FLEXIBILITY

BENDING MANDRELS: CYLINDRICAL AND CONICAL





Testing the flexibility and adhesion of coatings on substrates.

STANDARDS

ISO 1519 · UNE EN ISO 6860 · ASTM D522

NK Bending Mandrels by NEURTEK are the benchmark equipment for assessing the flexibility and adhesion of organic and inorganic coatings on metallic substrates through bending tests. Designed and manufactured entirely by NEURTEK, they are available in two versions — cylindrical and conical — which comply with the main international standards and are suited to different testing requirements.

The test involves bending a coated test specimen over the mandrel and observing the appearance of cracks or loss of coating adhesion. The result allows for an objective comparison of the ductility and flexibility of different coating systems or application processes.

APPLICATION

- **Industrial and decorative paints**: testing the flexibility of coatings on steel and aluminium sheet during production and material acceptance.
- **Architectural aluminium lacquering**: verification of flexibility requirements in accordance with Qualicoat specifications (cylindrical mandrel test).
- **Powder coatings**: assessment of the degree of curing and the ductility of thermosetting coatings on metal substrates.
- **Galvanising and pre-treatment:** verification of the adhesion and flexibility of primers and sealants on galvanised steel.
- **Automotive industry**: flexibility testing of bodywork paints, primers and protective coatings.
- **Coatings R&D**: development and comparison of formulations, solvents and curing systems to optimise coating ductility.

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GENERAL FEATURES

- Robust, low-maintenance design; manufactured entirely by NEURTEK in Spain.
- Cylindrical mandrel: 12 interchangeable steel mandrels (Ø 2 to 32 mm) or 7 mandrels for Ø 1/8 to 1" full coverage of the ISO 1519 and ASTM D522 standard range.
- Tapered mandrel: single cone, 200 mm long (Ø 3–37 mm), which determines the exact cracking point in a single bend.
- Cylindrical mandrel supplied in a case for transport and organised storage of the 12 mandrels.
- Instructions for use in English are included with the cylindrical mandrel.
- A traceable calibration certificate is available for the cylindrical mandrel (SER-CT030).

TEST PRINCIPLE

The test specimen (coated metal plate) is placed in the equipment compartment and progressively bent over the mandrel. At a certain point during bending, the first cracks appear or the coating begins to peel off. The diameter or position at which failure occurs is the test result.

The two models differ in the type of mandrel used and in how the result is expressed:

- **Cylindrical Mandrel:** the test specimen is bent successively over mandrels of decreasing until the first crack is detected. The result is the diameter of the smallest mandrel on which the coating shows no cracks.

- **Conical mandrel:** the test specimen is bent in a single movement over the cone (200 mm long, from Ø 37 mm to Ø 3 mm). The result is the position on the cone — that is, the diameter — where cracking begins.

COMPARISON OF MODELS

Feature	Cylindrical Mandrel	Conical Mandrel
Mandrel type	Interchangeable cylinders	Fixed cone
Test diameters	**Metric:** 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 32 mm **Imperial:** 1/8, 1/4, 3/8, 1/2, 5/8, 3/4 y 1"	Ø 3 – 37 mm continuous (200 mm length)
Mandrels included	12 mandrels (metric) or 7 mandrels (imperial)	1 single cone
Maximum specimen width	75 mm	-
Reading the result	Diameter of the mandrel where the first crack	Position (diameter) on the cone where the first crack
Main standard	UNE ISO 1519:2003	UNE EN ISO 6860 · ASTM D522-93a
Calibration certificate	SER-CT030 (with traceability)	Not available
Order reference	NK-CM6860 (metric) NK-CM6880 (imperial)	NK-CM1519





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TECHNICAL SPECIFICATIONS

Metric Cylindrical Chuck

Parameter	Value
Diameters — metric system (NK-CM6860)	2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25, 32 mm (12 steel mandrels)
Maximum specimen width	75 mm
Applicable standard	UNE ISO 1519:2003
Calibration certificate	SER-CT030 — with national traceability



Imperial cylindrical mandrel

Parameter	Value
Diameters — imperial system (NK-CM6880)	1/8", 1/4", 3/8", 1/2", 5/8", 3/4" y 1" (7 steel mandrels)
Maximum specimen width	75 mm
Applicable standard	UNE ISO 1519:2003
Calibration certificate	SER-CT030 — with national traceability



Conical mandrel

Parameter	Value
Cone length	200 mm
Diameter range	Ø 3 mm (thin end) – Ø 37 mm (thick end)
Applicable standard	UNE EN ISO 6860 · ASTM D522-93a
Calibration certificate	Not available

APPLICABLE STANDARDS

• **UNE ISO 1519:2003**: Paints and varnishes — Bending test with a cylindrical mandrel. This standard specifies the procedure for assessing the resistance to cracking of coatings on metal plates bent over cylindrical mandrels of decreasing diameter.

• **UNE EN ISO 6860**: Paints and varnishes — Conical mandrel bend test. Describes the method using a cone of variable diameter to determine the position (diameter) at which the coating fails during bending.

• **ASTM D522-93a**: Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings. Equivalent American standard for the cylindrical and conical mandrel bend test.

MODELS

Mandrels

Referencia	Description
NK-CM6860	CM6860 Cylindrical Mandrel — metric system. Includes: main bending unit + case with 12 mandrels (Ø 2, 3, 4, 5, 6, 8, 10, 12, 16, 20, 25 and 32 mm).
NK-CM6880	CM6880 Cylindrical Mandrel — imperial system. Includes: main bending unit + case with 7 mandrels (1/8", 1/4", 3/8", 1/2", 5/8", 3/4" and 1").
NK-CM1519	Conical mandrel — test kit with a 200 mm fixed cone (Ø 3–37 mm).

Optional calibration	Code	Description
✓	SER-CT030	Calibration Certificate for cylindrical mandrel (not available for the conical mandrel).

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