Introduction of Regulatory Requirements

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9. Registered Energy Assessors
Background

- Building Energy Code was launched Since 1995

<table>
<thead>
<tr>
<th>Area</th>
<th>First Issue</th>
<th>Current Version</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Envelope (OTTV)</td>
<td>1995</td>
<td>2011</td>
<td>Mandatory (by BD)</td>
</tr>
<tr>
<td>Lighting</td>
<td>1998</td>
<td>2012</td>
<td>Mandatory (by EMSD)</td>
</tr>
<tr>
<td>Air-conditioning</td>
<td>1998</td>
<td></td>
<td></td>
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<tr>
<td>Electrical</td>
<td>1999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lift &amp; Escalator</td>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance-based</td>
<td>2004</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Background

- EMSD issued 5 Building Energy codes since 1998 under the Hong Kong Energy Efficiency Registration Scheme for Buildings
- Voluntary for Application

- Require Registered Professional Engineer to sign
- Registration Certificate will be issued for individual installations
- “Energy Efficiency Building” Logo to Promote
Why Building Energy Code?

- Energy efficiency is often discounted in a commercial free market
- Barriers to energy efficiency
- Separation of interests between developers & tenants
- Time and capital constraints of designers/consumers
- Lack of institutional support & coordination
- BEC can promote efficiency and ensure good practice is considered & used
- People will follow the regulations

Why Building Energy Code?

- Trade Task Force
- Technical Task Force / Working Groups
- Business Impact Assessment
Road Map to Mandatory BEC

- Buildings Energy Efficiency Ordinance gazette on 3 December 2010
  - Consultation meetings with other bodies
  - Drafting of MBEC
- Gazette notice on 10 February 2012 – Issue of MBEC
  - Drafting of Technical Guidelines for BEC & EAC
- Full Operation on 21 September 2012
- First lot of Energy Audit completed on 20 September 2013

Status of Energy Use in HK

- Total electricity consumption remained on a rising trend in past years
- Total annual electricity consumption in 2010 is about 41.9 billion kWh (~54% of total fuel consumption)

Hong Kong Energy End-use Data 2012
Status of Energy Use in HK

• About 91% of electricity consumed by buildings
• Commercial sector consuming the most – about 65% in 2010

Energy Consumption by Sectors in 2010

- Commercial: 65%
- Residential: 26%
- Industrial: 7%
- Transport: 2%

Mandatory BEC will be an effective means to reduce energy consumption

Mandatory Implementation of BEC

• Voluntary compliance with higher energy efficiency standard not to be forthcoming in HK and amidst the growing environmental concerns
• Mandatory implementation of minimum energy efficiency standard in buildings by legislation widely adopted by overseas and Mainland China
• Mandatory implementation of the BECs to accompany market driven changes and to combat Climate Change
• Mandatory BEC formulated with the existing BEC 2007 Edition as the blueprint
Structure of Legislative Framework

- Buildings Energy Efficiency Ordinance (BEEO), Cap 610
  - Fees
  - Registered Energy Assessors (REA)
  - Subsidiary regulations
  - Energy Audit Code (EAC)
  - Building Energy Code (BEC)
  - Codes of Practice
Framework of Ordinance

Part 2: Prescribed Buildings at Design Stage and Occupation Approval Stage
Part 3: Major Retrofitting Works in Prescribed Buildings
Part 4: Energy Audit
Part 5: Improvement Notice
Part 6: Enforcement
Part 7: Registration of Registered Energy Assessors
Part 8: Appeal
Part 9: Code of Practice
Part 10: Miscellaneous Matters
Part 11: Transitional Provision

Schedule 1: Buildings that require Certificate of Compliance Registration (COCR) and Form of Compliance (FOC)
Schedule 2: Building Services Installations to which this Ordinance does not apply
Schedule 3: Major Retrofitting Works
Schedule 4: Buildings that require Energy Audit
Schedule 5: Schedule of the First Energy Audit for Buildings without COCR

Subsidiary Regulations

Buildings Energy Efficiency (Fees) Regulation:
Application fees for REA, COCR and duplicate copies of COCR, FOC, Energy Audit Form & REA Certificate

Buildings Energy Efficiency (Registered Energy Assessors) Regulation:
Details of Qualifications, Registration, Register, Disciplinary Proceedings for REA
Coverage

Coverage – Prescribed Buildings

Building Energy Code (BEC)
- Commercial building
- Industrial building – common area
- Residential building – common area
- Composite building – common area
- portion not for residential or industrial use
- Hotel & guesthouse
- Educational building
- Community building
- Municipal services
- Medical & health care
- Government building
- Airport passenger building
- Railway station

Energy Audit Code (EAC)
- Commercial building
- Composite building – commercial portion

BEEO does not govern
- Small building
- Building with main electrical switch with approved load ≤ 100A
- Historical building
- BS installations, with specific operational & technical natures such as fire protection, life safety, industrial undertaking etc.
BS Installations Not Applicable
(Schedule 2 of the BEEO)

Building services installations to which the Ordinance does not apply:

- Solely for fire suppression or extinguishing or a combination of the above
- Solely for surgical operation, clinical treatment, blood processing or providing or maintaining appropriate environmental settings for life protection, or any combination of the above
- In a construction site for construction work only
- Solely for industrial manufacturing
- Solely for research in education institution
- Lighting solely for exhibit illumination, product display, decoration or visual production
- Solely for air traffic regulation, safety or control
- Solely for railway traffic regulation, safety or control

Exemption for Individual Installation
(Sections 15, 20 & 25 of BEEO)

- Special Exemption on Individual BS Installations may be granted by Director of Electrical and Mechanical Services for heritage conservation or technical or operation reasons upon receiving written applications with justifications
Overview of Control Regimes

Different Regulatory Mechanism for “Newly Constructed Building after commencement of Legislation” and “Existing Building before Commencement of Legislation”

**Newly Constructed Building after Commencement of Legislation**
Buildings obtained consent to commencement of building works for superstructure construction from Building Authority after the legislation comes into full operation (i.e. 21 September 2012)

**Existing Building before Commencement of Legislation**
Buildings that obtained consent on or before the legislation comes into full operation (i.e. 21 September 2012)
Only applicable to Newly Constructed Buildings

- The developer of a building, upon completion of the building is required to submit a declaration to EMSD to apply for a Certificate of Compliance Registration (COCR)
- The declaration is to declare that all the building services installations provided by the developer comply with the Building Energy Code (BEC)
- The developer is required to engage a Registered Energy Assessor (REA) to certify his/her declaration before submission to EMSD
- EMSD will issue a COCR after verifying the developer’s submission
- COCR valid for 10 years only - subsequently, the owner is required to engage a REA to make similar certification every 10 years and submit application to EMSD for renewal of COCR

Major Retrofitting Works for Units or Common Areas in Newly Constructed and Existing Buildings

- The responsible person (e.g. owner, tenant, occupiers, etc) of a unit or common area, upon completion of “major retrofitting works”, is required to engage a REA to certify that the retrofitted building services installations comply with BEC
- The responsible person is then required to obtain a Form of Compliance (FOC) issued by REA
- Further endorsement on FOC by EMSD and renewal of FOC is not required
- The REA is also required to submit the copy of FOC to EMSD and the property management company for record (sample checking may be conducted by EMSD)
Only applicable to Central BS installations of Commercial Buildings and Commercial portions of Composite Buildings (Existing Buildings)

- The owner of a building is required to engage a REA to conduct Energy Audit every 10 years
- The owner is required to obtain an Energy Audit Form and an energy audit report from the REA
- The REA is required to submit a copy of Energy Audit Form and the energy audit report to EMSD for record
- The owner is required to exhibit the valid Energy Audit Form in a conspicuous position at the main entrance of the building

Overview of Control Regimes

Time Line of Implementation of BEC (Newly Constructed Buildings)
Application Procedure of COCR

Application Procedure of COCR
Application Procedure of COCR

1. Stage 1 Declaration (Form EE1)

Submit within 2 months after issue of “consent to commencement”
Stage 1 Declaration (Form EE1)

Stage 1 Declaration

Buildings Energy Efficiency Ordinance (Cap 610)

List of Buildings with Stage One Declaration submitted

Search results of Stage One Declaration

<table>
<thead>
<tr>
<th>Date of Declaration</th>
<th>Building Name</th>
<th>Address</th>
<th>List Number</th>
<th>DEC Edition</th>
</tr>
</thead>
</table>
Supplementary Information
(Form EE-SU)

Supplementary Information for Form EE1, EE2, EE3 or EE4
Submit within 4 months after issue of Occupation Permit
Renewal of COCR (Form EE3)

REA to make similar certification every 10 years and submit application to EMSD for Renewal of COCR

Existing Buildings (Part 3 of the BEEO)

- Control Regimes for Existing Buildings are different from Newly Constructed Buildings
  - Only Regulating Major Retrofitting Works prescribed in the Ordinance
  - No Retrospective Effect on Existing Installations
# Existing Buildings

## (Part 3 of the BEEO)

<table>
<thead>
<tr>
<th>Existing Buildings</th>
<th>Central BS Installations</th>
<th>Other BS Installations serving Individual Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>with internal floor area &lt; 500 m²</td>
</tr>
<tr>
<td>Need to comply with the BEC always?</td>
<td>✓ (for major retrofitting works only)</td>
<td>✗</td>
</tr>
<tr>
<td>Need to obtain a FOC from REA?</td>
<td>✓ (within 2 months after completion of major retrofitting works)</td>
<td>✗</td>
</tr>
</tbody>
</table>

*REA to copy the FOC to EMSD and property management company (if no such company, to the owner)*

| Owners | Responsible persons (who holds or are in possession or control of the building or units, such as owners, tenants, occupiers, etc.) |

## Form of Compliance (Form EE4)

REA to copy the FOC to EMSD and Property Management Company (if no such company, to the owner)
Major Retrofitting Works

(Schedule 3 of the BEEO)

Works Area

Addition/replacement of a BS installation specified in BEC at the following conditions:

- total floor area covered by the works (i.e. works area) ≥ 500 m² in a unit or a common area; and
- if the works are conducted as a same series of works in phases or at different places in a unit or a common area, total floor area covered by these works (i.e. works area) within 12 months aggregating to ≥ 500 m²

Central BS installation

Addition/replacement of a main component of a central BS installation, including:

- a complete electrical circuit at rating ≥ 400A;
  or
- a unitary air-conditioner or a chiller at rating ≥ 350kW (cooling or heating);
  or
- motor drive + mechanical drive of a lift, escalator or passenger conveyor

OR
Major Retrofitting Works
(Schedule 3 of the BEEO)

Further technical elaboration to the works prescribed in item 1 of Schedule 3 is set out in the mandatory version of BEC in order to avoid catching works of too minor nature:

- Addition/replacement of luminaires, where the total rated wattage of the additional/replacement luminaires ≥ 3kW
- Addition/replacement of air handling unit(s) or unitary air-conditioner(s) serving the area, where the sum of cooling/heating capacity ≥ 60kW;
- Addition/replacement of motor drive + mechanical drive of a lift, escalator or passenger conveyor

Exemption
Application Form for Exemption (Form EE-EX)

Section 3 乙 類 - Information of Relevant Units/Communal Area

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>English</th>
<th>Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address of Building</td>
<td>English</td>
<td>Chinese</td>
</tr>
</tbody>
</table>

Section 3 類 - Information of Building/Communal Area

<table>
<thead>
<tr>
<th>Name of Building</th>
<th>English</th>
<th>Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address of Building</td>
<td>English</td>
<td>Chinese</td>
</tr>
</tbody>
</table>

Please choose one or more items below:

- Measured by works: an area refer to Form 3 in Schedule 3 of the Ordinance for details.
- Works including addition or replacement of building services installation and covering a total floor area of not less than 500 m².

Note: Works that cover total floor area of less than 500 m² would not be regarded as major refurbishing works under the Ordinance.

- Addition or replacement of main component of central building services installation (refer to Form 2 in Schedule 3 of the Ordinance for details):
  - a complete electrical circuit at rating of 400A or above
  - an air-conditioner or air-conditioning unit at cooling or heating rating at or exceeding 350kW
  - a motor drive and mechanical drive of a lift, an escalator or a passenger conveyor
  - a distribution board or sub-panel board for the above system.
## Application Form for Exemption (Form EE-EX)

### Section C 丁節：Details of application for exemption (For Certificate of Compliance Registration and Form of Compliance)

<table>
<thead>
<tr>
<th>Type of Building Services Installation</th>
<th>Details of exemption to be applied for (such as detailed justification, exemption of which individual installations, etc.)</th>
<th>Edition of the relevant Code of Practice to be exempted (e.g. clause 3.5.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Lightning (照明)</td>
<td>□ Heritage conservation 保存文物 □ Technical 體能 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Air Condition (空調)</td>
<td>□ Heritage conservation 保存文物 □ Technical 體能 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Electrical (電力)</td>
<td>□ Heritage conservation 保存文物 □ Technical 體能 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Lift &amp; Escalator (升降機)</td>
<td>□ Heritage conservation 保存文物 □ Technical 體能 □ Operational 操作模式</td>
<td></td>
</tr>
</tbody>
</table>

For COCR and FOC

---

### Section D 丁節：Details of application for exemption (For Energy Audit)

<table>
<thead>
<tr>
<th>Type of Building Services Installation</th>
<th>Reason of applying for exemption (Can choose one or more reasons)</th>
<th>Details of exemption to be applied for (such as detailed justification, exemption of which individual installations, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Lightning (照明)</td>
<td>□ Heritage conservation 保存文物 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Air Condition (空調)</td>
<td>□ Heritage conservation 保存文物 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Electrical (電力)</td>
<td>□ Heritage conservation 保存文物 □ Operational 操作模式</td>
<td></td>
</tr>
<tr>
<td>□ Lift &amp; Escalator (升降機)</td>
<td>□ Heritage conservation 保存文物 □ Operational 操作模式</td>
<td></td>
</tr>
</tbody>
</table>

For Energy Audit
Section E: Supporting documents for exemption application

I attach the following supporting documents for applying the above exemptions:

[Insert Additional Paper if necessary]

* Delete as appropriate: 填寫不適用者

Section F: Declaration

I, the Director of Electrical and Mechanical Services, hereby declare that the relevant documents and information submitted with this form are true and correct to the best of my knowledge and belief.

[Signature]

Notes to the Form

1. The Director of Electrical and Mechanical Services may require the person concerned to submit additional supporting documents, or to submit the requirements of all the items in this form or in support of the form, for inspection by a professional person.

2. All the data that appear in the form shall be kept at the Electrical and Mechanical Services Department and disclosed to the Data Centre of the Government.
### Submission Forms / Template

### Forms for the Ordinance

<table>
<thead>
<tr>
<th>Form No</th>
<th>Type of Form</th>
</tr>
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<tbody>
<tr>
<td>EE1</td>
<td>Stage One Declaration</td>
</tr>
<tr>
<td>EE2</td>
<td>Stage Two Declaration</td>
</tr>
<tr>
<td>EE3</td>
<td>Application for Renewal of Certificate of Compliance Registration</td>
</tr>
<tr>
<td>EE4</td>
<td>Form of Compliance</td>
</tr>
<tr>
<td>EE5</td>
<td>Energy Audit Form</td>
</tr>
<tr>
<td>EE-CR</td>
<td>A sample of Certificate of Compliance Registration</td>
</tr>
<tr>
<td>EE-EX</td>
<td>Application Form for Exemption from Specified Standards and Requirements for Certificate of Compliance Registration, Form of Compliance or Energy Audit</td>
</tr>
<tr>
<td>EE-SU</td>
<td>Supplementary Information for Forms EE1, EE2, EE3 or EE4</td>
</tr>
</tbody>
</table>
## Technical Forms

<table>
<thead>
<tr>
<th>Form No</th>
<th>Type of Form</th>
</tr>
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<tbody>
<tr>
<td>EE-AC</td>
<td>Technical Data of Air-conditioning Installation for BEC 2012 Edition</td>
</tr>
<tr>
<td>EE-EL</td>
<td>Technical Data of Electrical Installation for BEC 2012 Edition</td>
</tr>
<tr>
<td>EE-LE</td>
<td>Technical Data of Lift &amp; Escalator Installation for BEC 2012 Edition</td>
</tr>
<tr>
<td>EE-LG</td>
<td>Technical Data of Lighting Installation for BEC 2012 Edition</td>
</tr>
<tr>
<td>EE-PB</td>
<td>Technical Data of Performance-based Approach for BEC 2012 Edition</td>
</tr>
<tr>
<td>EE-EA</td>
<td>Energy Audit Checklist for EAC 2012 Edition</td>
</tr>
<tr>
<td>EE-EAs</td>
<td>Executive Summary of Energy Audit Report for EAC 2012 Edition</td>
</tr>
<tr>
<td>AIT1</td>
<td>Template 1 on Additional Information to Executive Summary of Energy Audit Report</td>
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</tbody>
</table>

### Template for Additional Information

(adoption on voluntary basis, refer to TG-EAC clause 8.5)

<table>
<thead>
<tr>
<th>Template No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIT1</td>
<td>Template 1 on Additional Information to Executive Summary of Energy Audit Report</td>
</tr>
</tbody>
</table>

- to consolidate the findings in the energy audit report
- devised with reference to EAC clause 7.4.1
- Clause 7.4.1.2 of the Technical Guidelines on EAC further gives the guidance on comparing of performances using performance indicators
- gives a summary of these performance indicators that may be useful in the evaluation and appraisal
- voluntary basis, and its inclusion in the energy audit report is not a must

### Template for Additional Information
(adoption on voluntary basis, refer to TG-EAC clause 8.5)

#### Overall Building Energy Performance
- **Interior Lighting**
  - **Lamp**
    - *E = 0.50* (LM)
  - **Controlled Lighting**
    - *E = 0.50* (LM)
  - **Central Air Conditioning (HVAC)**
    - *E = 0.50* (kW)
  - **Central Heating**
    - *E = 0.50* (kW)
  - **Electrical Equipment**
    - *E = 0.50* (kW)
  - **Exterior Lighting**
    - *E = 0.50* (LM)

#### Conceptualised Ventilation
- **Central Air Conditioning (HVAC)**
  - *E = 0.50* (kW)
  - **Central Heating**
  - *E = 0.50* (kW)

#### A/C – Air conditioning Area
- **Central Air Conditioning (HVAC)**
  - *E = 0.50* (kW)
  - **Central Heating**
  - *E = 0.50* (kW)

#### IAQ – Indoor Air Quality
- **Central Air Conditioning (HVAC)**
  - *E = 0.50* (kW)
  - **Central Heating**
  - *E = 0.50* (kW)

#### Template for Additional Information
(adoption on voluntary basis, refer to TG-EAC clause 8.5)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

---

**Energy performance indices**
- **Building energy performance**
- **Energy use intensity**
- **Energy consumption**
- **Energy efficiency**

---

**References**
- **Bibliographic references**
- **Additional information**
- **Environmental impact**

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**Appendices**
- **Appendix A: Detailed Energy Analysis**
- **Appendix B: Questionnaire Survey**
- **Appendix C: Energy Conservation Strategies**

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**Figures and Tables**
- **Figure 1: Energy Consumption Breakdown**
- **Table 1: Energy Use Intensity by Building Component**
- **Table 2: Energy Consumption by Hour**

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**Acknowledgments**
- Acknowledgment to the team for their contribution to the project.
- Thank you to all stakeholders for their support.

---

**Authors**
- **Authors:** Name, Role, Institution
- **Contributors:** Name, Role, Institution

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**References**
- **References:** Author, Title, Year (e.g., Smith, J. (2020). Building Energy Performance.
- **Other sources:** Government reports, industry standards, etc.
Overview of Building Energy Code (BEC)

Mainly control the design but not the daily operation and settings of the concerned building services installations.

Need to comply with the mandatory standards for all the concerned 4 types of building services installations namely lighting, air-conditioning, electrical, and lift and escalator installation.

Not affecting the application of occupation permits nor any other licensing requirements.

No restriction on import and sale of any equipment in Hong Kong.
Key Efficiency Requirements in BEC

**Lighting Installation**
- Max Allowable Lighting Power Density
- Lighting Control

**Air-conditioning Installation**
- COP
- Air Distribution System Fan Power
- Piping System Frictional Loss
- Thermal Insulation
- Energy Efficiency System Control
- Energy Metering

**Electrical Installation**
- Motor Efficiency
- Power Distribution Loss
- Power Quality
- Energy Metering

**Lift and Escalator Installation**
- Electrical Power
- Power Quality
- Energy Metering
- Lift Decoration Load
- Idling
BEC Lighting Installations

Not regarded as installations to which BEEO applies –

- Exterior to a building – façade lighting, outdoor lighting
- Not of fixed type, connected via flexible cable with plug
- Integral to equipment or instrumentation (separate switch)
- Signage

Max Allowable Lighting Power Density (W/m²)

- Space with fixed lighting installation at or exceeding 100W

\[ \text{LPD} = \frac{\text{Total wattage of fixed lighting installation}}{\text{Internal floor area of that space}} \]

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>LPD (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrium / Foyer with headroom &gt; 5 m</td>
<td>20</td>
</tr>
<tr>
<td>Bar / Lounge</td>
<td>15</td>
</tr>
<tr>
<td>Banquet Room / Function Room / Ball Room</td>
<td>23</td>
</tr>
<tr>
<td>Canteen</td>
<td>13</td>
</tr>
<tr>
<td>Car Park</td>
<td>6</td>
</tr>
<tr>
<td>Classroom / Lecture Theatre / Training Room</td>
<td>15</td>
</tr>
<tr>
<td>Clinic</td>
<td>15</td>
</tr>
<tr>
<td>Conference / Seminar Room</td>
<td>16</td>
</tr>
<tr>
<td>Corridor</td>
<td>10</td>
</tr>
<tr>
<td>Dormitory / Quarters / Barrack</td>
<td>10</td>
</tr>
<tr>
<td>Entrance Lobby</td>
<td>15</td>
</tr>
</tbody>
</table>
### BEC Lighting Installations

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>LPD (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhibition Hall / Gallery</td>
<td>20</td>
</tr>
<tr>
<td>Guest room in Hotel or Guesthouse</td>
<td>15</td>
</tr>
<tr>
<td>Gymnasium / Exercise Room</td>
<td>15</td>
</tr>
<tr>
<td>Kitchen</td>
<td>15</td>
</tr>
<tr>
<td>Laboratory</td>
<td>15</td>
</tr>
<tr>
<td>Library – Reading Area, Stack Area or AV Centre</td>
<td>15</td>
</tr>
<tr>
<td>Lift Car</td>
<td>13</td>
</tr>
<tr>
<td>Lift Lobby</td>
<td>12</td>
</tr>
<tr>
<td>Loading &amp; Unloading Area</td>
<td>11</td>
</tr>
<tr>
<td>Office</td>
<td>15</td>
</tr>
<tr>
<td>Patient Ward / Day Care</td>
<td>15</td>
</tr>
<tr>
<td>Plant Room / Machine Room / Switch Room</td>
<td>12</td>
</tr>
<tr>
<td>Public Circular Area</td>
<td>15</td>
</tr>
<tr>
<td>Railway Station</td>
<td>20</td>
</tr>
<tr>
<td>Concourse / Platform / Entrance / Adit / Staircase, with headroom not exceeding 5 m</td>
<td>15</td>
</tr>
<tr>
<td>Concourse / Platform / Entrance / Adit / Staircase, with headroom not exceeding 5 m</td>
<td>20</td>
</tr>
</tbody>
</table>

### BEC Lighting Installations

<table>
<thead>
<tr>
<th>Type of Space</th>
<th>LPD (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurant</td>
<td>20</td>
</tr>
<tr>
<td>Retail</td>
<td>20</td>
</tr>
<tr>
<td>Seating Area inside Theatre / Cinema / Auditorium / Concert Hall / Arena</td>
<td>12</td>
</tr>
<tr>
<td>Sport Arena, Indoor, for recreational purpose</td>
<td>17</td>
</tr>
<tr>
<td>Staircase</td>
<td>8</td>
</tr>
<tr>
<td>Storeroom / Cleaner</td>
<td>11</td>
</tr>
<tr>
<td>Toilet / Washroom / Shower room</td>
<td>13</td>
</tr>
<tr>
<td>Workshop</td>
<td>14</td>
</tr>
</tbody>
</table>
BEC Lighting Installations

Lighting control

- Lighting to which BEEO is applicable and lighting to which BEEO is not applicable: separate switch
- Min No. of Lighting Control Points for Office Space

<table>
<thead>
<tr>
<th>Space Area A (m²)</th>
<th>N (N: integer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 x (N -1) &lt; A ≤ 15 x N</td>
<td>0 &lt; N ≤ 10</td>
</tr>
<tr>
<td>30 x (N-6) &lt; A ≤ 30 x (N – 5)</td>
<td>10 &lt; N ≤ 20</td>
</tr>
<tr>
<td>50 x (N -12) &lt; A ≤ 50 x (N-11)</td>
<td>N &gt; 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>&gt; 0 - 15</th>
<th>&gt; 15 - 30</th>
<th>&gt; 30 - 45</th>
<th>&gt; 45 - 60</th>
<th>&gt; 60 - 75</th>
<th>&gt; 75 - 90</th>
<th>&gt; 90 - 105</th>
<th>&gt; 105 - 120</th>
<th>&gt; 120 - 150</th>
<th>&gt; 150 - 180</th>
<th>&gt; 180 - 200</th>
<th>&gt; 200 - 225</th>
<th>&gt; 225 - 250</th>
<th>&gt; 250 - 275</th>
<th>&gt; 275 - 300</th>
<th>&gt; 300 - 325</th>
<th>&gt; 325 - 350</th>
<th>&gt; 350 - 375</th>
<th>&gt; 375 - 400</th>
<th>&gt; 400 - 425</th>
<th>&gt; 425 - 450</th>
<th>&gt; 450 - 475</th>
<th>&gt; 475 - 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

BEC Air- Conditioning Installations

Not regarded as installations to which BEEO applies –

- Equipment on high voltage (e.g. chiller)
BEC Air-Conditioning Installations

- **Load calculation**
  - Outdoor & Indoor design conditions
  - Established internationally recognized procedure

### Indoor, comfort applications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Season</th>
<th>Applications</th>
<th>Temperature / Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indoor</td>
<td>Summer</td>
<td>Office &amp; Classroom</td>
<td>Min dry bulb temperature 23°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Applications</td>
<td>Min relative humidity 50%</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td>Hotel</td>
<td>Max dry bulb temperature 23°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other applications</td>
<td>Max relative humidity 50%</td>
</tr>
<tr>
<td>Outdoor</td>
<td>Summer</td>
<td>All applications</td>
<td>Max dry bulb temperature 7°C</td>
</tr>
<tr>
<td></td>
<td>Winter</td>
<td></td>
<td>Min dry bulb temperature 23°C</td>
</tr>
</tbody>
</table>

### Outdoor Summer

- All applications
  - Max dry bulb temperature 35°C with wb temp lower than 29°C, or
  - Max wb temp of 29°C with db temp lower than 35°C

### Outdoor Winter

- All applications
  - Min dry bulb temperature 7°C
BEC Air-Conditioning Installations

- Air distribution ductwork leakage limit
  - Ductwork designed for > 750 Pa
  - min 25% leak-tested (DW143)

<table>
<thead>
<tr>
<th>Leakage Class</th>
<th>Operating Static Pressure (Pa)</th>
<th>Air Leakage Limit (L/s per m(^2) of duct surface)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&gt; 750 to 1000</td>
<td>0.009 (\times p^{0.65})</td>
</tr>
<tr>
<td>II</td>
<td>&gt; 1000 to 2000</td>
<td>0.003 (\times p^{0.65})</td>
</tr>
<tr>
<td>III</td>
<td>&gt; 2000</td>
<td>0.001 (\times p^{0.65})</td>
</tr>
</tbody>
</table>

\(p\) is the operating static pressure in Pascal

BEC Air-Conditioning Installations

- Air distribution system fan power® for conditioned space
  - CAV \(\leq\) 1.6 W / L/s (supply system air flow);
  - VAV \(\leq\) 2.1 W / L/s (supply system air flow)

® Sum of fan motor power of supply air fan & return air fan (excluding fan power for fresh air only or for exhaust only)

Exception: System power < 5 kW;
Fan motor power < 1 kW (e.g. FCU)

- VAV fan (supply or return) with motor output power \(\geq\) 5 kW
  - at 50% design flow, motor demands \(\leq\) 55% input power
BEC Air-Conditioning Installations

- Variable speed pump with motor output power $\geq 5$ kW
  - At 50% flow, motor demands $\leq 55\%$ input power

- Piping system frictional loss
  - Piping $\Phi > 50$ mm: frictional loss $\leq 400$ Pa/m
    & flow velocity $\leq 3$ m/s
  - Piping $\Phi \leq 50$ mm: flow velocity $\leq 1.2$ m/s

---

### Min Coefficient of Performance (COP) of Chiller

<table>
<thead>
<tr>
<th>Compressor Type</th>
<th>Capacity Range (kW)</th>
<th>Scroll COP</th>
<th>Screw COP</th>
<th>Centrifugal COP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air-cooled</strong></td>
<td>All Ratings</td>
<td>2.7</td>
<td>2.9</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Water-cooled</strong></td>
<td>Below 500 kW</td>
<td>4.1</td>
<td>4.6</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>500 - 1000 kW</td>
<td>4.6</td>
<td>4.7</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>Above 1000 kW</td>
<td>5.1</td>
<td>5.6</td>
<td>5.7</td>
</tr>
</tbody>
</table>
### Min COP of Unitary Air-conditioner

<table>
<thead>
<tr>
<th>Type of Cooling</th>
<th>Air-cooled</th>
<th>Water-cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity range (kW)</td>
<td>7.5 kW &amp; below, of types outside the scope of EMSD labelling scheme</td>
<td>Above 7.5 kW &amp; below 40 kW</td>
</tr>
<tr>
<td>Min COP at Cooling Mode (free air flow)</td>
<td>2.4 for split type</td>
<td>2.4</td>
</tr>
<tr>
<td>Min COP at Cooling Mode (free air flow)</td>
<td>2.1 for non-split type</td>
<td>3 for VRF</td>
</tr>
<tr>
<td>Min COP at Cooling Mode (free air flow)</td>
<td>2.4</td>
<td>2.7</td>
</tr>
</tbody>
</table>

### Unitary air-conditioner of type under EMSD labelling scheme

Fulfilling Energy Efficiency Grade 2 or Grade 1

### Thermal insulation – Min Thickness for Chilled Water Pipework

<table>
<thead>
<tr>
<th>Ambient</th>
<th>Outdoor</th>
<th>Unconditioned Space</th>
<th>Conditioned Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity λ (W/m·°C)</td>
<td>0.024</td>
<td>0.04</td>
<td>0.024</td>
</tr>
<tr>
<td>Surface coefficient h (W/m²·°C)</td>
<td>9</td>
<td>13.5</td>
<td>9</td>
</tr>
<tr>
<td>Pipe outer diameter dₒ (mm)</td>
<td>Insulation thickness (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.3 mm</td>
<td>20</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>26.9 mm</td>
<td>21</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td>33.7 mm</td>
<td>22</td>
<td>16</td>
<td>34</td>
</tr>
<tr>
<td>42.4 mm</td>
<td>23</td>
<td>17</td>
<td>35</td>
</tr>
<tr>
<td>48.3 mm</td>
<td>24</td>
<td>17</td>
<td>36</td>
</tr>
<tr>
<td>60.3 mm</td>
<td>25</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>76.1 mm</td>
<td>26</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>88.9 mm</td>
<td>26</td>
<td>19</td>
<td>41</td>
</tr>
</tbody>
</table>
### Thermal insulation – Min Thickness for Chilled Water Pipework

<table>
<thead>
<tr>
<th>Ambient</th>
<th>Outdoor</th>
<th>Unconditioned Space</th>
<th>Conditioned Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity $\lambda$ (W/m·°C)</td>
<td>0.024</td>
<td>0.04</td>
<td>0.024</td>
</tr>
<tr>
<td>Surface coefficient $h$ (W/m²·°C)</td>
<td>9</td>
<td>13.5</td>
<td>9</td>
</tr>
<tr>
<td>Pipe outer diameter $d_o$</td>
<td>Insulation thickness (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>114.3 mm</td>
<td>27</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>139.7 mm</td>
<td>28</td>
<td>20</td>
<td>44</td>
</tr>
<tr>
<td>168.3 mm</td>
<td>29</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>219.1 mm</td>
<td>29</td>
<td>20</td>
<td>47</td>
</tr>
<tr>
<td>273 mm</td>
<td>30</td>
<td>21</td>
<td>48</td>
</tr>
<tr>
<td>323.9 mm</td>
<td>30</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>355.6 mm</td>
<td>31</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>406.4 mm</td>
<td>31</td>
<td>21</td>
<td>50</td>
</tr>
</tbody>
</table>

---

### Thermal Insulation – Min Thickness for Ductwork & Refrigerant Pipe

<table>
<thead>
<tr>
<th>Ambient</th>
<th>Outdoor</th>
<th>Unconditioned Space</th>
<th>Conditioned Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity $\lambda$ (W/m·°C)</td>
<td>0.024</td>
<td>0.04</td>
<td>0.024</td>
</tr>
<tr>
<td>Surface coefficient $h$ (W/m²·°C)</td>
<td>9</td>
<td>13.5</td>
<td>9</td>
</tr>
<tr>
<td>Temperature difference between air inside duct/casing and surrounding</td>
<td>Ductwork &amp; Casing Insulation thickness (mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 °C</td>
<td>20</td>
<td>13</td>
<td>33</td>
</tr>
<tr>
<td>20 °C</td>
<td>27</td>
<td>18</td>
<td>46</td>
</tr>
<tr>
<td>Pipe outer diameter $d_o$ (mm)</td>
<td>Refrigerant Pipework Insulation thickness (mm)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 mm</td>
<td>22</td>
<td>16</td>
<td>33</td>
</tr>
<tr>
<td>28 mm</td>
<td>25</td>
<td>18</td>
<td>38</td>
</tr>
<tr>
<td>42 mm</td>
<td>28</td>
<td>20</td>
<td>41</td>
</tr>
</tbody>
</table>

* for line temp at 0°C
BEC Air-Conditioning Installations

- **System Control**
  - Off-hours control during periods of non-use
    - Each system to have auto control to reduce energy through control setback or equipment shutdown
    - **Exception:** system ≤ 10 kW cooling/heating capacity may be controlled by readily accessible manual off-hour control
  - Each zone controlled by separate temperature control
    - Zone normally not on separate floors
  - Each air-conditioned system provided with automatic temperature control

- **Design Conditions**
  - Outdoor and Indoor, for Load Calculation

---

**BEC Air-Conditioning Installations**

- **Energy Metering**
  - **Chiller, heat pump or unitary air-conditioner ≥ 350 kW cooling/heating capacity**
    - Continuous monitoring facilities to measure
      - input of power (kW) & energy (kWh)
      - output of cooling/heating power (kW) & energy (kWh)
      - COP
  - **Chilled/heated water plant ≥ 350 kW cooling/heating capacity**
    - Continuous monitoring facilities to measure
      - input of power (kW) & energy (kWh)
      - output of cooling/heating power (kW) & energy (kWh)
      - COP
Not regarded as installations to which BEEO applies -
- Operating on high voltage or extra low voltage
- Owned by electricity supplier & installed in consumer substation

### Power Distribution Loss – Max Allowable Circuit Copper Loss

<table>
<thead>
<tr>
<th>Circuit type</th>
<th>Connection</th>
<th>Copper Loss @</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main circuit</td>
<td>Distribution transformer to LV Switchboard</td>
<td>0.5 % (unless Tx Rm &amp; Main Sw Rm directly beside, above or below each other) Neutral conductor rating ≥ phase conductor rating</td>
</tr>
<tr>
<td>Feeder</td>
<td>LV Switchboard direct to equipment</td>
<td>2.5 %</td>
</tr>
<tr>
<td>Sub-main circuit ≤ 100m in non-residential building</td>
<td>LV Switchboard to Local Distribution Board</td>
<td>1.5 %</td>
</tr>
<tr>
<td>Sub-main circuit &gt; 100 m in non-residential building</td>
<td>Local Distribution Board</td>
<td>2.5 % [subject to sum of losses in sub main and final circuits (&gt; 32A) ≤ 2.5%]</td>
</tr>
<tr>
<td>Sub-main circuit in residential building</td>
<td>Local Distribution Board</td>
<td>2.5 %</td>
</tr>
<tr>
<td>Final circuit &gt; 32 A</td>
<td>Local Distribution Board to equipment / Outlet Points</td>
<td>1 %</td>
</tr>
</tbody>
</table>

@ total active power (1 or 3-phase), at designed circuit current
BEC Electrical Installations

Min Allowable Motor Efficiency

<table>
<thead>
<tr>
<th>Motor Rated Output (P)</th>
<th>Min Rated Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-pole</td>
</tr>
<tr>
<td>0.75 kW ≤ P &lt; 1.1 kW</td>
<td>77.4%</td>
</tr>
<tr>
<td>1.1 kW ≤ P &lt; 1.5 kW</td>
<td>79.6%</td>
</tr>
<tr>
<td>1.5 kW ≤ P &lt; 2.2 kW</td>
<td>81.3%</td>
</tr>
<tr>
<td>2.2 kW ≤ P &lt; 3 kW</td>
<td>83.2%</td>
</tr>
<tr>
<td>3 kW ≤ P &lt; 4 kW</td>
<td>84.6%</td>
</tr>
<tr>
<td>4 kW ≤ P &lt; 5.5 kW</td>
<td>85.8%</td>
</tr>
<tr>
<td>5.5 kW ≤ P &lt; 7.5 kW</td>
<td>87%</td>
</tr>
<tr>
<td>7.5 kW ≤ P &lt; 11 kW</td>
<td>88.1%</td>
</tr>
<tr>
<td>11 kW ≤ P &lt; 15 kW</td>
<td>89.4%</td>
</tr>
<tr>
<td>15 kW ≤ P &lt; 18.5 kW</td>
<td>90.3%</td>
</tr>
<tr>
<td>18.5 kW ≤ P &lt; 22 kW</td>
<td>90.9%</td>
</tr>
<tr>
<td>22 kW ≤ P &lt; 30 kW</td>
<td>91.3%</td>
</tr>
<tr>
<td>30 kW ≤ P &lt; 37 kW</td>
<td>92%</td>
</tr>
<tr>
<td>37 kW ≤ P &lt; 45 kW</td>
<td>92.5%</td>
</tr>
</tbody>
</table>

BEC Electrical Installations

Motor sizing for motor > 5 kW output power rating

- Ratio of motor output power to anticipated system load ≤ 125% (unless requiring a special high starting torque)

Balancing of Single-phase Loads

- 3-phase 4-wire circuits ≥ 400A, having 1-phase loads
- max unbalanced single-phase loads ≤ 10%
Ø Min Allowable Total Power Factor (TPF)
- Circuit design TPF (at Design Circuit Current) ≥ 0.85
- 3-phase circuit connecting to meter of electricity supplier, or
- For circuit ≥ 400A

Ø Max Allowable Total Harmonic Distortion (THD)
- Harmonic Current
  - 3-phase circuit connecting to meter of electricity supplier, or
  - For circuit ≥ 400A

<table>
<thead>
<tr>
<th>Designed Circuit Current (I, in A)</th>
<th>THD in % of Fundamental Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>I &lt; 40A</td>
<td>20.0 %</td>
</tr>
<tr>
<td>40A ≤ I &lt; 400A</td>
<td>15.0 %</td>
</tr>
<tr>
<td>400A ≤ I &lt; 800A</td>
<td>12.0 %</td>
</tr>
<tr>
<td>800A ≤ I &lt; 2000A</td>
<td>8.0 %</td>
</tr>
<tr>
<td>I ≥ 2000A</td>
<td>5.0 %</td>
</tr>
</tbody>
</table>

In fulfilling above TPF or THD requirement, a correction device or a connection point for the device should be incorporated
- at the source motor control centre or local distribution board
- in case a connection point, it should constitute a spare way solely for supplying power to the connection device

Ø Metering & Monitoring Facilities
- Main circuit at or above 400A
  - measuring voltage (phase-to-phase & phase-to-neutral), current (phases & neutral), energy consumption, max demand, TPF, THD
- Feeder & Sub-main circuit
  - Circuit exceeding 200A & below 400A
    - measuring current (phases & neutral), energy consumption
  - Circuit at or above 400A
    - measuring voltage (phase-to-phase & phase-to-neutral), current (phases & neutral), energy consumption, max demand, TPF, THD
BEC Electrical Installations

**Circuit Copper Loss**

Percentage copper loss with respect to the total active power transmitted (assuming negligible voltage distortion, skin effect & proximity effect)

\[
\% \text{ loss} = \frac{(3 \times l_n^2 + l_0^2) \times r \times L}{\sqrt{3} \times U_0 \cos \theta}
\]

- \( I_n \): Neutral current of the circuit in ampere
- \( I_0 \): Design r.m.s. phase current of the circuit in ampere
- \( I_f \): Fundamental phase current of the circuit in ampere
- \( r \): a.c. resistance per metre at the conductor operating temperature
- \( L \): Length of the cable in metre
- \( U_0 \): Supply line voltage at 380V

**Total Harmonic Distortion (THD) of Current**

'Total harmonic distortion (THD)' in the presence of several harmonics, means a ratio of the root mean square (r.m.s.) value of the harmonics to the r.m.s. value of the fundamental expressed in percentage. (In equation form, the definition of %THD for current is given by:

\[
\% \text{THD} = \sqrt{\frac{\sum (i_n)^2}{(i_f)^2}} \times 100
\]

where:

- \( i_f \): r.m.s. value of fundamental current
- \( i_n \): r.m.s. value of current of the n'th harmonic order

BEC Lift & Escalator Installations

Not regarded as installations to which BEOB applies –

- Mechanized vehicle parking system
- Service lift, stairlift
- Industrial truck loaded freight lift
- Lift in a performance stage
- Powered lifting platform
- Non-traction / Non-hydraulic driven
Max Allowable Electrical Power – running active electrical power

- Traction drive lift – Power of motor drive, at rated load rated speed upward
- Hydraulic lift – Power of hydraulic oil pump motor, at rated load rated speed upward
- Escalator / Passenger conveyor - Power of steps driving motor, no-load at rated speed

<table>
<thead>
<tr>
<th>Rated Load L (kg)</th>
<th>Rated Speed Vc (m/s)</th>
<th>Vc &lt; 1</th>
<th>1 ≤ Vc &lt; 1.5</th>
<th>1.5 ≤ Vc &lt; 2</th>
<th>2 ≤ Vc &lt; 2.5</th>
<th>2.5 ≤ Vc &lt; 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>L ≤ 750</td>
<td></td>
<td>6.7</td>
<td>9.5</td>
<td>11.4</td>
<td>15.2</td>
<td>17.1</td>
</tr>
<tr>
<td>750 ≤ L &lt; 1000</td>
<td></td>
<td>9.5</td>
<td>11.4</td>
<td>16.2</td>
<td>20</td>
<td>22.8</td>
</tr>
<tr>
<td>1000 ≤ L &lt; 1350</td>
<td></td>
<td>11.4</td>
<td>16.2</td>
<td>20.9</td>
<td>25.7</td>
<td>30.4</td>
</tr>
<tr>
<td>1350 ≤ L &lt; 1600</td>
<td></td>
<td>14.3</td>
<td>19</td>
<td>25.7</td>
<td>30.4</td>
<td>36.1</td>
</tr>
<tr>
<td>1600 ≤ L &lt; 2000</td>
<td></td>
<td>16.2</td>
<td>23.8</td>
<td>30.4</td>
<td>37.1</td>
<td>43.7</td>
</tr>
<tr>
<td>2000 ≤ L &lt; 3000</td>
<td></td>
<td>23.8</td>
<td>35.2</td>
<td>44.7</td>
<td>56.1</td>
<td>66.5</td>
</tr>
<tr>
<td>3000 ≤ L &lt; 4000</td>
<td></td>
<td>31.4</td>
<td>45.6</td>
<td>59.9</td>
<td>74.1</td>
<td>87.4</td>
</tr>
<tr>
<td></td>
<td>3 ≤ Vc &lt; 3.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.5 ≤ Vc &lt; 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 ≤ Vc &lt; 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 ≤ Vc &lt; 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 ≤ Vc &lt; 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| L ≤ 750          |                      | 20    | 21.9         | 23.8         | 28.5         | 32.3         |
| 750 ≤ L < 1000   |                      | 25.7  | 29.5         | 30.4         | 37.1         | 43.7         |
| 1000 ≤ L < 1350  |                      | 34.2  | 38           | 42.9         | 49.4         | 57           |
| 1350 ≤ L < 1600  |                      | 40.9  | 46.6         | 49.4         | 58.9         | 68.4         |
| 1600 ≤ L < 2000  |                      | 50.4  | 57           | 61.8         | 71.3         | 83.6         |
| 2000 ≤ L < 3000  |                      | 75.1  | 85.5         | 90.3         | 109.3        | 125.4        |
| 3000 ≤ L < 4000  |                      | 98.8  | 114          | 123.5        | 142.5        | 166.3        |
### Max Allowable Electrical Power of Escalator

<table>
<thead>
<tr>
<th>Nominal Width W (mm)</th>
<th>Rise R (m)</th>
<th>Non-Public Service Escalator</th>
<th>Public Service Escalator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Electrical Power (W) at Rated Speed Vr (m/s) No Load</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vr &lt; 0.5</td>
<td>0.5 ≤ Vr &lt; 0.6</td>
</tr>
<tr>
<td></td>
<td>R = 3.5</td>
<td>1283</td>
<td>1473</td>
</tr>
<tr>
<td></td>
<td>3.5 ≤ R &lt; 5</td>
<td>1520</td>
<td>1805</td>
</tr>
<tr>
<td></td>
<td>5 ≤ R &lt; 6.5</td>
<td>1758</td>
<td>2138</td>
</tr>
<tr>
<td></td>
<td>R ≥ 6.5</td>
<td>209R + 432</td>
<td>247R + 530</td>
</tr>
<tr>
<td>800</td>
<td>R = 3.5</td>
<td>1425</td>
<td>1615</td>
</tr>
<tr>
<td></td>
<td>3.5 ≤ R &lt; 5</td>
<td>1710</td>
<td>1995</td>
</tr>
<tr>
<td></td>
<td>5 ≤ R &lt; 6.5</td>
<td>1995</td>
<td>2375</td>
</tr>
<tr>
<td></td>
<td>R ≥ 6.5</td>
<td>2328</td>
<td>2755</td>
</tr>
<tr>
<td></td>
<td>R ≥ 8</td>
<td>230R + 768</td>
<td>253.6R + 694</td>
</tr>
<tr>
<td>1000</td>
<td>R = 3.5</td>
<td>1520</td>
<td>1805</td>
</tr>
<tr>
<td></td>
<td>3.5 ≤ R &lt; 5</td>
<td>1900</td>
<td>2185</td>
</tr>
<tr>
<td></td>
<td>5 ≤ R &lt; 6.5</td>
<td>2214</td>
<td>2660</td>
</tr>
<tr>
<td></td>
<td>R ≥ 6.5</td>
<td>2613</td>
<td>3040</td>
</tr>
<tr>
<td></td>
<td>R ≥ 8</td>
<td>268R + 653</td>
<td>349.6R + 771</td>
</tr>
</tbody>
</table>

### Max Allowable Lift Decoration Load

<table>
<thead>
<tr>
<th>Lift Rated Load L (kg)</th>
<th>Allowable Decoration Load D (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L &lt; 1800</td>
<td>D = 0.5 x L, or 600 whichever is smaller</td>
</tr>
<tr>
<td>L ≥ 1800</td>
<td>D = 0.38 x L – 0.000026 x L², or 1250 whichever is smaller</td>
</tr>
</tbody>
</table>

**Lift Parking Mode**

Lift bank: at least 1 lift to run at parking mode (during low traffic) and not respond to passenger call until return to normal operation mode.
BEC Lift & Escalator Installations

- Lift Ventilation and Air-conditioning
  
  Ventilation
  • Lift car after idling for 2 minutes: ventilation to be shut off automatically, until lift activated again by passenger call

  If air-conditioned
  • Lift after idling for 10 minutes: air-conditioning to be shut off automatically until lift activated again by passenger call, and resume operation no earlier than 5 minutes after the shut-off

  Exception: observation lift in unconditioned space

BEC Lift & Escalator Installations

- Min Allowable Total Power Factor (TPF)
  
  TPF of motor drive ≥ 0.85
  (at the isolator connecting to building’s electrical supply circuit)

  ✓ Lift – at rated load rated speed upward

  ✓ Escalator / passenger conveyor – at brake load rated speed (for equipment with a rise equipment travelling upward)
BEC Lift & Escalator Installations

Max Allowable Total Harmonic Distortion (THD)

<table>
<thead>
<tr>
<th>Circuit Fundamental Current of Motor Drive I (A)</th>
<th>THD (%) of Motor Drive in Each Phase (at isolator connecting to building’s electrical supply circuit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LIFT (rated load, rated speed up) Escalator and Passenger Conveyor (no load, rated speed)</td>
</tr>
<tr>
<td>I &lt; 40A</td>
<td>40% 35% (direct from feeder) 40% (not direct from feeder)</td>
</tr>
<tr>
<td>40A ≤ I &lt; 80A</td>
<td>35% 35%</td>
</tr>
<tr>
<td>80A ≤ I &lt; 400A</td>
<td>22.5% 22.5%</td>
</tr>
<tr>
<td>400A ≤ I &lt; 800A</td>
<td>15% Not applicable</td>
</tr>
</tbody>
</table>

Remarks
- In fulfilling TPF & THD requirements, corresponding correction device can be installed at the source motor control centre.
- Circuit fulfilling TPF & THD requirement not further governed by TPF & THD requirement under Electrical Installations.

Metering & Monitoring Facilities
(for each Lift, Escalator & Passenger Conveyor)

- Metering devices or the provision for measurement should be provided
  - Measuring voltage (phase-to-phase & phase-to-neutral), current (phases & neutral), power, energy consumption, max demand, TPF, THD
  - Provision for measurement
    - Electrical cubicle or junction box through which the electrical supply circuit passes
    - Right beside the control panel of the motor drive
    - Facilitate the ready connection and subsequent removal of the metering devices for measurement not entailing a stoppage or disruption to operation.
### Performance-based Approach
- Alternative BEC compliance approach
  - Focusing on total building energy using simulation software
  - Design energy should not exceed energy budget
  - Relaxing certain prescriptive requirements such as LPD, COP

### Requirements for Major Retrofitting Works
- **Examples**
  - Replacement of luminaries with total circuit wattage < 3kW
    - does not have to meet LPD requirements
  - Replacement of AHUs with cooling capacity < 60kW
    - does not have to meet COP requirements

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### Overview of Energy Audit Code (EAC)

Responsibility of Building Owner

- Engage REA to carry out energy audit according to prescribed time frame
- Obtain from REA the Energy Audit Form and energy audit report
- Energy audit form should show the annual Energy Utilization Index (EUI) in MJ/m²/annum of the building in the past 12 months
- Exhibit Energy Audit Form at building main entrance

- Energy audit totally independent from BEC compliance - not a checking for BEC compliance
- Implementation of EMO not mandatory
Energy Audit (Schedule 4 & Part 4 of BEO)

- Only apply to Central Building Services Installations of
  - Commercial buildings
  - A portion of a composite building that is for commercial use
- Does not apply to buildings that will cease to fall within the above building categories within 12 months

Central Building Services Installations

- Central Building Services Installations
  - BS Installation does not solely serve a unit of that Building
  - BS Installation has no common area except an installation that:
    - Solely serves a unit of that Building; and
    - Owned by a person who is not the owner of that Building
## Central Building Services Installations

<table>
<thead>
<tr>
<th>Individual Installation</th>
<th>Building with Designated Common Area</th>
<th>Building without Designated Common Area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lighting</strong></td>
<td>Located in the common area</td>
<td>located anywhere in that building unless it is in an individual unit and is separately owned by the responsible person of the unit who is not the owner of that building</td>
</tr>
<tr>
<td><strong>Air-conditioning</strong></td>
<td>Not separately owned by the responsible person of an individual unit</td>
<td>located anywhere in that building, unless it is separately owned by the responsible person of an individual unit who is not the owner of that building</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td>On the incoming side of an electricity supplier’s electricity meter for an individual unit</td>
<td>located anywhere in that building unless it is on the outgoing side of an electricity supplier’s electricity meter for an individual unit with its responsible person not being the owner of that building</td>
</tr>
<tr>
<td><strong>Lift &amp; Escalator</strong></td>
<td>Located in the common area, unless solely serving an individual unit</td>
<td>located anywhere in that building, unless it is solely serving an individual unit and is separately owned by the responsible person of that unit who is not the owner of that building</td>
</tr>
</tbody>
</table>

## Schedule of Energy Audit

**Newly Constructed Buildings**  
(Section 22(2) of the BEEO)  
- 1st energy audit within 10 years after the issue of the 1st Certificate of Compliance Registration (COCR)

**Existing Buildings**  
(Schedule 5 of the BEEO)  
- 1st round of energy audits will be completed in phases within 4 years  
- The Newer the Building (according to issue date of OP issued by BD), the earlier the Energy Audit should be carried out
## Energy Audit

### Carrying out of energy audit required under Ordinance?

<table>
<thead>
<tr>
<th>Existing building</th>
<th>Central BS installations</th>
<th>Non-central BS installations</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA on or after 1.1.1988</td>
<td><strong>Yes</strong>, in 12 months from 21.9.2012</td>
<td>No</td>
</tr>
<tr>
<td>OA on or before 31.12.1969</td>
<td><strong>Yes</strong>, in 48 months from 21.9.2012</td>
<td>No</td>
</tr>
<tr>
<td>Newly Constructed Building</td>
<td><strong>Yes</strong>, in 10 years after issue of Cert of Compliance Registration</td>
<td></td>
</tr>
</tbody>
</table>

### Energy Audit Objectives & Key Steps

**Objective**
- Systematic review
- Information for decision making - accounting for environmental & economic benefits

**Key Steps**
1. **Collecting Building Information**
2. **Review of Energy Consuming Equipment**
3. **Identification of Energy Management Opportunities (EMO)**
4. **Cost Benefit Analysis of EMO**
5. **Recommendations**
6. **Compiling Energy Audit Report**

**Implement energy saving measures**
1. Collection of Building Information

Appreciation of applicable energy consuming equipment & systems of central building services installations

Study of information / Site inspections

- Energy consuming equipment inventories, brochures, manuals, drawings
- Building’s internal floor areas
- Energy consumption data past 36 mths (or since Operation)
- Building’s O&M programmes
- Operation records hours, temp, flow, pressure vs settings
- Past audit / EMO

Technical Characteristics & Operating Characteristics

2. Review of Energy Consuming Equipment

Compile records based on findings
Calculate power & energy consumptions

- AC systems & components: chillers, AHUs, AC water pumps etc.
- Luminaires
- Lifts & escalators
- Other BS equipment/systems: plumbing & drainage pumps
- Electrical circuit power quality
- Types, capacity rating, rating conditions
- Control mechanism
- Utilization pattern – operation hours, occupant density etc.
- Indicative parameters, absolute & changes – temp, flow, pressure etc.
- Metering in-situ / external Measurement at representative instants & time
- Other characteristics affecting energy consumption (e.g. ext shading, glazing shading coefficient etc.)
3. Identification of EMO

Evaluation & appraisal

- Reference to codes, guidelines & practices of established international / local standards
- Energy performances Vs operation conditions
- Identify deviations from efficient operation
- Comparison with original design
- Applicable operating conditions & system configurations
- Behaviours of responsible persons affecting energy consumption

- Lighting W/m²
- Pump W/L/s
- Chiller / heat pump kWh/yr
- AHU/Fan system fan power W/L/s
- Others (major)
- EUI - MJ/m²/annum & kWh/m²/annum

4. Cost Benefit Analysis of EMO

- Potential EMO
- Cost benefit analysis
- Energy saving

- Cat I
  - Housing keeping measures
- Cat II
  - Low cost measures
- Cat III
  - Higher cost measures

5. Recommendations

- Known programmed O&M activities
- Need of further studies
### Typical EMO

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>第一類</td>
<td>Category I</td>
<td>Involving housekeeping measures which are improvements with practically no cost investment and no disruption to building operation</td>
</tr>
<tr>
<td>第二類</td>
<td>Category II</td>
<td>Involving changes in operation measures with relatively low cost investment</td>
</tr>
<tr>
<td>第三類</td>
<td>Category III</td>
<td>Involving relatively higher capital cost investment to attain efficient use of energy</td>
</tr>
</tbody>
</table>
6. Energy Audit Report

**Executive Summary**

- a. Energy audit scope
- b. Building characteristics
- c. General description of equipment / systems audited
- d. Energy consumption & performance evaluation
- e. Air-conditioning systems / equipment information – chiller/ air-conditioner capacity & type, system type (CAV, VAV etc)
- f. Lighting installations total lighting power
- g. Analysis of historical energy consumption
- h. Indication of energy supply to units from central BS installations
- i. Findings from information review & site inspections
- j. Evaluations of potential EMO
- k. Referencing to the past energy audit (e.g. sample version of energy audit form, executive summary and check list as posted on the BEEO website)
- l. EMO – recommendations
- m. Administrative information

**Energy Audit Procedures**

1. The owner of a commercial building or the commercial portion of a composite building (requisite of newly constructed or existing one), every 10 years, is required to engage a Registered Energy Assessor to carry out energy audit for the 4 key types of central building services installation (BTS).

2. The owner is required to submit an Energy Audit Form (EAF) and an energy audit report from the Registered Energy Assessor as soon as possible.

3. The owner is required to submit a copy of the Energy Audit Form and the energy audit report to the BEEO for record within 30 days after issuing the Energy Audit Form.
Energy Audit Procedures

Energy Audits to be completed in phases within 4 years

### Notes to Complete this Form

1. This form is the "specified form" under section 32E(3) of the Building Energy Efficiency Ordinance (Chapter 515). A Building Owner must complete and submit this form.

2. The form should be submitted with a signed energy audit report (Form EE5).

3. The Director of Electrical and Mechanical Services may require the person concerned to submit relevant supplementary statements, or written or oral evidence, in response to questions arising in the application of this Ordinance.

4. The energy audit form should be made available by the Director of Electrical and Mechanical Services (Building Energy Efficiency) to the Building Owner for five years from the date of completion of the audit.

5. All the rates and requirements that appear in the form must be kept by the Building Owner to show that he/she has fulfilled the requirements of the Ordinance.

6. Pursuant to section 32E(2) of the Building Energy Efficiency Ordinance (Chapter 515), an authorized energy auditor and an energy audit report are required to be submitted to the Director.

### Frequently Asked Questions

Frequently Asked Questions

Sample EA Report Submission
List of Buildings issued with Energy Audit Form

Registered Energy Assessors
Qualifications of Registered Energy Assessors

- **Registered Professional Engineer** under Engineers Registration Ordinance (Cap. 409) –
  - electrical, mechanical, building services or environmental discipline
  - at least 2 years post qualification practical experience
  - has the knowledge for the performance of the duties and functions under the BEEO

Or

- **Corporate Member of HKIE** in electrical, mechanical, building services or environmental discipline or equivalent qualification
  - at least 3 years post qualification practical experience
  - has the knowledge for the performance of the duties and functions under the BEEO

Duties of Registered Energy Assessors

- **Newly Constructed Buildings (Several Hundred Blocks every Year)**
  - Certify the Building Services Installations comply with the BEC for the developers to apply for the COCR
  - Certify the Building Services Installations comply with the BEC for the owners to apply for renewal of the COCR every 10 years
  - Issue the FOC for Major Retrofitting Works

- **Existing Buildings (>40,000 Blocks)**
  - Issue the FOC for Major Retrofitting Works

- **Commercial buildings (>10,000 Blocks)**
  - Conduct energy audits (around 3,000 buildings requiring Energy Audit every year in the first 4 years after full implementation of BEEO)
  - Issue Energy Audit Forms
  - Prepare Energy Audit Reports
How to Apply for REA

- Complete Form EA1
  http://www.emsd.gov.hk/
  (select “Public Forms”)
- Applicant is required to:
  - provide personal details
  - submit documentary proof of relevant practical experience and professional qualification
  - declare in the form that has the knowledge for the performance of the duties and functions of a REA under BEEO
- If all documents and information are clear, interview is usually not required
- CPD is not mandatory for renewal

REA Register