FIRST COMPRESSOR MANUFACTURER IN THE WORLD ACCREDITED ISO 50001 ENERGY MANAGEMENT

100% ALUMINUM TUBES AND CONNECTIONS

METALPLAN AIRPOWER

METALPLAN IS NUMBER ONE IN ENERGY EFFICIENCY

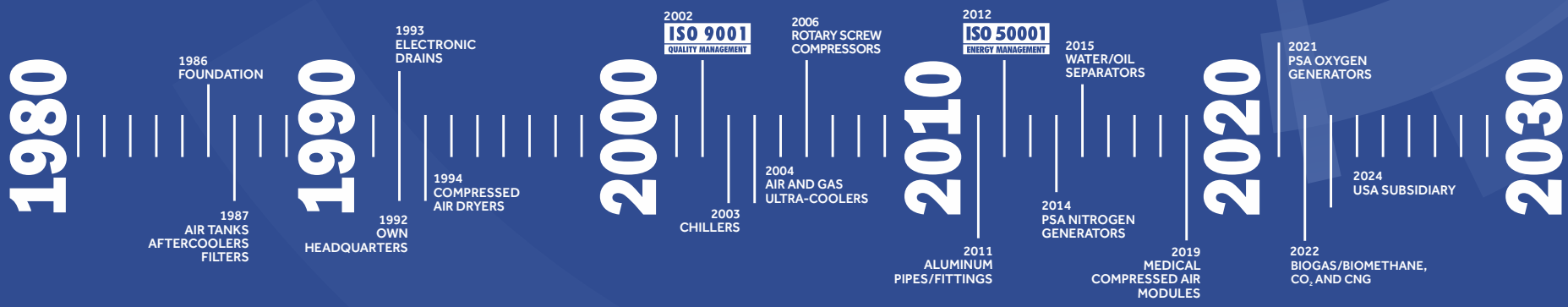
As the absolute leader in screw compressors up to 25 hp in Brazil, Metalplan is the world's first* compressor manufacturer accredited in ISO 50001 - Energy Management, demonstrating its commitment to energy efficiency, the foundation for sustainability and competitiveness of companies.

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, CO_2 and CNG.

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



One of the world's largest manufacturers of subsea pipelines chose AIRLINE for its compressed air network

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The Pre-Salt oil continues to attract the most important oil & gas companies in the world.
***Italian Saipem (Agip-ENI)** chose the city of Guarujá (SP) to host an important industrial complex, destined for the construction of subsea pipelines.*
*The entire compressed air system of this unit was designed and executed by Metalplan, with 1300 hp **TotalPack Flex DD** screw compressors and over 2 thousand meters of **AirLine** tubing, 100% aluminum.*

saipem Agip Eni

AIRLINE

100% ALUMINUM TUBES AND CONNECTIONS

AirLine is the only tubing and fitting system for compressed air networks made of 100% aluminum, an exclusive from Metalplan.

With AirLine, the time frame for implementing a network is radically shorter than any other system, the leak guarantee is total, the pressure drop is minimal, corrosion is zero, and your savings are maximum!

MODULAR

ASSEMBLE, DISASSEMBLE AND REMOUNT AS MANY TIMES AS YOU WANT

THREADLESS

NO NEED FOR SPECIAL TOOLS AND PREVENTS LEAKS

ZERO LEAKAGE
- Does not corrode.
- Does not leak in the tubes.
- Does not leak in the connections.

MINIMAL PRESSURE LOSS
- Ultra-smooth internal surface reduces flow turbulence.
- Low Reynolds number.
- Energy savings.

ZERO CORROSION
- Zero maintenance.
- Increases the lifespan of tubes and fittings.

CONSTANT QUALITY
- Calibrated diameters.
- Reduced tolerances.
- Controlled thickness painting.

70%

70% FASTER ASSEMBLY
- Easy and quick tube cutting system.
- Instantaneous coupling connections.

MAXIMUM CHEMICAL AND MECHANICAL RESISTANCE
- Resists all types of lubricants and condensate.
- Does not deform under mechanical stress.

AVAILABILITY
- Easy to add connections.
- Wide variety of fittings.

ISO 50001

HIGH ENERGY EFFICIENCY
- Minimized pressure drop reduces compressor load time.

DIAMETERS FROM 25 TO 160 mm
- Flexibility in designs.
- Meets flow rates exceeding 10,000 cfm.

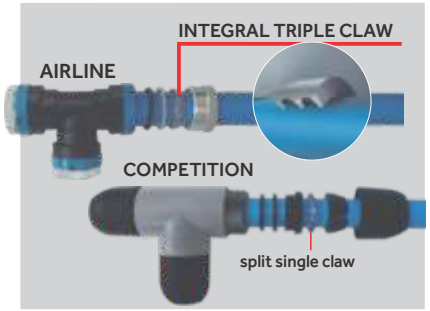
ALLOW MODIFICATION, EXPANSION, AND REUSE OF ALL MATERIALS

AIRLINE

100% ALUMINUM CONNECTIONS FOR ALL PURPOSES

	EXTERNAL DIAMETER					
	25 mm	40 mm	63 mm	90 mm	110 mm	160 mm
UNION (SLEEVE)	✓	✓	✓	✓	✓	✓
MALE ADAPTER	25x3/4"	40x1 1/4"	63x2"	90x3"	ND	ND
FEMALE ADAPTER	25x3/4"	40x1 1/4"	63x2"	ND	ND	ND
FLANGE ADAPTER	ND	ND	ND	ND	110x4"	160x6"
ELBOW	✓	✓	✓	✓	✓	✓
MF ELBOW	✓	✓	✓	ND	ND	ND
FLANGE ELBOW	ND	ND	ND	ND	110x4"	160x6"
TE	✓	✓	✓	✓	✓	✓
CENTRAL TE BSP	25x3/4"x25	40x1 1/4"x40	63x2"x63	ND	ND	ND
COLLAR	25x1/2"	40x1/2" 40x3/4"	63x1/2" 63x3/4" 63x1"	90x1" 90x2"	110x1" 110x2"	160x3"
DERIVATION	ND	40x25	63x25	ND	ND	ND
REDUCTION	ND	40 x 25	63 x 40	90 x 63	110 x 90	160 x 110

CONNECTIONS	HIGH AND LOW PRESSURE
Color	black
Maximum working pressure	70 bar(g) (1015 psi)
Design pressure	105 bar(g)
Hydrostatic test pressure	280 bar(g)
Continuous working temperature	-20°C to 100°C
Material	EN AW 6061 - T6
O-ring material	NBR 65°/75° Shore A
Ring material	Pa66
Tightening ring material	Stainless Steel AISI 304



AirLine connections ensure perfect and complete crimping with the tube. Together with the O-ring, they ensure total sealing of the piping.

AirLine connections are the only ones produced in aluminum: smaller, lighter, and more efficient.

Only AirLine compressed air networks are fully made of extruded and calibrated aluminum, including the connections.

Pressure drop for every 10 meters of pipe length (psi)

FLOW RATE pcm	EXTERNAL DIAMETER					
	25 mm	40 mm	63 mm	90 mm	110 mm	160 mm
50	0,44	0,03				
100	1,74	0,10				
200		0,44	0,04			
300		0,94	0,08			
500			0,23	0,03		
750			0,52	0,07	0,02	
1000			0,93	0,13	0,04	
1250			1,45	0,20	0,07	
1500				0,29	0,10	
2000				0,52	0,17	0,02
2500				0,81	0,27	0,04
3000				1,17	0,39	0,06
4000					0,69	0,10
6000					1,56	0,22
8000						0,40
10000						0,62

Always compare the internal diameter of AirLine tubing with the internal diameter of other tubing

Equivalent length of pipe	25 mm	40 mm	63 mm	90 mm	110 mm	160 mm
ELBOW	0,67 m	0,96 m	1,40 m	1,70 m	2,00 m	2,40 m
TE	0,60 m	1,00 m	1,95 m	2,40 m	3,10 m	8,30 m
VALVE GATE	0,20 m	0,31 m	0,52 m	0,58 m	0,76 m	0,98 m

AIRLINE

ALUMINUM PIPES FOR LOW AND HIGH PRESSURE (16 to 70 bar)

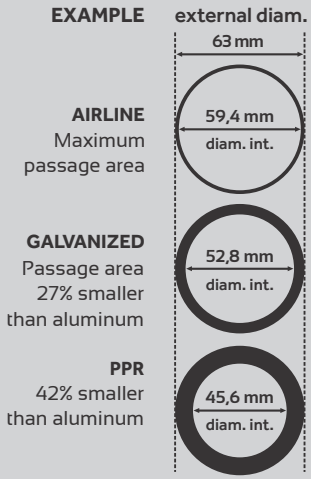
EXCLUSIVE SOFTWARE

Calculates the diameter of each section of the network and finds the exact balance between pressure drop and energy consumption.

PIPES	LOW PRESSURE			HIGH PRESSURE		
Color (compressed air blue - NBR standard)	RAL 5012			RAL 5017		
Maximum working pressure	16 bar(e) (232 psi)			70 bar(e) (1015 psi)		
Design pressure	24 bar(e)			105 bar(e)		
Hydrostatic test pressure	64 bar(e)			280 bar(e)		
Continuous working temperature	-20°C to 100°C			-20°C to 100°C		
Mechanical resistance	standard EN-755-2/2008			standard EN-755-2/2008		
Material	EN AW 6060 - T5			EN AW 6060 - T5		
Standard bar	6 m			6 m		
External diameter	25 mm	40 mm	63 mm	90 mm	110 mm	160 mm
Weight per linear meter	0,22 kg/m	0,43 kg/m	0,94 kg/m	1,79 kg/m	2,36 kg/m	3,22 kg/m
Wall thickness	1,1 mm	1,3 mm	1,8 mm	2,4 mm	3,0 mm	4,3 mm

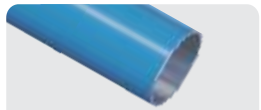
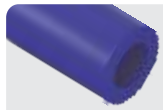
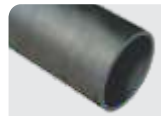
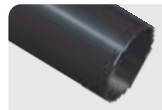
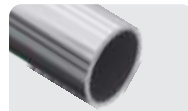
WITH ALUMINUM, YOU GET HIGHER FLOW AND LOWER PRESSURE DROP

For the same external diameter, aluminum piping always has the largest internal diameter.
Other materials require a much thicker wall to withstand pressure and meet additional requirements for strength and durability.
The larger internal area of aluminum pipes results in lower pressure drop. Or higher flow. Or both.



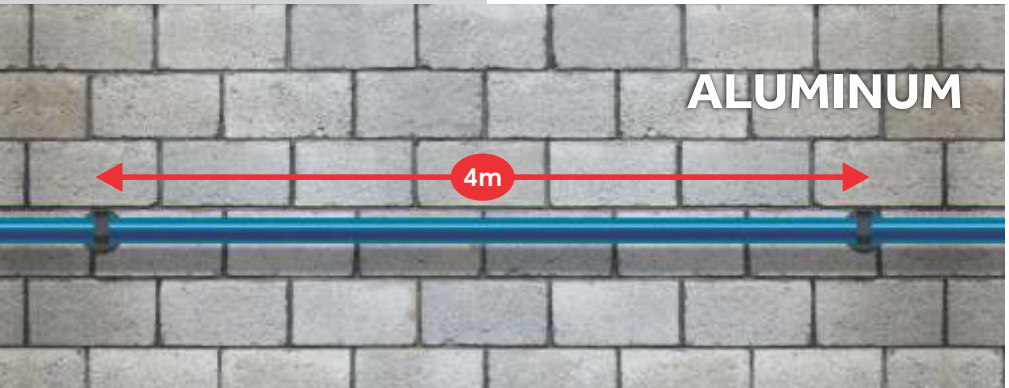
AIRLINE

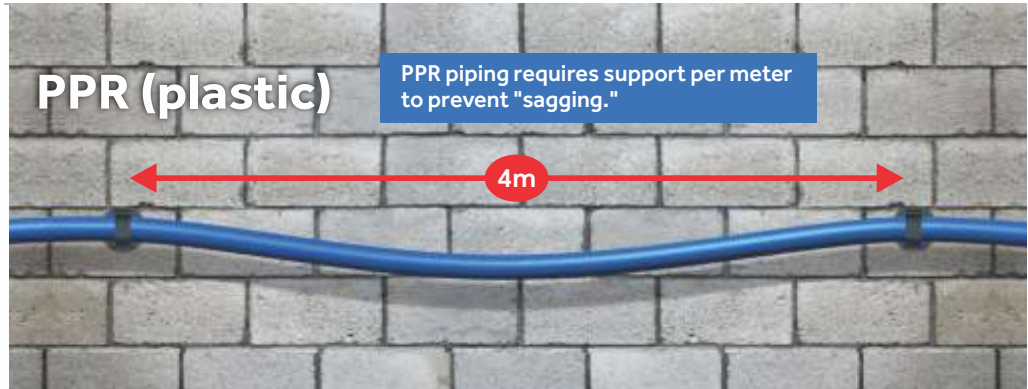
ALUMINUM X OTHER MATERIALS

	Aluminum	PPR (plastic)	Galvanized (carbon steel)	Black (carbon steel)	Stainless Steel
Energy efficiency	excellent ✓	regular ✗	regular ✗	poor ✗	excellent ✓
Pressure drop	minimum ✓	low ✓	average ✗	high ✗	low ✓
Leaks	0% ✓	0% ✓	10 ~ 40% ✗	10 ~ 40% ✗	0% ✓
Internal roughness	0.000004 mm ✓	0.007mm ✓	0.15 mm ✗	2.0 mm ✗	0.015 mm ✓
Corrosion-resistant	excellent ✓	great ✓	average ✗	low ✗	excellent ✓
Heat-resistant	high ✓	low ✗	high ✓	high ✓	high ✓
Impact-resistant	high ✓	low ✗	high ✓	high ✓	high ✓
UV radiation-resistant	high ✓	low ✗	high ✓	high ✓	high ✓
Hydrocarbon-resistant	high ✓	low ✗	high ✓	high ✓	very high ✓
Pressure-resistant	high ✓	low ✗	very high ✓	very high ✓	high ✓
External painting	electrostatic (blue) ✓	blue pigment ✓	requires painting* ✗	requires painting* ✗	requires painting* ✗
Reusable	yes ✓	rarely ✗	rarely ✗	rarely ✗	rarely ✗
Assembly time	very low ✓	high ✗	high ✗	high ✗	high ✗
Pressure x Temperature	16/70 bar(g) at 100°C ✓	20 bar(e) at 20°C ✗	OK ✓	OK ✓	OK ✓
Distance between supports	3 to 4 meters ✓	0.4 to 1.4 meters ✗	3 to 4 meters ✓	3 to 4 meters ✓	3 to 4 meters ✓

*Brazilian Association of Technical Standards-6493/1994 - Use of colors for pipe identification.
Compressed air: blue-security Munsell 2.5PB 4/10.





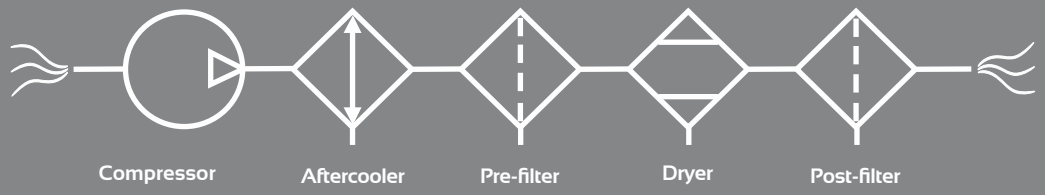
AIRLINE
INSTALLATIONS

The compressed air network at Cervejaria Colorado is AirLine, ensuring the excellence of its production in Ribeirão Preto (SP). When you enjoy a Colorado beer, you are savoring the quality of compressed air provided by Metalplan. Cheers!

Cervejaria Colorado
Natural de Ribeirão Preto

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

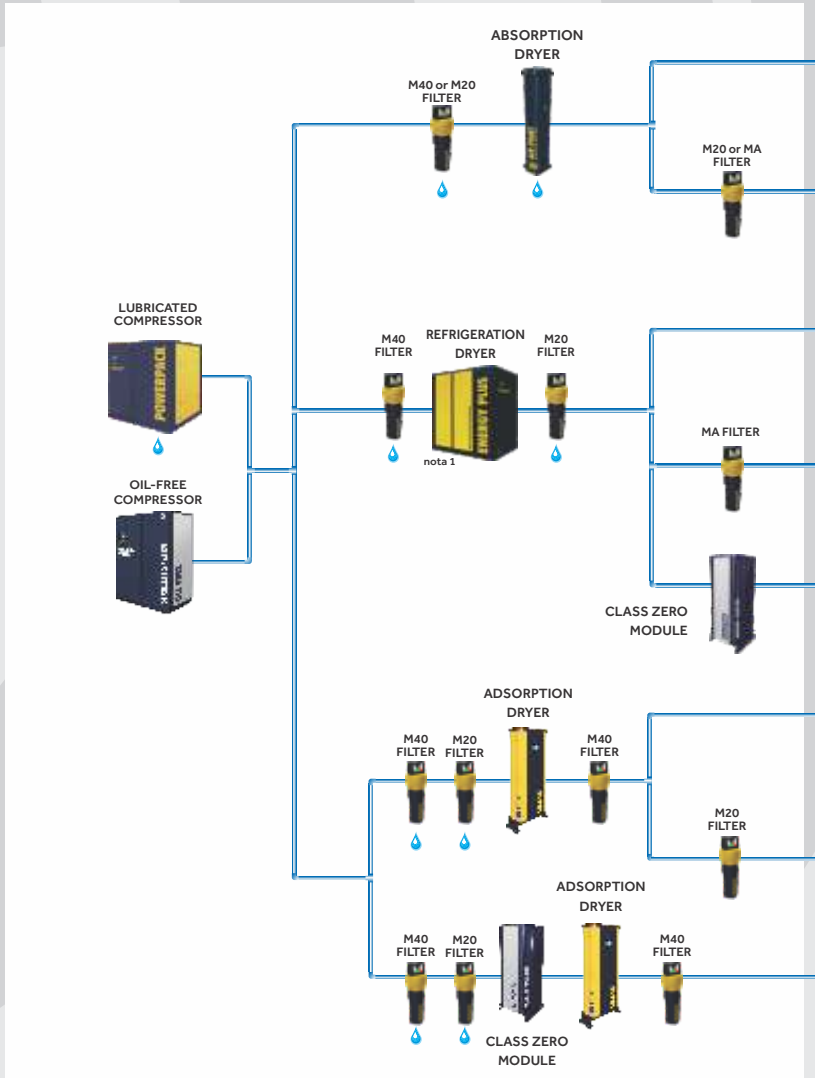
ISO 8573 is the international reference for compressed air systems, focusing on contamination levels.

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.

*Pressure loss = pressure drop

LEAKS AND PRESSURE LOSS*

THE VILLAINS OF COMPRESSED AIR DISTRIBUTION

Networks with leaks of 40% and pressure losses greater than 2 bar are very common, making it illogical to invest heavily in high-efficiency compressors that save only a fraction of the energy lost in the compressed air distribution system.

With current technologies, it is possible to detect and measure invisible and inaudible leaks with great precision, even in hard-to-reach areas. With just a few inputs, the detection instrument itself calculates the cost of each air leak, generating a detailed report of the situation.

State-of-the-art materials and innovative design and construction techniques also allow for leak-proof and low-pressure-loss networks that meet the best energy efficiency standards.

Nevertheless, it is important to observe some basic principles:

- The closed-loop system layout is the most recommended network design.
- For an initial pressure between 6 and 12 bar(e), the pressure loss between the main reservoir and the points of use should be between 0.1 and 0.3 bar, at most.
- Smaller volume reservoirs can be installed at the ends of the network or near higher consumption points. Since the most intense compressed air demands are typically short-term, these auxiliary reservoirs can help prevent excessive pressure loss at specific points in the system.
- The pipe diameter should balance the initial investment with the desired pressure loss throughout the system's lifetime.
- Prefer pipes and fittings that are resistant to oxidation, impacts, high temperatures, and UV rays.
- Derivations for each point of use should never be taken from the bottom of the pipes that form the main loop, to avoid potential contamination by condensate.
- Specific branches should be planned for condensate drainage in particular cases.
- It is highly recommended to establish a periodic investigation procedure for the network to check for leaks.

LEAK COST

Flow (m³/h)	3,2	6,4	12,7
Leak (m³/h)	45	180	720
Cost (R$/year)	28.880,00	115.200,00	460.800,00

P = 7 bar(e) | 8000h/year | 1,0kWh = R$ 0,80

COST OF PRESSURE LOSS

Flow (m³/h)	400	800	1600
ΔP (bar)	1,0		
Cost (R$/year)	18.800,00	37.600,00	75.200,00

P = 7 bar(e) | 8000h/year | 1,0kWh = R$ 0,80

Calculation of compressed air pipelines

INSTRUCTIONS FOR USE:

1. On the "Section Length" scale, mark a point on the equivalent length of the pipe, where you want to determine the internal diameter.

2. On the "Air Flow" scale, mark a point for the average compressed air flow in that section of the pipe.

3. Connect the two points with a straight line and mark where this line crosses the reference line A.

4. On the "Operating Pressure" scale, mark a point for the initial compressed air pressure at that section.

5. On the "Pressure Loss" scale, mark a point for the desired pressure loss for this section of the pipe.

6. Connect the two points with a straight line and mark where this line crosses the reference line B.

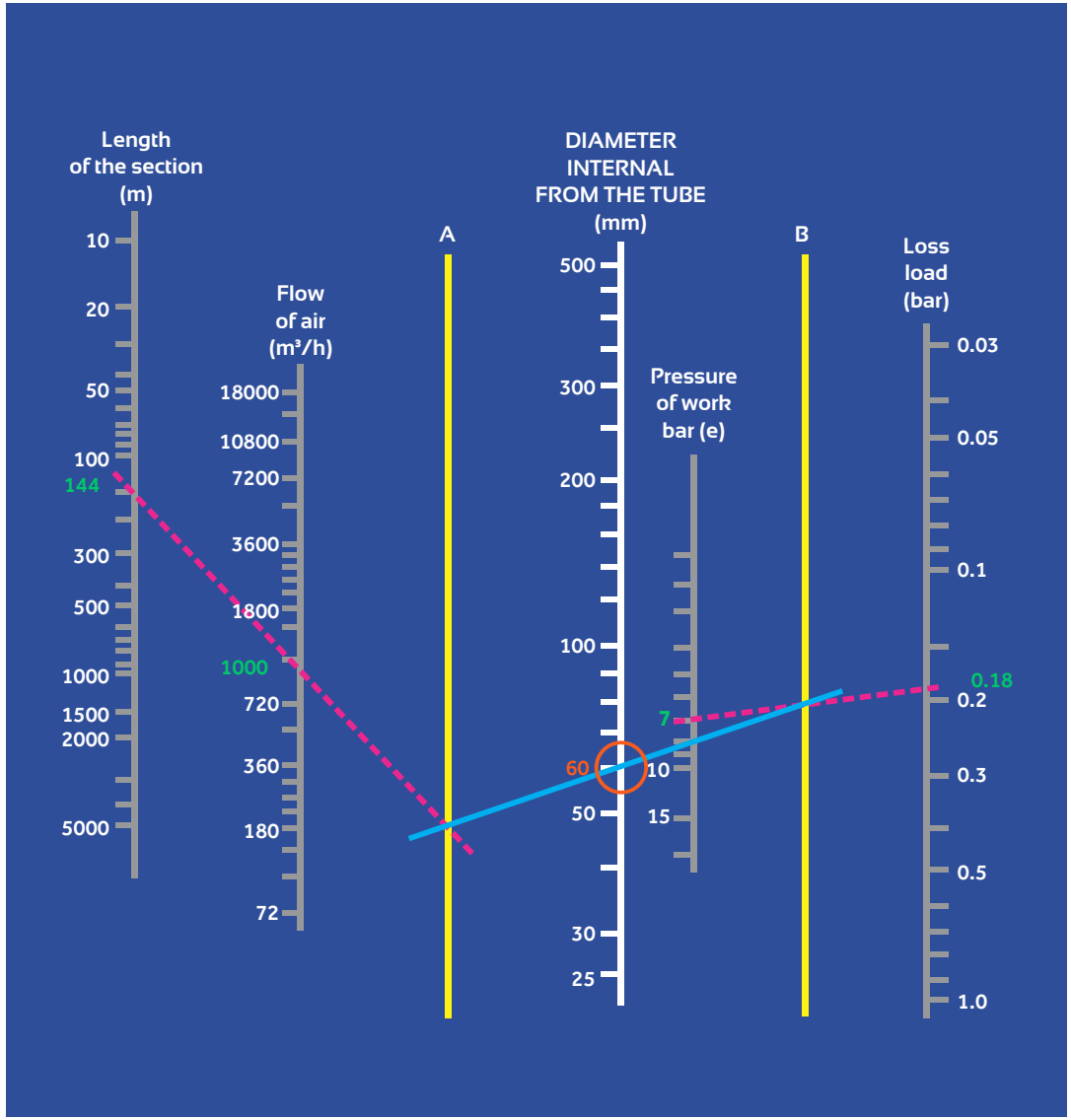
7. Draw a straight line between the two points on the reference lines A and B.

8. The intersection of this line with the "INTERNAL PIPE DIAMETER" scale indicates the required internal diameter.

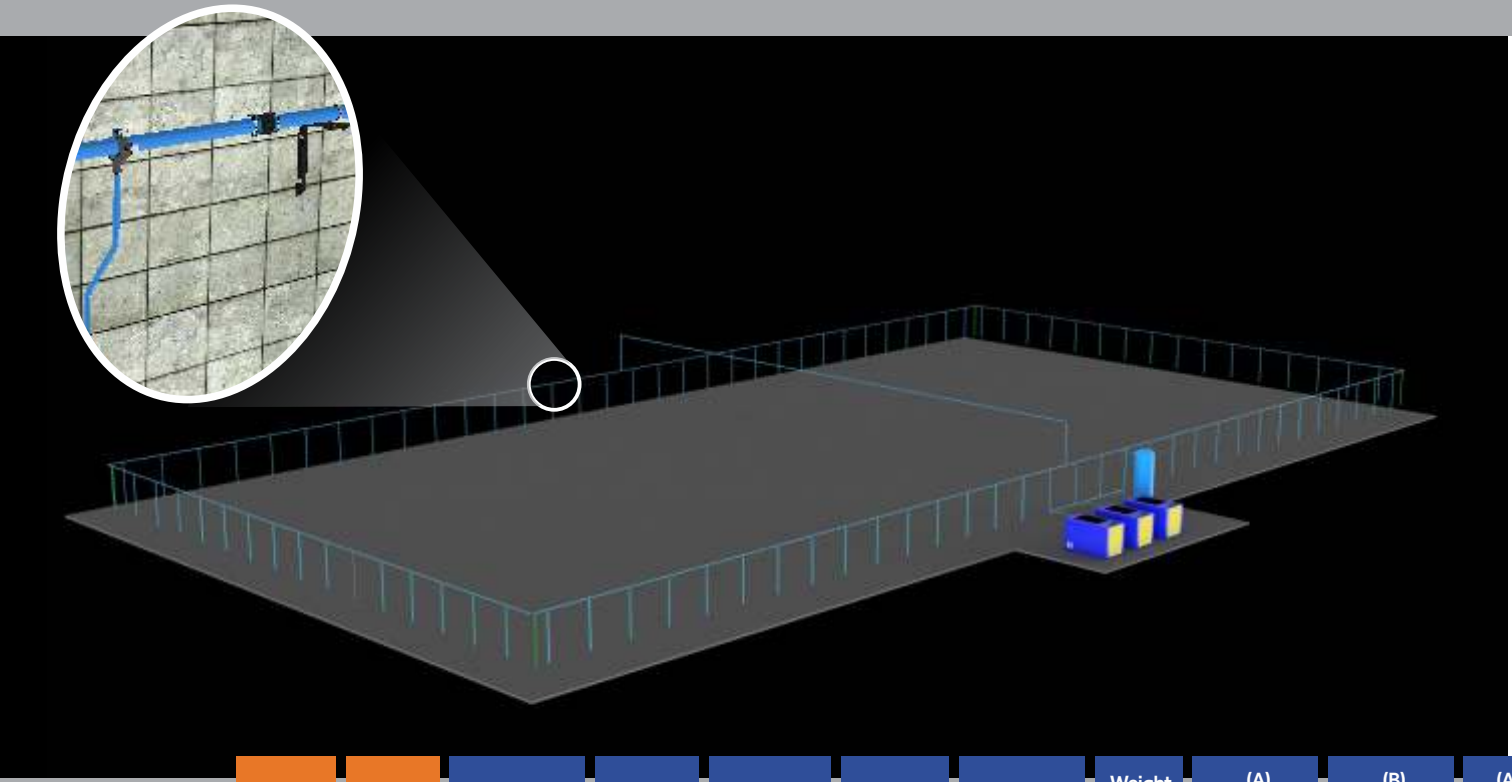
EXAMPLE:

Equivalent length of the pipe section:	144 meters
Average compressed air flow in the section:	1000 m³/h
Initial compressed air pressure in the section:	7 bar(e)
Maximum desired pressure loss in the section:	0.18 bar
Internal pipe diameter in the section:	**x**

In this case, x = 60 mm



COMPRESSED AIR FUNDAMENTALS



CASE STUDY

Problem:

Distribute a flow of 4000 m³/h @ 7.0 bar, with a maximum pressure loss of 0.18 bar.

The dimensions of the building are 96 m x 48 m, and the required pipe ceiling height is 4 meters.

Solution:

Ring network (96 m x 48 m), with a central interconnection to equalize the pressures.

96 derivations for points of use (every 3 meters), with a valve at the end of each derivation, 1 meter above the floor.

With aluminum, the main loop had an external diameter (ED) = 63 mm and met the required pressure loss (ΔP).

In the galvanized pipe version, the loop was defined with ED = 63 mm, but the ΔP was 30% above the required value. The ideal would have been ED = 75 mm.

In the plastic (PPR) version, it was necessary to use ED = 75 mm. Even so, the ΔP was 20% above the established value.

	Diameter external of the ring (mm)	Diameter internal of the ring (mm)	Time of installation of supports	Time of court	Time of thread or thermofusion	Time of painting	Time total of assembly	Weight total from the network (kg)	(A) Cost of labor (R$)	(B) Cost of materials (R$)	(A+B)=(C) Investment initial (R$)	Life useful of installation	(D) Cost ΔP/year (R$)	(C+D)=(E) Total cost in 10 years (R$)
ALUMINUM	63	59,4	12 h	4 h	X	X	16 h	500	4.000,00	119.891,00	123.891,00	vitalícia	30.000,00	423.891,00
PPR	75	54,2	24 h*	X	26 h	X	50 h	850	12.500,00	62.944,00	75.444,00	10 anos	37.600,00	451.444,00
GALVANIZED	63 **	52,8	12 h	16 h	38 h	9 h	75 h	2250	18.750,00	68.659,00	87.409,00	15-20 anos	40.000,00	487.409,00

288 supports for PPR, compared to 72 supports for galvanized or aluminum pipes. | Time was estimated for a 2-person team. | P = 7 bar(e) | 8000 hours/year | 1.0 kWh = R$ 0.80

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
- RESERVOIRS
- 100% ALUMINUM PIPING

OXYGEN & NITROGEN

- OXYGEN GENERATORS PSA / VSA ON SITE
- NITROGEN GENERATORS PSA ON SITE

INDUSTRIAL REFRIGERATION

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

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

METALPLAN

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55 11 4448-6900

FIRST COMPRESSOR MANUFACTURER IN THE WORLD ACCREDITED ISO 50001 ENERGY MANAGEMENT