plimat

ASPIRATING PIPE SYSTEMS

LPCB Tested

Material specification and general information

ABS Pressure Pipe Systems

General Information

ABS (Acrylonitrile Butadiene Styrene) is a homogenous material with good chemical resistance and high impact strength.
Other advantageous features are its suitability for use at low temperatures (-40°C) and its ease of jointing.

Standards

Plimat Aspirating Pipe and Fittings are produced under a strict quality control system approved to EN ISO 9001.

Plimat Aspirating Products have been Tested by LPCB to EN 54-20 Clause 5.7, EN 61386-1 Class 1131.
LPCB Test Report No- TE250773

Individual products are in accordance with the appropriate British Standards.

Fittings (inch) BS 5391 Part 1, EN 1452 Part 3, EN 54-20 Clause 5.7, EN 61386-1 Class 1131
Fittings (Metric) Din 8063, Kiwa 549, ISO 727
Pipe BS 5391 EN 61386-1 Class 1131
Adhesive BS 4346 Part 3

Colour

Plimat ABS products are manufactured in Red, White and a Mid Grey Colour.

Temperature

ABS is suitable for use over a wide temperature range from -40°C to 70°C

Technical

Jointing Guidelines

Plimat Solvent cement is specially formulated to chemically weld pipes and fittings together. The solvent cement chemically melts the two surfaces to be joined, so that when they are fitted together they form a homogenous mass, which then cures to form a weld. Note that this is not a glued joint. It is therefore important to choose the correct type of adhesive as another type may be detrimental to the integrity of the system.

1) Cut the pipe at right angles to its axis, and to the required length using the correct cutting shears.

2) Dry fit the pipe to the socket of the fittings. When the pipe is fully home in the socket, draw a line around the pipe at the edge of the socket. Where this is not possible (perhaps on larger fittings) measure the socket depth and draw a line at the corresponding point along the pipe. This will give a visual indication, to ensure that the pipe is fully pushed home in the socket.

3) Apply the solvent cement with a suitably sized brush or the brush provided in the Plimat adhesive lid. Ensure that the area of the pipe up to the visual indicator is completely covered with an even layer of cement. This part of the operation must be done quickly and neatly, as the solvent must still be wet when the pipe and fitting is pushed together.

4) Push the pipe and fittings together and hold in place for up to 30 seconds. When the joint is made, a bead of solvent cement will form around the outer joint of the pipe and socket. This excess cement should be wiped away leaving the outer part of the joint clean.

5) If a pressurized system is required please ask for industrial jointing guide lines

Jointing, "Do Not"s

a) Make joints in rain or wet conditions
b) Use dirty brushes or cleaning rags, which are dirty or oily.
c) Use the same brushes with different solvent cements.
d) Dilute or thin solvent cements with cleaner.
e) Leave solvent cement tins open. The contents will evaporate and the cement performance will be weakened.
f) Use near naked lights, or smoke whilst jointing. Solvents are highly inflammable.
g) Make joints in a confined space. Solvents emit hazardous vapours, which are dangerous.

Joints per Litre of Cement

As a rule of thumb we estimate that 170 joints can be made per 250ml of Plimat solvent cement when jointing either 25mm or ¾" ABS fittings and pipe.

Expansion and Contraction

Expansion or contraction of plastic pipe is caused by temperature change occurring within the pipe wall. When the operating temperature of a pipe is greater than when it was installed, then the pipe will expand. If the operating temperature is lower, then it will contract.

There are two factors to consider when calculating expansions or contractions in pipes.

1) ambient temperature of the (air temp) environment when installing the pipe
2) change of temperature of pipe contents or environment

Any change of the above factors will affect the mid-wall temperature of the pipe thus causing either expansion or contraction.
Please note that most pipework systems are installed between 5^{o}C and 25 ^{o}C.

Calculation Expansion/Contraction

1) The change in length due to contraction or expansion in a pipe system is determined by the following formula:

$\Delta L = \Delta T$ x L x ☐

Where	ΔL	Expansion (ΔLe) or contraction (ΔLc) in mm
	ΔT	Difference in temperature between the installation and the operating temperatures in ^{o}C (= $T_{operate}$ -$T_{install}$)
	L	Length of pipe when installed
	☐	Relevant coefficient of expansion

Example:

Find the expansion and contraction on a 25mm diameter ABS pipe system, installed at 10^{o}C. The maximum and minimum operating temperatures are 30^{o}C and 8 ^{o}C respectively. The overall length of the installation is 30m.

Step 1) Calculate temperature change for expansion and contraction:

$\Delta T = 30 - 10 = +20\ ^{o}$C.
$\Delta T = 8 - 10 = -2\ ^{o}$C.

Step 2) Now calculate expansion and contraction,

Expansion $\Delta Le = \Delta T$ x L x ☐☐☐ 20 x 30 x 0.100 = 60mm

Contraction $\Delta Lc = \Delta T$ x L x ☐☐☐ -2 x 30 x 0.100 = -6mm

Step 3) in order to provide for the correct solution, it is necessary to take the greater value, regardless whether it is due to expansion or contraction.
i.e. ΔL = 60mm.

How to Allow for Expansion or Contraction

The change of length in a pipe system, whether it is expansion or contraction, will require compensation, so that any stresses generated by the change will not cause damage to the system, this can be done in two ways, either by installing
1) An Expansion Loop.
2) An Expansion Joint.
3) Flexible arms.

1) Expansion Loops

These are designed to compensate for linear expansion or contraction within a pipe system. They are an option when facing a large amount of movement due to expansion or contraction. For large amounts of movement we have flexible connectors; solvent weld or mechanical joint connect one end to the pipe where you wish the expansion to be taken up and form a loop before connecting to the other end to the pipe system, the loop must be supported in the middle with a pipe clip, cable clip or other. Make sure the flexible loop will give the pipe enough movement for expansion and contraction and not put the flexible joints under stress. Suitable for use within a temperature range of -20ºC to 50ºC. See Data Sheet for these products

1) Expansion Joints

In line expansion sockets are a compact solution to allow for 70mm of travel. They have a fixed bracket which is clamped down securely and enables it to be screwed onto M8 or M10 threaded bar. The pipe is pushed into the expansion socket at both ends and must pass the o-ring on each end of the expansion joint. For contraction requirements the pipes can meet in the middle, and for expansion purposes the pipe from each side has to pass the o-ring sufficiently as to not pull out, whilst the space between the pipes inside the expansion socket will allow for the linear expansion of the pipes upto 70mm.

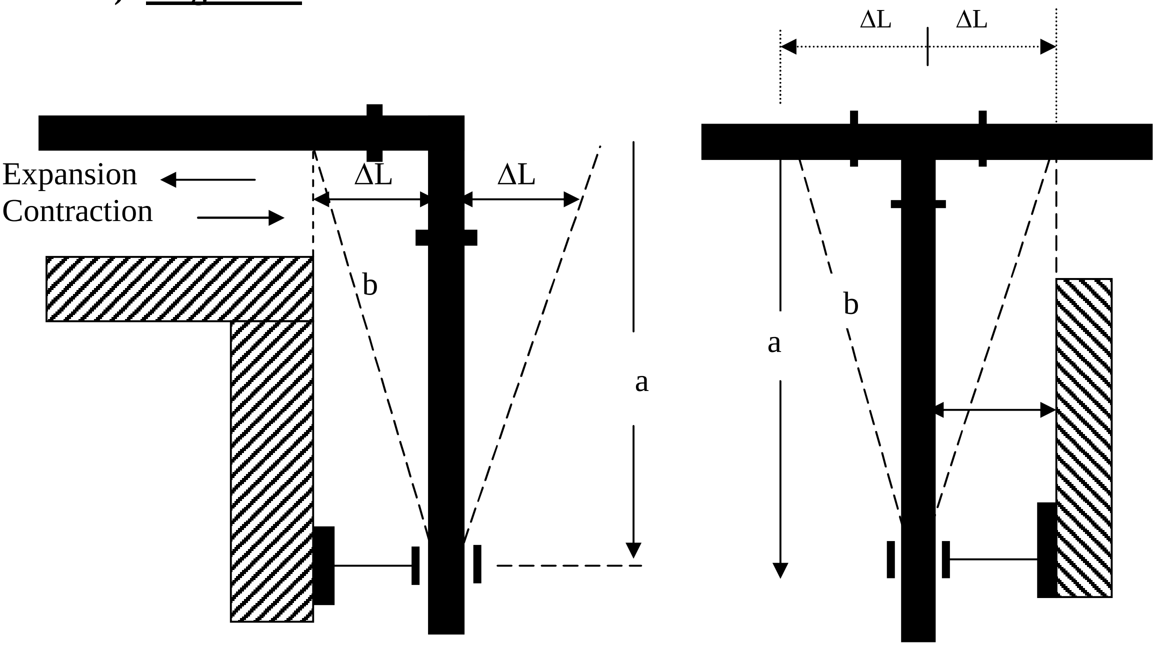
2) Flexible Arms

Flexible arms are simple and relatively inexpensive to install. The flexibility of plastics permits expansion or contraction to be compensated for, by means of, either directional change within a pipe system, or by the installation of expansion loops consisting of two flexible arms.

The length of the flexible arm is governed by the pipe diameter, and the amount of expansion or contraction that requires compensation.

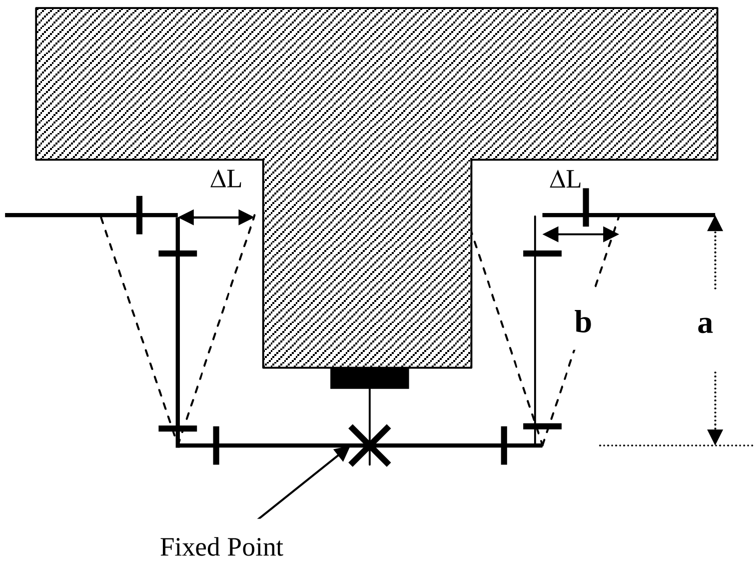
The following sketches show examples of flexible arms that can be utilised within a system.

1) <u>Single Arm</u>



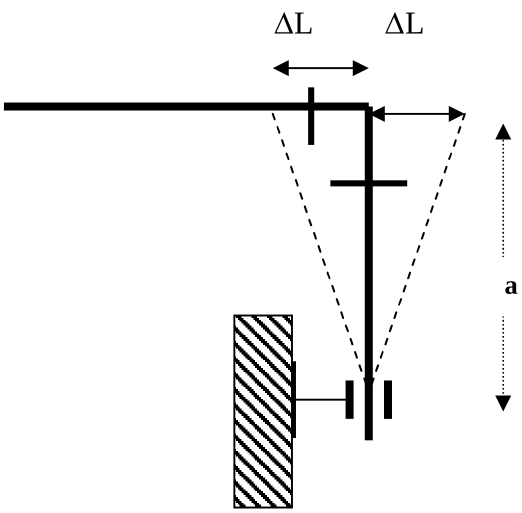
a	flexible arm length
b	distance from pipe OD to wall = ΔL + 10mm
ΔL	expansion/contraction length.

<u>2) Double Arm (expansion loop)</u>



How to find the flexible arm (a) length.

Single Arm



To calculate the length of a flexible arm (a) the following formula can be used.

$$a = \left(\sqrt{D\,x\,\Delta L}\right) x\,C$$

Where a = flexible arm length
d = pipe outside diameter
ΔL = expansion/contraction (mm)
C = constant for material, see Table 7.2

Table 7.2 Thermoplastic material constant C, used in calculating Flexible arm length

Thermoplastic Material	Constant C
PVC-u	33.5
ABS	32.7
PP	30.0
PE	26.0

Example 1

A 25mm ABS pipe has expanded in length 22mm.

What is the length required for the flexible arm.

Solution :

$a = (\sqrt{D \times \Delta L}) \times C^{m}$ $a = (\sqrt{25 \times 22}) \times 32.7$

a = 766.88mm

Example 2

Use the same parameters as example 1, and apply the double arm equation.

Solution :

The equation for a double arm expansion loop is as follows:

$$a = \left(\sqrt{D \, x \, \frac{\Delta L}{2}} \right) x \, C$$

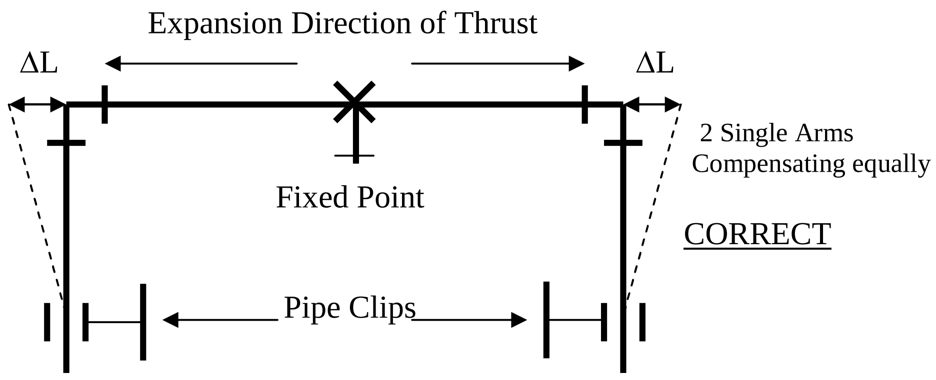
The equation is shown in this form, as the overall expansion (ΔL) is now compensated for over 2 flexible arms.

$$a = \left(\sqrt{25 \times \frac{22}{2}} \right) \times 32.7$$

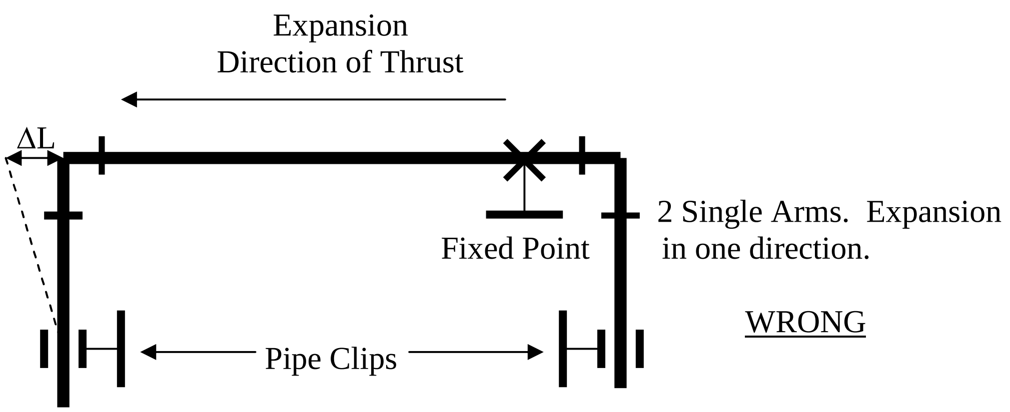
a = 542.27mm

Installation of Expansion Arms Single and Double (Loop)

In order to effectively utilise flexible arms, it is necessary to channel any change of length towards that arm, regardless of whether the change is expansion or contraction. This can be achieved by the use of strategically placed fixed brackets, anchoring the pipe firmly.

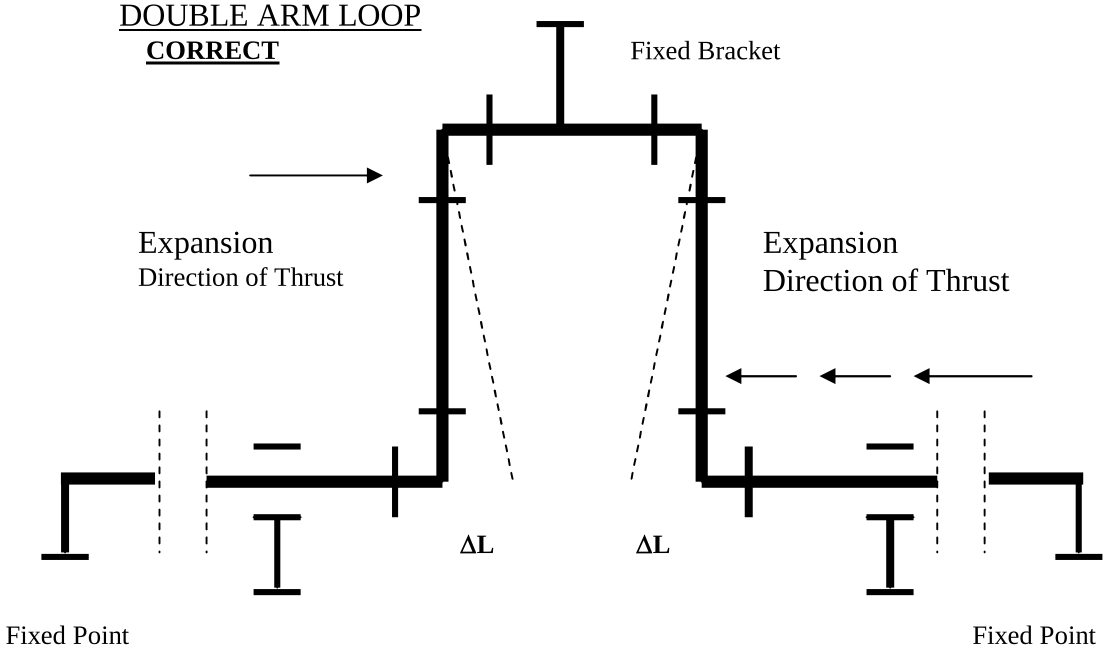


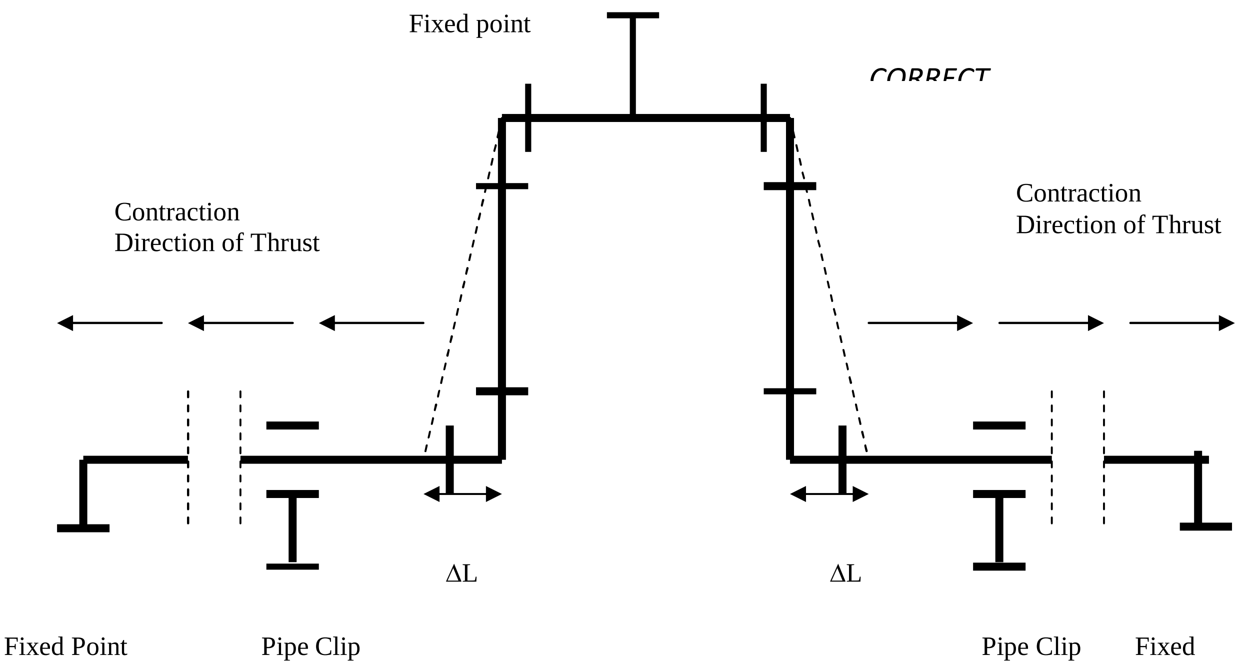
The bracket has been placed to ensure even distribution of length change, either side of the fixed point. It is not advisable to place the bracket so that the distribution is uneven.



DOUBLE ARM LOOP

CORRECT





Pre-Stressing Flexible Arms

Sometimes changes of length (ΔL) can only be channelled in one direction, possibly due to a flexible section having to operate in a confined space. When this occurs, the flexible arm can be pre-stressed. This achieves the following:

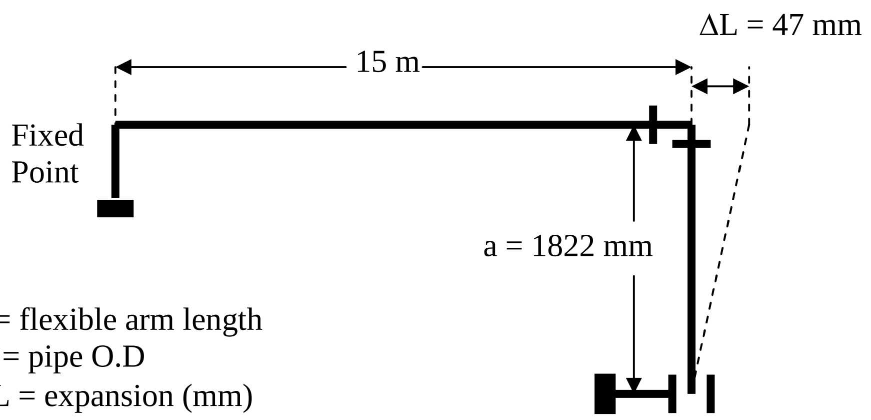
1) The flexible arm can be reduced in length
2) The flexible arm will straighten under working conditions thus relieving a large amount of stress.
3) The installation will look better when in service.

The following examples will demonstrate the above.

Example 3

Non Pre-Stressed Section

A 15 metre length of 63mm PVC-u pipe with a working temperature of 40 ^{o}C has expanded (ΔL) 47mm lineally.



a = flexible arm length
D = pipe O.D
ΔL = expansion (mm)
C = material constant

$$\therefore \quad a = \left(\sqrt{D\,x\,\Delta L}\right) x\, C \qquad = \left(\sqrt{63\,x\,47}\right) x\, 33.5$$

$$a = 54.4\, x\, 33.5 \qquad = 1822\, mm$$

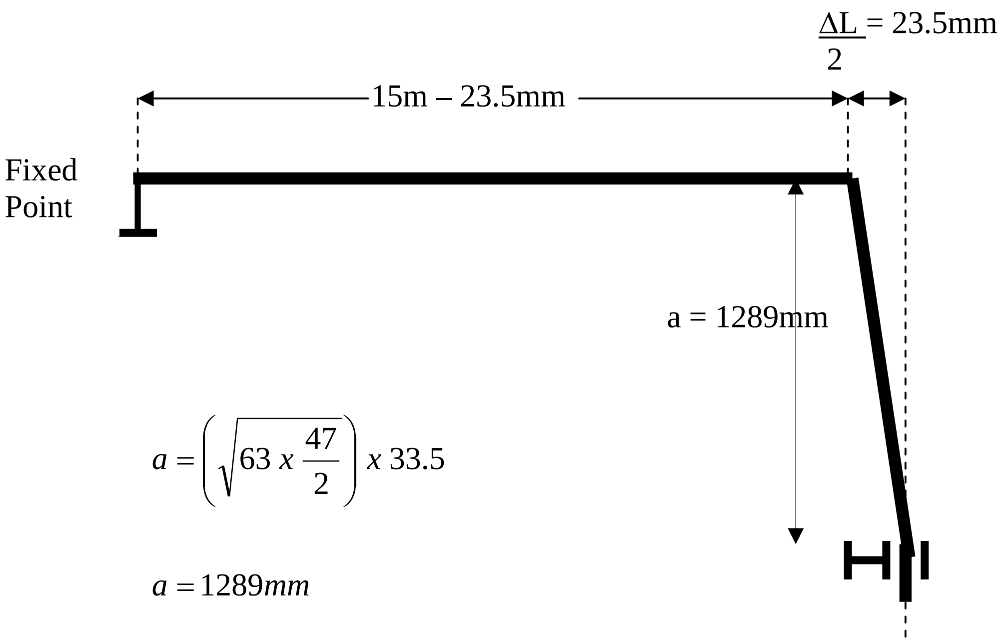
Example 4

Pre-Stressed Section

Using the previous example we shall now pre-stress the same section. To achieve this the overall expansion of 47mm must be taken into account, and reduced by half.

i.e. $\frac{\Delta L}{2} = \frac{47}{2} = 23.5\,mm$

What this means is, that if we cut 23.5mm off the 15m length of pipe, we will only need to allow for the remaining 23.5mm of expansion.

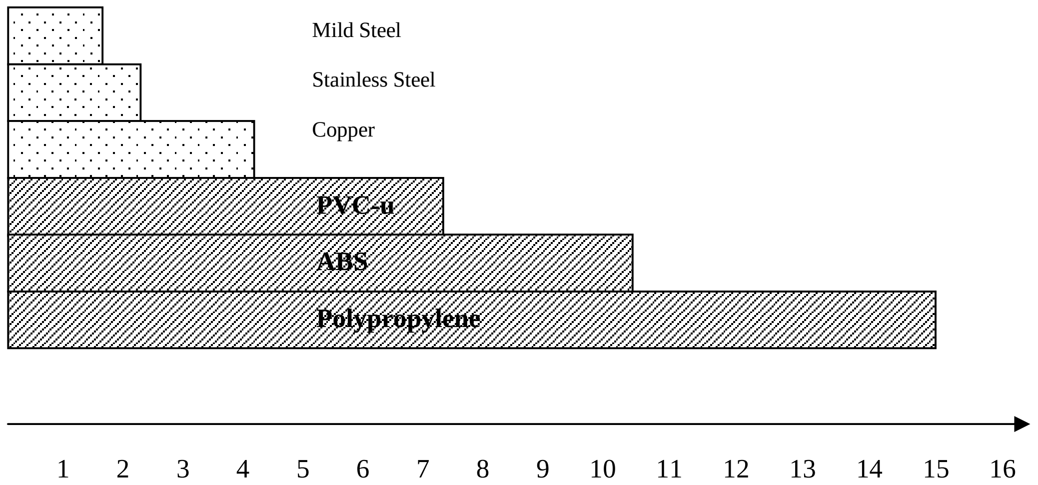


$$a = \left(\sqrt{63\ x\ \frac{47}{2}}\right) x\ 33.5$$

$$a = 1289mm$$

By pre-stressing the flexible arm it has been possible to reduce the arm length, and the pipe can now expand and allow (a) the flexible arm to straighten and to relieve the pre-stress.

Coefficient of Linear Expansion for Plastics



Comparison of thermal expansion of plastics and metals

Coefficient of Linear Expansion for Plastics

Material	Coefficient δ x (10^{-5} m/m°C)	Length/Temp°C Equipment mm/m°C
PVC-u	7.8	0.078
ABS	10.1	0.100
P.P	15.0	0.150
P.E.	20.0	0.200

The meaning of the above coefficients are for example: ABS will expand 0.100mm per metre, for every 10°C raised in mid-wall temp above the installation temperature.

Expansion in mm from 1°C to 20°C for 1 metre Length Pipe

°C	ABS	
1	0.100	
2	0.200	For the temperature range not
3	0.300	
4	0.400	on the chart, add the factors.
5	0.500	
6	0.600	
7	0.700	
8	0.800	i.e. for ABS @ 37°C
9	0.900	
10	1.000	
11	1.100	Add 20°C = 2.000
12	1.200	
13	1.300	17°C = 1.700
14	1.400	
15	1.500	37°C = 3.700
16	1.600	
17	1.700	
18	1.800	
19	1.900	
20	2.000	

Clips and Bracketing

Pipe brackets need to be made with the inside diameter of the bracket marginally larger than that of the pipe outer diameter. This allows for free lineal movement of the pipe, and avoids inhibiting expansion or contraction. They should also be smooth, to avoid damage to the outer surface of the pipe.

Plimat's plastic pipe clips meet all these requirements, and are strong, durable against temperature, Ultra Violet light and can also be used in corrosive or otherwise adverse environmental conditions.

Plimat pipe clips are adaptable and can fixed in the normal way or be screwed onto M6 or M8 threaded bar by inserting the respective nut into the side of the clip. They can also be fitted to the side of M6 or M8 threaded bar by utilising a rod adaptor. For an example of this please look to the photograph in the bottom left corner of the contents page

Bracket Spacing Intervals

Plastic pipe lines require regular support, and the spacing of clips or brackets depends on the pipe used, temperature, and density of the liquid carried.

The following tables show the centre to centre measurement between brackets.

ABS Pipe 15 Bar (217 Psi) Class E, Inch Sizes

Pipe Size		Bracket Spacing in Metres					
Inch	Metric	20°C	30°C	40°C	50°C	60°C	70°C
⅜		0.80	0.75	0.65	0.60	0.50	0.40
½	20	0.90	0.80	0.75	0.65	0.55	0.50
¾	25	1.00	0.95	0.85	0.75	0.70	0.60
1	32	1.10	1.00	0.95	0.80	0.75	0.65
1¼	40	1.20	1.10	1.00	0.90	0.80	0.70
1½	50	1.25	1.20	1.10	0.95	0.85	0.75
2	63	1.40	1.30	1.20	1.00	0.90	0.80
21/2	75	1.50	1.35	1.25	1.15	1.00	0.85
3	90	1.60	1.45	1.35	1.20	1.05	0.90
4	110	1.80	1.65	1.55	1.35	1.20	1.00
5	140	2.00	1.80	1.70	1.50	1.30	1.10
6	160	2.10	1.90	1.80	1.60	1.40	1.20