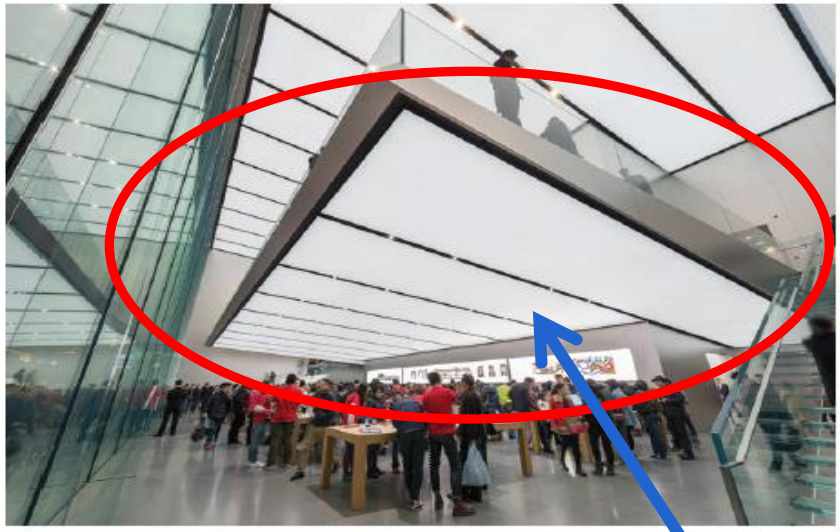
Lighting Installation

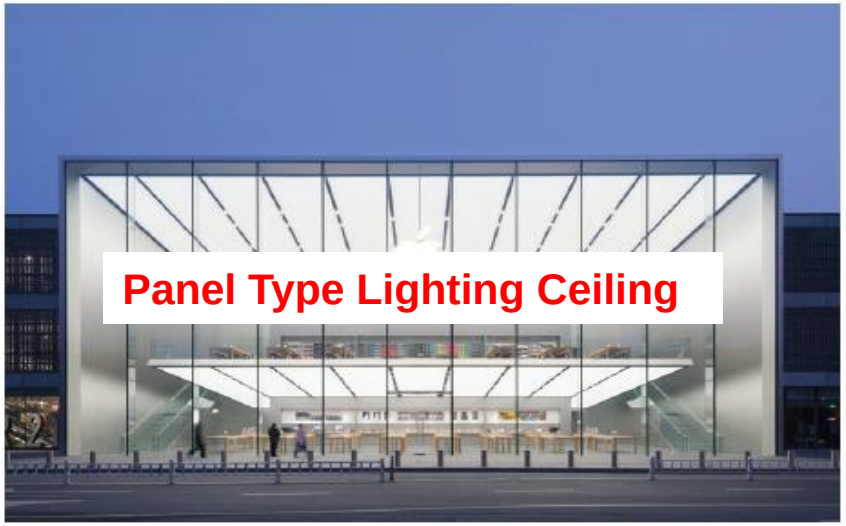
Clause 5.4.1
Exception on LPD requirement

BEC 2012 (Rev. 1)	BEC 2015
Does not exceed 100W	Does not exceed **70W**

Lighting Installation

Special cases for discussion:





Providing substantially uniform level of illumination throughout an area
→ General lighting;
→ Not solely used for decoration.

Lighting Installation

For the sole use as decorative light?

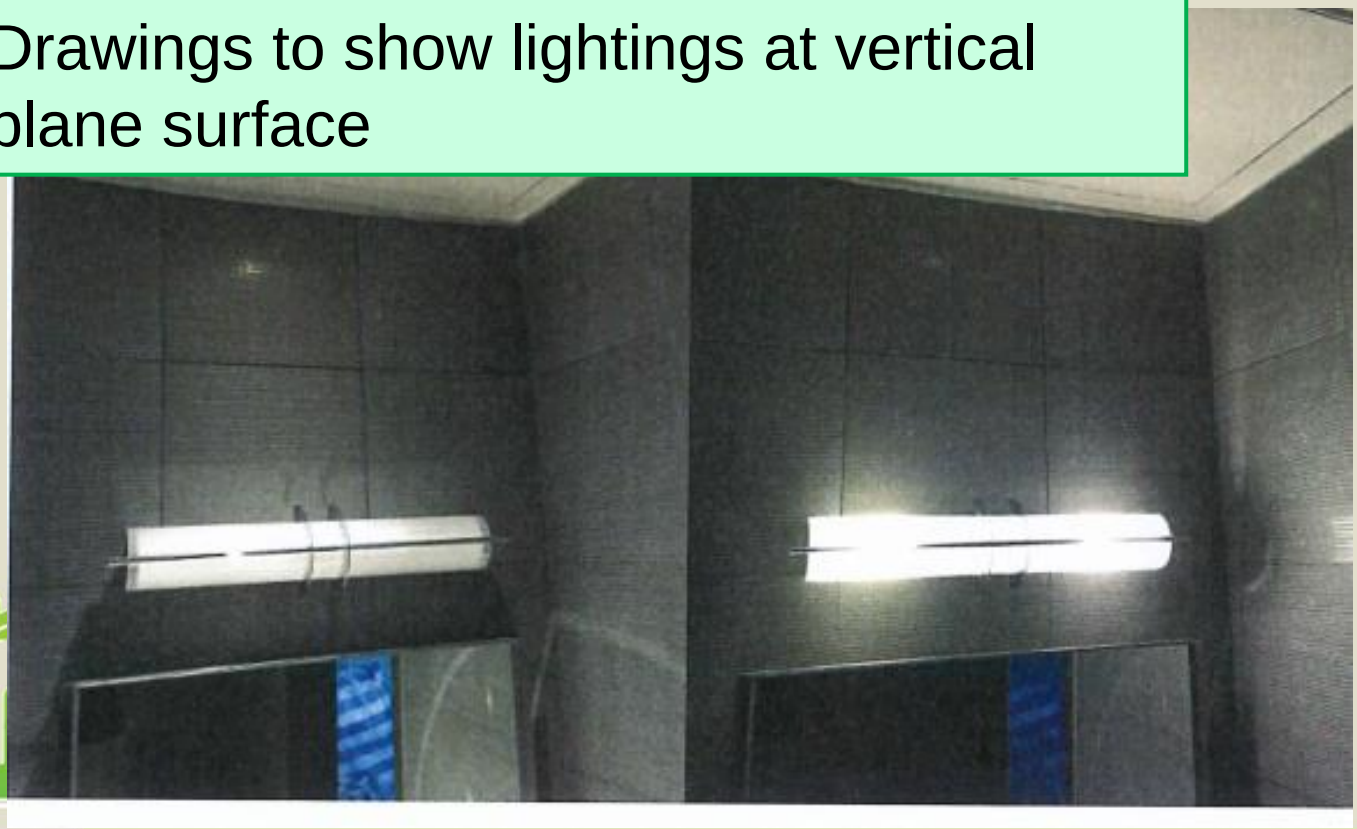
Not from:
- **type of luminaire**
- **statement or declaration from the designer;**
- **provided with separated circuit/switch**

But from the nature and usage:
- **the lighting layout (relation w/ other lighting fittings);**
- **photo (relation w/ the space)**

Providing substantially uniform level of illumination throughout an area
→ **General lighting;**
→ **Not solely used for decoration**

Lighting Installation

- For the sole use as decorative light?
  (Mirror-wall Interface)
- Drawings to show lightings at vertical plane surface



Lighting Installation

Clause 5.5
Lighting control point
(requirement extended to other spaces)

	BEC 2012 (Rev. 1)	BEC 2015
Office	According to Table 5.5 3 ranges of space areas: • Area≤150m^2 • 150<Area≤450m^2 • Area>450m^2	**No change**
Other Spaces	Not Specified	**A control point covers ≤ 500 m^2**
Exception: **Space with lighting installation designed of 7-day & 24-hour operation.**		

Lighting Installation

Clause 5.6 and Table 5.4

New requirement on automatic lighting control

Spaces Requiring Automatic Lighting Control	
Atrium	Lecture Theatre
Carpark (parking spaces only)	Lift Lobby
Classroom / Training Room	Loading and Unloading Area
Computer Room / Data Center	Office, enclosed and open plan
Conference / Seminar Room	Public Circulation Area
Corridor	Refuge Floor
Court Room	School Hall
Dormitory	Storeroom / Cleaner
Entrance Lobby	Toilet / Washroom / Shower Room
Gymnasium / Exercise Room	

Lighting Installation

Clause 5.6 Automatic Lighting Control

5.6.1	The Basic Provision
5.6.2	Daylight Responsive Control thro' Fenestrations on Exterior Wall
5.6.3	Daylight Responsive Control thro' Overhead Skylight

Lighting Installation

Clause 5.6.1 The Basic Provision

Automatic Lighting Control:

- To shut off or reduce the general lighting power by at least ***50% automatically***

- Control devices/systems :

  < 2000 m^2;

- Weekend & holiday operation pattern -
  Except **7-day 24-hour** operation lighting; and

- Serve only one floor, unless the floors are -
  - of similar configuration;
  - With similar lighting layout; and
  - of lighting installations under same owner.

Lighting Installation

Clause 5.6.1

Automatic Lighting Control: (Cont'd)

Selection of automatic control system under the designer's discretion:

- Occupant sensor
- Automatic Time Scheduling (e.g. thro' BMS)
- Daylight responsive control/ Timer switch
- Others……

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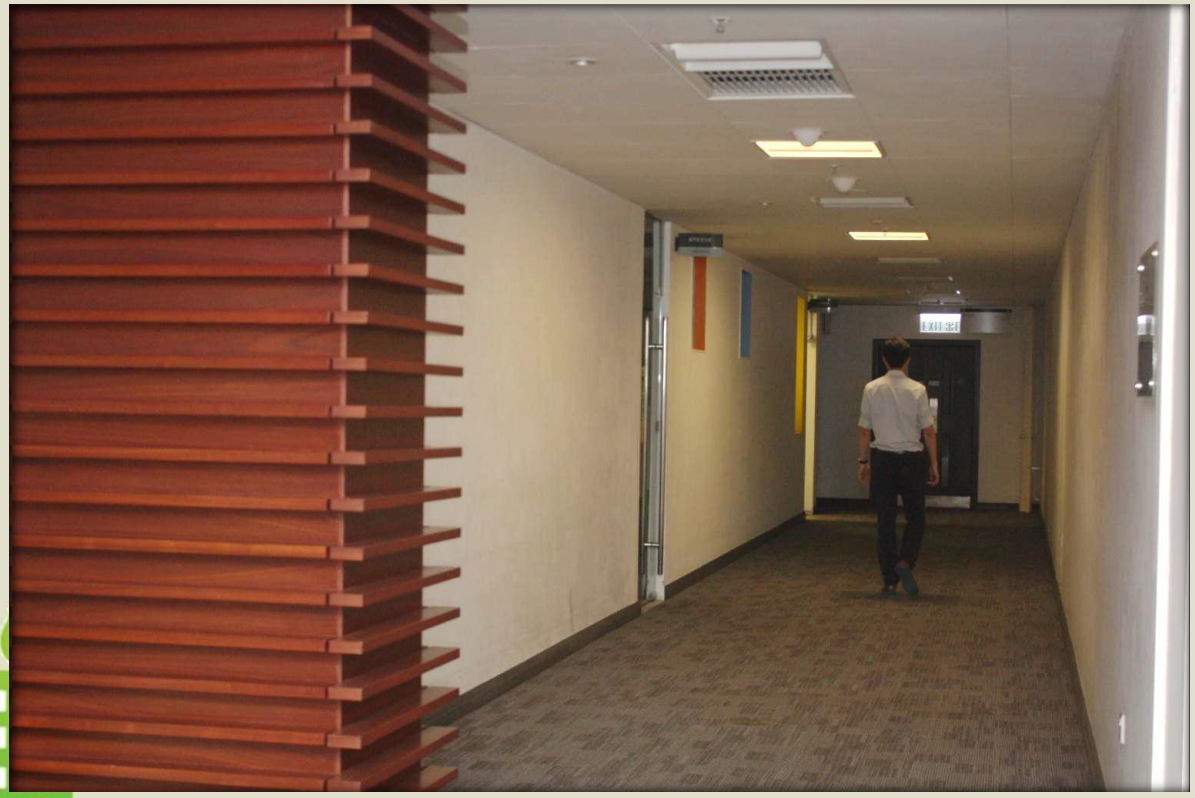
Lighting Installation

Occupant sensor



Occupant Sensor

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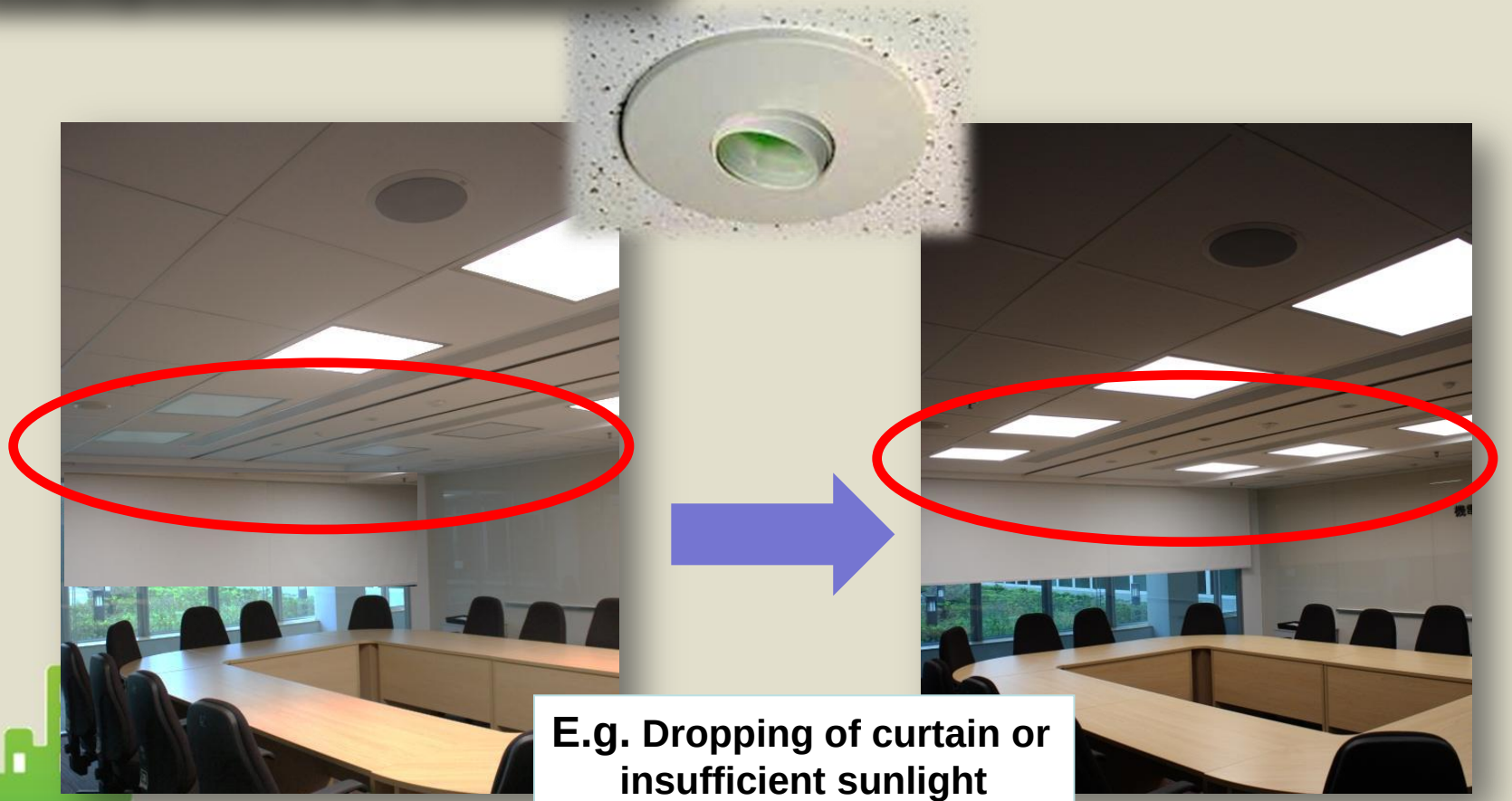
Lighting Installation

Daylight Responsive Control



E.g. Dropping of curtain or insufficient sunlight

Lighting Installation

Clause 5.6.1

Automatic Lighting Control: (Cont'd)

- Any overriding control by the space occupant, ***if provided*** :
  - ≤ ***500 m²*** ; and
  - ≤ ***2 hours*** per activation

- When using occupant sensors:
  - Activate within ***15 minutes*** when all occupants left

- Exception from automatic lighting control requirement:
  Space of fixed lighting ***≤ 150W***

Lighting Installation

Clause 5.6.2 and 5.6.3 Daylight Responsive Control

Thro' Fenestrations on Exterior Wall	Overhead Skylight
➢ Area of Fenestration(s) ***≥ 5m²***	
➢ A discrete fenestration or a series of fenestrations serves one ***lighting zone***	
➢ Separated control device for each ***lighting zone***	
➢ Shut off or reduce lighting power to ***50% or less***	
Lighting zone's area • ≥ ***2*** x fenestration area (discrete); • ≥ ***2*** x sum of fenestration areas	***Lighting zone's*** area • ≥ ***5*** x fenestration area (discrete); • ≥ ***5*** x sum of fenestration areas

Lighting Installation

Clause 5.6.2 and 5.6.3
Daylight Responsive Control

Thro' Fenestrations on Exterior Wall	Overhead Skylight
Exception: • Non-see-through fenestration; • Fixed lightings ≤ ***150W*** (wholly or partially within ***a lighting zone***); • Overlapped area of any lighting zone assigned under other daylight responsive control	

Electrical Installation

- **Motor Efficiency**
- Motor Sizing
- Power Distribution Loss
- Power Quality
- **Energy Metering**

Electrical Installation

Table 7.5.1
Update requirement on motor efficiency

	BEC 2012	BEC 2015	% of change
7.5 to 18.5 kW	88.7 – 91.2	90.4 – 92.6	1.9 – 1.5
22 to 45 kW	91.6 – 93.1	93.0 – 94.2	1.5 – 1.2
55 to 75 kW	93.5 – 94.0	94.6 – 95.0	1.2 – 1.1
90 kW or above	94.2 – 95.1	95.2 – 96.0	1.1 – 0.9
	(IE2 Motors)	(IE3 Motors) (IE2 < 7.5 kW)	

Only 4-pole motor shown as illustration

Electrical Installation

Section 7.7
Update requirement on Metering and Monitoring Facilities

Metering for energy, current, power factor, harmonics etc. measure

BEC 2012	***Clause 7.7.2*** Specified feeder or sub-main circuit **exceeding 200A** to be provided with metering device
BEC 2015	***Clause 7.7.3 (New Requirement)*** Additional requirement to provide separate metering devices for **each of the CBSI** (i) Entire chiller plants, all lifts etc.)

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(Session 2)

Air-conditioning Installation

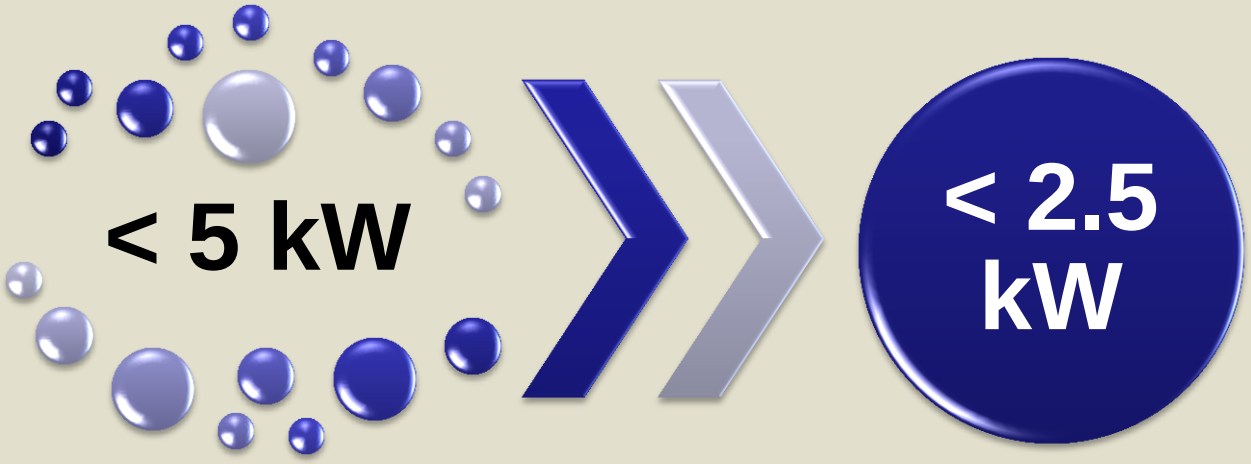
Lift and Escalator Installation

Air-conditioning Installation

Tightening Requirement	***New Requirement***	***Unchanged***
• Chiller / VRF System / Unitary Air-conditioner COP	➢ CAV with low speed mode	✓ Thermal insulation
• VAV fan motor power at min. speed	➢ Mechanical ventilation system fan motor power	✓ Temperature / Humidity / Zone / Off-hour Control
• Exception of system fan power	➢ Cooling tower fan performance	✓ Ductwork leakage limit
• Pipe Sizing	➢ Chiller isolation	✓ Energy metering
• Chilled water pump power consumption at reduced speed	➢ Air dampers at FA intake and EA discharge outlets	✓ Separate air distribution system for process zone
	➢ Isolation of zones	✓ System load calculation
	➢ Demand control ventilation	
	➢ Direct digital control	

Air-conditioning Installation

Clause 6.7
Tightening requirement on Air Distribution System Fan Power



BEC 2012 (Rev. 1)

BEC 2015

Air-conditioning Installation

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Clause 6.7
Tightening requirement on Air Distribution System Fan Power

Clause 6.7.6 (NEW)
Mechanical ventilation system fan motor power requirement

BEC 2012 (Rev. 1)

- Not specified

BEC 2015

- for system fan motor power $\geq$ 2.5kW
- $\leq 1.1\ W/L \cdot s$
- Deduct pressure drop across:
  - Grease Filter;
  - Water spray hood;
  - Activated carbon filter; or
  - Venturi scrubber etc.

Air-conditioning Installation

Clause 6.7.4
New & Revised requirement on CAV & VAV Air Distribution System

BEC 2012	
Clause 6.7.4	SAF/RAF for VAV flow (≥ 5 kW): • consume ≤ 55% power @ 50% flow

BEC 2015		
Clause 6.7.4	6.7.4.1	CAV Low-speed operation
	6.7.4.2	VAV minimum fan speed
	6.7.4.3	Conditioned space fresh air requirement take preference
Exception: fan motor power < 1.0 kW (e.g. FCU)		

Air-conditioning Installation

Clause 6.8
Update requirement on Pumping System Variable Flow

Restriction on pump power at part load of pump for variable flow system

Clause 6.8.2

BEC 2012 (Rev. 1)

- for variable speed pump ≥ 5kW
- pump motor consumes ≤ 55% full power @ 50% deign water volume flow

BEC 2015

- Chilled water pump motor output power > ***3.7 kW***,
  → variable speed drive
- pump motor consumes ***< 30%*** full power @ ***50%*** design water volume flow
- Exception:
  - with supply chilled water temp. reset;
  - ≤ 350 kW cooling capacity

Air-conditioning Installation

Clause 6.9
Update requirement on Water Pipe Sizing

BEC 2012 (Rev. 1)

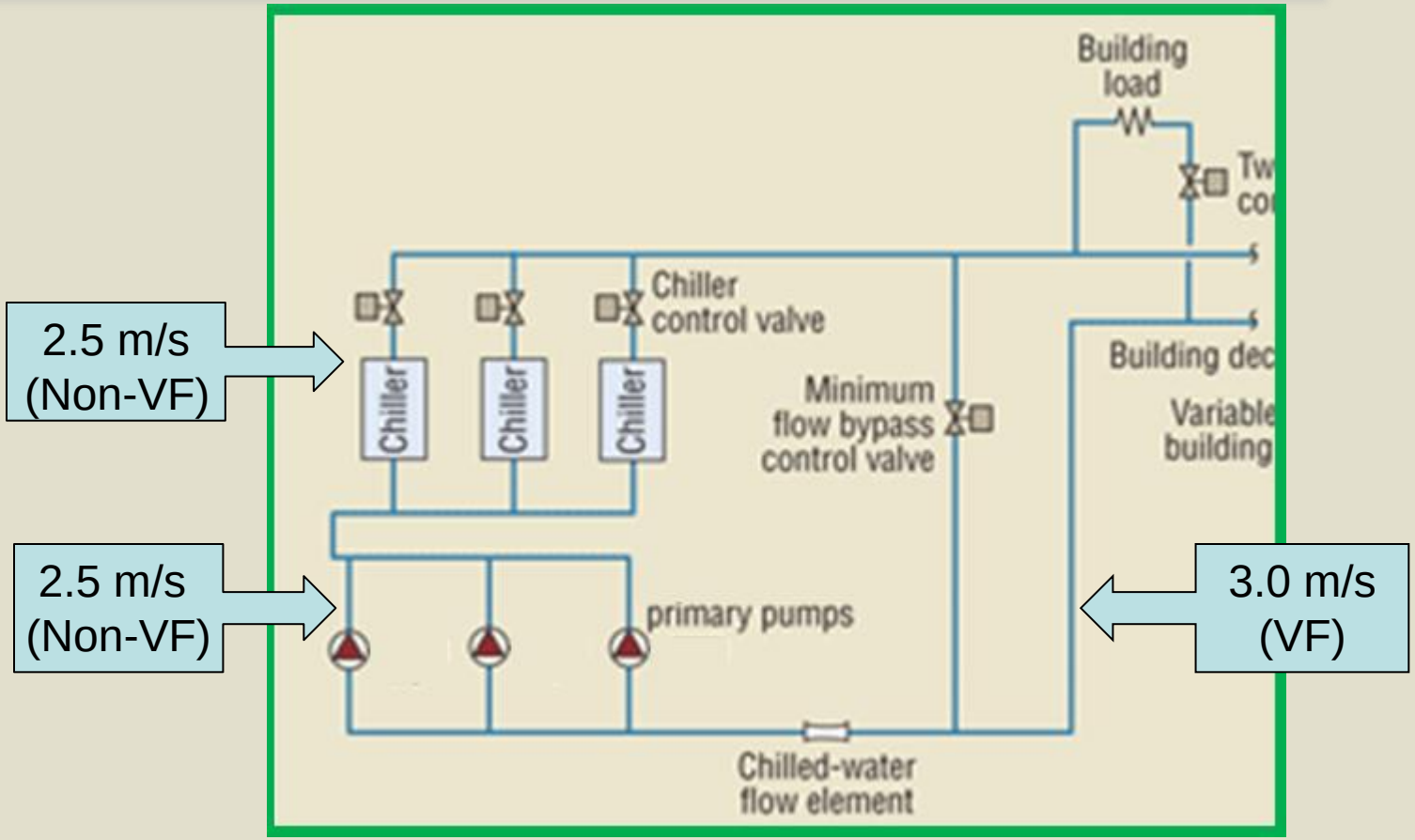
- Pipe ≤ ϕ50mm;
  ≤ 1.2 m/s
- Pipe > ϕ50mm;
  - ≤ 400 Pa/m &
  - ≤ 3 m/s

BEC 2015

- Pipe ≤ ϕ50mm;
  ≤ 1.2 m/s
- Pipe > ϕ50mm;
  - ≤ 400 Pa/m &
  - ≤ 3.0 m/s (variable flow) or
  - ≤ 2.5 m/s (non-variable flow)

Air-conditioning Installation

Clause 6.9
Update requirement on Water Pipe Sizing



Air-conditioning Installation

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Clause 6.10.7
New requirement on Demand Control Ventilation

Carpark provide staging or modulation of fan for ventilation system	*Clause 6.10.7.1* down to **< *50%*** design capacity based on the detected contaminant level basement floor: the control response also to temperature is permissible
AC system provision of demand control	*Clause 6.10.7.3* fresh air rate **> *1400 L/s***
	Clause 6.10.7.4 FA dampers shall be modulated based on the CO_2 level of the conditioned space

Air-conditioning Installation

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Clause 6.12
Update Minimum COP for different equipment type

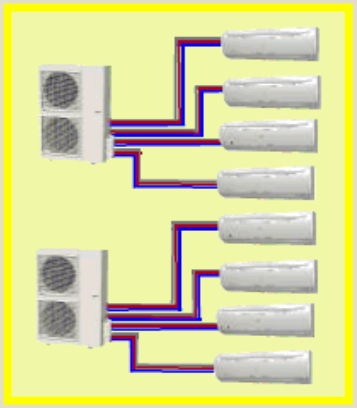
Equipment Type		BEC 2012 (Rev. 1)	BEC 2015
Unitary Air-conditioner (U-A/C) – (cooling mode)			
		Table 6.12a	***Table 6.12a – Part 1***
Air-cooled	≤ 7.5 kW	2.1 (non-split type)	2.3
	≤ 7.5 kW	2.4 (split type)	2.6
Variable Refrigerant Flow (VRF) System (cooling mode)			
		Table 6.12a	***Table 6.12a – Part 2***
Air-cooled		2.9 – 3.0 (*)	3.3
Water-cooled		3.0 (*)	4.3

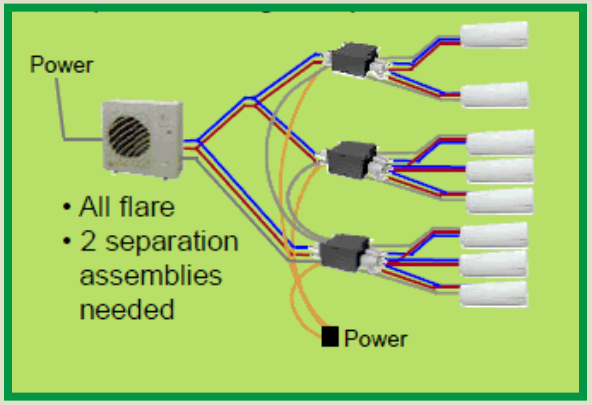
(*) Under U-A/C with variable refrigerant flow (BEC 2012)

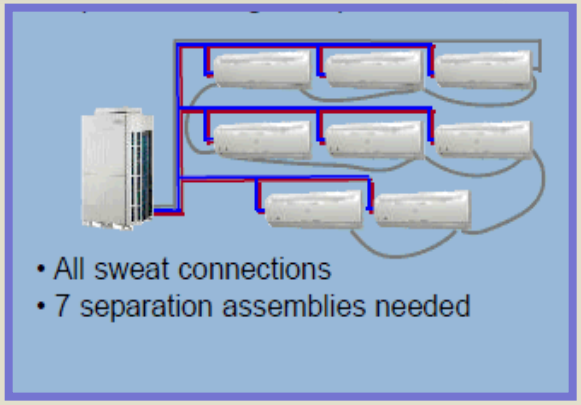
Air-conditioning Installation

Clause 6.12

Update Min. COP for different equipment type Unitary Air-Conditioner Vs VRF system







Typical multi-split	Hybrid multi-split	Typical VRF System

Unitary Air-Conditioner

Air-conditioning Installation

Clause 6.12
Update Minimum COP for different equipment type

Equipment Type		BEC 2012 (Rev. 1)	BEC 2015		
Chiller - Air Cooled		*Table 6.12b*	*Table 6.12b*		
Reciprocating or scroll	Above 400 kW	2.7 – 2.8	**2.9**		
Screw or VSD Screw (New)	Above 500 kW	2.9	**3.0**	**2.9 (1)**	**3.7 (2)**
Centrifugal or VSD Centrifugal (New)		2.8	**3.2**	**3.1 (1)**	**4.0 (2)**

(1) VSD at full load
(2) VSD at 75% load

Air-conditioning Installation

Clause 6.12
Update Minimum COP for different equipment type

Equipment Type		**BEC 2012 (Rev. 1)**	**BEC 2015**		
Chiller - Water Cooled		***Table 6.12b***	***Table 6.12b***		
Reciprocating / Scroll					
	500 to 1000kW	4.6	4.7 / 5.0		
	Above 1000 kW	5.2	5.3 / 5.5		
Screw or VSD screw					
	500 to 1000kW	4.7	5.0	4.9 (1)	6.3 (2)
	Above 1000 kW	5.5	5.5	5.2 (1)	6.7 (2)

(1) VSD at full load
(2) VSD at 75% load

Air-conditioning Installation

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Clause 6.12
Update Minimum COP for different equipment type

Equipment Type		**BEC 2012 (Rev. 1)**	**BEC 2015**	
Chiller - Water Cooled		***Table 6.12b***	***Table 6.12b***	
Centrifugal				
	1000 to 3000kW	5.6	5.7	
	Above 3000 kW	5.7	5.8	
VSD Centrifugal (New)		Not Specified		
	1000 to 3000kW		5.5	7.1 (75%)
	Above 3000 kW		5.6	7.2 (75%)

Air-conditioning Installation

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Clause 6.12
Update Minimum COP for different equipment type

Part Load COP of VSD Chiller	Air Cooled	Water-Cooled
Loading Condition	75% FL	75% FL
Standard Rating Condition	27 deg.C (Ambient air temperature)	24 deg.C (condensing water in)
Applicable also to: Oil free chiller / Magnetic Bearing Chiller		

Air-conditioning Installation

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Misc. Requirements

Clause No.	Requirement
6.8.3	Automatic isolation device at chiller
6.10.4.4	Automatic air dampers at FA intake and EA discharge
6.12.4	Cooling Tower (open circuit) Fan: For each kW (motor nameplate power) to achieve – ≥ 1.7 L/s condensing water flow (centrifugal); ≥ 3.4 L/s condensing water flow (propeller or axial)

Air-conditioning Installation

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Misc. Requirements

Clause No.	Requirement
6.13.5	Metering devices for: AHU ≥ ***5.0 kW*** rated motor and inside plant room
6.14	Direct Digital Control: • Chiller /heated water plant **≥ 350 kW** (cooling or heating capacity) • CAV/VAV of fan motor power ≥ **7.45 kW**

Lift and Escalator Installation

- **Electrical Power of motor drive**
- **Energy Metering**
- **Lift Decoration Load**
- **Lift idling**

Lift and Escalator Installation

Max. allowable traction lift electrical power ⇩ **3 ~ 5 %**

Table 8.4.1 of BEC 2012
→ Table 8.4.1a and Table 8.4.1b of BEC 2015

Code of Practice for Energy Efficiency of Building Services Inst

Table 8.4.1a : Maximum Electrical Power (kW) of Traction Drive Lift at Rated Load for Various Ranges of Rated Speed (applicable to new building)

Rated Load L (kg)	Rated Speed Vc (m/s)				
	Vc < 1	1 ≤ Vc < 1.5	1.5 ≤ Vc < 2	2 ≤ Vc < 2.5	2.5 ≤ Vc < 3
L < 750	6.5	9.2	11.1	14.7	16.6
750 ≤ L < 1000	9.2	11.1	15.7	19.4	22.1
1000 ≤ L < 1350	11.1	15.7	20.3	24.9	29.5

Lift and Escalator Installation

Table 8.4.1 of BEC 2012
→ Table 8.4.1a and Table 8.4.1b of BEC 2015

Table 8.4.1b : Maximum Electrical Power (kW) of Traction Drive Lift at Rated Load for Various Ranges of Rated Speed

(applicable to major retrofitting works in an existing building)

Rated Load L (kg)	Rated Speed Vc (m/s)				
	Vc < 1	1 ≤ Vc < 1.5	1.5 ≤ Vc < 2	2 ≤ Vc < 2.5	
L < 750	6.7	9.5	11.4	15.2	17.1
750 ≤ L < 1000	9.5	11.4	16.2	20	22.8
1000 ≤ L < 1350	11.4	16.2	20.9	25.7	30.4
1350 ≤ L < 1600	14.3	19	25.7	30.4	36.1
1600 ≤ L < 2000	16.2	23.8	30.4	37.1	43.7
2000 ≤ L < 3000	23.8	35.2	44.7	56.1	66.5

Requirements the same as BEC 2012

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Lift and Escalator Installation

- Max. allowable hydraulic lift electrical power ⇩ **5 %**
- Max. allowable escalator electrical power ⇩ **2 %**
- Max. allowable passenger conveyer electrical power ⇩ **2 %**

Lift and Escalator Installation

Max. lift decoration load ⇩ **10 %**

Table 8.5.2 : Maximum Lift Decoration Load	
Lift Rated Load L (kg)	Allowable Decoration Load D (kg)
L < 1800	D = 0.5 x L, or 540 whichever is smaller
L ⩾ 1800	D = 0.3422 x L – 0.00002344 x L^2, or 1125 whichever is smaller

Example

- Capacity: 1200kg.

  Maximum Decoration load : From 600kg to 540kg

Lift and Escalator Installation

New Requirement – Lift Installation

- Lift car ventilation fan power consumption: **≤ 0.7 W per L/s**
- Lift car automatic lighting control:

  Automatic cut lighting power to 50% or less

  (**15-min. or longer idling**)
- Regenerative braking system for lift of:

  Speed ≥ 3m/s; &

  Capacity ≥ 1000 kg

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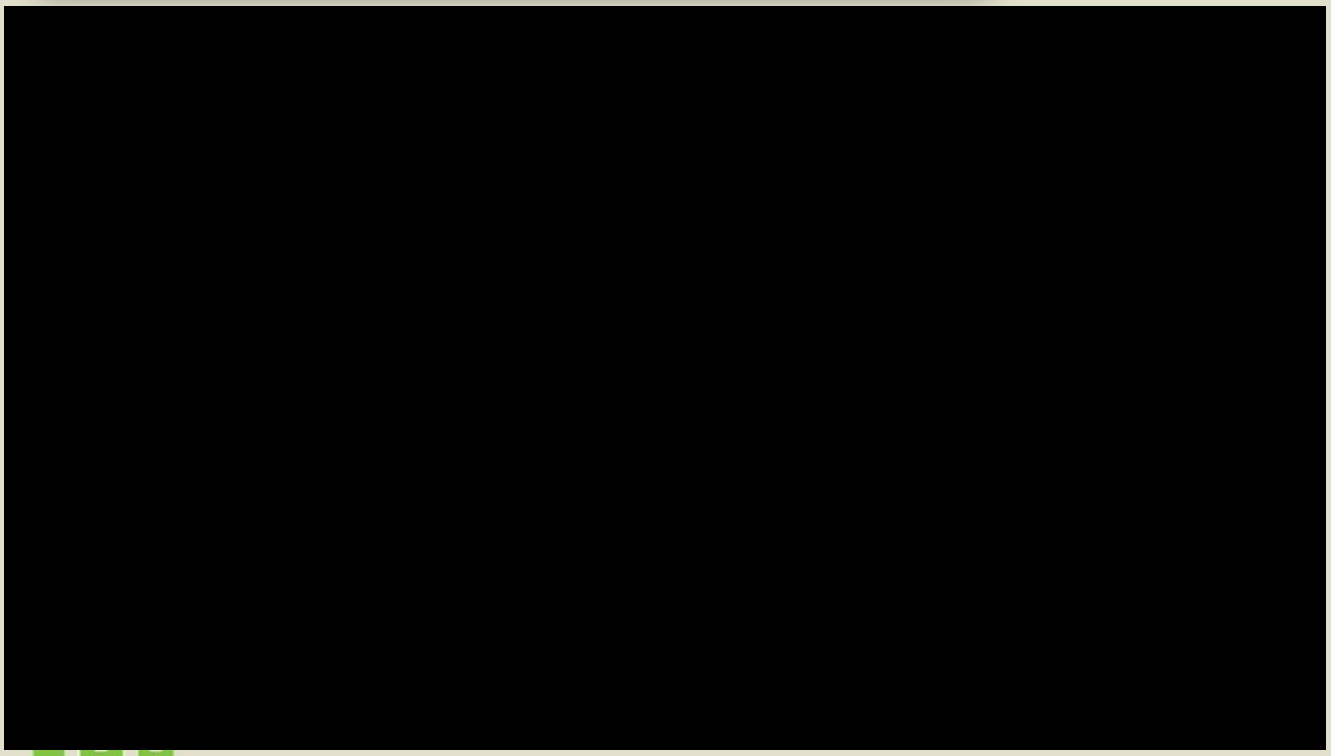
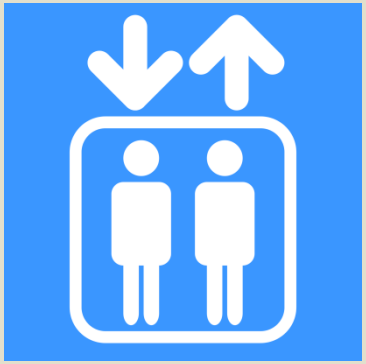
Lift and Escalator Installation

Lift Regenerative Braking





Lift and Escalator Installation

New Requirement – Escalator Installation
• Provision of automatic speed reduction mode.

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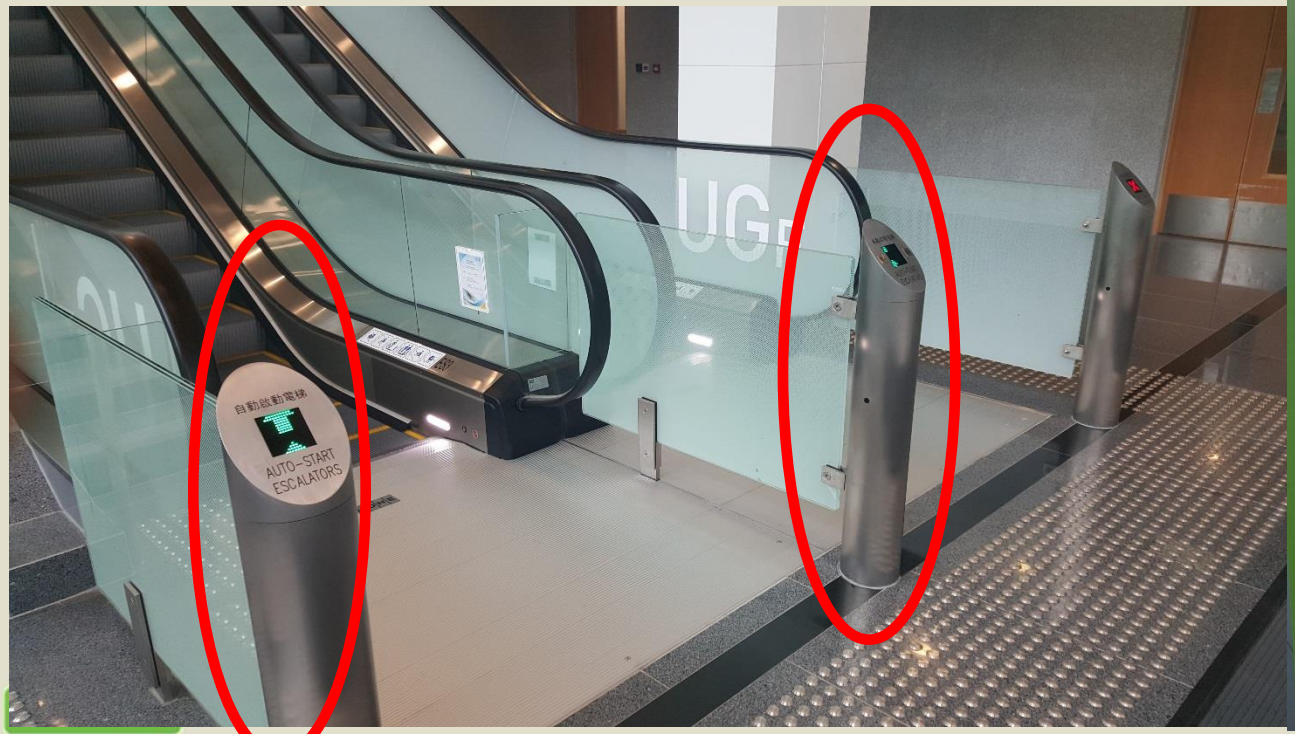
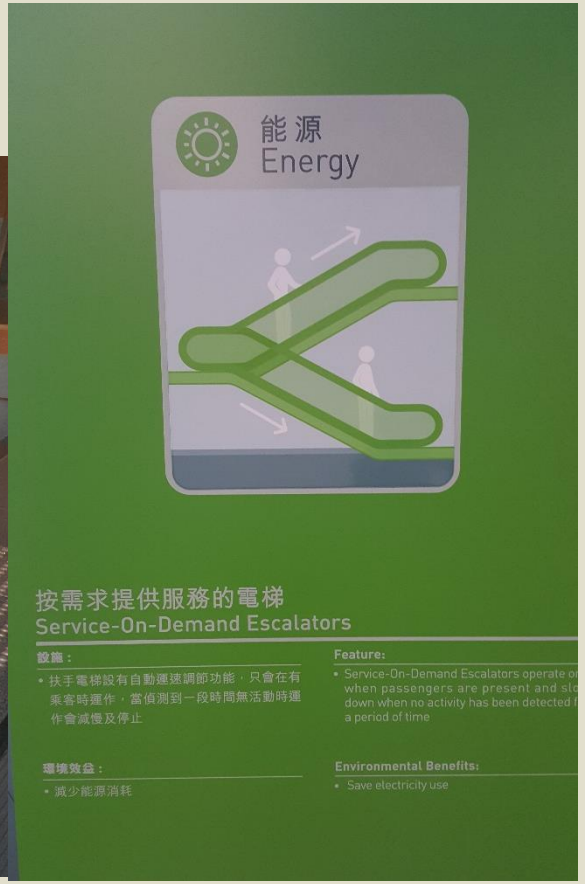
Lift and Escalator Installation

Automatic Speed Reduction





Lift and Escalator Installation

Revised Requirement
Each Lift, Escalator or Passenger Conveyor: To provide **metering devices.** (Requirement on provision of measurement removed)

Performance-based Approach

BEC 2012

Only three trade-off items under two installations

Lighting installations
Lighting power density (LPD)
Air-conditioning installations
Air-conditioning equipment efficiency
System Fan Power

Performance-based Approach

BEC 2015

Trade-off items cover all the four BS installations

Lighting installation
3 Items
LPD; Lighting Control Point and Automatic Lighting Control
Air-conditioning installation
9 Items
e.g. Insulation Thickness & Pipe Friction Loss etc.
Electrical installation
3 Items
Motor Efficiency; Cu Loss & Power Quality
Lift and escalator installation
3 Items
Electrical power; Utilization of Power & Total Harmonic Distortion

Performance-based Approach

15% Threshold:
Energy efficiency performance of trade-off item(s) should not *15%* below the prescriptive standard.

Different ownership of trade-off item:
Energy source from other parties (e.g. service provider of DCS, central plant in a campus-like developments)

No limit on the contribution of energy reduction by better OTTV
(5% limitation in BEC 2012)

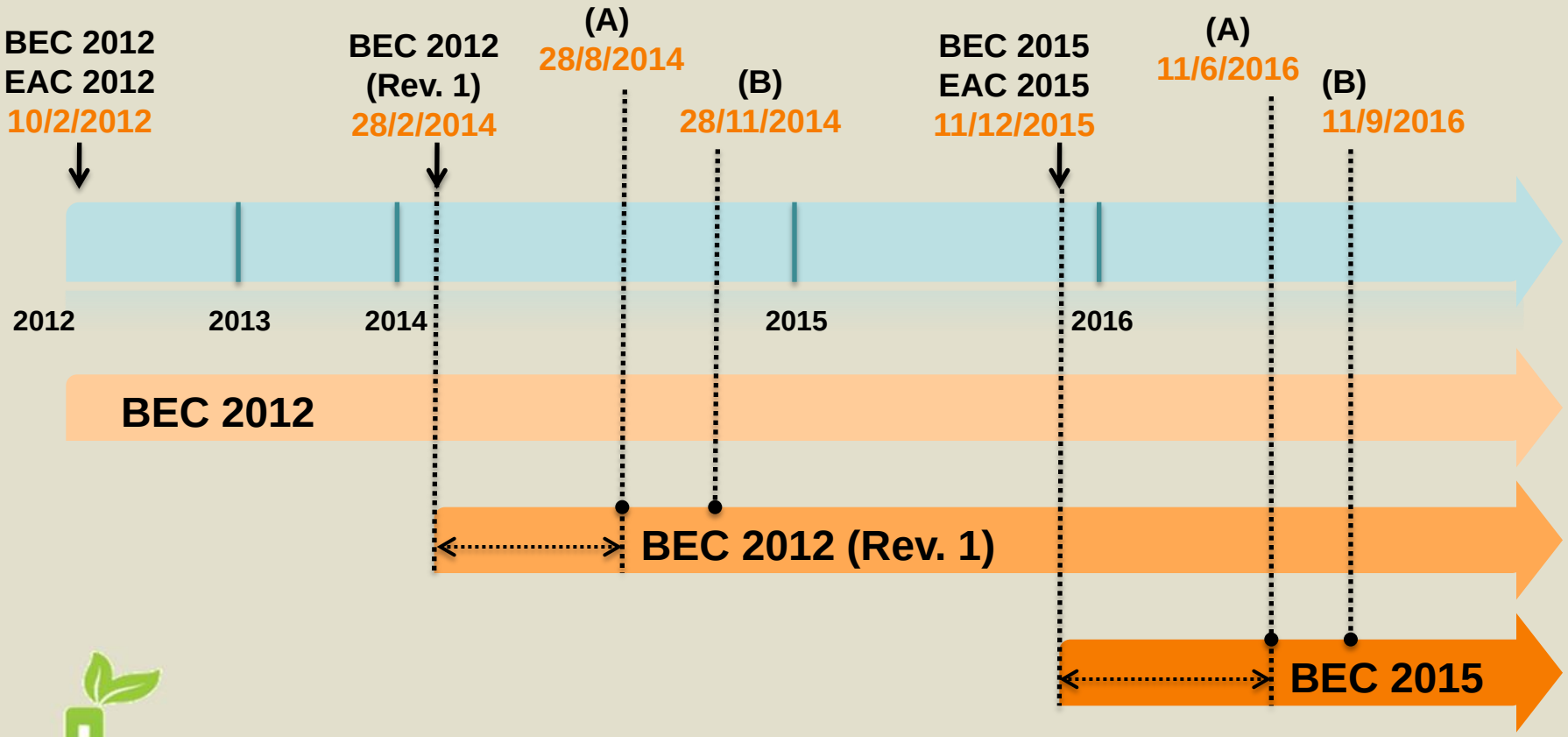
No limit on the contribution from on-site recovery /renewable energy
(5% limitation in ASHRAE 90.1 – 2013)

Editions of the BEC

11 December 2015: BEC 2015 Gazette Date

Submission	Date
Stage One Declaration	*11 June 2016* (Signed by the developer on or after 11.06.2016)
Form of Compliance	*11 September 2016* (Signed by the REA on or after 11.09.2016)

Editions of the BEC



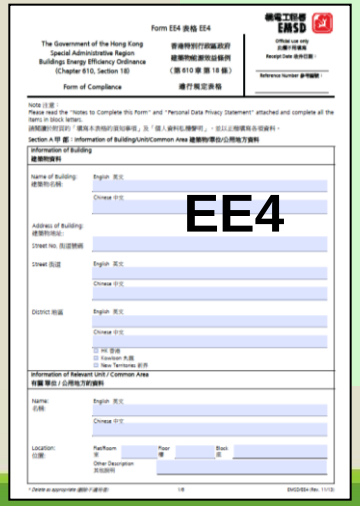
(A) Developer signs the Stage One Declaration on or thereafter
(B) REA signs the FOC on or thereafter

Editions of the BEC

BEC 2012 & BEC 2012 (Rev. 1) Are Still Applicable To: (Existing building and FOC Related)

- Forthcoming MRW being completed with the FOC signed and issued **before 11.09.2016** (i.e. comply with BEC 2012 (Rev. 1))

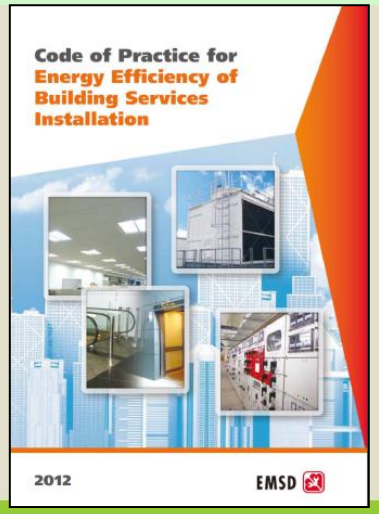
- CBSI/BSI issued with FOC under BEC 2012 or BEC 2012 (Rev. 1) previously:
  - **Owner** of the **CBSI** to maintain the installation(s) to the standard applied in the FOC [S18(2)];
  - **Responsible person** of a unit to maintain the **BSI** to the standard applied in the FOC [S18(2)]



Editions of the BEC

BEC 2012 & BEC 2012 (Rev. 1) Are Still Applicable To:
(COCR related)

- Building with **stage one** declaration made **before 11.06.2016** & the subsequent stage two declaration when reported the same edition;



Editions of the BEC

BEC 2012 & BEC 2012 (Rev. 1) <u>Are Still Applicable</u> To: (COCR related)

- Building issued with COCR in compliance with BEC 2012 or BEC 2012 (Rev. 1):
  - **Building owner** to maintain the **CBSI** to the standard applied in the COCR [S12(3)];
  - **Responsible person** of a unit to have the **BSIs** to ***meet***, and ***are maintained*** to the standard applied in the COCR [S12(4)]

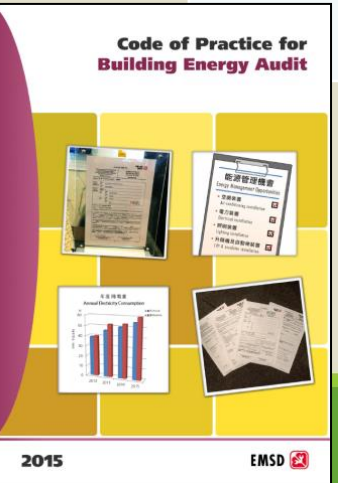
EAC 2015

EAC 2015

Further guidance on power consumption measurement

Explicitly allows applying on-site measurement for:

- aged building lack of engineering information; or
- the available engineering information not reflecting the actual situation nor accurate enough



EAC 2015

EAC 2015 (Cont'd)

EA Report to include:

- Judgement/rationale on proceeding with on-site measurement;
- methodology; and
- engineering information available (as reference)

Form EE-EAes (Executive Summary of EA Report):

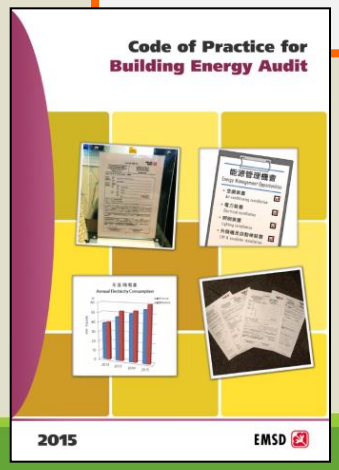
- Refined to suit:
  - Rated value of equipment capacity / power consumption
  - Measured / Calculated equipment capacity / power consumption
  - Chiller plant overall COP

EA exemption criteria updated

Effective Date of the EAC 2015

11 December 2015: EAC 2015 Gazette Date

	Date
Completion Date of the Energy Audit	*11 June 2016*



ENERGY SAVING FOR ALL 全民節能

Anticipated Effects

- ✓ Further improvement in energy efficiency: **10%**
- ✓ The saving of **5 billion kWh** for newly constructed buildings up to 2025

- The total reduction of CO_2 emission: **3.5 million tonnes**
- Equivalent to total annual electricity consumption by about **1 million households**

Way Forward

a) The Technical Taskforce will continue to review the BEC on a regular basis.

b) Update the pertinent requirements where necessary through addendum before the next round of comprehensive review.

c) Comprehensive review to be conducted in 2018, 2021 and 2024.

Thank you!