November 30, 2018

Mr. Bhavesh Shah
Reversomatic Manufacturing Ltd.
270 Orenda Road
Brampton, Ontario
L6T 4X6

*Via e-mail:*
bhavesh@reversomatic.com

Re: BRM-00300762-X0 Reversomatic HRV/ERV Intake/Exhaust Vents
**Re-Circulation Efficiency Testing Report**

Dear Mr. Shah:

EXP Services Inc. (EXP) was retained by Reversomatic Manufacturing Limited (Reversomatic) to assess the re-circulation efficiency of various HRV/ERV Intake and Exhaust Vents with differing configurations and louver grille designs. The vent boxes are typically utilized in condominium buildings as part of the HVAC system, mounted through the exterior wall, to exhaust interior air (Class 1 and 2, as per ASHRAE 62.1) and supply make-up air through a Heat/Energy Recovery Ventilation (HRV/ERV) system. *CSA Standard F326 - Residential Mechanical Ventilation Systems* allows up to 15% re-circulation of air from the exhaust vent into the intake vent.

# 1. Method

In the absence of a specified testing standard for determining re-circulation efficiency of intake and exhaust vents, EXP assessed the amount of re-circulation of air from the exhaust vent to the intake vent at various duct flow rates and wind speeds using tracer gas techniques. A tracer gas method utilizing Sulphur Hexafluoride ($SF_6$) was employed in which the exhaust duct was challenged with a known concentration of $SF_6$ and the resulting concentration was measured in the intake duct. Multiple tests were conducted for each vent box set-up at various balanced duct flow rates (60cfm and 100cfm) and increasing exterior wind speeds (0km/h, 10km/h and 23km/h).

The vent box was mounted to the “exterior” side of a plywood wall section, measuring approximately 8ft x 8ft, connected to approximately 10ft of duct on the “interior” side of the wall. Variable speed fans connected to the ducts were utilized to control the duct flow rate. Flow rate was measured with a differential pressure flow sensor (Nailor 36FMS) in conjunction with a manometer (Fluke 922). The gas concentration was measured by infrared spectroscopy utilizing a MIRAN SapphIRe XL portable ambient analyzer, manufactured by Thermo Scientific. Various wind speeds were achieved utilizing a centrifugal fan directed perpendicular to the wall, along with a pitot tube grid to measure the average wind speed. The wind speed was measured approximately 8ft in front of the wall. The tracer gas, $SF_6$, was injected into the exhaust duct immediately after the fan, approximately 10 duct diameters before the flow measurement device, followed by approximately 10 duct diameters to the vent box. The $SF_6$ concentration within the duct was

measured between the flow measurement device and the exhaust vent. Similarly, along the intake duct, the flow measurement device was located approximately 10 duct diameters from the vent box, with the $SF_6$ concentration measured in between, followed by approximately 10 duct diameters to the fan. Photographs of the test set-up are shown in the figures below.

**Figure 1 – "Interior" side**

**Figure 2 – "Exterior" side**

# 2. Results

The results for the various configurations of vent boxes provided by Reversomatic are shown in Table 1 below.

The percent re-circulation is defined as:

$$R = C_i / C_c \times 100$$

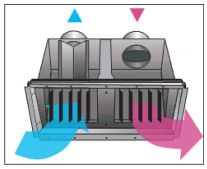
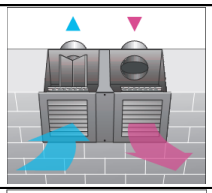
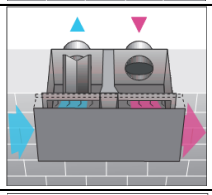
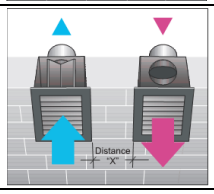
Where:

R = percent recirculation (%)

$C_c$ = $SF_6$ concentration in challenge gas in exhaust duct (PPM)

$C_i$ = $SF_6$ concentration in intake duct (PPM)

### Table 1 – Vent Box Re-Circulation Efficiency Test Results

| **Reversomatic HRV/ERV Intake and Exhaust Vents**<br>Re-circulation Efficiency Testing - Results Summary* | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Wind Speed [km/h]** | 0 | | 10 | | 23 | |
| | **Duct Flow Rate [cfm]** | 100 | 60 | 100 | 60 | 100 | 60 |
| **Box 1**<br>**DV-200**<br>**(Flush mount for Window Panel)** |  | 1.0** | 2.3 | 1.3** | 1.5 | 4.1** | 3.0 |
| **Box 2**<br>**DVG-200**<br>**(c/w extruded aluminum grilles)** |  | 2.6 | 3.7 | 2.1 | 1.6 | 2.9 | 3.3 |
| **Box 3**<br>**DVS-100**<br>**(c/w Side Exhaust/Intake Hood)** |  | 3.5 | 3.5 | 3.5 | 4.1 | 4.4 | 4.4 |
| **Box 4**<br>**SVE-50 & SVI-50 (3ft seperation)**<br>**(single vents c/w extruded aluminum grilles)** |  | 4.7 | 0.1 | 4.7 | 1.0 | 3.3 | 0.3 |

* Results displayed as percentage re-circulation.

Due to the low number of tests performed on single samples a statistical error analysis was not conducted, conservative numbers were utilized.

** Box 1 was tested at a high duct flow rate of 120cfm

# 3. Discussion

EXP has determined that the sealing of all seams within the vent boxes is critical to achieving the reported re-circulation values. In particular, the seams are to be sealed prior to the installation of the insulation. As some of these seals are concealed in the final product and cannot be verified, Reversomatic shall ensure proper quality control procedures are undertaken within their manufacturing process to mitigate the risk of omission of these seals and adversely affecting the performance of the vent boxes.

No consideration to various wind directions, wall configurations or obstructions that may be encountered in a field applied condition were employed during this testing which may have an impact on the re-circulation values. For example, the height of the vent boxes from the floor was approximately 3.5 ft, lower than what would be typical in a field installed application. This may influence the re-circulation values, more prominently for Box 4 due to the downward orientation of the louver fins. These values also represent the measured re-circulation for the specific vent boxes tested only. Variations in production may result in differing values within a production run or across multiple production runs of vent boxes. Due to the low number of tests performed on single samples, a statistical error analysis was not conducted to account for these variances.

# 4. General Limitations

The information and conclusions in this report are considered privileged and confidential and have been prepared exclusively for Reversomatic Manufacturing. The purpose of this report is to provide Reversomatic with a general assessment of the re-circulation efficiency of their various HRV/ERV Exhaust and Intake Vents with different louver grille configurations and at various duct flow rates and wind speeds. Achieving the objectives stated in this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgement was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice, we do not act as absolute insurers for the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Re-circulation values may vary across vent boxes within a production run, or across multiple production runs. Also, any changes to the proposed design or introduction of new processes may render the conclusions of this report inaccurate or invalid. In the event of any such changes, EXP should be contacted to re-evaluate the revised products and make appropriate revisions to the original conclusions of this report.

We trust this summary report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact the undersigned.

Sincerely,
EXP Services Inc.

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