ICS 77.040.20

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 42677-2023

Non-destructive testing (NDT) methods of steel tubes - Liquid penetrant inspection of seamless and welded steel tubes for the detection of surface imperfections

钢管无损检测 无缝和焊接钢管表面缺欠的液体渗透检测

Issued on: August 6, 2023 **Implemented on: March 1, 2024**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

Foreword

This document was issued on 6 August 2023 by the State Administration for Market Regulation; Standardization Administration of the PRC and takes effect on 1 March 2024.

It is a GB/T standard: recommended rather than compulsory, but it is the text a Chinese reviewer applies when assessing a submission.

1 Scope

GB/T 42677-2023 covers liquid penetrant inspection of seamless and welded steel tube for imperfections open to the surface, over all or part of that surface. The general requirements put the inspection at the end of the line: unless the product standard says otherwise, or supplier and purchaser agree otherwise, penetrant testing is done after rolling, heat treatment, cold working and the remaining production processes are finished - a step carried out afterwards can both create a defect and smear metal over one that is already there. The methods clause takes the sequence in order, penetrant applied to the surface, drawn into imperfections that are open to it, and the excess removed before the surface is examined, and the following clause deals with evaluating the indications that result. Acceptance is settled against a level: tube showing no indication above that level has passed, and tube showing indications above it falls under the rest of that clause. The test report, where required, goes to the purchaser carrying the number of this document among its contents. Penetrant testing works on material that cannot be magnetised, which is why it, rather than magnetic particle testing, is the surface method for stainless and other non-magnetic tube. It is used by tube mills, NDT service providers, fabricators, and purchasers writing an acceptance level into an order.

This document specifies the requirements for liquid penetrant inspection of seamless and welded steel tubes for the detection of surface imperfections.

This document applies to the detection of imperfections on all or part of the surface of steel tubes, and also applies to the detection of hollow profiles.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3059 Non-destructive testing - Penetrant testing and magnetic particle testing - Viewing conditions

ISO 3452-1 Non-destructive testing - Penetrant testing - Part 1: General principles

ISO 3452-2 Non-destructive testing - Penetrant testing - Part 2: Testing of penetrant materials

ISO 9712 Non-destructive testing - Qualification and certification of personnel

NOTE: GB/T 9445-2015 Non-destructive testing - Qualification and certification of personnel

(ISO 9712:2012, IDT)

ISO 11484 Steel products - Employer's qualification system for non-destructive testing (NDT) personnel

3 Terms and definitions

For the purpose of this document, the terms and definitions defined in ISO 3452-1 and ISO 11484 and the following apply.

3.1

tube

A long hollow product with open ends and a cross-section of any shape.

3.2

seamless tube

A hollow tube made by piercing a solid material, which is further hot or cold processed

into final dimensions.

3.3

welded tube

A hollow tube made from a strip by crimping and then welding, which may be further hot and cold processed into final dimensions.

3.4

manufacturer

An organization that produces products in accordance with relevant standards and declares that the delivered products comply with relevant standards.

3.5

agreement

The contract signed between the manufacturer and purchaser at the time of inquiry and order.

4 General requirements

4.1 Unless otherwise specified in the product standard or agreed upon between both supplier and purchaser, the liquid penetrant inspection shall be carried out after completion of all the production processes of steel tubes (rolling, heat treating, cold and hot processing, sizing, and straightening, etc.).

4.2 The surface of the steel tube to be inspected shall be clean enough and free of oil, grease, sand, scale or any other foreign matter that may affect the accuracy of the penetrant inspection results. The type of indications and the minimum imperfection dimension that can be detected depend on the specific steel tube manufacturing process and the surface finish.

4.3 The inspection shall be carried out by operators trained and qualified in accordance with ISO 9712, ISO 11484 or equivalent standards and under the supervision of competent personnel authorized by the manufacturer. In the case of third-party inspection, this item shall be agreed upon between the supplier and purchaser.

The employer shall issue operating authorization certificates in accordance with

procedural documents. NDT operations shall be authorized by a level 3 NDT personnel approved by the employer.

NOTE: The definitions of level 1, level 2, and level 3 can be found in the corresponding standards,

such as ISO 9712 and ISO 11484.

5 Inspection methods

5.1 General

5.1.1 A liquid penetrant is applied to the surface of the workpiece being inspected and penetrates into the opening imperfections, and excess penetrant is removed; the surface being inspected is dried and a developer is applied. The developer is used to adsorb the penetrant penetrates into the imperfections and provide a high-contrast background for indications. The indication of the penetrant can be a colored indication (visible under white light) or a fluorescent indication (visible under ultraviolet light). For these two penetrant inspection techniques, the following three penetrants can be used:

a) water washable type;

b) post-emulsifying type;

c) solvent removable type.

NOTE: The term "penetrant material" used in this document includes all penetrants, solvents,

cleaning agents, developers, etc. used in the inspection process.

5.1.2 For each steel tube to be inspected or each inspection position, it shall select one of three types of penetrating materials for the inspection using colored penetrant technique or fluorescent penetrant technique.

The general principles and verification methods for liquid penetrant inspection as described in ISO 3059, ISO 3452-1, ISO 3452-2 shall be used.

5.2 Detection of imperfections and their classification

The liquid penetrant inspection is an effective means of detecting surface opening imperfections (referred to as "surface imperfections" in this document). Typical surface imperfections that can be detected by this method are cracks, seams, laps, cold shuts,