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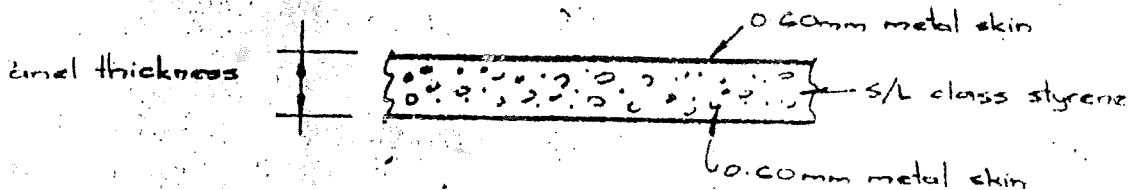
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Ref. 22025

12th September, 1978.

STRUCTURAL INSULATING PANELS

ENGINEERING CALCULATIONS.



Cross breaking strength	=	179kPa
Compressive strength at 10% deformation	=	69kPa
Flammability	-	Self extinguishing

1 ... Determination of design stresses in metal skins of panels.

(a) Bending Stresses.

See charts for test results on 150mm thick panels as beams.
Take top of straight section of load versus deflection curve as the maximum desired load.

Panels C & D - a core joint 900mm from centre of panel
(1200mm wide)
(150mm thick)

Maximum desired load from chart = 1300lbs.
= 5.78kN

Test panel loaded midspan

Span - 10' - 0" = 3.049m

BM in panel = $\frac{5.78 \times 3.049}{4}$
= 4.4kN

150 PANELS

C/C skins = 149.4mm

Max. compression and tension = $\frac{4.4}{.1494} = 29.5 \text{ kN}$

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$$\text{Stress} = \frac{29.5 \times 10^3}{1200 \times .6} = 41.0 \text{ MPa}$$

PANEL E

600mm wide
150mm thick

$$(i) \text{ Failure load} = 1000 \text{ lb.} = 4.45 \text{ kN}$$

$$(ii) \text{ Maximum desired load} = 700 \text{ lb.} = 3.11 \text{ kN}$$

(i) Failure load

$$\text{BM in panel} = \frac{4.45 \times 3.049}{4} = 3.39 \text{ kNm}$$

$$\text{load in skins} = \frac{3.39}{.1494} = 22.70 \text{ kN}$$

$$\text{Stress} = \frac{22.70 \times 10^3}{600 \times .6} = 63.07 \text{ MPa}$$

(ii) Maximum desired load

$$\text{BM in panel} = \frac{3.11 \times 3.049}{4} = 2.37 \text{ kNm}$$

$$\text{load in skins} = \frac{2.37}{.1494} = 15.89 \text{ kN}$$

$$\text{Stress} = \frac{15.89 \times 10^3}{600 \times .6} = 44.14 \text{ MPa}$$

75mm PANELS 1200mm wide

$$(i) \text{ Failure load} = 1050 \text{ lb.} = 4.67 \text{ kN}$$

$$\text{BM in panel} = \frac{4.67 \times 3.049}{4} = 3.56 \text{ kNm}$$

$$\text{load in skins} = \frac{3.56}{.0744} = 47.84 \text{ kN}$$

$$\text{Stress} = 66.45 \text{ MPa}$$

$$\text{Maximum desired load} = 850 \text{ lbs.} = 3.78 \text{ kN}$$

$$\text{BM in panel} = \frac{3.78 \times 3.049}{4} = 2.88 \text{ kNm}$$

$$\text{load in skins} = 38.73 \text{ kN}$$

$$\text{Stress} = 53.78 \text{ MPa}$$

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DESIGN STRESSES FOR PANEL SKINS

PANEL	Stress at Failure	Stress at max. desired load
	MPa	MPa
150mm		41.00
150	63.07	44.14
75	66.45	53.78

Adopt 40 MPa as maximum design stress in 0.6mm steel skins in panels when acting as beams.

COLUMNS

Test panels	3830 panel	$\frac{h}{t} = 51$
	150mm wide	
	75mm thick	
(i) Failure load	= 1000 lb	= 4.45 kN
Stress in skins		=
(assuming full load taken by steel)		$\frac{4.45 \times 10^3}{2 \times 150 \times}$
		= 24.7 MPa
(ii) Max. desired load	= 800 lb	= 3.56 kN
Stress in skins		=
		$\frac{3.56 \times 10^3}{2 \times 150 \times}$
		= 19.8 MPa

Adopt max. design stress in panels as columns to be 20 MPa
 for $\frac{h}{t} = 50$

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WALL PANELS.

Wind loading

$$\begin{aligned} V2 &= 44 \text{ m/s} \times .65 \text{ for Terrain Category 3} \\ &= 28.6 \text{ m/s} \\ q2 &= .6 \times 28.6^2 \times 10^{-3} \\ &= 0.49 \text{ kPa} \end{aligned}$$

Pressure coeff. C_p

$$\begin{aligned} \text{for External pressure} \quad C_p &= .80 \\ \text{Internal pressure} \quad C_p &= -.20 \end{aligned}$$

$$\begin{aligned} \text{Total inwards pressure on wall} &= 1.0 \times 0.49 \text{ kPa} \\ &= 0.49 \text{ kPa} \end{aligned}$$

$$\begin{aligned} \text{Allowable stress in metal skins} &= 40 \text{ MPa} \times 1.33 \text{ for wind} \\ &= 53.2 \text{ MPa} \end{aligned}$$

$$\begin{aligned} \text{Allowable load/ skin/ metre} &= 1000 \times .6 \times 53.2 \\ &= 31.92 \text{ kN} \end{aligned}$$

$$\begin{aligned} \text{BM in panels} &= \frac{0.49 \times L^2}{8} \text{ kNm} \quad L \text{ in metres} \\ &= 0.06125 L^2 \text{ kNm} \end{aligned}$$

$$\begin{aligned} \text{Load or force in skins} &= \frac{0.06125 L^2}{d} \\ &= 31.92 \end{aligned}$$

$$\text{ie } L^2 = \frac{31.92 \times d}{0.06125}$$

$$\begin{aligned} &= \frac{521 d}{\sqrt{521 d}} \quad d \text{ in metres} \end{aligned}$$

FACTORS:

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WALL PANELS

PANEL	d. m	max. L. m
50	.0494	5.07
75	.0744	6.22
100	.0994	7.20
125	.1244	8.05
150	.1494	8.82
175	.1744	9.53
200	.1994	10.20

ROOF PANELS

LOADING

Live loads LL. = $\frac{1.8}{A} + .12$
for a panel 1.2m x 4.0m
LL. = $\frac{1.8}{1.2 \times 4.0} + .12 = 0.5$

Take LL for all panels as 0.50 kPa

Dead load for a 200mm panel = 3.2 lb/ft²
= 15.63 kg/m
= .153 kPa
Total roof design load = 0.653 kPa

Design panels for 0.66 kPa loads

Allowable stress in metal skins = 40 MPa
Maximum allowable load in each skin
per metre = $1000 \times .6 \times 40$
= 24 kN
B.M. in panels = $\frac{0.66 \times L^2}{8}$ kNm
Force in metal skins = $\frac{.0825 L^2}{d}$
= $\frac{24.00}{.0825}$
ie $L^2 = \frac{24.00 \times d}{.0825} = 291 d$
L = $\sqrt{291 d}$

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PANEL	d m	max. L m
50	.0494	3.8
75	.0744	4.65
100	.0994	5.37
125	.1244	6.02
150	.1494	6.59
175	.1744	7.12
200	.1994	7.62

SUMMARY

MAXIMUM SPANS FOR STYRENE PANELS WITH 0.6mm STEEL SKINS

Wall panels have been designed for 44m/s wind velocities in a category 3 terrain. (Well wooded areas and suburbs, towns and industrial areas)

In areas of open and exposed terrain the spans will need to be reduced.

PANEL THICKNESS	MAX. SPAN metres	
	WALL PANELS	ROOF AND CEILING PANELS
50	5.0	3.8
75	6.2	4.6
100	7.2	5.3
125	8.0	6.0
150	8.8	6.5
175	9.5	7.1
200	10.2	7.6

J.B. Hall M.I.E.Aust
for KNEEBONE & BERETTA PTY. LTD.
Chartered Engineers.

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STRUCTURAL INSULATING STYRENE PANELS WITH 0.60mm STEEL SKINS

TERRAIN CATEGORY 2

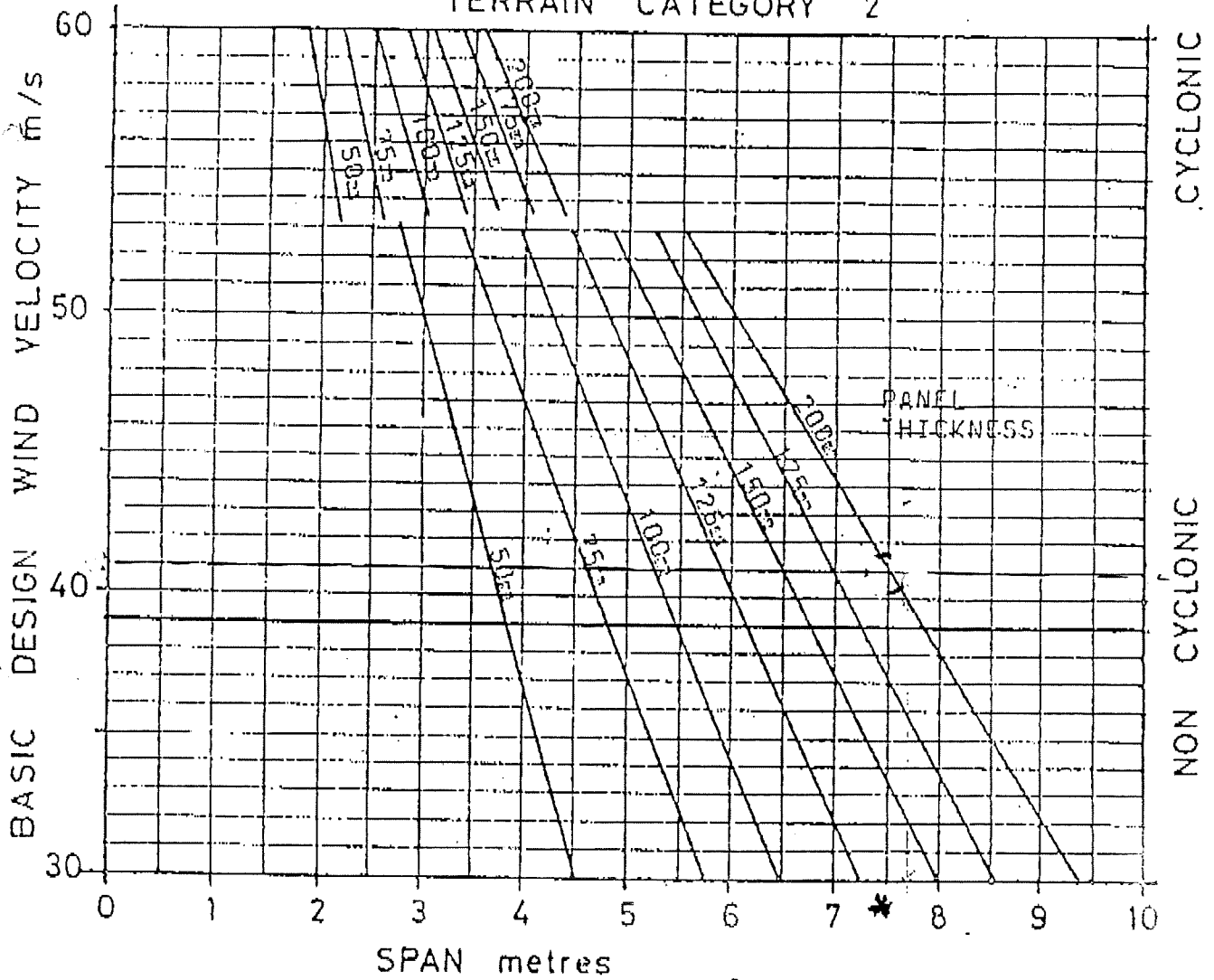


CHART FOR WALL PANELS

Max. deflection = $\frac{\text{span}}{250}$

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STRUCTURAL INSULATING STYRENE PANELS WITH 0.60mm STEEL SKINS

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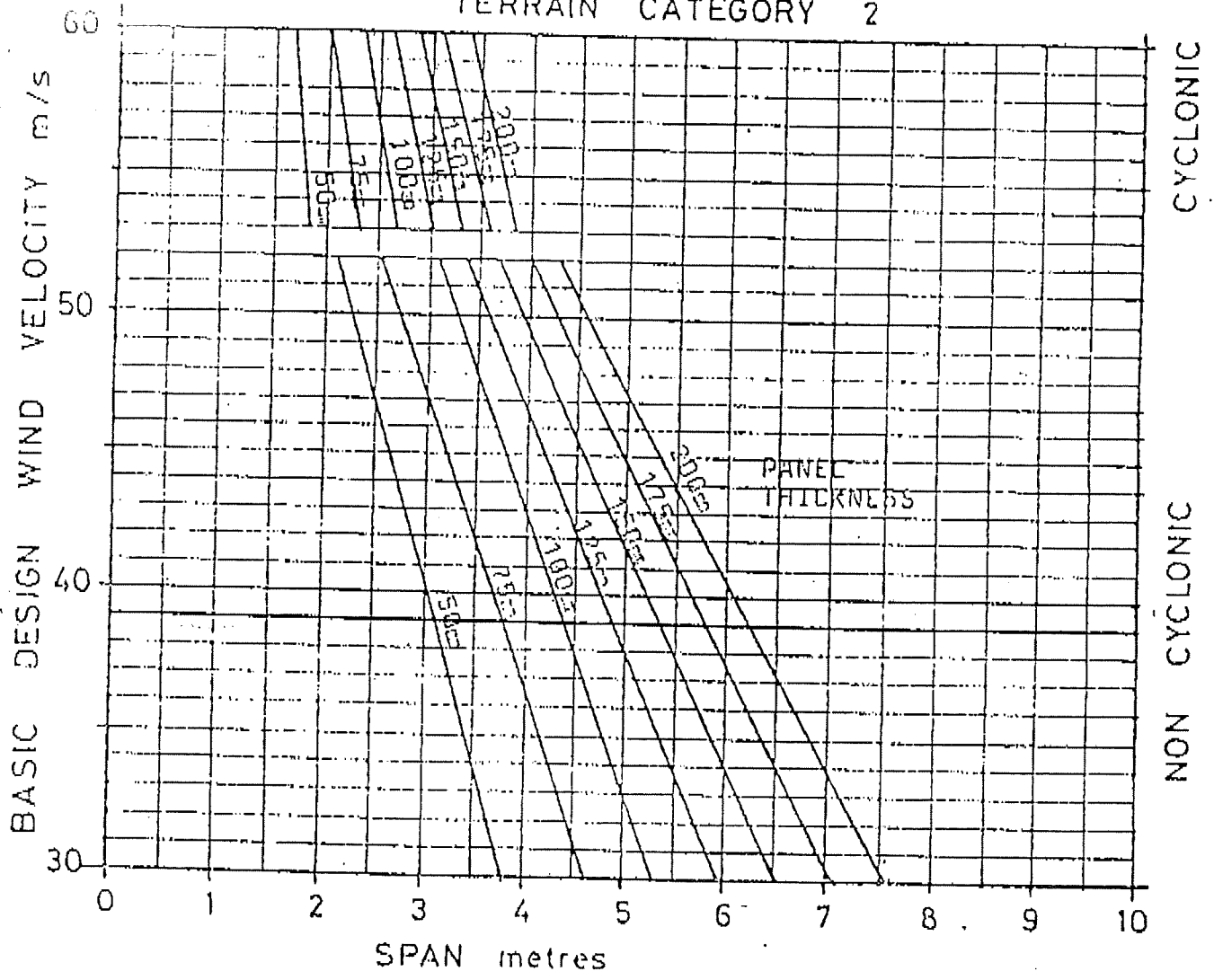


CHART FOR ROOF PANELS

Max. deflection = $\frac{\text{span}}{250}$

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150mm thick

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	75mm thick			
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Stress in skins		=		$\frac{4.45 \times 10^3}{2 \times 150 \times}$
(assuming full load taken by steel)		=		24.7 MPa
(ii) Max. desired load	= 300 lb	=		3.56 kN
Stress in skins		=		$\frac{3.56 \times 10^3}{2 \times 150 \times}$
		=		19.8 MPa

Adopt max. design stress in panels as columns to be 20 MPa
 for $\frac{h}{t} = 50$

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$$\begin{aligned} \text{ie } L &= \frac{521 d}{\sqrt{521 d}} \quad d \text{ in metres} \end{aligned}$$

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