

## 5 Installation

### 5.1 Pre-requisites

Principle pre-requisites for a professionally designed pipe system are good technical knowledge coupled with many years of experience in application and production techniques. Customers now expect that both the engineering (planning) firm and construction company possesses the appropriate theoretical basis and the correspondingly qualified professional personnel. In addition, they must be able to offer an environmentally-friendly, low-maintenance, economical and long-lasting pipe system, features that a plastic system can provide.

### 5.2 General

The references to corresponding chapters of the Specification Manual indicated in the figures will serve as guides to passages in which the relevant subjects are discussed in detail and should facilitate the use of this Specification Manual in specific applications.

### 5.3 Classification criteria

In the project planning and installation of thermoplastic pipe systems, consideration must always be given to material-specific properties. The applicability of general principles to specific applications is only possible when material variables and behaviours display similarities (to the requirements of the given situation). In the age of the PC, modern computer programmes are used to design reliable pipe systems, and graphical planning occurs with the support of modern CAD applications. But these are not sufficient to guarantee the operational reliability of pipes, which still depends on the professional processing and use of plastic. The following instructions should be used, especially in planning, as a guide for the design and construction of PE pipe systems. A general distinction in the classification of plastic pipe systems is based on the method of installation. In general, there are three main groups, which are shown in figure 5.1.

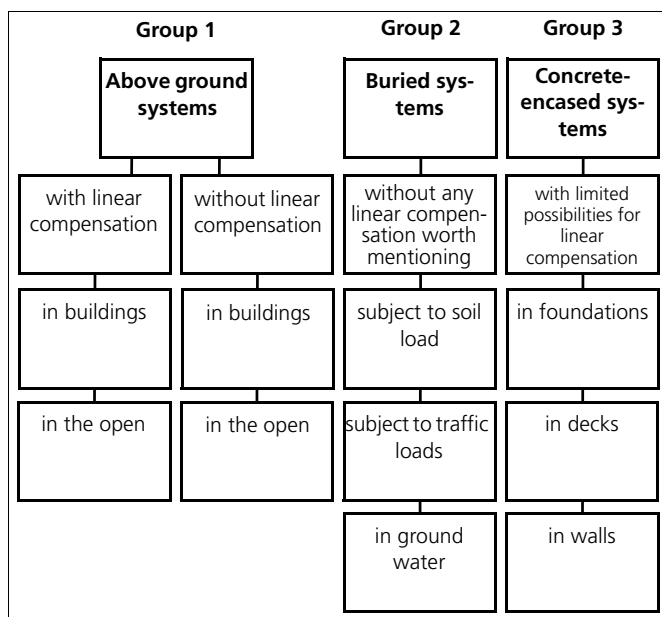


Figure 5.1 Pipe system applications

Group 1 consists of pipe systems with and without linear compensation. These systems require a bracket construction and are predominantly found in chemical or sewage plants, as well as in swimming pool construction. They generally require the largest project outlays. Planning

aids and discernible influential factors for these pipe systems can be seen in figures 5.2 and 5.3.

Groups 2 pipe installations are exemplified by the parts of a communal water supply network. They are, however, also frequently used in the area of industrial waste water technology. Due to the flexibility of PE pipes, the costs of groundwork are lower than they are when laying steel, ductile iron or concrete pipes. PE also has distinctive advantages over less flexible plastic pipes (such as PVC). Planning aids and discernible influential factors are shown in figure 5.4.

Group 3 pipe systems constitute exceptional cases, especially as the accessibility for maintenance is limited. If possible, a pipeline should be installed according to the principles of groups 1 or 2, and direct integration into structures be reserved for open channels or discharge pipes, which are subject to lower stress. Planning aids and discernible influential factors are shown in figure 5.5.

### 5.4 Influence of operating conditions

The influence of pressure and temperature fluctuations depends on the individual system.

Since the possibility of thermal linear compensation is not always available, this limitation must be taken into account when calculating load effects. Stress due to internal pressure, bending, external loads, etc can collectively occur and make it necessary for the individual pipe system to be sized in a system-dependent manner.

### 5.5 Structural analysis

Depending on the nature of the load, various tests can be run on buried pipe systems. In one design, it is the stress and deformation calculation that is important. In another, it is a stability test. A summary of the relevant considerations in this respect is presented in chapters 5.5.1 and 5.5.2. The principles underlying the calculations for buried plastic pipe installations are provided in ATVA 127 (calculations specific to the Netherlands are reported in NEN 3650, NEN 3651 and NPR 3659).

#### 5.5.1 The stress and deformation calculation

Soil loads and traffic loads give rise to pipe cross-section tensile and compressive stresses. The extent of the stress is influenced by the elasticity of the pipe. In general, increasing the elasticity of the pipe will reduce tension. The testing for stress is therefore to be conducted while considering all inner and outer influential factors (e.g. soil stress, traffic load, water, ground water, chemical resistance internal over- or underpressure). The manner of embedding in the ground is particularly responsible for degrees of pipe deformation. The higher the compression ratio of the surrounding ground, the smaller the deformation. The requirement of locating the pipe zone in compactable soil is derived from this observation. The acceptable vertical deformation of a PE pipe is currently 6% and is based on the average pipe diameter. Stress and deformation calculations are always performed in parallel.

#### 5.5.2 Stability test

In a PE pipe susceptible to deformation, exceeding a critical load will cause the pipe cross section to buckle. This occurs as a result of increased external (external overpressure due to the effects of groundwater, depth of the covering soil, etc) or internal (underpressure) stresses. The stability test is used to document the safety clearance between the critical and actually occurring load. Details and instructions for the calculation and the installation of the pipe systems are provided in the following chapter.

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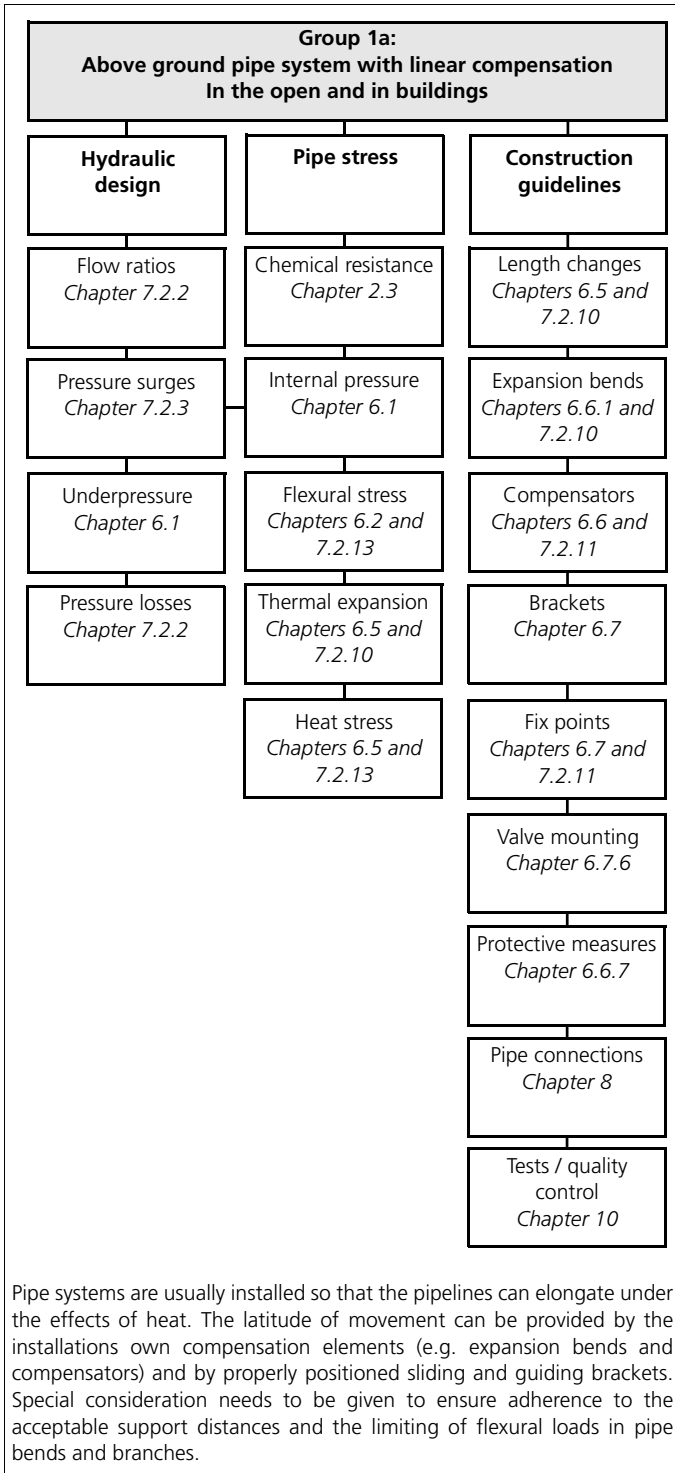


Figure 5.2 Above ground pipe systems with linear compensation

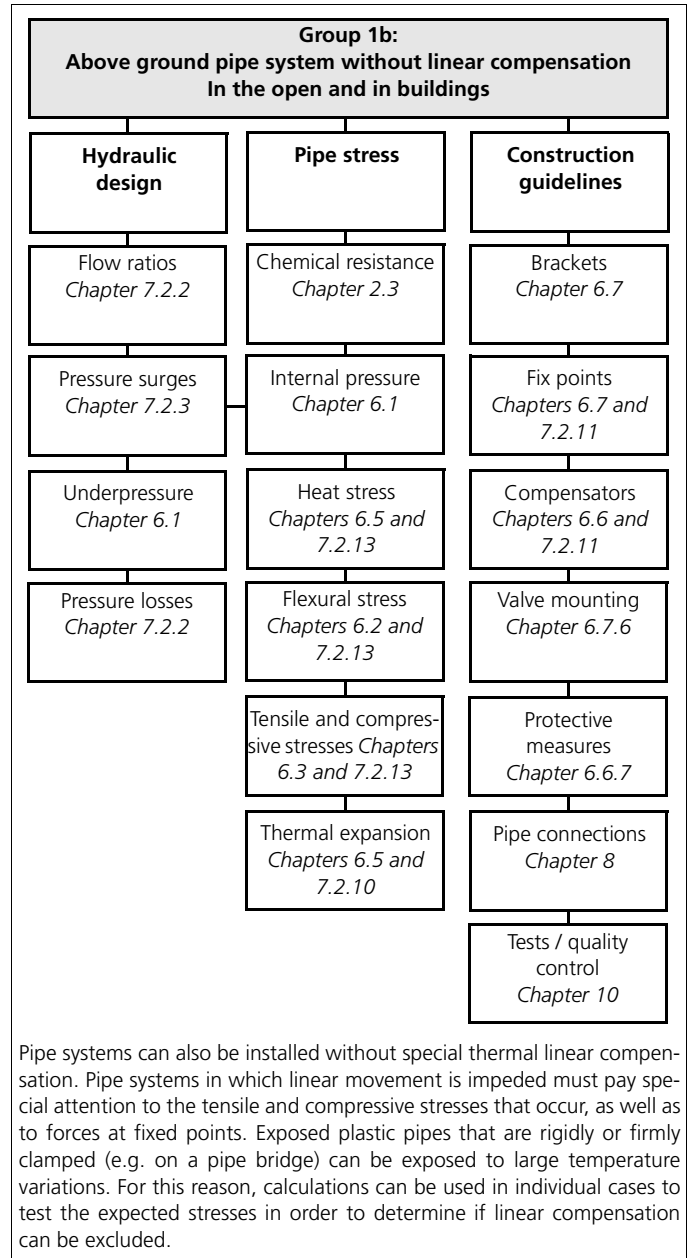
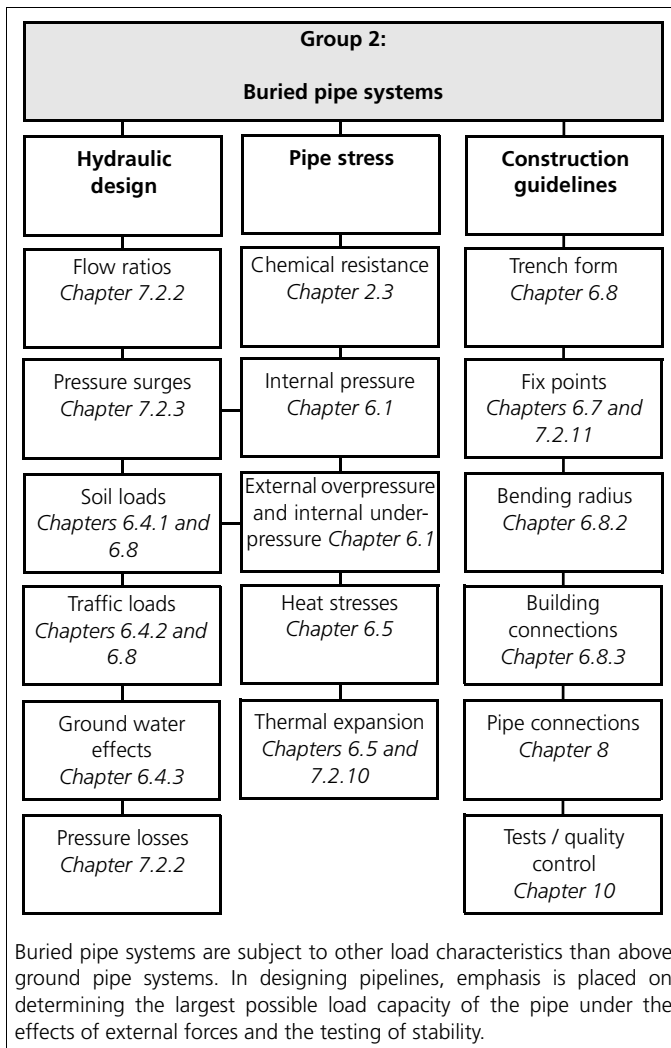
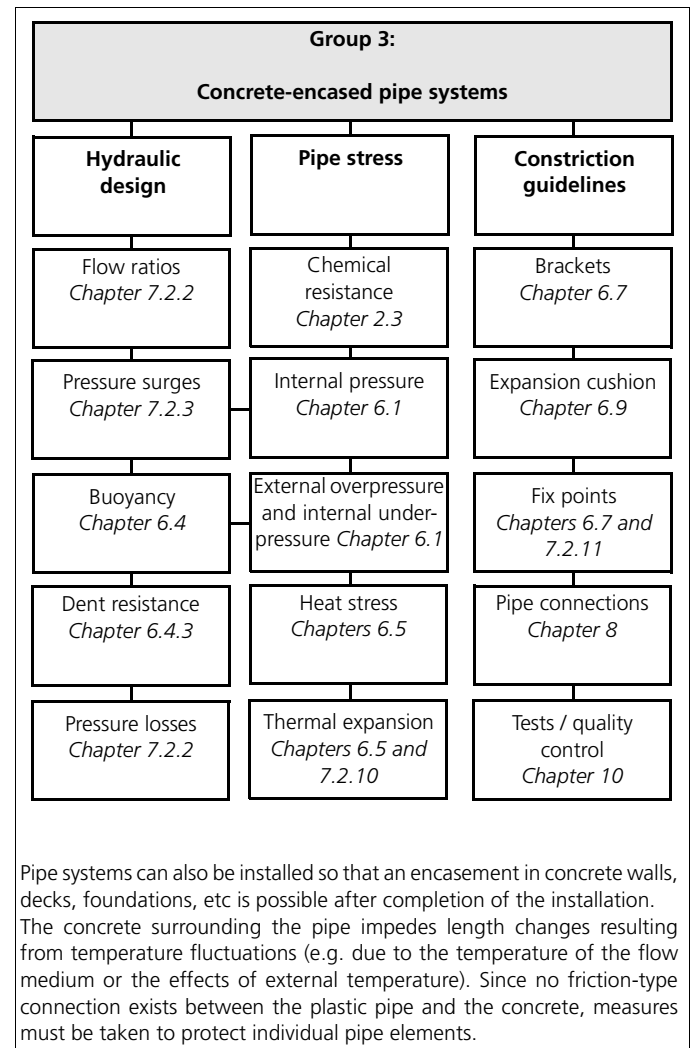


Figure 5.3 Above ground pipe systems without linear compensation


*Figure 5.4 Buried pipe systems*

*Figure 5.5 Concrete-encased pipe systems*