a) Immediately after placing the system in operation, a visual inspection shall be conducted to ensure that the thermal expansion is being absorbed by the expansion bellows in the manner for which they were designed.

b) A programme of periodic inspection shall be planned by the system designer and conducted throughout the operating life of the system. The frequency of these inspections will be determined by the service and environmental conditions involved. These conditions shall include an examination for signs of external corrosion, loosening of threaded and deterioration of anchors, guides and other hardware.
It must be understood that the inspection programme without any other back-up information, cannot give evidence of damage due to fatigue, stress corrosion or general internal corrosion.
These can be the cause of sudden failures and generally occur without any visible or audible warning.
Where the critical nature of the system warrants, it may be necessary to devise means for minimising the probability of this type of failure, including periodic preventive replacement of critical items.

c) When any inspection reveals evidence of malfunction, damage or deterioration, this shall be reviewed by the piping engineer.

SYSTEM OPERATION

1) A record shall be maintained of any changes in system operating conditions (such as pressure, temperature, thermal cycling, water treatment) and piping modifications. Any such change shall be reviewed by the piping designer to determine its effect on the performance of the anchors, guides and expansion joints.

Expansion joints which have been properly designed and manufactured for specific conditions have given many years of satisfactory service. Failures, of course, have occured which are of concern both to users and the reputable expansion joints manufacturers. Failures can occur for many reasons, but experience has shown that certain causes of failure fall into fairly distinct categories :

a) Shipping and handling damage.
Examples :
Denting or gouging of bellows from being struck by hard objects (tools, fork-lifts, adjacent structures)...
Improper stacking for shipping or storage. Insufficient protection from weather or other adverse environmental conditions.

b) Improper installation and insufficient protection during and after installation.
Examples :
Joints with internal sleeves installed in reverse direction with respect to flow.
Installing a joint in a location other than as precribed by the intallation drawings.
Premature removal of shipping restraints.
Springing of bellows to make up for piping misalignment.
Insufficient protection from mechanical damage due to work in the surrounding area.
Insufficient protection of bellows during nearby welding operations.
Failure to remove shipping restraints before placing system in operation.

c) Improper anchoring, guiding, supporting of the piping system. Anchor failure in service.

d) Bellows corrosion.
Examples :
Improper selection of bellows material for the flowing medium and/or adverse external environment.
Specifically, chlorides leaching from insulation, have been frequently the cause of stainless steel bellows corrosion.
300 series stainless steel can be subject to stress corrosion in the presence of chlorides. In these cases the use of high nickel alloys should be considered.

e) System over-pressure (in service or hydrotest).

f) Bellows vibration (mechanical or flow-induced) resulting in high-cycle fatigue).

g) Excessive bellows deflection (axial, lateral, angular deflection greater than design values).

h) Bellows erosion. Example : Bellows without internal sleeves installed in a system having a very high velocity and/or erosive flowing medium.

i) Packing of matter in bellows convolutions which inhibits proper movement of the bellows components.

In case of probleme or doubt, please do not hesitate to request our technical department.