## INTERNATIONAL STANDARD



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# Earthquake- and subsidence-resistant design of ductile iron pipelines

Conception de canalisations en fonte ductile résistant aux tremblements de terre et aux affaissements



Reference number ISO 16134:2006(E)

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## Foreword

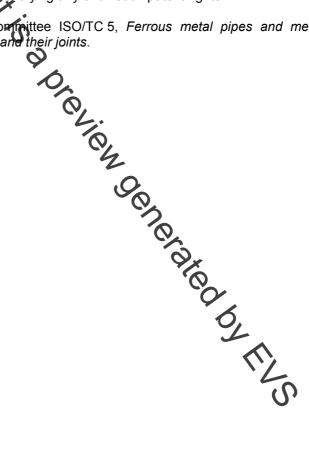
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### Introduction

Buried pipelines are often subjected to damage by earthquakes. It is therefore necessary to take earthquake resistance into consideration, where applicable, in the design of the pipelines. In reclaimed ground and other areas where ground subsidence is expected, the pipeline design must also take the subsidence into consideration.

areas where ground subsidence is expected, the pipeline design must also take the subsidence into consideration. Even though ducit iron pipelines are generally considered to be earthquake-resistant, since their joints are flexible and expandiontract according to the seismic motion to minimize the stress on the pipe body, nevertheless there have been reports of the joints becoming disconnected by either a large quake motion or major ground deformation such as liquefaction.

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## Earthquake- and subsidence-resistant design of ductile iron pipelines

## 1 Scope 🦯

This International Standard specifies the design of earthquake- and subsidence-resistant ductile iron pipelines suitable for use in areas where seismic activity and land subsidence can be expected. It provides a means of determining and checking the resistance of buried pipelines and also gives example calculations. It is applicable to ductile iron pipes and fittings with joints that have expansion/contraction and deflection capabilities, used in pipelines buried underground.

### 2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

#### 2.1

#### burying

placing of pipes underground in a condition where they touch the soil directly

#### 2.2

#### response displacement method

earthquake-resistant calculation method in which the inderground pipeline structure is affected by the ground displacement in its axial direction during an earthquake

#### 2.3

#### liquefaction

phenomenon in which sandy ground rapidly loses its strength and rigidity due to repeated stress during an earthquake, and where the whole ground behaves just like a liquo

#### 2.4

#### earthquake-resistant joint

joint having slip-out resistance as well as expansion/contraction and defection capabilities

#### 3 Earthquake-resistant design

#### 3.1 Seismic hazards to buried pipelines

In general, there are several main causes of seismic hazards to buried pipelines:

- a) ground displacement and ground strain caused by seismic ground shaking;
- b) ground deformation such as a ground surface crack, ground subsidence and lateral spread induced by liquefaction;
- c) relative displacement at the connecting part with the structure, etc.;
- d) ground displacement and rupture along a fault zone.

Since ductile iron pipe has high tensile strength as well as the capacity for expansion/contraction and deflection from its joint part, giving it the ability to follow the ground movement during the earthquake, the