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GRANDVIEW EA BUILDING SYSTEMS

TEST REPORT

TEST REPORT ISSUED TO
Grandview EA Building Systems
579-999 West Broadway
Vancouver, BC V5Z 1K5
Canada

SPECIFICATION
AAMA/WDMA/CSA 101/I.S.2/A440-11
AAMA/WDMA/CSA 101/I.S.2/A440-17
A440S1-17
A440S1-19

PRODUCT SERIES & TYPE
Enermax 150 Series Casement Window

PRIMARY DESIGNATION
Class AW – PG40 – Size Tested 905 x 1510 mm (36 x 59 in) – Type C

SECONDARY DESIGNATION
Positive Design Pressure = 1920 Pa (40.1 psf)
Negative Design Pressure = 1920 Pa (40.1 psf)
Water Penetration Resistance = 720 Pa (15.0 psf)
Canadian Air Leakage Resistance = A3

REPORT NUMBER
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TEST REPORT FOR GRANDVIEW EA BUILDING SYSTEMS

Report No.: 104182880COQ-001B
Date: 28-Jul-2020

CONCLUSION

The Enermax 150 Series Casement Window System, submitted by Grandview EA Building Systems, tested and described within this report, achieved the overall performance requirements of **Class AW – PG40** when tested in accordance with NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

For INTERTEK B&C:

COMPLETED BY:	Jason Komorski	**REVIEWED BY:**	David Park
TITLE:	Technician – Building & Construction	**TITLE:**	Reviewer – Building & Construction
SIGNATURE:		**SIGNATURE:**	
DATE:	28-Jul-2020	**DATE:**	28-Jul-2020

SECTION 1
SUMMARY OF RESULTS

A summary of results for AAMA/WDMA/CSA 101/I.S.2/A440-11 *"Standard/Specification for windows, doors, and unit skylights"*, AAMA/WDMA/CSA 101/I.S.2/A440-17 *"Standard/Specification for windows, doors, and unit skylights"*, A440S1-17 *"Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights"*, and A440S1-19 *"Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights"*, are as indicated in the table below:

Evaluation Property	Results
Operational Force	US – Pass; Can – Pass
Air Leakage Resistance @ 75 Pa (1.6 psf)	US – Pass; Can – A3
Air Leakage Resistance @ 300 Pa (6.3 psf)	US – Pass; Can – A3
Water Penetration Resistance (Static & Cyclic)	720 Pa (15.0 psf)
Uniform Load – Deflection	1920 Pa (40.1 psf)
Vent / Sash / Door Leaf Cycling	Pass
Locking Hardware Cycling	Pass
Misuse Test	Pass
Operational Force #2	US – Pass; Can – Pass
Thermal Cycling	Pass
Air Leakage Resistance #2 @ 75 Pa (1.6 psf)	US – Pass; Can – A3
Air Leakage Resistance #2 @ 300 Pa (6.3 psf)	US – Pass; Can – A3
Water Penetration Resistance #2 (Static & Cyclic)	720 Pa (15.0 psf)
Uniform Load – Structural	2880 Pa (60.2 psf)
Forced Entry Resistance	Gr. 20
Sash Vertical Deflection	Pass
Sash and Hardware Load Test	Pass
Sash/leaf Torsion Test	Pass
Thermoplastic Corner Weld Test	N/A

Details of the tested results can be found in Section 7 of this report.

Primary and Secondary Designations are as indicated below:

Enermax 150 Series Casement Window
Class AW – PG40 – Size Tested 905 x 1510 mm (36 x 59 in) – Type C

Secondary Designator
Positive Design Pressure = 1920 Pa (40.1 psf)
Negative Design Pressure = 1920 Pa (40.1 psf)
Water Penetration Resistance = 720 Pa (15.0 psf)
Canadian Air Leakage Resistance = A3

SECTION 2
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SECTION 3
OBJECTIVE

Intertek Testing Services NA Ltd. (Intertek) has conducted testing for **Grandview EA Building Systems** (Grandview) on a 905 mm (35.6") x 1510 mm (59.4") Enermax 150 Series Casement Window System. Testing was conducted in accordance with following standard / specification:

- AAMA/WDMA/CSA 101/I.S.2/ A440-11 *"Standard/Specification for windows, doors, and unit skylights"* (NAFS-11)
- A440S1-17 *"Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights"* (A440S1-17)
- AAMA/WDMA/CSA 101/I.S.2/ A440-17 *"Standard/Specification for windows, doors, and unit skylights"* (NAFS-17)
- A440S1-19 *"Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440, NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights"* (A440S1-19)

This evaluation was started on June 18, 2020 and completed on July 8, 2020.

SECTION 4
SAMPLE ASSEMBLY AND DESCRIPTION

Manufacturer Information	Grandview EA Building Systems 579–999 West Broadway Vancouver, BC V5Z 1K5 Canada
Model Name	• Enermax 150 Series Casement Window
Installation	• Test Buck: Test Buck: 2x8 #2 & better spf, box w/ 2x12, #2 & better spf, cladding, butt joints secured with 2x #8 x 3" flat head screws. The 2x12 clad was also butt jointed together with 4x #8 x 3" flat head screws and secured to the 2x8 with #8 x 3" flat head screws at least at every 305 mm (12"). An aluminum skin membrane was used over the entire test buck. • The head and sill are secured with a length of aluminum angle, approximately 2" x 1", 0.125" thick. Each angle is secured to the test buck with 3x #10 x 1-1/2" wafer head self-taping screws. Each angle is secured to the window frame with 3x #10 x 3/4" wafer head self-tapping screws. The jambs were not secured to the test buck with fasteners. • Backer rod and silicone were used to seal the rough opening of the buck on the interior and exterior full perimeter.

Size	• Overall Size:
	  • Width: 905 mm (35.6")
	  • Height: 1510 mm (59.4")

Frame	• Material: Aluminum with thermal struts • Corners: Mitre cut and secured with aluminum corner key, adhesive and 4x rivets. • Reinforcement: None

Operable Sash	• Material: Aluminum with thermal struts
	• Corners: Mitre cut and secured with aluminum corner key, adhesive and 4x rivets.
	• The limiters restricted the travel of the sash to approximately 100 mm (4”) from the closed position.
	• Sash Size:
	  • Width: 855 mm (33.7")
	  • Height: 1448 mm (57.0")

Locks and Hardware	• Multi-point (3-point) lock system controlled through a lock handle set located at approximately 724 mm (28-1/2”) from the bottom of the sash.
	  • Tie bar with 3 locking points slides in locking stile of the sash profile.
	  • Keepers: 3x keepers used on the locking jamb of the frame, centered approximately 165 mm (6-1/2”) from the inside edge of the head, and 57 mm (7”) and 664 mm (26-1/8”) from the inside edge of the sill. Each keeper is secured with 4x #8 x 5/8” flat-head self-tapping screws. Silicone is used for each screw.
	• A continuous hinge is used along the entire length of hinge side of the frame and sash. Secured to the frame with 21x 3/4” flat-head self-tapping screws, and the sash with 21x #8 x 1/2” flat-head self-tapping screws. The backside of the hinge is sealed to the sash with silicone.
	• 2x Limiter devices were used, one on the top and one on the bottom of the sash. Secured to each the frame with 3x #8 x 3/4” flat-head self-tapping screws, and to the sash with 3x #8 x 1/2" flat-head self-tapping screws.
	• A sash riser block is secured to the sill of the frame with 2x #8 x 1” flat head self-tapping screws. Centered approximately 32 mm (1-1/4”) from the locking side jamb.

Drainage	• 2x 3.5 mm (0.13”) diameter venting holes in to the sill, vertically. Holes are located approximately 203 mm (8”) from the inside edge of the hinge side jamb, and 64 mm (2-1/2”) from the locking side jamb. • 2x 8 mm (0.32”) diameter venting holes, 1x in to each jamb, approximately (6”) from the inside edge of the head.
Weather-strip	• The frame has 2x perimeters of exterior facing hollow bulb gaskets, inserted into a t-slot of the frame profile, each applied as 4 strips, mitre joined and welded at the corners. • The sash has 4x lengths of a fin seal gasket, inserted into a t-slot of the black pvc profile on the sash. The corners are overlapped with the intersecting gasket.

Glazing	• IGU specification:
	  • 6 mm / 6 mm clear annealed glass with a 12 mm (1/2”) spacer bar, sealed using polyisobutylene.
	  • Overall thickness, 24 mm (~1")
	• Laid-in, exterior glazed on top of a full perimeter of a closed cell foam glazing tape, approximately 6 mm (0.25”) x 11 mm (0.43”) applied as four strips with the corners butted. A cap bead of silicone was used around the entire interior perimeter between the glass and sash. The exterior side of the unit has a full perimeter of silicone over a foam backer rod.
	• Glazing Blocks: Black neoprene setting blocks, approximately 51 mm (2”) x 25 mm (1”) x 5 mm (0.20”). 2x at the bottom locking side corner, 1x on the side, 1x on the bottom. 2x on the top hinge side corner, 1x on the side, 1x on the top.
	• Glazing Stops: None

Drawings	• Copy of drawings supplied by Grandview EA Building Systems included in Appendix A.

SECTION 5
TESTING AND EVALUATION METHODS

OPERATING FORCE

The Operating Force Test was performed on the sash and latch in accordance with ASTM E2068-00(2016). The forces required initiate motion of the operable panel from both the fully open and fully closed positions, as well as the force required to maintain motion to the opposite limits of travel, were measured. The forces required to open and close the latches were also recorded.

AIR LEAKAGE RESISTANCE

The Air Leakage Resistance test was performed in accordance with ASTM E283-04(2012), *"Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen"*. Air infiltration and exfiltration tests were performed using test pressures of 75 Pa (1.57 psf). The maximum air leakage rate was calculated and compared to the allowable air leakage.

CYCLIC WATER PENETRATION RESISTANCE

The Cyclic Water Penetration Resistance Test was performed in accordance with ASTM E547-00(2016) *"Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference"* (ASTM E547). The test was performed using the specified pressure differential and a water spray rate of at least 204 L/m^2 per hour (5.0 U.S. gal/ft^2 per hour). Each cycle consisted of five minutes with the pressure applied and one minute with the pressure released, during which the water spray was continuously applied.

STATIC WATER PENETRATION RESISTANCE

The Static Water Penetration Resistance Test was performed in accordance with ASTM E331-00(2016) *"Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference"* (ASTM E331). The test was performed using the specified pressure differential and a water spray rate of at least 204 L/m^2 per hour (5.0 U.S. gal/ft^2 per hour). Duration of the test was 15 minutes, during which the water spray and air pressure was continuously applied.

UNIFORM LOAD DEFLECTION

The Uniform Load Deflection tests were conducted in accordance with ASTM E330/E330M-14 *"Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference"* (ASTM E330), Procedure A. The tests were performed in both the positive and negative directions. After a 10 second preload (50% of the test load), followed by 1 minute with the pressure released, the tests were conducted at the specified test pressure for a period of 10 seconds. Deflections were measured at the mid-span and at the ends. The end deflections were averaged and subtracted from the mid-span deflection (to eliminate deflections caused by movement at

the ends of the structural supporting members). Polyethylene film was used during the positive wind pressure sequences.

VENT / SASH / DOOR LEAF CYCLING (FIRST HALF)

The Vent / Sash / Door Leaf Cycling Test was performed in accordance with AAMA 910-16 *"Voluntary "Life Cycle" Specifications and Test Methods for AW Class Architectural Windows and Doors"* (AAMA 910). The Vent / Sash / Door Leaf was opened to at least 90° or the extent of its travel and then back to closed. This was performed for 2000 cycles where one cycle is considered the single action of open then close.

LOCKING HARDWARE CYCLING (FIRST HALF)

The Locking Hardware Cycling Test was performed in accordance with AAMA 910. Each of the locking hardware on the test specimen was operated for 2000 cycles where one cycle is considered the single action of 'lock' then 'unlock' positions.

MISUSE TEST

The Misuse test was performed in accordance with Section 3.6 of AAMA 910.

VENT / SASH / DOOR LEAF CYCLING (SECOND HALF)

The Vent / Sash / Door Leaf Cycling Test was performed in accordance with AAMA 910. The second half of this test was performed for 2000 cycles.

LOCKING HARDWARE CYCLING (SECOND HALF)

The Locking Hardware Cycling Test was performed in accordance with AAMA 910. The second half of this test was performed for 2000 cycles..

THERMAL CYCLING

The Thermal Cycling Test was performed in general accordance with AAMA 501.5 *"Test Method for Thermal Cycling of Exterior Walls"* following the cycle and temperature requirements in Section 3.7 of AAMA 910. The test consisted of six cycles of hot, 82°C (180°F) and cold, -18°C (0°F).

OPERATING FORCE #2

The Operating Force Test was repeated at the conclusion of the second half of the locking hardware cycling.

AIR LEAKAGE RESISTANCE #2

The Air Leakage Resistance test was repeated.

CYCLIC WATER PENETRATION RESISTANCE #2

The Cyclic Water Penetration Resistance test was repeated.

STATIC WATER PENETRATION RESISTANCE #2

The Static Water Penetration Resistance test was repeated.

UNIFORM LOAD STRUCTURAL

The Uniform Load Structural tests were conducted in accordance with ASTM E330/E330M-14 *"Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference"* (ASTM E330), Procedure A. After a 10 second preload (50% of test load), followed by 1 minute with the pressure released, the sample was subjected to a Uniform Load Structural test using a specified test pressure for a time of 10 seconds. The test was performed in both the positive and negative directions. After the test loads were released, the permanent deflections were recorded and the specimen was inspected for failure or permanent deformation of any part of the system that would cause any operational malfunction. Polyethylene film was used during the positive wind pressure sequences.

FORCED ENTRY RESISTANCE

The Forced-entry Resistance Test was conducted in accordance with ASTM F588-14 *"Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact"*. This included the Disassembly, Sash Manipulation, Lock Hardware Manipulation, and Assembly Tests.

SASH VERTICAL DEFLECTION TEST

The Sash Vertical Deflection Test was performed in accordance with Section 9.3.6.4.2 of NAFS-11. After the test load was released, the specimen was inspected for failure or permanent deformation of any part of the system that would cause any operational malfunction.

SASH AND HARDWARE LOAD TEST

The Sash and Hardware Load (distributed load) Test was performed in accordance with Section 9.3.6.5.2 of NAFS-11. After the test load was released, the specimen was inspected for failure or permanent deformation of any part of the system that would cause any operational malfunction.

SASH / LEAF TORSION TEST

The Sash / Leaf Torsion Test was performed in accordance with Section 7.3.4.2 of NAFS-11. After the test load was released, the specimen was inspected for failure or permanent deformation of any part of the system that would cause any operational malfunction.

DEVIATION FROM STANDARD METHOD

There were no noted deviations from the test standards used in the evaluation reported herein.

SECTION 6

TEST EQUIPMENT

Equipment used during testing is listed as follows:

Test	Equipment	Intertek ID#
Air Leakage Resistance, Water Penetration Resistance, and Uniform Load Deflection / Structural	Fenestration Testing Control Unit	60650
	Water spray assembly	60651
		60652
		60653
	20" Line Gauge	60673
		64928
		64926
Forced-entry Resistance	1000 lbs Load Cell	P60688
	200 lbs Load Cell	P60687
Sash Vertical Deflection Test, Sash/Leaf Torsion Test & Sash and Hardware Load Test	Digital Force Gauge	D2710
	Mitutoyo Digital Deflection Gauge	P60175

SECTION 7
RESULTS AND OBSERVATIONS

OPERATING FORCE

The forces required to operate the system:

Initiate Opening:	32.8 N (7.4 lbs)	Initiate Closing:	18.6 N (4.2 lbs)
Maintain Opening:	22.2 N (5.0 lbs)	Maintain Closing:	42.0 N (9.4 lbs)
Latch Opening:	58.6 N (13.2 lbs)	Latch Closing:	72.0 N (16.2 lbs)

Maximum allowable force to initiate motion:	155 N (34.9 lbs)
Maximum allowable force to maintain motion:	100 N (22.5 lbs)
Maximum allowable force to open and close latch:	100 N (22.5 lbs)

The tested specimen **met** the performance requirements of NAFS-11, NAFS-17, A440S1-17 and A440S1-19 for Operating Force.

AIR LEAKAGE RESISTANCE

Air test data is indicated in the following table:

Property	Test Pressure Pa (psf)	Area m^2 (ft^2)	Infiltration Rate L/s*m^2 (cfm/ft^2)	Exfiltration Rate L/s*m^2 (cfm/ft^2)	Compliance US (CAN)
Overall Assembly	75 (1.6)	1.37 (14.71)	0.02 (0.00)	0.01 (0.00)	Pass (A3)
Overall Assembly	300 (6.3)	1.37 (14.71)	0.18 (0.04)	0.20 (0.04)	Pass (A3)
Allowable Leakage Rates					
Maximum allowable air leakage rate (US):				1.5 L/s*m^2, 0.3 cfm/ft^2	
Maximum allowable air leakage rate (CAN – A3):				0.5 L/s*m^2, 0.1 cfm/ft^2	

The overall system **met** the US and Canadian performance requirements as reported above when evaluated under NAFS-11, NAFS-17, A440S1-17 and A440-S1-19.

CYCLIC WATER PENETRATION RESISTANCE

During the 24-minute test period, using a pressure differential of 720 Pa (15.0 psf), there was no water leakage observed. The system met the **(CAN) PG100** Water Penetration Resistance performance requirements under NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

STATIC WATER PENETRATION RESISTANCE

During the 15-minute test period, using a pressure differential of 720 Pa (15.0 psf), there was no water leakage observed. The system met the **(CAN) PG100** Water Penetration Resistance performance requirements under NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

VENT / SASH / DOOR LEAF CYCLING (FIRST HALF)

After 2000 cycles, there was found to be no failure or permanent deformation to the system that would cause any operational malfunction. The system **met** the Vent / Cycling / Door Leaf Cycling performance requirements of AAMA 910.

LOCKING HARDWARE CYCLING (FIRST HALF)

After 2000 cycles, there was found to be no failure or permanent deformation to the system that would cause any operational malfunction. The system **met** the Locking Hardware Cycling performance requirements of AAMA 910.

MISUSE TEST

After the loads were removed, there was found to be no failure or permanent deformation to the system that would cause any operational malfunction. The system **met** the Misuse test performance requirements of AAMA 910.

VENT / SASH / DOOR LEAF CYCLING (SECOND HALF)

After 2000 cycles, there was found to be no failure or permanent deformation to the system that would cause any operational malfunction. The system **met** the Vent / Cycling / Door Leaf Cycling performance requirements of AAMA 910.

LOCKING HARDWARE CYCLING (SECOND HALF)

After 2000 cycles, there was found to be no failure or permanent deformation to the system that would cause any operational malfunction. The system **met** the Locking Hardware Cycling performance requirements of AAMA 910.

OPERATING FORCE #2

The forces required to operate the system:

Initiate Opening:	34.6 N (7.8 lbs)	Initiate Closing:	20.8 N (4.7 lbs)
Maintain Opening:	20.0 N (4.7 lbs)	Maintain Closing:	46.6 N (10.5 lbs)
Latch Opening:	68.2 N (15.3 lbs)	Latch Closing:	75.4 N (17.0 lbs)

Maximum allowable force to initiate motion:	155 N (34.9 lbs)
Maximum allowable force to maintain motion:	100 N (22.5 lbs)
Maximum allowable force to open and close latch:	100 N (22.5 lbs)

The tested specimen **met** the performance requirements of NAFS-11, NAFS-17, A440S1-17 and A440S1-19 for Operating Force.

THERMAL CYCLING

No. of Cycles	Exterior Conditions		Interior Conditions
	Hot Temperature	Cold Temperature	
6	82°C (180°F)	-18°C (0°F)	24°C (74°F)

Upon completion of the thermal cycling, there was found to be no failure or permanent deformation due to the expansion and contraction of the system that would cause any operational malfunction. The system **met** the Thermal Cycling performance requirements of AAMA 910.

UNIFORM LOAD – DEFLECTION

Uniform Load Deflection data:
Locking stile span, L = 1440 mm (56.69")
Deflection limit, L/175 = 8.23 mm (0.32")

Test Pressure, Pa (psf)	Deflection Measurements, mm (in.)				Compliance
	Positive		Negative		
	Deflection	Residual	Deflection	Residual	
1920 (40.1)	1.40 (0.06)	0.01 (0.00)	2.14 (0.08)	0.03 (0.00)	Pass **DP40**

After the test loads were released, the specimen was inspected and there was found to be no failure or permanent deformation of any part of the window system that would cause any operational malfunction. The system met the deflection requirements for **DP40** Uniform Load performance requirements under NAFS-11 and NAFS-17.

AIR LEAKAGE RESISTANCE #2

Air test data is indicated in the following table:

Property	Test Pressure Pa (psf)	Area m^2 (ft^2)	Infiltration Rate L/s*m^2 (cfm/ft^2)	Exfiltration Rate L/s*m^2 (cfm/ft^2)	Compliance US (CAN)
Overall Assembly	75 (1.6)	1.40 (15.02)	0.03 (0.01)	0.04 (0.01)	Pass (A3)
Overall Assembly	300 (6.3)	1.40 (15.02)	0.01 (0.00)	0.06 (0.01)	Pass (A3)
Allowable Leakage Rates					
Maximum allowable air leakage rate (US):				1.5 L/s*m^2, 0.3 cfm/ft^2	
Maximum allowable air leakage rate (CAN – A3):				0.5 L/s*m^2, 0.1 cfm/ft^2	

The overall system **met** the US and Canadian performance requirements as reported above when evaluated under NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

CYCLIC WATER PENETRATION RESISTANCE #2

During the 24-minute test period, using a pressure differential of 720 Pa (15.0 psf), there was no water leakage observed. The system met the **(CAN) PG100** Water Penetration Resistance performance requirements under NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

STATIC WATER PENETRATION RESISTANCE #2

During the 15-minute test period, using a pressure differential of 720 Pa (15.0 psf), there was no water leakage observed. The system met the **(CAN) PG100** Water Penetration Resistance performance requirements under NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

UNIFORM LOAD – STRUCTURAL

Uniform Load Structural data:

Jamb span, L = 1440 mm (56.69")

Residual deflection limit, L*0.2% = 2.88 mm (0.11")

Test Pressure, Pa (psf)	Deflection Measurements, mm (in.)		Compliance
	Positive – Residual	Negative - Residual	
2880 (60.1)	0.03 (0.00)	0.00 (0.00)	Pass **DP40**

After the test loads were released, the specimen was inspected and there was found to be no failure or permanent deformation of any part of the window system that would cause any operational malfunction. The system met the structural requirements for **DP40** Uniform Load performance requirements under NAFS-11 and NAFS-17.

FORCED ENTRY RESISTANCE

Attempts to gain entry by opening the glazing panel, in accordance with the Disassembly and Sash Manipulation tests for a Type B assembly, were unsuccessful. The system met the **Grade 20** Forced-entry Resistance performance requirements of NAFS-11 and NAFS-17.

SASH VERTICAL DEFLECTION TEST

Test Load	Max. Deflection	Max. Allowable Deflection
270 N (61 lbs)	1.85 mm (0.07”)	17.1 mm (0.67”)

After the test load was released the specimen was inspected for failure or permanent deformation that would impair with the operation of the system. The system **met** the performance requirements of and NAFS-11 and NAFS-17 for the Sash Vertical Deflection test.

SASH AND HARDWARE LOAD TEST

After the test load was released it was found that the hardware was strong enough to support the 300 Pa (6.3 psf) load over the 10 second period. The system **met** the performance requirements of and NAFS-11 and NAFS-17 for the Sash and Hardware Load Test.

SASH / LEAF TORSION TEST

Test Load	Max. Deflection	Max. Allowable Deflection
90 N (20 lbs)	0.56 mm (0.02”)	70.1 mm (2.76”)

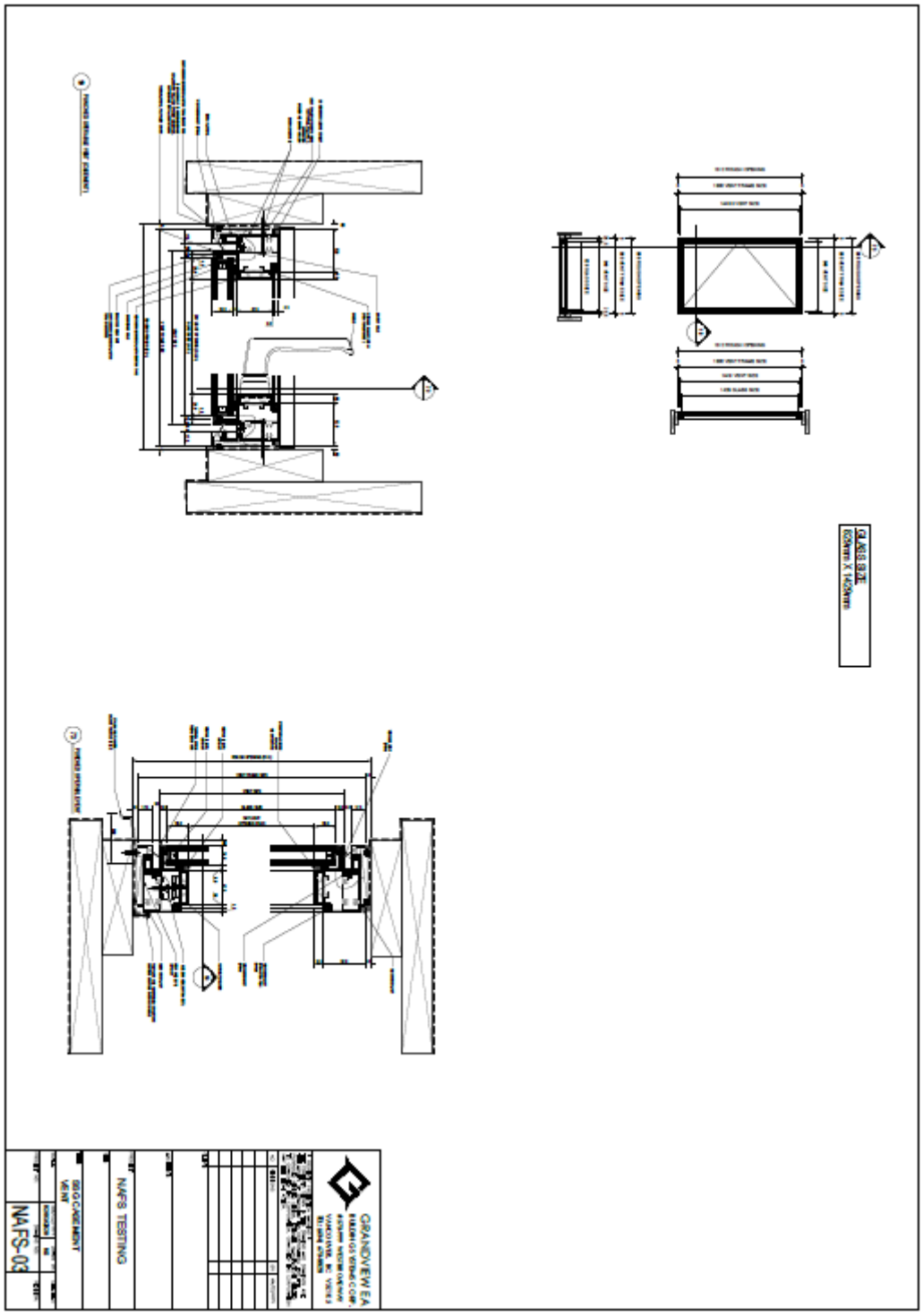
After the test load was released the specimen was inspected for failure or permanent deformation that would impair with the operation of the system. The system **met** the performance requirements of and NAFS-11 and NAFS-17 for the Sash/Leaf Torsion Test.

SECTION 8
CONCLUSION

The Enermax 150 Series Casement Window System, submitted by Grandview EA Building Systems, tested and described within this report, achieved the overall performance requirements **of Class AW – PG40** when tested in accordance with NAFS-11, NAFS-17, A440S1-17 and A440S1-19.

SECTION 9

APPENDIX A: DRAWINGS
(11 Pages)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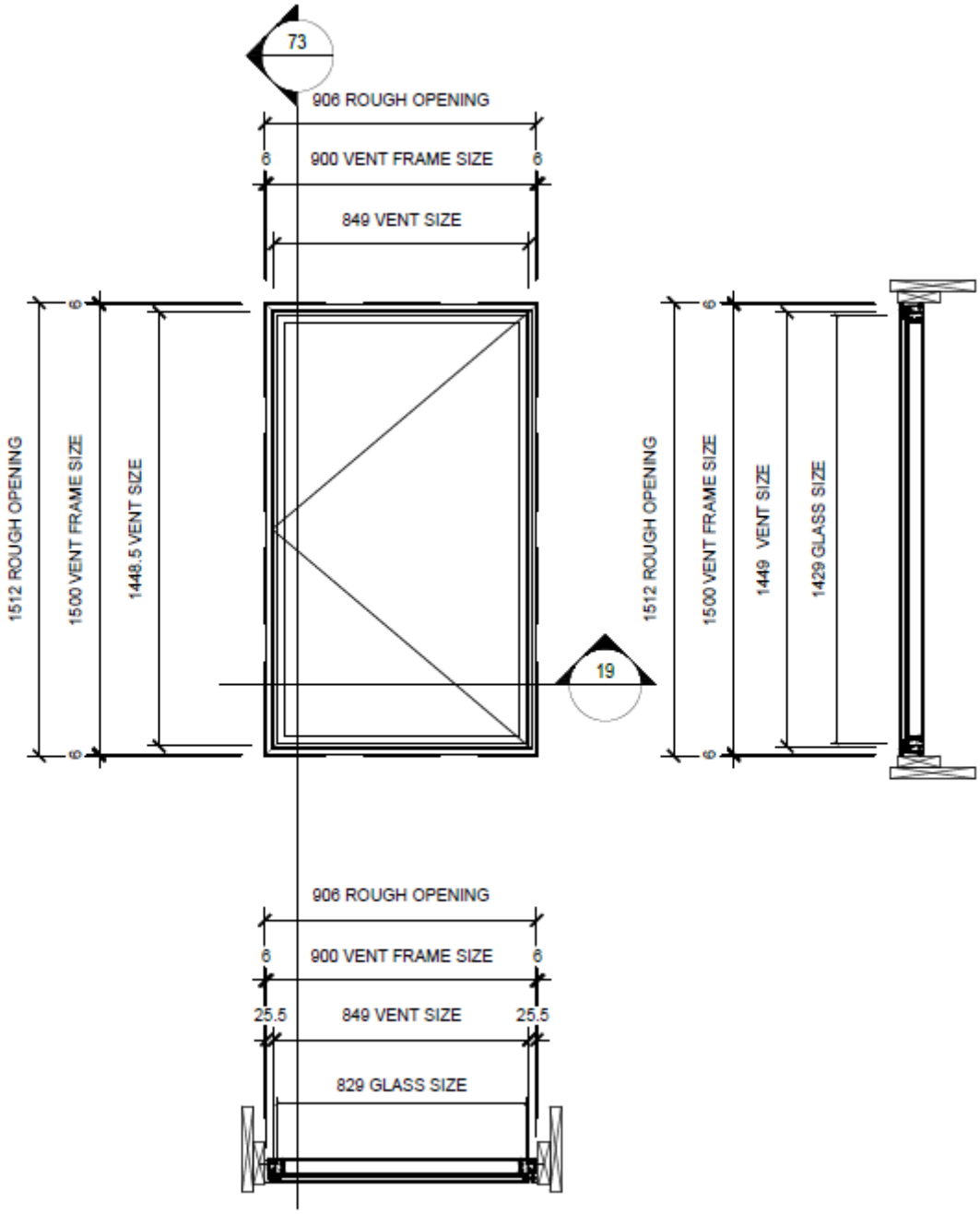
GRANDVIEW EA
NAFS TESTING
SEG CASEMENT
NAFS-03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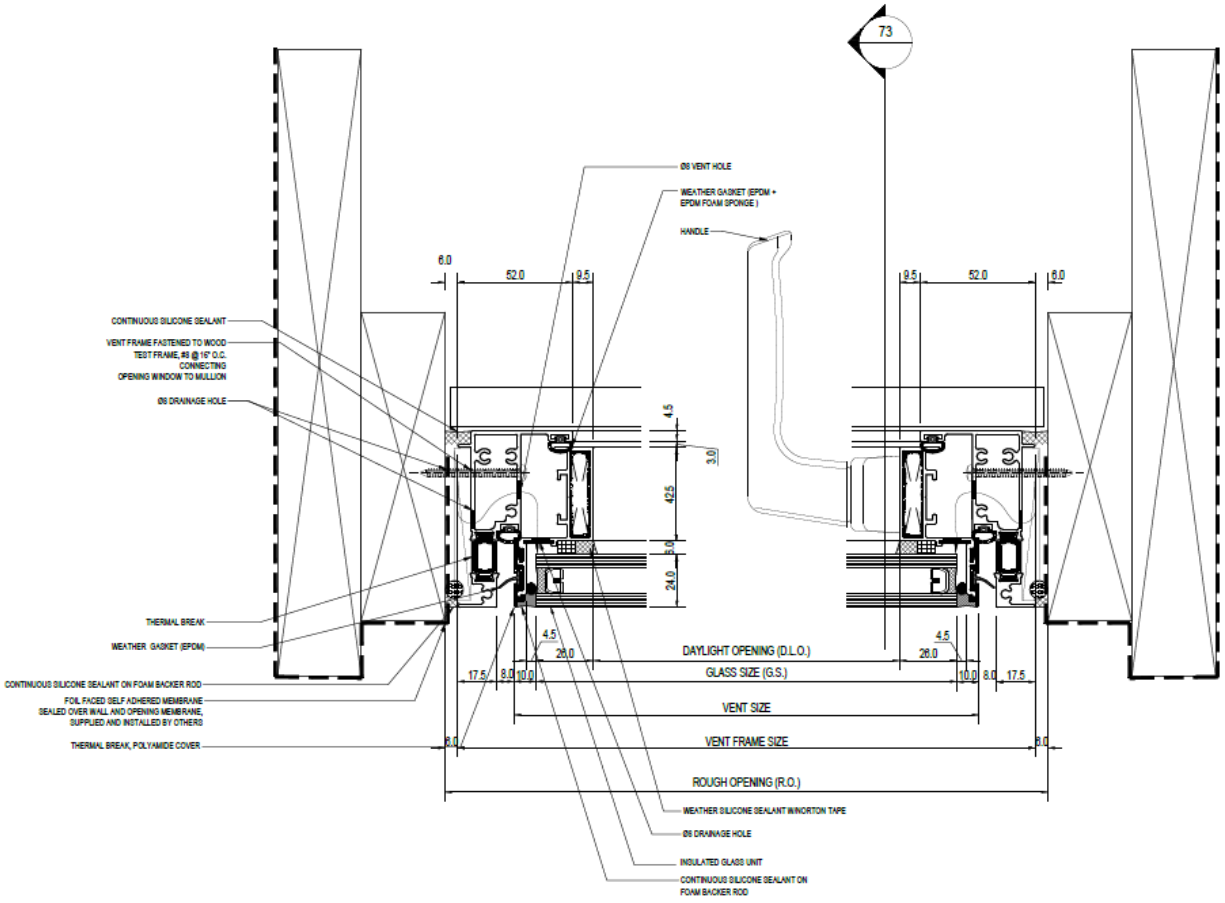
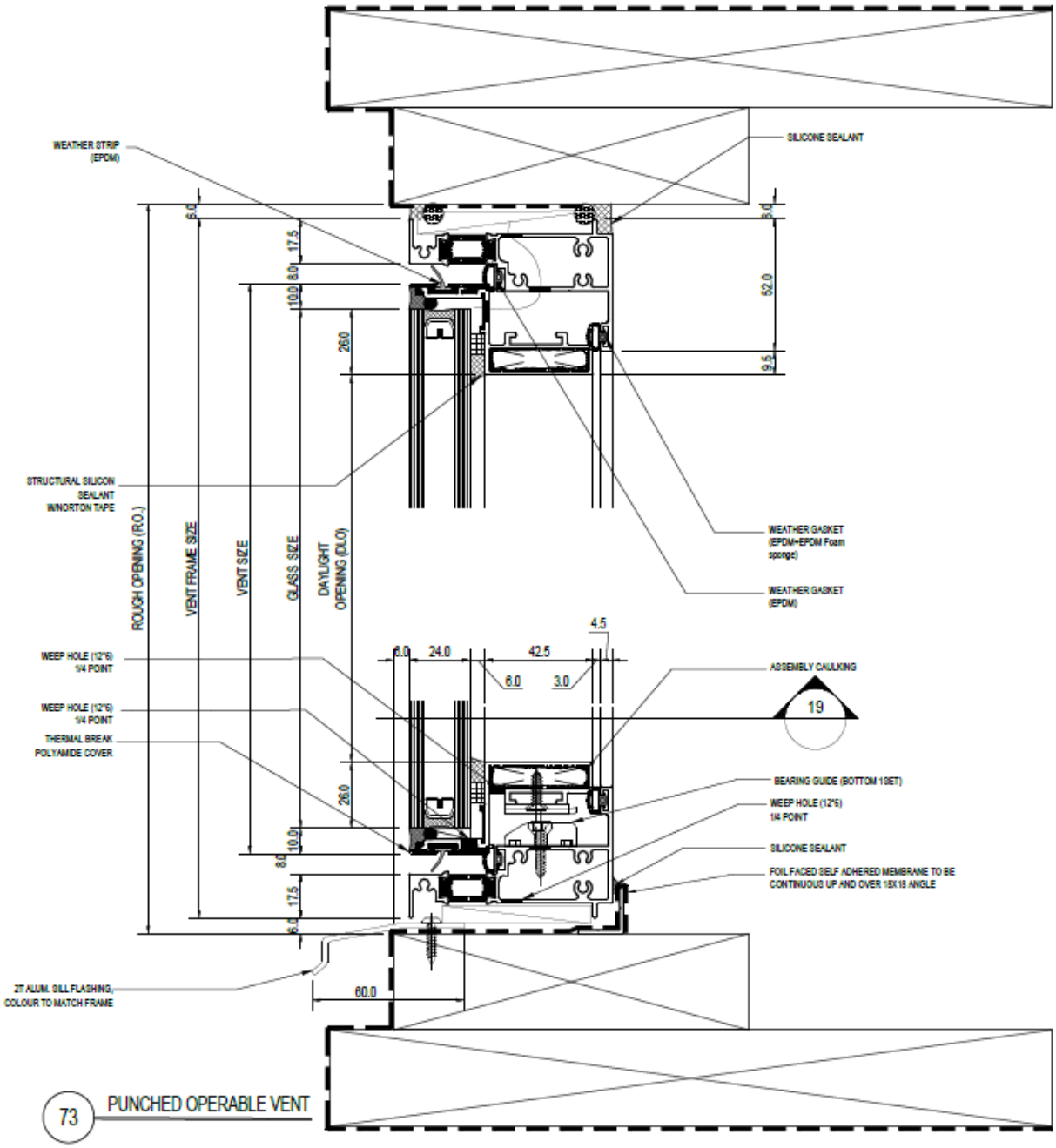
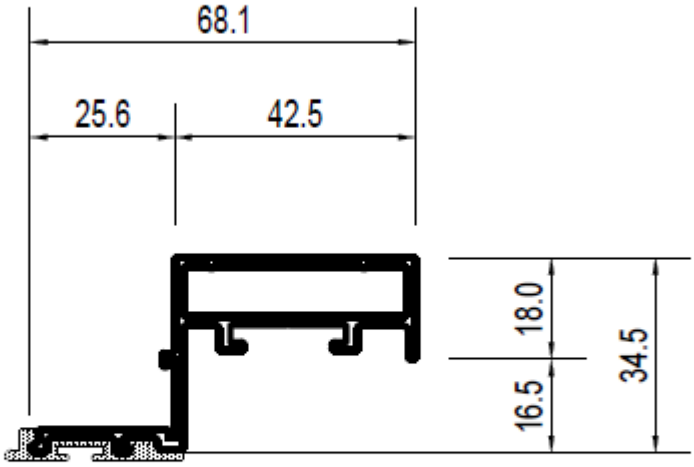


19 PUNCHED OPERABLE VENT (CASEMENT)

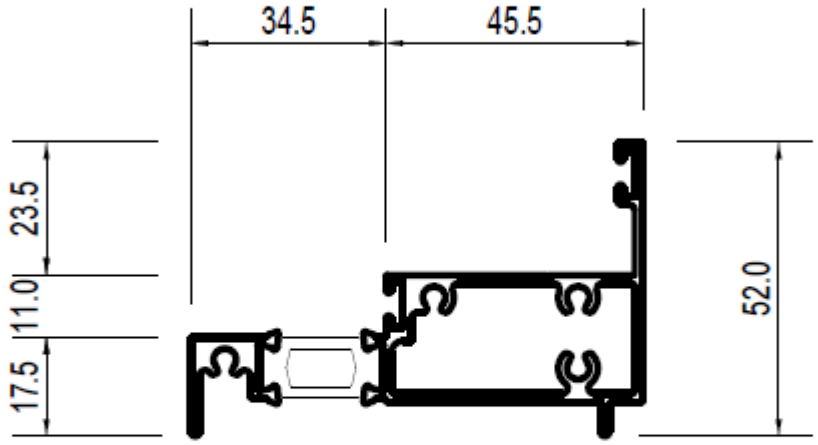

WEATHER STRIP (EPDM)
SILICONE SEALANT
STRUCTURAL SILICON SEALANT W/NORTON TAPE
ROUGH OPENING (R.O.)
VENT FRAME SIZE
VENT SIZE
GLASS SIZE
DAYLIGHT OPENING (DLO)
WEATHER GASKET (EPDM+EPDM Foam sponge)
WEATHER GASKET (EPDM)
WEEP HOLE (12"ö) 1/4 POINT
WEEP HOLE (12"ö) 1/4 POINT
THERMAL BREAK POLYAMIDE COVER
ASSEMBLY CAULKING
19
BEARING GUIDE (BOTTOM ISET)
WEEP HOLE (12"ö) 1/4 POINT
SILICONE SEALANT
FOIL FACED SELF ADHERED MEMBRANE TO BE CONTINUOUS UP AND OVER 18X18 ANGLE
ZT ALUM. SILL FLASHING, COLOUR TO MATCH FRAME
60.0
73
PUNCHED OPERABLE VENT

SVF



SHAPE NAME	VENT	SHAPE NO	CW-EXPC027
FINISH	PVDF-3		

VFM



VFMa
CW-EXPC044A

VFMb
CW-EXPC044B

SHAPE NAME	VENT FRAME	SHAPE NO	CW-EXPC044
FINISH	PVDF-3		
ALLOY&TEMP	A6063-T5		

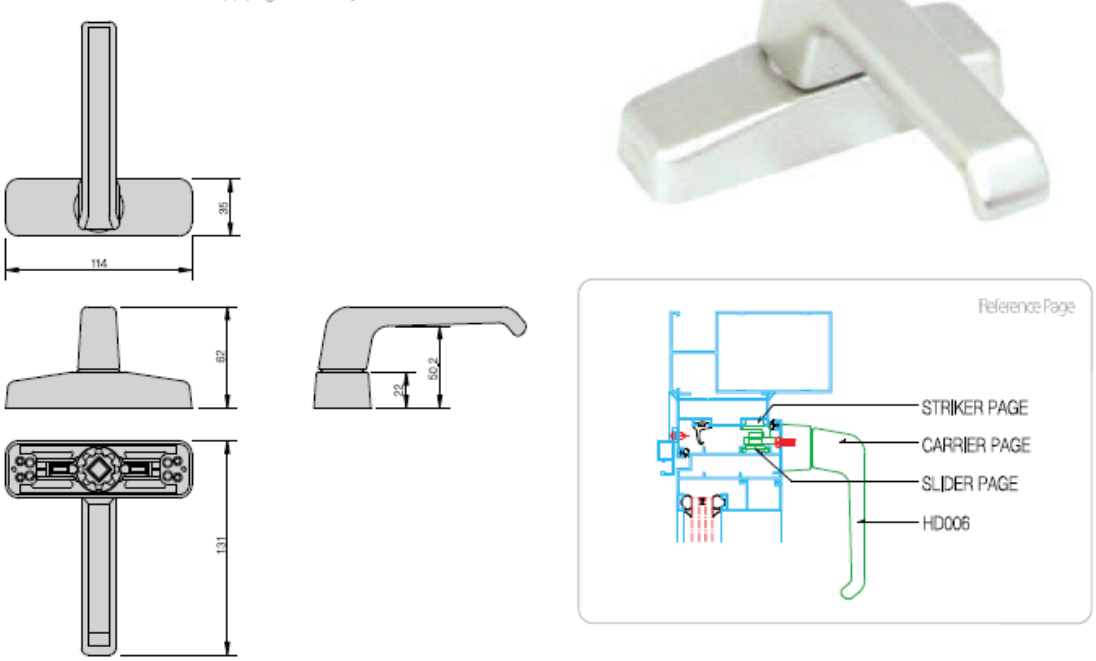
MULTI HANDLE

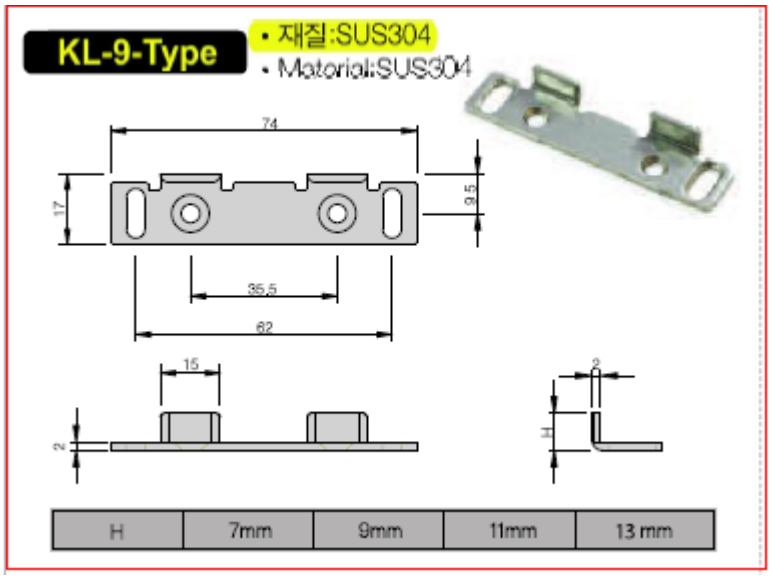
WATA® window & door hardware

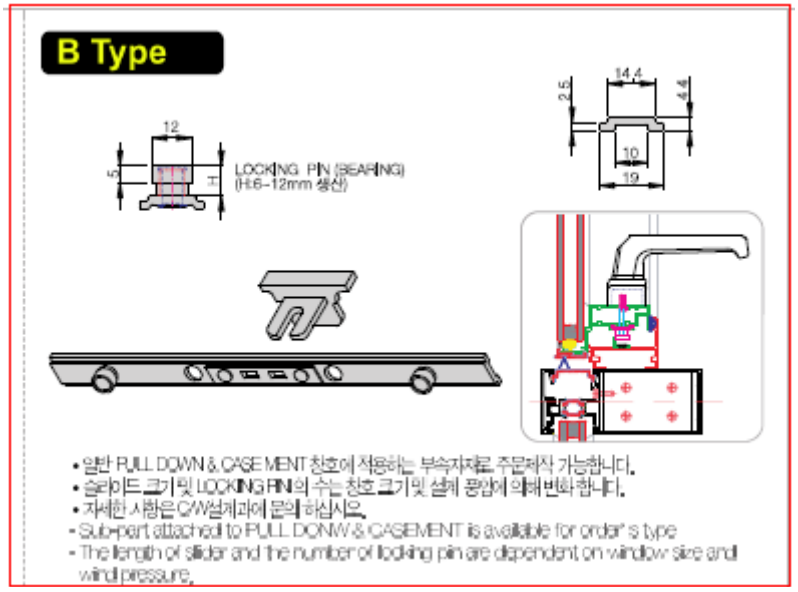
HD006 MH-T/T 적용시 ART-100

- 일반적인 멀티핸들
- 핸들 취부도 및 VENT 가공도는 C/W설계과에 문의 하십시오. • MH-T/T 적용시 반드시 ART-100을 사용

- Standard type.
- Need to consult with C/W design team on drawings for attaching handle and processing vent.
- Need to use the ART-100 when applying to MH-TT.




KL-9-Type
• 재질:SUS304
• Material:SUS304
74
17
9.5
35.5
62
15
2
2
H
H
7mm
9mm
11mm
13 mm


B Type
12
5
H
LOCKING PIN (BEARING)
(H:6~12mm 생산)
14.4
2.5
4.4
10
19
• 알반 PULL DOWN & CASEMENT 창호에 적용하는 부속자재로 주문제작 가능합니다.
• 슬라이드 크기및 LOCKING PIN의 수는 창호 크기및 설계 풍압에 의해변화 합니다.
• 자세한 사항은 C/W설계과에 문의 하십시오.
- Sub-part attached to PULL DOWN & CASEMENT is available for order's type
- The length of slider and the number of locking pin are dependent on window size and wind pressure.

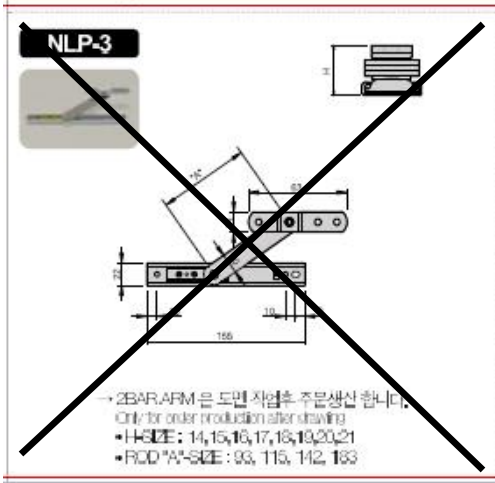
ETC (SUB PARTS)

WATA® window & door hardware

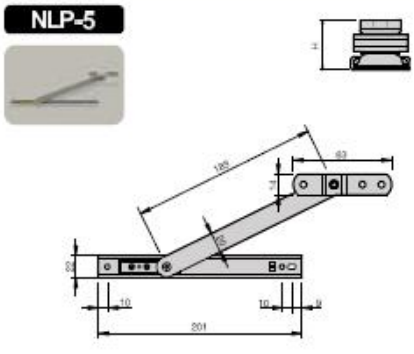
2BAR ARM의 작동 원리(내부 구조) I 2BAR ARM's Functioning Process(Formation)

- 보조암은 보통 상기 예시와 같이 창호의 오픈각도 및 창호 오픈상태에서 자재를 보호해 주는 역할을 합니다.(상기 그림 참조)
- 우측 그림과 같이 슬라이드상의 스크류의 조절을 통해 플라스틱 부품을 SUS트랙과의 마찰력을 조절하여 창호의 적절한 개폐압을 제어해 주는 핵심 부품입니다.
- 주로 CASEMENT 창호에서는 창호의 개폐력 제어와 최대오픈각도 조절용으로 많이 사용합니다.
- PROJECT 창호에서도 CASEMENT 창호와 동일하나 상부에 HINGE가 아닌 SHAFT형 4BAR ARM을 보조역할을 수행하며 높이가 큰 창호에 와풍에 의한 창호 슬래밍 현상을 방지하기 위해서도 사용가능합니다.
- PULL DOWN창호에서도 CASEMENT와 동일한 역할을 수행하며 창호 열림시 속도제어를 통해 사용자의 부상을 예방할 수 있습니다.
- 리모한 스크류 조절은 개폐 불능 또는 하드웨어 파손이 발생할 수 있습니다.

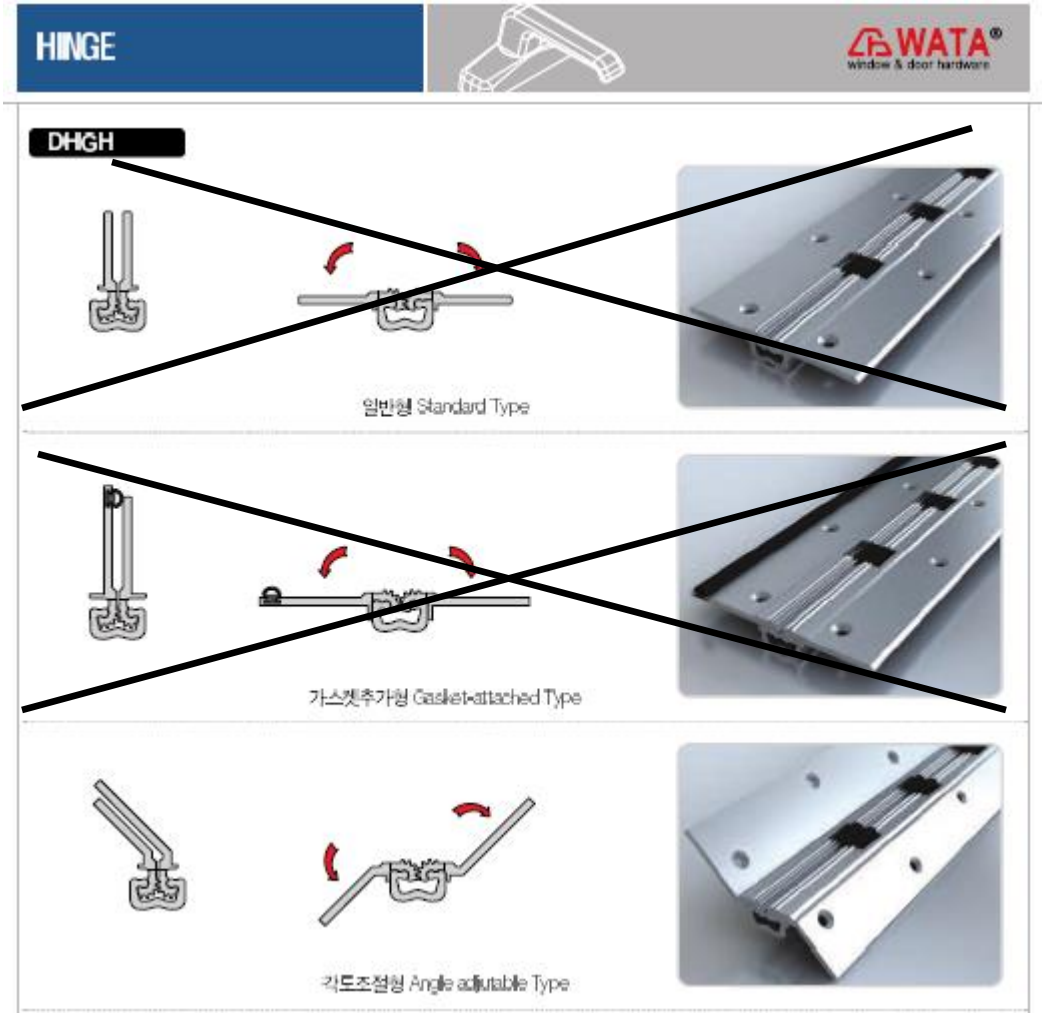
- Supporting ARM is fitted for keeping the window opening as the above image shows.
- Right image shows screwing to adjust friction between SUS track and plastic face of ARM for normal open and close.
- As for CASEMENT window, mainly used for controlling of open and close, and adjusting maximum open angle.
- As for PROJECT window, supporting ARM is used to brace SHAFT TYPE 4BAR ARM for preventing high window dropping by wind.
- As for PULLDOWN window, supporting ARM is used to adjust the speed of window for user's safety.



→ 2BAR ARM 은 도면 작업후 주문생산 합니다.
Only for order production after drawing
- H-SIZE : 14, 15, 16, 17, 18, 19, 20, 21
- ROD "A"-SIZE : 93, 115, 142, 183



→ 2BAR ARM 은 도면 작업후 주문생산 합니다.
Only for order production after drawing
- H-SIZE : 14, 15, 16, 17, 18, 19, 20, 21

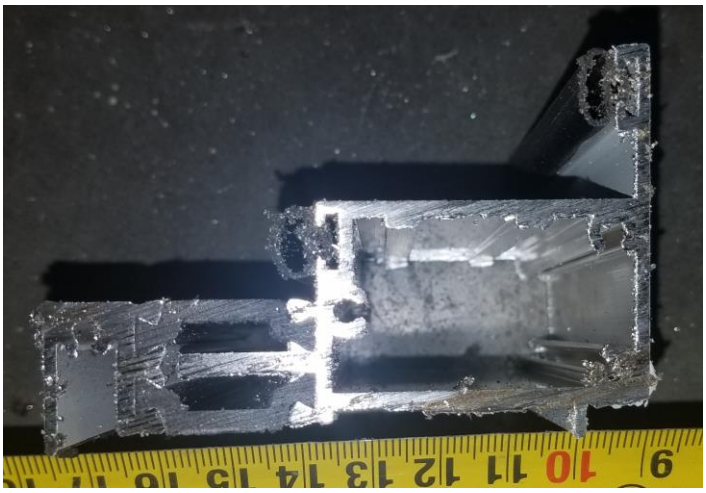

HINGE
WATA
window & door hardware
DHGH
일반형 Standard Type
가스켓추가형 Gasket-attached Type
각도조절형 Angle adjustable Type

Enermax 150 Series Casement Window – Parts List	
Glazing silicone	Dow Corning - CWS
Glazing tape	CRL - Norton Tape – V2100
Frame bulb weather-stripping	Hankook – CHGA-01
Sash fin weather-stripping	Hankook – CHUO-G12

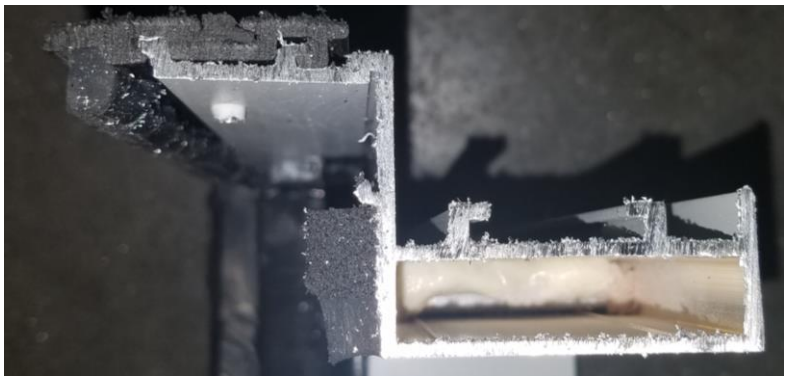
SECTION 10

APPENDIX B: PHOTOGRAPHS
(7 Pages)

Enermax 150 Series Fixed Window – Interior & Exterior



Frame profile



Sash assembly

Sash corner joint rivets

Locking handle and mid-point keeper

Multi-point locking bar

Sash limiter, riser block and bottom keeper

Sash limiter on the sash

Continuous hinge

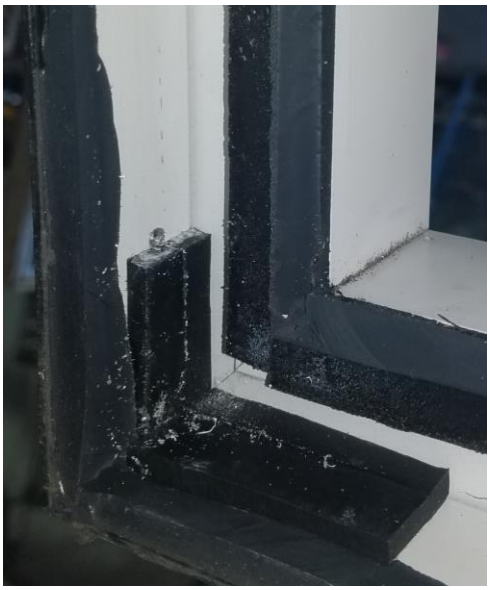
Top keeper and vent hole

Venting hole in the sill

Exterior glazing silicone

Interior glazing silicone

Exterior glazing silicone and interior glazing tape and silicone



Setting blocks

Sash corner weather-stripping corner

Frame weather-stripping corner

Weather-stripping profile

SECTION 11

APPENDIX C: REVISION TABLE
(1 Page)

Revision Table				
Date	**Section**	**Description**	**Technician**	**Reviewer**
28-Jul-2020	---	Original Issue Date	---	---