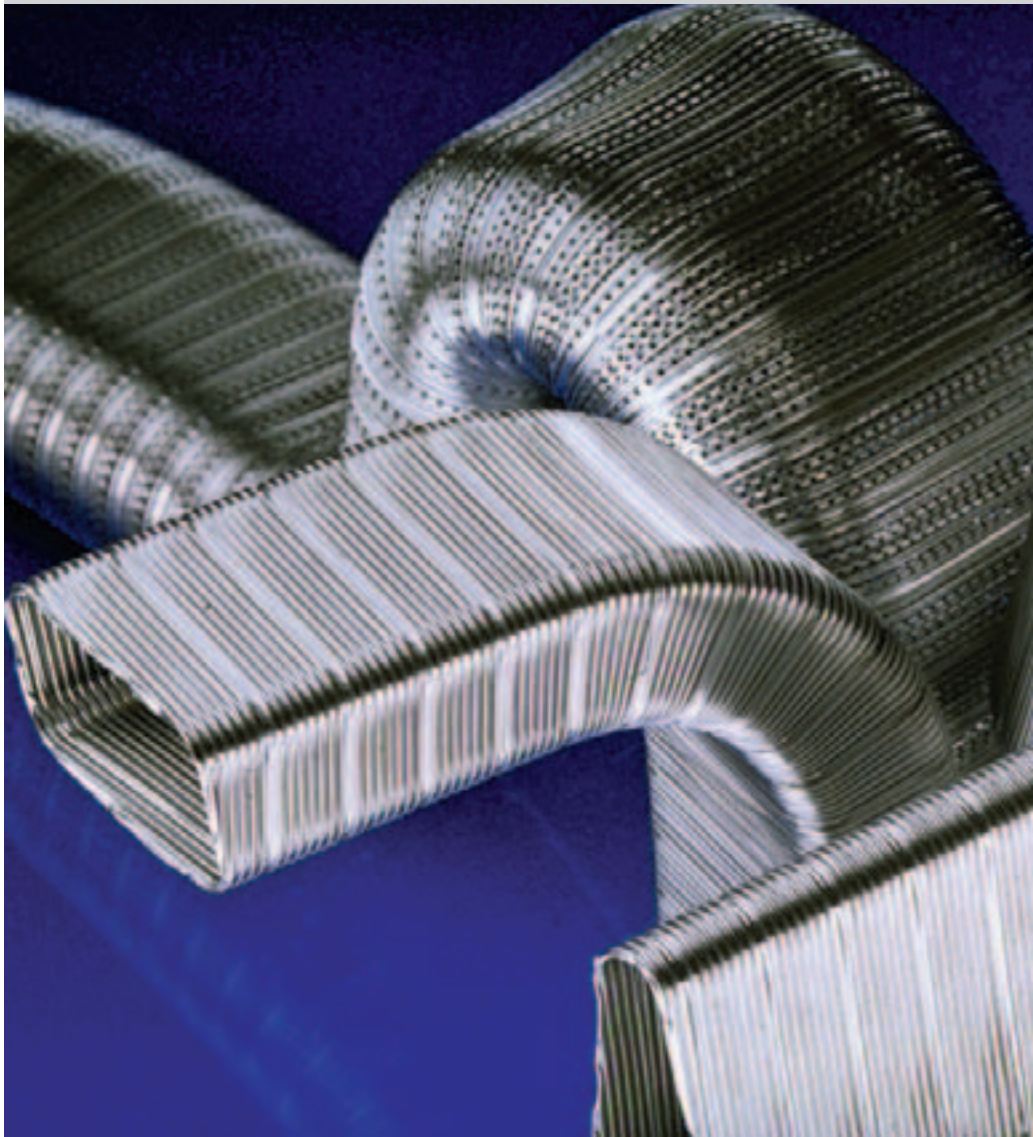
westaflex®

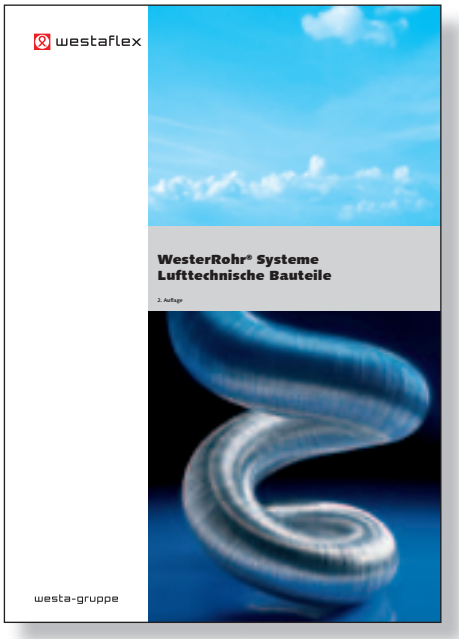
Westerquadro® Pipe Systems
Quadroflex – Quadrofix

flexible, rigid, multiangular, round, non-combustible

4. Edition



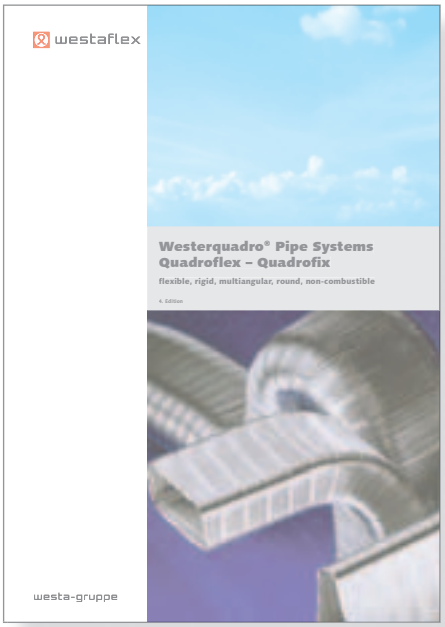
westa-gruppe



WesterRohr® systems
Ventilation components

Round, flexible pipes, mufflers
and insulated pipes.

Only in German available.



Westerquadro® Pipe Systems
Quadroflex - Quadrofix

Multi-angular pipes in a flexible and rigid design.
Metal stamping, attachment and acoustic components.

Acoustic weather guards

for the installation in facades of climatized and ventilated buildings. *(Only in German available as pdf file)*

Air-permeable noise barriers

for containing the sound emissions of noise sources on and outside of buildings.
(Only in German available as pdf file)

Acoustic overflow elements

for the exhaust air discharge - **integrated** in the wall and wall elements with high attenuation properties.

Only in German available.

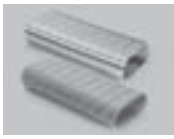
Westerquadro® Pipe Systems

WesterRohr® systems

Railway vehicle construction

Additional current information
can be obtained from the internet at:
www.westaflex.com
"Railway vehicle" term

Westaflex








1.1 Quadroflex®

Flexible, multiangular, flat pipes

Product description

Flexible, multiangular, flat pipes for the air and climate technology are produced from various materials and forms depending on the application.

Quadroflex® pipes can be bent all-around.

The ends of all sections can be formed to the connection diameter$_a$ (*see tables on pages 7 to 10*).

Transition or connecting pieces are possible for all profile forms.

Quadroflex® pipes form 3 can be turned by 90°.

Caution!

Turn clockwise.

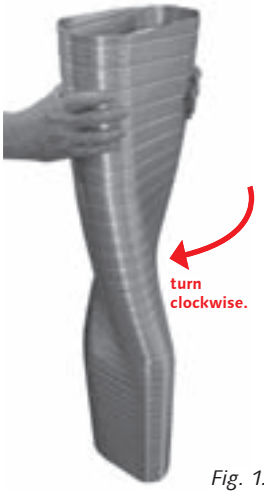


Fig. 1.1

The installation heights can be clearly reduced when compared to conventional air ducts when using the Quadroflex® pipe.

This therefore provides an optimal alternative for routing gaseous media in air conditioning systems, where round pipes cannot be used or can only be used with an increased effort due to their installation height.

The assembly does not require any additional tools. The pipe is cut to length with a conventional serrated knife.

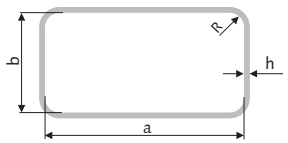
Technical data

Materials:	Non-combustible materials according to DIN 4102-A1, such as aluminium, galvanized steel strip, stainless steel or other metallic materials,
temperature resistance:	up to 200 °C (up to 500 °C depending on the material)
max. system pressure:	1,000 Pa
Standard lengths:	up to 3 m

Special lengths and dimensions: upon request

Cross-sectional forms

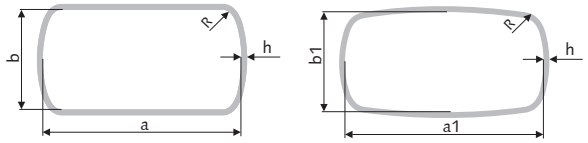
Form 1 : rectangular



Radius R: approx. 6-30 mm, depending on the dimensions
Nominal widths 80 x 40 to 370 x 240 mm
Bending radius R1* end-to-end approx. 1.5 × a
Bending radius R2* flat: approx. 2 × b
Profile depth h: approx. 3.5 mm

Fig. 1.2

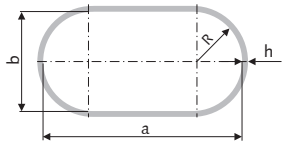
Form 2 : rectangular rounded



Radius R: approx. 10-20 mm, depending on the dimensions
Nominal widths 80 x 50 to 147 x 70 mm
Bending radius R1* end-to-end approx. 1.5 × a
Bending radius R2* flat: approx. 2 × b
Profile depth h: approx. 3.5 mm

Flg. 1.3

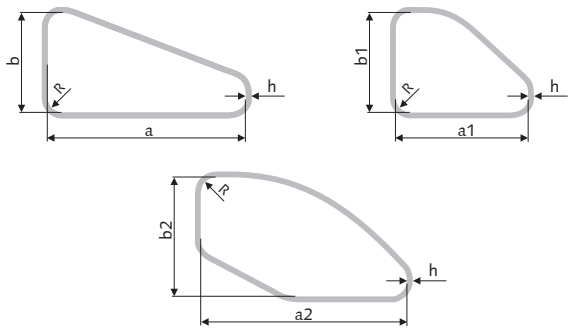
Form 3 : oval



Radius R: ½ × b
Nominal widths 60 x 30 to 390 x 185 mm
Bending radius R1* end-to-end approx. 1.5 × a
Bending radius R2* flat: approx. 2 × b
Profile depth h: approx. 3.5 mm

Fig. 1.4

Form 4 : Multiangular

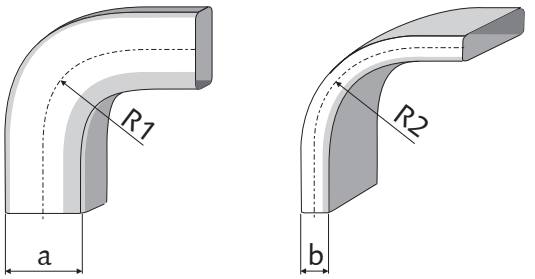


Radius R: approx. 15-30 mm, depending on the dimensions
Nominal widths 126 x 70 to 337 x 198 mm
Bending radius R1* end-to-end approx. 2 × a
Bending radius R2* flat: approx. 3 × b

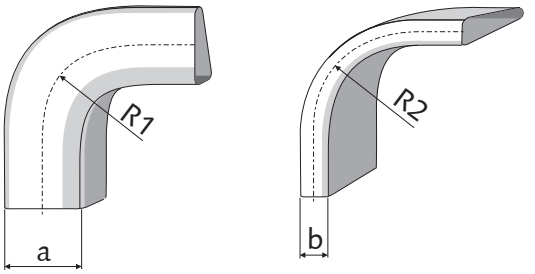
Fig. 1.5

* Wrinkle formation possible in the interior

Bending radius



Bending radii of form 1, 2 and 3 *Fig. 1.6*



Bending radii of form 4 *Fig. 1.7*

Tolerances

Length tolerances [mm]											
Length [mm]		up to 50	up to 100	up to 200	up to 300	up to 500	up to 800	up to 1000	up to 2000	up to 3000	up to 25000
Connection Ø d_a [mm]	up to 10	± 2	± 3	± 3	± 4	± 4	± 5	± 6	± 10	± 20	± 200
	up to 50	± 2	± 4	± 4	± 6	± 6	± 7	± 8	± 12	± 22	± 220
	up to 100	± 3	± 5	± 6	± 7	± 7	± 8	± 9	± 13	± 23	± 230
	up to 200	± 4	± 7	± 7	± 8	± 8	± 9	± 10	± 14	± 24	± 240
	up to 300	± 6	± 9	± 9	± 10	± 10	± 11	± 12	± 16	± 26	± 260
	up to 400	± 8	± 11	± 11	± 12	± 12	± 13	± 14	± 18	± 28	± 280
	up to 560	± 10	± 13	± 13	± 14	± 14	± 15	± 16	± 20	± 30	± 300

Table 1.0a

Connecting diameter tolerances [mm]	
Connection Ø d_a [mm]	Tolerance [mm]
up to 120	+ 1.0 / 0
up to 190	+ 2.0 / 0
> 190	+ 3.0 / 0
Width **a**	+ 2.0 / 0 Geometrical tolerance (**a** x b)
Height **b**	+ 2.0 / 0 Geometrical tolerance (a x **b**)

Table 1.0b

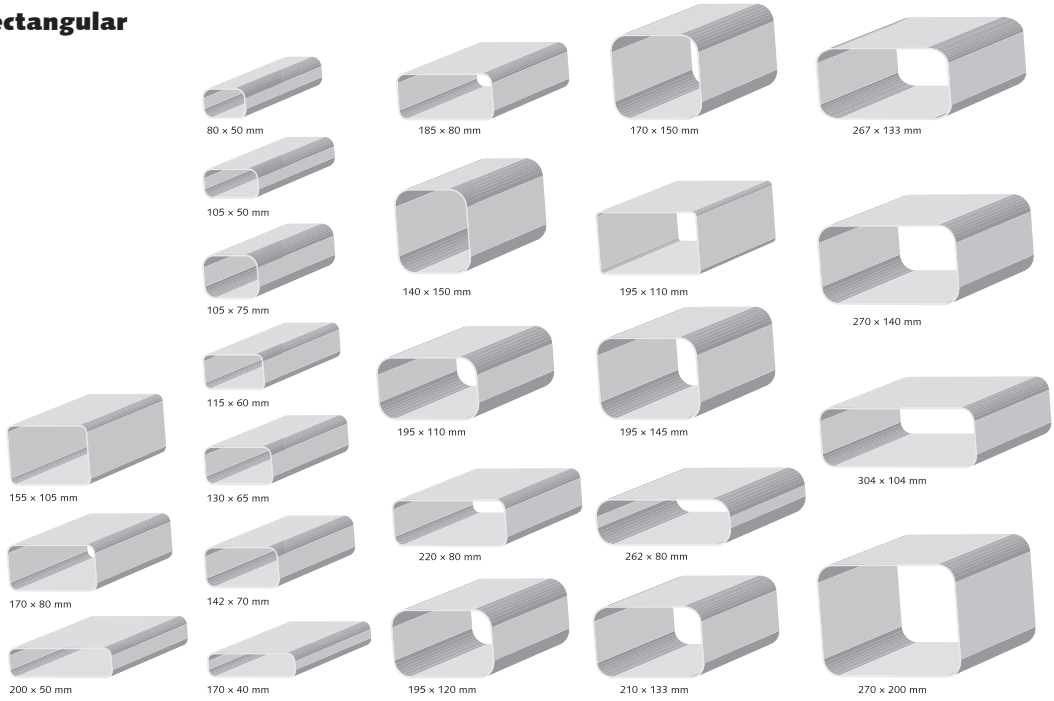
End processing

The pipe ends of all Quadroflex®-pipes can be formed to the respective round connecting diameters.

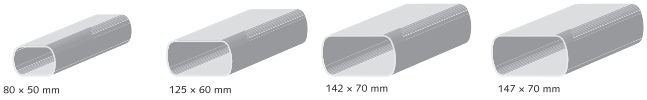
Fig 1.8

Technical modifications and errors excepted.

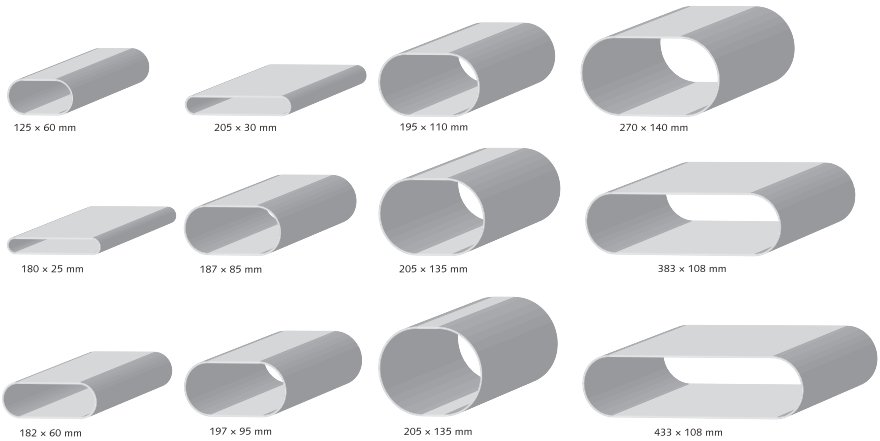
Form 1 : rectangular



Form 2 : rectangular rounded



Form 3 : oval



Form 4 : Multiangular

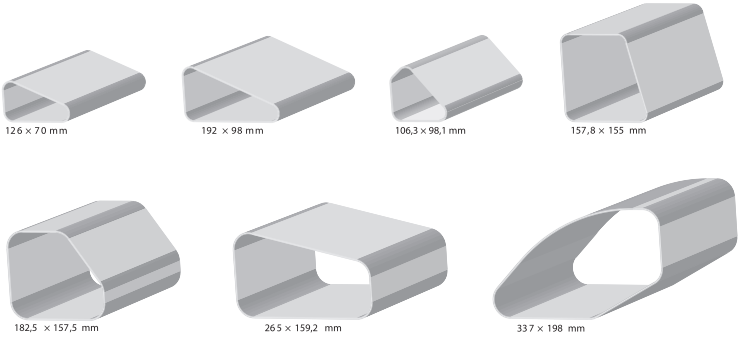
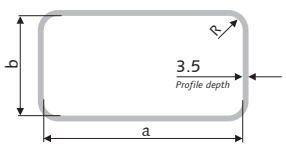
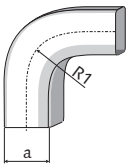
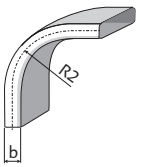
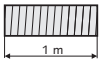


Fig. 1.9

Dimensions = internal dimensions

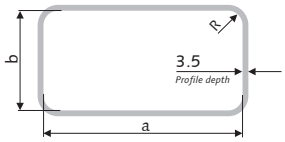
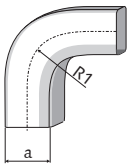
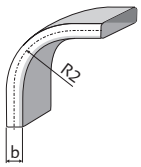
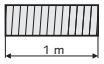
Technical modifications and errors excepted.

Cross-section form	Connection Ø	Nominal dimension		Nose radius	Friction coefficients ζ for bent Quadroflex pipes				Cross-section	Hydraulic Ø	Weight	Ratio* a : b
					Radius R1 (on end)		Radius R2 (flat)					
	d_a	a	b	R	45°	90°	45°	90°	A	d_h		
	mm	mm	mm	mm					mm²	mm	kg/m	
1	66	**80**	**40**	15	0.35	0.8	0.2	0.5	3,007	56	0.211	2 : 1
	73	**80**	**50**	15	0.35	0.8	0.2	0.5	3,807	65	0.229	2 : 1
	75	**90**	**40**	12	0.35	0.8	0.2	0.5	3,476	58	0.234	3 : 1
	77	**95**	**40**	15	0.35	0.8	0.2	0.5	3,607	59	0.239	3 : 1
	78	**100**	**40**	15	0.35	0.85	0.25	0.55	3,807	60	0.248	3 : 1
	82	**100**	**50**	15	0.35	0.85	0.25	0.55	4,807	70	0.267	2 : 1
	87	**83**	**63**	10	0.25	0.55	0.15	0.35	5,143	75	0.267	2 : 1
	89	**105**	**50**	15	0.35	0.85	0.25	0.55	5,057	71	0.276	3 : 1
	91	**80**	**80**	20	0.25	0.55	0.15	0.35	6,057	85	0.277	1 : 1
	91	**109**	**41**	6	0.35	0.85	0.25	0.55	4,438	61	0.281	3 : 1
	92	**100**	**60**	15	0.35	0.85	0.25	0.55	5,807	79	0.286	2 : 1
	93	**85**	**73**	15	0.25	0.55	0.15	0.35	6,012	83	0.282	2 : 1
	98	**100**	**65**	13	0.35	0.85	0.25	0.55	6,355	83	0.298	2 : 1
	101	**111**	**53.4**	6	0.3	0.7	0.2	0.45	5,896	74	0.308	3 : 1
	103	**105**	**75**	20	0.3	0.7	0.2	0.45	7,532	93	0.315	2 : 1
	105	**115**	**60**	10	0.35	0.85	0.2	0.55	6,814	82	0.322	2 : 1
	110	**125**	**60**	12	0.35	0.85	0.25	0.55	7,376	84	0.337	3 : 1
	114	**134**	**54**	10	0.35	0.85	0.25	0.55	7,150	80	0.346	3 : 1
	116	**130**	**65**	13	0.35	0.85	0.25	0.55	8,305	90	0.354	2 : 1
	116	**150**	**45**	15	0.35	0.85	0.25	0.55	6,557	72	0.351	**4 : 1**
	116	**100**	**100**	20	0.25	0.55	0.15	0.35	9,657	106	0.352	1 : 1
	119	**120**	**80**	15	0.35	0.85	0.25	0.55	9,407	101	0.360	2 : 1
	120	**142**	**59.5**	15	0.35	0.85	0.2	0.55	8,256	88	0.363	3 : 1
	125	**142**	**70**	15	0.35	0.85	0.25	0.55	9,747	98	0.383	3 : 1
	126	**170**	**40**	12	0.4	1	0.25	0.65	6,676	67	0.384	**5 : 1**
	130	**135**	**75**	6	0.35	0.85	0.25	0.55	10,094	99	0.394	2 : 1
	134	**143**	**93**	30	0.35	0.85	0.25	0.55	12,526	119	0.404	2 : 1
	138	**151**	**71**	6	0.35	0.85	0.25	0.55	10,690	99	0.416	3 : 1
	140	**160**	**80**	20	0.35	0.85	0.25	0.55	12,457	112	0.427	2 : 1
	140	**155**	**85**	20	0.35	0.85	0.25	0.55	12,832	115	0.427	2 : 1
	150	**205**	**40**	10	0.4	1	0.25	0.65	8,114	69	0.453	**6 : 1**
	151	**200**	**50**	12	0.4	1	0.25	0.65	9,876	82	0.459	**4 : 1**
	151	**170**	**80**	13	0.35	0.85	0.25	0.55	13,455	113	0.457	3 : 1
	156	**140**	**120**	15	0.25	0.55	0.15	0.35	16,607	134	0.473	2 : 1
	159	**155**	**105**	10	0.35	0.85	0.25	0.55	16,189	129	0.481	2 : 1
	159	**185**	**80**	15	0.35	0.9	0.25	0.6	14,607	116	0.482	3 : 1
	167	**150**	**140**	30	0.25	0.55	0.15	0.35	20,227	153	0.505	2 : 1
	168	**152**	**127**	15	0.25	0.55	0.15	0.35	19,111	144	0.508	2 : 1
	171	**148**	**138**	20	0.25	0.55	0.15	0.35	20,081	149	0.513	2 : 1
	174	**220**	**80**	30	0.4	0.9	0.25	0.55	16,827	123	0.524	3 : 1
	176	**195**	**110**	30	0.35	0.85	0.2	0.5	20,677	148	0.533	2 : 1
	179	**220**	**90**	30	0.4	0.9	0.25	0.55	19,027	134	0.542	3 : 1
	181	**220**	**80**	15	0.4	0.9	0.25	0.55	17,407	121	0.548	3 : 1
	183	**195**	**120**	30	0.35	0.8	0.2	0.5	22,627	156	0.552	2 : 1
	184	**158**	**146**	15	0.25	0.65	0.15	0.4	22,875	157	0.555	2 : 1
	184	**195**	**110**	15	0.35	0.85	0.2	0.5	21,257	146	0.557	2 : 1
	186	**180**	**140**	30	0.25	0.65	0.15	0.4	24,427	166	0.561	2 : 1
	186	**170**	**150**	30	0.25	0.65	0.15	0.4	24,727	168	0.561	2 : 1
	186	**220**	**85**	15	0.4	1	0.25	0.65	18,507	127	0.557	3 : 1
	187	**240**	**63**	10	0.4	1	0.25	0.65	15,034	102	0.561	**4 : 1**
	189	**195**	**110**	6	0.35	0.85	0.2	0.5	21,419	143	0.572	2 : 1
	190	**252**	**60**	15	0.4	1	0.25	0.65	14,927	100	0.570	**5 : 1**
	194	**180**	**150**	30	0.3	0.7	0.2	0.45	26,227	172	0.580	2 : 1
	196	**195**	**145**	30	0.3	0.7	0.2	0.45	27,502	175	0.599	2 : 1
	198	**230**	**100**	20	0.3	0.75	0.2	0.5	22,657	145	0.596	3 : 1
		**All dimensions are internal dimensions!** 							A			a : b

** Pressure loss calculation:* *Ratio a:b < 3:1 Preliminary selection of pressure loss - see page 11*
*Ratio **a:b > 3:1 (marked blue)** requires precise calculation - see pages 12-13*

Table 1.1a

Technical modifications and errors excepted.

Cross-section form	Connection Ø	Nominal dimension		Nose radius	Friction coefficients ζ for bent Quadroflex pipes				Cross-section	Hydraulic Ø	Weight	Ratio* a : b
					Radius R1 (on end)		Radius R2 (flat)					
	d_a	a	b	R	45°	90°	45°	90°	A	d_h		
	mm	mm	mm	mm					mm²	mm	kg/m	
1	199	**262**	**80**	30	0.4	1	0.25	0.65	20,187	128	0.602	**4 : 1**
	200	**210**	**133**	30	0.3	0.75	0.2	0.5	27,157	171	0.604	2 : 1
	205	**200**	**150**	30	0.3	0.75	0.2	0.5	29,227	180	0.617	2 : 1
	212	**210**	**150**	30	0.3	0.75	0.2	0.5	30,727	184	0.636	2 : 1
	213	**252**	**95**	15	0.4	1	0.25	0.65	23,747	142	0.636	3 : 1
	213	**220**	**140**	30	0.3	0.75	0.2	0.5	30,027	180	0.636	2 : 1
	218	**190**	**180**	30	0.35	0.85	0.2	0.55	33,427	194	0.655	2 : 1
	219	**230**	**140**	30	0.3	0.75	0.2	0.5	31,427	183	0.655	2 : 1
	220	**285**	**68**	10	0.4	1	0.25	0.65	19,294	112	0.655	**5 : 1**
	228	**185**	**140**	30	0.3	0.7	0.2	0.45	25,127	168	0.570	2 : 1
	228	**274**	**110**	30	0.4	0.9	0.25	0.55	29,367	164	0.681	3 : 1
	232	**266**	**126**	30	0.4	0.9	0.25	0.55	32,743	179	0.696	3 : 1
	234	**260**	**120**	12	0.4	0.9	0.25	0.55	31,076	168	0.702	3 : 1
	237	**267**	**133**	30	0.35	0.85	0.2	0.5	34,738	186	0.711	3 : 1
	242	**270**	**140**	30	0.35	0.85	0.2	0.55	37,027	193	0.730	2 : 1
	246	**304**	**104**	22	0.4	1	0.2	0.6	31,201	160	0.739	3 : 1
	251	**260**	**160**	30	0.35	0.8	0.2	0.5	40,827	207	0.748	2 : 1
	260	**270**	**170**	30	0.35	0.8	0.2	0.5	45,127	218	0.786	2 : 1
	268	**270**	**180**	30	0.3	0.75	0.2	0.5	47,827	225	0.805	2 : 1
	281	**270**	**200**	30	0.3	0.75	0.2	0.5	53,227	240	0.842	2 : 1
	289	**290**	**190**	30	0.35	0.8	0.2	0.5	54,327	239	0.861	2 : 1
	307	**270**	**240**	30	0.3	0.75	0.2	0.5	64,027	264	0.917	2 : 1
	346	**358**	**211**	30	0.3	0.75	0.2	0.5	74,765	275	1,027	2 : 1
	372	**370**	**240**	30	0.3	0.75	0.2	0.5	88,027	301	1,104	2 : 1
		**All dimensions are internal dimensions!** 							A			**a : b**

** Pressure loss calculation:* *Ratio a:b < 3:1 Preliminary selection of pressure loss - see page 11*
*Ratio **a:b > 3:1 (marked blue)** requires precise calculation - see pages 12-13*

Table 1.1b

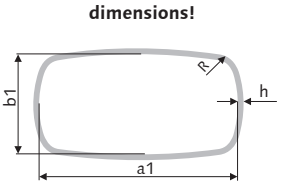
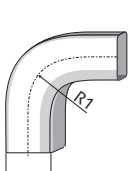
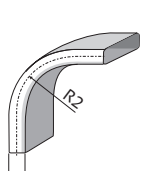
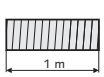
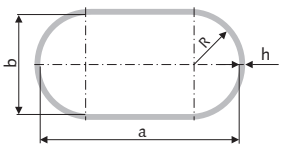
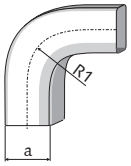
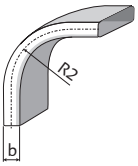
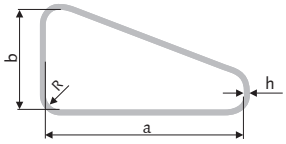
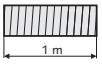
Cross-section form	Connection Ø	Nominal dimension		Nose radius	Friction coefficients ζ for bent Quadroflex pipes				Cross-section	Hydraulic Ø	Weight	Ratio* a : b
					Radius R1 (on end)		Radius R2 (flat)					
	d_a	a	b	R	45°	90°	45°	90°	A	d_h		
	mm	mm	mm	mm					mm²	mm	kg/m	
2	71	**80**	**50**	13	0.35	0.8	0.2	0.5	3,855	65	0.233	2 : 1
	106	**105**	**75**	15	0.35	0.82	0.25	0.55	7,370	88	0.323	2 : 1
	106	**125**	**60**	12	0.35	0.85	0.25	0.55	7,376	84	0.336	3 : 1
	121	**142**	**70**	15	0.35	0.85	0.2	0.55	9,455	95	0.383	3 : 1
	125	**147**	**70**	15	0.35	0.85	0.25	0.55	9,817	96	0.392	3 : 1
		**All dimensions are internal dimensions!** 							A			**a : b**

Table 1.2

Cross-section form	Connection Ø	Nominal dimension		Nose radius	Friction coefficients ζ for bent Quadroflex pipes				Cross-section	Hydraulic Ø	Weight	Ratio* a : b
					Radius R1 (on end)		Radius R2 (flat)					
	d_a	a	b	R	45°	90°	45°	90°	A	d_h		
	mm	mm	mm	mm					mm²	mm	kg/m	
3	49	**60**	**30**	15	0.35	0.8	0.2	0.5	1,607	42	0.154	2 : 1
	53	**74,5**	**16.5**	8.25	0.4	1	0.25	0.65	1,171	28	0.167	**5 : 1**
	60	**80**	**25**	12.5	0.35	0.85	0.25	0.55	1,866	40	0.187	**4 : 1**
	66	**80**	**40**	20	0.35	0.8	0.2	0.5	2,857	56	0.203	2 : 1
	70	**93**	**30**	15	0.35	0.85	0.25	0.55	2,597	47	0.216	**4 : 1**
	73	**100**	**30**	15	0.35	0.85	0.25	0.55	2,807	48	0.229	**4 : 1**
	76	**100**	**35**	17.5	0.35	0.85	0.25	0.55	3,237	54	0.235	3 : 1
	78	**100**	**40**	20	0.35	0.85	0.25	0.55	3,657	60	0.240	3 : 1
	82	**100**	**50**	25	0.35	0.85	0.25	0.55	4,463	69	0.251	2 : 1
	87	**125**	**25**	12.5	0.4	1	0.25	0.65	2,991	43	0.271	**5 : 1**
	94	**105**	**75**	37.5	0.35	0.85	0.25	0.55	6,668	90	0.287	2 : 1
	100	**125**	**60**	30	0.35	0.9	0.25	0.55	6,727	84	0.308	3 : 1
	100	**129**	**52**	26	0.35	0.9	0.25	0.55	6,128	77	0.307	3 : 1
	101	**133**	**46**	23	0.35	0.9	0.25	0.55	5,664	71	0.308	3 : 1
	106	**130**	**65**	32.5	0.35	0.9	0.25	0.55	7,543	90	0.323	2 : 1
	122	**180**	**25**	12.5	0.45	1.15	0.25	0.65	4,366	45	0.374	**8 : 1**
	123	**150**	**80**	40	0.35	0.85	0.25	0.55	10,627	109	0.376	2 : 1
	125	**158**	**70**	35	0.35	0.85	0.25	0.55	10,008	101	0.381	3 : 1
	136	**182**	**60**	30	0.4	1	0.25	0.65	10,147	94	0.415	**4 : 1**
	140	**205**	**30**	15	0.45	1.15	0.3	0.75	5,957	54	0.426	**7 : 1**
	141	**200**	**35**	17.5	0.45	1.15	0.3	0.75	6,737	61	0.422	**6 : 1**
	145	**200**	**50**	25	0.35	0.9	0.25	0.55	9,463	83	0.438	**4 : 1**
	149	**187**	**85**	42.5	0.35	0.9	0.25	0.55	14,345	122	0.451	3 : 1
	150	**192**	**80**	40	0.35	0.9	0.25	0.55	13,987	118	0.455	3 : 1
	151	**208**	**52**	26	0.45	1.15	0.3	0.75	10,236	86	0.455	**4 : 1**
	155	**200**	**80**	40	0.35	0.85	0.25	0.55	14,627	119	0.470	3 : 1
	158	**197**	**95**	47.5	0.35	0.85	0.25	0.55	16,778	134	0.480	3 : 1
	162	**195**	**110**	55	0.35	0.85	0.2	0.55	18,853	146	0.493	2 : 1
	162	**200**	**100**	50	0.35	0.85	0.2	0.55	17,854	139	0.491	2 : 1
	167	**225**	**65**	32.5	0.35	0.85	0.25	0.55	13,718	105	0.501	**4 : 1**
	178	**205**	**135**	67.5	0.3	0.75	0.2	0.5	23,764	169	0.538	2 : 1
	183	**200**	**157**	78	0.3	0.75	0.2	0.5	26,177	181	0.552	2 : 1
	184	**260**	**50**	25	0.4	1	0.25	0.65	12,463	86	0.550	**6 : 1**
	191	**220**	**140**	70	0.35	0.85	0.2	0.55	26,594	177	0.572	2 : 1
	192	**240**	**110**	55	0.35	0.85	0.2	0.55	23,803	157	0.577	3 : 1
	200	**271**	**80**	40	0.35	0.85	0.25	0.55	20,307	128	0.603	**4 : 1**
	205	**240**	**145**	72.5	0.35	0.85	0.2	0.55	30,288	188	0.614	2 : 1
	207	**285**	**70**	35	0.4	1	0.25	0.65	18,898	116	0.619	**5 : 1**
	215	**300**	**65**	32.5	0.4	1	0.25	0.65	18,593	110	0.641	**5 : 1**
	221	**270**	**140**	70	0.35	0.85	0.2	0.55	33,594	192	0.665	2 : 1
	231	**304**	**104**	52	0.35	0.85	0.25	0.55	29,295	161	0.690	3 : 1
	233	**320**	**80**	40	0.35	0.85	0.25	0.55	24,227	133	0.695	**4 : 1**
	250	**350**	**80**	40	0.4	1	0.25	0.65	26,627	135	0.751	**5 : 1**
	271	**340**	**150**	75	0.3	0.75	0.2	0.5	46,171	217	0.807	3 : 1
	281	**383**	**108**	54	0.35	0.85	0.25	0.55	38,861	175	0.843	**4 : 1**
	313	**433**	**108**	54	0.4	1	0.25	0.6	44,261	179	0.936	**5 : 1**
	314	**390**	**185**	92.5	0.3	0.75	0.2	0.5	64,805	262	0.938	3 : 1
		**All dimensions are internal dimensions!** 							A			**a : b**

* *Pressure loss calculation:* *Ratio a:b < 3:1 Preliminary selection of pressure loss - see page 11*
*Ratio **a:b > 3:1 (marked blue)** requires precise calculation - see pages 12-13*

Table 1.3

Cross-section form	Connection Ø d_a	Nominal dimension a	Nominal dimension b	Nose radius R	Cross-section A	Hydraulic Ø d_h	Weight
	mm	mm	mm	mm	mm²	mm	kg/m
4	105	**126**	**70**	15	6,227	68	0.353
	106	**105**	**75**	15	5,506	66	0.323
	107	**106.3**	**98.1**	15	7,386	88	0.374
	157	**192**	**98**	20	13,118	96	0.521
	181	**157.8**	**155**	15	21,848	146	0.572
	187	**182.5**	**157.5**	30	24,647	157	0.599
	200	**182.5**	**162.5**	30	25,720	161	0.608
	234	**265**	**152**	30	33,286	170	0.743
	278	**337**	**198**	30	46.605	183	0.964
		**All dimensions are internal dimensions!** 					

Preliminary selection for pressure losses page 11 does NOT apply for cross-section form 4

Table 1.4

Technical modifications and errors excepted.

straight Quadroflex pipes, ratio a:b = max. 3:1

The friction loss is calculated by the hydraulic diameter. The following is required for the ventilation calculation:

- ⇨ the air flow velocity in the profile cross-section
- ⇨ the pressure loss in bent Quadroflex® pipes - see page 13, example 2

Example

Wanted:	**Air flow velocity (m/s)** and **friction loss R (Pa/m)**	
Given:	Cross-section form 1	
Tab 1.1a page 7 ⇨	Nominal dimension **a × b**:	170 x 80 mm
Tab 1.1a page 7 ⇨	Cross-section **A**:	13,455 mm²
		0.013455 m²
	Air volume flow :	108 m³/h
Tab 1.1a page 7 ⇨	Hydraulic **Ø d_h** :	113 mm

$$w = \frac{\dot{V}}{A} = \frac{108\ m^3/h}{0.013455\ m^2 \times 3600} = \mathbf{2.23\ m/s}$$

*Diagram 1: From the hydraulic **Ø d_h** and the air flow velocity **w** results friction loss **R = 1.05 Pa/m***

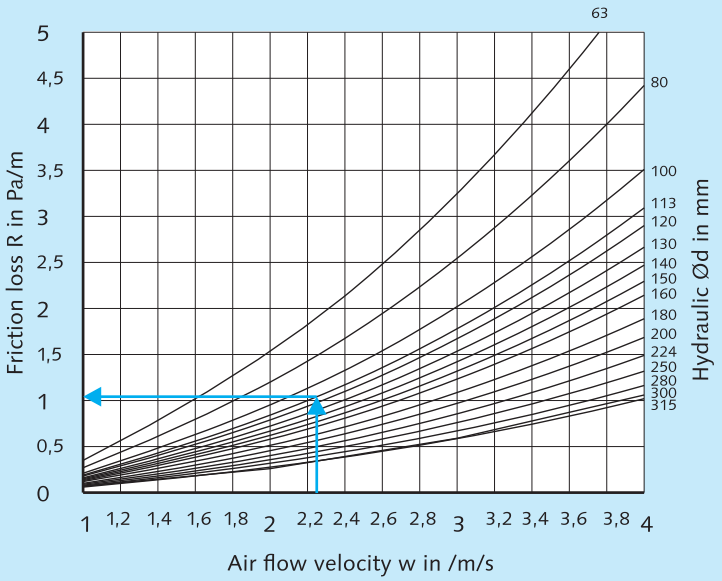


Fig. 1.10

Preliminary selection

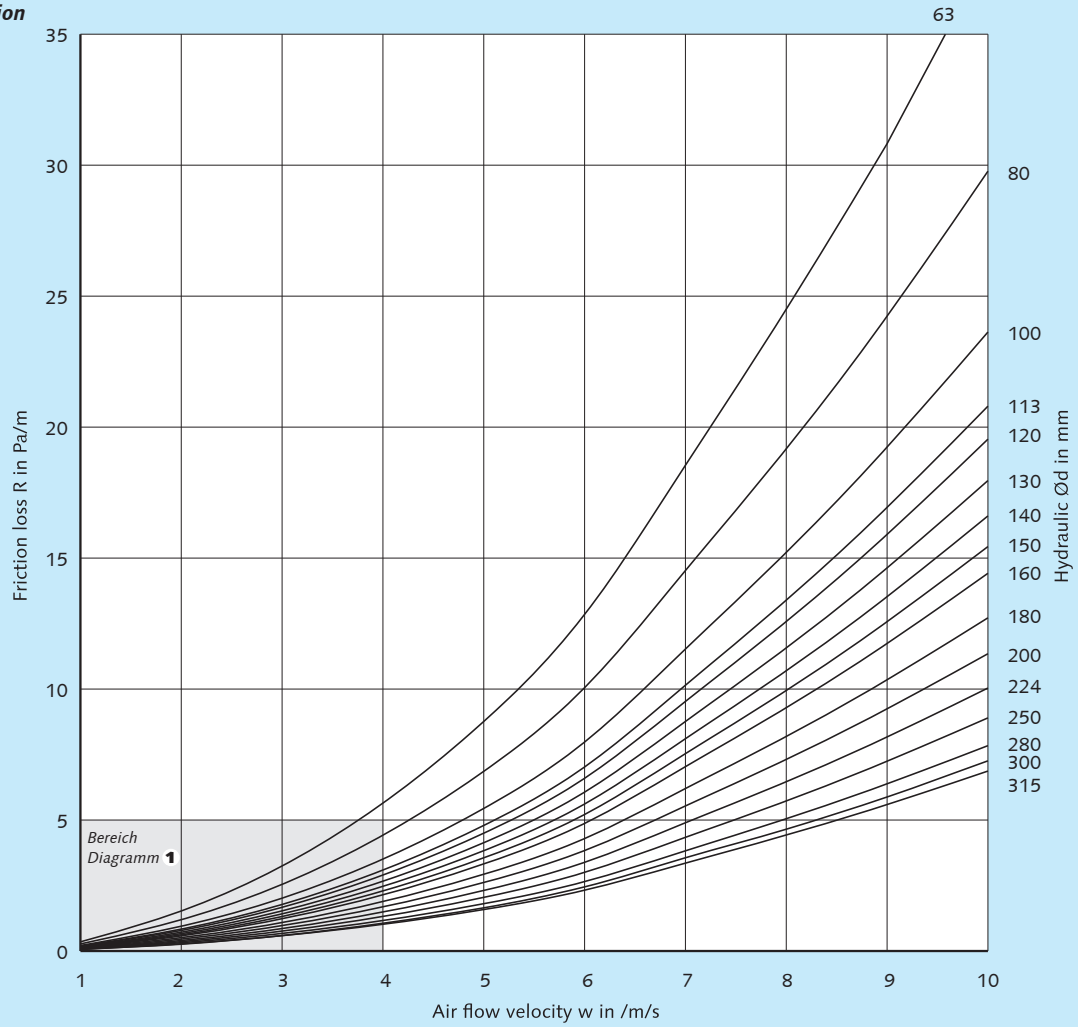


Fig. 1.11

Calculation of the pressure losses for straight, flexible Quadroflex® pipes form 1 and 3

General data

ν	=	15×10^{-6}	m^2/s	*Kinematic viscosity*
ϱ	=	1.2	kg/m^3	*Air density (20 °C)*
T	=	4.1	mm	*Standard values Pipe geometries*
t	=	3.2	mm	
u	=	1.9	mm	
K_3	=	50		*correction value*

Catalogue details *(pages7 to 9 – Table 1.1a/b and 1.3)*

Nominal dimension **a**	=	mm
Nominal dimension **b**	=	mm
Nose radius **R**	=	mm
Cross-section **A**	=	mm^2
	=	m^2
Hydraulic **Ød$_h$**	=	mm

The hydraulic diameter is a comparison diameter. It is equivalent to the diameter of a round duct in the duct calculation of a polygonal duct.

Calculation process

1. Calculation of the correction value **K_1**
2. Calculating the hydraulic **Ø d_h**
3. Calculating the pipe-friction coefficient λ
4. Calculation of the air flow velocity **w** (in reference to cross-section A)
5. Calculation of the pressure loss **Δp**

Calculation

1 Calculation of the correction value K_1

Correction value K_1 includes the geometric ratio of nominal dimensions **a** and **b**

$$K_1 = 0.0255 \left(\frac{a}{b}\right)^2 - 0.1393 \left(\frac{a}{b}\right) + 1.1485$$

2 Calculating the hydraulic Ø d_h

The details of the hydraulic Ø d_h, nominal dimensions a and b as well as nose radius R may be found on *pages 7 to 9 – Tab. 1.1a/b and 1.3*.

For **FORM 1**

$$d_h = \frac{2[(a-2R)\,b + 2(b-2R)\,R + R^2\,\pi]}{(a-2R) + R\,\pi + (b-2R)} \quad (mm)$$

For **FORM 3**

$$d_h = \frac{4\left[(a-b)\,b + b^2\,\frac{\pi}{4}\right]}{2\,(a-b) + b\,\pi} \quad (mm)$$

3 Calculating the pipe-friction coefficient λ

$$\lambda = K_1 \frac{0{,}25}{[\log(K_3\sqrt{0{,}674\,d_h})]^2}$$

4 Calculation of the air flow velocity w

Calculation with:

- **$\dot{V}$** Volumetric flow rate in m^3/h
- **A** Cross-section in m^2 *(pages 7 to 9 – Tab. 1.1a/b and 1.3)*

$$w = \frac{\dot{V}}{A \times 3600} \quad (m/s)$$

5 Calculation of the pressure loss Δp

Calculation with:

- λ Result 3
- **L** Assumption, i.e. 1,000 mm
- **d_h** Result 2 *or pages 7 to 9 – Tab. 1.1a/b and 1.3*
- ϱ 1.2 kg/m^3 *(air density at 20 °C)*
- **w** Result 4

$$\Delta p = \frac{\lambda\,L\,\varrho\,w^2}{d_h\,2} \quad (Pa)$$

Example 1

Pressure loss calculation of a **straight, flexible Quadroflex®** pipe form 3 - 125 x 25 mm.

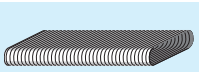


Fig. 1.12

Given:

Nominal dimension **a**	=	125	mm
Nominal dimension **b**	=	25	mm
Nose radius **R**	=	12.5	mm
Cross-section **A**	=	2,991	mm²
	=	0.002991	m²
hydraulic Ø	=	43	mm
Volumetric flow rate $\dot{V}$	=	108	m³/h
Pipe length **L**	=	1,000	mm

❶ **Calculation of the correction value K_1**

$$K_1 = 0.0255 \left(\frac{125}{25}\right)^2 - 0.1393 \left(\frac{125}{25}\right) + 1.1485$$

$$K_1 = 1.09$$

❷ **Calculating the hydraulic Ø d_h**

d_h = 43 mm *(See table 1.3 on page 9 for value)*

❸ **Calculating the pipe-friction coefficient λ**

$$\lambda = 1.09 \frac{0{,}25}{[\log(50\sqrt{0.674 \times 43})]^2}$$

$$\lambda = 0.046$$

❹ **Calculation of the air flow velocity w**

$$w = \frac{108}{0.002991 \times 3600}$$

w = 10 m/s

❺ **Calculation of the pressure loss Δp**

$$\Delta p = \frac{0{,}046 \times 1000 \times 1{,}2 \times 10^2}{43 \times 2}$$

Δp = 64.2 Pa

Example 2

Pressure loss calculation from a **90° - bent over the flat side - Quadroflex®** pipe form 1 - 170 x 80 mm.

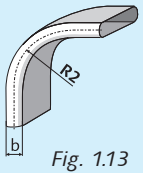


Fig. 1.13

Air flow velocity w in reference to cross-section A!

Given:

Nominal dimension **a**	=	170	mm
Nominal dimension **b**	=	80	mm
Air density	=	1.2	kg/m³
Friction coefficient ζ			
90° bow *(radius flat)*	=	0,55	
Volumetric flow rate $\dot{V}$	=	108	m³/h
Cross-section **A**	=	13,455	mm²
	=	0.013455	m²

$$w = \frac{\dot{V}}{A} = \frac{108\ m^3/h}{0.013455\ m^2 \times 3600\ s/h}$$

w = 2.23 m/s

$$\Delta p = w^2 \times \frac{\varrho}{2} \times \zeta$$

$$\Delta p = (2.23\ m/s)^2 \times \frac{1.2\ kg/m^3}{2} \times 0.55$$

Δp = 1.64 Pa

Technical modifications and errors excepted.

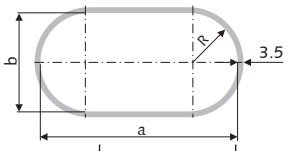
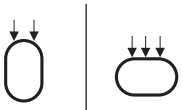
Connection Ø				Form	Material	Peak compressive strength		Excess and negative pressure	max. leakage loss* at 400 Pa
									
	a	b	R			a	b		
mm	mm	mm	mm			N/100mm		Pa	l/(h×m²)
100	129	52	26	3	Al	428	435	3150	540
100	129	52	26	3	St	1100	1050	3150	540
100	129	52	26	3	St	1340	1350	3150	540
151	208	52	26	3	Al	434	444	3150	540
151	208	52	26	3	St	818	779	3150	540
151	208	52	26	3	St	997	1090	3150	540
125	142	70	15	1	Al	549	623	3150	540

Tabelle 1.5 * DIN 24194-2 class IV*

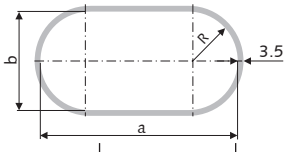
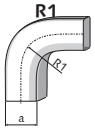
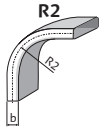
Connection Ø				Form	Material	min. bending radius R1	Ratio	min. bending radius R2	Ratio	Bending cycles over R=1.5xa R=1.5xb
										
	a	b	R							
mm	mm	mm	mm			mm	R/a	mm	R/b	180°
100	129	52	26	3	Al	110	0.9	60	1.2	min. 7
100	129	52	26	3	St	110	0.9	60	1.2	min. 7
100	129	52	26	3	St	110	0.9	60	1.2	min. 7
151	208	52	26	3	Al	180	0.9	60	1.2	min. 7
151	208	52	26	3	St	180	0.9	60	1.2	min. 7
151	208	52	26	3	St	180	0.9	60	1.2	min. 7
125	142	70	15	1	Al	130	0.9	80	1.1	min. 7

Table 1.6 *Technical data for additional dimension upon request.*

Longitudinal attenuation

Table 1.7

Description	Material	Item No.	Longitudinal attenuation D in dB/m Qktave band centre frequency in Hz							
			63	125	250	500	1000	2000	4000	8000
Quadroflex®	Aluminium	**100QUADRO3W**	0.9	0.9	0.7	0.8	0.9	0.9	1.0	1.2
Quadroflex®	galvanized	**100QUADRO3WV**	0.6	0.7	0.6	0.8	0.8	0.7	0.7	0.8

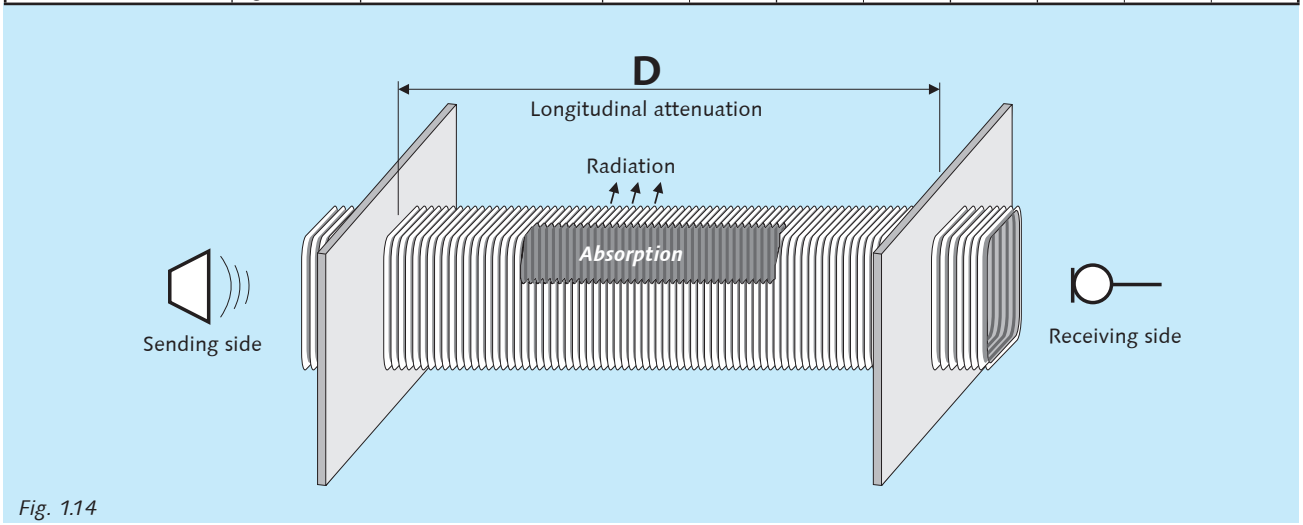


Fig. 1.14

Technical modifications and errors excepted.

Quadroflex pipes with tested cleanability!

biotec

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06648 Mötzelda · Telefon/Fax: (0 37 27) 97 63 11

Umwelt - Analytik - Beratung - Service GmbH

Zertifikat
zur Reinigungsfähigkeit

Hiermit bestätigen wir dem Unternehmen

Westaflexwerk GmbH
Thaddäusstraße 5, 3334 Gütersloh

die sehr gute Reinigungsfähigkeit der flexiblen, metallischen Rohre mit der Produktbezeichnung

Quadroflex.

Die Lüftungsleitungen wurden vom Labor biotec-GmbH mit Prüfstaub beaufschlagt und danach einer Reinigung unterzogen. Das Reinigungsverfahren entsprach hierbei den Praxisbedingungen von verbauten Lüftungsleitungen.

Die Staubbelastungen wurden nach der Reinigung

zu über 90%

aus den Untersuchungsobjekten entfernt.

Der Testbericht wird auf Anforderung zur Verfügung gestellt.

Gütersloh, 26. März 2006

Dr. rer. nat. Andreas Bernpohl

Biotec- GmbH (VDI-Institut)

HRB-Nr.: 3829 Amtsgericht Gütersloh

Fig. 1.15

Vibration and shock test for Quadroflex pipes!

Test procedure / principles

Vibration test, static:

Basic standard: DIN EN 60068-2-64
Test standard: DIN EN 61373,
Category 1, class A
(simulated service life test)

Shock test:

Basic standard: DIN EN 60068-2-27
Test standard: DIN EN 61373,
Category 1, class A

Tested by AKUVIB Engineering and Testing GmbH – Bochum. The complete test report No.: 2005-0166-V (pdf-file) may be downloaded free of charge at ***www.westaflex.com****.*

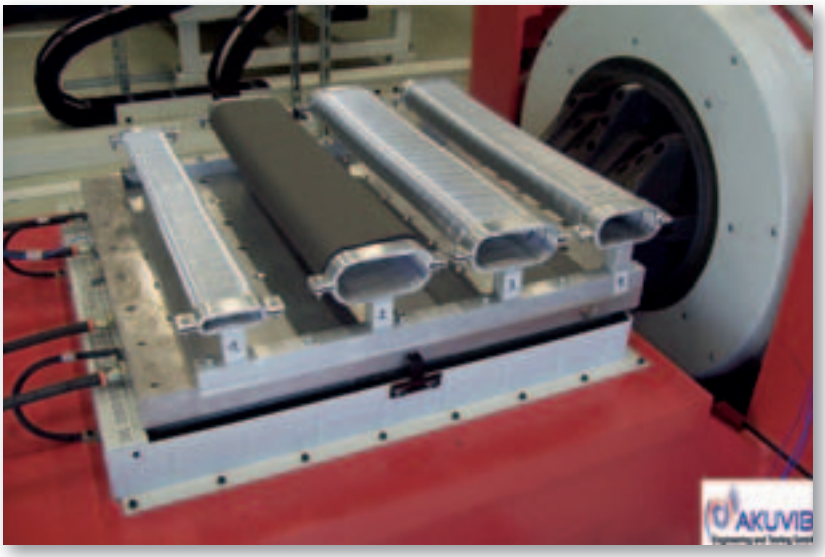
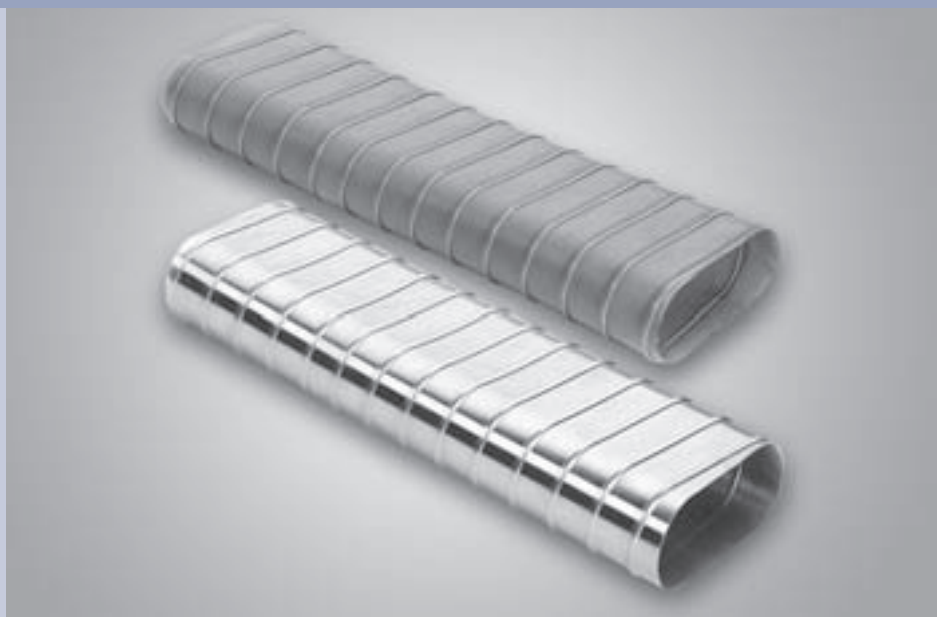


FIg. 1.16

Technical modifications and errors excepted.

2. Quadrofix®



Rigid pipes with a smooth interior

Product description

Quadrofix® ⇨ Smooth interior,
⇨ non-combustible
according to DIN 4102, A1

Multiangular pipes are indispensable for ventilation technology, if only a restricted building space is available.

The lowest pressure losses of the pipe system are important for long routing lines.

Westaflex has developed an additional product version of the multiangular pipes to reduce the pressure losses.

The smooth Quadrofix®pipe guarantees the lowest pressure loss. The edging technique makes the pipe stable and easy to handle at a weight reduction of up to 50% as opposed to a comparable rigid metal duct.

See pages 18 and 19 for the calculation of the pressure losses.

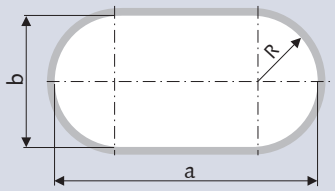
Technical data

Materials:	Non-combustible materials according to DIN 4102-A1, such as aluminium, galvanized steel strip, stainless steel or other metallic materials,
temperature resistance:	up to 200 °C (up to 500 °C depending on the material)
Standard lengths:	3 m

Special lengths and dimensions: upon request

Quadrofix® cross-section form

Form 3 : oval



Radius R: ½ × b

Fig. 2.1

Quadrofix® dimensions

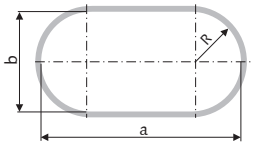
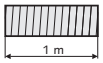
Cross-section form	Connection Ø	Nominal dimension		Nose radius	Cross-section	Hydraulic Ø	Weight	Ratio a:b
	d_a	a	b	R	A	d_h		
	mm	mm	mm	mm	mm²	mm	kg/m	
3	82	**100**	**50**	25	4,463	69	0.452	2 : 1
	94	**105**	**75**	37.5	6,668	90	0.517	2 : 1
	100	**128**	**54**	27	6,286	79	0.554	3 : 1
	100	**129**	**52**	26	6,128	77	0.553	3 : 1
	100	**125**	**60**	30	6,667	84	0.555	3 : 1
	106	**130**	**65**	32.5	7,543	90	0.582	2 : 1
	123	**150**	**80**	40	10,529	108	0.678	2 : 1
	125	**158**	**70**	35	10,008	101	0.686	3 : 1
	149	**187**	**85**	42.5	14,344	122	0.813	3 : 1
	150	**192**	**80**	40	13,987	118	0.820	3 : 1
	155	**200**	**80**	40	14,627	119	0.847	3 : 1
	158	**197**	**95**	47.5	16,653	133	0.866	3 : 1
	162	**195**	**110**	55	18,798	146	0.888	2 : 1
	162	**200**	**100**	50	17,854	139	0.885	2 : 1
	178	**205**	**135**	67.5	23,764	168	0.970	2 : 1
	183	**200**	**157**	78.5	26,110	180	0.995	2 : 1
	192	**240**	**110**	55	23,803	157	1.040	3 : 1
	201	**215**	**180**	90	31,747	200	1.090	2 : 1
	205	**240**	**145**	72.5	30,288	188	1.107	2 : 1
	221	**270**	**140**	70	33,558	192	1.199	2 : 1
	314	**390**	**185**	92.5	64,805	261	1,690	3 : 1
		**All dimensions are internal dimensions!** 			A			**a : b**

Table 2.1

Additional dimensions upon request,

Tolerances

Length tolerances [mm]											
Length [mm]		up to 50	up to 100	up to 200	up to 300	up to 500	up to 800	up to 1000	up to 2000	up to 3000	up to 25000
Connection Ø d_a [mm]	up to 10	± 2	± 3	± 3	± 4	± 4	± 5	± 6	± 10	± 20	± 200
	up to 50	± 2	± 4	± 4	± 6	± 6	± 7	± 8	± 12	± 22	± 220
	up to 100	± 3	± 5	± 6	± 7	± 7	± 8	± 9	± 13	± 23	± 230
	up to 200	± 4	± 7	± 7	± 8	± 8	± 9	± 10	± 14	± 24	± 240
	up to 300	± 6	± 9	± 9	± 10	± 10	± 11	± 12	± 16	± 26	± 260
	up to 400	± 8	± 11	± 11	± 12	± 12	± 13	± 14	± 18	± 28	± 280
	up to 560	± 10	± 13	± 13	± 14	± 14	± 15	± 16	± 20	± 30	± 300

Table 2.2a

Connecting diameter tolerances [mm]	
Connection Ø d_a [mm]	Tolerance [mm]
up to 120	+ 1.0 / 0
up to 190	+ 2.0 / 0
> 190	+ 3.0 / 0
Width **a**	+ 2.0 / 0 Geometrical tolerance (**a** x b)
Height **b**	+ 2.0 / 0 Geometrical tolerance (a x **b**)

Table 2.2b

Technical modifications and errors excepted.

3.13.2 Calculation of the pressure losses for straight, smooth Quadrofix®pipes form 3

General data

ν	= 15×10^{-6}	m²/s *Kinematic viscosity*
ϱ	= 1.2	kg/m³ *Air density (20 °C)*

Catalogue details *(page 17 – table 2.1)*

Nominal dimension **a**	=	mm
Nominal dimension **b**	=	mm
Nose radius **R**	=	mm
Cross-section **A**	=	mm²
	=	m²
Hydraulic **Ød$_h$**	=	mm

The hydraulic diameter is a comparison diameter and is equal with the diameter of a round pipe in the pipe calculation for a multiangular pipe.

Calculation process

1. Calculating the hydraulic **Ø d$_h$**
2. Calculation of the air flow velocity **w** *(in reference to cross-section A)*
3. Calculation of the Reynolds number **Re**
4. Calculating the pipe-friction coefficient λ
5. Calculation of the pressure loss **Δp**

Calculation

❶ **Calculating the hydraulic Ø d$_h$**

The details of the hydraulic Ø d$_h$, nominal dimensions a and b as well as nose radius R may be found in *table 2.1 on page 17.*

The calculation is performed according to the following formula:

$$\frac{4\left[(a-b)\,b + b^2\,\frac{\pi}{4}\right]}{2\,(a-b) + b\,\pi} \quad (mm)$$

❷ **Calculation of the air flow velocity w**

Calculation with:

- **$\dot{V}$** Volumetric flow rate in m³/h
- **A** Cross-section in m² *(see Tab. 2.1 on page 17)*

$$\frac{\dot{V}}{A \times 3600} \quad (m/s)$$

❸ **Calculation of the Reynolds number Re**

$$\frac{w\,d_h}{\nu}$$

❹ **Calculating the pipe-friction coefficient λ**

$$\frac{0.22}{Re^{0,2}}$$

❺ **Calculation of the pressure loss Δp**

Calculation with:

- **λ** Result ❹
- **L** Assumption, i.e. 1,000 mm
- **d$_h$** Result ❶ *or table 2.1 on page 17*
- **ϱ** 1.2 kg/m³ *(air density at 20 °C)*
- **w** Result ❷

$$\frac{\lambda\,L\,\varrho\,w^2}{d_h\,2} \quad (Pa)$$

Example

Pressure loss calculation of a **straight, flexible Quadrofix®** pipe form 3 - 158 × 70 mm.

Fig. 2.2

Given:

Nominal dimension **a**	=	158	mm
Nominal dimension **b**	=	70	mm
Nose radius **R**	=	35	mm
Cross-section **A**	=	10,008	mm^2
	=	0.010008	m^2
Hydraulic **Ød_h**	=	101	mm
Volumetric flow rate **$\dot{V}$**	=	144	m^3/h
Pipe length **L**	=	1	m

❶ **Calculating the hydraulic Ø d_h**

d_h = 101 mm *(See table 2.1 on page 17 for value)*
= 0.101 m

❷ **Calculation of the air flow velocity w**

$$w = \frac{144\ m^3/h}{0.010008\ m^2 \times 3600\ s/h}$$

w = 4.0 m/s

❸ **Calculation of the Reynolds number Re**

$$Re = \frac{4.0\ m/s \times 0.101\ m}{15 \times 10^{-6}\ m^2/s}$$

$Re = 2.693 \times 10^4$

❹ **Calculating the pipe-friction coefficient λ**

$$\lambda = \frac{0.22}{(2.693 \times 10^4)^{0,2}}$$

λ = 0.029

❺ **Calculation of the pressure loss Δp**

$$\Delta p = \frac{0.029 \times 1\ m \times 1.2\ kg/m^3 \times (4.0\ m/s)^2}{0.101\ m \times 2}$$

Δp = 2.76 Pa

Comparison of the pipe friction losses of the Quadroflex® with Quadrofix®pipe
Form 3 - 129 × 52 mm;
Connection Ø 100 mm;
Ratio approx. 3:1

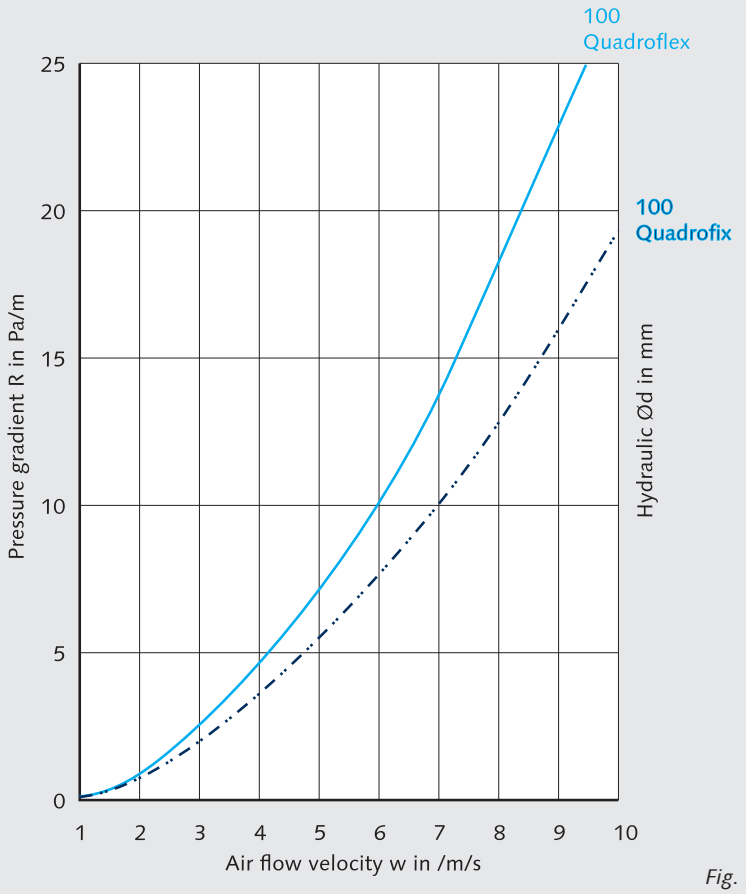


Fig. 2.3

Comparison of the pipe friction losses of the Quadroflex® with Quadrofix®pipe
Form 3 - 192 × 80 mm;
Connection Ø 150 mm;
Ratio approx. 3:1

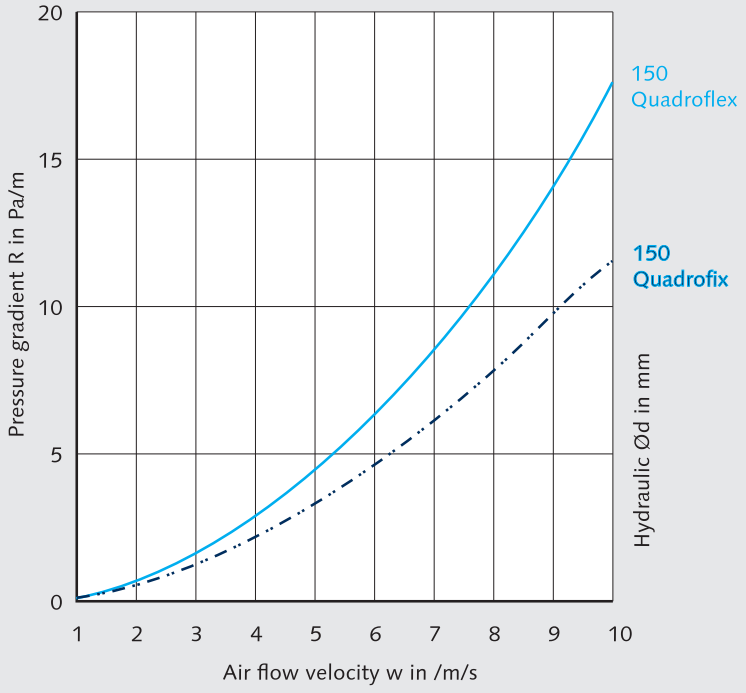
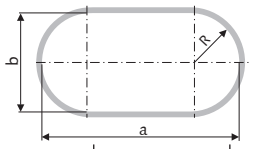


Fig. 2.4

Technical modifications and errors excepted.

Connection Ø				Form	Material	Peak compressive strength		Excess and negative pressure	max. leakage loss* at 400 Pa
	a	b	R			a	b		
mm	mm	mm	mm			N/100mm		Pa	l/(h×m²)
100	**129**	**52**	26	3	Al	347	285	3150	540
100	**129**	**52**	26	3	St	601	445	3150	540
151	**208**	**52**	26	3	Al	283	200	3150	540
151	**208**	**52**	26	3	St	549	404	3150	540

Technical data for additional dimension upon request. ** DIN 24194-2 class IV*

Table 2.3

Longitudinal attenuation

Table 2.4

Description	Material	Item No.	Longitudinal attenuation D in dB/m Qktave band centre frequency in Hz							
			63	125	250	500	1000	2000	4000	8000
Quadrofix®	Aluminium	**100QFIX3W**	1.0	0.4	0.5	0.6	0.7	0.5	0.9	1.0
Quadrofix®	galvanized	**100QFIX3WV**	0.5	0.8	0.6	0.7	0.7	0.6	0.6	0.7

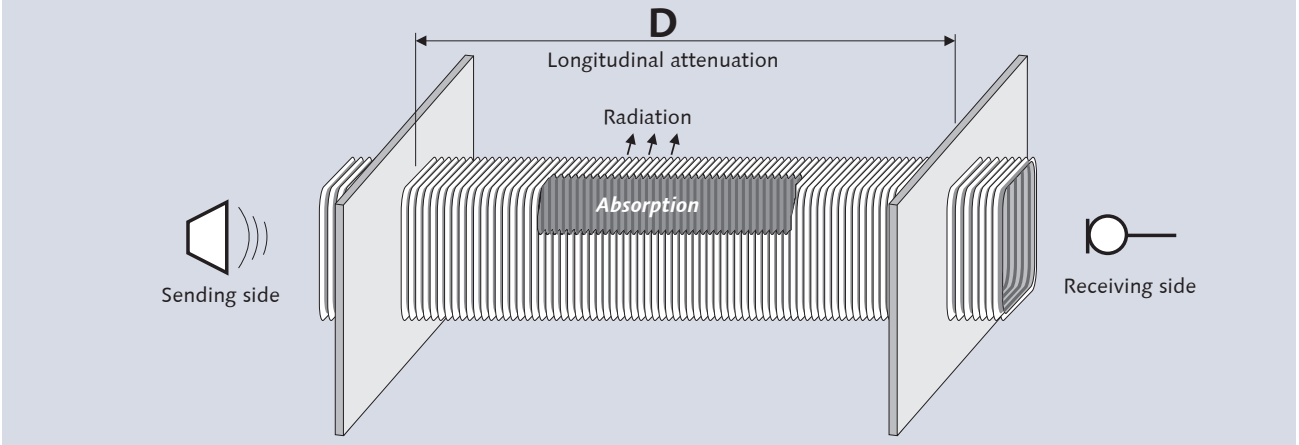
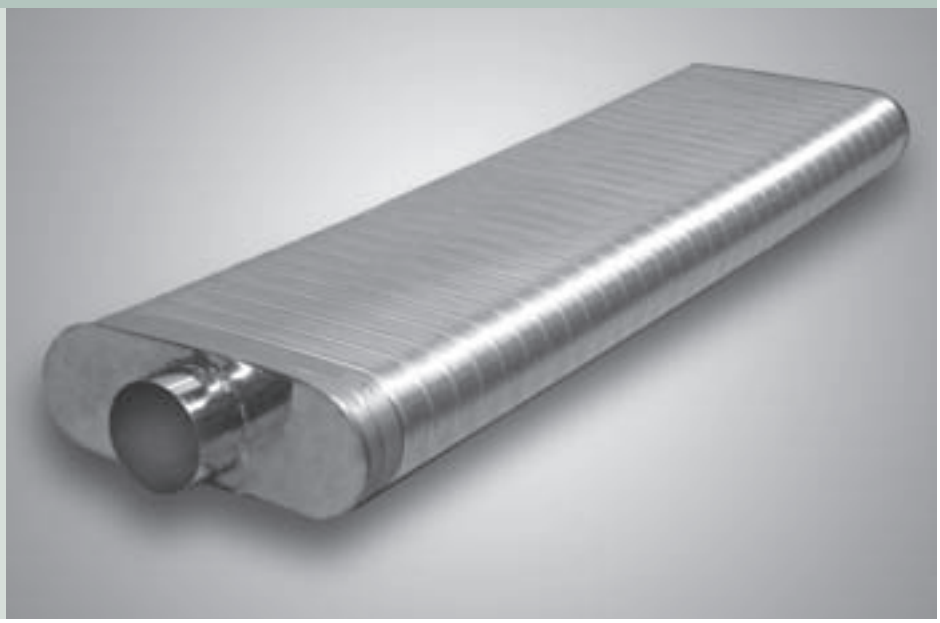


Fig. 2.5

3. Quadrosilent®

Flexible, oval or rectangular mufflers



Product description

Oval or rectangular mufflers with oval, rectangular or round connections.

Muffler can be bent over the longitudinal and lateral axis.

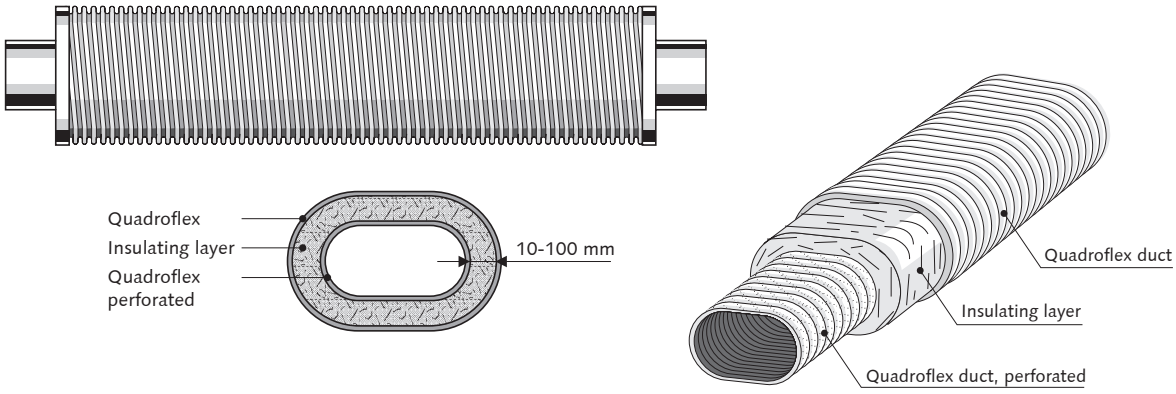
In order to attenuate the noises of the air treatment unit or the climate unit simultaneously within the air distribution, all Quadroflex®-profiles can also be produced of aluminium punched tape as flexible, rectangular interior muffler pipe.

Insulating layers between 10 to 50 mm or thicker depending on the attenuation task.

The insulating layer can be covered with an aluminium-coated mineral fibre fabric , whereby the bending capacity of the muffler pipe is retained (see page 23 – Fig. 3.2).

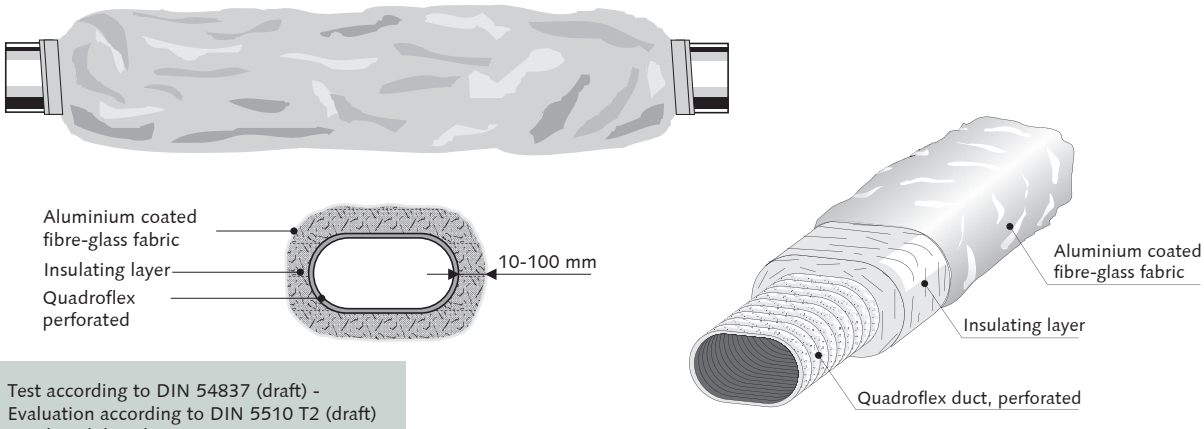
Technical data

Material*:	
Pipe interior:	Quadroflex®-pipe form 3 (Aluminium)
Exterior of pipe:	Quadroflex®-pipe form 3 (Aluminium)
Insulating layer:	Mineral fibre
	** other materials upon request*
	Model with Quadroquick® (see pages and 43) possible!
Temperature-resistance:	to 200 °C
Fire performance:	Non-combustible acc. to DIN 4102
Standard lengths::	up to 3 m



Non-combustible acc. to DIN 4102

Fig. 3.1



Test according to DIN 54837 (draft) -
Evaluation according to DIN 5510 T2 (draft)

Combustibility class:	S1 - S4
Smoke development class:	SR1 - SR2
Drip rating class:	ST1 - ST2

Fig. 3.2

Special models

upon request

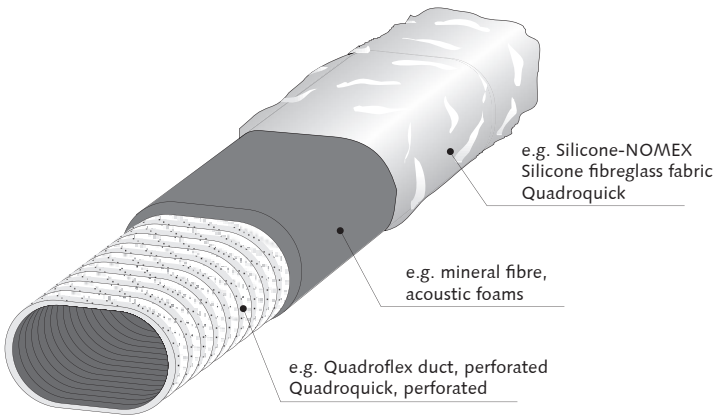


Fig. 3.3

Technical modifications and errors excepted.

Values apply for model fig. 3.1 - page 23 *Table 3.1*

Connecting pipe DN	Exterior pipe A (Form 3)	Interior pipe I (Form 3)	Length L	Insertion loss D_e in dB							
				Octave band centre frequency in Hz							
mm	mm	mm	mm	125	250	500	1000	2000	4000	8000	dB(A)*
50	**129 × 52**	**60 × 30**	500	9	9	10	33	45	45	45	23
			750	10	10	26	35	45	45	45	23
			1,000	11	14	27	44	45	45	45	25
			1,250	12	21	26	45	45	45	45	26
			1,500	13	18	27	45	45	45	45	27
			1,750	14	19	27	45	45	45	45	28
			2,000	15	24	28	45	45	45	45	29
50	**150 × 80**	**60 × 30**	500	18	16	19	42	45	45	45	26
			750	17	17	25	45	45	45	45	27
			1,000	19	20	31	45	45	45	45	28
			1,250	19	20	26	45	45	45	45	29
			1,500	20	21	27	45	45	45	45	30
			1,750	21	22	26	45	45	45	45	32
			2,000	22	23	27	45	45	45	45	34
63	**150 × 80**	**80 × 40**	500	13	15	20	45	45	45	45	24
			750	14	16	24	45	45	45	45	25
			1,000	16	19	30	45	45	45	45	26
			1,250	16	19	25	45	45	45	45	28
			1,500	17	20	26	45	45	45	45	28
			1,750	18	21	25	45	45	45	45	30
			2,000	19	22	26	45	45	45	45	31
80	**195 × 110**	**100 × 50**	500	10	12	19	45	45	45	45	21
			750	11	13	22	45	45	45	45	22
			1,000	13	16	27	45	45	45	45	23
			1,250	13	16	24	45	45	45	45	24
			1,500	14	17	25	45	45	45	45	25
			1,750	15	18	25	45	45	45	45	25
			2,000	16	19	26	45	45	45	45	26
100	**195 × 110**	**129 × 52**	500	8	10	18	46	50	44	38	19
			750	9	11	20	48	51	45	39	20
			1,000	11	14	24	50	53	46	41	21
			1,250	11	14	23	49	52	46	42	22
			1,500	12	15	24	50	53	46	43	23
			1,750	13	16	25	50	53	47	44	23
			2,000	14	17	26	49	54	47	45	24
125	**195 × 145**	**150 × 80**	500	5	7	16	38	48	34	24	14
			750	6	8	17	40	50	36	25	15
			1,000	6	9	19	42	52	39	27	16
			1,250	8	11	21	41	52	42	32	18
			1,500	10	12	23	42	51	45	36	19
			1,750	11	13	25	41	51	46	40	20
			2,000	12	15	26	42	52	48	44	22
150	**270 × 180**	**187 × 85**	500	8	10	20	37	46	24	17	17
			750	9	11	21	38	48	28	19	19
			1,000	11	13	23	41	51	31	21	21
			1,250	13	16	25	42	51	35	26	22
			1,500	14	18	29	44	52	38	30	24
			1,750	15	20	31	45	51	44	34	26
			2,000	17	21	35	47	51	47	39	28
160	**270 × 180**	**197 × 95**	500	8	10	21	37	47	22	15	18
			750	9	11	23	40	49	24	17	19
			1,000	10	13	25	42	53	26	18	21
			1,250	11	16	27	44	52	31	22	23
			1,500	13	18	30	45	52	35	26	25
			1,750	15	20	32	46	53	41	31	27
			2,000	16	23	34	48	51	45	36	29
180	**270 × 200**	**205 × 135**	500	6	8	17	33	41	17	8	14
			750	7	9	19	35	43	19	10	15
			1,000	7	10	21	37	46	21	11	17
			1,250	8	11	22	39	45	24	14	18
			1,500	9	13	23	40	45	27	16	20
			1,750	10	13	24	41	43	29	19	21
			2,000	12	15	25	43	44	33	21	22

** dB(A) = orientation value*

Interior pipe: perforated Quadroflex®-pipe
Insulation: approx. 30 mm of mineral fibre
Exterior pipe: Quadroflex®-pipe
Ends: optionally with connecting pieces for pipe or moulded parts

Temperature resistance: up to 200 °C (up to 500 °C depending on the material)

Nominal widths a × b
Interior/exterior pipe: from 60 × 30 / 129 × 52 mm to 205 × 135 / 270 × 200 mm

Bending radii: r = ca. 2 to 4 × a (exterior pipe)
(in reference to the centre axis) r = ca. 2 to 4 × b (exterior pipe)

Example sound level calculation

Noise source: Fan, calculated sound level L = 76 dB(A)
Muffler: Quadrosilent®, connection diameter DN 100,
Dimensions 195 × 110 mm, L = 1,000 mm

Sound level calculation		Octave band centre frequency in Hz						dB(A)
		125	250	500	1000	2000	4000	
measured sound level	**dB**	82.0	78.0	71.00	71.0	65.0	64.0	75.9
Insertion loss De *(page 24)*	**dB**	-11	-14	-24	-50	-53	-46	
Correction of the A evaluation		*-16.1*	*-8.6*	*-3.2*	*0*	*1.2*	*1*	
evaluated sound level	**dB**	54.9	55.4	43.8	21.0	13.2	19.0	
Total sound level								**58.0 dB**

Table 3.2

Sound level addition

If several different levels must be added, the procedure is accomplished in steps - see calculation.

	Sound level in dB										
$L_{W1} - L_{W2}$	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
ΔL	3.0	2.8	2.5	2.3	2.1	1.9	1.8	1.6	1.5	1.3	1.2
$L_{W1} - L_{W2}$	5.5	6.0	6.5	7.0	7.5	8.0	9.0	10.0	11.0	13.0	
ΔL	1.1	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	

L_W = *Sound level difference in dB*
ΔL = *Sound level increase in dB*

Table 3.3: Level increase with various sound sources

Example: How great is the total level of the sound sources evaluated in table 3.2?

Evaluation sound level	**54.9**	**55.4**	**43.8**	**21.0**	**13.2**	**19.0**
Difference		*-0.6*				
ΔL *from table 3.3*		**3.0**				
Equals		**57.9**				
Difference			*14.1*			
ΔL *from table 3.3*			**0.1**			
Equals			**58.0**			
Difference				*37.0*		
ΔL *from table 3.3*			**0**			

Result of sound pressure level = 58.0 dB(A)

Calculation of the insertion attenuation in the sound measuring duct

Measuring process according to EN 27 235 (DIN 45 646)

Sound measuring duct

Westaflex has a sound measuring duct, in which the effectiveness of sound attenuators can be determined.

Two versions for the calculation of the attenuation dimension of sound dampers are described in EN 27 235 (DIN 45 646) :

- Direct process
- Substitution process

Direct process

The insulation dimension D_d is determined in the direct process. It is the difference between the sound power level before and after the measuring object.

Substitution process

The insertion loss dimension D_e can be determined with the substitution process. The sound power levels behind a sound absorber and a substitution duct (replacement duct) are measured in this process. The insertion loss dimension results from the variance of the two values.

Total structure of the measuring duct

Before and after the centrally arranged measuring object (test object) is always a microphone. A loudspeaker unit is installed at the beginning of the duct and the end of the duct forms a low-reflection end.

A two-channel real time analyzer is used to record the sound levels. The determined data can be stored on a diskette and printed on a printer.

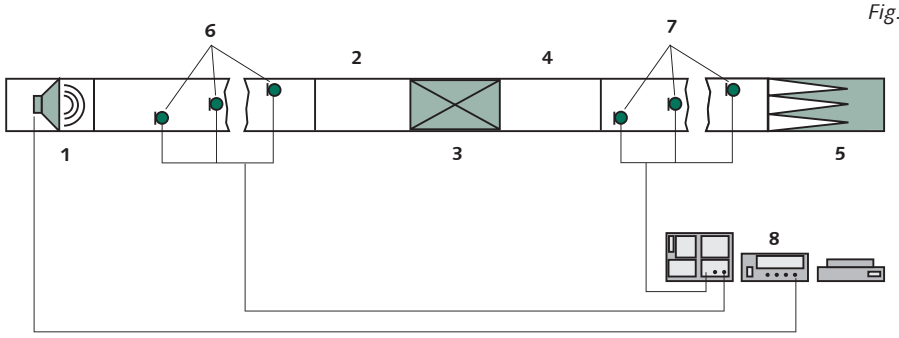


Fig. 3.4: Overall arrangement

1. *Loudspeaker unit*
2. *Measuring duct before the measuring object*
3. *Measuring object (examined sound absorber)*
4. *Measuring duct behind the measuring object*
5. *Low-reflection end*
6. *Microphone position before the Measuring object*
7. *Microphone position behind the Measuring object*
8. *Frequency analyzer, amplifier, printer*

Sound measuring duct structure with substitution duct (empty pipe)

The sound pressure levels (terces) are recorded on the microphone locations (4) after switching on the loudspeaker unit (1).

Sound measuring duct structure with measuring object (Sound absorber)

The sound pressure levels (terces) are recorded on the microphone locations (4) after switching on the loudspeaker unit (1). The resulting sound level variances, measured values according to Fig. 2 minus measured values according to Fig. 3, are then determined. The resulting number values are listed in the tables as insertion loss values.

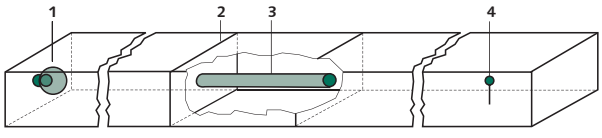


Fig. 3.5: Test structure A

1. *Loudspeaker unit*
2. *Recording disks*
3. *Measuring object, sound insulation interior replacement pipe*
4. *Microphone behind the measuring object*

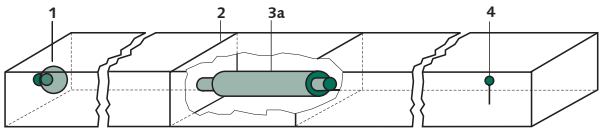
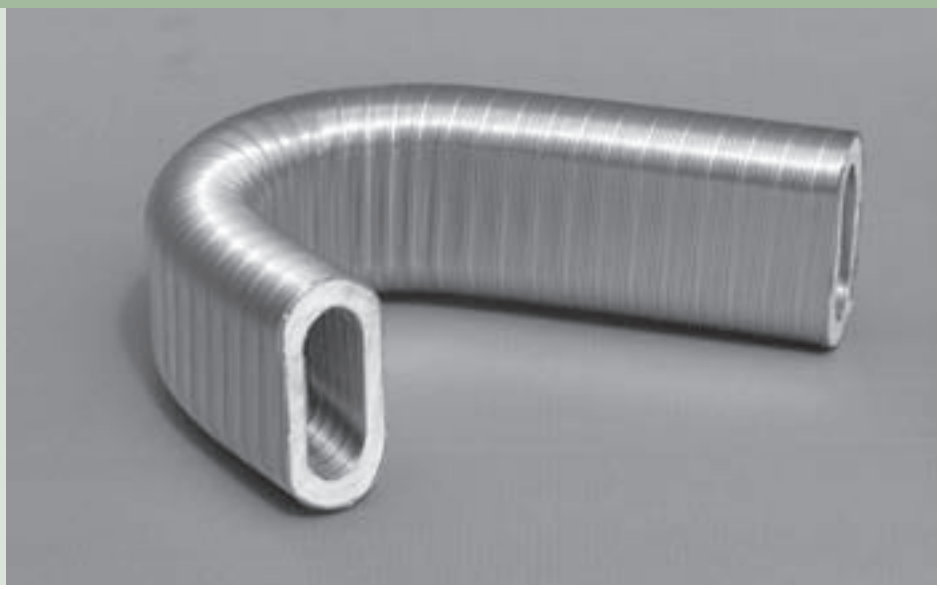


Fig. 3.6: Test structure B

1. *Loudspeaker unit*
2. *Recording disks*
3a. *Complete sound absorber*
4. *Microphone behind the measuring object*

4. Quadrotherm®

Flexible, oval heat-insulating twin pipes



Product description

All Quadroflex profiles can be insulated with variable materials as protection against energy losses for conducting climatized air.

The insulating thicknesses can be selected optionally.

Insulating thicknesses between 10 to 50 mm have been successful for the railway vehicle field.

Insulating materials: Mineral fibre,
fabric mineral fibre,
Foam

In order to maintain the excellent bending capacity of the Quadroflex® profiles, the insulating materials can be covered with a temperature-resistant, tear-resistant aluminium coated mineral fibre fabric (*see page 28 – Fig. 4.3*).

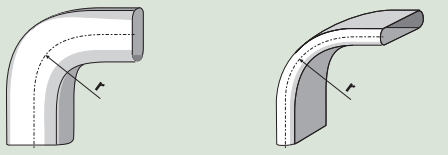
Technical data

Material*:

Pipe interior:	Quadroflex® pipe form 3 (Aluminium)
Exterior of pipe:	Quadroflex® pipe form 3 (Aluminium)
Insulating layer:	Mineral fibre * other materials upon request
Temperature resistance:	up to 200 °C
Fire performance:	Non-combustible according to DIN 4102

Bending radius:
(in reference to the centre axis)

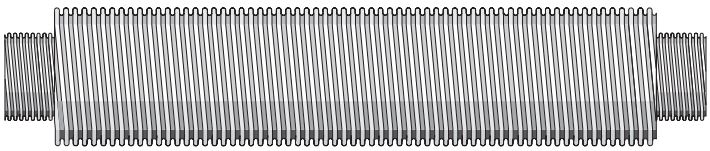
Fig. 4.1

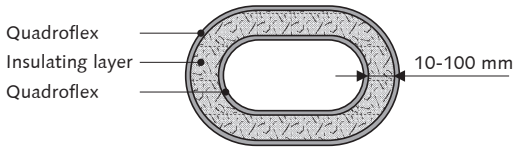


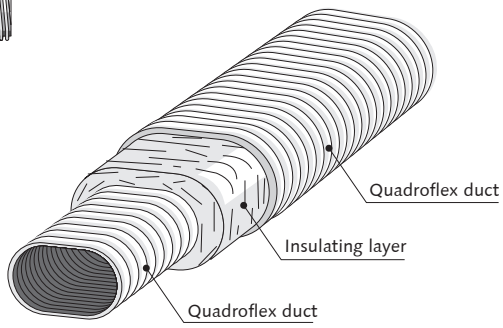
on end
r = 3 to 5 × a (exterior pipe)

flat
r = 3 to 5 × b (exterior pipe)

Standard lengths: up to 3 m

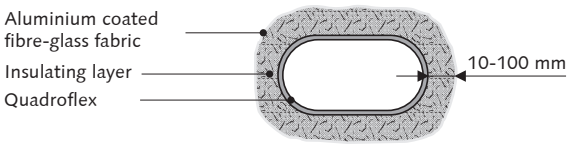


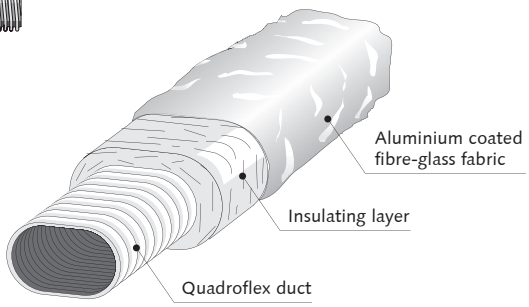




Non-combustible acc. to DIN 4102

Fig. 4.2





Test according to DIN 54837 (draft)
Evaluation according to DIN 5510 (draft)

Combustibility class:	S1 - S4
Smoke development class:	SR1 - SR2
Drip rating class:	ST1 - ST2

Fig. 4.3

Special models

(upon request)

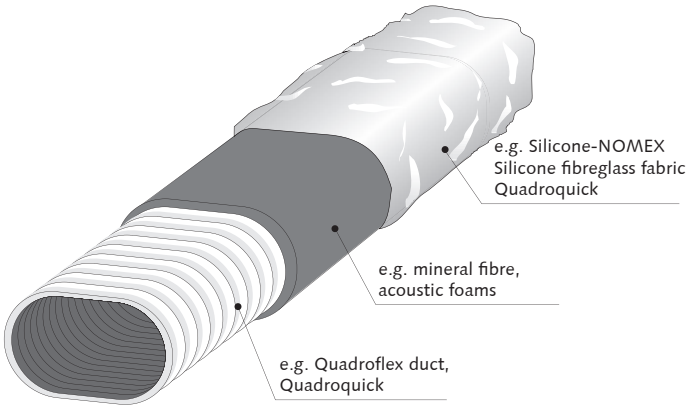


Fig. 4.4

Technical modifications and errors excepted.

Metal fittings

for the air duct, branch and distribution.
Produced according to drawing and **customer request**.

Materials

Aluminium	1.0 - 2.0 mm
stainless steel	0.5 - 2.0 mm

Inner connector

Reduction

Deflector

Angle

Bow
with throttling element

Y-joint

Welding

Certificate according to DIN EN ISO 3834-3
Qualification certificate according to DIN 6700-2
Certificate according to DIN EN 15085

Insulating options

Synth. rubber - Thicknesses 3, 6, 10, 13, 16, 19, 25 mm and special dimensions.

Test according to DIN 54837 (draft) -
Evaluation according to DIN 5510 T2 (draft)

Combustibility class:	S1 - S4
Smoke development class:	SR1 - SR2
Drip rating class:	ST1 - ST2

Model also in halogen-free.
Non-combustible according to DIN 4102-B1 (to 19 mm).
Non-combustible according to DIN 4102-B2 (from 20 mm).

Additional insulations upon request.

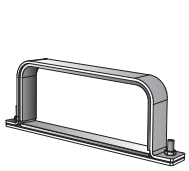
Technical modifications and errors excepted.

Clamps *(excerpt)*

for the attachment of various pipe sections and for attaching the pipes on metal moulds.
Produced according to drawing and **customer request**.

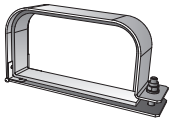
Materials	**Aluminium (standard)**	**3.0 mm**
	stainless steel	1.5 mm
Standard model	of aluminium 3 mm with a 4 mm thick sound insulation insert all-around, including fastening material	

Special designs for form 1 and form 3

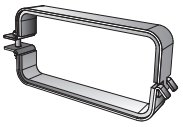


Pipe clip threaded on bottom

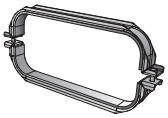
Pipe clip with threaded tree rod



Pipe clip with single hinge

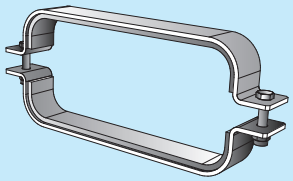


Pipe clip with joint



Pipe clip, reinforced model *(only in stainless steel)*

Suspension and installation clip *(will be bent on-site)*



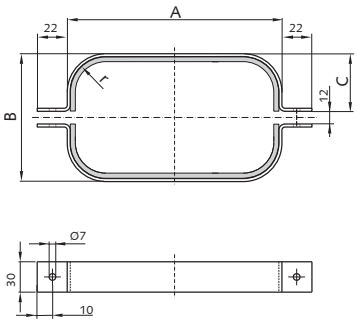


Fig. 5.1

Original item No.:
QPS1MALU (aluminium standard)
QPS1MIX (stainless steel)

Order examples:
Pipe clip (screwed in centre)
for Quadroflex® pipe form 1 - 170 x 150 mm with
connection Ø 186 mm
= **186**QPS1MALU (aluminium)
186QPS1MIX (stainless steel)

Pipe clip (screwed in centre)
for Quadroflex® pipe form 1 - 180 x 140 mm with
connection Ø 186 mm
= **186**QPS1MALU**001** (aluminium)
186QPS1MIX**001** (stainless steel)

Quadroflex® pipe form 1				Clamp				Weight	Item No.
Connection Ø	Nominal dimension		Nose radius				Nose radius	Clamp **Aluminium** insulated	(aluminium standard)
d_a	a	b	R	A	B	C	R		
mm	mm	mm	mm	mm	mm	mm	mm	kg/unit	
66	**80**	**40**	15	100	60	24	22	0.12	**66**QPS1MALU
73	**80**	**50**	15	100	70	29	22	0.13	**73**QPS1MALU
75	**90**	**40**	12	110	60	24	19	0.13	**75**QPS1MALU
78	**100**	**40**	15	120	60	24	22	0.13	**78**QPS1MALU
82	**100**	**50**	15	120	70	29	22	0.14	**82**QPS1MALU
89	**105**	**50**	15	125	70	29	22	0.14	**89**QPS1MALU
91	**109**	**41**	6	129	61	24.5	13	0.15	**91**QPS1MALU
92	**100**	**60**	15	120	80	34	22	0.15	**92**QPS1MALU
102	**107**	**73**	20	127	93	40.5	27	0.16	**102**QPS1MALU
103	**105**	**75**	20	125	95	41.5	27	0.16	**103**QPS1MALU
105	**115**	**60**	10	135	80	34	17	0.16	**105**QPS1MALU
110	**125**	**60**	12	145	80	34	19	0.16	**110**QPS1MALU
116	**130**	**65**	13	150	85	36.5	20	0.17	**116**QPS1MALU
125	**142**	**70**	15	162	90	39	22	0.18	**125**QPS1MALU
126	**170**	**40**	12	190	60	24	19	0.18	**126**QPS1MALU
130	**135**	**75**	6	155	95	41.5	13	0.18	**130**QPS1MALU
140	**155**	**85**	20	175	105	46.5	27	0.19	**140**QPS1MALU**001**
140	**160**	**80**	20	180	100	44	27	0.19	**140**QPS1MALU**002**
151	**170**	**80**	13	190	100	44	20	0.20	**151**QPS1MALU
151	**200**	**50**	12	220	70	29	19	0.20	**151**QPS1MALU**001**
156	**120**	**140**	15	140	160	74	22	0.20	**156**QPS1MALU
156	**140**	**120**	15	160	140	64	22	0.20	**156**QPS1MALU**001**
159	**185**	**80**	15	205	100	44	22	0.20	**159**QPS1MALU
159	**155**	**105**	10	175	125	56.5	17	0.20	**159**QPS1MALU**002**
167	**140**	**150**	30	160	170	79	37	0.21	**167**QPS1MALU
168	**152**	**127**	15	172	147	67.5	22	0.21	**168**QPS1MALU
174	**220**	**80**	30	240	100	44	37	0.22	**174**QPS1MALU
176	**195**	**110**	30	215	130	59	37	0.22	**176**QPS1MALU
179	**220**	**90**	30	240	110	49	37	0.22	**179**QPS1MALU
181	**220**	**80**	15	240	100	44	22	0.22	**181**QPS1MALU
183	**195**	**120**	30	215	140	64	37	0.23	**183**QPS1MALU
184	**195**	**110**	15	215	130	59	22	0.23	**184**QPS1MALU
184	**158**	**146**	15	178	166	77	22	0.23	**184**QPS1MALU**001**
186	**170**	**150**	30	190	170	79	37	0.23	**186**QPS1MALU
186	**180**	**140**	30	200	160	74	37	0.23	**186**QPS1MALU**001**
186	**150**	**170**	30	170	190	89	37	0.23	**186**QPS1MALU**H**
189	**195**	**110**	6	215	130	59	13	0.23	**189**QPS1MALU
196	**195**	**145**	30	215	165	76.5	37	0.24	**196**QPS1MALU
199	**262**	**80**	30	282	100	44	37	0.24	**199**QPS1MALU
200	**210**	**133**	30	230	153	70.5	37	0.24	**200**QPS1MALU
205	**200**	**150**	30	220	170	79	37	0.25	**205**QPS1MALU
212	**210**	**150**	30	230	170	79	37	0.25	**212**QPS1MALU
218	**180**	**190**	30	200	210	99	37	0.26	**218**QPS1MALU
228	**274**	**110**	30	294	130	59	37	0.27	**228**QPS1MALU
232	**266**	**126**	30	286	146	67	37	0.27	**232**QPS1MALU
234	**260**	**120**	12	280	140	64	19	0.27	**234**QPS1MALU**001**
234	**120**	**260**	12	140	280	134	19	0.27	**234**QPS1MALU**002**
237	**267**	**133**	30	287	153	70.5	37	0.27	**237**QPS1MALU
242	**270**	**140**	30	290	160	74	37	0.28	**242**QPS1MALU
246	**304**	**104**	22	324	124	56	29	0.28	**246**QPS1MALU
260	**270**	**170**	30	290	190	89	37	0.29	**260**QPS1MALU
268	**270**	**180**	30	290	200	94	37	0.30	**268**QPS1MALU
281	**270**	**200**	30	290	220	104	37	0.31	**281**QPS1MALU
307	**270**	**240**	30	290	260	124	37	0.33	**307**QPS1MALU

Technical modifications and errors excepted.

Table 5.1

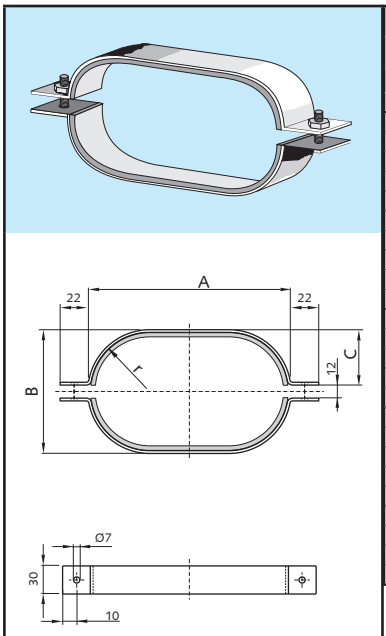


Fig. 5.2

Original item No.:
QPS3MALU (aluminium standard)
QPS3MIX (stainless steel)

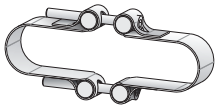
Order examples:
Pipe clip (screwed in centre)
for Quadroflex® pipe form 3 - 200 x 80 mm with
connection Ø 155 mm
= **155**QPS3MALU (aluminium)
155QPS3MIX (stainless steel)

Pipe clip (screwed in centre)
for Quadroflex® pipe form 3 - 200 x 100 mm with
connection Ø 162 mm
= **162**QPS3MALU**001** (aluminium)
162QPS3MIX**001** (stainless steel)

Quadroflex® pipe form 3				Clamp				Weight	Item No.
Connection Ø	Nominal dimension		Nose radius				Nose radius	Clamp **Aluminium** insulated	(aluminium standard)
d_a	a	b	R	A	B	C	R		
mm	mm	mm	mm	mm	mm	mm	mm	kg/unit	
66	**80**	**40**	20	98.5	60	24	27	0.12	**66**QPS3MALU
70	**93**	**30**	15	111.5	50	19	22	0.13	**70**QPS3MALU
73	**100**	**30**	15	118.5	50	19	22	0.13	**73**QPS3MALU
100	**125**	**60**	30	143.5	80	34	37	0.15	**100**QPS3MALU
122	**180**	**25**	12.5	198.5	45	16.5	19.5	0.16	**122**QPS3MALU
123	**150**	**80**	40	168.5	100	44	47	0.16	**123**QPS3MALU
136	**182**	**60**	30	200.5	80	34	37	0.18	**136**QPS3MALU
140	**205**	**30**	15	223.5	50	19	22	0.18	**140**QPS3MALU
149	**187**	**85**	42.5	205.5	105	46.5	49.5	0.18	**149**QPS3MALU
151	**208**	**52**	26	226.5	72	30	33	0.19	**151**QPS3MALU**W**
155	**200**	**80**	40	218.5	100	44	47	0.19	**155**QPS3MALU
158	**197**	**95**	47.5	215.5	115	51.5	54.5	0.20	**158**QPS3MALU
162	**195**	**110**	55	213.5	130	59	62	0.20	**162**QPS3MALU
162	**200**	**100**	50	218.5	120	54	57	0.20	**162**QPS3MALU**001**
167	**225**	**65**	32.5	243.5	85	36.5	39.5	0.21	**167**QPS3MALU
178	**205**	**135**	67.5	223.5	155	71.5	74.5	0.21	**178**QPS3MALU
183	**200**	**157**	78.5	218.5	177	82.5	85.5	0.23	**183**QPS3MALU
201	**215**	**180**	90	233.5	200	94	97	0.23	**201**QPS3MALU
205	**240**	**145**	72.5	258.5	165	76.5	79.5	0.24	**205**QPS3MALU
221	**270**	**140**	70	288.5	160	74	77	0.24	**221**QPS3MALU
250	**350**	**80**	40	368.5	100	44	47	0.26	**250**QPS3MALU
281	**383**	**108**	54	401.5	128	58	61	0.29	**281**QPS3MALU
313	**433**	**108**	54	451.5	128	58	61	0.34	**313**QPS3MALU
314	**390**	**185**	92.5	408.5	205	96.5	99.5	0.34	**314**QPS3MALU

Table 5.2

Special designs only for form 3



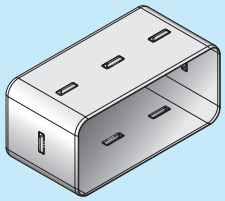
Fixing clip

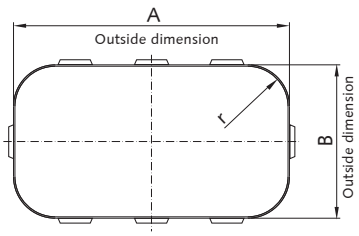
Clamping and fixing clip

Inner connector *(excerpt)*

for connecting pipe profiles.
Produced according to drawing and **customer request**.

Materials	Aluminium (standard)	1.0 mm
	stainless steel	0.5 mm





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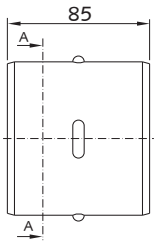


Ribbed form (stop rib or all-around ribbing) optional from the manufacturer!

Fig. 5.3

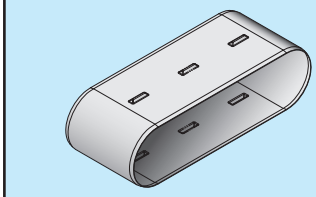
Quadroflex® pipe form 1				Inner connector			Weight	Item No.
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius	Inner connector **Aluminium**	(aluminium standard)
d_a	a	b	R	A	B	R		
mm	mm	mm	mm	mm	mm	mm	kg/unit	
73	**80**	**50**	15	79	49	14.5	0.06	**73**QIV1A
75	**90**	**40**	12	89	39	11.5	0.06	**75**QIV1A
78	**100**	**40**	15	99	39	14.5	0.06	**78**QIV1A
89	**105**	**50**	15	104	49	14.5	0.07	**89**QIV1A
91	**80**	**80**	20	79	79	19.5	0.07	**91**QIV1A**001**
91	**109**	**41**	6	108	40	5.5	0.08	**91**QIV1A
92	**100**	**60**	15	99	59	14.5	0.08	**92**QIV1A
101	**111**	**53.4**	6	110	52.4	5.5	0.08	**101**QIV1A
103	**105**	**75**	20	104	74	19.5	0.08	**103**QIV1A
105	**115**	**60**	10	114	59	9.5	0.09	**105**QIV1A
110	**125**	**60**	12	124	59	11.5	0.09	**110**QIV1A
116	**150**	**45**	15	149	44	14.5	0.09	**116**QIV1A**001**
116	**130**	**65**	13	129	64	12.5	0.10	**116**QIV1A
125	**142**	**70**	15	141	69	14.5	0.10	**125**QIV1A
126	**170**	**40**	12	169	39	11.5	0.10	**126**QIV1A
130	**135**	**75**	6	134	74	5.5	0.11	**130**QIV1A
138	**151**	**71**	6	150	70	5.5	0.11	**138**QIV1A
140	**155**	**85**	20	154	84	19.5	0.11	**140**QIV1A**001**
140	**160**	**80**	20	159	79	19.5	0.11	**140**QIV1A
151	**170**	**80**	13	169	79	12.5	0.12	**151**QIV1A
151	**200**	**50**	12	199	49	11.5	0.13	**151**QIV1A**001**
156	**140**	**120**	15	139	119	14.5	0.13	**156**QIV1A
159	**185**	**80**	15	184	79	14.5	0.13	**159**QIV1A**001**
159	**155**	**105**	10	154	104	9.5	0.13	**159**QIV1A
167	**140**	**150**	30	139	149	29.5	0.13	**167**QIV1A
168	**152**	**127**	15	151	126	14.5	0.14	**168**QIV1A
174	**220**	**80**	30	219	79	29.5	0.14	**174**QIV1A
176	**195**	**110**	30	194	109	29.5	0.14	**176**QIV1A
179	**220**	**90**	30	219	89	29.5	0.14	**179**QIV1A
181	**220**	**80**	15	219	79	14.5	0.15	**181**QIV1A
183	**195**	**120**	30	194	119	29.5	0.15	**183**QIV1A
184	**195**	**110**	15	194	109	14.5	0.15	**184**QIV1A
184	**158**	**146**	15	157	145	14.5	0.15	**184**QIV1A**001**
186	**170**	**150**	30	169	149	29.5	0.15	**186**QIV1A
186	**180**	**140**	30	179	139	29.5	0.15	**186**QIV1A**001**
189	**195**	**110**	6	194	109	5.5	0.16	**189**QIV1A
196	**195**	**145**	30	194	144	29.5	0.16	**196**QIV1A
199	**262**	**80**	30	261	79	29.5	0.16	**199**QIV1A
200	**210**	**133**	30	209	132	29.5	0.16	**200**QIV1A
205	**200**	**150**	30	199	149	29.5	0.17	**205**QIV1A
212	**210**	**150**	30	209	149	29.5	0.17	**212**QIV1A
218	**180**	**190**	30	179	189	29.5	0.18	**218**QIV1A
228	**274**	**110**	30	273	109	29.5	0.19	**228**QIV1A
232	**266**	**126**	30	265	125	29.5	0.19	**232**QIV1A
234	**260**	**120**	12	259	119	11.5	0.20	**234**QIV1A
237	**267**	**133**	30	266	132	29.5	0.19	**237**QIV1A
242	**270**	**140**	30	269	139	29.5	0.20	**242**QIV1A
246	**304**	**104**	22	303	103	21.5	0.20	**246**QIV1A
251	**260**	**160**	30	259	159	29.5	0.20	**251**QIV1A
260	**270**	**170**	30	269	169	29.5	0.22	**260**QIV1A
268	**270**	**180**	30	269	179	29.5	0.22	**268**QIV1A
281	**270**	**200**	30	269	199	29.5	0.23	**281**QIV1A
307	**270**	**240**	30	269	239	29.5	0.25	**307**QIV1A
372	**370**	**240**	30	369	239	29.5	0.31	**372**QIV1A

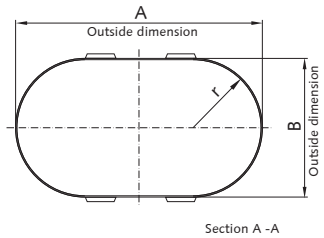
Original item No.: **QIV1A** (aluminium standard)
QIV1IX (stainless steel)

Order examples:
Inner connectors for Quadroflex pipe form 1 - 170 x 150 mm with **connection-Ø 186 mm** = **186**QIV1A (aluminium)
186QIV1IX (stainless steel)

Inner connectors for Quadroflex pipe form 1 - 180 x 140 mm with **connection-Ø 186 mm** = **186**QIV1A**001** (aluminium)
186QIV1IX**001**
(stainless steel)

Tabelle 5.3





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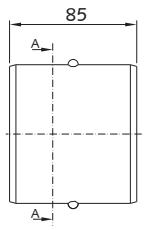


Ribbed form (stop rib or all-around ribbing) optional from the manufacturer!

Fig. 5.4

Quadroflex® pipe form 3				Inner connector			Weight Inner connector Aluminium	Item No. (aluminium standard)
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius		
d_a	a	b	R	A	B	R		
mm	mm	mm	mm	mm	mm	mm	kg/unit	
49	**60**	**30**	15	59	29	14.5	0.03	**49**QIV3A
66	**80**	**40**	20	79	39	19.5	0.05	**66**QIV3A
78	**100**	**40**	20	99	39	19.5	0.06	**78**QIV3A
82	**100**	**50**	25	99	49	24.5	0.06	**82**QIV3A
87	**125**	**25**	12.5	124	24	12	0.06	**87**QIV3A
100	**125**	**60**	30	124	59	29.5	0.07	**100**QIV3A
122	**180**	**25**	12.5	179	24	12	0.09	**122**QIV3A
123	**150**	**80**	40	149	79	39.5	0.09	**123**QIV3A
136	**182**	**60**	30	181	59	29.5	0.10	**136**QIV3A
140	**205**	**30**	15	204	29	14.5	0.10	**140**QIV3A
141	**200**	**35**	17.5	199	34	17	0.10	**141**QIV3A
149	**187**	**85**	42.5	186	84	42	0.11	**149**QIV3A
155	**200**	**80**	40	199	79	39.5	0.11	**155**QIV3A
158	**197**	**95**	47.5	196	94	47	0.11	**158**QIV3A
162	**195**	**110**	55	194	109	54.5	0.12	**162**QIV3A
167	**225**	**65**	32.5	224	64	32	0.12	**167**QIV3A
178	**205**	**135**	67.5	204	134	67	0.13	**178**QIV3A
183	**200**	**157**	78.5	199	156	78	0.13	**183**QIV3A
221	**270**	**140**	70	269	139	69.5	0.16	**221**QIV3A
281	**383**	**108**	54	382	107	53.5	0.20	**281**QIV3A
313	**433**	**108**	54	432	107	53.5	0.23	**313**QIV3A
314	**390**	**185**	92.5	389	184	92	0.23	**314**QIV3A

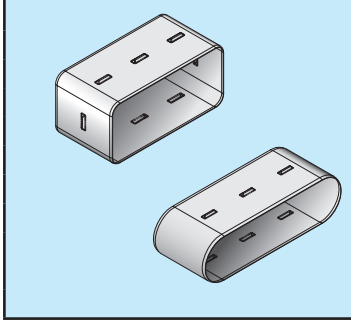
Original item No.: **QIV3A** (aluminium standard)
QIV3IX (stainless steel)

Order example:
Inner connectors for Quadroflex pipe form 3 - 125 x 60 mm with **connection-Ø 100 mm** = **100**QIV3A (Aluminium)
100QIV3IX (stainless steel)

Table 5.4

Pressure gradient of inner connector

Quadroflex® und Quadrofix®



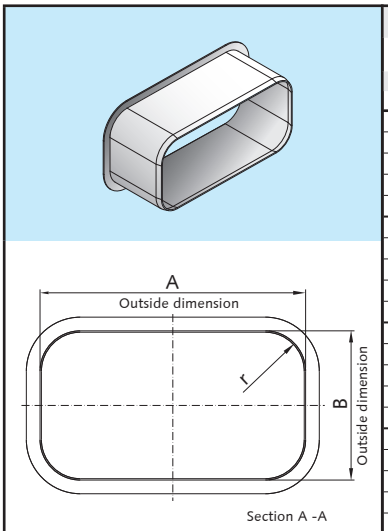
Cross-sectional form	Nominal dimension a × b mm	Connection Ø da mm	air volume m³/h	Air flow velocity w m/s	Pressure gradient Pa/m
1	80 × 50	73	14	1	0.1
			69	5	2.1
			137	10	9.5
1	170 × 80	151	48	1	-
			242	5	1.0
			484	10	5.3
3	270 × 140	221	120	1	-
			604	5	0.6
			1209	10	3.1

Tabelle 5.5

Spigot *(excerpt)*

Special production according to drawing and **customer request**.

Materials	Aluminium (standard)	1.0 mm
	stainless steel	0.5 mm



** The flange width deviates all around between 7 to 10 mm*

Fig. 5.5

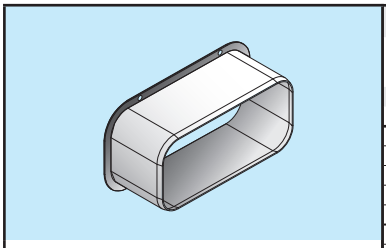
Quadroflex® pipe form 1				spigot			Weight spigot Aluminium	Item No. (aluminium standard)
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius		
d_a	a	b	R	A	B	R		
mm	mm	mm	mm	mm	mm	mm	kg/unit	
73	**80**	**50**	15	79	49	14.5	0.05	**73**QBK1A
75	**90**	**40**	12	89	39	11.5	0.06	**75**QBK1A
89	**105**	**50**	15	104	49	14.5	0.07	**89**QBK1A
91	**109**	**41**	6	108	40	5.5	0.07	**91**QBK1A
92	**100**	**60**	15	99	59	14.5	0.07	**92**QBK1A
93	**85**	**73**	15	84	72	14.5	0.07	**93**QBK1A
102	**107**	**73**	20	106	72	19.5	0.08	**102**QBK1A
103	**105**	**75**	20	104	74	19.5	0.08	**103**QBK1A
105	**115**	**60**	10	114	59	9.5	0.08	**105**QBK1A
110	**125**	**60**	12	124	59	11.5	0.09	**110**QBK1A
116	**130**	**65**	13	129	64	12.5	0.09	**116**QBK1A
125	**142**	**70**	15	141	69	14.5	0.10	**125**QBK1A
126	**170**	**40**	12	169	39	11.5	0.10	**126**QBK1A
140	**160**	**80**	20	159	79	19.5	0.11	**140**QBK1A**001**
140	**155**	**85**	20	154	84	19.5	0.11	**140**QBK1A
151	**170**	**80**	13	169	79	12.5	0.12	**151**QBK1A
151	**200**	**50**	12	199	49	11.5	0.12	**151**QBK1A**001**
156	**140**	**120**	15	139	149	14.5	0.14	**156**QBK1A
159	**185**	**80**	15	184	79	14.5	0.13	**159**QBK1A**001**
159	**155**	**105**	10	154	104	9.5	0.13	**159**QBK1A
167	**140**	**150**	30	139	149	29.5	0.13	**167**QBK1A
168	**152**	**127**	15	151	126	14.5	0.13	**168**QBK1A
174	**220**	**80**	30	219	79	29.5	0.13	**174**QBK1A
176	**195**	**110**	30	194	109	29.5	0.13	**176**QBK1A
179	**220**	**90**	30	219	89	29.5	0.14	**179**QBK1A
181	**220**	**80**	15	219	79	14.5	0.15	**181**QBK1A
183	**195**	**120**	30	194	119	29.5	0.14	**183**QBK1A
184	**195**	**110**	15	194	109	14.5	0.15	**184**QBK1A
184	**158**	**146**	15	157	145	14.5	0.15	**184**QBK1A**001**
186	**170**	**150**	30	169	149	29.5	0.14	**186**QBK1A
186	**180**	**140**	30	179	139	29.5	0.14	**186**QBK1A**001**
189	**195**	**110**	6	194	109	5.5	0.16	**189**QBK1A
196	**195**	**145**	30	194	144	29.5	0.15	**196**QBK1A
199	**262**	**80**	30	261	79	29.5	0.15	**199**QBK1A
200	**210**	**133**	30	209	132	29.5	0.15	**200**QBK1A
205	**200**	**150**	30	199	149	29.5	0.16	**205**QBK1A
212	**210**	**150**	30	209	149	29.5	0.16	**212**QBK1A
218	**180**	**190**	30	179	189	29.5	0.17	**218**QBK1A
232	**266**	**126**	30	265	125	29.5	0.18	**232**QBK1A
234	**260**	**120**	12	259	119	11.5	0.19	**234**QBK1A
237	**267**	**133**	30	266	132	29.5	0.18	**237**QBK1A
242	**270**	**140**	30	269	139	29.5	0.19	**242**QBK1A
246	**304**	**104**	22	303	103	21.5	0.20	**246**QBK1A
260	**270**	**170**	30	269	169	29.5	0.21	**260**QBK1A
268	**270**	**180**	30	269	179	29.5	0.21	**268**QBK1A
281	**270**	**200**	30	269	199	29.5	0.22	**281**QBK1A
307	**270**	**240**	30	269	239	29.5	0.24	**307**QBK1A
372	**370**	**240**	30	369	239	29.5	0.30	**372**QBK1A

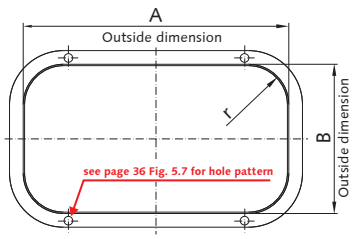
Original item No.: **QBK1A** (aluminium standard)
QBK1IX (stainless steel)

Order examples:
Spigot for Quadroflex pipe form 1 - 170 x 150 mm with **connection-Ø 186 mm** = **186**QBK1A (Aluminium)
186QBK1IX (stainless steel)

Spigot for Quadroflex pipe form 1 - 180 x 140 mm with **connection-Ø 186 mm** = **186**QBK1A**001** (aluminium)
186QBK1IX**001** (stainless steel)

Table 5.6





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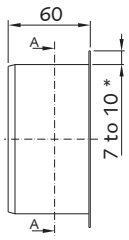


** The flange width deviates all around between 7 to 10 mm*

Fig. 5.6

Quadroflex® pipe form 1				spigot			spigot perforation								Weight spigot Aluminium	Item No. (aluminium standard)
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius	see page 36 - fig. 5.7									
d_a	a	b	R	A	B	r	C	D	E	F	G	Type	Quantity	ØH		
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm			mm	kg/unit	
66	**80**	**40**	15	79	39	14.5	40	48				A	4	3.4	0.05	**66**QBK1LA
73	**80**	**50**	15	79	49	14.5	40	58				A	4	3.4	0.05	**73**QBK1LA
75	**90**	**40**	12	89	39	11.5	56	48				A	4	3.4	0.06	**75**QBK1LA
77	**95**	**40**	15	94	39	14.5	55	48				A	4	3.4	0.06	**77**QBK1LA
78	**100**	**40**	15	99	39	14.5	60	48				A	4	3.4	0.06	**78**QBK1LA
82	**100**	**50**	15	99	49	14.5	60	58				A	4	3.4	0.07	**82**QBK1LA
87	**83**	**63**	10	82	62	9.5	53	71				A	4	3.4	0.07	**87**QBK1LA
89	**105**	**50**	15	104	49	14.5	65	58				A	4	3.4	0.07	**89**QBK1LA
91	**80**	**80**	20	79	79	19.5	30	88				A	6	3.4	0.07	**91**QBK1LA
91	**109**	**41**	6	108	40	5.5	87	49				A	4	3.4	0.07	**91**QBK1LA**001**
92	**100**	**60**	15	99	59	14.5	60	68				A	4	3.4	0.07	**92**QBK1LA
93	**85**	**73**	15	84	72	14.5	45	81				A	6	3.4	0.07	**93**QBK1LA
98	**100**	**65**	13	99	64	12.5	64	73				A	4	3.4	0.08	**98**QBK1LA
101	**111**	**53.4**	6	110	52.4	5.5	89	61.4				A	4	3.4	0.08	**101**QBK1LA
103	**105**	**75**	20	104	74	19.5	55	83				A	6	3.4	0.08	**103**QBK1LA
105	**115**	**60**	10	114	59	9.5	85	68				A	4	3.4	0.08	**105**QBK1LA
110	**125**	**60**	12	124	59	11.5	91	68				A	4	3.4	0.09	**110**QBK1LA
114	**134**	**54**	10	133	53	9.5	104	62				A	4	3.4	0.09	**114**QBK1LA
116	**130**	**65**	13	129	64	12.5	94	73				A	4	3.4	0.09	**116**QBK1LA
116	**150**	**45**	15	149	44	14.5	110	53				A	6	3.4	0.09	**116**QBK1LA**001**
116	**100**	**100**	20	99	99	19.5	50	108	108			B	6	3.4	0.09	**116**QBK1LA**002**
119	**120**	**80**	15	119	79	14.5	80	88	128			B	6	3.4	0.09	**119**QBK1LA
120	**142**	**59.5**	15	141	58.5	14.5	102	67.5				A	4	3.4	0.09	**120**QBK1LA
125	**142**	**70**	15	141	69	14.5	102	78	150			B	6	3.4	0.10	**125**QBK1LA
126	**170**	**40**	12	169	39	11.5	136	48				A	6	3.4	0.10	**126**QBK1LA
130	**135**	**75**	6	134	74	5.5	113	83	143			B	8	3.4	0.11	**130**QBK1LA
134	**143**	**93**	30	142	92	29.5	73	101	151			B	6	3.4	0.10	**134**QBK1LA
138	**151**	**71**	6	150	70	5.5	129	79	159			B	8	3.4	0.11	**138**QBK1LA
140	**160**	**80**	20	159	79	19.5	110	88	168			B	8	3.4	0.11	**140**QBK1LA
140	**155**	**85**	20	154	84	19.5	105	93	163			B	8	3.4	0.11	**140**QBK1LA**001**
150	**205**	**40**	10	204	39	9.5	175	48				A	6	3.4	0.12	**150**QBK1LA
151	**200**	**50**	12	199	49	11.5	166	58				A	6	3.4	0.12	**151**QBK1LA**001**
151	**170**	**80**	13	169	79	12.5	134	88	178			B	8	3.4	0.12	**151**QBK1LA
156	**140**	**120**	15	139	119	14.5	100	128	148			B	6	3.4	0.12	**156**QBK1LA
159	**155**	**105**	10	154	104	9.5	125	113	163			B	8	3.4	0.13	**159**QBK1LA
159	**185**	**80**	15	184	79	14.5	145	88	193			B	8	3.4	0.13	**159**QBK1LA**001**
167	**150**	**140**	30	149	139	29.5	80	148	158	70		C	8	3.4	0.13	**167**QBK1LA
168	**152**	**127**	15	151	126	14.5	112	135	160			B	8	3.4	0.13	**168**QBK1LA
171	**148**	**138**	20	147	137	19.5	98	146	156	88		C	8	3.4	0.13	**171**QBK1LA
174	**220**	**80**	30	219	79	29.5	150	88	228			B	8	3.4	0.13	**174**QBK1LA
176	**195**	**110**	30	194	109	29.5	125	118	203			B	8	3.4	0.13	**176**QBK1LA
179	**220**	**90**	30	219	89	29.5	150	98	228			B	8	3.4	0.14	**179**QBK1LA
181	**220**	**80**	15	219	79	14.5	180	88	228			B	8	3.4	0.15	**181**QBK1LA
183	**195**	**120**	30	194	119	29.5	125	128	203			B	8	3.4	0.14	**183**QBK1LA
184	**158**	**146**	15	157	145	14.5	118	154	166			B	8	3.4	0.15	**184**QBK1LA**001**
184	**195**	**110**	15	194	109	14.5	155	118	203			B	8	3.4	0.15	**184**QBK1LA
186	**180**	**140**	30	179	139	29.5	110	148	188	70		C	10	3.4	0.14	**186**QBK1LA**001**
186	**170**	**150**	30	169	149	29.5	100	158	178	80		C	8	3.4	0.14	**186**QBK1LA
186	**220**	**85**	15	219	84	14.5	180	93	228			B	8	3.4	0.15	**186**QBK1LA**002**
187	**240**	**63**	10	239	62	9.5	210	71				A	6	3.4	0.15	**187**QBK1LA
189	**195**	**110**	6	194	109	5.5	173	118	203			B	8	3.4	0.16	**189**QBK1LA
190	**252**	**60**	15	251	59	14.5	212	68	260			B	8	3.4	0.15	**190**QBK1LA
191	**185**	**140**	30	184	139	29.5	115	148	193	70		C	10	3.4	0.14	**191**QBK1LA
194	**180**	**150**	30	179	149	29.5	110	158	188	80		C	10	3.4	0.15	**194**QBK1LA
196	**195**	**145**	30	194	144	29.5	125	153	203	75		C	10	3.4	0.15	**196**QBK1LA
198	**230**	**100**	20	229	99	19.5	180	108	238			B	8	3.4	0.16	**198**QBK1LA
199	**262**	**80**	30	261	79	29.5	192	88	270			B	8	3.4	0.15	**199**QBK1LA
200	**210**	**133**	30	209	132	29.5	140	141	218	63		C	10	3.4	0.15	**200**QBK1LA
205	**200**	**150**	30	199	149	29.5	130	158	208	80		C	10	3.4	0.16	**205**QBK1LA
212	**210**	**150**	30	209	149	29.5	140	158	218	80		C	10	3.4	0.16	**212**QBK1LA
213	**252**	**95**	15	251	94	14.5	212	103	260			B	8	3.4	0.17	**213**QBK1LA**001**
213	**220**	**140**	30	219	139	29.5	150	148	228	70		C	10	3.4	0.16	**213**QBK1LA
218	**190**	**180**	30	189	179	29.5	120	188	198	90		C	10	3.4	0.17	**218**QBK1LA
219	**230**	**140**	30	229	139	29.5	160	148	238	70		C	10	3.4	0.17	**219**QBK1LA
220	**285**	**68**	10	284	67	9.5	255	76	293		85	D	10	3.4	0.18	**220**QBK1LA
228	**274**	**110**	30	273	109	29.5	204	118	282			B	8	3.4	0.18	**228**QBK1LA
232	**266**	**126**	30	265	125	29.5	196	134	274	56		C	10	3.4	0.18	**232**QBK1LA
234	**260**	**120**	12	259	119	11.5	226	128	268	66	75	D	12	3.4	0.19	**234**QBK1LA
237	**267**	**133**	30	266	132	29.5	197	141	275	63		C	10	3.4	0.18	**237**QBK1LA
242	**270**	**140**	30	269	139	29.5	200	148	278	70		C	10	3.4	0.19	**242**QBK1LA
246	**304**	**104**	22	303	103	21.5	250	112	312	50	83	D	12	3.4	0.20	**246**QBK1LA
251	**260**	**160**	30	259	159	29.5	190	168	268	80		C	10	3.4	0.20	**251**QBK1LA
260	**270**	**170**	30	269	169	29.5	200	178	278	90		C	10	3.4	0.21	**260**QBK1LA
268	**270**	**180**	30	269	179	29.5	200	188	278	90		C	10	3.4	0.21	**268**QBK1LA
281	**270**	**200**	30	269	199	29.5	200	208	278	100		C	10	3.4	0.22	**281**QBK1LA
289	**290**	**190**	30	289	189	29.5	220	198	298	90	73	D	12	3.4	0.23	**289**QBK1LA
307	**270**	**240**	30	269	239	29.5	200	248	278	160		C	12	3.4	0.24	**307**QBK1LA
346	**358**	**211**	30	357	210	29.5	288	219	366	131	96	D	14	3.4	0.28	**346**QBK1LA
372	**370**	**240**	30	369	239	29.5	300	248	378	160	100	D	14	3.4	0.30	**372**QBK1LA

Original item No.: **QBK1LA** (aluminium standard)
QBK1LIX (stainless steel)

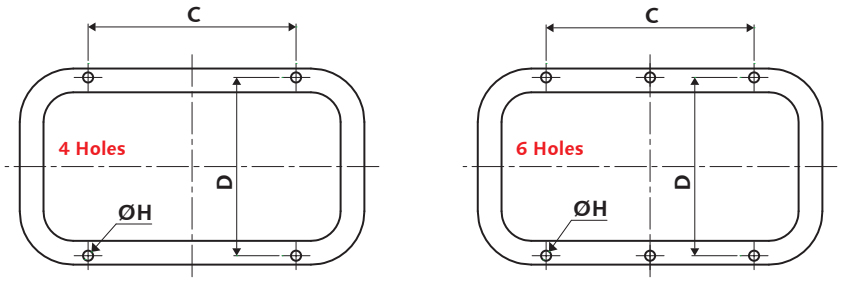
Order example: spigot. **perforated** for Quadroflex pipe form 1 - 170 × 150 mm with **connection-Ø 186 mm** = **186**QBK1LA (aluminium)
186QBK1LIX(stainless steel)

Table 5.7

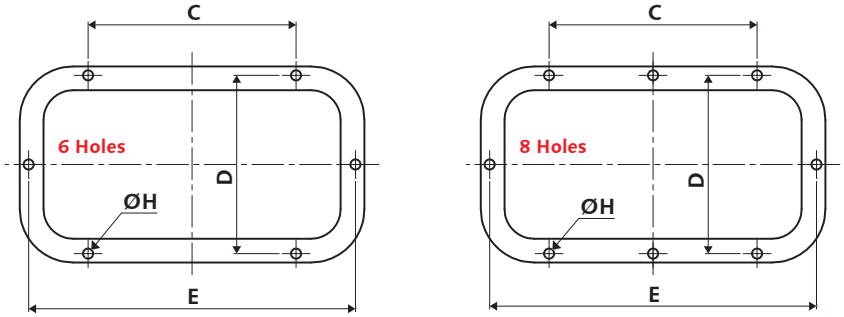
Technical modifications and errors excepted.

Designs A - D are relative to size, correspond with table 5.7 on page 35

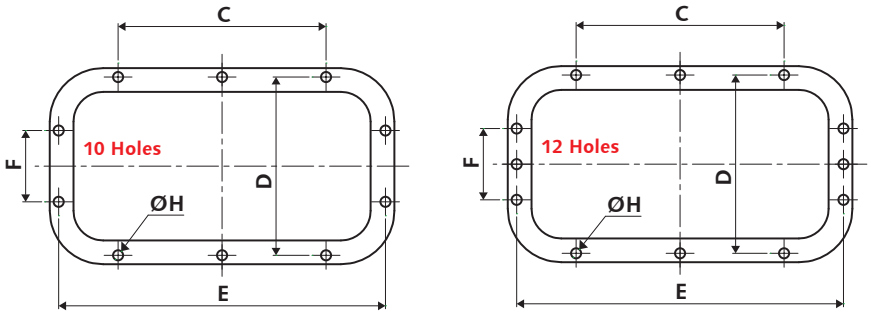
Design A



Design B



Design C



Design D

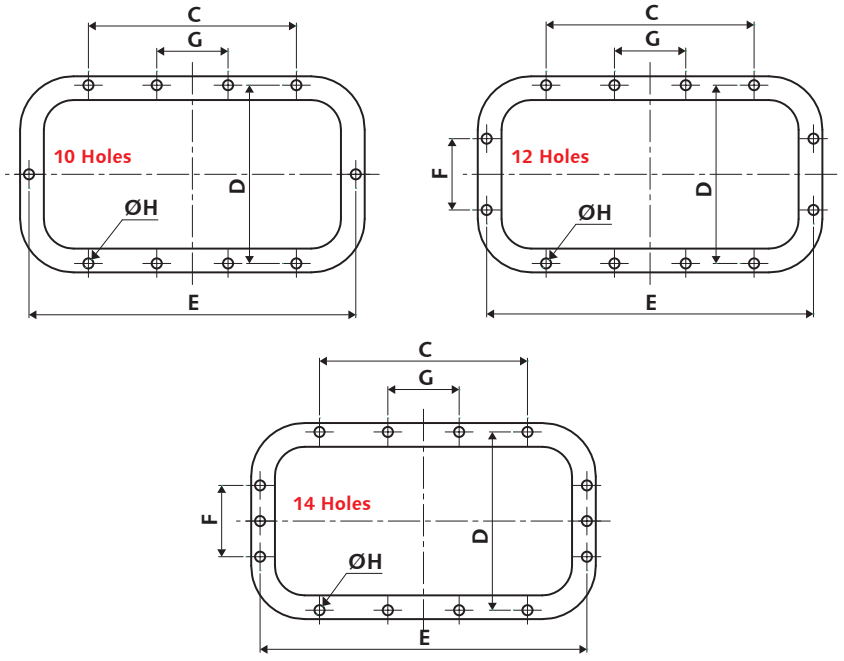
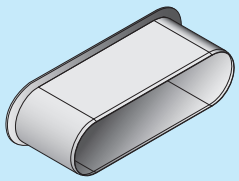
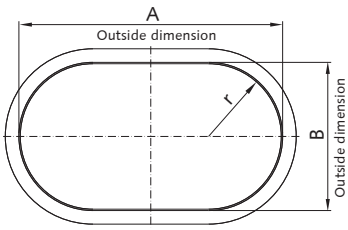


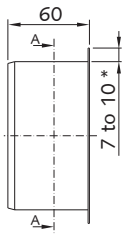
Fig. 5.7

Technical modifications and errors excepted.





Section A -A



** The flange width deviates all around between 7 to 10 mm*

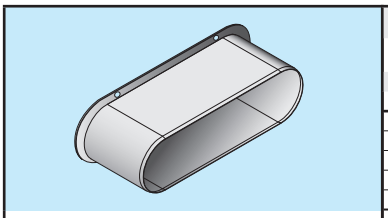
Fig. 5.8

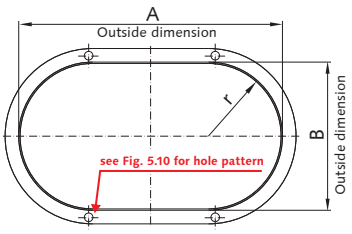
Quadroflex® pipe form 3				spigot			Weight	Item No.
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius	spigot Aluminium	(aluminium standard)
d_a	a	b	R	A	B	R		
mm	mm	mm	mm	mm	mm	mm	kg/unit	
49	**60**	**30**	15	59	29	14.5	0.03	**49**QBK3A
66	**80**	**40**	20	79	39	19.5	0.04	**66**QBK3A
70	**93**	**30**	15	92	29	14.5	0.04	**70**QBK3A
73	**100**	**30**	15	99	29	14.5	0.04	**73**QBK3A
76	**100**	**35**	17.5	99	34	17	0.04	**76**QBK3A
78	**100**	**40**	20	99	39	19.5	0.04	**78**QBK3A
82	**100**	**50**	25	99	49	24.5	0.05	**82**QBK3A
87	**125**	**25**	12.5	124	24	12	0.05	**87**QBK3A
100	**125**	**60**	30	124	59	29.5	0.06	**100**QBK3A
106	**130**	**65**	32.5	129	64	32	0.06	**106**QBK3A
119	**150**	**65**	32.5	149	64	32	0.07	**119**QBK3A
122	**180**	**25**	12.5	179	24	12	0.07	**122**QBK3A
123	**150**	**80**	40	149	79	39.5	0.07	**123**QBK3A
125	**158**	**70**	35	157	69	34.5	0.07	**125**QBK3A
125	**157**	**69**	34.5	156	68	34	0.07	**125**QBK3A
136	**182**	**60**	30	181	59	29.5	0.08	**136**QBK3A
140	**205**	**30**	15	204	29	14.5	0.08	**140**QBK3A
141	**200**	**35**	17.5	199	34	17	0.08	**141**QBK3A
149	**187**	**85**	42.5	186	84	42	0.08	**149**QBK3A
155	**200**	**80**	40	199	79	39.5	0.09	**155**QBK3A
158	**197**	**95**	47.5	196	94	47	0.09	**158**QBK3A
162	**195**	**110**	55	194	109	54.5	0.09	**162**QBK3A
167	**225**	**65**	32.5	224	64	32	0.09	**167**QBK3A
178	**205**	**135**	67.5	204	134	67	0.10	**178**QBK3A
183	**200**	**157**	78.5	199	156	78	0.10	**183**QBK3A
192	**240**	**110**	55	239	109	54.5	0.11	**192**QBK3A
200	**271**	**80**	40	270	79	39.5	0.11	**200**QBK3A
201	**215**	**180**	90	214	179	89.5	0.11	**201**QBK3A
221	**270**	**140**	70	269	139	69.5	0.13	**221**QBK3A
250	**350**	**80**	40	349	79	39.5	0.14	**250**QBK3A
281	**383**	**108**	54	382	107	53.5	0.16	**281**QBK3A
313	**433**	**108**	54	432	107	53.5	0.18	**313**QBK3A
314	**390**	**185**	92.5	389	184	92	0.18	**314**QBK3A

Original item No.: **QBK3A** (Aluminium)
QBK3IX (stainless steel)

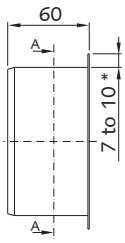
Order example:
Spigot for Quadroflex pipe form 3 - 125 x 60 mm with **connection-Ø 100 mm** = **100**QBK3A (Aluminium)
100QBK3IX (stainless steel)

Table 5.8





Section A -A



** The flange width deviates all around between 7 to 10 mm*

Fig. 5.9

Quadroflex® pipe form 3				spigot			spigot perforation				Weight spigot Aluminium	Item No. (aluminium standard)
Connection Ø	Nominal dimension		Nose radius	Outer dimension		Nose radius	see Fig. 5.10					
d_a	a	b	R	A	B	r	C	D	Quantity	ØH		
mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	kg/unit	
49	**60**	**30**	15	59	29	14.5	20	38	4	3.4	0.03	**49**QBK3LA
53	**74.5**	**16.5**	8.25	73.5	15.5	7.75	48	24.5	4	3.4	0.03	**53**QBK3LA
60	**80**	**25**	12.5	79	24	12	45	33	4	3.4	0.03	**60**QBK3LA
66	**80**	**40**	20	79	39	19.5	30	48	4	3.4	0.04	**66**QBK3LA
70	**93**	**30**	15	92	29	14.5	53	38	4	3.4	0.04	**70**QBK3LA
73	**100**	**30**	15	99	29	14.5	60	38	4	3.4	0.04	**73**QBK3LA
76	**100**	**35**	17.5	99	34	17	55	43	4	3.4	0.04	**76**QBK3LA
78	**100**	**40**	20	99	39	19.5	50	48	4	3.4	0.04	**78**QBK3LA
82	**100**	**50**	25	99	49	24.5	40	58	4	3.4	0.05	**82**QBK3LA
87	**125**	**25**	12.5	124	24	12	90	33	4	3.4	0.05	**87**QBK3LA
94	**105**	**75**	37.5	104	74	37	20	83	4	3.4	0.05	**94**QBK3LA
100	**125**	**60**	30	124	59	29.5	55	68	4	3.4	0.06	**100**QBK3LA
101	**133**	**46**	23	132	45	22.5	77	54	4	3.4	0.06	**101**QBK3LA
100	**129**	**52**	26	128	51	25.5	67	60	4	3.4	0.06	**100**QBK3LWA
106	**130**	**65**	32.5	129	64	32	55	73	4	3.4	0.06	**106**QBK3LA
122	**180**	**25**	12.5	179	24	12	145	33	6	3.4	0.07	**122**QBK3LA
123	**150**	**80**	40	149	79	39.5	60	88	4	3.4	0.07	**123**QBK3LA
125	**158**	**70**	35	157	69	34.5	78	78	4	3.4	0.07	**125**QBK3LWA
136	**182**	**60**	30	181	59	29.5	112	68	6	3.4	0.08	**136**QBK3LA
140	**205**	**30**	15	204	29	14.5	165	38	6	3.4	0.08	**140**QBK3LA
141	**200**	**35**	17.5	199	34	17	155	43	6	3.4	0.08	**141**QBK3LA
145	**200**	**50**	25	199	49	24.5	140	58	6	3.4	0.08	**145**QBK3LA
149	**187**	**85**	42.5	186	84	42	92	93	4	3.4	0.08	**149**QBK3LA
150	**192**	**80**	40	191	79	39.5	102	88	6	3.4	0.09	**150**QBK3LWA
151	**208**	**52**	26	207	51	25.5	146	60	6	3.4	0.09	**151**QBK3LWA
155	**200**	**80**	40	199	79	39.5	110	88	6	3.4	0.09	**155**QBK3LA
158	**197**	**95**	47.5	196	94	47	92	103	4	3.4	0.09	**158**QBK3LA
162	**195**	**110**	55	194	109	54.5	75	118	4	3.4	0.09	**162**QBK3LA
162	**200**	**100**	50	199	99	49.5	90	108	4	3.4	0.09	**162**QBK3LA001
167	**225**	**65**	32.5	224	64	32	150	73	6	3.4	0.09	**167**QBK3LA
178	**205**	**135**	67.5	204	134	67	60	143	4	3.4	0.10	**178**QBK3LA
183	**200**	**157**	78.5	199	156	78	33	165	4	3.4	0.10	**183**QBK3LA
184	**260**	**50**	25	259	49	24.5	200	58	6	3.4	0.10	**184**QBK3LA
191	**220**	**140**	70	219	139	69.5	70	148	4	3.4	0.11	**191**QBK3LA
192	**240**	**110**	55	239	109	54.5	120	118	6	3.4	0.11	**192**QBK3LA
200	**271**	**80**	40	270	79	39.5	181	88	6	3.4	0.11	**200**QBK3LWA
205	**240**	**145**	72.5	239	144	72	85	153	4	3.4	0.12	**205**QBK3LA
207	**285**	**70**	35	284	69	34.5	205	78	6	3.4	0.12	**207**QBK3LA
215	**300**	**65**	32.5	299	64	32	225	73	6	3.4	0.12	**215**QBK3LA
221	**270**	**140**	70	269	139	69.5	120	148	6	3.4	0.13	**221**QBK3LA
231	**304**	**104**	52	303	103	51.5	190	112	6	3.4	0.13	**231**QBK3LA
233	**320**	**80**	40	319	79	39.5	230	88	6	3.4	0.13	**233**QBK3LA
250	**350**	**80**	40	349	79	39.5	260	88	6	3.4	0.14	**250**QBK3LA
271	**340**	**150**	75	339	149	74.5	180	158	6	3.4	0.15	**271**QBK3LA
281	**383**	**108**	54	382	107	53.5	265	116	6	3.4	0.16	**281**QBK3LA
313	**433**	**108**	54	432	107	53.5	315	116	6	3.4	0.18	**313**QBK3LA
314	**390**	**185**	92.5	389	184	92	195	193	6	3.4	0.18	**314**QBK3LA

Original item No.: **QBK3LA** (aluminium)
QBK3LIX (stainless steel)

Order example:
spigot, **perforated** for Quadroflex pipe form 3 - 125 x 60 mm with **connection-Ø 100 mm** =**100**QBK3LA (Aluminium)
100QBK3LIX (stainless steel)

Table 5.9

See table 5.9 for number of holes

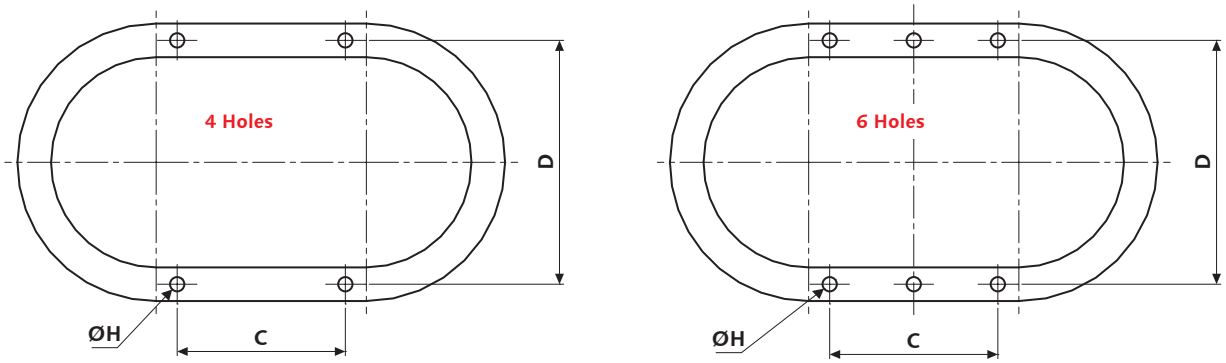


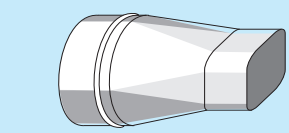
Fig. 5.10

Technical modifications and errors excepted.

Transition of Quadro to round *(excerpt)*

Special production according to drawing and **customer request**.

Materials	stainless steel (standard)	0.5 mm
	Aluminium	1.0 mm



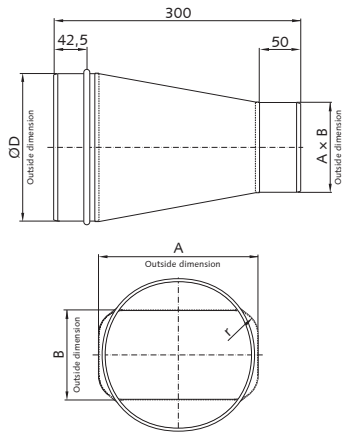


Fig. 5.11

Original item No.:
QUG1IX (stainless steel - standard)
QUG1A (Aluminium)

Order examples:
Transition for Quadroflex pipe form 1
170 × 150 mm with **connection Ø 186 mm**
to **around 180 mm** =
186QUG1IX (stainless steel)
186QUG1A (Aluminium)

Transition for Quadroflex pipe form 1
180 × 140 mm with **connection Ø 186 mm**
to **around 200 mm** =
186QUG1IX**200** (stainless steel)
186QUG1A**200** (aluminium)

Connection of Quadroflex® pipe form 1 to Westercompact pipe					Transition				Weight Transition stainless steel	Item No. (stainless steel standard)
Quadroflex® pipe					Outer dimension					
Connection Ø	Nominal dimension		Nose radius	Westercompact®	A	B	Nose radius	Ø D		
d_a	a	b	R	ØDN			r			
mm	mm	mm	mm	mm	mm	mm	mm	mm	kg/unit	
73	**80**	**50**	15	**75**	79	49	14.5	74	0.33	**73**QUG1IX
75	**90**	**40**	12	**75**	89	39	11.5	74	0.33	**75**QUG1IX
89	**105**	**50**	15	**90**	104	49	14.5	89	0.40	**89**QUG1IX
91	**109**	**41**	6	**90**	108	40	5.5	89	0.41	**91**QUG1IX
92	**100**	**60**	15	**90**	99	59	14.5	89	0.41	**92**QUG1IX
103	**105**	**75**	20	**103**	104	74	19.5	102	0.46	**103**QUG1IX
105	**115**	**60**	10	**103**	114	59	9.5	102	0.46	**105**QUG1IX
110	**125**	**60**	12	**110**	124	59	11.5	109	0.49	**110**QUG1IX
116	**130**	**65**	13	**120**	129	64	12.5	119	0.53	**116**QUG1IX
125	**142**	**70**	15	**125**	141	69	14.5	124	0.56	**125**QUG1IX
126	**170**	**40**	12	**125**	169	39	11.5	124	0.56	**126**QUG1IX
140	**160**	**80**	20	**140**	159	79	19.5	139	0.63	**140**QUG1IX
140	**155**	**85**	20	**140**	154	84	19.5	139	0.63	**140**QUG1IX
151	**170**	**80**	13	**150**	169	79	12.5	149	0.67	**151**QUG1IX
151	**200**	**50**	12	**150**	199	49	11.5	149	0.68	**151**QUG1IX
156	**140**	**120**	15	**155**	139	119	14.5	154	0.70	**156**QUG1IX
159	**155**	**105**	10	**160**	154	104	9.5	159	0.71	**159**QUG1IX
159	**185**	**80**	15	**160**	184	79	14.5	159	0.71	**159**QUG1IX
167	**150**	**140**	30	**160**	149	139	29.5	159	0.74	**167**QUG1IX
				180				179	0.76	**167**QUG1IX**180**
168	**152**	**127**	15	**160**	151	126	14.5	159	0.74	**168**QUG1IX
				180				179	0.76	**168**QUG1IX**180**
174	**220**	**80**	30	**180**	219	79	29.5	179	0.78	**174**QUG1IX
176	**195**	**110**	30	**180**	194	109	29.5	179	0.79	**176**QUG1IX
179	**220**	**90**	30	**180**	219	89	29.5	179	0.80	**179**QUG1IX
181	**220**	**80**	15	**180**	219	79	14.5	179	0.81	**181**QUG1IX
183	**195**	**120**	30	**180**	194	119	29.5	179	0.82	**183**QUG1IX
184	**158**	**146**	15	**180**	157	145	14.5	179	0.83	**184**QUG1IX
184	**195**	**110**	15	**180**	194	109	14.5	179	0.82	**184**QUG1IX
186	**170**	**150**	30	**180**	169	149	29.5	179	0.83	**186**QUG1IX
				200				199	0.84	**186**QUG1IX**200**
186	**180**	**140**	30	**180**	179	139	29.5	179	0.83	**186**QUG1IX**002**
				200				199	0.84	**186**QUG1IX**200001**
189	**195**	**110**	6	**180**	194	109	5.5	179	0.84	**189**QUG1IX
				200				199	0.85	**189**QUG1IX**200**
196	**195**	**145**	30	**200**	194	144	29.5	199	0.88	**196**QUG1IX
199	**262**	**80**	30	**200**	261	79	29.5	199	0.89	**199**QUG1IX
200	**210**	**133**	30	**200**	209	132	29.5	199	0.89	**200**QUG1IX
205	**200**	**150**	30	**200**	199	149	29.5	199	0.91	**205**QUG1IX
212	**210**	**150**	30	**220**	209	149	29.5	219	0.95	**212**QUG1IX
218	**180**	**190**	30	**220**	179	189	29.5	219	0.98	**218**QUG1IX
232	**266**	**126**	30	**224**	265	125	29.5	223	1.03	**232**QUG1IX
				250				249	1.05	**232**QUG1IX**250**
234	**260**	**120**	12	**224**	259	119	11.5	223	1.03	**234**QUG1IX
				250				249	1.06	**234**QUG1IX**250**
237	**267**	**133**	30	**224**	266	132	29.5	223	1.05	**237**QUG1IX
				250				249	1.07	**237**QUG1IX**250**
242	**270**	**140**	30	**250**	269	139	29.5	249	1.09	**242**QUG1IX
246	**304**	**104**	22	**250**	303	103	21.5	249	1.10	**246**QUG1IX
260	**270**	**170**	30	**250**	269	169	29.5	249	1.15	**260**QUG1IX
				280				279	1.18	**260**QUG1IX**280**
268	**270**	**180**	30	**250**	269	179	29.5	249	1.18	**268**QUG1IX
				280				279	1.21	**268**QUG1IX**280**
281	**270**	**200**	30	**280**	269	199	29.5	279	1.26	**281**QUG1IX
307	**270**	**240**	30	**300**	269	239	29.5	299	1.37	**307**QUG1IX
				315				314	1.38	**307**QUG1IX**315**

Table 5.10

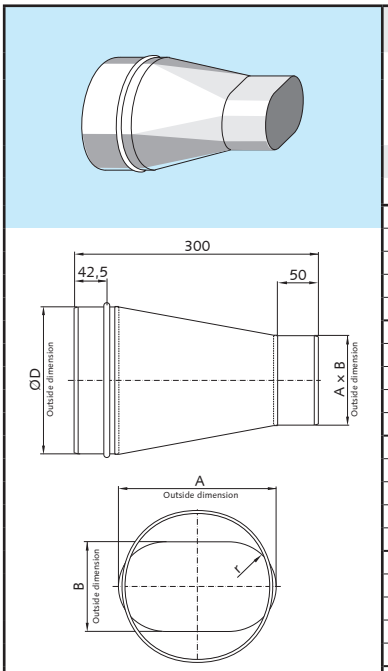


Fig. 5.12

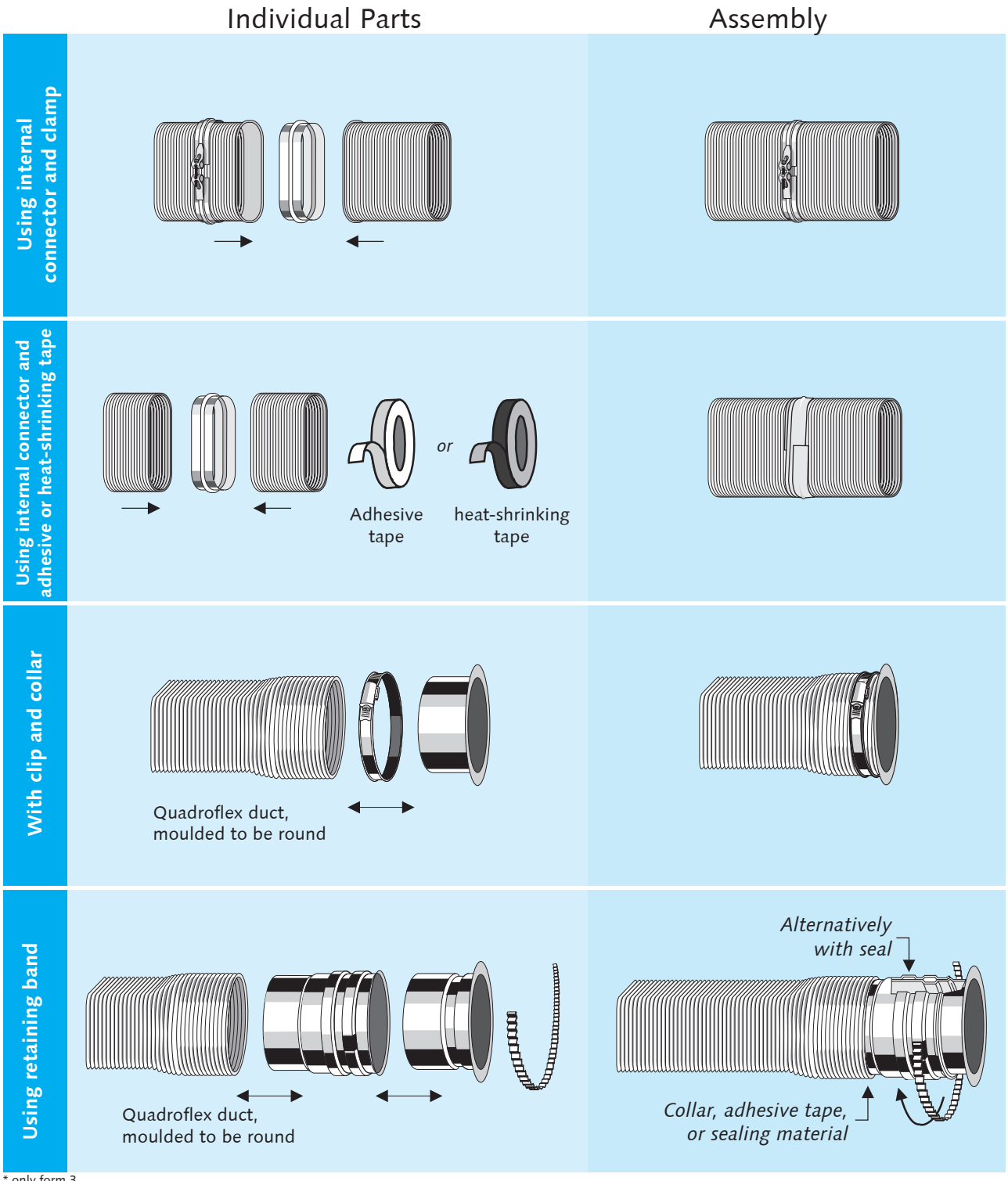
Connection of Quadroflex® pipe form 3 to Westercompact pipe					Transition				Weight Transition stainless steel	Item No. (stainless steel standard)
Quadroflex® pipe				Wester-compact®	Outer dimension					
Connec-tion Ø	Nominal dimension		Nose radius		A	B	Nose radius	Ø D		
d_a	a	b	R	ØDN			r			
mm	mm	mm	mm	mm	mm	mm	mm	mm	kg/unit	
73	**100**	**30**	0.5 x b	**75**	99	29	14.5	74	0.33	**73**QUG3IX
87	**125**	**25**	0.5 x b	**90**	124	24	12	89	0.40	**87**QUG3IX
100	**129**	**52**	0.5 x b	**100**	128	51	25.5	99	0.45	**100**QUG3**W**IX
100	**125**	**60**	0.5 x b	**100**	124	59	29.5	99	0.45	**100**QUG3IX
122	**180**	**25**	0.5 x b	**125**	179	24	12	124	0.55	**122**QUG3IX
123	**150**	**80**	0.5 x b	**125**	149	79	39.5	124	0.56	**123**QUG3IX
125	**158**	**70**	0.5 x b	**140**	157	69	34.5	139	0.58	**125**QUG3**W**IX
136	**182**	**60**	0.5 x b	**140**	181	59	29.5	139	0.62	**136**QUG3IX
140	**205**	**30**	0.5 x b	**140**	204	29	14.5	139	0.63	**140**QUG3IX
149	**187**	**85**	0.5 x b	**150**	186	84	42	149	0.67	**149**QUG3IX
150	**192**	**80**	0.5 x b	**150**	191	79	39.5	149	0.68	**150**QUG3**W**IX
155	**200**	**80**	0.5 x b	**160**	199	79	39.5	159	0.70	**155**QUG3IX
158	**197**	**95**	0.5 x b	**160**	196	94	47	159	0.72	**158**QUG3IX
162	**195**	**110**	0.5 x b	**160**	194	109	54.5	159	0.73	**162**QUG3IX
178	**205**	**135**	0.5 x b	**180**	204	134	67	179	0.80	**178**QUG3IX
183	**200**	**157**	0.5 x b	**180**	199	156	78	179	0.82	**183**QUG3IX
200	**271**	**80**	0.5 x b	**200**	270	79	39.5	199	0.90	**200**QUG3**W**IX
201	**215**	**180**	0.5 x b	**200**	214	179	89.5	199	0.90	**201**QUG3IX
221	**270**	**140**	0.5 x b	**220**	269	139	69.5	219	0.99	**221**QUG3IX
250	**350**	**80**	0.5 x b	**250**	349	79	39.5	249	1.13	**250**QUG3IX
281	**383**	**108**	0.5 x b	**280**	382	107	53.5	279	1.26	**281**QUG3IX
313	**433**	**108**	0.5 x b	**315**	432	107	53.5	314	1.41	**313**QUG3IX
314	**390**	**185**	0.5 x b	**315**	389	184	92	314	1.41	**314**QUG3IX

Original item No.: **QUG3IX** (stainless steel - standard)
QUG3A (aluminium)

Order examples: Transition for Quadroflex pipe form 3 - 129 x 52 mm with **connection-Ø 100 mm** = **100**QUG3**W**IX (stainless steel)
100QUG3**W**A (Aluminium)

Transition for Quadroflex pipe form 3 - 125 x 60 mm with **connection-Ø 100 mm** = **100**QUG3IX (stainless steel)
100QUG3A (Aluminium)

Table 5.11



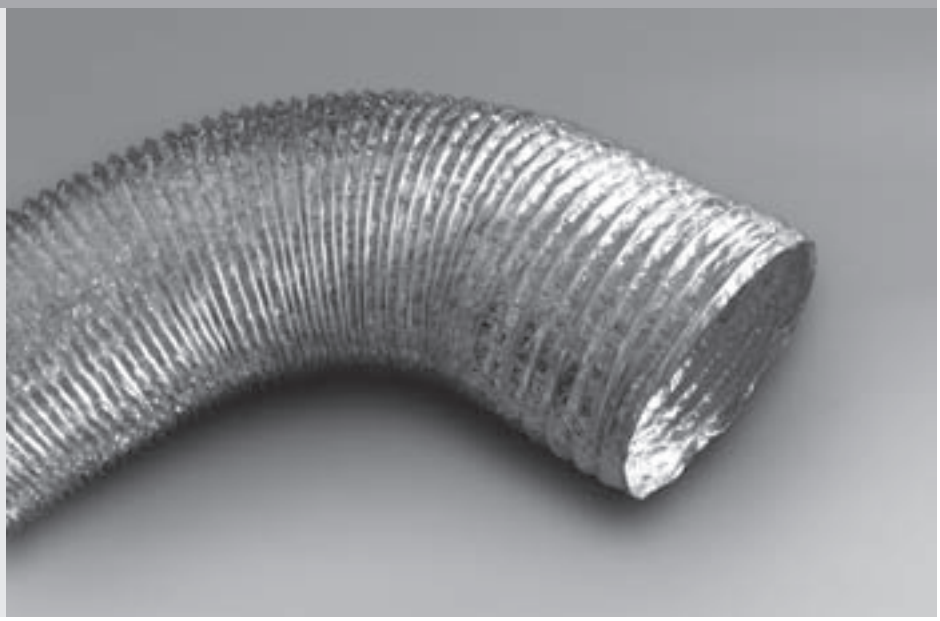
* only form 3

Fig. 5.13

Additional Information

Manufacturing special profiles
perforated Quadroflex® pipes as sound insulation and air outlets
Quadroflex pipes, insulated with various insulating thicknesses and materials as Quadrotherm® (*see page 27*)
preassembled as assembly with moulded parts
Quadroflex production units

6. Quadroquick®



Highly flexible, oval Wire coil hose

Product description

The Quadroquick is a highly flexible pipe, the walls of which consist of aluminium and PE layers. The shape retention is achieved by an interior steel wire coil.

The Quadroquick pipe is expandable and shrinkable at a bending radius of only 0.58 x a i.e. 0.58 x b.

The pipe is used for difficult assembly conditions where the pipe has to be shrunk and expanded at small bending radii.

Technical data

Material:	Aluminium Polyester/ Aluminium
Flexibility/shrinkable:	1:10
Bending radii:	0.58 × a 0.58 x b
Standard length:	10 m
max. operating pressure:	2,500 Pa
max. air flow velocity:	30 m/s
Ø range:	102 - 500 mm
Temperature resistance:	bis +120°C
Fire performance:	S4 according to DIN 5510

Dimensions (excerpt form 3)

Form 3 : oval

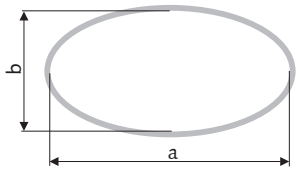


Fig. 6.1

Nominal widths 125 x 60 to 390 x 185 mm
Bending radius R1end-to-end: approx. 0.58 × a
Bending radius R2 flat: approx. 0.58 × b

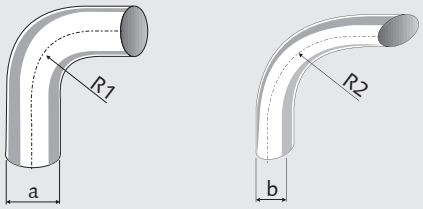


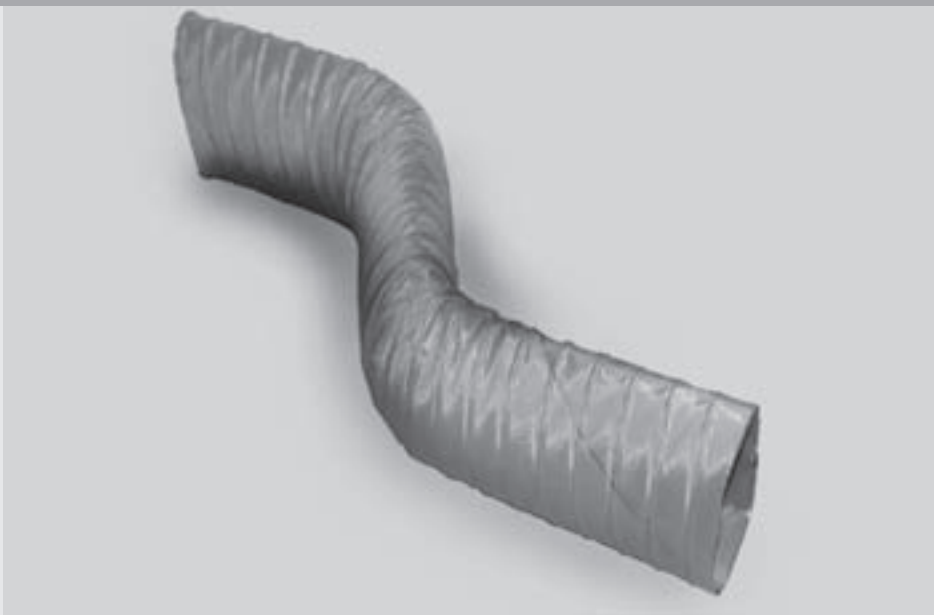
Fig. 6.2

Connection Ø (Inner dimension) mm	a mm	b mm	Weight kg/m
102	125	60	0.212
125	158	70	0.265
152	187	85	0.322
160	195	110	0.339
203	271	80	0.430
229	270	140	0.485
254	350	80	0.538
315	390	185	0.668

Additional dimensions upon request. *Table 6.1*

Technical modifications and errors excepted.

7. Quadroquick M2



Highly flexible, oval Wire coil hose

Product description

The pipe walls consist of neoprene coated fibreglass material for higher pressure and temperature loads.

Ready for installation, the pipes are equipped with connection and transition pieces on both sides or according to the customer's specifications.

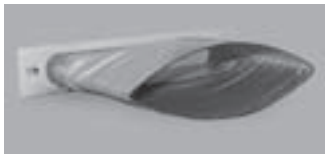


Fig. 7.1

Technical data

Flexibility/shrinkable:	1:4
Bending radii:	1 × a 1 x b
Standard length:	4 m
max. operating pressure:	3,000 - 50,000 Pa
Temperature resistance:	bis +150°C
Fire performance:	B1 according to DIN 4102

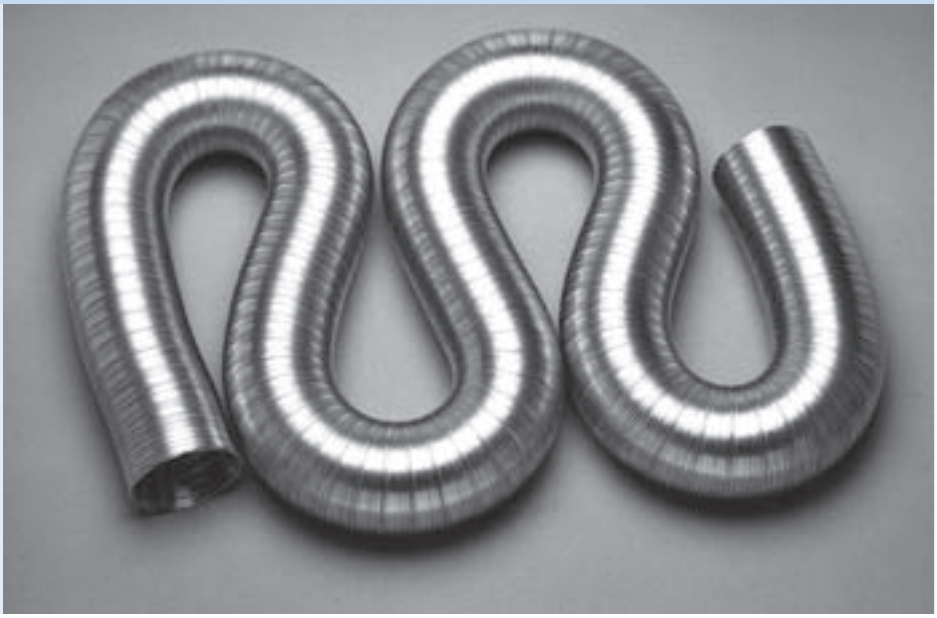
Insulation

Various insulations and insulating thicknesses are also possible, as well as the installation as sound insulation

Fig. 7.2

Fig. 7.3

8. westercompact®



Flexible, shrunk pipes expanded several times

Product description

Westercompact are flexible non-combustible pipes wrapped in foil for the air flow in industry and domestic engineering.

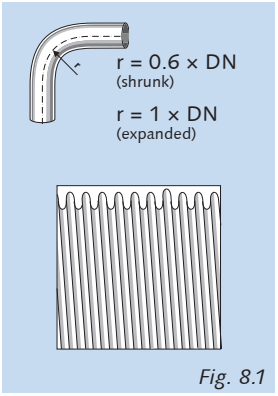
The pipes can be shrunk to a quarter of the manufactured length due to the special position of the seams. The pipe is stretched to the original manufactured length during the assembly.

Technical characteristics, such as the bending radius and peak compressive strength of the Westercompact pipes are differentiated according to DIN EN 13180.

Technical data

Material:	Aluminium *(also available of galvanized steel)*
Design:	DIN EN 13180
Pipe structure:	Grooved Folded spiral-seam pipe of 1 i.e. 2 layers Aluminium
Features:	extremely shrinkable and. expandable, Compression ratio 4:1
Dimensions:	DN 75 - DN 315
Temperature resistance:	bis +200°C
Fire performance:	Non-combustible according to DIN 4102 cl. A1

Bending radius:
(in reference to the centre axis)



Profile:

Fig. 8.1

Application length:	approx. 5 m (expanded)
Delivered forms:	1.25 m (shrunk) in boxes

Application

Personal field

Office buildings, shopping centres, hotels, restaurants, theatres and cinemas: Ventilation, air conditioning systems, air-forced heating systems.

Sanitary area

hospitals, therapy centres, schools, indoor swimming pools: Ventilation, air conditioning systems, air-forced heating systems.

Industry and research

Production buildings, warehouses, laboratories, power plants, research facilities: Ventilation, air conditioning, air discharge and air extraction systems for gases, steams or dusts as surface, spot and room extraction, shuttering, decoration, drying plants

Dimensions

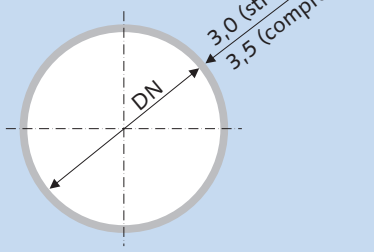


Fig. 8.2

Nominal diameter DN (Inner dimension)	Friction coefficients ζ Radius r		Cross-section A	Weight
mm	45°	90°	mm²	kg/m
55	0,3	0,5	2,376	0.1440
63	0.3	0.5	3,117	0.1650
70	0.3	0.5	3,848	0.1833
71	0.3	0.5	3,959	0.1859
75	0.3	0.5	4,418	0.1964
80	0.3	0.5	5,027	0.2095
90	0.3	0.5	6,362	0.2346
100	0.3	0.5	7,854	0.2597
103	0.3	0.5	8,332	0.2675
110	0.3	0.5	9,503	0.2846
112	0.3	0.5	9,852	0.2898
120	0.3	0.5	11,310	0.3104
125	0.3	0.5	12,272	0.3228
130	0.3	0.5	13,273	0.3358
140	0.3	0.5	15,394	0.3616
150	0.3	0.5	17,671	0.3874
155	0.3	0.5	18,869	0.4003
160	0.3	0.5	20,106	0.4132
180	0.3	0.5	25,447	0.4649
200	0.3	0.5	31,416	0.5165
220	0.3	0.5	38,013	0.5707
224	0.3	0.5	39,408	0.5811
250	0.3	0.5	49,087	0.6457
280	0.3	0.5	61,575	0.7232
300	0.3	0.5	70,686	0.7748
315	0.3	0.5	77,931	0.8135
350	0.3	0.5	96,211	0.9039
355	0.3	0.5	98,980	0.9168
400	0.3	0.5	125,664	1.0330
450	0.3	0.5	159,043	1.1621
500	0.3	0.5	196,350	1,2913

Table 8.1

Tolerances

Length tolerances [mm]											
Length [mm]		up to 50	up to 100	up to 200	up to 300	up to 500	up to 800	up to 1000	up to 2000	up to 3000	up to 25000
DN [mm]	up to 10	± 2	± 3	± 3	± 4	± 4	± 5	± 6	± 10	± 20	± 200
	up to 50	± 2	± 4	± 4	± 6	± 6	± 7	± 8	± 12	± 22	± 220
	up to 100	± 3	± 5	± 6	± 7	± 7	± 8	± 9	± 13	± 23	± 230
	up to 200	± 4	± 7	± 7	± 8	± 8	± 9	± 10	± 14	± 24	± 240
	up to 300	± 6	± 9	± 9	± 10	± 10	± 11	± 12	± 16	± 26	± 260
	up to 400	± 8	± 11	± 11	± 12	± 12	± 13	± 14	± 18	± 28	± 280
	up to 560	± 10	± 13	± 13	± 14	± 14	± 15	± 16	± 20	± 30	± 300

Table 8.2a

Diameter tolerances [mm]	
DN [mm]	**Tolerance** [mm]
up to 62	+ 1.0 / 0
up to 140	+ 1.0 / 0
up to 224	+ 1.5 / 0
up to 400	+ 2.0 / 0
up to 500	+ 2.5 / 0

Table 8.2b

Longitudinal attenuation

Tabelle 8.3

Description	Material	Item No.	Longitudinal attenuation D in dB/m Qktave band centre frequency in Hz							
			63	125	250	500	1000	2000	4000	8000
Westercompact	Aluminium	**100COMPD**	0.9	0.5	0.6	0.2	0.5	0.6	0.8	1.0

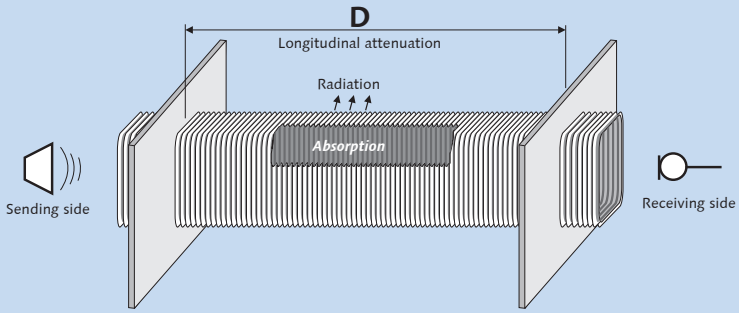


Fig 8.3

Technical modifications and errors excepted.

Clamp

for connecting
Westercompact pipe profiles.

Dimension ØDN see table 8.4

Fig. 8.4

Plug connection

for connecting the pipes. Produced according to drawing and **customer request**.

Material: Stainless steel 0.5 mm

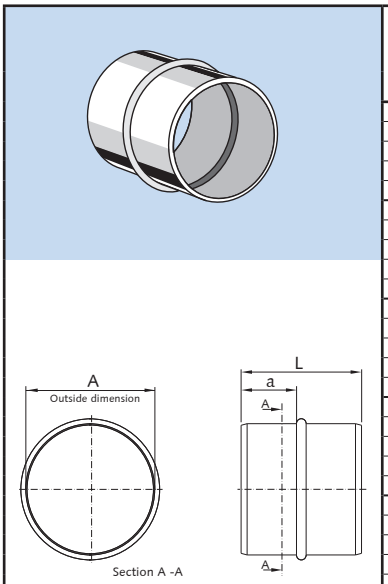


Fig. 8.5

Nominal diameter DN mm	ØA (Outer dimensions) mm	a mm	L mm	Weight of stainless steel kg/Stück	Article-No.
55	54			0.06	**55**STVIX
63	62			0.07	**63**STVIX
71	70			0.07	**71**STVIX
75	74			0.08	**75**STVIX
80	79			0.08	**80**STVIX
90	89			0.09	**90**STVIX
100	99			0.10	**100**STVIX
103	102			0.11	**103**STVIX
110	109			0.11	**110**STVIX
112	111	40	85	0.12	**112**STVIX
120	119			0.13	**120**STVIX
125	124			0.13	**125**STVIX
130	129			0.14	**130**STVIX
140	139			0.15	**140**STVIX
150	148.5			0.16	**150**STVIX
155	153.5			0.16	**155**STVIX
160	158.5			0.17	**160**STVIX
180	178.5			0.19	**180**STVIX
200	198.5			0.21	**200**STVIX
220	218.5			0.39	**220**STVIX
224	222.5			0.40	**224**STVIX
250	248.5			0.45	**250**STVIX
280	278.5			0.50	**280**STVIX
300	298.5			0.54	**300**STVIX
315	313.5	70	145	0.56	**315**STVIX
350	348			0.63	**350**STVIX
355	353			0.64	**355**STVIX
400	398			0.72	**400**STVIX
450	448			0.81	**450**STVIX
500	498			0.90	**500**STVIX

Table 8.4

spigot

for connecting the pipes. Produced according to drawing and **customer request**. Material: Stainless steel 0.5 mm

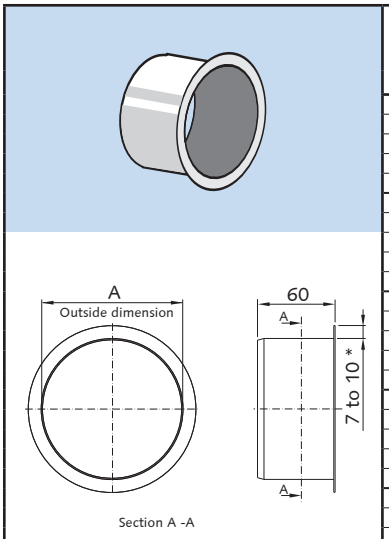


Fig. 8.6

Nominal diameter DN mm	ØA (Outer dimensions) mm	Weight of stainless steel kg/Stück	Article-No.
55	54	0.04	**55**BKIX
63	62	0.05	**63**BKIX
70	69	0.06	**70**BKIX
71	70	0.06	**71**BKIX
75	74	0.06	**75**BKIX
80	79	0.07	**80**BKIX
90	89	0.07	**90**BKIX
100	99	0.08	**100**BKIX
103	102	0.08	**103**BKIX
110	109	0.09	**110**BKIX
112	111	0.09	**112**BKIX
120	119	0.10	**120**BKIX
125	124	0.10	**125**BKIX
130	129	0.11	**130**BKIX
140	139	0.12	**140**BKIX
150	148.5	0.12	**150**BKIX
155	153.5	0.13	**155**BKIX
160	158.5	0.13	**160**BKIX
180	178.5	0.15	**180**BKIX
200	198.5	0.17	**200**BKIX
220	218.5	0.18	**220**BKIX
224	222.5	0.18	**224**BKIX
250	248.5	0.21	**250**BKIX
280	278.5	0.23	**280**BKIX
300	298.5	0.25	**300**BKIX
315	313.5	0.26	**315**BKIX
350	348	0.29	**350**BKIX
355	353	0.29	**355**BKIX
400	398	0.33	**400**BKIX
450	448	0.37	**450**BKIX
500	498	0.41	**500**BKIX

Tabelle 8.5

See table 8.6 for number of holes

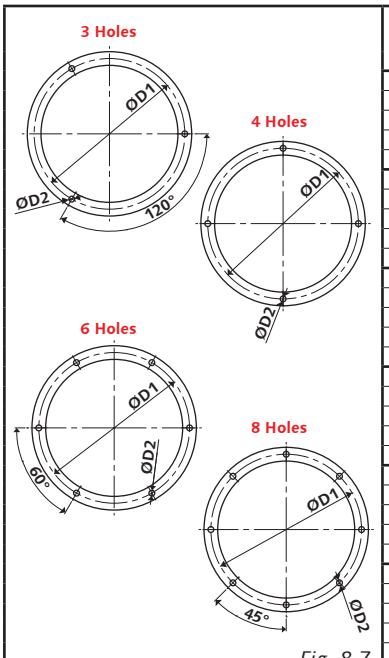


Fig. 8.7

Nominal diameter DN mm	Circular scale ØD1 mm	ØD2 mm	Number of holes	Article-No.
55	63	3.4	3	**55**BKLIX
63	71	3.4	3	**63**BKLIX
71	79	3.4	3	**71**BKLIX
70	78	3.4	3	**70**BKLIX
75	83	3.4	3	**75**BKLIX
80	88	3.4	3	**80**BKLIX
90	104	3.2	8	**90**BKLIX
100	110	4.2	4	**100**BKLIX
103	111	3.4	3	**103**BKLIX
110	118	3.4	3	**110**BKLIX
112	120	3.4	3	**112**BKLIX
120	128	3.4	3	**120**BKLIX
125	133	3.4	3	**125**BKLIX
130	138	3.4	3	**130**BKLIX
140	150	3.2	8	**140**BKLIX
150	161.5	4.2	8	**150**BKLIX
155	163	3.4	3	**155**BKLIX
160	168	3.4	3	**160**BKLIX
180	188	3.4	3	**180**BKLIX
200	208	3.4	4	**200**BKLIX
220	228	3.4	4	**220**BKLIX
224	232	3.4	4	**224**BKLIX
250	258	3.4	4	**250**BKLIX
280	288	3.4	4	**280**BKLIX
300	308	3.4	6	**300**BKLIX
315	323	3.4	6	**315**BKLIX
350	358	3.4	6	**350**BKLIX
355	363	3.4	6	**355**BKLIX
400	408	3.4	8	**400**BKLIX
450	458	3.4	8	**450**BKLIX
500	508	3.4	8	**500**BKLIX

Table 8.6

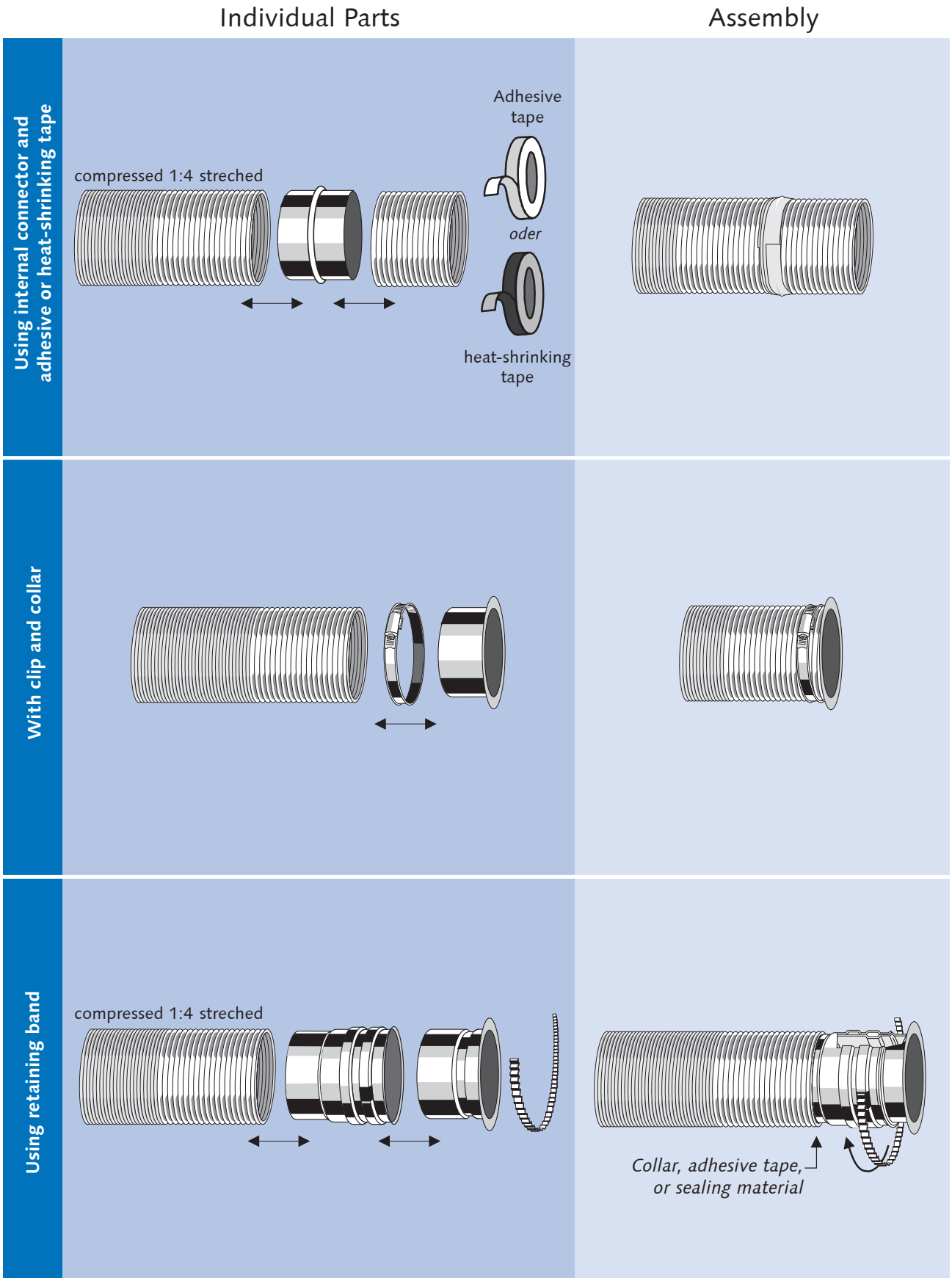


Fig. 8.8

Technical modifications and errors excepted.

Introduction

WESTAFLEX offers solutions for channelling the air in the most diverse railroad vehicles with multiple versions of pipe and component systems.

The combination of flexible pipe systems with rigid ducts uses the existing space optimally and cost-effectively.

The hygienic requirements for the ventilation technology, especially for passenger transportation in railroad vehicles, become increasingly more demanding.

The ducting hereby represents an important component in addition to the ventilation units.

The restricted installation space in railway vehicles is a special task for the designer when designing and planning the air conditioning system with ducting.

The optimal use of the existing spaces is a decisive criterion to supply the required air volumes with reduced noise, low pressure losses to the passenger compartments.

This consistent use of the installation situation is possible with Quadroflex pipes.

The Westaflex production process allows the production of random pipe sections that fit the existing installation space. Extensive requirements of the air conditioning technician regarding the required flow cross-section and the optimal dimension are fulfilled by the production of Quadroflex pipes with various side lengths.

The excellent bendability of the Quadroflex pipes allows an impact-free design of the air ducts without any additional moulded parts. Line lengths of up to 5 m without an impact point are possible.

The precise measurement of the air ducts can be omitted, since the ducts can be adjusted directly with a blade during the assembly.

Prefabricated, i.e. pipes cut with a round end shape or prevent, are also available from the plant. All profile forms of the flexible and multiangular pipes are completed with any insulating thicknesses and insulating materials. The insulation of the air ducts can also serve as a sound insulated line and as protection against energy losses.

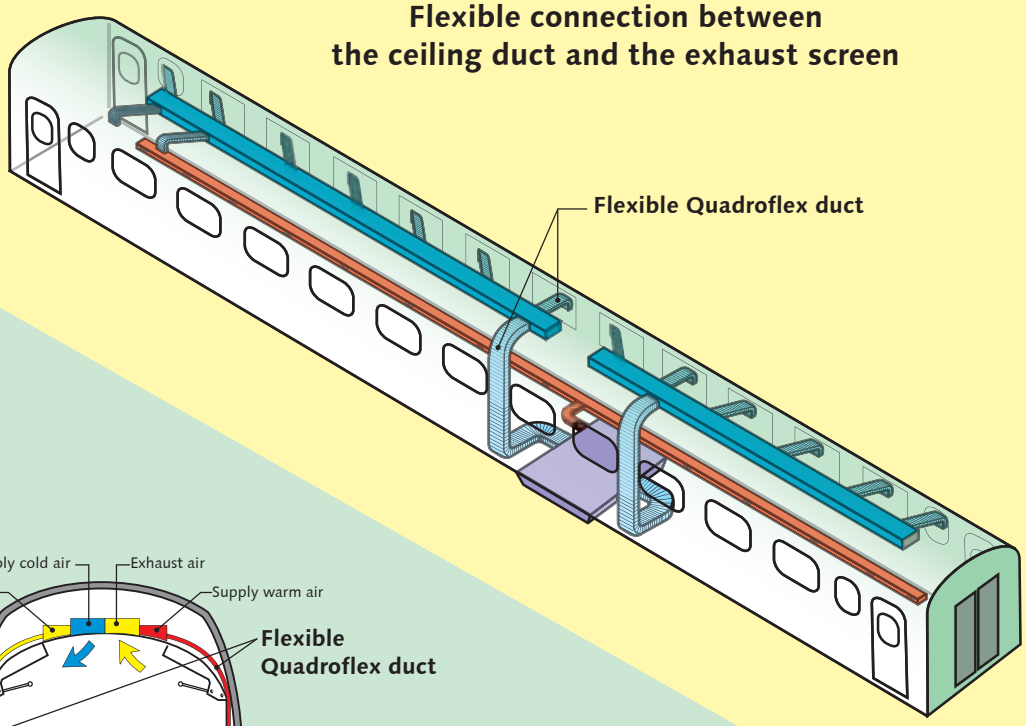
According to the acoustic sound insulating properties of the line or the climate requirements of the insulation, insulating thicknesses of 5 - 100 mm are preferably produced as complete line element. Mineral fibres, as well as fabric insulating materials and synthetic rubber are used.

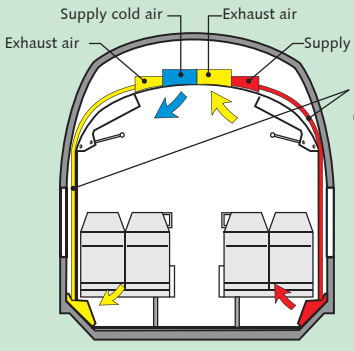
3,000 railway vehicles in Europe are already equipped with this new type of line system.

The Japanese car assembly also has been using the advantageous application of flexible multiangular pipes in the meantime. Not only the reduced weight in comparison to the rigid pipe systems of more than 60% is decisive, but also the cost-reduction for the buyer.

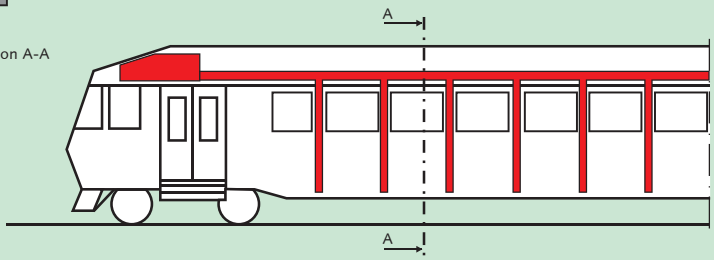
Especially the assembly cost reduction is a decisive advantage when using flexible multiangular air ducts.

Flexible connection between the ceiling duct and the exhaust screen

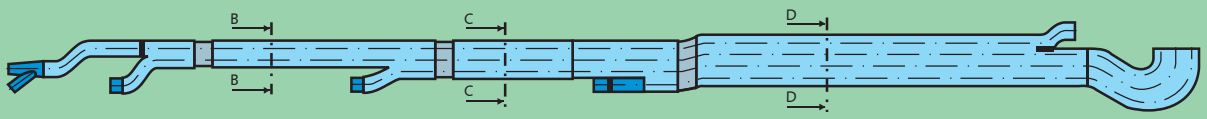




Cross section A-A



Premounted ceiling duct Insulated Quadroflex pipeline



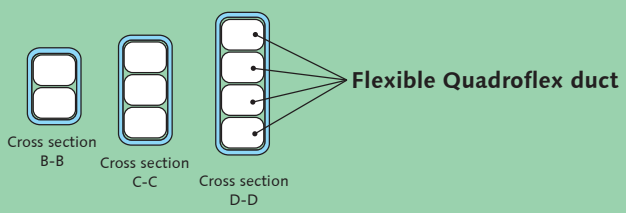
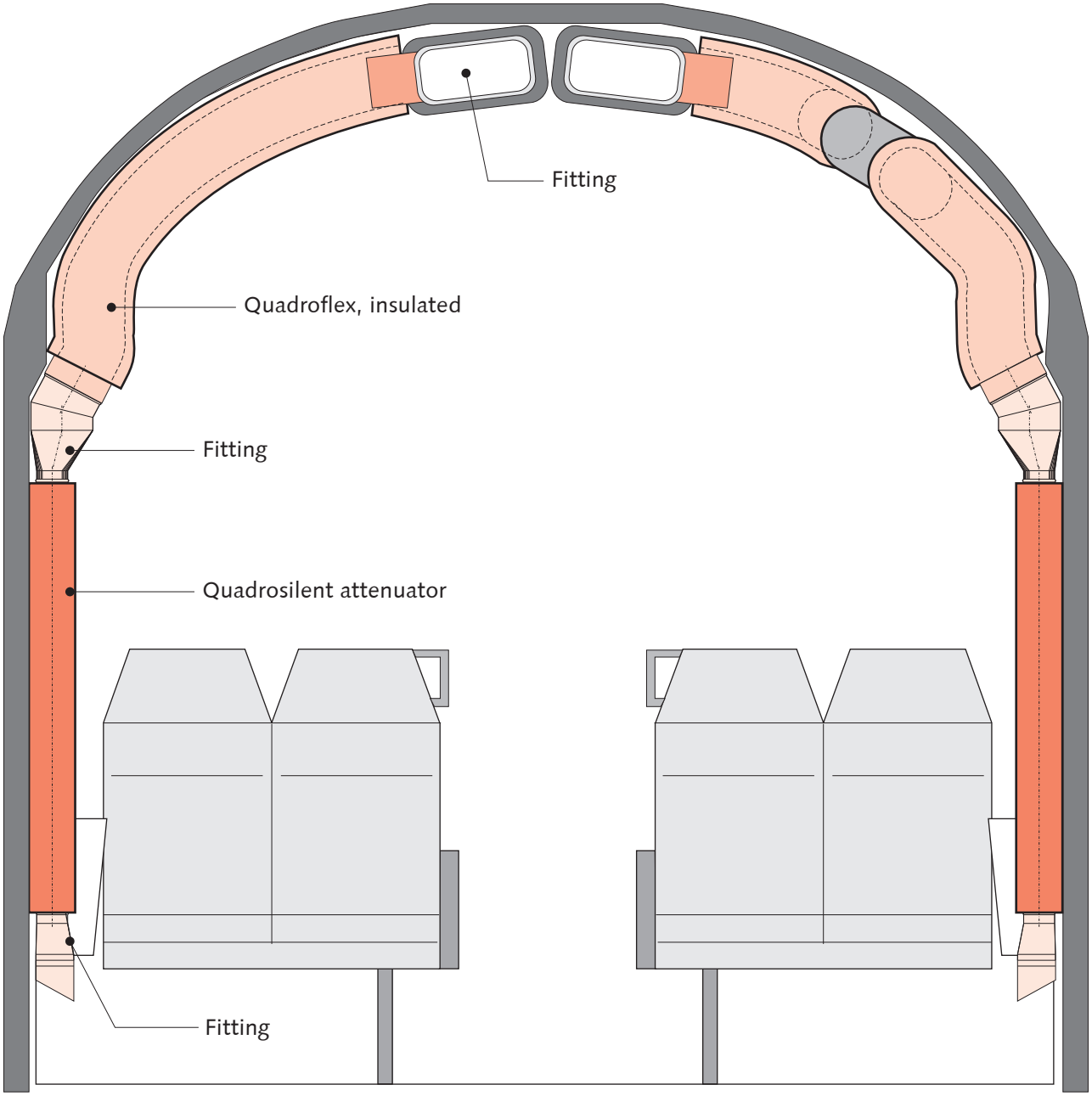


Fig. 9.1

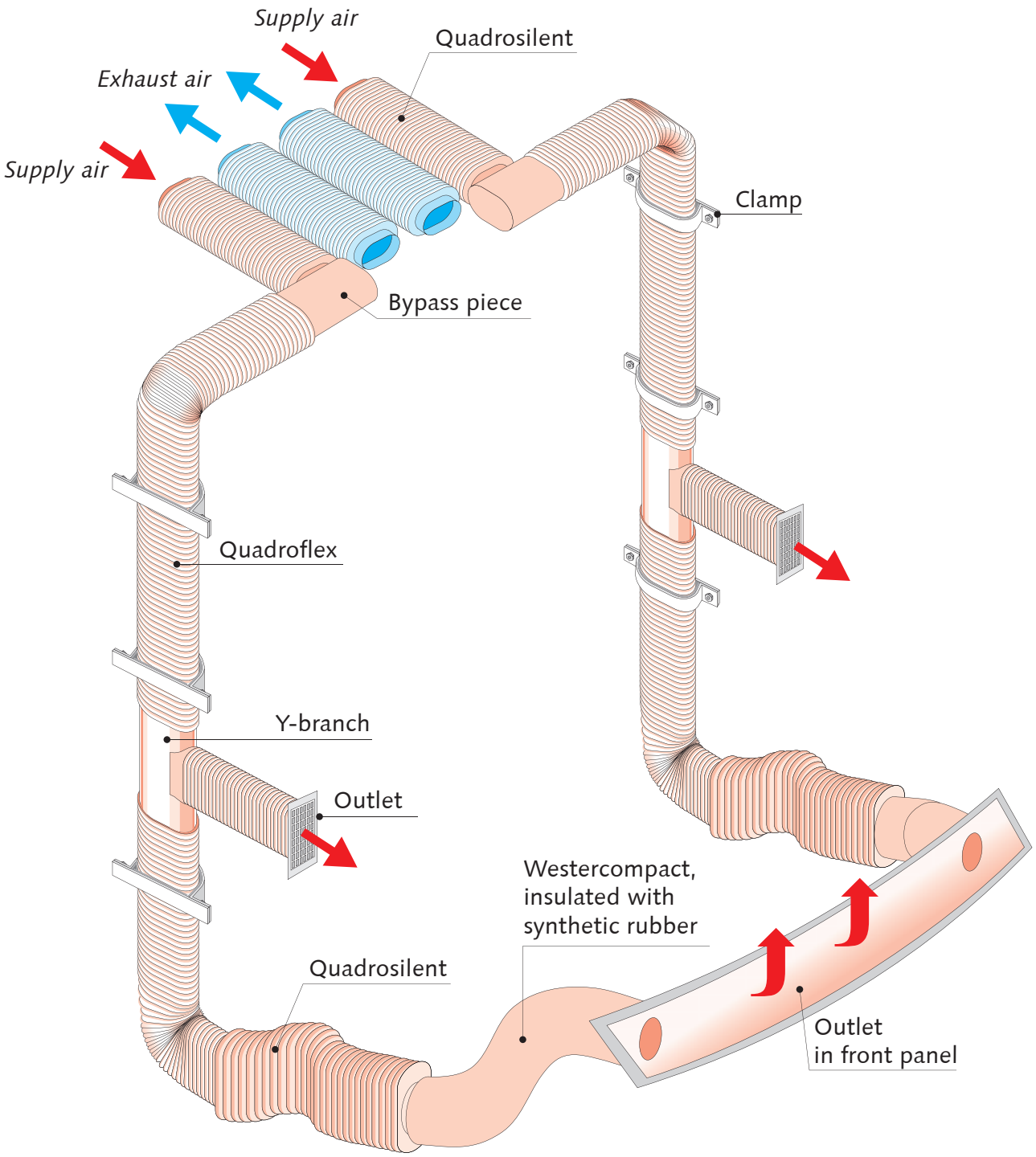
Technical modifications and errors excepted.



Duct installation situation
Westaflex - Duct System

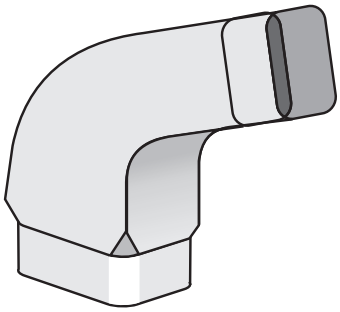
Cross section of rail vehicle

Fig. 9.2

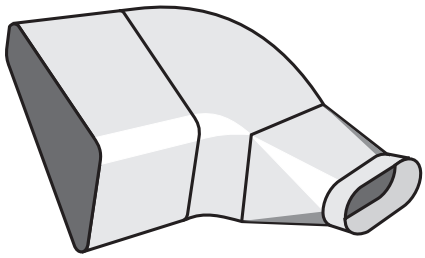


Technical modifications and errors excepted.

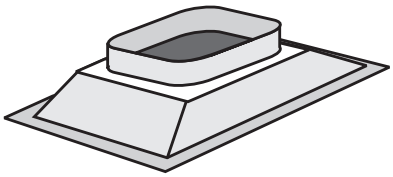
Fig. 9.3



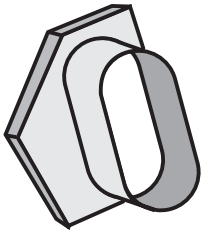
Fresh air duct



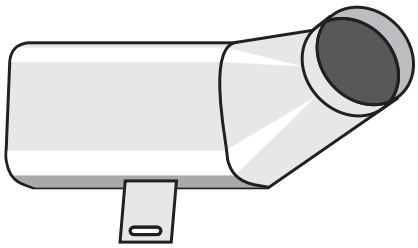
Connecting piece A



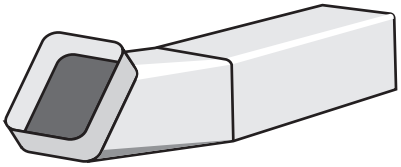
Discharge hood



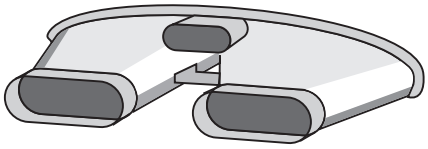
Pipe connection



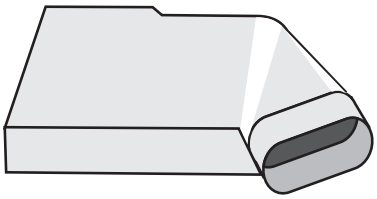
Connecting duct



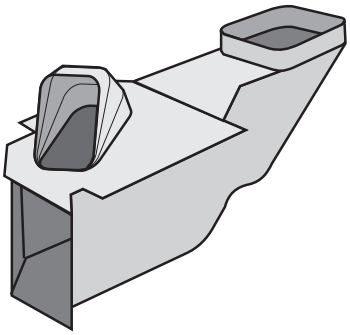
Connecting piece B



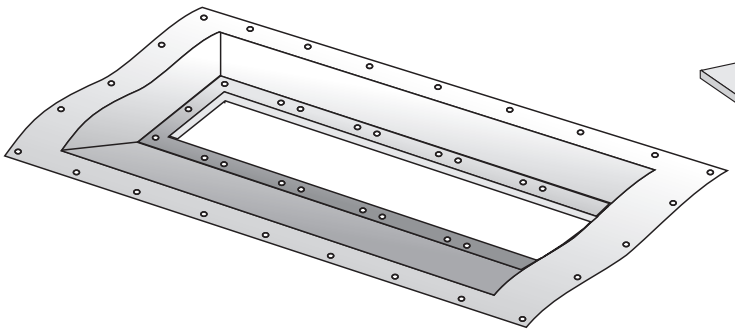
Air duct connection



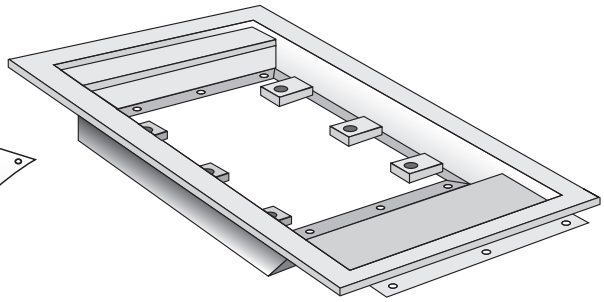
Connecting piece C



Connecting piece D



Frame for
air induction



Frame for
Outgoing air grate

Fig 9.4

Duct systems

Various railroad vehicles with various applications and operating requirements demand a multi-purpose pipe system for the ventilation routing.

Flexible pipe systems can therefore be used as ready-to install assembly for the length of the car. Rigid pipe systems with low installation quick connections can also be selected in the most diverse installation forms.

The combination of flexible pipe systems with rigid ducts is frequently the best solution.

Material and insulation of the components are designed according to the application.

Fig. 9.5: Air supply distributor (Siemens Vienna)

Fig. 9.6: Air conditioning duct

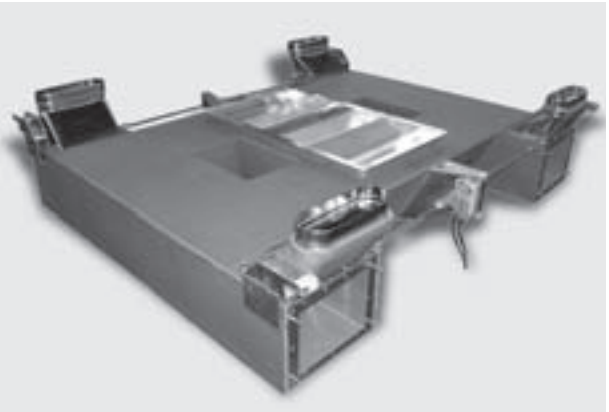


Fig. 9.7: Air diffuser (Siemens Vienna, Israel project)

Acoustic components and air diffusers

The acoustic requirements must be especially observed in addition to the flow-technical requirements on ventilation components.

The components can therefore also be designed as sound insulation in addition to their task for air distribution and flow deflection.

The walls of the ventilation components are fitted with matching absorber materials for the various sound insulating design.

Depending on the assembly space and the frequency spectrum of the noise interference, absorber materials can also be omitted by using micro-perforated materials.

Fig. 9.8: Roof duct

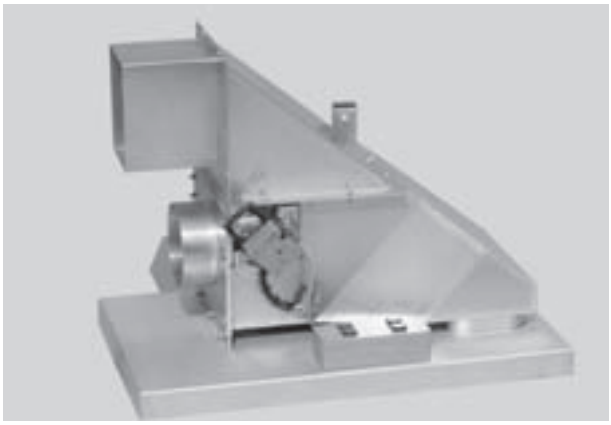


Fig. 9.9: Ventilation damper

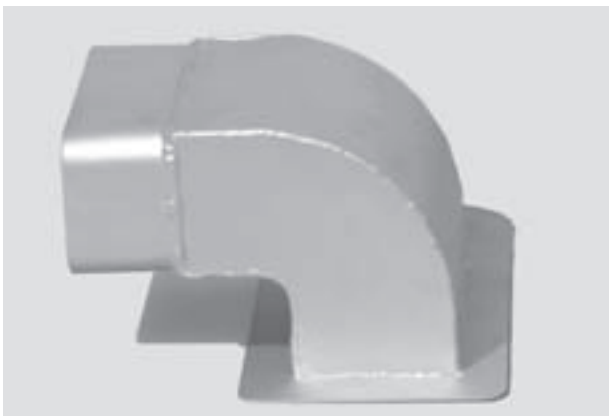


Fig. 9.10: Pipe elbow

Composite compensators and bellows

Compensators and bellows are ready-to install flexible connecting elements that are used as air channelling in pipes to absorb axial and radial movements.

They absorb vibrations and prevent noise transmissions. Low installation heights and a low weight offer an easy assembly, even when installing between assembly parts with various cross-section geometries.

The specific use determines the selection of the suitable material and connecting type:

Frequently used Materials	Medium	temperature	Fire perform-ance
Nomex fabric with PU coating	Air	up to 70 °C	flame-retardant
Nomex fabric with silicone coating	Air	up to 200 °C	S4 according to DIN 5510

Table 9.1

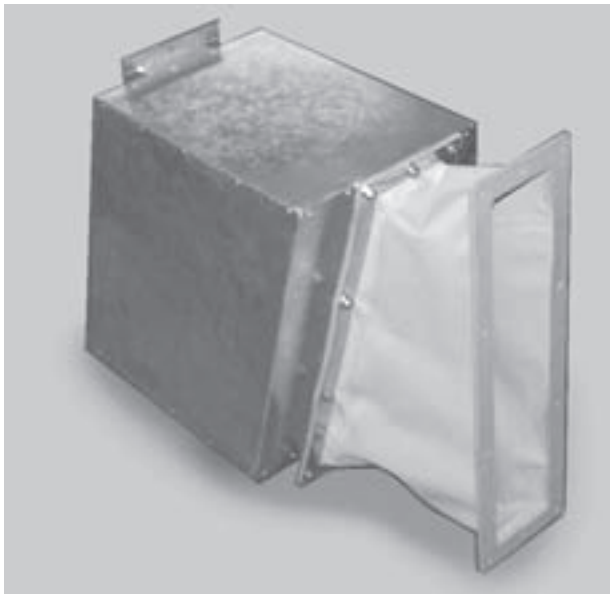


Fig. 9.11: Cylindrical attenuators with compensator, driver`s compartment area

Fig. 9.12: Heat insulating compensator

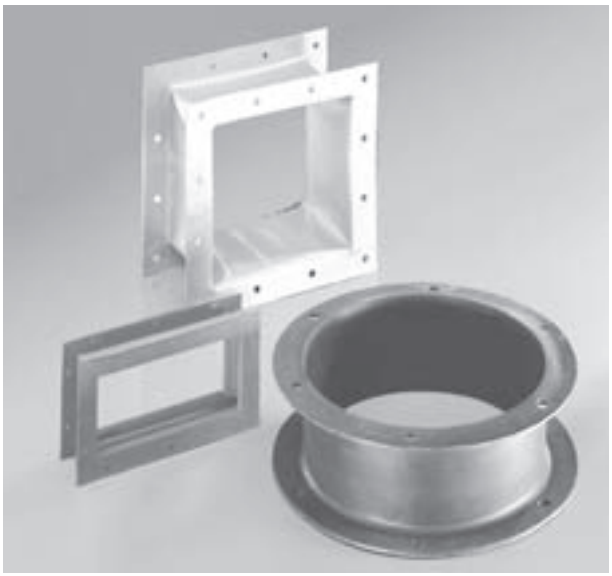


Fig. 9.13 Compensators for air conditioning ducts

Air exhausts and exhaust grates

Exhaust elements can be designed and manufactured cost-effectively according to order due to modern machinery.

Flow technical data will be determined in our test stand.

Fig. 9.14: Exhaust air grate - oval

Fig. 9.15: Exhaust air grating - round

Fig. 9.16: Air outlet with adjustable shutters

Fig. 9.17: Adjustable air outlet

Germany			
Customer	**Plant**	**Project**	**Assembly parts/components**
ALSTOM LHB GmbH	Salzgitter		Flexible pipes, Quadroflex pipes, var. fastening and connecting parts for pipes
Bombardier Transportation GmbH	Aachen	Talent NSB VIRM	var. Preformed metal parts (stainless steel, aluminium, galvanized steel), Quadroflex pipes
	Bautzen	Frankfurt Bogestra Rotterdam Dortmund Dresden Valencia, Bremen, Lodz RNB	Air ducts, flexible pipes, Quadrosilent sound insulation, var. fastening and connecting parts for pipes and sound insulation, plenum chambers, preformed metal parts
	Berlin		Quadrosilent sound insulation, var. fastening and connecting parts for pipes and sound insulation
	Görlitz	Double-decker train A-units and centre trailers	var. sound insulation units - duct joints, var. metal parts (stainless steel, aluminium, galvanized steel), connecting ducts
		ICNeiTech	Frames for outgoing air grates, frames for air induction, Acoustic cone (high and low tones)
		Double-decker Electric motor train	sound insulation unit - duct joint, var. preformed metal parts (stainless steel, aluminium, galvanized steel), air flaps, flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, var. fastening and connecting parts for pipes and sound insulation
	Hennigsdorf	Subway Munich Itino Odenwald	Throttle valves, plenum chambers with and without air flaps, Quadrosilent sound insulation, mufflers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), var. fastening and connecting parts for pipes and sound insulation, insulated flexible pipes
	Mannheim		Quadrosilent sound insulation, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), var. fastening and connecting parts for pipes and sound insulation
Deutsche Bahn AG	Berlin		flexible pipe, sound insulation, Quadroflex pipes, throttle valves
	Minden		Exhaust air valves, sound insulation, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), flexible pipes
	Wittenberge	Subsequent climatization Double-decker cars	Quadroflex pipes, duct joints var. fastening and connecting parts for Quadroflex pipes
Faiveley Transport GmbH	Schkeuditz	RET TGV / AGV VIRM	Quadroflex ducts, flexible pipes, Quadroflex pipes, grating, sound insulation, var. fastening and connecting parts for pipes and sound insulation, frames for air intake, Quadrosilent sound insulation
	Holysovicz	RET TGV / AGV VIRM	
Siemens AG	Krefeld		Duct connection, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), Flexible pipes, Quadrosilent sound insulation, var. fastening and connecting parts for pipes and sound insulation
Qantos GmbH	Weiden		Air diffusers, Quadrotherm pipes
VIS, Verkehrs Industrie Systeme	Halberstadt	DB Autozug Couchette car	complete air conditioning ducts, adjustable and remote controlled air exhausts, bellows, compensators, flexible pipes, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), sound insulation

Foreign European countries			
Customer	**Plant**	**Project**	**Assembly parts/components**
Alstom	Valencienne - France	Metro Budapest	Quadrosilent sound insulation, Quadroflex pipes, Westersilent sound insulation, compact pipes, var. fastening and connecting parts for pipes and sound insulation
Alstom Konstal	Chorzów - Poland	Metro Budapest	Quadrosilent sound insulation, Quadroflex pipes, Westersilent sound insulation, compact pipes, var. fastening and connecting parts for pipes and sound insulation
Ansaldobreda S.P.A.	Pistoia - Italy		flexible pipes, Quadroflex pipes
Bombardier Transportation	Pratteln Switzerland Plant	Double-decker train IC2000	Sound insulation unit - duct joint, diffuser, flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation
	Derby - England		var. Metal stampings (aluminium), Quadroflex pipes
	Bruges - Belgium	Tram Brussels Double decker train Belgium	Quadroflex pipe, metal stamping parts, air ducts, var. fastening material
	Villeneuve - Switzerland	INNOVA	Quadroflex pipes, var. fastening and connecting parts for pipes, Flexible pipes, var. metal stamping parts (aluminium)
	Vienna - Austria	Manchester Palermo Porto U6, Vienna	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation var. fastening and connecting parts for pipes and sound insulation
Faiveley NSF	Marcq-en-Baroeul Cedex - France	RET Rotterdam	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation var. fastening and connecting parts for pipes and sound insulation
Irati	Handaye - France		Quadroflex pipes, var. fastening and connecting parts for pipes and sound insulation, compensators
Liebherr Transportation Systems	Vienna - Austria		Diffuser, flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation
MERAK Systemas Integrados	Getafe - Madrid		Quadroflex pipes, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
Metal Artois	Arras Codex		Quadrotherm, var. fastening and connecting parts for pipes and sound insulation
Railtech	New Delhi - India	Indian Rail	Quadroflex pipes, compact pipes
Saira	Villafranca - Italy	ULF	Quadrotherm, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), air diffuser sound insulation
Shanghai Faiveley Railwac Technologie			Quadroflex pipes
Siemens NV/SA	Brussels	Double-decker train Belgium	Quadroflex pipes, piping offset, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
Siemens Transportation Systems	Vienna - Austria	Subway Vienna	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), bellows
		Metro MelbourneBayside	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
		ERL Malaysia	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
		ULF V car	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), Plenum chambers, air vent
		ÖBB Railjet	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), Ceiling ducts
		Israel	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel), Air supply - circulating air diffusers, heating ducts
		Oslo	Flexible pipes, Quadroflex pipes, Quadrosilent sound insulation, sound insulation, var. fastening and connecting parts for pipes and sound insulation, Air diffusers, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
Skoda Dopravni	Plzen - Czech Republic		Quadroflex pipes, var. fastening and connecting parts for pipes and sound insulation
SNCF	EIMM, Romilly	Refco-Projekt	Quadroflex pipes, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
Stadler	Bussnang - Schweiz	Algerien	Quadrotherm, var. fastening and connecting parts for pipes and sound insulation, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)
Vossloh-Kiepe GesmbH	Wien - Österreich		filter fan units, roof offset case, air deflector, fresh air and ceiling outlet, fresh air duct, var. Preformed metal parts (stainless steel, aluminium, galvanized steel)

Technical modifications and errors excepted.

● Laser cutting system Trumpf 2200 W Programming station TOPS	Working range: Material thickness:	2,500 × 1,250 mm St up to 15 mm VA up to 6 mm Aluminium up to 4 mm
TruLaser 2525; 4000 W	Working range: Material thickness:	2,500 × 1,250 mm St up to 20 mm VA up to 10 mm Aluminium up to 5 mm
● CNC Blechbearbeitungszentrum TRUMATIC 5000 R Stamping, nibble, remould	Working range: Material thickness:	2,500 × 1,280 mm max. 8 mm
● CNC folding press	125 t; 2.5 m	
● Folding press	80 t; 2.5 m	
● CNC swing folding machine	2.5 m; material thickness 5 mm	
● Motorized swing folding machine	2.5 m; material thickness: 2.5 mm	
● Glass bead shot blasting machine	2 m × 1 m (blasting surface)	
● Welding stations WIG Longitudinal seam automatic WIG welding machine Resistance spot welders	Length 1,100 mm; DN 80 - 800	
● 3 roller circular bending machines	2.0 m; material thickness 1.5 - 3.0 mm 1.25 m; material thickness 1.25 mm	
● 4 roller circular bending machines	1.1 m; material thickness 1.5 mm	
● Cut-to-length lines	3.5 t; 1100 x 1.5 mm 2.0 t; 600 x 1.5 mm	
● Guillotine plate shears	1.63 m wide; material thickness 2 mm 2.0 m wide; material thickness 3 mm	
● Hydraulic guillotine shears	3 m wide; material thickness 6 mm	
● Hydraulic drawing press	100 t and 30 t	
● Expansion fixture	DN 63 - 500	
● CNC machining centre	900 × 400 × 500 mm	
● CNC turning	Ø430 × 1,100 mm	
● Automatic band saw	Ø260 mm	

westaflex **achievements**

- Project-oriented solutions
- Developing and manufacturing according to customer specifications
- Designing
- Testing
- Prototype production
- Characteristic curve measurements
- Installation coordination
- Consideration of energetic aspects

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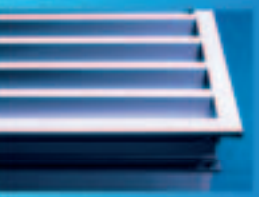
Round, flexible pipes, sound insulation and insulated pipes



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