Portable air treatment solutions guide

A practical guide to reliable air treatment in harsh conditions

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Introduction

Compressed air is a vital utility across industries — from oil and gas to construction, mining, and marine industries.

Yet, wherever compressed air is used, one challenge remains constant: **moisture**. It's invisible at first, but once it condenses, it can corrode pipelines, damage tools, and compromise product quality or process reliability.

Moisture is one of the leading causes of failure in compressed air system failures in the field. And while the effects may vary by application, the root cause is always the same: water vapor in the air.

Understanding where this moisture comes from — and how to remove it — is essential for anyone relying on compressed air in demanding environments.

Did you know?

Moisture is one of the leading causes of failure in compressed air systems—especially in demanding environments.

1. Why is compressed air wet?

Atmospheric air always contains water vapor. This is a natural result of the Earth's water cycle: evaporation from oceans, lakes, and soil, as well as transpiration from plants, adds moisture to the air around us. The amount of water vapor air can hold depends on its temperature — warmer air holds more, cooler air holds less.

For example, at 35°C (95°F) and 60% relative humidity, one cubic meter of air (about 35.3 cubic feet) contains about 23 grams (about 35.3 cubic feet) of water vapor. When that air is compressed to 7 bar(g) (101.5 psi), the water content per cubic meter increases to 184 grams (6.5 ounces) — over eight times more.

Initially, the high temperature of compression allows the air to retain this moisture. But as the air cools downstream, its capacity to hold water drops. Once it reaches its dew point — the temperature at which air becomes saturated — condensation begins. This is when water starts to form inside your system, leading to corrosion, contamination, and equipment failure.

This phenomenon isn't limited to hot climates. Even at 15°C (59°F) and moderate humidity, compressed air can carry significant amounts of water. And because pressure doesn't affect the air's moisture-holding capacity, the risk of condensation is present in virtually every compressed air system — unless it's properly treated.

2. Why is dry air essential for tough industries?

The consequences of moisture in compressed air are far-reaching. In oil and gas, for example, it can corrode pipelines or skew well test results.

In **mining**, moisture can damage pneumatic drills, clog valves, and disrupt dust suppression systems. In **marine** and **offshore** environments, it can block bubble curtain systems or freeze in control lines. Even in **construction** or **energy** applications, wet air can lead to inaccurate pressure readings or premature equipment wear.

In short, no application benefits from condensation. That's why more than half of all industrial compressed air systems rely on some form of drying — not just for performance, but for safety, compliance, and cost control.

Did you know?

According to the Compressed Air & Gas Institute (CAGI), many industrial processes rely on clean, dry compressed air to prevent equipment damage, product contamination, and costly downtime.

3. Applications where dry air makes the difference

Dry compressed air is essential across a wide range of industries. While the specific risks vary, the underlying challenge is the same: moisture compromises performance, safety, and reliability. Here are some of the most critical applications where air treatment is non-negotiable.

Oil & gas

- **Pipeline pigging and drying:** Residual moisture inside pipelines can lead to internal corrosion, pressure drops, and long-term integrity issues — especially in remote or offshore installations.
- **Well testing and blowdown:** Impurities in compressed air or nitrogen can skew test results, damage sensitive sensors, and compromise safety during depressurization.
- **Gas transmission and maintenance:** Moisture can freeze or chemically react with hydrocarbons, particularly in cold climates, leading to blockages or hazardous conditions.

Construction

- **Sandblasting and surface preparation:** In shipyards and infrastructure projects, contaminated air can reduce blasting efficiency, increase abrasive consumption, and cause poor coating adhesion — leading to costly rework.

Mining

- **Pneumatic drilling and material handling:** Moisture in compressed air can corrode drills, clog control valves, and disrupt dust suppression systems. In underground operations, it can also affect ventilation and safety-critical instrumentation.

Marine & offshore

- **Bubble curtain systems and subsea tools:** Dry air is essential for generating consistent bubble curtains used in underwater noise mitigation. Moisture can block nozzles and reduce system effectiveness.

Manufacturing & industrial processing

- **Automation, painting, and instrumentation:** Wet air can damage pneumatic actuators, cause paint defects, and lead to inaccurate readings in control systems — all of which impact product quality and uptime.

Rentals

Including compressed air dryers in rental fleets is a smart investment. They protect customer equipment from **moisture damage, reduce service issues, and extend compressor life.** In tough industries like construction, mining, and marine, reliable air treatment boosts performance and helps turn one-time rentals into long-term partnerships.

4. How to remove moisture

A closer look at drying technologies

There are several ways to remove water from compressed air, each with its own strengths and limitations. Choosing the right drying method depends on your operating environment, mobility needs, and the required dew point.

1

Over-compression is a basic method where air is compressed beyond the required pressure, forcing out moisture before reducing it again. While simple, this approach is energy-intensive and only practical for small volumes.

2

Cooling-based drying, such as refrigerant dryers, is common in stationary setups. These systems cool the air to just above freezing, condensing water vapor into liquid. However, they are limited by ambient conditions and can freeze in cold climates. Refrigerant dryers are sensitive to vibrations and movement. As a result, refrigerant dryers are not well suited for applications where the equipment is frequently moved.

3

Absorption dryers, like deliquescent dryers, use chemicals to bind moisture. While effective, they generate chemical waste and require frequent media replacement, making them costly and less sustainable. These systems are simple but offer limited dew point suppression and require regular maintenance.

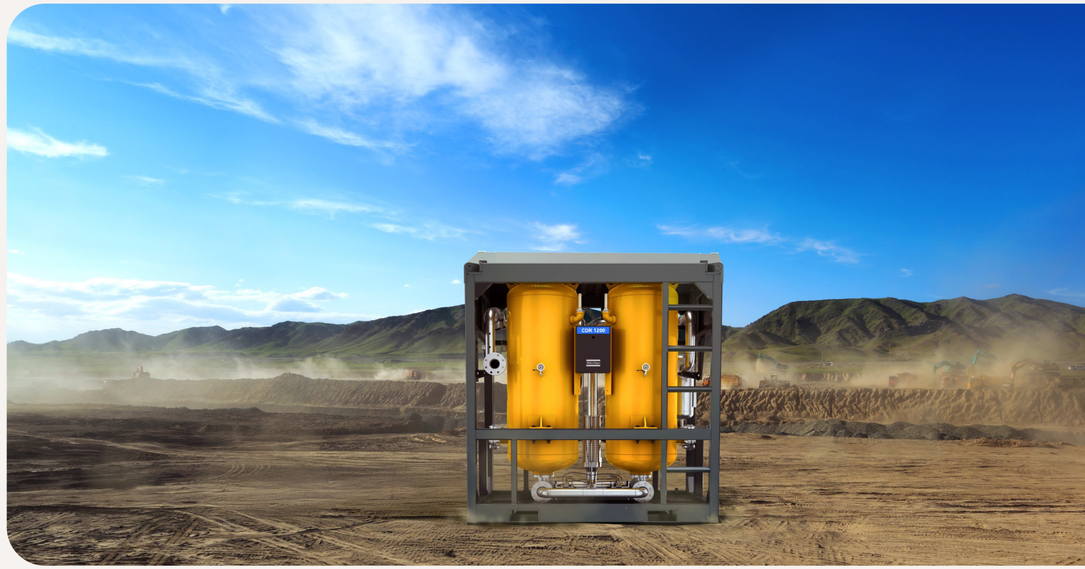
4

Adsorption dryers, also known as desiccant dryers, use hygroscopic beads to trap water vapor through a reversible physical process. These dryers are ideal for mobile and outdoor use, as they can achieve very low dew points (as low as -40°C (-40°F) or even -70°C (-94°F)) and operate reliably in extreme temperatures. Regeneration of the desiccant can be done using dry air or heat, making the system efficient and reusable.

Atlas Copco portable desiccant dryers

Built for the field

Atlas Copco’s portable desiccant dryers are engineered for the realities of remote and demanding work. They deliver consistent dew points in ambient conditions ranging from -25°C to +50°C (-13°F to 122°F), ensuring reliable performance wherever you operate. Designed for easy transport and ease of use, these dryers feature forklift-friendly frames, intuitive controls, and flow rates that match your portable compressor setup.



Ideal for mobile and outdoor use

Portable desiccant dryers offer consistent performance in hot, cold, or dusty environments — with no risk of freezing.

Click here to learn more about Atlas Copco’s portable desiccant dryers

5. How desiccant dryers work — and why it matters in the field

Compressed air dryers are not all created equal. In harsh or mobile environments, desiccant dryers stand out for their ability to deliver dry air — even when conditions are unpredictable. But how do they work?

Desiccant dryers remove moisture through **adsorption**, a physical process in which water vapor is drawn to the surface of a hygroscopic material (the desiccant) due to its higher affinity for water molecules than for air. As moist compressed air enters the drying tower from the bottom, it flows upward through the desiccant bed. Gravity helps pull condensed water downward, while the dry desiccant at the top continues to adsorb moisture. The result is a consistent **pressure dew point (PDP) as low as -40°C (-40°F)**, with water content reduced to just 0.117 g/m^3 (0.0018 oz/ft^3) — even if the inlet air contains 40 g/m^3 (0.64 oz/ft^3).

However, the desiccant's capacity is finite. As it becomes saturated, its ability to adsorb moisture declines. To maintain performance, the system must regenerate the desiccant — typically using a portion of the dried air (purge air) from the active tower. This purge air flows downward through the saturated tower, efficiently removing moisture from the lower layers where most of it accumulates.

Smart regeneration: CDR and CDR+ systems

In portable applications, where pressure and flow conditions vary, **precise control of purge air** is essential. Atlas Copco's portable desiccant dryers are equipped with advanced regeneration systems designed to optimize performance and minimize energy loss:

- **CDR (manually adjustable):** Allows operators to fine-tune purge flow based on current pressure conditions. While effective, it requires manual intervention and operator awareness.
- **CDR+ (automatic regulation):** Uses a pressure regulator and solenoid valve to maintain a constant regeneration pressure of 5 bar (72.5 psi), regardless of system fluctuations. This ensures optimal purge flow and efficient desiccant regeneration — without operator input.

These systems also manage **equalization**, a critical step that brings the regenerated tower back to system pressure before switching. This prevents pressure shocks that could damage the desiccant or disrupt downstream processes.

Click here to learn more about Atlas Copco's portable desiccant dryers

6. Why generate nitrogen on-site?

Compressed air treatment is only part of the solution. Many industries also rely on nitrogen for purging, blanketing, pressure testing, and inerting.

Traditionally, nitrogen is delivered in bottles or bulk tanks — but transporting it to remote sites is costly, slow, and logistically complex.

On-site nitrogen generation offers a smarter alternative. It gives you a reliable, continuous supply of nitrogen — with no waiting, no transport risks, and full control over purity and flow.

	Bottled nitrogen	On-site generation
Delivery delays	Common	Eliminated
Storage space	Large footprint	Compact unit
Purity control	Fixed levels	Adjustable
Operating cost	High (per liter)	Lower total cost of ownership (TCO)

Choose smart nitrogen supply

On-site nitrogen generation offers a reliable alternative to delivered gas, helping reduce operational costs while improving safety and supply continuity—especially in remote or high-demand environments.

Atlas Copco nitrogen membrane generators: Mobility meets performance

Atlas Copco’s nitrogen membrane generators are designed for field deployment. Compact, rugged, and easy to operate, they integrate seamlessly with portable compressors and deliver reliable nitrogen supply wherever you need it — without the hassle of bottles or bulk deliveries.

Learn more about Atlas Copco’s membrane nitrogen generators

7. Why choose Atlas Copco for air treatment?

Atlas Copco offers more than just products — we deliver a complete, integrated solution for portable air and gas treatment.

Our portable air compressors, desiccant dryers, nitrogen generators, and boosters are engineered to work together, ensuring optimal performance, efficiency, and reliability in the field.

Whether you're operating in oil & gas, mining, construction, marine, or energy, our systems are built to handle tough conditions — and backed by service support in over 180 countries.

- One partner for a total solution
- Seamless integration across units
- Proven performance in tough industries

Ready to learn more?

Let’s keep your air dry and your operations running.

- Talk to an expert about the right portable air solution for your next tough job
- Visit our product pages to explore the full range of portable air and gas solutions

Thank you for reading

Portable air treatment solutions guide

Contact us for more information