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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 20657-2022

Replacing GB/T 20657-2011

**Petroleum and natural gas industries - Formulae and
calculations for the properties of casing, tubing, drill pipe and
line pipe used as casing or tubing**

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foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part 1. Structure and Drafting Rules for Standardization Documents" drafting.

This document replaces GB/T 20657-2011 "Casing, tubing, drill pipe and line pipe used as casing or tubing for the oil and gas industry

Performance Formulas and Calculations". Compared with GB/T 20657-2011, this document has major technical changes except structural adjustment and editorial changes as follows.

- a) Changed the definition of effective axial force (see 3.7, 4.7 of the.2011 edition);
- b) Terminology and definitions such as principal stress, number of threads per inch, yield stress deviation, etc. are deleted (see 4.19, 4.23, 4.26 of the.2011 edition);
- c) Added abbreviations (see 4.2);
- d) The yield design formula of thin-walled pipes under only internal pressure and no axial load has been changed (see 6.6.2, 6.6.2 of the.2011 edition);
- e) Delete the M65 steel grade requirements and its data (see 7.3.2, 15, B.2.3.3, B.3.2, F.5.4, F.6.3, K.2, L.2);
- f) Delete the effect of internal pressure on collapse (see 8.4.7 of the.2011 edition);
- g) Added the collapse pressure formula under the combined action of axial stress and internal pressure (see 8.4.7);
- h) Deleted all the content related to the direct-connection bushing (see 9.2.4, 11.9.4, 11.10.5, J.2.4 of the.2011 edition);
- i) The calculation formula for the slippage strength of the oil pipe joint without thickening

used for calculating the make-up torque is added (see 9.3.2);

j) Added the calculation formula for the slippage strength of the thickened oil pipe joint used to calculate the make-up torque (see 9.3.3);

k) Changed the critical wall thickness of couplings of some specifications (see 17.1, 17.1 of the.2011 edition);

l) The calculated wall thickness of semi-finished couplings of some specifications has been changed (see 17.2, 17.2 of the.2011 edition);

m) The wall thickness required for machining transverse Charpy impact specimens for couplings of some specifications has been changed (see 17.3, 17.3 of the.2011 edition);

n) The wall thickness required for processing longitudinal Charpy impact specimens for couplings of some specifications has been changed (see 17.4, 17.4 of the.2011 edition);

o) The minimum size of the transverse impact test specimen for couplings of some specifications has been changed (see 17.5, 17.2 of the.2011 edition).

This document is modified to adopt ISO /T R10400.2018 "Casing, tubing, drill pipe and pipes used as casing or tubing for the oil and gas industry

Line Pipe Performance Formula and Calculation".

Compared with ISO /T R10400.2018, this document has made the following structural adjustments.

---4.1 corresponds to Chapter 4 in ISO /T R10400.2018, adding 4.2;

---Move Chapters 9 to 11 and the explanations of some symbols in the formulas and figures in the appendix to 4.1, and move the abbreviations in 9.1 to to 4.2;

--- Change A.1.3.3.1.1~A.1.3.3.1.4 to A.1.3.3.2~A.1.3.3.5, A.1.3.3.2 to A.1.3.3.6;

--- Move the content of K.2 in Appendix K and L.2 in Appendix L to the corresponding table, and delete the chapter numbers of K.1, K.2, L.1, and L.2 and title.

The technical differences between this document and ISO /T R10400.2018 and their reasons are as follows.

--- Deleted some symbols, these symbols are not used in the standard text (see Chapter 4);

--- Added symbols and abbreviations such as fht, fycom, CRS, CVN, FAD, etc., explained the symbols in the added formula, supplemented

Filled with commonly used abbreviations (see Chapter 4);

--- Added the calculation formula of collapse pressure under the composite action of axial stress and internal pressure (see 8.4.7) to clarify the collapse pressure under composite load

The force calculation method enhances the operability of the standard;

--- An example of calculation of external pressure collapse pressure (see 8.7) has been added to help users of this document understand the formula;

--- In combination with ISO 11960:2020, the critical wall thickness of API threaded couplings (see 17.1) has been changed to be consistent with relevant standards.

The following editorial changes were made to this document.

--- Supplement the L809Cr data (see 11.1, Table F.8 and Table F.9), and improve the existing steel grade data;

--- Deleted the introduction of some limitations background information (see F.1.1);

--- Adjusted some table numbers (see Table H.11 and Table H.12 in H.4.2);

--- Adjust the content of K.2 and L.2 to the corresponding table (see Table K.1~Table K.5 and Table L.1~Table L.5).

Please note that some contents of this document may refer to patents. The issuing agency of this document assumes no responsibility for identifying patents.

1 Scope

This document gives the necessary calculation formulas and templates for various pipe properties, including.

--- Pipe properties, such as tensile strength, internal pressure resistance and external extrusion strength;

--- Minimum physical index;

--- Make-up torque;

--- Product test pressure;

--- Product critical dimensions related to test and inspection standards;

--- The critical size of the test equipment;

--- Specimen critical size.

For the calculation formula of pipe performance, a large amount of background information related to its development and use is provided, see Appendix A~Appendix J for details.

This document applies to ISO 11960 or APISpec5CT, ISO 11961 or APISpec5D, ISO 3183

or APISpec

5L produced tubes. With caution, the formulas and templates in this document can be used for other pipes. Tubes that have had cold work during their manufacture

(such as cold straightened pipe) are also included in the scope of this document. This document does not apply to pipes that are cold-worked after the finished pipe, such as expanded pipes and connected pipes.

Refill hose.

The use of the performance calculation formulas in this document for linepipe and other pipe is limited to the use of these pipes as casing/tubing or laboratory use.

It is necessary to carefully correspond to the closest casing/tubing product for its heat treatment process, straightening process and yield strength. These formulas are used for

The same care must be taken when calculating drill pipe performance.

By entering the manufacturing parameters of the pipe, this document and the formulas contained in it can calculate the ISO 11960 or APISpec5CT,

The expected performance of pipes in ISO 11961 or APISpec5D, ISO 3183 or APISpec5L. The calculation result of the formula in this document cannot be understood

Guarantee for the production process. Manufacturers produce petroleum tubing according to production specifications that include product dimensions and physical and chemical properties. This document is designed

The formulas provide a reference for users to describe tubing performance and well design or tubing characterization studies.

This document is not a design specification, it only provides formulas and templates for the performance calculation of pipes used in downholes. This document does not provide any

Guidance regarding the loads the pipe may experience or the safety margins required for an acceptable design. User determines appropriate design loads and selection

Sufficient safety factor for safe and efficient design. Design loads and safety factors can be based on historical experience, local code requirements and specific

Well condition selection OK.

All formulas and pipe performance data listed in this document (see Appendix K and Appendix L) assume a benign environment and material properties are satisfactory.

Meet the requirements of ISO 11960 or APISpec5CT, ISO 11961 or APISpec5D, ISO 3183 or APISpec5L. other environment

Additional analyzes may be required, as listed in Appendix D.