CANADIAN STANDARDS ASSOCIATION

Z341 Series-10

Storage of hydrocarbons in underground formations

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CSA Standards

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Storage of hydrocarbons in underground formations

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Contents

Annexes

Figures

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Preface

This is the third edition of CSA Z341 Series, *Storage of hydrocarbons in underground formations,* which consists of CSA Z341.1, *Reservoir storage,* and CSA Z341.2, *Salt cavern storage*. It supersedes the previous editions, published in 2006 and 2002. It also replaces CSA Z341, published as a single Standard in 1998 and 1993.

This Series of Standards covers the storage of hydrocarbons in naturally formed geological reservoirs and solution-mined salt caverns. This Series is intended to establish essential requirements and minimum standards for the design, construction, operation, maintenance, abandonment, and safety of underground storage systems. Users are reminded that this Series is not a design handbook; it is necessary to exercise competent engineering judgment in conjunction with its use.

Major revisions to this edition include the following:

(a) CSA Z341.1:
  (i) Clause 5.4.7 (casing cementing accessories);
  (ii) Clauses 8.3.2 and 10.3.1 (cathodic protection);
  (iii) Clause 10.2.4 (casing inspection); and
  (iv) Clause 13 (well abandonment); and

(b) CSA Z341.2:
  (i) Clause 5.4.7 (casing cementing accessories);
  (ii) Clauses 8.4.2 and 10.3.1 (cathodic protection);
  (iii) Clause 10.2.3 (wellhead and casing vents); and
  (iv) Figures 4 and 5.

Annex A in both Standards provides commentary that complements and clarifies the clauses of CSA Z341.1 and CSA Z341.2.

The requirements of this Series are adequate under conditions normally encountered in the storage industry. Requirements for abnormal or unusual conditions are not specifically addressed, and complete details of engineering and construction are not provided. It is intended that all work performed within the scope of this Series will meet or exceed the safety standards expressed or implied in the Series. It is possible that changes will have to be made based on new experience or technology, or both. When necessary, amendments will be issued by CSA.

This Series of Standards was prepared by the Technical Committee on Storage in Underground Formations, under the jurisdiction of the Strategic Steering Committee on Petroleum and Natural Gas Industry Systems, and has been formally approved by the Technical Committee.

February 2010

Notes:

(1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*

(2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*

(3) *This publication was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as "substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity". It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this publication.*

(4) *CSA Standards are subject to periodic review, and suggestions for their improvement will be referred to the appropriate committee.*

(5) *All enquiries regarding this Standard, including requests for interpretation, should be addressed to Canadian Standards Association, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6.*

Requests for interpretation should

(a) define the problem, making reference to the specific clause, and, where appropriate, include an illustrative sketch;

(b) provide an explanation of circumstances surrounding the actual field condition; and

(c) be phrased where possible to permit a specific "yes" or "no" answer.

Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are published in CSA's periodical* Info Update*, which is available on the CSA Web site at www.csa.ca.*

CSA Standard

Z341.1-10
Reservoir storage

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Z341.1-10
Reservoir storage

1 Scope

1.1
This Standard sets out minimum requirements for the design, construction, operation, maintenance, abandonment, and safety of hydrocarbon storage in underground reservoir formations and associated equipment. The equipment considered includes
(a) storage wellhead and Christmas tree assemblies;
(b) wells and subsurface equipment; and
(c) safety equipment, including monitoring, control, and emergency shutdown systems.

Hydrocarbons covered by this Standard are restricted to natural gas.

1.2
The scope of this Standard is shown in Figure 1.

1.3
This Standard does not apply to
(a) underground storage facilities for gases or fluids other than hydrocarbons, such as storage facilities used for air storage, unless these fluids are used specifically for the displacement of stored hydrocarbons;
(b) underground storage facilities used for storing substances other than hydrocarbons, such as reaction chambers and waste disposal facilities;
(c) underground storage in overburden materials involving the use of tanks, such as gasoline tanks;
(d) design and fabrication of pressure vessels that are covered by pressure vessel codes;
(e) heat exchangers, pumps, compressors, and piping in processing plant facilities, manufacturing plants, or industrial plants that are covered by appropriate codes;
(f) gathering lines, flow lines, metering, compressors, and associated surface equipment beyond the first emergency shutdown valve (ESV) or block valve; and
(g) storage of hydrocarbons containing hydrogen sulphide in concentrations greater than 10 mol/kmol.

1.4
It is not the intent of this Standard to prevent the development of new equipment or practices, nor to prescribe how such innovations should be handled.

1.5
Where the requirements of this Standard differ from the requirements of other standards or codes referenced herein, the requirements of this Standard take precedence.

1.6
The requirements of this Standard do not apply retroactively to existing installations and installations under construction at the time of publication, but they do apply to the extension, replacement, maintenance, and upgrading of such installations.

1.7
In CSA Standards, "shall" is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; "should" is used to express a recommendation or that which is advised but not required; "may" is used to express an option or that which is permissible within the limits of the standard; and "can" is used to express possibility or capability. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and may be written as requirements. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

2 Reference publications
This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto. Some reference publications are supplemented or qualified, or both, by specific requirements noted in this Standard; reference publications should therefore be applied in the context of this Standard.

CSA (Canadian Standards Association)
C22.1-09
Canadian Electrical Code, Part I

Z245.1-07
Steel pipe

Z245.11-09
Steel fittings

Z245.12-09
Steel flanges

Z245.15-09
Steel valves

Z662-07
Oil and gas pipeline systems

CAN/CSA-Z731-03 (R2009)
Emergency preparedness and response

API (American Petroleum Institute)
RP 5A5 (2005)
Field Inspection of New Casing, Tubing, and Plain-End Drill Pipe

RP 5B1 (2004)
Recommended Practice for Gauging and Inspection of Casing, Tubing, and Line Pipe Threads

RP 5C1 (1999)
Recommended Practice for Care and Use of Casing and Tubing

Bulletin 5C2 (1999)
Performance Properties of Casing, Tubing, and Drill Pipe

Specification 6A (2004)
Specification for Wellhead and Christmas Tree Equipment