

APPROVED FRENCH STANDARD SPECIFICATION	IRON & STEEL PRODUCTS NON ALLOY CARBON STEEL WIRE RODS FOR HOT AND COLD FORMING Grades	NF A 35-053 July 1972
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GENERAL

1.1 PURPOSE

The purpose of the present Standard Specification is the determination of the non alloy carbon steel wire rod grades for the manufacture of hot and cold formed items (i.e. bolts, nuts and other similar items...) as well as the characteristics they must comply with.

1.2 SCOPE

The present Standard Specification is of application in the case of non alloy carbon steel wire rod grades to be used in the manufacture of hot and cold formed items. Two grades, FB & FR are herein determined, in correlation with ascending manufacturing requirements. Wire rod grades requiring an intermediate regenerative annealing in the course of the manufacturing cycle for instance, shall have to be ordered in the FR qualities.

The present Standard Specification is irrelevant in the case of wire rods intended for bolt & nut manufacture and undergoing a heat treatment. They are governed by the NF A 35-556, NF A 35-557, & NF A 35-564 Standard Specifications.

It is also irrelevant in the case of products about which different Standard Specifications have been provided for, such as :

- Wire rods for cold drawing & for cold rolling (NF A 35-051) ;
- Wire rods for the manufacture of concrete reinforcing welded mats (NF A 35-052)
- Wire rods for concrete reinforcement (NF A 35-015) ;
- Wire rods for concrete reinforcement, prestressed ;
- Free cutting quality wire rods (NF A 35-561) ;
- Alloy and non alloy special steel wire rods requiring heat treatment of the finished products (NF A 35-552 & NF A 35-562) ;
- Wire rods for coated & uncoated electrodes.

2 GRADES & QUALITIES

2.1 STANDARD QUALITIES AVAILABLE

Wire rod qualities mentioned in the Tables I & II are characterized by their chemical composition and their minimal yield values.

2.2 CHEMICAL COMPOSITION

For the FB and FR grades are respectively indicated in Tables I & II,

- The chemical compositions to be found with the ladle analysis ; values indicated correspond either to maxims or to ranges ;
- The admissible variations to be found when check(product) analysing.

TABLE I

CHEMICAL COMPOSITION OF THE FB GRADES

Grades	C % max		P % max		S % max		Mn %	Si %	N ₂ % max (*)	
	Ladle	Product	Ladle	Product	Ladle	Product			Ladle	Product
FB 5	≤ 0.06	≤ 0.08	0.040	0.050	0.040	0.050	0.25-0.45	—	0.009	0.011
FB 8	0.05-0.10	≤ 0.12	0.040	0.050	0.040	0.050	0.25-0.60	—	0.009	0.011
FB 10	0.08-0.14	± 0.02	0.040	0.050	0.040	0.050	0.30-0.70	—	0.009	0.011
FB 15	0.12-0.18	(1)	0.040	0.050	0.040	0.050	0.40-0.70	— (2)	0.009	0.011

(1) The maximal 0.04% ± variation of the carbon content in check analysis, is to be interpreted in correlation with the actual ladle analysis.

(2) When agreed upon ordering this grade can be supplied in the form of non rimming steels (Si ≤ 0.30 %). The carbon variation is then ± 0.03 % of the value recorded in the actual ladle analysis; the maximal P & S contents for check(product) analysis are limited to 0.44 %; finally the maximal specified Nitrogen content is limited to 0.009 % in product analysis.

(*) If electric furnace steel, the Nitrogen Max content is increased by 0.002 %

TABLE II

CHEMICAL COMPOSITION OF THE FR GRADES

Grades	C %		P % max		S % max		Mn %	Si %	N ₂ % max (*)	
	Ladle	Product	Ladle	Product	Ladle	Product			Ladle	Product
FR 5	≤ 0.06	≤ 0.08	0.035	0.044	0.035	0.044	0.25-0.45	(1)	0.007	0.009
FR 8	0.06-0.10	≤ 0.12	0.035	0.044	0.035	0.044	0.25-0.60	(1)	0.007	0.009
FR 10	0.08-0.13	± 0.02	0.035	0.044	0.035	0.044	0.30-0.70	(1)	0.007	0.009
FR 15	0.12-0.17	(2)	0.035	0.040	0.035	0.040	0.40-0.70	≤ 0.30(3)	—	(3)
FR 18	0.15-0.20	(2)	0.035	0.040	0.035	0.040	0.40-0.70	≤ 0.30(3)	—	(3)
FR 22	0.20-0.25	(2)	0.035	0.040	0.035	0.040	0.50-0.80	0.10-0.35	—	—

(1) When agreed on ordering these grades can be supplied in the form of non rimming steels (Si ≤ 0.30 %); the minimal Mn content can then, for the FR 5 & FR 8 grades be lowered to 0.20 %; the specified P, S & N contents in product analysis must be as follows :

$$P \leq 0.040 \% - S \leq 0.040 \% - N_2 \leq 0.008 \%$$

(2) The maximal ± 0.03 % carbon content variations in product analysis is to be interpreted in correlation with the actual ladle analysis.

$$[\text{i.e. : } C (\text{ladle}) = 0.17 \% - C (\text{Product}) = 0.14 - 0.20 \%]$$

(3) When agreed on ordering the FR 15 & FR 18 grades can be supplied in rimming steels; the carbon variation from the actual ladle analysis is then limited to ± 0.04 %; the maximal P and S contents are besides limited to 0.044 %; finally the maximal specified N content in product analysis is 0.009 %.

(*) If electric furnace steel, the Nitrogen max. content is increased by 0.002 %

2.3 MAXIMAL TENSILE STRENGTHS

The specified maximal tensile strength values for the different grades and qualities are shown in Table III.

These values are of application for checks proceeded to on coil ends and on products in their final delivery conditions.

TABLE - III

MAXIMAL TENSILE STRENGTHS

Grades FB	R max N/mm ²	Grades FR	R max N/mm ²
FB 5	420	FR 5	420
FB 8	460	FR 8	450
FB 10	480	FR 10	470
FB 15	510 (*)	FR 15	500 (*)
		FR 18	540 (*)
		FR 22	600
(*) when these grades are supplied non rimmed, the yield strength may be exceeded by 20 N			

3. SUPERFICIAL APPEARANCE - DEFECTS

In standard practice the products are expected to be supplied without such protective coatings (paint, oil, grease, pulverulent scale) liable to be detrimental to subsequent pickling operations.

Coil ends must stand unbent and carefully cropped.

A light surface grinding of the ends is only permissible, provided that the product remains within tolerances after such conditioning.

3.1 ADMISSIBLE DEFECT PENETRATION DEPTH

3.11 FB Grades

The FB grade wire rods must not present superficial defects showing penetration depths (*) superior to the values appearing in Table IV.

TABLE IV
ADMISSIBLE DEFECT PENETRATION DEPTHS FOR THE "FB" GRADE WIRE RODS

Diameters mm	Defect penetration depth mm
$5,5 \leq d < 10$	0,20
$10 \leq d < 18$	0,25
$18 \leq d < 30$	0,30

The penetration depth shall be determined by micrographic inspection of wire rod straight cross section at 100 X, basically.

3.12 FR Grades

The FR grade wire rods must not present superficial defects showing penetration depths (*) superior to the values appearing in Table V.

TABLE V
ADMISSIBLE DEFECT PENETRATION DEPTHS FOR THE "FR" GRADES WIRE RODS

Diameters mm	Defect penetration depth mm
$5,5 \leq d < 10$	0,15
$10 \leq d < 18$	0,20
$18 \leq d < 30$	0,25

The penetration depth shall be determined by micrographic inspection of a wire rod straight cross section at 100 X, basically.

Superficial and internal defects shall not, besides, assume such shapes consistency & nature as to induce possible disruptions within the metal when submitted to cold deformation, subject to proper performance of the processing.

(*) Defect penetration depth means the perpendicular distance from the "as rolled product surface" to the defect utmost penetration limit.

4. QUALIFICATION TEST

When agreed upon ordering, it is possible to check the product cold heading capacities by means of a compression test, conditions and standards of which can be mutually agreed.

Failing any indication and to the compression is proceeded to down to a reduction of $\frac{h}{2}$ concerning the FB grades and $\frac{h}{4}$ for the EB grade ones, d being the height of the test specimen equal to $\frac{1}{2}$ inch for diameters up to 8 mm incl., and equal to $1 \frac{1}{2}$ inch for the heavier diameters.

5. INSPECTION

5.1 GENERAL

The subject steel grades in the present Standard Specification may be inspected as to their chemical compositions, such as they are determined in Tables I & II; such inspection of the product analysis is only performed when so required with the order. These inspections are always carried out at the Producer's, generally by the Producer's own staff or, on particular agreement when ordering, by Purchaser's Representative.

5.2 BATCHING

On EB grades the inspection is generally performed by 50 tone lots. But when agreed on ordering it can be proceeded to by heat.

The FB grades are generally inspected by heat.

5.3 VERIFICATION OF THE CHEMICAL COMPOSITION

5.3.1 Test specimen sampling

For product(check) analysis purposes, specimen sampling is proceeded to by surfacing the cross section of 3 wire rod specimens sampled at random from 3 different coils cut 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 I & II.

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, the analysis methods shall then be agreed upon when ordering; same procedure is to apply in case of dispute.

5.3.3 Inspection reports

On request Mill Test Certificates can be made out with indication of the ladle analysis chemical composition.