

### PREFACE

Shelter is a basic need of the human being; every shelter needs a roof & wall cladding for protection. The approach applies to both residential as well as industrial structures.

MANAKSIA proffers an ideal means of providing 'cover' to all kinds of structures via Aluminium\* profiled building sheet that is far better than most of the conventional materials deployed for roof & cladding. Aluminium profiled building sheet fulfills most of the requirements of roof & wall cladding- both short as well as long term.

MANAKSIA produces Aluminium profiled building sheet using state-of- the-art roll former in mill finish as also in a range of RAL-compliant colours via its ultra modern pre-painting line.

Aluminium Alloy	Equivalent BIS Designation : IS 737	Ultimate Tensile Strength Guaranteed, kgf/mm <sup>2</sup>	Young's Modulus kgf/mm <sup>2</sup>
AA 8011 in Full Hard Temper	40800	17.5-19.5	7040

\*The term denotes aluminium alloy unless specifically qualified as pure.

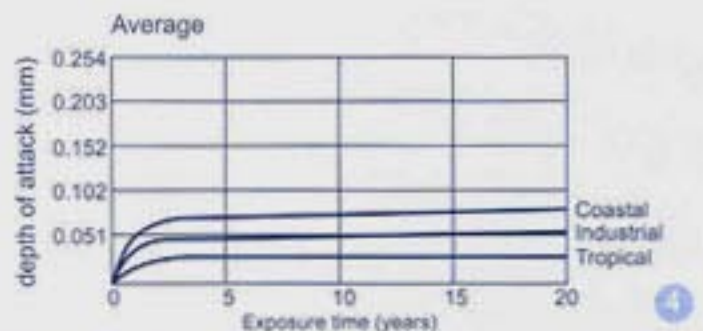
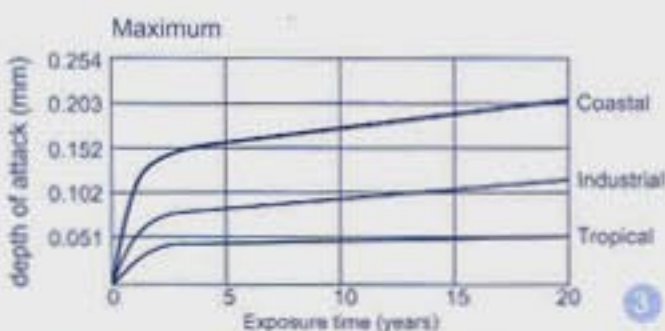
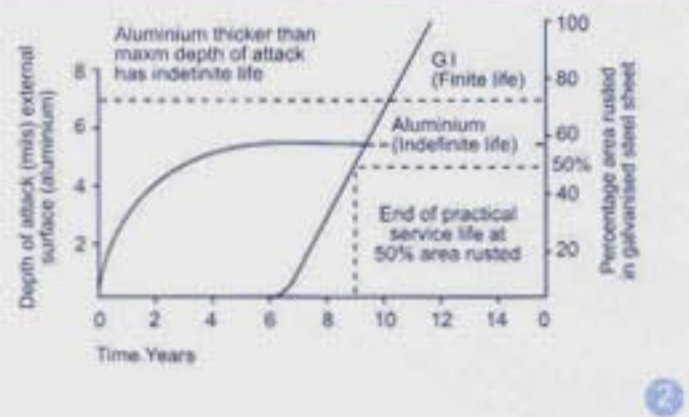
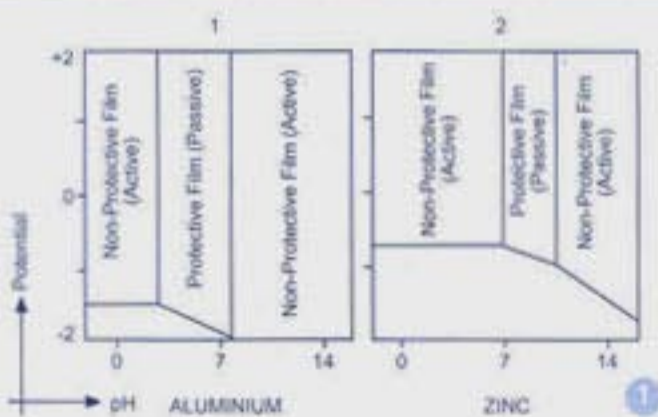
### PROFILE

Two basic profiles are offered by MANAKSIA-Trapezoidal (Industrial) and Circular (round/sinusoidal) The Former, having more load-bearing capacity, is universally used for industrial structures whereas the latter finds applications mostly in the residential dwellings.

### PROPERTIES

**Weight :** Having a density of 2.70gms/cm<sup>3</sup>, **lightness** is one of the most outstanding features of aluminium as a building material. At one-third the weight of galvanized steel corrugated sheet of the same section and about one-seventh that of standard asbestos corrugated roofing, MANAKSIA profiled building sheet reduces the size of the supporting structures, saves time in transportation and installation, imparts negligible damage to the in-mates in case of an accident e.g. collapse of roof due to natural calamity.

**Corrosion Resistance :** This unique property of aluminium lends itself to finding applications for this metal in corrosive environments in preference to galvanized steel. Aluminium acquires its high corrosive resistant property through ready formation of a thin (about 1micro-mm), transparent, and extremely hard film of inert aluminium oxide on its surface. The Pour Baix diagram (sketch-1) below reveals that aluminium oxide is passive (i.e. protective) between pH4 and pH8.5 while the corresponding range for zinc is pH7 to pH11. One practical consequence of this is that marine and industrial atmospheres affect zinc more than aluminium.



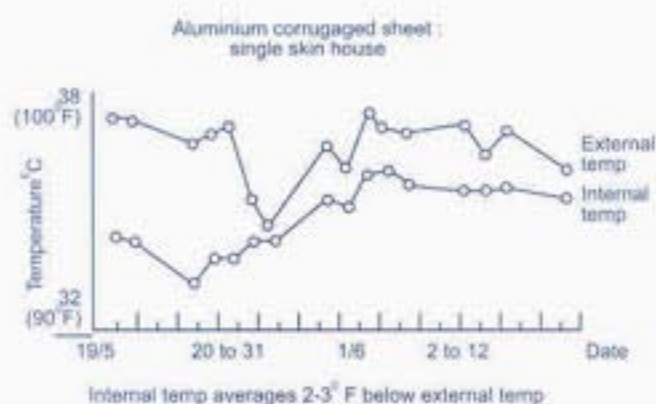
**Lightning** : Metal covered and metal framed buildings offer the safest possible guard during an electrical storm. Correctly earthed aluminium, because of its high electrical conductivity, offers excellent protection from lightning damage. For avoiding bi-metallic corrosion, it is always recommended that aluminium – not copper – lightning conductor system should be used on or next to an aluminium roof.

**Substructure Economy** : Light weight of aluminium in most cases leads to lighter structure. Purlin spacing can be increased when compared to asbestos reducing the number of purlins.

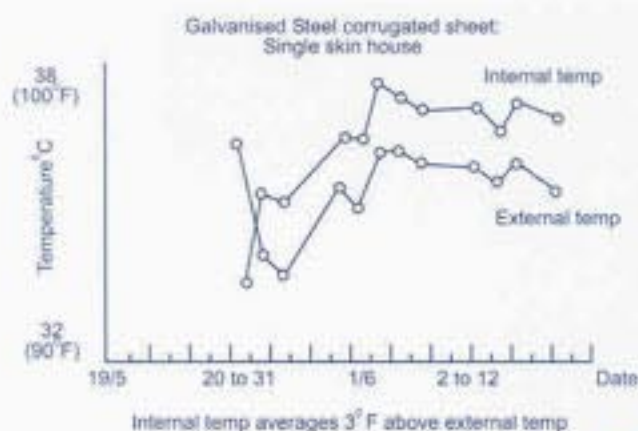
**Wind**: MANAKSIA Aluminium profiled building sheet is designed to withstand wind forces specified in IS 875.

**Thermal Movement** : Aluminium has a relatively high coefficient of linear expansion, 0.000024 per degree centigrade. Corrugations or troughs readily accommodate lateral expansion of building sheet. Lengthwise, expansion and contraction need to be allowed for by providing oversize holes for fixing along side large sealing washers. A variation in temperature of 38.7°C causes the length of an aluminium building sheet to change by about 0.12 mm per metre.

**Thermal Insulation** : Aluminium reflects a high proportion of the radiant heat falling on it and, it is largely by radiation through air spaces that heat loss in building occurs, aluminium cladding is an excellent insulator. Aluminium has low thermal emissivity and transmits little heat through the cladding skin.



5



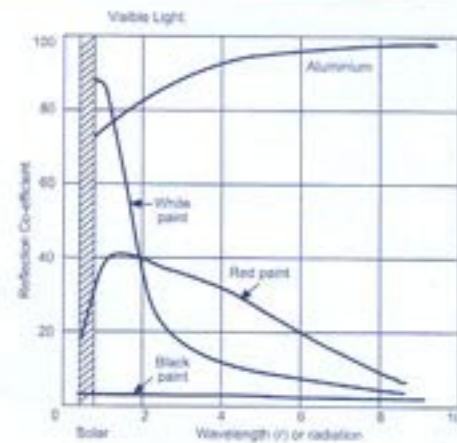
6

Average emissivities, absorptivities and reflectivities for some Surfaces common to building

Surface	Emissivity or absorptivity		Reflectivity	
	Low temperature radiation	Solar radiation	Solar radiation	Solar radiation
Aluminium bright	0.05	0.20	0.80	
Asbestos cement new	0.95	0.60	0.40	
Asbestos cement aged	0.95	0.75	0.25	
Asphalt pavement	0.95	0.90	0.10	
Brass and Copper, dull	0.20	0.60	0.40	
Brass and Copper, polished	0.02	0.30	0.70	
Brick, light buff	0.90	0.60	0.40	
Brick, red rough	0.90	0.70	0.30	
Cement, white polished	0.90	0.40	0.60	
Concrete, uncoloured	0.90	0.65	0.35	
Glass	0.90	--	--	
Marble, white	0.95	0.45	0.56	
Paint, aluminium	0.55	0.50	0.50	
Paint, white	0.90	0.30	0.70	
Paint, brown, red, green	0.90	0.70	0.30	
Paint, black	0.90	0.90	0.10	
Paper, white	0.90	0.30	0.70	
Slate, dark	0.90	0.90	0.10	
Steel, galvanized, new	0.25	0.55	0.45	
Steel, galvanized, weathered	0.25	0.75	0.30	
Tiles, red clay	0.90	0.70	0.30	

From Van Straaten 'Thermal Performance of Building'

Building Element	"U" Value
Aluminium	6.10
Galvanized Steel	6.25
Asbestos	7.90



**Condensation:** In most industrial buildings the relative humidity of the inside air is not high enough for condensation to be an issue. Condensation can arise from cooling, by radiation on a cool clear night, of metal roofs. The Building Research Station – in Digest 132 – refers to a recorded temperature drop of  $-12.2^{\circ}\text{C}$  between surrounding air and roof metal. It is experienced that good ventilation is an effective remedy, especially as on a cold clear night the atmosphere tends to be dry and condensation light and readily evaporated. Provision of sufficient slope on the roof avoids condensation drips.

**Acoustic:** Provision of over-purlin air space or over-purlin lining significantly reduces sound from drumming of rain on the metal roof.

**Hygiene:** Aluminium roof & cladding are ideal for premises intended for the storage, handling, and preparation of food, cereal, medicine, due to its non-toxic and non-absorbent properties as also its easily cleaned surface. Aluminium is proof against vermin and insects.

**Cryogenic:** Low temperatures have the effect of improving the mechanical and elastic properties of aluminium. From  $0^{\circ}$  down to about  $-73^{\circ}\text{C}$ , the differences are, however, negligible; at  $-196^{\circ}\text{C}$  tensile and yield strengths average 30% and 20% respectively higher than at room temperature. At  $-268^{\circ}\text{C}$  these increase to the region of 50% and 35%. MANAKSIA Aluminium *profiled building sheet* is an excellent material for roof & cladding applications in extremes of cold.

**Friability:** MANAKSIA Aluminium *profiled building sheet* is non-fragile. There is no wastage through breakage or cracking in transit and during laying of sheet. This guarantees total safety to the worker working on the roof-top.

**Fire Resistance:** Aluminium is a non-combustible, non-flammable, and non-sparking material.

**Hail Resistance:** Aluminium *profiled building sheet* is shatter-proof and will not disintegrate when hit by hail stone. Aluminium has a high resistance to denting due to its elasticity (this property also leads to the metal's usage in automobile bumper and highway crash barrier).

**Durability:** MANAKSIA Aluminium *profiled building sheet* has an extraordinarily long service life without resorting to periodic maintenance.



**Resale Value:** Due to the fact that aluminium can be recycled for infinite number of times, roof & side cladding made of aluminium fetch high resale value even after prolonged usage. Aluminium *profiled building sheet* remains a high value "asset" to any corporate or, individual.

**Appearance:** Buildings covered with Aluminium *profiled building sheet* look outstanding in its simplest form, - mill finish. The architectural appeal can be enhanced further via the usage of **pre-painted** material.



## PRECAUTION

MANAKSIA Aluminium *profiled building sheet* follows conventional procedure of laying as is prevalent for galvanized corrugated steel and asbestos corrugated roof & cladding. However, for ensuring best value in terms of reliability of erection and maintenance-free durability certain points of details need to be noted while deploying aluminium roof & cladding.

While aluminium is compatible with many building materials, contact of the metal with some specific ones requires proper understanding.

**Iron & Steel:** In clear rural and urban atmospheres painting the steel at contact areas with a bituminous or, red oxide/zinc chromate will suffice. Near the coast and in industrial atmospheres a three-coat painting consisting of two coats of red oxide/zinc chromate primer and one coat of aluminium paint is recommended. In aggressive industrial or marine environment chromate-impregnated tape or, roofing felt should be used.

**Lead:** Aluminium will not be affected by contact with lead except in most aggressive marine atmosphere. In such cases, both faying surfaces should be treated with a bituminous paint.

**Zinc:** Aluminium remains unaffected by contact with zinc. In aggressive environment zinc itself can suffer preferential attack.

**Copper & Copper Alloys:** Contact between copper and aluminium must be avoided or, aluminium will rapidly corrode. Care must also be taken to ensure that water running off copper should not fall on to aluminium.

**Non-Metallic Materials:** Absorbent non-metallic materials in contact with aluminium may lead to the corrosion of the latter due to 'poultice' effect, particularly if acids, alkalis, or salt can be leached from the former. With PORTLAND CEMENT, a bituminous coating on the aluminium *profiled building sheet* is desirable. Newly mixed CONCRETE and MORTAR cause a limited attack which ceases when the material is set. Except in continuously or, repeatedly wet conditions no attack occurs with mature concrete. PLASTER is generally less aggressive than Portland cement. Contact with corrosive and wet soil with aluminium should be avoided by using bituminous coating. Similarly, damp WOOD/TIMBER should be coated with aluminium paint when in contact with aluminium.

## PRODUCT SUPPORT

Installation of Aluminium *profiled building sheet* requires, like other conventional roof & cladding, certain essential supporting accessories.

**Fastener:** Seam bolts, hook bolts, angle bolts, etc should preferably be made of suitable aluminium alloys (AA 6063 is common). Aluminium washer with bitumen felt washer is recommended. Hot-dip galvanized steel fasteners too can be used. Stainless steel hardware is another material recommended except in strongly saline atmosphere.

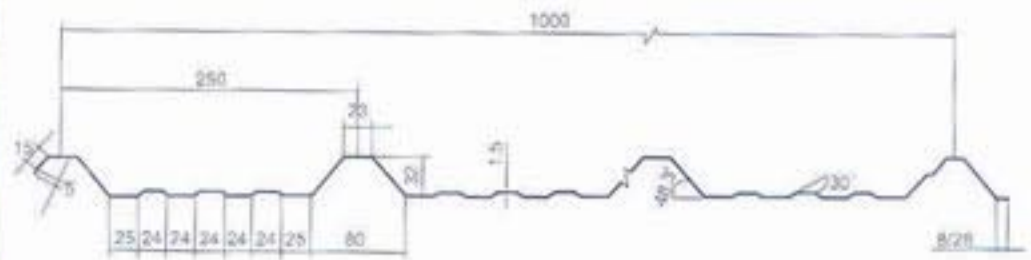
**Supporting Items:** Gutter (alloy AA 8011, three-quarter hard), Ridge Cap (alloy AA 8011, half-hard), North Light Curve (alloy AA 8011, half-hard), Flashing (alloy AA 8011, half-hard) are some of the most widely used items required with roof & cladding.

# Trapezoidal (Industrial) Building Sheet

## PRODUCT A

Trapezoidal (Industrial) profiled building sheet provides most ideal roof & cladding for

- All kinds of industrial sheds and warehouses
- Aircraft hangers, conveyor gantry housing
- Pre-fabricated shelters, bunk houses, tents, kiosks, exhibition pavilions
- Ship/steamer awning, boiler and fuel storage tank insulation covers
- Wall panels for high rise buildings, partition walls, false ceilings for large halls



Thickness	TYPE	Overall width
1.22 mm(18 SWG)	Industrial-5	1090mm (1000mm effective)
0.91 mm(20 SWG)		
0.71 mm(22 SWG)		
0.56 mm(24 SWG)		

## Weight & Structural Data

Thickness (mm)	Basic Weight kg/m <sup>2</sup>	kg/mtr	Moment of Inertia-I (mm <sup>4</sup> )	Section Modulus-Z (mm <sup>3</sup> )
1.22	4.29	3.95	47519	2820
0.91	3.20	2.94	39439	2615
0.71	2.50	2.30	28122	1752
0.56	1.87	1.81	19828	101

## Permissible Loading

Purlin Spacing	Thickness (mm)							
	Single Span				Multi Span			
	1.22	0.91	0.71	0.56	1.22	0.91	0.71	0.56
1524mm	302	256	210	156	483	300	237	200
1676mm	291	227	171	119	372	268	198	139
1829mm	244	189	138	87	302	227	156	109
1981mm	202	166	101	62	268	186	129	88
2134mm	187	120	82	-	211	135	96	59
2286mm	150	98	-	-	173	102	65	-
2438mm	122	73	-	-	149	79	-	-
2591mm	99	49	-	-	101	51	-	-
2743mm	76	22	-	-	83	32	-	-

NOTE: Walking should preferably be restricted on to or nearest to the purlins

## Number Of Sheets Per Tonne (Approx.)

Thickness (mm)	Length (metre)				
	1.83	2.13	2.44	2.74	3.05
Industrial-5					
1.22	138	118	103	92	83
0.91	185	159	139	123	111
0.71	238	204	178	158	142
0.56	301	258	226	201	181

## Maximum Loading for Trapezoidal Building Sheets (kg/m<sup>2</sup>)

Figures are based on an allowable stress corresponding to a factor of safety of approx 2 on 0.2% Proof Stress and a limiting deflection of SPAN/70

# Circular Corrugated Building Sheet

## PRODUCT B

Circular (Sinusoidal) profiled building sheet is mostly chosen for deployment as roof & cladding of:

- Rural houses
- Domestic Cladding
- Part replacement of damaged galvanized corrugated steel/asbestos corrugated sheet
- Industrial structures of any special design



Thickness	Type	Overall width
1.22mm (18SWG)	Ten pitches or 10/75mm	813±10mm
0.91mm (20SWG)		
0.71mm (22SWG)		
0.56mm (24SWG)		
0.46mm (26SWG)		
0.38mm (28 SWG)		

## Weight & Structural Data

Thickness (mm)	Basic Weight kg/m <sup>2</sup>	kg/mtr	Moment of Inertia-I (mm <sup>4</sup> )	Section Modulus-Z (mm <sup>3</sup> )
1.22	3.70	3.01	29288	3083
0.91	2.76	2.25	21846	2299
0.71	2.16	1.75	17045	1794
0.56	1.70	1.38	13444	1415
0.46	1.40	1.14	11043	1162
0.38	1.15	0.94	9123	960

## Permissible Loading

Purlin Spacing	Alloy	Thickness (mm)				
		1.22	0.91	0.71	0.56	0.46
914mm	3S&98S	562	430	337	264	220
1067mm	3S&98S	415	312	244	195	161
1219mm	3S&98S	318	239	190	147	122
1372mm	3S&98S	239	180	137	108	88
1524mm	3S&98S	176	132	103	78	63
1676mm	3S&98S	132	98	78	59	49
1829mm)	3S&98S	103	73	59	44	39

NOTE: Walking should preferably on or nearer to the purlins

## Number of Sheets per Tonne (Approx)

Thickness (mm)	Length (metre)									
	1.83	2.13	2.44	2.74	3.05	3.35	3.66	3.96	3.72	4.57
10/75 mm sheets										
1.22	181	155	136	121	108	99	90	83	77	72
0.91	243	208	182	162	146	132	121	112	104	97
0.71	312	267	234	208	187	170	156			
0.56	395	339	296	263	237					
0.46	481	412	361	321	289					
0.38	583	499	437	388	349					