

**AUTOMOTIVE INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

QC/T 1198-2023

**Cable assembly with function box of conductive charging for
electric vehicles
(English Translation)**

Issued on: May 9, 2025

Implemented on: November 1, 2025

Issued by: Ministry of Industry and Information Technology of PRC

Table of Contents

Foreword...	3
Introduction...	4
1 Scope...	5
2 Normative references...	5
3 Terms and definitions...	5
4 Types and composition...	7
5 Inspection methods...	7

1 Scope

This document specifies the terminology, definitions, types, composition, inspection methods for chromium-based ceramic composite coatings for automotive engine piston rings.

This document applies to the inspection of chromium-based ceramic composite coatings for automotive engine piston rings, which have cylinder diameters less than or equal to 160 mm. The inspection of other types and large-diameter piston ring composite coatings shall be conducted with reference to this document.

2 Normative references

The following documents, through normative references herein, constitute essential provisions 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.

GB/T 1149.1 Internal combustion engines - Piston rings - Part 1.General specifications

GB/T 1149.2 Internal combustion engines - Piston rings - Part 2.Vocabulary

GB/T 4340.1 Metallic materials - Vickers hardness test - Part 1.Test method

GB/T 6462 Metallic and oxide coatings - Measurement of coating thickness-
Microscopical method

3 Terms and definitions

The following terms and definitions apply to this document.

3.1

Chromium-based ceramic composite coating

A composite coating in which multiple layers of chromium are electroplated onto the outer surface of a piston ring, using a forward and reverse current electroplating method, with ceramic particles embedded within.

3.2

Ceramic particles

Tiny particles made of ceramic materials, characterized by high hardness, strong wear resistance, heat resistance, corrosion resistance.

Note: Examples include aluminum oxide particles (Al_2O_3), boron nitride particles (BN), silicon carbide particles (SiC).

3.3

Reticulate pattern

The grooves used to fill the ceramic particles.

3.4

Reticulation density

The number of reticulate lines per unit length of the coating structure.

3.5

Particle content

The percentage of ceramic particles in a unit coating layer.

Note: Includes percentage by unit area of particle, percentage by unit volume of particle, percentage by unit mass of particle.

3.6

Plating thickness

The distance between the outer surface of the coating and the surface of the piston ring substrate material.

Note: For conical rings, the working contact surface position is measured; for barrel rings, the apex position of the barrel surface is measured, as shown in d) and e) in Figure 1.

4 Types and composition

The types and composition structures of the chromium-based ceramic composite coating for piston rings are shown in Figures 1 and 2. Other component names shall comply with

GB/T 1149.1 and GB/T 1149.2.

5.1.1.1 Sample requirements

- a) The cross-section shall be perpendicular to the coating;
- b) The cross-sectional surface shall be flat; the entire width of the image shall be simultaneously focused on the magnification used during measurement;
- c) Deformed material caused by cutting and preparing the cross-section shall be removed;
- d) The interface line on the selected coating cross-section shall be clearly determined by visual contrast alone or by a fine line that is easily distinguishable.

5.1.1.2 Sample preparation shall be performed in accordance with GB/T 6462.

5.1.2 General principles

Both metallographic and non-destructive testing methods are applicable for coating thickness testing; the metallographic method is the arbitration method.

5.1.2.1 Metallographic method

A specimen is cut from the area to be tested on the piston ring and embedded in the metallographic microscope. The cross-section is then ground and polished. The thickness of the composite coating is measured, using a calibrated micrometer with a graduated eyepiece or an image analysis microscope. The measurement positions are opposite the piston ring opening and 15 mm to both sides of the opening.

5.1.2.2 Non-destructive testing method

The area to be tested is directly measured using calibrated non-destructive testing methods such as X-ray measuring instruments, beta-ray measuring instruments, magnetic thickness gauges.

5.2.1.1 Sample preparation

A specimen approximately 15 mm in length is cut from any part of the ring. During specimen preparation, the outer surface of the specimen is placed at the bottom of the specimen preparation module. To protect the coating, a casting or steel piece is placed in front of the specimen during preparation. When hot-pressing specimens, the specimen temperature shall not exceed 170 °C. Multiple specimens can be prepared simultaneously, arranged in the order of specimen 1, specimen 2, etc., as shown in

Figure 3.

.....