CONTROL DE CAMBIOS

Rev.	DATE	PAGE	CHANGES
1	22/06/2023	All	Creation of document

INDEX

1. PURPOSE

The purpose of this document is to establish the requirements that the synthesized wolfram sticks for part ref. MPT 70362 have to fulfill.

2. REFERENCE DOCUMENTATION

Current revision of the following documents:

Drawings:

70362

Standards:

- ISO 3369: Determination of densities
- ISO 3878: Hardness test
- ISO 6892: Tensile test
- DIN 50106: Compression test

3. REQUISITOS DEL MATERIAL

3.1. MARKING

Every stick parts (100% of the lot) will be marked on the front surface (end side of the ogive), according to the stick´s displacement direction during the heat treatment

These markings will be marked on circular Crown: Ø minor > 8,8 ; Ømajor < 20

Markings to be added:

- Manufacturer´s acronym **(in this case the acronym is HLS**)
- Lot number, not repeated within the running year
- Two last digits of the manufacturing year
- NDT´s (Non destructive test) Punch (Point 3.8)

Marking has to be legible and permanent on the whole life of the stick.

3.2. DIMENSIONAL

Wolfram sticks will be provided with the dimensions, tolerances and surface finishes shown on the drawings (please see Annexes 1 and 2 and point 5.2.1.).

The finishing process (forging, machining) and the stick´s definitive length will be specified on the contract by Mecánica de Precisión Tejedor, S. A**..**

In this case the finishing process is machining.

3.3. STICK CHEMICAL COMPOSITION

The chemical composition of the material of the bars will respond to that indicated with their corresponding tolerances:

- Nickel: 4,20 ± 0,16%
- Iron: 2,50 ± 0,14%
- Cobalt: 0,30 ± 0,04%
- Manganese: 0,04 ± 0,005%
- Wolfram:rest

Determination of the chemical composition will be carried out as per point 5.2.2.

3.4. MECHANICAL PROPERTIES

3.4.1. TENSILE STRENTH (Rm)

The material to be tested according to point 5.2.3.1 has to fulfill the following requirements:

- Every value will not be les than 1050 Mpa.
- Average value has to be 1080±25 MPa

3.4.2. YIELD STRENGTH (Rp 0,2)

The material to be tested according to point 5.2.3.1 has to fulfill the following requirements:

- Every value will not be less than 780 Mpa
- Average value has to be 860±50 MPa

3.4.3. STRAIN (A%)

The material to be tested according to point 5.2.3.1 has to fulfill the following requirements:

- Every value will not be less than 15%
- Average value has to be 15%

3.4.4. COMPRESSION

3.4.4.1. ELASTIC COMPRESSION (EC 1%)

The material to be tested according to point 5.2.3.2 has to fulfill the following requirements:

- Every value will not be less than 1030 MPa
- Average value has to be 1110±40 Mpa

3.4.4.2. RESISTANCE

After tests according to point 5.2.3.2, visible fissures are not allowed.

3.5. GRANULAR STRUCTURE

Granular structure´s formula:

α(W)+δ(Ni,Fe,W,Co,Mn)

The granular structure has to be uniform and globular with a maximum size of grain of 100 µm.

There will be neither porosities on any section along the stick higher than 5 µm, nor inclusions higher than 10 µm.

3.6. DENSITY

The density, determined according to the point 5.2.5, has to be 17,6 gr/cm^3

3.7. HARDNESS

The material to be tested according to point 5.2.3.3 has to fulfill the following requirements:

- Every value will not be less than HV30 350
- Average value has to be 375±15 HV30

3.8. MATERIAL DEFECTS

The sticks will be subjected to ultrasound NDTs in order ensure the absence of intern and extern defects.

As a contrast signal method, it will be used as a reference defect of Ø0,5 mm.
This test is carried is carried out according to point 5.1.2

4. LOT REQUIREMENTS

4.1. DEFINITION

For a lot, it is understood a group of sticks manufactured out of homogeneous components, by means an unique and continuous manufacturing process and subjected to an unique and uninterrupted heat and mechanical treatment.

4.2. SIZE

In this case, for deliveries of 2,000 units, the lot size will be 250 units. That is, each batch of 2,000 units will be divided into 8 lots of 250 units.

For the first 100 units, the lot will be made up of those 100 units.

5. QUALITY REQUIREMENTS

5.1. CONTROLES UNITARIOS

5.1.1. IDENTIFICACIÓN

5.1.1.1. EXECUTION

Sticks that compose the lot, to 100 %, will be all visually tested according to the requirements in 3.1.

5.1.1.2. CRITERIA

Every stick without NDT-marks will be rejected form the lot.

5.1.2. NON DESTRUCTIVE TESTS. ULTRASOUNDS

5.1.2.1. EXECUTION

Every stick of the lot, to 100 %, will be subjected to this test according to the requirement in point 3.8.

The test will be carried out by the manufacturer following their own test methods, prior to acceptation and knowledge of Mecánica de Precisión Tejedor, S. A.

In particular, it will be specified the following:

- Equipment and tools
- Execution process
- Pattern defect
- References for acceptation and reject
- Staff qualification

5.2. SAMPLE INSPECTIONS

5.2.1. RELATED TO DIMENSIONS

5.2.1.1. EXECUTION

13 sticks are taken as sample per lot. Every stick, one by one, is checked to (see annex 1 and 2):

- Diameter, lower to the minimum
- Length, lower to the minimum
- Perpendicularity
- Surface finish

See annex 1 for forged material (does not apply in this case) and **annex 2 for machined material**

5.2.1.2. CRITERIA

If more than 1 defect appears, the lot is rejected. If only 1 defect appears, a new 13-units-sample with no new defects is taken to accept the lot.

5.2.2. CHEMICAL COMPOSITION

5.2.2.1. EXECUTION

The methodology for the analysis is to be determined by the manufacturer. 3 chemical composition determinations, by lot, will be carried out of a unique stick from which a sample material is extracted from areas explained in Annex 3, mark Q:

For each component to be determined, an average value is calculated out of 3 results.

5.2.2.2. CRITERIA

Lot will be rejected if the requirement in point 3.3 is not fulfilled.

5.2.3. MECHANICAL TESTS ENSAYOS

5.2.3.1. TRACTION

5.2.3.1.1. EXECUTION

For this test, the regulation ISO 6892. 3 test tubes of material will be taken, by lot, out of an unique stick according to Annex 3, mark T.

Test tubes will be mechanized according to sketch in Annex 4.

For loading implementation, one of the following criteria will be used:

- Loading ratio: between 5000 and 10000 daN/min
- Clamp displacement speed: 5 mm/min

The following values will be obtained in every test tube:

- Ultimate Strength (Rm)
- Yield Strength (Rp 0,2)
- Strain (A%)

5.2.3.1.2. CRITERIA

For every obtained characteristic, the requirement I points 3.4.1., 3.4.2. and 3.4.3 will have to be fulfilled.

If after the test there are still reasonable doubts referred to some test tubes´ mechanizing which justify the non-accepted individual results, a second test is allowed. In this case,3 new test tubes out of a second stick of the lot will be obtained.

In this new second test, no deviations are allowed to accept the lot.

5.2.3.2. COMPRESSION

5.2.3.2.1. EXECUTION

This test will be carried out under the regulation DIN 50.106. Head´s displacement speed will be 2 mm/min. Tungsten carbide pieces will be placed between the head and test tube to avoid deformations and distortions.

3 test tubes will be tested. Every test tube is obtained out of stick according to Annex 3 (Marks C)

Test tube dimensions are described in the sketch (See Annex 4). Compression test keeps going until reaching a 23000 daN load to determine the material strength. This load, if the compression test machine is capable to deliver such load, will be kept for 3 seconds.

5.2.3.2.2. CRITERIA

The result of the 3 tests will have to fulfill the requirements in point 3.4.4.1.

During the compression test, none of the test tubes will show any visual evidence/signs of cracks according to the required in point 3.4.4.2.

If after the test there are still reasonable doubts referred to some test tubes´ mechanizing which justify the non-accepted individual results, a second test is allowed. In this case,3 new test tubes out of a second stick of the lot will be obtained.

In this new second test, no deviations are allowed to accept the lot.

5.2.3.3. HARDNESS

5.2.3.3.1. EXECUTION

This test is carried out under the regulation ISO 3878. Hardness VICKERS is determined under a load of 294,2 N (HV 30). By lot, a minimum of 16 measurements taken over an unique stick in two stages as indicated:

- 7 measurements will be taken on the tube test for the micrographic test (Annex 3, mark M)
- The other 9 measurements will be taken on marked areas with a thick line in the 3 test tubes for the traction test (Annex 3, marks T)

5.2.3.3.2. CRITERIO / CRITERIA

The taken measurements will have to fulfill the requirements on the point 3.7.

The measurements of both series, independently considered, must meet the second condition required in point 3.7.

5.2.4. METALLOGRAPHIC TESTS

5.2.4.1. EXECUTION

The test tube for the metallographic test is defined in the Annex 3, mark M.

Once the test tube is ready for testing, its structure will be analyzed on its surrounding area and on its center area by means of a microscope. It will get a 200-zoom-lens micrography.

This micrography will be provided with the rest of the lot as product documentation.

5.2.4.2. CRITERIA

This metallographic test hat to fulfill the requirement indicated in point 3.5.

5.2.5. DENSITY

5.2.5.1. EXECUTION

The density will be determined through the hydrostatic method according to regulation ISO 3369.

For its determination, 3 test tubes will be tested. These 3 tubes will be used later for the compression test once the density values are obtained.

5.2.5.2. CRITERIA

Density values will have to be within the value range indicated in point 3.6.

6. ADDITIONAL REQUIREMENT

In the following cases, all the above will apply except for point 5.2.3.1 (tensile test), which will be carried out on a double sample, for which a second te3st tube will be taken from the lot from which 3 new test tubes will be extracted.

These cases are:

a) Approval or quantification batch.
b) First batch manufactured after modifications to the product or manufacturing process.
c) First batch manufactured after an interruption of more than 12 months.
d) First batch manufactured after the rejection of 3 consecutive batches when these rejections have occurred as result of the tensile test.
e) First batch manufactured after the rejection of 5 consecutive batches when these rejections have occurred as result of the tensile test.

7. INCIDENCES

If one or more specimens are rejected at the machining stage, the following procedure will be applied:

7.1. TENSILE TEST TUBE REJECTION T1

In this case, a new test tube is extracted from the axis of the stick to the detriment of the compression specimen C1 and the rejected specimen.

7.2. TENSILE TEST TUBE REJECTION T2 OR T3

In this case, a new test tube is extracted from the axis of the stick to the detriment of the compression specimen C3 and the rejected specimen.

7.3. GLOBAL CRITERIA

If the procedure in 7.1 and 7.2 does not yield a minimum of 2 compression test tubes and 3 tensile test tubes, a second stick will be taken from the batch.

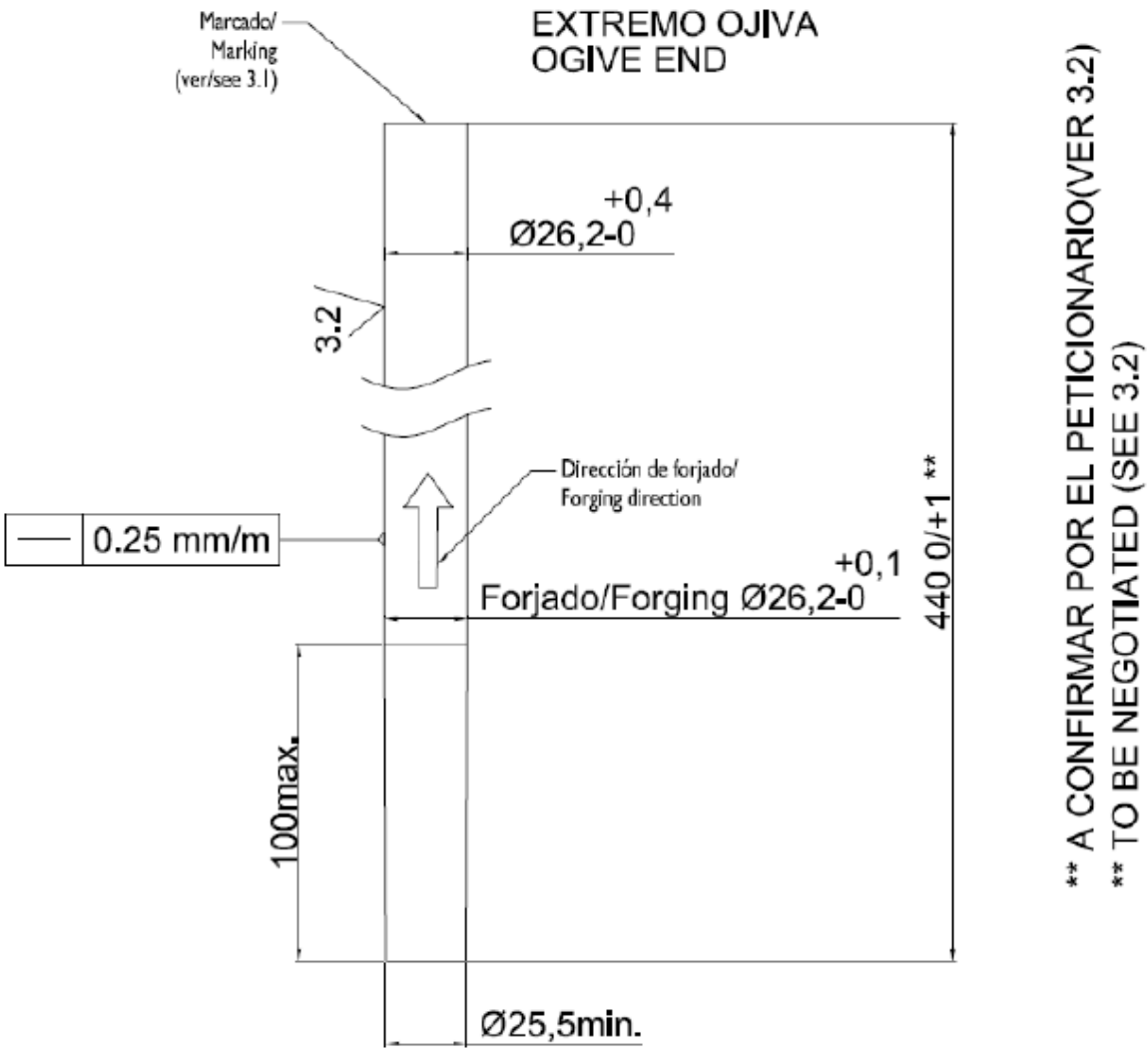
8. DOCUMENTATION

The batch of sticks will be accompanied by a certificate of tests and conformity which will include the numerical result, when applicable, of all those tests and inspections required by this specification.

For non-numerical characteristics, the indication of correct or incorrect will be sufficient. A summary table of the tests to be carried out is shown in Annex 6.

ANNEX 1

Forged bar sketch (NOT APPLICABLE)

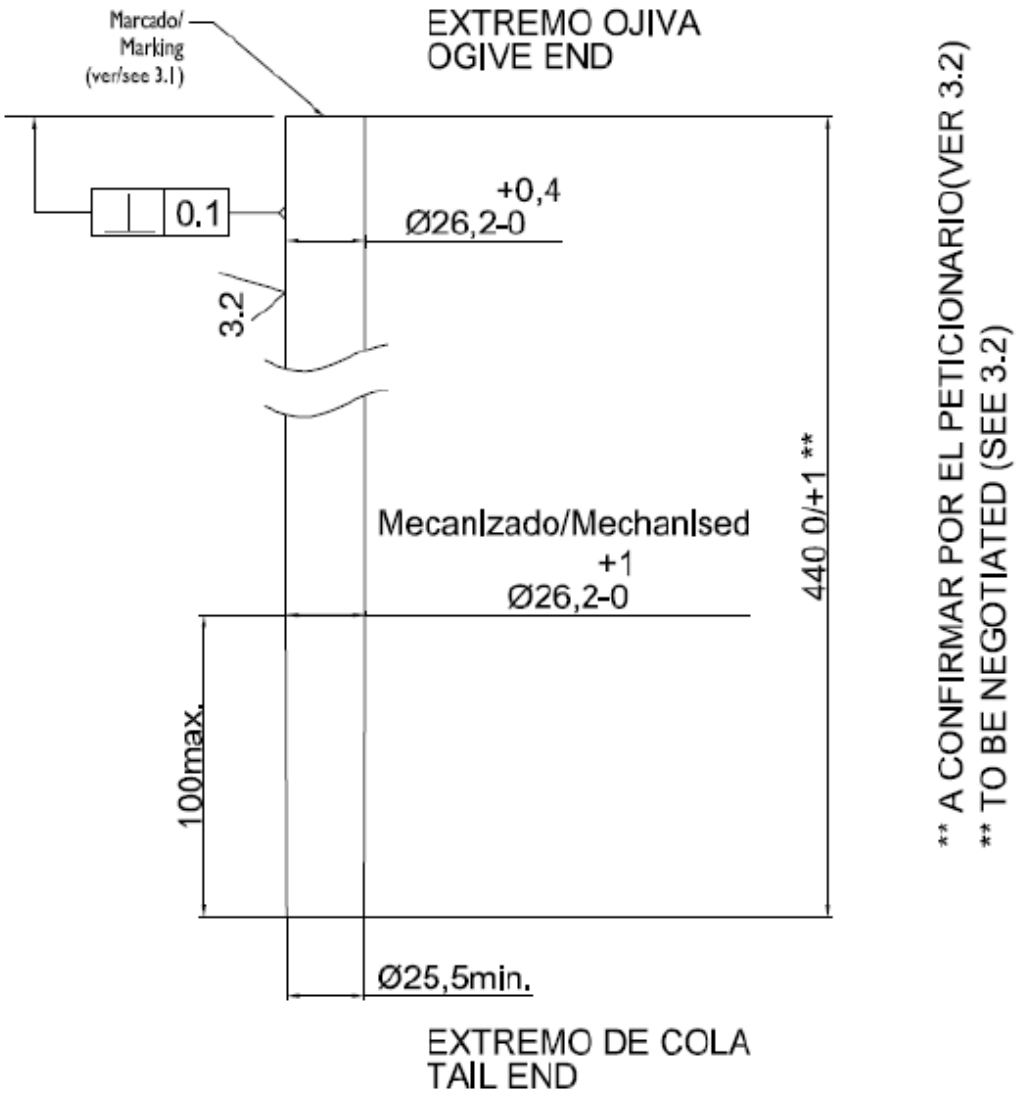


CROQUIS DE BARRA FORJADA
SKETCH FOR FORGED STICK

ANEXO 1 / ANNEX 1

ANNEX 2

Machined bar sketch

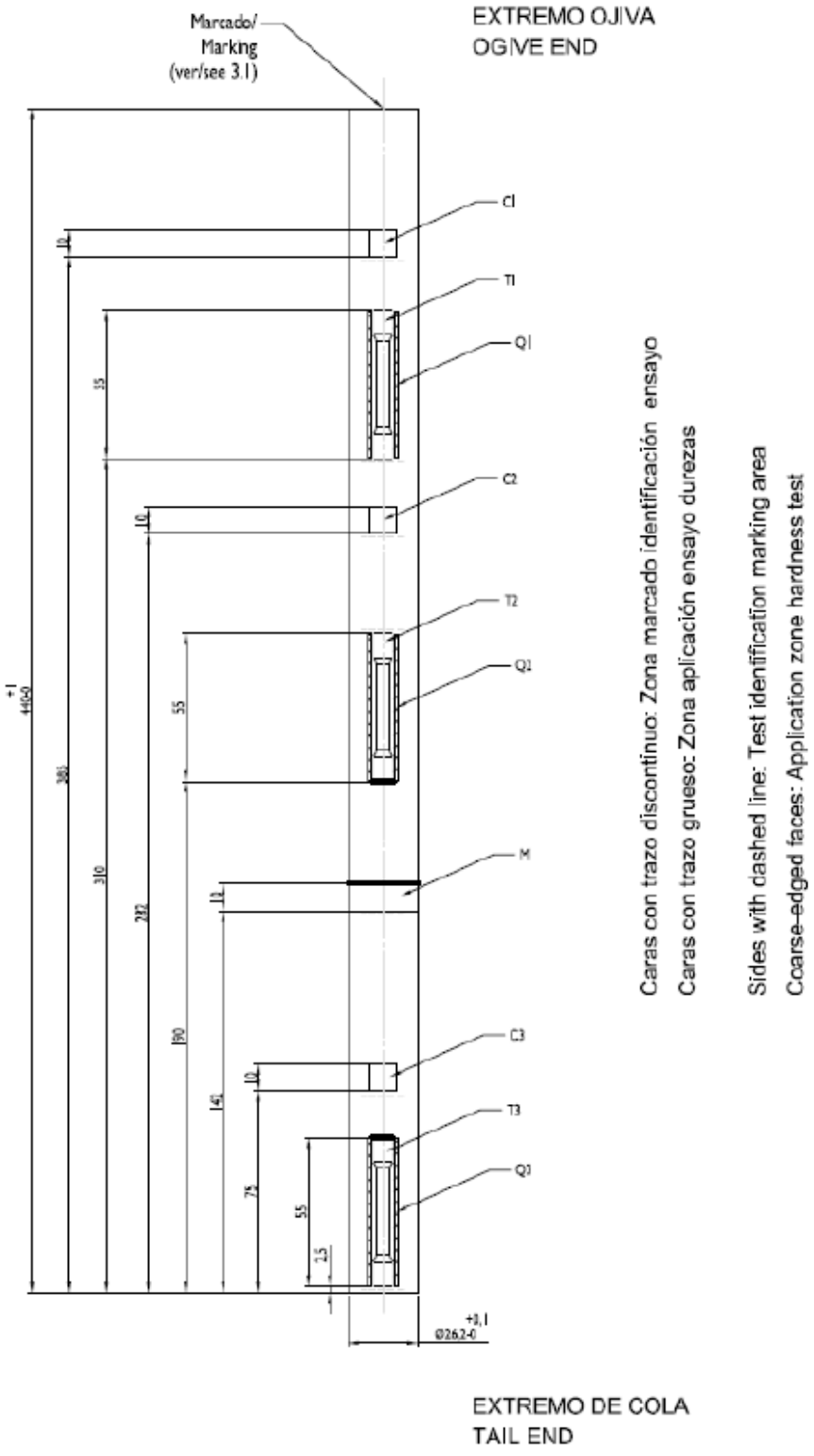


CROQUIS DE BARRA MECANIZADA
SKETCH FOR MECHANISED STICK

ANEXO 2 / ANNEX 2

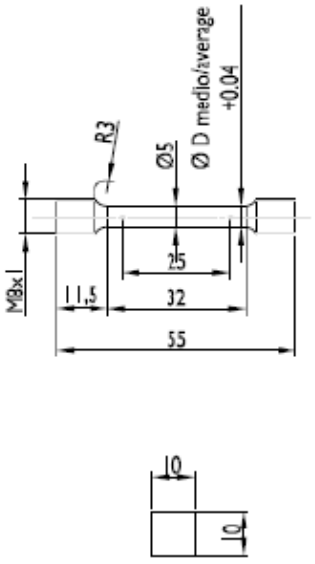
ANNEX 3

TEST TUBES EXTRACTION



ANNEX 4

MACHINING OF TENSILE TEST TUBES AND DIMENSIONS OF COMPRESSION TEST TUBES



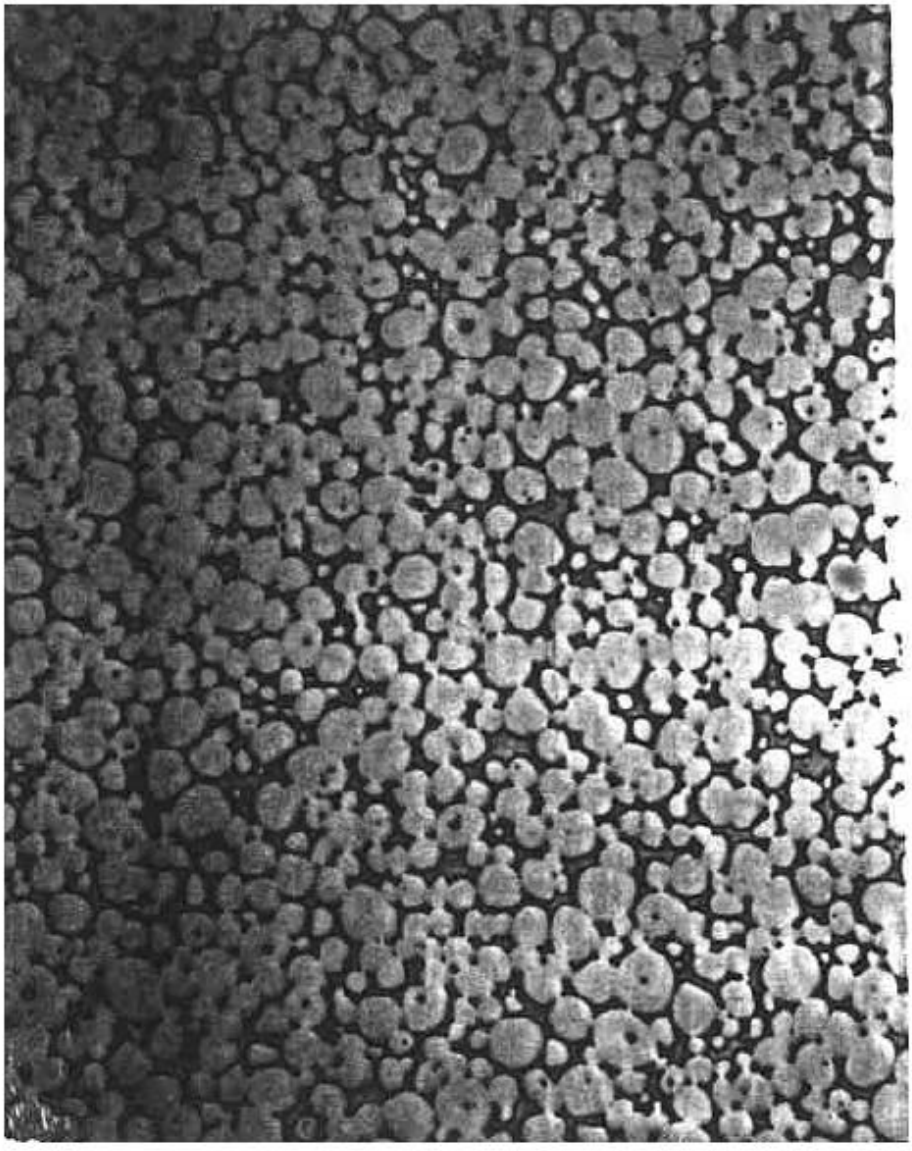
Toleranclas de forma IT9
Toleranclas dlmenslonales Js12
Acabado superficial N7(Ra=1,6)

Shape tolerances IT9
Dlmensional tolerances Js12
Surface flnlsh N7(Ra=1,6)

PROBETAS DE TRACCIÓN Y COMPRESIÓN
TEST TUBES FOR TRACTION AND COMPRESSION TESTS

ANNEX 5

MICROGRAFÍA/MICROGRAPHY



x200

ANNEX 6

SUMMARY TABLE OF THE TESTS TO BE CARRIED OUT

SUMMARY

REQUIREMENT	TEST		QUALITY REQUIREMENTS	SAMPLE (STICK) PER LOT	TESTS PER SAMPLE (TEST TUBES)	TREATMENT RESULTS	OBTAINING SPECIMENS ACCORDING TO		STANDARD / METHOD
3.2	Dimensional characteristics		5.2.1	13 min.			Annex 1 y 2		-
3.6	Physical characteristics	Density	5.2.5	1	3	1 average value	Annex 3	Mark C	ISO 3369
3.8		Surface defects	5.1.2	100%		UNTRASOUNDS	Test methods established by the manufacturer, prior knowledge and acceptation of MPT, S. A.		According to 5.2.4
		Intern defects							
3.5		Structure	5.2.4	1	1	MICROGRAPHY (example in annex 5)	Annex 3	Mark M	
		Grain size							
3.7	Mechanical characteristics	Hardness	5.2.3.3	1	16 (2 series)	2 average values	Annex 3 Annex 3	Mark M Mark T	ISO 3878
3.4		Traction	5.2.3.1	1 (1)	3	1 average value for every characteristic (Rm / Rp0,2 / A%)	Annex 3	Marca T	ISO 6892
		Compression	5.2.3.2	1	3	1 average value (Ec)	Annex 3	Mark C	DIN 50106
3.3	Chemical	Analysis	5.2.2	1	3	1 average value	Annex 3	Mark Q	Método a elección del fabricante
3.1	Identification marking		5.1.1	100%					

(1) Apply double sampling in the cases described in point 6