Introduction to ISO Air Quality Standards

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ISO

ISO (International Standards Organisation) is the world's largest developer and publisher of International Standards.

ISO is a network of the national standards institutes of 159 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that co-ordinates the system. ISO is a non-governmental organization that forms a bridge between the public and private sectors. On one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations.

Parker domnick hunter are members of governing bodies such as BCAS (UK), CAGI (USA) & VDME (Germany), which directly contribute to the development of international standards for compressed air quality and testing.

There are three standards currently in use which directly relate to compressed air quality (purity) and testing. These are:

ISO 8573 Series / ISO 12500 Series / ISO 7183 Series

The most commonly used standard is the ISO 8573 Series and in particular ISO 8573-1 : 2001.

Selecting purification equipment to meet ISO 8573 the compressed air quality standard

ISO 8573 is the group of international standards relating to the quality (or purity) of compressed air. The standard consists of nine separate parts, with part 1 specifying the quality requirements of the compressed air and parts 2 – 9 specifying the methods of testing for a range of contaminants.

ISO 8573-1 is the primary document used from the ISO 8573 series as it is this document which specifies the amount of contamination allowed in each cubic metre of compressed air.

ISO 8573-1 lists the main contaminants as Solid Particulate, Water & Oil. The purity levels for each contaminant are shown separately in tabular form, however for ease of use, this document combines all three contaminants into one easy to use table.

Changes to the ISO 8573-1 Standard

In 2001, the ISO 8573-1 air quality standard was amended in an effort to provide a more stringent air quality specifications for critical applications, with changes being specific to the purity levels relating to solid particulate and the introduction of a Class 0, allowing the user to specify an air purity cleaner than that specified in Class 1.

The latest revision of the standard is expressed as ISO 8573-1 : 2001.

Comparing both revisions of the standard

The two editions of the standard do not present particle contamination requirements in the same way.

The table from the 1991 edition shows a maximum size rating for the solid particulate and a concentration whilst the 2001 edition shows both a size rating for the particulate and the maximum number of particles allowed per cubic metre.

Extract from ISO 8573 : 1991 Part 1 for particulate (previous standard)

Class	Solid Particulate Particle size in micron	Concentration mg/m³
1	0.1	0.1
2	1	1
3	5	5
4	15	NOT SPECIFIED

Extract from ISO 8573 : 2001 Part 1 for particulate (latest standard)

Class	Solid Particulate Maximum number of particles per m³		
	0.1-0.5micron	0.5-1 micron	1.0-5micron
1	100	1	0
2	100,000	1,000	10
3	-	10,000	500
4	-	-	1,000
5	-	-	20,000
6	-	-	-

To show the differences between the two tables and highlight the improved air quality requirements, the concentration levels shown in the 1991 edition must be converted into a quantity of particles.

Using this method, shows that class 1 from the 1991 edition permitted a maximum of 191 billion particles per cubic metre, whereas the 2001 edition only allows 101.

The table below highlights exactly how much cleaner the 2001 edition is.

Quality Class	2001 edition X times cleaner than 1991 edition
1	1.9 billion times cleaner than 1991 Class 1
2	19 thousand times cleaner than 1991 Class 2
3	7 thousand times cleaner than 1991 Class 3
4	-

Selecting Parker domnick hunter purification equipment to comply with ISO 8573-1 : 2001 edition

ISO 8573-1:2001 CLASS	Solid Particulate					Water		Oil
	Maximum number of particles per m^3			Particle Size micron	Concentration mg/m^3	Vapour Pressure Dewpoint	Liquid g/m^3	Total Oil (aerosol liquid and vapour)
	0.1 - 0.5 micron	0.5 - 1 micron	1 - 5 micron					mg/m^3
0	As specified by the equipment user or supplier					As specified by the equipment user or supplier		As specified by the equipment user or supplier
1	100	1	0	-	-	-70°C	-	0.01
2	100,000	1,000	10	-	-	-40°C	-	0.1
3	-	10,000	500	-	-	-20°C	-	1
4	-	-	1,000	-	-	+3°C	-	5
5	-	-	20,000	-	-	+7°C	-	-
6	-	-	-	5	5	+10°C	-	-
7	-	-	-	40	10		0.5	-
8	-	-	-	-	-		5	-
9	-	-	-	-	-		10	-

ISO 8573-1:2001 CLASS	Solid Particulate		Water	Oil
	Wet Particulate	Dry Particulate	Vapour	Total Oil (aerosol liquid and vapour)
1	OIL-X EVOLUTION Grade AO + AA +TETPOR	OIL-X EVOLUTION Grade AR + AAR +TETPOR	PNEUDRI -70°C PDP WVM -70°C PDP	OIL-X EVOLUTION Grade AO + AA + OVR OIL-X EVOLUTION Grade AO + AA +ACS OIL-X EVOLUTION Grade AO + AC
2	OIL-X EVOLUTION Grade AO + AA	OIL-X EVOLUTION Grade AR + AAR	PNEUDRI -40°C PDP WVM -40°C PDP	OIL-X EVOLUTION Grade AO + AA
3	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PNEUDRI -20°C PDP WVM -20°C PDP	OIL-X EVOLUTION Grade AO
4	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PSD +3°C PDP	OIL-X EVOLUTION Grade AO
5	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PSD +7°C PDP	-
6	-	-	PSD +10°C PDP	-

Specifying air purity in accordance with ISO 8573-1 : 2001

When specifying the purity of air required, the standard must always be referenced, followed by the purity class selected for each contaminant (a different purity class can be selected for each contaminant if required).

An example of how to write an air quality specification is shown below :

ISO 8573-1 : 2001 Class 1.2.1
ISO 8573-1 : 2001 refers to the standard document and its revision, the three digits refer to the purity classifications selected for solid particulate, water and total oil. Selecting an air purity class of 1.2.1 would specify the following air quality when operating at the standard's reference conditions:

Class 1 Particulate
In each cubic metre of compressed air, no more than 100 particles in the 0.1 - 0.5 micron size range are allowed

In each cubic metre of compressed air, no more than 1 particle in the 0.5 - 1 micron size range is allowed

In each cubic metre of compressed air, no particles in the 1 - 5 micron size range are allowed

Class 2 Water
A pressure dewpoint of -40°C or better is required and no liquid water is allowed.

Class 1 Oil
In each cubic metre of compressed air, not more than 0.01mg of oil is allowed. This is a combined level for both oil aerosol and oil vapour.

ISO 8573-1 : 2001 Class 0

The ISO 8573-1 : 2001 table also includes a class 0 for each type of contaminant. Should an application require compressed air purity which is higher than the levels shown for class 1, then class 0 allows the user and an equipment manufacturer or supplier to agree their own levels within the following guidelines:

- **The purity levels selected must be more stringent than those of class 1**
- **The purity levels selected are measurable with the test equipment and methods of ISO 8573 parts 2 to 9**
- **The agreed levels are written as part of the air quality specification**

Important Notes

- **Class 0 does not mean zero contamination allowed in the compressed air**
- **Manufacturers should not state products comply with Class 0 unless purity levels have clearly been defined and agreed with the user**
- **Purity levels beyond the accurate measurement capabilities given in ISO 8573 parts 2 to 9 should not be selected as there is no accurate way of verifying product performance**
- **To operate a cost effective compressed air system, Class 0 should only be specified at the point of use and for the most critical of applications**

Should a user who's system has been specified in accordance with the 1991 edition of the standard require additional purification equipment the table below should be used.

Selecting Parker domnick hunter purification equipment to comply with ISO 8573-1 : 1991 edition

ISO 8573-1:1991 CLASS	Solid Particulate		Water	Oil
	Wet Particulate	Dry Particulate	Vapour	Total Oil (aerosol liquid and vapour)
1	OIL-X EVOLUTION Grade AO + AA	OIL-X EVOLUTION Grade AR + AAR	PNEUDRI -70°C PDP WVM -70°C PDP	OIL-X EVOLUTION Grade AO + AA + OVR OIL-X EVOLUTION Grade AO + AA +ACS OIL-X EVOLUTION Grade AO + AC
2	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PNEUDRI -40°C PDP WVM -40°C PDP	OIL-X EVOLUTION Grade AO + AA
3	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PNEUDRI -20°C PDP WVM -20°C PDP	OIL-X EVOLUTION Grade AO
4	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PSD +3°C PDP	OIL-X EVOLUTION Grade AO
5	OIL-X EVOLUTION Grade AO	OIL-X EVOLUTION Grade AR	PSD +7°C PDP	-
6	-	-	PSD +10°C PDP	-

Testing and Validation

Of the nine parts that make up ISO 8573, Parts 2 to 9 are used to specify the methods and equipment required to accurately test for contaminants in compressed air.

On-site testing using ISO 8573 Test Methods
On-site testing is often difficult due to the complexity of the test method and the expense of test equipment required and for this reason all Parker domnick hunter filtration products have been tested in accordance with the relevant parts of ISO 8573 with performance independently validated by Lloyds Register, one of the world's largest risk management organisations.

Using the standards to select and purchase purification products
Presenting product data in this way should allow users to easily compare the performance of purification products from different manufacturers and cost effectively meet the air quality requirements of their application, however the ISO 8573 test methods were primarily developed to verify air quality in a compressed air system, not test purification equipment, therefore not all products claiming compliance with the standards are tested in the same way.

To accurately detect contaminants in a compressed system and show compliance with the selected purity levels from ISO 8573-1, the equipment and methods shown in ISO 8573 parts 2 to 9 must be used.

These test methods can also be used to test the performance of purification equipment, however for this purpose, they contain a major omission, one which makes comparison and selection of compressed air filters extremely difficult for the user.

The vital piece of information which is missing when testing products is a challenge concentration. So even though different manufacturers claim their products meet a certain purity class, they will most likely have been tested with differing concentrations of contamination entering the product and as challenge concentrations are rarely included in technical data, filter performance which may look similar or identical on paper, can provide significantly different results when installed in a compressed air system.

Introducing ISO 12500
The ISO 8573 air quality standards were introduced to assist, not confuse compressed air users, so to overcome the problems associated with selecting products, a new standard has been introduced. This will complement the existing ISO 8573 series. The new standard, ISO 12500, will consist of three parts, with ISO 12500-1 covering the testing of compressed air coalescing filters for oil aerosol (liquid) removal, ISO 12500-2 to determine the adsorption capacity of oil vapour removal filters and ISO 12500-3 covering the testing of solid particulate filters. Parts one and two were released in June 2007, with part three to follow.

ISO 12500-1 – Testing of Coalescing Filters
ISO 12500-1 has introduced two challenge concentrations of oil aerosol to be used when testing coalescing filters, these are 40mg/m^3 and 10mg/m^3. The new standard requires filters to be tested using the existing test method and equipment shown in ISO 8573-2 whilst using one of the two challenge concentrations.

In addition to this, ISO 12500-1 requires filters to be "wetted out" which is representative of a filter in operation. Recording of the filters initial saturated pressure drop has also been included, again to give a more accurate and representative indication of the filters operational costs.

Three filters of each size must be tested and each filter tested three times. Published performance data is then an average of all the tests in order to provide the person selecting a new product with a more representative indication of performance.

ISO 12500-2 – Testing of Adsorption Filters
ISO 12500-2 has been introduced to assist users when selecting oil vapour removal filters or adsorption filters. Adsorption filters have a finite ability to remove oil vapour and when their capacity is used up, they must be replaced. ISO 12500-2 is an accelerated test of a filters adsorption capacity.

As the test is accelerated, the results must not be misinterpreted as the actual lifetime of the filter element or cartridge, it's purpose is to indicate which filter has the largest adsorption capacity and hence will require changing less frequently.

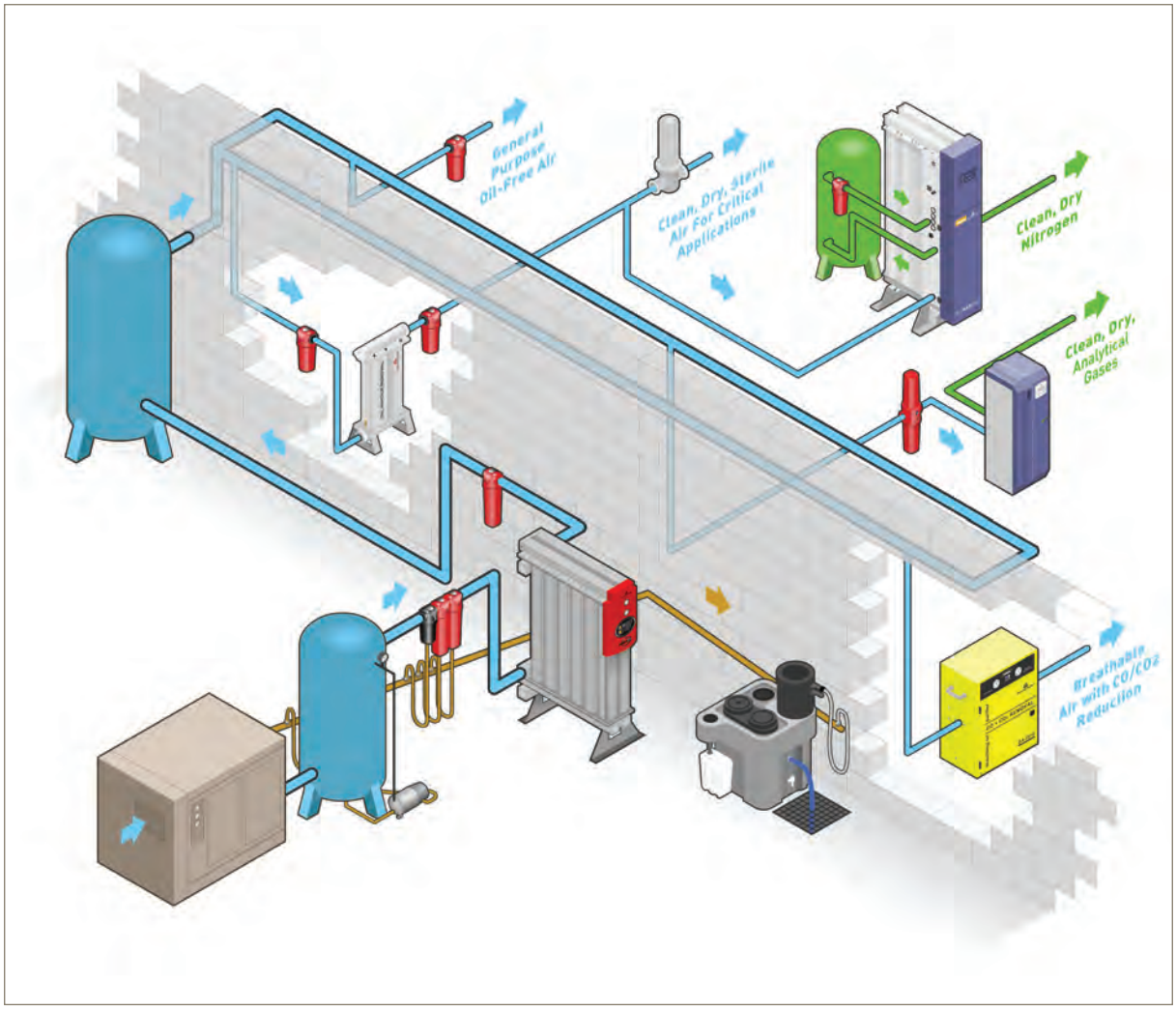
ISO 12500-3 – Testing of Particulate Removal Filters
ISO 12500-3 is not currently released.

ISO 7183 : 2007 specifies the performance data that is necessary to be stated in technical documentation as well as the applicable test methods for different types of compressed air dryers. It is applicable to compressed air dryers working in the 0.5 – 16 bar g pressure range and includes the following dryer types: adsorption dryers, membrane dryers and refrigeration dryers. ISO 7183 : 2007 identifies test methods for measuring dryer parameters that includes the following: pressure dew point, flow rate, pressure drop, compressed air loss, power consumption and noise emission. ISO 7183 : 2007 also provides partial-load tests for determining the performance of energy saving devices and describes the mounting, operating and loading conditions of dryers for the measurement of noise.

Optimised system design for typical applications

The quality of air required throughout a typical compressed air system can vary. The extensive range of purification equipment available from Parker domnick hunter allows the user to specify the quality of air for every application, from general purpose ring main protection, through to critical clean dry air (CDA) point of use systems.

Parker domnick hunter has comprehensive ranges of purification equipment available to exactly match system requirements, ensuring both capital and operational costs are kept to a minimum.



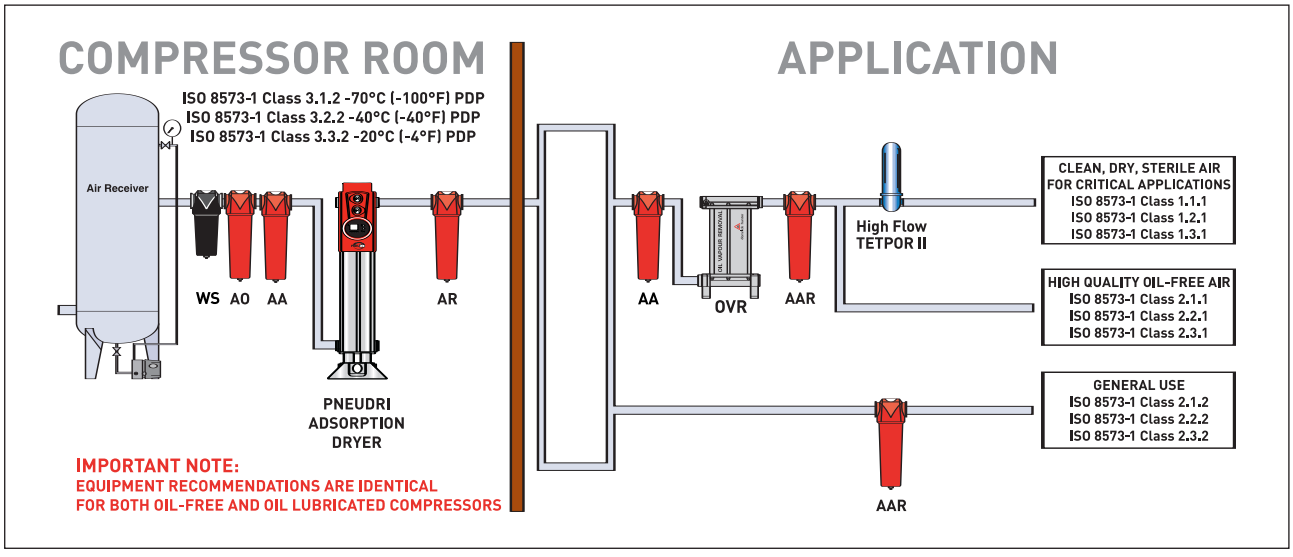
Cost effective system design

To achieve the stringent air quality levels required for today's modern production facilities, a careful approach to system design, commissioning and operation must be employed. Treatment at one point alone is not enough and it is highly recommended that the compressed air is treated prior to entry into the distribution system to a quality level suitable for protecting air receivers and distribution piping. Point of use purification should also be employed, with specific attention being focussed on the application and the level of air quality required. This approach to system design ensures that air is not "over treated" and provides the most cost effective solution to high quality compressed air.

Simple guidelines for the selection of purification equipment

1. Purification equipment is installed to provide air quality and you must first of all identify the quality of compressed air required for your system. Each usage point in the system may require a different quality of compressed air dependent upon the application. Using the quality classification's shown in ISO 8573-1 : 2001 will allow your equipment supplier to quickly and easily select the correct purification equipment necessary for each part of the system.
2. ISO 8573-1 : 2001 is the latest edition of the standard. Ensure it is written in full when contacting suppliers. Specifying air quality as "ISO 8573-1" or "ISO 8573-1 : 1991" refers to the previous edition of the standard and may result in a lower quality of delivered compressed air.
3. Ensure that the equipment under consideration will actually provide delivered air quality in accordance with the quality classifications you have selected from ISO 8573-1 : 2001.
4. When comparing coalescing filters, ensure that they have been tested in accordance with both the ISO 8573-2, ISO 8573-4 & ISO 12500-1 standards.
5. Ask for independent validation of product performance by a 3rd party.
6. For peace of mind, ensure the manufacturer provides a written guarantee of delivered air quality.
7. Oil-free compressor installations require the same filtration considerations as oil lubricated compressor installations.
8. When considering the operational costs of coalescing filters, only compare the initial saturated pressure loss as dry pressure loss is not representative of performance in a normally wet compressed air system. ISO 12500-1 requires pressure losses for coalescing filters to be recorded when the element is saturated
9. Look at the blockage characteristics of the filter. Just because it has a low starting dp, doesn't mean it will remain low throughout the filter element's lifetime. Energy costs should always be calculated based upon the blockage characteristics of the filter, not just initial saturated dp.
10. Look at the total cost of ownership for purification equipment (purchase cost, operational costs and maintenance costs), a low initial purchase price, may look inviting, but may end up costing significantly more in terms of poor air quality and high operational costs.

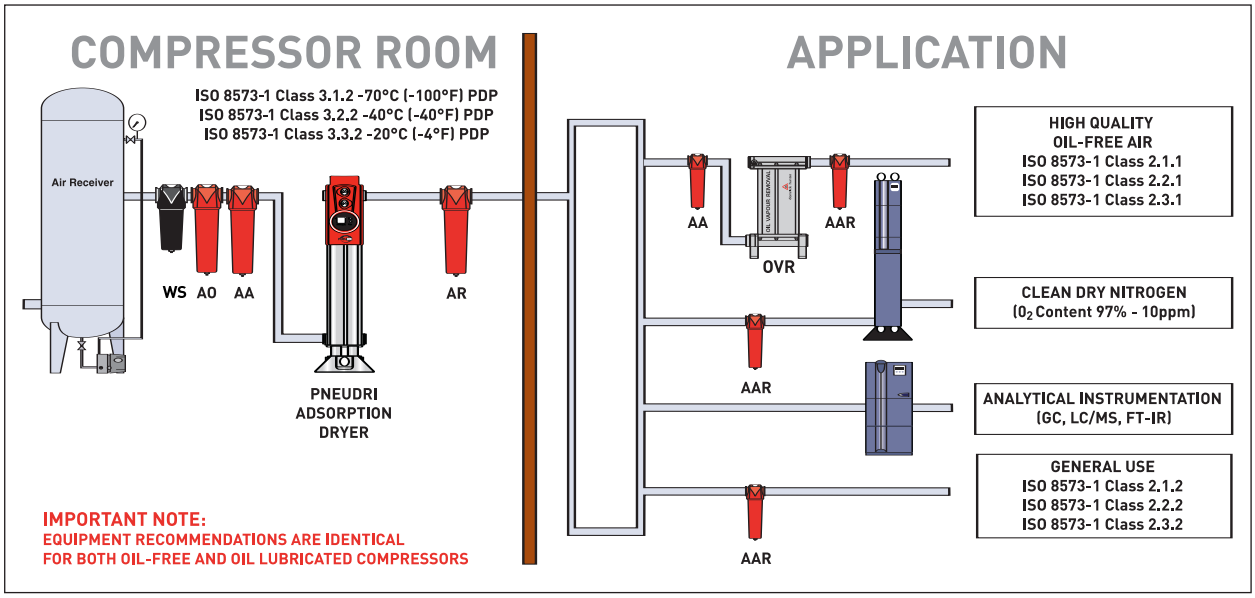
CRITICAL APPLICATIONS



Typical Applications

Pharmaceutical products
Silicon wafer manufacturing
TFT / LCD Screen manufacturing
Memory device manufacturing
Optical storage devices (CD, CD/RW, DVD, DVD/RW)
Optical disk manufacturing (CD's/DVD's):
Hard disk manufacturing
Foodstuffs
Dairies
Breweries
CDA systems for electronics manufacturing

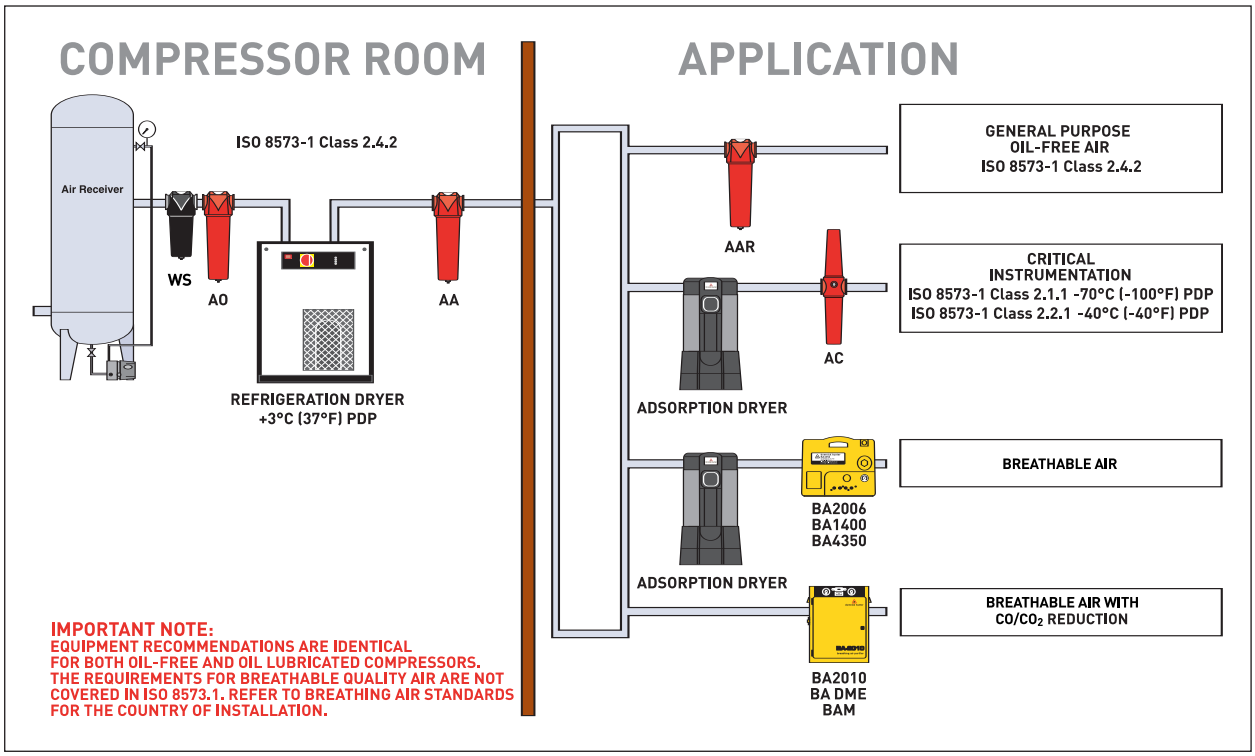
HIGH QUALITY OIL-FREE AIR



Typical Applications

Blow Moulding of Plastics e.g. P.E.T. Bottles
Film processing
Critical instrumentation
Advanced pneumatics
Air blast circuit breakers
Decompression chambers
Cosmetic production
Medical air
Dental air
Lasers and optics
Robotics
Spray Painting
Air bearings
Pipeline purging
Measuring equipment
Blanketing
Modified Atmosphere Packaging
Pre-treatment for on-site gas generation

GENERAL PURPOSE OIL-FREE AIR



Typical Applications

General ring main protection
Pre-filtration to point of use adsorption air dryers
Plant automation
Air Logistics
Pneumatic tools
General instrumentation
Metal stamping
Forging
General industrial assembly
(no external pipework)
Air conveying
Air motors
Workshop (Tools)
Garage (Tyre filling)
Temperature control systems
Blow guns
Gauging equipment
Raw material mixing
Sand / bead blasting

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