Industrial Fans
for Renewable Energy Generation: Wind

Industrial fans for use in the emerging renewable energy sector from the UK's leading independent fan integration experts.

AXAIR
FANS UK LIMITED

Offshore Wind

With increasing environmental awareness in consumers, the continued reduction of fossil fuels and the raising costs of power, there's now a focus on reinvigorating wind as a source of inexpensive and highly versatile renewable energy.

How Wind Turbines Work

Wind turbines operate on a simple principle. The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity.

In short, a wind turbine works in the opposite way to that of a fan. Instead of using electricity to create wind, like a fan would by running off mains electricity, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

The terms wind energy or wind power describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks such as grinding grain or pumping water, or a generator can convert this mechanical power into electricity.

Wind is a form of solar energy and is a result of the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and the rotation of the earth.

Uses of Industrial Fans

Wind turbines require fans to ventilate and cool several different areas to maintain and preserve the functioning of its equipment.

These areas include:

- Ventilating the tower and nacelle.
- Inverter cooling
- Cabinet ventilation
- Transformer cooling
- Generator cooling
- Hydrogen exhaust

> **"Wind turbines require fans to ventilate, cool & to exhaust air in different areas.**

Wind to Hydrogen Generation

A substantial proportion of offshore wind farms could eventually make Hydrogen rather than transmit electricity. Hydrogen exhaust will be a key factor in designing these emerging renewable electrolysis technologies.

Offshore Electrolysis

Although the most common element in the universe, Hydrogen isn't found in its purest form and must be either electrolysed from water or stripped out of natural gas. Both are energy intensive processes that result in greenhouse gas emissions. Using electricity in a process called electrolysis can split water into hydrogen and oxygen. By combinng wind turbines to hydrogen production there is a synergy that reduces the drawbacks of electrolysis.

For wind to hydrogen generation, these systems work by linking wind turbines to electrolysers which pass the wind generated electricity through water to split the liquid into hydrogen and oxygen. The hydrogen can then be stored and used later to generate electricity. The only by-product of producing hydrogen is water.

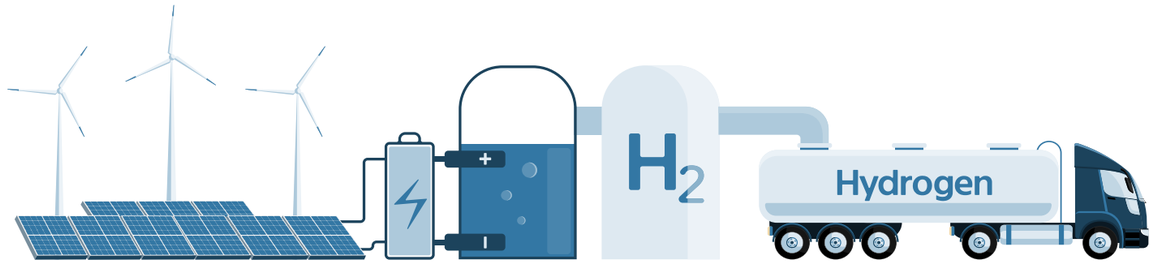
Current developments are allowing researchers to compare different type of electrolysers and work on increasing the efficiency of wind to hydrogen systems. The technology has the potential to deliver a completely emission free, climate-friendly method of making, storing and using energy in the future.

As wind turbines are placed further out to sea, hydrogen production close to source is now even more attractive.

Green Hydrogen

Green hydrogen is created when hydrogen is generated without any greenhouse gas emissions. If the electrolysers that split water into hydrogen and oxygen are powered by renewable sources. Today, the world produces 75 million tonnes of hydrogen each year, most of it generated from fossil fuels, mainly natural gas and coal resulting in 830 million tonnes of carbon dioxide being released each year. Producing hydrogen with green energy will substantially reduce emissions.

Green hydrogen starts with wind. Lots of wind. Harvesting wind offshore on a massive scale can produce stable green hydrogen on a large scale and quickly.

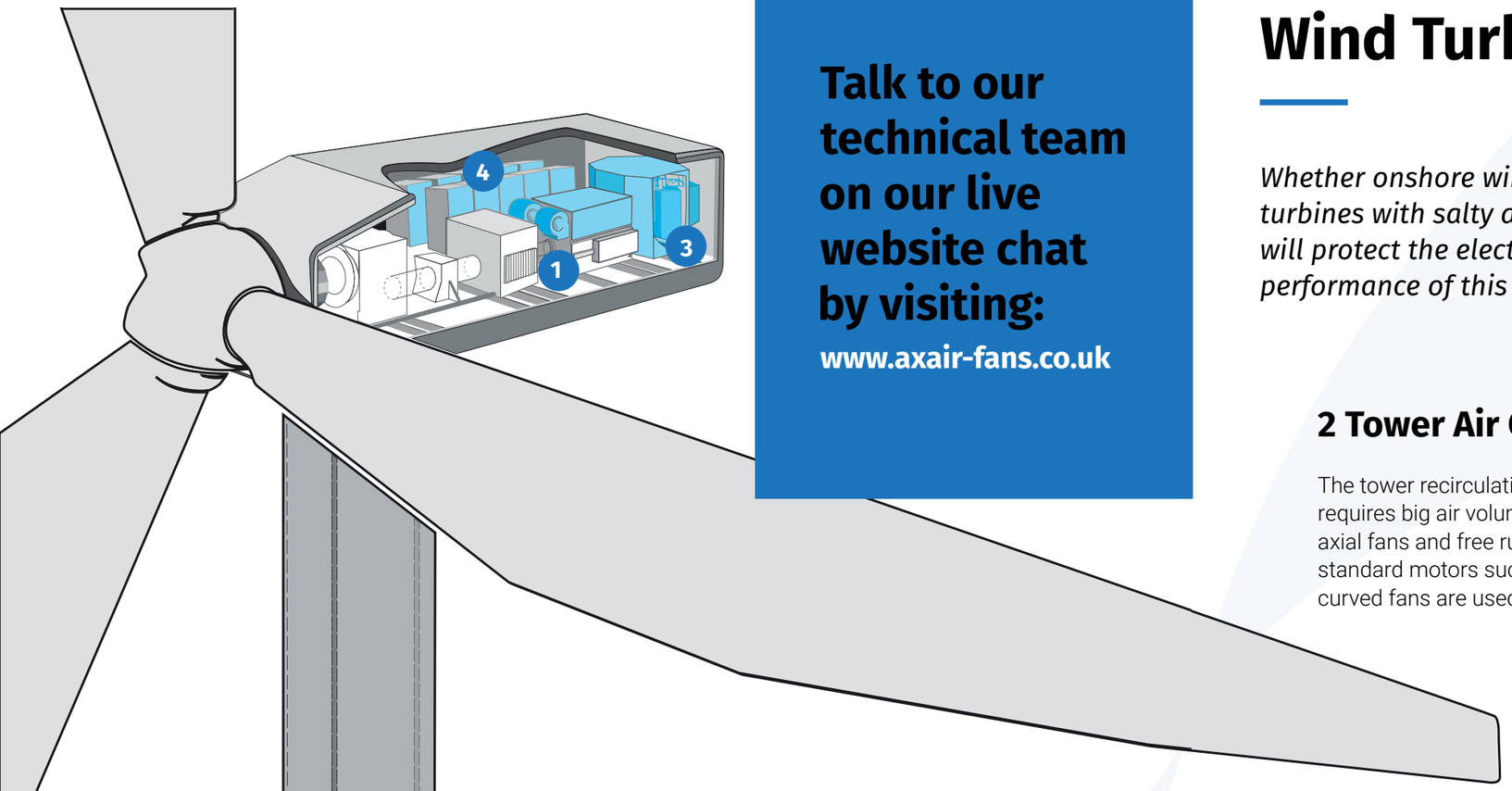


FMA FAN MANUFACTURERS ASSOCIATION

nqa ISO 9001 QUALITY MANAGEMENT · UKAS MANAGEMENT SYSTEMS

SMOKE CONTROL ASSOCIATION

A CarbonZero Company

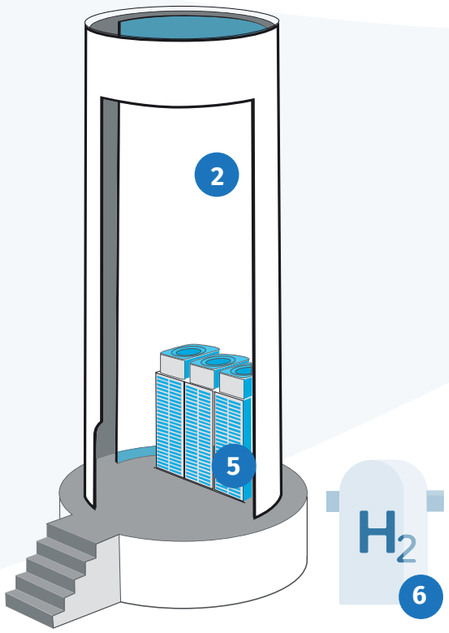


Talk to our technical team on our live website chat by visiting:

www.axair-fans.co.uk

Wind Turbine Ventilation

Whether onshore wind turbines that occupy green land in the UK, or offshore wind turbines with salty air and a high risk of corrosion, the effective dissipation of heat will protect the electrical components from premature failure and maintain the performance of this continually popular renewable energy source.



1 Generator Cooling

The generator is the core of the wind turbine. During the process of converting kinetic energy to electrical energy, heat is generated. Our supply partner, Rosenberg, have designed fans to be used as part of a generator cooling system. This provides the needed cooling load, safe operation, longevity and efficiency of the generator. Fan types DRA and AKF are ideally suited to this task.

2 Tower Air Circulation

The tower recirculation cooling of a wind turbine requires big air volumes. For this reason, various axial fans and free running impellers with IEC standard motors such as the DKNM backward curved fans are used.

3 Transformer Cooling

Heat generated in the winding of dry transformers must be dissipated over the surface of the coil. Industrial fans help to extract the dissipated heat and simultaneously use the ambient air to cool down the transformer. With efficient transformer cooling you can expect; higher peak loads, improved energy efficiency, to increase the power of the transformer, a longer life due to the constant distribution of temperature.

4 Cabinet Cooling

As with other areas of the turbine electronics, sufficient heat dissipation is required to protect the sensitive electronic components. Free running impellers such as the GKHR backward curved centrifugal fans and the ERA single inlet centrifugal fans have been specially developed for use in these applications.

5 Inverter Cooling

Inverters are required to ensure that the generated current can be injected into the grid at a constant voltage and frequency. For cooling the inverter and sensitive electronic components, fans can be roof mounted or extract from the sides of the enclosures. This can be achieved with a combination of filter fans and exhausts or GKH and DKH fans for higher airflows.

6 Explosive Gas Exhaust

In modern wind farm projects, electrolysis is used to seperate water and hydrogen molecules to generate hydrogen for use in industry. Hydrogen is one of the hottest and most dangerous gases and belongs to gas group IIC. Hydrogen exhaust fans must be accurate specified to prevent potential explosions.

ATEX Fans: IIC Hydrogen Exhaust

A wide range of ATEX compliant fans suitable for Gas Group IIC to ensure the adequate and safe removal of Hydrogen gas. Our entire range of ATEX certified fans are suitable for Gas Group IIC.

Ventilation should ideally be placed at both high points (for the exhaust of hydrogen that accumulates above the oxygen), and low points within the room to encourage forced ventilation out of the room. There should be no air recirculation under any circumstances as this encourages the mix of the two gases, where possible on a seperate ventilation system than the rest of the building.

Axial & Roof Fans

HBX Ex ec IIC T3
HBX Ex eb IIC T4

HBX Ex ec IIC T3
HBX Ex eb IIC T4

HBX Ex db IIC T5

HMX Ex ec IIC T3
HBX Ex eb IIC T4

CTH3-A Ex ec IIC T3
CTH3-A Ex db IIC T5

Please note: ATEX Certified fans for potentially explosive atmospheres are manufactured and tested according to legal regulations in the EU, Internationally and in the UK. Quoted ATEX fans all have conformance documents for review.

Centrifugal Fans

AAVA Ex ec IIC T3

AAVC Ex ec IIC T3

AAVG/N Ex ec IIC T3

AAVM/N Ex ec IIC T3

AAVP Ex ec IIC T3

AAX Ex ec IIC T3

AAZA Ex ec IIC T3

MAX Ex ec IIC T3
MAX Ex db IIC T4

MBCA Ex ec IIC T3
MBCA Ex eb IIC T4

MBGR Ex ec IIC T3

MBRM Ex ec IIC T3

MBRU Ex ec IIC T3

MBX Ex ec IIC T3
MBX Ex db IIC T4/T5

MBZM P/R Ex ec IIC T3

NIMAX Ex ec IIC T3

NIMUS Ex ec IIC T3

Please note: Equipment manufacturers and distributors are not ATEX consultants, cannot play any role in the process of determining the risk of explosion and cannot therefore specify the ATEX 2014/34/EU code for any product supplied.

Fan Integration Experts

Any structure containing hydrogen components should be adequately ventilated. The lightweight element can accumulate above oxygen causing a build up and in extreme circumstances explosions can occur. We're here to help when you need us.

"Our application knowledge covers a vast range of renewable technology systems including those designed and built around our fans in sources such as wind farms."

As fan integration experts we recieve a lot of enquiries around hydrogen exhaust for gas group IIC or IIB + hydrogen. In many instances it is necessary to integrate an ATEX fan whilst in some systems we can advise of methods of integrating an alternative fan and avoiding the requirement for ATEX certified industrial fan components.

Our application knowledge covers a vast range of renewable technology systems including those of renewable energy generation such as wind farms. You can trust that we'll supply the right industrial fan for your requirements.

All of our ATEX certified fans are suitable for IIC gas groups for the safe and effective removal of hydrogen gas.

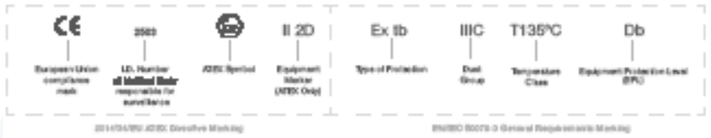
Contact our technical team on sales@axair-fans.co.uk to discuss your project in depth. We'll advise on possible fan integration options and where needed can refer you to an independent consultant to assess ATEX zones and classes.

Hazardous Area Guide

It is strictly the responsibility of the end user to perform a DSEAR risk assessment to ensure that flameproof zones are properly defined in terms recognised by ATEX 2014/34/EU. The below guide is intended for guidance only.

Typical Equipment Marking for Gas Atmospheres

Typical Equipment Marking for Dust Atmospheres



Gas Zones

Gas Zones	Pollution	ATEX Category	EPL	Required Protection
Methane	Mines with methane and dust. Equipment remains energised in explosive atmosphere	M1	Ma	Two Faults
Methane	Mines with methane and dust. Equipment is de-energised in explosive atmosphere	M2	Mb	Severe Normal Operation
Zone 0	Explosive atmosphere present continuously or for long periods, frequently	1G	Ga	Two Faults
Zone 1	Explosive atmosphere is likely to occur under normal conditions, occasionally	2G	Gb	One Fault
Zone 2	Explosive atmosphere is unlikely to occur under normal conditions, if it does	3G	Gc	Normal Operation

Dust Zones

Dust Zones	Pollution	ATEX Category	EPL	Required Protection
Zone 20	Explosive atmosphere present continuously or for long periods, frequently	1D	Da	Two Faults
Zone 21	Explosive atmosphere is likely to occur under normal conditions, occasionally	2D	Db	One Fault
Zone 22	Explosive atmosphere is unlikely to occur under normal conditions, if it does	3D	Dc	Normal Operation

Enclosure Ingress Protection (IP) Level

Enclosure Ingress Protection (IP) Level: To EN/IEC 60529	
First Number (Solid objects)	Second Number (Water)
0 No protection	0 No protection
1 Objects > Ø50 mm	1 Vertically dripping water
2 Objects > Ø12.5 mm	2 Vertically dripping water with enclosure tilted up 15°
3 Objects > Ø2.5 mm	3 Sprayed water up to 60° from the vertical
4 Objects > Ø1.0 mm	4 Sprayed water from all directions
5 Dust protected	5 Powerful water jets
6 Dust tight	6 Powerful water jets
7	7 Immersion up to 1m depth
8	8 Extended submersion > 1m depth

Ambient Temperature Range (T amb)

Tamb =	Temperature relating to the immediate surroundings of the equipment (assumed to be -20°C to +40°C, unless stated)

Protection Concept - Electrical - Gas

Type of Protection (electrical - gas)	Reference
General Requirements	EN/IEC 60079-0
Flameproof - Ex d / Ex da / Ex db / Ex dc	EN/IEC 60079-1
Purge/Pressurised - Ex p / pxb / pyb / pzc	IEC 60079-2
Quartz/Sand Filled - Ex q / qxb / qc	EN/IEC 60079-5
Oil Immersion - Ex o / ob / oc	EN/IEC 60079-6
Increased Safety - Ex e / eb / ec	EN/IEC 60079-7
Intrinsic Safety - Ex i / ia / ib / ic	EN/IEC 60079-11
Non Sparking - Ex nA / nC / nL	EN/IEC 60079-15
Encapsulation - Ex m / ma / mb / mc	EN/IEC 60079-18
Optical Radiation - Ex op is / op sh / op pr	EN/IEC 60079-28
Trace Heating Systems - Ex e / Ex 60079-30-1	EN/IEC 60079-30-1
Special Protection Ex s	EN/IEC 60079-33
Cesplight	EN/IEC 60079-35-1
Controlled Spark Duration Power i	TS 60079-39
Process Sealing	TS 60079-40
Flame Arrestors	EN 16852
Diesel Engines	EN 1834-1,2,3

Protection Concept - Electrical - Dust

Type of Protection (electrical - dust)	Reference
General Requirements	EN/IEC 60079-0
Enclosure - ta / tb / tc	EN/IEC 60079-31
Purge/Pressurised - Ex p / pxb / pyb / pzc	EN/IEC 60079-2
Intrinsic Safety - Ex i / ia / ib / ic	EN/IEC 60079-11
Encapsulation - Ex m / ma / mb / mc	EN/IEC 60079-18

Protection Concept - Non Electrical

Type of Protection (non-electrical) (gas & dust)	Reference (ATEX only)	(IECEx
[illegible]	[illegible]	[illegible]
Flow Restricting Enclosure - fr	EN 13463-2	-
[illegible]	[illegible]	-
Constructional Safety - c / k	EN 80079-37	IEC / IEC 80079-37
[illegible]	[illegible]	[illegible]
Pressurisation - p	EN 80079-2	-
[illegible]	[illegible]	[illegible]

Gas Groups

Gas Groups	[illegible]
IIA	[illegible]
IIB	Group IIA gases plus, Diethyl ether, Ethylene, Ethanol Methyl ethyl ketone (MEK), Propane-1-ol (n-propyl alcohol)
IIC	[illegible]

Dust Groups	Dusts are classified by the types of material that make up the dust
IIIA	[illegible]
IIIB	Group IIA dusts plus, Non Conductive Dusts
IIIC	[illegible]

Equipment Group	Suitable
Group I	[illegible]
Group II	Electrical equipment intended for use in explosive gas atmospheres
Group III	[illegible]

Temperature Class (T Class)	Highest temperature to achieve it under the most adverse equipment rating and loading conditions. (Flashpoint temperature of some gases)
T1 - 450°C	[illegible]
T2 - 300°C	Ethylene (425°C), Butane (372°C), Acetylene (298°C)
T3 - 200°C	[illegible]
T4 - 135°C	Diethyl Ether (160°C)
T5 - 100°C	[illegible]
T6 - 85°C	Carbon Disulphide (90°C)

ATEX Gas & Dust Zones

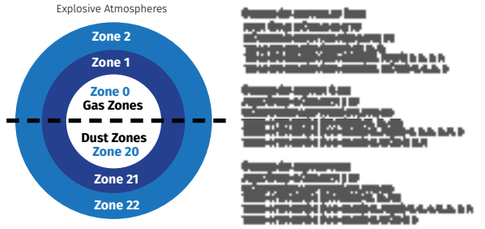
If an explosive atmosphere of flammable substances is specified, the following zones may exist:

ATEX Category	ATEX Zone (Gas & Vapour)	ATEX Zone (Dust)	Presence	ATEX Description
Category 2	Zone 1	Zone 21*	Present Intermittently	An explosive mixture may be present occasionally in normal operation
Category 3	Zone 2	Zone 22*	Present Abnormally	An explosive mixture is not expected to be present in normal operation or will only be present for a short time

Zone 22 dust fans available on request

Zones of Use

Explosive Atmospheres



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Contact Us

Whatever your issue, concern or question, contact our industrial team using the below contact details. Alternatively, visit our website and open a live chat to start discussions.

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