MOTION

Hose Live Length
The live length of the hose assembly must be sufficient in order for the hose to properly meet the movement requirements. A hose assembly with a live length shorter than suggested could cause premature failure.

Lateral Offset Motion
This motion occurs when the hose centerline is moved in a plane perpendicular to the longitudinal axis with the end remaining parallel. Dynamic offset motion should never be more than 25% of the minimum centerline bend radius. See page 24 for design information on lateral offset.

Angular Offset Motion
Angular movement is defined as the bending of the hose so that the ends are no longer parallel. Amount of movement is measured in degrees from centerline of the hose if were installed straight. See page 23 for design information on angular offset.

Axial Movement
Axial movement is compression or elongation along the longitudinal axis. Metal hose assemblies installed in line with the longitudinal axis of the piping should not be subjected to axial movement.

Two design options are available to compensate for axial movement. The first option is installation of the metal hose assembly perpendicular to the longitudinal axis of the pipeline. As axial movement occurs, the metal hose assembly will be subjected to lateral offset. See page 24 for additional design information.

The second option is the use of a Class "B" traveling loop. See page 22 for design requirements of traveling loops.

Torsion Movement
Torsion movement occurs when the hose is twisted or torqued such as when the hose bends out of plane or during improper installation.

Twisting forces are extremely destructive and are one of the most common causes for premature failure.

Motion Frequency
The rate of flexure that the hose is subjected to in a given time period. Three basic types of motion frequency include vibration, dynamic motion and continuous motion.

Vibration
This is low amplitude motion occurring at high frequency. Vibration is normally found in engine exhaust, pump and compressor applications. Hose resonance must be avoided to prevent premature failure. Consult OmegaFlex engineering if hose resonance is anticipated or for additional vibration data.

Dynamic/Intermittent Motion
Non-continuous or intermittent motion such as the result of thermal expansion. Dynamic bend radius is used in calculations determining the hose live length for lateral offset, angular offset and radial motion during dynamic or intermittent flexing.

Static Bend
A non-moving or fixed radius bend in a hose assembly used to compensate for misalignment.

Continuous Motion
Regular cyclic motion at a slow cyclic rate and constant travel. The dynamic minimum centerline bend radius must be doubled on continuous motion applications.

Random Motion
The uncontrolled motion of a metal hose such as motion that occurs during manual handling.

Bend Radius
The minimum radius the hose can be bent and still maintain the integrity of the hose. Usually expressed as dynamic or static centerline bend radius. The bend radius is used in calculations associated with angular and lateral offset motion.

Cycle Life
The number of cycles a hose is flexed before failure. Some factors that affect cycle life include working pressure, temperature, bend radius, hose and braid materials. OmegaFlex uses the ISO10380 fatigue test standard for cycle life testing. See page 32 for a more complete description of the ISO 10380 standard.

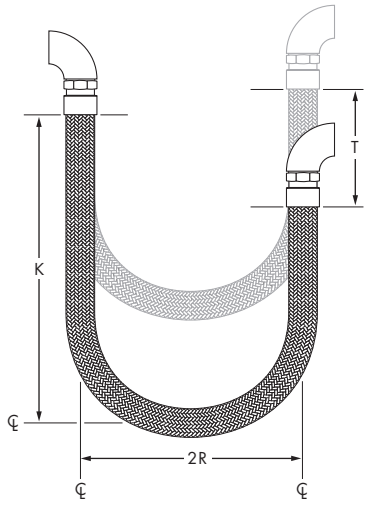
Radial Movement

This type of movement occurs when hoses are bent in a 180° arc such as in vertical or horizontal traveling loops. Traveling loops are classified a Class "A" where the bend radius remains constant and the one end of the hose moves parallel to the other end.

A Class "B" traveling loop has the hose installed in a U-shaped configuration and the ends move perpendicular to each other so as to enlarge or decrease the width of the loop.

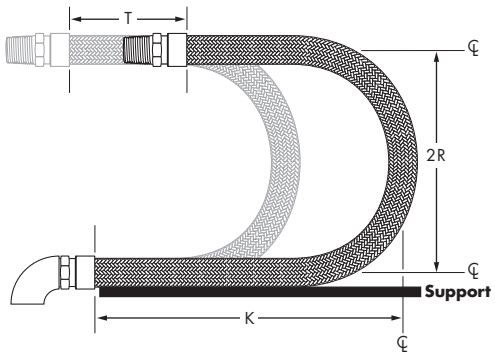
Horizontal travelling loops must have the bottom leg of the hose supported to avoid undue stress on the end of the hose. The weight of the hose and media inside the hose will reduce the pressure capability of the hose. Weight loads should be considered when engineering corrugated metal hose assemblies for travelling loop applications.

Class A Traveling Loops

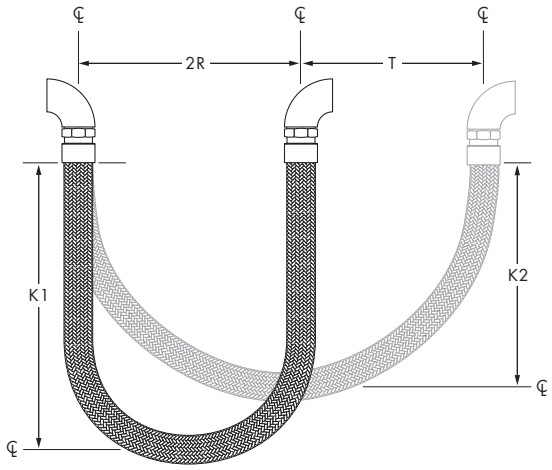


L = 4R + T/2

K = 1.43R + T/2



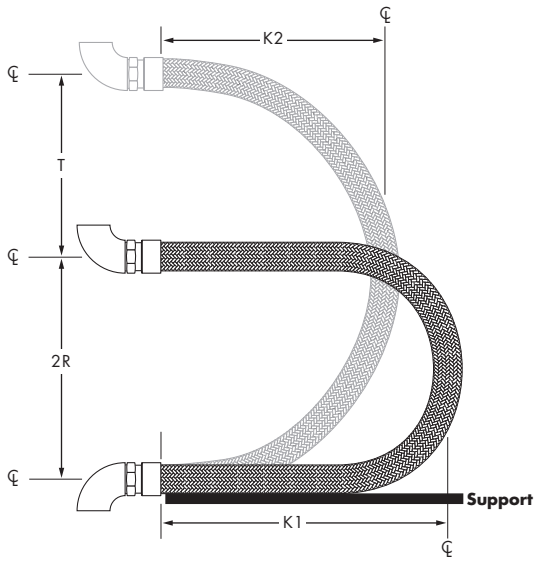
Class B Traveling Loops



L = 4R + 1.57T

K1 = 1.43R + .785T

K2 = 1.43R + T/2



T = Total travel (inches)

R = Centerline bend radius (inches)

L = Hose live length (inches)

K = Loop length (inches)

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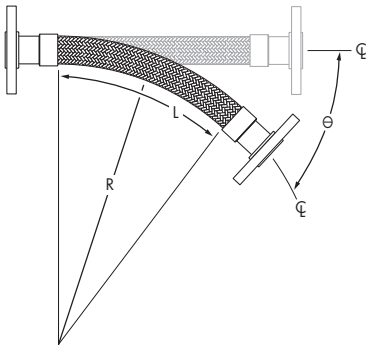
MOTION (Continued)

Angular Offset Motion

Angular movement is defined as the bending of the hose so that the ends are no longer parallel. Amount of movement is measured in degrees from centerline of the hose if were installed straight.

Minimum Live Length of Hose For Angular Offset Motion

Centerline Bend Radius (in.) = R	Degree of Angular Motion = θ													
	10	15	20	25	30	40	50	60	70	80	90	120	150	180
2	0.4	0.6	0.7	0.9	1.1	1.4	1.8	2.1	2.5	2.8	3.2	4.2	5.3	6.3
3	0.6	0.8	1.1	1.4	1.6	2.1	2.7	3.2	3.7	4.2	4.8	6.3	7.9	9.5
4	0.7	1.1	1.4	1.8	2.1	2.8	3.5	4.2	4.9	5.6	6.3	8.4	10.5	12.6
5	0.9	1.4	1.8	2.2	2.7	3.5	4.4	5.3	6.2	7.0	7.9	10.5	13.1	15.8
6	1.1	1.6	2.1	2.7	3.2	4.2	5.3	6.3	7.4	8.4	9.5	12.6	15.8	18.9
7	1.3	1.9	2.5	3.1	3.7	4.9	6.2	7.4	8.6	9.8	11.0	14.7	18.4	22.0
8	1.4	2.1	2.8	3.5	4.2	5.6	7.0	8.4	9.8	11.2	12.6	16.8	21.0	25.2
9	1.6	2.4	3.2	4.0	4.8	6.3	7.9	9.5	11.0	12.6	14.2	18.9	23.6	28.3
10	1.8	2.7	3.5	4.4	5.3	7.0	8.8	10.5	12.3	14.0	15.8	21.0	26.2	31.5
11	2.0	2.9	3.9	4.8	5.8	7.7	9.6	11.6	13.5	15.4	17.3	23.1	28.8	34.6
12	2.1	3.2	4.2	5.3	6.3	8.4	10.5	12.6	14.7	16.8	18.9	25.2	31.5	37.7
13	2.3	3.5	4.6	5.7	6.9	9.1	11.4	13.7	15.9	18.2	20.5	27.3	34.1	40.9
14	2.5	3.7	4.9	6.2	7.4	9.8	12.3	14.7	17.2	19.6	22.0	29.4	36.7	44.0
15	2.7	4.0	5.3	6.6	7.9	10.5	13.1	15.8	18.4	21.0	23.6	31.5	39.3	47.2
16	2.8	4.2	5.6	7.0	8.4	11.2	14.0	16.8	19.6	22.4	25.2	33.6	41.9	50.3
17	3.0	4.5	6.0	7.5	9.0	11.9	14.9	17.9	20.8	23.8	26.8	35.7	44.6	53.5
18	3.2	4.8	6.3	7.9	9.5	12.6	15.8	18.9	22.0	25.2	28.3	37.7	47.2	56.6
19	3.4	5.0	6.7	8.3	10.0	13.3	16.6	19.9	23.3	26.6	29.9	39.8	49.8	59.7
20	3.5	5.3	7.0	8.8	10.5	14.0	17.5	21.0	24.5	28.0	31.5	41.9	52.4	62.9
22	3.9	5.8	7.7	9.6	11.6	15.4	19.2	23.1	26.9	30.8	34.6	46.1	57.6	69.2
24	4.2	6.3	8.4	10.5	12.6	16.8	21.0	25.2	29.4	33.6	37.7	50.3	62.9	75.4
26	4.6	6.9	9.1	11.4	13.7	18.2	22.7	27.3	31.8	36.4	40.9	54.5	68.1	81.7
28	4.9	7.4	9.8	12.3	14.7	19.6	24.5	29.4	34.3	39.1	44.0	58.7	73.4	88.0
30	5.3	7.9	10.5	13.1	15.8	21.0	26.2	31.5	36.7	41.9	47.2	62.9	78.6	94.3
35	6.2	9.2	12.3	15.3	18.4	24.5	30.6	36.7	42.8	48.9	55.0	73.4	91.7	110.0
40	7.0	10.5	14.0	17.5	21.0	28.0	35.0	41.9	48.9	55.9	62.9	83.8	104.8	125.7
45	7.9	11.8	15.8	19.7	23.6	31.5	39.3	47.2	55.0	62.9	70.7	94.3	117.9	141.4
50	8.8	13.1	17.5	21.9	26.2	35.0	43.7	52.4	61.1	69.9	78.6	104.8	130.9	157.1
60	10.5	15.8	21.0	26.2	31.5	41.9	52.4	62.9	73.4	83.8	94.3	125.7	157.1	188.5
70	12.3	18.4	24.5	30.6	36.7	48.9	61.1	73.4	85.6	97.8	110.0	146.7	183.3	220.0
80	14.0	21.0	28.0	35.0	41.9	55.9	69.9	83.8	97.8	111.8	125.7	167.6	209.5	251.4
90	15.8	23.6	31.5	39.3	47.2	62.9	78.6	94.3	110.0	125.7	141.4	188.5	235.7	282.8
100	17.5	26.2	35.0	43.7	52.4	69.9	87.3	104.8	122.2	139.7	157.1	209.5	261.8	314.2



Formula: $L = \frac{\pi R \theta}{180}$

L = Live hose length (inches)
π = 3.1416
R = Minimum centerline bend radius for constant flexing (inches)
θ = Angular deflection (degrees)

Lateral Offset Motion

This motion occurs when the hose centerline is moved in a plane perpendicular to the longitudinal axis with the end remaining parallel. **Dynamic offset motion should never be more than 25% of the minimum centerline bend radius.**

Minimum Live Length of Hose For Lateral Offset Motion

Centerline Bend Radius (in.) = R	Dynamic Lateral Offset Motion (in.) = T													
	⅛	¼	⅜	½	¾	1	1½	2	3	4	5	6	8	10
2	1.3	1.8	2.2	2.5	3.1	3.7	4.5	5.3	6.8	8.0	9.3	10.4	12.7	14.9
3	1.6	2.2	2.7	3.1	3.8	4.4	5.5	6.4	8.0	9.4	10.8	12.0	14.5	16.8
4	1.8	2.5	3.1	3.5	4.4	5.0	6.2	7.3	9.0	10.6	12.1	13.5	16.0	18.5
5	2.0	2.8	3.4	4.0	4.9	5.6	6.9	8.0	10.0	11.7	13.3	14.7	17.5	20.0
6	2.2	3.1	3.7	4.3	5.3	6.1	7.5	8.8	10.9	12.7	14.4	15.9	18.8	21.5
7	2.3	3.3	4.0	4.7	5.7	6.6	8.1	9.4	11.7	13.6	15.4	17.0	20.0	22.9
8	2.5	3.5	4.3	5.0	6.1	7.0	8.7	10.0	12.4	14.5	16.3	18.0	21.2	24.1
9	2.7	3.7	4.6	5.3	6.5	7.5	9.2	10.6	13.1	15.3	17.2	19.0	22.3	25.3
10	2.8	3.9	4.8	5.5	6.8	7.9	9.7	11.2	13.8	16.0	18.1	19.9	23.4	26.5
11	2.9	4.1	5.0	5.8	7.1	8.2	10.1	11.7	14.4	16.8	18.9	20.8	24.4	27.6
12	3.1	4.3	5.3	6.1	7.4	8.6	10.5	12.2	15.0	17.5	19.7	21.7	25.3	28.7
13	3.2	4.5	5.5	6.3	7.7	8.9	11.0	12.7	15.6	18.2	20.4	22.5	26.3	29.7
14	3.3	4.6	5.7	6.5	8.0	9.3	11.4	13.2	16.2	18.8	21.1	23.3	27.2	30.7
15	3.4	4.8	5.9	6.8	8.3	9.6	11.8	13.6	16.8	19.4	21.8	24.0	28.0	31.7
16	3.5	5.0	6.1	7.0	8.6	9.9	12.1	14.0	17.3	20.0	22.5	24.8	28.9	32.6
17	3.6	5.1	6.2	7.2	8.8	10.2	12.5	14.5	17.8	20.6	23.2	25.5	29.7	33.5
18	3.7	5.3	6.4	7.4	9.1	10.5	12.9	14.9	18.3	21.2	23.8	26.2	30.5	34.4
19	3.8	5.4	6.6	7.6	9.3	10.8	13.2	15.3	18.8	21.8	24.4	26.9	31.3	35.3
20	3.9	5.5	6.8	7.8	9.6	11.0	13.5	15.7	19.3	22.3	25.0	27.5	32.0	36.1
22	4.1	5.8	7.1	8.2	10.0	11.6	14.2	16.4	20.2	23.4	26.2	28.8	33.5	37.7
24	4.3	6.1	7.4	8.5	10.5	12.1	14.8	17.1	21.0	24.4	27.3	30.0	34.9	39.3
26	4.5	6.3	7.7	8.9	10.9	12.6	15.4	17.8	21.9	25.3	28.4	31.2	36.3	40.8
28	4.6	6.5	8.0	9.2	11.3	13.0	16.0	18.5	22.7	26.3	29.5	32.4	37.6	42.2
30	4.8	6.8	8.3	9.5	11.7	13.5	16.5	19.1	23.5	27.2	30.5	33.5	38.8	43.6
35	5.2	7.3	8.9	10.3	12.6	14.6	17.9	20.6	25.3	29.3	32.8	36.0	41.8	47.0
40	5.5	7.8	9.5	11.0	13.5	15.6	19.1	22.0	27.0	31.3	35.0	38.5	44.6	50.0
45	5.9	8.3	10.1	11.7	14.3	16.5	20.2	23.4	28.7	33.2	37.1	40.7	47.2	53.0
50	6.2	8.7	10.7	12.3	15.1	17.4	21.3	24.6	30.2	34.9	39.1	42.9	49.7	55.7
60	6.8	9.5	11.7	13.5	16.5	19.0	23.3	27.0	33.0	38.2	42.8	46.9	54.3	60.9
70	7.3	10.3	12.6	14.5	17.8	20.6	25.2	29.1	35.7	41.2	46.1	50.6	58.6	65.6
80	7.8	11.0	13.5	15.5	19.0	22.0	26.9	31.1	38.1	44.0	49.3	54.0	62.5	70.0
90	8.3	11.7	14.3	16.5	20.2	23.3	28.5	33.0	40.4	46.7	52.3	57.3	66.3	74.2
100	8.7	12.3	15.1	17.4	21.3	24.6	30.1	34.7	42.6	49.2	55.0	60.3	69.8	78.2

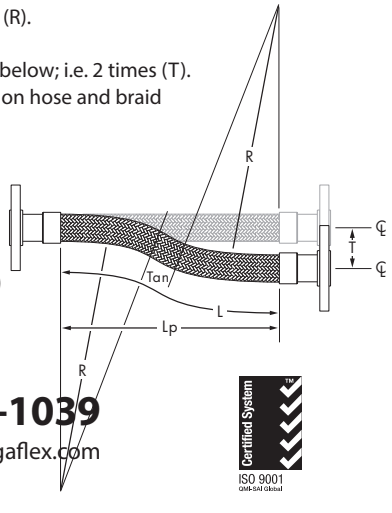
a. The offset distance (T) for dynamic flexing should never exceed 25% of the centerline bend radius (R).
b. The shaded area of this chart may be used only for static offset applications.
c. When the offset motion occurs to both sides of the hose centerline, use total travel in the formula below; i.e. 2 times (T).
d. If the difference between (L) and (Lp) is significant, exercise care during installation to avoid stress on hose and braid at the maximum offset distance.

Formula: $\mathbf{L} = \sqrt{6RT + T^2}$

$\mathbf{Lp} = \sqrt{L^2 - T^2}$

$\mathbf{Tm} = \sqrt{9R^2 + L^2} - 3R$

L = Live hose length (inches)
Lp = Projected live hose length (inches)
R = Minimum centerline bend radius (inches)
T = Offset motion to one side of centerline (inches)
Tm = Maximum centerline offset for a given L and R



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