TECHNICAL REPORT

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Techniques for rehabilitation of pipeline systems by the use of plastics pipes and fittings

Techniques de réhabilitation des réseaux de canalisation au moyen de tubes et raccords plastiques

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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 11295, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 138, *Plastics pipes, fittings and valves for the transport of fluids*.

For further information, see "Introduction".

Introduction

This technical report was prepared by TG 1 of ISO/TC 138/WG 12, *Rehabilitation of pipeline systems*.

The technical report describes methods of rehabilitation of pipeline systems which are "state of the art" and those still under technical development. This is the reason which led to the decision to publish this document in the form of a Technical Report type 3.

In the past 10 years rehabilitation of pipeline systems has become increasingly important.

Pipe systems are constantly required to satisfy physical, chemical, biochemical and biological demands. These demands depend on planning, material, construction, type and period of use.

When pipe systems have become operational they need proper system management. Next to inspection and cleaning, rehabilitation of the pipeline may be required. Rehabilitation is carried out when the performance of the pipeline system needs upgrading. It can consist of repair, renovation and replacement.

In September 1988, a task group of ISO/TC 138/WG 12 started preparing drafts for the standardization of plastics pipes and their constituents (fittings) used for rehabilitating pipe systems.

This Technical Report is meant to be a reference document for future ISO system standards on this matter. It will therefore have to be updated regularly.

The future International Standard will specify the characteristic requirements and methods to test pipes and fittings and/or their constituents used in renovating pipe systems. The International Standard will contain several subdivisions depending on the field of application.

Techniques for rehabilitation of pipeline systems by the use of plastics pipes and fittings

1 SCOPE

This Technical Report outlines methods of rehabilitation of non-pressure or pressure pipeline systems by the use of plastics pipes and their constituents involving:

- Renovation of existing pipeline systems, using one of the optional lining techniques, or
- Replacement of existing pipeline systems, using one of the optional trenchless techniques

2 DEFINITIONS

For the purpose of this Technical Report, the following definitions apply:

Pipeline system	The interconnecting pipe network for the conveyance of fluids e.g. water, sewage, gases, industrial flows (including slurries)
Rehabilitation	All aspects of maintaining or upgrading the performance of existing pipeline systems (maintenance, repair, renovation, replacement)
Maintenance	Maintaining the performance of pipeline systems (e.g. inspection, cleaning)
Repair	Rectification of local damage to the fabric of the pipelines or their joints (e.g. sealing)
Renovation	Methods by which the performance of pipeline systems is improved by incorporating the original fabric. (e.g. by inserting or applying a lining into the existing pipeline)
Replacement	Methods by which a new pipeline is constructed by replacing the original fabric

Design category	Categorisation of the behaviour of lining systems (see clause 6)
Grouting	Filling of the annular space between existing pipe and lining

3 SURVEY, PLANNING AND PRE-CONSTRUCTION

It is necessary to consider the condition of the existing pipeline in order to determine any required actions that must be taken to rehabilitate the pipeline system i.e. repair, renovation or replacement.

These measures would:

- Assess the hydraulic and structural condition of the pipeline system.

- Establish position, line and level of the existing system with regard to cross-section, length, material, junctions and laterals.
  . The system plan should be suitably amended when these facts are known.

- Establish the type of soil strata and expected changes in the groundwater table.

- Select the design category and the most appropriate technique.

- Set up planning and timing of construction so that the work proceeds efficiently.

- Allow for maintenance of continuity of flow during construction when considered advisable (e.g. methods and provision for storm flow).

- Inform residents of the possible environmental effects such as noise, traffic congestion and interruptions.

- Define costs and requirements of maintenance after completion.

4 MATERIALS

For rehabilitation the following plastics pipes reinforced or non reinforced or their constituents are generally used:

- Thermoplastics e.g. polyvinylchloride, polyethylene, polypropylene

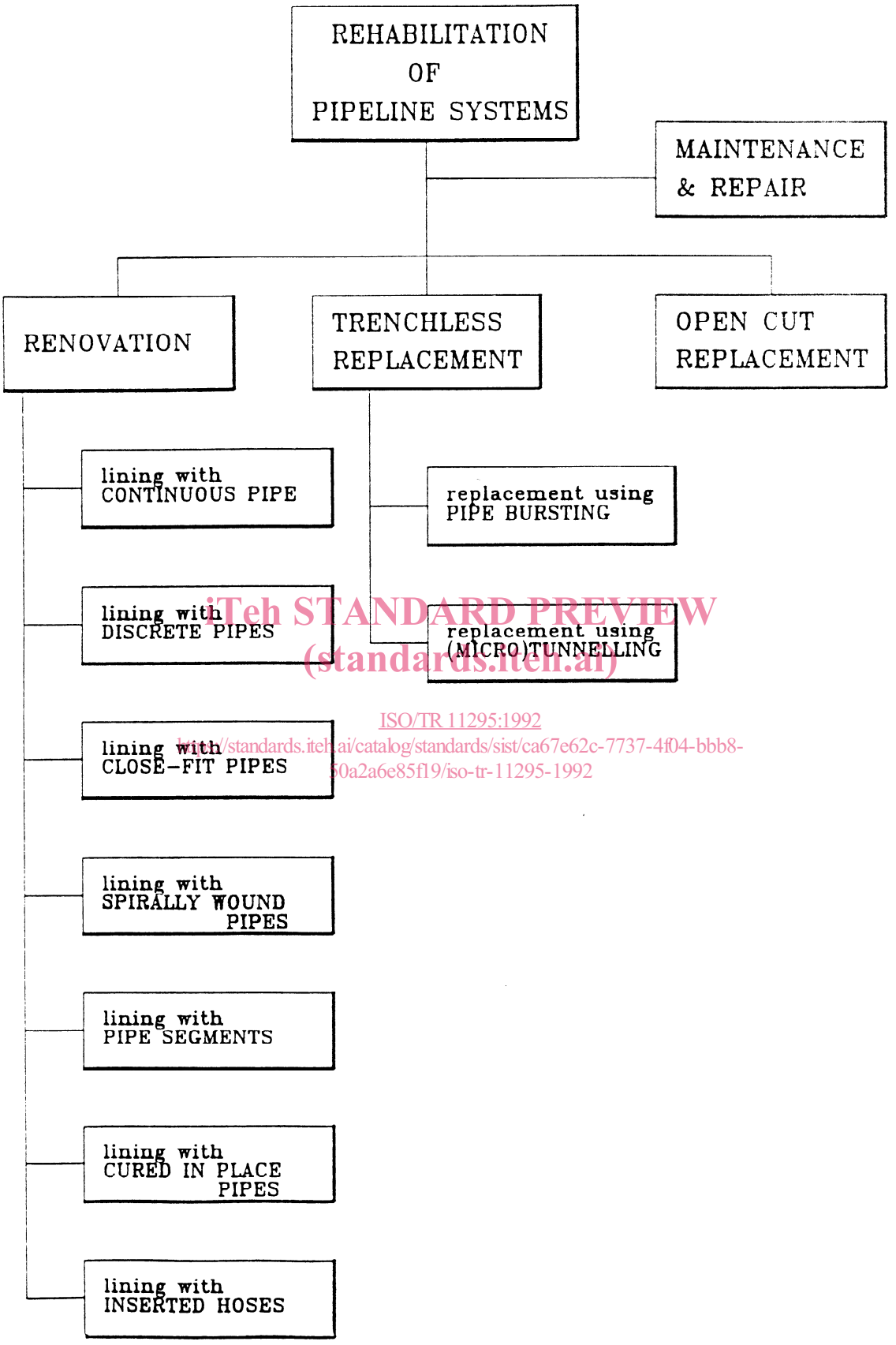
- Thermosets e.g. polyesters and epoxies

Combinations of the above are possible.

5 TECHNIQUES

5.1 General

This sub clause decribes the features of relevant rehabilitation methods. The various rehabilitation groupings are shown diagrammatically as follows:



A distinction has been made between:
- Renovation techniques (5.2) and
- Replacement techniques (trenchless) (5.3)

Note: Maintenance & repair and (traditional) open cut replacement techniques are not further dealt with in this document.

A further subdivision has been made into the following "families":

- Lining with continuous pipe lengths (5.2.1)
- Lining with discrete pipes (5.2.2)
- Lining with close-fit pipes (5.2.3)
- Lining with spirally wound pipes (5.2.4)
- Lining with pipe segments (5.2.5)
- Lining with cured in place pipes (5.2.6)
- Lining with inserted hoses (5.2.7)

- Replacement using pipe bursting (5.3.1)
- Replacement using micro-tunnelling (5.3.2)

The families are presented schematically on the following pages in the form of tables.

Note: The materials referred to are those in general use but not intended to be exclusive.

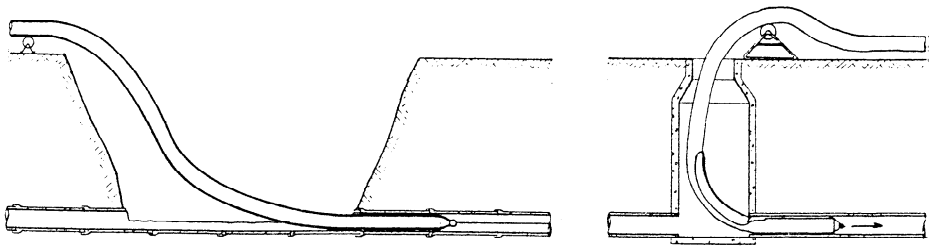
5.2 RENOVATION (LINING) TECHNIQUES

5.2.1 LINING WITH CONTINUOUS PIPE

FAMILY	: Lining with continuous pipe
DESCRIPTION	: Insertion into the existing pipeline of a single continuous pipe lining or jointed sections to form a continuous pipe
GENERAL APPLICATION	: Gravity and pressure pipelines

MATERIALS	: PE, PP, PE/EPDM, PVC
CHARACTERISTICS (GENERAL)	: - diameter range: up to 1600 mm - pipes manufactured or prior assembled into the continuous length required - in the case of pressure lines, so-called live insertion is optional; supply is continued via a by-pass or through the annular space - reduction in capacity : may be significant, dependent on liner pipe diameter and wall thickness (may be compensated e.g. by increasing the pressure) - lining can be accomplished either via an insertion pit or via a manhole (in the case of sewers); the latter requires a pipe with sufficient axial flexibility - in the case of gravity lines annular space usually grouted - lining is capable of accommodating (large radius) bends - method can be carried out by any pipe contractor relatively low degree of skill
OTHER CONSIDERATIONS	: . simple method . low investment . few joints

INSTALLATION METHOD (GENERAL) :



5.2.2 LINING WITH DISCRETE PIPES

FAMILY	: Lining with discrete pipes
DESCRIPTION	: Installation of individual pipes which are shorter than the section to be renovated and which may be jointed outside or in the pipeline to form a continuous lining
GENERAL APPLICATION	: Gravity and pressure pipelines

MATERIALS	: PE, PP, PVC, GRP (-EP & -UP)
CHARACTERISTICS (GENERAL)	: - diameter range: from 100 mm up to 4000 mm - pipes assembled with sealed, loose or tensile resistant (locked) joints - insertion pit can be avoided (with short lengths), so no-dig possible - reduction in capacity: may be significant by applying purpose made shaped pipes (oval, obovate) the reduction can be kept to a minimum - annular space generally grouted - method can be carried out by any pipe contractor/ by any municipality : relatively low degree of skill
OTHER CONSIDERATIONS	: . simple method . many joints . low investments

INSTALLATION METHOD (GENERAL) :