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THE PRESENT DOCUMENT IS A TRANSLATION OF CERTAIN FRENCH STANDARD SPECIFICATIONS
SHOULD ANY QUESTION ARISE AS TO THEIR INTERPRETATION, REFERENCE IS TO BE MADE
TO THE ORIGINAL FRENCH TEXT, WHICH REMAINS SOLELY VALID

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APPROVED FRENCH STANDARD SPECIFICATION	IRON & STEEL PRODUCTS NON ALLOY CARBON STEEL WIRE RODS FOR COLD DRAWING & COLD ROLLING Grades	NF A 35-051
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Approved as of for application as of		The present Standard Specification supersedes the former Standard under the same reference N° approved as of March 11th 1971 © AFNOR 1982 Worldwide Copyright's 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.

1 GENERAL

1.1 PURPOSE

The purpose of the present Standard Specification is the determination of the non alloy carbon steel wire rod grades intended for subsequent cold drawing or cold rolling operations.

1.2 SCOPE

The present Standard Specification is of application in the case of non alloy carbon steel wire rod grades & qualities intended for subsequent cold wire drawing and cold rolling.

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

- Wire rods for concrete reinforcement (NF A 35-015);
- Wire-rods for concrete reinforcement, prestressed (NF A 35-054);
- Wire-rods for concrete reinforcing mats (NF A 35-052);
- Free machining wire rods (NF A 35-055);
- Wire-rods for subsequent heat treatments (NF A 35-551, NF A 35-552);
- Wire-rods for coated electrodes (NF A 35-055);
- Wire-rods for shielded arc gas welding or flux welding (NF A 35-056);
- Wire-rods for the manufacture of high tensile spring wires (NF A 35-057).

1.3 RELATED STANDARD SPECIFICATIONS

- | | |
|-------------|--|
| NF A 03-115 | General Technical Conditions for the Supply of Steel Products. |
| NF A 35-015 | Plain wire rods for ferro-concrete reinforcement - Grades -. |
| NF A 35-052 | Non alloy carbon steel wire rods for welded mats . |
| NF A 35-053 | Non alloy carbon steel wire rods for hot & cold formed assemblies - Grades. |
| NF A 35-055 | Non alloy carbon steel wire rods for coated electrode manufacture - Grades & Qualities. |
| NF A 35-056 | Alloy & Non alloy carbon steel wire rods for the manufacture of gas shielded arc welding or flux powder arc welding electrodes - Grades & Qualities -. |
| NF A 35-057 | Non alloy carbon steel wire rods for the manufacture of cold formed high tensile spring wires - Grades -. |
| NF A 35-551 | Non alloy & special Alloy carbon steel wire rods for subsequent heat treatments - Grades & Qualities - I Overall General Specification -. |
| NF A 35-552 | Non alloy & special alloy carbon steel wire rods for subsequent heat treatments - Grades & Qualities - II Semis - Bars & wire rods -. |
| NF A 35-561 | General Purpose free cutting carbon steel bars & wire rods for wire drawing - Qualities -. |
| NF A 40-001 | Iron & Steel - General Specification re Sections & Sizes. |

2 DEFINITION

"Wire Rod" is a term applying to a solid cross sectional product, HR & coiled in loose strands. Its cross section can either be round, square, hexagonal, octagonal, half-round, rectangular or of any other type (ref. NF A 40-001).

3 GRADES & QUALITIES

3.1 STANDARD QUALITIES AVAILABLE

The wire rod grades shown in Tables 1 & 2 are characterized by their chemical compositions.

3.2 CHEMICAL COMPOSITION

In Tables 1 & 2 are listed the following data :

- the ladle chemical composition; values indicated correspond either to maxima or to range limits
- the permissible variations from product(check) analysis limits ;
- product(check)analysis carbon content.

When concerning the steel grades mentioned in Table 1, product(check) analysis carbon variations (+ & -) must be kept within the ranges therein specified.

As to the steel grades appearing in Table 2, variation levels shown refer to actual ladle analyses and not to the ranges indicated in the said Table.

4 STEELMAKING - MANUFACTURING

4.1 STEELMAKING

Steelmaking & pouring practices are left at Producer's option but the related information is to be communicated to the Purchaser.

4.2 SUPERFICIAL APPEARANCE - DEFECTS

4.2.1

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 be detrimental towards subsequent drawing operations.

4.2.2

Wire rods must not, besides, exhibit defects with depths exceeding the values hereunder :

$5.5 \leq d \leq 10 \text{ mm}$	0.25 mm
$10 \leq d \leq 30 \text{ mm}$	0.30 mm
$d \geq 30 \text{ mm}$	1% d

Is considered as satisfactory a supply for which 90% of the sampled specimens - at the rate of 10 samplings min. per 100 Tonnes - show full compliance with the above requirements.

4.2.3

Defect depth is the perpendicular distance from the product surface to the ultimate penetration limit of same.

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

5 INSPECTION

5.1 GENERAL

The subject grades in the present Standard Specification can eventually be inspected as to the product(check) analysis chemical composition and as to their superficial conditions, under the strict proviso of an anticipated agreement thereof when ordering. Said inspection is always proceeded to at the Purchaser's, under the supervision of Producer's Inspectors or, when agreed upon ordering, of Purchaser's Representative (ref. NF A 03-115).

Table 1

GRADES	C %		P % max		S % max		Mn %	Si %
	Ladle	Product	Ladle	Product	Ladle	Product		
FM 5	≤ 0.06	≤ 0.08	0.030	0.038	0.030	0.038	0.25-0.45	(1)
FM 6	≤ 0.08	≤ 0.10	0.035	0.044	0.035	0.044	0.25-0.50	(1)
FM 8	0.06-0.10	≤ 0.12	0.035	0.044	0.035	0.044	0.25-0.50	(1)
FM 9	≤ 0.10	≤ 0.14	0.050	0.065	0.050	0.065	0.25-0.60	
FM 10	0.08-0.13	± 0.02	0.035	0.044	0.035	0.044	0.30-0.60	(1)

(1) When concerning grades supplied in the form of non rimming steels (Si 0.30 %), deoxidizer contents are to be indicated, except as to what concerns the FM 9 Grade. On the other hand the specified contents for P and S for the product analysis are as follows :

- grade FM 9 $P \leq 0.055 \%$ $S \leq 0.055 \%$
- grades FM 6, FM 8, FM 10 $P \leq 0.040 \%$ $S \leq 0.040 \%$
- grade FM 5 $P \leq 0.035 \%$ $S \leq 0.035 \%$

Table 2 A — GRADES FM 15, FM 18, FM 20, FM 26

GRADES	C %		P % max		S % max		Mn %	Si % (1)
	Ladle	Product	Ladle	Product	Ladle	Product		
FM 15	0.12-0.17	(2)	0.035	0.040	0.035	0.040	0.40-0.70	0.10-0.35 (3)
FM 18	0.15-0.20	(2)	0.035	0.040	0.035	0.040	0.40-0.70	0.10-0.35 (3)
FM 20	0.18-0.23	(2)	0.035	0.040	0.035	0.040	0.40-0.70	0.10-0.35
FM 26	0.24-0.29	(2)	0.035	0.040	0.035	0.040	0.40-0.70	0.10-0.35

(1) The minimal Si content must exceed 0.05 % when other deoxidizers have been added

(2) Plus & minus carbon content variations to the limit of 0.03 when product checking is to be interpreted as referring to the actual ladle analysis :

i.e. C = 0.20 % C (Product) = 0.17-0.23 %

(3) This grade can also be supplied as rimmed: in such case the carbon content variation is limited to ± 0.04 in correlation to the actual ladle analysis and the P & S content limits are 0.044%.

Table 2 B — GRADES FM 32 to FM 86

GRADES (*)	C %		P % max		S % max		Mn % (1)	Si % (2)
	Ladle	Product	Ladle	Product	Ladle	Product		
FM 32	0.30-0.35	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 36	0.33-0.38	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 38	0.35-0.40	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 40	0.38-0.43	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 42	0.40-0.45	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 46	0.43-0.48	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 48	0.45-0.50	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 50	0.48-0.53	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 52	0.50-0.55	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 56	0.53-0.58	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 58	0.55-0.60	(3)	0.035	0.040	0.030	0.035	0.50-0.80	0.10-0.35
FM 60	0.58-0.63	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 62	0.60-0.65	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 66	0.63-0.68	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 68	0.65-0.70	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 70	0.68-0.73	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 72	0.70-0.75	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 76	0.73-0.78	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 78	0.75-0.80	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 80	0.78-0.83	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 82	0.80-0.85	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35
FM 86	0.83-0.88	(3)	0.035	0.040	0.030	0.035	0.60-0.90	0.10-0.35

(1) On agreement when ordering, it is possible to request a different Mn range from hereabove, provided that is maintained the same range amplitude whose maximal value is not to exceed 1.00%.

(2) The minimal Si content is to exceed 0.05 % when other deoxidizers have been added.

(3) When product(check) analysing, plus & minus Carbon content variations may reach 0.03 up to the FM 78 grade and ± 0.04 for the other grades and are to be interpreted as referring to actual ladle analysis.

i.e. C (ladle) = 0.44 % C (product) = 0.41-0.47 %
 C (ladle) = 0.82 % C (product) = 0.78-0.86 %

(*) For the following elements the specified maxima are as hereunder.

Cr < 0.15 % Ni < 0.25 % Cu < 0.20 % Cr - Ni - Cu < 0.45 %

5.2 BATCHING

Grade inspection is run per heat, except for FM 9 grade about which the inspection batch is limited to a 100 Tonnes.

5.3 PRODUCT CHEMICAL ANALYSIS INSPECTION

5.3.1 Test specimen sampling

For product(check) analysis purposes, specimen sampling is proceeded to by surfacing the cross sections of 3 wire rod specimens sampled at random from 3 different coils out of the lot or heat to be inspected. Chemical values for the elements of each inspected sample are to comply with the requirements of Tables 1 & 2.

5.3.2 Determination of the Inspection methods

Unless otherwise agreed determination of the chemical composition is proceeded to in accordance with the stipulations of the valid French Standard Specification to apply.

Should no Standard Specification be available for the purpose, analysis methods shall then be agreed upon when ordering. Same procedure is to apply in case of dispute.

5.3.3 Inspection Reports

A Mill Inspection Report can be made out on request, showing indications as to the ladle chemical composition.

5.4 INSPECTION OF THE SUPERFICIAL APPEARANCE

For the purpose of superficial appearance inspection, specimen sampling ratio is of one sample per 10 Tonnes, with a minimum quantity of 3 samples for lots between 10 and 30 Tonnes ; 90 % of these samples are to comply with the requirements of § 4.2.2. If this conditions is not met with fresh specimens are sampled so as to reach the full specified number of samples.