FIRST COMPRESSOR MANUFACTURER IN THE WORLD ACCREDITED **ISO 50001** ENERGY MANAGEMENT

CLASS ZERO MODULE

METALPLAN

METALPLAN IS NUMBER ONE IN ENERGY EFFICIENCY

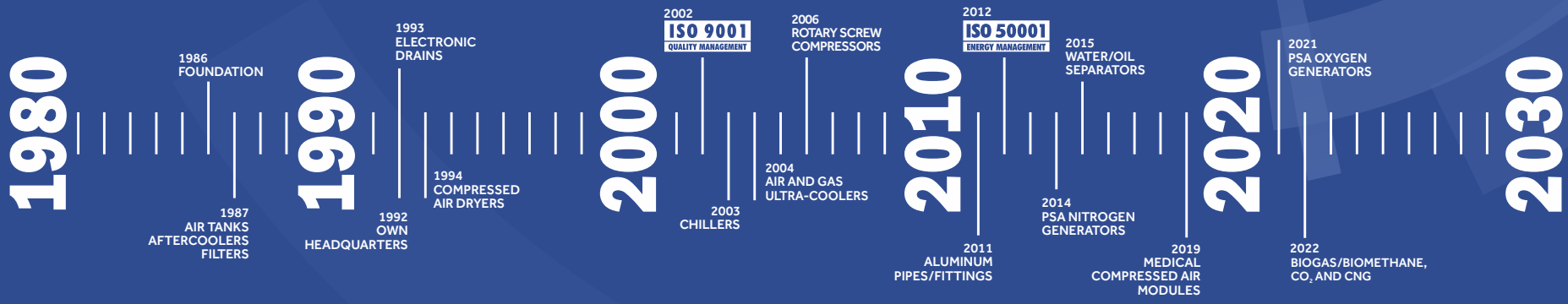
As the absolute leader in screw compressors up to 25 hp in Brazil, Metalplan is the world's first* compressor manufacturer accredited in ISO 50001 - Energy Management, demonstrating its commitment to energy efficiency, the foundation for sustainability and competitiveness of companies.

Founded in 1986, Metalplan has a production area of 6.000 m², developing innovative equipment with a high level of nationalization, exporting to over 20 countries.

Its network of authorized distributors and service centers includes over 300 highly specialized companies with extensive geographic coverage, capable of servicing over 100.000 operating equipment.

In recent years, Metalplan has been expanding its horizons to disruptive technologies in gases and renewable energies, such as on-site generation and compression of nitrogen, oxygen, biogas, biomethane, CO2 and CNG.

*in the compressed air, gases and industrial refrigeration segment.



CLASS ZERO MODULE

MODUCARB

OIL FREE AIR

ISO CLASS ZERO

RISK FREE

COMPRESSED AIR CLASS ZERO WITH ZERO RISK

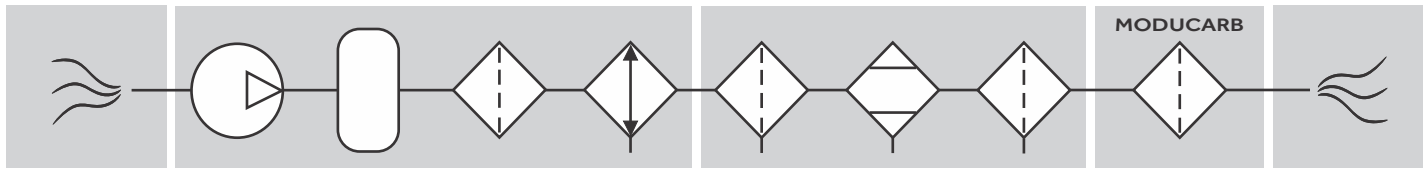
No international standard (ISO 22000, etc.) requires "oil-free" compressors to obtain Class Zero compressed air, since oil-free compressors DO NOT guarantee oil-free compressed air. For an oil-free compressor to deliver oil-free compressed air, the ambient air would need to be completely free of oil, which never happens.

This means that it is possible to keep your lubricated compressors in operation, with a method that guarantees, with zero risk, an oil residue within Class Zero limits.

To meet this demand, we developed the MODUCARB - Class Zero Safety Module, certified by the Compressed Air and Gas Systems Laboratory at IPT.

MODUCARB is an oversized barrier against oil passage, with negligible pressure loss and a guarantee of meeting Class Zero (≤ 0.003 mg/m³) thanks to its bed of activated carbon pellets, with controlled nanoporosity.

STANDARD INSTALLATION ISO 8573 / CLASS ZERO

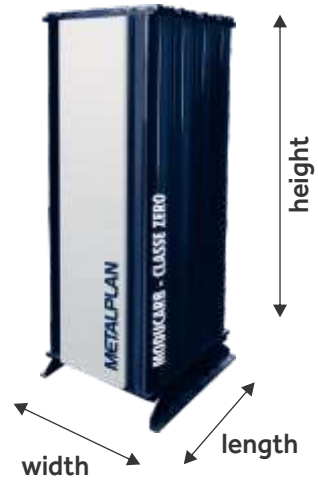


Ambient air (1)	Compressor	Tank Oil separator	Air/oil separator	Aftercooler	Pre-fine coalescent filter	Dryer (2)	Post-ultrafine coalescent filter	CLASS ZERO MODULE
0,3 mg/m³ (2)	500 mg/m³	100 mg/m³	3 mg/m³	3 mg/m³	1 mg/m³	1 mg/m³	0,01 mg/m³	0,003 mg/m³
38°C (3)	90°C	85°C	80°C	40°C	38°C	20°C	3°C	20°C
0 bar (4)	7,5 bar	7,5 bar	7,45 bar	7,45 bar	7,3 bar	7,25 bar	7,1 bar	7,0 bar
Class 2	Class X	Class X	Class 4	Class 4	Class 3	Class 3	Class 1	Class ZERO

(1) CAGI average - (2) Refrigeration/adsorption/absorption - (3) ISO 7183 - Option A2 - (4) Pressure gauge - ΔP average: 0.5 bar/min.: 0.25 bar/max.: 1 bar | The average pressure drop is not arithmetic mean.

TECHNICAL DATA

Model	Nominal flow rate		Connection (in.)	Dimensions (mm)			Weight (kg)	Material Towers/ Tubes
	pcm	m³/h		length	height	width		
MCZ - 060	60	102	L 1/2" NPT	150	531	630	38	Aluminum
MCZ - 100	100	170	L 1" NPT	150	744	630	45	
MCZ - 160	160	272	L 1" NPT	350	1029	630	54	
MCZ - 200	200	340	L 2" NPT	350	1313	630	64	
MCZ - 500	500	850	L2. 1/2" NPT	500	1598	630	146	
MCZ - 800	800	1360	L2. 1/2" NPT	650	1598	630	220	
MCZ - 1000	1000	1700	L2. 1/2" NPT	800	1598	630	293	
MCZ - 1300	1300	2210	FL.4" ANSI B16.5 150	950	1598	630	366	
MCZ - 1600	1600	2720	FL.4" ANSI B16.5 150	1100	1598	630	439	
MCZ - 2000	2000	3400	FL.4" ANSI B16.5 150	1400	1598	630	586	



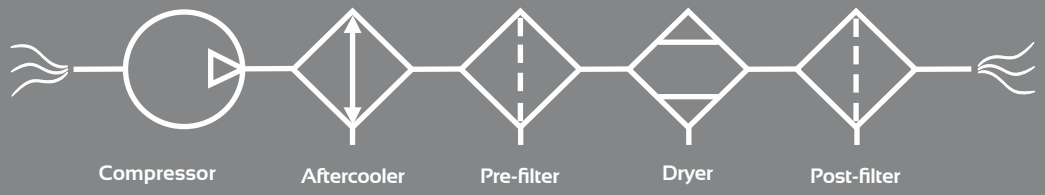
At the Moducarb inlet, the compressed air must comply with ISO 8573 class [1.4.1] or higher.
The maximum temperature of the compressed air and the environment should not exceed 38°C.
Under these conditions, the activated carbon pellets, with controlled nanoporosity, should be replaced every 4,000 hours of operation.

__On-site__ oxygen production requires compressed air of extremely high purity, with no detectable traces of oil, in accordance with ISO 8573 Class Zero. This is due to the risk of explosion when a fuel (oil) comes into contact with an oxidizer (oxygen). In systems supplied to __Air Liquide__, the __ModuCarb module__ is a mandatory component for the total removal of oil, regardless of the type of compressor used.

Air Liquide

COMPRESSED AIR FUNDAMENTALS

ISO 8573 STANDARD INSTALLATION



CONTAMINANTS & QUALITY CLASSES

class	SOLID PARTICLES maximum number of particles per m³ (d = particle size) 0,1µm < d ≤ 0,5µm	0,5µm < d ≤ 1µm	1µm < d ≤ 5µm	class	WATER moisture dew point (°C)	class	OIL - total concentration (liquid/aerosol/vapor) (mg/m³)
0	CLASS ZERO - as specified by the user or equipment supplier and stricter than Class 1						
1	≤ 20.000	≤ 400	≤ 10	1	-70	1	≤ 0,01
2	≤ 400.000	≤ 6.000	≤ 100	2	-40	2	≤ 0,1
3	-	≤ 90.000	≤ 1.000	3	-20	3	≤ 1
4	-	-	≤ 10.000	4	+3	4	≤ 5
5	-	-	≤ 100.000	5	+7	5	-
	Mass concentration - C_p (mg/m³)			6	+10	6	-
6	$0 < C_p \leq 5$				Liquid Water C_w g/m³)		
7	$5 < C_p \leq 10$			7	$C_w \leq 0,5$	7	-
8	-			8	$0,5 < C_w \leq 5$	8	-
9	-			9	$5 < C_w \leq 10$	9	-
X	$C_p > 10$			X	$C_w > 10$	X	> 5

ISO 8573 COMPRESSED AIR FOR GENERAL USE

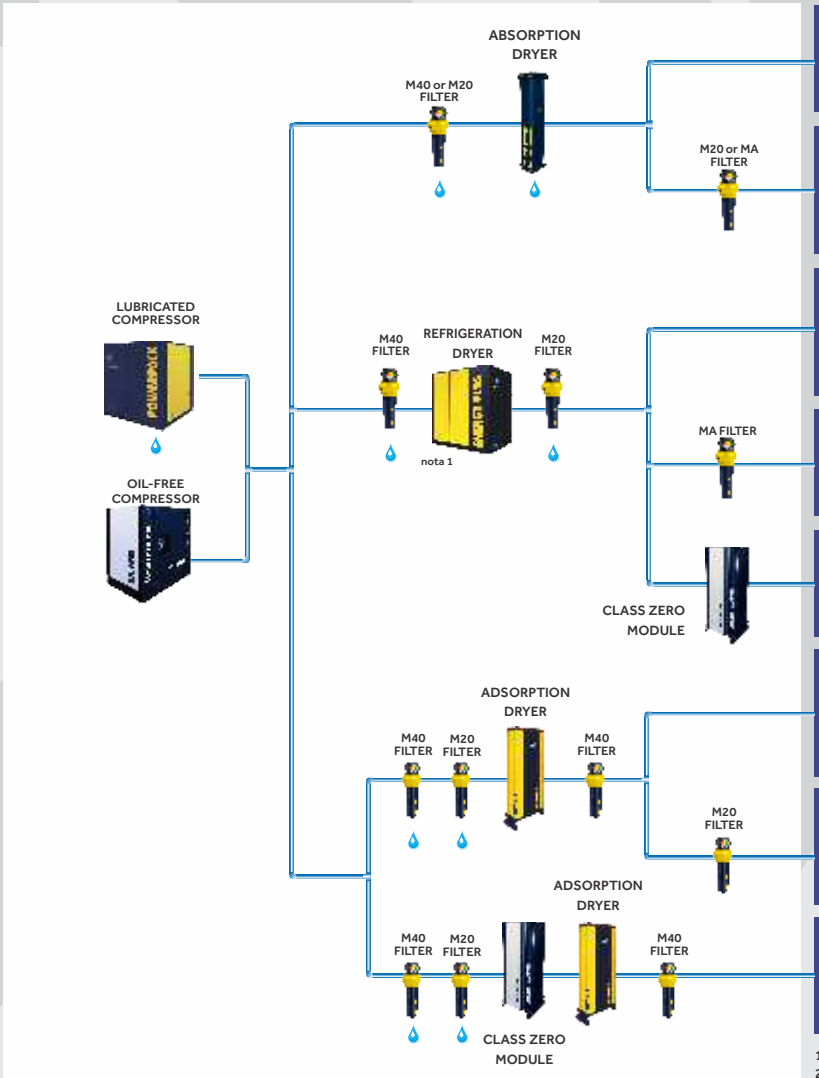
ISO 8573 is the international reference for compressed air systems, focusing on contamination levels.

The standard has various quality classes that serve multiple applications in industry and services, excluding human breathing and medicinal use.

Published in 1991, it was translated by Metalplan in 1992, positioning Brazil at the forefront of its utilization.

Its 3rd edition is from 2010, when Class Zero was introduced, with purity levels stricter than those found in Class One.

COMPRESSED AIR FUNDAMENTALS

ISO 8573 TYPICAL SYSTEMS	quality class	APPLICATIONS
	[1:6:1] [2]	Dry air, with dew point between 5°C and 15°C. Ideal for low flows and protection of valves, cylinders, pneumatic tools, automation, blasting, painting, etc.
	[1:6:1] [2] [1:6:0] [2]	Activated carbon filter eliminates odors, with residual oil of 0.003 mg/m³, suitable for dental clinics and similar applications, except for human breathing.
	[1:4:1]	This is the most used treatment system in the industry. Its level of protection meets various sectors such as automotive, plastic, textile, paper, mechanical, metallurgical, etc.
	[1:4:0]	Quality similar to the previous system, with odor elimination and lower residual oil (0.003 mg/m³), important in N2 and O2 generation and in the food, chemical, pharmaceutical industries, etc.
	[1:4:0]	Quality similar to the two previous systems, in terms of "water" and "solid particles". Meets Class Zero for the "oil" contaminant with total safety.
	[1:2:1] [1:1:1]	Prevents vapor absorption when air comes into direct contact with hygroscopic materials (cement, resins, powdered or freeze-dried foods and pharmaceuticals). Prevents freezing when air is subjected to negative temperatures. Applied in the generation of gases of very high purity.
	[1:2:1] [1:1:1]	Low dew point and maximum particle retention are essential in the manufacture of optical fibers, chips, critical instrumentation, steelmaking, nuclear reactors, etc.
	[1:2:0] [1:1:0]	Quality similar to the two previous systems, in terms of "water" and "solid particles". Meets Class Zero for the "oil" contaminant with total safety.

1 Energy Plus and Titan Plus dryers have integrated pre and post-filters
2 only if the compressed air inlet temperature is < 25°C

Install an AQUA + condensate treatment system.

DECIPHERING CLASS ZERO

When drafting Class Zero, ISO 8573 **failed to adopt the necessary clarity**. See the original text:

"Class 0: as specified by the equipment user or supplier and **more stringent than Class 1**"*

The standard requires that the contamination levels of Class Zero be **lower** – "more stringent" – than the levels of Class One, meaning, **the maximum levels of Class Zero must be below the lowest levels of Class One**. However, the standard does not establish the limit between these levels. When referring to the oil contaminant, we know that the most sophisticated instruments can detect up to 0.003 mg of oil in each m³ of compressed air. Therefore, this is the value that should be adopted as the minimum level of Class One and the maximum of Class Zero.

CHOOSE THE MOST SUITABLE CLASS FOR YOUR APPLICATION

When specifying the quality of compressed air, never go beyond the user's needs, avoiding high costs and inconveniences.

An example is the increasing demand for "100% oil-free/Class Zero" compressed air, even when there is no basis for it. There are specifications that opt for excessive caution, without considering that it is easy to eliminate the risk of contamination with very affordable devices.

It is up to the user, with the support of experts, to define the necessary and sufficient technical requirements for their application.

For situations where even the slightest presence of oil is not tolerable, a synthetic, non-toxic, colorless, and odorless lubricant can be used, of the food-grade type, approved and recommended by : National Health Surveillance Agency

OIL RESIDUE - ISO 8573

CASE STUDY

COMPRESSOR POWER	100 hp
TOTAL FLOW OF COMPRESSED AIR	7.7 million m³/year
TOTAL MASS OF COMPRESSED AIR	10 thousand tons/year
OIL RESIDUE IN CLASS ONE	86 grams/year
OIL RESIDUE IN CLASS ZERO	26 grams/year

OIL-FREE COMPRESSED AIR: DEBUNKING MYTHS

Air compressors draw in ambient air and all contamination around them: water vapor, oil vapor, and solid particles.

"Oil vapor" is the generic term for the combination of oil vapors, hydrocarbon vapors, and volatile organic compound (VOC) vapors present in the ambient air[1].

The concentration of oil vapors in the atmosphere is typically between 0.05 mg/m³ and 5 mg/m³ but can reach even higher levels in dense industrial or urban areas.
According to the UN, the ambient air in certain regions may contain a level 100 thousand times higher than Class Zero[2] of ISO 8573 Standard allows.

Conclusion: regardless of the type of compressor – **lubricated or oil-free** – the presence of oil in compressed air is inevitable, requiring appropriate treatment immediately after compression. Effectively, when using an oil-free compressor, achieving Class Zero is easier, while a lubricated compressor will require more safety devices.

THE AMBIENT AIR CAN CONTAIN UP TO 100 THOUSAND TIMES MORE OIL VAPORS THAN CLASS ZERO PERMITS

SOURCE	OIL CONCENTRATION – C	ISO 8573
CAGI – Compressed Air and Gas Institute (USA)	0.05 mg/m³ ≤ C ≤ 0.5 mg/m³	Classes 2 and 3
OSHA – Occupational Safety and Health Administration (USA)	C ≤ 5 mg/m³	Class 4
MTb – Ministry of Labor (Brazil)	C ≤ 5 mg/m³	Class 4
UN – United Nations Industrial Development Organization	C ≤ 300 mg/m³	Class X

GLOSSARY

[1] **Hydrocarbon**: organic compound formed by hydrogen and carbon atoms.
Oil: mixture of hydrocarbons formed by six or more carbon atoms (C6+).
Volatile Organic Compound: carbon compounds with a high vaporization rate (benzene, ethanol, acetone, formaldehyde, etc.)

[2] **Class Zero**: oil residue ≤ 0.003 mg/m³

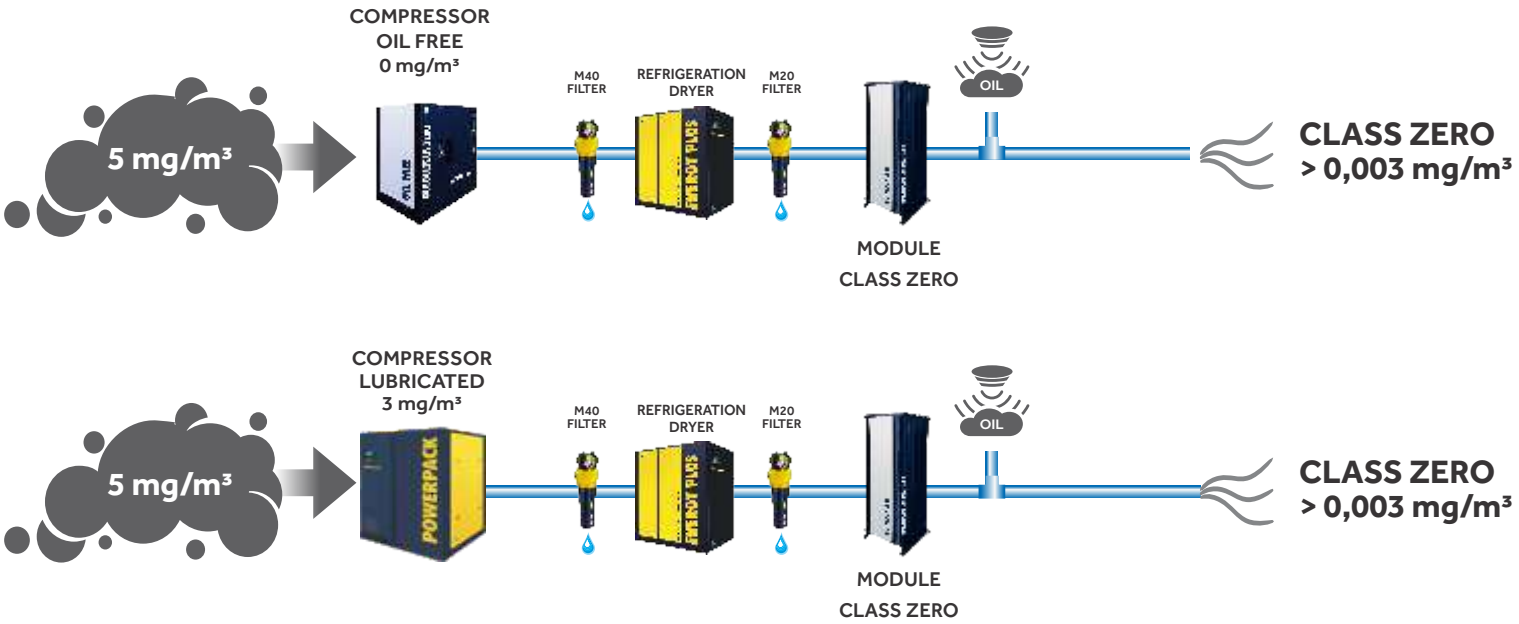
ACHIEVING ZERO CLASS WITH ZERO RISK

It is important to note that the presence of oil in the ambient air prevents any claims of "zero contamination risk" in a compressed air system, even when using oil-free compressors.

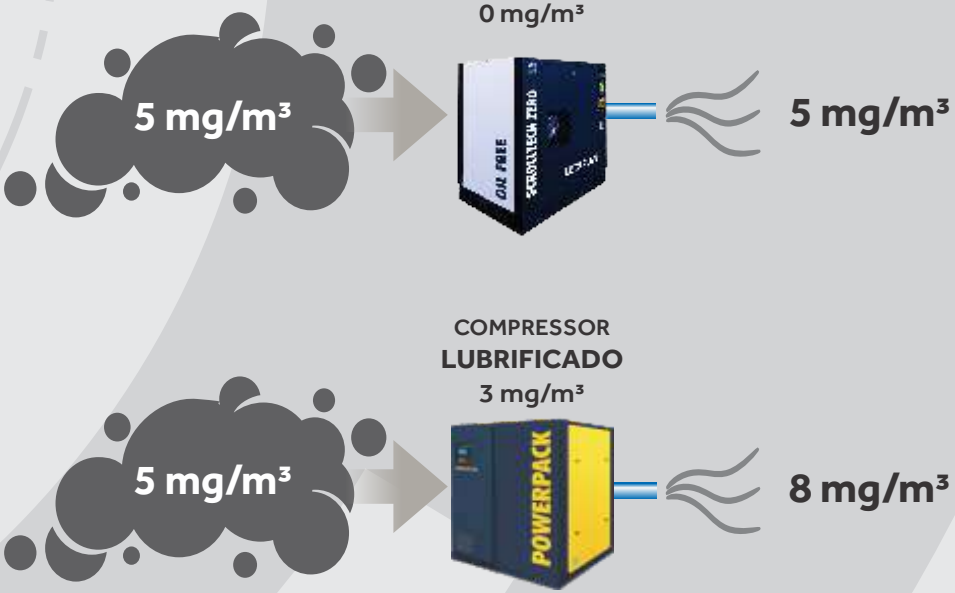
To fully mitigate this risk, there are devices[1] that ensure the retention of all oil, whether in liquid or gaseous form. These devices are monitored by oil sensors and equipped with backup and redundancy systems, ensuring a continuous supply of Zero Class compressed air.

It is thanks to these surveillance and protection mechanisms that, for example, gas oxygen plants (both medicinal and industrial) safely use lubricated compressors.

1 - Activated carbon modules or catalytic converters



COMPRESSED AIR FUNDAMENTALS



DOES A "ZERO CLASS COMPRESSOR" EXIST?

The ISO 8573 standard allows for the claim that "compressed air samples meet Zero Class," if these samples are collected and tested with the frequency required by the user.
However, there is no part of the standard that contains the term "Zero Class Compressor." This is self-evident, as no compressor can eliminate the oil present in the ambient air.
Whether lubricated or oil-free, any compressor will draw and compress the surrounding air, including the oil contained in it.

In installations with oil-free compressors, 100% of the oil in the compressed air will come from the surrounding environment.

In installations with lubricated compressors, the oil in the compressed air will be a combination of the oil present in the atmosphere and the oil released by the compressor itself, which is typically around 3 mg/m³ (*).

In both cases, the resulting contamination far exceeds Zero Class, requiring stringent treatment to meet the standard.

This treatment will also eliminate particles and moisture, which are inherent in any type of compressor.

In summary, the term "Zero Class Compressor" is a rhetorical construct with no real basis, regardless of how it is presented.

*Standard residual for oil-injected screw compressors.

MARKS OF OUR HISTORY

AFTER-SALE SERVICES

★★★★★

96% OF CUSTOMERS FULLY SATISFIED

In an Annual ISO 9001 Audited Survey, we achieved a 96% customer satisfaction rate for Technical Assistance. This percentage corresponds to the evaluations above 7 (seven), on a scale of 0 (zero) to 10 (ten).

This success is due to over 70 authorized workshops and 200 accredited technicians throughout American continent, supported by an exclusive partnership with National Service for Industrial Training for mechanic training, making our After-Sales Service the most acclaimed in the market.

SAM
Metalplan Authorized Service

Typical facade

COMPREHENSIVE INVENTORY OF ORIGINAL PARTS

MAXIMUM EFFICIENCY IN AFTER-SALES SERVICE

70 CERTIFIED WORKSHOPS

200 SPECIALIZED TECHNICIANS

OUR SOLUTIONS

COMPRESSED AIR

- COMPRESSORS
- DRYERS AND FILTERS
- RESERVATÓRIOS
- PIPES & FITTINGS 100% ALUMINUM
- NITROGEN GENERATORS AND OXYGEN

INDUSTRIAL REFRIGERATION

- WATER CHILLERS
- ULTRA AIR AND GAS COOLERS (-35°C)
- THERMOCHILLERS
- DRY COOLERS
- PUMPING

BIOGAS & CNG

- COMPRESSORS FOR BIOGAS, BIOMETHANE AND CNG
- BOOSTERS
- CHILLERS
- DISPENSERS

e-line

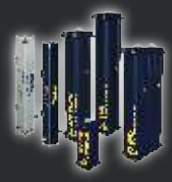
ROTARY SCREW COMPRESSORS

4 to 25 hp

REFRIGERATION DRYERS

20 to 250 pcm

ABSORPTION DRYERS



6 to 32 pcm

COALESCING FILTERS

25 to 300 pcm

AUTOMATIC DRAIN VALVES

electronic & magnetic

Premium line - 2025

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