

APPROVED FRENCH STANDARD SPECIFICATION	IRON & STEEL PRODUCTS NON ALLOY CARBON STEEL WIRE RODS FOR THE MANUFACTURE OF PRESTRESSED CONCRETE REINFORCEMENT WIRES Grades	NF A 35-054 June 1978
---	---	-----------------------------

CONTENTS

1	GENERAL	1
1.1	PURPOSE	1
1.2	SCOPE	1
2	GRADES AND QUALITIES	2
2.1	GRADES AND QUALITIES AVAILABLE	2
2.2	CHEMICAL COMPOSITION	2
	Table I. - Chemical composition	2
3	SUPERFICIAL APPEARANCE, INCLUSION CONTENT	3
3.1	SUPERFICIAL APPEARANCE, DEFECTS	3
3.2	INCLUSION CONTENT	3
	Table II. - Inclusion ratio	4

1 GENERAL

1.1 PURPOSE

The purpose of the present Standard Specification is to define the non alloy carbon steel wire rod grades and qualities intended for the manufacture of prestressed concrete reinforcement wires and the requirements they must comply with.

1.2 SCOPE

The present Standard Specification is of application in the case of non alloy carbon steel wire rods with carbon contents superior or equal to 0.60 % intended for the manufacture of prestressed concrete reinforcement wires.

The present document is irrelevant in the case of products for which different Standards or Specifications have been provided for, such as :

- Wire rods for cold drawing and cold rolling (NF A 35-051) ;
- Wire rods for the manufacture of improved adherence concrete reinforcement bars (NF A 35-016) ;
- Alloy and non alloy special steel wire rods for heat treatments (NF A 35-552).

Approved as of
1978-05-16
for application as of
1978-06-15

The present Standard Specification supersedes
the Tentative Specification under the same reference N°
as of March 1974

© AFNOR 1982
Worldwide Copyrights
reserved

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.

2. GRADES AND QUALITIES

2.1 GRADES AND QUALITIES AVAILABLE

Wire rod grades and qualities specified in Table I are characterized by their chemical composition.

Steels to be employed for these grades and qualities must originate from killed heats.

2.2 CHEMICAL COMPOSITION

Table I specifies :

- the ladle chemical composition ; values indicated correspond either to maxims or to ranges ;
- the permissible check(product) analysis variations.

2.2.1 Check(product) analysis carbon content

The check(product) analysis carbon content $\pm$ variations are to be interpreted in correlation with the actual ladle analysis and not with the whole carbon range.

2.2.2 Contents of residuals

The specified max. contents for residuals are as follows :

- for all qualities :
Ni < 0.25 % - Cr < 0.15 % - Mo < 0.10 % with an aggregated Ni + Cr + Mo < 0.40 %
- for quality 1 : Cu < 0.20 %
- for quality 2 & 3 : Cu < 0.15 %

TABLE I
CHEMICAL COMPOSITION

Grades	Qualities	C %		P % max.		S % max.		Mn % (2)	Si %
		ladle	product (1)	ladle	product	ladle	product		
FMP 62	1-2-3	0.60-0.65	± 0.03	}	}	}	}	0.60-0.90	0.10-0.35
FMP 66	1-2-3	0.63-0.68	± 0.03					0.60-0.90	0.10-0.35
FMP 68	1-2-3	0.65-0.70	± 0.03					0.60-0.90	0.10-0.35
FMP 70	1-2-3	0.68-0.73	± 0.03					0.60-0.90	0.10-0.35
FMP 72	1-2-3	0.70-0.75	± 0.03					0.60-0.90	0.10-0.35
FMP 76	1-2-3	0.73-0.78	± 0.03					0.60-0.90	0.10-0.35
FMP 78	1-2-3	0.75-0.80	± 0.03					0.60-0.90	0.10-0.35
FMP 80	1-2-3	0.78-0.83	± 0.04					0.60-0.90	0.10-0.35
FMP 82	1-2-3	0.80-0.85	± 0.04					0.60-0.90	0.10-0.35

(1) Ref. 2.2.1

(2) On agreement when ordering, it is possible to request a Manganese range different from here-above, provided that is maintained the same range amplitude, whose max. value is not to exceed 1.20 %.

(3) Phosphorus and Sulfur ladle analysis max. contents are as follows :

- quality 1 ... P ≤ 0.035 % S ≤ 0.035 %
- quality 2 ... P ≤ 0.035 % S ≤ 0.030 %
- quality 3 ... P ≤ 0.030 % S ≤ 0.030 %

(4) Phosphorus and Sulfur check(product) analysis max. contents are as follows :

- quality 1 ... P ≤ 0.040 % S ≤ 0.040 %
- quality 2 ... P ≤ 0.040 % S ≤ 0.035 %
- quality 3 ... P ≤ 0.035 % S ≤ 0.035 %

3 SUPERFICIAL APPEARANCE. INCLUSION CONTENT

3.1 SUPERFICIAL APPEARANCE. 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, laps, cracks.... liable to impair subsequent drawing.

3.1.2 PERMISSIBLE DEFECT DEPTH. SUPERFICIAL CRACK FACTOR

For each batch - the batching unit being the heat - a superficial crack factor is determined as follows :

3.1.2.1 From 20 % minimum (*) of the coils constituting the batch a specimen is sampled from which is determined by microscopic inspection of a straight cross section - basically at a 100 X amplification - the depth of the deepest defect. Defect depth means the perpendicular distance from the "as rolled" product surface to the utmost defect penetration limit.

3.1.2.2 The listed defects (*d*) are evaluated in relation to their depth and sorted out in 3 categories to which apply the following factors :

WIRE ROD DIAMETER			
5.5 ≤ D < 10 mm		10 ≤ D ≤ 18 mm	
Category of defects	Factor	Category of defects	Factor
1 : 120 < d ≤ 300 μm	1	1 : 140 < d ≤ 350 μm	1
2 : 80 < d ≤ 120 μm	0,5	2 : 90 < d ≤ 140 μm	0,5
3 : d ≤ 80 μm	0	3 : d ≤ 90 μm	0

3.1.2.3 If n_1 , n_2 and n_3 are respectively the number of specimens of each category, the superficial crack factor l_f results from the following formula :

$$l_f = \frac{n_1 + 0.5 n_2}{n_1 + n_2 + n_3} \cdot 100$$

the batch is accepted if $l_f < 50$ when concerning wire rods of the quality 1
 $l_f < 30$, when concerning wire rods of the quality 2,
 $l_f < 10$, when concerning wire rods of the quality 3.

3.1.2.4 In case of any contention as to the evaluation of the superficial crack factor the number of specimens to be sampled must be increased to 12 minimum.

3.1.2.5 Additional tests

If additional tests are to be proceeded to the number of specimens to be sampled and the evaluation of the results must be carried out in accordance with the requirements of the Informative Notice NF X 06-022.

3.2 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

(*) If the batch exceeds 100 coils the proportion of specimens to be sampled is reduced to 15 %.

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

In table II are specified the values of the factors to be taken into consideration for each type of inclusion.

TABLE. II
INCLUSION RATIO

Type of inclusions	Qualities 2 & 3	
	D < 10 mm	D ≥ 10 mm
A (sulfure)	2	3
B (aluminate)	3	3
C (silicate)	3	3
D (globular oxyde)	3	3

The verification of the inclusion ratio is to be carried out at the rate of one sampling per 30 Tonnes, with a minimum of three samplings per heat.