SSC DETECTOR SOLENOID DESIGN NOTE #19

TITLE: Workable Coil Design: 9.5 m ϕ x 2 m long, 2 T, 5 kA

AUTHOR: R.W. Fast

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Possible Coil Design

I. Geometry of 2-m coil module
See attached figure

II. Parameters

$I = 5000\,A$

$N = (6 \text{ layers})(108 \text{ turns/layer})$
$= 648 \text{ turns}$

$NI = 3.24 \times 10^6$ A-turns

Conductor dimensions $= 1.54 \times 1.91\ cm^2$

$J_{cond} = 5000A / 1.54 \times 1.91\ cm^2$

$= 1700\ A/cm^2$,

which is "quench safe" (DN #18).

$J_{coil} = 3.24 \times 10^6\ A / 15.85 \times 185\ cm^2$

$= 1105\ A/cm^2$

Packing factor $= J_{coil} / J_{cond}$

$= 0.65$

(MFTF solenoids was 0.684).

Surface heat flux $= I^2\rho / 2ab\,\gamma(a+b)$

$= 0.25 / 2 \times 1.54 \times 1.91 \times \gamma(1.54+1.91)$

$= 0.0123/\gamma$

where γ = fraction of conductor perimeter wetted by LHe

Using the MFTF value $\gamma = 0.25$

$q_\ell = 0.051\ W/cm^2$

(The value of q_ℓ for MFTF solenoids is $0.154\ W/cm^2$).

K+E 10 X 10 TO THE CENTIMETER 18 X 25 CM
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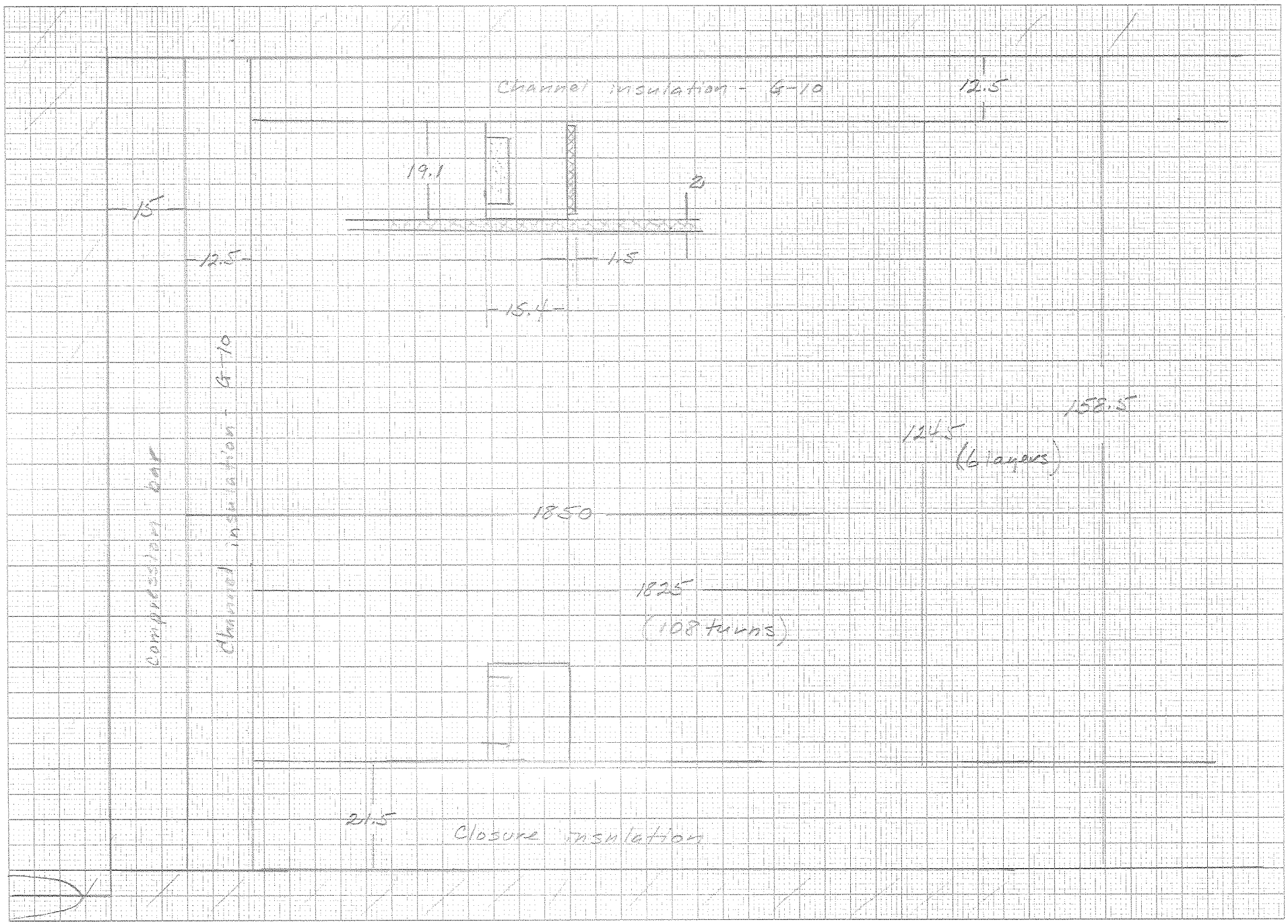

dimensions in mm.