

INDOOR AIR QUALITY

INDUSTRY-BEST RER

# 3 ÅNGSTROM WHEEL



**true 3Å**<sup>TM</sup>

**fusion 3A**





Independently tested wheel performance & AHRI certified.



Highest effectiveness and Recovery Efficiency Ratio (RER)

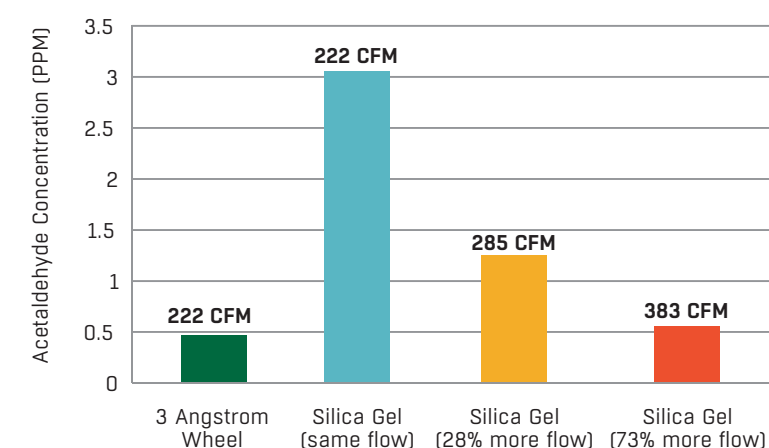


Reliable operation and long life expectancy backed by 30 years of proven product performance



Nearly 30 years ago FläktGroup® SEMCO® discovered that traditional energy wheels had the capability of adsorbing and transferring a substantial amount of the contaminants contained within an exhaust air stream along with the beneficial water vapor which allows for effective latent energy recovery. This problem caused owners to turn off wheels that had been installed in certain applications and prohibited engineers from employing total energy recovery in critical applications, like hospitals and laboratories, where substantial energy savings could be recognized. More routine applications suffered from poor ventilation effectiveness, receiving only a partial benefit of the outdoor airflow being provided (See chart at right).

**Acetaldehyde Concentration in Chamber After One Hour of Ventilation with 3 Angstrom Wheel versus Silica Gel Wheel at Various Air Flows**



## 3 ÅNGSTROM WHEEL

# THE UNIQUE ADVANTAGES OF FLÄKTGROUP SEMCO 3Å TECHNOLOGY

FläktGroup® SEMCO® has been producing and refining its 3 angstrom wheel technology for more than 25 years. In addition to being the first company worldwide to address the problem of desiccant carry-over, it was the first to apply molecular sieves, of any type, to a total energy wheel. FläktGroup SEMCO is the only US based company that is fully vertically integrated, making the wheel recovery media, wheel cassette and the systems that encompass the wheel technology. And, FläktGroup SEMCO remains the only company that can produce a wheel with true 3 angstrom capabilities, the only company with independent test data to support this capability and the only company with the expertise to support the design community with the analyses required for code compliance for critical applications such as hospitals, laboratories and smoking environments.



Use of the AHRI Certified™ mark indicates a manufacturer's participation in the certification program. For verification of certification for individual products, go to [www.ahrinet.org](http://www.ahrinet.org).



# SEMCO INVENTED THE 3 ÅNGSTROM WHEEL

# ELECTRON MICROSCOPIC IMAGE OF A 3Å MOLECULAR SIEVE

Through a substantial commitment to research, FläktGroup SEMCO developed and patented the True 3 Ångstrom wheel (True 3Å), the first energy recovery wheel that could solve the problem of effectively transferring water vapor while limiting desiccant-based transfer of the airborne contaminants.



Ironically, after years of aggressive marketing campaigns demeaning the SEMCO 3 angstrom technology - claiming

that molecular sieves could not transfer water vapor, limit contaminant carryover and even doubting that desiccant carry-over even exists - now almost every global recovery wheel manufacturer promotes a 3A molecular sieve wheel as their premier product. This dramatic market shift documents the technological leadership and credibility of SEMCO. It raises questions regarding the credibility of the competition.

Stated simply, achieving the desired 3 angstrom behavior – transferring water vapor while avoiding the transfer of airborne pollutants with a kinetic diameter larger than about 3 angstroms – is highly complex, involving far more knowhow than simply coating a 3A molecular sieve crystal onto aluminum. Before any 3 angstrom claims can be made, independent testing must be completed in accordance with ASHRAE 84 procedures, with precision instrumentation, using various classes of chemicals typical of those encountered in occupied spaces (Read more in the FläktGroup SEMCO technical document entitled “Results of Cross-contamination Testing of Desiccants”).

The FläktGroup SEMCO True 3Å wheel has been rigorously tested, repeatedly, in the laboratory and in the field over the past 20 years. SEMCO has also tested competitive products using 3A molecular sieves. The resultant performance is dramatically different than offered by the SEMCO True 3Å wheel – with the competitor’s carry-over being up to 500 times greater. (See **Figure 1**, taken from the FläktGroup SEMCO publication “Not All 3A Recovery Wheels Limit Contaminant Transfer”).

In short, a wheel coated with a 3A molecular sieve desiccant should not be confused with one that delivers 3 angstrom behavior.

STANDARD PRODUCT FEATURES	
	
Industry’s highest recovery performance (AHRI Certified) and Recovery Efficiency Ratios (RER)	Industry’s highest recovery performance (AHRI Certified) and Recovery Efficiency Ratios (RER)
270 mm deep transfer media	200 mm deep transfer media
True 3 angstrom performance – Independent testing to document the limitation of contaminant carry-over to less than .045% (See <b>FIGURE 2</b> on <b>PAGE 6</b> )	Reduced contaminant carry-over – equal to or better than other competitor’s wheels marketed as using a 3A molecular sieve (see <b>FIGURE 3</b> on <b>PAGE 7</b> )
Anti-corrosion, anti-microbial and anti-stick face coatings standard	Anti-corrosion face coating standard
Structural steel tubing support casing to limit deflection (> size TE-09)	Structural steel tubing support casing to limit deflection (> size TEC-09)
Extruded aluminum structural hub, spokes and rim system	Extruded aluminum structural hub, spokes and rim system
Comprehensive variable speed wheel DDC controls and sensors including Health and Safety Monitor	Comprehensive variable speed wheel DDC controls and sensors

**FIGURE 1.** Normalized comparison of carryover data for all wheels tested.

	Measured Contaminant Carryover Percentage Data – Normalized Data (400 ft/min face velocity)			
	Seibu-Giken ION <sup>(note 1)</sup>	Non-SEMCO 3A <sup>(note 1)</sup>	SEMCO 3A <sup>(note 2)</sup>	Non-SEMCO 3A <sup>(note 3)</sup>
Acetaldehyde/Formaldehyde	9.0	52.5	none detected	17.4
Acetic Acid	14.6	n/a	none detected	35.7
Carbon Dioxide	1.5	3.0	none detected	4.1
Isopropyl Alcohol	10.5	18.0	none detected	3.9
Methanol	n/a	n/a	none detected	11.3
MIBK	1.5	19.5	none detected	2.5
Propane	3.0	6.0	none detected	0.2
Xylene	3.0	28.5	none detected	13.1
Sulfur Hexafluoride	n/a	n/a	< .04%	0.3

Note 1 – wheels tested by Kanazawa University with data normalized to 400 ft/min for comparison.  
Note 2 – SEMCO wheel tested by the Georgia Tech Research Institute at 400 ft/min, acetic acid data measured by SEMCO not GTRI.  
Note 3 - wheel tested at SEMCO’s laboratory.  
Note: n/a means data not available.  
Note: Contamination carry-over percentage is defined by ASHRAE as follows:  
= (Supply Air Concentration – Outdoor Air Concentration)/(Return Air Concentration – Outdoor Air Concentration)



# true3Å™

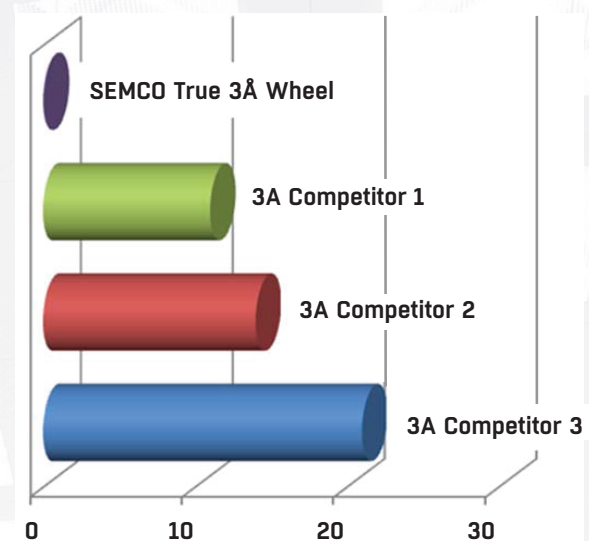
The FläktGroup SEMCO True 3Å wheel has been independently tested and shown to exhibit true 3 angstrom behavior, meaning that it has the unique capability of limiting the transfer of airborne chemical contaminants which have a kinetic diameter larger than 3 angstroms. As a result, water vapor (2.8 angstroms) is effectively transferred while essentially all contaminants of concern are not. SEMCO has invested 20 years of research to develop a 27 step proprietary process to achieve this true 3 angstrom performance. The performance of this product has been proven by 25 years of successful operation, numerous independent field investigations as well as three independent laboratory evaluations.

Producing a total energy wheel that exhibits true 3 angstrom behavior is highly complex. The cations within the molecular sieve desiccant, if not processed correctly, will move or be exchanged by other cations and thereby will allow contaminants larger than 3 angstroms to be transferred. In addition, there are numerous “grades” of 3A molecular sieves designed for various processes, some more costly than others and not all provide the desired true 3 angstrom behavior. The binding mechanism used to secure the desiccant to the wheel matrix can also transfer contaminants as can exposed (uncoated) aluminum wheel surfaces as they naturally oxidize. The SEMCO proprietary 27 step process has addressed all of these challenges.

## Application Limitations:

Critical applications like laboratories, hospitals and smoking facilities (i.e. casinos) must limit any contaminant carry-over to as low a level as possible for health and safety reasons and should only be served by the FläktGroup SEMCO True 3Å (TE) wheel. Both the NFPA 45 and the IMC code prohibit recirculation of exhaust air contaminants in laboratory applications. As a result, the

**FIGURE 2.** Measured Average Contaminant Carry-over Percentage<sup>1</sup> (%) of the True 3Å Wheel versus the competition.



**NOTE 1.** Results based upon laboratory testing showing average contaminant carry-over for eight different chemical families. ASHRAE 84 procedures followed, contaminant families chosen by the Georgia Tech Research Institute (GTRI)

independent carry-over testing involving contaminants of concern, only available for the True 3Å wheel, is often needed to confirm code compliance with local officials.

Although the potential for impacting the health and safety of the building occupants is greatly reduced for non-critical applications, more conventional applications like schools are nevertheless negatively impacted by significant contaminant carry-over. Eliminating the recirculation of contaminants substantially improves the ventilation effectiveness (see FläktGroup SEMCO Technical Bulletin entitled “Not All 3A is Equal”). As a result, the SEMCO True 3Å wheel benefits all projects and should be the product of choice for all applications unless budgetary restraints are more important than the resultant indoor air quality.



# fusion3A

The FläktGroup SEMCO Fusion 3A series product has been developed to optimize total recovery performance and wheel pressure loss, while limiting desiccant contaminant carry-over in a manner consistent with other 3A molecular sieve wheels. The Fusion 3A series has been designed for projects where limiting contaminant transfer is desired but achieving competitive bidding is considered more important.

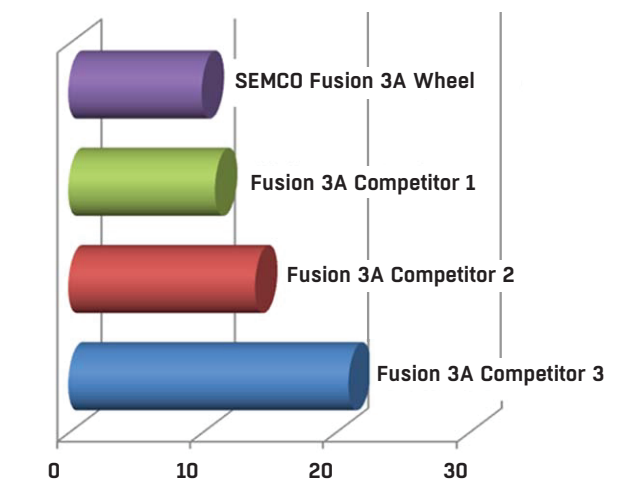
The Fusion 3A series incorporates the same high-grade 3A molecular sieve and binding system used to produce the FläktGroup SEMCO True 3Å wheel. However, the Fusion 3A product is produced without the use of SEMCO’s propriety 27 step process necessary to stabilize the cations and achieve true 3 angstrom behavior. While the Fusion 3A does not limit contaminant carry-over to the degree possible with the SEMCO True 3Å wheel, the cost of manufacturing the product is significantly reduced, allowing SEMCO to offer our OEM customers a more “competitive”, second tier 3A product.

The Fusion 3A series TEC product delivers the highest total energy recovery performance and recovery efficiency ratios (RER) of any certified 200 mm deep recovery wheel available.

## Application Limitations:

Recommended for non-critical applications where limiting contaminant transfer is desired. Non-critical applications can be defined by ASHRAE 62 Class 1 or Class 2 spaces where contamination transfer levels should be limited below 10%. This would include applications where the exhaust air stream contained chemicals with mild odors such as toilet exhaust.

**FIGURE 3.** Measured Average Contaminant Carry-over Percentage<sup>1</sup> (%) of the Fusion 3A Wheel versus the competition.





## **EXCELLENCE IN SOLUTIONS**

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FläktGroup® SEMCO® delivers smart and energy efficient Indoor Air and Critical Air solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

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