

**EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE**

CERN - PS DIVISION

PS/PA/NOTE 96 - 13 (spec.)

**SPECIFICATIONS OF STEEL ALMINATIONS FOR PULSED BOOSTER
EJECTION SEPTUM MAGNET**

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Geneva, Switzerland
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1. General

To eject or inject the particle beams between the different accelerators of the CERN PS and Booster complex, septum magnets are required. These dipole magnets have to produce a very homogenous field between their two pole faces, together with a very low leakage field on the outside of the magnet gaps.

These magnets work inside a vacuum chamber with a pressure level of 10^{-9} mBar. When pulsed they operate at a maximum rate of 1.2 seconds with a pulse width of 3 ms. These constraints imply the use of very high quality materials and tight tolerances for their manufacture. This specification outlines the requirements to ensure a reliable magnet for these applications.

The magnet characteristics are:

Nominal magnetic induction:	0.8 Tesla
Vertical gap height:	24 mm
Horizontal gap width:	86 mm
Maximum lamination sizes:	150 x 120 mm ²
Maximum core length:	1100 mm

2 Steel characteristics

We exclude in advance material of Fe Co class because of the presence of nuclear radiation, hence the choice is mainly directed toward soft magnetic steel (i.e. non oriented 3% content Si -steel)

The lamination thickness should not exceed 0.35 mm, because of the relatively short pulse width, corresponding to a frequency of 300 Hz.

The magnetic characteristics should be:

Saturation induction level:	$B_{\text{sat}} > 1.5 \text{ T}$
Coercitive force (after $B=1.5 \text{ T}$):	$H_C < 20 \text{ A/m}$

Minimum values in the final steel state:

B (in T)	0.5	0.8	1	1.2	1.3	1.4	1.5
H (in A/m)	40	80	120	200	300	500	1300
μ_r	10000	8000	6700	4800	3500	2200	900

3 Insulation

Since the magnet works in high vacuum **only inorganic insulation of the laminations would be acceptable**. The laminations must be coated on both sides and insulation thickness should not exceed 3% of the total thickness of the lamination (a thickness of about 3 microns on each side should be sufficient).

A minimum surface resistance of $15 \Omega \text{ cm}^{-2}$ is required.

After bake out of the laminations under vacuum at $200 \text{ }^\circ\text{C}$, the outgassing rate should not exceed $1 \cdot 10^{-9} \text{ mbar.l/s.cm}^2$ after 10 hours under vacuum and after 100 hours under vacuum it should not exceed $6 \cdot 10^{-11} \text{ mbar.l/s.cm}^2$.

4 Final treatment

The supplier should indicate if a special treatment is necessary after punching the laminations in order to reach the magnetic performances.

5 Production

Before the bulk production will start, sample laminations must be sent to Cern for verification purposes. After approval of the samples production can commence. The laminations should be produced in batches of 1000. The first lamination of each batch must be taken out of the bulk after the total bulk has been produced, these few laminations must be sent separately to Cern for verification purposes as soon as possible. The batches must be numbered and should be handled and packaged in such a way that they remain identifiable upon reception at Cern.

6 Form of supply

The laminations should have the profile indicated on the attached drawing number PS-PA-9447.4 and remain within the specified tolerance on this drawing. The maximum burr height should not exceed 0.01 mm. This requirement implies regular resharpenering of the punching tool during production (at least every 5000 laminations) as well as deburring by hand after punching. Dimensional control of the cut laminations should be performed by the manufacturer every 1000th lamination, and the results should be made available to Cern. The laminations must be shipped mechanically properly protected and identifiable per produced batch of 1000 laminations.

7 The quotation

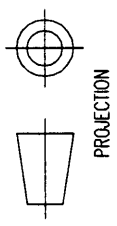
The quotation must be made for 30000 laminations. When a punching tool is used to cut the laminations quote separately for the punching tool. This tool has to remain CERN property, for future use. The tools must be kept in perfect condition for at least 10 years. After punching the laminations should be deburred. Please quote separately for this deburring.

The following material characteristics should be provided with your quotation:

- the B - H curve of the material
- the losses of the material at 300 Hz
- type and specifications of the proposed insulation (thickness, nature and physical properties)

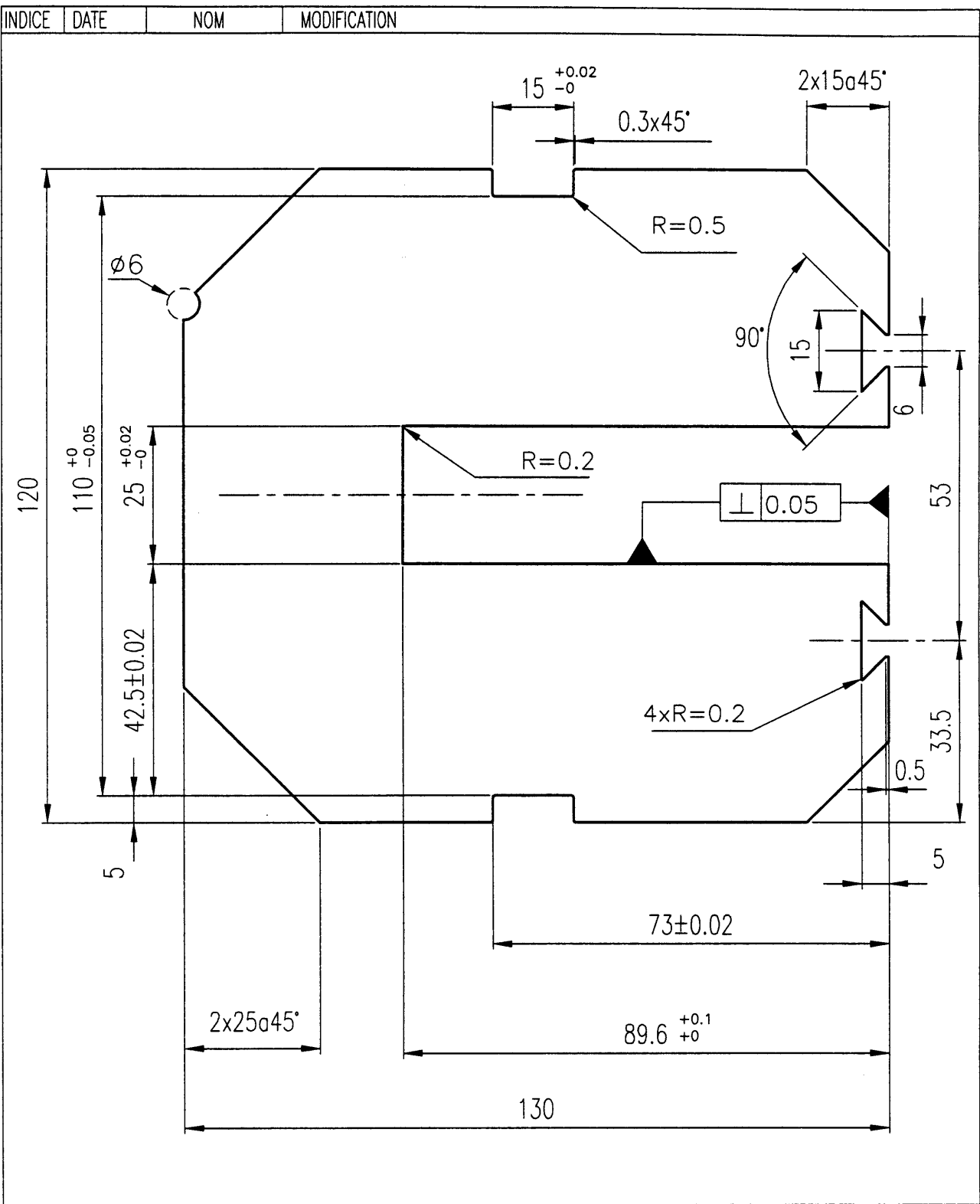
INDICE	DATE	NOM	MODIFICATION
>2000			
>1000			
>315			
>120			
>30			
>6			
<=6			
DIMENSION	USINAGE MOYEN/MEDIUM MACHINING		
	MECANO. SOUDURE/WELDED STRUCTURE		
GENERAL TOLERANCES	GENERAL TOLERANCES		
GENERAL TOLERANCES	GENERAL TOLERANCES		

DESSIN, RUGOSITE, TOLERANCES
SELON NORMES ISO
DRAWING, RUGOSITY, TOLERANCES
ACCORDING TO ISO STANDARDS



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GENEVE

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QUANT.	DESCRIPTION	POS	MAT.	OBSERVATIONS	REF.CERN	
	ENS/ASS		S.ENS/S.ASS			
LAMIATION BESMH PULSE				ECHELLE SCALE		
				DES/DRA.	NOM/NAME BORBURGH	DATE 1996-04-30
				CONTROL.		
				APPRO.		
				C:\JMD\YANNE\PSPA9447		
				REPLACE/REPLACES		
NON VALABLE POUR EXECUTION NOT VALID FOR EXECUTION		PSPA		9447.4		
				IND.		