

Form No. C

Certificate from ECBC Expert / Design Professional on Completion of Construction for Punjab ECBC Compliant Building Certificate

I being an authorised ECBC Expert / Design Professional having Registration No. _____ hereby state I have verified all the energy conservation measures and have inspected the construction documents, compliance forms, check-lists, submitted on the completion of building in respect of the various elements of the components referred to the proposed Punjab Energy Conservation Building Code (Punjab ECBC) compliant building in the premises of Plot No. _____ Block No. _____ Scheme _____ Town / City _____ State of _____ and certify that:-

- a. All the mandatory provision are complying with the requirements of Punjab ECBC. The works have been implemented as per the requirements covered under the Punjab Energy Conservation Building Code (Punjab ECBC) to the best of my satisfaction. The details of the various components/system completed as per Punjab ECBC are enlisted in Annexure 1.
- b. A list of energy conservation measures taken during the construction of the building are enclosed in Annexure-2. The detailed report with compliance of requirements of Punjab ECBC is placed at Annexure-3.
- c. The building meets the requirements of the Punjab ECBC compliant building and is also fit for occupancy for which it has been constructed.
- d. All the professional skill, diligence and care has been taken in verifying the construction documents and compliance forms in respect of the various elements of the components covered under the Punjab ECBC and contents are a true representation of the facts and meets the requirements of Punjab ECBC.

The check-list is completed and duly signed and sealed by the undersigned is enclosed.

Date

Signature
Building Owner/Applicant

Signature
Name of the ECBC Expert / Design Professional
Registration no. with SEAL

CC:

Commissioner, Authority having Jurisdiction/Name of the City/Town
Chief Executive, State Designated Agency/Name of State/Address

Enclosures:

- Annexure 1 - Punjab ECBC Compliance Forms (Summary + Checklists)
- Annexure 2 - List of Energy Conservation Measures
- Annexure-3 – ECBC Compliance Report at Completion stage (including Simulation report, if applicable)
- Annexure-4 – Certificate of BEE Empanelled ECBC Expert/Design Professional
- Annexure-5 – Comparison Summary at Design Stage and Completion Stage

PROJECT DATA REQUIREMENTS FOR PUNJAB ECBC COMPLIANT BUILDING

Following are the list of documents required for the compliance of Punjab ECBC at completion stage:

S.No.	Project Requirements	Annexure
<input type="checkbox"/>	ECBC Compliance Forms (including Summary & Checklist) (Form-1 to Form-9)	Annexure- 1
<input type="checkbox"/>	List of Energy Conservation Measures (ECMs) incorporated at Construction Stage	Annexure- 2
<input type="checkbox"/>	ECBC Compliance Report (including Whole Building Energy Simulation report, if applicable)	Annexure-3
<input type="checkbox"/>	Certificate of BEE Empaneled ECBC Expert/Design Professionals or BEE Certified ECBC Master Trainers	Annexure-4

Punjab ECBC Compliance Forms

Form 1 - Envelope Summary

Envelope Summary
The Punjab Energy Conservation Code Compliance Forms

Project Info	Project Address		Date	
			For Building Department Use	
	Applicant Name			
	Applicant Address			
	Applicant Phone			
Project Description	<input type="checkbox"/> New Building	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Change of Use

Compliance option	<input type="checkbox"/> Prescriptive	<input type="checkbox"/> Envelope Trade off (Appendix D)	<input type="checkbox"/> Whole Building
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	<input type="checkbox"/> Hospital, hotel, call center (24 hour)		<input type="checkbox"/> Other building types (daytime)		
Vertical Fenestration Area Calculations	Total Vertical Fenestration Area (rough opening)	divided by	Gross exterior wall area	times 100 equals	%vertical fenestration
		÷		×100	
Skylight Area Calculation	Total Skylight Area (rough opening)	divided by	Gross exterior wall area	times 100 equals	%vertical fenestration
		÷		×100	

Note: Vertical fenestration area cannot exceed 40% of the gross wall area for prescriptive option

Note: Skylight area cannot exceed 5% of the gross roof area for prescriptive compliance

Hospital, hotel, call center (24 hour)			Other building type (daytime)		
OPAQUE ASSEMBLY			OPAQUE ASSEMBLY		
<i>Roof</i>	Minimum Insulation R-value		<i>Roof</i>	Minimum Insulation R-value	
<i>Wall</i>	Minimum Insulation R-value		<i>Wall</i>	Minimum Insulation R-value	
FENESTRATION			FENESTRATION		
<i>Vertical</i>			<i>Vertical</i>		
	Maximum U-factor			Maximum U-factor	
	Maximum SHGC (or SC)			Maximum SHGC (or SC)	
<i>Overhang (yes or no)</i>			<i>Overhang (yes or no)</i>		
	If yes, enter Projection Factor			If yes, enter Projection Factor	
<i>Side fins (yes or no)</i>			<i>Side fins (yes or no)</i>		
	If yes, enter Projection Factor			If yes, enter Projection Factor	
<i>Skylight</i>			<i>Skylight</i>		
	Maximum U-factor			Maximum U-factor	
	Maximum SHGC (or SC)			Maximum SHGC (or SC)	

Owner/s

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Form 2 - Building Permit Plans Checklist

Building Permit Plans Checklist The Punjab Energy Conservation Code Compliance Forms	Envelope Checklist
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Project Address			Date			
The following information is necessary to check a building permit application for compliance with the building envelop requirements in The Punjab Energy Conservation Building Code.						
Applicability (yes, no, n.a.)	Code Section	Component	Information required		Location on Plans	Building Departments Notes
MANDATORY PROVISIONS (section 4.2)						
	4.2.1	Fenestration rating				
	4.2.1.1	U-factor	Specify whether per 4.2.1.1 or default in Appendix C			
	4.2.1.1	SHGC	Specify whether per 4.2.1.2 or default in Appendix C			
	4.2.1.1	Air Leakage	Specify leakage rates			
	4.2.2	Opaque U- factors	Specify whether per default in Appendix C or ASHRAE			
	4.2.3	Bldg. envelop sealing	Indicate sealing, caulking, gasketing, and weather stripping			
PRESCRIPTIVE COMPLIANCE OPTION (section 4.3)						
	4.3.1	Roofs	Indicate R-values on roof sections			
	4.3.2	Cool roof	Indicate minimum reflectance and emittance on plans			
	4.3.3	Roof	Indicate R-values on wall sections			
	4.3.4	Vertical fenestration	1) Indicate U-factors on fenestration schedule. Indicate if values are rated or default. If values are default, then specify frame type, glazing layers, gap- width, low-e 2) Indicate SHGC or SC on fenestration schedule. Indicate if values are rated or default 3) Indicate if overhangs or side fins are used for compliance purposes. If so, provide projection factor calculation.			
	4.3.5	Skylights	1) Indicate U-factors on fenestration schedule. Indicate if values are rated or default. If values are default, then specify frame type, glazing layers, gap- width, low-e 2) Indicate SHGC or SC on fenestration schedule. Indicate if values are rated or default			
BUILDING ENVELOPE TRADE-OFF OPTION (section 4.4)						
			Provide Calculations			

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Form 3 - Mechanical Summary

Mechanical Summary
The Punjab Energy Conservation Code Compliance Forms

Project Info	Project Address:			Date
				For Building Department Use
	Applicant Name:			
	Applicant Address:			
	Applicant Phone:			
Project Description Briefly describe mechanical system type and features. <input type="checkbox"/> Includes Plans				
Compliance option	<input type="checkbox"/> Simple	<input type="checkbox"/> Prescriptive	<input type="checkbox"/> Whole Building	
Equipment Schedules	The following information is required to be incorporated with the mechanical equipment schedules on the plans. For projects without plans, fill in the required information below			

Cooling Equipment Schedule								
Equipment ID	Brand Name	Model No	Capacity kW	Total L/s	OSA CFM or Econo?	SEER or EER	IPLV	Location
Heating Equipment Schedule								
Equipment ID	Brand Name	Model No	Capacity kW	Total L/s	OSA CFM or Econo?	SEER or EER	IPLV	Location
Fan Equipment Schedule								
Equipment ID	Brand Name	Model No	Capacity kW	Total L/s	OSA CFM or Econo	SEER or EER	IPLV	Location

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Form 4 - Mechanical Permit Checklist

Mechanical Permit Checklist The Punjab Energy Conservation Code Compliance Forms	Mechanical Checklist
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Project Address	Date
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The following information is necessary to check a building permit application for compliance with the mechanical requirements in The Punjab Energy Conservation Building Code.

Applicability (yes, no, n.a.)	Code Section	Component	Information required	Location on Plans	Building Dept. Notes
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HEATING, VENTILATION, AND AIR CONDITION (Chapter 5)

MANDATORY PROVISIONS (Section 5.2)

	5.2.2	Equipment efficiency	Provide equipment schedule with type, capacity, efficiency		
	5.2.4	Controls			
	5.2.4.1	Time clocks	Indicate thermostat with night setback, 3 different day types and 2-hour manual override		
	5.2.4.2	Temp. & dead band	Indicate temperature control with 3°C dead band minimum		
	5.2.4.3	Clg. tower, fluid cooler	Indicate two-speed motor, pony motor, or variable speed drive to control the fans		
	5.2.5.1	Piping & ductwork	Indicate sealing, caulking, gasketing, and weather stripping		
	5.2.5.1	Piping insulation	Indicate R-value of insulation		
	5.2.5.1	Ductwork insulation	Indicate R-value of insulation		
	5.2.5.1	Ductwork sealing	Specify sealing types and locations		
	5.2.6	System balancing	Specify system balancing		

PRESCRIPTIVE COMPLIANCE OPTION (Section 5.3)

	5.3		Indicate whether project is complying with Punjab ECBC Prescriptive Option OR with ASHRAE Standard 90.1-2004		
	5.3.1	Economizer			
	5.3.1.1	Air economizer	Indicate 100% capability on schedule		
	5.3.1.2	Integrated operation	Indicate capability for partial cooling		
	5.3.1.3	Field testing	Specify tests		
	5.3.2	Variable flow hydronic			
	5.3.2.1	Pump flow rates	Indicate variable flow capacity on schedules		
	5.3.2.2	Isolation valves	Indicate two-way automatic isolation valves		
	5.3.2.3	Variable speed drive	Indicate variable speed drive		

SERVICE WATER HEATING AND PUMPING (Chapter 6)

	6.2.1	Solar Water Heating	provide calculations to justify capacity to meet 20% threshold		
	6.2.2	Equipment efficiency	Provide equipment schedule with type, capacity, efficiency		
	6.2.4	Piping insulation	Indicate R-value of insulation		
	6.2.5	Heat traps	Indicate heat trap on drawings or provide manufacturers specifications to show that equipment has internal heat trap		

		6.2.6	Pool covers	Provide vapor retardant cover for pools		
		6.2.6	Pool over 32° C	Provide R-2.1 insulation		

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Form 5 - Lighting Summary

Lighting Summary
The Punjab Energy Conservation Code Compliance Forms

Project Info	Project Address			Date	
				For Building Department Use	
	Applicant Name:				
	Applicant Address:				
	Applicant Phone:				
Project Description	<input type="checkbox"/> New Building	<input type="checkbox"/> Addition	<input type="checkbox"/> Alteration	<input type="checkbox"/> Change of Use	
Compliance option	<input type="checkbox"/> Prescriptive	<input type="checkbox"/> System Analysis			
Alteration Exceptions (check box, if appropriate)	<input type="checkbox"/> Less than 50% of the fixtures are new and installed lighting wattage is not being increased				
Maximum Allowed Lighting Wattage (Interior, section 7.3)					
Location (floor/room no.)	Occupancy description	Allowed Watt/m ²	Area in m ²	Allowed x area	
** Document all exceptions			Total allowed Watts		
Proposed Lighting Wattage (Interior)					
Location (floor/room no.)	Fixture Description	Number of Fixtures	Watts/fixture	Watts Proposed	
Total Proposed Watts may not exceed Total Allowed Watts for Interior			Total Proposed Watts		
Maximum Allowed Lighting Wattage (Exterior, Section 7.4)					
Location	Description	Allowed Watts/m ²	Area in m ² (or lm for perimeter)	Allowed watts x m ² (or x lm)	
			Total Allowed Watts		
Proposed Lighting Wattage (Exterior)					
Location	Fixture Description	Number of fixtures	Watts /fixture	Watts proposed	

Total Proposed Watts may not exceed Total Allowed Watts for Interior Watts	Total Proposed	
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Form 6 - Lighting Permit Checklist

Lighting Permit Checklist The Punjab Energy Conservation Code Compliance Forms	Lighting Checklist
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Project Address			Date		
The following information is necessary to check a building permit application for compliance with the lighting requirements in The Punjab Energy Conservation Building Code.					
Applicability (yes, no, n.a.)	Code section	Component	Information required	Location on Plans	Building Dept. Notes
LIGHTING (Chapter 7)					
MANDATORY PROVISIONS (Section 7.2)					
		7.2.1	Lighting Controls		
		7.2.1.1	Automatic shut off	Indicate automatic shutoff locations or occupancy sensors	
		7.2.1.2	Space Control	Provide schedule with type, indicate locations	
		7.2.1.3	Daylight Zones	Provide schedule with type and features, indicate locations	
		7.2.1.4	Ext. Lighting Control	Indicate photo sensor or astronomical time switch	
		7.2.1.5	Additional Controls	Provide schedule with type, indicate locations	
		7.2.2	Signage/ Advertizing signage	Indicate 5 watts maximum	
		7.2.3	Exterior building grounds lighting	Indicate minimum efficacy of 60 lumens/Watt	
PRESCRIPTIVE INTERIOR LIGHTING POWER COMPLIANCE OPTION (Section 7.3)					
		7.3		Indicate whether project is complying with the Building Area Method (7.3.1) or the Space Function Method (7.3.2)	
		7.3.2	Building Area Method	Provide lighting schedule with wattage of lamp and ballast and number of fixtures. Document all exceptions	
		7.3.3	Space function method	Provide lighting schedule with wattage of lamp and ballast and number of fixtures. Document all exceptions	
		7.3.4.1	Luminarie Wattage	Indicate on plans	
PRESCRIPTIVE EXTERIOR LIGHTING POWER COMPLIANCE OPTIONS (Section 7.3.5)					
		7.3.5	Exterior Lighting Power	Provide lighting schedule with wattage of lamp and ballast and number of fixtures. Document all exceptions.	
ELECTRICAL POWER (Chapter 8)					
MANDATORY PROVISIONS (Section 8.2)					
		8.2.1	Transformers	Provide schedule with transformers losses	
		8.2.2	Motor efficiency	Provide equipment schedule with motor capacity efficiency	
		8.2.3	Power factor correction	Provide schedule with power factor correction	
		8.2.4	Check metering	Provide check metering and monitoring	

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Form 7 - Whole Building Performance Method Compliance Report

Project Name		Date	
Project Address		Telephone	
Designer of record			
Contact Person			
City:			
Weather Data:			
Climatic Zone:			
Total Conditioned Area(sqft)	Total Unconditioned Area(sqft)	Total Floor Area (sqft)	
Advisory Message			
		Proposed Design	Standard Design
Number of hours of heating loads unmet(system /plant)			
Number of hours of cooling loads (system/plant)			
Number of warnings			
Number of errors			
Number of defaults			
Additional building Information			
Number of floors			
Simulation program			
Comparison of Input Parameters in proposed design and standard design			
Building element	Proposed Design Input		Standard design Input
Envelop			
Above Grade Wall construction(s)			
Below grade construction			
Roof construction			
Exterior Floor construction			
Slab-on-grade construction			
Window to gross wall ratio			
Fenestration types(s)			
Fenestration Assembly U-factor			
Fenestration Assembly SHGC			
Fenestration Visual light transmittance			
Fixed Shading devices			
Automated movable shading devices			
Electrical system & process loads			
Ambient light power density and lighting design description			
Process lighting			
Lighting occupant sensor controls			
Day lighting controls			
Receptacle equipment			

Elevators or escalators		
Re-refrigeration equipment		
Other process loads		
Mechanical and plumbing systems		
HVAC systems	Variable air volume	Constant air volume
Design supply air temperature differential		
Fan Control		
Fan Power		
Economizer Control		
Demand control ventilation		
Unitary Equipment cooling efficiency		
Unitary Equipment heating efficiency		
Chiller type, capacity and efficiency		
Cooling tower		
Boiler efficiency		
Chilled water loop and Pump parameters		
Condenser water loop and Pump parameters		
Hot water loop and pump parameters		
Domestic Hot Water pump parameters		

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Form 8 – End Use Summary

Standard design – End Use Summary											
End Use		0° rotation		90° rotation		180° rotation		270° rotation		Average	
	Energy type	Energy (KwH)	Peak (kW)	Energy (KwH)	Peak (kW)	Energy (KwH)	Peak (kW)	Energy (KwH)	Peak (kW)	Energy (KwH)	Peak (kW)
Interior lighting	Elec										
Interior Lighting (process)	Elec										
Exterior lighting	Elec										
Space Heating (Fuel 1)	Natural gas										
Space Heating (Fuel 2)	Elec										
Space cooling	Elec										
Pumps	Elec										
Heat rejection	Elec										
Fans Interior	Elec										
Fans Parking Garage	Elec										
Service Water Heating (Fuel 1)	Natural gas										
Service Water Heating (Fuel 2)	Elec										
Receptacle Equipment	Elec										
Refrigeration (Food, etc.)	Elec										
Cooking commercial, (Fuel 1)	Elec										
Cooking commercial, (Fuel 2)	Elec										
Elevators and escalators	Elec										
Other process	Elec										
Total building consumption / demand	Elec										
Total process energy	Elec										

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Form 9 – Energy Summary by End Use

Energy Summary by End Use						
	Proposed Design			Standard Design		
	Energy Type	Energy (kWh)	Peak (kW)	Energy (kWh)	Peak (kW)	Energy (%)
Interior Light (Ambient)	Elec.					
Interior Lighting (Process)	Elec.					
Exterior Lighting	Elec.					
Space Heating (Fuel 1)	Natural gas					
Space Heating (Fuel 2)	Elec.					
Space cooling	Elec.					
Pumps	Elec.					
Heat Rejection	Elec.					
Fans-Interior	Elec.					
Fans-Parking Garage	Elec.					
Service Water Heating (Fuel 1)	Natural gas					
Service Water Heating (Fuel 2)	Elec.					
Receptacle equipment	Elec.					
Refrigeration (food, etc.)	Elec.					
Cooking (commercial, Fuel 1)	Natural gas					
Cooking (commercial, Fuel 2)	Elec.					
Elevators and escalators	Elec.					
Other process	Elec.					
Total building consumption						

Owner/s

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Comparison Summary – Design Stage vs Completion Stage

PUNJAB ECBC PERFORMA

BUILDING ENVELOPE

MANDATORY REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
FENESTRATIONS			
a) Fenestrations			
- U-Factor for overall fenestration ISO 15099 certified	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- SHGC for overall fenestration ISO 15099 certified	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Overhangs/ Fins			
	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Air Leakage			
- For glazed swinging/revolving doors not to exceed 5.0 l/s-m ²	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- For other fenestration and doors not exceed 2.0 l/s-m ²	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
OPAQUE CONSTRUCTION			
a) Default U-factors for opaque construction should be ISO 15099 certified	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
BUILDING ENVELOPE SEALING			
a) Sealing of joints around fenestration and door frames	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Sealing of openings between Walls & Foundations and between walls and roofs and wall panels	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Sealing of openings at penetrations of utility services (Roofs, walls and floors)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Ducts, plenums and other openings in building envelope (if any)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
PRESCRIPTIVE REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS

ROOFS			
a) U-factor for 24-hour use buildings be greater than equal to $0.26 \text{ W/m}^2\text{-}^0 \text{ C}$	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Minimum R-value for 24-hour use buildings less than or equal to $3.5 \text{ m}^2\text{-}^0 \text{ C /W}$	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) U-factor for daytime use building or other buildings types be greater than or equal to $0.409 \text{ W/m}^2\text{-}^0 \text{ C}$	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Minimum R-value of insulation for daytime or other buildings types be less than or equal to $2.1 \text{ m}^2\text{-}^0 \text{ C /W}$	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
e) For sloped roofs less than 20 degrees have an initial solar reflectance of more than 0.7 and initial emittance of more than 0.75	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

OPAQUE WALLS			
a) U-factor for 24-hour use buildings be greater than equal to $0.440 \text{ W/m}^2\text{-}^0 \text{ C}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Minimum R-value for 24-hour use buildings less than or equal to $2.10 \text{ m}^2\text{-}^0 \text{ C /W}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) U-factor for daytime use building or other buildings types be great than or equal to $0.440 \text{ W/m}^2\text{-}^0 \text{ C}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Minimum R-value of insulation for daytime or other buildings types be less than or equal to $2.10 \text{ m}^2\text{-}^0 \text{ C /W}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

VERTICAL FENESTRATION			
a) Maximum U-factor for WWR less than 40% should be $3.30 \text{ W/m}^2\text{-}^0 \text{ C}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Maximum SHGC for WWR less than 40% should be 0.25.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Maximum U-factor for WWR between 40% & 60% should be $3.30 \text{ W/m}^2\text{-}^0 \text{ C}$.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Maximum SHGC for WWR between 40% & 60% should be 0.20.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
e) Minimum VLT requirements as per the defined WWR complying ECBC.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
f) Skylight area be limited to maximum 5% of gross roof area.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

WHOLE BUILDING SIMULATION METHOD	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS

VERTICAL FENESTRATIONS

a) EPF of proposed design less than standard design.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
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PUNJAB ECBC PERFORMA**HEATING, VENTILATION AND AIR-CONDITIONING**

MANDATORY REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
NATURAL VENTILATION			
d) Shall comply with the NBC criteria	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
MINIMUM EQUIPMENT EFFICIENCIES			
b) Cooling equipment is meeting or exceeding the minimum COP and IPLV values as per different chillers equipment class for Punjab ECBC	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Boilers requirement shall comply with requirements of IS 13980	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Unitary AC's and Split air AC's shall comply with the IS 1391 (Part 1) & (Part-2) respectively.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
e) All the ceiling fans, wall mounted fans, pedestal fans and exhaust fans are labeled with minimum BEE 3 star rating.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
CONTROLS			
e) All mechanical cooling and heating systems controlled by a time clock which can start and stop the system under different schedules for 3 different day-types and capable of retaining programming and time setting during loss of power for at least 10hours	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
e) Units providing both heating and cooling equipment be temperature controlled.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
f) Cooling towers and Closed circuit fluid coolers have either 2 speed motors or variable speed drives controlling the fans	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
g) Door gaps or closure provided in all AC rooms.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

h) Temperature sensors located in the zone or return air path for controlling the supply of cooling energy to each zone	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
PIPING & DUCTWORK			
a) Piping for heating systems with design operating temperature greater than 60° C have at least R-4 insulation i.e., R-0.70	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Piping for heating systems with design operating temperature less than 60° C but greater than 40° C and piping for cooling have at least R-2 insulation i.e., R-0.35.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Insulation of the pipes exposed to weather with insulating material or paints.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Ductwork insulation			
- For exterior/ventilated attic/unventilated attic without roof insulation duct locations have Supply ducts R-value of 1.4m ² C/W and Return ducts R-value of 0.6m ² C/W.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- For unventilated attic with roof insulation/Unconditioned Space shall have Supply Ducts R-value of 0.6m ² C/W.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SYSTEM BALANCING			
a) Written balance report to the owner for HVAC systems serving zones with total conditioned area exceeding 500m ² (5000sq.ft.)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Air system balancing for fans with fan system of power greater than 0.75KW(1HP) and to reduce throttling losses	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Hydronic System Balancing by adjustment of pump speed or reduction in impeller size for pumps with pump motor greater than 7.5KW (10HP) and to reduce throttling losses.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
CONDENSERS			
a) Condensers are located as such the heat sink is free of interference from heat discharge by devices located in adjoining spaces and/or outdoor units especially of unit room AC's located in	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

shaded and ventilated area close to indoor unit.			
b) Centralized Cooling water system use treated water or soft water for condensers and chilled water systems.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
PRESCRIPTIVE REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
ECONOMIZERS			
a) For air side economizers individual cooling fan systems shall have design supply capacity over 1200 l/s (2500cfm) and total mechanical cooling capacity over 22kW(6.3tons).	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
VARIABLE FLOW HYDRONIC SYSTEMS			
a) Chilled or hot water system designed for the variable fluid flow and capable of reducing the pump flow rate not more than 50% of the design flow rate or minimum flow required by the equipment manufacturer for proper operation of chillers or boilers.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Water cooled AC's or Heat Pump units with a pump motor greater than or equal to 3.7KW(5HP) have 2 way automatic isolation valves on each unit interlocked with compressor to shutoff condenser.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

PUNJAB ECBC PERFORMA

SERVICE HOT WATER AND PUMPING

MANDATORY REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
SOLAR WATER HEATING			
Residential facilities, hotels and hospitals with centralized systems have solar water heating for 1/5th (20%) of the design capacity.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

EQUIPMENT EFFICIENCY				
a) Solar water heater meets the performance level as mentioned in IS 13129 Part (1&2)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b) Gas instantaneous Water heaters meets the performance level mentioned in IS 15558 with above 80% efficiency.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c) Electric water heater meets the performance level mentioned in IS 2082.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

SUPPLEMENTARY WATER HEATING SYSTEM				
f) Designed to maximize energy efficiency of the system with maximum heat recovery from hot discharge system like condensers of AC units.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
g) Use of gas fired heaters and electrical heaters.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

PIPING INSULATION				
a) All hot water systems including storage tanks, pipelines insulated have R-4 insulation with R value of 0.70 for design operating temperature of greater than 60° C	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
h) All hot water systems including storage tanks, pipelines insulated have R-2 insulation with R value of 0.35 for design operating temperature of less than 60° C and greater than 40° C	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

HEAT TRAPS				
a) On both the inlet and outlet piping as close as practical to the storage tanks	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

SWIMMING POOLS				
i) Pools provided with vapor-retardant pool cover on or at the water surface.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
j) Pools heated to more than 32 have pool cover with minimum insulation Value of R-2.1 (R-12)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

PUNJAB ECBC PERFORMA

LIGHTING SYSTEMS

MANDATORY REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
LIGHTING CONTROL			
a) Automatic Lighting Shutoff			
- Interior lighting systems in buildings larger than 500m ² equipped with automatic control device.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- All office areas(less than 30m ²), conference & meeting rooms, school classrooms, and all storage spaces equipped with occupancy sensors.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Space Control			
- Each space enclosed by ceiling-height partitions shall have at least 1 control device to independently to control the general lighting within the space.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Control a maximum of 250m ² for a space less than or equal to 1000m ² and a maximum of 1000m ² for space greater than 1000m ² .	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Control in day lighted areas			
- Areas greater than 25m ² equipped with a manual or automatic Control i.e., capable of reducing light output of luminaries by at least 50%	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Areas greater than 25m ² equipped with a manual or automatic Controls only the luminaries located entirely within the day lighted Area.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
d) Exterior Lighting Control			
- Lighting for all the exterior applications be controlled by photo Sensor or astronomical time switch that is capable of automatically turning off the exterior lighting when not required	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

e) Additional Control			
- Display/Accent Lighting for greater than 300m2 area have separate control device	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Case Lighting for display purposes for area greater than 300m2 Equipped with	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Master control device provided at hotel and motel guest rooms Or suites at the main entry that controls permanently installed Luminaries and switched receptacles.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Task lighting permanently installed under shelf or under cabinet accompanied by control device readily accessible and located so the occupant can see control.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Lighting for non-visual applications as for plant growth and food Warming, equipped with separate control device	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Lighting for sale or demonstrations in lighting education equipped with a separate control device accessible only to authorized personnel	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SIGNAGE/ADVERTISING SIGNAGE			
a) Internally-Illuminated exit signs or other signage's LPD not to exceed 5W/sq.ft. Externally-illuminated signage's LPD not to exceed 2.5W/sq.ft. or option for LEDs usage.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
EXTERIOR BUILDING GROUNDS LIGHTING			
a) Lighting for exterior building grounds operating at greater than 100W is accompanied by a lamp of efficacy 60lumen/W or LED type unless controlled by motion sensor.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

PRESCRIPTIVE REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
INTERIOR LIGHTING POWER			
a) Installed interior lighting power for a building separately metered or Permitted portion of building include all power used luminaries Lamps, ballasts, current regulators & control devices and not Exceeding the LP allowance as per Building area method & Space Function method.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
BUILDING AREA METHOD			
a) The interior lighting power allowance complies with the building area method in W as per the different building area type with their respective LPD's (W/m2) as defined in Punjab ECBC	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
SPACE FUNCTION METHOD			
a) The interior lighting power allowance complies with the space function method in W as per the different space functions/areas with their respective LPD's (W/m2) as defined in Punjab ECBC	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
INSTALLED INTERIOR LIGHTING POWER			
a) All the luminaries, ballast, lighting tracks and flexible lighting systems are labeled with the respective luminaries wattage.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
EXTERIOR LIGHTING POWER			
a) For building exterior lighting application connected lighting power Not exceed the specified lighting power limits as described in Punjab ECBC.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
LIGHTING TYPE AND EFFICIENCY			
a) All the lightings type have minimum BEE 3 star rating or above	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

PUNJAB ECBC PERFORMA

ELECTRICAL

MANDATORY REQUIREMENTS	AT DESIGN STAGE (Tick Yes if compliant and No if non-compliant)	AT COMPLETION STAGE (Tick Yes if compliant and No if non-compliant)	REMARKS
TRANSFORMERS			
a) Maximum Allowable Power Transformer Losses			
- Minimizes the total of its initial cost in addition to the present value of the cost of its total lost energy while serving its estimated loads during its respective life span.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Complies with the provisions of clause 3.1.4.6.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) Measurement and Reporting of Transformer Losses			
- Measurement of losses be carried out using calibrated digital meters of class 0.5 or better accuracy and certified by the manufacturer.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
- Transformers of capacity 500kVA and above be equipped with additional metering class current transformers (CTs) and potential transformers (PTs).	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
ENERGY EFFICIENT MOTORS			
a) All permanently wired motors of 0.375 kW or more expected to operate more than 1,500 hours per year shall have minimum acceptable nominal full load efficiency not less than IS12615	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
b) All permanently wired polyphaser motors of 50 kW or more expected to operate more than 500 hours per year shall have minimum acceptable nominal full load efficiency not less than IS12615	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Motors of horsepower differing from table shall have efficiency greater than next	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

listed kW motor.			
d) Motor horsepower rating shall not exceed 20% of calculated maximum load being served.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
e) Motor nameplates list the nominal full load motor efficiencies and the full load power factor.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
f) Proper rewinding practices for rewound motors.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
g) Motor efficiency certificates kept on record. New efficiency test shall be performed and recorded post rewinding.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
h) All motors and pump sets shall comply with the provisions of clause 3.1.4.6.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

POWER FACTOR CORRECTION

a) All electricity supplies exceeding 100A, 3 phases shall maintain power factor between 0.95 lag, unity at the point of connection	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
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CHECK - METERING AND MONITORING

b) Service exceeding 120 kVA have permanently installed electrical metering to record demand(kVA), energy(kWh) and total power factor. It shall display current (in each phase and neutral), voltage (between phases and each phase and neutral), total harmonic distortion(THD) as a % of the current.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
c) Service not exceeding 120kVA but over 65kVA shall have permanently installed electric metering to record demand (Kw), energy (kWh) and total power factor (or kVARh)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

POWER DISTRIBUTION SYSTEMS

a) Power cabling adequately sized as to maintain distribution losses below or equal to 1% of total power usage. Record of design calculations be maintained.	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
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