CSA Z341 Series:22

Storage of hydrocarbons in underground formations

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CSA Z341 Series:22
March 2022

Title: *Storage of hydrocarbons in underground formations*

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CSA Z341 Series:22

Storage of hydrocarbons in underground formations

Published in March 2022 by CSA Group
A not-for-profit private sector organization
178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3

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ICS 23.020
ISBN 978-1-4883-3945-5

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Preface

This is the sixth edition of CSA Z341 Series, *Storage of hydrocarbons in underground formations,* which consists of CSA Z341.1, *Reservoir storage*, CSA Z341.2, *Salt cavern storage*, and CSA Z341.4, *Salt cavern waste disposal.* It supersedes the previous editions published in 2018, 2014, 2010, 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 and wastes from hydrocarbon production 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 are found as follows:

a) CSA Z341.1:
   i) Clause 7.5 (cased hole integrity inspection);
   ii) Clause 8.2.2 (wellhead size);
   iii) Clause 8.3.3 (ESV requirements);
   iv) Clause 9.1 (pre-commissioning pressure test);
   v) Clause 9.2 (pre-commissioning integrity inspection);
   vi) Clause 9.5 (corrosion control);
   vii) Clause 10.1.2 (emergency response plan);
   viii) Clause 10.2 (inspections and testing);
   ix) Clause 12.3 (emergency planning); and
   x) Annex A (updates reflecting changes to the clauses above).

b) CSA Z341.2:
   i) Clause 1.1 (scope);
   ii) Clause 5.1 (risk assessment);
   iii) Clause 5.6 (operation limits);
   iv) Clause 7.2 (core acquisition);
   v) Clause 7.5 (cased hole integrity inspection);
   vi) Clause 8.2 (wellhead and Christmas tree assembly pressure rating);
   vii) Clause 8.3 (emergency shutdown valves);
   viii) Clause 9.3 (cavern commissioning);
   ix) Clause 9.4 (corrosion control);
   x) Clause 10.1 (procedures);
   xi) Clause 10.2 (inspections and testing);
   xii) Clause 11.1 (inventory verification);
   xiii) Clause 12.3 (emergency planning);
   xiv) Clause 13.2.1 (preparation for stabilization period);
   xv) Annex A (updates reflecting changes to the clauses above); and
   xvi) Annex C (guidelines for mechanical integrity testing of storage caverns).

c) CSA Z341.4:
   i) Clause 1.1 (scope);
   ii) Clause 5.1 (risk assessment);
   iii) Clause 5.6 (operation limits);
   iv) Clause 7.3.17 [(casing) pressure testing — field];
   v) Clause 7.5 (cased hole integrity inspection);

vi) Clause 8.2 (wellhead and Christmas tree assembly pressure rating);
vii) Clause 8.3 (emergency shutdown valves);
viii) Clause 9.3 (cavern commissioning);
ix) Clause 9.4 (corrosion control);
x) Clause 10.1 (procedures);
xi) Clause 10.2 (inspections and testing);
xii) Clause 12.3 (emergency planning);
xiii) Clause 13.2.1 (preparation for stabilization period);
xiv) Annex A (updates reflecting changes to the clauses above); and
xv) Annex C (guidelines for mechanical integrity testing of waste disposal caverns).

Annex A in each Standard provides commentary that complements and clarifies the clauses of CSA Z341.1, CSA Z341.2, and CSA Z341.4.

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.

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 Standard 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 Standard.*
4) *To submit a request for interpretation of this Standard, please send the following information to inquiries@csagroup.org and include "Request for interpretation" in the subject line:*
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   Committee interpretations are processed in accordance with the CSA Directives and guidelines governing standardization *and are available on the* Current Standards Activities *page at standardsactivities.csa.ca.*
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   a) *Standard designation (number);*
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   c) *wording of the proposed change; and*
   d) *rationale for the change.*

CSA Z341.1:22
Reservoir storage

Published in March 2022 by CSA Group
A not-for-profit private sector organization
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ICS 23.020
ISBN 978-1-4883-3945-5

CSA Z341.1:22
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.

Note: *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.

