

**Concast billets designed for rolling and die
forging**

Elaborated by	Checked by	Approved by
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1. Introduction

These Technical Conditions of Concast Billets (TCCB) are valid for ordering and delivering of concast billets with round section \varnothing 170 mm, rectangular section 140x165 mm and square sections 100, 120, 130, 140 and 160 mm cast on the CC machine at FERROSTAL ŁABĘDY.

The subject of TCCB are concast steel billets produced in the process of continuous casting designed for rolling. The billets can be also raw material for die forging.

2. General stipulations

The steel is melted in a high-power electric arc furnace of EBT type in the quantity of 65 ± 2 mt/heat, refined in a ladle furnace (without vacuum degassing) and cast on an arc steel continuous casting machine using the technology of submerged casting or the open casting technology.

Round concast billets are cast only by using submerged casting.

All concast billets are cast with the use of electromagnetic mixing in a continuous casting mould and at the end of secondary cooling water.

It is possible to cast the following steels in accordance with national and foreign standards:

- constructional carbon steels with carbon content in the range: 0,06÷0,80%,
- low-alloy steels with microadditions,
- special medium-alloy steels,

The steel is cast in the following sizes and lengths:

- square: 100x100, 120x120, 130x130, 140x140 and 160x160mm,
- rectangle: 140x165mm
- circle \varnothing 170
- in lengths 5,6 ÷ 12,4 running metres.

3. Technical conditions of the order

The order must contain the following data:

- weight in mt of the concast billets,
- steel grade,
- number of standard,
- section of the concast billet,
- length (permissible deviations),
- quantity of shorts in the delivery,
- application of concast billets,
- for special quality steels additional requirements, exceeding the scope of TCCP, must be mutually coordinated.

4. Requirements.

a) Surface

The surface is typical for the steel continuous casting process.

On the surface of concast billets the following defects with depth lower than 1.5% of the crosswise dimension are permitted:

- oscillatory teeming laps,
- scratches,
- pinholes,
- slag inclusions,
- shrinkage depressions,
- dents.

Upon agreement with the orderer it is permitted to deliver billets with surface defects deeper than 1.5% of the crosswise dimension, if the intensity and depth of these defects do not cause worsening of the surface quality of the finished products under further processing.

It is allowed to remove surface defects of greater depth by flame desurfacing (rinsing) or mechanical cleaning (chiselling, grinding), whereas the machined surface should have soft cavities and rounded edges, and the depth at the place of the removed defect should not exceed 6% of the billet crosswise dimension.

b) Internal quality.

- **For concast billets with square and rectangular sections:**

Pursuant to tables below, FERROSTAL ŁABĘDY confirms the internal quality of concast billets according to the below mentioned classes:

◆ axial porosity (table 1)	I / 2 – min. 90 % of billets
◆ axial micro-shrinkage (table 2)	II / 2 – min. 90 % of billets
◆ internal cracks over grain boundaries (table 3)	III / 2
◆ cracks over diagonals (table 4)	IV / 2
◆ star-shaped cracks (table 5)	V / 2
◆ pinholes and subcutaneous blowholes (table 6)	VI / 2

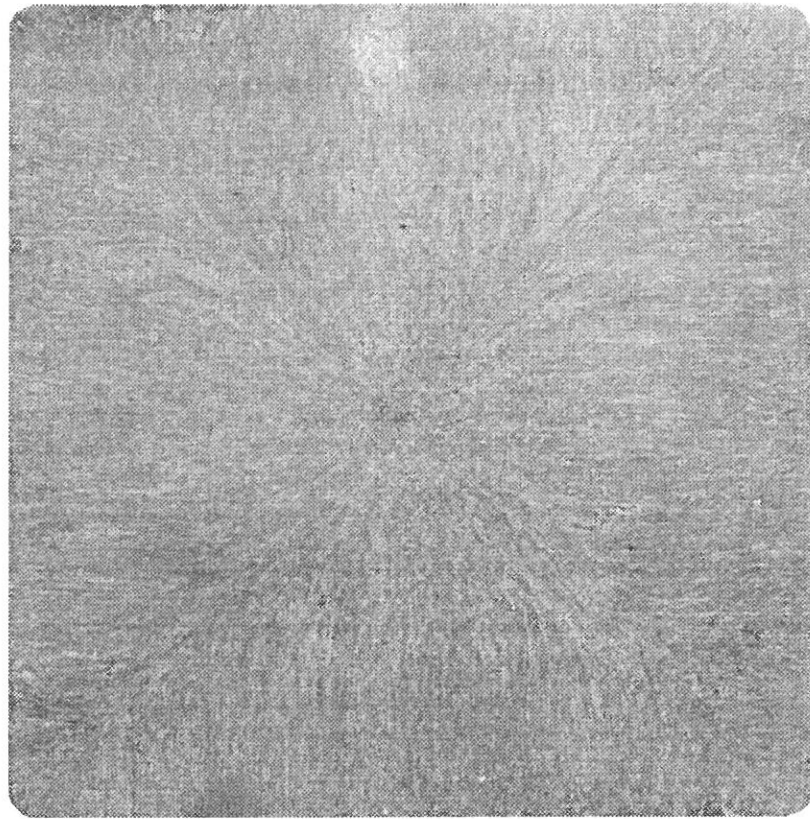
- **For concast billets with round section:**

The concast billets should meet the undermentioned requirements according to the classification of Mannesman Demag concerning internal defects in the continuously cast material. FERROSTAL ŁABĘDY confirms the internal quality of concast billets according to the below mentioned classes:

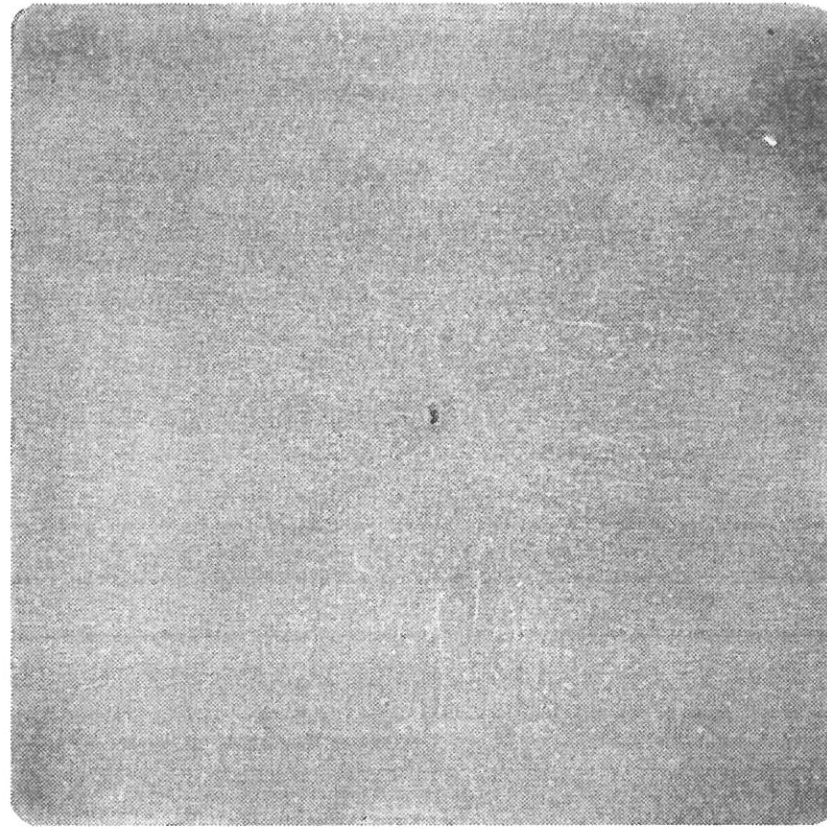
◆ Degree of purity	2
◆ Surface zone	2
◆ Middle zone	2
◆ Core zone	2

In case the orderer is interested in other standards, it should be each time stated in the order.

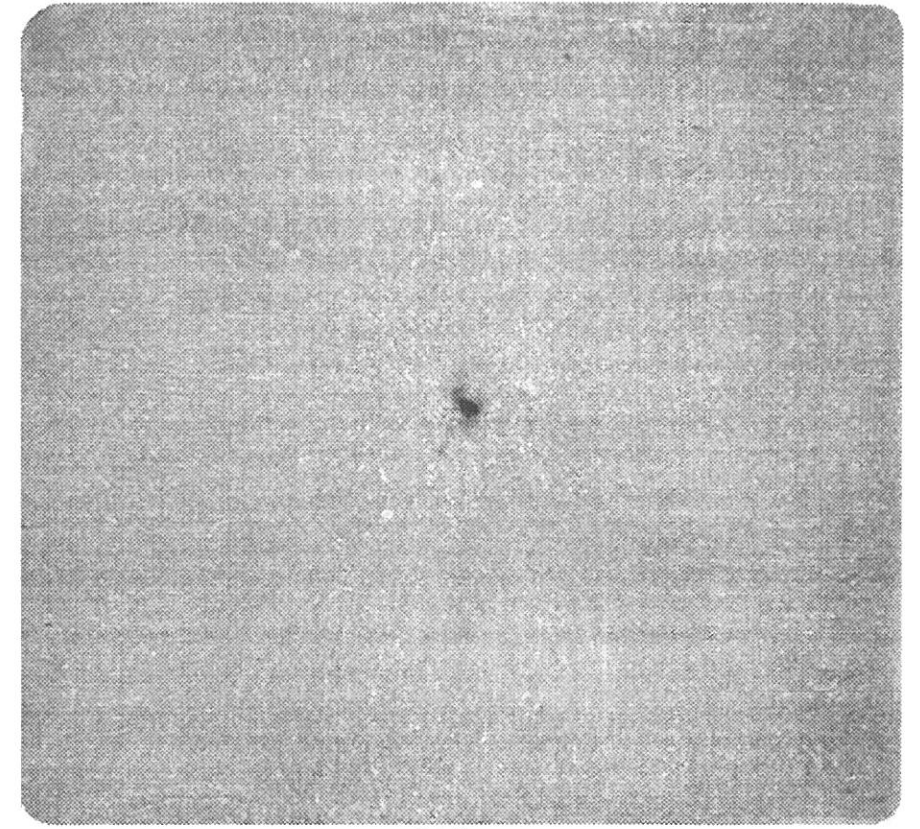
Table 1 Axial porosity



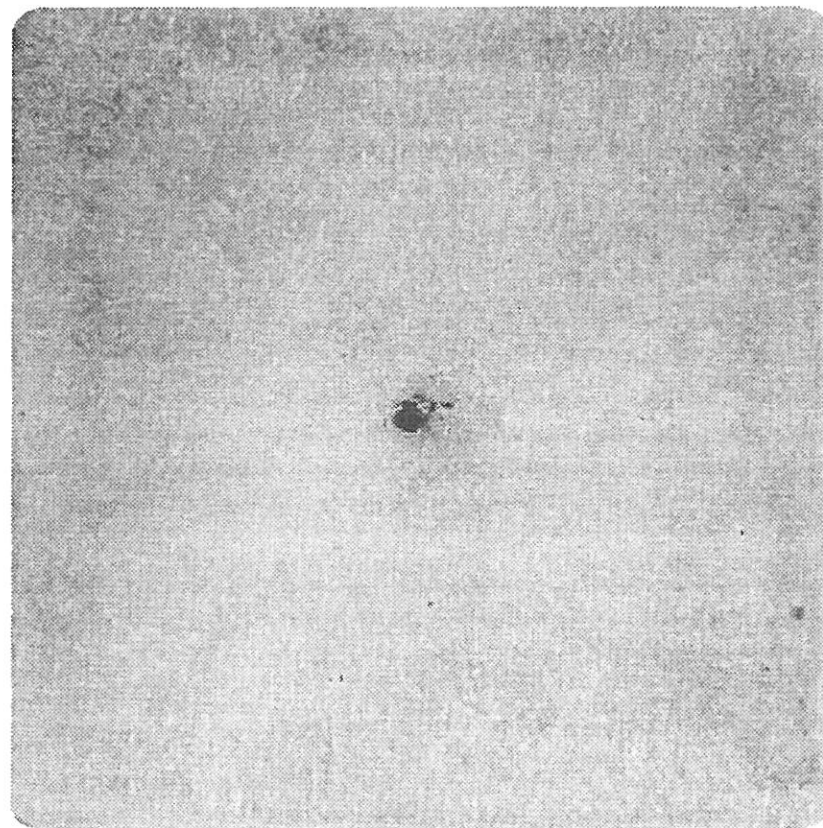
I/1



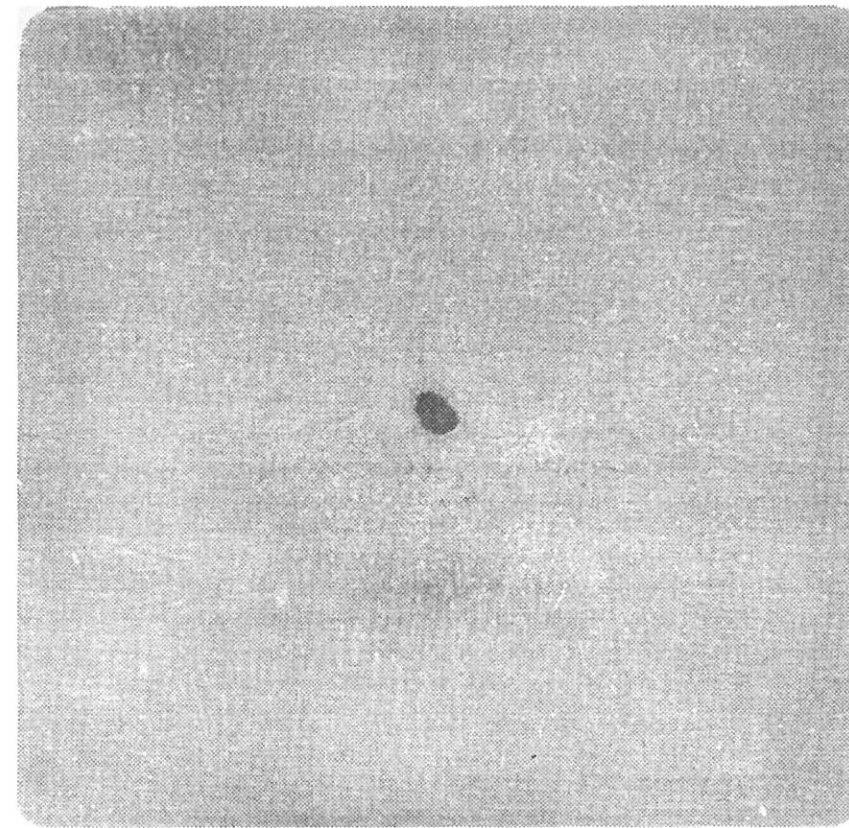
I/2



I/3

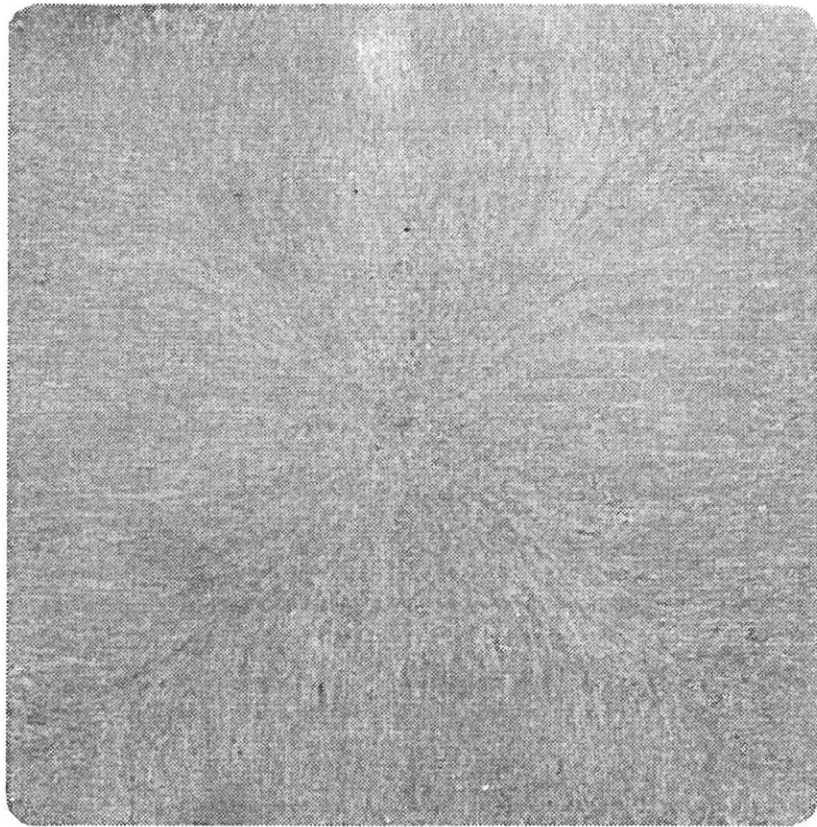


I/4

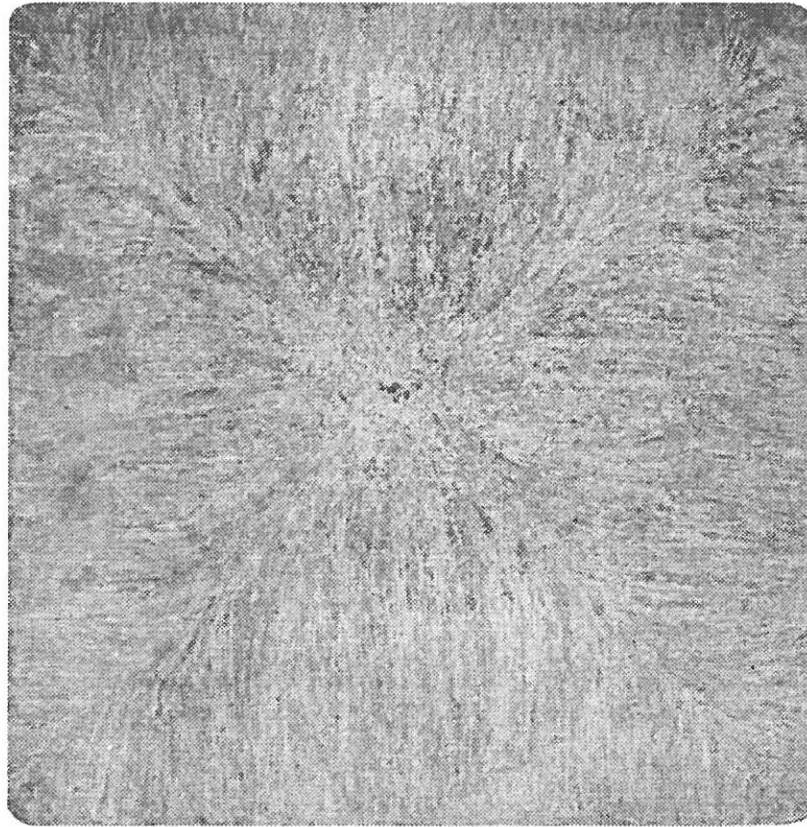


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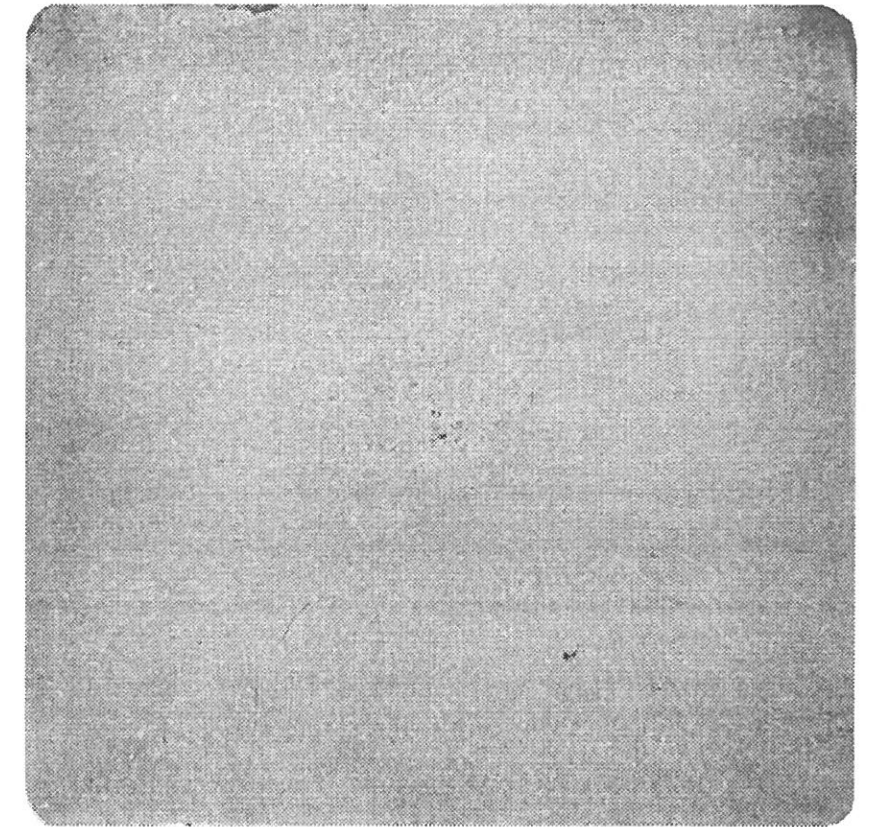
Table 2 Axial micro-shrinkage



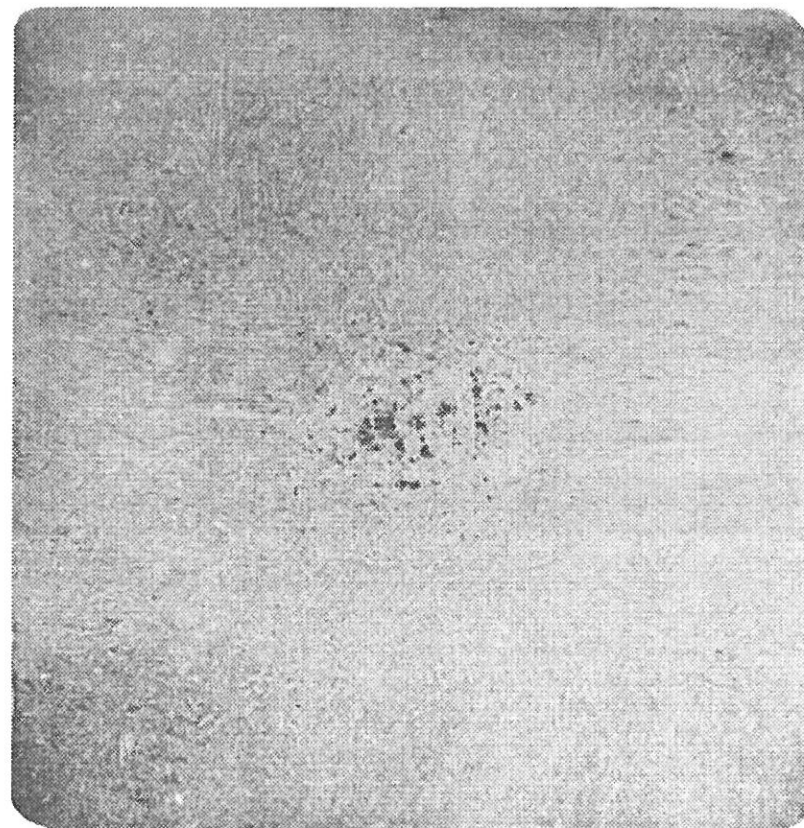
II / 1



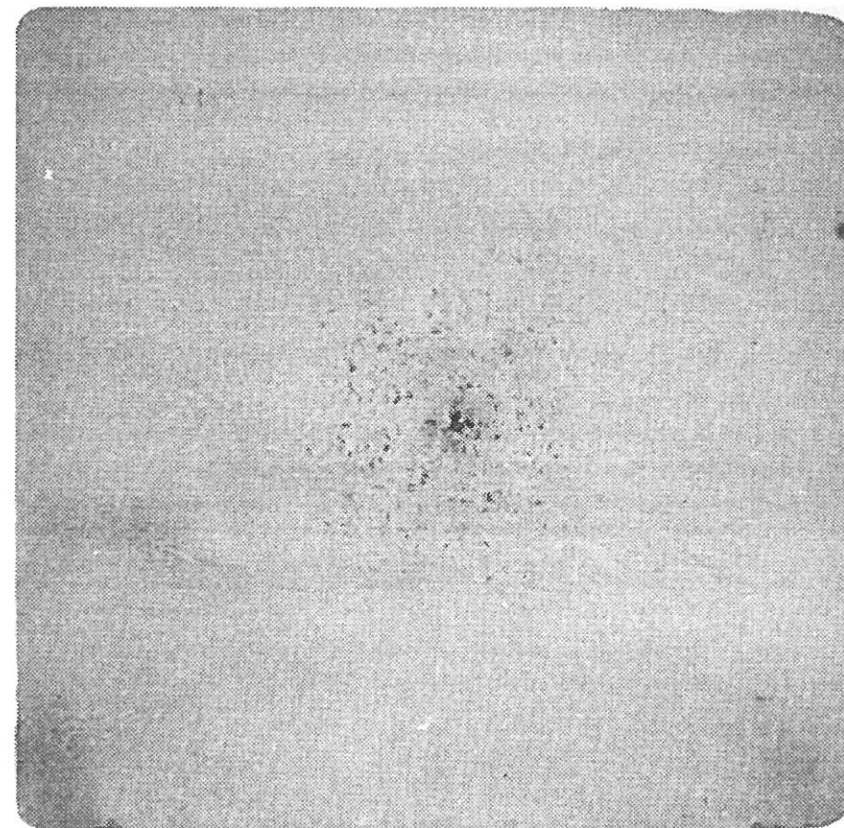
II / 2



II / 3

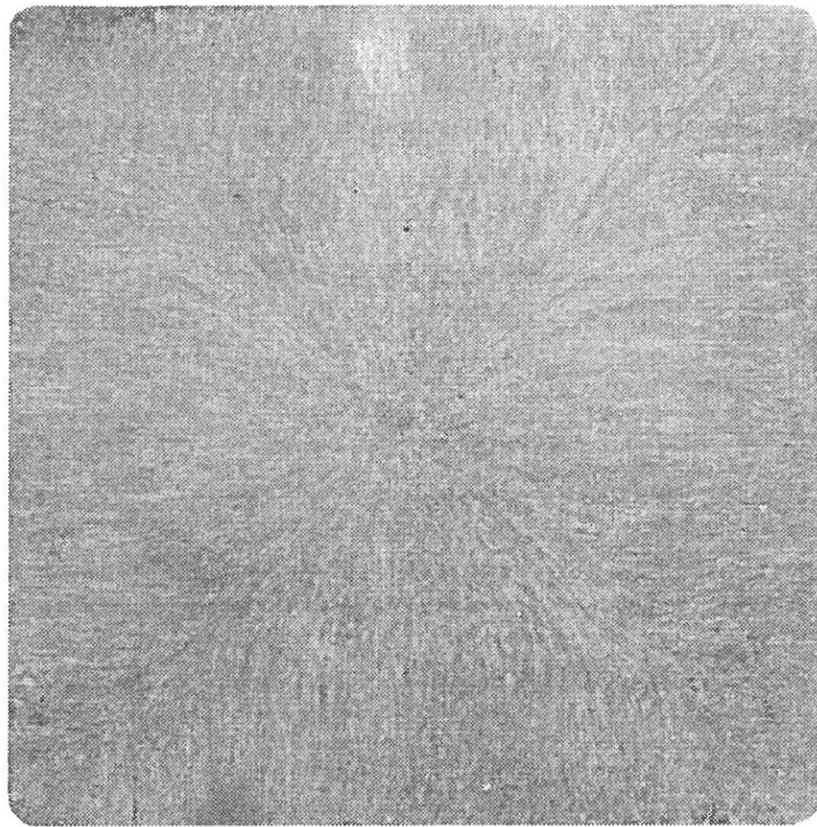


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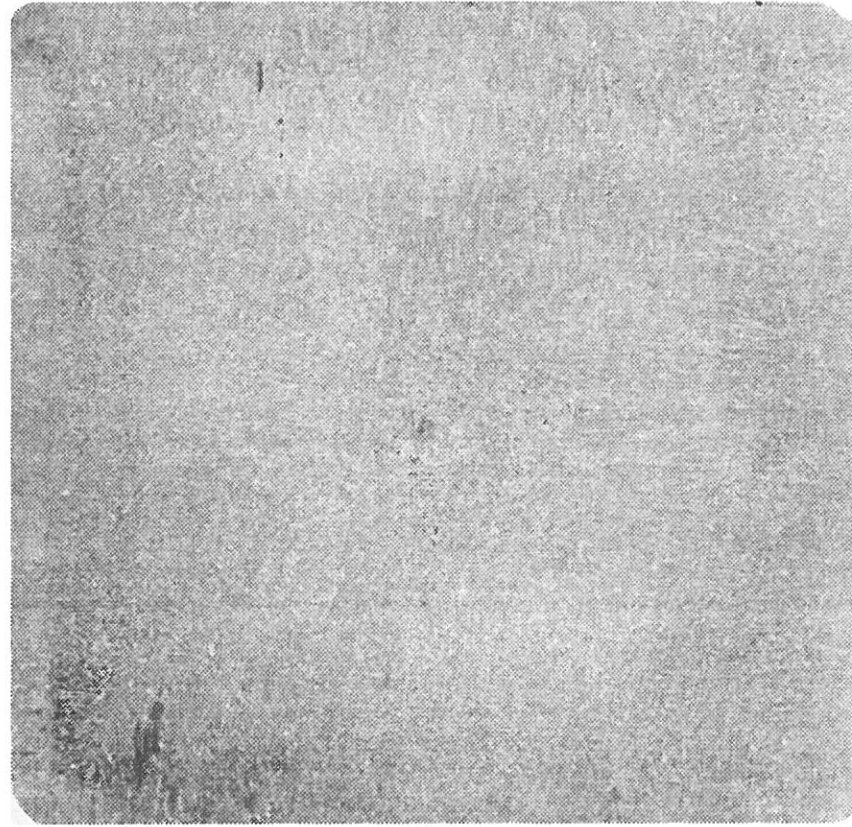


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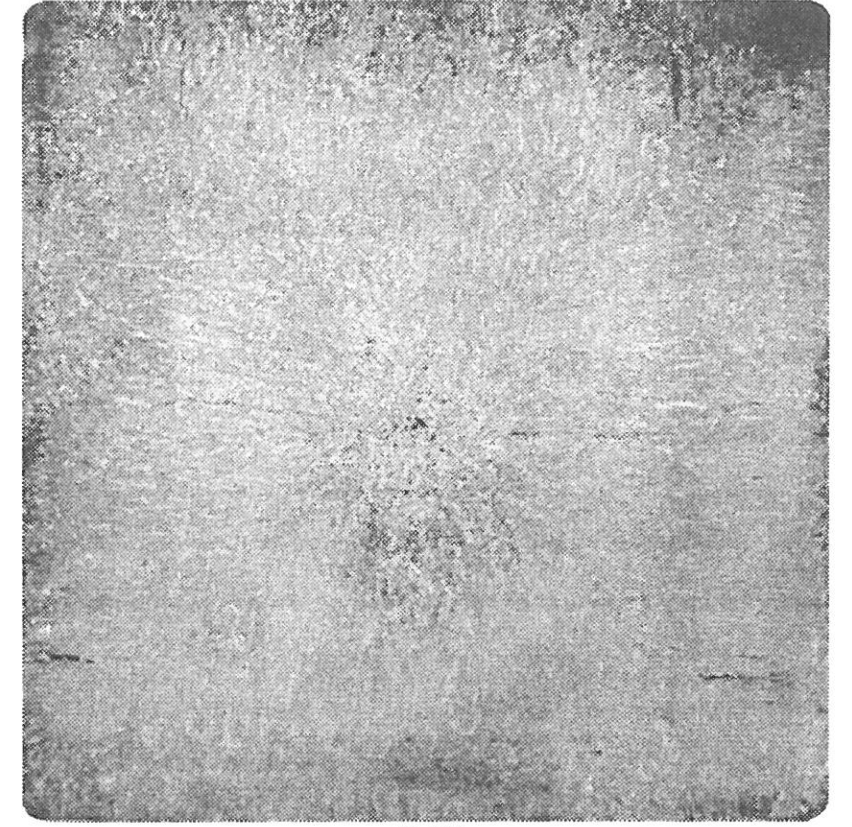
Table 3 Internal cracks over grain boundaries



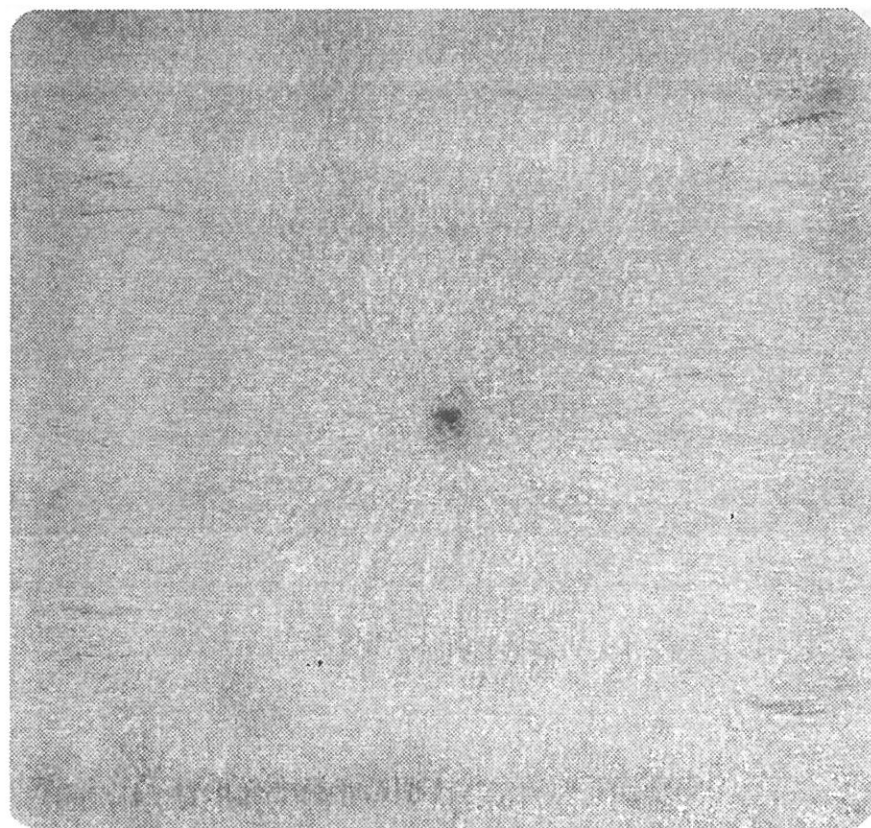
III / 1



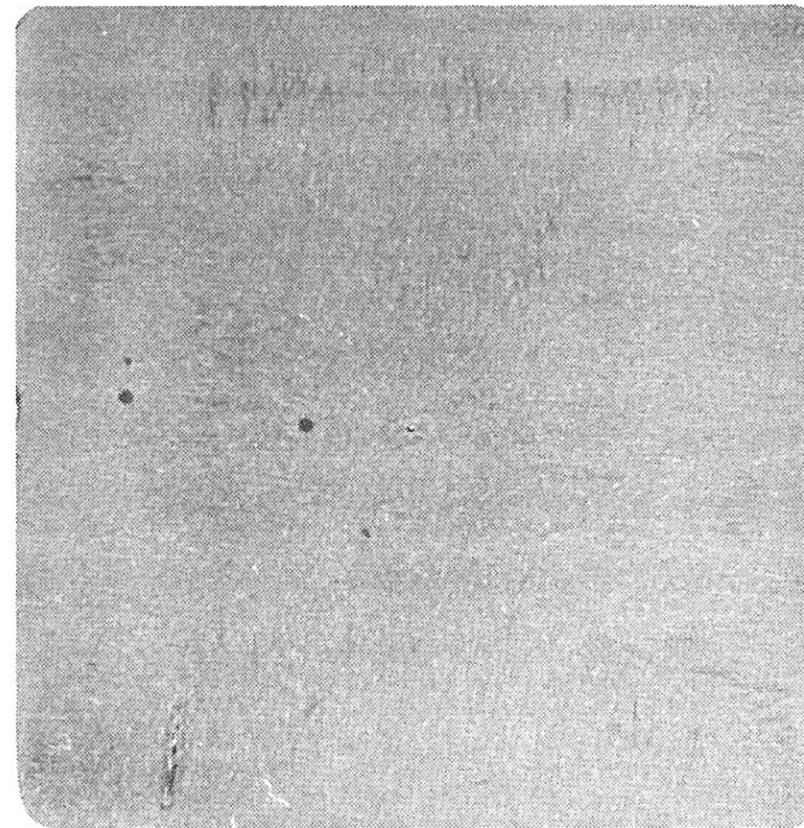
III / 2



III / 3

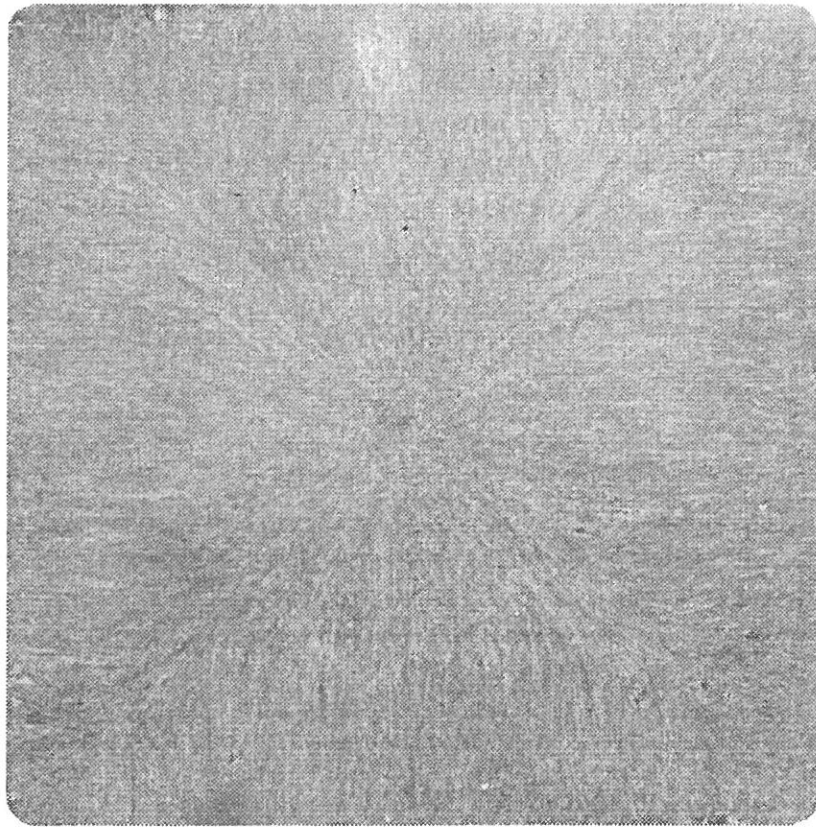


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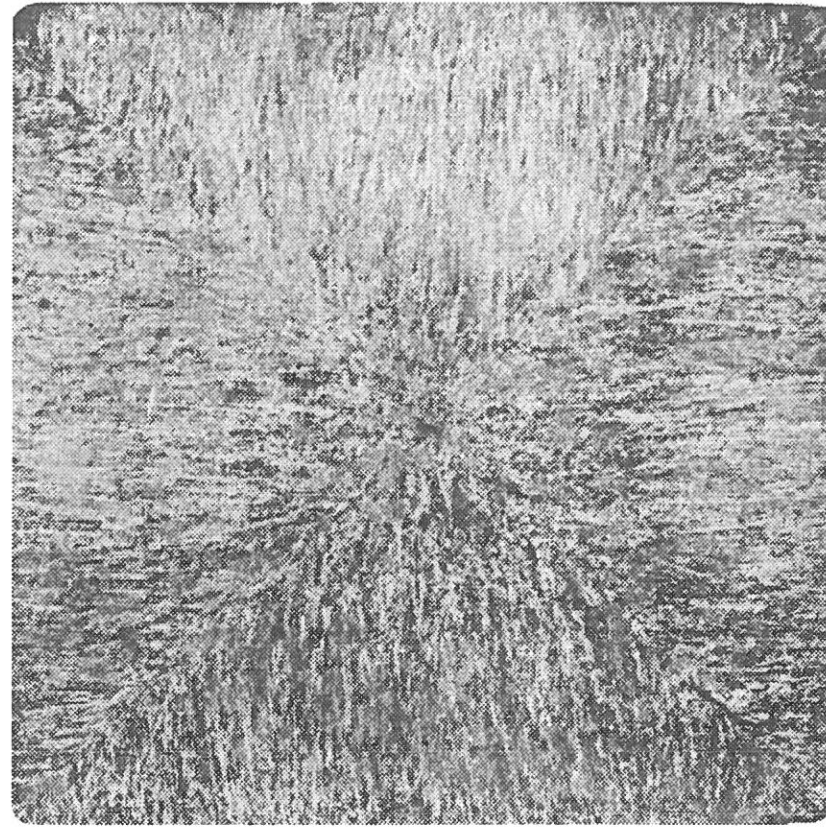


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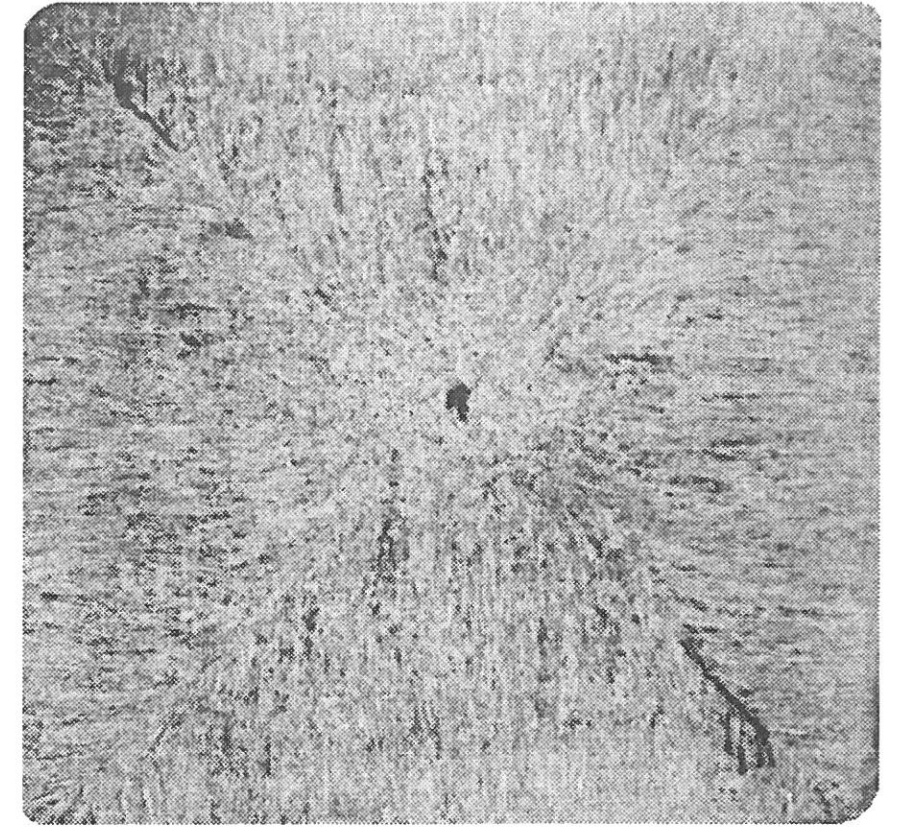
Table 4 Cracks over diagonals



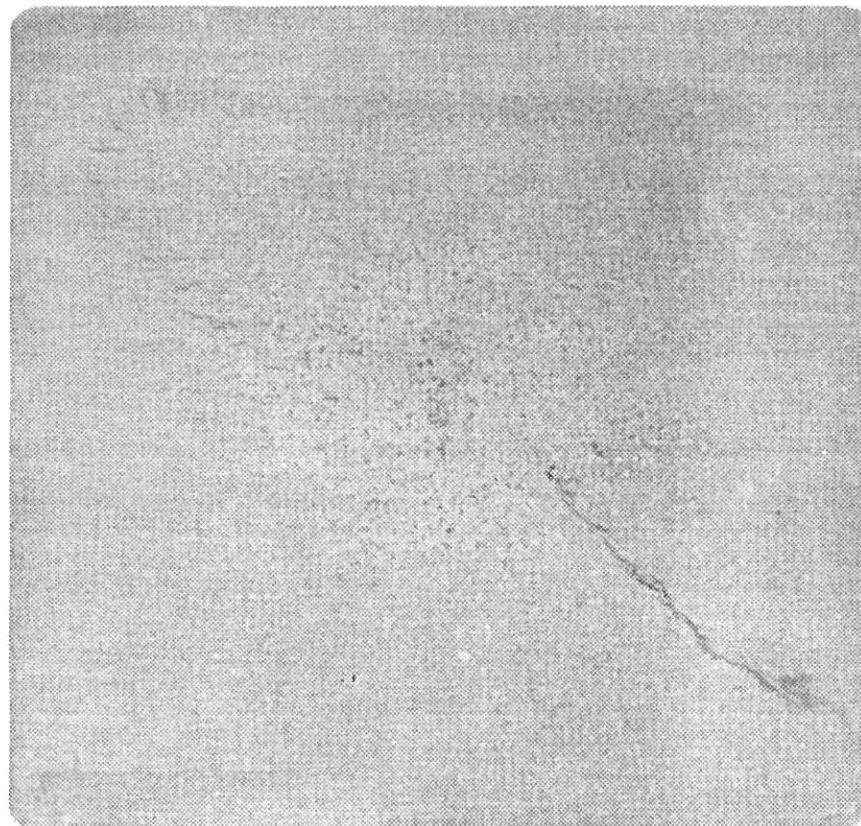
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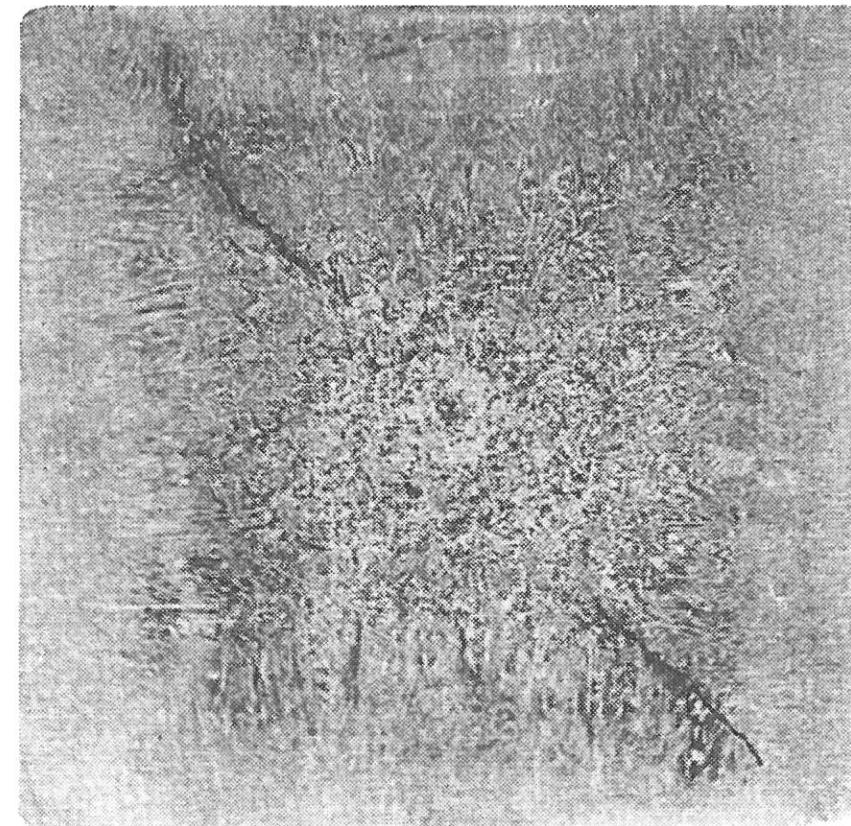
IV/2



IV/3

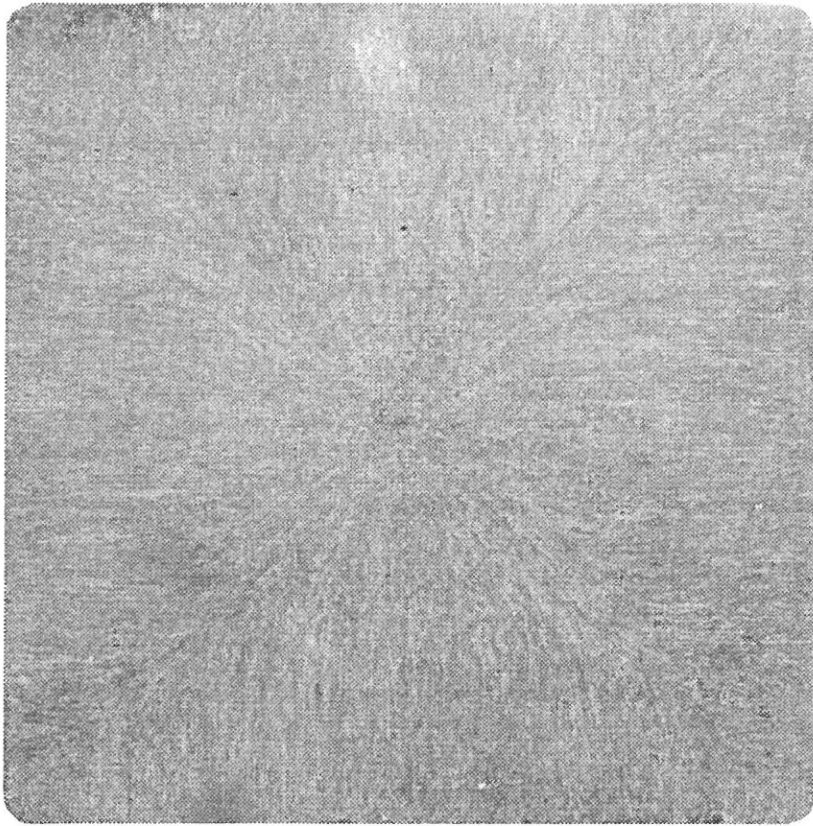


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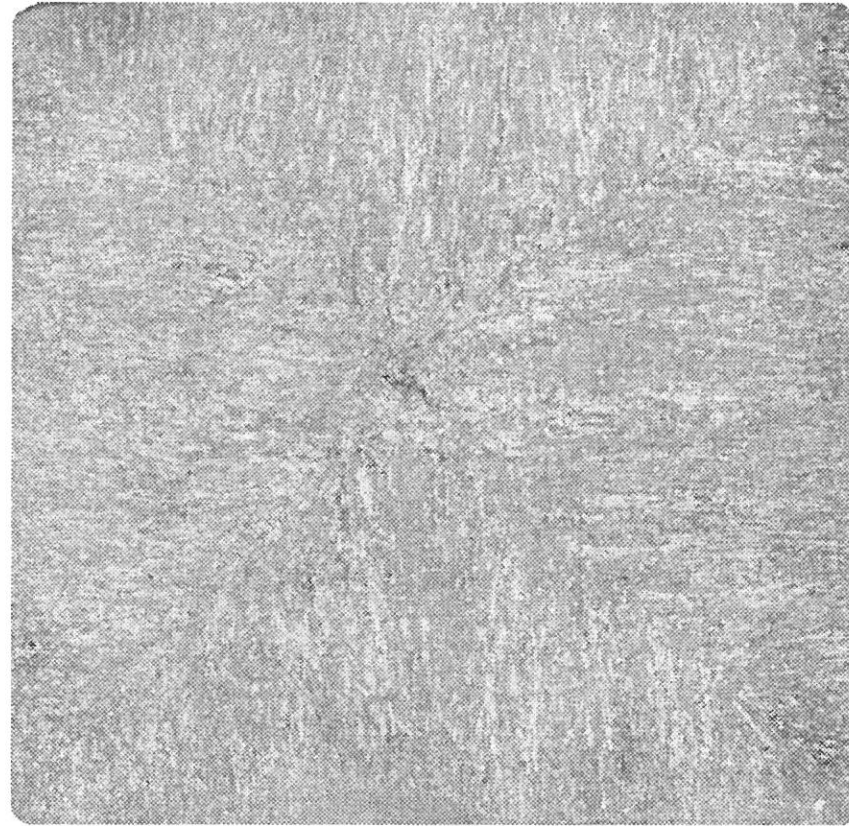


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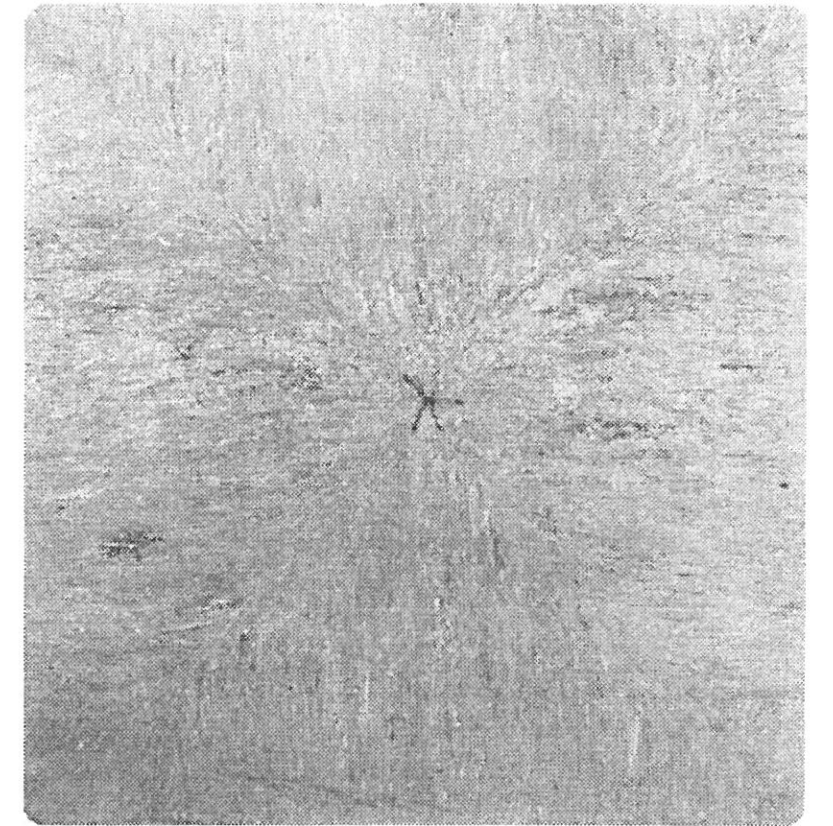
Table 5 Star-shaped cracks



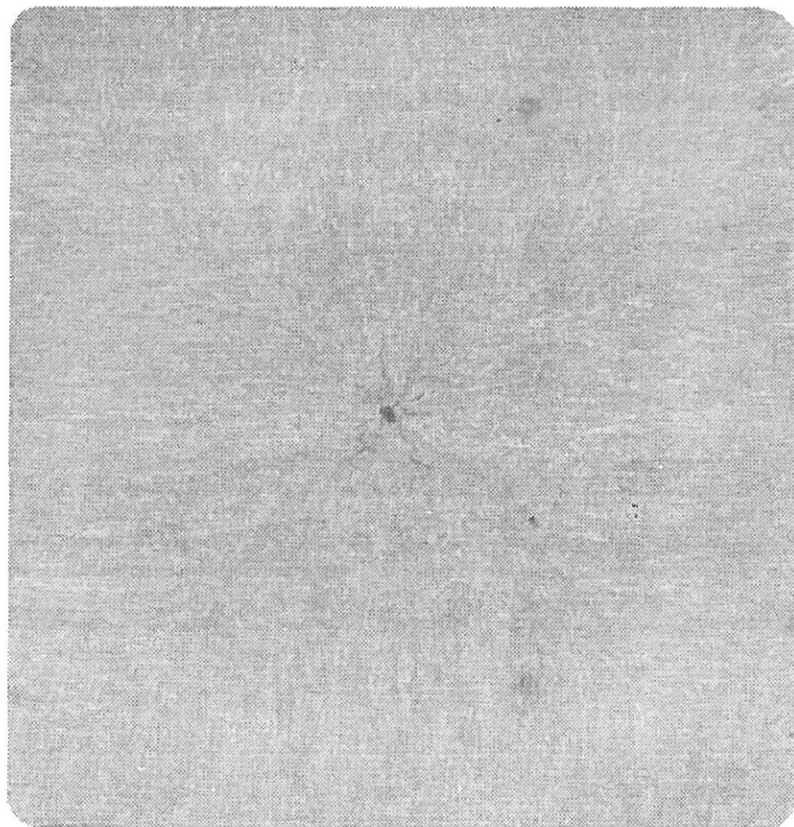
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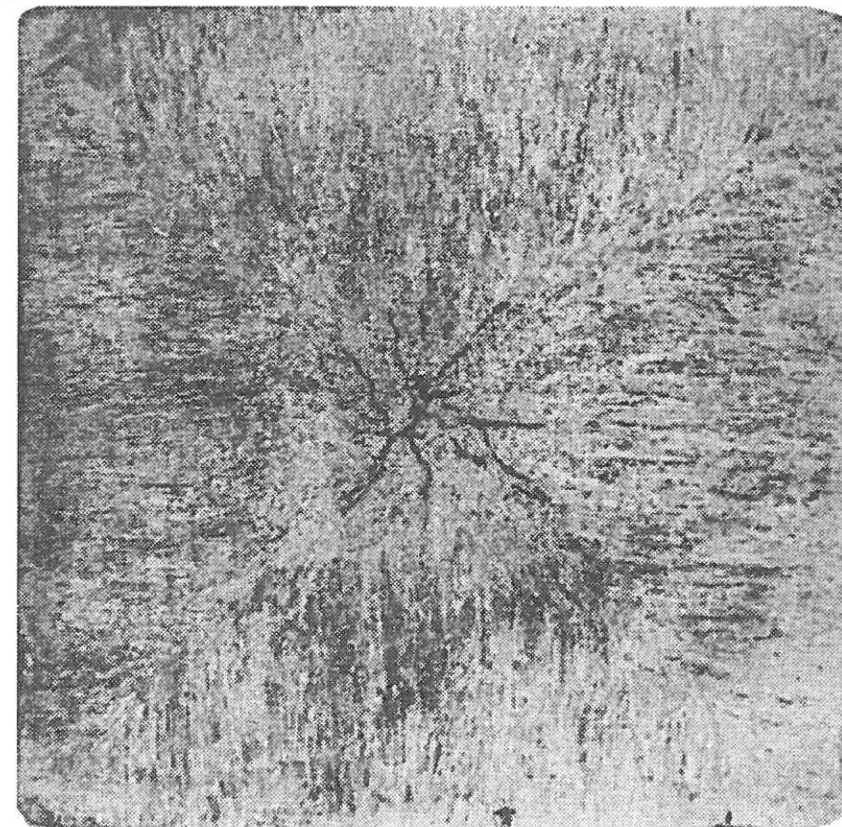
V/2



V/3

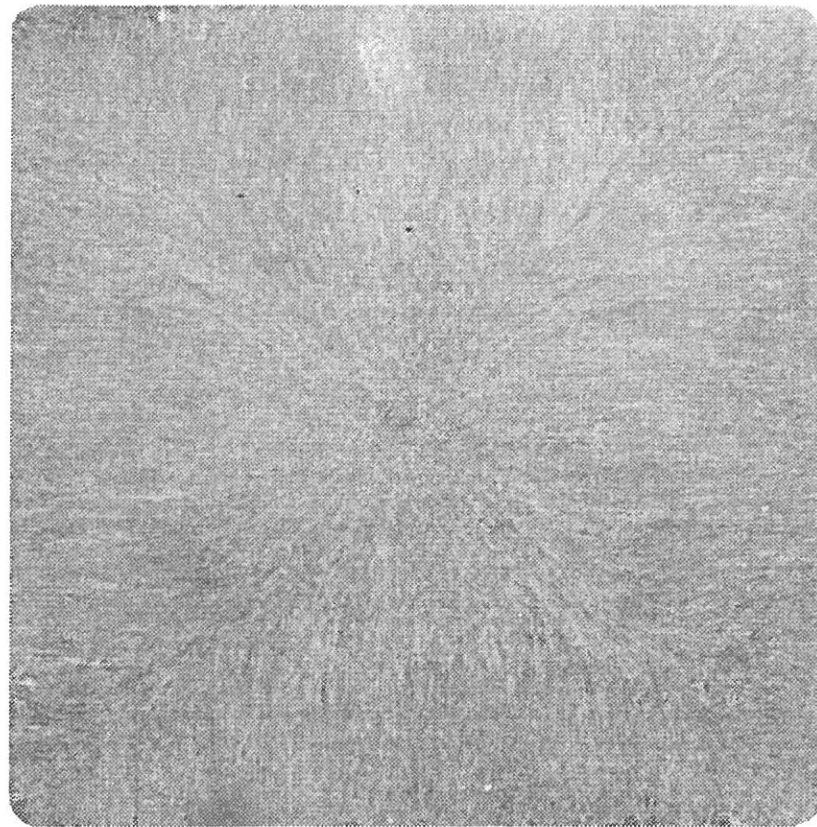


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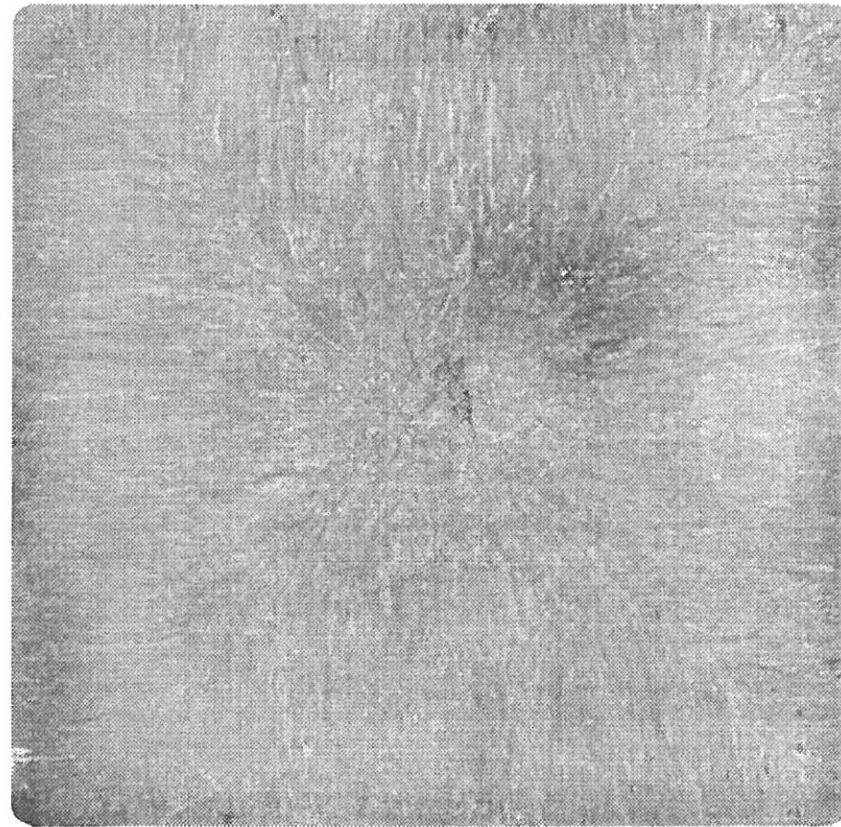


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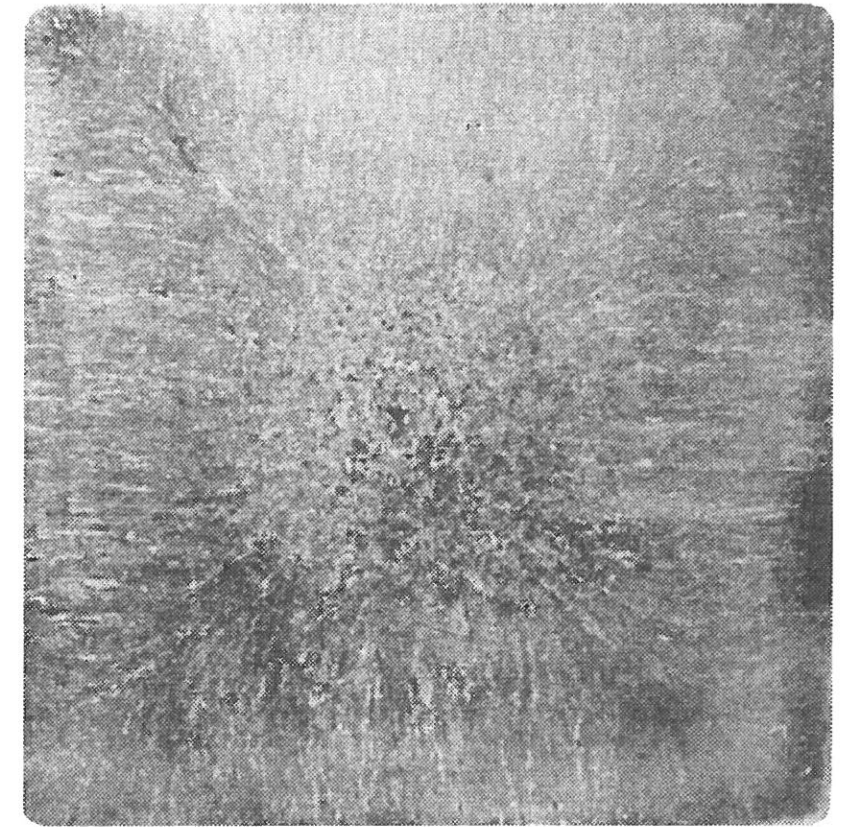
Table 6 Pinholes and subcutaneous blowholes



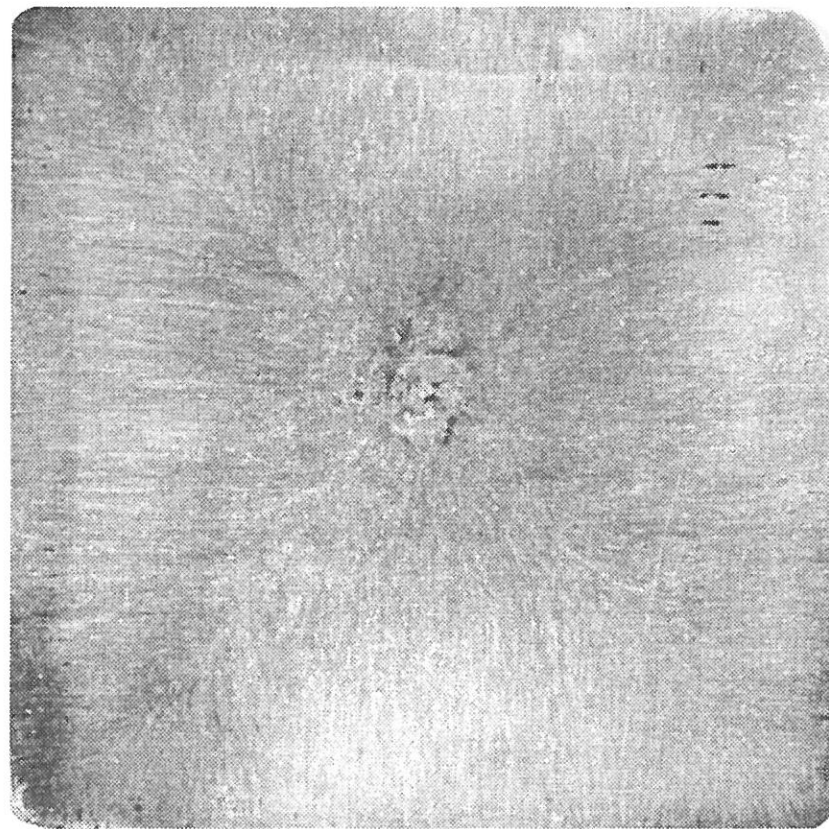
VI/1



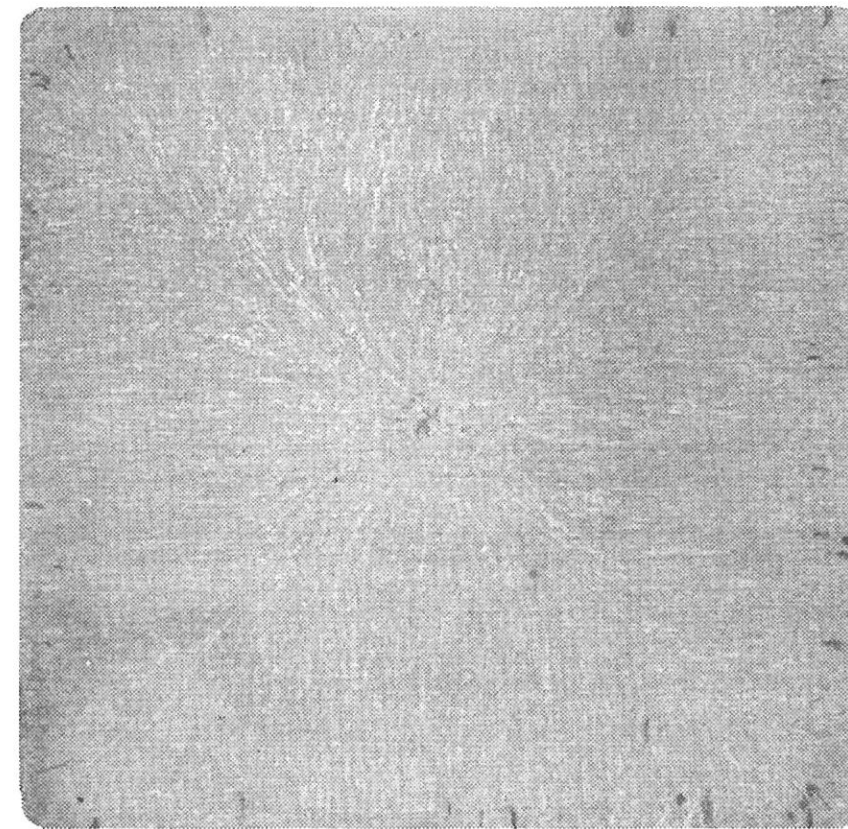
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VI/3



VI/4



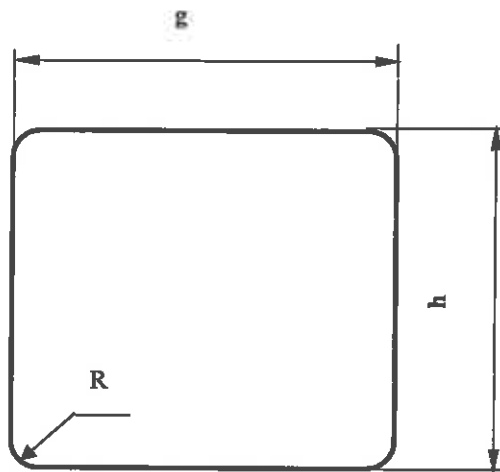
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c) Dimensions of concast billets.

- Nominal dimensions of the cross section, acceptable dimensional deviations, weight of 1 running metre of billet are presented on the drawings and table.

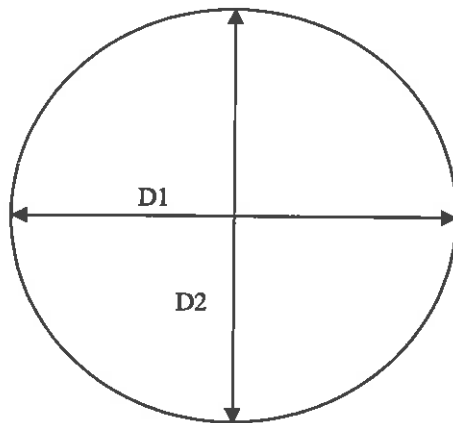
- For concast billets with square and rectangular sections



Dimensions of section [mm]	Dimensions and acceptable dimensional deviations				Corner radius: R [mm]	Weight of 1 running metre of concast billet [kg]
	g [mm]	max. deviation [mm]	h [mm]	max. deviation [mm]		
100 x 100	100	± 3	100	± 3	4	77,0
120 x 120	120	± 3	120	± 3	4	110,0
130 x 130	130	± 5	130	± 5	6	130,0
140 x 140	140	± 5	140	± 5	6	151,0
140 x 165	140	± 5	165	± 5	6	177,0
160 x 160	160	± 5	160	± 5	6	196,0

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- For concast billets with round section:



Weight of 1 running metre of concast billet amounts to 175.0 kg

d) Skewness

- For concast billets with square and rectangular sections

The acceptable skewness of the cross section measured as the difference of section diagonals should not exceed:


- 8mm (for square 100x100, 120x120, 130x130 and 140x140mm),
- 10mm (for rectangle 140x165 and square 160x160mm),
- 12mm (for square 160x160mm – only for grades with carbon content C > 0,17% open cast)

- For concast billets with round section:

Diameter tolerance	+3/-3 mm
Local ovality	max 2,5%

The ovality is calculated according to the formula:

$$OV = \frac{2(D_1 - D_2)}{D_1 + D_2} \times 100 \%$$

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e) Length

- Concast billets are delivered in lengths 5,6 ÷ 12,4m.
- The delivery of concast billets in shorter lengths is permitted upon additional agreement. The minimum length of the concast billet mechanically cut amounts to 4,6m.
- The permissible deviation of the concast billet length should not exceed $\pm 100\text{mm}$.
- In the delivery of concast billets up to 5% of shorts resulting from the technological process of the CC machine is permitted.

f) Straightness

- Concast billets are delivered as not straightened.
- The permissible straightness deviation should not exceed 1% of the measured length.

g) Twist

- Twist along the longitudinal axis of max. 1° over the length of 1m is permitted.

h) Ends

- On the end faces of concast billets the occurrence of out-of-flatness, grooves, partial melting and pits typical for the cutting process with gas and oxygen torches is accepted.
- At the ends of concast billets the occurrence of fin typical for cutting of concast billets with gas and oxygen torches is permitted.
- In the axial zone the occurrence of fine cracks, micro-shrinkage and porosity is accepted.


i) Processing reduction ratio

The minimum processing reduction ratio of concast billets should be 6,0:1.

j) Marking

Concast billets are marked with the following marks on the end face or lateral surface:

- number of heat,
- grade of steel,
- Another way of marking is acceptable upon agreement.

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k) Dispatch

Concast billets are dispatched together with a documentation (specification of delivery), which should include the following information:

- heat No,
- length of billets,
- wagon No/truck No,
- number of billets,
- weight of billets,
- order No.

5. Inspection.

The inspection of surface, dimensions and internal quality is performed by the Quality Inspection in accordance with these TCCB and order confirmation. The results of testing the samples performed in the works laboratory are used for the quality evaluation.


6. Test certificate and acceptance certificate.

For each batch of production FERROSTAL ŁABĘDY issues an acceptance certificate or test certificate according to PN-EN 10204:2006 including:

- name of producer,
- product designation,
- chemical composition,
- quality inspection mark stating the conformity of the product with the requirements,
- name of orderer.

7. Sampling of test pieces.

Sampling of test pieces is carried out according to the Instruction: „Instruction of sampling and testing”.

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8. List of documents connected with TCCB.

PN-88/H-04420	-Metals. Steel semi-products and products. Measurement of shape deviations
PN-EN 10204:2006	-Metal products. Types of inspection documents
Procedure according to PN EN ISO 9001:2015	-PP:8.5-01.11. Final inspection of blooms.
Criteria of Mannesman Demag AG	-Classification of internal defects on round blooms cast on steel continuous casting equipment