

PART 1 – GENERAL

1.1 Work Included

- 1.1.1 Supply and installation of Automatic Vertically Retractable Acoustical Wall(s) as shown on the architectural drawings. All necessary hardware, seals, lifting machinery, electrical controls are included.

1.2 Related Work (NOT INCLUDED)

- 1.2.1 The main support steel beam for the wall, as well as the miscellaneous support steel for the lifting machinery for the Automatic Vertically Retractable Acoustical Wall – Section _____ .
- 1.2.2 Ceiling storage pockets along axis of Automatic Vertically Retractable Acoustical Wall – Section _____ .
- 1.2.3 Bulkheads and sound insulation above, below, and in the fixed walls at both ends of the Automatic Vertically Retractable Acoustical Wall, as per ASTM E557 - Section _____ .
- 1.2.4 All site wiring and connections for main power, including disconnect switches at each motor location. All site wiring and connections for control, including installation of key switches – Section _____ .

1.3 System Description

1.3.1 Definition

- 1.3.1.1 Automatic Vertically Retractable Acoustical Wall (from here on called Operable Wall) shall refer specifically to acoustical operable walls that, when in the down position (closed) are hard, rigid, flat, plumb walls, made of a grid of rectangular acoustical panels, and when are lifted (opened), fold upward (vertically) without the use of any manual labor, in a manner similar to an accordion, into a pocket in the ceiling, between roof joists, or up between built in bulkheads. In the down (closed) position, the wall shall be comprised of two vertical planes of acoustical panels, separated by an acoustical air space.

The operable wall shall open and close in a manner similar to an accordion, in that all wall panels fold and unfold at the exact same time, at the exact same rate.

There are two types of drive systems available for the operable wall:

Standard Drive System:

The motor drive assembly is mounted directly above the centre line of the operable wall. Support steel is only required at one location.

Minimum wall length without modifying our system is 11'-3" (3430mm). Used for walls up to the following finished ceiling heights:

Skyfold® Classic 51™ 36'-0" (11000mm)

Skyfold Classic Models include: Skyfold® Classic 51™, Skyfold® Classic 55™, Skyfold® Classic 60™, Skyfold® Classic NRC™

Skyfold® Classic 55™	36'-0" (11000mm)
Skyfold® Classic 60™	28'-2" (8585mm)
Skyfold® Classic NRC™	36'-0" (11000mm)

Micro Drive System:

The motor drive assembly is mounted directly above the centre line of the operable wall. Support steel is only required in one location. The size restriction for the system is maximum 36'-0" (10,975mm) long x 9'-0" (2745 mm) to the finished ceiling (or smaller). Minimum wall length is 11'-10" (3605 mm).

- 1.3.1.2 The operable wall shall be opened and closed, in the standard scenario, using two push button switches wired in series with power controlled by a single, three position key switch, Or, in the optional scenario, using two touch screen operator stations. In the standard, push button scenario, turning the key from the "off" position shall cause the wall to move in the designated direction "up" or "down" once both push buttons are depressed. In the optional, touch screen scenario, pressing and holding the up or down directional arrow symbol on one touch screen while simultaneously pressing and holding the button symbol on the second screen shall cause the wall to move in the selected direction. In both scenarios, when hand pressure is removed, the wall shall immediately stop. The operable wall shall stop in a quick and positive fashion without coasting. As a normal part of the operation, it shall be possible to partially open (or close) the wall, stop it and then reverse the operation. There shall be two (2) switches per operable wall, located on opposite sides of the wall at opposite ends of the wall, wired in series. In the standard condition, one switch shall be equipped with an LED that flashes fault codes in case of a failure with the electrical system. In the optional, touch screen scenario, the screens will display faults in case of a failure with the electrical system.
- 1.3.1.3 From a fully open position, the operable wall shall be able to go through its entire cycle of closing and/or opening without any manual intervention.
- 1.3.1.4 When the operable wall is being lowered (closed) it shall come automatically to rest once it has reached the fully down (closed) position.
- 1.3.1.5 When the operable wall is being lifted (opened) it shall come automatically to rest once it has reached the fully up (open) position.
- 1.3.1.6 The operable wall shall automatically and acoustically seal against the floor without the need for any manual intervention. The floor seals shall leave a joint between the floor and the bottom acoustical panels of not more than approximately 2" (51 mm).
- 1.3.1.7 The operable wall shall automatically and acoustically seal against the two end walls without the need for any manual intervention. The end seals shall act in such a way as not to come into contact with the end walls while the operable wall is in motion. The end seals shall leave a joint between the acoustical panels and the end walls of no more than

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approximately 1" (25 mm). Seals that rub or brush against the end walls are not acceptable. Once the wall reaches the full down position, the end seals shall activate automatically. The key switch does not need to be held during the deployment of the ends seals.

- 1.3.1.8 The operable wall shall automatically and acoustically seal against the ceiling without any manual intervention. The top seals shall leave a joint between the top acoustical panels and the ceiling of the pocket of not more than approximately 2" (51 mm).
- 1.3.1.9 The operable wall shall open and close at an average speed of approximately 5 to 10 vertical feet per minute (1.5 to 3 meters per minute).
- 1.3.1.10 When the operable wall is being lowered (closed), it shall stop if the leading (bottom) edge comes into firm contact with any object between it and the floor. The wall will then automatically reverse its direction and ascend for approximately 3 seconds to clear the object. The regular operation of the wall can resume once the obstruction has been removed.
- 1.3.1.11 The operable wall shall be visibly flat and rigid in the down (closed) position.
- 1.3.1.12 There shall be no exposed hinges, brackets, screws, and no part of the mechanical system shall be visible when the operable wall is in the down (closed) position.
- 1.3.1.13 All of the panel edges shall be right angled, with a minimum radius not more than 1/16" (1.6 mm).
- 1.3.1.14 All of the panels shall be rectangular, nominally of the same size, unless requested otherwise by the architect.
- 1.3.1.15 Joints between panel, vertical and horizontal, shall be no more than approximately ½" (12.7 mm) wide.
- 1.3.1.16 For operable walls using the Micro Drive System, the operable wall shall stack in the up (open) position into a space no greater than 69" (1750mm) wide. For operable walls using the Standard Drive System, the operable wall shall stack in the up (open) position into a space no greater than 65" (1650mm) wide. The operable wall shall have a stacking height ratio in the range of 1:5 to 1:10, depending on the height of the wall.
- 1.3.1.17 Each acoustical panel shall be individually removable using only a screw driver. No special tools or equipment shall be required. The removal of a single acoustical panel shall not affect, dislocate or cause the removal of any adjacent panels or other acoustical panels.
- 1.3.1.18 The operable wall shall not weigh more than the following:

Skyfold® Classic 51™	~7.0 lbs per ft ² (34.2 kg per m ²)
Skyfold® Classic 55™	~7.6 lbs per ft ² (37.1 kg per m ²)

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Skyfold® Classic 60™ ~9.4 lbs per ft² (46.0 kg per m²)

Skyfold® Classic NRC™ ~7.5 lbs per ft² (36.6 kg per m²)

The preceding weights do not include the motor drive or the architectural finish on the acoustical panels and are based on 24'-0" long x 14'-1" high (7315mm x 4290mm) operable wall.

- 1.3.1.19 A completely functioning operable wall, tested in full accordance and compliance with ASTM E90 (ISO 140-3), shall achieve, from an independent laboratory, a Sound Transmission Class (STC) rating (Rw value) of not less than the following:

Skyfold® Classic 51™:

System STC 51 (Rw 51), Panel Construction STC 61 (Rw 60)

Skyfold® Classic 55™:

System STC 55 (Rw 54), Panel Construction STC 61(Rw 60)

Skyfold® Classic 60™:

System STC 60 (Rw 59), Panel Construction STC 66 (Rw 64)

Skyfold® Classic NRC™:

System STC 50 (Rw 49), Panel Construction STC 60 (Rw 58)

- 1.3.1.20 A completely functioning operable wall, tested in full accordance and compliance with ASTM C423 (ISO 354) shall achieve, from an independent laboratory, a Noise Reduction Coefficient (NRC)** rating of up to the following:

Skyfold® Classic NRC™ system: NRC 0.65 (SAC 0.65)

** only available on the Skyfold® Classic NRC™ system.

- 1.3.1.21 The operable wall shall be designed to have a design life of at least 10,000 complete closed to opened to closed cycles.

1.4. Quality Assurance

- 1.4.1. The products herein specified established the standard of quality for the operable wall based on the following Skyfold® Classic™ Automatic Vertically Retractable Acoustic Walls by Skyfold Inc. of Baie d'Urfe (Montréal), Québec, Canada:

Skyfold® Classic 51™: System STC 51 (Rw 51), Panel Construction STC 61 (Rw 60)

Skyfold® Classic 55™: System STC 55 (Rw 54), Panel Construction STC 61 (Rw 60)

Skyfold® Classic 60™: System STC 60 (Rw 59), Panel Construction STC 66 (Rw 64)

Skyfold® Classic NRC™: System STC 50 (Rw 49), Panel Construction STC 60 (Rw 58)

NRC up to 0.65 /SAC up to 0.65

Proposals for substitution of products or techniques not conforming to these specifications must be submitted at least ten (10) days prior to bidding. Independent test reports which meet the requirements and design specified herein must be submitted to obtain approval.

Skyfold Classic Models include: Skyfold® Classic 51™, Skyfold® Classic 55™, Skyfold® Classic 60™, Skyfold® Classic NRC™

- 1.4.2 All work and materials specified herein, shall be installed only by qualified representatives and/or installers and/or distributors of the manufacturer, according to the manufacturers written instructions.
- 1.4.3 The operable wall must be manufactured by a certified ISO-9001-2008 company or an equivalent quality control system.

1.5 References

- 1.5.1 ASTM E90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
Annex A1.15 Operable (Folding or Sliding Walls)
Annex A1.15.3 Operation – “The specimen shall not be designated an operable wall unless it opens and closes in a normal manner. It shall be fully opened and closed at least five times after installation is completed and tested without further adjustments.”
- 1.5.2 ASTM E413, Classification for Rating Sound Insulation.
- 1.5.3 ASTM E557, Standard Practice for Architectural Application and Insulation of Operable Partitions.
- 1.5.4 ISO 354, Measurement of Sound Absorption
- 1.5.5 ISO 140-3, Measurement of Airborne Sound Insulation
- 1.5.6 ASTM C423, Measurement of Sound Absorption

1.6 Submittals

- 1.6.1 Submit manufacturers' technical data for each type of operable wall specified herein.
- 1.6.2 Submit shop drawings showing complete layout of operable wall system based on field verified dimensions. The drawings shall include dimensional relationship to adjoining work. Include details indicating materials, finishes, tolerances, and methods of attachment to building steel and electrical requirements.
- 1.6.3 Submit certified test reports evidencing compliance to acoustical STC (Rw) requirements as specified in paragraph 1.3.2.19 and in accordance to references listed in paragraphs 1.5.1 and 1.5.5.

1.7 Site Conditions

- 1.7.1 The floor underneath the operable wall along its axis, shall be flat to within +/- 1/4" (6 mm) over the entire length of an operable wall. The peak to valley undulation of +/- 1/4" (6 mm) shall not be closer together than 24" (610 mm) and a peak to valley undulation of +/- 1/8" (3 mm) shall not be closer than 12" (305 mm).
- 1.7.2 Support steel above the operable wall along its axis shall be parallel to the floor within +/- 1/2" (12.7 mm) for the entire length of the operable wall. This includes

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loaded deflection. The beam must also be parallel to the centre line of the wall within $\pm 1/8"$ (3 mm), left to right.

1.7.3 The fixed walls at either end of the operable wall shall be within $+1/4"$ (6 mm)-0", from plumb vertical.

1.7.4 The fixed walls at either end of the operable wall shall be flat to within $+0"$, $-1/4"$ (6 mm).

1.8 Warranty

1.8.1 **Basic Warranty:** The operable wall shall be warranted free from defects in material and workmanship for a period of two (2) years or five thousand (5,000) cycles, whichever occurs first, from the date of shipment. Extended Parts Warranty (optional): An extended warranty on parts (excluding touch screen operator stations) is available in addition to the basic warranty. It includes coverage on all parts for a period of ten (10) years or five thousand (5,000) cycles, whichever occurs first from date of shipment. Refer to Owner's manual for full warranty details.

1.8.2 **Acoustical Performance:** The operable wall shall retain its acoustical properties for 10 years from the date of shipment providing proper maintenance has been performed on the operable wall.

1.8.3 Parts and labor required to maintain the operable wall and part subject to normal wear and tear are not covered under the warranty and are the owner's responsibility. (Refer to Maintenance Program).

PART 2 – PRODUCTS

2.1. Acceptable Manufacturer

2.1.1 Skyfold® Classic™ Automatic Vertically Retractable Acoustic Walls as manufactured by Skyfold Inc. of Baie d'Urfe (Montréal), Québec, Canada
E-mail: skyfold@skyfold.com
Web-site: www.skyfold.com

Skyfold® Classic 51™: System STC 51 (Rw 51), Panel Construction STC 61 (Rw 60)
Skyfold® Classic 55™: System STC 55 (Rw 54), Panel Construction STC 61 (Rw 60)
Skyfold® Classic 60™: System STC 60 (Rw 59), Panel Construction STC 66 (Rw 64)
Skyfold® Classic NRC™: System STC 50 (Rw 49), Panel Construction STC 60 (Rw 58)
NRC up to 0.65 /SAC up to 0.65

2.1.2 Alternate systems can be used if they meet or exceed the performance criteria outlined in Part 1 - General above and if they are approved according to the provisions of 1.4.1 above.

2.2 Materials

2.2.1 Acoustical Panels

Skyfold Classic Models include: Skyfold® Classic 51™, Skyfold® Classic 55™, Skyfold® Classic 60™, Skyfold® Classic NRC™

2.2.1.1 Acoustical panels shall be faced with steel that is compatible with a wide variety of architectural finishes such as paint, vinyl, fabric*, specialty metals, wood veneer, etc.

*Only acoustically transparent fabric finish for Skyfold® Classic NRC™.

2.2.1.2 Acoustical panels, together with all of the sound insulation, shall be, as much as possible, made of non-combustible or fire-treated materials.

2.2.1.3 Acoustical panels shall be fabricated to be as stiff as possible in order to satisfy the rigid criteria when the operable wall is down (closed) and to ensure that there is no interference between panels when the wall is in motion.

2.2.1.4 Acoustical panels shall be architecturally flat with no bowing, oil canning, warping, waviness or any other surface deformation and discontinuity.

2.2.1.5 Acoustical panels shall have the finish of the architect's choice, provided that the finish has been approved by the operable wall manufacturer to ensure compatibility with the wall panels. The following criteria must be met:

Maximum weight of material: 0.111 lbs/ft² (0.542 kg/m²)

Maximum thickness of material: 1/8" (3mm)

No brittle materials.

Finishes are railroaded onto the panels, applied horizontally along the panel length. Pricing will vary depending on finish selection.

*Only acoustically transparent fabric finish for Skyfold® Classic NRC™.

2.2.1.6 Acoustical panels shall meet the following STC ratings in accordance with ASTM E90 (ISO 140-3) specification as reported by an independent laboratory.

Skyfold Product	Panel Construction	Fully Automatic Operable wall
Skyfold® Classic 51™	61 STC (60 Rw)	51 STC (51 Rw)
Skyfold® Classic 55™	61 STC (60 Rw)	55 STC (54 Rw)
Skyfold® Classic 60™	66 STC (64 Rw)	60 STC (59 Rw)
Skyfold® Classic NRC™	60 STC (58 Rw)	50 STC (49 Rw)

2.2.2 Folding Mechanism

2.2.2.1 The hanging, folding and extension mechanism shall be, as much as possible, made from structural grade aluminum extrusions and structural shapes, in order to minimize the weight of the system.

2.2.2.2 All wear surfaces, such as bushings, spacers, pins, discs, bearings, and sleeves shall be designed to function quietly and with minimum wear, over the 10,000 cycle design life of the operable wall.

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2.2.2.3 The hangers, which fasten the lifting mechanism to the support steel, shall be fabricated from steel and shall be welded or bolted to the support steel supplied by others.

2.2.3 Motor Drive

2.2.3.1 The motor drive shall be sized properly so that it can open and close the wall effectively over the 10,000 cycle design life of the wall, at the minimum design speed specified in point 1.3.2.8.

2.2.3.2 The folding mechanism shall be designed to function as smoothly, quietly and safely as possible. Wherever possible, ball bearings shall be used instead of bushings and wear surfaces. In no circumstance shall chain or belt drive systems be acceptable.

2.2.3.3 There shall be a wire rope cable for every set of folding mechanism. This cable shall be of 6 x 31 construction aircraft cable and shall be made of galvanized steel. The diameter of the cables shall be sized so that they shall be able to hold the entire weight of the wall, with the appropriate safety factor.

2.2.3.4 The cable wraps on yoyo drums with 2 safety wraps and multiple layers of cable.

2.2.3.5 The line shaft, sized to deliver the required torque with minimum deflection, shall support and rotate the cable drums.

2.2.3.6 Flange bearings shall be used for the drive system, located immediately on both sides of the drum assembly.

2.2.3.7 The motor drive shall be sized to deliver sufficient amount of torque to safely and effectively raise and lower the operable wall over its design life.

2.2.3.8 The motor drive shall use the latest in industry standards in thermal protection, overload protection, quick acting fuses, etc., in order to ensure the safety and reliability of the system.

2.2.4. Safety Equipment

2.2.4.1 The operable wall shall employ an electromagnetic type of brake which shall activate firmly, without hesitation, when power is lost to the system. This brake shall have a minimum retarding torque rating equal to 200% of the motor drive's full load torque. The drive system shall be equipped with a manual override and a brake release lever.

2.2.4.2 The operable wall shall employ a dynamic brake, distinct and separate from the brake in 2.2.4.1, in order to lower the wall at a controlled speed of no more than approximately 150% of the normal down speed, in the case of a catastrophic failure in the motor drive's power train. Alternately, the operable wall shall employ a brake, distinct and separate from the brake in 2.2.4.1, in order to completely halt the downward motion of the wall in the case of a catastrophic failure in the power train.

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2.2.4.3 The operable wall shall employ electrical or other limit switches in order to stop the wall at its up and down travel limits.

2.2.4.4 The operable wall shall employ an over torque detector in order to sense a jam in the system and to act as an over travel limit in the up direction should the primary limit switch fail to act in 1.3.2.4. This over torque sensor shall be mechanical, using the motor's torque arm in its over torque detection.

2.2.4.5 The entire length of the bottom edge of the operable wall shall be equipped with a continuous pressure sensing strip which shall cut power to the motor drive and shall activate the brake outlined in 2.2.4.1, if the sensing edge comes in firm contact with an object, before the operable wall is in the full down (closed) position. The operable wall will automatically reverse direction and ascend for approximately 3 seconds to clear the obstruction. The power shall remain cut to the motor drive until the switches have been released. The operation of the operable wall can resume once the obstruction is removed.

2.2.5 Electrical

2.2.5.1 The operable wall shall be equipped for a three phase power supply to the electrical control box.

2.2.5.2 Standard electrical control box will be NEMA 1. NEMA 4 is also available upon request.

2.2.5.3 Low voltage wiring (by others). 18 gauge wiring from the switches to the control box.

2.2.5.4 Switches (standard): Two (2) push button switches wired in series with power controlled by a single, three position key switch. One push button switch shall be equipped with an LED that flashes fault codes in case of an electrical system failure. (Installation and wiring by others).
Touch Screen Operator Stations (optional): Two (2), 4.3" resistive LCD touch screens, wired in series with multilingual capabilities and 4-digit adjustable user pin. The screens will display faults in case of a failure with the electrical system. (wiring by others)

2.3. Fabrication

2.3.1 Factory assemble all components, assemblies and systems into the largest possible assemblies in order to minimize the amount of assembly on site.

PART 3 – EXECUTION

Skyfold Classic Models include: Skyfold® Classic 51™, Skyfold® Classic 55™, Skyfold® Classic 60™, Skyfold® Classic NRC™

3.1 Inspection

- 3.1.1 Inspect the relevant aspects of the site such as the evenness of the floor, walls, structural steel, etc., and ensure that these are within the tolerances stated in Part – 1 of this specification.
- 3.1.2 Confirm in writing to the General Contractor or contract manager any deviations from these tolerances. Do not proceed until these conditions are made good.
- 3.1.3 Carry out all appropriate field measurements before manufacturing any components or assemblies.

3.2 Installation

- 3.2.1 Install operable walls in accordance with the manufacturer's printed instructions.
- 3.2.2 The operable wall supplier shall not deliver or install this product until the General Contractor can ensure in writing safe storage and protection for the operable wall for the duration of the project.

3.3 Adjusting and Cleaning

- 3.3.1 Adjust and fine-tune the operable walls to ensure that all seals are operating and sealing properly and that the operable walls are in correct and smooth operation.
- 3.3.2 Clean up any dirt, oil, grime, etc., that may have found its way onto the acoustical panels. Leave the wall in a state of architectural cleanliness.

3.4. Spare Parts

- 3.4.1 Ensure the manufacturer has ample stock available for repairs.