Green Building Energy Sustainability Inc.

2021 IECC Residential

DFW Area Zone 2/3 Energy Code handout

The 2021 IECC has been adopted by Plano in 2022. The 2021 IECC breaks the DFW area into two separate zones. Zone 2 covers Dallas and Tarrant County and counties to the south. Zone 3 covers Denton and Collin County and counties to the north. There are dramatically different insulation and U values between the two different zones. The Energy Path document is now required in all areas and the Performance / ERI (Energy Reference Index including the HERS rating) can make up a little difference, but new Zone 3 requirements are considerably more significant. Areas of change in the 2021 IECC are noted in the red text.

102.1.1 **All Performance Path component requirement options are limited to no less than the 2009 IECC.**

103.2 **Information required on construction documents**

1. **Energy Compliance Path**
2. **Depiction of the Thermal Building Envelope on the plans**
3. **Insulation Material and their R-Value**
4. **Fenestration U and SHGC values**
5. **Area weighted U factor & SHGC calculations**
6. **Mechanical system design criteria (Manual J & S)**
7. **Mechanical and Water heating equipment types, sizes, and efficiencies**
8. **Equipment and system controls**
9. **Duct sealing, duct & pipe insulation, and duct location (Manual D layout)**
10. **Air Sealing details**

103.4 **Amended construction documents shall be resubmitted for approval**

104.2 **Required Energy inspections – The permit applicant must cause the work to remain visible and able to be accessed for inspection purposes until approved.**

104.2.1 **Footing and foundation inspection for insulation on the foundation and buried plumbing. (Zone 3 slab inspections will now require an insulation inspection).**

104.2.2 **Framing (Predrywall) inspection for air sealing, insulation, U and SHGC values (a separate air barrier insulation may be required based on the construction schedule)**

104.2.3 **Plumbing insulation and control inspection**

104.2.4 **Mechanical inspection of system size & efficiency, duct insulation, duct leakage testing, programmable thermostat and minimum fan efficiency**

104.2.5 **Final inspection of attic insulation and high-efficacy lamps**

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202 Definitions

Dwelling Unit Enclosure area – sum of the floors, walls and ceilings separating a dwellings conditioned space from the exterior or adjacent unit. Wall height will be measured from the dwelling's finished floor to the bottom of the underside of the floor above.

High Efficacy Light Sources – Lamps require more than 65 lumens per watt or Luminary require more than 45 lumens per watt.

Renewable Energy Certificate (REC) – An instrument that represents the environmental attributes of a one-megawatt hour of renewable energy; also known as an Energy Attribute Certificate (EAC).

Thermal Distribution Efficiency (TDE) – The resistance to change in air heat as air is conveyed through a distance of duct. TDE is a heat loss calculation evaluating the difference in the temperature of the air between the entrance and outlet of the duct, expressed as a percentage of difference.

301 Climate Zones – Note changes in North Texas counties moving from Climate Zone 3 into Zone 2. Climate Zone 2 now covers Dallas, Ellis (Waxahachie), Johnson (Cleburne), Navarro (Corsicana), Tarrant (Fort Worth). Climate Zone 3 covers Collin, Cooke, Denton, Grayson, Wise, Parker, Rockwall, and Kaufman counties

302.1 Interior design temperatures for heating and cooling load calculations (Manual J and S as required per 312 of the Mechanical Code) shall be a maximum of 72° for heating and a minimum of 75° for cooling.

303.1.1.1 Attic insulation depth marker every 300 sqft. R-value certificate for installed insulation with thickness and R-value for SPF included on the certificate

303.1.3 Fenestration product rating chart on every window with U – factor, SHGC, and Visible Transmission

301.1.5 Air Permeable Insulation not greater than 0.004 cfm / sf at 75 Pa.

303.2 Insulation installation to manufacturer's instructions and IBC / IRC requirements

401.2 All new construction will comply with 401.2.5 and either 401.2.1, 401.2.2, 401.2.3 or 401.2.4. The Prescriptive Path (R401 through 404), Performance Path (R405), ERI Path (R-406). An addition energy Efficiency requirement is established in 408.2 Performance Path and ERI Path shall be 5% more efficient than the reference design (Prescriptive).

401.3 Certificate posted on a wall where the furnace is located, a utility room, or other approved location with system R or U values of system components, SHGC, mechanical system efficiencies, Photovoltaic array capacity, ERI score, and IECC code addition for the compliance path.

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402.1.1 Building Envelope General exemptions for < 3.4 Btu/h/sqft or 1.0 watt/sqft

402.1.2 Zone 2 Prescriptive requirements for assembly components for Dallas, Fort Worth, Johnson, Ellis, and Navarro counties

Fenestration	U – Factor	≤ 0.40
Skylight	U – Factor	≤ 0.65
Solar Heat Gain Coefficient	SHGC value	≤ 0.25
Ceiling	R – Value	R - 49
Walls	R – Value	R – 13 or 0 + 10 ci
Floors	R – value	R - 13
Crawlspace / Basement	R value	R – 0

Zone 3 Prescriptive requirements for assembly components for Collin, Cooke, Denton, Grayson, Wise, Parker, Rockwall, and Kaufman counties

Fenestration	U – Factor	≤ 0.30
Skylight	U – Factor	≤ 0.55
Solar Heat Gain Coefficient	SHGC value	≤ 0.25
Ceiling	R – value	R - 49
Walls	R – value	R – 20 or 0 + 15 ci
Floors	R – value	R - 19
Crawlspace / Basement	R value	R – 5 ci or R13

402.2.1 R-49 ceiling insulation minimum required in all areas unless 100% coverage with R-38 including top plates coverage. Uncompressed R – 38 insulation over the exterior wall top plate will be deemed to meet the R-49 requirement. Performance Path can adjust attic insulation levels down to 2009 IECC levels

402.2.2 In ceilings without attic spaces. R30 insulation is acceptable so long as uncompressed insulation of R-30 is over the top plate (limited to 500 sqft or 20% of total ceiling area). This insulation scheme does not apply to the UA Compliance Path.

402.2.3 Eave baffle required in vented attics adjacent to soffit or eave vents and maintain the same size as vent and extend over the top of air-permeable insulation. Continuous soffit vents require continuous baffles.

402.2.4 Attic access hatches and doors must be weather-stripped and insulated to the same level as surrounding spaces. A retainer is required to prevent loose insulation from spilling into the living area. Vertical attic doors must have a U factor on .35 or less. Horizontal pull-down stairways will have an average insulative value of R-10 or greater and at least 75% of the stairway will have an insulative value of R-13 or greater. The pull-down stairway opening must be less than 13.5 sf.

402.2.5 Above ground mass walls, having a heating capacity of greater than or equal to 6 Btu/ sqft per degree of Fahrenheit may be constructed of materials such as concrete block, concrete, insulated concrete form, masonry cavity, brick (not brick veneer), adobe, compressed earth block, rammed earth, solid timber or solid logs.

402.2.6 Steel framing has increased insulation values. See chart 402.2.6

Wood Frame R-value – 16 inch centers	Steel Frame equilivant– 16 inch centers
R-38 Ceiling	R-49 or R-38 + R-3 ci
R-49 Ceiling	R-38 + R-5 ci
R-13 Wall	R13+R4.2 ci or R21_ R2.8 ci or R9.3 ci
R-20 Wall	R0+R14 ci or R-13+ R8.9 ci

402.2.8 Floor insulation will be installed with permanent contact to the underside of subfloor decking or meet the floor insulation value and completely insulate the floor rim joist area to wall values. Cavity and continuous insulation may be used to meet the R-value requirements.

402.2.9 Slab on grade floors with less than 12 inches below grade will still need to meet 402.1.3 requirements (24 inches) in Zone 3, however very high termite infestation areas (such as DFW) may be exempted by the code official.

402.2.10 Crawlspace walls may be insulated if not vented to the exterior using alternative method with horizontal insulation extending 24 inches and all exposed earth covered with a Class 1 vapor retarder. Joints shall be lapped 6 inches and be taped or sealed. Vapor retarder will extend at least 6 inches up stem wall.

402.2.12 Heated Garages will have a minimum ceiling insulation requirement of r19 and wall insulation of R13

402.3.4 Opaque door assemblies less than 24 sf are exempt from the prescriptive U-factor requirements in R402.1.2 except for UA Path projects.

402.3.5 Heated Garage fenestration will not exceed a U value of 0.45 and SHGC values of 0.70

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402.4.1.2 Air leakage will be tested with a Blower Door and limited to 5 ACH in Zone 2 and 3 ACH in Zone 3 (Air Changes per Hour) at 50 Pascals under a Prescriptive Path. Performance Path projects are limited to 5 ACH. Written results will be provided to the code official. Testing will be performed following RESNET / ICC 380. Exterior or interior terminations for continuous ventilation systems will be sealed. On individual dwelling units, air leakage will not exceed 0.30 CFM / sf on attached single and multi-family dwelling units or units that are smaller than 1500 sf.

402.4.2 Woodburning fireplaces will have tight-fitting flue dampers or doors and an outdoor combustion air source. The door will be tested by the manufacturer and listed for the fireplace.

402.4.4 Rooms containing a fuel-burning appliance with open combustion air ducts, the ducts will be insulated where they pass through conditioned space to a minimum R-8 value.

402.4.1.1 Cavities within corners and headers or framing walls shall be insulated by completely filling the cavity with a material that has an R-3 per inch value. A continuous air barrier is required on the exterior from the top plate to the foundation ≤ 8 Perms

402.4.5 Recessed Lights will be IC rated & Airtight (<2 cfm @ 75 Pa). Seal building envelope penetration using gasket or caulk

402.4.6 Electrical and communication outlet boxes (air-sealed boxes) will not have a leakage rate of greater than 2 cfm at 75 Pa and marked NEMA OS 4 or OS 4.

402.5 The maximum area-weighted average for fenestration SHGC factor is .50 using a Performance Path of compliance

403.1 Programmable thermostat with a daily schedule with setback capabilities with an initial programming setpoint no less than 55° F and no greater than 85° F with an initial setpoint no greater than 70° F for heat and no less than 78° F for cooling

403.3.1 Duct insulation on supply and return ducts will be a minimum of R-8 on ducts greater than 3 inches in diameter and R-6 on ducts less than 3 inches. Ducts buried beneath the building will meet all requirements of having a TDE.

403.3.2.1 Ducts located in conditioned spaces must be located inside the continuous air barrier and building envelope.

403.2.2.2 The duct leakage test will be performed at rough-in or post-construction using a leakage to outside test with less than 1.5 cfm/100sf of conditioned area.

403.3.2.3 Ducts located outside the conditioned space must be located inside the continuous air barrier and then completely buried in the thermal building envelope insulation and the insulation value against and above the duct will be equal to or greater than the proposed ceiling insulation value less the duct insulation value.

403.3.2.3 Ducts located in floor cavities must have a continuous air barrier installed between the unconditioned space and the duct, meet a minimum R-19 flooring insulation requirements.

403.3.2.4 Ducts in exterior walls must have a continuous air barrier between the ducts and the unconditioned space, minimum R10 insulation separating the duct from the outside sheathing, and have the remainder of the wall cavity fully insulated.

403.3.3 Ducts buried within ceiling insulation requirements include R8 ducts, R-19 ceiling insulation on all sides (not including the R-value of the duct) unless in zones 0A,1A, 2A, and 3A than R-13

403.3.4 Ducts, air handlers, and filter boxes shall be sealed per the IRC or IMC. Air Impermeable spray foam products are permitted without additional joint seals.

403.3.4.1 Air handlers will have a manufacturer's designation of no greater than 2% leakage at design rated flow as per ASHRAE 193.

403.3.3.5 Duct tightness verification required (@ 25 Pa) in accordance with ANSI/RESNET/ICC 380. Written results will be provided to the code official. Testing ducts for heat or energy recovery ventilators that are not integrated into the duct system is not required.

403.3.3.6 Rough-in test ≤ 4 cfm / 100 Sqft of conditioned area. Where the air handler is not installed, leakage is limited to 3 cfm/100 Sqft

1. Post-construction test ≤ 4 cfm / 100 Sqft of conditioned area
2. Ducts located within the thermal envelop must have less than 8 cfm/100sf

403.3.7 Building cavities may not be used as supply ducts

403.4 Mechanical system piping requires R – 3 insulation if carrying fluids above 105° or below 55°

403.4.1 Pipe insulation exposed to the weather shall be protected from damage caused by sunlight, moisture, equipment maintenance, and wind.

403.5.1.1 Demand recirculating water systems will have controls that will start the pump upon receiving a signal from the action of a user by sensing the presence of a user or sensing the flow of hot water. The fixture will also limit the temperature of the hot water from being no greater than 104 ° in the cold water line

403.5.2 Minimum R-3 insulation will be used on hot water piping ¾ " and larger, piping serving more than 1 unit, piping outside the conditioned space, piping from a water heater to a distribution manifold, piping under a slab floor, buried in piping, or hot and cold piping on recirculation systems other than demand systems.

403.6 Mechanical ventilation outdoor intakes and exhaust vents will have automatic or gravity dampers that close when the system is not in operation.

403.6.2 The vent fan efficiency will meet the efficiency requirements in Table R403.6.2

Table R403.6.2 Mechanical Ventilation System Fan Efficacy

Fan Location	CFM flow rate minimum	Min CFM / Watt
ERV or HRV	Any	1.2 cfm/watt
In-line fan supply or exhaust fan	Any	3.8 cfm/watt
Exhaust Fans	< 90	2.8 cfm/watt
Exhaust Fans	≥ 90	3.5 cfm/watt
Air Handler	Any	1.2 cfm/watt

403.6.3 Mechanical Ventilation systems will be tested to verify flow rates using a flow hood, box, or another measuring device. Written results will be provided to the code official. Exemption for range vent hoods ducted to outside with a 6" or larger duct.

403.7 Manual J and S calculations are required for HVAC system sizing

403.10.1 Electric power to pool and spa heaters will be controlled by a ready accessible on/off switch within 3 feet of the heater.

403.10.2 Timer switches shall be installed on pool and spa heaters and pump motors.

403.10.3 Outdoor heated pools and permanently installed outdoor spas (hard wired into an electrical system and has a water supply) will have a vapor-retardant cover provided except where 75% of the energy for heating is from a heat pump or onsite energy production.

403.10.3.11 Electrically powered portable spas are regulated by APSP 15

404.1 Lighting Requirement of all lamps are high efficacy lamps

404.1.2 Fuel gas lamp shall not have continuous burning pilot lights

404.2 Permanently installed interior lights will be controlled by a dimmer, occupant sensor, or other control installed in the fixture.

402.3 Exterior light controls will be controlled with a manual on/off switch with automatic controls to shut the lights off during daylight hours

405.1 Simulated Performance Energy Reports shall include building envelope, heating, cooling, mechanical ventilation, and service water heating values

405.4.2 The building envelope will be greater than or equal to the 2009 IECC efficiency requirements and be less than or equal to the annual energy cost of the Standard Reference Design (Prescriptive Path)

405.3.2 Upon completion of the building, a compliance report based on the as-built conditions will be submitted to the code official before a certificate of occupancy is issued.

406.1 The Energy Reference Index (ERI) will be calculated in accordance of RESNET / ICC 301

406.3.1 If onsite renewable energy is not used, the Building thermal envelope UA factor will be less than or equal to an adjusted value of 1.15% and weighted SHGC values in zone 0-3 will be .30

406.3.2 If onsite renewable energy is used the Building Thermal Envelope will be greater than or equal to the efficiency levels of the 2018 IECC

406.4 The ERI score will use the following ventilation rate: CFM = (.01 x total square footage of house) + (7.5 x number of bedrooms = 1). Energy used to recharge or refuel a vehicle used for transportation on roads will not be included in the ERI rated design

406.4 The ERI based Compliance score for zone 2 is 52 and zone 3 is 51

406.7.3 Renewable Energy Certificates (REC) will be provided to the code official when the ERI path is used showing that the onsite energy is owned by the homeowner of a contract that conveys the REC associated with the renewable energy

408 Additional Efficiency Package Options – An additional energy efficiency option must be selected to meet the code requirements following R401.2.5

408.2.1 Enhanced Envelope Performance 5% or greater UA savings on UA/SHGC calculations

408.2.2 Enhanced HVAC Efficiencies – Select 1 (all installed systems must comply)

1. 95 AFUE gas furnace and 16 SEER AC unit
2. 10 HSPF / 16 SEER Heat Pump
3. 3.5 or greater COP ground source Heat pump

408.2.3 Reduced energy use for water heating – Select 1

1. 0.82 EF or better fossil Fuel water heater
2. 2.0 EF or better Electric water heater
3. 0.4 or better Solar faction solar water heater

408.2.4 More efficient HVAC duct Thermal Distribution Efficiency – Select 1

1. 100% of ducts and air handlers in the building envelope
2. 100% of ductless system in the building envelope
3. 100% of the ducts within the conditioned space

408.2.5 Air Leakage rate of 3.0 ACH50 with ERV/HRV with 75% or greater Sensible Recovery Efficiency with less than 1.1cfm/watt. The ERV will have 50% or greater Latent Recovery/moisture Transfer

Existing Buildings – Additions, Alterations, Repairs, or Changes of Occupancy

501.1.1.1 Existing Buildings will have all new work comply with Section R502, R503, or R504. Unaltered portions of existing buildings are not required to comply with the energy code

501.1.5 New and replacement materials will comply with New Construction requirements

502 Additions shall comply with 502.2 or 502.3

502.2 Change is Occupancy – Any low energy space that is altered to conditioned space (converted garage for example) will need to be brought into full compliance

Exceptions: Performance Path is permitted to be 110 % of the cost allowed in 405.2

Total UA Path permitted to meet Total UA of the existing building

502.3 Prescriptive requirements comply for the addition

502.3.2 New HVAC equipment must comply with R403. Extension of new ducts on an existing system is exempt

503 Alterations – New construction will comply with new construction requirements and the altered building generally is exempt

504 Repairs – work that covers repairs of damage and damaged components are not considered alterations and is generally exempt from the energy code.

505 Change of Occupancy or Use of the property that increases the energy use of the building must comply with the energy code. Converting one portion of a building to another use will comply with the energy code.

Component	Air Barrier Criteria	Insulation Criteria
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed	Air-permeable insulation shall not be used as a sealing method
Ceiling/attic	The air barrier in any drop ceiling/soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access opening, drop down stairways, or knee wall doors to unconditioned attic spaces shall be sealed	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of the exterior wall shall be sealed. Knee walls shall be sealed	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance of R-3 per inch minimum. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier
Windows, skylights, and doors	The space between window/door jambs and framing and skylights and framing shall be sealed.	
Rim Joist	Rim joist shall include the air barrier	Rim Joist shall be insulated
Floors (including above garage and cantilevered floors	The air barrier shall be at any exposed edge of insulation	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subflooring, or floor framing cavity insulation shall be permitted to be in contact with the top side of the sheathing or continuous insulation on the underside of floor framing and extends from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class 1 vapor retarder with overlapping joints taped	Where provided instead of floor insulation, insulation shall be permanently attached to the crawl space walls.

Component	Air Barrier Criteria	Insulation Criteria
Shaft, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed	Insulation will be tightly fitted around utilities passing through shafts and penetrations
Narrow Cavities		Batts in narrow cavities shall be cut to fit, or narrow cavities shall be filled by insulation that on installation readily conforms to the available cavity space
Garage separations	Air sealing shall be provided between the garage and conditioned spaces	Insulated portions of the garage assembly will be installed following 303 and 402.2.7
Recessed Lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed following 402.4.5.	Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated.
Plumbing and wiring	All holes created by wiring, plumbing, or other obstructions in the air barrier will be sealed.	Batt insulation shall be cut neatly to fit around wiring and plumbing in exterior walls or insulation that on installation readily conforms to available space shall extend behind piping and wiring
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the showers and tubs.	Exterior walls adjacent to showers and tubs shall be insulated
Electrical/phone box on exterior walls	The air barrier shall be installed behind the electrical or communication boxes or air-sealed boxes shall be sealed	
HVAC register boots	HVAC register boots that penetrate the building thermal envelope shall be sealed to the subfloor, wall covering, or ceiling by the boot	
Concealed sprinklers	When required to be sealed, concealed fire sprinkler shall be sealed in a manner that is recommended by the manufacturer. Caulking or another adhesive sealant shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings	