

APPROVED FRENCH STANDARD SPECIFICATION	IRON & STEEL PRODUCTS NON ALLOY CARBON STEEL WIRE RODS FOR THE MANUFACTURE OF COLD FORMED HIGH STRENGTH WIRES FOR MECHANICAL SPRINGS - Grades -	NF A 35-057 December 1979
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1. GENERAL

1.1 PURPOSE

The purpose of the present Standard Specification is the determination the non alloy carbon steel wire rod grades for the manufacture of cold formed high strength wires for mechanical springs and the requirements these grades must comply with

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The present document is a translation of the above French Standard Specification. Should any question or doubt arise concerning its interpretation, reference is exclusively to be made to the original French text as remaining the sole valid.

The present Standard Specification is of application for non alloy carbon steel wire rods with carbon contents from 0.48 % and upwards, intended for the manufacture of high strength cold rolled spring wires.

The present document is irrelevant when concerning products about which different Standards & Specifications have been provided for, such as :

- wire rods for cold drawing and for cold rolling (NF A 35-051),
- wire rods intended for the manufacture of prestressed concrete reinforcement (NF A 35-054),
- alloy and non alloy special carbon steel wire rods for heat treatment after fabrication (NF A 35-571).

2. GRADES AND QUALITIES

2.1 GRADES & QUALITIES AVAILABLE

The wire rod grades specified in Table I are characterized by their chemical compositions.

2.2 CHEMICAL COMPOSITION

The steels to be applied must originate from killed heats ; titanium killing is however prohibited.

The following information is specified in the Table 1 :

- the chemical composition to be found in the heat analysis ; the values shown correspond either to maximas or to ranges ;
- the admissible variations in product(check) analysis.

2.2.1 Product(check) analysis carbon content

The $\pm$ product(check) analysis carbon content variations refer to actual ladle analyses and not to ranges.

TABLE 1 — CHEMICAL COMPOSITION

Grades	C %		P % max		S % max		Mn % (2)	Si %
	Ladle	Product (1)	Ladle	Product	Ladle	Product		
FMR 62	0,60/0,65	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 66	0,63/0,68	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 68	0,65/0,70	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 70	0,68/0,73	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 72	0,70/0,75	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 76	0,73/0,78	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 78	0,75/0,80	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 80	0,78/0,83	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 82	0,80/0,85	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35
FMR 86	0,83/0,88	$\pm$ 0,03	0,030	0,035	0,030	0,035	0,60-0,90	0,10-0,35

(1) Ref. to 2.2.1

(2) By agreement when ordering it is possible to specify a manganese range different from above, with a same range amplitude the maximal value of which is not to exceed 1.00 %

2.2.2

Residual element contents

Are specified for the residual elements the following max.values:

- for all grades : $\text{Ni} \leq 0.10 \%$ - $\text{Cr} \leq 0.10 \%$ - $\text{Mo} \leq 0.05 \%$ with an associated $\text{Ni} + \text{Cr} + \text{Mo} \text{ value} \leq 0.12 \%$

3. SUPERFICIAL APPEARANCE

3.1

DEFECTS

3.1.1

Wire rods are not to show any internal defect such as cavities, pipes or superficial imperfections such as pits, score marks, cracks.... liable to impair subsequent drawing or fabrication.

3.1.2

Permissible defect depth

Wire rods are not to show any superficial defect in depths(*) superior to the values specified in the Table 2.

TABLE 2 - PERMISSIBLE DEFECT DEPTH

Diameter mm	Defect depth mm
$d < 10$	0.15
$10 \leq d < 18$	0.20
$18 \leq d$	0.25

The determination of the defect depth is proceeded to by microscopic inspection of a perpendicular cross section, basically under a 100 X magnification.

3.2

DECARBURIZATION

As a rule the wire rods may only be partially decarburized.

This partial decarburization must not exceed 1 % of the diameter, exclusive of any superficial defect.

The verification of the decarburization shall be proceeded to in accordance with the requirements of the NF A 04-201 Standard Specification on a micrographic specimen subsequently to a Nital etching, at a 100 X magnification, at the rate of one sampling per 20 Tonnes and with a minimum of three samplings per heat.

4. INTERNAL SOUNDNESS

4.1

INCLUSION CONTENT

The levels of the inclusion contents are determined in accordance with the specifications of the NF A 04-106 Standard and by using the indications of the Plate I of this Standard (**).

When concerning wire rod diameters inferior to 10 mm the method of the worst background is resorted to whereas for the diameters of 10 mm and over it is the method of averages which is applied.

In Table 3 are specified the inclusion level values to be taken into consideration for each type of inclusion.

(*)

Defect depth means the perpendicular distance from the "as rolled" product surface to the ultimate penetration limit of same.

(**)

Pending the issue of the NF A 04-107 Standard Specification (under preparation) concerning the determination of the inclusion levels in wire rods.

TABLE 3 - RATE OF INCLUSIONS

Types of inclusions	$d < 10$ mm	$d \geq 10$ mm
A (Sulfure)	2	3
B (Aluminate)	2	2
C (Silicate)	2	2
D (Globular oxyde)	1	2

Verification of the inclusion levels shall be proceeded to at the rate of one sampling per 20 Tonnes, with a minimum of three samplings per heat.

4.2 SEGREGATION

Levels of permissible segregation are determined in accordance with the requirements of the NF A Standard Specification (under preparation).

4.3 STRUCTURE

The inner structure must be homogenous and no cementite networks are in particular to appear at the grain boundaries.