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Fibre-reinforced polymer (FRP) reinforcement of concrete — Test methods —

Part 1: FRP bars

PROOF

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 71, *Concrete, reinforced concrete and pre-stressed concrete*, Subcommittee SC 6, *Non-traditional reinforcing materials for concrete structures*.

This third edition cancels and replaces the second edition (ISO 10406-1:2015), which has been technically revised.

The main changes are as follows:

— inclusion of thermoplastic resin for FRP bars;

— addition of the test method for fibre volume fraction of FRP bars;

— revision of test methods for alkaline resistance, long-term relaxation, tensile fatigue strength, and creep failure strength to enhance rigor and comprehensiveness;

— increase in the minimum number of test specimens from 3 to 5 for all test methods to ensure data reliability.

A list of all parts in the ISO 10406 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Fibre reinforced polymer (FRP) bars, renowned for their high strength, lightweight nature, excellent bond behaviour, and superior durability, serve a pivotal role in reinforcing new constructions and rehabilitating existing reinforced concrete structures. As the global use of FRP bars continues to expand, the need for standardized test methods has become paramount. Unlike steel, FRP bars exhibit anisotropic behaviour and their performance is influenced by the type of fibres, resin matrix, and manufacturing processes. As such, rigorous and consistent test methods are essential to accurately evaluate the physical properties, mechanical properties, long-term durability, and reliability of FRP bars in various environmental and loading conditions.

This document provides a comprehensive framework for evaluating the physical properties, mechanical properties, durability, and long-term performance of FRP bars. It aims to promote uniformity in test methods globally, thereby ensuring consistency in product quality and facilitating international trade. By establishing these test methods, this document supports engineers, manufacturers, and regulators in the design, production, and certification of FRP reinforcement systems for safe and sustainable infrastructure.

Fibre-reinforced polymer (FRP) reinforcement of concrete — Test methods —

Part 1:
FRP bars

1 Scope

This document specifies test methods application to fibre-reinforced polymer (FRP) bars as reinforcement or pre-stressing tendons in concrete, including physical, mechanical, durability, and long-term properties.

FRP bars in this document are made of fibre and resin matrix. Types of fibres are aramid fibre, basalt fibre, carbon fibre or glass fibre. The matrix includes thermosetting resins, such as vinylester, unsaturated polyester resins, as well as thermoplastic resins, including polypropylene, polyamides, and polymethyl methacrylate.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 291:2008, *Plastics — Standard atmospheres for conditioning and testing*

ISO 3611, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Design and metrological characteristics of micrometers for external measurements*

ISO 4788, *Laboratory glassware — Graduated measuring cylinders*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 13385-1, *Geometrical product specifications (GPS) — Dimensional measuring equipment — Part 1: Design and metrological characteristics of callipers*

MB/ NC[1]	Line number	Clause/ Subclause	Paragraph/ Figure/Table	Type of comment[2]	Comments	Proposed change	Observations of the secretariat	Responses

3 Terms, definition, and symbols

3.1 Terms and definition

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
average load
average of the maximum and minimum repeated load

3.1.2
bending angle
angle formed by the straight sections of a test piece on either side of the deflector

1 **MB** = Member body / **NC** = National Committee (enter the ISO 3166 two-letter country code, e.g. CN for China; comments from the ISO/CS editing unit are identified by **)

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial