

## GENERAL ANNEX A1

### RECOMMENDATIONS FOR TAKING INTO ACCOUNT BUOYANCY

#### (Mandatory annex)

#### A1.1 - GENERAL

For the piping system design, the conditions imposed by the environment may lead to take into account the buoyancy effects, e. g. in the following cases:

- a* - pipings above ground, in ducts or in tunnels in regions likely to be flooded,
- b* - pipings « immersed » when crossing a water course.
- c* - buried pipings subjected to ground water level changes,

For these various conditions, the piping shall be checked taking account of the buoyancy effects. Especially, a particular attention shall be paid to the condition corresponding to the empty piping, with respect to piping supporting.

These additional loadings shall be taken into account within the framework of the flexibility analysis (Division 1 - C3) and the corresponding stresses shall be considered as primary stresses.

However, the conditions considered taking account of these additional loadings are either exceptional operating conditions (case *a*) or normal operating conditions (case *b* and *c*) and the allowable stresses shall thus be determined accordingly.

Note 1: In the case of a « flooding » condition due to rupturing of a storage vessel, the fluid density may differ from 1.

Note 2: Pipings conveying fluids at elevated temperature are generally subjected to special provisions which are out of the scope of this Annex.

#### A1.2 - PARTICULAR CONSTRUCTION PROVISIONS

##### A1.2.1 - Pipings above ground, in ducts or in tunnels.

The exceptional loadings due to buoyancy may be taken up by "anti-buoyancy" collar elements fitted at

the supporting points located in the regions liable to flooding (fig. A1.2.1) or using any other appropriate device (fig.. A1.2.1 and A1.2.2)

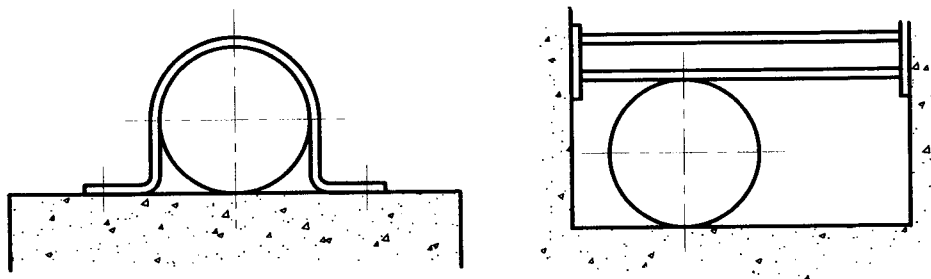


Figure A1.2.1

**A1.2.2 - Pippings "immersed" when crossing a water course**

Generally, the piping shall be ballasted.

This ballasting may be carried out continuously (concrete coating), by means of overloading clamps or collars (Figure A1.2.2).

The spacing between these clamps or collars shall then be defined from the flexibility analysis.

**A1.2.3 - Buried pippings.**

The provisions of A1.2.2 shall apply (see also General annex A2).

Note: Under the "flooding" conditions, the density of the « wet » backfill may perhaps differ from the density taken into account in the calculations corresponding to the normal operating conditions.

## Clamp and collar

