

CURVING OF CORRUGATED STEEL SHEETING

TECHNICAL BULLETIN TB-6

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INTRODUCTION

Corrugated steel roofing has been in continuous demand for well over a century in Australia.

The same profile is also used in curved form to provide the traditional bullnosed verandah cladding and walls of rainwater tanks.

The curving process is not a difficult task for the experienced tankmaker who follows the basics of feeding the sheets squarely into the curving rolls and making sufficient passes rather than forcing the process.

While most tankmakers do not report problems in performing this task there are nevertheless others who do find recurring difficulties.

This bulletin sets out to list the common problems, to explain the cause and suggest the remedies.

A common comment from those having problems is that the steel is "too hard" or at least "different" from the steel of yester - year.

However, others do not experience curving difficulties despite the fact that the steel strip used to produce the corrugated sheets has come from the same source. Steel hardness or otherwise has little to do with the problem.

For trouble free production of curved corrugated steel sheet the basics consist of:

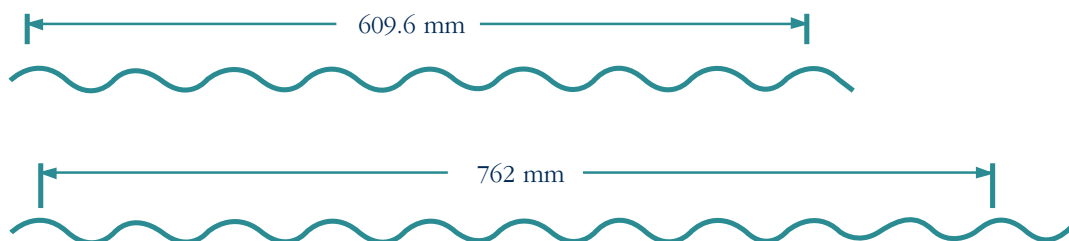
- the correct material for corrugating
- appropriate curving rolls

MATERIAL

This is specified in terms of steel sheet type and corrugated profile (number of corrugations). Corrugated steel sheet suitable for curving is available as follows:

	Thickness, mm		SCPD Sheet type	No. of corrugations
	Base	TCT		
1. Roofing	0.60	0.66	ZINCALUME [®] AZ 150 G300	8, 10.5
	0.80	0.86	ZINCALUME [®] AZ 150 G300	8, 10.5
	0.60	0.69	ZINCFORM [®] G300 Z600	8, 10.5
	0.80	0.89	ZINCFORM [®] G300 Z600	10.5
	0.60	0.65	COLORBOND [®] ZINCALUME G300 AZ 150	10.5
2. Tanks	0.60	0.64	AQUAPLATE [®]	8, 10.5
	0.80	0.84	AQUAPLATE [®] (subject to enquiry)	

KEY DIMENSIONS OF CORRUGATED SHEETS



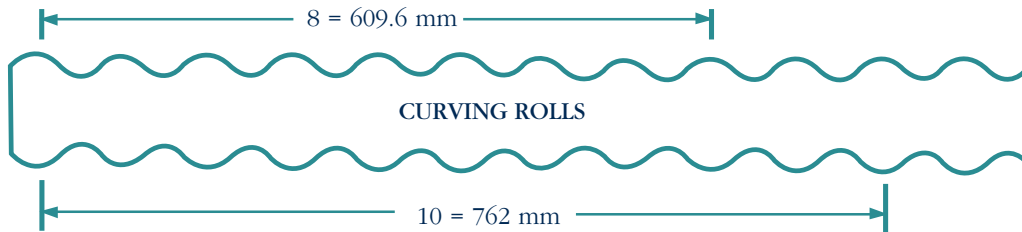
Note:

1. Orders for this purpose must be specific. Either the correct product name or the notation "for curving" should be used.
PROFILE: 8 or 10.5 corrugations X 76.2 mm pitch X 17 mm deep.
2. The commonly specified dimension of 76 mm is a rounded off figure and should actually be 76.2 (3"). Lengths are custom cut to order or as stocked by the distributor. Width tolerance is:
8 X 76.2 ± 2 mm = 610 ± 2 mm, 10.5 X 76.2 ± 2 mm = 762 ± 2 mm
3. The appropriate Australian standard is AS1445 'Hot-dipped Zinc Coated or Aluminium/zinc Coated Steel Sheet - 76 mm Pitch Corrugated.'

THE CURVING ROLLS

Curving rolls to suit 8 or up to 10.5 corrugations are available as either horizontal or vertical machines.

These machines have rollers which have been contoured to match the theoretical profile dimensions of the corrugated sheets.



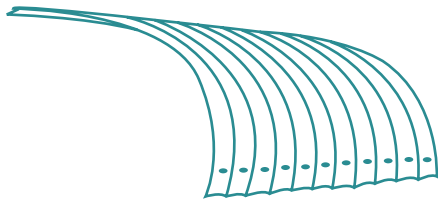
Recent experience indicates that the depth of the flutes of the curving rolls should be slightly deeper than the profile of the sheet.

The pitch of these machines goes back to the days of imperial measurement and with the exception of a very small number of metric machines, measures 609.6 mm for 8 corrugations and 762 mm for 10 corrugations being based on a pitch of 3 inches or 76.2 mm.

The machinery, being of fixed pitch, will accommodate those corrugated profiles which match within a small tolerance and curve them smoothly provided the width of the corrugated sheets is within specification.

PROBLEMS AND REMEDIES

1. Problem. A crease or break occurs across the sheet about 100 mm from the leading edge as fed to the curving rolls.



The crease occurs where the pressure roll exerts its force between the two bottom rolls.

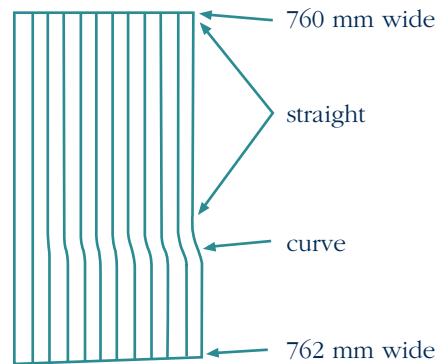
Cause. Harsh setting of the pressure rolls prior to feeding the sheet is the most likely cause.

A further reason could be that many curving rolls have a wide space between the lower rolls (200 mm). Those with 150 mm have fewer problems.

However, it has been observed that the creasing is reduced if the sheet pitch/width match the rolls.

Remedy. The most effective practice involves sizing the sheet ends prior to applying the bending force and then exerting the pressure while the sheet is on the move rather than stationary.

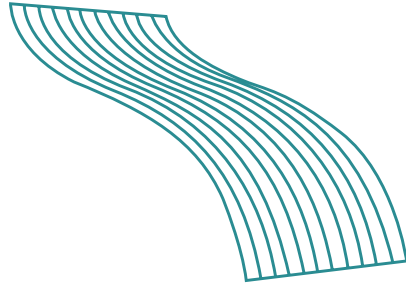
2. Problem. The curved end is wider than the straight section of the sheet and the corrugations are out of line. The problem is very bad when opposed forming occurs, such as for an OGEE shape.



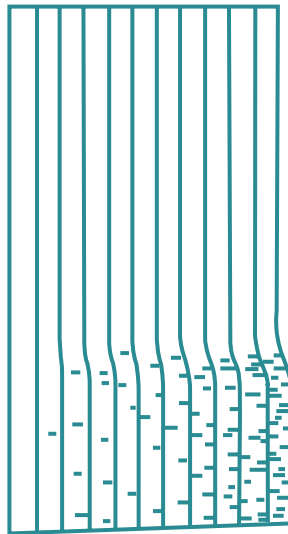
Cause. Although the theoretical width dimension may claim 762 ± 2 mm, the actual dimensions of the sheet may be as low as 753 mm. Unless the total length has been passed through the curving rolls to "size" the profile to achieve a match with the rolls, the curved end will naturally follow the roll dimension of 762 mm while the straight section will be unaltered. This results in one lap edge being out of line and causes difficulties when the neighbouring sheet with the same problem has its "in line" lap edge mated to the "out of line" edge of the previous sheet.

OGEE forming requires that sheet be formed at both ends and this forms a twist in the corrugation line.

Remedy. (i) The corrugated sheets must be within 3 to 4 mm of correct total pitch width or (ii) the total sheet length must be "sized" by repeated passes through the rolls. If the total sum of the pitches is too narrow it may not be possible to "resize" due to distortion.



- 3. Problem.** Valley ripples across the curved sheet. There may be no rippling on one side at all but as each succeeding valley corrugation is inspected, the rippling will become progressively worse. This problem is usually associated with those covered in (2).



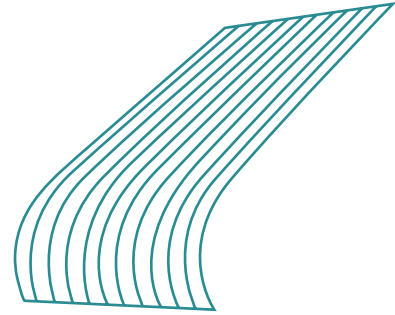
Cause. As for (2)

Further to this, a deeper corrugation can occur when the sheet is rolled narrow. This removes the valley from contact with the rolls.

Remedy. (a) As for (2). (b) As the common practice of taping of rolls for COLORBOND® steel can inhibit the natural tendency for the corrugations to conform to the contour of the rolls, tape may have to be removed for non-painted sheet.

- 4. Problem.** Wavy or rippled edges on the compression side. The lap which has the sheet edge curved toward the inside of the radius is referred to as the compression edge.

The edge often has a series of waves at regular intervals around the curve. The scalloped effect looks very untidy under unlined verandahs.



Cause. Excess width of side lap on the compression edge. The ideal width appears to be about 23 mm from the top centre of the last corrugation to the lap edge.

Remedy. Trim excess edge back to 23 mm. Alternatively, request that sheets be supplied to this dimension. However, it is important that uncurved sheets be produced symmetrically or a leak may occur on one side.

- 5. Problem.** Sawtooth Effect.

This problem is seen when the fixed sheets have uneven length on the end at gutter level. The ends cannot be lined up and each succeeding sheet appears to be considerably shorter or longer than the neighbouring sheet.

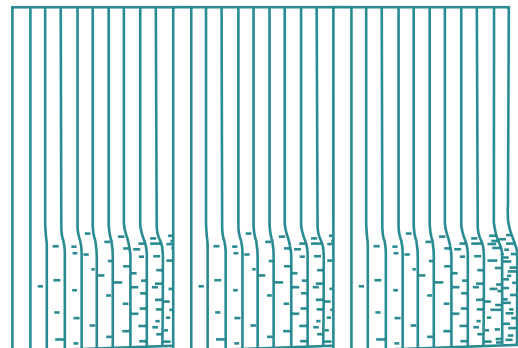
Cause. Refer to (2). The progressively worsening valley ripple across the sheet as described in (3) gradually absorbs length resulting in a shortening of the most affected side.

A further reason could be that the sheet ends are not cut off squarely.

Remedy. Refer to (2).

Note:

Due to the fact that one sheet laps over its neighbour there will always be a very slight difference in length or saw-tooth effect along the line of the bottom edge of the bullnosed end. It will be found that when long length curving is involved such as barrel vaulting, the down side lap will always lose length - this is unavoidable and post trimming may be necessary.



SUMMARY

Problems are usually caused by one or more of the following reasons:

- (1) the total pitch of the sheet is not within tolerance across its width,
- (2) too much metal width at side laps,
- (3) careless presentation of the sheet to the curving rolls or
- (4) attempts to use too few passes.

Curving of COLORBOND® Steel Corrugated Profiles

The factors previously discussed apply to COLORBOND® steel in the same manner. However, scuffing and abrasion can damage the finish unless additional care is taken.

The curving rolls must be clean and free of burrs and metal particles. Grease and dirt can be removed by wiping with a solvent soaked rag but care must be taken to avoid washing the lubricant from transmission and bearings. Reinforced PVC tape with single side adhesion is effective when continuously bound around the roll(s) in contact with the visible surface of the sheet.

This tape does not last for many passes and usually needs renewing after 15 sheets or so have been formed. Urethane rolls are obtainable and these are probably the best protection. Although the cost could be high the amount of use may well make this alternative economical.

Alternative treatments of the curving rolls are:

1. No wrapping at all but lubricating the rolls with various substances. Only products such as SHELLSOL T are recommended. Other lubricants may affect long term performance of the COLORBOND® steel finish.
2. No treatment at all where the rolls are in perfect condition.

Curving of AQUAPLATE® Steel Corrugated Sheet

Apart from ensuring curving rolls are clean and free of burrs and metal particles, it should be noted that AQUAPLATE® steel sheet does not require any lubrication during curving.

Curving of ZINCALUME® Steel Corrugated Profiles.

The organic passivation film on ZINCALUME® strip and sheet provides a self lubricating feature so that the use of lubricating oils for roll-forming or curving should generally be unnecessary. In the rare event that some roll-forming lubricant, eg, SHELLSOL T must be used because of forming conditions, KEROSENE OR KEROSENE BASED LUBRICANTS MUST NOT BE USED. These may cause softening and partial removal of the organic passivation film and result in the loss of most of the advantages imparted by the film to the product surface, and possible aesthetic variations.

The information and advice contained in this Bulletin is of a general nature only, and has not been prepared with your specific needs in mind. You should always obtain specialist advice to ensure that the materials, approach and techniques referred to in this Bulletin meet your specific requirements.

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