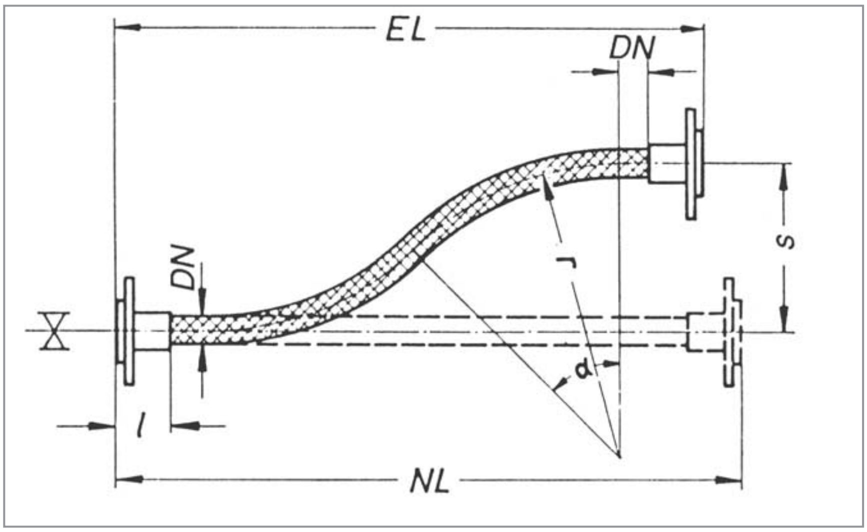
Typical Cases Calculations

Absorption of Lateral Deflection without Movement

Determination of hose length. Installation in S-shape, only static demands, not for axial movements or vibrations.



s = axis deflexion [mm]
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
α = bend angle [°]
l = length of connecting component [mm]
DN = nominal hose size [mm]
EL = installation length [mm]
NL = nominal length [mm]

- Bend angle α for hoses with braiding: max. 45°

$$NL = [(r \cdot \pi \cdot \alpha)/90] + 2(l + DN)$$
$$EL = 2r \cdot \sin\alpha + 2\ (l + DN)$$
$$s = 2r(1 - \cos\alpha)$$

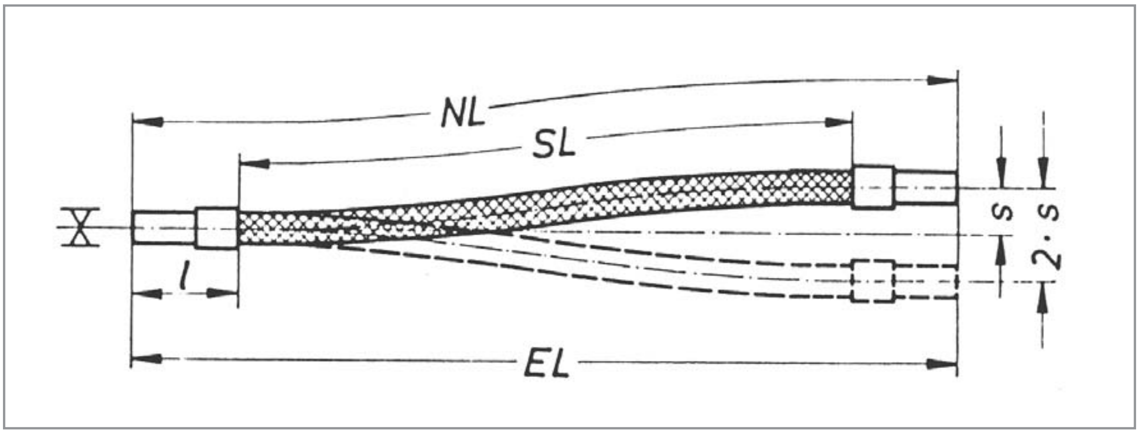
- If a is greater than 45°, installation length (EL) and nominal length (NL) are calculated as follows:

$$EL = 2{,}414s + 2(l + DN)$$
$$NL = 2{,}68s + 2(l + DN)$$

Absorption of Thermal Expansion

▷ Case 1

Length determination for metal hoses with lateral movements. Fit hose right-angled to the direction of movement. Max.lateral movement +/-100mm. Not for vibrations!



2 · s = total lateral movement [mm]
s = lat.movement from the middle axis [mm]
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
SL = movable hose length [mm]
EL = installation length [mm]
NL = nominal length [mm]

EL = installation length
SL = hose length
SL_{min} = minimal hose length

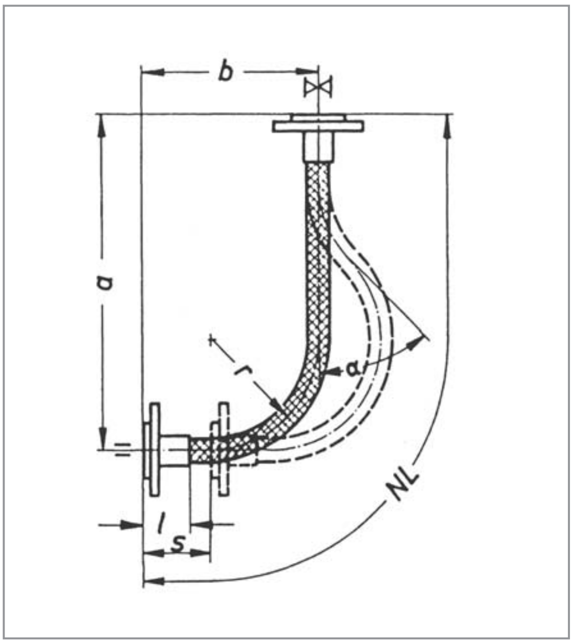
$$NL = \sqrt{20 \cdot r \cdot s} + 2l$$
$$s = SL^2/20r$$
$$EL = 0{,}995NL$$
$$SL = NL - 2l$$
$$SL_{min} = 6s$$

- Avoid condition of stress in neutral position.

▷ Case 2

Length determination for metal hoses for installation as a 90° bend for movements from one direction.

This layout does not apply to any vibration absorption!



s = movement [mm]
a = installation distance [mm]
b = installation distance [mm]
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
α = bend angle [°]
NL = nominal length [mm]

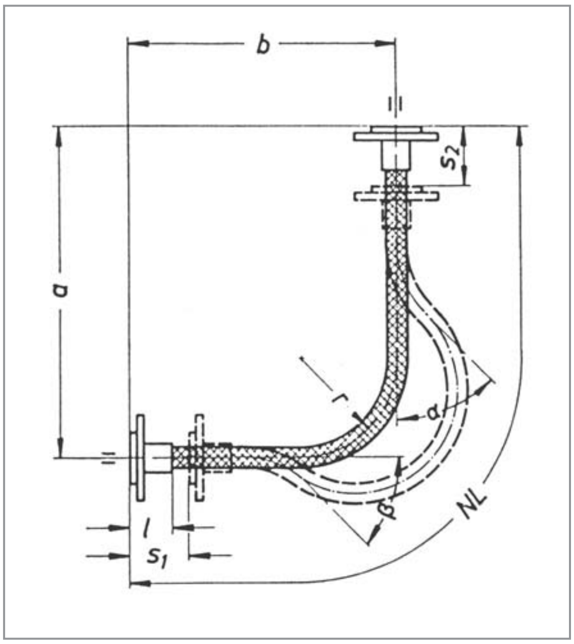
$$NL = 0{,}035r \cdot \alpha + 1{,}57r + 2l$$
$$a = r + (2r \cdot \sin\alpha) + l$$
$$b = r + r(0{,}035\alpha - 2\sin\alpha) + l$$
$$f_\alpha = s/r$$
$$\alpha < 60\,°$$

f_α - see table on page 4.4 for bend angles

▷ Case 3

Length determination for metal hoses for installation as a 90° bend for movements from two directions.

This layout does not apply to any vibration absorption!



s_1 = movements [mm]
s_2 = movements [mm]
a = installation distances [mm]
b = installation distances [mm]
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
α = bend angles [°]
β = bend angles [°]
NL = nominal length [mm]

$$NL = 0{,}035r \cdot (\alpha + \beta) + 1{,}57r + 2l$$
$$a = r + 2r \cdot \sin\alpha + r(0{,}035\beta - 2\sin\beta) + l$$
$$b = r + 2r \cdot \sin\beta + r(0{,}035\alpha - 2\sin\alpha) + l$$
$$f_\alpha = s_1/r$$
$$f_\beta = s_2/r$$
$$\alpha < 45\,°$$
$$\beta < 45\,°$$

f_α , f_β – see table on page 4.4 for bend angles

Table of bend angles to determine the bend angle for calculating 90° bends.

0° – 30°				30° – 60°			
Bend angle α, β	Angle factor f_α , f_β			Bend angle α, β	Angle factor f_α , f_β		
Degr.\min.	0°	30°	60°	Degr.\min.	0°	30°	60°
0	0,0000	0,0001	0,0003	30	0,3151	0,3263	0,3377
1	0,0003	0,0007	0,0012	31	0,3377	0,3493	0,3611
2	0,0012	0,0019	0,0028	32	0,3611	0,3731	0,3853
3	0,0028	0,0038	0,0050	33	0,3853	0,3977	0,4104
4	0,0050	0,0063	0,0078	34	0,4104	0,4232	0,4363
5	0,0078	0,0095	0,0113	35	0,4363	0,4495	0,4630
6	0,0113	0,0133	0,0155	36	0,4630	0,4767	0,4906
7	0,0155	0,0179	0,0204	37	0,4906	0,5048	0,5191
8	0,0204	0,0231	0,0259	38	0,5191	0,5337	0,5484
9	0,0259	0,0289	0,0322	39	0,5484	0,5634	0,5786
10	0,0322	0,0355	0,0391	40	0,5786	0,5940	0,6096
11	0,0391	0,0428	0,0468	41	0,6096	0,6255	0,6415
12	0,0468	0,0509	0,0551	42	0,6415	0,6578	0,6743
13	0,0551	0,0596	0,0643	43	0,6743	0,6910	0,7079
14	0,0643	0,0690	0,0741	44	0,7079	0,7250	0,7424
15	0,0741	0,0793	0,0847	45	0,7424	0,7599	0,7777
16	0,0847	0,0903	0,0961	46	0,7777	0,7957	0,8139
17	0,0961	0,1020	0,1082	47	0,8139	0,8323	0,8510
18	0,1082	0,1145	0,1211	48	0,8510	0,8698	0,8889
19	0,1211	0,1278	0,1347	49	0,8889	0,9082	0,9277
20	0,1347	0,1418	0,1491	50	0,9277	0,9474	0,9673
21	0,1491	0,1567	0,1644	51	0,9673	0,9874	1,0078
22	0,1644	0,1723	0,1804	52	1,0078	1,0284	1,0491
23	0,1804	0,1887	0,1972	53	1,0491	1,0701	1,0914
24	0,1972	0,2059	0,2148	54	1,0914	1,1128	1,1344
25	0,2148	0,2239	0,2332	55	1,1344	1,1563	1,1783
26	0,2332	0,2428	0,2525	56	1,1783	1,2006	1,2230
27	0,2525	0,2624	0,2725	57	1,2230	1,2457	1,2686
28	0,2725	0,2829	0,2934	58	1,2686	1,2918	1,3150
29	0,2934	0,3042	0,3151	59	1,3150	1,3386	1,3623

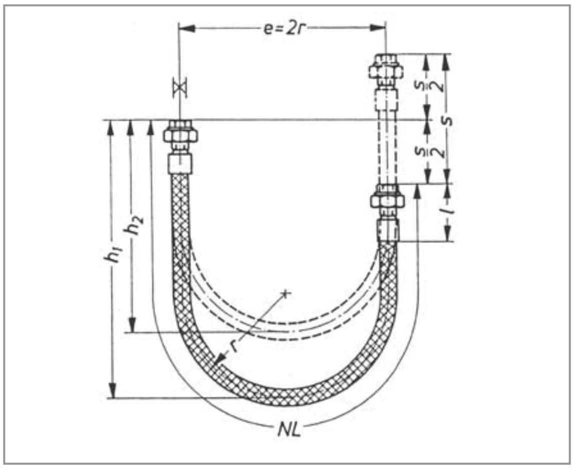
The bend angle must not exceed 60°. If the calculated value of s/r exceeds 1,3623, the bend angle must be calculated again with a larger bend radius r.

f_α , f_β = angle factor
r = bend radius
(see tables on page 4.4)
s = movements in mm
α = bend angle
β = bend angle

Absorption of Reciprocating Movements

▷ Case 1

Length determination for metal hoses for installation as a 180° bend. Vertical movement.



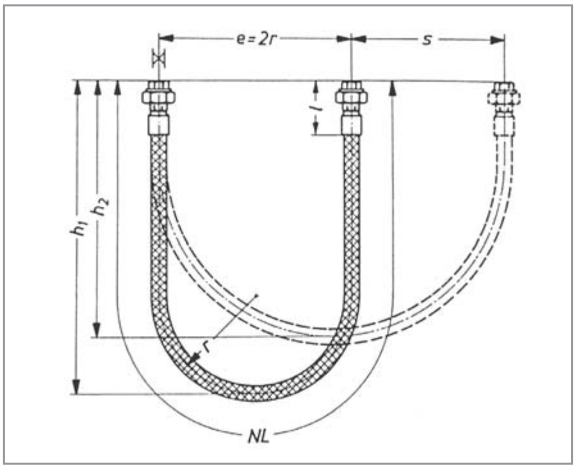
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
e = installation distance [mm]
l = length of connecting components [mm]
(see tables on connecting components)
h_1 = max. height of the 180° bend [mm]
h_2 = min. height of the 180° bend [mm]
s = movement [mm]
NL = nominal length [mm]

$$NL = 4r + s/2 + 2l$$
$$h_1 = 1{,}43r + s/2 + l$$
$$h_2 = 1{,}43r + l$$

- The chosen bend radii shall be multiplied with a factor f_{si} for life-time between 1,5 and 4 according to the operating data and the requested life-time.

▷ Case 2

Length determination for metal hoses for installation as a 180° bend. Horizontal movement.



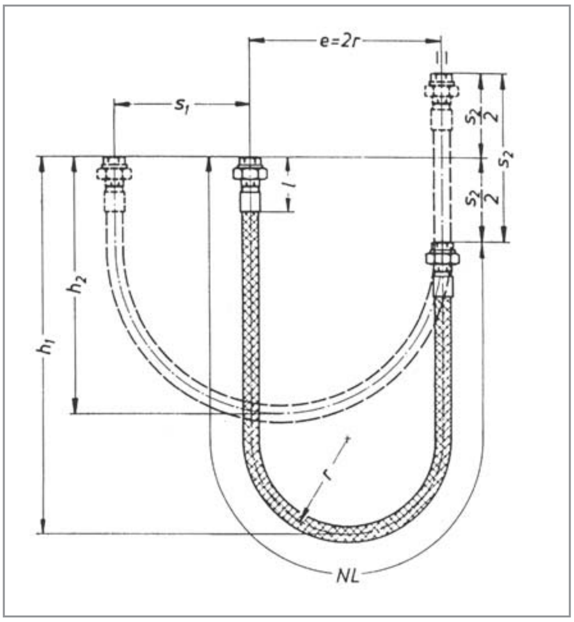
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
h_1 = max. height of the 180° bend [mm]
h_2 = min. height of the 180° bend [mm]
s = movement [mm]
NL = nominal length in mm

$$NL = 4r + 1{,}57s + 2l$$
$$h_1 = 1{,}43r + 0{,}785s + l$$
$$h_2 = 1{,}43r + s/2 + l$$

- The chosen bend radii shall be multiplied with a factor f_{si} for life-time between 1,5 and 4 according to the operating data and the requested life-time.

▷ Case 3

Length determination for metal hoses for installation as a 180° bend. Vertical and horizontal movements (each side one direction of movement only).



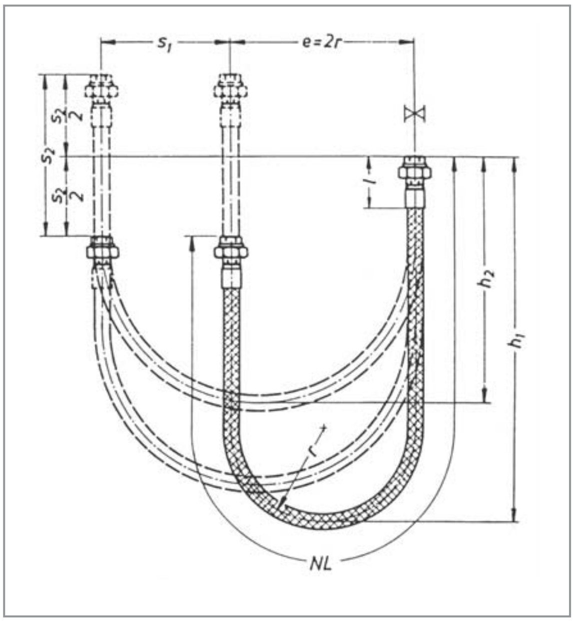
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
h_1 = max. height of the 180° bend [mm]
h_2 = min. height of the 180° bend [mm]
s_1 = horizontal movement [mm]
s_2 = vertical movement [mm]
NL = nominal length [mm]

$$NL = 4r + 1{,}57s_1 + s_2/2 + 2l$$
$$h_1 = 1{,}43r + 0{,}785s_1 + s_2/2 + l$$
$$h_2 = 1{,}43r + s_1/2 + l$$

- The chosen bend radii shall be multiplied with a factor f_{si} for life-time between 1,5 and 4 according to the operating data and the requested life-time.

▷ Case 4

Length determination for metal hoses for installation as a 180° bend for absorption of movements from two directions with high amplitude and low frequency. Vertical and horizontal movements (one side fixed, other side moving in both directions).



r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
h_1 = max. height of the 180° bend [mm]
h_2 = min. height of the 180° bend [mm]
s_1 = horizontal movement [mm]
s_2 = vertical movement [mm]
NL = nominal length [mm]

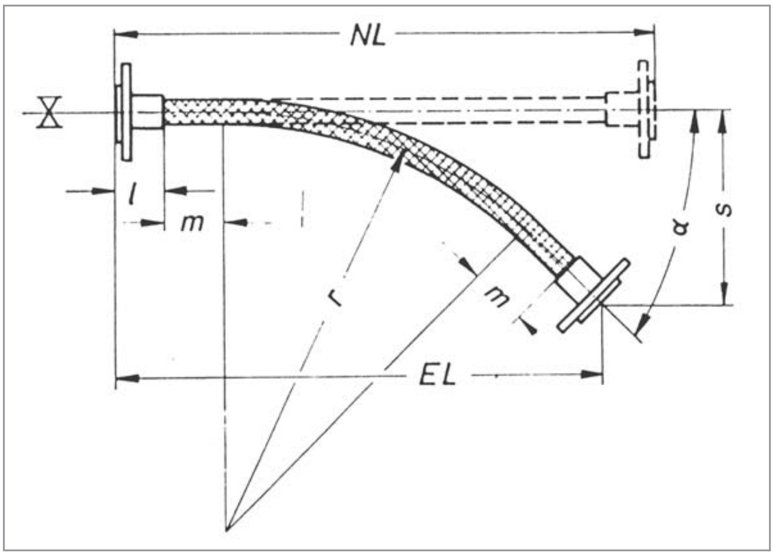
$$NL = 4r + 1{,}57s_1 + s_2/2 + 2l$$
$$h_1 = 1{,}43r + 0{,}785s_1 + s_2/2 + l$$
$$h_2 = 1{,}43r + s_1/2 + l$$

- The chosen bend radii shall be multiplied with a factor f_{si} for life-time between 1,5 and 4 according to the operating data and the requested life-time.

▷ Case 5

Length determination for metal hoses for absorption of angular movements. The hose bend must be in the plane of movement.

This case does not apply to any vibration absorption!



α = bend angle [°]
r = bend radius [mm]
(see tables on page 4.4 for bend radii)
l = length of connecting components [mm]
(see tables on connecting components)
m = length allowance [mm]
(see table below for values)
s = deflexion distance [mm]
EL = installation length [mm]
NL = nominal length [mm]

$$NL = [(r \cdot \pi \cdot \alpha)/180] + 2(l + m)$$
$$EL = r \cdot \sin\alpha + (l + m)(1 + \cos\alpha)$$
$$s = r(1 - \cos\alpha) + (l + m)\sin\alpha$$

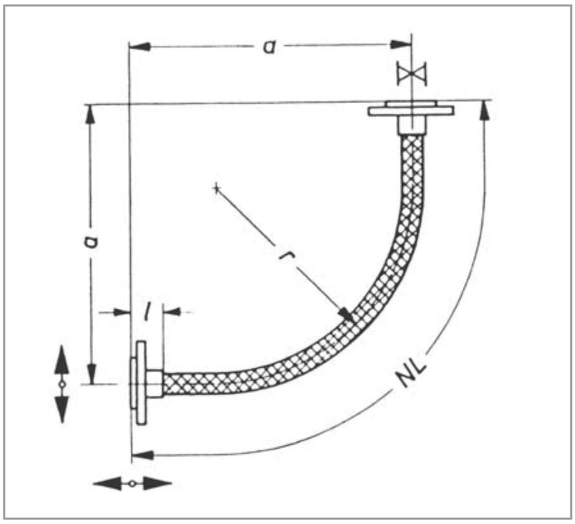
DN range [mm]	≥ 10	13 – 25	32 – 40	50 – 65	80 – 100	125 – 150	200 – 300
Length allowance [mm]	20	40	60	80	120	160	250

Absorption of Vibrations

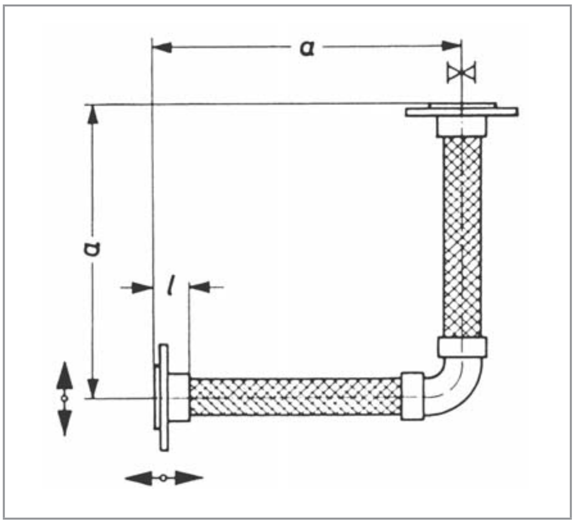
▷ Case 1

Length determination for metal hoses for installation as a 90° bend for absorbing vibrations.

- Installation form 1 (DN15-100), 90° bend for installation form 1:
- Installation form 2 (DN125-300), 90° angle



NL = 2,3r + 2l
a = 1,365r + l



Permissible amplitude at permanent load:
± 1 mm in the normal case
max. ± 10 mm during turn on and turn off

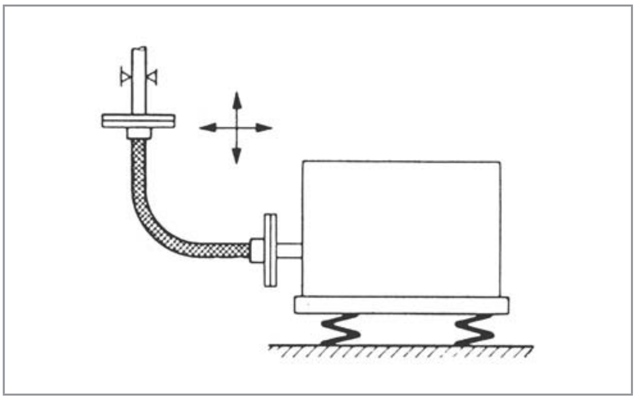
Note: Always fit the hose in hanging position as illustrated above.

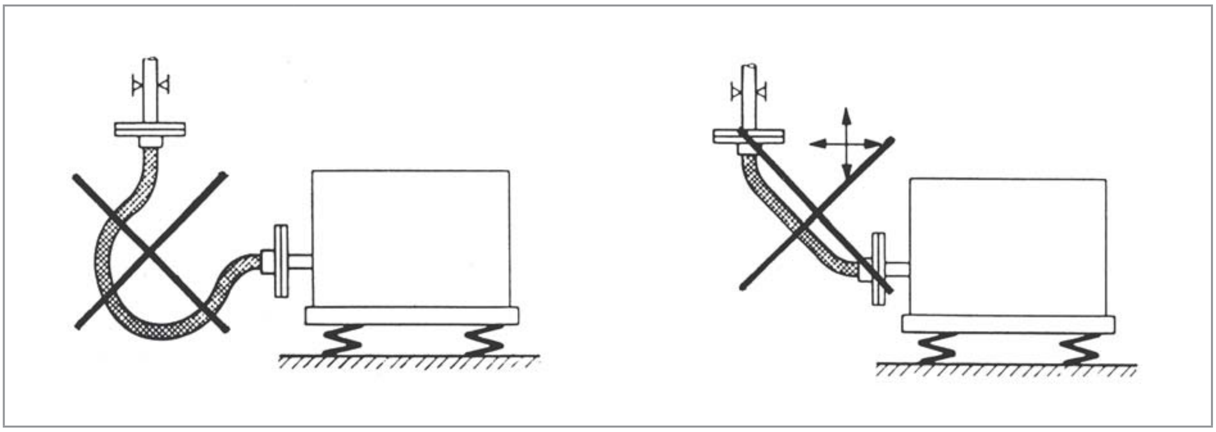
SE111 Type	Installation form 1 90° bend									Installation form 2 90° angle				
DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300
r	110	150	170	200	240	280	300	350	400	-	-	-	-	-
a	200	255	285	340	400	460	490	575	635	700	800	950	1100	1300
l_{max}	50	50	55	70	75	80	80	95	95	120	130	140	150	160
NL	350	450	500	600	700	800	850	1000	1100	-	-	-	-	-

Measures in mm.

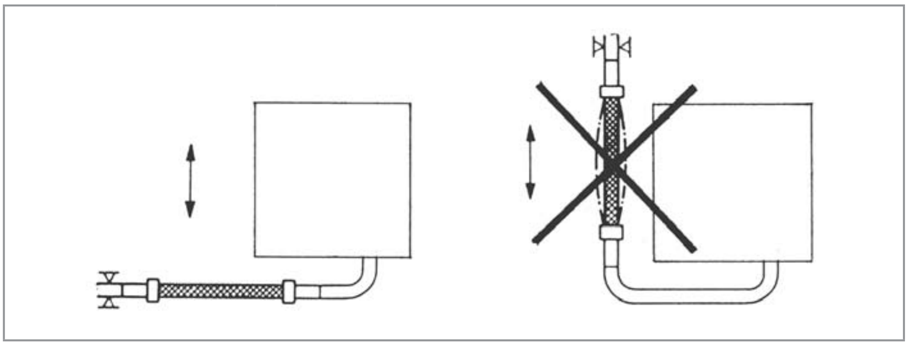
▷ Case 2

- Install 90° bend with permissible bend radius and sufficiently long neutral hose ends. Excessive curving and stretching of the hose elbow is not permissible!





- Install hose right-angled to the direction of vibration.



- To absorb two- or three-dimensional vibrations, install hoses in a 90° arrangement. Axial vibrations are not absorbed by hoses.