

**Interpretation of Sour Service Material Requirements
for New Pipeline Construction
as Compliant with CSA Z662-07; CSA Z245.11-, 12-, and 15-05;
CSA Z245.1-07; and NACE MR0175/ISO 15156 - 2003
Revision Date: January 2009**

Recent changes to the CSA Z662: Oil and Gas Pipeline Systems standard, the CSA Z245 series standards, and to NACE MR0175/ ISO 15156: Petroleum and Natural Gas Industries - Materials for Use in H₂S-containing Environments in Oil and Gas Production have resulted in fundamental changes to the interpretation of which materials are suitable for sour service in pipeline service. The most significant change is NACE MR0175/ISO 15156's new designation of three distinct regions of susceptibility to sulphide stress cracking. CSA now requires all sour service materials to meet the most stringent criteria, Region 3. This has resulted in some confusion over the documentation necessary to assure appropriate materials have been obtained.

The following five questions and answers apply to the material requirements for the construction of NEW sour service pipelines. Sour service is defined in Clause 16.2 of CSA Z662-07.

Question 1:

I am planning to construct a new sour service pipeline in accordance with CSA Z662-07, Clause 16. What are the requirements for sour service materials?

Answer:

The Alberta *Pipeline Regulation*, Section 9, specifies that except where superseded by the *Pipeline Regulation*, the minimum requirements for the design, construction, testing, operation, maintenance, repair, and leak detection of pipelines are set out in CSA Z662. Thus, the requirements contained in CSA Z662 are the **mandatory minimums** for oil and gas pipelines. Clause 16 of CSA Z662-07 additionally requires that sour service materials comply with the sour service clauses contained in the CSA Z245 series standards, namely:

- CSA Z245.1-07: Steel Pipe
- CSA Z245.11-05: Steel Fittings
- CSA Z245.12-05: Steel Flanges
- CSA Z245.15-05: Steel Valves

Pipe, fittings, flanges, and valves used in sour service must meet these additional sour service requirements. If no applicable CSA standard exists for a pipe or a component (e.g., weld-o-let, sock-o-let, valves smaller than 2 inches), the pipe or component must meet the requirements of NACE MR0175/ISO 15156 (NACE/ISO) to be allowable for sour service.

CSA Z662-07 allows for some non-CSA components to be used, subject to the limitations described in Table 5.3 of the standard; however, such components must comply with all the **additional** provisions of the sour service clause of the appropriate CSA Z245.xx standard. Evaluation by knowledgeable personnel may be necessary to verify sour service compliance with the CSA Z245.xx requirements for (as examples) material selection, chemistry, manufacturing processes, heat treatment, hardness, quality testing, mechanical

properties, maximum yield strength, inspection, and quality program compliance. Due to uncertainty about material properties and manufacturing processes of materials of unknown origin, the ERCB will not permit the use of unknown materials in sour service.

In the case of flanges, fittings, and valves, all the CSA Z245.xx standards (except for pipe) require that materials must be resistant to sulphide stress cracking (SSC) in Region 3 sour service as defined in NACE MR0175/ISO 15156. The SSC “regions” refer to specified service ranges, with Region 3 being the most severe. Materials that are generally resistant to sulphide stress cracking in the various regions are listed in the appendices of the NACE/ISO standard. Note, however, that these are *general* lists and in all cases the user is required to consider the additional influences of the specific production fluids before deciding if a material is acceptable for use. NACE/ISO clearly states that the final choice of material is the responsibility of the **user**. It is important to understand that NACE/ISO does not provide a list of materials that can simply be assumed to be acceptable for any sour service.

Question 2:

Would the components I purchased for sour service be compliant with Region 3 if the manufacturer stated on the material test report that the fittings, flanges, and valves are in accordance with all the requirements of a) the applicable CSA Z245.xx standard (2005 or later publication) but without the words “sour service,” and/or b) NACE MR0175/ISO 15156?

Answer:

No. The manufacturer has only confirmed that the components meet the general sour service manufacturing requirements of NACE MR0175/ISO 15156 without consideration of the service region and that the components were manufactured in accordance with the CSA Z245 general requirements, but not specifically in accordance with the CSA Z245.xx additional requirements for sour service.

If the material test report (MTR) stated compliance with the applicable CSA Z245.xx (2005 or later publication) sour service (SS), this would be acceptable. By adding the SS, the manufacturer is acknowledging compliance with the additional manufacturing requirements for sour service, as well as the material requirements specified for Region 3. (These were first published in the 2005 editions.) This is why stated compliance to NACE/ISO (but without specific Region 3 compliance) is not enough to achieve equivalency to the CSA sour service requirements. Similarly, certification to earlier editions of CSA Z245.xx does not signify compliance with Region 3 service, as it only became required in 2005.

If the material test report specifies compliance to CSA Z245.xx SS, the material must then have the mandatory physical markings for sour service in accordance with that standard.

Question 3:

If the licensee could not get confirmation by the manufacturer that the material met all requirements of the applicable CSA Z245.xx standard, including being suitable for Region 3, could the licensee evaluate the material test reports for the material in question using the applicable CSA Z245.xx standard and NACE MR0175/ISO 15156-2 (carbon steels) for Region 3 and NACE MR0175/ISO 15156-3 (alloys) for Region 3 to ensure that the components meet the applicable sour service requirements?

Answer:

Yes. The licensee can perform the evaluation and provide a statement confirming that the components meet all the necessary material and manufacturing requirements of the applicable CSA Z245.xx standard, including being suitable for Region 3, if required by the CSA Z245.xx standard. This engineering assessment must be done by suitably knowledgeable personnel and must be stamped by a professional engineer.

Question 4:

Is CSA Z245.1 steel pipe for sour service required to meet Region 3?

Answer:

No. CSA Z245.1-07 does not require steel pipe to meet NACE MR0175/ISO 15156, Region 3. However, there are specific sour service manufacturing requirements, as specified in CSA Z245.1, that the steel pipe must meet. This is why CSA Z245.1 pipe for sour service must include the SS on the material test report.

Question 5:

Does seamless pipe fall under the scope of CSA Z245.1 for sour service?

Answer:

Yes. CSA Z245.1 certified seamless pipe must also include certification to CSA Z245.1 SS on the material test report if it is to be used in sour service. For non-CSA Z245.1 certified seamless pipe listed in Table 5.3, of CSA Z662, the material provisions of NACE MR0175/ ISO 15156 (Region 3 not required for pipe) shall apply, but the pipe must also be evaluated to confirm compliance with the CSA Z245.1 manufacturing requirements for sour service pipe, including lamination restrictions as described in CSA Z245.1, Clause 16. This engineering assessment must be done by suitably knowledgeable personnel and must be stamped by a professional engineer.

Note that previous review has satisfied the ERCB that ASTM A106 and ASTM A333 Grade 6 line pipes do meet the supplemental sour service manufacturing requirements of CSA Z245.1. As long as these pipes are certified to NACE MR0175/ISO 15156, they can be used without further assessment, subject, however, to the limitations of CSA Z662, Table 5.3, and consideration of the effects of the service fluids.

References

- CSA Z245.1-07: Steel Pipe
- CSA Z245.11-05: Steel Fittings
- CSA Z245.12-05: Steel Flanges
- CSA Z245.15-05: Steel Valves
- CSA Z662-07: Oil and Gas Pipeline Systems

NACE MR0175/ISO 15156-1:2003—Petroleum and Natural Gas Industries - Materials for Use in H₂S-containing Environments in Oil and Gas Production, Part 1: General Principles for Selection of Cracking-resistant Materials.

NACE MR0175/ISO 15156-2:2003—Petroleum and Natural Gas Industries - Materials for Use in H₂S-containing Environments in Oil and Gas Production, Part 2: Cracking-resistant Carbon and Low Alloy Steels, and the Use of Cast Irons.

NACE MR0175/ISO 15156-3:2003—Petroleum and Natural Gas Industries - Materials for Use in H₂S-containing Environments in Oil and Gas Production, Part 3: Cracking-resistant CRAs (Corrosion-resistant Alloys) and Other Alloys.