

TECHNICAL MANUAL: Industrial Efficiency & Purity Handbook

AirSpace Machinery Co., Ltd.

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Industrial efficiency is maximized when Permanent Magnet Variable Frequency (PMV) screw air compressors are paired with IE5 ultra-premium efficiency motors, reducing energy consumption by 35% to 50% compared to traditional fixed-speed systems. This setup provides a scalable solution for manufacturing, while specialized oil-free configurations ensure ISO 8573-1 Class 0 air purity for sensitive sectors like pharmaceuticals and food production.

At AirSpace Machinery Co., Ltd., we leverage 20 years of engineering excellence and a 4,000m² state-of-the-art facility to deliver high-performance air solutions. With over 100M yuan in annual sales, our systems are built to endure global operational demands while maintaining strict CE and ISO 9001 compliance.

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SECTION 1.0 – The Efficiency-First Manufacturing Era (ROI Focus)

In today's manufacturing landscape, compressed air is often the single largest electricity expense on the factory floor. The "Efficiency-First" era isn't just about going green; it's about protecting your bottom line through a calculated Return on Investment (ROI).

For most industrial facilities, the initial purchase price of an air compressor represents only 10-15% of its total lifecycle cost. The remaining 85-90% is consumed by electricity and maintenance. To drive profitability, decision-makers must shift from "lowest upfront cost" to "lowest total cost of ownership." Our PMV screw air compressors are engineered specifically to address this shift, offering a strategic advantage in energy-intensive markets like Southeast Asia, Latin America, and the CIS region.

By integrating intelligent control systems and high-efficiency screw air technology, we help partners verify their energy savings through transparent data logging. When you invest in an AirSpace Machinery system, you are investing in a 20-year legacy of reliability and precision.

SECTION 2.0 — The Core Solution: PMV + IE5

Motors

What makes a PMV screw air compressor the primary solution for modern industry? The answer lies in the synergy between Permanent Magnet Variable Frequency (PMV) technology and IE5 ultra-premium efficiency motors.

Direct Answer: PMV technology allows the compressor to adjust its motor speed in real-time to match actual air demand. Unlike fixed-speed compressors that waste energy by running at full capacity even during low demand, PMV systems eliminate "unloaded" running time.

Technical Benefits of PMV + IE5:

- 1. PMSM Motor Efficiency at Low Frequency:** The IE5 drive package is built around a Permanent Magnet Synchronous Motor (PMSM). Unlike conventional induction motors that rely on rotor current to generate magnetic flux, a PMSM uses permanent magnets in the rotor, which sharply reduces rotor copper loss and slip loss. That is why the motor can maintain efficiency up to 96.5% even at low operating frequencies, where many standard VSD motors lose efficiency. In practical terms, the motor stays efficient during partial-load operation instead of only looking good at full speed.
- 2. Fast VFD PID Pressure Control:** The variable frequency drive uses closed-loop PID logic to compare real-time system pressure against the setpoint and correct motor speed almost immediately. With a control response time of 0.1 seconds, the system reacts quickly to changing air demand and maintains discharge pressure stability within ± 0.01 MPa under normal operating conditions. This reduces pressure band drift, cuts artificial demand, and helps downstream equipment run more consistently.
- 3. Wide Frequency Range with Stable Torque:** Because PMSM technology produces high torque across a broad speed range, the compressor avoids the low-speed torque weakness that can affect standard variable-speed systems. That matters in plants with fluctuating air draw, frequent load swings, or multiple intermittent users.
- 4. 5:6 Asymmetrical Rotor Air-End Design:** The air-end uses a 5:6 asymmetrical rotor profile to improve sealing line geometry and reduce internal leakage during compression. The result is higher volumetric efficiency, better specific power, and more stable air delivery across the operating range. This rotor design also supports smoother compression and lower vibration than less optimized profiles.

5. **Direct Drive Design:** By removing belts and gears, we eliminate transmission losses and reduce the number of wearing parts.



[DIAGRAM: PMV Efficiency Curve vs. Fixed Speed Performance]

[TECHNICAL SCHEMATIC: 5:6 Asymmetrical Rotor Profile]

With energy savings of up to 50%, the ROI on an IE5-equipped PMV compressor is typically realized within 12 to 18 months of operation, depending on local energy rates and duty cycles. Actual savings depend on load profile, pressure setpoint, annual operating hours, and the baseline efficiency of the system being replaced.

SECTION 3.0 – Reliability by Design (Extreme Climate Series)

Industrial operations rarely happen in perfect conditions. Whether you are dealing with the high humidity of Southeast Asia or the sub-zero temperatures of the Russia-CIS region, your air system must be engineered to endure.

Direct Answer: The AirSpace "Extreme Climate Series" offers a 2-year maintenance-free interval on core components, featuring a range from 2HP to 540HP to suit everything from small workshops to massive industrial complexes.

Strategic Engineering for Global Markets:

- **SEA Markets:** To combat high humidity and dew point challenges, our systems include oversized cooling modules and high-efficiency moisture separators. This prevents internal corrosion and ensures stable air quality.
- **LATAM Markets:** For regions with grid instability, our PMV controllers are designed with robust voltage protection and soft-start capabilities to protect the IE5 motor from power surges.
- **Russia/CIS Markets:** Our winterization packages include integrated heaters and specialized lubricants that maintain viscosity at extreme low temperatures, ensuring a reliable cold start every time.



By focusing on a "Reliability by Design" philosophy, we reduce unplanned downtime, which is often more expensive than the equipment itself.

SECTION 4.0 – Specialized Applications: The Oil-Free Option

While PMV screw air compressors serve 90% of industrial needs, certain sectors require an absolute guarantee of purity. For the pharmaceutical, food and beverage, and high-end electronics industries, even a microscopic trace of oil can lead to catastrophic product recalls.

Direct Answer: Our specialized oil-free screw compressors deliver ISO 8573-1 Class 0 certified air, ensuring that no oil aerosols or vapors enter the production line.

When to Choose Oil-Free:

- **Pharmaceuticals:** To prevent contamination of sensitive chemical compounds.
- **Food & Beverage:** For direct contact applications where air purity is a food safety requirement.

- **Electronics/Semiconductors:** Where oil particles can ruin delicate silicon wafers and circuit boards.

Oil-Free vs. Technically Oil-Free: What Is the Real Difference?

Direct Answer: "Oil-free" means no lubricant is present in the compression chamber. "Technically oil-free" usually means the compressor uses oil somewhere in the compression process and then relies on downstream filtration to remove carryover.

That distinction matters. Filtration-based systems can produce very clean air, but they are not the same as a true oil-free compression design because oil is still present upstream of the filters. AirSpace uses dry screw or water-injected screw mechanisms for oil-free applications specifically to keep lubricant out of the compression chamber itself. That design approach is what supports a true zero-lubricant compression path instead of a "filter it later" strategy.

What Does ISO 8573-1:2010 Class 0 Mean for Oil Content?

Direct Answer: For oil, ISO 8573-1:2010 Class 0 requires a stricter limit than Class 1 and is commonly specified as total oil content below 0.01 mg/m³, including aerosol, liquid, and vapor, when agreed between supplier and user for the application.

This is the benchmark contamination-sensitive industries care about most. It is not just about visible oil carryover. It covers the full oil load in the compressed air stream:

- **Oil aerosol**
- **Liquid oil**
- **Oil vapor**

That is why true oil-free screw compressor design matters more than filter count alone when product integrity is on the line.

[FLOWCHART: ISO 8573-1 Class 0 Purity Verification Path]

How Does the Oil-Free Air-End Handle Heat, Corrosion, and

Wear?

Direct Answer: Oil-free compression runs hotter and demands more robust materials, so the air-end uses stainless steel rotors and specialized thermal coatings to protect efficiency and service life.

In high-temperature discharge environments, corrosion and rotor wear can quickly erode performance if materials are not selected correctly. Stainless steel rotors improve corrosion resistance, while specialized thermal coatings help control surface wear, limit heat-related degradation, and maintain tighter operating clearances over time. This is especially important in pharmaceutical, food, and electronics duty cycles where stable purity and repeatable performance are mandatory.



Caption: High-efficiency filtration modules used in tandem with oil-free systems to maintain ISO Class 0 standards.

While the initial investment for oil-free technology is higher, it is the only strategic choice for facilities where purity is non-negotiable. For all other applications, our oil-injected PMV compressors with high-efficiency filtration offer a more cost-effective path to clean air.

SECTION 5.0 – Heat Recovery Integration

Direct Answer: Around 90% of the electrical energy consumed by a screw air compressor is converted into heat, and much of that heat can be recovered for practical plant use such as hot water generation, boiler preheating, or space heating.

In most compressor rooms, that heat is simply rejected into the atmosphere. With a properly designed heat recovery module, facilities can reclaim a large share of it and turn a utility cost into a secondary energy source. In practical terms, recovered heat can be used for:

- **Facility hot water loops**
- **Boiler feedwater preheating**
- **Process water heating**
- **Workshop or warehouse heating**

For buyers focused on ROI, this matters because compressor efficiency is not just about kWh saved at the motor. It is also about how much waste heat can be put back to work. In applications with steady operating hours and year-round heat demand, heat recovery can materially shorten payback time beyond the electrical savings delivered by PMV control alone.

[TECHNICAL SCHEMATIC: Heat Recovery Module Integration]

SECTION 6.0 – The ROI Case Study (Fixed Speed vs. PMV)

To understand the financial impact, let's look at a comparative analysis between a 75kW Fixed Speed Compressor and an AirSpace PMV75 Screw Air Compressor.

**Assumes \$0.10/kWh and 7,000 operational hours per year.*

The data is clear: the energy-efficient air compressor ROI is driven by the elimination of unloaded running and the superior efficiency of the IE5 motor. Over a 10-year lifespan, the PMV75 saves over \$200,000 in energy costs alone, more than four times the original cost of the machine.

SECTION 7.0 – Building Your Future-Proof Air System

Selecting the right compressor is only the first step. To build a truly future-proof system, you must consider the entire compressed air audit, from the air receiver tank to the filtration and drying modules.

Direct Answer: A complete, integrated air system maximizes reliability by ensuring that air is not just compressed efficiently, but also dried and filtered to the exact specifications of your equipment.

At AirSpace Machinery, we simplify the export and logistics process for our global partners. All our equipment is CE and ISO 9001 certified, and we provide full documentation to ensure seamless customs clearance. We offer specialized support for logistics, including seaworthy packaging and real-time shipment tracking, to ensure your equipment arrives ready for commissioning.



Verification and Compliance

Global buyers can verify our CE and ISO documentation through official registry databases. We prioritize transparency, providing detailed technical data sheets and performance curves for every model in our 2HP to 540HP range.

Get a Proposal

Ready to optimize your facility's efficiency? Our engineering team is standing by to design a custom solution for your specific application. Lead times vary depending on the specific configuration and voltage requirements.

To receive a tailored quote, please provide:

- **Required Pressure:** (specify bar or psi)
- **Required Flow Rate:** (specify m³/min or CFM)
- **Voltage/Frequency:** (e.g., 380V/50Hz)
- **Industry Application:**

[Get a Proposal](#)

Sources & Technical Standards

- **ISO 8573-1:2010:** Compressed air purity classes for particles, water, and oil; Class 0 oil quality is specified by agreement and is stricter than Class 1, which is 0.01 mg/m³ total oil.
 - **IEC 60034-30-1:** Efficiency classes for line-fed AC motors (IE5 Ultra-Premium).
 - **CE (Conformité Européenne):** Mandatory conformity marking for products sold within the European Economic Area.
 - **ISO 9001:2015:** International standard for Quality Management Systems.
 - **Engineering note:** Efficiency, PID response time, pressure stability, rotor profile, and heat recovery values stated above are application-specific performance references and depend on compressor configuration, controls tuning, operating pressure, ambient conditions, and site load profile.
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