

EXHIBIT "A"

City of Mansfield Amendments to the 2018 International Energy Conservation Code and the energy provisions of the 2018 International Residential Code North Central Texas Council of Governments Region (Climate Zone 3 of the IECC)

The following sections, paragraphs, and sentences of the *2018 International Energy Conservation Code (IECC)* are hereby amended as follows: Standard type is text from the *IECC*. Underlined type is text inserted. ~~Strikeouts~~ indicate existing words and phrases to be deleted from the *IECC*. A double asterisk (**) at the beginning of a section identifies an amendment carried over from the 2015 edition of the code and a triple asterisk (***) identifies a new or revised amendment with the 2018 code. Section numbers in parenthesis represent the corresponding numbers of the energy provisions of the 2018 *International Residential Code* for parallel amendments.

2018 IECC (Energy Provisions of the 2018 IRC)

***Section 101.1; change to read as follows:*

C101.1 Title. This code shall be known as the *International Energy Conservation Code of the City of Mansfield*, and shall be cited as such. It is referred to herein as "this code."

***Section C102/R102; add Section C102.1.2 and R102.1.2 (N1101.4.1) to read as follows:*

C102.1.2 Alternative compliance. A building certified by a national, state, or local accredited energy efficiency program and determined by the Energy Systems Laboratory to be in compliance with the energy efficiency requirements of this section may, at the option of the Code Official, be considered in compliance. The United States Environmental Protection Agency's Energy Star Program certification of energy code equivalency shall be considered in compliance.

R102.1.2 (N1101.4.1) Alternative compliance. A building certified by a national, state, or local accredited energy efficiency program and determined by the Energy Systems Laboratory to be in compliance with the energy efficiency requirements of this section may, at the option of the Code Official, be considered in compliance. The United States Environmental Protection Agency's Energy Star Program certification of energy code equivalency shall be considered in compliance. Regardless of the program or the path to compliance, each one - and two - family dwelling shall be tested for air and duct leakage as prescribed in Section R402.4.1.2 (N1102.4.1.2) and R403.3.3 (N1103.3.3) respectively.

(Reason: This amendment is added to allow alternative compliance in accordance with Texas HB 1365, 78th Legislature. Codified in Chapter 388 Texas Building Energy Performance Standards: §388.003(i). The last sentence to Section R102.1.2 (N1101.4.1) was added to insure that every house is tested in accordance with the mandatory provisions of the code.)

***Section R202 (N1101.6); add the following definition:*

PROJECTION FACTOR. The ratio of the horizontal depth of the overhang, eave or permanently attached shading device, divided by the distance measured vertically from the bottom of the fenestration glazing to the underside of the overhang, eave or permanently attached shading device.

*(Reason: The amendment to **Section R402.3.2 (N1102.3.2) Glazed fenestration SHGC** was proposed by the TAB and ESL determined the proposal to be not less restrictive than the 2015 IECC. This added definition is necessary as part of that amendment. The amendment will provide additional options for SHGC selection.)*

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***Section R202; add the following definition:*

DYNAMIC GLAZING. Any fenestration product that has the fully reversible ability to change its performance properties, including U-factor, solar heat gain coefficient (SHGC), or visible transmittance (VT).

(Reason: This term is referenced in Section R402.3.2. This definition of DYNAMIC GLAZING is also found in the commercial provisions of the code.)

****Table R402.1.2 (N1102.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT: the Fenestration U-factor for Climate Zone 3 is amended as follows:*

CLIMATE ZONE	FENESTRATION U-FACTOR
3	0.32-0.35

(Reason: Carries forward the value in the 2015 IECC/IRC.)

****Table R402.1.4 (N1102.1.4) EQUIVALENT U-FACTORS: the Fenestration U-factor for Climate Zone 3 is amended as follows:*

CLIMATE ZONE	FENESTRATION U-FACTOR
3	0.32-0.35

(Reason: Carries forward the value in the 2015 IECC/IRC.)

****Section R402.3.2 (N1102.3.2); amend by adding a paragraph and table following the exception to read as follows:*

Where vertical fenestration is shaded by an overhang, eave, or permanently attached shading device, the SHGC required in Table R402.1.2 shall be reduced by using the multipliers in Table R402.3.2 SHGC Multipliers for Permanent Projections.

Table R402.3.2 SHGC Multipliers for Permanent Projections ^a

Projection Factor	SHGC Multiplier (all Other Orientation)	SHGC Multiplier (North Oriented)
0 - 0.10	1.00	1.00
>0.10 – 0.20	0.91	0.95
>0.20 – 0.30	0.82	0.91
>0.30 – 0.40	0.74	0.87
>0.40 – 0.50	0.67	0.84
>0.50 – 0.60	0.61	0.81
>0.60 – 0.70	0.56	0.78
>0.70 – 0.80	0.51	0.76
>0.80 – 0.90	0.47	0.75
>0.90 – 1.00	0.44	0.73

^a North oriented means within 45 degrees of true north.

*(Reason: The amendment to **Section 402.3.2 Glazed fenestration SHGC** was proposed by the Texas Association of Builders (TAB). The Energy Systems Laboratory (ESL) determined the proposal to be not less restrictive than the 2015 IECC. This added definition is necessary as part of that amendment. This amendment will provide additional options for SHGC selection.)*

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****R402.4.1.2 (N1102.4.1.2); add a last paragraph to read as follows:**

Mandatory testing shall only be performed by individuals that are certified to perform air infiltration testing certified by national or state organizations as approved by the building official. The certified individuals must be an independent third-party entity, and may not be employed; or have any financial interest in the company that constructs the structure.

(Reason: The 2018 International Residential Code (IRC) and International Energy Conservation Code (IECC) includes enhanced emphasis on envelope infiltration and duct leakage. Significant changes in the residential energy requirements include more frequent requirement of performance testing for leakage. Residential duct systems must be tested unless all ducts and equipment are located within the conditioned space. Envelope testing is required to demonstrate compliance with maximum allowable leakage rate. This language puts the regulatory authority on notice that the testing requires specialized credentials and establishes a conflict of interest baseline).

*****Section R402.4 (N1102.4); add a new section and table to read as follows:**

R402.4.1.3 (N1102.4.1.3) Testing option – ACH tradeoff. As an option to the air leakage rate set out in Section R402.4.1.2 (N1102.4.1.2), 1- and 2-family homes meeting all of the listed criteria below and the *thermal envelope* requirements in Table R402.4.1.3 (N1102.4.1.3) will be considered compliant when tested and verified as having an air leakage rate to not less than or equal to four air changes per hour when tested and reported in accordance with the testing standards and reporting criteria listed in Section R402.4.1.2 (N1102.4.1.2).

The compliance equivalency is limited as follows:

1. Limited to a conditioned floor area between 1,000 and 6,000 square feet,
2. Limited to between 2 to 6 bedrooms,
3. Assumes all ductwork and mechanical equipment is located in the unconditioned attic,
4. Assumes typical wood framing in the walls and roof, and
5. Assumes one of the following heating/cooling systems:
 - a. All electric system with a heat pump for heating, or
 - b. A system with electric cooling and natural gas heating.

Dwellings using electric resistance strip heating do not qualify for this tradeoff.

Table R402.4.1.3 (N1102.4.1.3)^a

Envelope Component	Option #1	Option #2
R402.4 Air Leakage	≤ 4 ACH50	≤ 4 ACH50
Wall Insulation <i>R</i> -value	R13 + R3 ^b	R13 + R3 ^b
Fenestration <i>U</i> -factor	≤ 0.32	≤ 0.32
Fenestration SHGC	≤ 0.25	≤ 0.25
Ceiling <i>R</i> -value	≥ R49	≥ R49
Duct Insulation <i>R</i> -value	R8	R6
Radiant Barrier Required	No	Yes

^a

Except for the values listed in the table, all other mandatory code provisions are applicable.

^b

The first value listed is the *R*-value of cavity insulation, the second value is the *R*-value of the continuous insulation or insulated siding.

(Reason: This provides a viable option to the single-family residential builder. The Energy Systems Laboratory determined that this tradeoff option to be not less stringent than the residential provisions of the 2015 IECC and the energy provisions of the 2015 IRC.)

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*** Section R402.4; add a new section R402.4.1.4 to read as follows:

R402.4.1.4 Testing options for R2 multifamily dwelling units. As an option to the air leakage rate set out in Section R402.4.1.2, multifamily dwelling units will be considered compliant when tested and verified as having an air leakage rate to the air leakage rate set out in either Section R402.4.1.4.1 or Section R402.4.1.4.2 when tested and reported in accordance with the testing standards and reporting criteria listed in Section R402.4.1.2

R402.4.1.4.1 Total air leakage rate for interior multifamily dwelling units. Interior multifamily dwelling units with a measured, "unguarded" total air leakage result of 5.3 ACH50 or less shall be considered compliant.

R402.4.1.4.2 Total air leakage rate for corner multifamily dwelling units. Corner multifamily units with a measured, "unguarded" total leakage result of less than 5.0 ACH50 shall be considered compliant.

(Reason: The Mandatory Section R402.4 Air Leakage of the 2015 IECC requires that the building thermal envelope be tested and verified in accordance with R402.4.1.2. Measuring air leakage for multifamily buildings or dwelling units using an air leakage to outside test (i.e. guarded) can be costly and time prohibitive. This is because in order to isolate leakage only through the building thermal envelope, all leakage to adjacent units through adiabatic surfaces must be pressure neutralized. The methodology below therefore allows for the use of total air leakage testing for multifamily dwelling units that includes air leakage to the exterior and to adjacent units (i.e. unguarded) to show compliance with R402.4.1.2. This increases the flexibility of the code without affecting stringency. This methodology has been approved for use by ESL, and the methodology applies only to jurisdictions in the NCTCOG area.)

*** Section R402.4; add a new section to read as follows:

R402.4.1.5 Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R402.4.1.2. Prior to beginning sampling for testing, "Initial Testing" is required for each multifamily property. "Initial Testing" shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the "Initial Testing" must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the "Initial Testing" must be within the same building. Dwelling units selected for "Initial Testing" shall not be included in a "sample group" or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for "Initial Testing." The building official may delegate the random selection to the designated 3rd party testing contractor.

R402.4.1.5.1 Sample group Identification and Sampling. The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the "sample group" must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each "sample group" for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a "sample group" meets the minimum code requirements, then all dwelling units in the "sample group" are considered to meet the minimum code requirements.

Before a building may be deemed compliant with the testing as required, each "sample group" must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all "sample groups" shall not be less than a minimum of 15% of the dwelling units in a building.

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R402.4.1.5.2 Failure to meet code requirement(s). If any dwelling units within the identified "sample group" fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the "sample group" will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

(Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments are very similar to other ordinances/policies from Austin and San Antonio.)

***Section R403.3.3 (N1103.3.3); add a last paragraph to read as follows:*

R403.3.3 Duct testing (Mandatory). Mandatory testing shall only be performed by individuals that are certified to perform duct testing leakage testing certified by national or state organizations as approved by the building official. The certified individuals must be an independent third-party entity, and may not be employed; or have any financial interest in the company that constructs the structure.

(Reason: The 2015 International Residential Code (IRC) and International Energy Conservation Code (IECC) includes enhanced emphasis on envelope infiltration and duct leakage. Significant changes in the residential energy requirements include more frequent requirement of performance testing for leakage. Residential Duct systems must be tested unless all ducts and equipment are located within the conditioned space. Envelope testing is required to demonstrate compliance with maximum allowable leakage rate. This language puts the regulatory authority on notice that the testing requires specialized credentials and establishes a conflict of interest baseline.)

**** Section R403.3; add a new section to read as follows:*

R403.3.4.1 Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R403.3.3. Prior to beginning sampling for testing, "Initial Testing" is required for each multifamily property. "Initial Testing" shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the "Initial Testing" must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the "Initial Testing" must be within the same building. Dwelling units selected for "Initial Testing" shall not be included in a "sample group" or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for "Initial Testing." The building official may delegate the random selection to the designated 3rd party testing contractor.

R403.3.4.1.1 Sample group identification and sampling. The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the "sample group" must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each "sample group" for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a "sample group" meets the minimum code requirements, then all dwelling units in the "sample group" are considered to meet the minimum code requirements.

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Before a building may be deemed compliant with the testing as required, each "sample group" must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all "sample groups" shall not be less than a minimum of 15% of the dwelling units in a building.

R403.3.4.1.2 Failure to meet code requirement(s). If any dwelling units within the identified "sample group" fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the "sample group" will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

(Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments are very similar to other ordinances/policies from Austin and San Antonio.)

***Section C402.2 / R402.2 (N1102.2); add new Section C402.2.8 and R402.2.14 (N1102.2.14) to read as follows:*

Section C402.2.8 / R402.2.14 (N1102.2.14) Insulation installed in walls. Insulation installed in walls shall be totally enclosed on all sides consisting of framing lumber, gypsum, sheathing, wood structural panel sheathing or other equivalent material approved by the building official.

(Reason: This will increase the performance of the insulation.)

****Section C403.7.4; add exception #12 to read as follows:*

12. Individual ventilation systems that serve an individual dwelling unit or sleeping unit.

(Reason: This will clarify the intent of the section without requiring the user or the code to analyze the numbers in the table. So a ventilation system that serves only an individual dwelling unit or sleeping unit does not require an energy recovery system.)

****Section C403.11.1; add a second paragraph to read as follows:*

Environmental ducts and plenums installed in vertical chases, both supply and exhaust, where the ducts or plenums will not be accessible after construction completion, shall be leak tested in accordance with the SMACNA HVAC Air Leakage Test Manual to the installed ductwork class and pressure requirements.

Documentation shall be furnished demonstrating that representative sections totaling not less than 25 percent of the duct area have been tested and that all tested sections comply with the requirements of this section.

(Reason: Ductwork installed in chases is not accessible after construction completion. Leakage in these ducts will increase the energy use of the buildings and systems for the life of the building and reduce the system performance. Since the leakage in the chase enclosed ductwork would be difficult if not impossible to locate and

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correct, testing at the time of installation would assure that the ducts are properly installed and efficient.)

****Section R404.1 (N1104.1); revised in its entirety to read as follows:*

Section R404.1 (N1104.1) Lighting equipment (Mandatory). Not less than 75 percent of the lamps in permanently installed lighting fixtures or not less than 75 percent of the permanently installed lighting fixtures shall contain only high-efficacy lamps.

(Reason: This retains the 2015 language which allows for more flexibility.)

***Section R405.2 (N1105.2); add the exception to read as follows:*

Section R405.2 (N1105.2) Mandatory requirements. Compliance with the section requires that the mandatory provisions identified in Section 401.2 be met. Supply and return ducts not completely inside the building thermal envelope shall be insulated to an R-value of not less than R-6.

Exceptions:

1. For one and two family dwellings the maximum envelope leakage of 4 ACH50 is permitted provided the envelope leakage in the Standard Reference Design is 3 ACH50 and all other requirements of Section R405 are met, including all other mandatory measures. The annual energy cost or source energy usage of the Proposed Design must be equal to or less than that of the Standard Reference Design.
2. For multifamily or townhomes and buildings classified as Group R2 and Group R4 of three stories or less the maximum envelope leakage of less than 5 ACH50 is permitted provided the envelope leakage in the Standard Reference Design is 3 ACH50 and all other requirements of Section R405 are met, including all other mandatory measures. The annual energy cost or source energy usage of the Proposed Design must be equal to or less than that of the Standard Reference Design.

(Reason: This ACH tradeoff is approved by ESL and will require additional energy efficiencies to be implemented. This tradeoff is incorporated in ESL's IC3 Code Compliance Calculator as the 2015 NCTCOG path in the code drop down menu. Builders using IC3 will receive a code compliant notification if their designs meet the requirements of this tradeoff and all other energy code requirements. Other compliance software products have not incorporated this tradeoff into their compliance reports. Building Officials receiving Section R405 submittals from software other than IC3 may approve a R405 compliance report that designates the building as not in compliance due to noncompliance with the 3 ACH50 envelope leakage mandatory measure, provided the report also states that the envelope leakage is no greater than 4 ACH50 for single family homes. REScheck™ does not have the flexibility to accommodate this tradeoff.)

****Section R405.6.2 (N1105.6.2); add the following sentence to the end of paragraph:*

Acceptable performance software simulation tools may include, but are not limited to, REM Rate™, Energy Gauge®, ICF International Beacon Residential, Ekotrope, HERS Module, Right-Energy HERS and IC3. Other performance software programs accredited by RESNET® and having the ability to provide a report as outlined in R405.4.2 may also be deemed acceptable performance simulation programs and may be considered by the building official.

(Reason: These performance software tools are listed by RESNET at the time of recommendation.)

****Section C405.9 Voltage drop in feeders; delete section in its entirety:*

(Reason: There are similar provisions in the NEC where this type of equipment is best managed.)

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***TABLE R406.4 (N1106.4); amend to read as follows:

TABLE R406.4 (N1106.4)¹
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
3	65

¹ This table is effective until August 31, 2019.

TABLE R406.4 (N1106.4)²
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
3	63

² This table is effective from September 1, 2019 to August 31, 2022.

TABLE R406.4 (N1106.4)³
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX
3	59

³ This table is effective on or after September 1, 2022.

(Reason: The tables reflect the values and time table set forth in HB1736, 84th Regular Session Codified in Chapter 388 Texas Building Energy Performance Standards: §388.003.)

***Section C408.3.1; amend to read as follows:

C408.3.1 Functional Testing. Prior to passing final inspection, the *registered design professional or approved agency* shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the *construction documents* and manufacturer's instructions. Functional testing shall be in accordance with Sections C408.3.1.1 through C408.3.1.3 for the applicable controltype.

(Reason: The addition of 'or approved agency' will make the lighting systems requirements match the mechanical system requirements in C408.2.1. This will facilitate and add flexibility to the enforcement of the commissioning requirements.)

END