

2015 Design and Trades Conference

2012 IECC

(International Energy Conservation Code)

Commercial Requirements







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2012 IECC

- Commercial Provisions
 1. Scope and Administration
 2. Definitions
 3. General Requirements
 4. Commercial Energy Efficiency *(Versus Chapter 5 in 2009 IECC)*
 5. Reference Standards
- Residential Provisions
 1. Scope and Administration
 2. Definitions
 3. General Requirements
 4. Residential Energy Efficiency *(Versus Chapter 4 in 2009 IECC)*
 5. Reference Standards

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IECC - Buildings

Residential building (definition for this code)

- Detached one- and two-family dwellings
- Multiple single-family dwellings (townhouses)
- R-2, R-3 and R-4 buildings three stories or less in height above grade plane *(Versus all R-3 in 2009 IECC)*

Commercial building (definition for this code)

- All not included in residential building definition

Intent: This code regulates the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.

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Applicability

- New construction
 - Existing & historic buildings
 - Additions, alterations, renovations or repairs
- Exceptions:
1. Storm windows over existing fenestration
 2. Glass only replacement in existing sash & frame
 3. Existing cavities exposed during construction that are filled with insulation
 4. Construction where existing cavity not exposed
 5. Reroofing where neither sheathing nor insulation is exposed
 6. Vestibule not required when replacing door
 7. Replacement $\leq 50\%$ of luminaires in a space*
 8. Bulb & ballast replacement in existing luminaire*
- *Provided installed interior lighting power does not increase
- Change in occupancy or use
 - Increasing demand for either fossil fuel or electrical energy
 - Space change from one building/space type to another in lighting tables
 - Change in space conditioning
 - Mixed occupancy

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Information on Construction Documents

- Insulation materials and their R-values
- Fenestration U-factors and SHGCs
- Area-weighted U-factor and SHGC calculations
- Mechanical system design criteria
- Mechanical and service water heating system and equipment types, sizes and efficiencies
- Economizer description
- Equipment and systems controls
- Fan motor horsepower (hp) and controls
- Duct sealing
- Duct and pipe insulation and location
- Lighting fixture schedules with wattage and control narrative
- Air seal details

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Definitions

- Skylights, Glass or other transparent or translucent glazing material installed $< 60^\circ$ from horizontal. ($\geq 15^\circ$ from vertical in 2009 IECC)
- Above Grade Wall:
 - Residential, $> 50\%$ above grade
 - Commercial, $> 15\%$ above grade

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Commercial Energy Efficiency

- Application: comply with ONE of:
 1. ANSI/ASHRAE/IESNA Standard 90.1-2010
 2. Sections C402 (Envelope), C403 (Mechanical Systems), C404 (Service Water Heating), C405 (Electrical Power and Lighting Systems) and **with one of Additional Efficiency Package Options (New)**
 3. Section C407 (Total Building Performance) and all mandatory requirements. **Building energy cost shall be ≤85% of standard reference design building. (New)**
- Application to existing building

Additions, alterations and repairs shall comply with ONE of:

 - Individual applicable sections, or
 - ANSI/ASHRAE/IESNA Standard 90.1-2010

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Additional Efficiency Package Options

(New)

- Buildings comply with at least one of
 - Efficient HVAC performance
 - Efficient lighting system
 - On-site supply of renewable energy
- Individual tenant spaces comply with either
 - Efficient HVAC performance or
 - Efficient lighting system
 - Unless documented compliance with on-site supply of renewable energy for entire building

Envelope Requirements

Climate Zone	Zone 4/5	Zone 6	Zone 7	Zone 8
Roofs				
Location: Interior below deck	R-25ci	R-25ci		
Metal Buildings: Above Deck	R-199ci or 11R3	R-199ci or 11R3		
Attic and Other	R-38	R-49		
Walls: Above Grade				
Mass	R-11.6ci	R-13.3ci		
Metal Buildings	R-139ci or 13ci	R-139ci or 13ci		
Metal Framed	R-139ci or 7.5ci	R-139ci or 7.5ci		
Wood Framed and Other	R-139ci or 20 or R-20	R-139ci or 7.5ci or R-10		
Walls: Below Grade				
Below grade/wall	R-7.5ci	R-7.5ci		
Floors				
Mass	R-10ci	R-12.5ci		
Joist/Framing	R-30	R-30		
Slab-on-Grade/Floors				
Unheated Slabs	R-108ci or 24"	R-108ci or 24"		
Heated Slabs	R-128ci or 24"	R-128ci or 24"		
Opaque Doors				
Swinging	U-0.37	U-0.37		
Roll-up/Sliding	R-4.75	R-4.75		

Climate Zone	Zone 5
Vertical Fenestration	
Fixed Fenestration	U-factor 0.38
Operable Fenestration	0.45
Entrance Doors	0.77
	SHGC
Solar Heat Gain Coefficient	0.40
Skylights	
	U-factor 0.50
	SHGC 0.40

Yellow indicates change from 2009 IECC

Continuous insulation (ci): Insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. (from Standard 90.1-2010)

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Minimum Skylight Fenestration *(New)*

- Above enclosed space
 - >10,000 sq. ft. directly under a roof
 - >15 feet ceiling height
 - Used as office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop
- Minimum areas
 - Total daylight zone ≥50% of floor area
 - Skylight area to daylight zone under skylights
 - ≥3% with skylight VT ≥0.40 or
 - Provide skylight effective aperture ≥1%
 - Exceptions:
 - General lighting power density <0.5 W/sq. ft.
 - Blockage of direct beam sunlight on ≥50% roof over space for more than 1,500 daylight hours per year
 - Daylight zone under roof monitors >50% of enclosed space floor area

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Fenestration

- Lighting controls in daylight zones under skylights *(New)*
 - All lighting in daylight zone shall be controlled by multilevel lighting controls in Lighting Section
 - Exceptions:
 - General lighting power density <0.5 W/sq. ft.
 - Blockage of direct beam sunlight on ≥50% roof over space for more than 1,500 daylight hours per year
 - Daylight zone under roof monitors >50% of enclosed space floor area
- Haze factor
 - >90% for skylights in office, storage, automotive service, manufacturing, non-refrigerated warehouse, retail store, and distribution/sorting area
 - Exception: Skylights designed to exclude direct sunlight

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Fenestration

- SHGC adjustment
(SHGC = 0.40 for PF <0.25 and NR for PF ≥0.25 in 2009 IECC)

Table C402.3.3.1 SHGC Adjustment Multipliers		
Projection Factor	Oriented within 45° of True North	All Other Orientation
0.2 ≤ PF < 0.5	1.1	1.2
PF ≥ 0.5	1.2	1.6



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Fenestration

- Increased skylight SHGC *(New)*
 - Maximum 0.60 permitted when located above daylight zone provided with automatic daylighting controls
- Increased skylight U-factor *(New)*
 - Maximum 0.75 permitted when installed above daylight zone provided with automatic daylighting controls
- Dynamic glazing *(New)*
 - Use manufacturer's lowest-rated SHGC & VT/SHGC ratio
 - Cannot be area-weighted averaged with non-dynamic glazing

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Air Barrier

- Continuous throughout thermal envelope *(New)*
- Construction *(New)*
 - Continuous for all envelope assemblies and across joints & assemblies
 - Seal joints & seams including transitions in places and changes in materials
 - Seal penetrations
 - Ability to resist positive and negative pressure
 - Exception for buildings passing air leakage test

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Air Barrier

- Compliance options *(New)*
 - Materials
 - Air permeability ≤ 0.004 cfm/sq. ft. @ 0.3" wg
 - List of 15 material deemed to comply provided joints are sealed and installed per manufacturer's instructions
 - Assemblies
 - Air leakage rate ≤ 0.04 cfm/sq. ft. @ 0.3" wg
 - List of 2 assemblies deemed to comply
 - Building test
 - Building air leakage rate ≤ 0.40 cfm/sq. ft. @ 0.3" wg

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Fenestration Air Leakage

- (Revised from 2009 IECC)

Fenestration Assembly	Max Rate (cfm/sf)
Windows	0.20
Sliding doors	0.20
Swinging doors	0.20
Skylights with condensation weepage openings	0.30
Skylights and others	0.20
Curtain walls	0.06
Storefront glazing	0.06
Commercial glazed swinging entrance doors	1.00
Revolving doors	1.00
Garage doors	0.40
Rolling doors	1.00

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Air Leakage

- Doors & access openings to shafts, chutes, stairways and elevator lobbies
 - Meet infiltration rates, or
 - Be gasketed, weatherstripped or sealed.
- Air intakes, exhaust openings, stairways and shafts integral to building envelope (Revised from 2009 IECC)
 - Motorized dampers with leakage rate ≤ 4 cfm/sf @ 1.0" wg

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Applicable to All Mechanical Systems

- Calculation of heating and cooling loads
 - In accordance with ASHRAE Standard 183
 - Accounting for all loads based on project design (New)
 - Adjusted to account for load reduction due to energy recovery
- Equipment and system sizing
 - Output capacity shall not exceed calculated loads

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HVAC Equipment Performance

(Revised from 2009 IECC)

- Unitary air conditioners and condensing units
- Unitary and applied heat pumps
- Packaged terminal air conditioners, package terminal heat pumps, room air conditioners and room air-conditioner heat pumps
- Single-packaged vertical air conditioners and single-package vertical heat pumps (New)
- Warm air furnaces and combination warm air furnaces/air-conditioning units, warm air duct furnaces and unit heaters
- Gas- and oil-fired boilers
- Electrically operated condensing units
- Water chilling packages
- Heat rejection equipment (New)
- Heat transfer equipment (New)

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Mechanical System Controls

- Humidification system control
- Heat pump supplementary heat control
- Thermostatic controls
 - Set point overlap restrictions
 - Off-hour controls
 - Automatic setback controls for each zone
 - Automatic control to set back or temporarily operate system
 - Capabilities
 - 7 different daily schedules per week
 - 10 hour backup power to retain time and programming
 - Manual override for up to 2 hours or occupancy sensor
 - Automatic start capabilities (New)
 - Automatically shut both outdoor air supply and exhaust dampers when systems or spaces served not in use

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Ventilation System Requirements

- Capability to reduce outdoor air to minimum required by IMC
- Demand controlled ventilation
 - Provided for:
 - spaces >500 sq. ft., and
 - Average occupant load of 25 people per 1,000 sq. ft. (40 people in 2009 IECC), and
 - Served by systems with one or more of:
 - Air-side economizer
 - Automatic outdoor air modulating damper control
 - Design outdoor airflow >3,000 cfm
 - Exceptions:
 - Systems with energy recovery
 - Multiple zone systems without DDC with central control panel
 - Design outdoor airflow <1,200 cfm
 - Supply airflow rate minus makeup or transfer air requirement <1,200 cfm
 - Ventilation provided for process loads only

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Economizers

- On systems $\geq 33,000$ Btu/h (*54,000 in 2009 IECC*)
- Either air or water side
 - Air economizer
 - Modulates outdoor air and return dampers
 - Provide outside air up to 100% of design supply air
 - Sequenced with mechanical cooling
 - Shutoff when no longer reduces cooling energy use
 - Relieves excess outdoor air
 - Water side economizer
 - Serving up to 100% cooling load when outdoor air 50° db & 45° wb
 - <15 feet water side pressure drop or secondary loop
 - Integrated with mechanical cooling system
 - Does not increase heating energy use

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HVAC Fan Systems

- Variable air volume (VAV) fan control
 - Individual fans ≥ 7.5 hp (*10 in 2009 IECC*)
 - Variable speed (mechanical or electrical)
 - Variable-pitch vane-axial fan (*New*), or
 - $\leq 30\%$ of design wattage at 50% design airflow & $\frac{1}{2}$ total design static pressure
 - Static pressure reset for systems with direct digital control of zone boxes reporting to central control

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Hydronic Systems

- Hydronic system controls
 - No three pipe systems
 - $\geq 15^{\circ}$ deadband on two-pipe changeover systems
 - Part load controls for systems $\geq 300,000$ Btu/h
 - Automatic isolation of equipment in central plant
- Hydronic (water loop) heat pumps systems
 - $\geq 20^{\circ}$ deadband between heat rejection and heat addition
 - Open- or closed-circuit cooling tower:
 - Separate heat exchanger to isolate tower from loop
 - Automatic shutoff of tower loop pump, and
 - Automatic valve on tower loop to stop flow
 - Two-position valve on each hydronic heat pump with total pump system power >10 hp

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HVAC Systems

- Heat rejection equipment fan speed control
 - Automatic speed control on each fan with motor ≥ 7.5 hp
- Mechanical systems serving multiple zones
 - Shall be variable air volume (VAV) systems
 - Automatic supply air temperature reset control
- Heat recovery for service water heating
 - Facility operating 24 hours per day
 - $>6,000,000$ Btu/h water-cooled heat rejection
 - $>1,000,000$ Btu/h design service water load

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Service Water Heating

- Equipment performance requirements
- Temperature controls
- Heat traps
- Pipe insulation
 - $\geq 1"$ for automatic-circulating hot water and heat-traced systems (*Heat-traced new*)
 - $\frac{1}{2}"$ for first 8' in non temperature maintenance systems without integral heat traps in equipment (*Called noncirculating systems in 2009 IECC*)
- Hot water system controls
 - Automatic or manual circulating pump or heat trace shut-off when limited hot water demand
 - Readily accessible controls

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Lighting System Controls

- ≥ 1 interior lighting control for each enclosed area
- Bi-level switching for each area requiring manual control
- Automatic time switch control in all areas of building (*For buildings $>5,000$ sq. ft. in 2009 IECC*)
- Occupancy sensors (*New*)
 - Required in classrooms, conference/meeting rooms, employee lunch & break rooms, private offices, restrooms, storage rooms, janitorial closets, and other spaces ≤ 300 sq. ft.
 - Automatic off within 30 minutes
 - Manual on or automatic on to $\leq 50\%$ power

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Daylight Zone Lighting Control

(Revised)

- Independent of general area lighting
- Manual controls
- Automatic controls
 - Required for increased vertical fenestration area and increased skylight area, U-factor, SHGC
 - Continuous dimming to <35% rated power
 - Stepped dimming with one control step between 50% & 70% and one step ≤35% of design power
- Multi-level lighting controls
 - Required for minimum skylight area spaces
 - Reduces lighting in response to available daylight in space
 - When daylight illuminance > design general illuminance, automatically reduces general lighting to ≤35% of design power

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Interior Lighting

- Total connected power ≤ calculated power
 - Total connected interior lighting power
 - Sum of all interior lighting equipment in watts
 - Screw lamp holders (maximum labeled wattage)
 - Low-voltage lighting (transformer wattage)
 - Other luminaires (verified data)
 - Line-voltage lighting track and plug-in busway
 - Specified wattage of luminaires with minimum of 30 W/in. ft.
 - Wattage limit circuit breaker or other permanent current limiting device
 - Exceptions as listed
 - Calculated interior lighting power
 - Building Area Method, or
 - Space-by-Space Method (New)

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Interior Lighting Power Allowance

■ Building Area Method

BuildingAreaType	LPD	BuildingAreaType	LPD	BuildingAreaType	LPD
AutomotiveFacility	0.9	Hospital	1.2	PerformingArtsTheater	1.6
ConventionCenter	1.2	Hotel	1.0	Police	1.0
Courthouse	1.2	Library	1.3	PostOffice	1.1
DiningBarLounge/Leisure	1.3	ManufacturingFacility	1.3	ReligiousBuilding	1.3
DiningCafeteria/FastFood	1.4	Motel	1.0	Retail	1.4
DiningFamily	1.6	MotionPictureTheater	1.2	School/University	1.2
Dormitory	1.0	Multifamily	0.7	SportsArena	1.1
ExerciseCenter	1.0	Museum	1.1	TownHall	1.1
FireStation	0.8	Office	0.9	Transportation	1.0
Gymnasium	1.1	ParkingGarage	0.3	Warehouse	0.6
HealthCareClinic	1.0	Penitentiary	1.0	Workshop	1.4

Yellow indicates change from 2009 IECC

(Additional lighting power allowance under building area method in 2009 IECC is not permitted. It can be used in the 2012 IECC space-by-space method)

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Efficient HVAC Performance Option

- In addition to requirements of Section C403
- Can only be used where efficiencies are greater than equipment efficiencies in Section C403.
- Minimum equipment efficiency requirements for:
 - Unitary air conditioners and condensing units
 - Unitary and applied heat pumps
 - Package terminal air conditioners and package terminal heat pumps
 - Warm air furnaces and combination warm air furnaces/air conditioning units, warm air duct furnaces and unit heaters
 - Boiler
 - Chillers
 - Absorption chillers

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Efficient Lighting System Option

- Reduced whole building lighting power density

Reduced Interior Lighting Power

Building Area Type	LPD	Building Area Type	LPD	Building Area Type	LPD
Automotive Facility	0.82	Hotel	1.10	Police/Fire Station	0.96
Convention Center	1.08	Library	1.18	Post Office	0.87
Court House	1.05	Manufacturing Facility	1.11	Religious Building	1.05
Dining/Bar/Lounge/Leisure	0.99	Motel	0.88	Retail	1.40/ 1.30*
Dining/Cafeteria/Fast Food	0.90	Motion Picture Theater	0.83	School/University	0.99
Dining/Family	0.89	Multifamily	0.60	Sports Arena	0.78
Dormitory	0.61	Museum	1.06	Town Hall	0.92
Exercise Center	0.88	Office	0.90/ 0.85*	Transportation	0.77
Gymnasium	0.71	Performing Arts Theater	1.39	Warehouse	0.60
Healthcare Clinic	1.00	Parking Garage (if not entry level)		Workshop	1.20
Hospital	0.87				

*If first floor is applicable, the second floor is not applicable. If the second floor is applicable, the first floor is not applicable.

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On-site Renewable Energy Option

- Total minimum rating comply with one of:
 1. ≥ 1.75 Btu or ≥ 0.50 watts/sf of conditioned floor area
 2. $\geq 3\%$ energy used in building for
 - Building mechanical equipment
 - Water heating equipment, and
 - Regulated lighting

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System Commissioning *(Revised & New)*

- Covers commissioning of *(New)*
 - Building mechanical systems
 - Electrical power and lighting systems
- Definition *(New)*

Building commissioning. A process that verifies and documents that the selected building systems have been designed, installed and function according to the owner's project requirements and construction documents, and to minimum code requirements.

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System Commissioning *(Revised & New)*

- Mechanical systems commissioning and completion requirements
 - Prior to passing final mechanical inspection
 - Registered design professional shall provide
 - Evidence of mechanical system commissioning
 - Evidence of completion
 - Clearly indicated on construction documents
 - Documents
 - Given to owner
 - Available to building official

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System Commissioning *(Revised & New)*

- Mechanical systems commissioning and completion requirements
 - Exception:
 1. Total mechanical equipment capacity in building:
 - <480,000 Btu/h cooling capacity, and
 - <600,000 Btu/h heating capacity
 2. Systems serving
 - Dwelling units
 - Sleeping units in hotels, motels, boarding houses, or similar units

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System Commissioning *(Revised & New)*

- Commissioning plan *(New)*
 - Narrative description of activities
 - List of specific equipment, appliances or systems to be tested and description of tests to be performed
 - Functions to be tested
 - Conditions at which tests will be performed
 - Measurable performance criteria
- Systems adjusting and balancing *(Relocated and revised from 2009 IECC)*

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Mechanical System Commissioning

- Functional performance testing *(New)*
 - Equipment (components, systems and system-to-system interfacing)
 - All modes in sequence of operation
 - Redundant or automatic back-up mode
 - Performance of alarms; and
 - Operation upon loss of power and restoration of power
 - Controls
 - Economizers

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Mechanical System Commissioning

- Preliminary commissioning report *(New)*
 - Completed & certified by registered design professional or approved agency
 - Identifies:
 - Itemization of deficiencies that have not been corrected
 - Deferred tests because of climate conditions
 - Climate conditions for deferred tests
 - Acceptance of report
 - Letter from building owner acknowledging receipt
 - Copy of report

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Mechanical System Completion

Documentation requirements

Provided to building owner within 90 days of receipt of CO

Drawings *(New)*

Manuals

- Submittal data
- Manufacturer's operation manuals and maintenance manuals
- Name and address of service agency
- HVAC controls system maintenance and calibration information
- Narrative of how each system is intended to operate

System balancing report

Final commissioning report

- Functional performance tests results
- Disposition of deficiencies including used or proposed corrective measures
- Functional performance test procedures

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Lighting System Commissioning *(New)*

Lighting system functional testing

Construction documents define who will conduct required test

Procedures for installed controls:

- Confirm placement, sensitivity and time-out adjustments for occupant sensors
- Confirm time switches and programmable schedule controls are programmed to turn lights off
- Confirm placement and sensitivity adjustments for photosensor controls

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Questions

Thank You!

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