INTERNATIONAL STANDARD



First edition 2006-02-01

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)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parametres were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below

The series of th

© ISO 2006

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office Case postale 56 • CH-1211 Geneva 20 Tel. + 41 22 749 01 11 Fax + 41 22 749 09 47 E-mail copyright@iso.org Web www.iso.org Published in Switzerland

Contents

Forewo	ord	iv
Introdu	iction	v
1	Scope	1
2	Terms and definitions	1
3 3.1 3.2 3.3 3.4 3.5	Earthquake resistant design Seismic haza () to buried pipelines Qualitative design considerations Design procedure Earthquake resistance calculations and safety checking Calculation of earthquake resistance — Response displacement method	1 2 3 3
4 4.1 4.2 4.3	Design for ground deformation by earthquake General Evaluation of possibility of figuefaction Checking basic resistance	6 6 7
5 5.1 5.2	Design for ground subsidence in soft ground (e.g. reclaimed ground) Calculating ground subsidence Basic safety checking	7 7 7
6 6.1 6.2	Calculating ground subsidence Basic safety checking Pipeline system design Pipeline components Earthquake-resistant joints A (informative) Example of earthquake resistance calculation	8 8 8
Annex	A (informative) Example of earthquake resistance calculation	9
Annex	B (informative) Relationship between seismic intensity scales and ground surface acceleration	
Annex	C (informative) Example of calculation of liquefaction resistance coefficient value	8
Annex	D (informative) Checking pipeline resistance to ground deformation	23
Annex	E (informative) Example of ground subsidence calculation	:6
Bibliog	raphy	32
	D (informative) Checking pipeline resistance to ground deformation	

Foreword

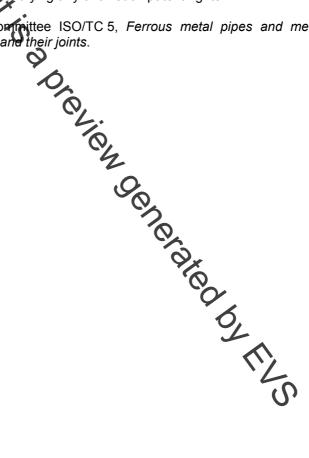
ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires applied by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16134 was prepared by Technical Committee ISO/TC 5, Ferrous metal pipes and metallic fittings, Subcommittee SC 2, Cast iron pipes, fittings and their joints.



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.

this document is a preview denerated by EUS

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