LGAI Technological Center, S.A. (APPLUS)
Campus de la UAB
Ronda de la Font del Carme s/n
08193 Bellaterra (Barcelona)
T +34 93 567 20 00
www.appluslaboratories.com

Results marked with '' are not covered by the ENAC accreditation*

Bellaterra: 7th of May, 2021

File number: 21/25000-1102

Client reference: **ROS DUCTING, S.L.U.**
Pol. Ind. Pla de Poliger Sector Nord – SAU 1
17854, Sant Jaume de Llierca (Girona)

TEST REPORT

Specimen assembled on: 21st of April, 2021

Date of Test: 21st of April, 2021

TEST ELEMENT

Straight sheet metal air duct with circular section of 1000 mm diameter and total length of 2970 mm. Composed of three ducts of 990 mm of length. Fabricated in galvanized steel sheet of 1 mm thickness and with a total surface area of 10,90 m^2.

Referenced **Multiform duct System**.

REQUESTED TEST

Leakage test of the sheet metal air duct with circular section according to the Standard:

- UNE-EN 12237:2003 and UNE-EN 12237:2003+Erratum:2007. *'Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts'.*

Test carried out by Adrián Esteban (Enclosures Laboratory – Applus+ Laboratories)

The reproduction of this document is only authorised if it is made in its totality. Electronically signed reports in digital format are considered original documents, as well as its electronic copies. Their printing has no legal validity.

INDEX

1. TEST OBJECT

The sheet metal air duct has been subjected to the leakage test to evaluate its compliance with the requirements defined in Standard:

- UNE-EN 12237:2003 and UNE-EN 12237:2003+Erratum:2007. *'Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts.'* Section 5.1 *'Leakage'.*

2. TEST ELEMENT DESCRIPTION

Technical specifications and drawings of the test specimen are provided by the client and attached in the Annex B (TECHNICAL DOCUMENTATION). LGAI Technological Center, S.A. is not responsible for this information.

The main characteristics of the test element are listed below. The references/models and the information indicated with *(*)* is provided by the test petitioner.

Applus register number	21/1102
Manufacturer	ROS DUCTING, S.L.U.
Model / Reference	**Multiform duct System**
Supplied by	ROS DUCTING, S.L.U.
Date received	20th of April, 2021
Type of test element	Sheet metal air duct with circular section
Composition *(*)*	Straight duct fabricated in galvanised steel sheet of 1 mm thickness composed of 3 ducts of 990 mm of length.
Total surface area, *S*	10,9 m^2
Total joint length, *L*	12,6 m
Joint treatment *(*)*	Transverse joint: - Multiform duct System with hybrid clamping ring with EPDM profiled sealing ring.
Test element assembling (carried out by/date)	ROS DUCTING / 20th of April, 2021

3. ASSEMBLY METHOD AND INSTALLATION OF SPECIMEN

The duct has been connected to the Test Bench K. SCHULTEN FENSTERTECHNIK model KS 4040/650 PC through the connection cap. Final piece has been closed through the final cap to provide a proper sealing.

Test place: LGAI Technological Center, S.A. (APPLUS)
Campus UAB – Ronda de la Font del Carme s/n
08193 Bellaterra (Barcelona)

4. SPECIMEN CONDITIONING

The specimen remains more than 4 hours conditioned in the Test Bench Room with a temperature between 10ºC and 30ºC and a relative humidity between 25% and 75%.

Environmental conditions:

TEMPERATURE:	18,1 ºC
RELATIVE HUMIDITY:	59,7 %
ATMOSPHERIC PRESSURE:	99,90 kPa

5. EQUIPMENT AND ITS CALIBRATION

The equipment used in the test is the following:

Apparatus	Identification	Date last calibration
Tape measure	171057	12.02.2020
Meteorological station	171040	28.11.2019
Pressure sensor	130118	30.01.2019
Anemometer 1	130119	14.09.2018
Chronometer	170278	18.07.2019

6. RESULTS. LEAKAGE TEST

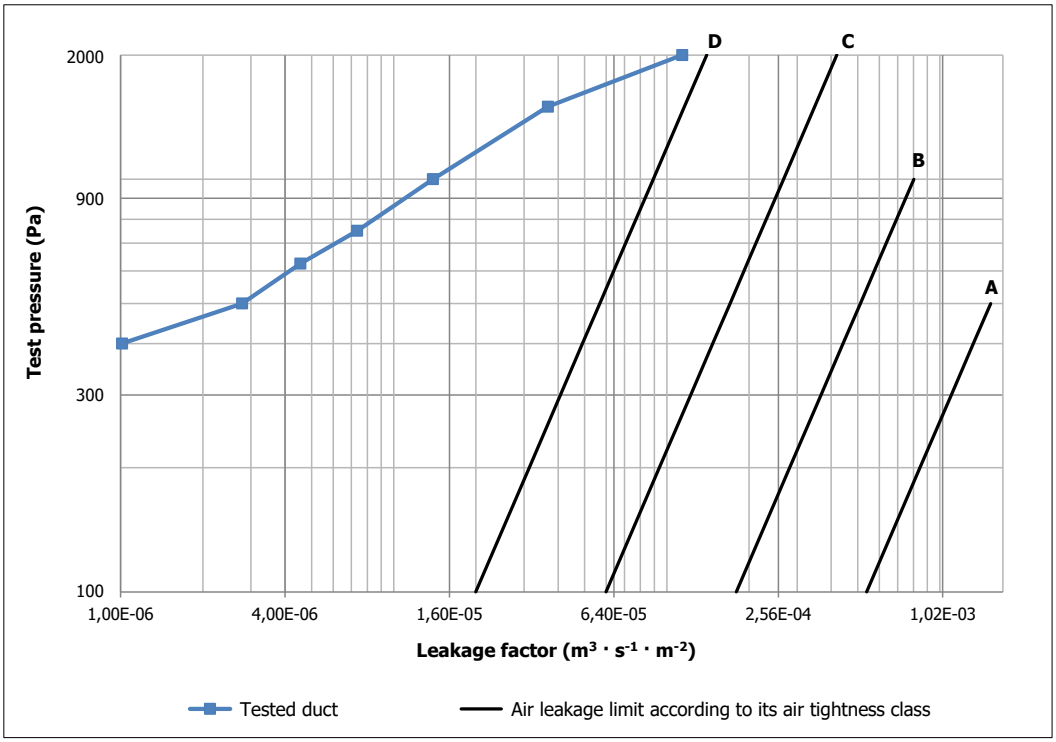
Leakage checking of the test specimen is the air leak that passes through the test specimen with positive and negative pressures.

The time for stable pressure at each measuring point is 1 minute. Air leak results obtained over the test specimen have been as follows:

POSITIVE PRESSURES

Total Pressure	Leakage flow rate $Q_{measured}$	Leakage flow fate corrected q_v	Leakage factor f	Air leakage limit $f_{max.}$ ($m^3/s \cdot m^2$)			
Pa	m^3/h	m^3/h	$m^3/s \cdot m^2$	CLASS A	CLASS B	CLASS C	CLASS D
200	<1,00 **0,00*	<0,99 **0,00*	<2,529E-05 **0,000E-00*	8,453E-04	2,818E-04	9,393E-05	3,131E-05
300	<1,00 **0,00*	<0,99 **0,00*	<2,529E-05 **0,000E-00*	1,100E-03	3,668E-04	1,223E-04	4,075E-05
400	<1,00 **0,04*	<0,99 **0,04*	<2,529E-05 **1,012E-06*	1,326E-03	4,422E-04	1,474E-04	4,913E-05
500	<1,00 **0,11*	<0,99 **0,11*	<2,529E-05 **2,782E-06*	1,534E-03	5,112E-04	1,704E-04	5,680E-05
625	<1,00 **0,18*	<0,99 **0,18*	<2,529E-05 **4,552E-06*		5,910E-04	1,970E-04	6,566E-05
750	<1,00 **0,29*	<0,99 **0,29*	<2,529E-05 **7,334E-06*		6,653E-04	2,218E-04	7,392E-05
1000	<1,00 **0,55*	<0,99 **0,55*	<2,529E-05 **1,391E-05*		8,021E-04	2,674E-04	8,913E-05
1500	1,45	1,44	3,667E-05			3,480E-04	1,160E-04
2000	4,50	4,47	1,138E-04			4,196E-04	1,399E-04

Leakage table in positive pressures



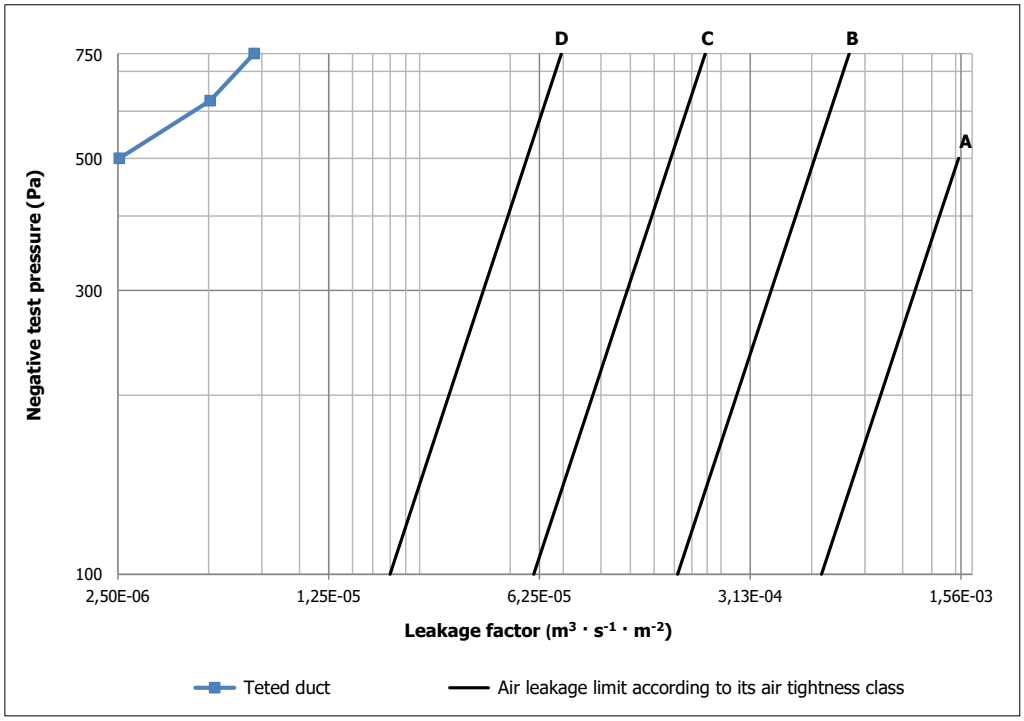
Graph of leakage in positive pressures

Remarks: The pressure limit is established in 2000 Pa.

NEGATIVE PRESSURES

Total Pressure	Leakage flow rate $Q_{measured}$	Leakage flow fate corrected q_v	Leakage factor f	Air leakage limit $f_{max.}$ ($m^3/s \cdot m^2$)			
Pa	m^3/h	m^3/h	$m^3/s \cdot m^2$	CLASS A	CLASS B	CLASS C	CLASS D
-200	<1,00 **0,00*	<0,99 **0,00*	<2,529E-05 **0,000E-00*	8,453E-04	2,818E-04	9,393E-05	3,131E-05
-300	<1,00 **0,00*	<0,99 **0,00*	<2,529E-05 **0,000E-00*	1,100E-03	3,668E-04	1,223E-04	4,075E-05
-400	<1,00 **0,00*	<0,99 **0,00*	<2,529E-05 **0,000E-00*	1,326E-03	4,422E-04	1,474E-04	4,913E-05
-500	<1,00 **0,10*	<0,99 **0,10*	<2,529E-05 **2,529E-06*	1,534E-03	5,112E-04	1,704E-04	5,680E-05
-625	<1,00 **0,20*	<0,99 **0,20*	<2,529E-05 **5,058E-06*		5,910E-04	1,970E-04	6,566E-05
-750	<1,00 **0,28*	<0,99 **0,28*	<2,529E-05 **7,081E-06*		6,653E-04	2,218E-04	7,392E-05

Leakage table in negative pressures



Graph of leakage in negative pressures

Remarks: The pressure limit is established in -750 Pa.

*** NOTE:** Leakage flow rates indicated with '*' are lower than 1,00 m^3/h, so they are out of the calibrated measurement range of the apparatus. Thus, these values are not covered by the ENAC accreditation. They are expressed only for informational purposes and they are not considered in terms of classification.

Expanded uncertainty of airflow measurements does not exceed ± 5%.

Expanded uncertainty of measurement has been given as measurement typical uncertainty multiplied by a factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

The decision rule taken for the declaration of conformity is a non-simple binary decision rule with a guard band equal to the uncertainty value (w = U). In this case, the upper limit of the probability value of false acceptance, according to ILAC G8, is 2,5%.

7. TEST CONCLUSION

Straight sheet metal air duct with circular section of 1000 mm diameter and total length of 2970 mm. Composed of three ducts of 990 mm of length. Fabricated in galvanized steel sheet of 1 mm thickness and with a total surface area of 10,90 m^2. Referenced **Multiform duct System**.

Has been tested according to UNE-EN 12237:2003 and UNE-EN 12237:2003+Erratum:2007. *'Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts'*, Section 5.1 *'Leakage'* obtaining the following classification:

STATIC GAUGE POSITIVE PRESSURE LIMIT	**+ 2000 Pa**
STATIC GAUGE NEGATIVE PRESSURE LIMIT	**- 750 Pa**
AIR TIGHTNESS CLASSIFICATION	**CLASS D**

Xavier Molins
Technician Responsible Enclosures Laboratory
LGAI Technological Center, S.A. (APPLUS)

The results reported in this document relate only to the sample, product or item delivered to LGAI Technological Center the appointed day having been tested under the conditions established in this document.
The decision rule taken for the declaration of conformity is a non-simple binary decision rule with a guard band equal to the uncertainty value (w = U). In this case, the upper limit of the probability value of false acceptance, according to ILAC G8, is 2,5%.

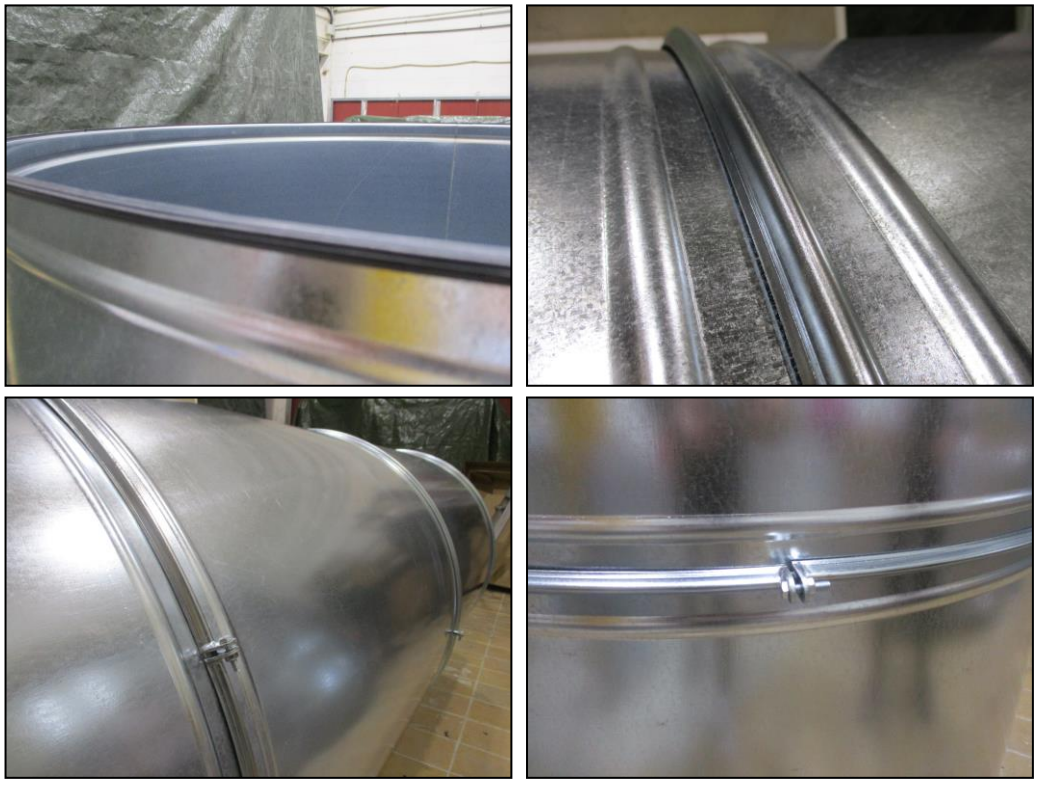
Service Quality Assurance
Applus+ guarantees that this work has been made in accordance with our Quality and Sustainability System, fulfilling the contractual conditions and legal norms. Within our improvement program we would be grateful if you would send us any commentary that you consider opportune, to the person in charge who signs this document, or to the Quality Manager of Applus+, in the following e-mail address: satisfaccion.cliente@applus.com

ANNEXES

A. PICTURES

Picture Nº.1. General view of test specimen

Picture Nº.2. Detail of transverse joint



Picture Nº.3. General view of test specimen connexion to bench test

B. TECHNICAL DOCUMENTATION

GENERAL INFORMATION

Our ducting system

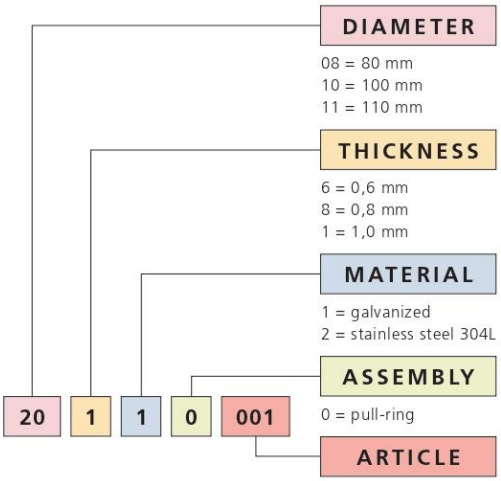
ROS DUCTING modular ducting system consists of a set of parts manufactured from metal sheet and assembled together by pull-rings.

The pieces of this system are characteristic because they have a lip and a reinforcement bead at each edge.

The main advantage of the ROS ducting is its quick and easy installation, as well as the modularity and versatility provided by the assembly of segmented bends, which allows to adapt to any installation, no matter how difficult the design is.

Coding guide

Ex: **20 1 1 0 001** = pipe with lip for pull-ring assembly, galvanized, thickness 1mm, DN 200 mm, length 1000 mm



Materials and finishes

- Galvanized DX51D+Z200-140 MA C according to UNE-EN-10346
- Stainless steel AISI 304L 2B (1.4307)
- Other materials on request: AISI 316L (1.4404), AISI 441 (1.4509), steel DC 01, etc.
- Other finishes on request: powder coating, vitrified, protective coatings, etc.

Thicknesses

- **Galvanized:**
  - DN 80 - DN 175 mm: 0,8 mm
  - DN 200 - DN 1000 mm: 1,0 mm
- **Stainless steel:**
  - DN 80 - DN 175 mm: 0,6 mm
  - DN 200 - DN 1000 mm: 0,8 mm

Assembly components

1) Multiform Pull-ring assembly

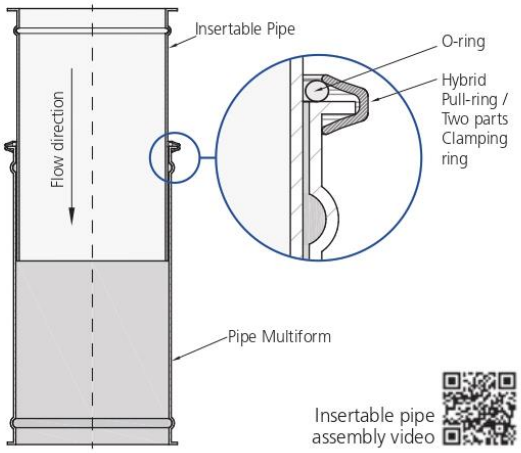
Multiform Pull-ring assembly video

2) Hybrid Pull-ring assembly

Hybrid Pull-ring assembly video

3) Loose Flange assembly

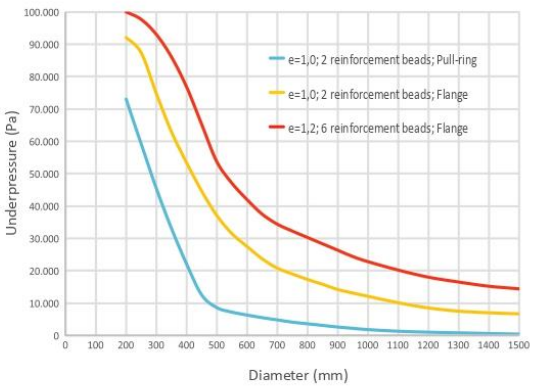
Insertable pipe assembly



Underpressure

The standard parts of the ROS modular ducting system are designed to cover almost all applications of dust extraction, product low pressure conveying and industrial ventilation.

Maximum allowable underpressure depending on the diameter of the pipe



Tightness

The air leakage measured per connection is much lower than the values permitted by DIN-EN-12237, class D tightness.

Tolerances

Pipe lengths and segments angles according to the DIN-ISO-2768-1-V standard.

Fixing components

Maximum recommended distance between supports for horizontal pipes, depending on the assembly component:

Diameter DN (mm)	Multiform Pull-ring (m)	Hybrid Pull-ring (m)	Flange (m)
80 -175	5	5	6
200 - 350	4	4	5
400 - 650	3	3	4
700 - 1000	2	2	3

Considerations

- In installations where the pipeline is outside, it is recommended to increase the number of supports by 25%, in order to minimize the effects of atmospheric agents.
- For equipment connections, the installation of a flexible component is recommended to minimize the transmission of vibrations to the pipeline.
- In the case of extraction of solids by gravitational drop or pneumatic transport, it is advisable that the customer studies, based on the load of the solid, the risk of accumulation in certain points of the installation.
- The correct assembly of the pipeline and fixing components (tightening torque, alignment, etc.) by the company in charge of the installation is assumed.
- These values are merely informative, with the corresponding structural study being the responsibility of the client to define in each case the adequate and necessary fixing components.

Potential equalisation

The standard ROS modular ducting system guarantees the electrical conductivity throughout the installation, since the assemblies made by Multiform Pull-ring are metal-metal.

The connection with Hybrid Pull-ring, requires the use of conductive sealing-rings to maintain the potential equalisation. In case of using non-conductive sealing-rings or the need to reaffirm the conductivity, grounding clips or earthing cables are available.

Certifications

TÜVRheinland CERTIFICADO

Sistema de Gestión
ISO 9001:2015
ISO 14001:2015

www.tuv.com
ID 9105084846