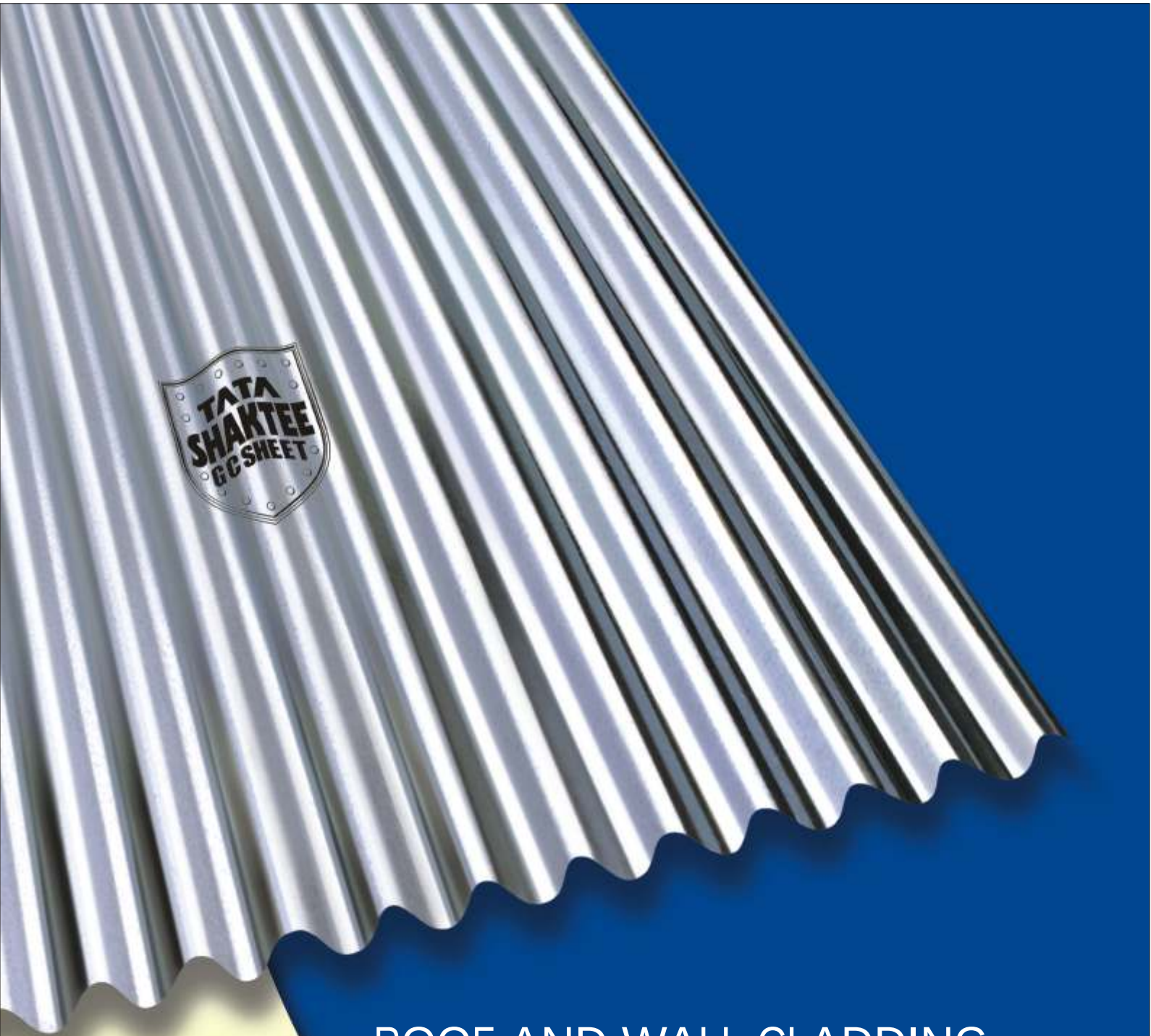
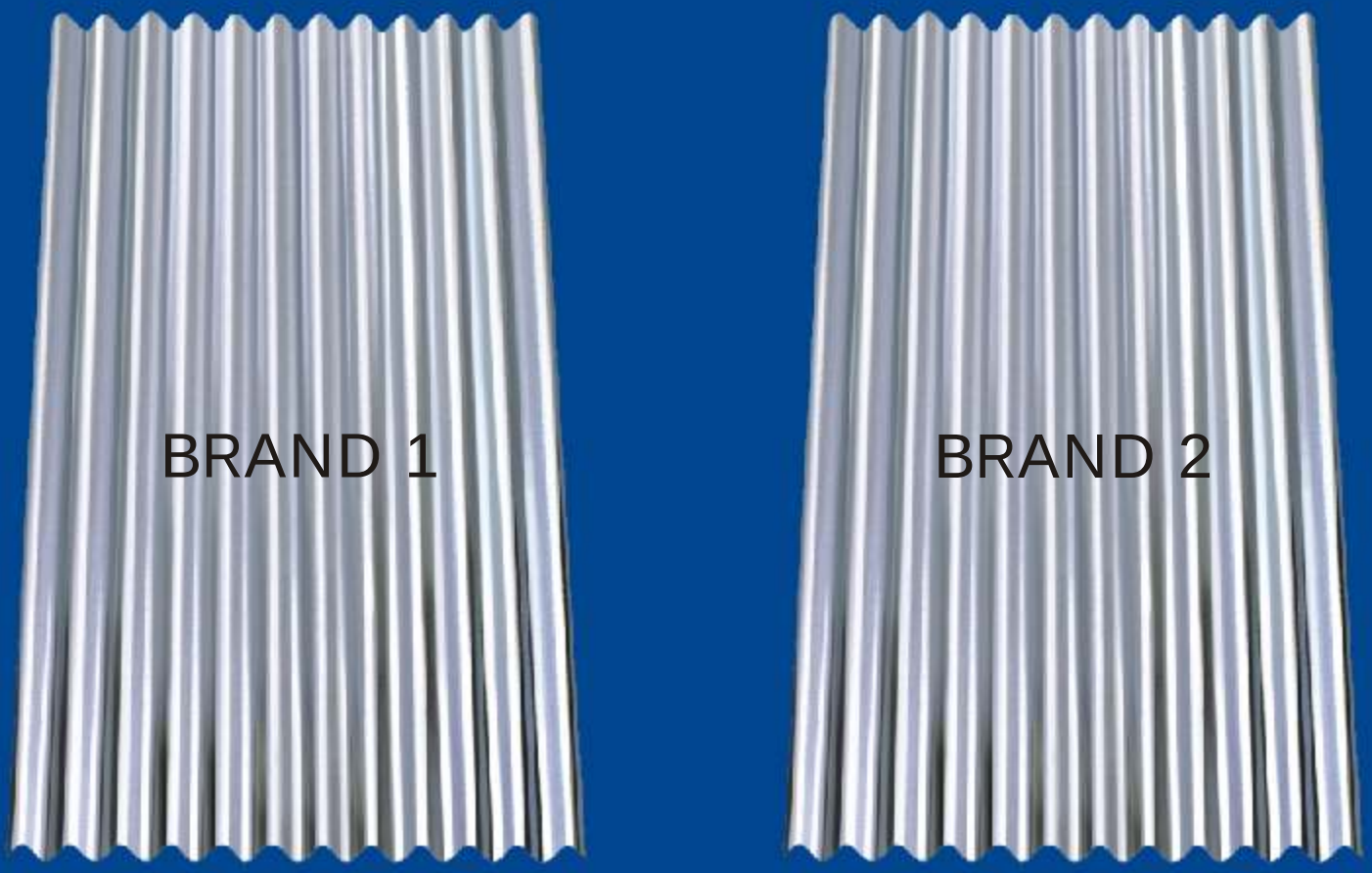


ROOF AND WALL CLADDING

TATA
SHAKTEE
GC SHEET

LASTS LONGEST



All new Galvanised **Roofing Sheets** look alike...

Right Hardness for Roofing

Optimum Chromating

Excellent Zinc Adherence

Accurate Dimension

Printed Thickness and Zinc Coating

Perfect Overlapping

Maximum Strength

Uniform Zinc Coating

Assured Thickness

Superior Packaging

Fixed and Transparent Pricing

Superior Distribution Network

...but only the best stand the test of time.

TATA Shaktee GC sheets truly last the longest. After all, they are brought to you from the house of TATA's. The sheets pass through stringent quality tests that ensure uniform Zinc coating, proper hardness for roofing, superior Zinc adherence, high tensile strength and accurate dimensions. All this and more add up to the quality valued by millions of consumers over decades.

TATA SHAKTEE GC SHEET

LASTS LONGEST

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FOR MORE DETAILS, PLEASE GET IN TOUCH WITH MARKETING & SALES

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Authorised Distributor

LASTS LONGEST

CONTENTS

INTRODUCTION

Over the years, TATA Steel has altered the landscape of the roofing industry in India. The company has been a pioneer in the field of manufacturing superior quality TATA Shaktee Galvanised Corrugated (GC) sheets. Manufactured with world-class technological expertise, these GC sheets are stronger and longer lasting than any other ordinary GC sheets. TATA Shaktee GC Sheets are not only made of virgin steel processed at TATA Steel's state-of-the-art Cold Rolling Mill but also have uniform Zinc coating on them, which gives them the required strength in fighting the weather and to last longest.

Living up to the company's assurance of good quality and trustworthy products, these sheets are manufactured to exact parameters of thickness, length, width and Zinc coating as per the specified requirements. In addition to this, TATA Shaktee GC sheets are ISI certified under Bureau of Indian Standards (BIS).

All in all, TATA Shaktee GC sheets give more value for money and are the best choice for anyone looking for a product that will perform year after year.

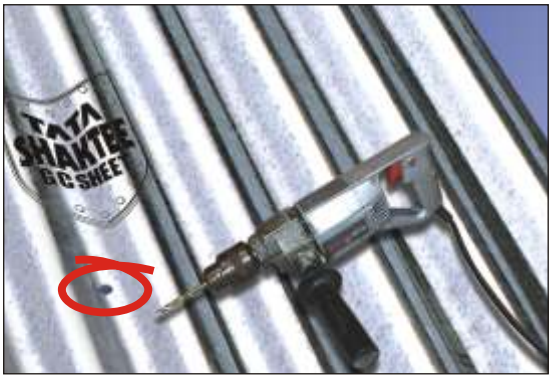
This manual has been created in order to make consumers aware of the best engineering practices involved in installation and maintenance of Galvanised Corrugated Steel sheets used in Roof and Wall Cladding applications. We have attempted to collate best practices recommended by various Indian and global standards alongwith those received from practising shed fabricators and architects.

Please feel free to send your suggestions/feedback for improvements on this manual, if any, to
Brand Manager - Tata Shaktee, Tata Centre, 43 Jawaharlal Nehru Road, Kolkata 700 071

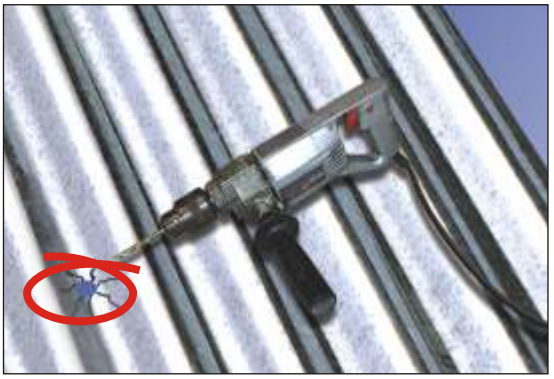
TATA SHAKTEE GC SHEET

ORDINARY GC SHEET

RIGHT HARDNESS FOR ROOFING



Accurate tempering in TATA Shaktee GC Sheets resist cracks and fissures during drilling.



Uneven tempering causes ordinary sheets to crack during drilling.

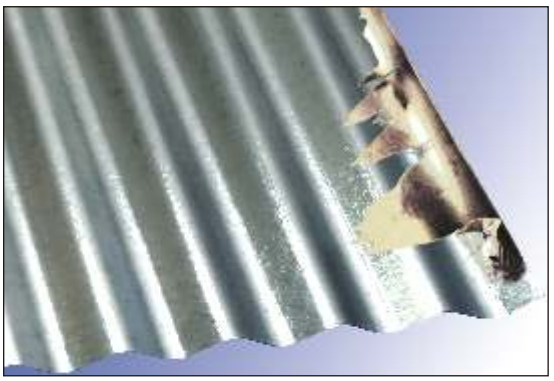
HIGH TENSILE STRENGTH

High tensile strength (approx 700 mpa) of TATA Shaktee GC Sheets resist natural forces like hailstorms and other external forces.

Low tensile strength of ordinary sheets results in damage/rupture caused by hailstorms and other external forces.

EXCELLENT ZINC ADHERENCE

Superior technology and process control ensures proper surface cleaning before coating. This means a cleaner steel surface that results in excellent Zinc adherence.



Inferior technology and process control results in unclean steel surface leading to low adherence of Zinc coating. This causes the galvanised surface to peel off resulting in reduced sheet life.

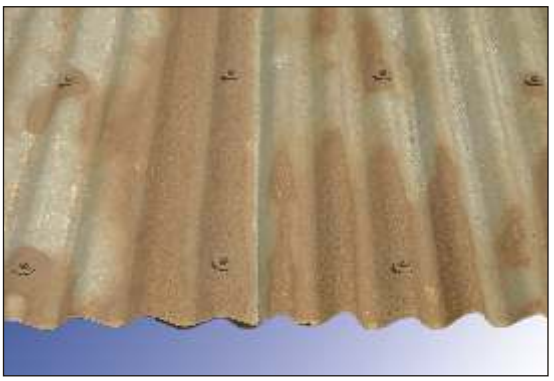
THE SHAKTEE EDGE

TATA SHAKTEE GC SHEET

ORDINARY GC SHEET

UNIFORM ZINC COATING

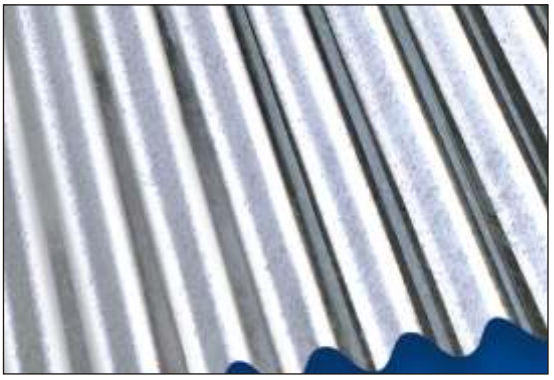
Uniform 120 gsm Zinc coating ensured by the sophisticated FEED FORWARD X-RAY COATING GAUGE results in even surface protection.



Non-uniform Zinc coating cause parts of galvanised surface with low Zinc coating to corrode faster. This reduces the sheet life drastically.

ASSURED THICKNESS AND ZINC COATING

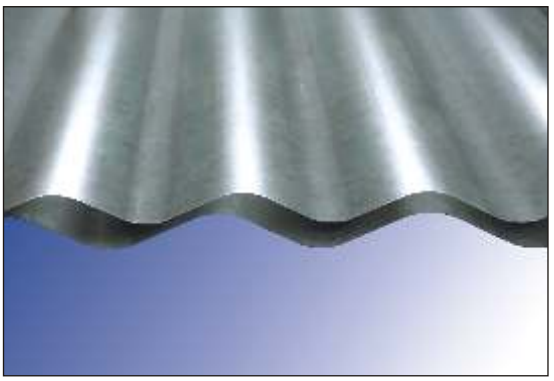
Each sheet has its thickness and Zinc coating printed on it to ensure that the customers get what they have paid for.



Thickness of the sheet and the Zinc coating applied to it is not mentioned and even if it is, it is generally incorrect. As a result, customers are often cheated during purchase.

PERFECT OVERLAPPING

Even corrugations ensure perfect overlapping which results in improved weather-proofing. Moreover, there is no unwanted retention of particles and moisture between the overlapped joints. This prevents corrosion originating from overlappings.



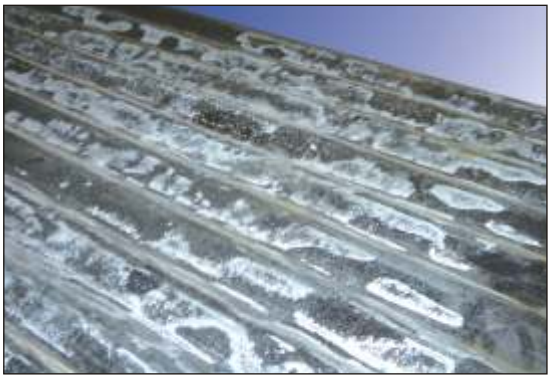
Uneven corrugations and edge waviness lead to gaps in overlapping, resulting in a badly fabricated roof. Unwanted particles and moisture stuck between the sheet overlappings results in corrosion starting from the joint.

TATA SHAKTEE GC SHEET

ORDINARY GC SHEET

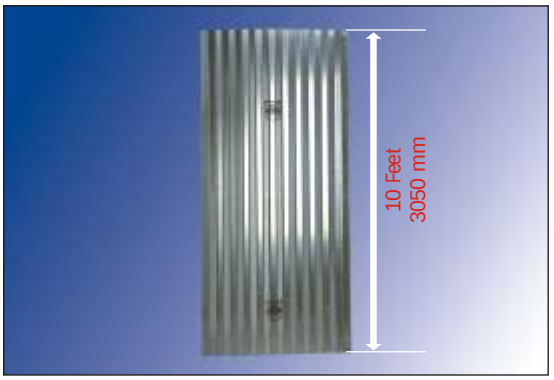
ADEQUATE CHROMATING

Usage of the best and adequate chromate solution at the galvanising stage prevents formation of white rust on the sheets. As a result, sheet life is enhanced.

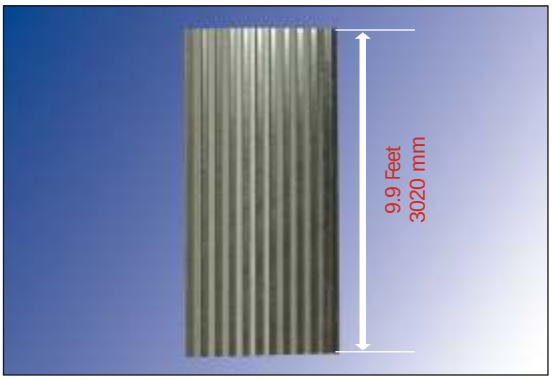


In case of ordinary GC sheets, inadequate chromating on the galvanised surface results in formation of white rust on the sheets that reduces sheet life.

ACCURATE DIMENSION



The length of the sheet is equal to the standard specified length, giving you true value for your money.



Ordinary sheets,quite often, are of lower length than the standard length specified. As a result you get lesser value for your money.

ASSURED THICKNESS

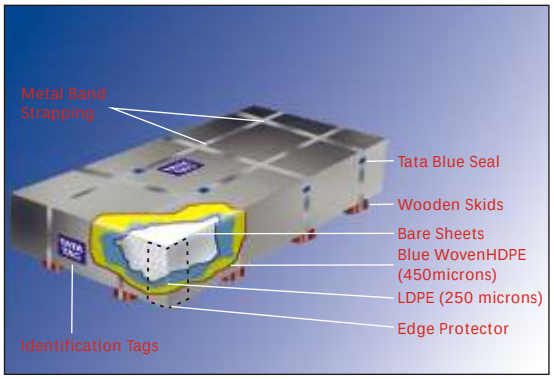
TATA Shaktee GC sheets come with assured thickness. The tolerance maintained is more stringent than the standards defined by Bureau of Indian Standards (BIS).

In ordinary GC sheets, the thickness is not printed and even if it is, the actual thickness is usually lower than the thickness claimed.

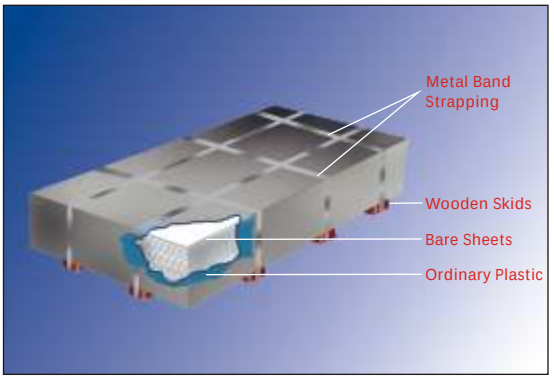
TATA SHAKTEE GC SHEET

ORDINARY GC SHEET

SUPERIOR PACKAGING

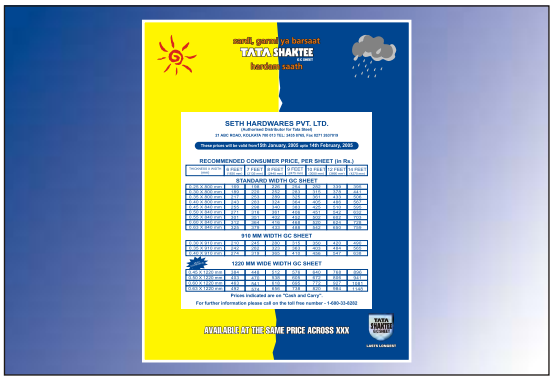


TATA Shaktee GC sheets are packaged with Blue Woven HDPE (450 microns) and LDPE (250 microns) plastics alongwith edge protectors, tamper proof seals and metal jackets on the top that protects sheet quality, especially during transit.

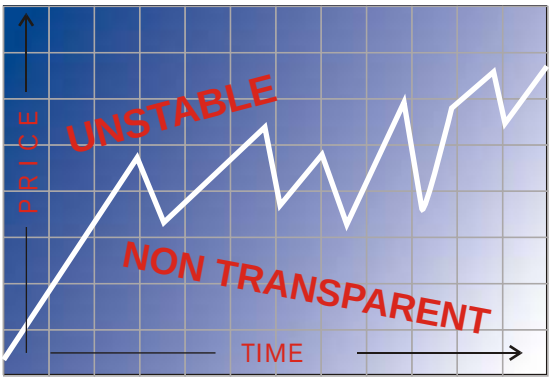


Ordinary sheets are packaged with poor quality plastics with a metal jacket on top that is susceptible to damage during transit.

STABLE AND TRANSPARENT PRICING



The Recommended Consumer Price of TATA Shaktee GC Sheets ensures the required transparency and stability in prices across the states.



Pricing of ordinary GC sheets is opportunistic and unfair, which means that prices are unstable and non-transparent, thereby subject to change even on a weekly basis.

SUPERIOR DISTRIBUTION NETWORK

A superior distribution network comprising 3500 dealers and 28 distributors spread across the country ensures excellent reach and regular supply of TATA Shaktee GC Sheets, as and when required.

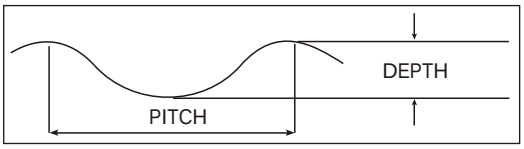
Nonexistence of authorised dealer network leads to irregular supply and even sales of substandard products.

PHYSICAL PROFILE

THICKNESS		LENGTH		WIDTH (mm)
(mm)	(gauge)	(mm)	(feet)	
0.30	30	1830	6	800
0.35	29	2140	7	840
0.40	28	2440	8	910
0.45	27	2745	9	1220
0.50	26	3050	10	
0.55	25	3660	12	
0.60	24	4270	14	
0.63	24	4880	16	
0.80	22			
1.00	20			
1.25	18			

Note: (1) Width of 1220 mm is available from 0.45 mm thickness onwards. (2) Thickness of 0.60 mm in gauge term is referred to as 24 "LOW".

DEPTH AND PITCH OF CORRUGATION



WIDTH OF GC SHEET AFTER CORRUGATION (mm)	DEPTH OF CORRUGATION (mm)	PITCH OF CORRUGATION (mm)	NO. OF CORRUGATIONS
800	17.5	75	10 + ½ + ½
840	12.5	78	10 + ½ + ½
910	17.5	75	11 + ½ + ½
1220	17.5	75	15 + ½ + ½

TOLERANCE LEVELS

PARAMETERS		BIS	TATA SHAKTEE
LENGTH		+15 mm, - 0	+15 mm, - 0
WIDTH	Before corrugation	+10 mm, - 0 mm	+10 mm, - 0 mm
	After corrugation	± 25 mm	±15 mm
THICKNESS		± .05 mm	± .03 mm
DIAGONAL DIFFERENCE		Should not differ more than 20 mm	Should not differ more than 20 mm
DEPTH OF CORRUGATION		±2.5 mm	± 2.5 mm
PITCH OF CORRUGATION		± 5 mm	± 5 mm

Note: TATA Shaktee tolerance levels are more stringent as compared to BIS specifications owing to superior process control.

COATING

TYPE OF COATING	Galvanised (Zinc) Spangled
COATING WEIGHT	120 gsm (gram per square metre), Class 8 (as per BIS) (For tailor made products Zinc coating, may vary between 60-600 gsm)

Note: BIS recommends thickness of 0.63mm with Zinc coating of minimum 275 gsm. (Refer to para 7.3, Note 1 on page 2 of IS277: 1992).

APPROXIMATE WEIGHT PER SQUARE METRE OF SHEET (for 120 gsm coating)

THICKNESS (mm)	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.63	0.80	1.00	1.25
APPROXIMATE WEIGHT (Kg) PER SQUARE METRE	2.25	2.65	3.00	3.40	3.80	4.20	4.55	4.80	6.10	7.45	9.25

APPROXIMATE WEIGHT PER SHEET (for 120 gsm coating)

SIZE (THICKNESS X WIDTH)	APPROXIMATE WEIGHT PER PIECE FOR VARIOUS LENGTHS OF SHEET (in Kg)							
(mm)	6ft (1830mm)	7ft (2135mm)	8ft (2440mm)	9ft (2740mm)	10ft (3050mm)	12ft (3660mm)	14ft (4270mm)	16ft (4880mm)
0.30 x 800	3.663	4.296	4.883	5.494	6.137	7.325	8.592	9.767
0.35 x 800	4.339	5.007	5.785	6.508	7.153	8.678	10.015	11.570
0.40 x 800	4.939	5.766	6.585	7.408	8.238	9.877	11.533	13.169
0.45 x 840	5.577	6.508	7.436	8.365	9.297	11.153	13.016	14.871
0.50 x 840	6.201	7.235	8.269	9.302	10.336	12.430	14.520	16.537
0.55 x 840	6.862	8.013	9.149	10.293	11.448	13.724	16.027	18.298
0.60 x 840	7.496	8.753	9.994	11.244	12.504	14.991	17.505	19.989
0.63 x 840	7.881	9.205	10.508	11.822	13.151	15.762	18.411	21.016
0.80 x 840	10.051	11.737	13.402	15.077	16.767	20.102	23.473	26.803
0.30 x 910	4.047	4.724	5.397	6.071	6.748	8.095	9.447	10.793
0.35 x 910	4.837	5.656	6.450	7.256	8.081	9.674	11.313	12.899
0.40 x 910	5.564	6.496	7.419	8.346	9.280	11.129	13.000	14.838
0.45 x 910	6.283	7.323	8.377	9.425	10.461	12.566	14.645	16.755
0.50 x 910	6.991	8.166	9.322	10.487	11.666	14.000	16.332	18.680
0.60 x 910	8.485	10.013	11.313	12.727	14.304	16.980	20.025	22.626
0.63 x 910	8.961	10.387	11.948	13.441	14.838	17.922	20.773	23.896
0.80 x 910	11.149	12.998	14.866	16.724	18.569	22.298	25.997	29.731
0.45 x 1220	8.378	9.767	11.170	12.566	13.952	16.755	19.533	22.340
0.50 x 1220	9.370	10.922	12.493	14.055	15.603	18.740	21.844	24.986
0.60 x 1220	11.289	13.191	15.052	16.934	18.844	22.579	26.381	30.105
0.63 x 1220	11.877	13.844	15.836	17.815	19.776	23.754	27.687	31.672
0.80 x 1220	15.473	17.092	20.631	23.210	24.417	30.946	34.184	41.262

Note: 1) BIS tolerance for the "Bundle Weight" (70/72 running feet of sheets) is ± 0.5%.
2) Length of 16 feet (4880 mm) is available only from 0.40 mm thickness onwards.
3) Weight per sheet for thickness 1.00 and 1.25 mm has not been indicated in the above table since these are not standard sizes. However, these sizes can be produced on demand.

WIND FORCES

Speed of wind creates considerable forces on both top and bottom sides of the Roof Cladding and hence one must consider wind speed and its resultant forces while designing and installing a roof. Whilst the forces acting inward through the topside of the roofing sheet tend to push the Roof Cladding downwards, the outward forces acting through the bottom side of the roofing sheet tend to lift the Roof Cladding from its frame. Outward forces could be generated by either negative wind pressures outside the building or positive wind pressure inside the building.

Outward forces acting on roofing sheets through bottom side are most common and these forces must be balanced by providing right spacing between the Purlins (Figure 1 on page 10) and by selection of right diameter, length and number of fasteners. In cyclonic areas, extra care must be taken in designing and installation of roofs by consulting architects or professional shed fabricators.

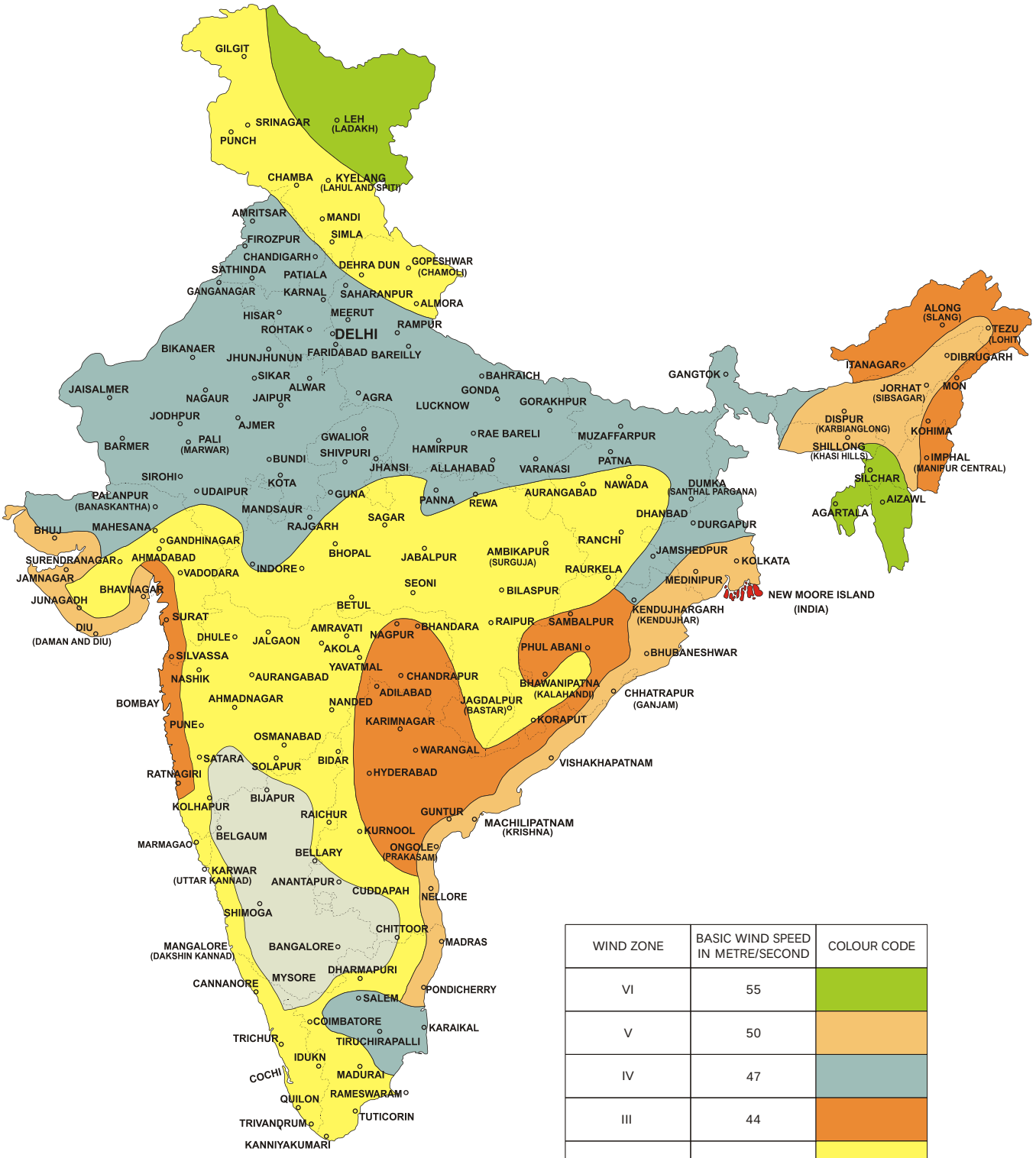
RECOMMENDED SPACING BETWEEN PURLINS FOR DIFFERENT WIND ZONES*

THICKNESS OF SHEETS (mm)	ROOF SLOPE	SPACINGS BETWEEN PURLINS (mm)					
		Wind Zone I	Wind Zone II	Wind Zone III	Wind Zone IV	Wind Zone V	Wind Zone VI
0.30	1 in 3	1090	1090	1090	1090	1090	1090
	1 in 4	1070	1070	1070	1070	1070	1070
0.35	1 in 3	1230	1230	1230	1230	1230	1160
	1 in 4	1220	1220	1220	1220	1220	1120
0.40	1 in 3	1320	1320	1320	1320	1290	1210
	1 in 4	1310	1310	1310	1310	1250	1170
0.45	1 in 3	1400	1400	1400	1400	1350	1260
	1 in 4	1380	1380	1380	1380	1300	1220
0.50	1 in 3	1480	1480	1480	1460	1200	1300
	1 in 4	1460	1460	1460	1410	1350	1270
0.55	1 in 3	1550	1550	1550	1500	1440	1350
	1 in 4	1530	1530	1530	1450	1400	1330
0.60	1 in 3	1620	1620	1620	1550	1480	1390
	1 in 4	1600	1600	1600	1500	1440	1350
0.63	1 in 3	1650	1650	1650	1580	1510	1420
	1 in 4	1640	1640	1600	1520	1460	1370
0.80	1 in 3	1860	1860	1800	1720	1650	1540
	1 in 4	1850	1850	1740	1660	1590	1490
1.00	1 in 3	2090	2090	1950	1860	1780	1660
	1 in 4	2000	2000	1880	1880	1720	1610
1.25	1 in 3	2230	2230	2120	2000	1930	1800
	1 in 4	2130	2130	2050	1950	1860	1740

* Calculations are based on basic principles of Structural Engineering in respect to Strength and Deflection.

WIND FORCES

WIND ZONES



WIND ZONE	BASIC WIND SPEED IN METRE/SECOND	COLOUR CODE
VI	55	
V	50	
IV	47	
III	44	
II	39	
I	33	

Source: United Nations Development Programme
Website: www.undp.org

While one of the most important roles of roofing is to fight the weather, they also have significant effects on the aesthetic, cost and durability of a building. In Roof Cladding, factors such as rainfall, wind speed, height of building and walking weight on roofs (arising out of maintenance) have considerable effect on design of roof slope, supporting structures and spacing between Purlins (Figure-1).

Design parameters for Wall Cladding is simple and straightforward compared to Roof Cladding. The main consideration in the design is spacing between the supports, known as "Side Girt" (equivalent of Purlins used in Roof Cladding). Wind speed and thickness of sheets play major role in arriving at the spacing between Side Girt.

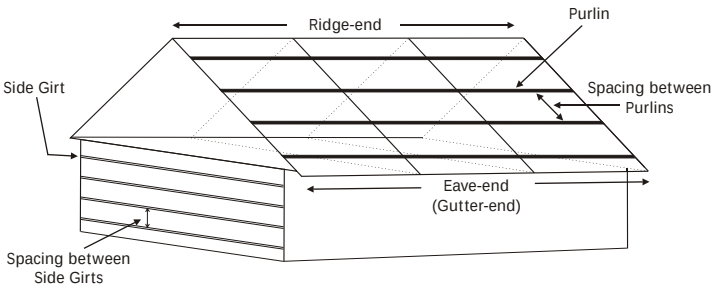
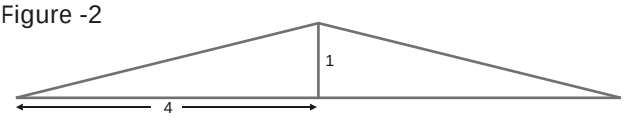


Figure -1

SLOPE

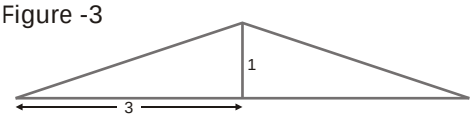
Slope is a major component of roof design. In absence of adequate roof slope, there is danger of water accumulation, which can lead to leakage and reduced sheet life. Most commonly used roof slopes in India are 1 in 4 (14º) and 1 in 3 (18º) (Figure 2 & 3). However, various other slopes can be used depending upon the intensity of rainfall and wind force. In case of sinusoidal profiles, it is recommended that one should not go below slope of 1 in 12 (5º). It is important to use sealants at the end lap of sheets in case roof slope is below 5º.

Figure -2



1 in 4 (14º)

Figure -3



1 in 3 (18º)

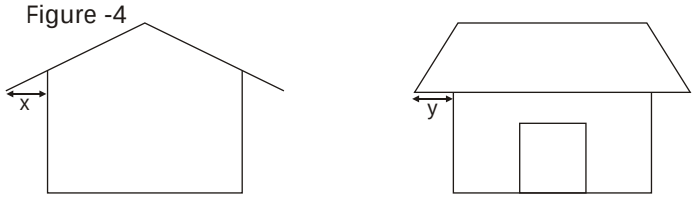
Note: Roof slopes with 1 in 3 and higher are prevalent in locations with high rainfall/snowfall

OVERHANG

Overhang in Roof Cladding is important from the angle of complete weather-proofing of the building. While "End Overhang" maintained at the "Eave End" (Gutter end) of the roof facilitates proper drainage of water without drenching the inside of building from its front, the "Side Overhang" makes sure the rain water does not enter the building from sides (Figure-4). Overhangs are recommended below as per good engineering practice.

END OVERHANG (x)	SIDE OVERHANG (y)
300 mm	100 mm

Figure -4



JOINTS ON THE SHEETS

Joints on the roofing sheets, also known as 'Laps', are critical in fabrication of leakageproof roofs. Joints on the side of the roofing sheet (along sheet length) is known as "Side Lap" (Figure-5) while joint at the end of the sheet (along sheet width) is known as "End Lap" (Figure-6). Slope of the roof plays a major role in deciding the area of laps.

SIDE LAP OF SHEETS

FOR ROOF CLADDING	FOR WALL CLADDING
1½ CORRUGATIONS	1 CORRUGATION

Note: In areas of heavy rainfall, the laps at sides should be suitably increased..

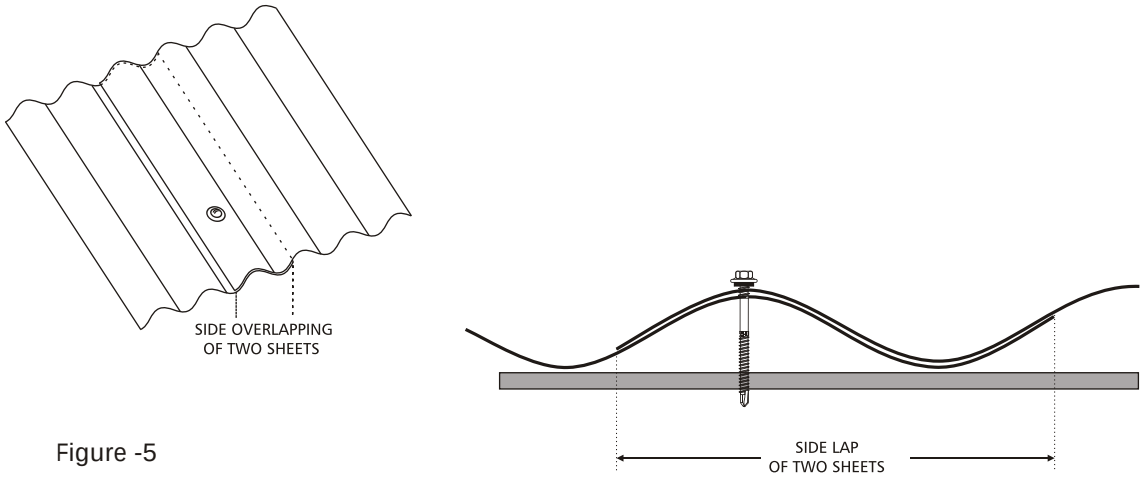


Figure -5

END LAP OF SHEETS

ROOF SLOPE	FOR ROOF CLADDING	FOR WALL CLADDING
1 in 3 (18º)	150 mm	100 mm
1 in 4 (14º)	200 mm	100 mm

Note: For roof slopes lesser than 14º recommended end lap is 200 mm

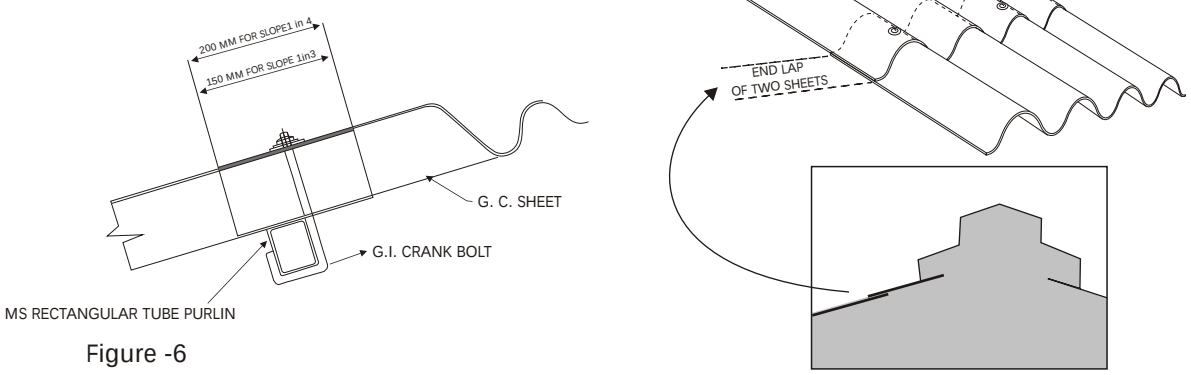


Figure -6

NUMBER OF SHEETS REQUIRED FOR VARIOUS LENGTH OF ROOFS

LENGTH OF ROOF		NO.OF SHEETS REQUIRED FOR DIFFERENT WIDTHS OF SHEETS			
(mm)	(feet)	800 mm	840 mm	910 mm	1220 mm
915	3	2	2	2	1
1525	5	3	3	2	2
3050	10	5	5	4	3
4575	15	7	7	6	5
6100	20	9	9	8	6
7625	25	12	11	10	7
9150	30	14	13	12	9
10675	35	16	15	14	10
12200	40	18	17	16	11
13725	45	20	19	18	13
15250	50	23	21	20	14
18300	60	27	26	23	17
21350	70	31	30	27	20
24400	80	36	34	31	22
27450	90	40	38	35	25
30500	100	45	42	39	28

CALCULATION OF NUMBER OF SHEETS REQUIRED FOR VARIOUS LENGTH AND WIDTH OF ROOFS:

L : Length of roof (in metre)
W : Width of roof (in metre)
L_S : Length of GC sheet used (in metre)
N_L : Number of sheets required for a given length and width of roof, (fig.7) will be = $N_L \times N_W$
N_W: Number of sheets required along the width of roof

Total number of sheets required will be $N_L \times N_W$ (for a given length and width of roof, dimensions explained in Figure-7)

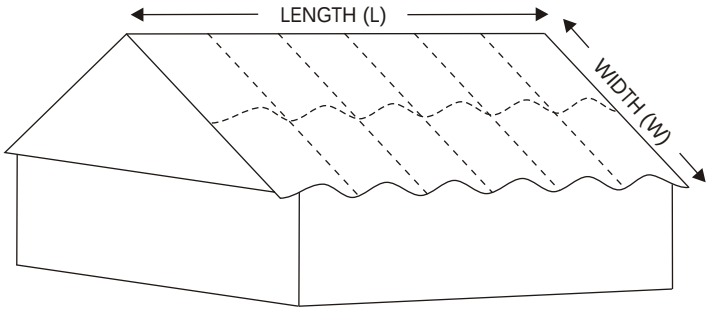


Figure -7

WIDTH OF SHEET	NO. OF SHEETS ALONG LENGTH OF ROOF	NO. OF SHEETS ALONG WIDTH OF ROOF
1220 mm	$N_L = (L + 0.0875) / 1.1075$	$N_W = (W + 0.4) / L_S - 0.2$
910 mm	$N_L = (L + 0.0875) / 0.7975$	
840 mm	$N_L = (L + 0.0875) / 0.7275$	
800 mm	$N_L = (L + 0.0875) / 0.6875$	

Note: (1.) End lap of 200 mm and Side lap of 112.5 mm considered to arrive at number of sheets across length of roof.
(2.) Overhang of 300 mm at eave-end and 100 mm at ridge-end considered to arrive at number of sheets across width of roof.

SAVINGS UNLIMITED

ADVANTAGES OF TATA SHAKTEE WIDER (1220 MM) GC SHEET

Lesser number of sheets required:
You will require lesser number of TATA Shaktee Wider GC Sheets as compared to other narrow widths of GC sheets available in the market in order to cover a given roof size.

Fewer joints required:
Lesser number of roofing sheets mean fewer overlaps which reduces wastage of steel at side overlappings. Less number of overlappings ensure substantial cost savings.

Fewer seepage points:
Lesser number of joints mean fewer holes need to be drilled to fix TATA Shaktee Wider GC Sheets, resulting in lower number of seepage points on the roof and enhanced sheet life.

Fewer accessories required:
Fewer holes in fixing TATA Shaktee Wider GC Sheets reduce requirement of fasteners and substantially resulting in cost savings.

Greater savings:
All the above benefits result in unlimited monetary savings.

SAVINGS FROM TATA SHAKTEE WIDER (1220 MM) GC SHEET

LENGTH OF ROOF		NO. OF SHEET REQD. FROM 840MM WIDE GC	NO. OF SHEET REQD. FROM 1220MM WIDE GC	NO.OF OVERLAPPING SAVED
(mm)	(feet)			
915	3	2	1	1
1525	5	3	2	1
3050	10	5	3	2
4575	15	7	5	2
6100	20	9	6	3
7625	25	11	7	4
9150	30	13	9	4
10675	35	15	10	5
12200	40	17	11	6
13725	45	19	13	6
15250	50	21	14	7
18300	60	26	17	9
21350	70	30	20	10
24400	80	34	22	12
27450	90	38	25	13
30500	100	42	28	14

ACCESSORIES

Usage of recommended accessories leads to enhanced life of Roofs and Walls. Poor and substandard quality of accessories may adversely affect the superior quality of cladding sheets leading to reduced life. Accessories and the cladding material should have similar life expectancies as that of the main structure and hence criteria for selecting the accessories such as Fasteners, Gutters and Flashings must be based on the design life of the structure.

FASTENERS

Researches executed on causes of steel building failures worldwide indicate that almost 80% of failures start from the fasteners. Since fasteners, used on cladding and structure together, constitute roughly 6-8% of the entire project cost, several builders have the tendency to neglect this vital aspect of their project.

Fasteners used on steel Roof and Wall Cladding must be of good quality and properly galvanized conforming to IS:730 standards. This will go a long way in providing a weather proof and long lasting roof. Different components of good quality fastener is depicted below in Figure-8.

There are various kind of hooks and screws available in the market depending upon the material and type of purlins on which sheets need to be fixed (Figure-9). G.I. Hook Bolt should be used for fixing sheets to angle Iron purlins. G.I. Crank Bolt should be used for fixing sheets to channels or rectangular/square tubes purlins. G.I. Coach screw (square head) should be used for fixing sheets to wooden purlins only.

TYPICAL FASTENERS FOR CLADDING

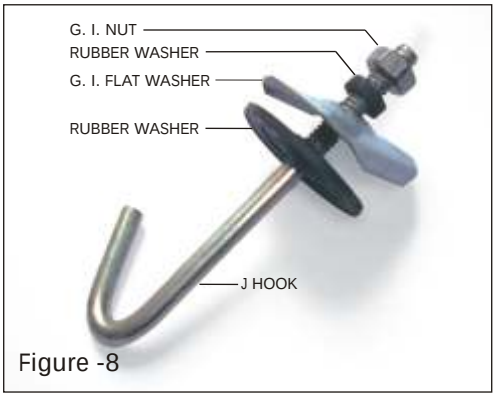


Figure -8

TYPES OF HOOKS/SCREWS

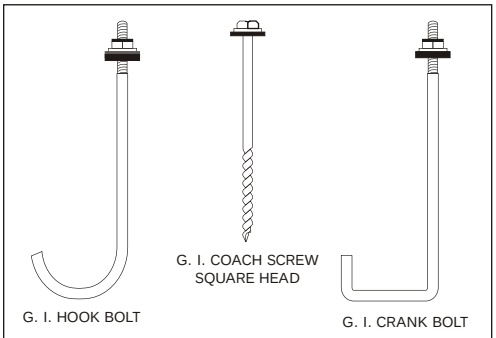


Figure -9

The rubber washer should be 25 mm in diameter and 3 mm thick with 6 mm bore to suit 8 mm diameter bolts. This bond between rubber washer and bolt ensures water proof sealing.

The G.I. flat washer is 25 mm in diameter (if it is a round washer) and 1.60 mm thick with central hole to suit 8 mm diameter fixing bolt or screw.

The sheets are fastened to purlins (in case of Roof Cladding) or side girts (in case of Wall Cladding) by minimum 8 mm diameter hook bolts at a maximum pitch of 375 mm.

ACCESSORIES

USAGE OF RUBBER WASHER

RUBBER WASHER	
NEW	AFTER FEW YEARS
	

Usage of rubber washer enhances sheet life. The rubber washer does not absorb water or moisture and thus prevents the sheet from rusting.

BITUMEN WASHER	
NEW	AFTER FEW YEARS
	

Usage of bitumen washer, commonly used with J hooks, retains water/moisture that leads to rusting that begin at the joints and spreads to the sheet reducing sheet life.

USAGE OF GALVANISED FASTENERS

GALVANISED J HOOK AND WASHER	
NEW	AFTER FEW YEARS
	

Usage of galvanised J hook, washer and nut enhances sheet life by preventing corrosion at the joints.

ALUMINIUM PAINTED J HOOK AND WASHER	
NEW	AFTER FEW YEARS
	

Usage of aluminium painted J hook, washer and nut that looks similar to galvanised accessories lead to rusting. This begins at the joints and spreads to the entire sheet, reducing sheet life.

LIFE COMPARISON OF FASTENERS USED WITH RUBBER AND BITUMEN WASHERS

FASTENER WITH RUBBER WASHER	
NEW	AFTER FEW YEARS
	

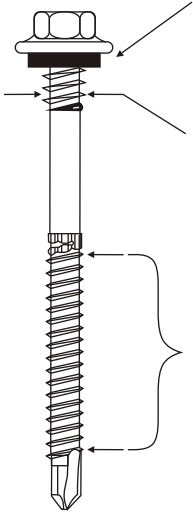
Usage of recommended fasteners enhance sheet life.

FASTENER WITH BITUMEN WASHER	
NEW	AFTER FEW YEARS
	

Usage of poor quality fasteners lead to rusting that begin at the joints and spreads to the sheet reducing sheet life.

SELF DRILLING SCREWS

Recent developments in the field of cladding fasteners have promoted usage of self-drilling screws designed to provide exceptional corrosion resistance and weather proofing. These screws confirm to international standards such as DIN, ASTM, AS and as the name implies, they are directly screwed through sheets onto the purlin with the help of a drill machine. Identification of these screws is depicted below.(Figure - 10)



EPDM WASHER (these washer are co-polymers, consisting of ethylene, propylene with proportion of diene and they offer extended life with best weather-proofing characteristics under extreme climatic condition)

SCREW GAUGE (gauge of a screw is determined by the basic of the thread outside diameter)

THREAD PITCH (thread pitch is the number of thread crests counted along a linear measurement of one inch)

IDENTIFICATION CODES of self-drilling screws is as follows:

12	-	14	X	25
Screw Gauge (Thread outside diameter)		Thread Pitch (threads per inch)		Overall length of the screw measured from under the head (mm)

Figure -10

FLASHINGS & RIDGES

Flashings are made from strips of galvanised metal in order to provide the essential weatherproofing at the edges of the cladding apart from making the finished job look neat. Flashings, depending upon their placement over the cladding, could be either longitudinal or transverse. Longitudinal Flashings run parallel to the valleys (Figure: 12) and are made to suit the profile of the sheets. During installation, one must turn down their edge towards the valley in order to achieve best weather protection. Transverse Flashings, also know as Ridges, run perpendicular to the valleys. In order to achieve maximum weather-proofing, the bent edge of the Ridge must sit onto the profile of the sheet (Figure: 13).

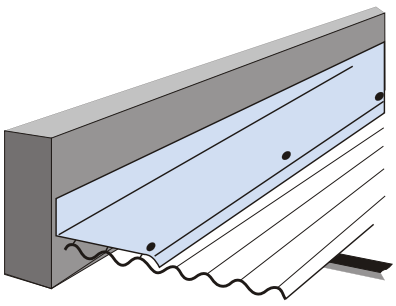


Figure -12

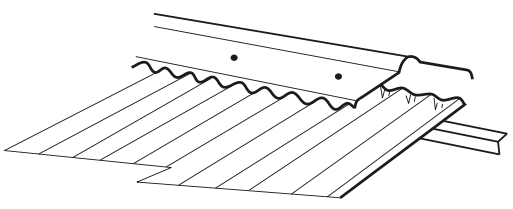


Figure -13

ROOF DRAINAGE & GUTTERS

Drainage of water from the roof is extremely important in order to achieve complete weather-proofing of the building. A well designed water collection system, through set of Gutters and Drain Pipes at eave-end, not only protect property and building but also helps in water harvesting.

Gutters (Figure-14), made out of galvanized metal strips, are installed with a generous slope to avoid water accumulation. To be on safer side, Gutters should have a slope steeper than 1 in 500.Typically, slope on house gutters is maintained at 1 in 250. Design of Gutters and Drain Pipes is based on rainfall intensities (mm/hour) for a given territory along with water receiving area of the roof. “Total Water Receiving area of Roof - TWRR” can be calculated from the plan of the structure. To allow for the slope of the roof, increase the plan area by 1% for every degree of increase in slope up to 40 degree. For a given rainfall intensity and cross sectional area of Gutter, “Total Water Receiving area of a single Drain Pipe (TWRD)” can be calculated from the graph below. The diameter of Drain Pipes considered in the graph is 100 mm. The required number of 100 mm diameter Drain Pipes can be arrived by dividing TWRR by TWRD. An example calculating the required numbers of Drain Pipes is indicated in Figure-15. An illustrative example of Drain Pipe arrangement along with high points of water drainage is indicated below (Figure-16).

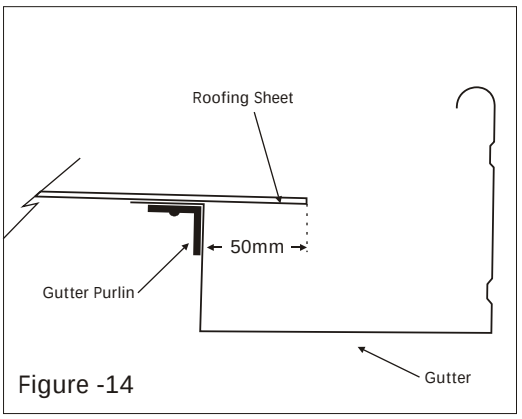


Figure -14

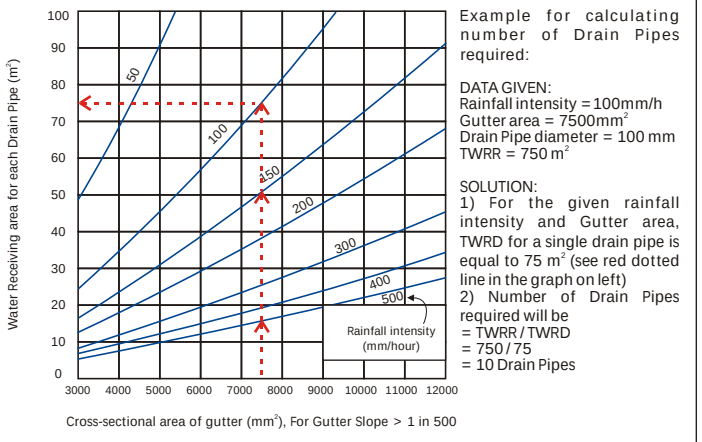


Figure -15

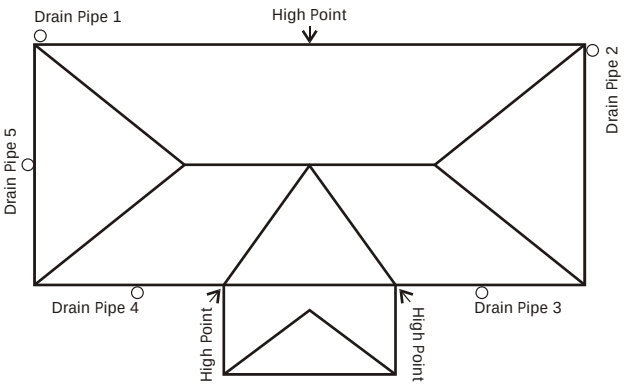


Figure -16

Source: National Plumbing and Drainage Standards, Australia
AS 3500.3.2:1998

GUIDELINES FOR INSTALLATION

FOR ROOFING

- Check flatness, slope and overhang of the frame on which the sheets are to be laid. Please remember that any correction in the frame required after laying the sheets will be difficult and at times impossible to rectify.
- Before lifting the sheets on to the roof, check if they are right side up.
- Place bundle of sheets over and near the firm supports and not at the mid-span of roof members.
- Sheets are normally laid from left to right commencing at Eaves, explained in figure-17 with sheets being numbered in order of fixing.
- The first sheet is laid at the Eaves, right angled (90 degrees) to the purlin with a side lap of one and a half corrugation.
- The minimum free overhang at Eaves must not exceed 300 mm. Care should be taken to ensure a minimum overhang of 100 mm at the side of the sheets. Ensure that the roofing sheets overhang minimum 50 mm into the Gutter at eave-end.
- It is generally considered good practice to use fasteners along side-laps of sheets.
- To be on safer side, do not fix fasteners less than 25 mm from the end of the sheets. Maximum pitch between two fasteners, across the width of the sheet, should be 375 mm.
- While laying the first sheet at left of eave-end, please ensure that it is correctly located in relation to other parts of the building such as end and/or side-wall.
- Check alignment of sheets at repeated intervals. It is important to keep the gutter-end and ridge-end of all sheets in a straight line. This can be achieved by keeping the sheets parallel with respect to the first sheet.
- One can either fix each sheet completely before laying the next or can fix the sheet sufficiently to ensure it can't move, complete laying all sheets at one row and then return to place all intermediate fasteners.

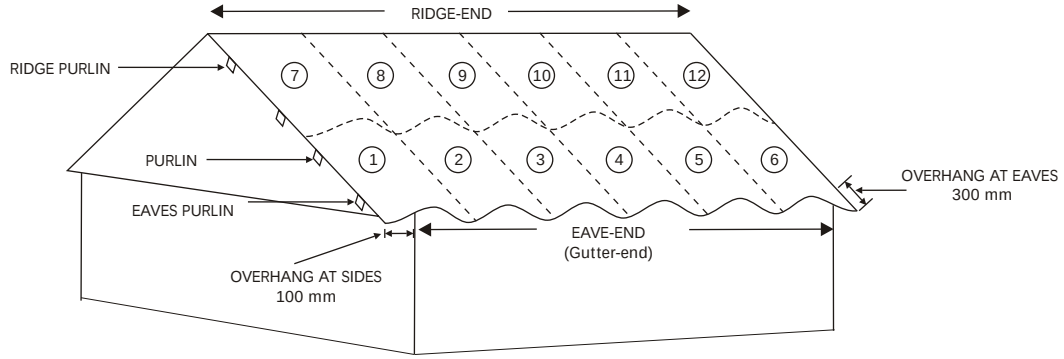


Figure -17

- In Roof Cladding, for maximum water-tightness, fastening screws through the crest of the sheets on to the purlin is highly recommended (Figure 5 , Page 11). Always drive screws perpendicular to the sheet and at the centre of the corrugation. Placing screws on valleys may be susceptible to leakage in Roof Cladding.
- The sheets on the next row are fixed similarly making an end lap (joint along the length of the sheet - Figure 6, Page 11) of minimum 150 mm.
- For Roof Cladding, allow a minimum end-lap of 200 mm for slopes of 5 to 14 degree, and 150 mm for slopes above 14 degree. For walls, allow minimum end lap of 100 mm.
- For slopes below 1 in 4 it is recommended to use sealant at the end lap with a minimum 3 mm bead of natural cure sillicon sealant along the centre line of the fastener hole.
- Where four sheets meet at their corners, the total thickness becomes very thick. This gives a hump at the corners. To provide neat fit to the sheets at this junction any two corners of the diagonally opposite sheets have to be cut (mitred). Mitring means cutting of corners of the sheets to the measurement of side lap and end lap of the sheets.

- Care should be taken to ensure that the sheets do not butt against each other. The gap between each mitred corner should be approximately 2 mm. (The two diagonally mitred corners being covered by the uncut corners of the covering sheets will provide for perfect sealing against weather). Mitring should be done by carpenter's saw and sheets should never be chipped.

- At the ridge end of roofing, wind can push water up under the ridge, into the building. In order to arrest this problem, valleys of the sheets are bent upward at the ridge-end of roofing (Figure-18). This process blocks the valleys at ridge-end thereby preventing water from entering the building through ridge-end. This process is highly useful in roofs with slopes below 1 in 2 (25°). In contrast, valleys at the eave-end of roofing sheet are bent down in order to achieve enhanced weatherproofness and smooth flow of water into the Gutters. Bending of sheets at valleys can be done with the help of multi-grip pliers or a sliding spanner.

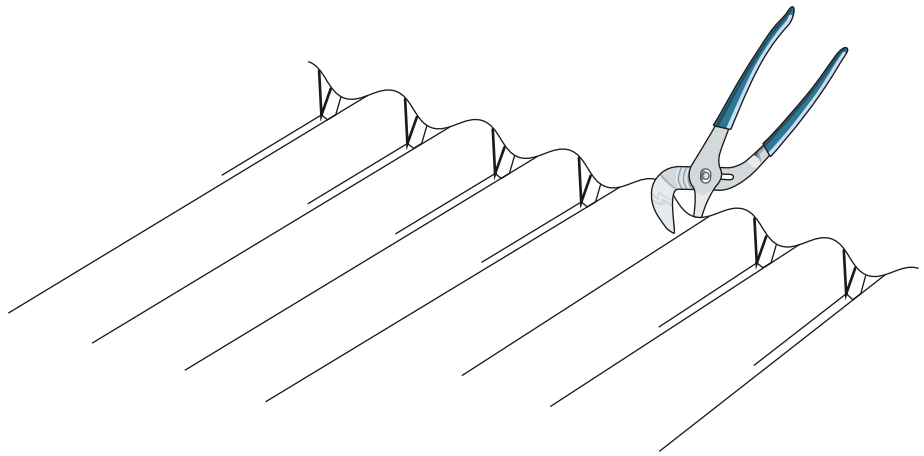


Figure -18

FOR WALL CLADDING

- In Wall Cladding fasteners are usually placed in the valley of the sheets since water penetration is not a problem in Wall Cladding. Fasteners at valleys are less noticeable and do not affect the aesthetic of the Steel Cladding. Also fasteners fixed on valleys of Wall Cladding minimize the risk of deformation of profile since the fastener rests flat against its support, i.e. Side Girt (Figure1, Page 10).

- However, when valley-fixed, the cladding needs a side-lap fastener in all laps, in order to hold the profiles of two sheets together (Figure19, Page 21).

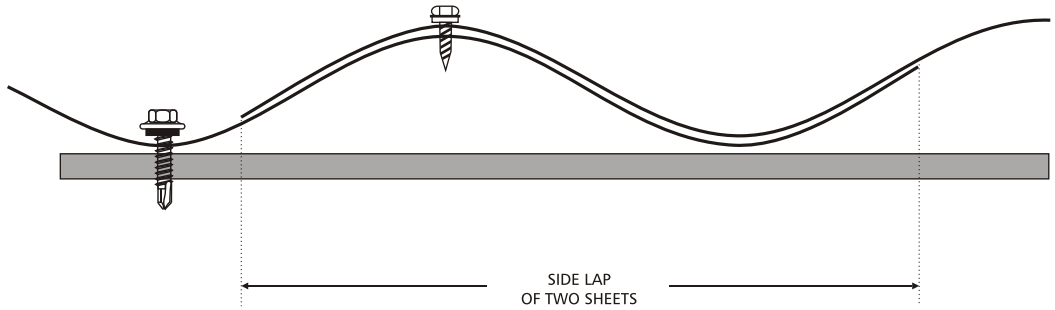


Figure -19

CONDENSATION & HEAT CONTROL

When the air in a building in contact with metal cladding is warmer than the cladding, moisture in the air can condense on the inside of cladding. Condensation can lead to deterioration of building components, staining of ceiling & walls and even deterioration of items stocked inside the stocking area. The amount of condensation depends upon the amount of moisture present in the air and this varies with climatic conditions. Activities within a building such as washing and drying of cloths, cooking, showering etc. may also add substantially to the amount of moisture in the air. In the event of extreme moisture content inside the building, it is essential to either keep cladding away from moist atmosphere inside the building or vent substantial amount of air moisture to the outside of the building.

To minimize the risk of condensation on the inner-side of cladding a vapour barrier is often used to prevent contact of warm moist air with roofing. Reflective foil laminates are commonly used for this purpose. Such foils are also simple, inexpensive and very effective method to control heat. Additional heat insulation is often achieved by using bulk insulation blankets, which is a combination of reflective foil laminates, glass wool and wire mesh laid down on the frame before installing the coated sheets.

GENERAL CARE AND MAINTENANCE

Handling: For personal safety it is recommended to wear clean dry gloves while handling the sheets. Sliding of sheets over rough surfaces or over each other results in scratches and uprooting Zinc from the sheet surface.

Storage: Due to capillary action, moisture easily enters between the surfaces of stacked sheets. In areas of high humidity, wind takes them between the sheets. The trapped moisture between the sheets cannot evaporate easily leading to deterioration of the surface coating, a phenomenon known as White Rusting. This leads to reduced life of sheets and poor appearance. In areas of high humidity levels, it is advisable to have exhaust fans to reduce humidity level inside the sheet storage point.

If the sheets are not required for immediate use, it should be stacked neatly and clear of the ground at covered space. It is advisable to protect them with waterproof covers.

If stacked sheets become wet, separate it without delay, wipe it with a clean cloth or saw dust and stack it under sun till it dries thoroughly.

Keep the stacked sheets as far as possible away from the non-compatible material as indicated in Table-1.

Marking, cutting and drilling during installation: Avoid usage of black pencils, i.e. lead pencils, to mark a galvanised surface as the graphite content can create an electric cell when wet and this may cause deterioration of the finish of surface. One can use coloured pencils or a fine felt-tipped marker.

For cutting thin metal sheets on site, it is recommended to use a hand or electric saw with a metal-cutting blade since it produces lesser damaging metal particles and burr on the sheets.

Holes on the sheets should be made by drilling. Use of punch in making holes should be avoided as it may not produce a clean cut hole and may even damage the profile of the sheet.

GENERAL CARE AND MAINTENANCE

Maintenance: Besides roof design and the environment, maintenance also plays an important role on the life of a roof or wall. Maintenance includes the following:

- Preferably, washing should be done at least every six months and more frequently in coastal areas where moisture in atmosphere contains high level of salt.Washing of roof is also recommended in areas of high industrialization, which have higher content of oxides of sulphur, nitrogen and chloride salts along with humidity in the air.
- Regular inspection of roofs and walls for problems before they become major corrosion sites.
- Removal of foreign particles such as leaves and debris from gutters and flashings.
- Keep Wall Claddings free of soil, concrete and debris near the ground.

Contact with incompatible material: To enhance life of galvanized steel sheets, it is important to note its compatibility with other commonly used material in construction. Contact with some non-compatible material and even water or moisture flowing from such material can adversely affect the life of the sheets.

TABLE- 1: LIST OF NON-COMPATIBLE MATERIALS

- Limestone (commonly used in colouring the cement walls)
- Pesticides
- Wet and dry concrete
- Soils
- Lead
- Copper
- Uncoated steel
- Carbon (in pencils and some rubbers)
- Chemically treated wood or plywood
- Materials having excessive moisture content
  (Non-seasoned timber, bitumen sheets and washers)

Note: The list mentioned above is not exhaustive. In case of doubts on compatibility of other products being used with roofing sheets but not mentioned above, kindly seek advice from the manufacturer of Galvanised roofing sheets.

TATA SHAKTEE EDGE- AT A GLANCE

Sl. No.	GC SHEET ATTRIBUTES	TATA SHAKTEE GC SHEET	ORDINARY GC SHEET
1	Hardness in Roofing Sheets	Accurate tempering resists cracks and fissures.	Uneven tempering causes cracks during installation.
2	Tensile Strength	High tensile strength resists external forces.	Low tensile strength results in damage and dents.
3	Zinc Adherence	Superior technology and process control leads to cleaner steel surface that enhances sheet life.	Inferior and outdated technology results in unclean steel surface leading to Zinc peel-off and reduced sheet life.
4	Zinc Coating Technology	Uniform 120 gsm Zinc coating through 'Feed Forward X-Ray Coating Gauge' ensures even surface protection.	Non-uniform Zinc coating causes parts of GC sheet to corrode faster.
5	Zinc Mass	Correctly printed thickness and Zinc coating on sheet assures true value for money.	Low Zinc coating, not verifiable through naked eye while buying new GC sheet, results in lower sheet life.
6	Overlapping	Even corrugations ensure perfect overlapping that results in a neat roof structure.	Uneven corrugations lead to gaps in overlapping that ensures a badly fabricated roof and poor weather proofing.
7	Physical Dimension	Length of sheet equal or more than standard specified length.	Length of sheet lower than standard specified length.
8	Chromating	Usage of the best and adequate chromate solution prevents formation of white rust.	Inadequate chromate solution results in formation of white rust.
9	Thickness	Thickness of the sheet is equal to or more than the standard specified thickness printed on the sheet.	The thickness printed is very often incorrect and lower to the standard specified thickness.
10	Packaging	Packaged with Blue Woven HDPE (450 microns) and LDPE (250 microns) plastic and shielded by the edge protector that preserves sheet quality.	Ordinary sheets are packaged in a poor quality plastic that results in damage to sheets.
11	Pricing	The Recommended Consumer Price (RCP)ensures that prices are uniform and transparent across the state.	Pricing of ordinary GC sheets is oppurtunistic and unfair, which means that prices are unstable and prone to opportunism
12	Distribution Network	A network comprising 3500 dealers and 28 distributors ensures excellent and regular supply.	A poor distribution network in absence of distribution guidelines results in irregular supply of GC sheets.

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