

Simulation THERM/WINDOW v/s FENSIZ E Comparison Results :

For several examples (Aluminum, Thermally Broken Aluminum, Fiber-glass and Vinyl-reinforced frames) total product indices, U-factor, SHGC and VT, are determined using current NFRC approved THER/WINDOW programs and component calculation program FENSIZ E algorithm. Those results are labeled as FENSIZ E) and presented in series of tables with corresponding results obtained from simulation using current THERM5/WINDOW5 procedure. TRR-01, TRR-097, TRR-099 and TRR-02 are NFRC round robin results while Fiberglass and TR-4600 are products provided by manufacturer.

Conclusion/ Observation:

NFRC size differences in U-factor are no greater than 0.01 Btu/hr-ft²-F, for SHGC no greater than 0.001 and for VT there are no difference 0.000.

Sizes other than NFRC standard size the differences in U-factor are no greater than 0.02 Btu/hr-ft²-F, for SHGC no greater than 0.001 and for VT there are no difference 0.000.

Table 1: TRR-01 - Thermally Broken frame Fix window-(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft ² *F) | | | SHGC (-) | | | VT (-) | | |
|--------|----------------------|--|---------------|---------------------------------|----------|--------|-------------|----------|-------|-----------|----------|-------|
| | | | | T5/W5 | FENSIZ E | | T5/W5 | FENSIZ E | | T5/W5 | FENSIZ E | |
| TRR-01 | clr/ar/clr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.532 | 0.527 | -0.005 | 0.561 | 0.561 | 0.000 | 0.569 | 0.569 | 0.000 |
| | | | 48x36 | 0.510 | 0.507 | -0.003 | 0.624 | 0.625 | 0.001 | 0.640 | 0.640 | 0.000 |
| | | | 47.244x59.055 | 0.494 | 0.497 | 0.003 | 0.657 | 0.658 | 0.001 | 0.678 | 0.678 | 0.000 |
| | | | 72x54 | 0.489 | 0.491 | 0.002 | 0.676 | 0.676 | 0.000 | 0.698 | 0.698 | 0.000 |
| | | | 96x72 | 0.476 | 0.483 | 0.007 | 0.702 | 0.703 | 0.001 | 0.728 | 0.728 | 0.000 |
| | | Edgetech S-class (5/8") | 36x24 | 0.511 | 0.515 | 0.004 | 0.560 | 0.560 | 0.000 | 0.569 | 0.569 | 0.000 |
| | | | 48x36 | 0.494 | 0.498 | 0.004 | 0.624 | 0.624 | 0.000 | 0.640 | 0.640 | 0.000 |
| | | | 47.244x59.055 | 0.482 | 0.490 | 0.008 | 0.657 | 0.658 | 0.001 | 0.678 | 0.678 | 0.000 |
| | | | 72x54 | 0.478 | 0.485 | 0.007 | 0.675 | 0.676 | 0.001 | 0.698 | 0.698 | 0.000 |
| | | | 96x72 | 0.468 | 0.478 | 0.010 | 0.702 | 0.703 | 0.001 | 0.728 | 0.728 | 0.000 |
| | 034/ar/clr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.391 | 0.394 | 0.003 | 0.342 | 0.343 | 0.001 | 0.493 | 0.493 | 0.000 |
| | | | 48x36 | 0.352 | 0.354 | 0.002 | 0.379 | 0.379 | 0.000 | 0.555 | 0.555 | 0.000 |
| | | | 47.244x59.055 | 0.332 | 0.333 | 0.001 | 0.398 | 0.399 | 0.001 | 0.587 | 0.587 | 0.000 |
| | | | 72x54 | 0.320 | 0.321 | 0.001 | 0.409 | 0.409 | 0.000 | 0.605 | 0.605 | 0.000 |
| | | | 96x72 | 0.302 | 0.304 | 0.002 | 0.424 | 0.425 | 0.001 | 0.631 | 0.631 | 0.000 |
| | | Edgetech S-class (5/8") | 36x24 | 0.373 | 0.378 | 0.005 | 0.342 | 0.342 | 0.000 | 0.493 | 0.493 | 0.000 |
| | | | 48x36 | 0.339 | 0.342 | 0.003 | 0.379 | 0.379 | 0.000 | 0.555 | 0.555 | 0.000 |
| | | | 47.244x59.055 | 0.320 | 0.323 | 0.003 | 0.398 | 0.398 | 0.000 | 0.587 | 0.587 | 0.000 |
| | | 72x54 | 0.310 | 0.313 | 0.003 | 0.408 | 0.409 | 0.001 | 0.605 | 0.605 | 0.000 | |
| | | 96x72 | 0.295 | 0.298 | 0.003 | 0.424 | 0.424 | 0.000 | 0.631 | 0.631 | 0.000 | |

Note: NFRC standardized dimensions are marked yellow.

Table 2: TRR-97 - Aluminum Clad Fix Window-(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft ² *F) | | | SHGC (-) | | | VT (-) | | |
|---------------|----------------------|--|---------------|---------------------------------|---------|--------|-------------|---------|-------|-----------|---------|-------|
| | | | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | |
| TRR-97 | Clr/ar/Clr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.490 | 0.485 | -0.005 | 0.591 | 0.591 | 0.000 | 0.612 | 0.612 | 0.000 |
| | | | 48x36 | 0.480 | 0.477 | -0.003 | 0.647 | 0.647 | 0.000 | 0.672 | 0.672 | 0.000 |
| | | | 47.244x59.055 | 0.470 | 0.473 | 0.003 | 0.676 | 0.676 | 0.000 | 0.703 | 0.703 | 0.000 |
| | | | 72x54 | 0.468 | 0.470 | 0.002 | 0.692 | 0.692 | 0.000 | 0.720 | 0.720 | 0.000 |
| | | | 96x72 | 0.461 | 0.467 | 0.006 | 0.714 | 0.715 | 0.001 | 0.745 | 0.745 | 0.000 |
| | | | | | | | | | | | | |
| | | Edgetech S-class (5/8") | 36x24 | 0.450 | 0.463 | 0.013 | 0.590 | 0.591 | 0.001 | 0.612 | 0.612 | 0.000 |
| | | | 48x36 | 0.450 | 0.461 | 0.011 | 0.646 | 0.647 | 0.001 | 0.672 | 0.672 | 0.000 |
| | | | 47.244x59.055 | 0.447 | 0.460 | 0.013 | 0.675 | 0.676 | 0.001 | 0.703 | 0.703 | 0.000 |
| | | | 72x54 | 0.448 | 0.460 | 0.012 | 0.691 | 0.692 | 0.001 | 0.720 | 0.720 | 0.000 |
| | 96x72 | | 0.445 | 0.459 | 0.014 | 0.714 | 0.715 | 0.001 | 0.745 | 0.745 | 0.000 | |
| | | | | | | | | | | | | |
| | 034/ar/Clr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.348 | 0.341 | -0.007 | 0.357 | 0.357 | 0.000 | 0.530 | 0.530 | 0.000 |
| | | | 48x36 | 0.322 | 0.316 | -0.006 | 0.390 | 0.390 | 0.000 | 0.582 | 0.582 | 0.000 |
| | | | 47.244x59.055 | 0.306 | 0.303 | -0.003 | 0.407 | 0.407 | 0.000 | 0.609 | 0.609 | 0.000 |
| | | | 72x54 | 0.299 | 0.295 | -0.004 | 0.417 | 0.417 | 0.000 | 0.623 | 0.623 | 0.000 |
| | | | 96x72 | 0.286 | 0.285 | -0.001 | 0.430 | 0.430 | 0.000 | 0.645 | 0.645 | 0.000 |
| | | | | | | | | | | | | |
| | | Edgetech S-class (5/8") | 36x24 | 0.302 | 0.313 | 0.011 | 0.356 | 0.356 | 0.000 | 0.530 | 0.530 | 0.000 |
| | | | 48x36 | 0.288 | 0.296 | 0.008 | 0.389 | 0.390 | 0.001 | 0.582 | 0.582 | 0.000 |
| 47.244x59.055 | | | 0.279 | 0.287 | 0.008 | 0.406 | 0.407 | 0.001 | 0.609 | 0.609 | 0.000 | |
| 72x54 | | | 0.275 | 0.282 | 0.007 | 0.416 | 0.416 | 0.000 | 0.623 | 0.623 | 0.000 | |
| 96x72 | 0.268 | | 0.274 | 0.006 | 0.430 | 0.430 | 0.000 | 0.645 | 0.645 | 0.000 | | |
| | | | | | | | | | | | | |

Note: NFRC standardized dimensions are marked yellow.

Table 3: TRR-99 - Aluminum Horizontal Slider-(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft ² *F) | | | SHGC (-) | | | VT (-) | | |
|--------|----------------------|--|---------------|---------------------------------|---------|--------|-------------|---------|-------|-----------|---------|-------|
| | | | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | |
| TRR-99 | clr/ar/clr (3/4") | Allmetal Standard Aluminum (1/2") | 36x24 | 0.687 | 0.682 | -0.005 | 0.630 | 0.630 | 0.000 | 0.643 | 0.643 | 0.000 |
| | | | 48x36 | 0.621 | 0.618 | -0.003 | 0.674 | 0.674 | 0.000 | 0.693 | 0.693 | 0.000 |
| | | | 59.055x47.244 | 0.585 | 0.584 | -0.001 | 0.697 | 0.697 | 0.000 | 0.720 | 0.720 | 0.000 |
| | | | 72x54 | 0.564 | 0.565 | 0.001 | 0.710 | 0.710 | 0.000 | 0.735 | 0.735 | 0.000 |
| | | | 96x72 | 0.532 | 0.537 | 0.005 | 0.728 | 0.729 | 0.001 | 0.756 | 0.756 | 0.000 |
| | | Edgetech S-class (1/2") | 36x24 | 0.676 | 0.677 | 0.001 | 0.630 | 0.630 | 0.000 | 0.643 | 0.643 | 0.000 |
| | | | 48x36 | 0.613 | 0.614 | 0.001 | 0.674 | 0.674 | 0.000 | 0.693 | 0.693 | 0.000 |
| | | | 59.055x47.244 | 0.578 | 0.581 | 0.003 | 0.697 | 0.697 | 0.000 | 0.720 | 0.720 | 0.000 |
| | | | 72x54 | 0.558 | 0.562 | 0.004 | 0.710 | 0.710 | 0.000 | 0.735 | 0.735 | 0.000 |
| | | | 96x72 | 0.528 | 0.535 | 0.007 | 0.728 | 0.729 | 0.001 | 0.756 | 0.756 | 0.000 |
| | 034/ar/clr (3/4") | Allmetal Standard Aluminum (1/2") | 36x24 | 0.540 | 0.536 | -0.004 | 0.384 | 0.385 | 0.001 | 0.557 | 0.557 | 0.000 |
| | | | 48x36 | 0.459 | 0.454 | -0.005 | 0.409 | 0.410 | 0.001 | 0.600 | 0.600 | 0.000 |
| | | | 59.055x47.244 | 0.416 | 0.411 | -0.005 | 0.423 | 0.423 | 0.000 | 0.623 | 0.623 | 0.000 |
| | | | 72x54 | 0.390 | 0.386 | -0.004 | 0.430 | 0.430 | 0.000 | 0.636 | 0.636 | 0.000 |
| | | | 96x72 | 0.353 | 0.351 | -0.002 | 0.441 | 0.441 | 0.000 | 0.655 | 0.655 | 0.000 |
| | | Edgetech S-class (1/2") | 36x24 | 0.526 | 0.529 | 0.003 | 0.384 | 0.384 | 0.000 | 0.557 | 0.557 | 0.000 |
| | | | 48x36 | 0.449 | 0.449 | 0.000 | 0.409 | 0.410 | 0.001 | 0.600 | 0.600 | 0.000 |
| | | | 59.055x47.244 | 0.407 | 0.407 | 0.000 | 0.422 | 0.423 | 0.001 | 0.623 | 0.623 | 0.000 |
| 72x54 | | | 0.382 | 0.382 | 0.000 | 0.430 | 0.430 | 0.000 | 0.636 | 0.636 | 0.000 | |
| 96x72 | | | 0.347 | 0.348 | 0.001 | 0.440 | 0.441 | 0.001 | 0.655 | 0.655 | 0.000 | |

Note: NFRC standardized dimensions are marked yellow.

Table 4: TRR-02 - Thermally improved with bolts -Curtain wall -(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft ² *F) | | | SHGC (-) | | | VT (-) | | |
|--------------|--------------------|-----------------------------------|---------------|---------------------------------|--------|-------|-------------|--------|-------|-----------|--------|-------|
| | | | | T5/W5 | FENSIZ | | T5/W5 | FENSIZ | | T5/W5 | FENSIZ | |
| Curtain wall | clr/ar/clr (1") | Allmetal Standard Aluminum (3/4") | 48x36 | 0.763 | 0.768 | 0.005 | 0.588 | 0.588 | 0.000 | 0.585 | 0.585 | 0.000 |
| | | | 59.055x47.244 | 0.702 | 0.708 | 0.006 | 0.627 | 0.627 | 0.000 | 0.631 | 0.631 | 0.000 |
| | | | 72x54 | 0.664 | 0.671 | 0.007 | 0.650 | 0.651 | 0.001 | 0.659 | 0.659 | 0.000 |
| | | | 96x72 | 0.611 | 0.621 | 0.010 | 0.683 | 0.683 | 0.000 | 0.698 | 0.698 | 0.000 |
| | | Edgetech S-class (3/4") | 48x36 | 0.737 | 0.751 | 0.014 | 0.587 | 0.588 | 0.001 | 0.585 | 0.585 | 0.000 |
| | | | 59.055x47.244 | 0.681 | 0.694 | 0.013 | 0.626 | 0.627 | 0.001 | 0.631 | 0.631 | 0.000 |
| | | | 72x54 | 0.646 | 0.659 | 0.013 | 0.649 | 0.650 | 0.001 | 0.659 | 0.659 | 0.000 |
| | | | 96x72 | 0.597 | 0.612 | 0.015 | 0.682 | 0.683 | 0.001 | 0.698 | 0.698 | 0.000 |
| | 034/ar/clr (1") | Allmetal Standard Aluminum (3/4") | 48x36 | 0.634 | 0.638 | 0.004 | 0.364 | 0.364 | 0.000 | 0.506 | 0.506 | 0.000 |
| | | | 59.055x47.244 | 0.561 | 0.564 | 0.003 | 0.385 | 0.386 | 0.001 | 0.547 | 0.547 | 0.000 |
| | | | 72x54 | 0.516 | 0.519 | 0.003 | 0.398 | 0.398 | 0.000 | 0.571 | 0.571 | 0.000 |
| | | | 96x72 | 0.453 | 0.457 | 0.004 | 0.416 | 0.416 | 0.000 | 0.605 | 0.605 | 0.000 |
| | | Edgetech S-class (3/4") | 48x36 | 0.604 | 0.618 | 0.014 | 0.363 | 0.363 | 0.000 | 0.506 | 0.506 | 0.000 |
| | | | 59.055x47.244 | 0.536 | 0.548 | 0.012 | 0.384 | 0.385 | 0.001 | 0.547 | 0.547 | 0.000 |
| | | | 72x54 | 0.495 | 0.505 | 0.010 | 0.397 | 0.398 | 0.001 | 0.571 | 0.571 | 0.000 |
| | | | 96x72 | 0.437 | 0.446 | 0.009 | 0.415 | 0.416 | 0.001 | 0.605 | 0.605 | 0.000 |

Note: NFRC standardized dimensions are marked yellow.

Table 5: Fiberglass Casement -(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft ² *F) | | | SHGC (-) | | | VT (-) | | |
|------------|--------------------|--|---------------|---------------------------------|---------|--------|-------------|---------|-------|-----------|---------|-------|
| | | | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | | T5/W5 | FENSIZE | |
| Fiberglass | clr/ar/cfr (1") | Allmetal Standard Aluminum (3/4") | 36x24 | 0.452 | 0.448 | -0.004 | 0.521 | 0.521 | 0.000 | 0.534 | 0.534 | 0.000 |
| | | | 23.622x59.055 | 0.452 | 0.449 | -0.003 | 0.553 | 0.553 | 0.000 | 0.569 | 0.569 | 0.000 |
| | | | 48x36 | 0.454 | 0.451 | -0.003 | 0.595 | 0.595 | 0.000 | 0.614 | 0.614 | 0.000 |
| | | | 72x54 | 0.452 | 0.454 | 0.002 | 0.655 | 0.656 | 0.001 | 0.680 | 0.680 | 0.000 |
| | | | 96x72 | 0.449 | 0.456 | 0.007 | 0.687 | 0.687 | 0.000 | 0.714 | 0.714 | 0.000 |
| | | Edgetech S-class (3/4") | 36x24 | 0.428 | 0.435 | 0.007 | 0.520 | 0.520 | 0.000 | 0.534 | 0.534 | 0.000 |
| | | | 23.622x59.055 | 0.430 | 0.438 | 0.008 | 0.552 | 0.553 | 0.001 | 0.569 | 0.569 | 0.000 |
| | | | 48x36 | 0.436 | 0.442 | 0.006 | 0.594 | 0.595 | 0.001 | 0.614 | 0.614 | 0.000 |
| | | | 72x54 | 0.440 | 0.448 | 0.008 | 0.655 | 0.656 | 0.001 | 0.680 | 0.680 | 0.000 |
| | | | 96x72 | 0.440 | 0.451 | 0.011 | 0.686 | 0.687 | 0.001 | 0.714 | 0.714 | 0.000 |
| | 034/ar/cfr (1") | Allmetal Standard Aluminum (3/4") | 36x24 | 0.332 | 0.324 | -0.008 | 0.316 | 0.316 | 0.000 | 0.462 | 0.462 | 0.000 |
| | | | 23.622x59.055 | 0.326 | 0.316 | -0.010 | 0.335 | 0.335 | 0.000 | 0.493 | 0.493 | 0.000 |
| | | | 48x36 | 0.313 | 0.306 | -0.007 | 0.360 | 0.360 | 0.000 | 0.532 | 0.532 | 0.000 |
| | | | 72x54 | 0.295 | 0.291 | -0.004 | 0.395 | 0.395 | 0.000 | 0.589 | 0.589 | 0.000 |
| | | | 96x72 | 0.285 | 0.283 | -0.002 | 0.414 | 0.414 | 0.000 | 0.618 | 0.618 | 0.000 |
| | | Edgetech S-class (3/4") | 36x24 | 0.302 | 0.308 | 0.006 | 0.315 | 0.315 | 0.000 | 0.462 | 0.462 | 0.000 |
| | | | 23.622x59.055 | 0.299 | 0.302 | 0.003 | 0.334 | 0.335 | 0.001 | 0.493 | 0.493 | 0.000 |
| | | | 48x36 | 0.290 | 0.294 | 0.004 | 0.359 | 0.359 | 0.000 | 0.532 | 0.532 | 0.000 |
| | | | 72x54 | 0.279 | 0.283 | 0.004 | 0.395 | 0.395 | 0.000 | 0.589 | 0.589 | 0.000 |
| | | | 96x72 | 0.273 | 0.277 | 0.004 | 0.413 | 0.414 | 0.001 | 0.618 | 0.618 | 0.000 |

Note: NFRC standardized dimensions are marked yellow.

Table 6: TR-4600 – Vinyl with Reinforcement Vertical Double hung -(Comparison Results)

| Model | Glazing System | Spacer | Size (in) | U (Btu/h*ft²*F) | | | SHGC (-) | | | VT (-) | | |
|---------|----------------------|--|---------------|--------------------|--------|--------|-------------|--------|--------|-----------|--------|-------|
| | | | | T5/W5 | FENSIZ | E | T5/W5 | FENSIZ | E | T5/W5 | FENSIZ | E |
| TR-4600 | clr/ar/cfr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.471 | 0.457 | -0.014 | 0.487 | 0.486 | -0.001 | 0.500 | 0.500 | 0.000 |
| | | | 48x36 | 0.466 | 0.457 | -0.009 | 0.570 | 0.570 | 0.000 | 0.589 | 0.589 | 0.000 |
| | | | 47.244x59.055 | 0.459 | 0.457 | -0.002 | 0.615 | 0.615 | 0.000 | 0.638 | 0.638 | 0.000 |
| | | | 72x54 | 0.461 | 0.457 | -0.004 | 0.638 | 0.638 | 0.000 | 0.663 | 0.663 | 0.000 |
| | | | 96x72 | 0.456 | 0.457 | 0.001 | 0.673 | 0.674 | 0.001 | 0.701 | 0.701 | 0.000 |
| | | Edgetech S-class (5/8") | 36x24 | 0.433 | 0.436 | 0.003 | 0.486 | 0.486 | 0.000 | 0.500 | 0.500 | 0.000 |
| | | | 48x36 | 0.438 | 0.442 | 0.004 | 0.569 | 0.570 | 0.001 | 0.589 | 0.589 | 0.000 |
| | | | 47.244x59.055 | 0.438 | 0.445 | 0.007 | 0.614 | 0.615 | 0.001 | 0.638 | 0.638 | 0.000 |
| | | | 72x54 | 0.441 | 0.446 | 0.005 | 0.638 | 0.638 | 0.000 | 0.663 | 0.663 | 0.000 |
| | | | 96x72 | 0.441 | 0.449 | 0.008 | 0.673 | 0.674 | 0.001 | 0.701 | 0.701 | 0.000 |
| | 034/ar/cfr (7/8") | Allmetal Standard Aluminum (5/8") | 36x24 | 0.363 | 0.344 | -0.019 | 0.295 | 0.295 | 0.000 | 0.433 | 0.433 | 0.000 |
| | | | 48x36 | 0.333 | 0.318 | -0.015 | 0.344 | 0.344 | 0.000 | 0.510 | 0.510 | 0.000 |
| | | | 47.244x59.055 | 0.312 | 0.304 | -0.008 | 0.371 | 0.371 | 0.000 | 0.552 | 0.552 | 0.000 |
| | | | 72x54 | 0.308 | 0.297 | -0.011 | 0.385 | 0.385 | 0.000 | 0.574 | 0.574 | 0.000 |
| | | | 96x72 | 0.294 | 0.287 | -0.007 | 0.406 | 0.406 | 0.000 | 0.607 | 0.607 | 0.000 |
| | | Edgetech S-class (5/8") | 36x24 | 0.316 | 0.316 | 0.000 | 0.294 | 0.294 | 0.000 | 0.433 | 0.433 | 0.000 |
| | | | 48x36 | 0.298 | 0.298 | 0.000 | 0.344 | 0.344 | 0.000 | 0.510 | 0.510 | 0.000 |
| | | | 47.244x59.055 | 0.286 | 0.289 | 0.003 | 0.371 | 0.371 | 0.000 | 0.552 | 0.552 | 0.000 |
| | | | 72x54 | 0.283 | 0.284 | 0.001 | 0.384 | 0.385 | 0.001 | 0.574 | 0.574 | 0.000 |
| | | | 96x72 | 0.275 | 0.276 | 0.001 | 0.405 | 0.406 | 0.001 | 0.607 | 0.607 | 0.000 |

Note: NFRC standardized dimensions are marked yellow.