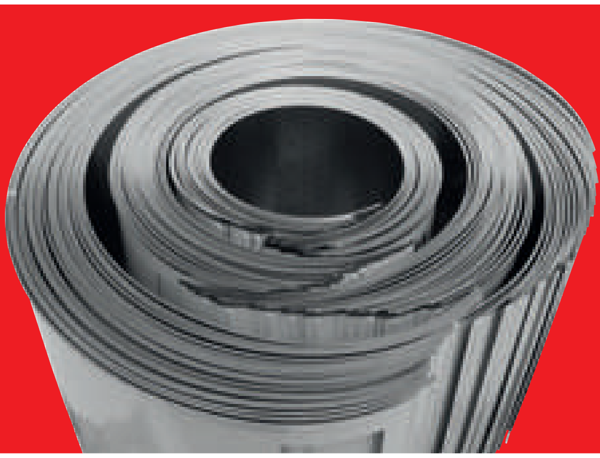
SPIROPACK®

SINTRA

SISTEMI INNOVATIVI TRATTAMENTO ARIA AMBIENTE



AIR DISTRIBUTION

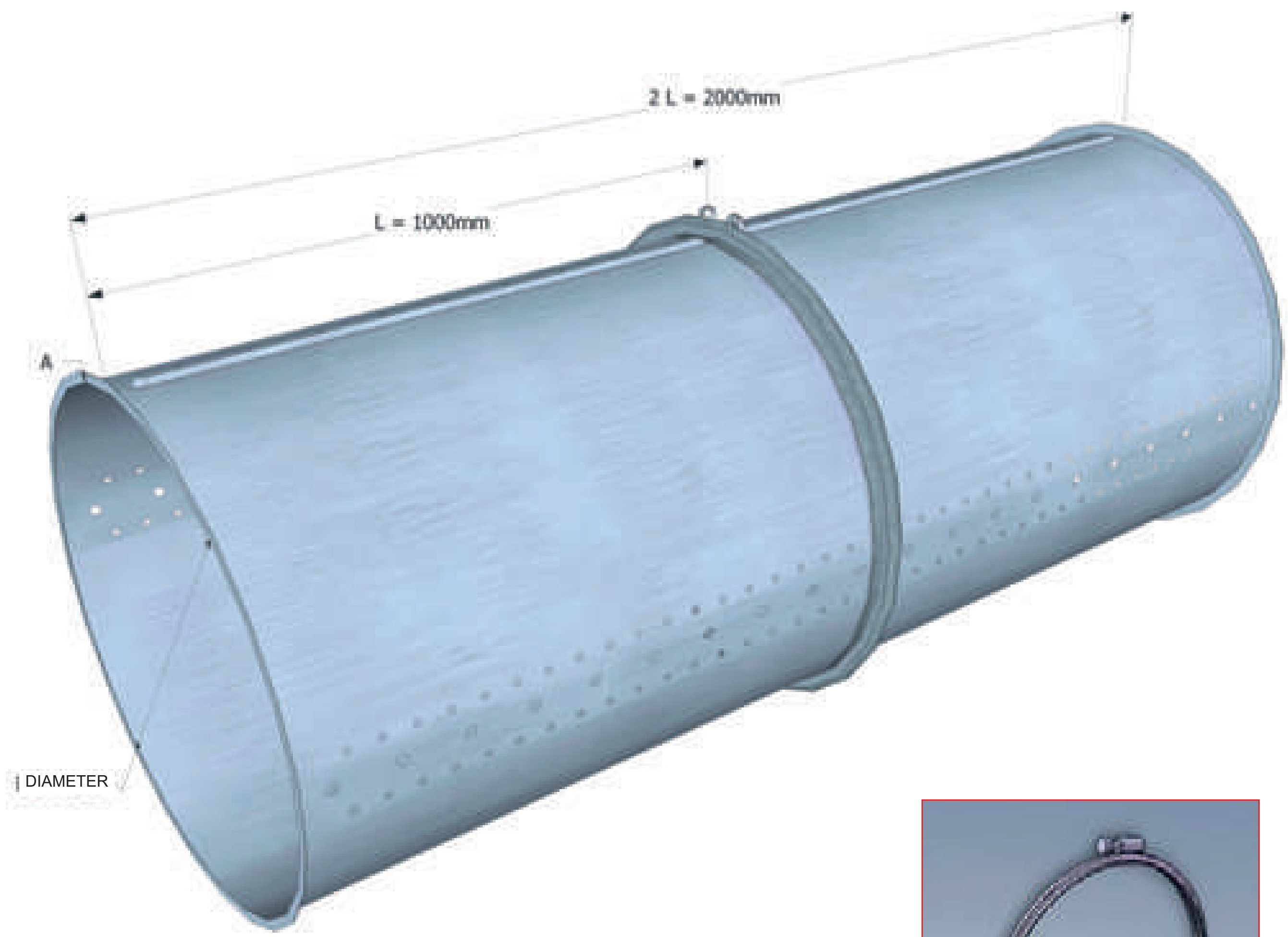
PERFORATED METALLIC DUCTS WITH AN OPEN CIRCUMFERENCE

SELECTION CATALOGUE

SISTEMI INNOVATIVI DI TRATTAMENTO ARIA AMBIENTE

JULY 2012 EDITION

DIMENSIONS AND MATERIAL



The metallic ducts with **SPIROPACK™** technology are built in pieces with a length of 1m with 8mm flanges at each end. These flanges are made to couple the pieces together, which will be then united with an omega collar.

The available versions are:

- Zn high quality galvanized steel SG250
- Ep painted with high resistancy epoxy powders (ral color on demand)
- Inox/s 430 satinized stainless steel AISI 430
- Inox/L 430 polished stainless steel AISI 430

All pieces are supplied with a protective polyethylene film, which must be removed within 10 days from the delivery of the ducts.

Upon request, it is possible to also have the following materials:

- Inox /s 304 satinized stainless steel AISI 304
- Inox /s 316L satinized stainless steel AISI 316L
- Cu Copper
- All Aluminium

PATENTED GREEN TECHNOLOGY

SPIROPACK™

SINTRA's ducts are produced with the patented **SPIROPACK™** green technology. This technique consists in producing the ducts with an open circumference, with a set warpage of the diameter, which allows:

- reduction of the transportation costs
- reduction of the packing costs
- easiness to assembly on site
- reduction of the assembly costs and times
- easy to inspect
- protection of the external surface with film

This **SPIROPACK™** technology, despite the riveting which has to be done on site, allows great savings on the assembling times due to a better management of the encumbrances and to an easy way to find the pieces.

SINTRA

CHART

		GALVANIZED STEEL THICKNESS				INOX THICKNESS			ALUMINIUM THICKNESS	COPPER THICKNESS
Ø	EXPANSION	8/10	10/10	12/10	15/10	8/10	10/10	12/10	10/10	10/10
mm	mm	Kg	Kg	Kg	Kg	Kg	Kg	Kg	Kg	Kg
280	879	5,7	7,0	8,8	11,4	5,7	7,0	8,8	2,4	6,3
300	942	6,1	7,5	9,4	11,3	6,1	7,5	9,4	2,5	6,8
315	989	6,4	7,9	9,9	11,9	6,4	7,9	9,9	2,7	7,1
350	1.099	7,1	8,8	11,0	13,2	7,1	8,8	11,0	3,0	7,9
355	1.115	7,2	8,9	11,1	13,4	7,2	8,9	11,1	3,0	8,0
400	1.256	8,2	10,0	12,6	15,1	8,2	10,0	12,6	3,4	9,0
450	1.413	9,2	11,3	14,1	17,0	9,2	11,3	14,1	3,8	10,2
500	1.570	10,2	12,6	15,7	18,8	10,2	12,6	15,7	4,2	11,3
550	1.727	11,2	13,8	17,3	20,7	11,2	13,8	17,3	4,7	12,4
560	1.758	11,4	14,1	17,6	21,1	11,4	14,1	17,6	4,7	12,7
600	1.884	12,2	15,1	18,8	22,6	12,2	15,1	18,8	5,1	13,6
630	1.978	12,9	15,8	19,8	23,7	12,9	15,8	19,8	5,3	14,2
650	2.041	13,3	16,3	20,4	24,5	13,3	16,3	20,4	5,5	14,7
700	2.198	14,3	17,6	22,0	26,4	14,3	17,6	22,0	5,9	15,8
710	2.229	14,5	17,8	22,3	26,8	14,5	17,8	22,3	6,0	16,1
750	2.355	15,3	18,8	23,6	28,3	15,3	18,8	23,6	6,4	17,0
800	2.512	16,3	20,1	25,1	30,1	16,3	20,1	25,1	6,8	18,1
850	2.669	17,3	21,4	26,7	32,0	17,3	21,4	26,7	7,2	19,2
900	2.826	18,4	22,6	28,3	33,9	18,4	22,6	28,3	7,6	20,3
950	2.983	19,4	23,9	29,8	35,8	19,4	23,9	29,8	8,1	21,5
1.000	3.140	20,4	25,1	31,4	37,7	20,4	25,1	31,4	8,5	22,6
1.050	3.297	21,4	26,4	33,0	39,6	21,4	26,4	33,0	8,9	23,7
1.100	3.454	22,5	27,6	34,5	41,4	22,5	27,6	34,5	9,3	24,9
1.150	3.611	23,5	28,9	36,1	43,3	23,5	28,9	36,1	9,7	26,0
1.200	3.768	24,5	30,1	37,7	45,2	24,5	30,1	37,7	10,2	27,1
1.250	3.925	25,5	31,4	39,3	47,1	25,5	31,4	39,3	10,6	28,3
1.300	4.082	26,5	32,7	40,8	49,0	26,5	32,7	40,8	11,0	29,4
1.350	4.239	27,6	33,9	42,4	50,9	27,6	33,9	42,4	11,4	30,5
1.400	4.396	28,6	35,2	44,0	52,8	28,6	35,2	44,0	11,9	31,7
1.450	4.553	29,6	36,4	45,5	54,6	29,6	36,4	45,5	12,3	32,8
1.500	4.710	30,6	37,7	47,1	56,5	30,6	37,7	47,1	12,7	33,9
1.550	4.867	31,6	38,9	48,7	58,4	31,6	38,9	48,7	13,1	35,0
1.600	5.024	32,7	40,2	50,2	60,3	32,7	40,2	50,2	13,6	36,2

Suggested thickness

PRESSURE DROPS

LINEAR DISTRIBUTED PRESSURE DROPS

The duct's pressure drops are determined by three factors:

- Pressure drops generated by the hole punching
- Pressure drops due to the air transportation inside the duct itself
- Pressure drops due to the presence of connection pieces such as bends, taperings, etc.

Here following there is a graph of the linear pressure drops distributed inside blind ducts with a roughness of 0.1mm ("smooth" circular ducts) and at 0m on the sea level.

Legend:

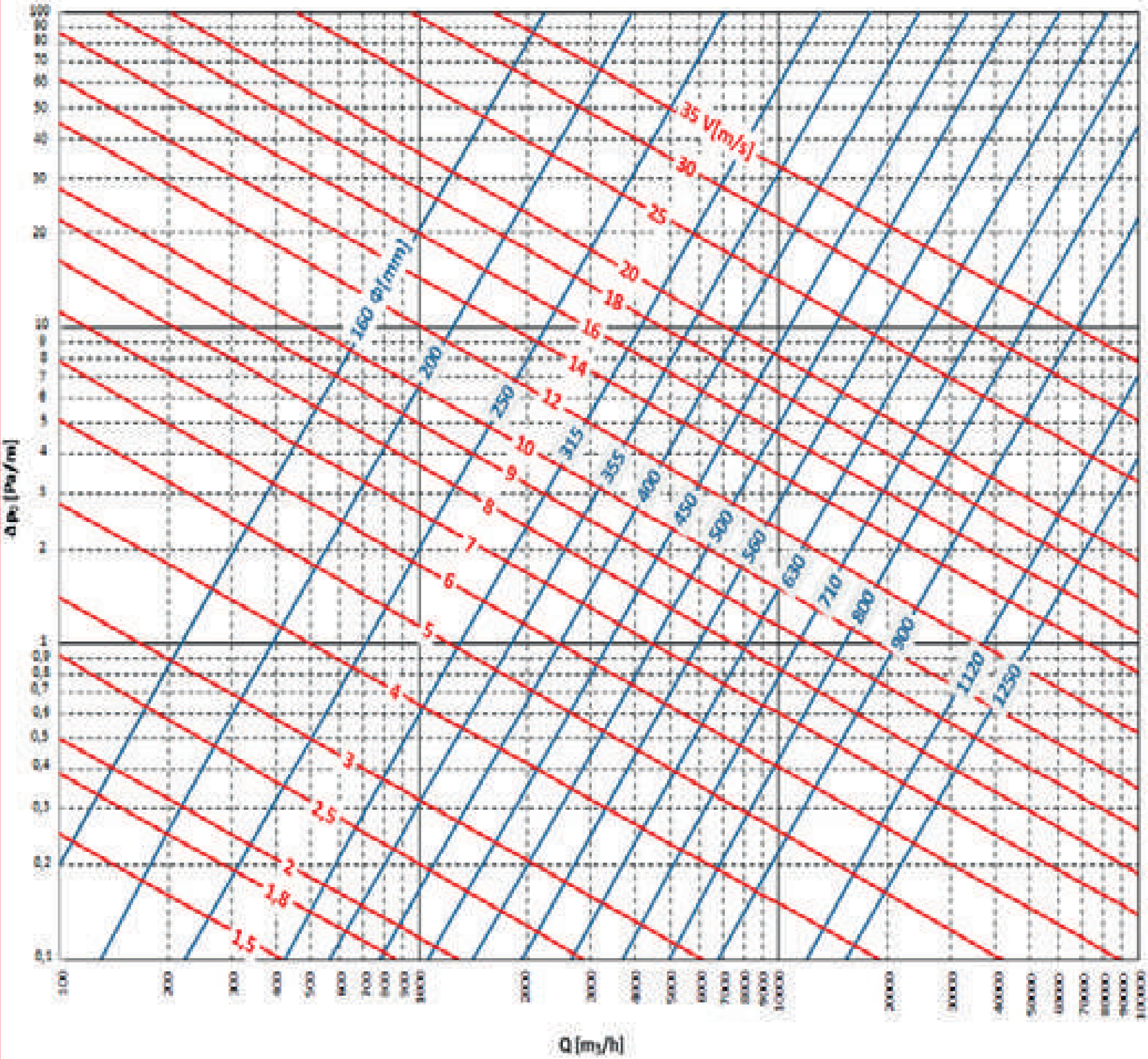
Q: air flow (m³/h/m)

Ø: duct's diameter

V: air crossing speed

ΔP0: Pressure drop in Pa per linear meter

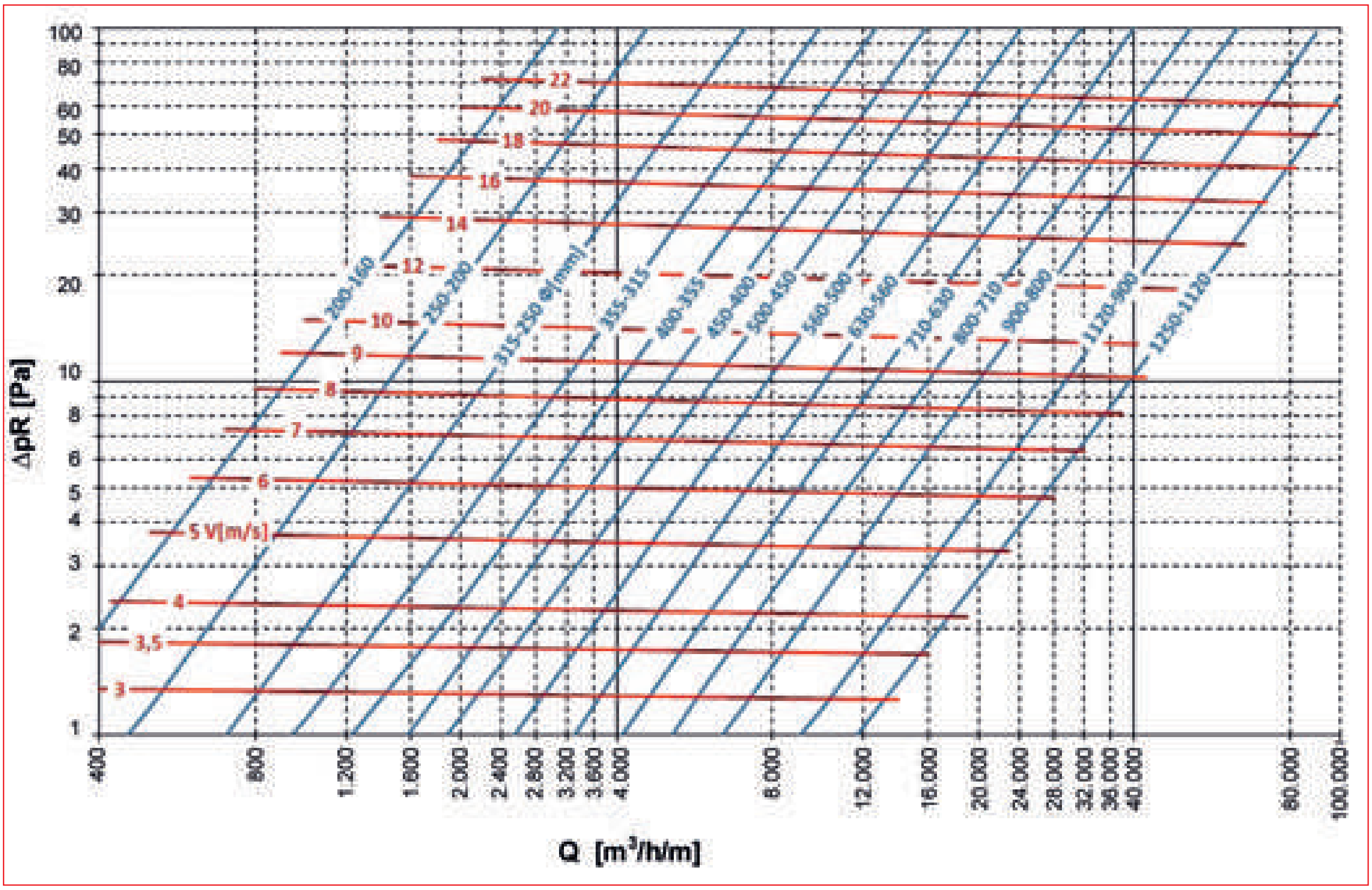
Pressure drops distributed in blind ducts

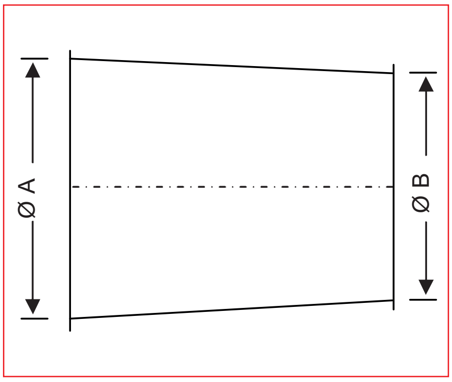


SINTRA

PRESSURE DROPS

PRESSURE DROPS CONCENTRATED IN THE TAPERINGS





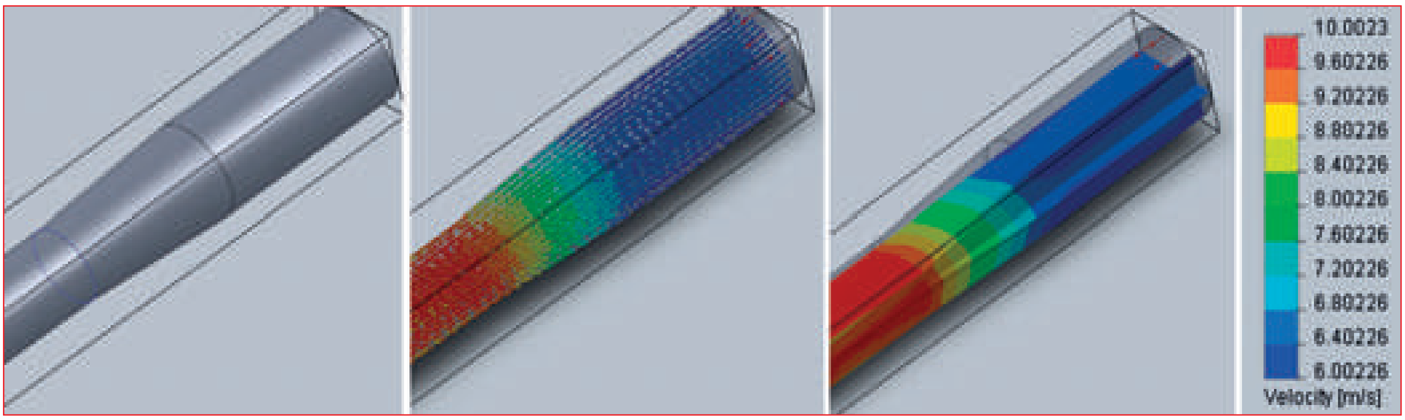
Legend:

Q: *air flow (m³/h) at the tapering's entrance*

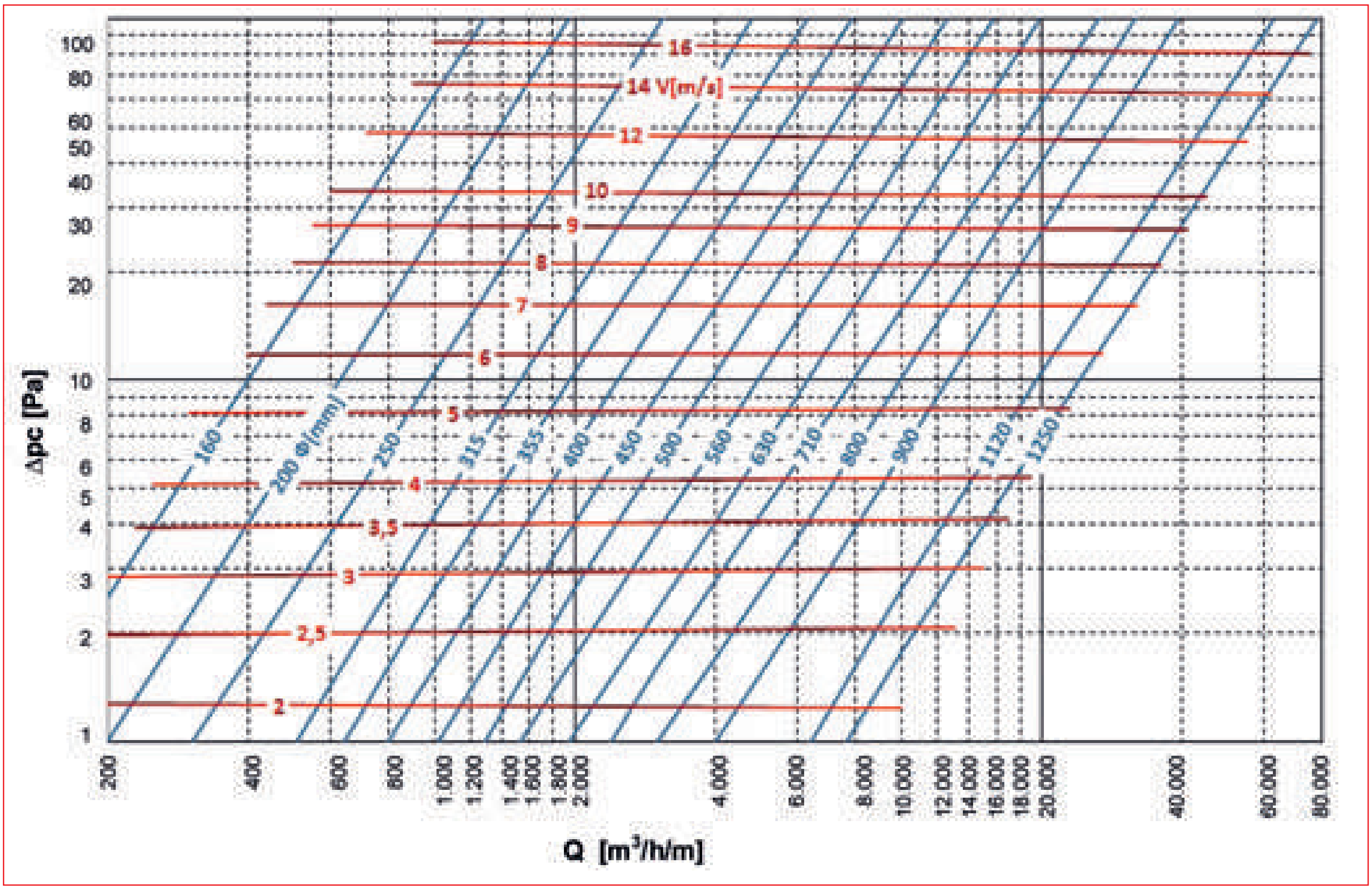
Ø: *tapering's initial and final diameter*

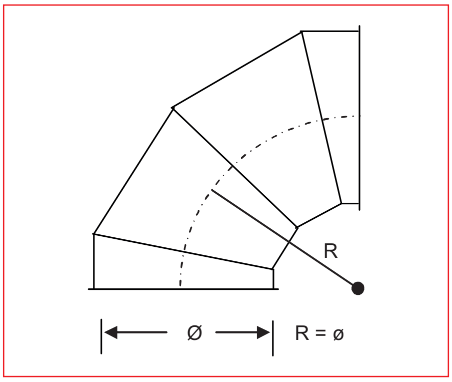
V: *air crossing speed*

ΔP0: *pressure drops concentrated in the tapering*



PRESSURE DROPS CONCENTRATED IN 90° BENDS





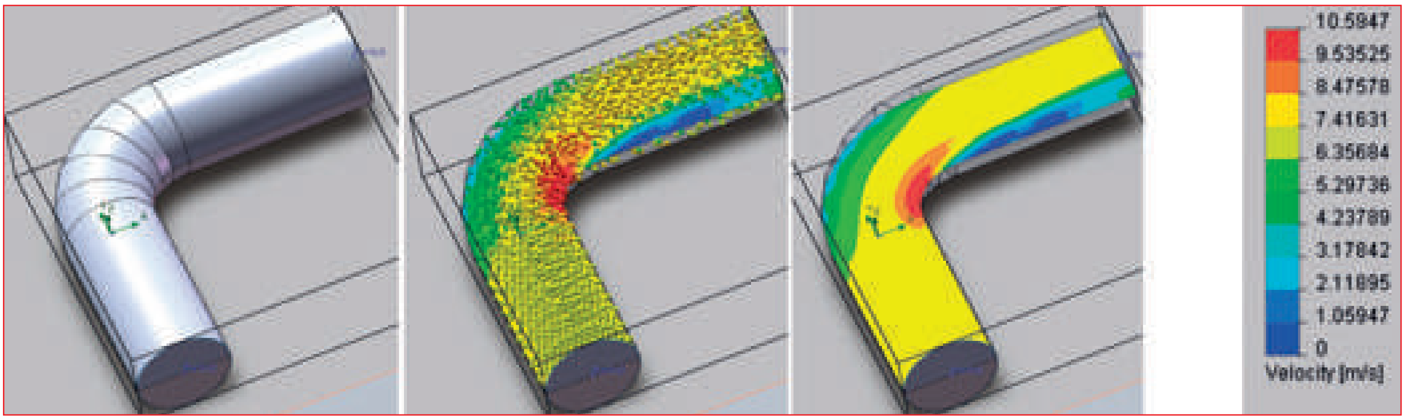
Legend:

Q: air flow (m³/h) at the bend's entrance

Ø: bend's initial and final diameter

V: air crossing speed

ΔP0: pressure drops concentrated in the bend



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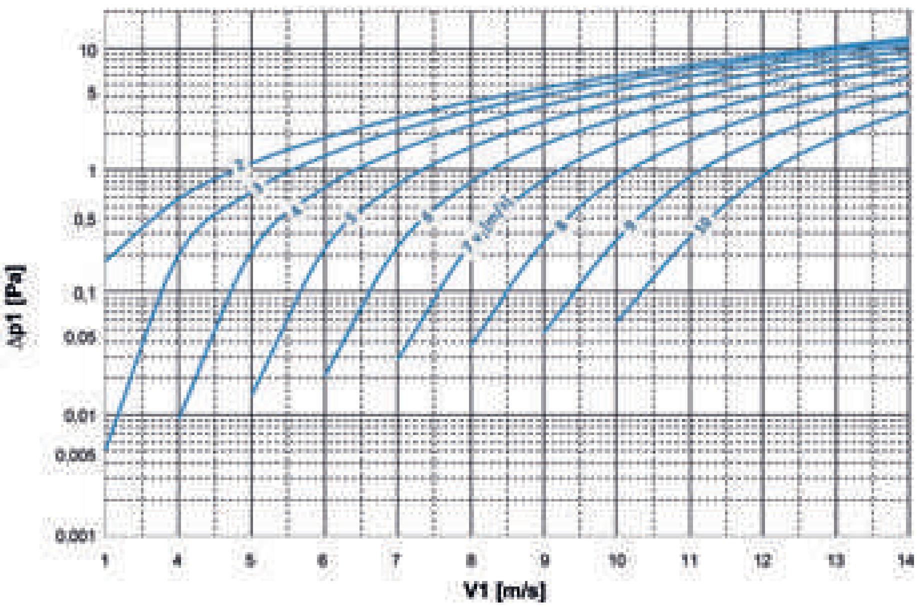
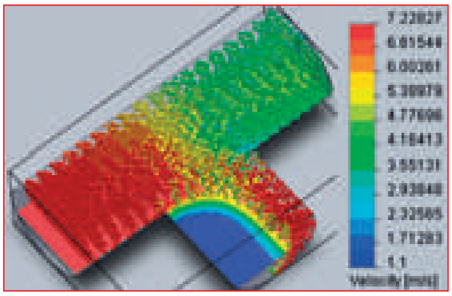
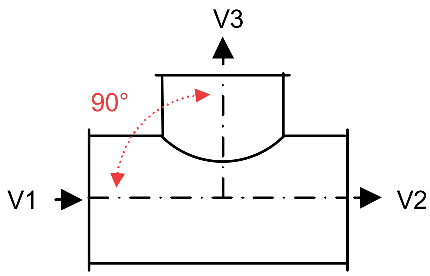
PRESSURE DROPS

PRESSURE DROPS CONCENTRATED IN THE T WITH A 90° BRANCH

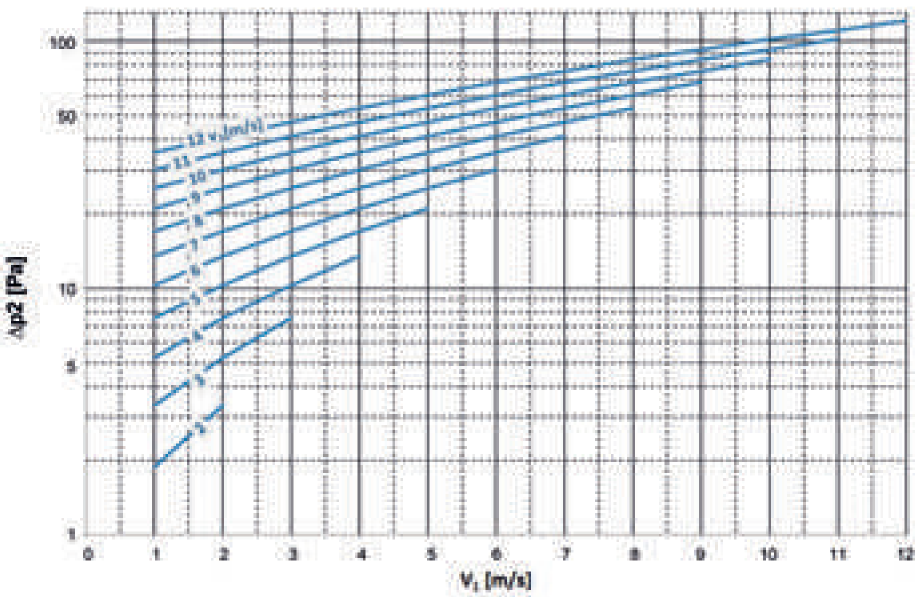
Concentrated pressure drop with regard to the axial exit







Concentrated pressure drop with regard to the 90° lateral exit



Legend:

V1 [m/s]: *Air speed at the T's entrance*

V2 [m/s]: *Air speed at the T's exit (opposed to the entrance)*

V3 [m/s]: *Air speed at the T's exit (90° opposed to the entrance)*

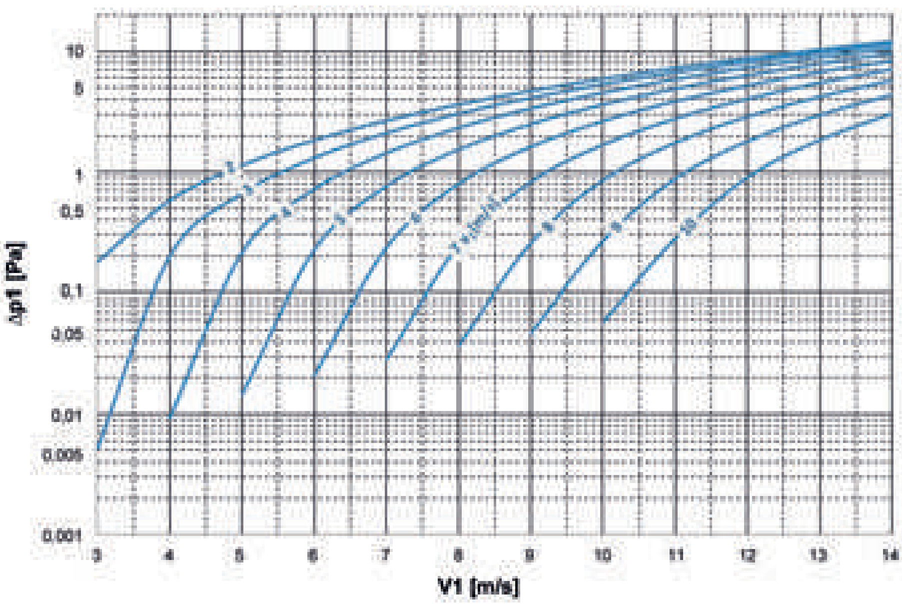
Δp1 [Pa]: *Pressure loss concentrated between V1 and V3*

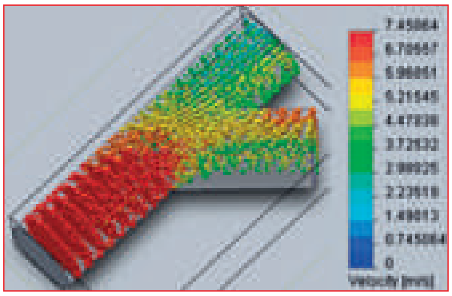
Δp2 [Pa]: *Pressure loss concentrated between V1 and V2*

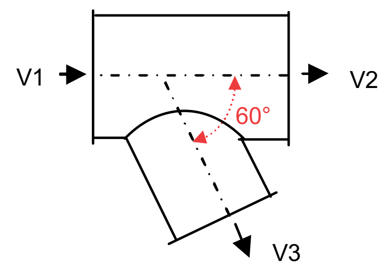
PRESSURE DROPS

PRESSURE DROPS CONCENTRATED IN THE Y BRANCHES WITH A 60° BRANCH

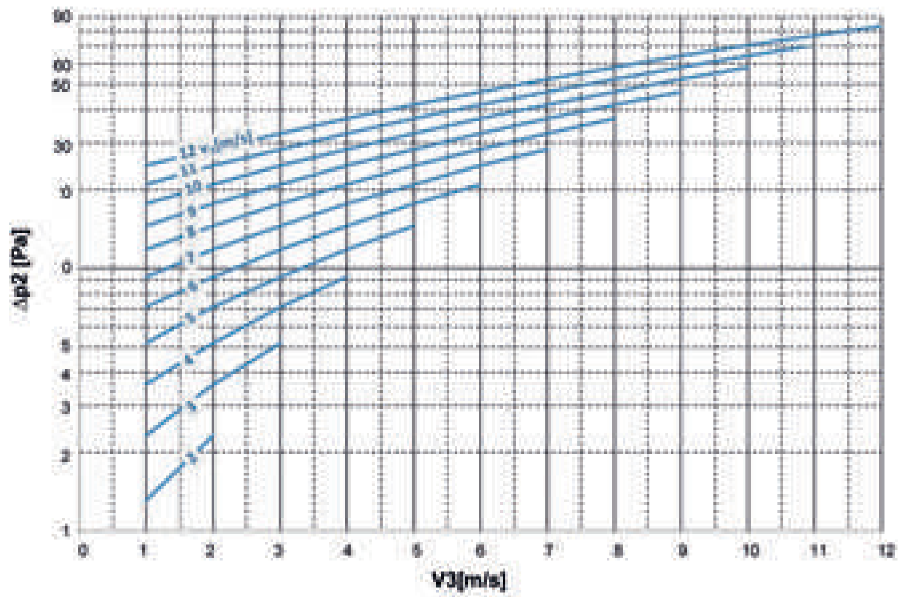
Concentrated pressure drop with regard to the axial exit







Concentrated pressure drop with regard to the 60° lateral exit



Legend:

V1 [m/s]: *Air speed at the branch entrance*

V2 [m/s]: *Air speed at the branch exit (opposed to the entrance)*

V3 [m/s]: *Air speed at the branch exit (90° opposed to the entrance)*

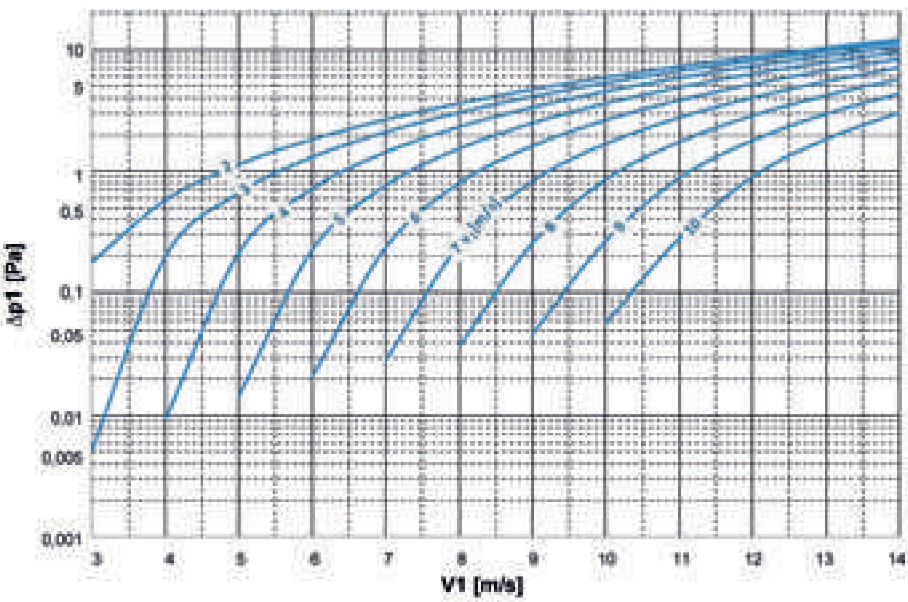
Δp1 [Pa]: *Pressure loss concentrated between V1 and V3*

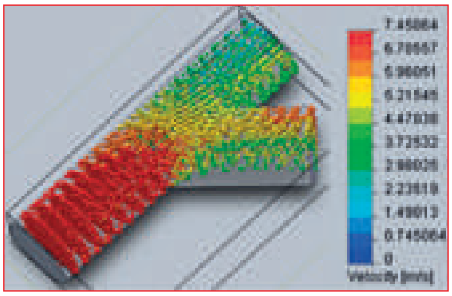
Δp2 [Pa]: *Pressure loss concentrated between V1 and V2*

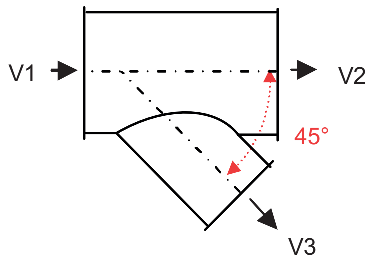
PRESSURE DROPS

PRESSURE DROPS CONCENTRATED IN THE Y BRANCHES WITH A 45° BRANCH

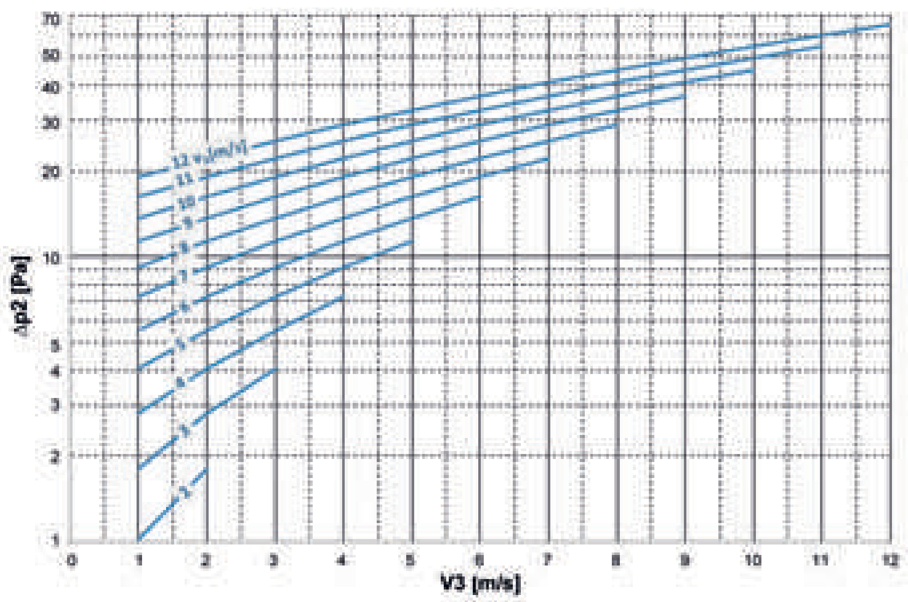
Concentrated pressure drop with regard to the axial exit







Concentrated pressure drop with regard to the 45° lateral exit



Legend:

V1 [m/s]: *Air speed at the branch entrance*

V2 [m/s]: *Air speed at the branch exit (opposed to the entrance)*

V3 [m/s]: *Air speed at the branch exit (90° opposed to the entrance)*

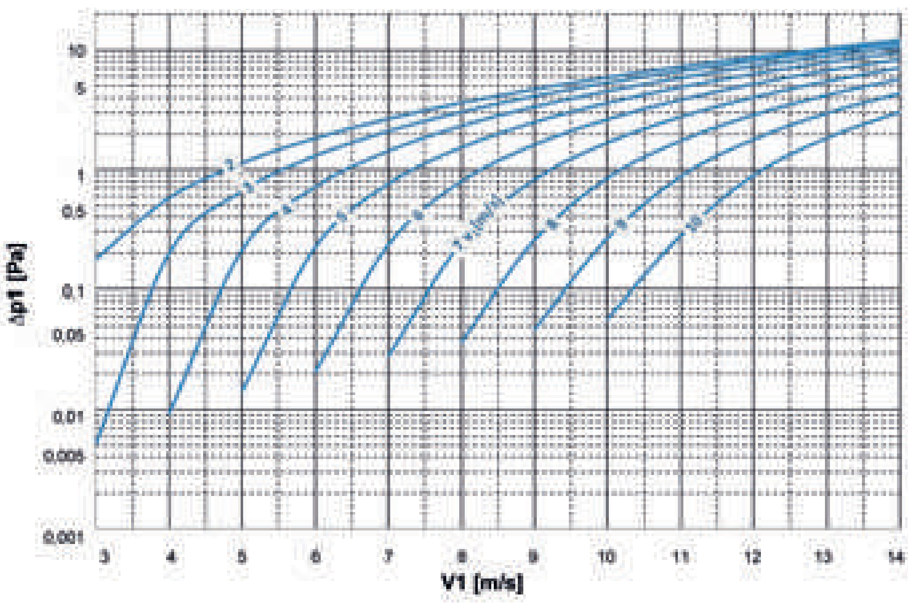
Δp1 [Pa]: *Pressure loss concentrated between V1 and V3*

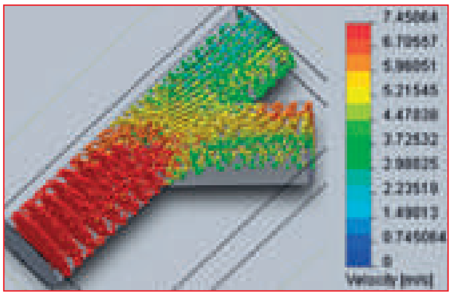
Δp2 [Pa]: *Pressure loss concentrated between V1 and V2*

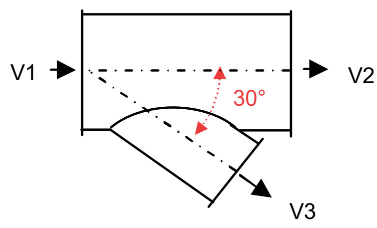
PRESSURE DROPS

PRESSURE DROPS CONCENTRATED IN THE Y BRANCHES WITH A 30° BRANCH

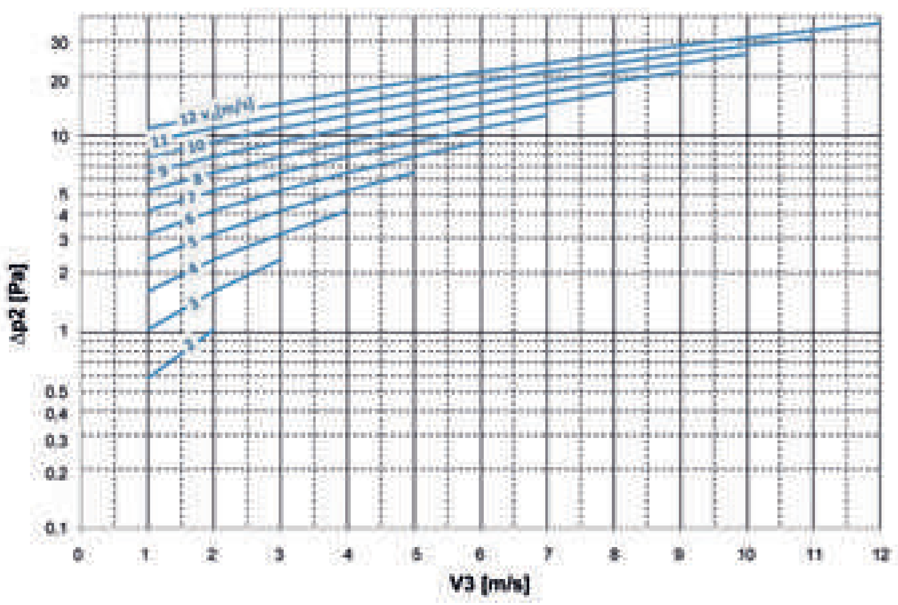
Concentrated pressure drop with regard to the axial exit







Concentrated pressure drop with regard to the 30° lateral exit



Legend:

V1 [m/s]: *Air speed at the branch entrance*

V2 [m/s]: *Air speed at the branch exit (opposed to the entrance)*

V3 [m/s]: *Air speed at the branch exit (90° opposed to the entrance)*

Δp1 [Pa]: *Pressure loss concentrated between V1 and V3*

Δp2 [Pa]: *Pressure loss concentrated between V1 and V2*

PRESSURE LOSSES

CONCENTRATED PRESSURE LOSSES

VOLUMETRIC MASS CHART FOR THE HUMID AIR AT 1013 mbar - SI UNIT (Kg/m³)

TEMPERATURE		RELATIVE HUMIDITY										
°C	°F	SECCA	10	20	30	40	50	60	70	80	90	100
-15	5	1.368	1.366	1.366	1.366	1.366	1.366	1.366	1.365	1.365	1.365	1.365
-10	14	1.342	1.40	1.340	1.340	1.340	1.339	1.339	1.339	1.339	1.339	1.339
-5	23	1.317	1.315	1.315	1.314	1.314	1.314	1.314	1.314	1.314	1.313	1.313
0	32	1.293	1.291	1.290	1.290	1.290	1.289	1.289	1.289	1.289	1.288	1.288
5	41	1.270	1.267	1.267	1.267	1.266	1.266	1.265	1.265	1.265	1.264	1.264
10	50	1.247	1.245	1.244	1.244	1.243	1.243	1.242	1.241	1.241	1.240	1.240
15	59	1.226	1.223	1.222	1.221	1.221	1.220	1.219	1.218	1.218	1.217	1.216
20	68	1.205	1.202	1.201	1.200	1.199	1.199	1.197	1.196	1.195	1.194	1.192
25	77	1.185	1.181	1.180	1.179	1.177	1.176	1.174	1.173	14.172	1.170	1.169
30	86	1.165	1.161	1.160	1.158	1.156	1.154	1.152	1.150	1.149	1.147	1.145
35	95	1.146	1.142	1.140	1.137	1.135	1.1133	1.130	1.128	1.129	1.123	1.121
40	104	1.128	1.123	1.120	1.119	1.117	1.111	1.108	1.104	1.101	1.098	1.1095
45	113	1.110	1.104	1.101	1.097	1.093	1.089	1.085	1.081	1.077	1.073	1.069
50	122	1.093	1.086	1.081	1.076	1.071	1.066	1.061	1.056	1.051	1.046	1.041
55	131	1.076	1.068	1.062	1.056	1.049	1.043	1.037	1.031	1.021	1.018	1.012
60	140	1.060	1.0151	1.043	1.035	1.027	1.019	1.011	1.004	1.996	0.988	0.950
65	149	1.044	1.033	1.023	1.014	1.004	0.994	0.985	0.0975	0.965	0.956	0.946
70	158	1.029	1.016	1.004	0.992	0.980	0.938	0.956	0.944	0.932	0.920	0.908
75	167	1.014	0.998	0.984	0.969	0.955	0.940	0.926	0.911	0.897	0.882	0.868
80	176	1.000	0.981	0.963	0.946	0.928	0.911	0.893	0.875	0.858	0.842	0.823
85	185	0.986	0.963	0.942	0.921	0.900	0.879	0.857	0.836	0.815	0.794	0.773
90	194	0.973	0.946	0.920	0.895	0.870	0.744	0.719	0.794	0.768	0.743	0.718
95	203	0.959	0.928	0.898	0.867	0.837	0.807	0.777	0.747	0.717	0.687	0.657
100	212	0.946	0.909	0.874	0.838	0.802	0.767	0.731	0.696	0.660	0.624	0.589

Localized pressure losses are determined by the following formula:

$Pc = \xi * \rho * v^2/2$ where:

Pc = localized pressure loss (Pa)

ξ = localized pressure loss coefficient, dimensionless

ρ = air's volumetric mass (Kg/m³)

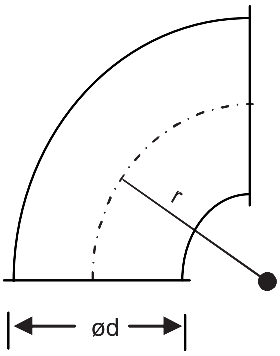
V = air's medium speed (m/s)

SINTRA

PRESSURE LOSSES

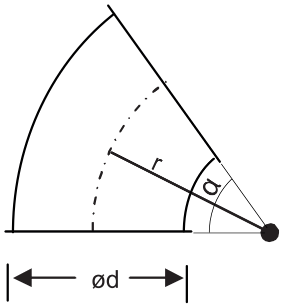
PRESSURE LOSSES CONCENTRATED IN THE BENDS

90° bend



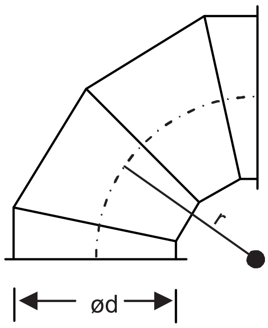
r/d	ξ
0.5	0.9
0.75	0.5
1.00	0.4
1.50	0.3
2.00	0.2

30°, 45° and 60° bends



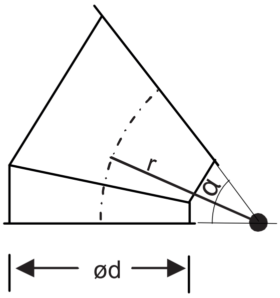
r/d	ξ		
	α=30°	α=45°	α=60°
0.5	0.3	0.5	0.7
0.75	0.2	0.3	0.3
1.00	0.1	0.2	0.3
1.50	0.1	0.2	0.2
2.00	0.1	0.1	0.1

Parted 90° bend



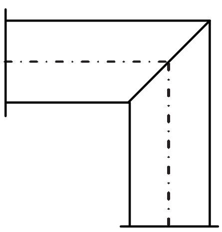
r/d	ξ
0.5	1.1
0.75	0.6
1.00	0.4
1.50	0.3
2.00	0.2

Parted 30°, 45° and 60° bends



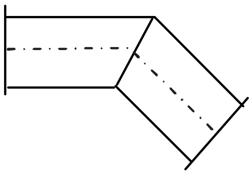
r/d	ξ		
	α=30°	α=45°	α=60°
0.5	0.4	0.6	0.7
0.75	0.2	0.3	0.4
1.00	0.1	0.2	0.3
1.50	0.1	0.2	0.2
2.00	0.1	0.1	0.1

Rough edge 90° bend



ξ =1.3

Rough edge 30°, 45° and 60° bends



ξ		
α=30°	α=45°	α=60°
0.4	0.7	1.0

Localized pressure losses are determined by the following formula:

$Pc = \xi * \rho * v^2/2$ where:

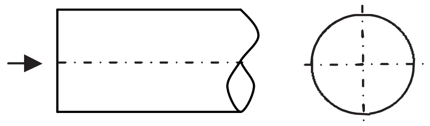
Pc = localized pressure loss (Pa) • ξ = localized pressure loss coefficient, dimensionless

ρ = air's volumetric mass (Kg/m³) • V = air's medium speed (m/s)

PRESSURE LOSSES

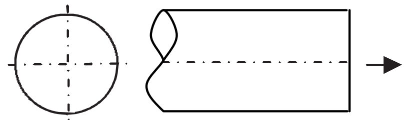
CONCENTRATED PRESSURE LOSSES: INLETS AND OUTLETS

Inlet without lead hole



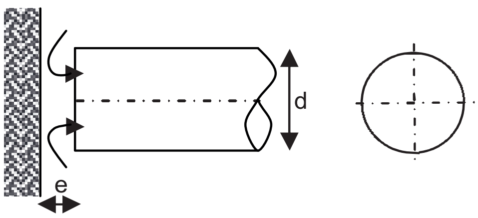
ξ = 0.8

Outlet without lead hole



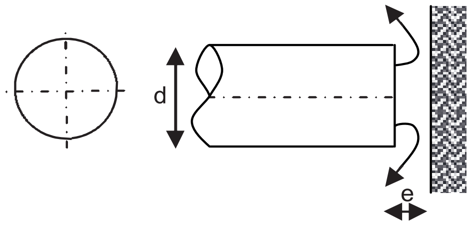
ξ = 1.0

Inlet without lead hole with frontal obstacle



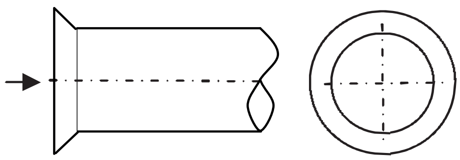
e/d	ξ
0.2	2.6
0.4	1.5
0.6	1.2
0.8	1.0
1.0	0.8

Outlet without lead hole with frontal obstacle



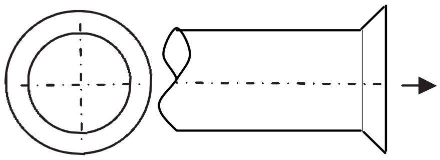
e/d	ξ
0.4	1.8
0.6	1.4
0.8	1.2
1.0	1.0

Inlet with lead hole



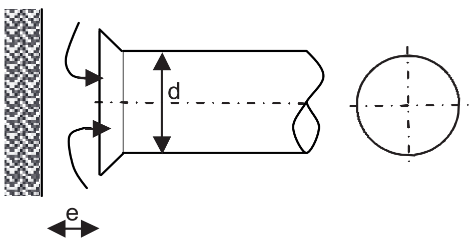
ξ = 0.4

Outlet with lead hole



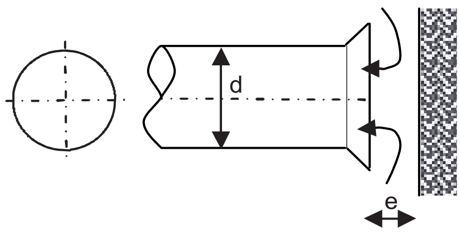
ξ = 0.6

Inlet with lead hole with frontal obstacle



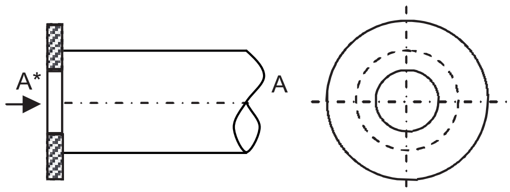
e/d	ξ
0.2	1.2
0.4	0.7
0.6	0.6
0.8	0.5
1.0	0.4

Outlet with lead hole with frontal obstacle



e/d	ξ
0.4	1.2
0.6	1.0
0.8	0.8
1.0	0.6

Inlet with midriff

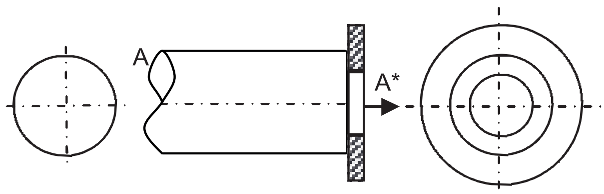


A: section's area of the duct

A*: midriff passing area

A*/A	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ξ	24	11	6.2	3.0	2.2	1.4	1.2

Outlet with midriff



A: section's area of the duct

A*: midriff passing area

A*/A	0.3	0.4	0.5	0.6	0.7	0.8	0.9
ξ	28	13	7.8	3.6	2.6	1.7	1.4

Localized pressure losses are determined by the following formula:

$Pc = \xi * \rho * v^2/2$ where:

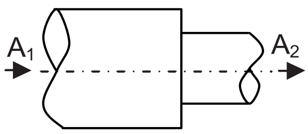
Pc = localized pressure loss (Pa) • ξ = localized pressure loss coefficient, dimensionless

ρ = air's volumetric mass (Kg/m^3) • V = air's medium speed (m/s)

PRESSURE LOSSES

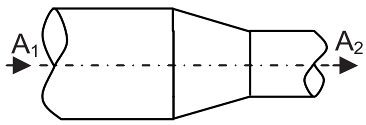
CONCENTRATED PRESSURE LOSSES

Narrowing without lead hole



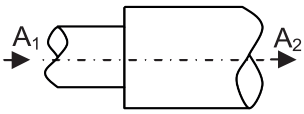
A_2/A_1	ξ
0.2	0.5
0.4	0.4
0.6	0.3
0.8	0.2

Narrowing without lead hole



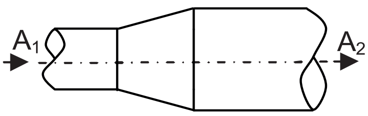
ξ = 0.2

Widening without lead hole



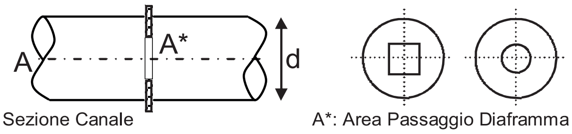
A_2/A_1	ξ
0.1	0.9
0.2	0.7
0.4	0.4
0.6	0.2

Widening without lead hole



A_2/A_1	ξ
0.1	0.5
0.2	0.3
0.4	0.2
0.6	0.2

Balancing midriff

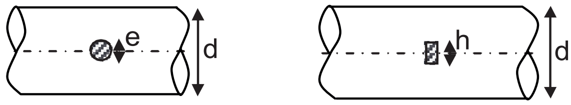


A: Area Sezione Canale

A*: Area Passaggio Diaframma

A*/A	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
ξ	50	30	20	15	8	7	4	3	2

Pipes and rods going through the duct



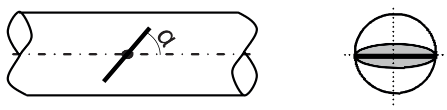
TUBI

e/d	0.10	0.25	0.50
ξ	0.2	0.6	2.0

BARRE

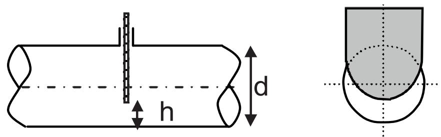
h/d	0.10	0.25	0.50
ξ	0.7	1.4	4.0

Butterfly regulator



α	0°	10°	20°	30°	40°	45°	50°	55°	60°
ξ	0.2	0.6	1.8	4.4	11	21	35	65	105

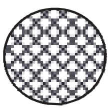
Damper regulator



h/d	0.2	0.3	0.4	0.5	0.6	0.7
ξ	30	11	5.2	2.2	1.3	0.5

Protection mesh

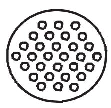
A: section's area of the duct
A*: midriff passing area



A*/A	0.2	0.3	0.4	0.5	0.6	0.7
ξ	17	6.5	3.0	1.7	1.0	0.8

Perforated metal sheet

A: section's area of the duct
A*: midriff passing area



A*/A	0.2	0.3	0.4	0.5	0.6	0.7
ξ	60	22	9.0	4.0	2.2	1.0

Localized pressure losses are determined by the following formula:

$Pc = \xi * \rho * v^2/2$ where:

Pc = localized pressure loss (Pa) • ξ = localized pressure loss coefficient, dimensionless

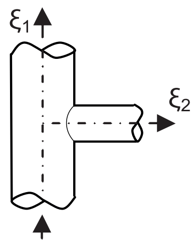
ρ = air's volumetric mass (Kg/m^3) • V = air's medium speed (m/s)

SINTRA

PRESSURE LOSSES

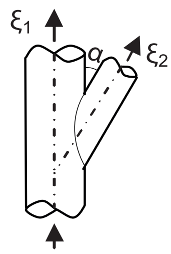
PRESSURE LOSSES IN THE CONNECTION PIECES

90° T branch



$\xi_1 = 0.2$ $\xi_2 = 1.3$

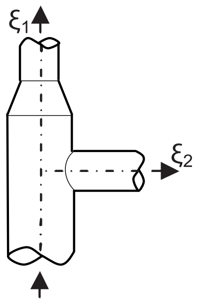
30°, 45° and 60° Y branch



$\xi_1 = 0.2$

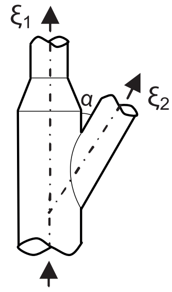
α	30°	45°	60°
ξ_2	0.4	0.7	0.9

90° T branch with tapering



$\xi_1 = 0.4$ $\xi_2 = 1.3$

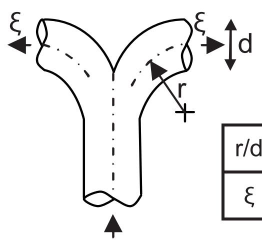
30°, 45° and 60° Y branch with tapering



$\xi_1 = 0.4$

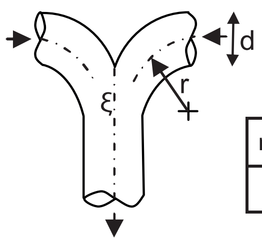
α	30°	45°	60°
ξ_2	0.4	0.7	0.9

Double bend branch



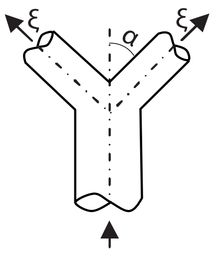
r/d	0.50	0.75	1.00	1.50	2.00
ξ	1.2	0.6	0.4	0.3	0.2

Double bend confluence



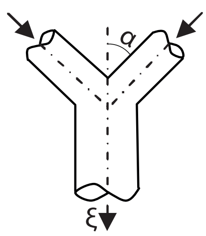
r/d	0.50	0.75	1.00	1.50	2.00
ξ	1.1	0.5	0.3	0.2	0.2

Double Y branch



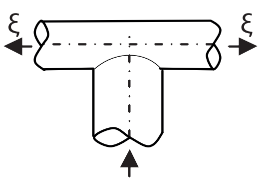
α	30°	45°	60°
ξ	0.3	0.7	1.0

Double Y confluence



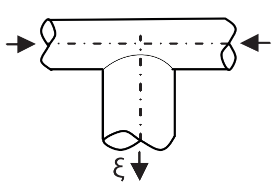
α	30°	45°	60°
ξ	0.3	0.6	0.9

T branch



$\xi = 1.4$

T confluence



$\xi = 1.3$

Localized pressure losses are determined by the following formula:

$Pc = \xi * \rho * v^2/2$ where:

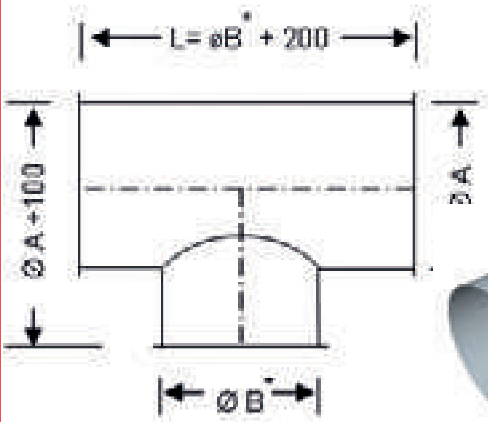
Pc = localized pressure loss (Pa) • ξ = localized pressure loss coefficient, dimensionless

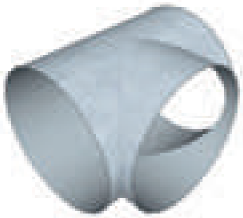
ρ = air's volumetric mass (Kg/m^3) • V = air's medium speed (m/s)

SINTRA

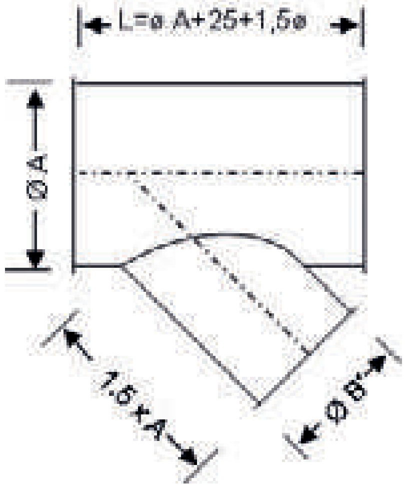
CONNECTION PIECES

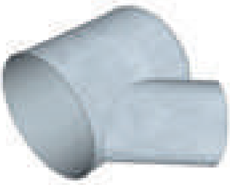
T BRANCH



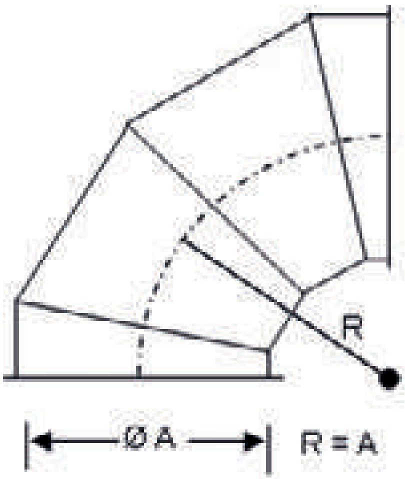



Y BRANCH 30 ° - 45° - 60°



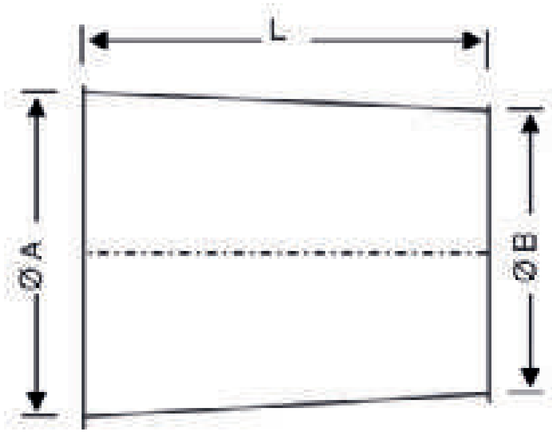



BENDS



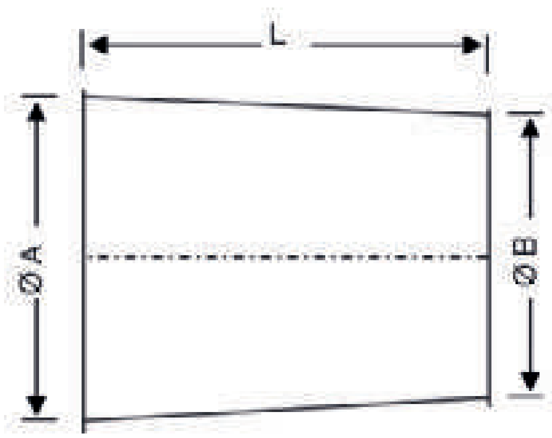

These are examples of standard pieces. Custom pieces can be produced according to the customer’s needs.

ECCENTRICAL TAPERING



		LENGTH L (mm)						
Ø A (mm)		200-400	450-600	650-800	850-1000	1050-1200	1250-1400	1450-1600
Ø B (mm)	= øA -50mm	800	800	800	700	700	700	700
	= øA -100mm	800	800	800	700	700	700	700
	= øA -150mm	/	/	/	/	/	/	/

CONCENTRICAL TAPERING



		LENGTH L (mm)						
Ø A (mm)		200-400	450-600	650-800	850-1000	1050-1200	1250-1400	1450-1600
Ø B (mm)	= øA -50mm	800	800	800	800	800	800	800
	= øA -100mm	800	800	800	800	800	800	800
	= øA -150mm	800	800	800	/	/	/	/

These are examples of standard pieces. Custom pieces can be produced according to the customer's needs.

ACCESSORIES

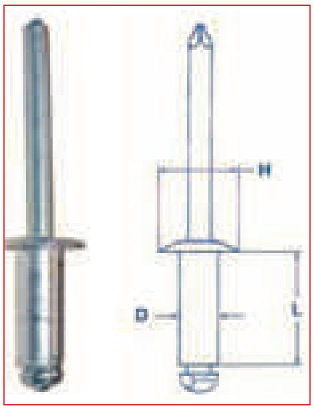
ABS GASKET FOR PIECES' JUNCTION

The ABS gasket is suggested for plants with installation heights over 4m and available static pressures over 140Pa. Thanks to the particular shape of the profile, the installation on the duct's edge folding is simple and quick.

LIQUID GASKET

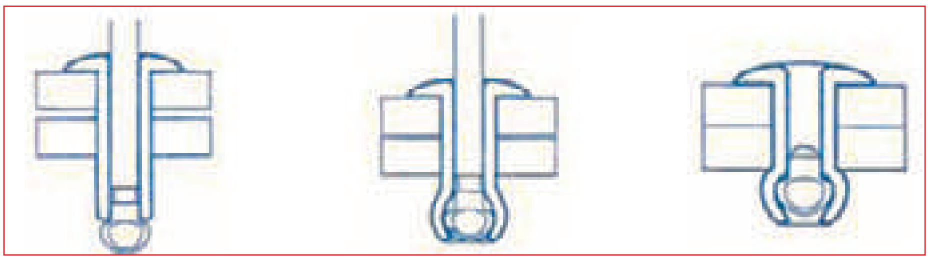
The liquid gasket has to be applied on the closure of each single piece, and it is suggested for plants with installation heights above 5m and available static pressures above 200Pa.

FIXING RIVETS



The fixing rivets can be in stainless steel or galvanized steel.
Stainless steel is suggested for diameters bigger than 900 mm.

DESCRIPTION	MEASURES		H	THICKNESS	HOLE	TENSILE LOAD - NEWTON -		PIECES IN BOX
	D	L	mm	mm	Ø mm	CUT	RESISTANCE	N°
Stainless steel	32	60	6,5	1.0 - 3.0	3,3	2700	3000	1000
Stainless steel	32	100	6,5	5.0 - 7.0	3,3	2700	3000	1000
Galvanized steel	32	60	6,5	2.0 - 3.0	3,3	1300	1650	1000
Galvanized steel	32	100	6,5	6.0 - 7.0	3,3	1300	3000	1000



SINTRA

COMPRESSOR AND RIVETING GUN

High quality air compressor, complying to the highest international standards. It is extremely manageable, easy to use and with low noise production. It is used, together with the riveting gun, to close the duct’s modules on site, reducing:

- installation times
- manipulation of the pieces
- damage risks due to manipulation

Compressor’s technical characteristics: 230V/50HZ,2HP,50L

Riveting gun’s technical characteristics:

- Ø rivets: from 2.4mm to 4.8mm
- max length of the head: 14mm
- weight: 1.8kg
- working pressure: 6.3kg/cm2
- max closing effort: 8360Nm

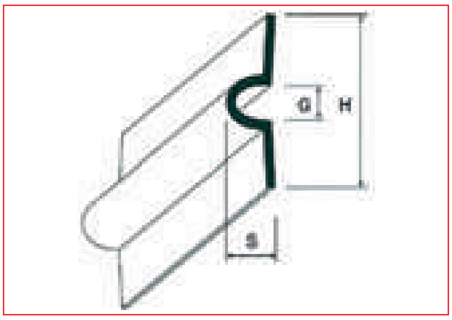
JUNCTION COLLARS

Omega section collar built in one piece for the junction of the duct’s modules.

Ø mm	(G) mm	(H) mm	(S) mm	thickness mm	Ø mm	(G) mm	(H) mm	(S) mm	thickness mm	Ø mm	(G) mm	(H) mm	(S) mm	thickness mm
250	8	37	8	0.8	600	10	38	10	1.0	1100	14	42	13	1.0
280	8	37	8	0.8	630	10	38	10	1.0	1150	14	42	13	1.0
300	8	37	8	0.8	650	10	38	10	1.0	1200	14	42	13	1.0
315	8	37	8	0.8	700	10	38	10	1.0	1250	14	42	13	1.0
350	8	37	8	0.8	750	10	38	10	1.0	1300	14	42	13	1.0
355	8	37	8	0.8	800	14	42	13	1.0	1350	14	42	13	1.0
400	10	38	10	0.8	850	14	42	13	1.0	1400	14	42	13	1.0
450	10	38	10	0.8	900	14	42	13	1.0	1450	14	42	13	1.0
500	10	38	10	1.0	950	14	42	13	1.0	1500	14	42	13	1.0
550	10	38	10	1.0	1000	14	42	13	1.0	1550	14	42	13	1.0
560	10	38	10	1.0	1050	14	42	13	1.0	1600	14	42	13	1.0

KINDS OF MATERIALS

Duct’s material	Junction collar’s material
Galvanized steel	Galvanized steel
AISI 430 Stainless steel	AISI 304 Stainless steel
AISI 304 Stainless steel	IAISI 304 Stainless steel
AISI 316 Stainless steel	IAISI 316 Stainless steel
Copper	Copper
Aluminum	AISI 304 Stainless steel
Painted	Painted



DIFFERENT MATERIALS

GALVANIZED STEEL CZn

PAINTED STEEL CEp

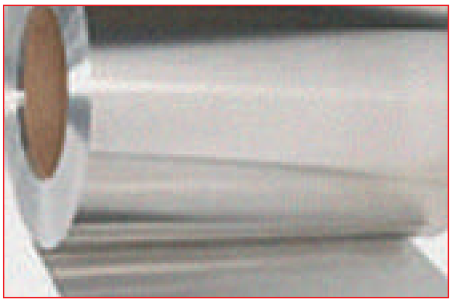
SATINIZED INOX Cinox/s

POLISHED INOX Cinox/L

ALUMINIUM CAl

COPPER CCu

S 250 GD + Z EN 10346



Sintra, for the construction of the metallic ducts with SPIROPACK™ technology, does not use classic DX51 galvanized steel, but only selected galvanized steel with qualities above standard.
This choice, which is necessary to allow the construction of the ducts following high quality standards, always allows a detailed control on the material's characteristics and as a consequence, a structural uniformity which is constant in time.

BRAND CORRESPONDENCE

Structural steels

DIRECTION	THICKNESS (MM)	R_e(MPa)	R_m(MPa)	A80(%)	MP GUARANTEES (MONTHS)	R90	N90
	0.2 - 0.5			≥ 15			
L	0.5 - 0.7	≥ 250	≥ 330	≥ 17	< 1	—	—
	0.7 - 6			≥ 19			

Legenda
Re *= yield limit in N/mm²*
Rm *= mechanical resi stance to breaking in N/mm²*
A 80 % *= stretching percentage samples 80m mm*

MECHANICAL PROPERTIES

Structural steels

10142:1991	
DIN 17162/1	
NF A36-321	
BS 2989	Z25G
ASTM A653	SS Grade 230
EN 10142:2000	
PN-89/H-92125:1989	
EN 10292:2007	
EN 10147:2000	S250GD+Z
EN 10326:2004	S250GD+Z
EN 10327:2004	
EN 10346:2009	S250GD+Z
EN 10147:1991	FeE250G
DIN 17162/2	StE 250-2Z
NF A36-322	C.250
Old brand names	S250GD+Z

DIMENSION

Structural steels

THICKNESS (MM)	S250GD+Z EN 10346 MAX WIDTH	THICKNESS (MM)	S250GD+Z EN 10346 MAX WIDTH
0.25 ≤ TH ≤ 0.30	1250	1.50 ≤ TH ≤ 1.75	2060
0.30 ≤ TH ≤ 0.35	1290	1.75 ≤ TH ≤ 1.80	2060
0.35 ≤ TH ≤ 0.40	1350	1.80 ≤ TH ≤ 1.85	2060
0.40 ≤ TH ≤ 0.45	1450	1.85 ≤ TH ≤ 1.90	1970
0.45 ≤ TH ≤ 0.50	1560	1.90 ≤ TH ≤ 1.95	1920
0.50 ≤ TH ≤ 0.55	1640	1.95 ≤ TH ≤ 2.00	1870
0.55 ≤ TH ≤ 0.60	1730	2.00 ≤ TH ≤ 2.05	1830
0.60 ≤ TH ≤ 0.65	1840	2.05 ≤ TH ≤ 2.10	1780
0.65 ≤ TH ≤ 0.70	1860	2.10 ≤ TH ≤ 2.15	1740
0.70 ≤ TH ≤ 0.75	1970	2.15 ≤ TH ≤ 2.20	1700
0.75 ≤ TH ≤ 0.80	2060	2.20 ≤ TH ≤ 2.25	1690
0.80 ≤ TH ≤ 0.85	2060	2.25 ≤ TH ≤ 2.30	1700
0.85 ≤ TH ≤ 1.05	2060	2.30 ≤ TH ≤ 2.35	1750
1.05 ≤ TH ≤ 1.50	2060		

CHEMICAL COMPOSITION

Structural steels

C (%)	Mn (%)	P (%)	S (%)	Si (%)	Al (%)	Nb (%)	Ti (%)
≤ 0.200	≤ 1.70	≤ 0.100	≤ 0.045	≤ 0.60	—	—	—

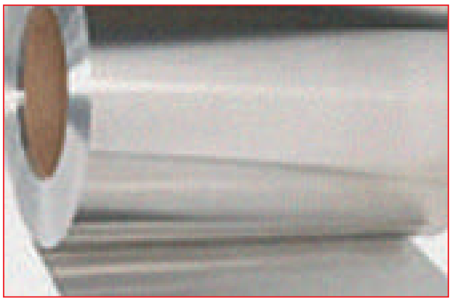
COATING PROPERTIES

DESIGNATION EN 10346	COATING WEIGHT DOUBLE SIDED (G/M²)	COATING THICKNESS (µM PER SIDE)
Z 140	140	10.0

The data quoted above are indicative and are not binding.
SINTRA reserves itself the right to modify them at any time, with no obligation of advanced notification

AISI 430

Sintra, in order to give the ducts a more pleasant appearance without having to bear heavily on the costs, introduced the use of the AISI 430 stainless steel instead of the AISI 304 stainless steel, which can be used in all plants as a substitute for galvanized steel.



General characteristics

The main characteristics of the AISI 430 stainless steel for applications close to room temperature are:

- Resistance to corrosion with moderately aggressive media
- It can be readily cold formed by all standard processes (enhanced performance for K30D)
- Excellent aesthetical appearance

AISI 430 stainless steel also have a good resistance to oxidation due to high temperatures.

CHEMICAL COMPOSITION

This grade complies with:

- Stainless Europe material safety data sheet n° 1: stainless steel (European directive 2001/58/EC)
- European directive 2000/53/EC on end-of-life vehicles, and on the annex II dated 27 june 2002.
- NFA 36 711 standard "stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)
- Requirements of NSF/ANSI 51 – 2007 international standard edition for "Food Equipment Materials" and of the FDA (United States Food and Drug Administration) regarding materials used for food contact
- French decree Nr. 92-631 dated 8 July 1992 and Regulation No.1935-2004 of the European parliament and of the council of 27 October 2004 on materials and articles intended to come into contact with food (and repealing directives 80/590/EEC and 89/109/EEC)
- French regulatory paper dated 13 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs

GRADE DESIGNATION	INOX430D	INOX430D
ELEMENTS	%	%
C	0.05	0.035
Si	0.35	0.35
Mn	0.40	0.40
Cr	16.5	16.5

Typical values

INOX430	INOX430D
Standard level grade	Enhanced forming performance grade

GRADE DESIGNATION	EUROPEAN DESIGNATION	
X6Cr17	1.4016[(1)]	Type 430[(2)]

[(1)]According to EN 10088-2 [(2)]According to ASTM A 240

COLD FORMED METAL SHEET – STRENGTHENED

Our 430 stainless steel can be readily cold formed by all standard processes (bending, contour forming, drawing, deep drawing, flow turning and stretching).

The drawing operations which imply a considerable "stretching", can be eased by the initial forming, by producing modules with a wide bending radius.

Stretching (Erichsen test)

GRADE DESIGNATION	EUROPEAN DESIGNATION	ASTM A 240	ERICHSEN DEFLECTION*
K30	1.4016	Type 430	mm 8.7

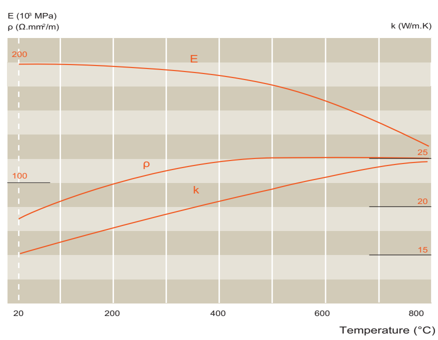
Deep drawing (Swift test)

GRADE DESIGNATION	EUROPEAN DESIGNATION	ASTM A 240	LDR* (mm)
K30	1.4016	Type 430	2.05-2.10

PHYSICAL PROPERTIES

Cold rolled sheet - annealed

Density	d	kg/dm^3	20°C	7.7
Fusion temperature		°C		1500
Specific heat	c	J/kg.K	20°C	460
			400°C	600
			800°C	800
Thermal conductivity	k	W/m.K	20°C	25
Mean coefficient of thermal expansion	a	10^{-6}/K	20-200°C	10.5
			20-400°C	11.5
			20-600°C	11.7
			20-600°C	12.5
Electrical resistivity	p	Ω mm^2/m	20°C	0.60
Magnetic permeability	μ	At 0.8 kA/m DC or AC	20°C	1000
Young modulus	E	MPa.10^3	20°C	220



AISI 430

MECHANICAL PROPRETIES

GRADE DESIGNATION	CONDITIONS	R_m (1) (MPa)	$R_{p0.2}$ (2) (MPa)	A (3) (%)	HV5
K30	Cold rolled**	510	340	26	155
K30D	Cold rolled**	490	320	29	150

1 MPa - 1 N/mm^2 **Typical values

(1)Ultimate Tensile Strength (UTS) (2)Yield Strength (YS) (3)Elongation (A)

Annealed condition

According to EN 10002-1 (july 2001).

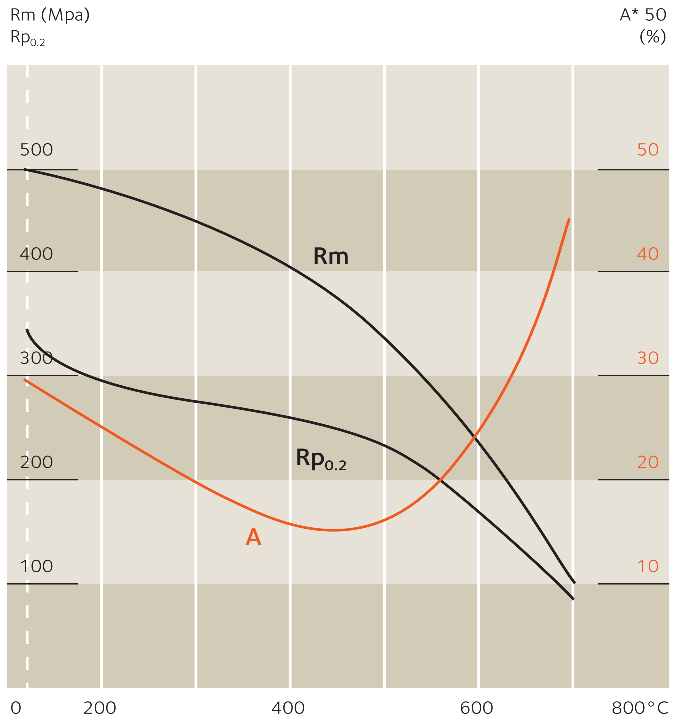
Specimen perpendicular to the rolling direction

Specimen

Lo = 80 mm (thickness < 3 mm)

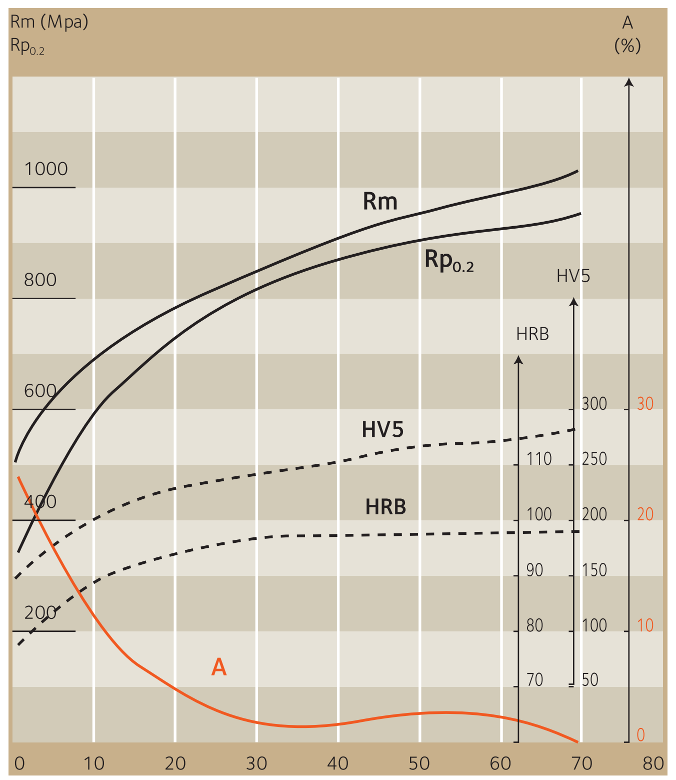
Lo = 5.65 √So (thickness ≥ 3 mm)

At high temperatures (K30)



Typical values.
* based from specimen 20x50 mm

Effect of cold rolling (K30)



CREEP PROPERTIES

Mean stresses (Mpa) for different rupture levels according to temperature

Temperature (°C)	100 h	10000 h	100000 h
400	400	340	300
500	180	140	120
600	60	45	30
700	20	13	7

Typical values

Mean stresses (Mpa) for 1% elongation at different times according to temperature

Temperature (°C)	1000 h	10000 h	100000 h
400	340	280	210
500	130	90	60
600	50	35	20

Typical values

HEAT TREATMENT AND FINISHING

Annealed at 800 °C after cold forming.

For what concerns the polishing, brushing, buffing, satin finishing there are no particular difficulties encountered.

Pickling

Nitric-hydrofluoric acid mixture (10% HNO_3 + 2% HF)

De-scaling paste for welded areas

Passivation

HNO_3 solution at 20-25% (36° Baumé) at 20°C.

Passivating paste for welded areas

AISI 430

CORROSION RESISTANCE

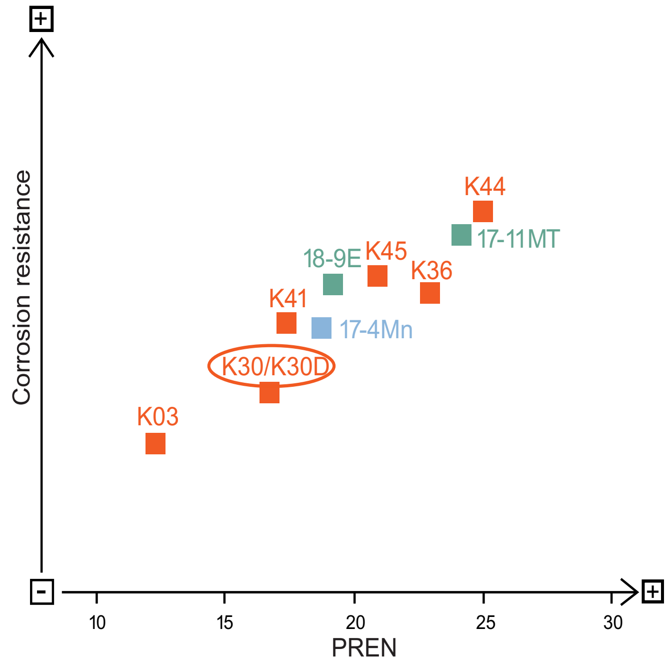
430 stainless steel has a good corrosion resistance in a large number of applications:
- domestic environments;
- domestic handling of foodstuffs
- soaps and detergents
- alkaline solutions at room temperature
- certain diluted organic acids at room temperature
- neutral and alkaline salt solutions other than those containing halides (chlorides, fluorides, bromides, iodides)
- numerous organic substances
- Oxidation limits the continuous service temperature of 430 stainless steel to 800°C

Localised corrosion resistance

Grade designations	Standards		
	ASTM Designations		EN
	Type	UNS	
K03		S41003	1.4003
K30/K30D	430	S43000	1.4016
K41	441 (1)	S43932	1.4509
K45	445 (1)	S44500	1.4621 (2)
K36	436	S43600	1.4526
K44	444	S44400	1.4521
17-4Mn	201.1	S20100 (3)	1.4618 (2)
18-9 E	304	S30400	1.4301
17-11 MT	316Ti	S31635	1.4571

(1) Common designation.
(2) Pending update of the standard.
(3) With copper addition and 201.1 «rich side» properties per ASTM A240

Typical values of pitting corrosion potential in NaCl 0.02M, 23°C, pH6.6 as a function of PREN (%Cr+3.3%Mo+16%N).



WELDING

In general 430 stainless steel is poorly suited to welding operations, since it readily forms martensite in the weld, leading to brittle and relatively undeformable joints. However, satisfactory results can be obtained without having to resort to post-weld treatments, providing that the welding process employed forges the weld sufficiently and that the welding power is not too high. 430 stainless steel is not recommended for heavy gage welded structures, due to the brittleness of the non-forged weld joints. There is no thermal treatment required after the welding.
Welding points must be mechanically or chemically descaled, then passivated.

Welding process	No filler metal	With filler metal			Shielding gas*
	Typical thicknesses	Thicknesses	Filler metal		
			Rod	Wire	
Resistance: Spot, Seam	≤ 2 mm				
TIG	< 1.5 mm	> 0.5 mm	W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	Argon
PLASMA	< 1.5 mm	> 0.5 mm		W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	Argon
MIG[(2)]		> 0.8 mm		W.N° 1.4370 ER 309 L (Si) ER 316 L (Si)	Argon + 2% CO Argon + 2% O
S.A.W[(2)]		> 2 mm		ER 309 L ER 316 L	
Electrode		Repairs	ER 309 L ER 316 L		
Laser	< 5 mm				Helium

(1)The S.A.W. process is not recommended, due to the high power input.
(2)Pulsed MIG welding preferred, due to the lower power input.

AISI 304

General characteristics

The main characteristics of the 304 stainless steel are:

- Good resistance to corrosion in acids and chlorides containing media
- Very good resistance to pitting corrosion and crevice corrosion
- Very good resistance to intergranular corrosion, even after welding
- Excellent weldability
- High ductility
- Good drawability
- Excellent polishing

CHEMICAL COMPOSITION

This 304 stainless steel complies with:

- Stainless Europe material safety data sheet n° 1: stainless steel (European directive 2001/58/EC)
- European directive 2000/53/EC on end-of-life vehicles, and on the annex II dated 27 June 2002.
- NFA 36 711 standard "stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)
- Requirements of NSF / ANSI 51-2009 International edition for "Collective Restoration Materials" and of FDA (United States Food and Drug Administration) for what concerns materials used for contact with foodstuffs
- French decree Nr. 92-631 dated 8 July 1992 and Regulation No.1935-2004 of the European parliament and of the council of 27 October 2004 on materials and articles intended to come into contact with food (and repealing directives 80/590/EEC and 89/109/EEC)
- French regulatory paper dated 13 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs
- Italian decree dated 21 March1973: a list of steel kinds appropriate to the "rules for the hygiene of packaging, and instruments destined to come in contact with foodstuffs or with substances for personal use"
- PED (Pressure Equipment Directive) according to EN 10028-7 and AD2000 Merkblatt and W2 and W10 (TÜV WB494).

TEMPERATURE (°C)	100 H	10000 H	100000 H
400	400	340	300
500	180	140	120
600	60	45	30
700	20	13	7

Typical values

TEMPERATURE (°C)	100 H	10000 H	100000 H
400	400	340	300
500	180	140	120
600	60	45	30
700	20	13	7

Typical values

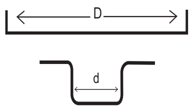
COLD FORMING

In the strengthened condition, 304 stainless steel can be readily cold formed by all standard processes (bending, contour forming, drawing, deep drawing, flow turning and stretching). Some forming operations are easier when performed hot. Subsequent pickling is necessary.

Deep drawing (Swift test)

The Swift test is a method used to determinate the Limiting Drawing Ratio (LDR). This LDR is defined by the maximum ratio between the blank diameter (variable) and the punch diameter (fixed) for which the drawing can be performed successfully in one step.

Grade designation	LDR* (mm)
18-9E	1.96
18-9ED	1.98
18-9DDQ	2.02
17-4Mn	1.92
K41	2.29
K45	2.28

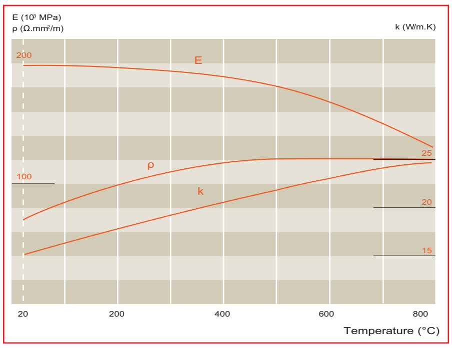


$$LDR = \frac{D_{max}}{d}$$

* Limiting Drawing Ratio - Lubricant = Mobilux EP00
Typical values tests done on 0.8mm thick.

PHYSICAL PROPERTIES

Cold rolled and annealed sheet



DENSITY	D	KG/DM³	20 °C	7.9
MELTING TEMPERATURE		°C	LIQUIDUS	1450
SPECIFIC HEAT	C	J/KG.K	20 °C	500
THERMAL CONDUCTIVITY	K	W/M.K	20 °C	15
MEAN COEFFICIENT OF THERMAL EXPANSION	ά	10^{-6}/K	20-100 °C	16.0
			20-200 °C	16.5
			20-400 °C	17.0
			20-600 °C	17.5
			20-800 °C	18.0
ELECTRICAL RESISTIVITY	ρ	Ω MM²/M	20 °C	0.73
MAGNETIC PERMEABILITY	μ	AT 0.8 KA/M DC OR AC	20 °C	1.02
YOUNG'S MODULUS	E	MPA.10³	20 °C	200

Poisson's coefficient: 0.30

AISI 304

MECHANICAL PROPRETIES

GRADE DESIGNATION	EUROPEAN DESIGNATION	ASTM A240	R_m(1) (MPa)	$R_{p0.2}$(2) (MPa)	A(3) (%)
1B-9E	1.4301	304	670	320	50
18-9ED	1.4301	304	630	300	55
18-9DDQ	1.4301	304	610	270	57
17-4Mn	1.4618	201.1	650	330	50
K41	1.4509	441(a)	480	310	30
K41	1.4621(b)	445(a)	510	360	29

1 MPa - 1 N/mn² — Typical values

(1)Ultimate Tensile Strength (UTS) (2)Yield Strength (YS) (3)Elongation (A)

(a)Common designation (b)Pending update of the standard

According to EN 10002-1 (July 2001), test piece perpendicular to rolling direction.

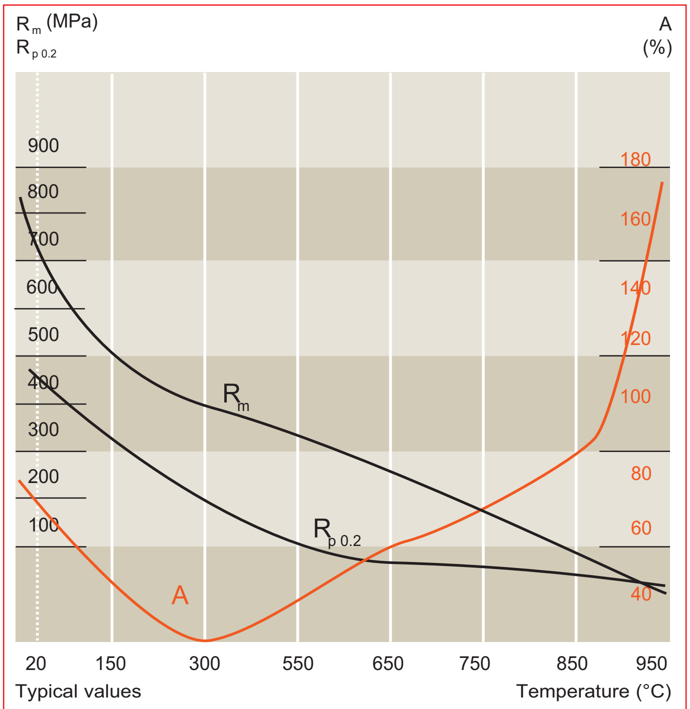
Test piece

Length = 80 mm (thickness < 3 mm)

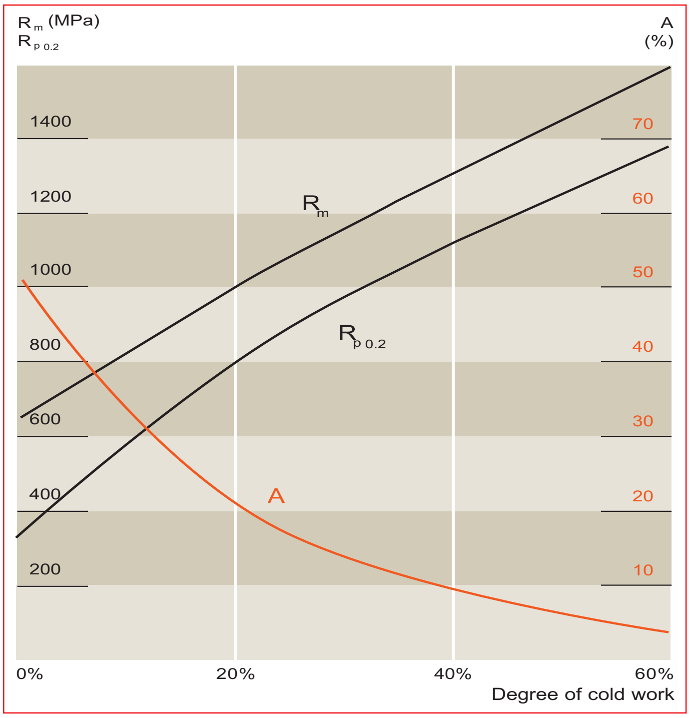
Length = 5.65 √So (thickness ≥ 3 mm)

Cold rolled

At high temperatures (18-9DDQ)

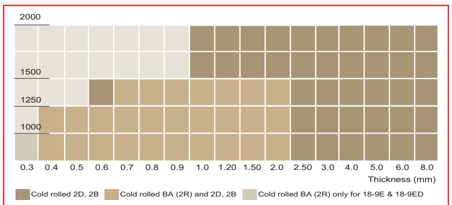


Work hardened condition (18-9E)

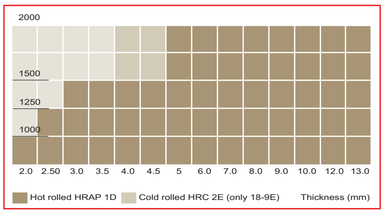


Size Range

Cold Rolled (width (mm))



Hot Rolled and HRC



Our size range is based on our production capabilities. For the latest information on our offer, please consult us.

Heat treatment and finishing

Temperature

After cold forming (work hardening) and after welding (risk of intergranular corrosion in the weld joint) an annealing treatment for a couple of minutes at 1075 ± 25°C followed by air cooling, restores the microstructure (recrystallization and dissolution of carbides) and eliminates internal stresses. After annealing, pickling followed by passivation is necessary.

Pickling

Nitric-hydrofluoric acid mixture (10% HNO3 + 2% HF) at room temperature or up to 60°C

Sulfuric-nitric acid mixture (10% H2So4 + 0,5% HNO3) at 60°C

Descaling paste for welded areas

Passivation

20-25% HNO3 solution(36° Baumé) at 20°C - passivating paste for the welded areas

Polishing

The surface of the 304 stainless steel is indicated for all kinds of polishing (grit, scotch-brite, electropolishing)

AISI 304

CORROSION RESISTANCE

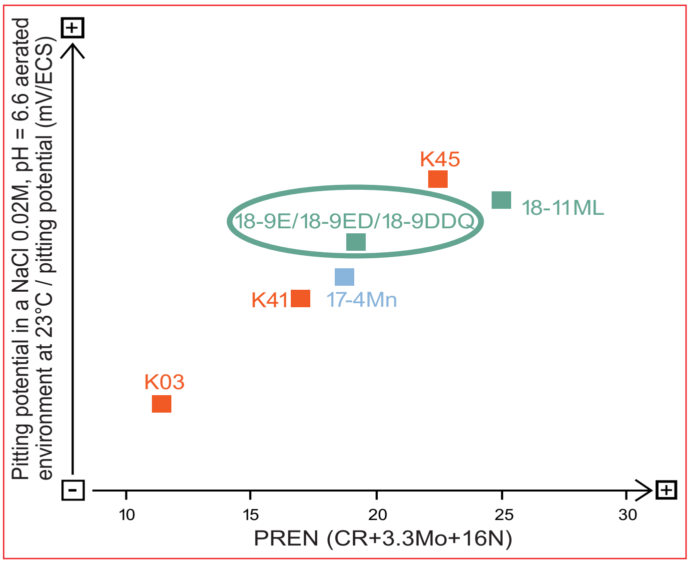
304 stainless steel have a good resistance to the common corrosive media, but are not recommended where there is a risk of intergranular corrosion. They are will adapted for exposure in fresh water and urban and rural atmospheres. In all cases, regular cleaning of exposed external surfaces is necessary to conserve their original appearance.

304 stainless steel has a good resistance to various acids:

- phosphoric acid in all concentrations at room temperature
- nitric acid up to 65% (40° Baumé), between 20 and 50 °C
- formic and lactic acids at room temperature
- acetic acid between 20 and 50°C

They are recommended for use in contact with cold or hot foodstuffs such as wine, beer, milk (curdled or otherwise) natural fruit juices, syrups, molasses, etc.

Pitting corrosion

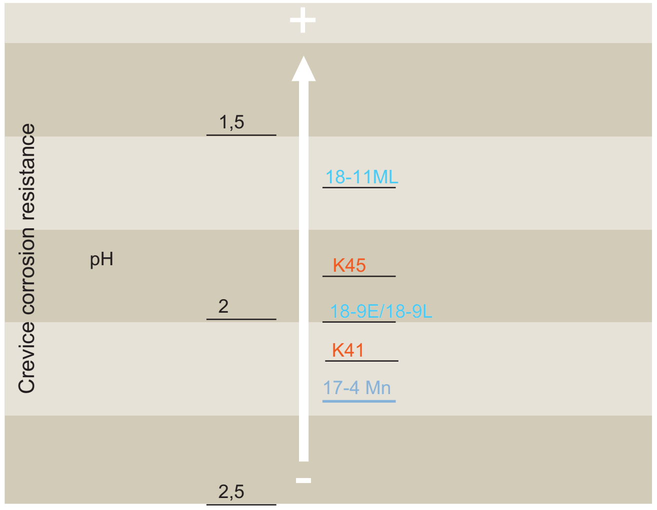


Pitting potential in various solutions of temperature and chloride concentration (mV).

GRADE DESIGNATION	NaCl 0.02/23°C	NaCl 0.02/50°C	NaCl 0.05/23°C	NaCl 0.02/50°C
18-9E/ED/DDQ	540	385	305	175
Typical values				

Crevice corrosion

Depassivation pH in a deaerated NaCl 2M environment at 23°C



Crevice corrosion is a type of corrosion that can be divided into processes. During the first process, called initiation, discrete pits are formed within the crevice region if the pH is below the depassivation pH of the local grade.

Propagation is the second process and it consists in the dissolution of the metal.

WELDING

In general heat treatment is not required after welding. However, in order to fully restore the corrosion resistance of the metal the welds must be chemically descaled and passivated. If there is a risk of intergranular corrosion, a treatment with annealing solution at 1075 ± 25°C must be carried out.

WELDING PROCESS	NO FILLER METAL	WITH FILLER METAL			SHIELDING GAS*
	TYPICAL THICKNESSES	THICKNESSES	FILLER METAL ROD	FILLER METAL WIRE	
Resistance: Spot, Seam	< 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 308 L(1) ER 347 L(2)	ER 308 L(1) ER 347 L(2)	Argon Argon+5%Hydrogen Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 308 L(1) ER 347 L(2)	Argon Argon+5%Hydrogen Argon + Helium
MIG(2)		> 0.8 mm		ER 308 L(1) ER 347 L(2)	Argon + 2% CO_2 Argon + 2% O_2 Argon + 2% CO_2+1% H_2 Argon + Helium
S.A.W(2)		> 2 mm		ER 308 L(1)	
Electrode		Repairs	ER 308 ER 308 L(1) ER 347 L(2)		
Laser	< 5 mm				Helium under certain circumstances Argon Nitrogen

(1)ER 308L (AWS A5.9) = G 19 9 L (NF EN ISO 14343)
(2)ER 347 (AWS A5.9) = G 19 9 Nb (NF EN ISO 14343)
(3)E308L (AWS A5.4) = E 19 9 L (EN1600)
(4)E347 (AWS A5.4) = E 19 9 Nb (EN1600)

AISI 316/316L

The main characteristics of the 304 stainless steel are:

- Good resistance to corrosion in acids and chlorides containing media
- Very good resistance to pitting corrosion and crevice corrosion
- Very good resistance to intergranular corrosion, even after welding
- Excellent weldability
- High ductility
- Good drawability
- Excellent polishing

CHEMICAL COMPOSITION

This 316/316L stainless steel complies with:

- Stainless Europe material safety data sheet n° 1: stainless steel (European directive 2001/58/EC)
- European directive 2000/53/EC on end-of-life vehicles, and on the annex II dated 27 June 2002.
- PED (pressure equipment directive) according to EN 10028-7 andAD2000 Merkblatt W2 e W10 (TUV WB494)
- NFA 36 711 standard “stainless steel intended for use in contact with foodstuffs, products and beverages for human and animal consumption (non packaging steel)
- Requirements of NSF / ANSI 51-2009 International edition for "Collective Restoration Materials" and of FDA (United States Food and Drug Administration) for what concerns materials used for contact with foodstuffs
- French decree Nr. 92-631 dated 8 July 1992 and Regulation No.1935-2004 of the European parliament and of the council of 27 October 2004 on materials and articles intended to come into contact with food (and repealing directives 80/590/EEC and 89/109/EEC)
- French regulatory paper dated 13 January 1976 relating to materials and articles made of stainless steel in contact with foodstuffs
- Italian decree dated 21 March1973: a list of steel kinds appropriate to the “rules for the hygiene of packaging, and instruments destined to come in contact with foodstuffs or with substances for personal use”

Elements%	C	Si	Mn	Cr	Ni	Mo
18-11ML	≤ 0.02	0.40	1.20	16.70	10.05	2.05

Typical values

Grade designation	European designation	American designation	IMDS Nr
18-11ML	X5CrNiMo 17-12-2/1.4401(1)	UNS 31600/ Type 316(2)	2934460
18-11ML	X5CrNiMo 17-12-2/1.4404(1)	UNS 31603/ Type 316L(2)	2934460

(1)According to EN 10088-2

(2)According to ASTM A240

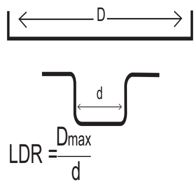
COLD FORMING

In the strengthened condition, 316/316L stainless steel can be readily cold formed by all standard processes (bending, contour forming, drawing, deep drawing, flow turning and stretching).

Deep drawing (Swift test)

The Swift test is a method used to determinate the Limiting Drawing Ratio (LDR). This LDR is defined by the maximum ratio between the blank diameter (variable) and the punch diameter (fixed) for which the drawing can be performed successfully in one step.

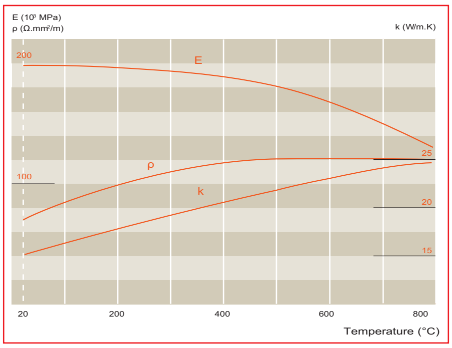
Grade designation	LDR*
18-11ML	2.01
DX22-05	1.9 – 1.95
K44	2.10 - 2.15



* Limiting Drawing Ratio – Lubricant = Mobilux EP00 0.8 mm thick sheet

PHYSICAL PROPERTIES

Cold rolled sheet - annealed



Density	d	kg/dm³	20 °C	7.9
Melting Temperature		°C	Liquidus	1440
Specific heat	c	J/kg.K	20 °C	500
Thermal conductivity	k	W/m.K	20 °C	15
Mean coefficient of thermal thermal expansion	ά	10^{-6}/K	20-100 °C	16.0
			20-300 °C	17.0
			20-500 °C	18.0
Electrical resistivity	ρ	Ω mm²/m	20 °C	0.75
Magnetic permeability	μ	at 0.8 kA/m DC or AC	20 °C	1005
Young's Modulus	E	MPa.10³	20 °C	200

AISI 316/316L

MECHANICAL PROPRETIES

GRADE DESIGNATION	EUROPEAN DESIGNATION	ASTM A240	R_m[1] (MPa)	$R_{p0.2}$[2] (MPa)	A[3] (%)
18-11ML	1.4001/4404	316/316L	620	310	48
22-05	1.4462	2205	840	620	29
K44	1.4521	444	520	380	28

1 MPa - 1 N/mn² Typical values

[1]Ultimate Tensile Strength (UTS) [2]Yield Strength (YS) [3]Elongation (A)

In the annealed condition. In accordance EN 10002-1 (July 2001), test piece perpendicular to rolling direction.

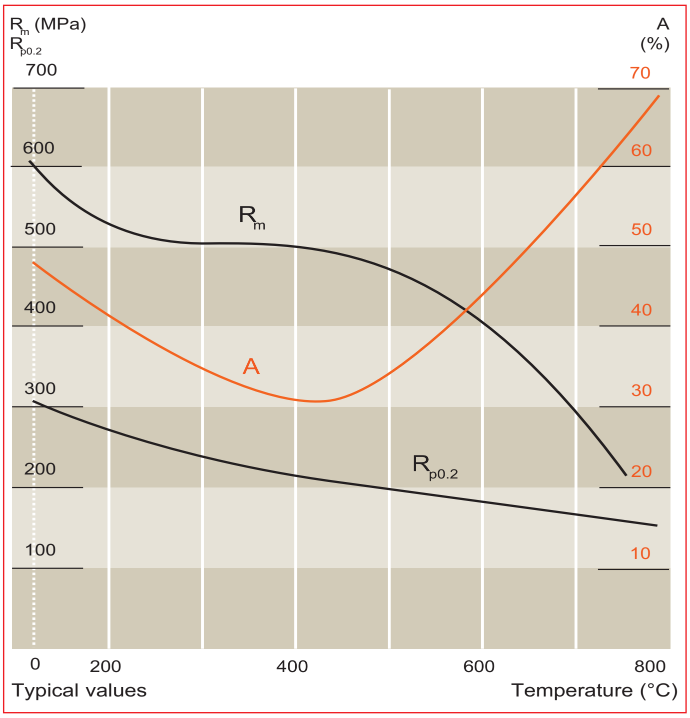
Test piece

Length = 80 mm (thickness < 3 mm)

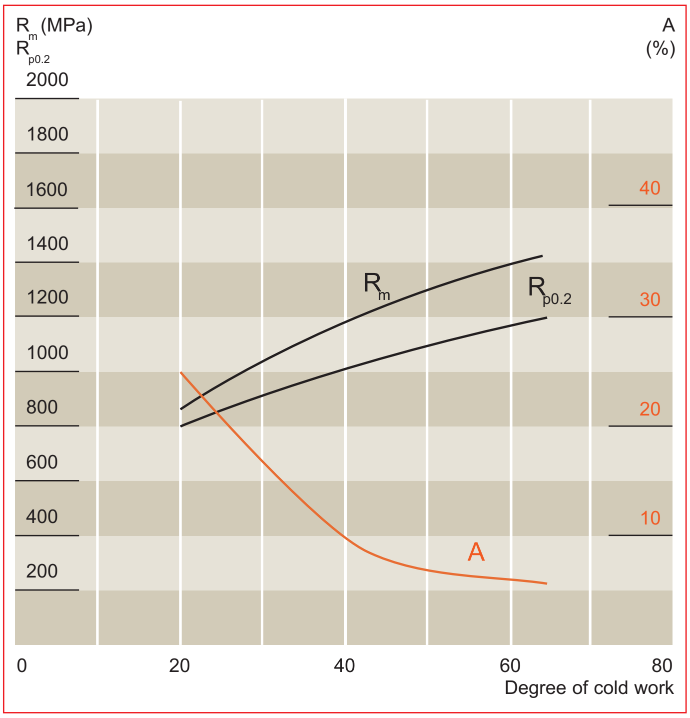
Length = 5.65 √So (thickness ≥ 3 mm)

Cold rolled

At elevated temperatures



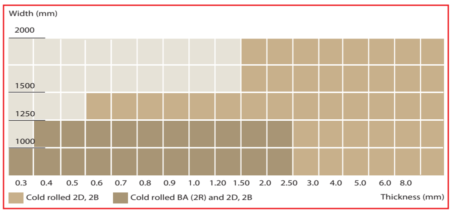
Work hardened condition



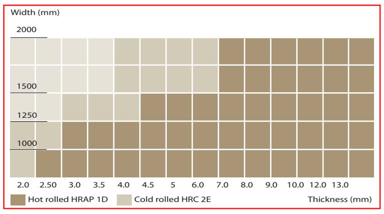
Size Range

Our size range is based on our production capabilities. For the latest information on our offer, please consult us.

Cold Rolled



Hot Rolled and HRC



Heat treatment and finishing

Temperature

After cold forming (work hardening) and after welding (risk of intergranular corrosion in the weld joint) an annealing treatment for a couple of minutes at 1075 ± 25°C followed by air cooling, restores the microstructure (recrystallization and dissolution of carbides) and eliminates internal stresses. After annealing, pickling followed by passivation is necessary.

Pickling

Nitric-hydrofluoric acid mixture (10% HNO3 + 2% HF) st room temperature or up to 60°C

Sulfuric-nitric acid mixture (10% H2So4 + 0,5% HNO3) at 60°C

Descaling paste for welded areas

Passivation

20-25% HNO3 solution (36° Baumé) at 20°C - passivating paste for the welded areas

Polishing

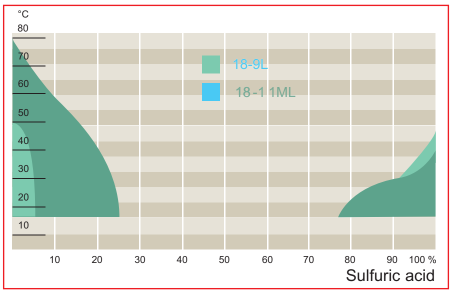
The surface of the 316/316L stainless steel is indicated for all kinds of polishing (grit, scotch-brite, electropolishing)

AISI 316/316L

CORROSION RESISTANCE

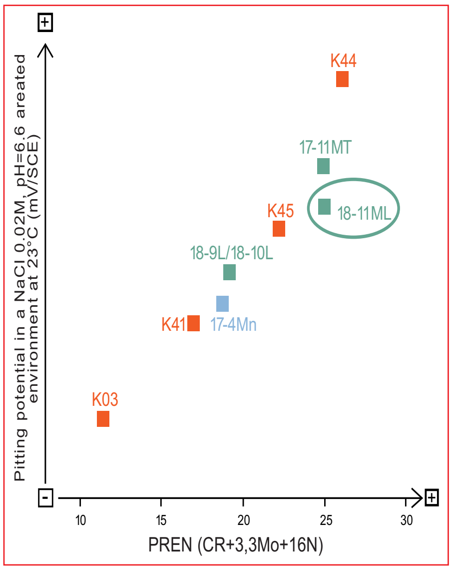
AISI 316/316L stainless steel has an excellent resistance in acid solutions and shows a good resistance in chloride-containing media. This steel is then used for the production of parts which come into contact with low temperature salt water.

Intergranular corrosion



This steel is also recommended where there is a risk of intergranular corrosion by meeting the following requirements of the standard intergranular corrosion tests: EN ISO 3651-2 (sensitizing treatments T1and T2), ASTM A 262, ex DIN 50914.

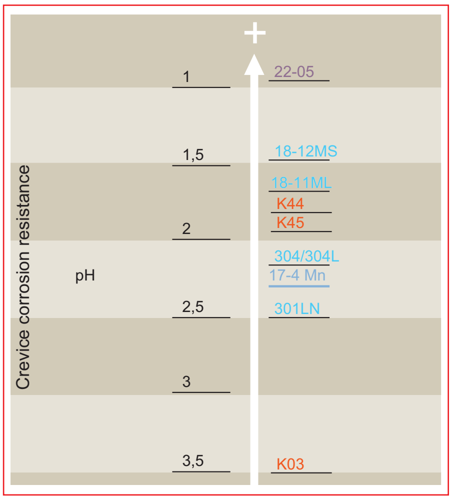
Pitting corrosion



K44 and double DX2205 (1.4462) and DX2304 (1.4362) are alternatives for 8-11ML. Thanks to their higher resistance to corrosion, duplex pitting potentials cannot be determined in such conditions of temperature (23°C) and chloride concentration (0.02M). To consider them, please report to their specific data sheets.

Crevice corrosion

Depassivation pH in a deaerated NaCl 2M environment at 23°C



Crevice corrosion is a type of corrosion that can be divided into processes.
During the first process, called initiation, discrete pits are formed within the crevice region if the pH is below the depassivation pH of the local grade.
Propagation is the second process and it consists in the dissolution of the metal.

Pitting potential in various solutions of temperature and chloride concentration (mV).

GRADE DESIGNATION	NaCl 0.02/23°C	NaCl 0.02/50°C	NaCl 0.05/23°C	NaCl 0.02/50°C
18-11ML	630	500	455	270

Typical values

WELDING

In general heat treatment is not required after welding. However, in order to fully restore the corrosion resistance of the metal, the welds must be mechanically or chemically descaled and passivated. In case of applications at temperatures above 500°C, a specific filler material has to be used to guarantee a ferrite level below 8% in the weld.

WELDING PROCESS	NO FILLER METAL TYPICAL THICKNESSES	WITH FILLER METAL THICKNESSES	FILLER METAL ROD	FILLER METAL WIRE	SHIELDING GAS*
Resistance: Spot, Seam	< 2 mm				
TIG	< 1.5 mm	> 0.5 mm	ER 316 L(1)	ER 316 L(1)	Argon Argon+5%Hydrogen Argon + Helium
PLASMA	< 1.5 mm	> 0.5 mm		ER 316 L(1)	Argon Argon+5%Hydrogen Argon + Helium
MIG		> 0.8 mm		ER 316 L Si(1)	Argon + 2% CO_2 Argon + 2% O_2 Argon + 2% CO_2+1% H_2 Argon + Helium
S.A.W		> 2 mm		ER 316 L(1)	
Electrode		Repairs	ER 316 L(1)		
Laser	< 5 mm				Helium under certain circumstances Argon Nitrogen

(1)ER 316L (AWS A5.9) = G 19 12 3 L (EN 14343)
(2)E 316L (AWS A5.4) = E 19 12 3 L (EN 1600)

STAINLESS STEEL

AISI 304

Indicative correspondance

EN 10088/3	W.	JIS	AISI
10088/3 (European rules) X 5 Cr Ni 18-10	(Germany) 1.4301	(Japan) SUS 304	(U.S.A.) 304

Description

It is the most popular between stainless steels.

Austenitic stainless steel, non-magnetic at the annealed state, slightly magnetic if cold rolled.

Hardenable through cold forming.

Good mechanical characteristics, not too elevated when at room temperature but excellent at very low temperatures, particularly for what concerns resilience as well as the high resistance to effort with little sensitivity to incisions.

Physical characteristics

Elasticity module:	200.000 [N/mm2]
Thermal conductivity:	15 [W/mK]
Specific heat:	500 [J/KgK]
Coefficients of thermal expansion:	(20°-200°C) 16.5 [10^{-6} K^{-1}] (20°- 400°C) 17.5 [10^{-6} K^{-1}] (20°- 600°C) 18.5 [10^{-6} K^{-1}]

Mechanical characteristics at room temperature

Yield stress:	RP O.2 ≥ 190 [N/mm2]
Tensile strength:	Rm 500 ÷ 700 [N/mm2]
Stretching:	A 5% ≥ 45
Brinell stretching test:	HB ≤ 215

Indicative analisys %

C	MnMAX	PMAX	SMAX	SiMAX	Cr	Ni	Mo	ALTRI ELEMENTI
0,045MAX	2	0.045	0.015(A)	0.45	17.8 ÷ 18.5	8 ÷ 10	-	N ≤ 0.11

AISI 316

Indicative correspondance

EN 10088/3	W.	JIS	AISI
10088/3 (European rules) X 5 Cr Ni Mb17-12-2	(Germany) 1.4401 1	(Japan) SUS 316	(U.S.A.) 304

Description

Austenitic stainless steel, non-magnetic at the annealed state, slightly magnetic if cold rolled.

Hardenable through cold forming. It has a resistance to corrosion higher than the 304 steel, for what concerns pitting caused by chloride ions and corrosion under tension.

Physical characteristics

Elasticity module:	200.000 [N/mm2]
hermal conductivity:	15 [W/mK]
Specific heat:	500 [J/KgK]
Coefficients of thermal expansion:	(20°-200°C) 16.5 [10^{-6} K^{-1}] (20°- 400°C) 17.5 [10^{-6} K^{-1}] (20°- 600°C) 19.0 [10^{-6} K^{-1}]

Mechanical characteristics at room temperature

Yield stress:	RP O.2 ≥ 190 [N/mm2]
Tensile strength:	Rm 500 ÷ 700 [N/mm2]
Stretching:	A 5% ≥ 40
Brinell stretching test:	HB ≤ 215

Indicative analisys %

C	MnMAX	PMAX	SMAX	SiMAX	Cr	Ni	Mo	ALTRI ELEMENTI
0,02MAX	1.2	0.045	0.015(A)	0.4	16.5 ÷ 17.5	10 ÷ 11	2 ÷ 2.1	N ≤ 0.11

AISI 316L

Indicative correspondance

EN 10088/3	W.	JIS	AISI
EN 10088/3 (European rules) X 2 Cr Ni 17-12-2	(Germany) 1.4404	(Japan) SUS 316L	(U.S.A.) 316L

Description

Austenitic stainless steel, non-magnetic at the annealed state, slightly magnetic if cold rolled. Hardenable through cold forming.
Resistance to corrosion and to pitting caused by chloride ions. Compared to AISI 316, it has a lower carbon content.

Resistance to corrosion

Very good in atmosphere and in a wide variety of salts, organic acids and foodstuffs, discrete towards solutions with low in reducing acids and towards halides and sea water. 316L stainless steel, thanks to the very low carbon content, is virtually insensible to intercrystalline corrosion.

Physical characteristics

Elasticity module: 200.000 [N/mm2]
Thermal conductivity: 15 [W/mK]
Specific heat: 500 [J/KgK]
Coefficients of thermal expansion: (20°-200°C) 16.5 [10^{-6} K^{-1}]
(20°- 400°C) 17.5 [10^{-6} K^{-1}]
(20°- 600°C) 18.8 [10^{-6} K^{-1}]

Mechanical characteristics at room temperature

Yield stress: RP O.2 ≥ 190 [N/mm2]
Tensile strength: Rm 500 ÷ 700 [N/mm2]
Stretching: A 5% ≥ 40
Brinell stretching test: HB ≤ 215

Indicative analisys %

C	Mnmax	Pmax	Smax	Simax	Cr	Ni	Mo	Altri elementi
0,045	2	0.045	0.015(A)	0.45	17.8 ÷ 18.5	10 ÷ 13(B)	2 ÷ 2.5	N ≤ 0.11

AISI 430

Indicative correspondance

EN 10088/3	W.	JIS	AISI
10088/3 (European rules) X 6 Cr 17	(Germany) 1.4016	(Japan) SUS 430	(U.S.A.) 430

Description

Ferritic and ferromagnetic stainless steel. Hardenable through cold forming.

Physical characteristics

Elasticity module: 220.000 [N/mm2]
Thermal conductivity: 25 [W/mK]
Specific heat: 460 [J/KgK]
Coefficients of thermal expansion: (20°-200°C) 10.0 [10^{-6} K^{-1}]
(20°- 400°C) 10.5 [10^{-6} K^{-1}]
(20°- 600°C) 12.0 [10^{-6} K^{-1}]

Mechanical characteristics at room temperature

Yield stress: RP O.2 ≥ 240 [N/mm2]
Tensile strength: Rm 460 ÷ 630 [N/mm2]
Stretching: A 5% ≥ 20
Brinell stretching test: HB ≤ 205

Indicative analisys %

C	Mnmax	Pmax	Smax	Simax	Cr	Ni	Mo	Altri elementi
0.035 ÷ 0.05	0.4	0.045	0.015(A)	0.35	16.0 ÷ 17.0	-	-	-

AGGRESSIVE ENVIRONMENTS

The definition of this metal has been given when its prerogatives were still not well-known, seen as steel can actually OXYDIZE, and the causes which can trigger the corrosive phenomenons can be many:

- Thermal alterations such as welding or laser cut
- Contaminations with traces of iron (coming from the use of non-dedicated utensils, or from promiscuous processing with steel and iron)
- Uneven surfaces where the stagnation of polluting elements is possible
- Surface finishings which entail a roughness increase, such as glazing, flourishing or sanding, which can caus eth einclusion of polluting elements
- Aggressive environments, such as marine environments or environments with the presence of chlorine
- Sanding carried out with sand which is not perfectly clean, or is contaminated with ferrous materials

And many more.

In order guarantee the stainlessness of the steel, it is indispensable to have a work cycle constituted by:

De-greasing, de-contamination, deoxydizing: consisting in the elimination of traces of oil, greases and other contaminants due to the processing

Pickling: (removal of the de-chromed area): it is the base treatment in order to eliminate the oxide traces due to chemical alterations. The removal of the de-chromed area has the function to take off the impoverished chrome layer, which is a critical area for the corrosive attack.

Restoration of the chrome oxide film: after having de-contaminated and de-oxydized the manufactured product from possible polluting agents, stainless steel can remain with no protection, and therefore exposed to eventual external aggressive attacks. It is fundamental to restore the chrome oxide layer on the surface. It is an indispensable process in order to be able to guarantee the stainlessness of the stainless steel.

SWIMMING POOL WITH AISI 316L stainless steel ducts, correctly pickled

SWIMMING POOL WITH AISI 316L stainless steel ducts, correctly pickled

SWIMMING POOL WITH AISI 316L non-pickled

The chlorine evaporation due to the water's thermal treatment when the ventilation plant was off, allowed the condensation of the duct's surface, which has been then corroded in a significant way as a result of the incorrect pickling process.

AGGRESSIVE ENVIRONMENTS

Following the considerations developed for the use of stainless steel in environments with an oxydation and corrosion risk, we suggest the use of galvanized steel painted with expoxy powders

PRODUCT DESCRIPTION

SINTRA uses a range of powder paints formulated for the coating of aluminium and galvanized steel.
These paints are available in a wide range of colours and they have been specifically chosen between those that do not contain TGIC. Also, they offer an excellent external durability and an optimal colour retention in compliance with the characteristics required by all major standard European specifications for architecture.
All the powders used fully comply with the rules di BS6496:1984, BS6497:1984, Qualicoat Class1 and GSB.

POWDER'S CHARACTERISTICS

Chemical nature:	Polyester
Shine:	0 - 30 % (60°)
Granulometry:	Suitable for electrostatic applications
Specific weight:	1.2 - 1.9 g/cm3 (depending on the color)
Storage:	Keep in a dry environment not above 35°C and in a closed box
Durability:	12 months
Cooking times:	15 minutes at 190°C
(object's temperature)	10 minutes at 200°C
	9 minutes at 205°C

APPLICATIVE CONDITIONS

The following results are based on mechanical and chemical tests which, except for different indications, have been carried out in laboratory and are purely indicatives. The effective performance will depend on the product's applicative conditions.

Substrate:	Aluminium
Pre-treatment:	Chromate-based conversion
Thickness of the paint film:	60 microns
Cooking:	10 minutes at 200°C (object's temperature)

MECHANICAL TESTS

Flexibility:	BS 3900 - E11 (conical mandrel) Passes 3mm ISO 1519/73 (E) (cylindrical mandrel) Passes 3/16"
Adherence:	ISO 2409 (Comb 2mm) : class 0
	DIN 53151 (Comb 2mm) : GT0>95%
Deep drawing:	ISO 1520 : Passes > 7mm
Hardness:	ISO 2815 (4000gr): Passes - (does not penetrate into the substrate)
	ASTM D 3363/74(pencils) : Passes H - 2H
Impact resistance:	ECCA T5: Passes 3 joules D/R
	UNI 8901: Passes 30Kg x cm D/R

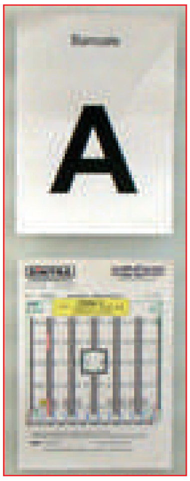
CHEMICAL TESTS FOR DURABILITY

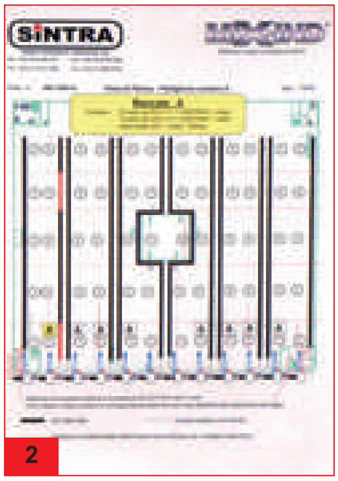
Aluminium and bronze/copper based metal products, even if keeping the general protective and anti-corrosive characteristics of the powder paints, show a quick loss of the metallic finishing when subject to the following tests:

Saline fog:	ISO 1456 : passes at 1000 hours - no corrosion area over 3mm from the incision's edge
Acetic saline fog:	ISO 9227 : passes at 1000 hours - < 16mm2 corrosion /10cm
Humidity cycle:	DIN 50017 : Passes at 1000 hours - no blistering or shine loss
Sulfur dioxide:	ISO 3231 (Kesternich) : Passes - no blistering or shine loss / fading after 30 cycles
Chemical resistance:	Generally it has a good resistance to most acids and of diluted alkals to oils at room temperature of 25°C

ASSEMBLING

ASSEMBLING SEQUENCE





1. Each pallet has, on the four sides, an identification letter with the general layout of the plant, the number and kind of ducts it contains and the gross weight.
2. On the layout sheet we indicate exactly where in the building the pallet must be positioned in order to be exactly centred, underneath the area where the ducts have to be installed.

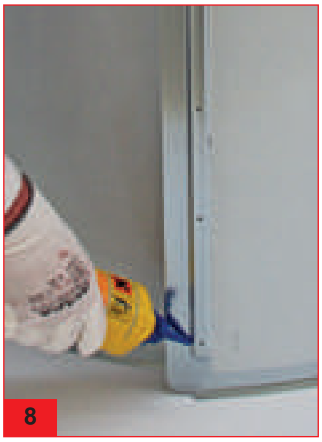
3. Once the external packaging has been removed, we can see the ducts bundled together in their characteristic SPIROPACK™ shape. On top of the ducts you can find the collars and the accessories box.

4. Start from the first duct on the outside, taking advantage of the elasticity of the sheet metal.
5. Please note that the edge next to the deep drawing is narrower on one side and wider on the other.
6. You must take the protective film off from the wider edge and the deep drawing before proceeding with the duct's assembly.

ASSEMBLING

ASSEMBLING SEQUENCE

7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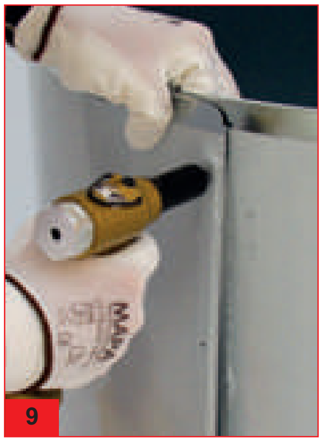
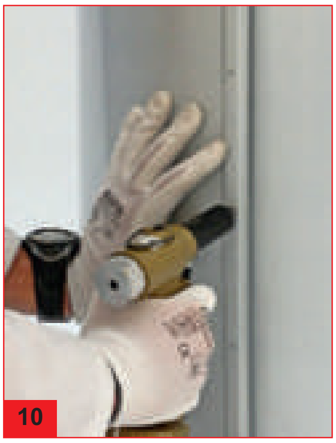

9

7. We provide the fixing rivets, the blue gasket and, upon request, the air compressor with pneumatic riveting machine and a liquid mastic that expands for better hold.
8. You should put a thin layer of mastic at the base of the deep drawing (only next to the wide edge) wich, when the two deep drawings will overlap, will be positioned on the inside of the duct.
9. You can now proceed with the closure of the duct, fixing the first rivet in the higher part of the deep drawing.


10

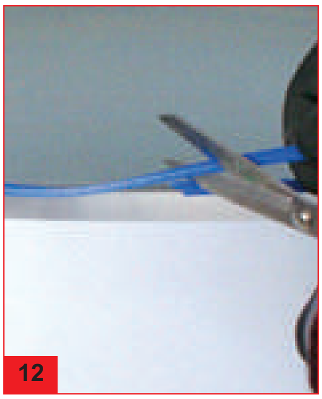

10


10

10. The second rivet will be fixed at the opposite extremity, the third one in the center and then you can fix the other rivets, for a total of nine rivets, positioned in the central part of the deep drawing.
11. In cases where the working pressure is elevated, a second row of nine holes, parallel to the deep drawing's base can be foreseen.


11


11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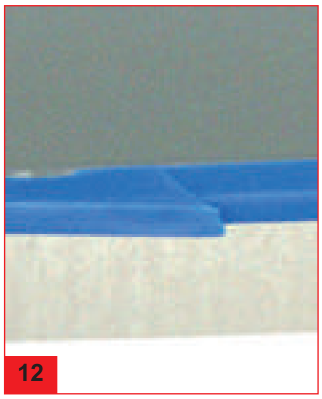

12

12. The gasket (which has to be installed only on one edge for each duct module) has to be wedged in on the duct's edge, being careful NOT to start in correspondence with the deep drawing.
13. The gasket is then cut at a 45° angle leaving an overlap in order to hav a better hold when it is going to be compressed by the collar.

ASSEMBLING

ASSEMBLING SEQUENCE

14. In order to tighten and to facilitate the manipulation of every single duct on the yard, we give an extra collar that has to be positioned a few centimetres away from the lower part of the duct, but NOT on the edge.

15. This collar is not used to join two duct modules, but just as a reinforcement for the handling in the yard and can be removed at the end of the assembly.

16. The second collar is then mounted in correspondance of the gasketed edge.

17. This is the collar that will be used fto fix two duct modules together.

In an average time of 2-3 minutes of assembly, the duct is now ready to be mounted.

For the clamping there aren't any particular directions, it is therefore possible to follow any system that is normally used for spiraloid ducts.

N.B.

Should you have any doubt or need advice about the assembly, please call:

TECHNICAL ASSISTANCE

(+39) 0322 - 86 36 01

SINTRA

VARITRAP®'S ASSEMBLING

ASSEMBLING SEQUENCE


1


2

1. All the accessories necessary for the assemblying of the VARITRAP® (screwer excluded) will be delivered to the building site.

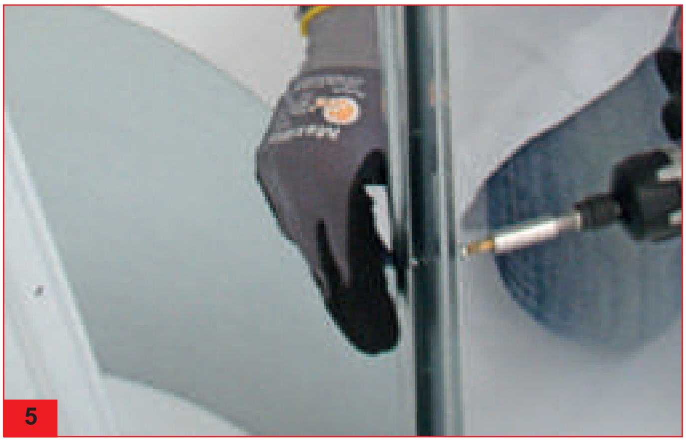
2. The duct module has two rectangular openings and, for each opening, two lines of holes ø 4,2 mm. The provided 5 self-threading screws must be inserted in the ø 4,2 mm holes, and will automatically be driven into the ø 3,3 mm holes placed on the supplied holding profiles.


3

3-4. Insert the screw into the first ø 4,2 hole on the external surface of the duct, and at the same time place the holding profile on the inside in the same position shown in the picture.


4

ASSEMBLING SEQUENCE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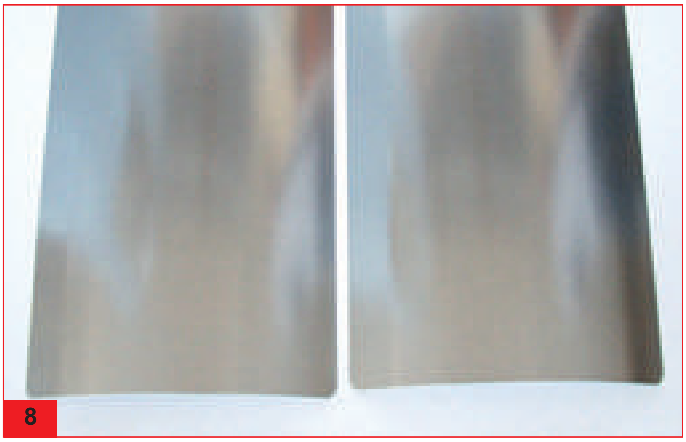
6


7

5-6-7. While holding the profile pressed closely to the internal surface of the duct's module, fix all the screws in, without tightening them too much.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9

8-9. Take the sliding door which must be insterted in the previously fixed holding profiles.

VARITRAP®'S ASSEMBLING

ASSEMBLING SEQUENCE


10


11


12

10-11-12. Slide in the door, carefully pushing evenly on both sides to make sure it slides in the correct way; avoiding to get stuck if it should rotate on one side. Proceed with the complete fixing of the screws.


13


14

13. Insert the clear palstic plug to close the hole on the sliding door.

14. The plastic plug will be removed solely for the VARITRAP®'s calibration, by instering a pivot and sligthly tapping it with a hammer. After this operation is done, the plastic plug will be inserted again.

In a medium time of 1/2 minutes of assemblying, the Pulser module is now assembled and ready to be installed.

N.B.

Should you have any doubt or need advice about the assembly, please call:

TECHNICAL ASSISTANCE

(+39) 0322 - 86 36 01

ADJUSTABLE TELESCOPIC PIECE

ASSEMBLING SEQUENCE

1-2. Close with the rivets both the piece with the 8mm folding at both endings, and the “male” piece, with the 8mm folding just on one side.

3. Mark the adjustable piece in the exact point where it will have to be cut to measure. (The “male” adjustable piece has to enter in the “female” piece for a length included between 100 mm and 250 mm).

4. Cut the male piece along the previously marked line.

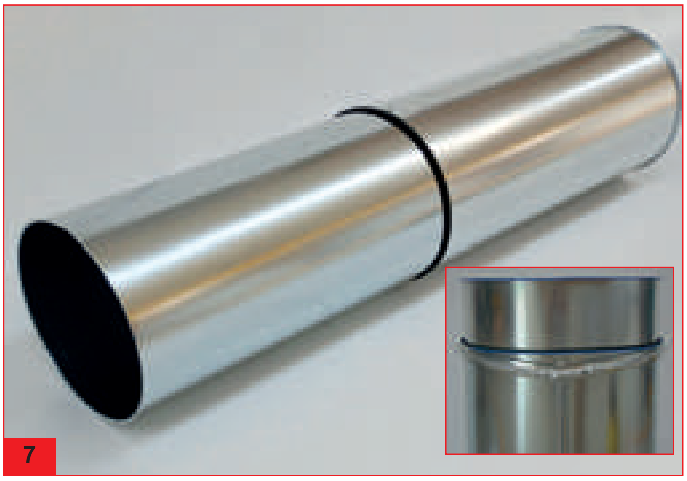
ADJUSTABLE TELESCOPIC PIECE

ASSEMBLING SEQUENCE

5

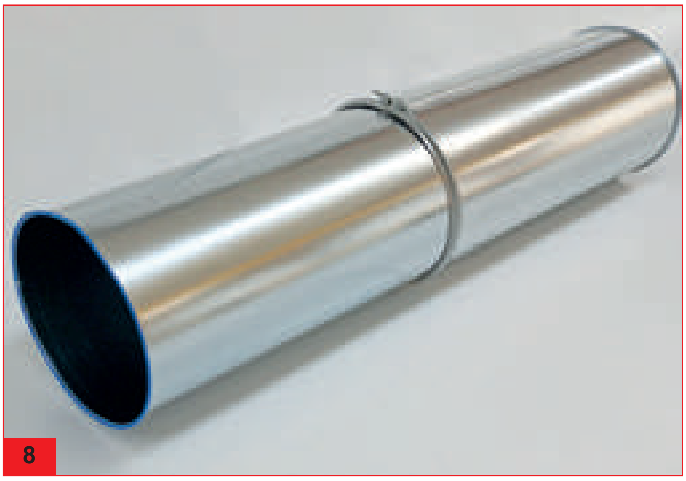
5. Fix the provided black gasket at the desired distance from the edge of the duct.

6



7

6-7. Insert the adjustable “male” piece inside the “female” piece until the black gasket is compressed between the two pieces.



8

8

8. Fix the omega collar by tightening the screw and bolt until it it blocked. The duct piece is ready to be installed.

FASTENING

FASTENING EXAMPLES

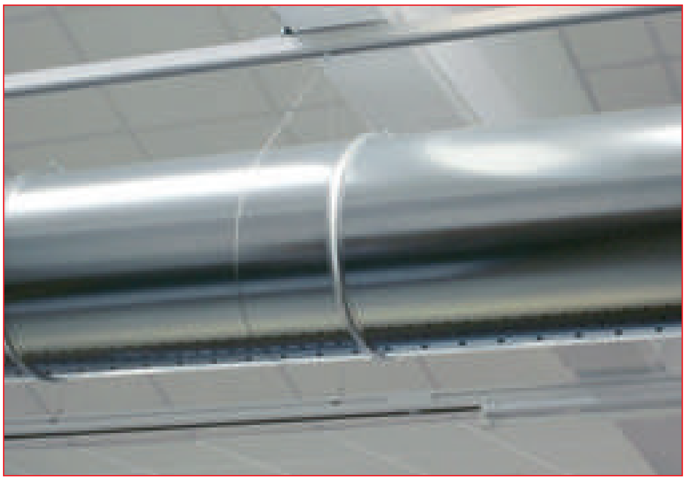
For the fastening, SINTRA suggests the use of systems which wrap the duct without blocking it.

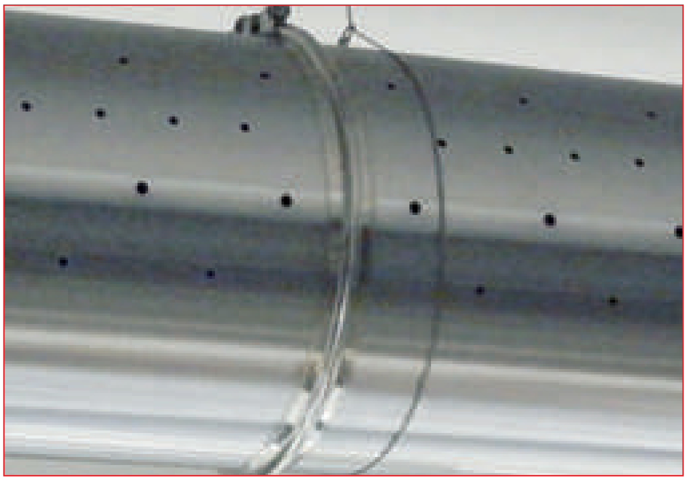
SINTRA advises against the fastening on the collar.

For the fixing of the SPIROPACK™ ducts, all the systems normally used to fix circular section ducts can be used, the only required condition is that the fixing will not obstruct any of the holes, and that it will not be welded or punched into the duct.

We advise against the suspension through the collar’s closing bolt for diameters over 400mm, since the effort which is necessary to hold the duct up would totally be upon the collar’s welding.

The best solution suggested by SINTRA is to use systems of the “GRIPPLE” kind, with a stainless steel cable which wraps the duct’s circumference.





SISTEMI INNOVATIVI DI TRATTAMENTO ARIA AMBIENTE

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